LOUISIANA COASTAL AREA, BARATARIA BASIN BARRIER SHORELINE RESTORATION PROJECT LAFOURCHE, JEFFERSON, AND PLAQUEMINES PARISHES, LOUISIANA FINAL REPORT

COMMUNICATION

FROM

THE ASSISTANT SECRETARY, ARMY, CIVIL WORKS, THE DEPARTMENT OF DEFENSE

TRANSMITTING

LOUISIANA COASTAL AREA, BARATARIA BASIN BARRIER SHORELINE RESTORATION PROJECT LAFOURCHE, JEFFERSON, AND PLAQUEMINES PARISHES, LOUISIANA FINAL REPORT

PART 3 OF 3

JULY 8, 2013.—Referred to the Committee on Transportation and Infrastructure and ordered to be printed

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U.S. GOVERNMENT PRINTING OFFICE

81–893 WASHINGTON : 2013

AUTHENTICATED
U.S. GOVERNMENT
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LOUISIANA COASTAL AREA
BARATARIA BASIN BARRIER SHORELINE RESTORATION
FINAL CONSTRUCTION REPORT
AND
FINAL ENVIRONMENTAL IMPACT STATEMENT

ECONOMICS
APPENDIX B

Cost Effective and Incremental Cost Analyses

Introduction

For environmental planning, where traditional benefit-cost analysis is not possible because costs and benefits are expressed in different units, two analytical methods are used to assist Corps planners in the decision process. First, cost effectiveness (CE) analysis is conducted to ensure that the least cost solution is identified for each possible level of environmental output. Subsequent incremental cost analysis (ICA) of the cost effective solutions is conducted to reveal changes in costs for increasing levels of environmental outputs. In the absence of a common measurement unit for comparing the non-monetary benefits with the monetary costs of environmental plans, cost effectiveness and incremental cost analysis are valuable tools to assist in decision making.

It is important to keep in mind that the most useful information developed by these two methods is what it tells decision makers about the relative relationships among solutions that one will likely produce greater output than another, or one is likely to be more costly than another – rather than the specific numbers that are calculated. Furthermore, these analyses will usually not lead, and are not intended to lead, to a single best solution (as in economic cost-benefit analysis); however, they will improve the quality of decision making by ensuring that a rational, supportable approach is used in considering and selecting alternative methods to produce environmental outputs.

To perform the CE/ICA, use was made of the IWR Planning Suite Decision Support Software developed by the US Army Corps of Engineers Institute for Water Resources (IWR). IWR Planning Suite has been developed to assist with plan comparison by conducting cost effectiveness and incremental cost analyses, identifying the plans which are the best financial investments ("Best Buys"), and displaying the effects of each on a range of decision variables. The software is available via the IWR Planning Suite Internet. The latest version (1.0.11.0) has been certified for use by USACE Headquarters, meaning that it has been reviewed and certified by the appropriate Planning Center of Expertise (PCX) and represents a corporate approval that the model is sound and functional.

Caminada Headland and Shell Island

This study evaluated several frameworks designed to preserve coastal habitat and functions in the Barataria Study area now recognized as a vital national resource. The intent is to save these important resources in a manner that also sustains or increases other economic resources that are the traditional focus of the Federal water resource program. In this analysis four environmental restoration alternatives are being evaluated at both locations of Caminada Headland and Shell Island. Table 1 displays the expected environmental outputs in terms of average annual habitat units along with the average annual costs for each of the restoration alternatives and no action plans. Tables 1a and 1b display the detailed cost estimates that were used to calculate the average annual estimates for each alternative referenced in Table 1. Average annual costs were

calculated using the federal discount rate of 4.0 percent and assuming a 50 year period of analysis. It should be noted that since Shell Island plans S3 and S5 have a 3 year construction schedule, as opposed to all other plans that have a 2 year construction schedule, their base years (the first year of project operation) are 1 year later than these other plans. Therefore, in order to make appropriate comparisons, the average annual estimates of plans S3 and S5 were discounted by 1 year for this purpose. Costs in Tables 1a and 1b reflect 2007 price levels but were updated to 2011 price levels for all other tables using the Civil Works Construction Cost Index (EM 1110-2-1304).

A more accurate depiction of the performance associated with each restoration alternative is displayed in Table 2. This displays the incremental outputs compared to the no action plan for each of the restoration alternatives. For example, the incremental outputs associated with the S1 alternative equals 355.9 average annual habitat units representing the difference between the 302.9 AAHU's that alternative S1 is expected to produce and the -53 AAHU's that Shell Island will lose if no action is taken.

Since each of the restoration alternatives at both Caminada Headland and Shell Island can be implemented with every alternative from the other area, the next step in this analysis is to calculate the outputs and costs of all the possible combinations of restoration alternatives. The IWR Planning model performed these calculations and the results are presented in Table 3, which show the sums of the combined measured increments for all of the possible alternatives. For example, if both restoration alternatives C5 and S1 are taken, then the overall increase in AAHU over the no action plan is estimated to be 1,954.8. This is calculated by summing the incremental AAHU's associated with C5 (1,598.9) and S1 (355.9) respectively in Table 2.

Cost Effective Solutions

In cost effectiveness analysis, it is necessary to filter out plans that produce the same output level as another plan, but cost more; or cost the same amount or more than another plan, but produces less output. This CE analysis was performed by the IWR planning model and those plans that are economically inefficient have been eliminated from further analysis. As an example, the restoration alternatives labeled C6, C7, and C9 produce less output but cost more than the alternative labeled C5; consequently the alternatives C6, C7, and C9 should not be included in further analysis.

Table 4 displays the remaining levels of output for the considered measures representing the "cost effectiveness frontier." For each remaining level of output, it indicates that at least one solution is available to produce that output; and if more than one solution would produce that level of output, only the least costly solution has been retained.

Cost Effective and Incrementally Justified (Best Buy Plans)

The final step in the analysis is to determine which subset of the cost effective solutions is also incrementally justified. These solutions, also known as Best Buy Plans or Best Buy Alternatives, are those plans that provide increases in benefits at the lowest average

cost (per HU). The IWR Planning model was run to make the necessary calculations producing the results shown in Table 5.

Included in Table 5 is the incremental cost per HU for each of the Best Buy plans that can be used to assist in the decision making process. Incremental cost is calculated by dividing the difference between two solution's costs by the difference between the two solution's outputs. Reviewing this table, with the incremental cost information, now allows the decision maker to make the following comparisons of alternative restoration plans and to progressively ask "Is it worth it?"

In the first comparison, the first level of additional output is 1598.9 AAHU, which could be produced at an incremental cost of $8,418 per AAHU. If decision makers determine that 1598.9 AAHU are worth $8,418 apiece, then they should proceed to the next level of output and repeat the questioning. In this case the next level of additional output is 783.6 AAHU, which means that an additional 783.6 AAHU could be produced at an additional incremental cost of $14,684 per AAHU.

As noted previously, neither cost effectiveness analysis nor incremental cost analysis will tell the decision maker what choice to make. However, the information developed by both analyses will help the decision maker make a better-informed decision and, once a decision is made, they will help you to better understand its consequences in relation to your other choices.

Figure 1 shows the full range of solutions, and highlights the cost effective solutions and the incrementally justified (Best Buy) solutions. Figure 2 shows the incremental cost and output for the Best Buy plans.

Table 1
Summary of Outputs and Average Annual Costs

Shell Island

Name of Alternative	Description	Outputs (AAHU)	Average Annual Costs ($)
No Action	No Action	-53	-
S1	Two Islands with No Renourishment	302.9	7,400,433
S2	Two Islands with Renourishment	672.7	12,047,740
S3	Single Island with 10 Year Advanced Fill and No Renourishment	522.9	9,476,986
S5	Single Island with 10 Year Advanced Fill and 2 Renourishments	730.6	11,506,705

Caminada Headland

Name of Alternative	Description	Outputs (AAHU)	Average Annual Costs ($)
No Action	No Action	-610.6	-
C5	Landward/Seaward Combination with Additional Marsh and Renourishment	988.3	13,459,269
C6	Landward/Seaward Combination with Additional Marsh and 1 replenishment	600.9	17,623,677
C7	Landward/Seaward Combination with Additional Marsh and 2 replenishment	639.6	21,068,033
C9	Landward/Seaward Combination with additional marsh construction and 4 replenishments	922.3	27,548,949

Notes:
(1) 2010 Price Levels
(2) 4 1/8 Interest Rate
(3) AAHU - Average Annual Habitat Units

Table 1a

Caminada Headlands Detailed Cost Estimates by Alternative

($, 2007 Price Levels)

Alternative 5 Cost Categories	Base Year -1	Base Year 0	Present Value	Average Annual
Construction Cost	78,475,875	78,475,875		
Contingency	15,695,175	15,695,175		
E & D (Engineering & Design)	2,004,782	2,004,782		
S & A (Supervision & Administration)	1,594,684	1,594,684		
O & M (Operations and Maintenance)	-	-		
O & M Renourishment Only	-	-		2,849,606
Total	97,770,516	97,770,516	199,574,065	12,339,550

Alternative 6 Cost Categories	Base Year -1	Base Year 0	Base Year +25	Present Value	Average Annual
Construction Cost	78,475,875	78,475,875	312,239,045		
Contingency	15,695,175	15,695,175	62,447,809		
E & D (Engineering & Design)	2,004,782	2,004,782	5,226,023		
S & A (Supervision & Administration)	1,594,684	1,594,684	5,284,150		
O & M (Operations and Maintenance)	-	-	-		
Total	97,770,516	97,770,516	385,197,027	339,793,292	16,157,508

Alternative 7 Cost Categories	Base Year -1	Base Year 0	Base Year +20	Base Year +40	Present Value	Average Annual
Construction Cost	78,475,875	78,475,875	274,374,231	226,441,989		
Contingency	15,695,175	15,695,175	54,874,846	45,288,398		
E & D (Engineering & Design)	2,004,782	2,004,782	5,082,843	3,677,295		
S & A (Supervision & Administration)	1,594,684	1,594,684	5,069,427	3,694,468		
O & M (Operations and Maintenance)	-	-	-	-		
Total	97,770,516	97,770,516	339,401,348	279,102,150	406,202,215	19,315,318

Alternative 9 Cost Categories	Base Year -1	Base Year 0	Base Year +10	Base Year +20	Base Year +30	Base Year +40	Present Value	Average Annual
Construction Cost	78,475,875	78,475,875	171,225,001	174,705,082	153,376,325	147,429,726		
Contingency	15,695,175	15,695,175	34,245,000	34,941,016	30,675,265	29,485,945		
E & D (Engineering & Design)	2,004,782	2,004,782	4,041,838	3,793,548	3,184,682	2,823,383		
S & A (Supervision & Administration)	1,594,684	1,594,684	3,426,857	3,455,191	2,995,382	2,779,051		
O & M (Operations and Maintenance)	-	-	-	-	-	-		
Total	97,770,516	97,770,516	212,938,696	216,894,837	190,231,654	182,518,106	531,157,508	25,257,066

Note: Present Value estimates and Average Annual estimates were calculated using the federal discount rate of 4.125 percent and a 50 year period of analysis.

Table 1b
Shell Island Detailed Cost Estimates by Alternative
($, 2007 Price Levels)

Alternative 1 Cost Categories	Base Year -1	Base Year 0	Present Value	Average Annual
Construction Cost	52,954,800	52,954,800		
Contingency	10,590,960	10,590,960		
E & D (Engineering & Design)	3,177,288	3,177,288		
S & A (Supervision & Administration)	3,177,288	3,177,288		
O & M (Operations and Maintenance)	-	-		
Total	69,900,336	69,900,336	142,684,061	6,784,768

Alternative 2 Cost Categories	Base Year -1	Base Year 0	Base Year +10	Base Year +20	Base Year +30	Base Year +40	Present Value	Average Annual
Construction Cost	53,972,450	53,972,450	42,795,508	48,539,508	33,663,028	28,202,548		
Contingency	10,794,500	10,794,500	8,559,000	9,708,000	6,733,000	5,641,000		
E & D (Engineering & Design)	3,238,348	3,238,348	2,567,725	2,912,375	2,019,801	1,692,177		
S & A (Supervision & Administration)	3,238,348	3,238,348	2,567,725	2,912,375	2,019,801	1,692,177		
O & M (Operations and Maintenance)	-	-	-	-	-	-		
Total	71,243,645	71,243,645	56,489,959	64,072,259	44,435,631	37,227,903	232,286,444	11,045,451

Alternative 3 Cost Categories	Base Year -2	Base Year -1	Base Year 0	Present Value	Average Annual
Construction Cost	46,116,531	46,116,531	46,116,531		
Contingency	9,223,333	9,223,333	9,223,333		
E & D (Engineering & Design)	2,766,993	2,766,993	2,766,993		
S & A (Supervision & Administration)	2,766,993	2,766,993	2,766,993		
O & M (Operations and Maintenance)	-	-	-		
Total	60,873,850	60,873,850	60,873,850	190,258,271	8,688,566

Alternative 5 Cost Categories	Base Year -2	Base Year -1	Base Year 0	Base Year +20	Base Year +40	Present Value	Average Annual
Construction Cost	46,116,531	46,116,531	46,116,531	48,410,344	46,849,832		
Contingency	9,223,333	9,223,333	9,223,333	9,682,000	9,370,000		
E & D (Engineering & Design)	2,766,993	2,766,993	2,766,993	2,904,617	2,810,992		
S & A (Supervision & Administration)	2,766,993	2,766,993	2,766,993	2,904,617	2,810,992		
O & M (Operations and Maintenance)	-	-	-	-	-		
Total	60,873,850	60,873,850	60,873,850	63,901,578	61,841,815	231,006,533	10,549,426

Note: Present Value estimates and Average Annual estimates were calculated using the federal discount rate of 4.125 percent and a 50 year period of analysis.

Table 2
Incremental Outputs by Alternative

Name of Alternative	Description	Outputs (AAHU)
S1	Two Islands with No Renourishment	355.9
S2	Two Islands with Renourishment	725.8
S3	Single Island with 10 Year Advanced Fill and No Renourishment	575.9
S5	Single Island with 10 Year Advanced Fill and 2 Renourishments	783.6
C5	Landward/Seaward Combination with Additional Marsh and Renourishment	1,598.9
C6	Landward/Seaward Combination with Additional Marsh and 1 replenishment	1,211.5
C7	Landward/Seaward Combination with Additional Marsh and 2 replenishment	1,250.2
C9	Landward/Seaward Combination with additional marsh construction and 4 replenishments	1,532.9

Notes:
(1) 2010 Price Levels
(2) 4 1/8 Interest Rate
(3) AAHU - Average Annual Habitat Units

Table 3
Summary of Outputs and Average Annual Costs of All Solutions

Name of Solution	Description	Outputs (AAHU)	Average Annual Costs ($)
No Action	No Action	0	-
C5	Landward/Seaward Combination with Additional Marsh and Renourishment	1598.9	13,459,269
C6	Landward/Seaward Combination with Additional Marsh and 1 replenishment	1211.5	17,623,677
C7	Landward/Seaward Combination with Additional Marsh and 2 replenishment	1250.2	21,068,033
C9	Landward/Seaward Combination with additional marsh construction and 4 replenishments	1532.9	27,548,949
S1	Two Islands with No Renourishment	355.9	7,400,433
S2	Two Islands with Renourishment	725.8	12,047,740
S3	Single Island with 10 Year Advanced Fill and No Renourishment	575.9	9,476,986
S5	Single Island with 10 Year Advanced Fill and 2 Renourishments	783.6	11,506,705
C5/S1	C5 plus S1	1954.8	20,859,702
C5/S2	C5 plus S2	2324.6	25,507,009
C5/S3	C5 plus S3	2174.8	22,936,255
C5/S5	C5 plus S5	2382.5	24,965,974
C6/S1	C6 plus S1	1567.4	25,024,110
C6/S2	C6 plus S2	1937.3	29,671,417
C6/S3	C6 plus S3	1787.4	27,100,663
C6/S5	C6 plus S5	1995.4	29,130,382
C7/S1	C7 plus S1	1606.1	28,468,466
C7/S2	C7 plus S2	1976.0	33,115,773
C7/S3	C7 plus S3	1826.1	30,545,019
C7/S5	C7 plus S5	2034.1	32,574,738
C9/S1	C9 plus S1	1888.8	34,949,382
C9/S2	C9 plus S2	2258.7	39,596,689
C9/S3	C9 plus S3	2108.8	37,025,935
C9/S5	C9 plus S5	2316.8	39,055,654

Notes:
(1) 2010 Price Levels
(2) 4 1/8 Interest Rate
(3) AAHU - Average Annual Habitat Units

Table 4
Cost Effective Solutions

Name of Solution	Description	Outputs (AAHU)	Average Annual Costs ($)
No Action	No Action	0	0
S1	Two Islands with No Renourishment	355.9	7,400,433
S3	Single Island with 10 Year Advanced Fill and No Renourishment	575.9	9,476,986
S5	Single Island with 10 Year Advanced Fill and 2 Renourishments	783.6	11,506,705
C5	Landward/Seaward Combination with Additional Marsh and Renourishment	1598.9	13,459,269
C5/S1	C5 plus S1	1954.8	20,859,702
C5/S3	C5 plus S3	2174.8	22,936,255
C5/S5	C5 plus S5	2382.5	24,965,974

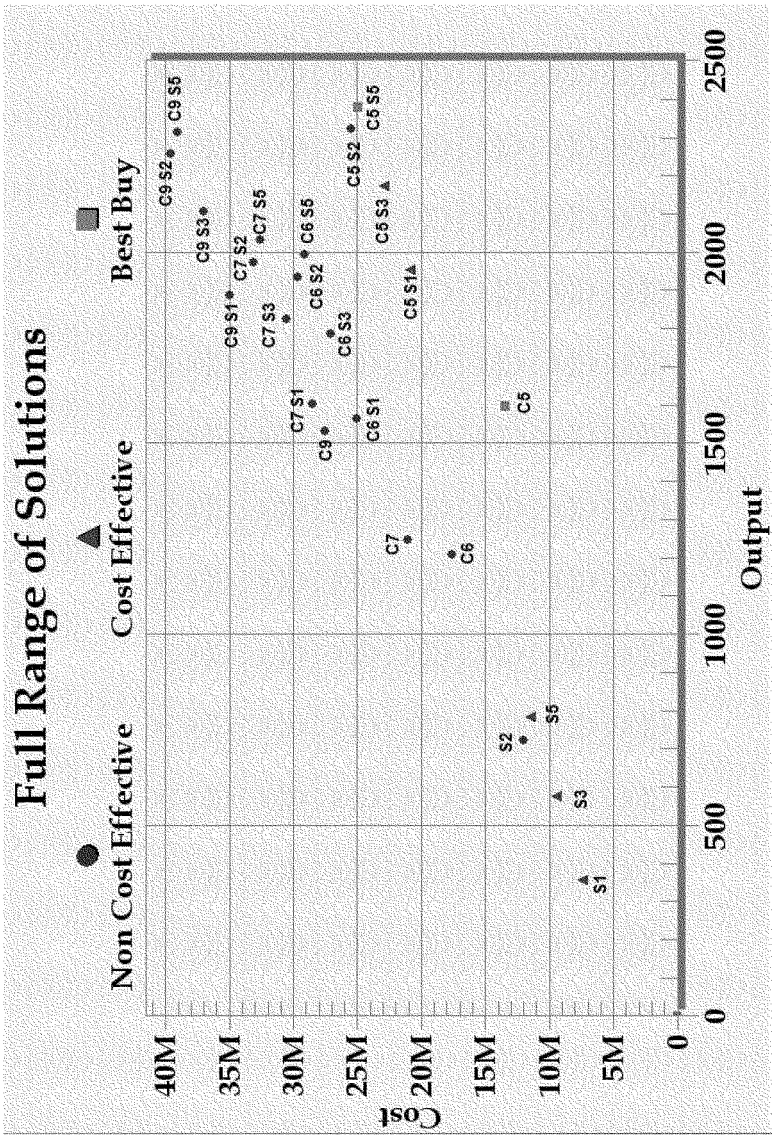
Notes:
(1) 2010 Price Levels
(2) 4 1/8 Interest Rate
(3) AAHU - Average Annual Habitat Units

Table 5
Incremental Costs

Name of Solution	Output (AAHU)	Avg. Ann. Costs ($)	Additional Output (AAHU)	Additional Costs ($)	Incremental Costs ($ per AAHU)
No Action	0	0	--	--	--
C5	1598.9	13,459,269	1598.9	13,459,269	8,418
C5/S5	2382.5	24,965,974	783.6	11,506,705	14,684

Notes:
(1) 2010 Price Levels
(2) 4 1/8 Interest Rate
(3) AAHU - Average Annual Habitat Units

Lowest average cost solutions.


Full Range of Solutions
Non Cost Effective
Cost Effective
Best Buy
Cost
Output
40M
35M
30M
25M
20M
15M
10M
5M
0
0
500
1000
1500
2000
2500
C9 S2
C9 S5
C9 S3
C9 S1
C7 S2
C7 S5
C7 S3
C6 S5
C6 S2
C7 S1
C6 S3
C5 S2
C5 S5
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C7
C6
C5
S2
S5
S3
S1

Figure 1

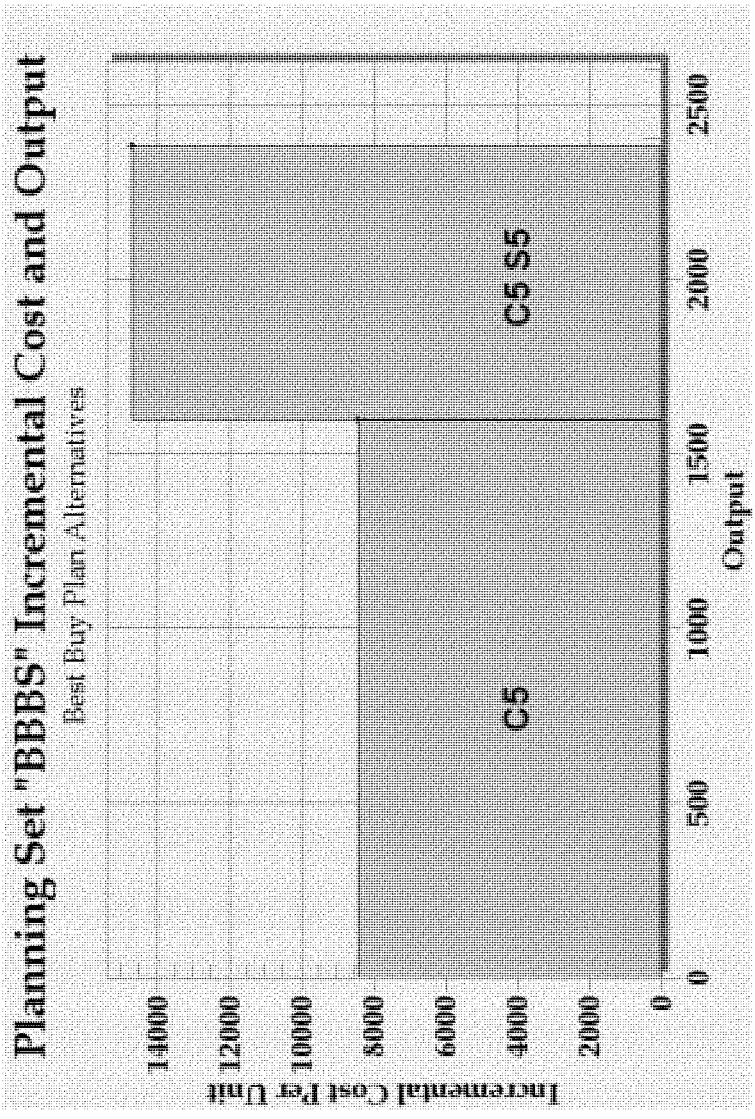
Planning Set "BBBS" Incremental Cost and Output
Best Buy Plan Alternatives
Incremental Cost Per Unit
14000
12000
10000
8000
6000
4000
2000
0
0
500
1000
1500
2000
2500
Output
C5
C5 S5

Figure 2

LOUISIANA COASTAL AREA
BARATARIA BASIN BARRIER SHORELINE RESTORATION
FINAL CONSTRUCTION REPORT
AND
FINAL ENVIRONMENTAL IMPACT STATEMENT

REAL ESTATE PLAN
APPENDIX C

REAL ESTATE PLAN
BARATARIA BASIN BARRIER SHORELINE RESTORATION PROJECT
LOUISIANA COASTAL AREA
LAFOURCHE, JEFFERSON, AND PLAQUEMINES PARISHES, LOUISIANA

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1. Project Name and Purpose. The purpose of this Real Estate Plan (REP) is to present the overall plan describing the real estate requirements and costs for the Louisiana Coastal Authority, Barataria Basin Barrier Shoreline Restoration Project. The Barataria Basin Barrier Shoreline Restoration Project was identified as a critical near-term restoration project in the *Louisiana Coastal Area, Louisiana Ecosystem Restoration Study Report* (LCA Report). This project was recommended for authorization by the Chief of Engineers on 31 January 2005, and was transmitted by the Assistant Secretary of the Army for Civil Works (ASA(CW)) to Congress on November 18, 2005. Title VII of the Water Resources Development Act of 2007, section 7006(c)(1)(C) requires USACE to submit a construction report to the House Committee for Transportation and Infrastructure and the Senate Committee for the Environment and Public works for approval to commence construction.

The proposed action to be evaluated in the Chief's Report is the restoration of the Barataria Basin Barrier Shoreline through shoreface, dune, and marsh creation and nourishment. The purpose of the proposed action is to restore the geomorphic functions of the barrier shoreline to improve ecosystem habitat.

The non-Federal Sponsor for this study is the State of Louisiana's Coastal Protection and Restoration Authority (CPRA) and includes participation by the Louisiana Department of Natural Resources and the Louisiana Department of Wildlife and Fisheries. The information contained herein is tentative and for planning purposes only. The final real property acquisition lines are subject to change even after approval of this report. All exhibits referred to are attached herein.

2. Authorization. The Barataria Basin Barrier Shoreline Restoration Feasibility Study, as described in the LCA Study, was conducted under the authority provided to USACE through resolutions adopted by the Committees on Public Works of the Senate and U.S. House of Representatives dated 19 April 1967 and 19 October 1967, respectively. These resolutions requested a review of prior USACE reports by the Chief of Engineers to determine the advisability of improvements or modifications to existing improvements in the coastal area of Louisiana in the interest of hurricane protection, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and related water resources purposes. These resolutions contain the following language.

> "RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors created under Section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby requested to review the reports of the Chief of Engineers on the Mermentau River and Tributaries and Gulf Intracoastal Waterway and Connecting Waters, Louisiana, published as Senate Document Numbered 231, Seventy-ninth Congress, on the Bayou Teche,

Teche-Vermilion Waterway and Vermilion River, Louisiana, published as Senate Document Numbered 93, Seventy-seventh Congress, on the Calcasieu River Salt Water Barrier, Louisiana, published as House Document Numbered 582, Eighty-seventh Congress, and on Bayous Terrebonne, Petit Caillou, Grand Caillou, DuLarge, and Connecting Channels, Louisiana, and the Atchafalaya River, Morgan City to the Gulf of Mexico, published as House Document Numbered 583, Eighty-seventh Congress, and other pertinent reports including that on Bayou Lafourche and Lafourche-Jump Waterway, Louisiana, published as House Document Numbered 112, Eighty-sixth Congress, with a view to determining the advisability of improvements or modifications to existing improvements in the coastal area of Louisiana in the interest of hurricane protection, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and related water resource purposes."

3. Study Area. The Barataria Basin Barrier Shoreline Study includes two areas. The first is the Caminada Headland, located near the southern end of Louisiana Highway 1, which terminates at Grand Isle. The second is Shell Island, located offshore in Plaquemines Parish, near the southern end of the Empire Waterway. A pipeline corridor near Empire, Louisiana will be required to transport dredge material from the Mississippi River to the Shell Island project site.

The majority of the Caminada Headland is located at the southern end of Lafourche Parish. Lafourche Parish is situated in southeast Louisiana, and its parish seat of Thibodaux is located approximately 63 miles southwest of New Orleans. A small portion of the eastern part of Caminada Headland is located in Jefferson Parish. Thunder Bayou separates Jefferson from Lafourche Parish. Jefferson Parish is bordered on the northern side by Lake Pontchartrain and on the southern side by the Gulf of Mexico. The parish is located on both sides of the Mississippi River. The southern portion of Jefferson Parish is part of the Barataria-Terrebonne Basin. Located between the Mississippi River and the Atchafalaya Swamp, the Barataria-Terrebonne Basin encompasses more coastal wetlands than any other estuary in the United States. The area of the Caminada Headland in Jefferson Parish is called Cheniere Caminada. This area is closely tied economically and socially to Grand Isle.

Grand Isle, located to the east of the project area, is the only inhabited, incorporated coastal island in the Louisiana barrier shoreline. The primary industries on Grand Isle are tourism, commercial fisheries, and oilfield related services. Approximately 1,500 people live on Grand Isle, but during the summer months, Grand Isle witnesses a boost in tourism, due to its close proximity to the Gulf of Mexico and its available amenities.

The Greater Lafourche Port Commission, located near the project area, was established in 1960 and exercises jurisdiction over an area south of the Intracoastal Waterway including Port Fourchon and the South Lafourche Leonard Miller, Jr. Airport. Port Fourchon's primary service market is domestic deepwater oil and gas exploration, drilling, and production in the Gulf of Mexico. The port comprises 600 developed acres of service facilities, and is in the midst of a 700 acre expansion to the north of its current facilities. It is a land base for offshore oil support services as well as a land base for the Louisiana Offshore Oil Port (LOOP). Additionally, it serves as a commercial and recreational fishing area, and foreign cargo shipping terminal. Port Fourchon is located on the western end of the Caminada Headland at the mouth of Bayou Lafourche.

Louisiana Highway 1 is located north of the project area. Highway 1 is the only hurricane evacuation route for Grand Isle and for the southern parts of Lafourche Parish. It is also the only route to Port Fourchon and to Louisiana Offshore Oil Port (LOOP). The U.S. Congress designated Highway 1 as a "high-priority corridor" because of its role as critical energy infrastructure. Currently, an ongoing project to expand the entirety of Highway 1 will result in 18 miles of four-lined elevated roadway from Golden Meadow to Port Fourchon. Port Fourchon supports more than 75% of the Gulf of Mexico's deepwater oil production, and more than 18% of the United States' oil supply traverses the Highway 1 corridor.

Shell Island is located at the southwestern edge of Plaquemines Parish. Plaquemines Parish is a long, narrow parish where the northern boundary begins slightly down-river from New Orleans and traverses the Mississippi River on both the east and west banks to the mouth of the river at the Gulf of Mexico. Shell Island is part of the Plaquemines barrier shoreline. The Plaquemines shoreline has undergone a dramatic transformation due to subsidence, extensive canal dredging, and lack of sediment.

Plaquemines Parish is serviced by rail lines, which run along both banks of the rivers. On the east bank, the Norfolk-Southern Railroad follows Highway 39 north connecting with the main Norfolk-Southern railroad line, offering direct single-system rail service to Kansas City in the west and to Buffalo, NY, Washington, D.C., and Jacksonville, FL in the east. Plaquemines Parish also contains major ports, due to its proximity and relatively easy access to the Gulf of Mexico and its access to several natural resources.

4. Description of Work

The measures for approaching the solution to the rapid coastal erosion in the aforementioned areas were divided into three general categories: (1) shoreline restoration and protection, (2) marsh restoration, and (3) supporting measures to enhance or maintain shoreline and marsh features. It should be noted that shoreline restoration at Caminada Headland and Shell Island is needed to stabilize these geomorphic features and reduce the rapid rate of shoreline erosion, while marsh restoration alone does not provide the coastal protection against everyday wave action or storm events. Shoreline restoration is necessary in conjunction with marsh restoration for optimal shoreline protection and ecosystem restoration.

Shell Island Alternative for Recommended Plan -- Alternative 5: One Island with Renourishment

Under alternative 5, the Shell Island reach would be restored as one island. The island would include shoreface, dune, and marsh platform features. This alternative would restore Shell Island to a form similar to its pre-Hurricane Bob (1979) condition.

The landward edge of the dune of alternative 5 would be located seaward of the existing shoreline. The west end of the alternative 5 single island would be terminated approximately 0.5 mile before Grand Bayou. It is anticipated that the closure of Coupe Bob would return the tidal prism to its pre-1979 path—flowing through Grand Bayou, with Grand Bayou increasing in size in response to the altered tidal flow pattern. The west end of alternative 5 is close to the western limit of Shell Island that was observed in 1973, prior to the opening of Coupe Bob. The

proposed island follows the shortest and shallowest route across Coupe Bob. The east end of the island would then follow the remnants of Shell Island East, and has a concave shape towards land. The eastern end of the island would be located near the Empire Waterway. The constructed dune would have a uniform width of 189 feet along the length of the restored barrier island.

However, in deeper water (bathymetry below -3.0 feet), it is not feasible to construct the marsh section with only marsh sediments, as the marsh would settle too rapidly and nonuniformly to perform its intended purpose effectively. Instead it is recommended to construct a sand base across Coupe Bob, at -3.0 feet, using shoreline fill material. The marsh can then be constructed on top of this base, which would reduce settlement of the marsh material. A second option is to install a geotextile tube for containment of the marsh fill where the -3 feet NAVD sand base is constructed. The geotextile tube could be filled with sand from the sand base. This option was used for the development of alternative 5. It is estimated that 5.6 million cubic yards of shoreline fill would be required to construct 317 acres of shoreline/dune area (area above +2 feet, NAVD). Approximately 2.1 million cubic yards of marsh fill would be required to construct 466 acres of marsh.

Shell Island would be re-nourished 20 years and 40 years after initial construction to the original template of 317 beach/dune acres. The marsh fill for alternative 5 would also be re-nourished to its original construction template at this time interval. Alternative 5 will create 730.6 AAHUs.

The borrow source for the dune/beach would be a large sand deposit near Nairn in the Mississippi River between mile markers 32 and 34, approximately 11 miles north of the project area. Based on samples obtained from vibracores, the sand grain size is comparable to the sand at the project site. The dredged material would be pumped from the Mississippi River via pipeline. The borrow source for the marsh restoration would be the Empire deposit, approximately 1.5 miles from the Empire Jetties. The borrow area occupies about 207 acres and total mixed sediment volumes range from 5.5 million to 6.6 million cubic yards for 15 foot and 20 foot cut depths, respectively.

Caminada Headland Alternative for Recommended Plan: Alternative 5: Preferred Dune with Expanded Marsh

The conceptual design for the dune/beach restoration feature for Alternative 5 includes two components: design fill and advanced fill. The marsh platform fill would extend along the landward edge of the dune ridge from a point near the terminus of Louisiana Highway 3090 westward through Bay Champagne to the eastern edge of the project boundary where a small spit forms the western edge of Caminada Pass. Additional marsh would also be restored in an area between two existing canals west of the petroleum storage facility immediately landward of the existing dune ridge. Fill quantities for the beach/dune and marsh features for Alternative 5 would be 5.1 million and 5.4 million cubic yards, respectively. Louisiana State Highway 3090 bisects the Caminada Headland project area. The State acquired road servitude over the highway right-of-way and will therefore be utilized to access both the Caminada project area and the construction staging area.

5. Description of Lands, Easements, Rights-of-Way, Relocations, and Dredged Material Disposal Areas (LERRD).

Caminada Headland Alternative
Caminada Headland is located at the mouth of Bayou Lafourche and is defined as the area south of Highway 1 between Belle Pass and Caminada Pass. The beach from Belle Pass to Highway 3090 is known as Fourchon Beach, and the beach at the eastern end of the headland is known as Elmer's Island. Spits have formed at either end of the headland. The 13-mile long beach is narrow and has numerous storm overwashes, particularly after Hurricane Katrina. Back-barrier lagoons include Bay Champagne, Caminada Bay, and several irregular shaped ponds. Numerous small bayous wind through the back barrier wetlands and there are also several man-made pipeline canals. The Chevron canal is parallel to shore, only about 1,200 feet inland from the Gulf, and runs nearly the entire length of the headland. There are also 13 offshore breakwaters west of Bay Champagne.

Caminada Headland will be fronted by a sand dune, in order to better protect and promote the development of the wetlands behind it. The project also includes enhancement of the wetlands in the landward side of the Headland. The dune restoration/creation work will impact approximately 987 acres and for the marsh restoration/creation work which will impact 1,186 acres. This acreage will be acquired from five private landowners on Caminada. The project areas are identified in the Caminada Headland engineering maps found on Exhibit A. Corps of Engineers regulations indicate that real estate interests for the construction of ecosystem restoration projects should generally be acquired in Fee. Therefore, we propose to acquire a standard Fee, Excluding Minerals (with restrictions on use of the surface) estate to accomplish the work for this project. However, a Request to Deviate from Fee Acquisition and Request for Approval of Non-Standard Estates has been submitted and is currently under review. This is discussed further below.

The proposed source of borrow sand for Caminada Headland is Ship Shoal, a sand body in the Gulf located approximately 50 miles southwest of Belle Pass. It is about 31 miles long and 7 miles wide, lying at a water depth of 9 to 30 feet. It is the remaining seaward shoal from one of the older abandoned deltas. Ship Shoal is composed of well-graded quartz sand and is ideal for use in restoring the Caminada Headland since its grain size is slightly larger than the sand found at the headland. Ship Shoal is located in the Gulf of Mexico in water's of the State of Louisiana or the United States; therefore, no real estate interests need to be acquired for excavation of the sand.

Shell Island Alternative
The Shell Island Reach stretches approximately 2.5 miles, from Grand Bayou Pass to the Empire Waterway. The Shell Island Reach is currently highly fragmented into small, shallow shoals and islands, which represent only a fraction of the once continuous shoreline. The remaining shoals and islands have migrated northward into Bastian Bay.

This project will employ the same restoration method utilized for the Caminada Headland, with a sand dune facing the gulf to protect and better ensure the growth of the newly created marsh in

the rear. Shell Island is one island and is identified in the attached engineering maps on Exhibit A. This project proposes to restore/create dunes in an area of 453 acres and to restore/create marsh in an area of 448 acres. As previously discussed, Corps of Engineers regulations indicate that real estate interests for the construction of ecosystem restoration projects should generally be acquired in Fee. Therefore, we propose to acquire a standard Fee, Excluding Minerals (with restrictions on use of the surface) estate to accomplish the work for this project. However, a Request to Deviate from Fee Acquisition and Request for Approval of Non-Standard Estates has been submitted and is currently under review. This is discussed further below.

The proposed source of borrow sand for the Shell Island shoreline/dune fill is the Mississippi River. The primary potential source for borrow is from the vicinity of Nairn, which is located 2 to 4 miles upriver from Empire between Mile Marker (MM) 32 and MM 34 and about 11 miles from the center of Shell Island. The deposit is located in a river meander where greater sediment thickness may be anticipated due to the presence of relict (vertically stacked) sand bars. The Mississippi River is a State of Louisiana/United States waterbottom; therefore, no real estate interests need to be acquired for excavation of the sand.

In addition, due to the need to move dredge material from the Mississippi River to Shell Island, a standard Utility And/Or Pipeline Easement (standard estate) is needed over approximately 174 total acres. At this time, the specific location of the pipeline has not yet been finalized, but a map depicting the approximate location of the pipeline is attached in Exhibit A. The dredged material pipeline will be located slightly south of the Hwy 23 Empire Bridge. It will begin at the Mississippi River levee, traversing the area across Highways 11 and 23, crossing the Hurricane Protection Levee and continuing through the marsh and waterways to Shell Island.

A staging area will be located near Highway 23 on the property owned by Plaquemines Parish south of the Empire Bridge and adjacent to the pipeline easement. Highway 23 provides access to the staging area, making it relatively easy to access. The staging area, totaling four (4) acres will be encumbered by a standard Temporary Work Area Easement for approximately five (5) years.

Construction of this project will impact four owners on Shell Island and nine owners over areas impacted by the pipeline and staging areas. The acreage approximations are based on current information and are subject to change during future phases of this project.

6. Non-Federal Sponsor Owned LER. A State Land Determination dated March 15, 2005 for Shell Island and Caminada Headland was received. The position of the State of Louisiana is that the State of Louisiana is the owner of the bed and bottom of all navigable waterways within the State. The State possesses ownership of the beds and bottoms of all navigable waterways within its boundaries, has asserted public ownership in running waters, the waters and bottoms of natural navigable water bodies, the territorial sea, arms of the sea, the seashore, and beds of certain navigable waterways near the Gulf of Mexico. The above interests are recognized in the Louisiana Civil Code as "public things" owned by the State in its capacity as a public person.

7. Estates. It is Corps of Engineers policy to acquire fee simple title for ecosystem restoration projects. Two reasons for such requirement is to reduce the risk that incompatible uses on project land will occur after project construction and to ensure that ownership rights vested in the project are clear and enforceable (ER 1105-2-100, Appendix F, Amendment #2, F-20b(2)(a). However, regulations also indicate that a lesser interest, such as, a specific type of permanent easement, may be appropriate depending upon the operational requirements of the project and other circumstances relevant to project implementation, including landowner preference (EP 1165-2-502, 17b). Circumstances wherein the acquisition of interests less than fee may be appropriate is where only select and easily identifiable and narrow affirmative rights are required for successful implementation of the project (ER 1105-2-100, Appendix F, Amendment #2, F-20b (2)(b)(i)).

To deviate from acquisition of the fee estate, the District must request approval of a waiver from the Headquarters office. It is the opinion of the Non-Federal Sponsor and the District that construction and maintenance of this project can be accomplished through the acquisition of easements rather than fee. A Request to Deviate from Fee Acquisition and Request for Approval of Non-Standard Estates has been submitted as an independent document for this project, and is currently under review.

The District has prepared a non-standard perpetual Wetland Creation and Restoration Easement describing the real estate interests necessary for areas of marsh restoration/creation and a non-standard perpetual Dune Restoration and Creation Easement describing the real estate interests necessary for areas of dune restoration/creation. Estates similar to these were presented in the Louisiana Coastal Area-Louisiana Ecosystem Restoration Study, dated November 2004. The request includes justifications for acquiring these non-standard estates rather than fee.

However, because the waiver to acquire interests less than fee has not been approved by HQUSACE as of the date of this report, the report proposes the acquisition of the Fee, Excluding Minerals (with restrictions on use of the surface) for the dune restoration/creation and the marsh restoration/creation features of the project. With HQUSACE approval, of the request to deviate from fee acquisition, these non-standard estates will be the estates acquired for the project.

8. Existing Federal Interests. Completed in 1950, the Waterway from Empire, LA to the Gulf of Mexico provides for a navigable channel 9-by-80 feet from Empire to the Gulf of Mexico with construction of stone jetties to the 6-foot depth contour. The length of the waterway is 10 miles. Within the right-of-way acquired, the Government has the right to dredge the waterway and deposit the dredged material.

The dredged material pipeline will cross the New Orleans to Venice Hurricane Protection Project both along the Mississippi River and the back hurricane protection levee. Real Estate interests were transferred to the local levee board.

9. Navigation Servitude. Derived from the Commerce Clause of the U.S. Constitution, Article I, section 8, clause 3, the navigation servitude is the dominant right of the United States to use, control, and regulate the navigable waters and submerged lands underneath. The applicability of the navigation servitude depends on both legal and factual determinations. The Government

must first determine whether a project feature serves a purpose in aid of commerce. If the legal determination supports assertion of the navigation servitude, then the second step is to determine the geographical area over which the servitude can be asserted. In tidal areas, the servitude extends to all lands below the mean high water mark, whereas in non-tidal areas, the servitude extends to all lands within the bed and banks of a navigable stream that lie below the ordinary high water mark. The navigation servitude can be asserted on the Mississippi River.

10. Flooding Induced by the Project. No flooding will be induced by this project.

11. Maps. Maps of the project area are included in Exhibit A of this report.

12. Baseline Cost Estimate/Chart of Accounts (COAs). The real estate costs have been estimated to be $2,010,000 for Shell Island and $1,651,000 for Caminada Headland. These costs include land payments and administrative costs to acquire real estate rights. An estimate to cover the administrative costs of possible condemnation is included in the COA. This is based on a percentage of total ownerships. A 25% contingency has been included in the estimate. The contingencies are estimated to cover the scope of work that can be achieved in the Feasibility phase of a project. Most of the right way could only be inspected from aerial photography. Ownership information is very preliminary. The right of way requirements could change during the PED phase. Furthermore, although the locals seem to be in favor of this project, approximately 30% of the affected owners could require condemnation either for price or title. The contingency compensates for court awards above the appraiser value.

The LERRD estimate is based on a gross appraisal last amended on 10 November 2010 and has been reviewed and approved within the New Orleans District. A copy of the chart of accounts is included as Exhibit C.

13. Uniform Relocation Assistance (PL 91-646) as amended, Title II. Benefit payments under the provisions of Title II of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended, are not anticipated. Construction of this project will not cause the displacement of persons or habitable or commercial structures. However, should current plans change, and the displacement of persons and habitable or commercial structures be required during the construction of the project, Title II of this Act may become applicable.

14. Oil & Gas Activities/Timber & Crop Harvesting. Under Louisiana law, a landowner does not own oil, gas, or other oil & gas "occurring naturally in liquid or gaseous form." However, the owner does have the exclusive right to explore and develop the land for the production of oil & gas. A landowner cannot transfer the oil & gas estate independent of the surface property, but the owner may convey or lease the right to produce the oil & gas in the form of a servitude or easement. Between private parties, if an oil & gas owner does not exercise the right within ten years, the servitude is extinguished for "non-use," and reverts to the surface owner. This "prescription of non-use" does not apply, however, in instances when the United States or the State of Louisiana, or any subdivision or agency of either, acquires property but reserves the oil & gas interests to the landowner. The statute, La. R.S. 31:149, describes the rights of

landowners involved in a government acquisition and indicates that the owner of the mineral interests will enjoy the right explore and develop oil & gas in perpetuity.

For this project, oil & gas rights will not be acquired. The proposed Fee estate excludes mineral rights from the acquisition but restricts the use of the surface. Furthermore, the non-standard estates included in the request to deviate from fee acquisition also specifically reserve the oil & gas to the landowners, but the surface rights are restricted. If possible, alternative methods to access the oil & gas would be allowed. If the project prevents access to the oil & gas, compensation for the diminished use or enjoyment will be required. If the oil & gas rights owners' rights are completely diminished because oil & gas cannot be accessed, then payment will be required for the oil & gas rights.

Currently, there are several active state leases and a number of conservation units that overlap the project boundaries, but there are no active wells within the project construction areas. There are 4 to 6 active oil wells in the area surrounding the Caminada project, so care would have to be taken in order to not interfere with ongoing production, especially if offshore dredge sites are anticipated as sand sources for the marsh creation portion of the Caminada reach. In the Shell Island project area, there are 3 active units near the project boundaries, but there are no active wells within the project boundaries. Any wells within the project area are either plugged and abandoned or dry and abandoned. However, considering the extent of directional drilling used today, it is unlikely that the marsh creation part of the project would be problematic. There are a number of well heads located offshore which were directionally drilled onshore.

It is noted that the extraction of oil and gas under project areas through directional drilling would not impact the surface. The location of oil and gas in these areas is thousands of feet below the surface of the earth. Therefore, there extraction of oil or gas will not cause the surface of the earth to cave in.

Neither merchantable timber nor crops will be affected by this project.

15. Ownership of Accreted and Emergent Lands and Oil & gas Rights. Pursuant to Article IX, Section 3 of the Louisiana Constitution, owners of land contiguous to and abutting navigable waters, bays, arms of the sea, the Gulf of Mexico, and navigable lakes belonging to the state shall have the right to reclaim or recover land lost through erosion, compaction, subsidence, or sea level rise occurring on or after July 1, 1921. Such private efforts to reclaim or restore lost lands can be made at any time. Coastal restoration projects implemented pursuant to R.S. 49:214.1 et seq. (Act 6, Louisiana Wetlands Conservation and Restoration Act, 1989) might, if successful, impinge upon those private reclamation rights. Accordingly, R.S. 41:1702.D(2)(a) provides that the Louisiana Department of Natural Resources may enter into negotiated boundary agreements with such disaffected landowners to address the anticipated loss of their ownership and reclamation rights in the area of the proposed project where the creation of land is anticipated. In the Caminada Headland project area, Caillouet Land Corporation has filed a reclamation claim to the 1921 shoreline with the State Land Office. The Edward Wisner Foundation, the major landowner in the Caminada Headland area, is considering filing a similar reclamation claim with the State Land Office. In 1955, Wisner negotiated a settlement with the State of Louisiana in which Wisner may claim royalties up to the 1935 coastline.

The state of Louisiana's position is that, with respect to coastal restoration projects that build land on state water bottoms, the riparian landowners may have a claim for inverse condemnation of their right to reclaim. The value of such a reclamation right, if there is any, is too speculative to assess. If a reclamation issue is raised by a landowner, a case-by-case handling is recommended. A specific claim may be denied on the basis of lack of evidence of value, or, if warranted by the circumstances, compromised pursuant to rather complex legal provisions.

16. Non-Federal Sponsor. An assessment of the non-Federal sponsor was completed and coordinated with CPRA and is included as Exhibit D. The non-Federal Sponsor (NFS) of this project is the Louisiana Coastal Protection and Restoration Authority (CPRA). The Office of Coastal Protection & Restoration (OCPR), a component of CPRA, performs all Real Estate Acquisition activities in support of local levee districts and/or Louisiana Parishes. OCPR has full acquisition capability, except quick-take authorities. In such cases where quick-take authorities are needed, OCPR will engage the Parish Governments and/or Levee Districts impacted by this project, in order to acquire the necessary LER more expeditiously.

17. Zoning Ordinances. No application or enactment of zoning ordinances is proposed in lieu of, or to facilitate, acquisition in connection with this project.

18. Acquisition Schedule. It is expected CPRA through its Office of Coastal Protection and Restoration (OCPR) will acquire all LERRD. The Government will receive an Authorization for Entry for construction to all State lands and water bottoms required for this project as well as obtaining an appropriate real estate instrument from the State of Louisiana. The acquisition schedule is based on having a signed cost share agreement, receiving environmental clearances, and the completion of rights-of-way maps. No acquisition will take place prior to the completion of these activities.

Acquisition Schedule

Task	Duration
Obtain mapping information	60
Obtain title	60
Obtain appraisals	120
Negotiate and issue right of entry	180
Begins condemnation proceedings, if necessary	6 Months

19. Facility/Utility and Cemetery Relocations. Any conclusion or categorization contained in the Real Estate Plan, or elsewhere in this project report, that an item is a utility or facility relocation to be performed is preliminary only. The Government will make a final determination of the relocations necessary for the construction, operation, or maintenance of the project after further analysis and completion and approval of final attorney's opinions of compensability for each of the impacted utilities and facilities.

At this time, it appears that no facility, utility, or cemetery relocations are necessary for this project.

20. Cultural/Environmental. Environmental documentation (i.e. NEPA) has been prepared and coordinated, as required by law. A preliminary hazardous, toxic, and radioactive waste (HTRW) assessment is not needed at this time, as the nature of the project will not impact lands suspected of containing HTRW. If, during future phases of the project, it is determined construction will adversely impact environmental features, a mitigation strategy will be initiated. A determination of impact on cultural resources will be reached, and provided the discovery of potential impacts to cultural resources, alterations in plan implementation will ensue. Neither acquisition of lands nor initiation of construction will commence until all NEPA requirements are met.

21. Landowner Concerns. Efforts were made to contact each of the major landowners in the Caminada area. Those who responded are generally supportive of the project. However, the landowners are worried about public access and the destruction of their private property by the public. At this time the attitude of landowners impacted by Shell Island project are not known.

22. Notification of Risk. CPRA will be responsible for providing all real estate interests that are owned, claimed, or controlled by the State of Louisiana, including oyster leases, as well as privately owned real estate interests needed for the project. The Non-Federal sponsor is a member of the planning team. The sponsor has been advised by letter dated June 6, 2011 of the risks of commencing acquisition of real estate interests prior to approval of the Chief's report.

23. Access. Access to the project sites will be either over public roads or navigable waterways. In the Caminada area, the public roads utilized will be Louisiana Highways 1 and 3090. Additional access will be over navigable waterways such as the Gulf of Mexico, Bay Champagne, Caminada Pass, and Bayou Moreau. In the Empire area, Louisiana Highways 11 and 23 will be utilized. Shell Island will be accessed by navigable waters such as the Empire Waterway, the Gulf of Mexico, and Bastian Bay.

24. Oysters. The construction and operation of the project will require the acquisition of oyster leases in both the Caminada Headland and Shell Island project areas. The Louisiana Department of Wildlife and Fisheries (LaDWF) leases State of Louisiana water bottoms for oyster production for $2.00 per acre per year plus survey fees, for a 15-year initial term. The leases give the lessee the exclusive right to harvest oysters from within the leased area. There is no midterm termination clause. An oyster lease has been recognized as a real estate interest by both statute and case law.

During the 2006 legislative session, the Louisiana legislature passed Act 425 which establishes a procedure for the State to acquire oyster leases that are directly impacted by coastal restoration, protection, or conservation projects. The exclusive use of the water bottoms is subordinate to the rights of the State, any political subdivision of the State, the United States, or any of its agencies or agents to take any action in the furtherance of coastal protection, restoration, or conservation. Direct impact is defined as dredging, direct placement of material on the oyster leases, or other work necessary for the construction or maintenance of a project. Only the portion that is directly impacted by the project right-of-way will be acquired unless it is deemed that the remainder of the lease is an uneconomic remnant.

Depending on the plan schedule, the oyster lessee may be allowed to harvest the oysters at his own expense. However, if the plan schedule prevents the oyster lessee from removing the oysters, then the lessee would be compensated for the oyster crop. The lessee would not be allowed to harvest the crop if payment has been made for the oysters. Real Estate costs include the costs associated with oyster lease acquisition.

The State would be obligated to provide real estate as necessary for the construction, operation, and maintenance, repair, rehabilitation, and replacement of the project. As such, the State may acquire existing oyster leases anticipated to be adversely impacted by the project, and the State may choose to not enter into any new oyster leases within oyster impact areas.

Oyster impacts and costs were provided by LaOCPR. Approximately twenty-four (24) leases, comprising approximately 904 acres will be acquired for the Shell Island portion project; approximately eight (8) leases, comprising approximately 170.5 acres, will be acquired for the Caminada Headland portion of the project.

25. Operations and Maintenance.

After completion of construction, the State will assume all operation and maintenance responsibilities associated with this project. Two renourishment cycles are planned after the initial construction of the project, in the 20th year and another in the 40th year of the project life. As previously stated, regulations indicate that a Fee estate should be acquired for ecosystem restoration projects. If a Fee estate is acquired, then all necessary rights will be available for operation and maintenance of the project. The non-standard estates included in the request to deviate from fee acquisition include language that would protect the project area from human influences such as construction of habitable dwellings, vehicular access, excavation or disposal. In the event that approval to deviate from fee acquisition is granted and the non-standard estates are approved, the Non-Federal sponsor shall be responsible for operating the project to maintain the integrity of the restored features by enforcing the protective restrictions on the land and preventing any foreseeable, non-nature induced alteration. The NFS will be responsible for the maintenance, repair, and rehabilitation of the project features such as the sand fencing. The NFS would be required to monitor the project area to ensure that no unauthorized disposal or excavation has occurred on the project site, and no habitable structures were constructed.

This real estate plan was prepared and reviewed by the following Real Estate personnel in USACE, New Orleans District.

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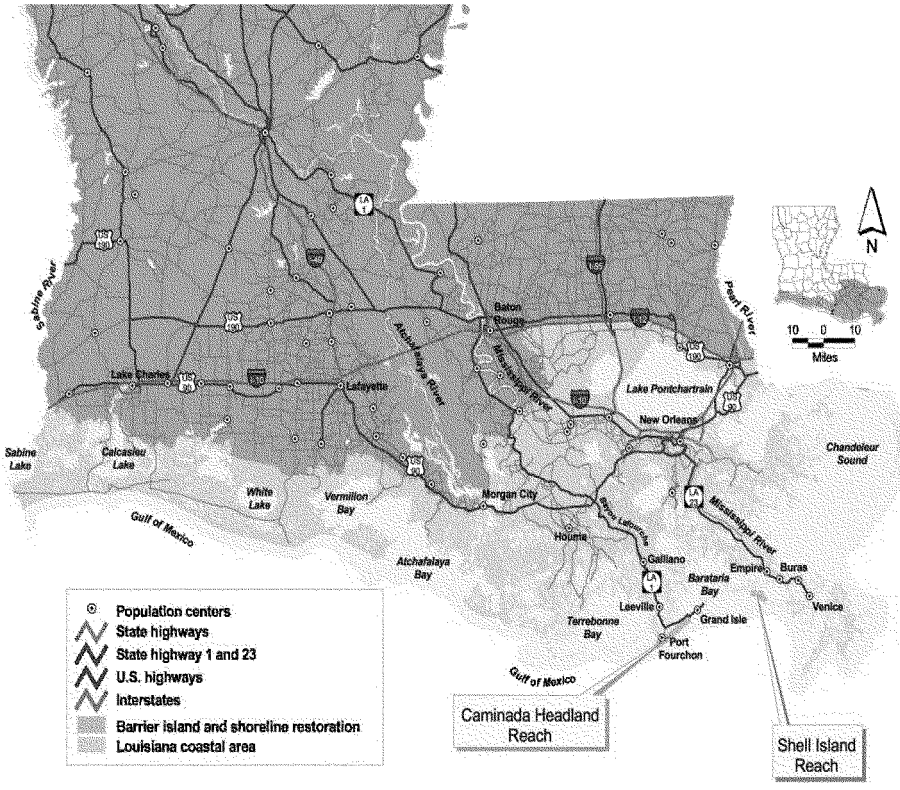
Dated: June 7, 2011

EXHIBIT A
MAPS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Vermilion Bay
Morgan City
Chandeleur Sound
Gulf of Mexico
Atchafalaya Bay
Houma
Bayou Lafourche
Galliano
Empire
Buras
Barataria Bay
Leeville
Grand Isle
Venice
Terrebonne Bay
Port Fourchon
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N
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Miles
Population centers
State highways
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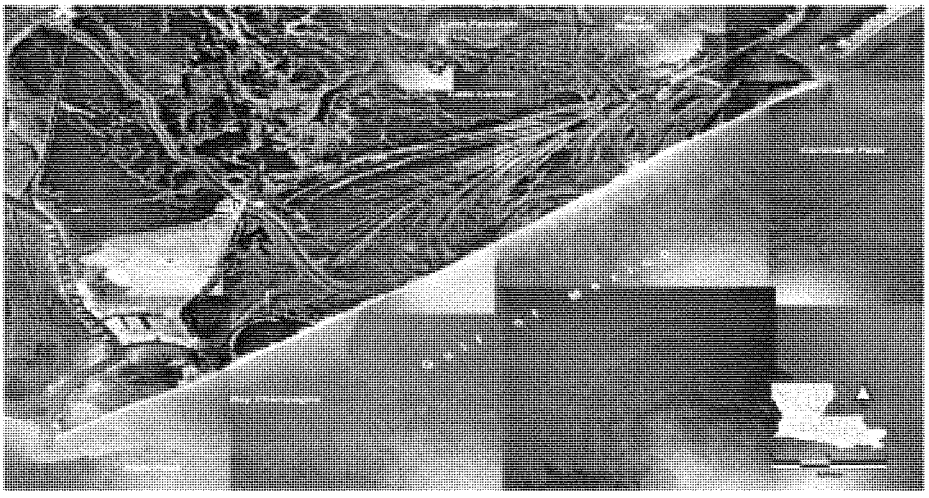
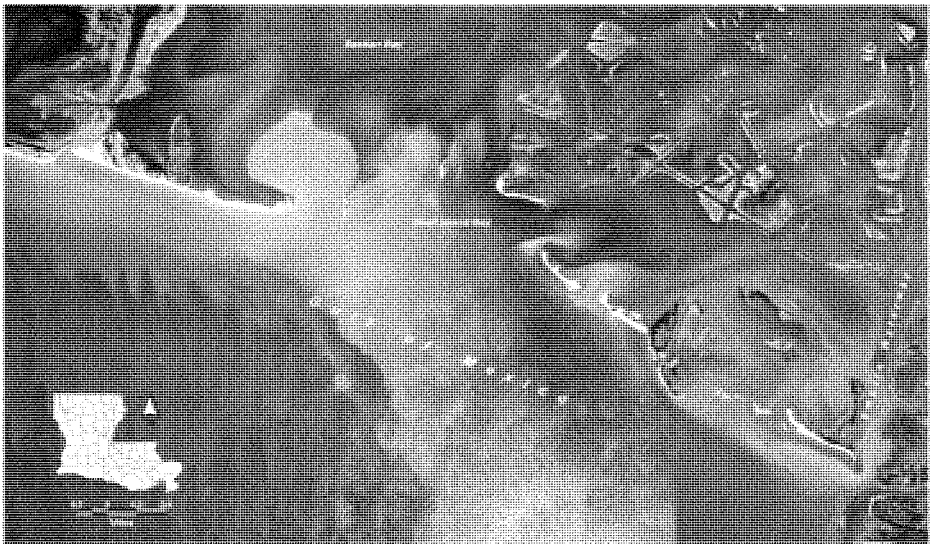
U.S. highways
Interstates
Barrier island and shoreline restoration
Louisiana coastal area
Caminada Headland Reach
Shell Island Reach

Caminada



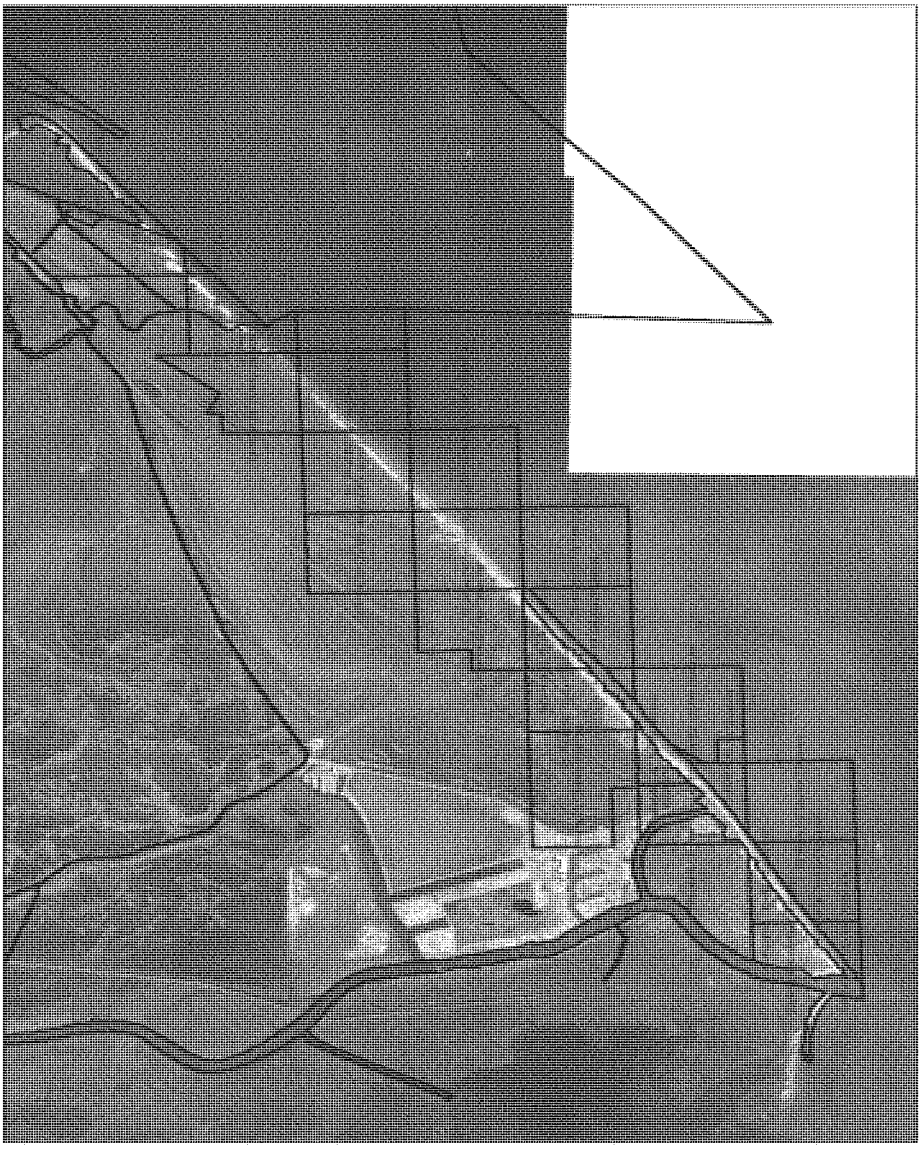
Shell Island



Caminada Headland - Project Map

Shell Island - Project Map

Caminada Headland – Ownership Map



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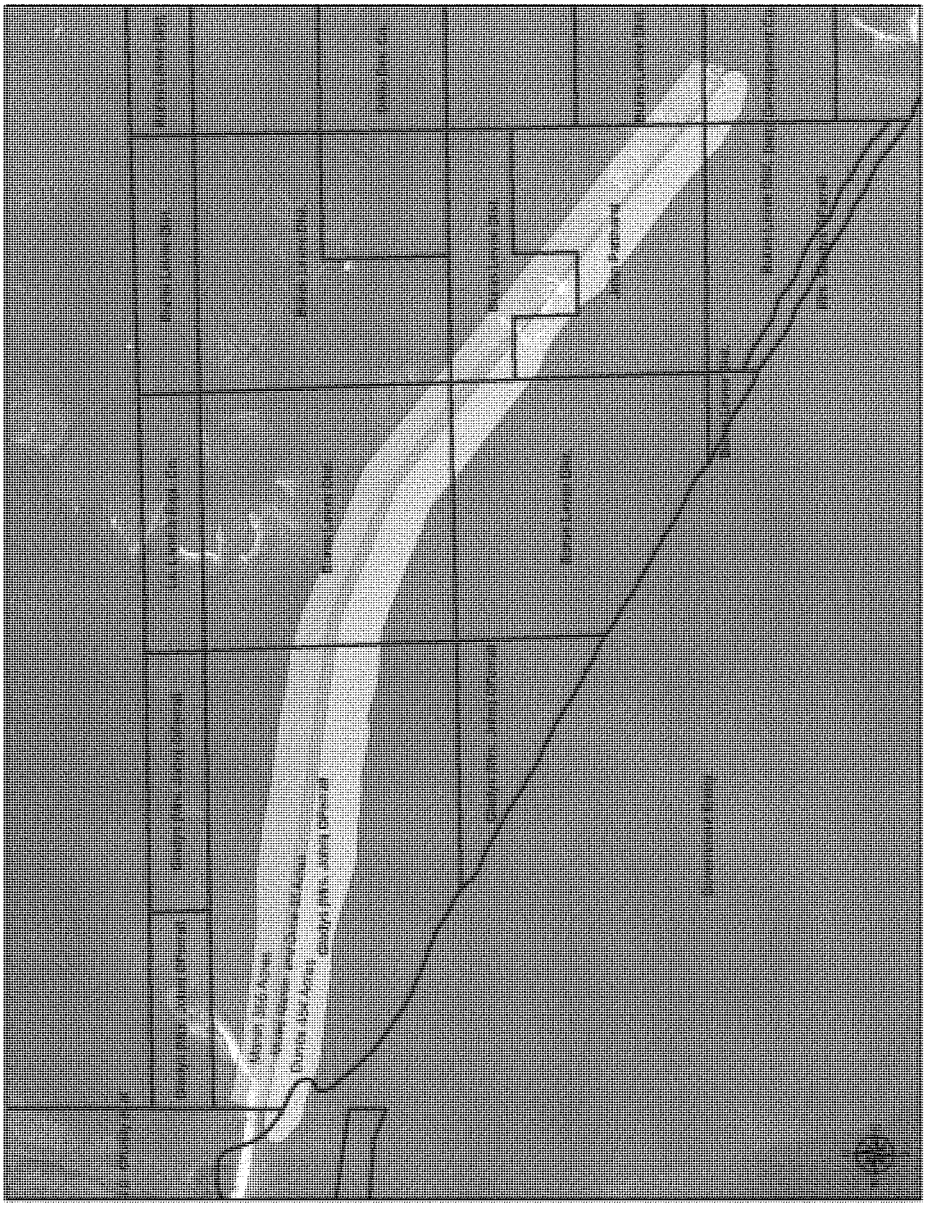
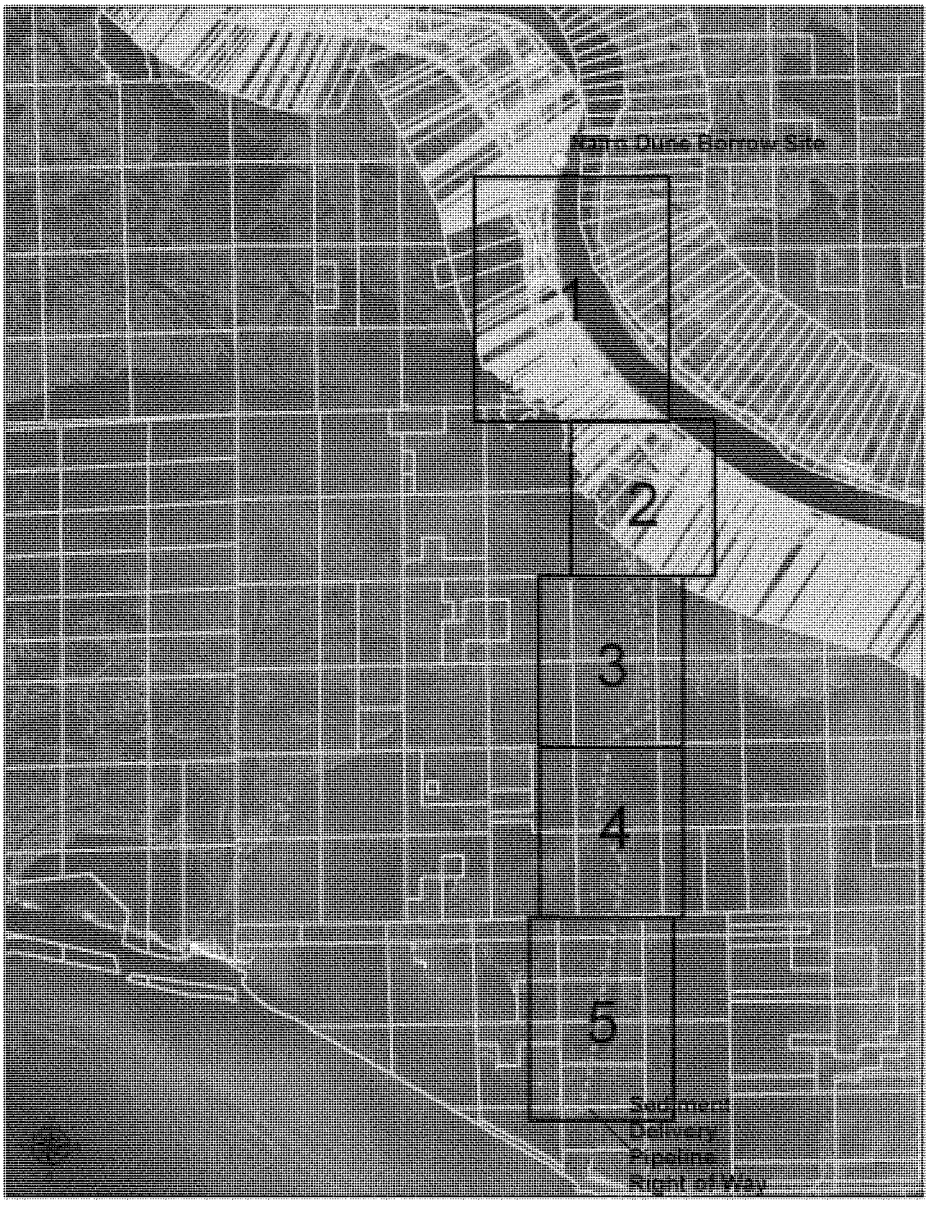


Shell Island – Ownership Maps for Pipeline Right of Way



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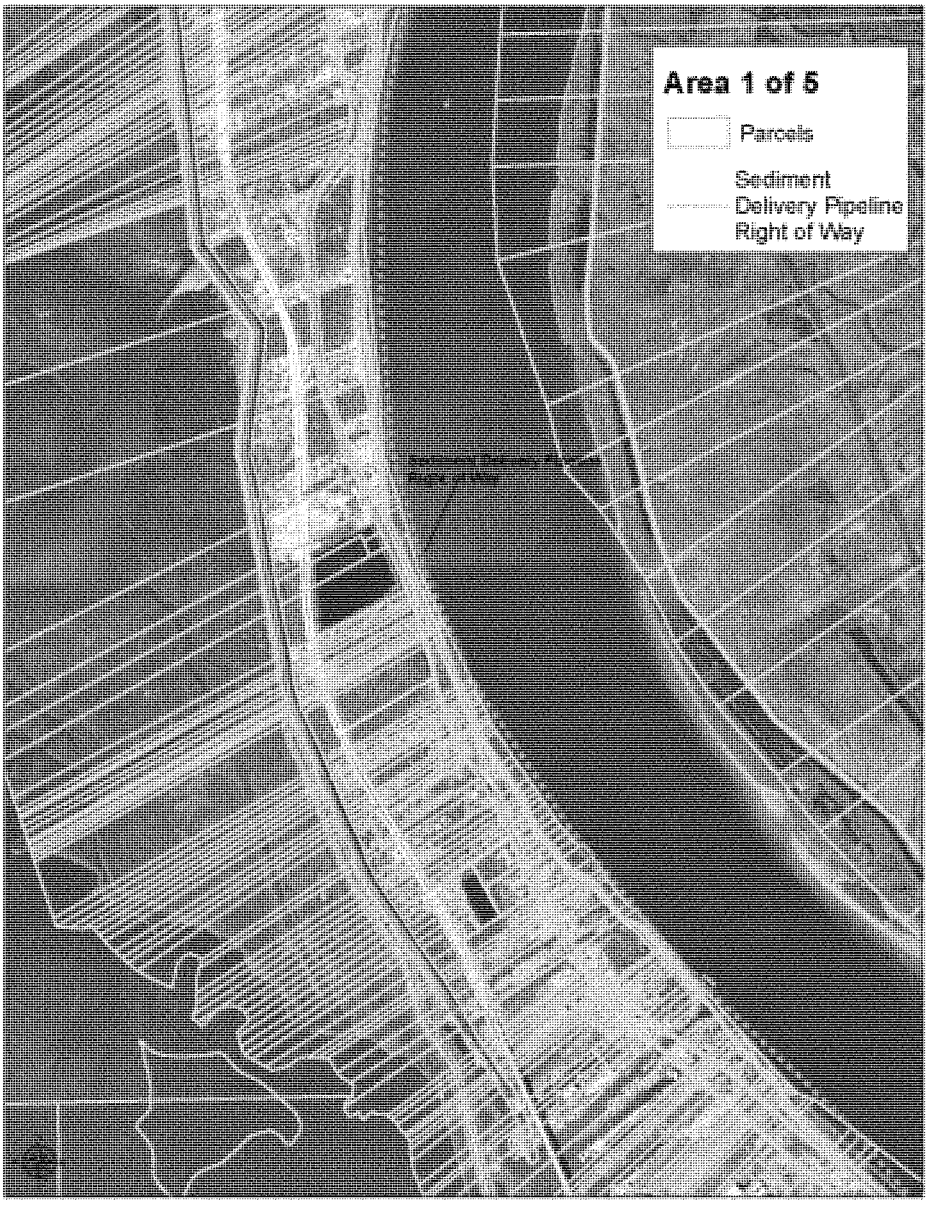

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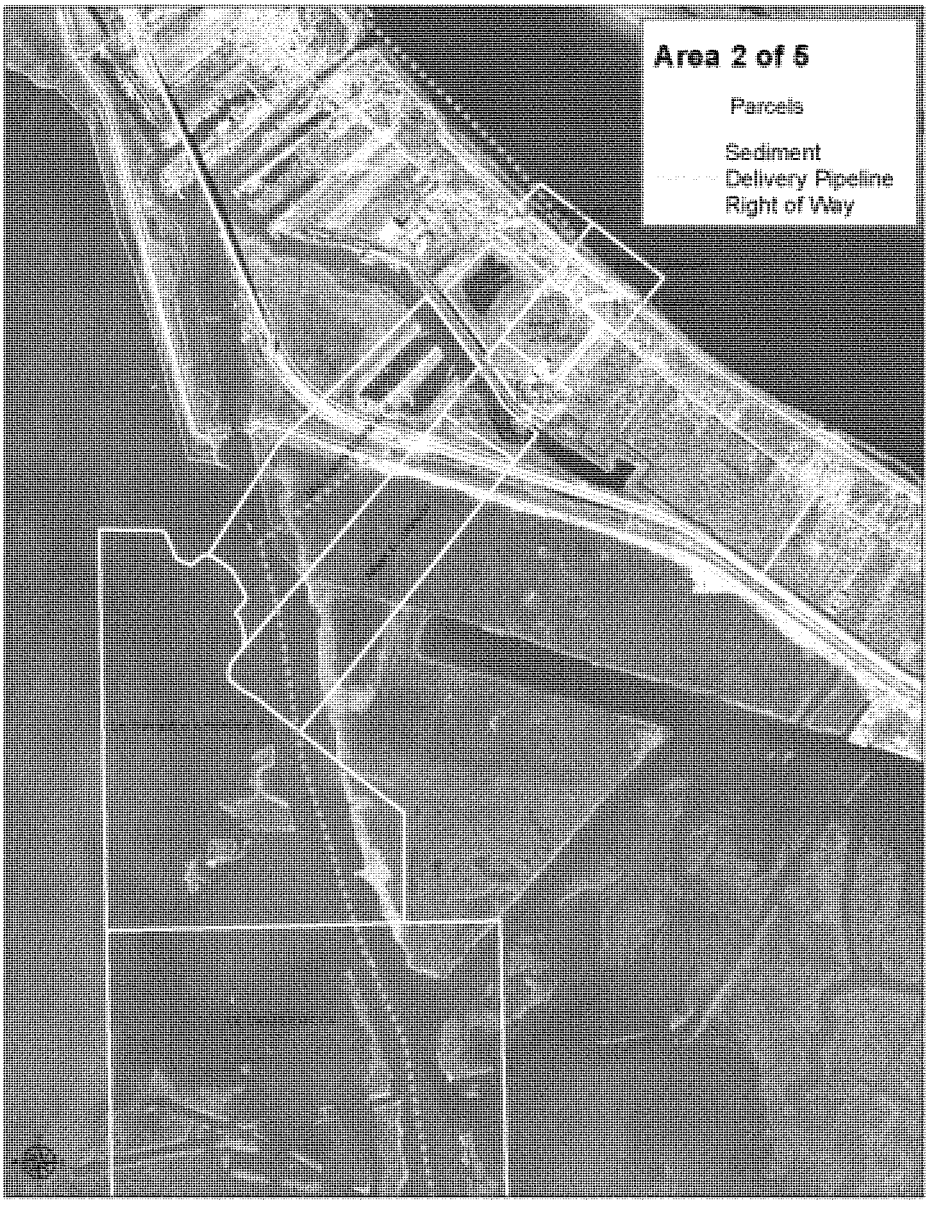
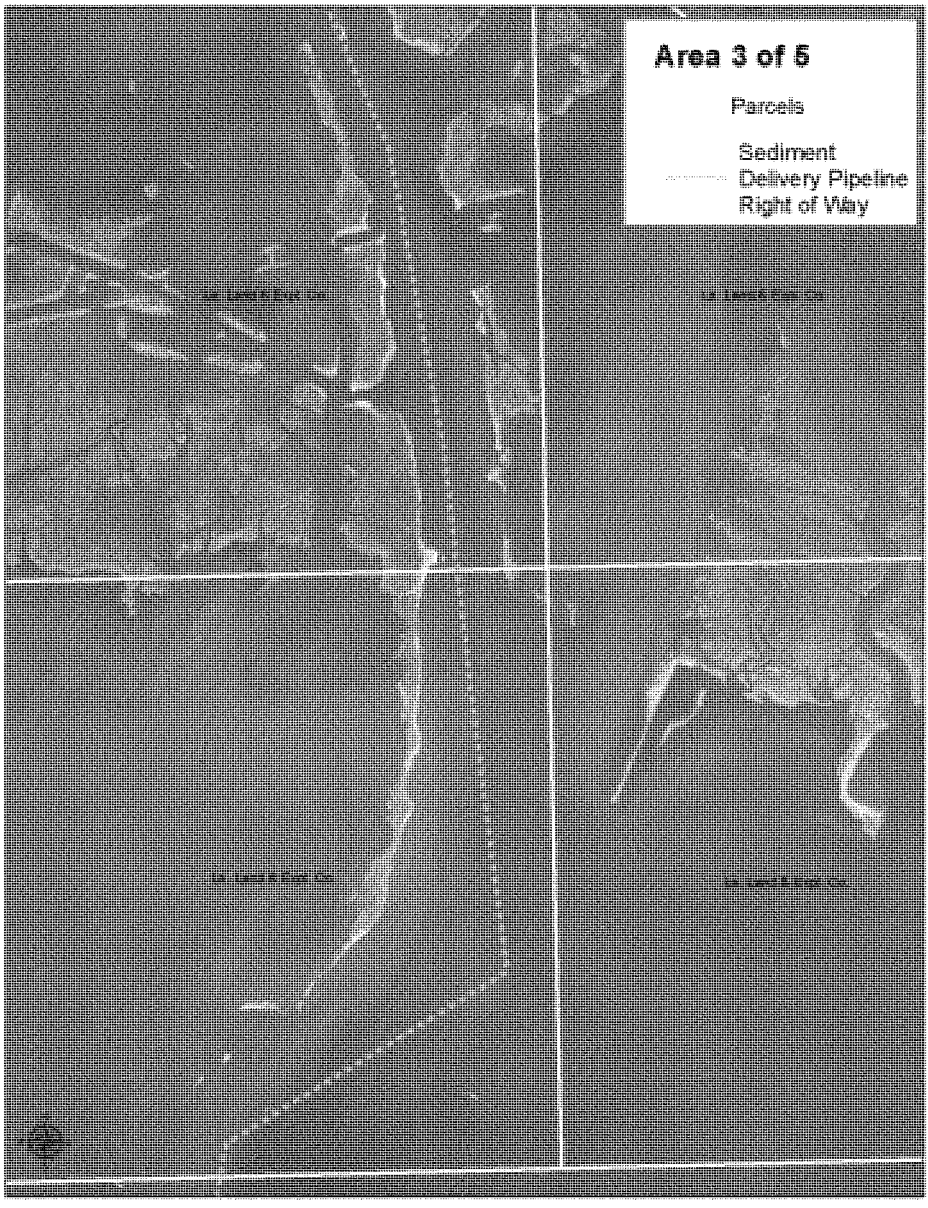
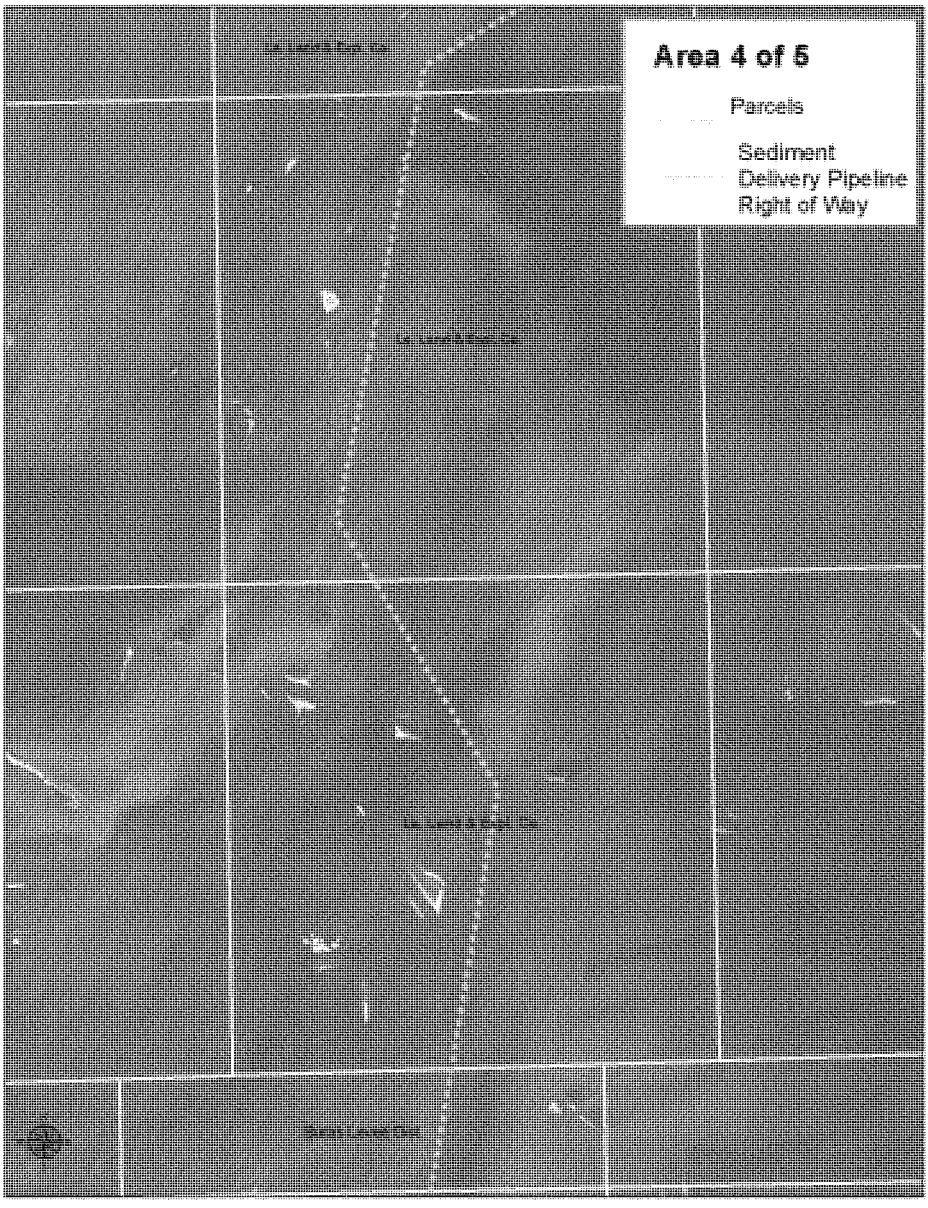


Shell Island – Ownership Maps for Pipeline Right of Way



Shell Island – Ownership Maps for Pipeline Right of Way



Shell Island – Ownership Maps for Pipeline Right of Way

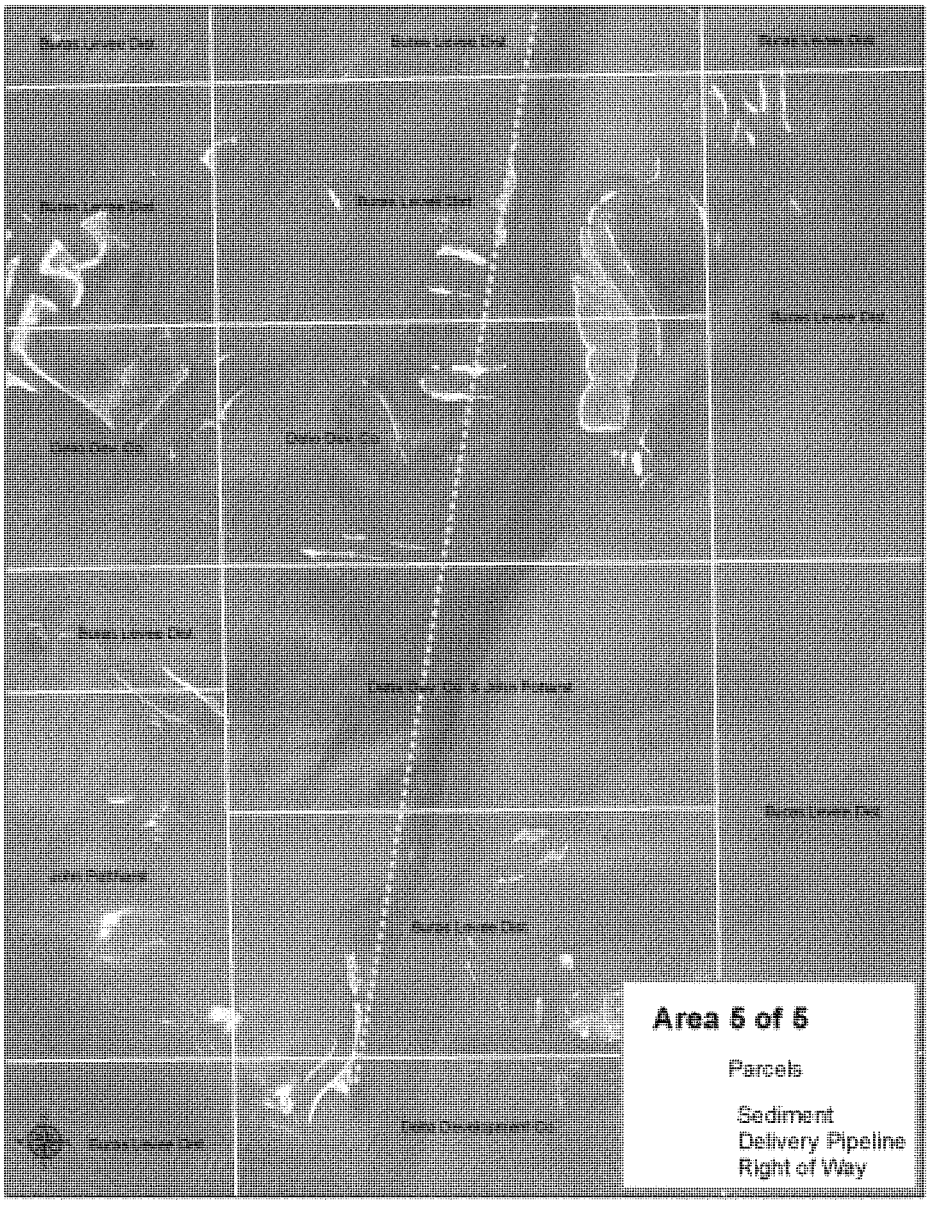


EXHIBIT B
STANDARD ESTATES

FEE EXCLUDING MINERALS
(With Restriction on Use of the Surface)
(Standard Estate)

The fee simple title to (the land described in Schedule A) (Tracts Nos. ___, ___, and ___), subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines; excepting and excluding from the taking all (coal) (oil and gas), in and under said land and all appurtenant rights for the exploration, development, production and removal of said (coal) (oil and gas), but without the right to enter upon or over the surface of said land for the purpose of drilling and extracting there from said (coal) (oil and gas).

UTILITY AND/OR PIPELINE EASEMENT
(Standard Estate)

A perpetual and assignable easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos. _____,_____ and _____), for the location, construction, operation, maintenance, alteration; repair and patrol of (overhead) (underground) (specifically name type of utility or pipeline); together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions and other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and
pipelines.

TEMPORARY WORK AREA EASEMENT
(Standard Estate)

A temporary easement and right of way in, on, over and across (the land described in Schedule A) (Tracts Nos. _____, _____ and _____), for a period not to exceed _____, beginning with date possession of the land is granted to the United States, for use by the United States, its representatives, agents, and contractors as a (borrow area) (work area), including the right to (borrow and/or deposit fill, spoil and waste material thereon) (move, store and remove equipment and supplies, and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the _____ Project, together with the right to trim, cut, fell and remove there from all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right of way; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

EXHIBIT C
CHART OF ACCOUNTS

	LCA - Barataria Bay Basin						
					AMOUNT	CONTINGENCY	PROJECT
	SHELL ISLAND COST						COST
						ROUNDED	$2,010,000
	TOTAL PROJECT COSTS				$1,607,600	$401,900	$2,009,500
01	**LANDS AND DAMAGES**		CONTINGENCY	PROJECT	$1,607,600	$401,900	$2,009,500
				COST			
01B	**ACQUISITIONS**						
01B10	BY GOVERNMENT	0	0	0			
01B20	BY NON-FEDERAL SPONSOR (NFS)	$215,000	$53,750	$268,750			
01B30	BY GOVT ON BEHALF OF NFS	0	0	0			
01B40	REVIEW OF NFS	$63,000	$15,750	$78,750			
01C	**CONDEMNATIONS**						
01C10	BY GOVERNMENT	0	0	0			
01C20	BY NFS	$140,000	$35,000	$175,000			
01C30	BY GOVT ON BEHALF OF NFS	0	0	0			
01C40	REVIEW OF NFS	$14,000	$3,500	$17,500			
01E	**APPRAISAL**						
01E10	BY GOVT (IN HOUSE)	0	0	0			
01E20	BY GOVT (CONTRACT)	0	0	0			
01E30	BY NFS	$239,600	$59,900	$299,500			
01E40	BY GOVT ON BEHALF OF NFS	0	0	0			
01E50	REVIEW OF NFS	$40,000.0	$10,000.0	$50,000			
01F	**PL 91-646 ASSISTANCE**						
01F10	BY GOVERNMENT	0	0	0			
01F20	BY NFS	0	0	0			
01F30	BY GOVT ON BEHALF OF NFS	0	0	0			
01F40	REVIEW OF NFS	0	0	0			
01G	**TEMPORARY PERMITS/LICENSES/RIGHTS-OF-ENTRY**						
01G10	BY GOVERNMENT	0	0	0			
01G20	BY NFS	0	0	0			
01G30	BY GOVT ON BEHALF OF NFS	0	0	0			
01G40	REVIEW OF NFS	0	0	0			
01G50	OTHER	0	0	0			
01G60	DAMAGE CLAIMS	0	0	0			
01N00	**FACILITY/UTILITY RELOCATIONS (Subordination Agreement)**						
01R	**REAL ESTATE PAYMENTS**						
01R1	**LAND PAYMENTS**						
01R1A	BY GOVERNMENT	0	0	0			
01R1B	BY NFS	$896,000	$224,000	$1,120,000			
01R1C	BY GOVT ON BEHALF OF NFS	0	0	0			
01R1D	REVIEW OF NFS	0	0	0			
01R2	**PL 91-646 ASSISTANCE PAYMENTS**						
01R2A	BY GOVERNMENT	0	0	0			
01R2B	BY NFS	0	0	0			
01R2C	BY GOVT ON BEHALF OF NFS	0	0	0			
01R2D	REVIEW OF NFS	0	0	0			
01R3	**DAMAGE PAYMENTS**						
01R3A	BY GOVERNMENT	0	0	0			
01R3B	BY NFS	0	0	0			
01R3C	BY GOVT ON BEHALF OF NFS	0	0	0			
01R3D	REVIEW OF NFS	0	0	0			
01R9	**OTHER**	0	0	0			
01T	**LERRD CREDITING**						
01T20	ADMINISTRATIVE COSTS (By Gov't and NFS)	0	0	0			
	Revision -6/7/2011 revised LS to NFS						

	LCA - Barataria Bay Basin						
					AMOUNT	CONTINGENC	PROJECT
	CAMAINADA HEADLAND COST						COST
						ROUNDED	$1,651,000
	TOTAL PROJECT COSTS				$1,320,600	$330,160	$1,650,760
01	LANDS AND DAMAGES		CONTINGENCY	PROJECT	$1,320,600	$330,160	$1,650,760
				COST			
01B	ACQUISITIONS						
01B10	BY GOVERNMENT	0	0	0			
01B20	BY NON-FEDERAL SPONSOR (NFS)	$74,500	$18,630	$93,130			
01B30	BY GOVT ON BEHALF OF NFS	0	0	0			
01B40	REVIEW OF NFS	$22,500	$5,630	$28,130			
01C	CONDEMNATIONS						
01C10	BY GOVERNMENT	0	0	0			
01C20	BY NFS	$50,000	$12,500	$62,500			
01C30	BY GOVT ON BEHALF OF NFS	0	0	0			
01C40	REVIEW OF NFS	$5,000	$1,250	$6,250			
01E	APPRAISAL						
01E10	BY GOVT (IN HOUSE)	0	0	0			
01E20	BY GOVT (CONTRACT)	0	0	0			
01E30	BY NFS	$61,600	$15,400	$77,000			
01E40	BY GOVT ON BEHALF OF NFS	0	0	0			
01E50	REVIEW OF NFS	$14,000.0	$3,500.0	$17,500			
01F	PL 91-646 ASSISTANCE						
01F10	BY GOVERNMENT	0	0	0			
01F20	BY NFS	0	0	0			
01F30	BY GOVT ON BEHALF OF NFS	0	0	0			
01F40	REVIEW OF NFS	0	0	0			
01G	TEMPORARY PERMITS/LICENSES/RIGHTS-OF-ENTRY						
01G10	BY GOVERNMENT	0	0	0			
01G20	BY NFS	0	0	0			
01G30	BY GOVT ON BEHALF OF NFS	0	0	0			
01G40	REVIEW OF NFS	0	0	0			
01G50	OTHER	0	0	0			
01G60	DAMAGE CLAIMS	0	0	0			
01N00	FACILITY/UTILITY RELOCATIONS (Subordination Agreement)						
01R	REAL ESTATE PAYMENTS						
01R1	LAND PAYMENTS						
01R1A	BY GOVERNMENT	0	0	0			
01R1B	BY NFS	$1,093,000	$273,250	$1,366,250			
01R1C	BY GOVT ON BEHALF OF NFS	0	0	0			
01R1D	REVIEW OF NFS	0	0	0			
01R2	PL 91-646 ASSISTANCE PAYMENTS						
01R2A	BY GOVERNMENT	0	0	0			
01R2B	BY NFS	0	0	0			
01R2C	BY GOVT ON BEHALF OF NFS	0	0	0			
01R2D	REVIEW OF NFS	0	0	0			
01R3	DAMAGE PAYMENTS						
01R3A	BY GOVERNMENT	0	0	0			
01R3B	BY NFS	0	0	0			
01R3C	BY GOVT ON BEHALF OF NFS	0	0	0			
01R3D	REVIEW OF NFS	0	0	0			
01R9	OTHER	0	0	0			
01T	LERRD CREDITING						
01T20	ADMINISTRATIVE COSTS (By Gov't and NFS)	0	0	0			
	Revision - 6/7/2011 revised LS to NFS						

EXHIBIT D
NON FEDERAL SPONSOR ASSESSMENT

ASSESSMENT OF NON-FEDERAL SPONSOR'S
REAL ESTATE ACQUISITION CAPABILITY
(Office of Coastal Protection and Restoration (OCPR))

I. Legal Authority:

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? **YES**

b. Does the sponsor have the power of eminent domain for this project? **YES**

c. Does the sponsor have "quick-take" authority for this project? **NO**
Although the sponsor does not have quick take authority, if this should be needed for the project, the sponsor may partner with a Levee District or Parish Government which has that authority.

d. Are any of the lands/interests in land required for the project located outside the sponsor's political boundary? **NO**

e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? **NO**

II. Human Resource Requirements:

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? **NO**

b. If the answer to II.a. is "yes," has a reasonable plan been developed to provide such training? **N/A**

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? **N/A**

d. Is the sponsor's projected in-house staffing level sufficient considering its other workload, if any, and the project schedule?

Not at this time. CPRA is presently under development. It is expected that the staff will continue to grow in the upcoming months/years, provided sufficient budget & proper legal authorities.

e. Can the sponsor obtain contractor support, if required in a timely fashion? **YES**

f. Will the sponsor likely request USACE assistance in acquiring real estate?
It is not likely that the sponsor will request assistance.

III. Other Project Variables:

a. Will the sponsor's staff be located within reasonable proximity to the project site? **YES**

b. Has the sponsor approved the project/real estate schedule/milestones?

At the feasibility level there are too many unknowns to develop a definite project schedule. Once project designs are finalized, the sponsor will be requested to provide an acquisition schedule.

IV. Overall Assessment:

a. Has the sponsor performed satisfactorily on other USACE projects? **YES**

b. With regard to this project, the sponsor is anticipated to be: highly capable/fully capable/moderately capable/marginally capable/insufficiently capable.

Fully capable

V. Coordination:

a. Has this assessment been coordinated with the sponsor?
YES

b. Does the sponsor concur with this assessment?
YES

Prepared by:
Judith Y. Gutierrez
Chief, Appraisal. & Planning Branch

Approved by:
Linda C. Labure
Chief, Real Estate Division

LOUISIANA COASTAL AREA
BARATARIA BASIN BARRIER SHORELINE RESTORATION
FINAL CONSTRUCTION REPORT
AND
FINAL ENVIRONMENTAL IMPACT STATEMENT

APPENDIX D
ENVIRONMENTAL APPENDIX

Annex A: Clean Water Act Section 401 Water Quality Certification
Clean Water Act Section 404(b)(1) Evaluation

Annex B: Louisiana Coastal Resources Program Consistency Determination

Annex C: National Marine Fisheries Service Scoping / Planning Aid Letter

Annex D: State Historic Preservation Officer (SHPO) and Tribal Coordination Letters

Annex E: USACE Draft and Final Biological Assessment
U.S. Fish and Wildlife Service Draft and Final Biological Opinion

Annex F: U.S. Fish and Wildlife Service Draft and Final Coordination Act Report

Annex G: U.S. Fish and Wildlife Service Cooperating Agency Letter
U.S. Fish and Wildlife Service Scoping / Planning Aid Letter

LOUISIANA COASTAL AREA
BARATARIA BASIN BARRIER SHORELINE RESTORATION
FINAL CONSTRUCTION REPORT
AND
FINAL ENVIRONMENTAL IMPACT STATEMENT

APPENDIX D
ANNEX A

Clean Water Act Section 401 Water Quality Certification

Clean Water Act Section 404(b)(1) Evaluation

BOBBY JINDAL
GOVERNOR

PEGGY M. HATCH
SECRETARY

State of Louisiana

DEPARTMENT OF ENVIRONMENTAL QUALITY
ENVIRONMENTAL SERVICES

SEP 30 2011

U.S. Army Corps of Engineers- New Orleans District
P.O. Box 60267
New Orleans, LA 70160-0267

Attention: William Klein

RE: Water Quality Certification (WQC 110830-01/AI 101235/CER 20110007)
Louisiana Coastal Area- Barataria Basin Shoreline Restoration project
Lafourche, Jefferson & Plaquemines Parishes

Dear Mr. Klein:

The Louisiana Department of Environmental Quality (the Department) has reviewed your application to restore barrier islands, in the vicinity between the Caminada Headland to Shell Island, Louisiana.

Based on the information provided in the application, the Department made a determination that the requirements for a Water Quality Certification have been met and concludes that the placement of the fill material will not violate water quality standards of Louisiana as provided for in LAC 33:IX.Chapter 11. Therefore, the Department hereby issues a Water Quality Certification to the U.S. Army Corps of Engineers- New Orleans District.

If you have any questions, please call Jamie Phillippe at 225-219-3225.

Sincerely,

Melvin C. Mitchell, Sr.
Administrator
Water Permits Division

MCM/jjp

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT *(33 CFR 325)*	*OMB APPROVAL NO. 0710-003* *Expires October 1996*

Public reporting burden for this collection of information is estimated to average 5 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Service Directorate of Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003), Washington, DC 20503. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authority: 33 USC 401, Section 10; 1413, Section 404. Principal Purpose: These laws require permits authorizing activities in, or affecting, navigable waters of the United States, the discharge of dredged of fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters. Routine Uses: Information provided on this form will be used in evaluating the application or a permit. Disclosure: Disclosure of requested information is voluntary. If information is not provided, however, the permit application cannot be processed nor can a permit be issued.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	*2. FIELD OFFICE CODE*	*3. DATE RECEIVED*	*4. DATE APPLICATION COMPLETED*

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME US Army Corps of Engineers, New Orleans District	*8. AUTHORIZED AGENT'S NAME AND TITLE (an agent is not required)* Same as Applicant
6. APPLICANT'S ADDRESS Planning , Programs and Programs and Project Management Division CEMVN-PDR-RS P.O. Box 60267 New Orleans, LA 70160-0267 ATTN:	*9. AGENT'S ADDRESS*
7. APPLICANT'S PHONE NOS. W/AREA CODE	*10. AGENT'S PHONE NOS. W/AREA CODE*
a. Residence ***b. Business*** (504) 862-2540	*a. Residence* *b. Business*

11. STATEMENT OF AUTHORIZATION

_____
APPLICANT'S SIGNATURE *DATE*

NAME, LOCATION AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)

Louisiana Coastal Area (LCA), Barataria Basin Barrier Shoreline Restoration

13. NAME OF WATERBODY, IF KNOWN (if applicable) Gulf of Mexico, Mississippi River, Bayou Lafourche	*14. PROJECT STREET ADDRESS (if applicable)*
15. LOCATION OF PROJECT *Lafourche, Jefferson and Plaquemines* Louisiana *COUNTY* *STATE*	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN, (see instructions)

17. DIRECTIONS TO THE SITE

The project site extends along the Barataria Basin shoreline from Belle Pass (mouth of Bayou Lafourche) to Shell Island

18. Nature of Activity (Description of project, include all features.)

The Tentatively Selected Plan (TSP) is a combination of Caminada Headland alternative 5 and Shell Island alternative 1. Title VII of WRDA 2007, Section 7006 (c)(1)(C) authorizes the construction of the BBBS Project in accordance with the restoration plan as outlined in the Report of the Chief of Engineers dated January 31, 2005. WRDA 2007 states that the cost of a project, including any modifications to the project, shall not exceed 150 percent of the cost of the project set in the authorization document. The cost stated in WRDA 2007 is $242,600,000. Therefore, as authorized, the BBBS Project is limited to a cost of $363,900,000. Of the final array, only Caminada alternative 5 and the combination of Caminada alternative 5 and Shell Island alternative 1 are within the authorized costs of WRDA 2007. Caminada alternative 5 as a stand alone alternative was eliminated due to its inability to meet the project goal listed in the 2004 report of preventing the intrusion of the Gulf of Mexico into the interior bays and marshes in Plaquemines Parish. Consequently, the interdisciplinary and interagency project delivery team selected the cost effective combined alternative of Caminada Alternative 5 and Shell Island 1 since the cost of this alternative was within the WRDA 2007 authorization and meets project objectives.

Caminada Headland

Caminada Headland Alternative 5 proposes a dune height of +7 feet NAVD88 with a dune width of 290 feet. Alternative 5 also proposes a landward beach and dune component in order to maximize acreage and longevity. The landward and seaward slopes would be set 20 horizontal to 1 vertical. The marsh fill is proposed on the landward side of the dune at an elevation of +2.0 feet NAVD88. Approximately 880 acres of beach/dune and 1,186 acres of marsh would be created, resulting in a total of 2,066 acres. Fill quantities for the dune and marsh fills would be 5.1 million and 5.36 million cubic yards, respectively. For the dune area, the material would be pumped from the dredge to the beach. The material would then be worked on the beach by bulldozers and front-end loaders. Points of direct access to the project area are Louisiana Highway 3090 and a beach road at Elmer's Island on the eastern end. For the marsh area, the material would be pumped from the offshore borrow site. The dune would serve as the southern dike for the marsh fill. Additional dikes would be constructed around the remaining perimeter. These operations would be completed in a manner that would minimize turbidity of the water at the dredge site and the discharge site. Figure 3-5 shows the plan view of alternative 5.

Approximately 71,500 feet of sand fencing would be installed. The sand fences would be porous barriers that would reduce wind speed along the coast such that sand being transported by the wind accumulates on the downwind side of the fence. The sand fences would promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings. Vegetative plantings would include a variety of native species. The recommended planting density is no greater than 8-foot centers.

The borrow area identified for the beach/dune restoration is Ship Shoal, a large submerged sand body in the Gulf of Mexico located offshore in south-central Louisiana. The shoal is about 31 miles long and 7 miles wide, lying in water depths of 9 feet to 30 feet. Preliminary studies have shown it is the remaining seaward shoal from one of the older, abandoned Mississippi River deltas. It is composed of well-graded quartz sand and is suitable for use in restoring the Caminada Headland since its grain size is similar to the sand found on the headland. The sediment is to originate from South Pelto, Blocks 12 and 13, which is approximately 40 miles from the project site. The borrow site for the marsh restoration would be located approximately 1.5 miles south of the central portion of the Caminada Headland, and 4.7 miles southwest of Caminada Pass. The estimated cost of construction, including contingencies, supervision and administration, real estate, and preconstruction engineering and design (PED), is $200,699,000. The estimated duration of construction is 939 days. It is estimated that the duration of plantings would be 750 days over a 3-year period. A complete construction design description is located in appendix A, annex 1 of the Integrated Construction Report and Draft Environmental Impact Statement.

The TSP will include renourishment of the Caminada Headland per the 2004 LCA report which included near-shore recovery of 2 million cubic yards of sand every 10 years. USACE operations and maintenance dredging of the Bayon Lafourche, Louisiana (Belle Pass) navigation project yields on average approximately 650,000 cubic yards of material every 1.5 to 2 years. Of this material, 500,000 cubic yards will be placed in the littoral drift south of Bayou Moreau where the long shore transport of material splits going east and west. The material will be placed, allowing the long shore transport and wave action to move and place the sediment along the headland. Over each 10 year period, an estimated 2 million cubic yards of material will be returned to the headland, replacing 53% of the sediment lost from the headland. Dredged material in excess of 500,000 cubic yards will be used beneficially per the requirements of the Bayou Lafourche, Louisiana navigation project. This renourishment is part of the non-Federal sponsor's operations and maintenance requirements. The non-Federal sponsor will pay the incremental cost of beneficially using this material over the federal standard. The average annual cost of the renourishment is estimated to be $2,852,103. Additional description of the O&M plan is included in section 3.9.6 of the integrated Construction Report and Draft EIS.

For the Caminada Headland component of the project, the estimation of average annual benefits measured in AAHUs, associated with periodic renourishment was not included as an output of the WVA model. Until remodeling is completed, an alternative method of computing the contribution of renourishment to total AAHUs was performed by directly adding to the existing estimate an incremental AAHU value that is equivalent to material quantities placed during each renourishment event. The renourishment cycle was set to correspond to existing target years depicted in the AAHU computational spreadsheet, except that target years 30 and 40 were added to ensure consistency of renourishment performance. Once the AAHUs associated with renourishment were added, the periodic and cumulative AAHUs estimates were recomputed consistent with existing methodology. The quantity of added AAHUs that is attributable to renourishment represents a target value that replaces 53 percent of the material that is currently being lost. With renourishment, the WVAs are estimated to increase to 417.3 for the Caminada Headland.

The renouishment will create a feeder beach along the nodal zone of the Caminada Headland. The nodal point is a "hot spot" due to bifurcation of the sediment transport, thus it breaches more frequently thau other locations on the Headland. By placing the material at the nodal point, the entire Headland will benefit by reducing breaching.

Shell Island

Under alternative 1, the Shell Island reach would be restored as two islands (Shell Island East and Shell Island West). Each island would include shoreface, dune, and marsh platforn features. The general alignment and configuration of this alternative is based on the restoration feature identified in the LCA Main Report. Shell Island East would be constructed with a dune width of approximately 281 feet. The width would be uniform along the restored shoreline, which would be 15,400 feet in length. The landward edge of the dune for Shell Island East for alternative 1 would be located along the approximate mean high water line of the remaining islands. With this alignment, the majority of the sand fill would be placed in front of the existing remnant islands. Shell Island East would be constructed with 232 acres of dune/berm and 206 acres of marsh.

On Shell Island West, the proposed shoreline restoration would extend partially into Coupe Bob, extending the length of the barrier shoreline provided by the existing islands. The dune width would be 250 feet. Shell Island West would be constructed with 100 acres of dune/berm and 145 acres of marsh. The dunes on both Shell Island East and Shell Island West would be built to a height of +6 feet NAVD.

The marsh on Shell Island East would have a typical width of 525 feet, widening along the northernmost 2,400 feet of the island to just over 1,200 feet wide. The marsh on Shell Island West follows the outline of the restoration feature described in the LCA 2004 Report, which has a triangular shape. The marsh platform at Shell Island West extends along approximately 4,500 feet of shoreline, with a maximum width of approximately 2,300 feet. In total, alternative 1 would create 332 acres of dune/beach and 351 acres of marsh, or 683 acres.

While the optimum upper elevation of the marsh surface is +2.0 feet, which is the upper elevation of the bay intertidal range, the post-construction marsh volumes are calculated based on the post-construction elevation of +2.5-feet. Settlement of the marsh material would lower the marsh elevation to the bay intertidal range within 1 year. Approximately 4,130,000 cubic yards of beach fill and 1,876,500 cubic yards of marsh would be required to construct alternative 1. Sand fencing and vegetative plantings would be similar to those described for the Caminada Headland alternative.

The borrow source for the dune/beach would be a large sand deposit near Nairn in the Mississippi River between mile markers 32 and 34, approximately 11 miles north of the project area. The borrow site is located in a river meander where greater sediment thickness is anticipated due to the presence of relict (vertically stacked) sand bars. USACE boring date indicates sand thickness of at least 70 feet. Based on samples obtained from vibracores, the saud grain size is comparable to the sand at the project site. The dredged material would be pumped from the Mississippi River via pipeline. The borrow source for the marsh restoration would be the Empire deposit, approximately 1.5 miles from the Empire Jetties. Water depths in the borrow area are from 16 feet to 20 feet. The borrow area occupies about 207 acres and total mixed sediment volumes range from 5.5 million to 6.6 million cubic yards for 15 foot and 20 foot cut depths, respectively. The sedimentary characteristics indicate a silt content of about 40 percent, a clay content of about 22 percent and sand content of about 38.percent. The estimated construction cost, including contingencies, supervision and administration, real estate, and PED is $141,659,000. It is estimated that duration for construction wonld be 635 days. It is estimated that the duration for the plantings would be 420 days over a period of 3 years. Complete design details are located in appendix A, annex 2 of the integrated Construction Report and Draft EIS.

19. Project Purpose (Describe the reason or purpose of the project, (see instrucion.)

The purpose of this study is to evaluate alternatives to restore the Barataria Bain barrier shoreline through shoreline and marsh restoration to ensure the continuing geomorphic and hydrologic form and function of the barrier structures.

USE BLOCKS 20-22 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

The purpose of the proposed action is to evaluate alternatives to restore the Caminada Headland and Shell Island features of the Barataria Basin barrier system through shoreline and marsh restoration to ensure the continuing geomorphic and hydrologic form and function of the barrier structures. Louisiana contains one of the largest expanses of coastal wetlands in the contiguous U.S. and accounts for 90 percent of the total coastal marsh loss occurring in the nation. The coastal wetlands, built by the deltaic process of the Mississippi River, contain an extraordinary diversity of habitats ranging from narrow natural levees and dunes to expanses of forested swamps and freshwater, intermediate, and brackish, and saline marshes. Without any action, the Caminada Headland would lose about 3,750 acres from the headlaud and approximately 14,780 acres from the area to the north (an area extending inland between Bayou Lafourche and Caminada Bay) (LCA Report 2004). Without any action, the Caminada Headland would likely be converted into shallow open water bottoms with only a skeletal framework of higher natural barrier ridges and canal spoil banks likely remaining by 2050. Without any action, land loss at Shell Island would likely continue at rates similar to present with an annual average rate of loss of 38.5 feet per year (range of 8.0 to 101.5 feet year). The coastal Louisiana land loss model predicts that all 386 acres of Shell Island could be lost by 2009 to 2027, depending ou which rate of land loss (short-term or long-tern) was used.

In addition to continued high rates of coastal barrier land loss, without implementing the proposed action other adverse impacts would include the loss of important and essential vegetated habitats used by fish and wildlife for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements; loss of productivity; loss of transitional habitat between estuarine and marine environments; and increased inter- and intra-specific competition between resident and migratory fish and wildlife species for decreasing wetland resources. There would also be a reduction in the availability of important stopover habitats used by migrating neotropical birds.

These coastal barrier landforms, along with their related hydrologic and biological processes, provide unique habitats that are crucial to the viability of migratory birds (providing breeding, wintering, and stopover habitat), commercial and recreational fisheries. Restoration of the shoreline and marsh platforms of Caminada Headland and Shell Island would restore the natural hydrologic function of the barrier island system. Restoration of these barrier shoreline landforms would decrease shoreline erosion and loss of interior wetlands in the Barataria Basin by reducing the extent and intensity of tidal, wave and storm processes behind the shorelines. An incidental benefit of the proposed action would be reduction of storm surge that would result from restored shoreline integrity and protected wetlands. Coastal landforms and wetlands are one of the "first lines of defense" for storm surges and thereby reduce the impact of flooding and storm surges on infrastructure in the coastal region.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Years.

Caminada Headland discharge site: The Ship Shoal borrow site would be used for construction of Caminada Headland barrier shoreline (beach and dune). This area is located in the Gulf of Mexico approximately 40 miles from the Caminada Headland. The Caminada Gulf of Mexico near-shore borrow site would be used for construction of marsh and is located approximately 1.5 miles south of the central portion of the Caminada Headland, and 4.7 miles southwest of the Caminada Pass (figure 6). Maintenance-dredged material from the Bayou Lafourche navigation bar channel would be used for renourishment of the Caminada Headland.

Shell Island discharge site: The Mississippi River borrow site, a large sand deposit located in the Mississippi River between mile markers 32 and 34 near Nairn, Louisiana, would be used for construction of barrier shoreline (beach and dune) at the proposed Shell Island discharge site. The Empire deposit, located approximately 1.5 miles from the Empire jetties, would be used as the near-shore Gulf of Mexico borrow site for construction of marsh (figure 7).

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Caminada Headland discharge site: The Caminada Headland discharge site is approximately 889 acres of barrier beach, dune and supratidal habitats and 1,186 acres of bayside intertidal salt marsh. Situated along the coastline of the Gulf of Mexico, the Caminada Headland is bounded on the west by Bayou Lafourche and the Belle Pass jetty, extending approximately 13 miles east to Caminada Pass, thence north to the Chevron pipeline canal. The back-barrier marsh component of the Caminada Headland is separated from the Chenier Unit to the north by a pipeline canal and is bounded to the south by the gulf shoreline. It is composed of a system of elevated ridges that support a maritime forest important to the physical integrity of the estuary and provides habitat for neotropical migratory birds. The Caminada Headland is unarmored and unstructured. There is evidence of longshore transport from east to west along the eastern section, including spit growth at an unknown rate (Ritchie et al., 1999) and bypassing of about 83,000 cy per year to Grand Isle (USACE 2004). See also Section I.C.- "General Description" in the integrated Construction Report and Draft EIS.

The TSP will include re-nourishment of the Caminada Headland per the 2004 LCA report which included near-shore recovery of 2 million cubic yards of sand every 10 years. USACE operations and maintenance dredging of the Bayou Lafourche, Louisiana (Belle Pass) navigation project yields on average approximately 650,000 cubic yards of material every 1.5 to 2 years. Approximately 500,000 cy of this maintenance dredged material will be placed in the littoral drift south of Bayou Moreau where the long shore transport of material splits going east and west. The material will be placed, allowing the longshore transport and wave action to move and place the sediment along the headland. Over each 10 year period, an estimated 2 million cubic yards of material will be returned to the headland, replacing 53 percent of the sediment lost from the headland. Dredged material in excess of 500,000 cubic yards would be used beneficially per the requirements of the Bayou Lafourche, Louisiana navigation project. This re-nourishment is part of the non-Federal sponsor's operations and maintenance requirements. The non-Federal sponsor will pay the incremental cost of beneficially using this material over the federal standard. The average annual cost of the re-nourishment is estimated to be $2,852,103. Additional description of the O&M plan is included in section 3.9.6 of the Integrated Construction Report and draft environmental impact statement.

Shell Island discharge site: The Shell Island discharge site is approximately 332 acres of barrier shoreline, dune and supratidal habitat and 351 acres of intertidal salt marsh. Situated along the coastline of the Gulf of Mexico, Shell Island is bounded on the west by Grand Bayou Pass, extending approximately 5.3miles to the Empire waterway and the west Empire jetty. See also Section I.C.-A General Description" in the integrated Construction Report and Draft EIS

23. Is Any Portion of the Work Already Complete? Yes _____ No __X___ IF YES, DESCRIBE THE COMPLETED WORK

24. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (If more than can be entered here, please attach a supplemental list.

25. *List of Other Certifications or Approvals/Denials Received from other Federal, State or Local Agencies for Work Described in This Application.*

AGENCY	TYPE APPROVAL	IDENTIFICATION NO.	DATE APPLIED	DATE APPROVED	DATE DENIED

To the best of my knowledge the proposed activity described in my permit application complies with and will be conducted in a manner that is consistent with the LA Coastal management Program.
**Would include but is not restricted to zoning, building and flood plain permits.*

26. *Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.*

SIGNATURE OF APPLICANT	DATE	SIGNATURE OF AGENT	DATE

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency The United States knowingly and willfully falsifies, conceals, or covers up by any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than five years, or both.

**U.S. :1994-520-478/82018*

CLEAN WATER ACT SECTION **404(b)(1) EVALUATION**

Louisiana Coastal Area (LCA)
Barataria Basin Barrier Shoreline Restoration
Integrated Construction Report and Final Environmental Impact Statement

I. PLAN DESCRIPTION

A. LOCATION

The Louisiana Coastal Area (LCA), Barataria Basin Barrier Shoreline (BBBS) Restoration Feasibility Study area is part of the 300-mile long Louisiana barrier system. The study area is within the Barataria Basin, situated along Louisiana's Gulf of Mexico coastline between the west bank of the Mississippi River at the active delta and the eastern shore of Terrebonne Bay. The basin covers a surface area of approximately 2,446 square miles. It is separated from the Gulf of Mexico by a chain of barrier islands which form the BBBS. The BBBS serves as a natural barrier to storm events, and to reduce marine influences on interior wetlands within the basin. It is comprised of six reaches, including the Caminada Headland, Grand Isle, Grand Terre, Chenier Ronquille, Shell Island, and Scofield (**figure 1**)(USACE 2004). The proposed shoreline restoration for the BBBS includes the Caminada Headland and Shell Island.

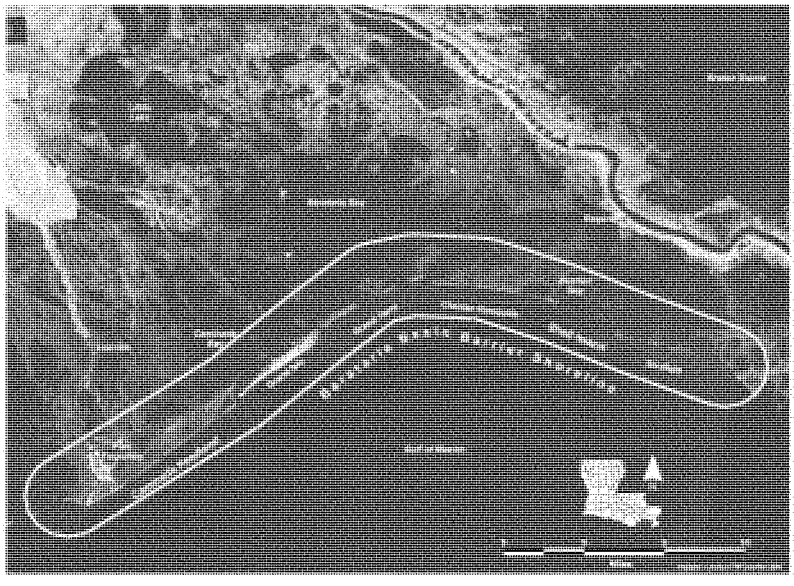


Figure 1. Barataria Basin Barrier Shoreline.

1.4.1 Caminada Headland

The Caminada barrier headland (also known as the Caminada-Moreau Headland) is the predominant feature of the Bayou Lafourche barrier system, and includes flanking islands and the retreating headland of the Bayou Lafourche distributary of the Mississippi River (**figure 2**). The southwest to northwest-oriented Caminada-Moreau Headland extends approximately 13 miles between Belle Pass to the west and Caminada Pass to the east. Hundreds of offshore drilling rigs in the Gulf of Mexico send gas and oil to the mainland through Port Fourchon. It is one of the most rapidly eroding shorelines in the United States (McBride et al. 1992). Historic maps show that the west end of the Caminada-Moreau Headland is retreating more rapidly than the east end of the headland (Williams et al. 1992).

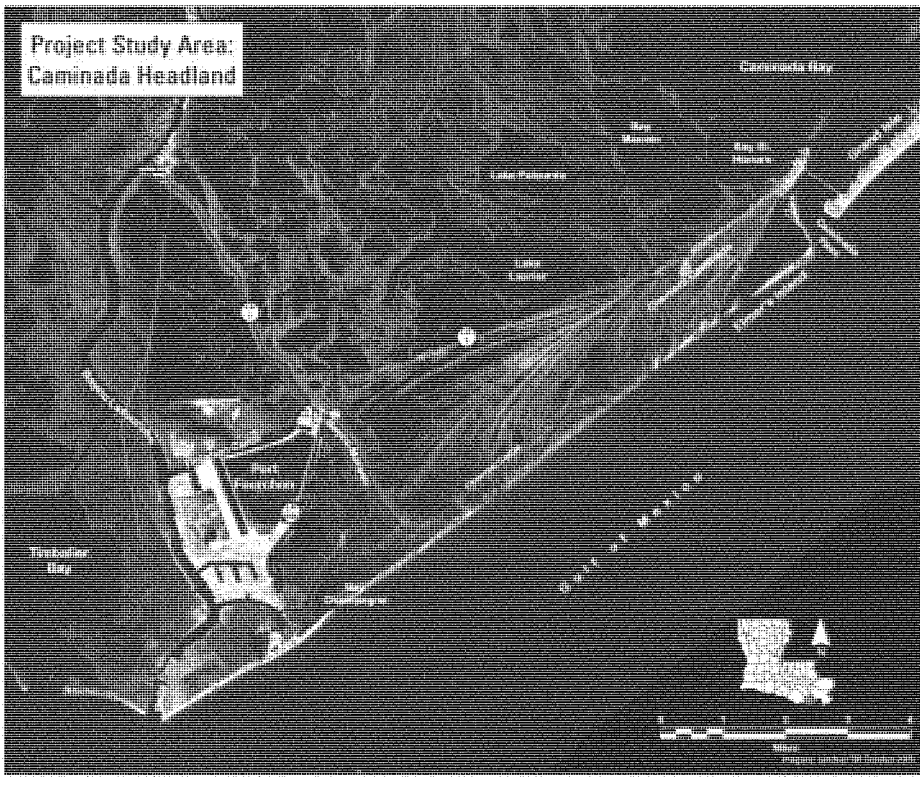


Figure 2. Caminada Headland study area.

1.4.2 Shell Island

The Shell Island reach (formerly Lanaux Island) is part of the 25-mile long Plaquemines barrier system, and is characterized by rapidly retreating remnant barrier islands and spits which enclose shallow bays such as Shell Island Bay and Bastian Bay (**figure 3**). The Shell Island reach extends approximately 5.2 miles between Grand Bayou Pass to the west to Fontanelle Pass and the Empire jetties to the east. The approximately 1.4-mile long Shell Island West extends from Grand Bayou Pass to Coupe Bob, and is composed primarily of reworked oyster shells that formed into ridges and swales produced by waves refracting into the entrance to Grand Bayou Pass. Shell Island East is approximately 2.5 miles long and extends from Coupe Bob to Fontanelle Pass. These rapidly retreating barrier islands are becoming increasingly narrower and separated from the remnants of the Plaquemines interior marshes.

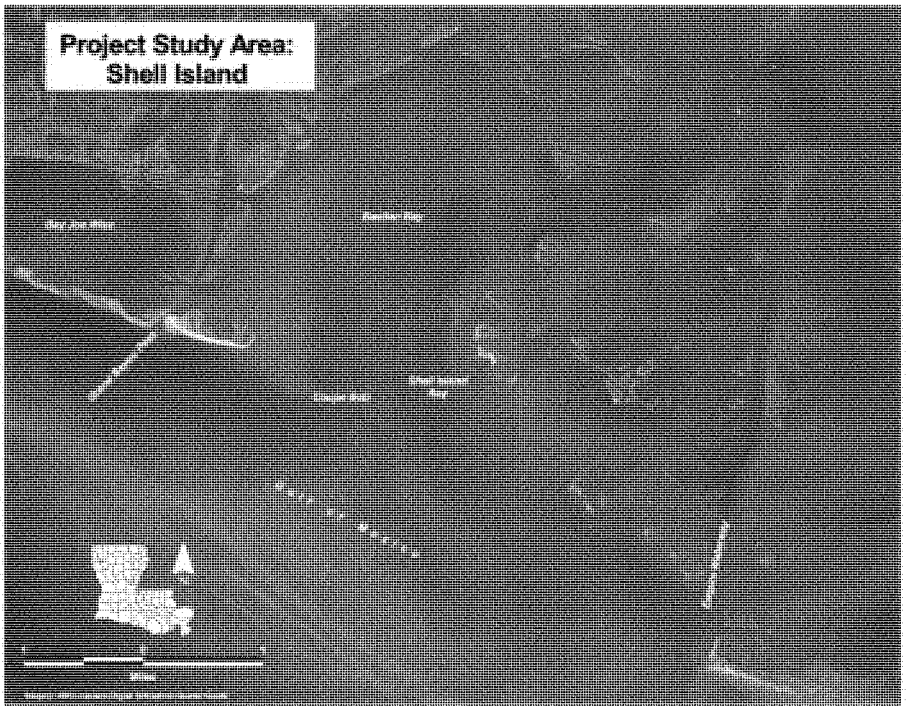


Figure 3. Shell Island reach study area.

B. STUDY AUTHORITY

The LCA Barataria Basin Barrier Shoreline Restoration Study is authorized through resolutions of the U.S. House of Representatives and Senate Committees on Public Works, 19 April 1967 and 19 October 1967. These resolutions requested a review of prior USACE reports by the Chief

of Engineers to determine the advisability of improvements or modifications to existing improvements in the coastal area of Louisiana in the interest of hurricane protection, prevention of saltwater intrusion and erosion, preservation of fish and wildlife, and related water resources purposes. These resolutions contain the following language:

> *"RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors created under Section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby requested to review the reports of the Chief of Engineers on the Mermentau River and Tributaries and Gulf Intracoastal Waterway and connecting waters, Louisiana, published as Senate Document Numbered 231, Seventy-ninth Congress, on the Bayou Teche, Teche-Vermilion Waterway and Vermilion River, Louisiana, published as Senate Document Numbered 93, Seventy-seventh Congress, on the Calcasieu River salt water barrier, Louisiana, published as House Document Numbered 582, Eighty-seventh Congress, and on Bayous Terrebonne, Petit Caillou, Grand Caillou, Dularge, and connecting channels, Louisiana, and the Atchafalaya River, Morgan City to the Gulf of Mexico, published as House Document Numbered 583, Eighty-seventh Congress, and other pertinent reports including that on Bayou Lafourche and Lafourche-Jump Waterway, Louisiana, published as House Document Numbered 112, Eighty-sixth Congress, with a view to determining the advisability of improvements or modifications to existing improvements in the coastal area of Louisiana in the interest of hurricane protection, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and related water resource purposes."*

The Barataria Basin Barrier Shoreline Restoration Project was identified as one of 15 critical near-term restoration projects in the Louisiana Coastal Area (LCA), Louisiana, Ecosystem Restoration Study (LCA Report 2004). The LCA Ecosystem Restoration Plan was recommended for authorization by the Chief of Engineers on 21 January 2005. The Assistant Secretary of the Army for Civil Works, after obtaining the concurrence of the Office of Management and Budget, provided his report on the Louisiana Coastal Area to Congress on 18 November 2005. Title VII of the Water Resources Development Act of 2007, P.L. 110-114, Section 7006(c)(1)(C) authorizes construction, subject to approval of the Secretary of the Army, of the Barataria Basin Shoreline Restoration project.

C. STUDY PURPOSE AND SCOPE

The purpose of the proposed action is to restore the geomorphic form and function of the Caminada Headland and Shell Island reaches of the BBBS. The proposed action is needed to reverse the current trend of degradation in the Caminada Headland and Shell Island areas of the barrier shoreline. Without any action, the Caminada Headland would lose approximately 3,750 acres from the headland and approximately 14,780 acres from the area to the north (an area extending inland between Bayou Lafourche and Caminada Bay), and would likely convert to shallow open water bottoms with only a skeletal framework of higher natural barrier ridges and canal spoil banks likely remaining by 2050 (LCA Report 2004). Land loss at Shell Island would

likely continue at rates similar to present with an annual average rate of loss of 38.5 feet-per-year (range of 8.0 to 101.5 feet-per-year). The coastal Louisiana land loss model predicted that all 386 acres of Shell Island would be lost by 2009 to 2027, depending on which rate of land loss (short-term or long-term) was used. Restoration efforts would target ecologically distinct, critical, high priority areas that would increase sustainability with essential form and function of the natural barrier ecosystem.

In addition to high rates of coastal land loss, without implementing the proposed action, other adverse impacts would include the loss of important and essential vegetated habitats used by fish and wildlife for shelter, nesting, roosting, cover, nursery, and other life requirements; loss of transitional habitat between estuarine and marine environments; and increased inter- and intra-specific competition between resident and migratory fish and wildlife species for decreasing wetland resources. There would also be a reduction in the availability of important stopover habitats used by migrating neotropical birds.

These coastal barrier landforms, along with their related hydrologic and biological processes, provide unique habitats that are crucial to the viability of migratory birds (providing breeding, wintering, and stopover habitat), as well as commercial and recreational fisheries. Restoration of the shoreline and marsh platforms of Caminada Headland and Shell Island would restore the natural hydrologic function of the barrier island system. Restoration of these barrier shoreline landforms would decrease shoreline erosion and the loss of interior wetlands in the Barataria Basin by reducing the extent and intensity of tidal, wave and storm processes behind the shorelines. An incidental benefit of the proposed action would be reduction of storm surge that would result from restored shoreline integrity and protected wetlands. Coastal landforms and wetlands are one of the "first lines of defense" for storm surges and thereby reduce the impact of flooding and storm surges on infrastructure in the coastal region.

Model results from the Louisiana Coastal Protection and Restoration Study (LACPR 2009) indicate that the barrier islands provide some level of protection as the first line of defense. Raising the barrier islands caused a decrease in the peak water level and wave energy landward of the barrier islands. The primary infrastructure that would be protected by this project includes the only evacuation route for that area (Louisiana Highway 1), as well as Port Fourchon and related petroleum storage and transport facilities, including the onshore component of the Louisiana Offshore Oil Port (LOOP)—the Fourchon Booster Station, which supplies oil to the Clovelly Dome Storage Terminal. By supplying oil to Clovelly Dome and its interconnection to other pipelines, crude oil from LOOP can be pumped to nearly 50 percent of the nation's refining capacity. These major infrastructure facilities are located on the inland portion of the Caminada Headland. Port Fourchon supports 75 percent of the deepwater oil and gas production in the Gulf as the point of departure for crew boats, equipment and supplies, rig components, and oilfield services.

C. GENERAL DESCRIPTION

The Recommended Plan (RP) is Alternative C5/S5 (RP): Caminada Alternative 5 – Preferred Dune with Expanded Marsh and Renourishment / Shell Island Alternative 5 – Single Island with 10 year Advanced Fill, and 2 Renourishments. A total of approximately 2,066 acres, including

880 acres of beach/dune and 1,186 acres of back barrier marsh, would be restored at the Caminada Headland (**figure 4**). The borrow area identified for the beach/dune restoration component of the Caminada Headland would be Ship Shoal, a large submerged sand body located in the Gulf of Mexico approximately 40 miles from the Caminada Headland. The near-shore Caminada borrow site for the marsh restoration is located approximately 1.5 miles south of the central portion of the Caminada Headland, and 4.7 miles southwest of Caminada Pass. Fill quantities for the beach/dune and marsh restoration features would be approximately 5.1 million cubic yards (cubic yards) and 5.4 million cubic yards, respectively. The dune would be constructed to an elevation of +7 feet NAVD with a width of approximately 209 feet. Material would be pumped from the dredge to the beach and worked on the beach by bulldozers and front-end loaders. For the marsh restoration area, material would be pumped from the Caminada nearshore borrow site and placed on the landward side of the dune to a final elevation of +2.0 feet NAVD. The dune would serve as the southern dike for the marsh fill and additional dikes would be constructed around the remaining perimeter. Vegetative plantings would include a variety of native species with a planting density of no greater than 8-foot centers. Approximately 71,500 feet of sand fencing would be installed to promote deposition of windblown sand, create dune features, reduce trampling of existing dunes, and protect vegetative plantings.

In addition, the Recommended Plan for the Caminada Headland will include renourishment of the headland per the 2004 LCA report, which included near-shore recovery of 2 million cubic yards of sand every 10 years. USACE operations and maintenance dredging of the Bayou Lafourche, Louisiana (Belle Pass) navigation project yields, on average, approximately 650,000 cubic yards of material every 1.5 to 2 years. This material will be placed in the littoral drift south of Bayou Moreau where the sediment budget indicates that the long shore transport of material splits going east and west. The material will be placed unconfined between 100 and 300 feet offshore from the shoreline's top of bank, allowing the long shore transport and wave action to move and place the sediment along the headland. The material will be pumped offshore of the nodal point directly impacting approximately 67 acres.

The Caminada Headland is a high energy wave environment that is very dynamic. The material will be stacked no higher than + 6 feet MLG, but will be quickly reworked by the wind and waves. The pumping of the material will take approximately 54 days, with placement and removal of the pipeline taking a total of approximately 98 days. The pipe will be placed offshore. The material will be dredged from a federal navigation channel which previously received NEPA clearance for the maintenance dredging of the Bayou Lafourche channel. Approximately 124.2 acres will be directly impacted by the dredging. Over each 10 year period, an estimated 3.9 million cubic yards of material from six dredging cycles (650,000 cubic yards (cy) per cycle) will be returned to the headland. Unless the shoreline is in danger of breaching, timing of the renourishment will be dependent upon the maintenance dredging requirements of the Bayou Lafourche, Louisiana navigation project. Historically, maintenance dredging has begun as early as March and ended as late as November. This renourishment is part of the non-Federal sponsor's operations and maintenance requirements.

The purpose of the Operations and Maintenance (O&M) is to sustain the constructed footprint

and protect the headland north of the project footprint. The O&M is driven by the need to ensure continuity of the shoreface, and is not determined by the dredging cycle. The beach and dunes protect the more fragile marsh habitats. Once the shoreline has been breached, erosion rates increase. Should the shoreline be in danger of breaching, sediment would be placed near the breach to supplement the existing sediment. If maintenance dredging of the Bayou Lafourche channel is not scheduled, the non-Federal sponsor must provide another source of materials. Any changes to the approved OMRR&R plan must receive environmental clearances, including consultation with the appropriate agencies for compliance with the Endangered Species Act (ESA.) Additionally, because the Belle Pass jetties provide the important function of acting as a terminal groin and trapping sediment, prior to any OMRR&R event, the stability of the jetties will be inspected. If stabilization is necessary, some of the material will be placed to support the jetties.

The non-Federal sponsor will pay the incremental cost of beneficially using this material over the federal standard. For the Bayou Lafourche navigation channel, the federal standard, which is the least costly, environmentally acceptable plan for disposal of the dredged material, is to pump the material to the beach adjacent to the channel a minimum of 1,000 feet away from the jetties for an average pump distance of 4,000 feet. The material utilized for O&M will be placed approximately 5 miles from the navigation channel. The total estimated cost for dredging and placement of the 650,000 cy is $13,270,000 with $5,920,000 being the estimated cost for the federal standard and $7,350,000 the estimated incremental cost attributable to the BBBS project.

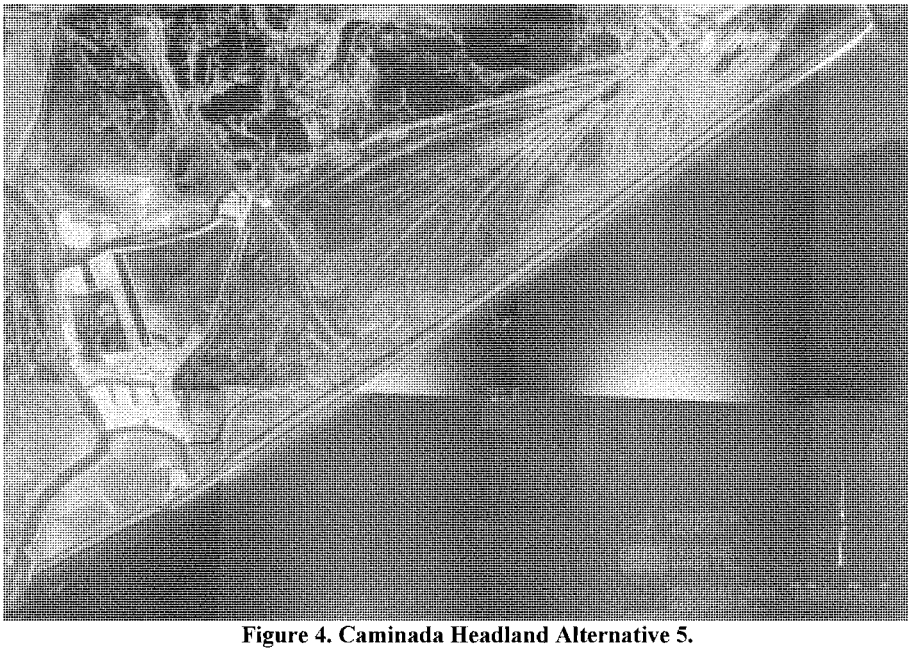


Figure 4. Caminada Headland Alternative 5.

Shell Island would be restored as one island under alternative 5. This alternative would include

shoreface, dune, and marsh platform features, and would restore Shell Island to a form similar to its pre-Hurricane Bob (1979) condition. **Figure 5** shows a plan view of Shell Island alternative 5.

The landward edge of the dune for this alternative would be located seaward of the existing shoreline. The west end of the constructed island would terminate approximately 0.5 mile before Grand Bayou. It is anticipated that the closure of Coupe Bob would return the tidal prism to its pre-1979 path—flowing through Grand Bayou, with Grand Bayou increasing in size in response to the altered tidal flow pattern. The proposed island follows the shortest and shallowest route across Coupe Bob. The constructed dune would have a uniform width of 189 feet along the length of the restored barrier island.

A uniform marsh width of 735 feet was chosen to construct an island that is approximately 1,240 feet wide following equilibration of the shoreline fill. The fill source for dike construction was located within the marsh fill footprint where the existing bathymetry is relatively shallow (less than -2.0 feet NAVD88). In deeper water (bathymetry below -3.0 feet NAVD88), it is not feasible to construct the marsh section with only marsh sediments, as the marsh would settle too rapidly and nonuniformly to perform its intended purpose effectively. Instead, a geotextile tube would be installed for containment of the marsh fill where the -3 feet NAVD sand base is constructed. The geotextile tube could be filled with sand from the sand base. This option was used for the development of Shell Island alternative 5.

It is estimated that 5.6 million cubic yards of shoreline fill would be required for the initial construction of 317 acres of shoreline/dune area (area above +2 feet, NAVD). Approximately 2.1 million cubic yards of marsh fill would be required for the initial construction of 466 acres of marsh.

Shell Island would be renourished 20 years and 40 years after initial construction to the original template of 317 beach/dune acres. The marsh fill for this alternative would also be renourished to its original construction template at this time interval. Approximately 1.5 million cubic yards of beach fill would be required for renourishment cycles in years 20 and 40. In year 20, approximately 907,200 cubic yards of marsh fill would be required and in year 40, 604,700 cubic yards would be required for renourishment. The borrow source for the dune/beach would be a large sand deposit near Nairn in the Mississippi River between mile markers 32 and 34, approximately 11 miles north of the project area. The dredged material would be pumped from the Mississippi River via pipeline. The borrow source for the marsh restoration would be the Empire deposit, approximately 1.5 miles from the Empire Jetties.

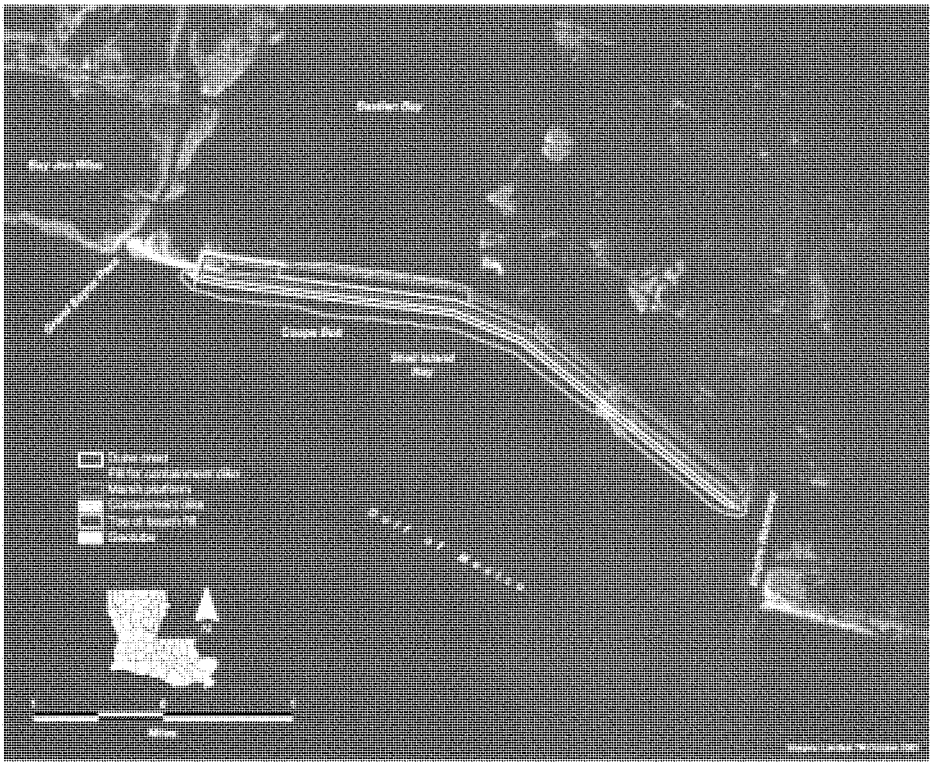


Figure 5. Plan View of Shell Island Alternative 5.

D. GENERAL DESCRIPTION OF DREDGED OR FILL MATERIAL

(1) Soil Types at the Discharge Sites

Caminada Headland discharge site: Soil surveys of the Caminada Headland (Mathews 1983; Mathews 1984) are designated as Scatlake series. Scatlake series is formed in saline marshes and consists of level, very poorly drained to very slowly permeable, moderately alkaline, peat, clay, fine sandy loam, and fine sand. These soils are saline, semi-fluid, and ponded or flooded. Scatlake soils have a dark gray to mottled gray and brown clay and muck overlying dark gray, green gray, to black clay and muck. The elevation of the Scatlake soils is from 0 to 1 feet mean sea level (MSL), and they have a slope of less than 0.5 percent. Ritchie et al. (1995) characterize the barrier shoreline of the Caminada Headland as comprised of very well sorted sand with mean grain sizes for various reaches along the headland ranging from 2.36 phi (near Bay Marchand) to 2.82 phi (west of the LOOP pipeline).

Shell Island discharge site: Soil surveys of the Shell Island area (Trahan 2000) are designated as the Felicity series. Felicity series form sandy ridges along the Gulf of Mexico as barrier islands. These soils consist of gently undulating, somewhat poorly drained to rapidly permeable, occasionally flooded, saline, moderately alkaline, brown, yellowish brown, to black, loamy fine sand with occasional shell fragments. The elevation of the Felicity soils is from 2 to 5 feet MSL, and they have a slope of 0 to 3 percent. Ritchie et al. (1990) characterize the barrier shoreline of the Shell Island area as a recently breached recurved spit composed of beach sand along the Gulf shoreline and reworked oyster shells with thin layers of sand strata behind the narrow flat eroding beaches. The shell deposits, with an average size of 12 cm, are formed into well-defined ridges and swales. Although the vegetation and surface forms resemble dune ridges, there is no aeolian (wind-driven) sand.

(2) Quantity of Material

Caminada Headland discharge site: Approximately 5.1 million cubic yards of material would be used for restoration of the Caminada Headland barrier shoreline (beach and dune); approximately 5.4 million cubic yards of material would be used for restoration of back barrier salt marsh. In addition, over each 10 year maintenance period for the Bayou Lafourche, Louisiana (Belle Pass) navigation project, approximately 3.9 million cubic yards of maintenance material will be used to renourish the headland.

Shell Island discharge site: It is estimated that 5.6 million cubic yards of shoreline fill would be required for the initial restoration of the shoreline/dune area, and approximately 2.1 million cubic yards of marsh fill would be required for initial marsh restoration.

Shell Island would be renourished 20 years and 40 years after initial construction to the original beach/dune and marsh fill templates. Approximately 1.5 million cubic yards of beach fill would be required for each renourishment. In year 20, approximately 907,200 cubic yards of marsh fill would be required for renourishment, while in year 40, 604,700 cubic yards would be required for renourishment.

(3) Source of Material

Caminada Headland discharge site: The Ship Shoal borrow site would be used for construction of Caminada Headland barrier shoreline (beach and dune). This area is located in the Gulf of Mexico approximately 40 miles from the Caminada Headland. The Caminada Gulf of Mexico near-shore borrow site would be used for construction of marsh and is located approximately 1.5 miles south of the central portion of the Caminada Headland, and 4.7 miles southwest of the Caminada Pass (**figure 6**).

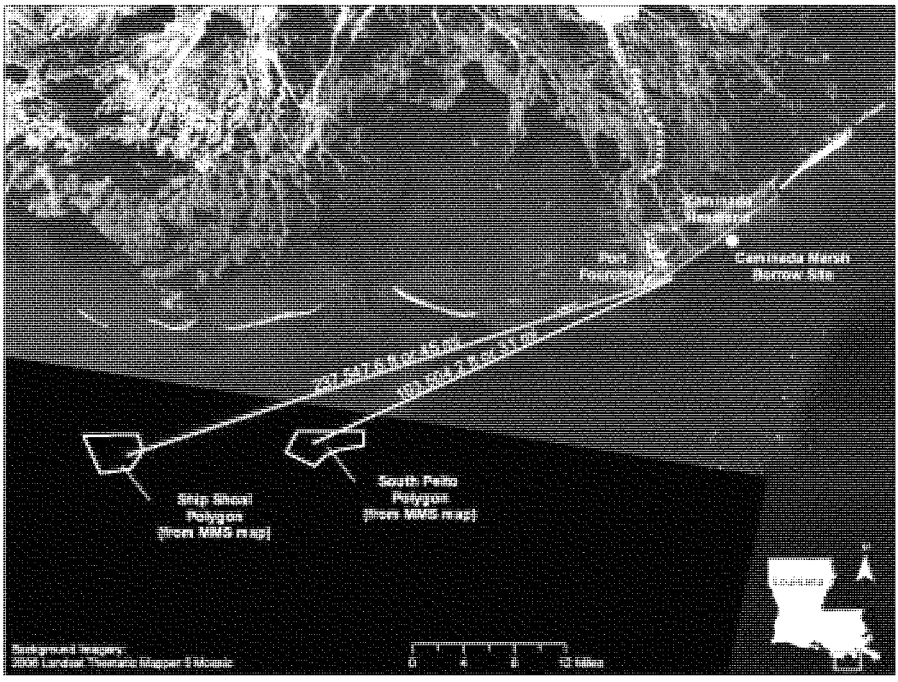


Figure 6. Borrow sources for the Caminada Headland

Shell Island discharge site: The Mississippi River borrow site, a large sand deposit located in the Mississippi River between mile markers 32 and 34 near Nairn, Louisiana, would be used for construction of barrier shoreline (beach and dune) at the proposed Shell Island discharge site. The Empire deposit, located approximately 1.5 miles from the Empire jetties, would be used as the near-shore Gulf of Mexico borrow site for construction of marsh (**figure 7**).

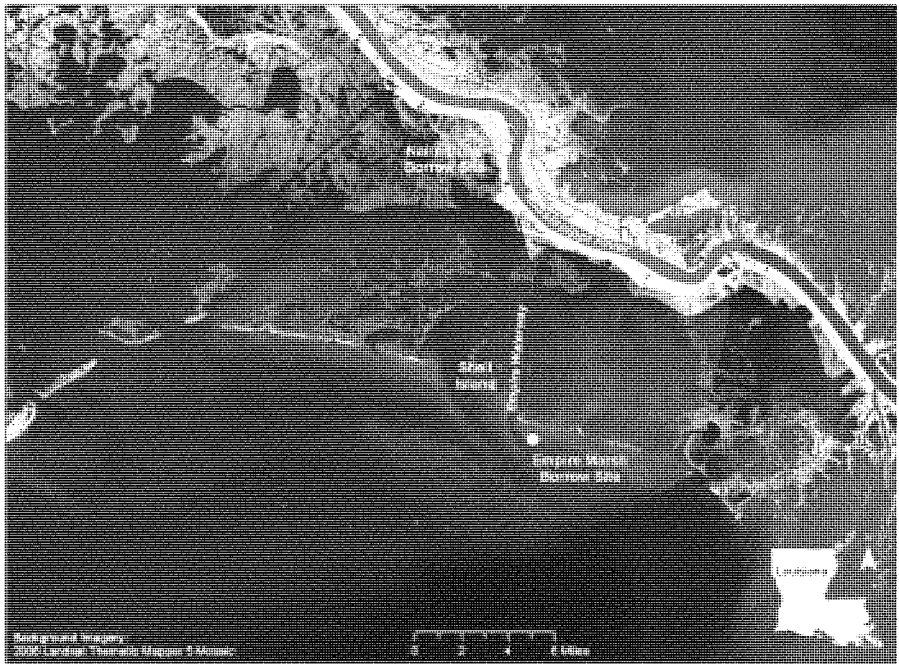


Figure 7. Borrow Sites for Shell Island.

E. DESCRIPTION OF THE PROPOSED DISCHARGE SITE

(1) Location and Size of Site and Type of Habitat

The Barataria Basin barrier system is located along Louisiana's Gulf of Mexico coastline between the active delta of the west bank of the Mississippi River and the eastern shore of Terrebonne Bay. The study area is comprised of a chain of barrier islands and Headland, separated by tidal inlets, which enclose shallow bays. The most prominent physiographic features in the area are the numerous narrow beaches and their associated dunes, overwash fans, spits, tidal inlets, marshes, and bays. Elevations range from a maximum of approximately 5 feet National Geodetic Vertical Datum (NGVD) on the highest dunes to near 0 feet NGVD in the back barrier marshes. All of the island segments are currently retreating. Erosion, reworking, and redistribution of the coarser deltaic material led to the development of the barrier island chain present today. Much of the erosion and transport of material takes place during storms (frontal passages and tropical storms/hurricanes).

Caminada Headland discharge site: The Caminada Headland discharge site is approximately 889 acres of barrier beach, dune and supratidal habitats and 1,186 acres of bayside intertidal salt marsh. Situated along the coastline of the Gulf of Mexico, the Caminada Headland is bounded on the west by Bayou Lafourche and the Belle Pass jetty, extending approximately 13 miles east to Caminada Pass, thence north to the Chevron pipeline canal. The back-barrier marsh component of the Caminada Headland is separated from the Chenier Unit to the north by a pipeline canal and is bounded to the south by the gulf shoreline. It is composed of a system of elevated ridges that support a maritime forest important to the physical integrity of the estuary and provide habitat for neotropical migratory birds. The Caminada Headland is unarmored and unstructured. There is evidence of longshore transport from east to west along the eastern section, including spit growth at an unknown rate (Ritchie et al., 1999) and bypassing of about 83,000 cubic yards per year to Grand Isle (USACE 2004). See also Section I.C.- "General Description."

Shell Island discharge site: The Shell Island discharge site is approximately 317 acres of barrier shoreline, dune and supratidal habitat and 466 acres of intertidal salt marsh. Situated along the coastline of the Gulf of Mexico, Shell Island is bounded on the west by Grand Bayou Pass, extending approximately 5.3 miles to the Empire waterway and the west Empire jetty. See also Section I.C.-General Description.

(2) Timing and Duration of Discharge

Caminada Headland discharge site: Construction duration for the Caminada Headland is estimated to be 936 days. The estimated duration of plantings is 750 days over a three year period.

Shell Island discharge site: The estimated duration for initial construction and for plantings is 834 days and 420 days, respectively. Based on estimates for initial construction, each renourishment would require a duration of approximately 300 days. Construction timeline details are provided in Annex C-7 of the EIS.

F. DESCRIPTION OF DISPOSAL METHODS

Caminada Headland discharge site: Material would be deposited using a hydraulic dredge or the most appropriate and practicable means to minimize adverse impacts.

Shell Island discharge site: Material would be deposited using a hydraulic dredge or the most appropriate and practicable means to minimize any adverse impacts.

II. FACTUAL DETERMINATIONS

A. PHYSICAL SUBSTRATE DETERMINATIONS

(1) Effects on Substrate Elevation and Slope

Caminada Headland discharge site: The placement of dredged material to restore and semi-annually renourish the Caminada Headland would compact the existing substrate and alter existing elevations and slopes.

The selected plan for the Caminada Headland includes a dune height of +7 feet NAVD with a dune crest width of 290 feet, along with a landward beach and dune component in order to maximize acreage and longevity. The landward and seaward slopes are set 20 horizontal to 1 vertical. Marsh fill is proposed on the landward side of the dune at an elevation of +2.0 feet NAVD88. Fill quantities for the dune and marsh fills are 5.1 million and 5.4 million cubic yards, respectively. This project would create 880 acres of dune/beach and 1,186 acres of saline marsh. **Figure 4** shows the plan view of the project design, while **figure 8** displays the cross-sections for the locations previously displayed in **figure 4**.

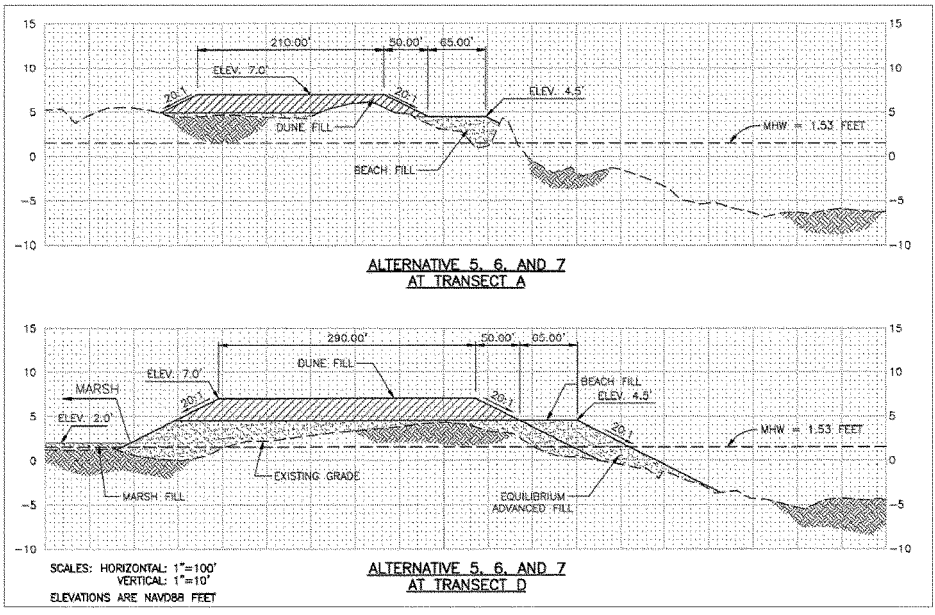


Figure 8 - Cross-sections of the selected alternative design for the Caminada Headland (source: Barataria Barrier Shoreline Restoration EIS (2009), Appendix A, Annex 1)

In addition, the selected plan includes renourishment of the headland by placing a total of 3.9 million cubic yards of sand material in the littoral drift south of Bayou Moreau and west of the Belle Pass jetties over every ten year maintenance dredging period for Bayou Lafourche/Belle Pass. The placement of sand within the littoral drift will allow long shore transport and wave action to distribute sediment along the headland.

These design features would alter substrate elevation and slope for the Caminada Headland for the life of the project.

Shell Island discharge site: The placement of dredged and fill material to restore and renourish Shell Island would compact the existing substrate and alter the existing elevations and slopes. The selected plan for Shell Island includes a dune height of +6 feet NAVD with a dune crest width of 189 feet, along with a seaward beach and dune component in order to maximize acreage and longevity. The landward and seaward slopes are set 45 horizontal to 1 vertical. Marsh fill is proposed on the landward side of the dune at an elevation of +2.0 feet NAVD88. Initial fill quantities for the dune and marsh fills are 5.6 million and 2.1 million cubic yards, respectively. Approximately 1.5 million cubic yards of beach fill would be required for renourishment cycles in years 20 and 40. In year 20, approximately 907,200 cubic yards of marsh fill would be required and in year 40, 604,700 cubic yards would be required for renourishment.
This project would create and nourish 317 acres of dune/beach and 466 acres of saline marsh.

Figure 9 shows the plan view of the project design for Shell Island, while **figure 10** depicts an example cross-section for Shell Island. While the optimum upper elevation of the marsh surface is +2.0 feet, which is the upper elevation of the bay intertidal range, the post-construction marsh volumes are calculated based on the post-construction elevation of +2.5-feet. Settlement of the marsh material is expected to lower the marsh elevation to the bay intertidal range within one year. These design features would alter substrate elevation and slope for Shell Island for the life of the project.

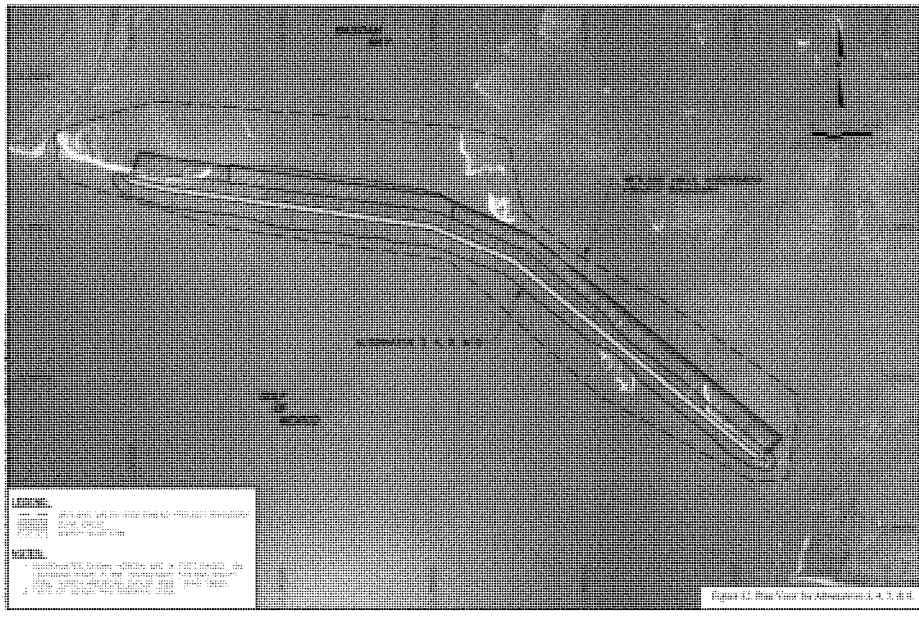


Figure 9. – Shell Island restoration feature plan view.

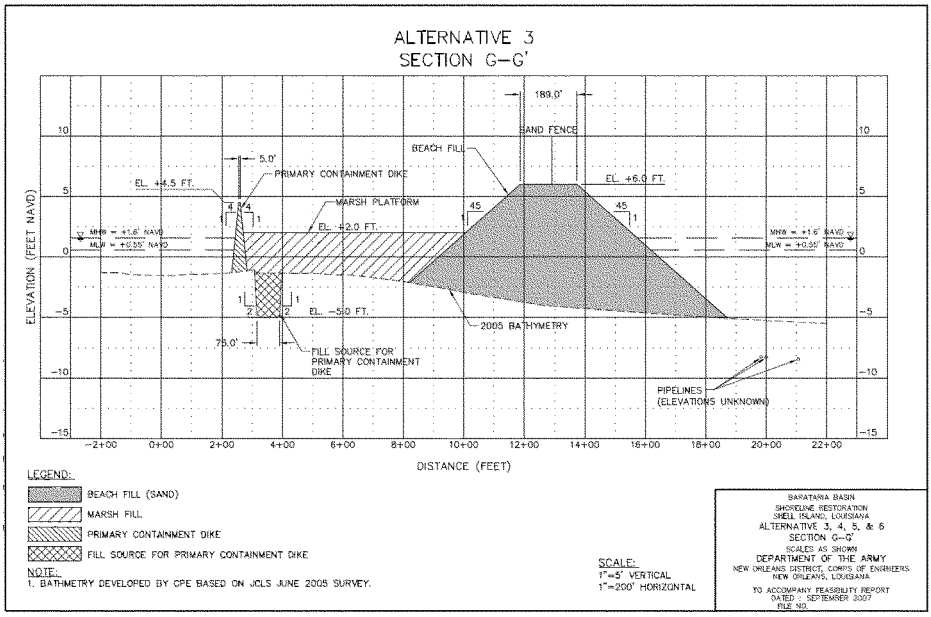


Figure 10. – Typical cross-section of the selected alternative design for Shell Island.

(2) Effects on Sediment Type

Caminada Headland discharge site: Ritchie et al. (1995) characterize the barrier shoreline of the Caminada Headland as comprised of very well sorted sand with mean grain sizes for various reaches along the headland ranging from 2.36 phi (near Bay Marchand) to 2.82 phi.

The potential beach and dune fill borrow area for Caminada Headland restoration is the South Pelto block of Ship Shoal. Ship Shoal, the largest submerged shoal off Louisiana, is a Holocene sand body located on the inner shelf about nine miles seaward of the Isles Dernieres. A compatibility analysis was conducted to compare the grain size distribution of sediments from the Caminada Headland restoration area native beach with South Pelto borrow area sediments to evaluate the proposed borrow material for use as beach and dune fill. **Figure 11** presents the cumulative grain-size distributions of the composite native beach sediments compared to the composite borrow area sediments. The curves have a high degree of similarity. Also presented are the reference ranges for the native beach and borrow area samples.

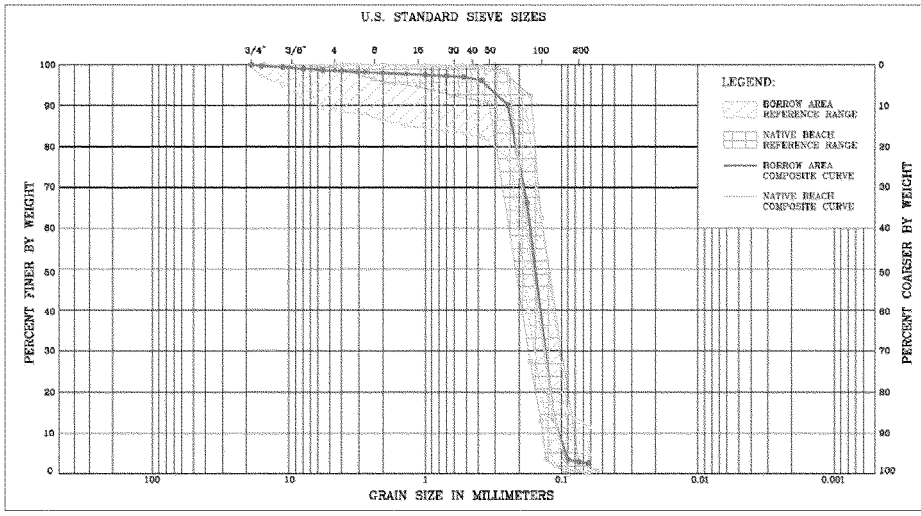


Figure 11. - Grain size distribution curves for the Caminada Headland beach area and for the proposed beach and dune fill material.

The ranges included in **figure 11** depict the coarse and fine extremes of the samples for each grouping. The two ranges exhibit a fair degree of similarity, indicating the borrow area sediments are compatible with the native beach. The borrow area material is composed of well-graded quartz sand and is ideal for use in restoring the Caminada Headland since its grain size is generally slightly larger than the sand found at the headland. Coarser grain sand is more resistant to erosion.

Native marsh samples from the Caminada Headland restoration area were collected and analyzed for grain size distribution to allow numerical characterization of the natural marsh sediment, providing a basis for comparison and evaluation of potential borrow materials for use in marsh creation. The percent sand ranged from 22.7 to 76.5 percent, while the percent silts/clays ranged from 23.4 to 77.3 percent, and organic content from 2.4 to 7.4 percent. The potential marsh fill borrow area for Caminada Headland marsh restoration is the Caminada Headland borrow area. Sediment borings extracted from this area revealed a sand content ranging from 0 to 53.5 percent, and a silt/clay content ranging from 45.7 to 100 percent (USGS 2010). Based on the comparison between native marsh and borrow area sediments, borrow area sediments are expected to be more fine-grained in nature than the native marsh sediments. This may pose a concern in regards to overwash-induced erosion (such as storm surge) prior to the establishment of saltwater marsh vegetation along the marsh restoration area. Following the establishment of marsh vegetation, and after sand overwashes into marsh areas, material would be less likely to erode and the difference in grain size would eventually reach background levels near the surface.

No physical sediment data was available for the proposed borrow area for the renourishment of the Caminada Headland, located within Belle Pass. However, material within the upper strata of

the water bottom within Belle Pass is expected to contain a high sand content due to the expected water velocities in the channel, which would prevent the deposition of fine-grained materials. It is therefore probable that borrow area and native headland beachfront sediments will be compatible.

Shell Island discharge site: The barrier shoreline of the Shell Island area is characterized as a recently breached, recurved spit composed of beach sand along the Gulf shoreline and reworked oyster shells with thin layers of sand strata behind the narrow, flat eroding beaches. Louisiana's native barrier beaches generally consist of sands with average grain sizes ranging from 0.10 mm to 0.14 mm (Thomson et al. (2008), Annex C-2)

Fill material used for the shoreline restoration feature for this island would be borrowed from either Sandy Point or the Nairn site at the Mississippi River. Sediment borings indicate an average grain size for river sediments at the Mississippi River borrow area which range between 0.2 mm and 0.23 mm (Thomson et al. (2008), Annex C-2). The borrow area material is ideal for use in restoring the Shell Island since its grain size is generally slightly larger than the sand found at Shell Island.

A part of the Sandy Point deposit, situated 12 to 16 miles from the Shell Island project site, is being considered for the restoration of Pelican Island. The Sandy Point depositional area is less attractive than the Mississippi River sands due to the presence of extensive oil and gas infrastructure, relatively thick layers of mud on top of sands (muddy overburden), and limited lateral and vertical extent of sand layers. Already considered for the restoration of Pelican Island is the most feasible segment of this deposit (in terms of sand versus thickness of mud overburden and dredging setbacks from oil/gas infrastructure), further restricting development of the potential borrow area. Despite these limitations, the area may still provide enough sediment to support restoration of Shell Island. Grain sizes in these deposits average 0.11mm and silt content varies around 10 percent.

Shell Island is characterized by soils of the Felicity series (Trahan 2000). Material used for restoration of salt marsh would be borrowed from the adjacent Empire Borrow Area. Previous geological studies (*e.g.* Kindinger *et al.*, 2001; Suter *et al.*, 1991) described the depositional environments in the Empire borrow area in terms of migrating (overlapping) fluvial and deltaic deposits where channels were filled by riverine and non-riverine sediments, both of which were subsequently covered by modern muds. Preliminary borrow area sedimentary characteristics indicate a mean grain size of 0.06 mm, a silt content of about 39 percent a clay content about 22 percent and sand contents that range from 37 percent to 38 percent (**table 1**).

Table 1. - Physical properties of Empire borrow area sediments.

Marsh Borrow Area	20 ft. Cut	15 ft. Cut
Area (ft^2)	9,019,962	9,019,962
Volume(cubic yards)	6,681,000	5,011,000
Grain size (mm)	0.06	0.06
Sorting (phi)	1.59	1.55
% Silt	39.77	39.57
% Clay	22.99	22.34
% Sand	37.24	38.1

(3) Effects on Fill Material Movement

Caminada Headland discharge site: The Caminada Headland is an erosional headland within a dynamic high-energy barrier system, characterized by sands and sediments moving in response to longshore transport, tides, wind, waves, storms, hurricanes, and other natural phenomena. Placement of approximately 9.5 million cubic yards of fill material for restoration and a total of 2 million cubic yards of sand every 10 years for renourishment would restore the geomorphic continuity of this fragmented barrier headland.

Upon completion of construction, fill material would mimic existing conditions, moving in response to longshore transport, tides, wind, waves, storms, hurricanes, and other natural phenomena.

Present sediment movement at the Headland is characterized by diverging sediment transport. The Ritchie et al. (1995) summary of diverging sediment transport along the Caminada Headland has been confirmed in multiple publications. **Figure 12** depicts the general Headland features and divergence of transport with the node located in the vicinity of Bayou Moreau.

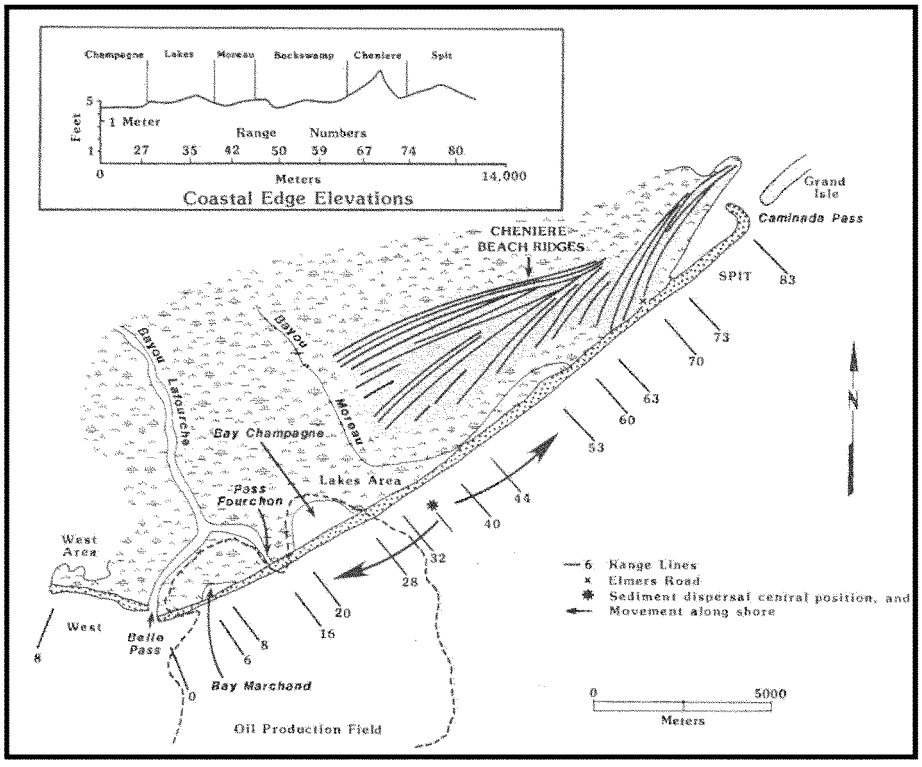


Figure 12. - Sediment dispersal along the Caminada Headland (Ritchie et al. 1995)

Williams et al. (1992) reported the historical shoreline changes along the Caminada Headland. The reported rates were highest just east of Bay Champagne, corresponding to the location of sediment divergence reported by Ritchie et al. (1995), dissipating slightly to the west to Belle Pass and reducing significantly to the east to Caminada Pass. The computed shoreline change rates at mean high water were highest near Bay Champagne, while smaller change rates observed to the west of Bay Champagne can be attributed to the breakwaters and jetty impounding sand. Rates to the east do not exhibit any trend.

The cumulative volume change along the headland from Belle Pass to Caminada Pass, between 2000 and 2005, equals approximately 615,000 cubic yards per year. The overwash accumulation on the landward side of the existing dune for the same time period between Bayou Moreau and Caminada Pass equals approximately 311,000 cubic yards per year. The cumulative change includes the overwash accumulation. Therefore, the total net gulf shoreline erosion loss equals approximately 926,000 cubic yards per year. The sediment budget is presented in **figure 13**.

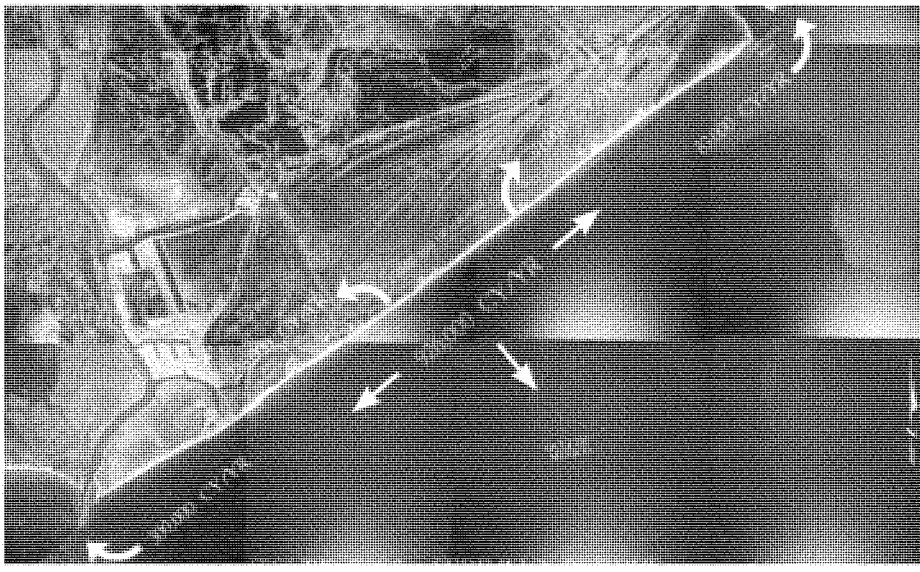


Figure 13. - Estimated sediment budget for the Caminada Headland

Restoration of the Headland would likely contribute to alteration of the tidal prism, thereby reducing formation of any additional tidal passes as well as "healing" (closing or narrowing) existing tidal passes and overwash areas. Alteration of gulf water bottoms may potentially change littoral drift dynamics. However, the Caminada Headland would continue its function as an erosional headland of nourishing Grand Isle with sand transport.

Material placed for renourishment of the Caminada Headland would be located in the littoral drift south of Bayou Moreau, where the long shore transport of material splits between going east and west, as well as west of the Bell Pass jetties. Placement of material in the littoral drift will allow long shore transport and wave action to move and place the sediment along the headland. Over each 10 year period of maintenance, an estimated 3.9 million cubic yards of material from six dredging cycles (650,000 cubic yards per cycle) will be returned to the headland. Unless the shoreline is in danger of breaching, timing of the renourishment will be dependent upon the maintenance dredging requirements of the Bayou Lafourche, Louisiana navigation project.

Shell Island discharge site: The Shell Island area is a dynamic, high-energy barrier system with sands moving in response to longshore transport, tides, wind, waves, storms, hurricanes, and other natural phenomena. Placement of approximately 12 million cubic yards of fill material would temporarily restore the geomorphic continuity of this fragmented barrier island.

Upon the completion of initial construction and of renourishment 20 and 40 years after initial construction, fill material would move in response to longshore transport, tides, wind, waves, storms, hurricanes, and other natural phenomena. Restoration would likely alter the tidal prism

of adjacent, existing tidal passes, thereby reducing the formation of additional tidal passes as well as "healing" (closing or narrowing) existing tidal passes and overwash areas. Also, the alteration of gulf water bottoms may change littoral drift dynamics. Other barrier shorelines/islands within the barrier island chain may also receive indirect benefits from the introduction of sand via littoral drift from the newly rebuilt islands. The project would help restore natural sand transport along this reach of the coast and support adjacent regional shorelines and various shoreline habitats.

The projected west-to-east longshore loss from Shell Island is approximately 1,000 cubic yards/year (**figure 14**). Sediment transport modeling suggests that, with the closure of Coupe Bob, the longshore transport losses are mainly to Grand Bayou at 44,000 cubic yards/year. Losses to Fontanelle Pass are expected to be small (approximately 1,000 cubic yards/year) due to the alignment of the east end and the sheltering provided by the Empire Jetties. Longshore losses are matched by losses due to relative sea level rise and overwash, which are estimated to be equivalent to 32,200 cubic yards/year. With an island length of 23,400 feet and an active profile height of 11 feet, the recession rate due to longshore losses was calculated to be 4.6 feet/year. The recession rate due to relative sea level rise, based on a beach width of 864 feet, was calculated to be 3.4 feet/year, creating a total Gulf side recession rate of 7.9 feet/year.

The construction of Shell Island Alternative 5 will result in increased flow through Grand Bayou and Fontanelle Pass, as the tidal prism is redirected due to the closure of Coupe Bob. It is expected that the increased flow through Grand Bayou will start to reopen the pass and it could expand to its pre-1979 size. The western end of Shell Island West would likely be eroded and the sediment transported to the Grand Bayou ebb shoal. It is assumed that the erosion of the west end of Shell Island West will occur within 10 years of construction, and within ten years of the project renourishment cycles.

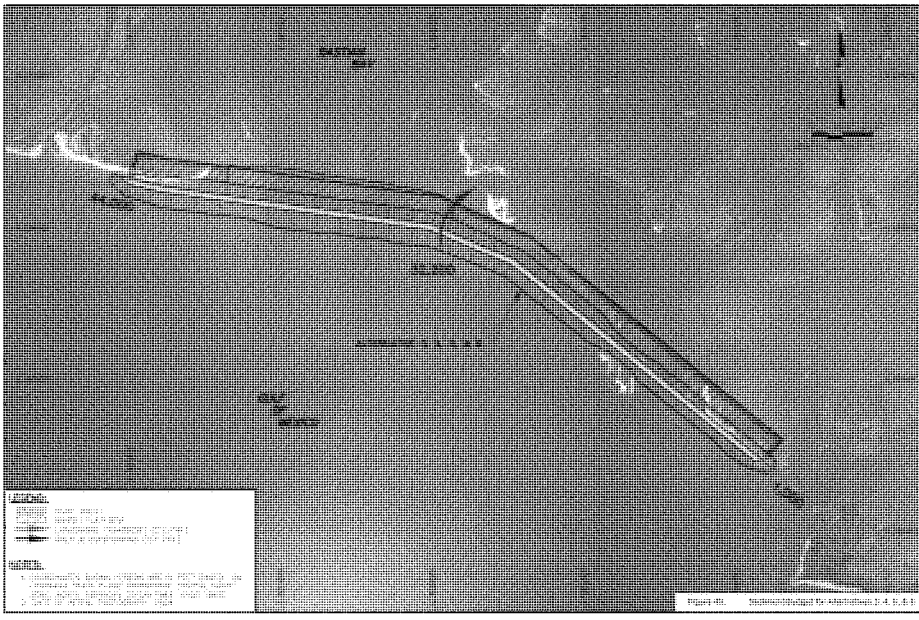


Figure 14. - Sediment budget for Shell Island

(4) Physical Effects on Benthos

Placement of borrow material for barrier habitat restoration would cover approximately 2,849 acres of shallow open water and existing fragmented barrier habitats. These actions would directly impact and destroy any slow-moving or sessile benthic organisms found within the proposed borrow areas, and intertidal footprints of the restoration sites. More mobile benthic species utilizing these areas would likely be displaced to more suitable habitats. Other direct impacts to the benthos would be localized and confined to construction areas. However, the prolific nature of the benthic community is expected to in rapid re-colonization of substrates once construction is completed.

There could be potential adverse impacts for water bottoms and recolonization by benthic organisms if renourishment of the Caminada Headland occurs at 1.6 year intervals. Benthic organisms require a period of at least 1.5 to 2 years to recolonize. The proposed dredged material placement cycle is at the borderline time frame for recovery and has been of particular concern to USFWS as it is considered as not providing sufficient time for recovery of benthic habitat/prey used by the threatened piping plover.

(5) Actions to Minimize Impacts

Actions take to minimize potential impacts during construction could include the use of silt curtains and retention dikes to minimize the effects of storm water runoff, overland flow, sediment movement and erosion into adjacent waters and wetlands. This would also restrict the extent of turbidity and suspended particulates to the immediate construction area. These actions would thereby minimize any short-term adverse biotic effects associated with increased turbidity and suspended particulates. These measures could also help to restrict the extent of increases in turbidity and suspended particulates to the immediate construction area. Sand fencing would be installed to promote additional dune elevation and capture transported sand.

B. WATER CIRCULATION, FLUCTUATION, AND SALINITY DETERMINATIONS

(1) Effects on Water

(a) Effects on Salinity:

For the discharge of dredged material from the Mississippi River Borrow Area, negligible local effects on salinity regimes may occur, depending on the dredging location and the location of the Mississippi River saltwater wedge at the time of dredging. This potential discharge of freshwater dredged material slurry into a saline aquatic environment would quickly become dispersed and diluted by tidal action. For all other borrow areas are located in the Gulf of Mexico, water associated with dredged material discharges will be of similar salinity to the waters adjacent to the Caminada Headland and Shell Island, and would therefore have no impact on salinities. Therefore, direct no significant impacts to salinity regimes are expected in the study area, adjacent waterways (e.g. Bell Pass, Caminada Pass, Grand Bayou Pass, or the Empire navigation channel), or adjacent wetlands.

Indirect impacts to salinity would be negligible. The Caminada Headland and Shell Island restoration projects alone would have very little influence on regional salinities with or without implementation, due to the fact that inlets to the coastal bay areas of the Barataria basin will allow for substantial saltwater to enter the basin, with or without these project features.

(b) Effects on Water Chemistry:

Sandy Point, Mississippi River, Ship Shoal, and Empire borrow area sediments: In order to assist in predicting the short-term impacts to the water column and long-term impacts to the water bottom associated with the project, water and sediment samples were collected from Caminada Headland, Shell Island, and four areas from which borrow sediments could be used to restore the barrier islands (**figure 15**). The potential sediment borrow areas for Shell Island coastal restoration include the Empire borrow area, Sandy Point borrow area, and the Nairn site at the Mississippi River. The potential sediment borrow areas for Caminada Headland restoration include the South Pelto block of Ship Shoal, Belle Pass, and the Caminada Headland borrow area, the latter two of which were mistakenly omitted from the additional data collection.

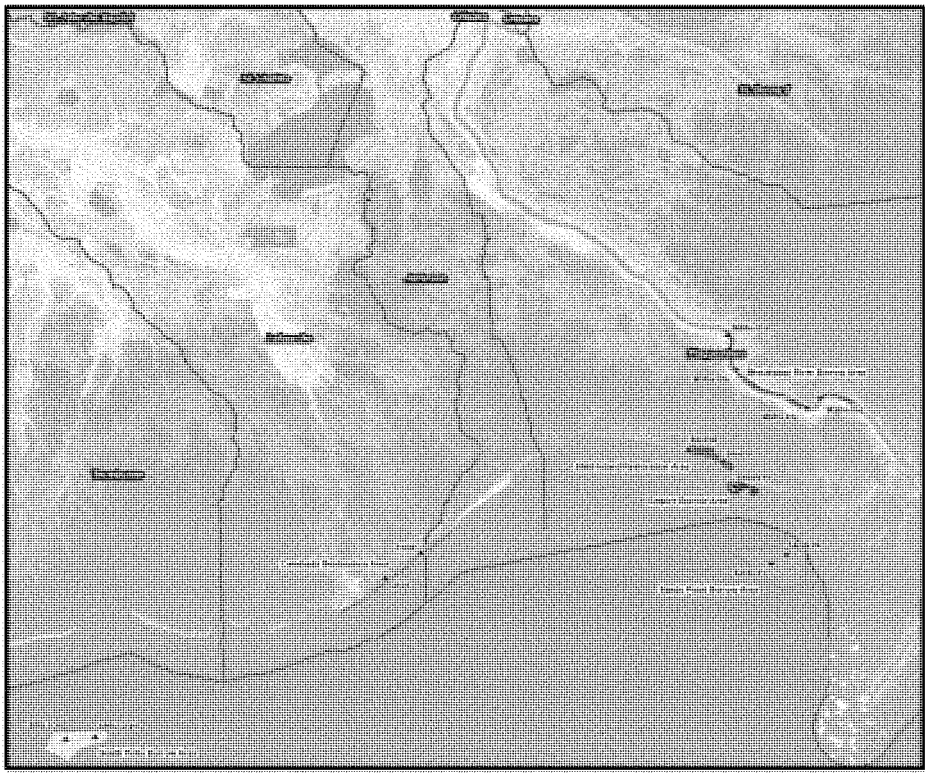


Figure 15. - Project area, including borrow areas, beach/marsh restoration areas, and sampling locations included in the Louisiana Department of Natural Resources water quality assessment for Camiuada Headland and Shell Island.

Chemical analyses were performed on water and sediments, as well as elutriates, which are a mixture of dredging site water and sediment that simulates and is used to predict the chemical properties of dredged material effluent waters exiting the restoration site during a dredged material disposal operation. Chemical classes analyzed (with number the number of parameters analyzed for each chemical class included in parentheses) include metals (7), volatile organic compounds (28), semivolatile organic compounds (57), pesticides and herbicides (18), and PCBs (7). Details of the sampling and analysis for this project are included in the water quality assessment report for Caminada Headland and Shells Island restoration projects developed by the Louisiana Department of Natural Resources (Parker 2007).

Surface Water Chemistry – Summary of Results

Results for chemical analyses of surface waters adjacent to the restoration areas are useful in addressing the abilities of those waters to dilute the dredged material effluent waters which will discharge from the site during dredged material disposal operations. **Table 2** summarizes the surface water chemistry results for both Caminada Headland and Shell Island. Of the 117 chemical compounds which were analyzed for, laboratory instruments were only able to detect the presence of four (4) metals in Caminada Headland waters and seven (7) metals in Shell Island waters. At both sites, all of the metals detected in surface waters were below both U.S. Environmental Protection Agency (EPA) and Louisiana Department of Environmental Quality (LDEQ) water quality criteria (USEPA 2010; LDEQ 2010).

Table 2. - Comparison of parameters detected in surface waters to LDEQ and EPA Water Quality Criteria.

	Most Stringent Marine State/Federal Water Quality Criteria		Sampling Location	
	Acute	Chronic	CH 01	Shell 01
Parameter	**(All values in ?g/L units)**			
Metals				
Arsenic	**69**	**36**	1.4	1.8
Beryllium			BDL	0.16
Cadmium	**40**	**1.51**	BDL	0.17
Copper	**3.63**	**3.1**	0.69	1.3
Nickel	**74**	**8.2**	1.3	1.5
Thallium			BDL	0.39
Zinc	**90**	**81**	13	15

Key:

No criteria available

BDL Result is below the laboratory instrument detection limit

Sediment Chemistry – Summary of Results

Sediment chemistry results are useful in determining, at a reconnaissance level, the potential for long-term effects of sediments on organisms which are in direct contact with the water bottom of the restoration areas. **Table 3** summarizes the sediment chemistry results for the four potential borrow sources. Of the 117 parameters which were analyzed for, laboratory instruments were only able to detect the presence of eight (8) metals in the Ship Shoal borrow area sediments, twelve (12) metals in the Sandy Point borrow area sediments, and ten (10) metals in Empire borrow area sediment; a total of eleven (11) metals and twenty (20) semivolatile organic compounds were detected in Mississippi River borrow area sediments. None of these parameters were detected at concentrations exceeding saltwater sediment screening values. Therefore, no long term impacts to aquatic organisms are expected due to the placement of dredged sediments from the South Pelto block of Ship Shoal, Sandy Point, or Empire Borrow Areas for barrier island restoration features.

Table 3. - Comparison of parameters detected in sediment to NOAA Sediment Screening Values.

Parameter	NOAA Marine Sediment Screening Values		Sampling Location					
	TEL	PEL	Empire 01	MSRiv 01	Sandy 01	Sandy 02	SPELTO 01	SPELTO 02
	(All values in µg/kg units)							
Metals								
Arsenic	**7,240**	**41,600**	2,100	5,500	BDL	3,500	1,900	2,300
Beryllium			140	560	BDL	300	83	98
Cadmium	**680**	**4,210**	94	390	BDL	74	BDL	BDL
Chromium	**52,300**	**160,000**	5,100	15,000	BDL	8,200	3,200	3,400
Copper	**18,700**	**108,000**	1,500	12,000	BDL	6,100	720	980
Lead	**30,240**	**112,000**	3,100	15,000	BDL	6,000	1,800	1,900
Mercury	**130**	**700**	12	41	22	11	BDL	8.9
Nickel	**15,900**	**42,800**	6,200	16,000	9,000	7,600	4,200	5,300
Selenium			BDL	320	BDL	140	BDL	BDL
Silver	**730**	**1,770**	BDL	BDL	BDL	49	BDL	BDL
Thallium			58	140	BDL	140	BDL	BDL
Zinc	**124,000**	**271,000**	17,000	58,000	BDL	28,000	12,000	13,000
Semivolatile Organic Compounds								
Acenaphthylene	**5.87**	**128**	BDL	5.1	BDL	BDL	BDL	BDL
Anthracene			BDL	21	BDL	BDL	BDL	BDL
Benzo(a)anthracene	**74.8**	**693**	BDL	45	BDL	BDL	BDL	BDL
Benzo(a)pyrene	**88.8**	**763**	BDL	43	BDL	BDL	BDL	BDL
Benzo(b)fluoranthene			BDL	66	BDL	BDL	BDL	BDL
Benzo(g,h,i)perylene			BDL	34	BDL	BDL	BDL	BDL
Benzo(k)fluoranthene			BDL	19	BDL	BDL	BDL	BDL
Chrysene	**108**	**846**	BDL	**80**	BDL	BDL	BDL	BDL
Fluoranthene	**113**	**1494**	BDL	83	2.2	BDL	BDL	BDL
Fluorene	**21.2**	**144**	BDL	6.4	BDL	BDL	BDL	BDL
Hexachlorobenzene			BDL	15	BDL	BDL	BDL	BDL
hexachlorobutadiene			BDL	12	BDL	BDL	BDL	BDL
Hexachlorocyclopentadiene			BDL	10	BDL	BDL	BDL	BDL
Hexachloroethane			BDL	13	BDL	BDL	BDL	BDL
Indeno(1,2,3-cd)pyrene			BDL	26	BDL	BDL	BDL	BDL
Isophorone			BDL	15	BDL	BDL	BDL	BDL
Naphthalene	**34.6**	**391**	BDL	8.8	BDL	BDL	BDL	BDL
Nitrobenzene			BDL	12	BDL	BDL	BDL	BDL
Phenanthrene	**86.7**	**544**	BDL	**47**	BDL	BDL	BDL	BDL
Pyrene	**153**	**1398**	BDL	**94**	2.8	BDL	BDL	BDL

Key:

Result exceeds TEL

No sediment screening value available

BDL Result is below the laboratory instrument detection limit

Elutriate Chemistry – Summary of Results

Results for the chemical analysis of elutriates can be used to estimate the dissolved chemical concentrations in dredged material effluent waters being discharged from each restoration site, and can assist in determining whether the discharge of dredged material effluent waters has the potential to result in any short-term impacts to the receiving waterbody.

For elutriates results, several water quality criteria and standards exist which are used to determine whether estimated chemical concentrations in dredged material effluent waters will have adverse water column impacts. Federal and State water quality criteria are promulgated by the U.S. Environmental Protection Agency (EPA) and State of Louisiana Department of Environmental Quality (LDEQ). Federal aquatic life criteria are published by the EPA pursuant

to section 304(a) of the Clean Water Act (CWA); numerical criteria are available for approximately 150 contaminants, and the application of criteria for each contaminant is dependent on salinity regime (freshwater and marine) and duration of effect (acute and chronic) (USEPA 2010). State aquatic life criteria for toxic substances, metals, and inorganics published by the LDEQ have been derived mostly from EPA publications for water quality criteria, but also consider background conditions of state waterbodies (Louisiana Administrative Code (LAC) Title 33, Part IX, Subpart 1, Section 1113). These numerical criteria have been derived primarily for the attainment of fish and wildlife propagation use. Similar to EPA criteria, the application of State numerical criteria for each contaminant is dependent on salinity regime (freshwater, brackish, and marine) and duration of effect (acute and chronic).

In order to meet compliance with State of Louisiana water quality standards, the discharge of dredged material effluent associated with the restoration of Shell Island and the Caminada Headland is required to meet all State and Federal aquatic life criteria beyond the State-defined mixing zone, which is defined as "those portions of water bodies where effluent waters are dispersed into receiving waters" (LAC Title 33, Part IX, Subpart 1, Section 1115). The mixing zone for any particular effluent discharge is dependent upon the type of receiving waterbody. Table 2a in LAC Title 33, Part IX, Subpart 1, Section 1115 describes each category of waterbody and its applicable mixing zone. The receiving waterbody for both the Caminada Headland and Shell Island restoration sites is the Gulf of Mexico, which has a mixing zone of a radial distance of 400 feet from the point of discharge.

Table 4 depicts the exceedences of water quality criteria for detectable elutriate chemistry results for the Sandy Point, Mississippi River, Ship Shoal, and Empire borrow areas, along with the dilution required to meet acute and chronic water quality criteria for these results. It should be noted that, while the elutriates analysis performed for this study was for the total contaminant fraction, State and Federal water quality criteria for metals are for the dissolved fraction. Therefore, the elutriates results for metals collected for this study are not representative of the contaminant fraction which should be analyzed for comparison to water quality criteria, and provide an extremely conservative prediction of dissolved contaminant concentrations associated with the discharge of dredged material effluent from the project area.

The results for total elutriates indicate possible exceedences of chronic water quality criteria for all borrow areas, with exceedences of chronic criteria for lead and copper for elutriates derived from Mississippi River Sediments, an exceedence of chronic criteria for copper for elutriates derived from Sandy Point sediments, and an exceedence of mercury criteria for elutriates derived from South Pelto sediments. In addition, these results indicate the possible exceedence of acute water quality criteria for copper for elutriates derived from Mississippi River sediments. Dilution requirements for all exceedences are relatively minor (less than 10). Considering the relatively low dilution requirements associated with total elutriates results exceeding water quality criteria, it is anticipated that sufficient dilution would be achieved in order to meet compliance with water quality criteria before the edge of the mixing zone (a radial distance of 400 feet from the point of discharge) at both restoration sites for Sandy Point, Mississippi River, Ship Shoal, and Empire borrow area sediments.

Table 4. – Parameters detected in elutriates (total fraction) derived from Mississippi River, Sandy Point, and Ship Shoal borrow area sediments which exceeded the most stringent State/Federal acute and/or chronic criteria, and associated dilution required to achieve compliance with water quality criteria at the edge of the mixing zone.

Borrow Area	Parameter	Most Stringent Marine State/Federal Water Quality Criteria		Result	Dilution Required to Meet Most Stringent State/Federal Water Quality Criteria	
		Acute	Chronic		Acute	Chronic
		(Criteria and sample results in µg/L units)				
Mississippi River	Copper	3.63	3.1	19	6.6	8.83
	Lead	209	8.1	19		4.84
Sandy Point	Copper	3.63	3.1	3.4		0.17
South Pelto	Mercury	1.8	0.025	0.24		

Key:

Comparison indicates that result exceeds most stringent State/Federal chronic water quality criteria only

Comparison indicates that result exceeds most stringent State/Federal acute and chronic water quality criteria

No dilution required

Caminada Headland/Belle Pass borrow area sediments: It was discovered that the collection of additional sediment, water, and elutriate data for the barrier shoreline restoration project omitted the collection of data for the Caminada Headland and Belle Pass borrow areas, which prompted additional review of historical data in the vicinity of these borrow areas.

Historical sediment evaluation data in the vicinity of the borrow area is presented in the 1994 Port Fourchon Feasibility Study (USACE 1994), and includes data for Belle Pass. The data included in this feasibility study is for samples located within eight miles of the Caminada Headland borrow area, within the Caminada Headland renourishment borrow area location of Belle Pass. At the time samples were collected from Belle Pass (1989), Port Fourchon was less developed, and it would thus be expected that sediment quality would be less influenced by Port Fourchon industry and therefore possibly more representative of the Caminada Headland borrow area, but may be less representative of the Belle Pass borrow area.

Chemical analyses were performed on water and sediment, as well as elutriates, which are a mixture of dredging site water and sediment that simulates and is used to predict the chemical properties of dredged material effluent waters exiting the restoration site during a dredged material disposal operation. Chemical classes measured (with the number of chemical compounds measured in each chemical class in parenthesis) include metals (10), chlorinated pesticides (15), inorganics (7), and oil and grease.

Surface Water Chemistry – Summary of Results

Results for chemical analyses of surface waters adjacent to the restoration areas are useful in addressing the abilities of those waters to dilute the dredged material effluent waters which will discharge from the site during dredged material disposal operations. Although surface water chemistry results for the Caminada Headland borrow area were not available in the Port Fourchon Feasibility Study, the additional data collection for the Caminada Headland and Shell Island restoration projects includes water chemistry results for a sample collected in the vicinity of the Caminada Headland and Belle Pass borrow areas, the summary of results for which is located in **table 2**.

Sediment Chemistry – Summary of Results

Sediment chemistry results are useful in determining, at a reconnaissance level, the potential for long-term effects of sediments on organisms which are in direct contact with surface sediments of the restoration areas. In addition, the comparison of sediment chemistry to sediment screening values can be performed to determine whether further investigation of the sediment (elutriate chemistry and biological testing, the latter of which includes the direct exposure of benthic and water column organisms to sediments) is warranted. **Table 5** summarizes the sediment chemistry results for Belle Pass.

A total of six (6) metals, two (2) inorganics and one (1) chlorinated pesticide were detected in selected Belle Pass sediments, with none of the parameters being detected at levels which exceed sediment screening values (NOAA 2008). If, in addition to providing sediment chemistry for the Belle Pass borrow area, the Belle Pass data is used as a surrogate for data for the Caminada Headland borrow area, the sediment chemistry results indicate that it is not expected that the placement of dredged sediments from these borrow areas would result in adverse long-term impacts to aquatic organisms.

Table 5. - Belle Pass Water and Sediment Evaluation - Sediment Chemistry Results.

Parameter	NOAA Marine Sediment Screening Values		Sampling Location
	TEL	PEL	BL#6-8
	(All values in µg/kg units)		
Metals			
Cadmium	680	4,210	59
Calcium			729
Chromium	52,300	160,000	3,540
Magnesium			297
Nickel	15,900	42,800	2,410
Zinc	124,000	271,000	274
Inorganic/General Chemistry			
Ammonia-N			7,260
Nitrogen, Total Kjeldahl			638,000
Chlorinated Pesticides			
Dichlorophenoxy acetic acid (2,4-D)			77

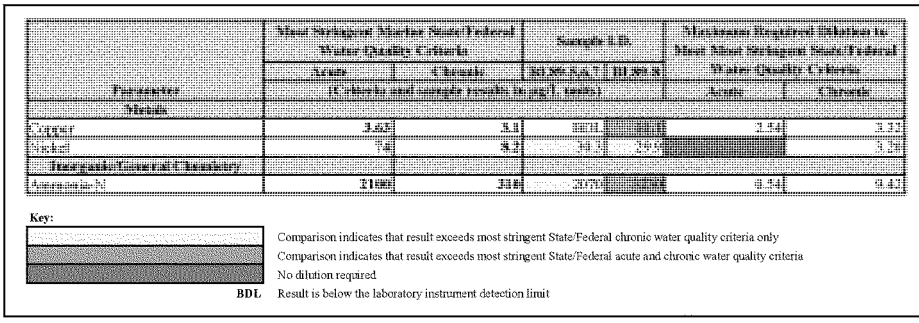
No sediment screening value available

BDL Result is below the laboratory instrument detection limit

Elutriate Chemistry – Summary of Results

Table 6 depicts the exceedences of water quality criteria for detectable elutriate chemistry results for sediments derived from the Belle Pass borrow area, along with the dilution required to meet acute and chronic water quality criteria for these results. Results indicate the potential for exceedences of chronic criteria for copper, nickel, and ammonia. In addition, results indicate the potential for exceedences of acute water quality criteria for copper and ammonia. Dilution requirements for all exceedences are relatively minor (less than 10). Considering the relatively low dilution requirements, it is anticipated that sufficient dilution would be achieved in order to meet compliance with water quality criteria before the edge of the mixing zone (a radial distance of 400 feet from the point of discharge) for Belle Pass and Caminada Headland borrow area sediments.

Table 6. – Parameters detected in elutriates derived from Bell Pass sediments which exceeded the most stringent State/Federal acute and/or chronic criteria, and associated dilution required to achieve compliance with water quality criteria at the edge of the mixing zone.



Parameter	Most Stringent Marine State/Federal Water Quality Criteria		Sample I.D.	Maximum Required Dilution to Meet Most Stringent State/Federal Water Quality Criteria	
	Acute	Chronic	[illegible]	Acute	Chronic
	(Criteria and sample results in mg/L unless)				
Metals					
Copper	3.63	2.9	[illegible]	2.54	3.33
Nickel	74	8.3	[illegible]	[illegible]	3.28
Inorganic/General Chemistry					
Ammonia-N	2.86	2.86	[illegible]	0.54	0.43

Key:

Comparison indicates that result exceeds most stringent State/Federal chronic water quality criteria only

Comparison indicates that result exceeds most stringent State/Federal acute and chronic water quality criteria

No dilution required

BDL Result is below the laboratory instrument detection limit

(c) Effects on Clarity: For all discharge sites evaluated, temporary and localized elevated turbidity and suspended solids levels would reduce surface water clarity for a short time during construction and placement of fill material or incidental discharge. Any effects would be short-term and clarity would return to background conditions following these activities.

(d) Effects on Color: For all discharge sites evaluated, color in surface waters within and immediately adjacent to the restoration area may be intensified for a short time, primarily during construction and placement of fill material or incidental discharge. Any effects would be short-term and color would return to background conditions following these activities.

(e) Effects on Odor: For all discharge sites evaluated, organic materials present in the fill material discharged would likely release odors otherwise contained. This localized and short-lived condition would not be hazardous. Any effects would be short-term and odor would return to background conditions following these activities.

(f) Effects on Taste: For all discharge sites evaluated, alteration of taste caused by construction activities would be short-term and of little consequence as there are no potable water intakes within the study area.

(g) Effects on Dissolved Gas Levels: For all discharge sites evaluated, short term decreases in dissolved oxygen levels could occur in the areas of construction, due to the oxygen demands associated with fill placement and the disturbance of sediments. These conditions would be short-term with dissolved oxygen returning to background levels shortly after construction is completed.

(h) Effects on Nutrients:

Caminada Headland discharge site: Some nutrient concentrations would likely increase as a result of construction activities and placement of fill material. **Table 7** displays a comparison between nutrient concentrations in elutriates derived from Belle Pass sediments (sediments representative of the Caminada Headland and Belle Pass borrow areas)and in surface water adjacent to the Headland. For Belle Pass sediments, these elutriates results reveal that the placement of dredged material from the borrow area may temporarily elevate levels of ammonia, Kjeldahl nitrogen, and nitrate + nitrite nitrogen present in surface waters adjacent to the headland. For the South Pelto borrow area sediments, the elutriates results reveal that the placement of dredged material from the borrow area may temporarily elevate levels of ammonia and nitrate + nitrite nitrogen. The source of these increases would be the organic components of fill material discharged during restoration activities. These conditions would be short-term and nutrient levels would return to background concentrations shortly after construction is completed.

Table 7. - Comparison of Caminada Headland borrow area elutriates to surface water for nutrients.

Nutrient	Caminada Headland Surface	Elutriates		
		Caminada Headland/Belle Pass	South Pelto 1	South Pelto 2
	(All values in mg/L units)			
Ammonia	BDL	3.23[a]	0.019	0.027
Kjeldahl Nitrogen	1.2	3.93[a]	0.2	0.3
Nitrate + Nitrite Nitrogen	BDL	0.25[a]	0.49	0.61
Total Phosphorus	48	BDL[a]	0.19	0.13
Organic Nitrogen	2.7	-[a]	0.18	0.28

[a] Results extracted form the 1994 Port Fourchon Feasibility Study

BDL = result is below the laboratory instrument detection limit

Shell Island discharge site: Some nutrient concentrations would likely increase as a result of construction activities and placement of fill material. **Table 8** displays a comparison between nutrient concentrations in elutriates derived from borrow material and in surface water present at Shell Island. For elutriates derived from Mississippi River and Sandy Point borrow area sediments, results reveal that the placement of dredged material from the borrow areas may temporarily elevate levels of ammonia, Kjeldahl nitrogen, nitrate + nitrite nitrogen, and organic nitrogen present in waters adjacent to Shell Island. For the Empire borrow area sediments, the elutriates results reveal that the placement of dredged material from the borrow area may temporarily elevate levels of Kjeldahl nitrogen, nitrate + nitrite nitrogen, and organic nitrogen. The source of these increases would be the organic components of fill material discharged during restoration activities. These conditions would be short-term and nutrient levels would return to background concentrations shortly after construction is completed.

Table 8. - Comparison of Shell Island borrow area elutriates to surface water for nutrients

Nutrient	Shell Island Surface Water	Elutriate			
		Empire	Mississippi River	Sandy Point 1	Sandy Point 2
	(All values in mg/L units)				
Ammonia	0.014	BDL	0.47	0.022	0.12
Kjeldahl Nitrogen	0.14	1	1.9	0.81	1.2
Nitrate + Nitrite Nitrogen	BDL	0.56	2	1.7	1.7
Total Phosphorus	83	0.34	0.82	0.2	0.15
Organic Nitrogen	0.25	1	1.4	0.79	1.1

(i) Effects on Eutrophication: For all discharge sites evaluated, minor eutrophication could occur in the short term due to increased nutrient levels caused by placement of fill material for restoration of the barrier system. However, following completion of construction activities, no additional nutrients would be available to contribute to an increase in eutrophic levels. No long-term enrichment of surface waters in the study area is likely to occur.

(2) Effects on Current Patterns and Circulation:

(a) Effects on Current Patterns and Flow: Barrier system restoration—including interior marsh restoration, beach and dune fill, and renourishment features—would likely alter the tidal prism, thereby reducing formation of any additional tidal passes as well as "healing" (closing or narrowing) existing tidal passes and overwash areas. This in turn would affect the strength and direction of current patterns and flow in a manner which would help restore natural sand transport along this reach of the coast, supporting the adjacent regional shorelines and various shoreline habitats.

The restoration of the islands would also help reduce, to some undetermined level, storm surges that could reach the back levee near Empire. Hurricane Danny, a weak Category 1 hurricane in 1997, caused damage to Empire and the surrounding communities because of the absence of the Shell Island Reach and the trajectory of this storm. The Shell Island project would help provide some undetermined level of protection to the communities of Empire, Sunrise, Buras, and Triumph. Restoration of these barrier systems would provide natural storm buffering, contribute to limiting storm surge heights, and provide some undetermined level of protection for the interior wetlands, bays, and estuaries.

For all discharge sites evaluated, existing current patterns and flows through degraded barrier habitats and marsh would be modified by proposed restoration activities. Existing breaches, overwash areas, inlets (e.g., Coupe Bob), and shallow open water areas would be filled for restoration/creation of barrier habitats and salt marsh.

As the project will help to reduce the dieback of backbarrier marsh, it will therefore aid in maintaining and improving present current pattern and flow conditions for marsh areas. The immediate reduction in current and flow that the barrier islands provide serve to protect these marsh areas from erosional loss due to the high energy Gulf of Mexico waters.

(b) Effects on Velocity: For all discharge sites evaluated, the proposed action would generally have little appreciable effect on velocity. Placement of fill material for restoration of the barrier system would fill some shallow water areas and close existing breaches, overwash areas, and some storm-induced tidal inlets. The proposed action would not affect velocities of adjacent waterways.

(c) Effects on Stratification: For all discharge sites evaluated, the proposed action would have little, if any, appreciable effect on water column stratification from current conditions. The dynamic, relatively high-energy shallow waters along the barrier shoreline would prevent the occurrence of stratification in the project vicinity.

(d) Effects on the Hydrologic Regime: For all discharge sites evaluated, the proposed action would modify the hydrologic regime by closing existing breaches, overwash areas, storm-induced inlets (e.g., Coupe Bob), and filling shallow open water areas. The proposed action would partially restore the historical hydrologic regime of the area by facilitating a slower and more natural tidal exchange. Stabilization of the barrier shoreline would restore the integrity of existing barrier habitat and interior salt marshes adjacent to this area, as well as reduce the continued fragmentation and loss of these habitats.

(3) Effects on Normal Water Level Fluctuations: For all discharge sites evaluated, the proposed action would affect existing water level fluctuations by closing existing breaches, overwash areas, and storm-induced tidal inlets along the barrier shoreline. The proposed action would partially restore normal water level fluctuations in the area by facilitating a slower and more natural tidal exchange. Stabilization of the barrier shoreline would restore the integrity of existing barrier habitat and interior salt marshes adjacent to this area, as well as reduce the continued fragmentation and loss of these habitats.

(4) Effects on Salinity Gradients: For all discharge sites evaluated, the proposed action would not affect normal salinity gradients.

C. SUSPENDED PARTICULATE/TURBIDITY DETERMINATIONS

(1) Expected Changes in Suspended Particulate and Turbidity Levels in the Vicinity of the Discharge Sites: For all discharge sites evaluated, there would be a localized short-term increase in suspended particulates and turbidity levels during and shortly after placement of fill material. Increased concentrations of turbidity would occur in close proximity to the construction activities, with concentrations decreasing with distance away from the construction activities. Mitigation methods may include controlling sediment dispersion near the construction site or providing a barrier for outside activities. Methods to reduce sediment dispersion in open water areas resulting from construction activities may include silt/turbidity screens or other devices.

The increased concentrations of TSS and turbidity would result in short term disruption and some temporary displacement of aquatic communities in the restoration areas during the construction phase of the project. No adverse impacts from turbidity are expected to persist beyond the construction phase, as suspended particulates and turbidity levels would return to

background levels following completion of construction.

(2) Effects on Chemical and Physical Properties of the Water Column

(a) Effects on Light Penetration: For all discharge sites evaluated, there would be localized short-term decreases in light penetration associated with increased suspended particulates and turbidity levels in the water column generated during construction. Light penetration would return to background levels shortly after construction is completed.

(b) Effects on Dissolved Oxygen: For all discharge sites evaluated, there would be localized short-term decreases in dissolved oxygen levels due to release of nutrients from organic soils used as borrow. Dissolved oxygen would return to background levels shortly after construction is completed.

(c) Effects on Toxic Metals and Organics

Caminada Headland discharge site: The fill material secured from the South Pelto block of Ship Shoal, Belle Pass, and the Caminada Headland borrow areas would have a limited degree of metal and organic constituents. As such, the proposed action would not result in significant increases in metals or organics. Incidental discharges resulting from restoration construction activities could cause a temporary increase in metals and organics through reintroduction into the water column. Any releases would be minimal and limited to the construction area. Levels would return to background upon the completion of construction.

Shell Island discharge site: The fill material secured from the Sandy Point, Empire, and Mississippi River borrow areas would have a limited degree of metal and organic constituents. As such, the proposed action would not result in significant increases in metals or organics. Incidental discharges resulting from restoration construction activities could cause a temporary increase in metals and organics through reintroduction into the water column. Any releases would be minimal and limited to the construction area. Levels would return to background upon the completion of construction.

(d) Effects on Pathogens: For all discharge sites evaluated, the proposed action would have no significant effect on pathogenic organism concentrations.

(e) Effects on Esthetics: For all discharge sites evaluated, localized short-term increased turbidities, slight odors, and off-coloration of waters resulting from placement of fill material would be esthetically displeasing. Following construction, esthetics would be improved by restoration of degraded barrier habitats and salt marsh.

(3) Effects on Biota

(a) Primary Production and Photosynthesis: For all discharge sites evaluated, localized short-term elevated suspended particulate and turbidity levels associated with fill material discharge and construction activities would limit light penetration and reduce photosynthesis. There could also be some associated reductions in primary productivity in adjacent waterways. However, the discharge would be localized and of short duration; hence,

any loss of biomass caused by the reduction in photosynthesis and primary productivity would only be minor.

(b) Suspension/Filter Feeders: For all discharge sites evaluated, impacts on suspension or filter feeders would only be minor due to increased localized short-term increases in suspended particulates and turbidity. The Waterways Experiment Station Dredged Material Research Program has demonstrated that adult filter feeders are capable of withstanding temporary increases in suspended particulates and can recover from minor amounts of new sediment deposits. Larval and juvenile forms may be lost even with temporary turbidity increases. However, repopulation of suspension/filter feeders would occur following completion of construction.

(c) Sight Feeders: For all discharge sites evaluated, sight feeders, primarily fish and mobile shellfish, would not be adversely affected by the temporarily increased suspended particulates or turbidities. These animals are generally mobile and can escape or avoid any areas of high turbidities.

(4) Actions Taken to Minimize Impacts: For all discharge sites, see Section II. A.5-Actions Taken to Minimize Impacts.

D. CONTAMINANT DETERMINATIONS

For all discharge sites evaluated, a phase 1 Hazardous, Toxic, and Radiological Waste investigation concluded there is little if any potential for contaminants within the borrow material, or at the restoration sites.

Sediment and water collected by the Louisiana Department of Natural Resources (LDNR) from all of the proposed borrow sites except for the Caminada Headland and Belle Pass borrow areas, which were mistakenly overlooked for the collection effort, revealed no levels of contaminants in borrow area sediments which exceeded NOAA sediment screening values (NOAA 2008). Because no sediment screening values were exceeded, the review of elutriates derived from sediments from these borrow areas is not necessary, and no adverse impacts to the water column are expected from the proposed dredging material placement activities for these borrow areas.

Sediment collected by for the Port Fourchon Feasibility study from Belle Pass, which in addition to representing Belle Pass borrow area material is expected to be similar to Caminada Headland borrow area material, revealed no levels of contaminants in borrow area sediments which exceeded NOAA sediment screening values (NOAA 2008). Because no sediment screening values were exceeded, the review of elutriates derived from sediments from these borrow areas is not necessary, and no adverse impacts to the water column are expected from the proposed dredging material placement activities for these borrow areas.

In addition, it is expected that any level of contaminants present in the water column during dredged material placement operations and construction activities will be quickly dispersed and diluted by tidal action.

E. AQUATIC ECOSYSTEM AND ORGANISM DETERMINATIONS

(1) Effects on Plankton: Suspended particulates and turbidity associated with discharge would temporarily reduce photosynthesis, primary productivity, and biomass. Since discharges would be of short duration, eutrophication is not likely to occur, thus there would be minimal effects on plankton populations. See also Section II.C.(3)(a)-Primary Production and Photosynthesis above.

(2) Effects on Benthos: See Section II.A.(4)-Physical Effects on Benthos and Section II.C.(3).(a)-Primary Production and Photosynthesis, above.

(3) Effects on Nekton: Nekton species inhabiting the proposed action area are typically very mobile, would likely relocate from the construction site, and would not be otherwise affected by the proposed action. However, nekton may be destroyed during construction if they could not escape the construction area. Potential adverse effects of increased suspended particulates, turbidity, low dissolved oxygen, contaminants, or water quality on the nekton are not likely to occur. See also Section II.C.(3)(c)-Sight Feeders.

(4) Effects on the Aquatic Food Web: For all discharge sites evaluated, there would be localized short-term reduction in habitat quality that could adversely affect the aquatic food chain. The restoration of approximately 1,212 acres of barrier habitat and 1,537 acres of salt marsh would positively impact the aquatic food web by increasing available habitat for aquatic most, if not all aquatic organisms. The restoration of critical and essential transitional barrier habitats would provide energy inputs to the benthic food web. More nutrients and detritus would be added to the food web, thereby increasing fish productivity and providing a benefit to local fisheries.

(5) Effects on Special Aquatic Sites

(a) Wetlands: Placement of material at the disposal sites would impact approximately 1,020 acres of waterbottoms and 2,849 acres of fragmented barrier habitats.

Caminada Headland discharge site: Approximately 1,186 acres of fragmented salt marsh and associated shallow open water areas within the project area would be restored by placement of fill material to an elevation of about +2.0 to +2.5 feet NAVD. Approximately 880 acres of barrier beach, dune, supratidal and intertidal habitat would be restored or created thereby providing significant increase in wetland habitat for this high land loss barrier system. Restoration of supratidal and intertidal vegetated coastal barrier habitats would be expected to reduce conversion of these habitats to open water habitat; and provide higher quality essential fish habitat, especially nursery habitat, for several aquatic species. Vegetative plantings would contribute to re-establishment of a variety of wetland species that would further aid in sediment trapping.

Operations and maintenance of the Caminada Headland will include renourishment beneficially used in conjunction with the USACE operations and maintenance dredging of the bar channel of Bayou Lafourche, Louisiana (Belle Pass) navigation project. Dredging of the pass yields on average approximately 650,000 gross cubic yards of material every 1.5 to 2 years. This material will be placed in the littoral drift south of Bayou Moreau where the sediment budget indicates

that the long shore transport of material splits going east and west. The material will be placed unconfined between 100 and 300 feet offshore from the shoreline's top of bank, allowing the long shore transport and wave action to move and place the sediment along the headland. The material will be pumped offshore of the nodal point directly impacting approximately 67 acres. The Caminada Headland is a high energy wave environment that is very dynamic. The material will be stacked no higher than + 6 feet MLG, but will be quickly reworked by the wind and waves. The pumping of the material will take approximately 54 days, with placement and removal of the pipeline taking a total of approximately 98 days. The pipe will be placed offshore. The material will be dredged from a federal navigation channel which previously received NEPA clearance for the maintenance dredging of the Bayou Lafourche channel. Approximately 124.2 acres will be directly impacted by the dredging. Over each 10 year period, an estimated 3.9 million cubic yards of material from six dredging cycles (650,000 cubic yards per cycle) will be returned to the headland.

Shell Island discharge site: Approximately 351 acres of fragmented salt marsh and associated shallow open water areas within the project area would be restored by placement of fill material to an elevation of about +2.0 to +2.5 feet NAVD. Approximately 332 acres of barrier beach, dune, supratidal and intertidal habitat would be restored or created thereby providing significant increase in wetland habitat for this high land loss barrier system. Other impacts are expected to be similar to those for the Caminada Headland.

(b) Mudflats: Placement of material at the disposal sites would impact approximately 1,020 acres of waterbottoms. Most, if not all, of existing mudflats and associated shallow open water areas within the proposed action area would be converted to barrier habitat or salt marsh. However, with the addition of approximately 16,466,500 cubic yards of material into the barrier system, new mudflats would likely be formed.

(c) Vegetated Shallows: There are no vegetated shallows within the proposed action area.

(d) Coral Reefs: There are no coral reefs within or nearby the proposed action area.

(e) Riffle and Pool Complexes: The proposed action area is a barrier system with no riffle or pool complexes.

(f) Sanctuaries and Refuges: There are no sanctuaries or refuges within the or immediately adjacent to the proposed action area. The nearest such entities are outside the proposed action area and include the Wisner Wildlife Management Area and the Grand Isle State Park.

(6) Threatened or Endangered Species: A Biological Assessment (BA) has been prepared evaluating potential impacts of the proposed action on Federally-listed and proposed threatened and endangered species and designated and proposed critical habitat, to determine whether any such species or critical habitat would likely be adversely affected by the action within the proposed action area. For all discharge sites evaluated, the proposed action would not

affect threatened or endangered species outside of the proposed action area. The conclusion of formal consultation with the USFWS is anticipated on 12 January 2012 for the BBBS project. A preliminary draft BO has been received and no changes to this draft are anticipated at this time. Impacts to sea turtles would within federal waters so consultation with the NMFS is being coordinated with the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE). A summary of the protected species within the project area is presented below.

There are no known threatened or endangered floral species in the vicinity of the proposed action. The threatened piping plover (*Charadrius melodus*) may winter in or near the project area, frequenting outer beaches and occasionally foraging on mudflats within the project area. In the July, 2001 Final Rule, the USFWS designated critical habitat for wintering populations of the endangered piping plover, which includes the Caminada Headland (Unit LA 5 Timbalier Island to East Grand Terre), as well as most of Louisiana's barrier islands (Federal Register, Vol. 66, No. 132). Critical habitat is habitat essential for the conservation or recovery of an endangered or threatened species. MVN has determined that the proposed action may affect, but not likely to adversely affect this species. The endangered West Indian manatee (*Trichechus manatus*) has been reported in the Lake Pontchartrain basin and Mississippi River, during the summer months and may be a rare visitor in the project area. Threatened and endangered sea turtles typically frequent the Louisiana coast as they forage in estuarine waters. MVN has determined that the proposed action would not likely adversely affect this species. Three species of sea turtle classified as endangered including the hawksbill (*Eretomchelys imbricata*), Kemp's ridley (*Lepidochelys kempii*), and leatherback (*Dermochelys coriacea*) and two species of sea turtles classified as threatened including the green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) may occur in the project area. Though, any of the turtles could potentially inhabit the general vicinity of the coastal portions of the project area, MVN has determined that the proposed action would not likely adversely affect these species.(NMFS and USFWS 1991a, 1991b; NMFS and USFWS 1992a; USFWS and NMFS 1992b; NMFS and USFWS 1993). Five endangered whale species might be present in offshore Louisiana waters. All whales are principally marine deepwater species and would not likely be impacted by the proposed action..

(7) Wildlife: Dundee and Rossman (1989) report that Louisiana is a herpetological crossroads with most of the taxa considered extraneous; that is, they reach one periphery of their range in Louisiana and presumably originated elsewhere. With the exception of American alligator (*Alligator mississippiensis*) harvest data, little if any information exists regarding population status of amphibians and reptiles in the study area. The herpetofauna typically found in the Gulf salt marsh environments are the Gulf salt marsh snake (*Nerodia clarkii clarkia*), the Gulf coast toad (*Bufo valliceps*), and the diamondback terrapin (*Malaclemys terrapin)* (Abernethy (1987).

Abernethy (1987) reports 411 species of birds inhabit the Barataria-Terrebonne estuary. BTNEP Report #21 (Condrey et al. 1995) cites 353 species of birds occurring throughout the Barataria-Terrebonne estuary. Many of these birds, because of their life history requirements, would not likely be found in the Caminada Headland or Shell Island study area. Typical avifauna that may be found in the proposed action area included seabirds; wading birds; shorebirds; dabbling and diving ducks; geese; raptors; rails, coots, and gallinules; other marsh open water residents; other woodland residents; other marsh open water migrants; and other woodland migrants.

Lowery (1974a) provides one of the earliest comprehensive descriptions of Louisiana's mammals. Abernethy (1987) reports 32 species of mammals inhabit the Barataria-Terrebonne estuary. Choate et al. (1994) identifies 48 species of mammals as occurring, potentially occurring, or historically occurring in the Barataria-Terrebonne estuary system. BTNEP Report #21 (Condrey et al. 1995) cites 48 species of mammals occurring throughout the Barataria-Terrebonne estuary. Many of these mammals, because of their life history requirements, would not likely be found in the Caminada Headland or Shell Island areas. Mammals that occur or potentially occur in the study area include: bats (*Chiroptera spps*), raccoon (*Procubic yardson lotor*), coyote (*Canis latrans*), mink (*Mustela vision*), muskrats (*Ondatra zibethicus*), nutria (*Myocastor coypus*), river otter (*Lutra canadensis*) striped skunk (*Mephitis mephitis)*, swamp rabbit (*Sylvilagus aquaticus*), and small mammals such as rats, mice, and shrews. The bottlenose dolphin (*Tursiops truncates*) is the primary marine mammal frequenting the study area, often foraging in the barrier passes and inlets. The West Indian manatee (*Trichechus manatus*) has been documented occasionally in the Lake Pontchartrain Basin. Various species of whales have also been documented occasionally in the offshore waters of the study area. Six marine mammals, that are primarily pelagic, may occur in the waters of the Gulf of Mexico, they include the blue (*Balaenoptera musculus*), finback (*Balaenoptera physalus*), humpback (*Megaptera novaeangliae*), sei (*Balaenoptera borealis*), and sperm (*Physeter macrocephalus*) whales.

Impacts to wildlife from the proposed action would primarily result from construction activities related to placement of borrow material on existing fragmented dune, supratidal, intertidal (Gulfside and bayside) and shallow open water habitats. The proposed action would restore a total of 2,849 acres of beach, dune, supratidal and marsh habitats for use by different wildlife species (**table 5-3)**. Shell Island would be restored as two islands. During implementation of Alternative C5/S1 (RP), construction activities may disrupt or displace wildlife species. However, any such impacts would be localized and temporary, and most wildlife species would move to an area with more favorable conditions and return after construction is completed. No permanent displacement would be expected from the construction of the foreshore protection features. A net total of 1,684 acres of important and essential vegetated habitats would be used by fish and wildlife for shelter, nesting, feeding, roosting, cover, nursery and other life requirements; increased vegetation growth and productivity; and reduced inter- and intra-specific species competition between resident and non-resident fish and wildlife species for limited coastal vegetation. Important stopover habitats used by migrating neotropical birds would be restored and sustained for future use over the 50-year period of analysis.

(8) Actions to Minimize Impacts: Specific actions to minimize impacts are defined in Section II.A.5-Actions Taken to Minimize Impacts.

F. PROPOSED DISPOSAL SITE DETERMINATIONS

(1) Mixing Zone Determination

Sandy Point, Mississippi River, Ship Shoal, and Empire borrow area sediments: Dilution requirements for all exceedences are relatively minor (less than 10). Considering the relatively low dilution requirements associated with total elutriates results exceeding water quality criteria, it is anticipated that sufficient dilution would be achieved in order to meet compliance with water quality criteria before the edge of the mixing zone (a radial distance of 400 feet from the point of

discharge) at both restoration sites for Sandy Point, Mississippi River, Ship Shoal, and Empire borrow area sediments.

Caminada Headland/Belle Pass borrow area sediments: Dilution requirements for all exceedences are relatively minor (less than 10). Considering the relatively low dilution requirements, it is anticipated that sufficient dilution would be achieved in order to meet compliance with water quality criteria before the edge of the mixing zone (a radial distance of 400 feet from the point of discharge) for Belle Pass and Caminada Headland borrow area sediments.

(2) Determination of Compliance with Applicable Water Quality Standards:

(a) Effects of Construction:

Construction activities may result in temporarily elevated levels of some water quality parameters, including: floating, suspended, and settleable solids, color, taste and odor, nutrients, turbidity, total dissolved solids, and dissolved oxygen levels. Any elevated levels of these parameters present at the dredged material disposal site would very quickly be dispersed and thereby diluted by the Gulf of Mexico tides.

(b) Effects of Removing the Study Area From the Floodplain:

(c) Summary of Effects: The primary effects of this project are minor short term effects from construction that may include increased turbidity and sedimentation, and contamination from construction equipment and operations. The effects of construction are generally temporary and would subside when construction ceases.

(3) Potential Effects on Human Use Characteristics

(a) Municipal and Private Water Supply: For all discharge sites evaluated, the proposed action would have no effect on any municipal or private water supply intakes.

(b) Recreational and Commercial Fisheries: The proposed action area would be unavailable for use during actual restoration construction operations. However, this would be of short duration and is not expected to adversely alter or destroy areas of public use or concern. The proposed action would restore approximately 2,849 acres of barrier habitat and salt marsh that includes shoreline access points and recreation areas. Additionally, the increase in wetland acreage would provide additional habitat for fishery resources, including improved quality and quantity of essential fish habitat, increasing the opportunities for fishing activities in the project area.

(c) Water Related Recreation: Water related recreational activities in the study area are abundant and include boating and recreational fishing. The proposed action area would be unavailable for use during actually restoration construction operations. After restoration activities, the proposed action area would be more attractive for public use and would address the expressed concern for restoring Louisiana's barrier systems. The increase in the

quality and quantity of aquatic habitat would increase recreational opportunities in the area, especially water related recreation.

(d) Esthetics: For all discharge sites evaluated, esthetics would be adversely impacted due to the presence of mud, machinery, and other equipment associated with construction. In addition, the visual quality of the area would be adversely impacted due to the temporary However, volunteer vegetation will become established and return some of this visual quality. There would be temporary, minor adverse impacts to air quality near construction areas. Dust and exhaust fumes from construction equipment would occur during construction; however, no violations of state air quality standards are expected to occur during construction. Deposition of material would cause esthetic concerns related primarily to increases in turbidity and water discoloration during construction. Noise levels would increase temporarily in the study area during construction. Since construction would take place during daylight hours, sleep interference would be minimal. EPA has a limit of 85 dBA for eight hours of continuous exposure to protect against permanent hearing loss. Noise above this level would not occur for periods longer than eight hours.

(e) Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites and Similar Preserves: No such sites occur in the proposed action area. However, areas of significance in the general vicinity of the proposed action area include Wisner Wildlife Management Area and Grand Isle State Park. There would be no direct impact to these areas from the proposed action.

(f) Determination of Cumulative Effects on the Aquatic Ecosystem: The project would synergistically interact with other Federal, state, local, and private restoration efforts in the area further providing important and essential wetland habitats. The proposed action would restore a net total of 1,684 acres of transitional estuarine-marine habitats used for spawning, nursery, nesting, and foraging by commercially and recreationally important species of finfish and shellfish, as well as other aquatic organisms. The proposed action would also provide additional essential transitional barrier habitat which provide energy inputs to the benthic food web thereby increasing the base of the existing food web and providing a positive benefit to local area fisheries.

(g) Determination of Secondary Effects on the Aquatic Ecosystem: Restoration would provide additional habitats for foraging, breeding, spawning, and cover for a variety of larval, juvenile, and adult fishes. A localized increase in biodiversity, some fish

populations, and fish productivity would be expected to occur due to the net increase in emergent wetlands constructed and the additional nutrients and detritus added to the food web.

Deepwater Horizon April 20, 2010, Oil Spill

The shoreline will be cleaned, using 2011-2012 SCCP Endpoints Criteria, to the level that is acceptable to the USCG and the landowner. A minor amount of residual petroleum product, in the form of Submerged Residue Balls (SRBs) or Submerged Residue Patties (SRPs) could remain within the sub-tidal zone, inter-tidal zone, and supra-tidal zone of the shorelines following final sign off and agreement that removal actions are deemed complete for the affected segments. Any remaining, residual oil would slowly and naturally degrade or attenuate. Tides and wave action could bring additional oil ashore (re-oiling) from deeper water, such as from residual mats remaining in the subtidal zones. Should re-oiling occur within any of these segments and should the product be identified as MC252 oil, the affected segment(s) will follow the process defined in the SCCP, Section 1, Page 5, and will be responded to by the existing response organization and resource infrastructure in each state. The existing infrastructure includes the National Response Center (NRC) Process, as defined in 40 CFR, Part 300.

Gulf Oil Spill Additional Sample Collection

In conjunction with the BP Gulf of Mexico oil spill, the U.S. Environmental Protection Agency (EPA) has been conducting sampling and chemical analysis of air, surface water, and water bottom sediments to aid in determining the locations and mediums most affected by the spill, for the purposes of protection of human health and aquatic life (USEPA 2011). For the project area encompassed by the Barataria Basin Barrier Shoreline (BBBS) Restoration project, several sediment samples were collected for chemical analysis of compounds expected to be released by the oil spill and by dispersant application which are likely to be indicative of the short- and possibly long-term effects of the spill on borrow area and restoration area sediments.

Table 9 includes sediment chemistry results for samples collected by the EPA in the footprint of the BBBS project, and includes samples collected in proximity to the Caminada Headland and Shell Island, as well as to the nearshore borrow areas for both of these restoration features (see also **figure 16**). Results were compared to NOAA Screening Quick References Tables (SQuiRTs) sediment screening values for available chemical compounds in order to predict whether nearshore borrow area sediments or existing sediments at restoration feature areas have the potential for adverse long-term impacts to benthic organisms (NOAA 2008). Eighteen (18) samples were collected in the vicinity of restoration features and nearshore borrow areas over a time period ranging from April 30th to September 17th, 2010; between all of these samples analysis was conducted for two (2) different metals, fourteen (14) different polycyclic aromatic hydrocarbons, twenty one (21) semi-volatile organic compounds, total petroleum hydrocarbons (oil and gasoline), and eight (8) different volatile organic compounds.

For two samples located nearby Shell Island (one sample located inland and one sample located nearshore of the island), which were collected in September 2010, chemistry results exceeded low-level NOAA sediment screening values. For the sample collected inland of Shell Island (collected at EPA Station I.D. T001-SV231, 29.3218°N, -89.738067°W), the measured concentration of nickel exceeded the effects-range low (ERL) screening value, while the measured concentration of dibenzo(a,h)anthracene exceeded the threshold-effects level (TEL) screening value. For the sample collected nearshore to Shell Island (collected at EPA Station I.D. T008-R650, 29.26712°N, -89.69924°W), the measured concentration of nickel exceeded the

TEL screening value. These exceedences of screening values are indicative of possible effects levels for associated contaminants. For the remaining samples located in the vicinity of both restoration features and associated nearshore borrow areas, no contaminant concentrations were measured at levels exceeding NOAA sediment screening values.

Based on the evaluation of available sediment chemistry results for EPA samples collected in the vicinity of restoration features and associated nearshore borrow areas, it is possible that restoration areas and nearshore borrow areas for the BBBS project may contain levels of contaminants in sediment that could have adverse effects on bethic organisms. However, most sediment samples collected in the vicinity of restoration features and nearshore borrow areas did not reveal any levels of contaminants exceeding NOAA sediment screening values, and the two samples which did reveal exceedences of sediment screening values only revealed possible effects levels for two contaminants. Therefore, available sediment chemistry results do not indicate that, overall, that placement of nearshore borrow sediments for marsh restoration at Shell Island and the Caminada Headland would result in adverse long-term impacts to benthic organisms. However, as the EPA samples analyzed are not site-specific, and because remnant oil from the spill remains in areas of coastal Louisiana, this conclusion is not steadfast and only represents an evaluation of best available information.

Following the BP oil spill, a report was prepared by USCG Operational Science and Advisory Team (OSAT) characterizing sub-sea and sub-surface oil and dispersants (OSAT 2010). The purpose of the report was "to provide the Federal On-Scene Coordinator for the Deepwater Horizon MC252 Spill of National Significance with sufficient information to determine the presence or absence of sub-surface oil and dispersants amenable to removal actions under the provisions of the Clean Water Act, the Oil Pollution Act of 1990, and the National Oil and Hazardous Substances Pollution Contingency Plan. Key finding in this report which relate to borrow areas and restoration features (as included in the executive summary of the report) include the following:

- No deposits of MC252 oil in the liquid phase were identified in sediments beyond the shoreline.
- No exceedences of EPA Human Health of dispersant benchmarks were observed.
- After August 2010, less than 1% of water samples and approximately 1% of sediment samples exceeded EPA Aquatic Life benchmarks for polycyclic aromatic hydrocarbons (PAHs). No exceedences observed in water samples were found to be a result of MC252 oil, and only sediment exceedences within 3 km of the MC252 wellhead were found to be a result of MC252 oil.
- Published research summarized in the report indicates MC252 oil is weathering and biodegrading naturally.

The report also documents the finding of tar mats in sub-tidal nearshore areas which have the potential to remobilize and cause shoreline re-oiling. Based on the executive summary prepared for the report (insuffucuent time was available to review the remainder of the report), it does not appear that borrow area sediments would contain levels of contaminants associated with MC252 with the potential to cause adverse impacts to aquatic organisms.

Additionally, and more recently, the Louisiana Office of Coastal Protection and Restoration conducted an evaluation of sediments in the South Pelto block of Ship Shoal, a proposed borrow area for the BBBS project (BEM 2011). Although insufficient time was available to prepare a summary of this evaluation based on a thorough review of its contents, the abstract for the evaluation states that sediments evaluated are not expected to adversely affect aquatic organisms.

As a result of the widespread coverage of the BP oil spill, it is possible that oil sheens or slicks may be observed either at the disposal sites or near the dredging sites during dredging operations, and field personnel / dredging crew should periodically inspect both the dredging and disposal sites for the presence of oil during daylight hours. Periodic inspections may coincide with shift changes, repositioning of equipment, or other activities related to dredging and disposal operations. Time conducted and results of these inspections should be recorded. If oil in any form is observed, dredging should cease and the USCG National Spill Response Center should immediately be contacted (1-800-424-8802). The USCG New Orleans Sector (504 365-2200). should then be notified of the incident. Field personnel should document the incident (take photographs, mark location and time observed, record color and size of sheen, etc.) to assist the USCG's investigation and response. Dredging operations should not resume until approved by the USCG and CEMVN.

Table 9. Sediment chemistry results for samples collected by the EPA in the footprint of the BBBS project.

		Station I.D.:	T001-SV231	T008-R650	2008 NOAA Screening Quick Reference Tables (SQuiRTs) Screening Levels for Marine Sediments			
		Latitude:	29.3218	29.26712				
		Longitude:	-89.738067	-89.69924				
Parameter	Units	Collection Date:	9/14/2010	9/3/2010	TEL	ERL	PEL	ERM
Nickel	µg/kg		24,900	19,300	15,900	20,900	42,800	51,600
Dibenzo(a,h)anthracene	µg/kg		6.50	5.50	6.22	63.4	135	260

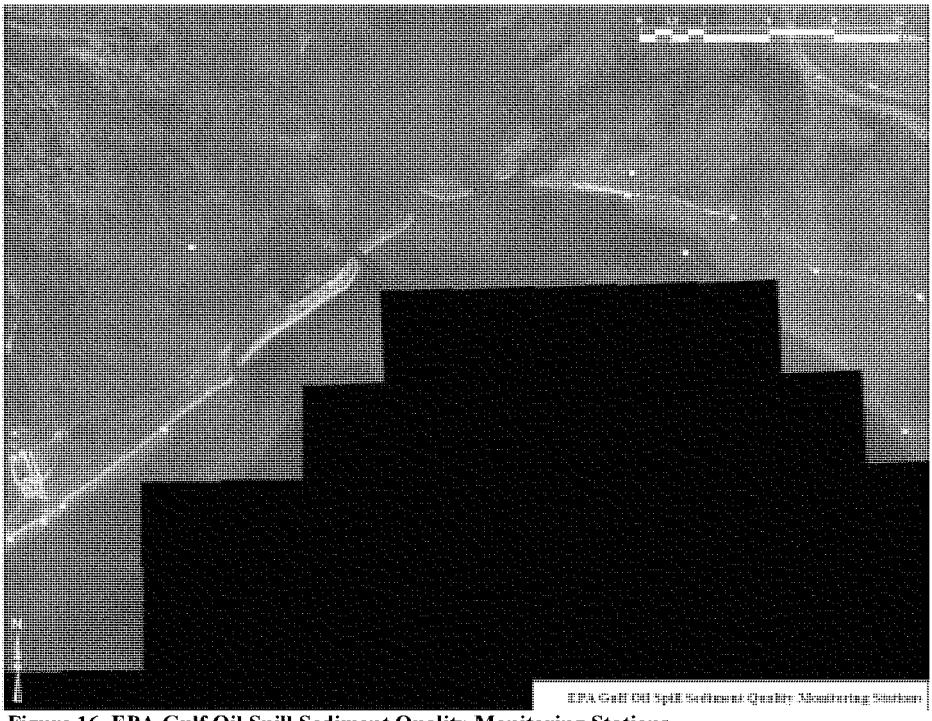


Figure 16. EPA Gulf Oil Spill Sediment Quality Monitoring Stations.

III. FINDING OF COMPLIANCE FOR LOUISIANA COASTAL AREA (LCA) CAMINADA HEADLAND AND SHELL ISLAND RESTORATION FEASIBILITY STUDY

A. ADAPTATION OF THE SECTION 404 (B)(1) GUIDELINES TO THIS EVALUATION

No significant adaptation of the guidelines were made relative to this evaluation.

B. EVALUATION OF AVAILABILITY OF PRACTICABLE ALTERNATIVES TO THE PROPOSED DISCHARGE SITE WHICH WOULD HAVE LESS ADVERSE IMPACT ON THE AQUATIC ECOSYSTEM

Management measures were combined into 10 alternatives for the Caminada Headland and 8 alternatives for Shell Island. These alternatives were further narrowed to an array of 4 Caminada Headland and 4 Shell Island alternatives. The resulting Caminada alternatives have the same initial footprint but varying renourishment volumes. The array of Shell Island alternatives includes both the one island and two islands configurations. There is no practicable alternative to the proposed discharge which would restore 1,537 acres of barrier habitat and 1,212 acres of salt marsh habitat. The No Action alternative would result in continued coastal land loss of 6,600 acres per year with estimated 328,000 acres lost by 2050 (Barras et al. 2003). The Recommended Plan was identified taking into consideration economic feasibility and cost, existing technology, and logistics in light of overall project purposes and based on minimal impact to the aquatic ecosystem.

C. COMPLIANCE WITH APPLICABLE STATE WATER QUALITY STANDARDS

A discussion of the water quality effects of the Recommended Plan is presented in Section II. F. (2): Determination of Compliance with Applicable Water Quality Standards. In addition, the plan has been coordinated with the Louisiana Department of Environmental Quality-Office of Water Resources (LDEQ). A Water Quality Certification Application is currently being prepared and will be submitted to LDEQ in conjunction with the DEIS.

D. COMPLIANCE WITH APPLICABLE TOXIC EFFLUENT STANDARD OF PROHIBITION UNDER SECTION 307 OF THE CLEAN WATER ACT

Fill materials will be hauled-in from sources determined to be uncontaminated and the use of such material would not be expected to exceed applicable Louisiana Water Quality Standards or U.S. Environmental Protection Agency Water Quality Criteria.

E. COMPLIANCE WITH ENDANGERED SPECIES ACT OF 1973

The proposed discharge would not jeopardize the continued existence of any threatened or endangered species, nor result in the destruction or adverse modification of critical habitat

according to consultation with the U.S. Fish and Wildlife Service (USFWS). CEMVN has determined the proposed action is not likely to adversely affect any threatened or endangered species, nor result in the destruction or adverse modification of critical habitat. The proposed action would restore 1,684 net acres of barrier habitats, including critical habitat for piping plover.
Following a review of a Biological Assessment (Appendix D of EIS #05-05) for the proposed action as part of formal consultation under provisions of the Endangered Species Act of 1073 (87 Stat. 884, as amended; 16 U.S.C 1531 et seq.), the USFWS concurred with this determination by personal communication dated May 11, 2009.

F. COMPLIANCE WITH SPECIFIED PROTECTION MEASURES FOR MARINE SANCTUARIES DESIGNATED BY THE MARINE PROTECTION, RESEARCH AND SANCTUARIES ACT OF 1972

The Marine Protection, Research and Sanctuaries Act of 1972 would not apply.

G. EVALUATION OF EXTENT OF DEGRADATION OF THE WATERS OF THE UNITED STATES

None of the proposed discharges would result in unacceptable adverse effects on human health and welfare, including: municipal and private water supplies, recreational and commercial fisheries, plankton, fish, shellfish, wildlife, and special aquatic sites. Furthermore, none of the discharges would result in unacceptable adverse effects on the life stages of aquatic or semi-aquatic organisms, the aquatic ecosystem, diversity, productivity, stability, or recreation and esthetics resources, and economic values.

H. APPROPRIATE AND PRACTICABLE STEPS TAKEN TO MINIMIZE POTENTIAL ADVERSE IMPACTS OF THE DISCHARGE ON THE AQUATIC ECOSYSTEM

Appropriate and practicable steps would be taken to minimize potential adverse impacts of the proposed action on the aquatic ecosystem.

I. EVALUATION RESPONSIBILITY

Evaluation prepared by: Ms. Kellen Smith, Mr. Eric Glisch and Dr. William Klein.

J. ON THE BASIS OF THE GUIDELINES, THE PROPOSED DISPOSAL SITES FOR THE DISCHARGE OF DREDGED OR FILL MATERIAL ARE SPECIFIED AS COMPLYING WITH THE REQUIREMENTS OF THESE GUIDELINES, WITH THE INCLUSION OF THE APPROPRIATE AND PRACTICAL CONDITIONS TO MINIMIZE ADVERSE EFFECTS ON THE AQUATIC ECOSYSTEM

With inclusion of the above discussed conditions to minimize adverse effects to the aquatic ecosystem, it is concluded that the proposed action is in compliance with the Section 404(b)(1) guidelines.

3 January 2012
DATE

Edward R. Fleming
Colonel, U.S. Army
District Engineer

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LOUISIANA COASTAL AREA
BARATARIA BASIN BARRIER SHORELINE RESTORATION
FINAL CONSTRUCTION REPORT
AND
FINAL ENVIRONMENTAL IMPACT STATEMENT

APPENDIX D
ANNEX B

Louisiana Department of Natural Resources Consistency Letter C20110034

Louisiana Coastal Resources Program Consistency Determination

BOBBY JINDAL
GOVERNOR

SCOTT A. ANGELLE
SECRETARY

State of Louisiana

DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL MANAGEMENT

September 13, 2011

Dr. William Klein, Jr.
U.S. Army Corps of Engineers
New Orleans District, CEMVN-PM-RS
PO Box 60267
New Orleans, LA 70160-0267

RE: **C20110034,** Coastal Zone Consistency
New Orleans District, Corps of Engineers
Direct Federal Action
LCA – Barataria Basin Barrier Shoreline Restoration Project
Jefferson, Lafourche and Plaquemines Parishes, Louisiana

Dear Dr. Klein:

The above referenced project has been reviewed for consistency with the approved Louisiana Coastal Resource Program (LCRP) as required by Section 307 of the Coastal Zone Management Act of 1972, as amended. The project, as proposed in the application, is consistent with the LCRP provided the Corps coordinates with LDWF and USFWS regarding piping plover and critical habitat as agreed in email of August 30, 2011 from William Klein. Also, the Corps shall coordinate all matters that may affect Elmer's Island with LDWF through Julia Lightner at 504-286-4041. If you have any questions concerning this information request, please contact Brian Marcks of the Consistency Section at (225) 342-7939 or 1-800-267-4019.

Sincerely,

Keith Lovell
Administrator
Interagency Affairs/Field Services Division

KL/JDH/bgm

cc: Dave Butler, LDWF
Kirk Kilgen, OCM FC
Brad Rieck, USFWS, Lafayette
Jason Smith, Jefferson Parish
Archie Chaisson, Lafourche Parish
Albertine Kimble, Plaquemines Parish

LOUISIANA COASTAL RESOURCES PROGRAM CONSISTENCY DETERMINATION

LOUISIANA COASTAL AREA (LCA) — LOUISIANA, BARATARIA BASIN BARRIER SHORELINE RESTORATION STUDY

Lafourche, Jefferson, and Plaquemines Parish, Louisiana

EIS #05-05

INTRODUCTION

Section 307 of the Coastal Zone Management Act of 1972, 16 U.S.C. 1451 et. seq., requires that "each Federal agency conducting or supporting activities directly affecting the coastal zone shall conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with state approved management programs." In accordance with Section 307, the US Army Corps of Engineers (USACE), New Orleans District (CEMVN) has prepared this consistency determination to evaluate the potential impacts associated with the proposed restoration of the Caminada Headland and Shell Island reaches of the Barataria Basin barrier system. The proposed action area is located in Lafourche, Jefferson and Plaquemines Parishes, Louisiana. Coastal Use Guidelines were written to implement the policies and goals of the Louisiana Coastal Resources Program and to serve as a set of performance standards for evaluating projects. Compliance with the Louisiana Coastal Resources Program and, therefore, Section 307, requires compliance with applicable Coastal Use Guidelines.

PURPOSE AND NEED FOR THE PROPOSED ACTION

The Louisiana Coastal Area Barataria Basin Barrier Shoreline Study (LCA BBBS) was conducted under the authority provided to the USACE through resolutions adopted by the Committees on Public Works of the Senate and U.S. House of Representatives dated April 19, 1967 and October 19, 1967, respectively. These resolutions requested a review of prior USACE reports by the Chief of Engineers to determine the advisability of improvements or modifications to existing improvements in the coastal area of Louisiana, in the interest of hurricane risk reduction, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and related water resources purposes. These resolutions contain the following language:

> *RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors created under Section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby requested to review the reports of the Chief of Engineers on the Mermentau River and Tributaries and Gulf Intracoastal Waterway and connecting waters, Louisiana, published as Senate Document Numbered 231, Seventy-ninth Congress, on the Bayou Teche, Teche-Vermilion Waterway and Vermilion River, Louisiana, published as Senate Document Numbered 93, Seventy-seventh Congress, on the Calcasieu River salt water barrier, Louisiana, published as House Document Numbered 582, Eighty-seventh Congress, and on Bayous Terrebonne, Petit Caillou, Grand Caillou, DuLarge, and connecting channels, Louisiana, and the Atchafalaya River, Morgan City to the Gulf of Mexico, published as House Document Numbered 583, Eighty-seventh Congress, and other pertinent reports including that on Bayou Lafourche and Lafourche-Jump Waterway, Louisiana, published as House Document Numbered 112, Eighty-sixth Congress, with a view to determining the advisability of improvements or modifications to existing*

improvements in the coastal area of Louisiana in the interest of hurricane protection, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and related water resource purposes.

Title VII of the WRDA of 2007, P.L. 110-114, Section 7006(c)(1)(C) authorizes construction of the LCA Barataria Basin Barrier Shoreline Restoration project in accordance with the restoration plan in the Report of the Chief of Engineers, dated January 31, 2005, contingent upon completion of a construction report documenting any modifications to the Chief's Report, approval of the Secretary of the Army, and submission to the House Transportation and Infrastructure Committee and Senate Environmental and Public Works Committee. Section 7006(c)(1)(C) states:

Initial projects. – In General – the Secretary is authorized to carry out the following projects substantially in accordance with the restoration plan:C. Barataria Basin barrier shoreline restoration at a total cost of $242,600,000.

Section 7006(c)(3) and Section 7006(c)(4) state:

Construction reports – Before the Secretary may begin construction of any project under this subsection, the Secretary shall submit a report documenting any modifications to the project, including cost changes, to the Committee on Transportation and Infrastructure of the House of Representatives and the Committee on Environmental and Public Works of the Senate.

Applicability of other provisions- Notwithstanding section 902 of the Water Resources Development Act of 1986 (33 U.S.C.2280), the cost of a project under this subsection, including any modifications to the project, shall not exceed 150 percent of the cost of such project set forth in paragraph 1.

The LCA Barataria Basin Barrier Shoreline Restoration Project was identified as one of 15 critical near-term restoration projects in the Louisiana Coastal Area (LCA), Louisiana, Ecosystem Restoration Study (LCA Report 2004). The LCA Ecosystem Restoration Plan was recommended for authorization by the Chief of Engineers on 31 January 2005. The Assistant Secretary of the Army for Civil Works, after obtaining the concurrence of the Office of Management and Budget, provided his report on the Louisiana Coastal Area to Congress on 18 November 2005. Title VII of the Water Resources Development Act of 2007, P.L. 110-114, Section 7006(c)(1)(C) authorizes construction of the Barataria Basin Shoreline Restoration project.

The Barataria Basin barrier shoreline (**figure 1**) is situated along Louisiana's Gulf of Mexico coastline between the west bank of the Mississippi River at the active delta and the eastern shore of Terrebonne Bay. The Barataria Basin barrier shoreline is comprised of six reaches including the Caminada Headland, Grand Isle, Grand Terre, Chenier Ronqille, Shell Island, and Scofield. Ecosystem restoration projects have been constructed, are currently under construction, or are in the planning phase for all of these reaches except the Caminada Headland and Shell Island. The LCA Report (2004) identified restoration of the Caminada Headland and Shell Island reaches as a critical near-term project for the Barataria Basin Barrier Shoreline.

The purpose of the proposed action is to evaluate alternatives to restore the Caminada Headland and Shell Island features of the Barataria Basin barrier system through shoreline and marsh restoration to ensure the continuing geomorphic and hydrologic form and function of the barrier structures. Louisiana contains one of the largest expanses of coastal wetlands in the contiguous U.S. and accounts for 90 percent of the total coastal marsh loss occurring in the nation. The coastal wetlands, built by the deltaic process of the Mississippi River, contain an extraordinary diversity of habitats ranging from narrow natural levees and dunes to expanses of forested swamps and freshwater, intermediate, and brackish, and saline marshes.

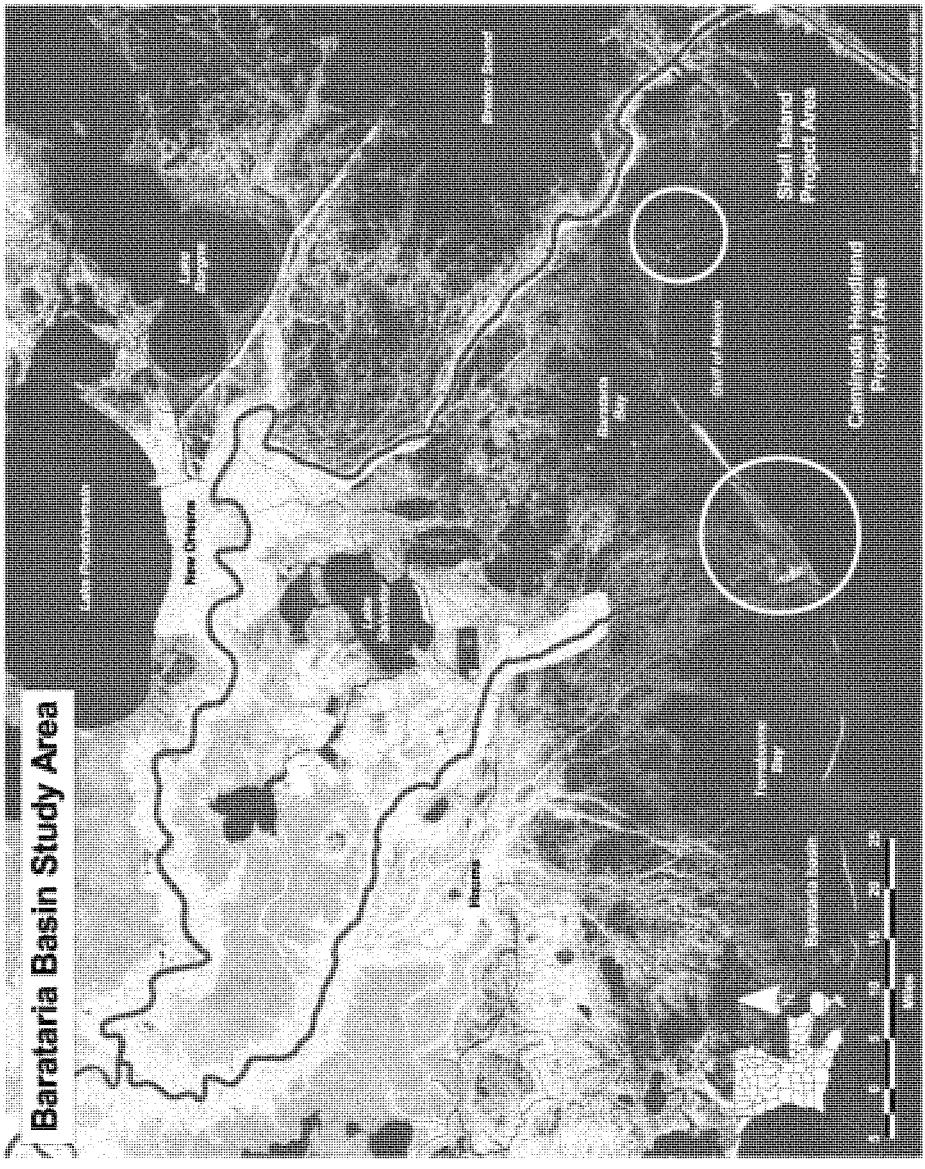

Figure 1. Barataria Basin Barrier Shoreline.

Without any action, the Caminada Headland would lose about 3,750 acres from the headland and approximately 14,780 acres from the area to the north (an area extending inland between Bayou Lafourche and Caminada Bay) (LCA Report 2004). Without any action, the Caminada Headland would likely be converted into shallow open water bottoms with only a skeletal framework of higher natural barrier ridges and canal spoil banks likely remaining by 2050. Without any action, land loss at Shell Island would likely continue at rates similar to present with an annual average rate of loss of 38.5 feet per year (range of 8.0 to 101.5 feet year). The coastal Louisiana land loss model predicts that all 386 acres of Shell Island could be lost by 2009 to 2027, depending on which rate of land loss (short-term or long-term) was used.

In addition to continued high rates of coastal barrier land loss, without implementing the proposed action other adverse impacts would include the loss of important and essential vegetated habitats used by fish and wildlife for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements; loss of productivity; loss of transitional habitat between estuarine and marine environments; and increased inter- and intra-specific competition between resident and migratory fish and wildlife species for decreasing wetland resources. There would also be a reduction in the availability of important stopover habitats used by migrating neotropical birds.

In addition to continued high rates of coastal barrier land loss, without implementing the proposed action other adverse impacts would include the loss of important and essential vegetated habitats used by fish and wildlife for shelter, nesting, feeding, roosting, cover, nursery, and other life requirements; loss of productivity; loss of transitional habitat between estuarine and marine environments; and increased inter- and intra-specific competition between resident and migratory fish and wildlife species for decreasing wetland resources. There would also be a reduction in the availability of important stopover habitats used by migrating neotropical birds.

These coastal barrier landforms, along with their related hydrologic and biological processes, provide unique habitats that are crucial to the viability of migratory birds (providing breeding, wintering, and stopover habitat), commercial and recreational fisheries. Restoration of the shoreline and marsh platforms of Caminada Headland and Shell Island would restore the natural hydrologic function of the barrier island system. Restoration of these barrier shoreline landforms would decrease shoreline erosion and loss of interior wetlands in the Barataria Basin by reducing the extent and intensity of tidal, wave and storm processes behind the shorelines. An incidental benefit of the proposed action would be reduction of storm surge that would result from restored shoreline integrity and protected wetlands. Coastal landforms and wetlands are one of the "first lines of defense" for storm surges and thereby reduce the impact of flooding and storm surges on infrastructure in the coastal region.

Model results from the Louisiana Coastal Protection and Restoration Study (LACPR 2009) indicate that the barrier islands provide some level of protection as the first line of defense. Raising the barrier islands caused a decrease in the peak water level and wave energy landward of the barrier islands. The primary infrastructure that would be protected by this project includes the only evacuation route for that area (Louisiana Highway 1), as well as Port Fourchon and related petroleum storage and transport facilities, including the onshore component of the Louisiana Offshore Oil Port (LOOP)—the Fourchon Booster Station, which supplies oil to the Clovelly Dome Storage Terminal. By supplying oil to Clovelly Dome and its interconnection to other pipelines, crude oil from LOOP can be pumped to nearly 50 percent of the nation's refining capacity. These major infrastructure facilities are located on the inland portion of the Caminada Headland. Port Fourchon supports 75 percent of the deepwater oil and gas production in the Gulf as the point of departure for crew boats, equipment and supplies, rig components, and oilfield services.

DESCRIPTION OF THE PROPOSED ACTION

The Tentatively Selected Plan (TSP) is also the National Ecosystem Restoration (NER) Plan and is Alternative C5/S1 (TSP/NER): Caminada Alternative 5 – Preferred Dune with Expanded Marsh / Shell Island Alternative 5 - One Island with Re-nourishment at Years 20 and 40 Alternative.

Caminada Headland Component of the TSP/NER

The TSP/NER is comprised of the Caminada Headland Alternative 5: Preferred Dune with Expanded Marsh and the Shell Island Alternative 5: Single Island with 10 year Advanced Fill, and 2 Re-nourishments restoration components. The Caminada Headland component of the TSP/NER proposes a dune height of +7 feet NAVD88 with a dune width of 290 feet. The Caminada Headland component also proposes a landward beach and dune component in order to maximize acreage and longevity. The landward and seaward slopes would be set 20 horizontal to 1 vertical. The marsh fill is proposed on the landward side of the dune at an elevation of +2.0 feet NAVD88. Approximately 880 acres of beach/dune and 1,186 acres of marsh would be created, resulting in a total of 2,066 acres. Fill quantities for the dune and marsh fills would be 5.1 million and 5.36 million cubic yards (cy), respectively. For the dune area, the material would be pumped from the dredge to the beach. The material would then be worked on the beach by bulldozers and front-end loaders. Points of direct access to the project area are Louisiana Highway 3090 and a beach road at Elmer's Island on the eastern end. For the marsh area, the material would be pumped from the offshore borrow site. The dune would serve as the southern dike for the marsh fill. Additional dikes would be constructed around the remaining perimeter. These operations would be completed in a manner that would minimize turbidity of the water at the dredge site and the discharge site. **Figure 2** shows the plan view of Caminada Headland component of the TSP/NER.

Approximately 71,500 feet of sand fencing would be installed. The sand fences would be porous barriers that would reduce wind speed along the coast such that sand being transported by the wind accumulates on the downwind side of the fence. The sand fences would promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings. Vegetative plantings would include a variety of native species. The recommended planting density is no greater than 8-foot centers.

The borrow area identified for the beach/dune restoration is Ship Shoal, a large submerged sand body in the Gulf of Mexico located offshore in south-central Louisiana. The shoal is about 31 miles long and 7 miles wide, lying in water depths of 9 feet to 30 feet. Preliminary studies have shown it is the remaining seaward shoal from one of the older, abandoned Mississippi River deltas. It is composed of well-graded quartz sand and is suitable for use in restoring the Caminada Headland since its grain size is similar to the sand found on the headland. The sediment is to originate from South Pelto, Blocks 12 and 13, which is approximately 40 miles from the project site. The borrow site for the marsh restoration would be located approximately 1.5 miles south of the central portion of the Caminada Headland, and 4.7 miles southwest of Caminada Pass. The estimated cost of construction, including contingencies, supervision and administration, real estate, and preconstruction engineering and design (PED), is $220,440,000 (October 2010). The estimated duration of construction would be 936 days. It is estimated that the duration of plantings would be 750 days over a 3-year period.

A complete construction design description is located in appendix A, annex 1 of the integrated construction report and draft EIS.

The Caminada Headland component of the TSP/NER would include renourishment of the Caminada Headland per the 2004 LCA report which included near-shore recovery of 2 million cy of sand every 10 years. Operations and maintenance (O&M) of the headland will include renourishment beneficially used in conjunction with the USACE operations and maintenance dredging of the bar channel of Bayou Lafourche, Louisiana (Belle Pass) navigation project. Dredging of the pass yields on average approximately 650,000 gross cubic yards of material every 1.5 to 2 years. This

material will be placed in the littoral drift south of Bayou Moreau where the sediment budget indicates that the long shore transport of material splits going east and west. The material will be placed unconfined between 100 and 300 feet offshore from the shoreline's top of bank, allowing the long shore transport and wave action to move and place the sediment along the headland. The material will be pumped offshore of the nodal point directly impacting approximately 67 acres. The Caminada Headland is a high energy wave environment that is very dynamic. The material will be stacked no higher than + 6 feet MLG, but will be quickly reworked by the wind and waves. The pumping of the material will take approximately 54 days, with placement and removal of the pipeline taking a total of approximately 98 days. The pipe will be placed offshore. The material will be dredged from a federal navigation channel which previously received NEPA clearance for the maintenance dredging of the Bayou Lafourche channel. Approximately 124.2 acres will be directly impacted by the dredging. Over each 10 year period, an estimated 3.9 million cubic yards of material from six dredging cycles (650,000 cubic yards per cycle) will be returned to the headland. Unless the shoreline is in danger of breaching, timing of the renourishment will be dependent upon the maintenance dredging requirements of the Bayou Lafourche, Louisiana navigation project. Historically, maintenance dredging has begun as early as March and ended as late as November. This renourishment is part of the non-Federal sponsor's operations and maintenance requirements.

The purpose of the O&M is to sustain the constructed footprint and protect the headland north of the project footprint. The O&M is driven by the need to ensure continuity of the shoreface, and is not determined by the dredging cycle. The beach and dunes protect the more fragile marsh habitats. Once the shoreline has been breached, erosion rates increase. Should the shoreline be in danger of breaching, sediment would be placed near the breach to supplement the existing sediment. If maintenance dredging of the Bayou Lafourche channel is not scheduled, the non-Federal sponsor must provide another source of materials. Any changes to the approved OMRR&R plan must receive environmental clearances, including consultation with the appropriate agencies for compliance with the Endangered Species Act (ESA.) Additionally, because the Belle Pass jetties provide the important function of acting as a terminal groin and trapping sediment, prior to any OMRR&R event, the stability of the jetties will be inspected. If stabilization is necessary, some of the material will be placed to support the jetties.

The non-Federal sponsor will pay the incremental cost of beneficially using this material over the federal standard. For the Bayou Lafourche navigation channel, the federal standard, which is the least costly, environmentally acceptable plan for disposal of the dredged material, is to pump the material to the beach adjacent to the channel a minimum of 1,000 feet away from the jetties for an average pump distance of 4,000 feet. The material utilized for O&M will be placed approximately 5 miles from the navigation channel. The total estimated cost for dredging and placement of the 650,000 cy is $13,270,000 with $5,920,000 being the estimated cost for the federal standard and $7,350,000 the estimated incremental cost attributable to the BBBS project.

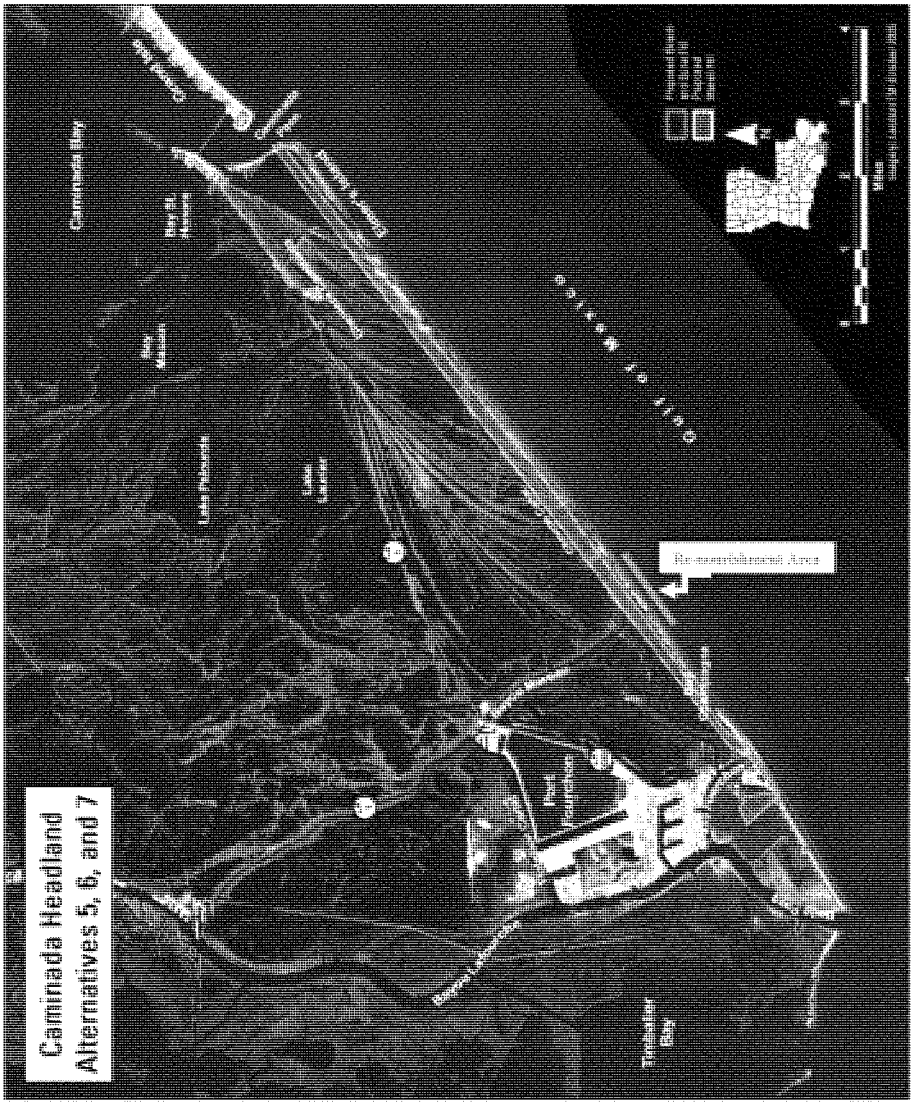

Figure 2: Caminada Headland Alternative 5 Plan View.

Renourishment would create a feeder beach, where material is introduced in the littoral zone and distributed by the long shore current, near the nodal point of the Caminada Headland. The nodal point is a "hot spot" due to bifurcation of the sediment transport, thus it breaches more frequently than other locations on the Headland. By placing the material at the nodal point, the entire Caminada Headland would benefit by reducing breaching. The project area, which is only a portion of the headland, would contain approximately 1,023 acres at TY50.

Shell Island Component of the TSP/NER

The Shell Island alternative 5 component of the TSP/NER would restore Shell Island as one island. Restoration would include shore face, dune, and marsh platform features. The Shell Island component of the TSP/NER would restore Shell Island to a form similar to its pre-Hurricane Bob (1979) condition. **Figure 3** shows a plan view of Shell Island alternative 5 component of the TSP/NER.

The landward edge of the dune of Shell Island alternative 5 would be located seaward of the existing shoreline. The west end of the Shell Island alternative 5 single island would be terminated approximately 0.5 mile before Grand Bayou. It is anticipated that the closure of Coupe Bob would return the tidal prism to its pre-1979 path—flowing through Grand Bayou, with Grand Bayou increasing in size in response to the altered tidal flow pattern. The west end of Shell Island alternative 5 is close to the western limit of Shell Island that was observed in 1973, prior to the opening of Coupe Bob. The proposed island follows the shortest and shallowest route across Coupe Bob. The east end of the island would then follow the remnants of Shell Island East, but has a concave shape towards land. This would be required to maintain a smooth shoreline. The eastern end of the island would be located near the Empire Waterway. The constructed dune would have a uniform width of 189 feet along the length of the restored barrier island.

Louisiana barrier islands have typical widths in the region of 1,000 feet to 1,500 feet wide from the gulf shoreline to the bayward limit of the marsh. A uniform marsh width of 735 feet was chosen to construct an island that is approximately 1,240 feet wide following equilibration of the shoreline fill. The fill source for dike construction was located within the marsh fill footprint where the existing bathymetry is relatively shallow (less than -2.0 feet).

However, in deeper water (bathymetry below -3.0 feet), it is not feasible to construct the marsh section with only marsh sediments, as the marsh would settle too rapidly and nonuniformly to perform its intended purpose effectively. Instead it is recommended to construct a sand base across Coupe Bob, at -3.0 feet, using shoreline fill material. The marsh can then be constructed on top of this base, which would reduce settlement of the marsh material. A second option is to install a geotextile tube for containment of the marsh fill where the -3 feet NAVD sand base is constructed. The geotextile tube could be filled with sand from the sand base. This option was used for the development of alternative 5.

It is estimated that 5.6 million cy of shoreline fill would be required to construct 317 acres of shoreline/dune area (area above +2 feet, NAVD). Approximately 2.1 million cy of marsh fill would be required to construct 466 acres of marsh.

Figure 3: Shell Island Alternative 5 Component Plan View.

Under the TSP/NER, Shell Island would be re-nourished 20 years and 40 years after initial construction to the original template of 317 beach/dune acres. The marsh fill would also be re-nourished to its original construction template at this time interval. Approximately 1.5 million cy of beach fill would be required for re-nourishment cycles in years 20 and 40. In year 20, approximately 907,200 cy of marsh fill would be required and in year 40, 604,700 cy would be required for re-nourishment. The renourishment in year 20 is estimated to be $63.3 million and the renourishment is year 40 is estimated to cost $60.9 million. The Shell Island Alternative 5 component of the TSP/NER would create 730.6 AAHUs. At TY50, Shell Island would encompass 799 acres.

The borrow source for the dune/beach would be a large sand deposit near Naim in the Mississippi River between mile markers 32 and 34, approximately 11 miles north of the project area. The borrow site is located in a river meander where greater sediment thickness is anticipated due to the presence of relict (vertically stacked) sand bars. USACE boring date indicates sand thickness of at least 70 feet. Based on samples obtained from vibracores, the sand grain size is comparable to the sand at the project site. The dredged material would be pumped from the Mississippi River via pipeline. The borrow source for the marsh restoration would be the Empire deposit, approximately 1.5 miles from the Empire Jetties. Water depths in the borrow area are from 16 feet to 20 feet. The borrow area occupies about 207 acres and total mixed sediment volumes range from 5.5 million to 6.6 million cy for 15 foot and 20 foot cut depths, respectively. The sedimentary characteristics indicate a silt content of about 40 percent, a clay content of about 22 percent and sand content of about 38 percent. The estimated construction cost, including contingencies, supervision and administration, real estate, and PED is $200,524,000. It is estimated that duration for construction would be 787 days. It is estimated that the duration for the plantings would be 360 days over a period of 3 years. Complete design details are located in appendix A, annex 2 of the integrated construction report and draft EIS. **Figures 4, 5 and 6** displays the project areas and the borrow sites.

Operation and Maintenance

Based on the sediment budget prepared for the Caminada Headland, the loss of sediment from the headland, which is derived from the total gulf shoreline erosion loss minus the total overwash accumulation, is estimated to be 379,000 cubic yards per year. Operations and maintenance of the headland will include renourishment beneficially used in conjunction with the USACE operations and maintenance dredging of the bar channel of Bayou Lafourche, Louisiana (Belle Pass) navigation project. Dredging of the pass yields on average approximately 650,000 gross cubic yards of material every 1.5 to 2 years. This material will be placed in the littoral drift south of Bayou Moreau where the sediment budget indicates that the long shore transport of material splits going east and west. The material will be placed unconfined between 100 and 300 feet offshore from the shoreline's top of bank, allowing the long shore transport and wave action to move and place the sediment along the headland. The material will be pumped offshore of the nodal point directly impacting approximately 67 acres. The Caminada Headland is a high energy wave environment that is very dynamic. The material will be stacked no higher than + 6 feet MLG, but will be quickly reworked by the wind and waves. The pumping of the material will take approximately 54 days, with placement and removal of the pipeline taking a total of approximately 98 days. The pipe will be placed offshore. The material will be dredged from a federal navigation channel which previously received NEPA clearance for the maintenance dredging of the Bayou Lafourche channel. Approximately 124.2 acres will be directly impacted by the dredging. Over each 10 year period, an estimated 3.9 million cubic yards of material from six dredging cycles (650,000 cubic yards per cycle) will be returned to the headland. Unless the shoreline is in danger of breaching, timing of the renourishment will be dependent upon the maintenance dredging requirements of the Bayou Lafourche, Louisiana navigation project.

Historically, maintenance dredging has begun as early as March and ended as late as November. This renourishment is part of the non-Federal sponsor's operations and maintenance requirements.

The purpose of the O&M is to sustain the constructed footprint and protect the headland north of the project footprint. The O&M is driven by the need to ensure continuity of the shoreface, and is not determined by the dredging cycle. The beach and dunes protect the more fragile marsh habitats. Once the shoreline has been breached, erosion rates increase. Should the shoreline be in danger of breaching, sediment would be placed near the breach to supplement the existing sediment. If maintenance dredging of the Bayou Lafourche channel is not scheduled, the non-Federal sponsor must provide another source of materials. Any changes to the approved OMRR&R plan must receive environmental clearances, including consultation with the appropriate agencies for compliance with the Endangered Species Act (ESA.) Additionally, because the Belle Pass jetties provide the important function of acting as a terminal groin and trapping sediment, prior to any OMRR&R event, the stability of the jetties will be inspected. If stabilization is necessary, some of the material will be placed to support the jetties.

The non-Federal sponsor will pay the incremental cost of beneficially using this material over the federal standard. For the Bayou Lafourche navigation channel, the federal standard, which is the least costly, environmentally acceptable plan for disposal of the dredged material, is to pump the material to the beach adjacent to the channel a minimum of 1,000 feet away from the jetties for an average pump distance of 4,000 feet. The material utilized for O&M will be placed approximately 5 miles from the navigation channel. The total estimated cost for dredging and placement of the 650,000 cy is $13,270,000 with $5,920,000 being the estimated cost for the federal standard and $7,350,000 the estimated incremental cost attributable to the BBBS project.

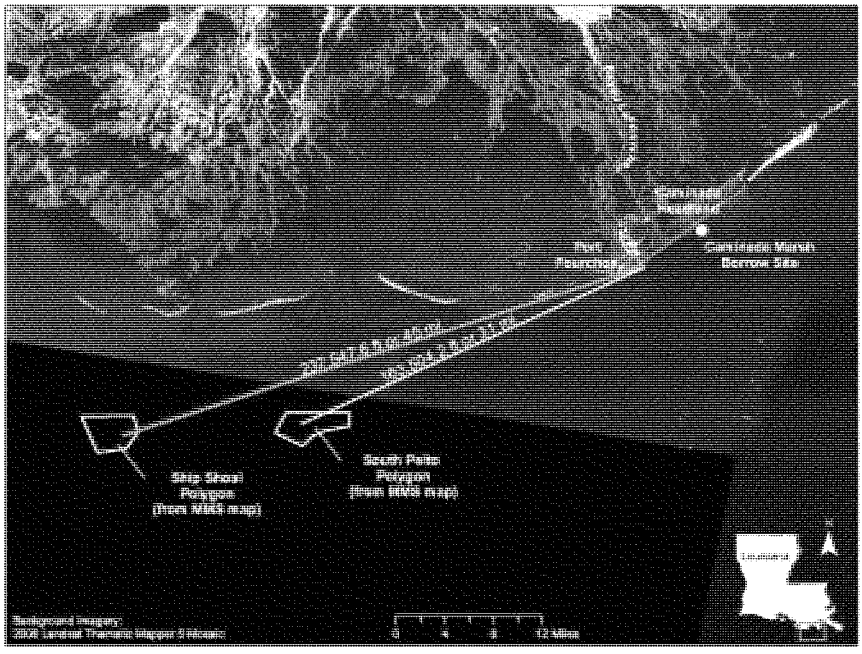

Figure 4. Borrow Sources for the Caminada Headland.

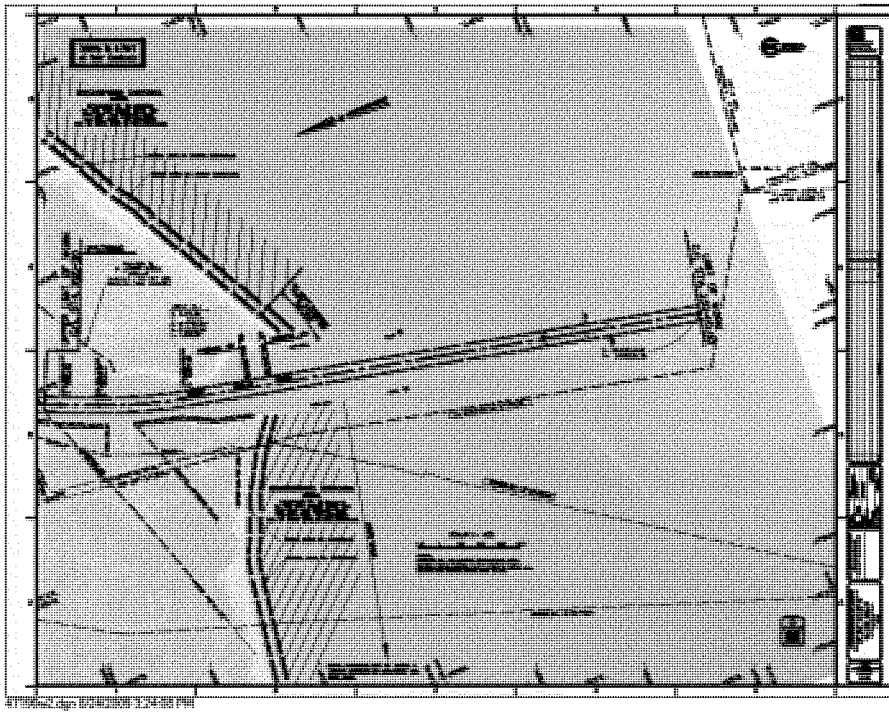

Figure 5. Bayou Lafourche Navigation Channel (bar channel borrow site).

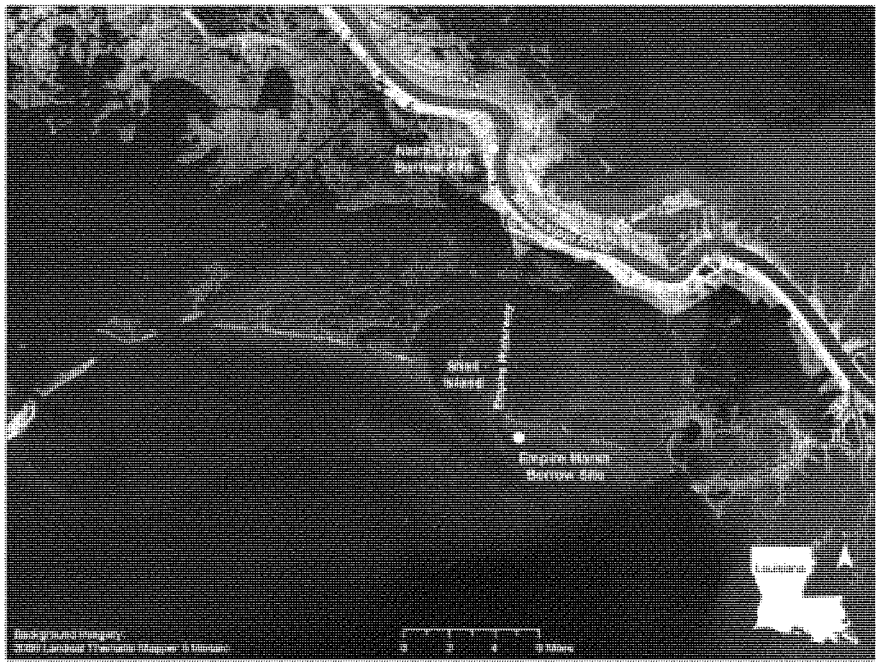

Figure 6 Borrow Sites for Shell Island.

This renourishment is part of the non-Federal sponsor's operations and maintenance requirements. The non-Federal sponsor will pay the incremental cost of beneficially using this material over the federal standard. The estimated costs per event are $6.2 million.

Shell Island would be renourished 20 and 40 years after initial construction. The marsh is renourished back to an elevation of +2.0 feet NAVD. The volume of marsh fill required for the first renourishment is approximately 907,200 cy while the volume for the second renourishment is 643,600 cy. The volume of beach fill required for each of the beach renourishment cycles is approximately 1,512,000 cy of sediment. The O&M borrow sources are the same as the construction borrow sources. The non-Federal sponsor is responsible for the O&M of Shell Island. The estimated cost of Shell Island O&M is $123,700,000 with an estimated cost of $63.3 million in TY 20 and $60.9 million in TY 40.

O&M would also include repair and/or maintenance of sand fencing. The maintenance estimate for sand fencing includes complete replacement in year 5 with 20 percent replacement every 5 years until the end of the period of analysis. In addition to this task, the non-Federal sponsor would monitor the project area and enforce the restrictions of the easements through yearly inspections of the project area. Sufficient land rights will be obtained to perform operations and maintenance for the period of analysis. The present value of the operations and maintenance costs including renourishment is $94,917,524 with an average annual cost of $4,513,422.

The impacts of the Deepwater Horizon oil spill on coastal Louisiana are uncertain at this time (August 2010). The impacts of the oil spill as well as the various actions taken to address oil spill impacts (e.g., use of oil dispersants, creation of sand berms, use of HESCO baskets and other shoreline protection/restoration measures along the Caminada Headland, and others) could potentially adversely impact USACE water resources projects and studies within the Louisiana coastal area. Potential impacts could include factors such as changes to existing conditions, as well as changes to future-without and future with project conditions. The USACE will continue to monitor and closely coordinate with other Federal and state resource agencies and local sponsors in determining how to best address any potential problems associated with the oil spill that may adversely impact. In addition, the USACE would work within the "Oil Pollution Act of 1990" (33 U.S.C. 2701 et seq) which provides that each responsible party for a facility from which oil is discharged into or upon navigable waters or adjoining shorelines is liable for the removal costs and damages from such incident.

GUIDELINES

GUIDELINES APPLICABLE TO ALL USES

Guideline 1.1 The guidelines must be read in their entirety. Any proposed use may be subject to the requirements of more than one guideline or section of guidelines and all applicable guidelines must be complied with.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

Guideline 1.2 Conformance with applicable water and air quality laws, standards and regulations, and with those other laws, standards and regulations which have been incorporated into the coastal resources program shall be deemed in conformance with the program except to the extent that these guidelines would impose additional requirements.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

Guideline 1.3 The guidelines include both general provisions applicable to all uses and specific provisions applicable only to certain types of uses. The general guidelines apply in all situations. The specific guidelines apply only to the situations they address. Specific and general guidelines should be interpreted to be consistent with each other. In the event there is an inconsistency, the specific should prevail.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

Guideline 1.4 These guidelines are not intended to nor shall they be interpreted so as to result in an involuntary acquisition or taking of property.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

Guideline 1.5 No use or activity shall be carried out or conducted in such a manner as to constitute a violation of the terms of a grant or donation of any lands or water-bottoms to the State or any subdivision thereof. Revocations of such grants and donations shall be avoided.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

Guideline 1.6 Information regarding the following general factors shall be utilized by the permitting authority in evaluating whether the proposed use is in compliance with the guidelines.

a) type, nature and location of use.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

b) elevation, soil and water conditions and flood and storm hazard characteristics of site.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

c) techniques and materials used in construction, operation and maintenance of use.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

d) existing drainage patterns and water regimes of surrounding area including flow, circulation, quality, quantity and salinity; and impacts on them.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

e) availability of feasible alternative sites or methods – for implementing the use.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

f) designation of the area for certain uses as part of a local program.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

g) economic need for use and extent of impacts of use on economy of locality.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

h) extent of resulting public and private benefits.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

i) extent of coastal water dependency of the use.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

j) existence of necessary infrastructure to support the use and public costs resulting from use.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

k) extent of impacts on existing and traditional uses of the area and on future uses for which the area is suited.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

l) proximity to, and extent of impacts on important natural features such as beaches, barrier islands, tidal passes, wildlife and aquatic habitats, and forest lands.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

m) the extent to which regional, state and national interests are served including the national interest in resources and the siting of facilities in the coastal zones as identified in the coastal resources program.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

n) proximity to, and extent of impacts on, special areas, particular areas, or other areas of particular concern of the state program or local programs.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

o) likelihood of, and extent of impacts of, resulting secondary impacts and cumulative impacts.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

p) proximity to and extent of impacts on public lands or works, or historic, recreational or cultural resources.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

q) extent of impacts on navigation, fishing, public access, and recreational opportunities.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

r) extent of compatibility with natural and cultural setting.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

s) extent of long term benefits or adverse impacts.

Response: These guidelines are acknowledged and have been addressed through the preparation of responses to the guidelines contained within the specific use categories.

Guideline 1.7 It is the policy of the coastal resources program to avoid the following adverse impacts. To this end, all uses and activities shall be planned, sited, designed, constructed, operated and maintained to avoid to the maximum extent practicable significant:

a) reductions in the natural supply of sediment and nutrients to the coastal system by alterations of freshwater flow.

Response: The proposed action is not expected to adversely alter freshwater flows. Rather, the proposed action would restore barrier habitats including barrier shorelines, islands, headlands, and interior and back-barrier salt marsh thereby providing shoreline protection to reduce interior marsh loss by reducing wave-induced shoreline erosion.

b) adverse economic impacts on the locality of the use and affected governmental bodies.

Response: The proposed action is not expected to have any adverse economic impacts on the locality of use or nearby governmental bodies. No industries, jobs, or other economic activities would be adversely impacted by the hydrologic restoration. Rather, the proposed action would restore and create essential fish habitat that would positively benefit commercial and recreational fisheries economies in both the Caminada Headland and Shell Island areas. Restoration of the Caminada Headland would close the breach at Bay Champagne that presently connects directly to the Gulf of Mexico and threatens the oil, gas, and port facilities located at Port Fourchon.

c) detrimental discharges of inorganic nutrient compounds into coastal waters.

Response: There would be a temporary increase in the concentration of inorganic nutrient compounds near borrow and restoration sites due to suspension of sediments during dredging and restoration operations. Any effects are expected to be minor and would occur only during actual dredging and construction operations. Conditions would return to ambient conditions following dredging and construction operations.

d) alterations in the natural concentration of oxygen in coastal waters.

Response: There would be a temporary decrease in dissolved oxygen concentrations during dredging and restoration operations, as well as for a short time thereafter. Any effects are expected to be minor and would occur only during actual dredging and restoration operations. Dissolved oxygen levels would return to ambient levels following dredging and restoration operations.

e) destruction or adverse alterations of streams, wetland, tidal passes, inshore waters and waterbottoms, beaches, dunes, barrier islands, and other natural biologically valuable areas or protective coastal features.

Response: The proposed action, including re-nourishment (O&M), would place approximately 29.41 million cy of sediments into this sediment-starved system. Approximately 10.46 million cy of dredged material would be placed on the Caminada Headland and approximately 7.7 million cy of dredged material would be placed on Shell Island. Re-nourishment (O&M) of the Caminada Headland every 1.5 to 2 years would include placement of about 650,000 cy per cycle. Over each 10 year period, an estimated 3.9 million cubic yards of material from six dredging cycles (650,000 cubic yards per cycle) will be returned to the headland.. Renourishment of Shell Island at TY 20 and TY 40 would require 604,700 cy and 907,200 cy, respectively. This would impact a total of 1,070 acres of water bottoms at the borrow sites including 315 acres at Ship Shoal, 334 acres at the Caminada Headland near shore Gulf of Mexico borrow site, 255 acres at the Mississippi River borrow site, 124 acres at the Bayou Lafourche navigation channel borrow site and 116 acres at the Empire near shore Gulf of Mexico borrow site. The proposed action would restore approximately 880 acres of beach/dune and 1,186 acres of marsh on the Caminada Headland and 317 acres of beach/dune and 466 acres of back barrier marsh on Shell Island for a total of 2,849 acres. Borrow material would be placed over shallow open water and existing fragmented barrier shorelines, dunes, barrier islands, overwashes, tidal passes, inshore waters, waterbottoms, and degraded salt marsh. The proposed action would close breaches and reduce or close some existing tidal

passes (e.g., Coupe Bob). The proposed action would restore the integrity of the barrier shoreline by closing breaches that directly connect interior habitats to the high-energy waves and salinities of the Gulf of Mexico.

The Caminada Headland would be re-nourished with approximately 650,000 cy of maintenance dredged material removed from the Bayou Lafourche navigation channel every 1.5 to 2 years equal to an estimated 3.9 million cy over each 10 year period for a total of 19.5 million cy over the 50-year period of analysis. Re-nourishment material would be placed unconfined at approximately 100 to 300 feet from the existing shoreline in a "feeder berm" thereby allowing longshore transport and wave action to move and redistribute the sediment along the headland both to the east and the west. GENESIS simulations of the Caminada Headland shoreline change analysis without and with the re-nourishment feeder berm indicate that at the end of the 2-year period the feeder berm diffuses to the east and west of its initial placement by approximately 2,000 feet. Lateral diffusion will occur relatively quickly reducing the density of the feeder berm along the placement area. The added width will afford protection to the upper beach by attenuating wave run-up and thus reducing storm damage. Any storm damage reduction would be localized to the nodal zone and adjacent beaches as the fill diffuses. This methodology would avoid direct disturbance to piping plover critical habitat and would enable wave action to carry finer sediments onto the beach face making the material available for Aeolian transport to move onto the dune and thereby nourishing the barrier shoreline system. This will result in benefits to vegetation, fish and wildlife and various barrier habitats. The benefits of feeder berms are documented in the literature including Beachler (1993), Work and Otay (1996), Dean and Browder (2000), and Pendleton (2003).

Shell Island would be re-nourished at 20 years and 40 years after initial construction to the original template of 317 beach/dune acres. The marsh fill for alternative 5 would also be re-nourished to its original construction template at this time interval. Approximately 1.5 million cy of beach fill would be required for re-nourishment cycles in years 20 and 40. In year 20, approximately 907,200 cy of marsh fill would be required and in year 40, approximately 604,700 cy would be required for re-nourishment.

f) adverse disruption of existing social patterns.

Response: The borrow and restoration areas would be temporarily unavailable for use during dredging and restoration operations. However, any disruptions would be temporary and short-term and are not expected to adversely disrupt existing social patterns. Rather, the proposed action would restore barrier shoreline, island, and headland as well as interior salt marsh that would make the area more attractive for human use.

g) alterations of the natural temperature regime of coastal waters.

Response: Increased turbidity, associated with dredging and restoration operations, could lead to increased water temperatures in the immediate vicinity of these activities. However, these conditions would be temporary and short term in nature; temperatures would return to ambient conditions following completion of dredging and construction activities.

h) detrimental changes in existing salinity regimes.

Response: The proposed action is not expected to detrimentally change existing salinity regimes. The proposed action area is characterized by numerous barrier shoreline overwashes, tidal passes, oil and gas access canals, and navigation channels that provide rapid tidal exchanges between surrounding bays and interior marshes and has altered the natural hydrologic regime contributing to the land loss of the area. The proposed action would restore the barrier shorelines, islands, headlands and interior salt marsh thereby moderating rapid changes to interior salinity regimes.

i) detrimental changes in littoral and sediment transport processes.

Response: The natural hydrology of the area, including the littoral and sediment transport processes, have been altered by construction of oil and gas access and exploration canals, construction of the Belle Pass and Empire jetties, and construction of navigation channels (Bayou Lafourche and Empire Waterway). These man-induced changes and natural processes have synergistically worked together resulting in increased tidal exchange and tidal scouring that contribute to the erosion and breakup of barrier habitats and interior marshes. The proposed action would help restore the natural hydrology of the area by closing some existing oil and gas canals, breaches, thereby decreasing the adverse effects. The proposed action would reduce the effects of increased tidal exchange and tidal scouring between the Gulf of Mexico and interior portions of the Caminada Headland and Shell Island. The proposed action, including re-nourishment (O&M), would place approximately 29.41 million cy of sediments into this sediment-starved system thereby providing sediments for the littoral and sediment transport processes (e.g. longshore transport). The filling of the shoreline gap at Shell Island would enhance longshore transport to downdrift shorelines.

GENESIS simulations of the Caminada Headland shoreline change analysis without and with the re-nourishment feeder berm indicate that at the end of the 2-year period the feeder berm diffuses to the east and west of its initial placement by approximately 2,000 feet. Lateral diffusion will occur relatively quickly reducing the density of the feeder berm along the placement area. The added width will afford protection to the upper beach by attenuating wave run-up and thus reducing storm damage. Any storm damage reduction would be localized to the nodal zone and adjacent beaches as the fill diffuses.

j) adverse effects of cumulative impacts.

Response: There are other existing and on-going studies and projects in the project area. There are three basic types of related water resources and flood control projects and studies that were considered during the planning of the proposed project. These include barrier shoreline stabilization and restoration projects, interior marsh restoration projects, and other water resource projects involving navigation related structures and flood control structures. The proposed action is not expected to cause any adverse cumulative impacts. Rather, the proposed action would provide positive cumulative long-term impacts by restoring approximately 2,849 acres of barrier habitats and salt marsh that would provide stopover habitat for migrating neotropic birds, essential fish habitat, and critical habitat for the threatened and endangered species (piping plover, brown pelican, and sea turtles). The proposed project would is expected to work in conjunction with other restoration projects in the vicinity of the project area.

k) detrimental discharges of suspended solids into coastal waters, including turbidity resulting from dredging.

Response: There would be a temporary increase in turbidity and suspended solids during dredging and placement of material. This would result in a decrease in the dissolved oxygen concentrations during dredging and restoration operations, and for a short time thereafter. Any effects are expected to be minor and temporary, primarily during actual dredging and restoration operations and for a short time thereafter. Coastal waters would return to ambient conditions following dredging and restoration activities.

l) reductions or blockage of water flow or natural circulation patterns within or into an estuarine system or a wetland forest.

Response: Existing oil and gas canals, the Belle Pass and Empire jetties, and navigation channels (Bayou Lafourche and Empire Waterway) have altered the natural hydrology of the area. The proposed action would assist in restoring the natural hydrology of the area, moderate the effects of tidal scouring and tidal

exchange, and reduce interior marsh losses. Integrity of the barrier system would be enhanced by closing breaches that directly connect the interior habitats to high-energy waves and salinities of the Gulf of Mexico.

m) discharges of pathogens or toxic substances into coastal waters.

Response: The proposed action is not expected to discharge pathogens or toxic substances into coastal waters. Consistent with ER 1165-2-132, an HTRW investigation of the project area was conducted. Based upon findings from this investigation, there are several petroleum pipelines in the area, but as long as they are not damaged the potential for direct impacts to the project area from implementation of the proposed action would be low and would likely continue to be low into the future (see section 5.19 of EIS #0505).

n) adverse alteration or destruction of archaeological, historical, or other cultural resources.

Response: Adverse alteration or destruction of archaeological, historical, or other cultural resources is not expected to occur. A cultural resources survey has been conducted on all borrow and restoration areas. Cultural resource investigations for the Caminada Headland yielded four archeological sites during survey investigations. Two of these archeological sites have been destroyed by pipeline construction. An intact shell midden, considered eligible for the National Register of Historic Places, was recorded in the general study area but is located outside of the proposed Caminada Headland restoration footprint. Another cultural site discovered during the 2005 cultural resources survey was considered eligible for the National Register of Historic Places but has been completely destroyed by recent storms including Hurricanes Gustav and Ike. The proposed action would have no direct impacts to cultural resources on Shell Island, as the cultural integrity of the area has been compromised due to continued coastal land loss. There are no submerged cultural resources at the proposed borrow areas blocks 12, 13, and 88 on Ship Shoal. Hence, there would be no direct impacts from implementing the proposed action. Review of historic maps and shipwreck data indicate the borrow areas to be low probability for cultural resources. Based on these data, no impacts to significant cultural resources are expected and no additional investigations are warranted for the current project areas. In the event that significant cultural resources are encountered in the location of the construction site, work at that location would be halted, and a CEMVN archeologist and the State Historic Preservation Office would be notified for further consultation. An Unanticipated Discovery Plan will be included in the construction and dredging plans and specifications.

o) fostering of detrimental secondary impacts in undisturbed or biologically highly productive wetland areas.

Response: Detrimental secondary impacts from implementing the proposed action are not expected. Rather, the proposed action would positively benefit the barrier habitats and interior salt marsh by restoring lost landforms. The proposed action area has been repeatedly disturbed by construction of oil and gas access and exploration canals, navigation channels, jetties, and unregulated all-terrain vehicle (ATV) riding along dunes. In addition, shoreline erosion and salt marsh loss has increased the tidal exchange, tidal scouring, and interior emergent wetland fragmentation and loss as well as altering the biological productivity of the area.

GENESIS simulations of the Caminada Headland shoreline change analysis without and with the re-nourishment feeder berm indicate that at the end of the 2-year period the feeder berm diffuses to the east and west of its initial placement by approximately 2,000 feet. Lateral diffusion will occur relatively quickly reducing the density of the feeder berm along the placement area. The added width will afford

protection to the upper beach by attenuating wave run-up and thus reducing storm damage. Any storm damage reduction would be localized to the nodal zone and adjacent beaches as the fill diffuses.

p) adverse alteration or destruction of unique or valuable habitats, critical habitat for endangered species, important wildlife or fishery breeding or nursery areas, designated wildlife management or sanctuary areas, or forestlands.

Response: The entire study area is considered essential fish habitat (EFH) (personal communication NMFS), important habitat for sea turtles, as well as important stopover habitat for migrating neotropical birds. The Caminada Headland is designated critieal habitat for wintering populations of the threatened piping plover. Restoration of the area would result in the unavoidable impacts to these existing habitats. However, any impacts would be localized and temporary and most species would be able to move to an area with more favorable conditions and return after construction is completed. Further, the proposed action would restore and positively increase approximately 2,849 acres of barrier habitats and salt marsh. Existing shallow open water and fragmented barrier wetland essential fish habitat would be converted into more continuous emergent wetlands increasing the quality of essential fish habitat and habitat for terrestrial animals along the Caminada Headland and Shell Island. Henee, the quantity and quality of available habitats for use by terrestrial and aquatic organisms would significantly increase. Approximately 10.25 miles of the Caminada Headland are located within designated piping plover critical habitat Unit LA-5. However, temporary project-induced impacts of implementing the proposed action would be offset by restoration of dune and marsh habitat on the Caminada Headlands. CEMVN has determined the proposed action is not likely to adversely affect the brown pelican, the piping plover, or piping plover critical habitat. Following review of a Biological Assessment (Appendix D of EIS #05-05) for the proposed action as part of formal consultation under provisions of the Endangered Species Act of 1073 (87 Stat. 884, as amended; 16 U.S.C 1531 et seq.), the USFWS concurred with this determination by personal communication dated May 11, 2009. The USACE is presently appending its Biological Assessment to include a re-nourishment component at the Caminada Headland. The USACE and USFWS are presently in formal coordination with regard to potential impacts to critical habitat for the piping plover. It is anticipated that this formal coordination will be completed prior to release of the final EIS.

q) adverse alteration or destruction of public parks, shoreline access points, public works, designated recreation areas, scenic rivers, or other areas of public use and concern.

Response: The proposed aetion area would be unavailable for use during actual restoration construction operations. However, this would be of short duration and is not expected to adversely alter or destroy areas of public use or eoncern. The proposed action would restore approximately 2,849 acres of barrier habitat and salt marsh that includes shoreline access points and recreation areas. The proposed action would make the area more attractive for public use as would address the expressed public concern for restoring Louisiana's barrier systems. The increase in wildlife habitat would increase recreational opportunities in the area, especially wildlife-dependent activities including recreation fishing and hunting.

r) adverse disruptions of coastal wildlife and fishery migratory patterns.

Response: Short-term, minor disruptions to coastal wildlife would occur during actual dredging and restoration construction operations. However, these impacts would be minimally disruptive since most wildlife species in the area are mobile and would move to adjacent undisturbed areas during construction activities. Some fishery movement patterns would be altered from existing conditions by closing existing overwashes and converting shallow open water to barrier habitat and salt marsh. Fishery migratory patterns are not expected to be adversely disrupted due to implementation of the proposed action. Creation and restoration of barrier habitat and saline marsh habitat would provide additional resting areas

for many migrating neotropic birds, seabirds, waterfowl, and other organisms. Dredging of access and floatation channels would alter water bottom topography. However, these impacts would likely be short-lived due to the dynamic nature of the area.

s) land loss, erosion and subsidence.

Response: Project benefits were calculated with a broad assumption that the proposed action would stabilize shorelines and reduce erosion rates present in the project area. Barrier beach and surf, dune, supratidal and intertidal wetlands within the study area have undergone substantial loss due to oil and gas activities, construction of navigation channels and jetties, subsidence, sea-level rise, and marine and wind-induced erosion. Between 1887 and 1988, derived shoreline changes at the Caminada Headland range from approximately 970 feet to 6,640 feet with an average of approximately 4,620 feet. These changes over the 101 year time frame equate to shoreline change rates of approximately 9.6 to 65.8 feet per year, with an average of approximately 45.8 feet per year (LCA Report 2004). Shell Island was, at one time, a continuous island. Historic shoreline analysis shows that the island has a history of small inlets cutting through the island which have closed naturally. The long-term erosion rate for Shell Island is 38.5 feet per year with a range of 8.0 to 101.5 feet per year. Overall, the proposed action would result in the restoration and protection of a net total of approximately 111 acres of barrier and saline marsh habitat over the 50-year project period of analysis . Borrow sites would be located a minimum of 3,000 feet from the shoreline to minimize the potential for increased erosion, due to potential changes in wave climate of unprotected shorelines.

t) increases in the potential for flood, hurricane or other storm damage, or increases in the likelihood that damage will occur from such hazards.

Response: The proposed action is not expected to increase the potential for flood, hurricane, or other storm damage, or increase the likelihood of damage from such hazards. Rather, the proposed action would reduce coastal flooding during periods of storm surge and prevent direct ocean wave attack, which accelerate rates of erosion and degradation of marshes. Restoration of the barrier systems would provide natural storm buffering, limit storm heights, and provide protection for the interior wetlands, bays, and estuaries.

u) reductions in the long-term biological productivity of the coastal ecosystem.

Response: Continued shoreline erosion, increasing tidal exchange and tidal scouring, the continued loss of interior salt marsh, and changes to the natural hydrology of the area have all adversely impacted the long-term biological productivity in the area. The proposed action would provide a total of approximately 2,849 acres of additional habitat. Hence, the proposed action would likely increase the long-term biological productivity in this coastal ecosystem over the 50-year project period of analysis.

Guideline 1.8 In those guidelines in which the modifier "maximum extent practicable" is used, the proposed use is in compliance with the guideline if the standard modified by the term is complied with. If the modified standard is not complied with, the use will be in compliance with the guideline if the permitting authority finds, after a systematic consideration of all pertinent information regarding the use, the site and the impacts of the use as set forth in guideline 1.6, and a balancing of their relative significance, that the benefits resulting from the proposed use would clearly outweigh the adverse impacts resulting from non-compliance with the modified standard and there are no feasible and practical alternative locations, methods and practices for the use that are in compliance with the modified standard and:

a) significant public benefits will result from the use, or;

b) the use would serve important regional, state or national interests, including the national interest in resources and the siting of facilities in the coastal zone identified in the coastal resources program, or;

c) the use is coastal water dependent.

The systematic consideration process shall also result in a determination of those conditions necessary for the use to be in compliance with the guideline. Those conditions shall assure that the use is carried out utilizing those locations, methods and practices which maximize conformance to the modified standard; are technically, economically, environmentally, socially and legally feasible and practical and minimize or offset those adverse impacts listed in guideline 1.7 and in the guideline at issue.

Response: Acknowledged.

Guideline 1.9 Uses shall to the maximum extent practicable be designed and carried out to permit multiple concurrent uses which are appropriate for the location and to avoid unnecessary conflicts with other uses of the vicinity.

Response: Generally, the proposed action area would be unavailable for use during actual restoration construction operations. However, the proposed action area would again be available for multiple uses followiug actual construction operations.

Guideline 1.10 These guidelines are not intended to be, nor shall they be, interpreted to allow expansion of governmental authority beyond that established by La. R.S. 49:213.1 through 213.21, as amended; nor shall these guidelines be interpreted so as to require permits for specific uses legally commenced or established prior to the effective date of the coastal use permit program nor to normal maintenance or repair of such uses.

Response: Acknowledged.

GUIDELINES FOR LEVEES

Guideline 2.1 The leveeing of unmodified or biologically productive wetlands shall be avoided to the maximum extent practicable.

Response: Not applicable.

Guideline 2.2 Levees shall be planned and sited to avoid segmentation of wetland areas and systems to the maximum extent practicable.

Response: Not applicable.

Guideline 2.3 Levees constructed for the purpose of developing or otherwise changing the use of a wetland area shall be avoided to the maximum extent practicable.

Response: Not applicable.

Guideline 2.4 Hurricane and flood protection levees shall be located at the non-wetland/wetland interface or landward to the maximum extent practicable.

Response: Not applicable.

Guideline 2.5 Impoundment levees shall only be constructed in wetland areas as part of approved water or marsh. management projects or to prevent release of pollutants.

Response: Not applicable.

Guideline 2.6 Hurricane or flood protection levee systems shall be designed, built and thereafter operated and maintained utilizing best practical techniques to minimize disruptions of existing hydrologic patterns, and the interchange of water, beneficial nutrients and aquatic organisms between enclosed wetlands and those outside the levee system.

Response: Not applicable.

GUIDELINES FOR LINEAR FACILITIES

Guideline 3.1 Linear use alignments shall be planned to avoid adverse impacts on areas of high biological productivity or irreplaceable resource areas.

Response: Not applicable.

Guideline 3.2 Linear facilities involving the use of dredging or filling shall be avoided in wetland and estuarine areas to the maximum extent practicable.

Response: Not applicable.

Guideline 3.3 Linear facilities involving dredging shall be of the minimum practical size and length.

Response: Not applicable.

Guideline 3.4 To the maximum extent practicable, pipelines shall be installed through the "push ditch" method and the ditch backfilled.

Response: Not applicable.

Guideline 3.5 Existing corridors, rights-of-way, canals, and streams shall be utilized to the maximum extent practicable for linear facilities.

Response: Not applicable.

Guideline 3.6 Linear facilities and alignments shall be, to the maximum extent practicable, designed and constructed to permit multiple uses consistent with the nature of the facility.

Response: Not applicable.

Guideline 3.7 Linear facilities involving dredging shall not traverse or adversely affect any barrier island.

Response: Not applicable.

Guideline 3.8 Linear facilities involving dredging shall not traverse beaches, tidal passes, protective reefs or other natural gulf shoreline unless no other alternative exists. If a beach, tidal pass, reef or other natural gulf shoreline must be traversed for a non-navigation canal, they shall be restored at least to their natural condition immediately upon completion of construction. Tidal passes shall not be permanently widened or deepened except when necessary to conduct the use. The best available restoration techniques which improve the traversed area's ability to serve as a shoreline shall be used.

Response: Not applicable.

Guideline 3.9 Linear facilities shall be planned, designed, located and built using the best practical techniques to minimize disruption of natural hydrologic and sediment transport patterns, sheet flow, and water quality, and to minimize adverse impacts on wetlands.

Response: Not applicable.

Guideline 3.10 Linear facilities shall be planned, designed, and built using the best practical techniques to prevent bank slumping and erosion, saltwater intrusion, and to minimize the potential for inland movement of storm-generated surges. Consideration shall be given to the use of locks in navigation canals and channels which connect more saline areas with fresher areas.

Response: Not applicable.

Guideline 3.11 All non-navigation canals, channels and ditches which connect more saline areas with fresher areas shall be plugged at all waterway crossings and at intervals between crossings in order to compartmentalize them. The plugs shall be properly maintained.

Response: Not applicable.

Guideline 3.12 The multiple use of existing canals, directional drilling and other practical techniques shall be utilized to the maximum extent practicable to minimize the number and size of access canals, to minimize changes of natural systems and to minimize adverse impacts on natural areas and wildlife and fisheries habitat.

Response: Not applicable.

Guideline 3.13 All pipelines shall be constructed in accordance with parts 191, 192, and 195 of Title 49 of the Code of Federal Regulations, as amended, and in conformance with the Commissioner of Conservation's Pipeline Safety Rules and Regulations and those safety requirements established by La. R. S. 45:408, whichever would require higher standards.

Response: Not applicable.

Guideline 3.14 Areas dredged for linear facilities shall be backfilled or otherwise restored to the pre-existing conditions upon cessation of use for navigation purposes to the maximum extent practicable.

Response: Not applicable.

Guideline 3.15 The best practical techniques for site restoration and re-vegetation shall be utilized for all linear facilities.

Response: Not applicable.

Guideline 3.16 Confined and dead end canals shall be avoided to the maximum extent practicable. Approved canals must be designed and constructed using the best practical techniques to avoid water stagnation and eutrophication.

Response: Not applicable.

GUIDELINES FOR DREDGED MATERIAL DEPOSITION

Guideline 4.1 Spoil shall be deposited utilizing the best practical techniques to avoid disruption of water movement, flow, circulation and quality.

Response: Because of the large quantities of material required, the quality, and the comparable size of sands required for restoration, three different borrow sites would be utilized. Approximately 5,100,000 cy of offshore Gulf water bottoms would be borrowed from Ship Shoal (see Figure 2); approximately 1,876,500 cy of nearshore Gulf water bottoms would be borrowed in the vicinity of the Empire deposit (see Figure 2); and approximately 4,130,000 cy of water bottoms from the Mississippi River in the vicinity of Naim, Louisiana (see Figure 2). Approximately 5.1 million cy of material would be used for dune fill and approximately 5.4 million cy of material would be used for marsh fill. Material would be deposited using a hydrologic dredge to restore barrier shoreline, island, headland, and interior salt marsh. The best practical restoration techniques would be utilized to avoid disruption of natural water movement, flow, circulation and quality. Restoration would restore approximately 15,400 feet of barrier shorelines, close numerous barrier shoreline overwashes and breaches, and fill in shallow open water creating and restoring 2,849 acres of salt marsh.

The proposed action includes periodic re-nourishment of the Caminada Headland. The Caminada Headland would be re-nourished with approximately 650,000 cy of maintenance dredged material removed from the Bayou Lafourche navigation channel every 1.5 to 2 years equal to an estimated 3.9 million cy over each 10 year period for a total of 19.5 million cy over the 50-year period of analysis. Re-nourishment material would be placed unconfined at approximately 100 to 300 feet from the existing shoreline in a "feeder berm" thereby allowing longshore transport and wave action to move and redistribute the sediment along the headland both to the east and the west. GENESIS simulations of the Caminada Headland shoreline change analysis without and with the re-nourishment feeder berm indicate that at the end of the 2-year period the re-nourishment feeder berm diffuses to the east and west of its initial placement by approximately 2,000 feet. Lateral diffusion will occur relatively quickly reducing the density of the feeder berm along the placement area. The added width will afford protection to the upper beach by attenuating wave run-up and thus reducing storm damage. Any storm damage reduction would be localized to the nodal zone and adjacent beaches as the fill diffuses.

Guideline 4.2 Spoil shall be used beneficially to the maximum extent practicable to improve productivity or create new habitat, reduce or compensate for environmental damage done by dredging activities, or prevent environmental damage. Otherwise, existing spoil disposal areas or upland disposal shall be utilized to the maximum extent practicable rather than creating new disposal areas.

Response: All material dredged from the borrow sites would be used to restore, create, or re-nourish additional beach/dune habitat and marsh habitat at the Caminada Headland and the Shell Island disposal sites.

Guideline 4.3 Spoil shall not be disposed of in a manner which could result in the impounding or draining of wetlands or the creation of development sites unless the spoil deposition is part of an approved levee or land surface alteration project.

Response: The proposed action would not impound or drain wetlands. Existing dunes would serve as dikes and additional dikes would be constructed around the perimeter of the sites. Dredged material would be placed in a manner to restore and/or create 2,849 acres of barrier shoreline, island, headlands, and interior salt marsh.

Guideline 4.4 Spoil shall not be disposed of on marsh, known oyster or clam reefs or in areas of submersed vegetation to the maximum extent practicable.

Response: The proposed action would involve the placement of material on existing fragmented dune, supratidal, intertidal, and shallow open water habitats. Dune restoration for the proposed action would include the installation of sand fencing and plantings of native vegetation. Marsh restoration would include plantings of marsh platform areas. Impacts to oyster leases would be related to construction activities and would include disruption of water bottoms, increased turbidity, temperature, biological demand, and decreased dissolved oxygen. There are seven existing oyster leases on the Caminada Headland and twenty-two leases on the Shell Island reach (source: http://sonris-www.dnr.state.la.us/www_root/snoris_portal_1.htm). These impacts would not be detrimental and restoration in the project area would provide important habitat and increase the availability of catabolic products utilized by primary producers which can be used by oysters leading to increased yields in the long-term.

Guideline 4.5 Spoil shall not be disposed of in such a manner as to create a hindrance to navigation or fishing, or hinder timber growth.

Response: Disposal of material would not create a hindrance to navigation or hinder timber growth. The project area would be unavailable for fishing activities during construction activities. However, alternative fishing areas in the vicinity of the project area would be available during construction and fishing access to the area would be restored after the completion of construction activities. Additionally, the increase in wetland acreage would provide additional habitat for fishery resources, including improved quality and quantity of essential fish habitat, increasing the opportunities for fishing activities in the project area.

Guideline 4.6 Spoil disposal areas shall be designed and constructed and maintained using the best practical techniques to retain the spoil at the site, reduce turbidity, and reduce shoreline erosion when appropriate.

Response: For the Caminada Headland area, the dune would serve as the southern dike for the marsh fill, with a system of dikes constructed around the remaining perimeter for containment of the fill material to minimize turbidity of the water at the dredge site and the discharge sites. Dikes would be constructed at the Shell Island site to control the placement of marsh fill. The bayward side of the beach fill would act as a dike to control fill on the south side of the marsh. Approximately 71,500 feet of sand fencing would be installed to accumulate sand on the downwind side of the fence and promote deposition of windblown sand, create dune features, reduce trampling of existing dunes, and protect vegetative plantings. Borrow sites would be located a minimum of 3,000 feet from the shoreline to minimize the potential for increased erosion.

The Caminada Headland would be re-nourished with approximately 650,000 cy of maintenance dredged material removed from the Bayou Lafourche navigation channel every 1.5 to 2 years equal to an estimated 3.9 million cy over each 10 year period for a total of 19.5 million cy over the 50-year period of analysis. Re-nourishment material would be placed unconfined at approximately 100 to 300 feet from the existing shoreline in a "feeder berm" thereby allowing longshore transport and wave action to move and redistribute the sediment along the headland both to the east and the west. GENESIS simulations of the Caminada Headland shoreline change analysis without and with the re-nourishment feeder berm indicate that at the end of the 2-year period the feeder berm diffuses to the east and west of its initial placement by approximately 2,000 feet. Lateral diffusion will occur relatively quickly reducing the density of the feeder berm along the placement area.

Guideline 4.7 The alienation of state-owned property shall not result from spoil deposition activities without the consent of the Department of Natural Resources.

Response: The proposed action would not result in the alienation of state owned property.

GUIDELINES FOR SHORELINE MODIFICATION

Guideline 5.1 Non-structural methods of shoreline protection shall be utilized to the maximum extent practicable.

Response: A total of approximately 2,066 acres, including 880 acres of beach/dune and 1,186 acres of back barrier marsh, would be restored at the Caminada Headland (**figure 3**). Fill quantities for the beach/dune and marsh restoration features would be approximately 5.1 million cy and 5.4 million cy, respectively. The dune would be constructed to an elevation of +7 feet NAVD with a width of approximately 209 feet. Material would be pumped from the dredge to the beach and worked on the beach by bulldozers and front-end loaders. For the marsh restoration area, material would be pumped from the Caminada nearshore borrow site and placed on the landward side of the dune to a final elevation of +2.0 feet NAVD. The dune would serve as the southern dike for the marsh fill and additional dikes would be constructed around the remaining perimeter. Vegetative plantings would include a variety of native species with a planting density of no greater than 8-foot centers. Approximately 71,500 feet of sand fencing would be installed to promote deposition of windblown sand, create dune features, reduce trampling of existing dunes, and protect vegetative plantings. The TSP/NER will include re-nourishment of the Caminada Headland per the 2004 LCA report which included near-shore recovery of 2 million cy of sand every 10 years. USACE operations and maintenance dredging of the Bayou Lafourche, Louisiana (Belle Pass) navigation project yields on average approximately 650,000 cy of material every 1.5 to 2 years. This material will be placed in the littoral drift south of Bayou Moreau where the long shore transport of material splits going east and west. The material will be placed, allowing the longshore transport and wave action to move and place the sediment along the headland. Over each 10 year period, an estimated 3.9 million cubic yards of material from six dredging cycles (650,000 cubic yards per cycle) will be returned to the headland. Unless the shoreline is in danger of breaching, timing of the renourishment will be dependent upon the maintenance dredging requirements of the Bayou Lafourche, Louisiana navigation project. Historically, maintenance dredging has begun as early as March and ended as late as November. This renourishment is part of the non-Federal sponsor's operations and maintenance requirements.

The Shell Island alternative 5 component of the TSP/NER would restore Shell Island as one island. Restoration would include shore face, dune, and marsh platform features. The Shell Island component of the TSP/NER would restore Shell Island to a form similar to its pre-Hurricane Bob (1979) condition. **Figure 3** shows a plan view of Shell Island alternative 5 component of the TSP/NER.

The landward edge of the dune of Shell Island alternative 5 would be located seaward of the existing shoreline. The west end of the Shell Island alternative 5 single island would be terminated approximately 0.5 mile before Grand Bayou. It is anticipated that the closure of Coupe Bob would return the tidal prism to its pre-1979 path—flowing through Grand Bayou, with Grand Bayou increasing in size in response to the altered tidal flow pattern. The west end of Shell Island alternative 5 is close to the western limit of Shell Island that was observed in 1973, prior to the opening of Coupe Bob. The proposed island follows the shortest and shallowest route across Coupe Bob. The east end of the island would then follow the remnants of Shell Island East, but has a concave shape towards land. This would be required to maintain

a smooth shoreline. The eastern end of the island would be located near the Empire Waterway. The constructed dune would have a uniform width of 189 feet along the length of the restored barrier island.

Louisiana barrier islands have typical widths in the region of 1,000 feet to 1,500 feet wide from the gulf shoreline to the bayward limit of the marsh. A uniform marsh width of 735 feet was chosen to construct an island that is approximately 1,240 feet wide following equilibration of the shoreline fill. The fill source for dike construction was located within the marsh fill footprint where the existing bathymetry is relatively shallow (less than -2.0 feet).

However, in deeper water (bathymetry below -3.0 feet), it is not feasible to construct the marsh section with only marsh sediments, as the marsh would settle too rapidly and nonuniformly to perform its intended purpose effectively. Instead it is recommended to construct a sand base across Coupe Bob, at -3.0 feet, using shoreline fill material. The marsh can then be constructed on top of this base, which would reduce settlement of the marsh material. A second option is to install a geotextile tube for containment of the marsh fill where the -3 feet NAVD sand base is constructed. The geotextile tube could be filled with sand from the sand base. This option was used for the development of alternative 5.

It is estimated that 5.6 million cy of shoreline fill would be required to construct 317 acres of shoreline/dune area (area above +2 feet, NAVD). Approximately 2.1 million cy of marsh fill would be required to construct 466 acres of marsh.

Under the TSP/NER, Shell Island would be re-nourished 20 years and 40 years after initial construction to the original template of 317 beach/dune acres. The marsh fill would also be re-nourished to its original construction template at this time interval. Approximately 1.5 million cy of beach fill would be required for re-nourishment cycles in years 20 and 40. In year 20, approximately 907,200 cy of marsh fill would be required and in year 40, 604,700 cy would be required for re-nourishment. The renourishment in year 20 is estimated to be $63.3 million and the renourishment is year 40 is estimated to cost $60.9 million. The Shell Island Alternative 5 component of the TSP/NER would create 730.6 AAHUs. At TY50, Shell Island would encompass 799 acres.

The borrow source for the dune/beach would be a large sand deposit near Nairn in the Mississippi River between mile markers 32 and 34, approximately 11 miles north of the project area. The borrow site is located in a river meander where greater sediment thickness is anticipated due to the presence of relict (vertically stacked) sand bars. USACE boring date indicates sand thickness of at least 70 feet. Based on samples obtained from vibracores, the sand grain size is comparable to the sand at the project site. The dredged material would be pumped from the Mississippi River via pipeline. The borrow source for the marsh restoration would be the Empire deposit, approximately 1.5 miles from the Empire Jetties. Water depths in the borrow area are from 16 feet to 20 feet. The borrow area occupies about 207 acres and total mixed sediment volumes range from 5.5 million to 6.6 million cy for 15 foot and 20 foot cut depths, respectively. The sedimentary characteristics indicate a silt content of about 40 percent, a clay content of about 22 percent and sand content of about 38 percent. It is estimated that duration for construction would be 787 days. It is estimated that the duration for the plantings would be 360 days over a period of 3 years. Complete design details are located in appendix A, annex 2 of the integrated construction report and draft EIS. **Figure 4** displays the project areas and the borrow sources.

Guideline 5.2 Shoreline modification structures shall be designed and built using best practical techniques to minimize adverse environmental impacts.

Response: Not applicable.

Guideline 5.3 Shoreline modification structures shall be lighted or marked in accordance with U.S. Coast Guard regulations, not interfere with navigation, and should foster fishing, other recreational opportunities, and public access.

Response: Not applicable.

Guideline 5.4 Shoreline modification structures shall be built using best practical materials and techniques to avoid the introduction of pollutants and toxic substances into coastal waters.

Response: Not applicable.

Guideline 5.5 Piers and docks and other harbor structures shall be designed and built using best practical techniques to avoid obstruction of water circulation.

Response: Not applicable.

Guideline 5.6 Marinas, and similar commercial and recreational developments shall to the maximum extent practicable not be located so as to result in adverse impacts on open productive oyster beds, or submersed grass beds.

Response: Not applicable.

Guideline 5.7 Neglected or abandoned shoreline modification structures, piers, docks, mooring and other harbor structures shall be removed at the owner's expense, when appropriate.

Response: Not applicable.

Guideline 5.8 Shoreline stabilization structures shall not be built for the purpose of creating fill areas for development unless part of an approved surface alteration use.

Response: Not applicable.

Guideline 5.9 Jetties, groins, breakwaters and similar structures shall be planned, designed and constructed so as to avoid to the maximum extent practicable downstream land loss and erosion.

Response: Not applicable.

GUIDELINES FOR SURFACE ALTERATIONS

Guideline 6.1 Industrial, commercial, urban, residential, and recreational uses are necessary to provide adequate economic growth and development. To this end, such uses will be encouraged in those areas of the coastal zone that are suitable for development. Those uses shall be consistent with the other guidelines and shall, to the maximum extent practicable, take place only:

a) **on lands five feet or more above sea level or within fast lands; or**

b) **on lands which have foundation conditions sufficiently stable to support the use, and where flood and storm hazards are minimal or where protection from these hazards can be reasonably well achieved, and where the public safety would not be unreasonably endangered; and**

   1) **the land is already in high intensity of development use, or**

   2) **there is adequate supporting infrastructure, or**

   3) **the vicinity has a tradition of use for similar habitation or development**

Response: Not applicable.

Guideline 6.2 Public and private works projects such as levees, drainage improvements, roads, airports, ports, and public utilities are necessary to protect and support needed development and shall be encouraged. Such projects shall, to the maximum extent practicable, take place only when:

a) they protect or serve those areas suitable for development pursuant to Guideline 6.1; and

b) they are consistent with the other guidelines; and

d) they are consistent with all relevant adopted state, local and regional plans.

Response: Not applicable.

Guideline 6.3 BLANK (Deleted)

Guideline 6.4 To the maximum extent practicable wetland areas shall not be drained -or filled. Any approved drain or fill project shall be designed and constructed using best practical techniques to minimize present and future property damage and adverse environmental impacts.

Response: Not applicable.
Guideline 6.5 Coastal water dependent uses shall be given special consideration in permitting because of their reduced choice of alternatives.

Response: Not applicable.

Guideline 6.6 Areas modified by surface alteration activities shall, to the maximum extent practicable, be re-vegetated, refilled, cleaned and restored to their predevelopment condition upon termination of the use

Response: After deposition of dredged material at the project area, vegetative plantings of native species would occur.

Guideline 6.7 Site clearing shall to the maximum extent practicable be limited to those areas immediately required for physical development.

Response: Not applicable.

Guideline 6.8 Surface alterations shall, to the maximum extent practicable, be located away from critical wildlife areas and vegetation areas. Alterations in wildlife preserves and management areas shall be conducted in strict accord with the requirements of the wildlife management body.

Response: Not applicable.

Guideline 6.9 Surface alterations which have high adverse impacts on natural functions shall not occur, to the maximum extent practicable, on barrier islands and beaches, isolated cheniers, isolated natural ridges or levees,' or in wildlife and aquatic species breeding or spawning areas, or in important migratory routes.

Response: The proposed action does not involve adverse impacts to natural functions of the barrier system. The purpose of the proposed action is to restore the natural functions and enhance habitat along the Barataria Basin Barrier shoreline.

Guideline 6.10 The creation of low dissolved oxygen conditions in the water or traps for heavy metals shall be avoided to the maximum extent practicable.

Response: The creation of low dissolved oxygen conditions in the water or traps for heavy metals would be avoided to the maximum extent practicable. However, the proposed action would temporarily increase low dissolved oxygen levels in the immediate vicinity of the dredging activities. However, these conditions would be temporary and would return to pre-construction conditions following the completion of construction activities.

Guideline 6.11 Surface mining and shell dredging shall be carried out utilizing the best practical techniques to minimize adverse environmental impacts.

Response: Not applicable.

Guideline 6.12 The creation of underwater obstructions which adversely affect fishing or navigation shall be avoided to the maximum extent practicable.

Response: Operating dredging plants at the borrow areas within the Mississippi River and the Bayou Lafourche navigation channel could potentially cause some interference or slowdown of navigation traffic. However, CEMVN has had many years of experience in dredging activities along the Mississippi River and the Bayou Lafourche and has developed dredging operation and management techniques to avoid, minimize, and reduce the potential of interference or slowdown of river navigation traffic.

Guideline 6.13 Surface alteration sites and facilities shall be designed, constructed, and operated using the best practical techniques to prevent the release of pollutants or toxic substances into the environment and minimize other adverse impacts.

Response: Not applicable.

Guideline 6.14 To the maximum extent practicable only material that is free of contaminants and compatible with the environmental setting shall be used as fill.

Response: A Phase I ESA survey for HTRW was conducted for material to be used as fill and results indicated a low probability of contamination for these sediments.

GUIDELINES FOR HYDROLOGIC AND SEDIMENT TRANSPORT MODIFICATIONS

Guideline 7.1 The controlled diversion of sediment-laden waters to initiate new cycles of marsh building and sediment. nourishment shall be encouraged and utilized whenever such diversion will enhance the viability and productivity of the outfall area. Such diversions shall incorporate a plan for monitoring and reduction and/or amelioration of the effects of pollutants present in the freshwater source.

Response: Not applicable.

Guideline 7.2 Sediment deposition systems may be used to offset land loss, to create or restore wetland areas or enhance building characteristics of a development site. Such systems shall only be utilized as part of an approved plan. Sediment from these systems shall only be discharged in the area that the proposed use is to be accomplished.

Response: Not applicable.

Guideline 7.3 Undesirable deposition of sediments in sensitive habitat or navigation areas shall be avoided through the use of the best preventive techniques.

Response: Not applicable.

Guideline 7.4 The diversion of freshwater through siphons and controlled conduits and channels, and overland flow to offset saltwater intrusion and to introduce nutrients into wetlands shall be encouraged and utilized whenever such diversion will enhance the viability and productivity of the outfall area. Such diversions shall incorporate a plan for monitoring and reduction and/or amelioration of the effects of pollutants present in the freshwater source.

Response: Not applicable.

Guideline 7.5 Water or marsh management plans shall result in an overall benefit to the productivity of the area.

Response: Not applicable.

Guideline 7.6 Water control structures shall be assessed separately based on their individual merits and impacts and in relation to their overall water or marsh management plan of which they are a part.

Response: Not applicable.

Guideline 7.7 Weirs and similar water control structures shall be designed and built using the best practical techniques to prevent "cut arounds," permit tidal exchange in tidal areas, and minimize obstruction of the migration of aquatic organisms.
Response: Not applicable.

Guideline 7.8 Impoundments which prevent normal tidal exchange and/or the migration of aquatic organisms shall not be constructed in brackish and saline areas to the maximum extent practicable.

Response: Not applicable.

Guideline 7.9 Withdrawal of surface and ground water shall not result in saltwater intrusion or land subsidence to the maximum extent practicable.

Response: Not applicable.

GUIDELINES FOR DISPOSAL OF WASTES

Guideline 8.1 The location and operation of waste storage, treatment, and disposal facilities shall be avoided in wetlands to the maximum extent practicable, and best practical techniques shall be used to minimize adverse impacts which may result from such use.

Response: Not applicable.

Guideline 8.2 The generation, transportation, treatment, storage and disposal of hazardous wastes shall be pursuant to the substantive requirements of the Department of Natural Resources adopted pursuant to Act 334 of 1978 and approved pursuant to the Resource Conservation and Recovery Act. of 1976 P. 0. 94-580, and of the Office of Conservation for injection below surface.

Response: Not applicable.

Guideline 8.3 Waste facilities located in wetlands shall be designed and built to withstand all expectable adverse conditions without releasing pollutants.

Response: Not applicable.

Guideline 8.4 Waste facilities shall be designed and constructed using best practical techniques to prevent leaching, control leachate production, and prevent the movement of leachate away from the facility.

Response: Not applicable.

Guideline 8.5 The use of overland flow systems for non-toxic, biodegradable wastes, and the use of sump lagoons and reservoirs utilizing aquatic vegetation to remove pollutants and nutrients shall be encouraged.

Response: Not applicable.

Guideline 8.6 All waste disposal sites shall be marked and, to the maximum extent practicable, all components of waste shall be identified.

Response: Not applicable.

Guideline 8.7 Waste facilities in wetlands with identifiable pollution problems that are not feasible and practical to correct shall be closed and either removed or sealed, and shall be properly re-vegetated using the best practical techniques.

Response: Not applicable.

Guideline 8.8 Waste shall be disposed of only at approved disposal sites.

Response: Not applicable.

Guideline 8.9 Radioactive wastes shall not be temporarily or permanently disposed of in the coastal zone.

Response: Not applicable.

GUIDELINES FOR USES THAT RESULT IN THE ALTERATION OF WATERS DRAINING INTO COASTAL WATERS

Guideline 9.1 Upland and upstream water management programs which affect coastal waters and wetlands shall be designed and constructed to preserve or enhance existing water quality, volume, and rate of flow to the maximum extent practicable.

Response: Not applicable.

Guideline 9.2 Runoff from developed areas shall to the maximum extent practicable be managed to simulate natural water patterns, quantity, quality and rate of flow.

Response: Not applicable.

Guideline 9.3 Runoff and erosion from agricultural lands shall be minimized through the best practical techniques.

Response: Not applicable.

GUIDELINES FOR OIL, GAS, AND OTHER MINERAL ACTIVITIES

Guideline 10.1 Geophysical surveying shall utilize the best practical techniques to minimize disturbance or damage to wetlands, fish and wildlife and other coastal resources.

Response: Not applicable.

Guideline 10.2 To the maximum extent practicable, the number of mineral exploration and production sites in wetland areas requiring flotation access shall be held to the minimum number, consistent with good recovery and conservation practices and the need for energy development, by directional drilling, multiple use of existing access canals and other practical techniques.

Response: Not applicable.

Guideline 10.3 Exploration, production and refining activities shall, to the maximum extent practicable, be located away from critical wildlife areas and vegetation areas. Mineral operations in wildlife preserves and management areas shall be conducted in strict accordance with the requirements of the wildlife management body.

Response: Not applicable.

Guideline 10.4 Mineral exploration and production facilities shall be to the maximum extent practicable designed, constructed and maintained in such a manner to maintain natural water flow regimes, avoid blocking surface drainage, and avoid erosion.

Guideline 10.5 Access routes to mineral exploration, production and refining sites shall be designed and aligned so as to avoid adverse impacts on critical wildlife and vegetation areas to the maximum extent practicable.

Response: Not applicable.

Guideline 10.6 Drilling and production sites shall be prepared, constructed, and operated using the best practical techniques to prevent the release of pollutants or toxic substances into the environment.

Response: Not applicable.

Guideline 10.7 All drilling activities, supplies, and equipment shall be kept on barges, on drilling rigs, within ring levees, or on the well site.

Response: Not applicable.

Guideline 10.8 Drilling ring levees shall to the maximum extent practicable be replaced with smaller production levees or removed entirely.

Response: Not applicable.

Guideline 10.9 All drilling and production equipment, structures, and storage facilities shall be designed and constructed utilizing best practical techniques to withstand all expectable adverse conditions without releasing pollutants.

Response: Not applicable.

Guideline 10.10 Mineral exploration, production and refining facilities shall be designed and constructed using best practical techniques to minimize adverse environmental impacts.

Response: Not applicable.

Guideline 10.11 Effective environmental protection and emergency or contingency plans shall be developed and complied with for all mineral operations.

Response: Not applicable.

Guideline 10.12 The use of dispersants, emulsifiers and other similar chemical agents on oil spills is prohibited without the prior approval of the Coast Guard or Environmental Protection Agency on-Scene Coordinator, in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan.

Response: Not applicable.

Guideline 10.13 Mineral exploration and production sites shall be cleared, re-vegetated, detoxified and otherwise restored as near as practicable to their original condition upon termination of operations to the maximum extent practicable.

Response: Not applicable.

Guideline 10.14 The creation of underwater obstructions which adversely affect fishing or navigation shall be avoided to the maximum extent practicable.

Response: Not applicable.

GUIDELINE DEFINITIONS

Levees - any use or activity which creates an embankment to control or prevent water movement, to retain water or other material, or to raise a road or other lineal use above normal or flood water levels. Examples include levees, dikes and embankments of any sort.

Linear Facilities - those uses and activities which result in creation of structures or works which are primarily linear in nature. Examples include pipelines, roads, canals, channels, and powerlines.

Shoreline Modifications - those uses and activities planned or constructed with the intention of directly or indirectly changing or preventing change of a shoreline. Examples include bulkheading, piers, docks, wharves, slips and short canals, and jetties.

Spoil Deposition - the deposition of any excavated or dredged material.

Surface Alterations - those uses and activities which change the surface or usability of a land area or water bottom. Examples include fill deposition, land reclamation, beach nourishment, dredging (primarily areal), clearing, draining, surface mining, construction and operation of transportation, mineral, energy and industrial facilities, and industrial, commercial and urban developments.

Hydrologic and Sediment Transport Modifications - those uses and activities intended to change water circulation, direction of flow, velocity, level, or quality or quantity of transported sediment. Examples include locks, water gates, impoundments, jetties, groins, fixed and variable weirs, dams, diversion pipes, siphons, canals, and surface and groundwater withdrawals.

Waste Disposal - those uses and activities which involve the collections, storage and discarding or disposing of any solid or liquid material. Examples include littering; landfill; open dumping; incineration; industrial waste treatment facilities; sewerage treatment; storage in pits, ponds or lagoons; ocean dumping and subsurface disposal.

Alterations of Waters Draining in Coastal Waters - those uses or activities that would alter, change, or introduce polluting substances into runoff and thereby modify the quality of coastal waters. Examples include water control impoundments, upland and water management programs, and drainage projects from urban, agricultural and industrial developments.

Oil, Gas and Other Mineral Activities - those uses and activities which are directly involved in the exploration, production, and refining of oil, gas and other minerals. Examples include geophysical surveying, establishment of drill sites and access to them, drilling, on site storage of supplies, products and waste materials, production, refining, and spill cleanup.

Coastal Water Dependent Uses - those which must be carried out on, in or adjacent to coastal water areas or wetlands because the use requires access to the water body or wetland or requires the consumption, harvesting or other direct use of coastal resources, or requires the use of coastal water in the manufacturing or transportation of goods. Examples include surface and subsurface mineral extraction, fishing, ports and necessary supporting commercial and industrial facilities, facilities for the construction, repair and maintenance of vessels, navigation projects, and fishery processing plants.

Best Practical Techniques - best practical techniques shall mean those methods or techniques which would result in the greatest possible minimization of the adverse impacts listed in Guideline 1.7 and

in specific guidelines applicable to the proposed use. Those methods or techniques shall be the best methods or techniques which are in use in the industry or trade or among practitioners of the use, and which are feasible and practical for utilization.

Water or Marsh Management Plan - a systematic development and control plan to improve and increase biological productivity, or to minimize land loss, saltwater intrusion, erosion or other such environmental problems, or to enhance recreation.

Impoundment Levees - those levees and associated water control structures whose primary purpose is to contain water within the levee system either for the prevention of the release of pollutants, to create fresh water reservoirs, or for management of fish or wildlife resources.

Hurricane or Flood Protection Levees - those levees and associated water control structures whose primary purpose is to prevent occasional surges of flood or storm generated high water. Such levee systems do not include those built to permit drainage or development of enclosed wetland areas.

Development Levees - those levees and associated water control structures whose purpose is to allow control of water levels within the area enclosed by the levees to facilitate drainage or development within the leveed areas. Such levee systems also commonly serve for hurricane or flood protection, but are not so defined for purposes of these guidelines.

Feasible and Practical - those locations, methods and/or practices which are of established usefulness and efficiency and allow the use or activity to be carried out successfully.

Minerals - oil, gas, sulfur, geothermal, geopressured, salt, or other naturally occurring energy or chemical resources which are produced from below the surface in the coastal zone. Not included are such surface resources as clam or oyster shells, dirt, sand, or gravel.

Sediment Deposition Systems - controlled diversions of sediment-laden water in order to initiate land building or sediment nourishment or to minimize undesirable deposition of sediment in navigation channels or habitat areas. Typical activities include diversion channels, jetties, groins or sediment pumps.

Radioactive Wastes - Wastes containing source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923).

OTHER STATE POLICIES INCORPORATED INTO THE PROGRAM

Section 213.8A of Act 361 directs the Secretary of DOTD, in developing the LCRP, to include all applicable legal and management provisions that affect the coastal zone or are necessary to achieve the purposes of Act 361 or to implement the guidelines effectively. It states:

The Secretary shall develop the overall state coastal management program consisting of all applicable constitutional provisions, laws and regulations of this state which affect the coastal zone in accordance with the provisions of this Part and shall include within the program such other applicable constitutional or statutory provisions, or other regulatory or management programs or activities as may be necessary to achieve the purposes of this Part or necessary to implement the guidelines hereinafter set forth.

The constitutional provisions and other statutory provisions, regulations, and management and regulatory programs incorporated into the LCRP are identified and described in Appendix 1. A description of how these other authorities are integrated into the LCRP and coordinated during program implementation is presented in Chapter IV. Since all of these policies are incorporated into the LCRP, federal agencies must ensure that their proposed actions are consistent with these policies as well as the coastal use guidelines. (CZMA, Section 307)

CONSISTENCY DETERMINATION

The proposed action would restore the physical features and function of the Barataria Basin Barrier shoreline through beach/dune and marsh restoration. All material removed from the borrow areas would be used beneficially to restore barrier beach/dune and marsh habitat on the Caminada Headland and Shell Island reaches along the barrier shoreline. The proposed action would address interior marsh loss that has occurred in the area and provide protection to interior marsh from wind and wave-induced erosive forces. Placement of material would convert an area of fragmented barrier beach, dune and back marsh and shallow open water into beach/dune and marsh habitat creating an additional 2,849 acres of beach/dune and wetland habitat in the project area and a total of 730.6 AAHUs. The amount and quality of essential fish habitat and available habitat for terrestrial and aquatic wildlife species in the project area would increase as a result of the proposed action. Salinities and area hydrology would not be adversely impacted or altered by the proposed action. The proposed action would have temporary minimal impacts on the shallow open waters of the proposed project area. Any adverse impacts, including increases in turbidity and dissolved oxygen levels in the borrow and placement areas during construction, would be temporary and localized. Conditions would be expected to return to pre-construction levels shortly after the completion of construction activities.

Based on this evaluation, and the findings of the accompanying Draft Environmental Impact Statement (#EIS 05-05), the US Army Corps of Engineers, New Orleans District, has determined that the proposed is consistent, to the maximum extent practicable, with the State of Louisiana's Coastal Resources Program.

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LOUISIANA COASTAL AREA
BARATARIA BASIN BARRIER SHORELINE RESTORATION
FINAL CONSTRUCTION REPORT
AND
FINAL ENVIRONMENTAL IMPACT STATEMENT

APPENDIX D
ANNEX C

National Marine Fisheries Service Scoping / Planning Aid Letter

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701

June 15, 2005 F/SER46/RH:jk
225/389-0508

Dr. William P. Klein, Jr.
CEMVN-PM-RS
New Orleans District, Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Dr. Klein:

NOAA's National Marine Fisheries Service (NMFS) has received the undated Public Notice (PN) announcing a scoping meeting regarding development of an environmental impact statement (EIS) for the Louisiana Coastal Area (LCA), Louisiana; Caminada Headland and Shell Island Restoration Feasibility Study. According to the PN, the proposed action entails the mining of offshore and/or riverine sediment sources to provide fill to reestablish barrier systems in the Caminada Headland and Shell Island segments of the Barataria barrier shoreline system. The draft EIS for this project will evaluate various borrow sources, widths and configurations of shoreline and dune heights, marsh restoration as a platform for barrier shoreline rollover, as well as other recommendations provided to the New Orleans District (NOD). The Caminada Headland and Shell Island projects are Near Term Plan components of the LCA Feasibility Study. NMFS has agreed to be a cooperating agency on the EIS for this project.

The NOD is requesting public and natural resource agency comments on resources and issues to be addressed in the EIS for this proposed action. Most specifically, the NOD has requested the identification of: 1) critical problems and needs; 2) resources of concern; and, 3) restoration alternatives which should be addressed in the EIS.

One of the most critical problems that should be addressed in the EIS is the rapid erosion occurring at Shell Island and the Caminada Headland and the need to undertake efforts to quickly stabilize the remaining subaerial features and initiate restoration actions. The document should quantify land loss and shoreline retreat rates and evaluate various alternatives that could fund restoration efforts on those areas. In addition, these barrier shorelines help protect roads, pipelines and other critical infrastructure, as well as wetlands, from storm surge and wave erosion. The EIS for this project should identify this protection function and discuss the potential impacts that may occur from the loss of these geographic features.

It should be noted that aquatic and tidally influenced wetland habitats in the project area, including the potential offshore borrow site(s) consist of EFH for the species and life stages listed in the table below.

2

Species	Life Stage(s)
White shrimp	Eggs, larvae, postlarvae/juvenile, subadult, adult
Brown shrimp	Eggs, larvae, postlarvae/juvenile, subadult, adult
Red drum	Eggs, larvae, postlarvae/juvenile, subadult, adult
Red snapper	Eggs, larvae, postlarvae/juvenile, subadult, adult
Spanish mackerel	Juvenile
King mackerel	Juvenile
Cobia	Larvae, postlarvae/juvenile, adult
Bluefish	Postlarvae/juvenile, adult
Little tunny	Postlarvae/juvenile, adult
Bonnethead shark	Juvenile, adult
Atlantic sharpnose shark	Juvenile, adult

Categories of EFH in the project area include estuarine emergent wetlands; mud, sand and shell substrates; estuarine and marine water column, and natural structural features (e.g., shoal areas and topographic features). Detailed information on Federally-managed fisheries and their EFH is provided in the 1998 generic amendment of the Fishery Management Plans (FMPs) for the Gulf of Mexico prepared by the Gulf of Mexico Fishery Management Council (GMFMC). The generic amendment was prepared as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA, P.L. 104-297). Information on EFH for highly migratory species is contained in the Atlantic Billfish and Atlantic Tunas, Swordfish, and Sharks FMPs prepared by the Department of Commerce.

To fully address EFH and dependent fisheries in the project area, NMFS recommends the EIS include sections titled "Essential Fish Habitat" and "Marine Fishery Resources" that describe the potential adverse impacts and benefits of undertaking the various alternatives to stabilize the Caminada Headland and Shell Island. If any alternatives include the borrowing of fill from offshore shoals for placement in the coastal zone, the direct and indirect impacts of that alternative on benthic communities, wave patterns, and tidal currents should be fully evaluated. These recommended sections of the document should describe and quantify the potential impacts of the proposed alternatives on the sub-categories (e.g., marsh edge, marsh ponds, mud bottoms, tidal creeks, oyster reefs, marine and estuarine water column, beaches, inlets, etc.) of EFH within the project area. In addition, this section should describe the potential impacts of the proposed project on the utilization of these sub-categories of EFH by each fishery species and life stages included in the above table.

In addition to being designated as EFH for the species listed above, waterbodies and wetlands in the project area provide nursery and foraging habitats supportive of a variety of economically-important marine fishery species, such as striped mullet, Atlantic croaker, gulf menhaden, spotted and sand seatrout, southern flounder, black drum, and blue crab. Some of these species also serve as prey for other fish species managed under the MSFCMA by the GMFMC (e.g., mackerels, snappers, and groupers) and highly migratory species managed by NMFS (e.g., billfishes and sharks). We recommend the EIS fully describe the use of the project area by these species and evaluate the potential impacts and benefits of project implementation on marine fishery utilization of wetlands, water bottoms and water column within the project area.

The NMFS also recommends that prior to the initiation of engineering and design activities, project goals and objectives be clearly identified in consultation with NMFS and other entities possessing expertise and interest in the proposed action. After project objectives are clearly articulated, the objectives should be used to evaluate engineering and ecological performance of alternatives and features. Furthermore, we recommend the EIS thoroughly evaluate, using commonly accepted engineering procedures and current predictive models, the performance of the various shoreline restoration design alternatives. Based on our experience with the engineering and design of barrier island projects, some design alternatives may be extremely expensive and provide little additional environmental benefit or project longevity over less expensive alternatives. The document should assess and quantify the direct and indirect benefits, impacts, and costs of a variety of design templates.

We appreciate the opportunity to provide scoping comments on this project. If you have any questions regarding our recommendations, please contact Richard Hartman at (225) 389-0508, ext. 203.

Sincerely,

For Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

cc:
FWS, Lafayette
EPA, Dallas, Lawrence
NRCS, Alexandria, Paul
LA DNR, Consistency
F/SER46, Ruebsamen
Files

LOUISIANA COASTAL AREA
BARATARIA BASIN BARRIER SHORELINE RESTORATION
FINAL CONSTRUCTION REPORT
AND
FINAL ENVIRONMENTAL IMPACT STATEMENT

APPENDIX D
ANNEX D

State Historic Preservation Officer (SHPO) and Tribal Coordination Letters

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF

June 22, 2009

Planning, Programs, and
Project Management Division
Environmental Planning
and Compliance Branch

Mr. Scott Hutcheson
State Historic Preservation Officer
Office of Cultural Development
Department of Culture, Recreation and Tourism
P.O. Box 44247
Baton Rouge, Louisiana 70804

No known historic properties will be affected by this undertaking. This effect determination could change should new information come to our attention.

Scott Hutcheson 7-24-09
Scott Hutcheson Date
State Historic Preservation Officer

Dear Mr. Hutcheson:

This letter addresses the updated site status of two sites previously considered eligible for the National Register of Historic Places in the report titled "***Cultural Resources Survey of the Caminada Headland Restoration Feasibility Study, Lafource and Jefferson Parishes, Louisiana"*, LA DOA report number: 22-2966**. The New Orleans District is to place dredge material to restore the shoreline of the Caminada Headland that have eroded into the Gulf of Mexico. It is the opinion of Corps archeologist that project implementation will prevent and protect the area from further land loss due to encroaching open waters as well as protect inland sites from further erosion into the Gulf of Mexico. In May and June of 2009 this office revisited the Velella (16LF274) and Feti (16LF271) sites that were surveyed and recommended potentially eligible for inclusion into the National Register of Historic Places by Coastal Environments, Inc., in the spring of 2006. Updated site forms are attached.

The project location is along the shoreline of the Caminada Headlands and extends to an existing oil and gas pipeline canal just below Bayou Moreau. Shoreline changes in the project area have varied considerably between the eastern and western portions of the project area. In the western portion of the project area (Bayou Lafouche and Port Fourchon area) there has been a trend toward reconfiguration of the shoreline rather than wholesale shoreline erosion or disappearance. The eastern portion of the proposed project area (near Grand Isle) has undergone considerable erosion and beach re-nourishment during the past 50 years. The marsh area along Bayou Moreau has experienced significant subsidence, bankline erosion and inundation since Hurricanes Katrina and Rita in 2005 and Hurricane Gustav in 2008. Both the Velella site (16LF274) and the Feti site (16LF271) are located halfway between the eastern and western portions of the project area (see attached map).

The Velella site (16LF274), which would have been directly impacted from coastal restoration and dredge placement efforts, was recommended in the feasibility report for further analysis and considered potentially eligible for the National Register of Historic Places. In May 2009 the Velella sites GPS location of E. 779520 N. 3226480 was revisited and currently sits

JUN 25 2009

below approximately 12-18 feet of water based on the sites recorded boundaries, and is 1,345 ft. from the current shoreline. Photographs were taken and fifteen (15) shovel test were done along the beach parallel to the Velella site at 5m (16ft) intervals. Shovel test were approximately 13in deep and 12in in circumference. Surface shell stretches along much of the beach and can be found to a depth of 6-8 inches in some places, no cultural artifacts were found in the soil. The photographs of the Velella site are from the current shoreline as well as from the Gulf side facing the shoreline.

The Feti site (16LF271), which falls outside of the dredge disposal placement boundary, will not be impacted by the proposed project. Its GPS coordinates of E. 780619 N. 3228415, places the site approximately 1,500 ft. from the current shoreline along the bank of Bayou Moreau. According to the feasibility report, this site was originally recorded as a destroyed shell midden. During the feasibility study, the site was discovered to be in tact and was located approximately 11.8in below the surface, along the shoreline of the natural levee of Bayou Moreau. This site was considered potentially eligible for the National Register of Historic Places, and so was revisited in June 2009. Photographs were taken and eight (8) shovel test were conducted at the site at 10ft intervals, 12.5in deep and 12in wide in June 2009. Three (3) augur test were also done just off the bankline below 2 feet of water surface and to a depth of approximately 12in. The shovel and augur test revealed very sandy soils 6in deep and mottled dark gray and brown clays 12in deep at the base, no shell deposits or artifacts were noted at this location.

Based on current conditions as of June 2009, site context, which made the Velella (16LF274) and Feti (16LF271) sites potentially eligible for inclusion into the National Register of Historic Places, has been lost due to storm damage, shoreline erosion, bankline erosion and inundation. They are no longer eligible for inclusion in the National Register of Historic Places. The location of the sites is in Township 22 south and Range 23 east, section 34 as identified in the Corps files. The attached maps show the location of the Velella and Feti Sites.

Based on the 2009 field visits by Corps archaeologist, it is our view that the proposed action will not impact any historic properties. Therefore, no additional cultural resources investigations are recommended for this project. In the event that significant cultural resources were to be encountered, work in the location of the site would be halted, and an Army Corps of Engineers archaeologist and your office will be notified for further consultation. Please provide our office with your opinion regarding our "no historic properties affected" finding within 30 days of receipt of this letter.

Please Contact Jerica Richardson at (504) 862-2038 if you have any questions.

Sincerely,

Richard E. Boe
Acting Chief, Environmental Planning
and Compliance Branch

MITCHELL J. LANDRIEU
LIEUTENANT GOVERNOR

State of Louisiana
OFFICE OF THE LIEUTENANT GOVERNOR
DEPARTMENT OF CULTURE, RECREATION & TOURISM
OFFICE OF CULTURAL DEVELOPMENT
DIVISION OF ARCHAEOLOGY

DAWN ROMERO WATSON
SECRETARY

PAM BREAUX
ASSISTANT SECRETARY

June 11, 2008

Ms. Elizabeth Wiggins
Environmental Planning and Compliance Branch
New Orleans District, Corps of Engineers
P.O. Box 60267
New Orleans, LA 70160-0267

Re: . Draft Phase I CRM Report
LA Division of Archaeology Report No. 22-3106
Phase I Marine Archaeological Remote Sensing Survey of the Proposed Mississippi River Sand Borrow Sites for the Louisiana Coastal Area Barrier Shoreline Restoration Project, Plaquemines Parish, Louisiana
R. Christopher Goodwin and Associates, Inc.

Dear Ms. Wiggins:

We are in receipt of your letter of May 22, 2008, transmitting two copies of the above-cited report from R. Christopher Goodwin and Associates, Inc. We have completed our review and have the following comments to offer.

We concur with the findings presented in the report, which recommends that there are possibly four submerged cultural resources within the project area that should be avoided or further evaluated, if avoidance is not possible.

Technical comments of a minor nature are enclosed and should be considered with the submission of a final report for this project. If you have any questions or comments concerning this project, please feel free to contact Dennis Jones at (225) 342-8170 or djones@crt.state.la.us.

Sincerely,

Pam Breaux

Pam Breaux
State Historic Preservation Officer

PB:DJ:s

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF

May 15, 2008

Planning, Programs, and
Project Management Division
Environmental Planning And
Compliance Branch
Attn: CEMVN-PM-RN

Date: 6-12-08
No known archaeological sites or historic properties will be affected by this undertaking. This effect determination could change should new information come to our attention.
Pam Breaux: Pam Breaux
State Historic Preservation Officer

Ms. Pam Breaux
State Historic Preservation Officer
Office of Cultural Development
Department of Culture, Recreation and Tourism
P.O. Box 4427
Baton Rouge, Louisiana 70804

Dear Ms. Breaux:

The New Orleans District is planning project work to dredge approximately 3.5 million yards of sand for coastal and barrier island restoration projects from Ship Shoal, a bathymetric feature located offshore central Louisiana. The proposed project work calls for sand to be dredged from borrow sites identified from within two designated polygons: the first located in Ship Shoal OCS area on Block 88, and the second located in South Pelto OCS area on Blocks 12 and 13.

Sand emplacement for barrier island restoration would take place on the west flank of Whiskey Island and at New Cut, two areas located within the Isles Dernieres barrier island arc offshore of Terrebonne Parish, Louisiana. The dredging will likely incorporate the use of either a trailing suction hopper dredge or a cutterhead suction dredge to remove material from Ship Shoal; the sand will then be transported within the hopper to an offloading point and pumped onto shore or pumped as a slurry from the cutterhead dredge through a pipeline laid on the seabed to the discharge point.

The U.S. Environmental Protection Agency (EPA) conducted surveys in the area in 2003 and in a letter dated July 9, 2004 your office agreed that no known archaeological sites or historic properties would be affected by project undertakings. This letter addressed and Environmental Assessment for the proposed Ship Shoal Whiskey Island West Flank (TE-47) and Whiskey Island Back Barrier Marsh Creation (TE-50) which includes Blocks 12, 13 and 88.

The attached maps (enclosed) shows the location of the Ship Shoal, Ship Shoal Block segments as well as the location of magnetic anomalies, including one that may belong to a sunken vessel from the 1960s. These anomalies would be avoided during project implementation as they could also belong to pipelines that crisscross the area.

MAY 21 2008

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO ATTENTION OF

March 20, 2008

Date: 4-24-08
No known archaeological sites or historic properties will be affected by this undertaking. This effect determination could change should new information come to our attention.
Pam Breaux: Pam Breaux
State Historic Preservation Officer

Planning, Programs, and
Project Management Division
Environmental Planning And
Compliance Branch
Attn: CEMVN-PM-RN

Ms. Pam Breaux
State Historic Preservation Officer
Office of Cultural Development
Department of Culture, Recreation and Tourism
P.O. Box 4427
Baton Rouge, Louisiana 70804

Dear Ms. Breaux:

The New Orleans District is planning project work to place dredge material to restore portions of Shell Island that have eroded into Shell Island Bay. It is the opinion of Corps archeologist that project implementation will prevent and protect the island from further land loss due to encroaching open waters as well as protecting inland sites from further erosion into the Gulf of Mexico. In March of 2005 this office had the opportunity to revisit the area and found the location to be significantly inundated by encroaching open waters with small pockets of land remaining, most used for oil platforms.

Shoreline changes in the proposed project area have varied considerably between the eastern and western portions. In the western portion of the project area (Bastian Island/Bastian Bay area) there has been a trend toward reconfiguration of the shoreline rather than wholesale shoreline erosion or disappearance. This pattern has undoubtedly impacted potential cultural resources, and it is unlikely that potential cultural resources have experienced any long term stability of context. The eastern portion of the proposed project area (Shell Island Bay area) has undergone considerable erosion during the past 120 years. Much of the land around Shell Island Bay has disappeared, but some areas have clearly remained intact. Given the lack of knowledge of the density and frequency of (prehistoric and even historic) cultural resources in the proposed project area, both portions should probably be considered to potentially contain significant cultural resources. Extreme land loss, however, may prevent any attempt to evaluate cultural resources in these areas.

It was discovered that in the early 1950s a former oyster midden site, numbered ~~16SB03~~ was discovered in the area by Fredrick Kniffen, who noted that the site had sustained significant damage due to encroaching open waters and continued erosion of the island. The attached photograph, taken in 2005, show the amount of subsidence and inundation the island has received in that 50 year span and it is highly likely that the site has been completely lost after both Hurricane's Katrina and Rita in August of 2005. The location of the site is in Township 21

MAR 2 4 2008

MITCHELL J. LANDRIEU
LIEUTENANT GOVERNOR

State of Louisiana
OFFICE OF THE LIEUTENANT GOVERNOR
DEPARTMENT OF CULTURE, RECREATION & TOURISM
OFFICE OF CULTURAL DEVELOPMENT
DIVISION OF ARCHAEOLOGY

ANGÈLE DAVIS
SECRETARY

PAM BREAUX
ASSISTANT SECRETARY

October 18, 2007

Ms. Elizabeth Wiggins
Environmental Planning and Compliance Branch
New Orleans District, Corps of Engineers
P.O. Box 60267
New Orleans, LA 70160-0267

Re: Draft Phase I CRM Report
LA Division of Archaeology Report No. 22-2966
Cultural Resources Survey of the Caminada Headland Restoration Feasibility Study, Lafourche and Jefferson Parishes, Louisiana
Coastal Environments, Inc.

Dear Ms. Wiggins:

We acknowledge receipt of your letter dated August 13, 2007, transmitting two copies of the above-referenced report. We have completed our review and offer the following comments.

The report meets the Division of Archaeology's standards and we concur with the findings presented in the report by Coastal Environments, Inc. We agree that the newly reported sites 16LF271 and 16LF274 are potentially eligible for the National Register of Historic Places and concur with CEI's recommendations that these sites undergo Phase II archaeological testing should they be affected by proposed shoreline restoration.

Technical comments are included with this letter, as are photocopied pages of the report with other comments/corrections noted. Please address these as appropriate and transmit two copies of the final report. Should you have any questions concerning our comments, do not hesitate to contact Dennis Jones in the Division of Archaeology at (225) 342-8170 or by email at djones@crt.state.la.us.

Sincerely,

Pam Breaux

Pam Breaux
State Historic Preservation Officer

PB:DJ:s

C: Dr. David Kelley, Coastal Environments, Inc. (w/enclosures)

MITCHELL J. LANDRIEU
LIEUTENANT GOVERNOR

State of Louisiana
OFFICE OF THE LIEUTENANT GOVERNOR
DEPARTMENT OF CULTURE, RECREATION & TOURISM
OFFICE OF CULTURAL DEVELOPMENT
DIVISION OF ARCHAEOLOGY

ANGÈLE DAVIS
SECRETARY

PAM BREAUX
ASSISTANT SECRETARY

September 20, 2007

Elizabeth Wiggins
Planning, Programs, and Project Management Division
Environmental and Planning and Compliance Branch
Department of the Army
New Orleans District, Corps of Engineers
P.O. Box 60267
New Orleans, LA 701160-0267

Re: Draft Phase I CRM Report 22-2952
Phase I Underwater Remote Sensing Survey of The Caminada Headlands Borrow Area for the Louisiana Coastal Area Barrier Shoreline Restoration Project, Lafourche Parish, Louisiana

Dear Ms. Wiggins,

We acknowledge receipt of your letter dated June 29, 2007, transmitting a copy of the above-referenced report. We have completed our review and offer the following comments.

The report meets the Division of Archaeology's standards and we concur that significant historic properties should not be affected by the proposed undertaking. Consequently, we have no objections to its implementation.

Technical comments are included with this letter, as are photocopied pages of the report with other comments/corrections noted. Please address these as appropriate and transmit **two** copies of the final report. Should you have any questions concerning our comments, do not hesitate to contact Dennis Jones in the Division of Archaeology at (225) 342-8170 or by email at djones@crt.state.la.us.

Sincerely,

Pam Breaux

Pam Breaux
State Historic Preservation Officer

PB:DJ:s

Enclosures: as stated

C: R. Christopher Goodwin & Associates, Inc.
241 E. Fourth Street, Suite 100
Frederick, Maryland 21701

LOUISIANA COASTAL AREA
BARATARIA BASIN BARRIER SHORELINE RESTORATION
FINAL CONSTRUCTION REPORT
AND
FINAL ENVIRONMENTAL IMPACT STATEMENT

APPENDIX D
ANNEX E

USACE Draft and Final Biological Assessment

U.S. Fish and Wildlife Service Draft and Final Biological Opinion

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

May 1, 2009

Planning, Programs, and Project Management Division
Environmental Planning and Compliance Branch

Mr. Jim Boggs
U.S. Fish and Wildlife Service
Lafayette Field Office
646 Cajundome Blvd., Suite 400
Lafayette, Louisiana 70506

Dear Mr. Boggs:

The U.S. Army Corps of Engineers, New Orleans District is in the process of preparing a feasibility report and environmental impact statement for the LCA – Barataria Basin Barrier Shoreline Restoration Feasibility Study, Louisiana. The purpose of the study is to restore and protect the natural barrier shoreline system to support the re-establishment of a sustainable ecosystem in the Barataria Basin. Restoration of the Caminada Headland and Shell Island would preserve the integrity of the western and central boundaries of the Barataria Basin and protect fragile inland marshes from encroachment by the Gulf of Mexico. The tentatively selected plan is the Caminada Headland Alternative 5 and Shell Island Alternative 1 which would restore 2749 acres of dune/beach/marsh habitat.

In accordance with the Endangered Species Act of 1973 (as amended), the enclosed biological assessment describes the potential effects of the proposed project on federally threatened and endangered species within the vicinity of the proposed area. Species that occur in LaFourche Parish include the brown pelican, piping plover, green sea turtle, Hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle, piping plover, red-cockaded woodpecker, and the West Indian Manatee. Two of these species, the brown pelican and piping plover, have been observed in the project area.

It is the opinion of the U.S. Army Corps of Engineers, New Orleans District that the proposed project is not likely to affect the threatened brown pelican and may affect but is not likely to adversely affect the continued existence or critical habitat for the piping plover.

This office seeks your comments and concurrence with our assessment. Please direct any questions concerning this action to Ms. Sandra Stiles at 504-862-1583.

Sincerely,

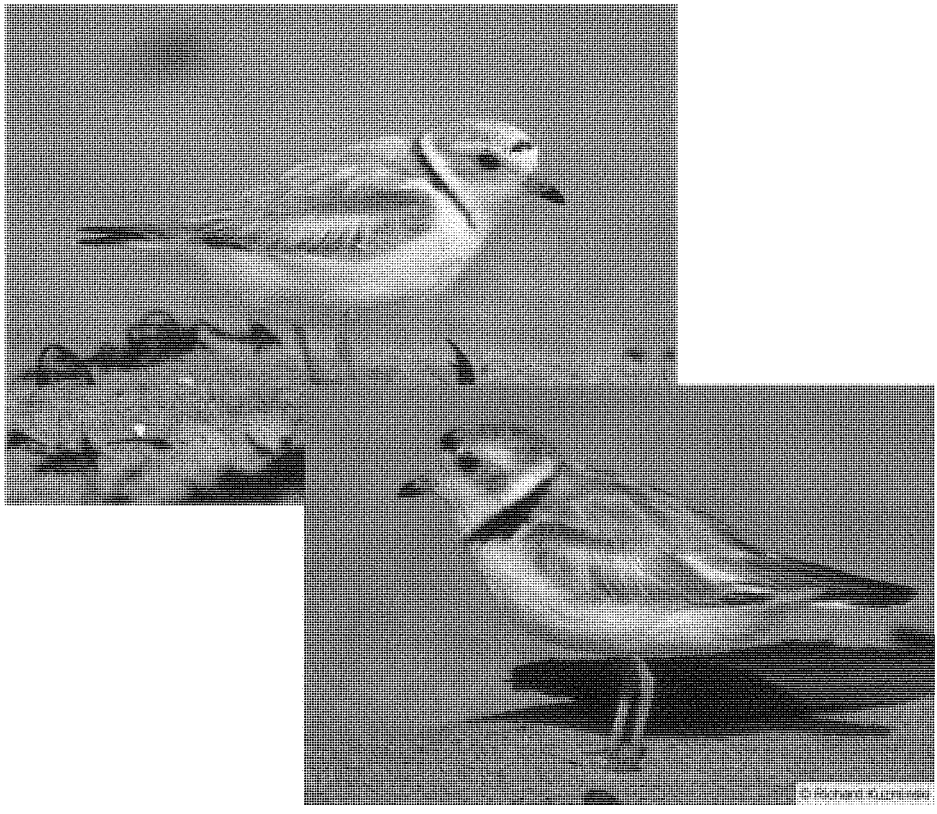
Joan M Exnicios

Enclosure

Joan Exnicios
Acting Chief, Environmental Planning and Compliance Branch

BIOLOGICAL ASSESSMENT

Louisiana Coastal Area (LCA)
Barataria Basin Barrier Shoreline Restoration Feasibility Study
Caminada Headland and Shell Island Restoration



APRIL 24, 2009

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BIOLOGICAL ASSESSMENT

Louisiana Coastal Area (LCA)
Barataria Basin Barrier Shoreline Restoration Feasibility Study
Caminada Headland and Shell Island Restoration

1.0 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, requires that, *"Each Federal agency shall, in consultation with and with the assistance of the secretary, insure that any action authorized, funded, or carried, out by such agency.... Is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species..."*

This Biological Assessment (BA) provides the information required pursuant to the ESA and implementing regulation (50 CFR 402.14), to comply with the ESA. Additional jurisprudence includes the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. section 4321, *et seq.;* the Fish and Wildlife Conservation Act of 1958 (PL 85-624; 16 U.S.C. 661 *et seq.*); the Marine Mammal Protection Act of 1972; and the Bald Eagle Protection Act of 1940. This BA evaluates the potential impacts of the proposed restoration of the Caminada Headland and Shell Island Study on Federally-listed and proposed threatened and endangered species, designated and proposed critical habitat, and determines whether any such species or habitat are likely to be adversely affected by implementing the tentatively selected plan (TSP).

A programmatic BA was prepared in 2004 for the LCA Ecosystem Restoration Study (USACE 2004). This proposed action is an outgrowth of the LCA comprehensive programmatic restoration study. The 2004 programmatic BA is thereby incorporated by reference (Appendix A).

2.0 PURPOSE AND NEED FOR ACTION

The purpose of the study is to restore the geomorphic function and unique critical and essential fish and wildlife habitats of the Caminada Headland's barrier system and reverse the current trend of degradation in the Caminada Headland and Shell Island reaches. Restoration efforts would target ecologically distinct, critical, high priority areas that would increase sustainability with essential form and function of the natural barrier ecosystem.

3.0 PROPOSED ACTION

The proposed action is the restoration of the Caminada Headland and Shell Island reaches o f the Barataria barrier system.

The study considers mining offshore, nearshore, riverine, and other sediment sources to re-establish a sustainable barrier system (e.g. barrier islands, shorelines, and headlands) at the Caminada Headland and Shell Island reaches of the Barataria Barrier System. The study considers all reasonable alternatives including:

- Build on alternatives considered under the LCA Barrier Shoreline Restoration Study and the LCA Wetland Restoration/Creation Study.
- Borrow sources considered included: offshore, nearshore, riverine, and other sources.
- Consider varying widths and configurations of barrier shorelines as well as varying heights of restored dunes.
- Consider marsh restoration as a platform for barrier shoreline rollover.
- Recommendations from interested parties submitted during scoping and public meetings, and meetings with stakeholders.

The Ecosystem Objective is to sustain productive and diverse fish and wildlife habitats. The Hydrogeomorphic Objective is to maintain or establish natural landscape features and hydrologic processes.

4.0 DESCRIPTION OF THE STUDY AREA

The study area is part of the 300-mile long Louisiana barrier system. The Caminada Headland and Shell Island reaches are located along the Barataria barrier shoreline comprising the area designated as Subprovince 2 in the LCA study (USACE 2004). Subprovince 2 is defined by the hydrologic boundary of the Barataria Basin, which is approximately 2,446 square miles and the western portion of the lower Mississippi River Delta. The basin is separated from the Gulf of Mexico by a chain of barrier islands, which serve as a natural barrier to storm events and reduce marine influences on interior wetlands within the basin (**figure 1**).

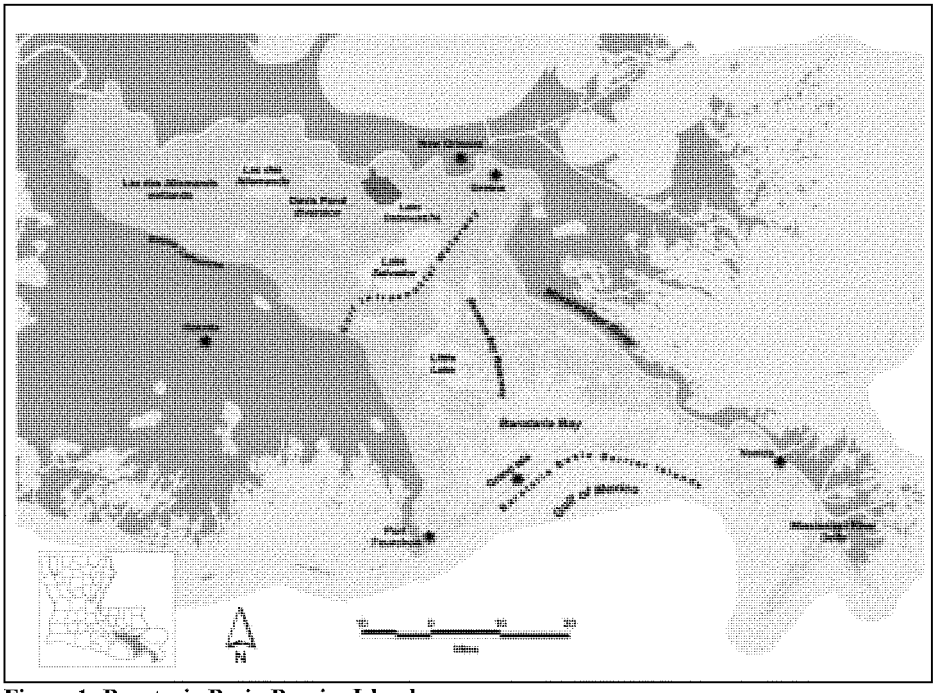

Figure 1: Barataria Basin Barrier Islands

5.0 DETAILED DESCRIPTION OF EACH PROJECT REACH

5.1 CAMINADA HEADLANDS REACH

The Caminada barrier headland (also known as the Caminada-Moreau headland) is the predominant feature of the Bayou Lafourche barrier system that includes flanking islands and the retreating headland of the Bayou Lafourche distributary of the Mississippi River (**figure 2**). It is one of the most rapidly eroding shorelines in the United States (McBride et al. 1992; Connor 2004). The southwest to northwest-oriented Caminada-Moreau headland extends approximately 13.18 miles (21.21 km) between Belle Pass in the west and Caminada Pass in the east. Historic maps show that the west end of the Caminada-Moreau headland is retreating more rapidly than the east end of the headland (Williams et al. 1992). Hundreds of offshore drilling rigs in the Gulf of Mexico send gas and oil to the mainland through Port Fourchon.

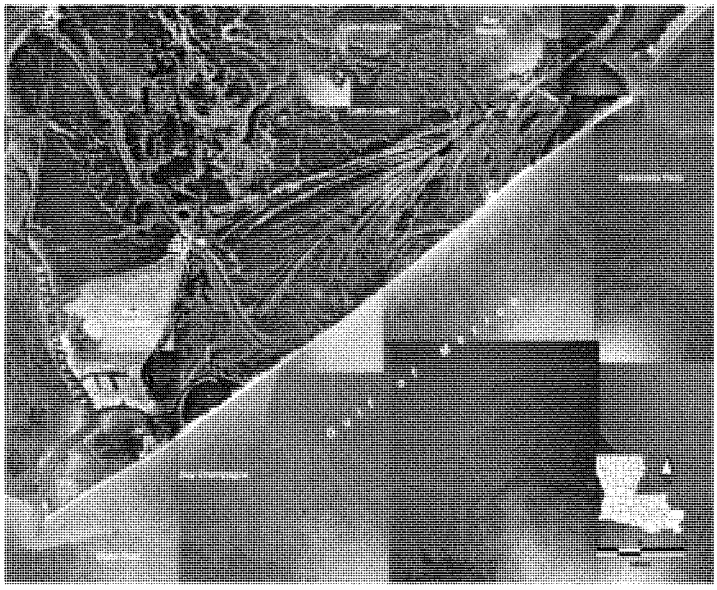

Figure 2: Caminada Headlands

5.1.1 Caminada Headland Reach Purpose:

The purpose of the proposed action is to restore the geomorphic function and unique critical and essential fish and wildlife habitats of the Caminada Headland's barrier system. The study period is fifty years.

The goals and objectives for restoring the Caminada Headland Reach include:

- Sustain and improve shoreline, dune, and interior marsh habitat for essential fish and wildlife species
- Reduce wave energy transmission by providing a natural storm protective buffer for interior marsh and chenier ridge habitats north of Caminada Headland
- Address the severity of erosion along the gulf-front shoreline
- Close the breaches that have occurred due to recent storm and hurricane damage and prevent breaching during the design life
- Vegetate newly created marsh and dune areas
- Provide compatible sediments for marsh, beach and dune restoration
- Avoid impacts to adjacent shorelines from borrow area excavation
- Maintain the Caminada Headland without disrupting the natural hydrologic regime

5.1.2 Caminada Headland Project Area:

The project area lies within the Barataria Basin, which comprises the area between the Mississippi River and Bayou Lafourche. The 13-miles long Caminada Headland located in Lafourche and Jefferson Parishes extends from the Belle Pass jetties at the mouth of Bayou Lafourche on the western end of the headland to Caminada Pass on the eastern end of the headland. The project area is bounded by the Gulf of Mexico to the south and approximately 2250 feet north of the Gulf to the North. The headland maintains the integrity of the gulf shoreline and protects the interior coast from further deterioration. The Caminada Headland consists of narrow and low-lying sand dune and beach berm, barrier marshes, and chenier ridges interspersed with mangrove thickets, coastal dune shrub thickets, lagoons and small bayous. The average dune elevation is estimated to be +3.5 feet North American Vertical Datum of 1988 (NAVD)and the back-barrier marsh was determined to be 0.94 feet NAVD.

5.1.3 Caminada Headland Needs:

The erosional Caminada Headland has historically suffered loss of wetland habitat and diminished function within the gulf shoreline. The marsh, beach, and dune habitats within the project area have undergone significant loss due to storm overtopping and breaching, saltwater intrusion, wind and wave induced erosion, sea level rise, subsidence, and man-made structures. The observed long-term (100 years) average shoreline erosion rate at the Caminada Headland, approximately 45 feet per year, would likely continue for the foreseeable future. The beach has eroded and the dune ridge has been breached by overwash from storm surges at several locations, including multiple shoreline breaches during the 2002, 2004 and 2005 hurricane seasons. Increased stress on the fish and wildlife is expected as various fish and wildlife nursery, feeding, nesting and roosting habitats continue to be lost.

A coastal Louisiana land loss model presented in the LCA Study (USACE 2004) indicates that with no intervention, the Caminada Headland will experience a projected land loss of 3,750 acres from the Headland and 14,780 acres from the area to the north from 2000 to 2050. Only a skeletal framework of natural barrier ridges and spoil banks would remain in 2050. Port Fourchon would be further isolated from the remaining mainland, and could become a detached small barrier island.

5.2 SHELL ISLAND

The Shell Island reach (formerly Lanaux Island) is part of the 24.8-mile long (40-km long) Plaquemines barrier system and is characterized as rapidly retreating remnant barrier islands and spits which enclose shallow bays such as Shell Island Bay and Bastian Bay (**figure 3**). The Shell Island reach extends approximately 5.24 miles (8.43 km) between Grand Bayou Pass on the west to Fontanelle Pass and the Empire jetties on the east. The approximately 1.41-mile long (2.27 km) Shell Island (west) extends from Grand Bayou Pass to Coupe Bob, and is composed primarily of reworked oyster shells

that formed into ridges and swales produced by waves refracting into the entrance to Grand Bayou Pass. Shell Island (east) is approximately 2.54 miles long (4.09 km) and extends from Coupe Bob to Fontanelle Pass. These rapidly retreating barrier islands are becoming increasingly narrower and separated from the remnants of Plaquemines interior marshes.

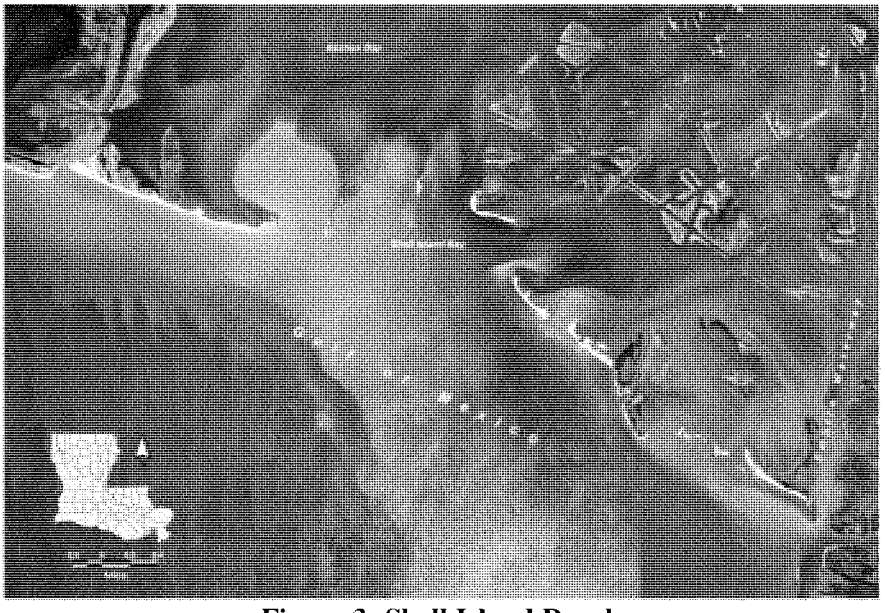

Figure 3: Shell Island Reach

5.2.1 Shell Island Reach Purpose:

The objectives of this project are to reestablish a barrier(s) between a threatened estuarine ecosystem and the Gulf of Mexico, increase the sustainability of the barrier island shoreline system, restore the geomorphic function of the barrier shoreline in the vicinity of Shell Island, restore shoreline, dune, and back-barrier marsh to increase habitat utilization by essential fish and wildlife species both on the barrier island and in the consequently developed quiescent bays.

The goals and objectives for restoring the Shell Island Reach include:

- Achieve 158 acres of dune and supratidal acreage on Shell Island West.
- Achieve 74 acres of marsh (intertidal acreage) on Shell Island West.
- Achieve 223 acres of dune and supratidal acreage on Shell Island East.
- Achieve 191 acres of marsh (intertidal acreage) on Shell Island East.

5.2.2 Shell Island Reach Project Area:

The Barataria/Plaquemines barrier island complex lays approximately 49 miles south-southeast of New Orleans, Louisiana. Tidal creeks, man-made canals, marshlands, sandy barrier islands, and several bays characterize the barrier island complex. The remnants of Shell Island are located between Fontanelle Pass (Empire Jetties) and Grand Bayou Pass. Shell Island used to enclose both Bastian Bay and Shell Island Bay but has since disintegrated into several smaller islands and shoals. The project area is located in Plaquemines Parish.

The project boundaries were defined based on the outer edges of the landmasses digitized from the 2004 DOQQ's. The west end of Shell Island West was included within the project boundary as it was anticipated that area could be affected by construction of any alternative. Existing Shell Island remnants were included within the boundary to incorporate the without project conditions.

5.2.3 Shell Island Reach Needs:

Shoreline recession and erosion have resulted in the disintegration of Shell Island. The few remaining islands and shoal remnants provide limited protection to the back barrier environment from waves and flooding. The construction of the Empire Jetties restricted the east to west long-shore transport and increased the loss rates of Shell Island. Hurricane Bob in 1979 created a new inlet (Coupe Bob) that accelerated retreat and sediment loss.

The average wave height is 2.7 feet. The rate of relative sea level rise is treated as a constant over the 50-year project life, equal to 0.0430 feet/year. Hurricane Bob occurred in 1979. The formation of Coupe Bob caused a quadrupling of the retreat rates of Shell Island and is the major reason for the disintegration of the island. The Empire Jetties were constructed in 1950. The Empire Jetties increased shoreline recession approximately 10 feet/year along the easternmost 5,000 to 8,000 feet of the island

6.0 TENTATIVELY SELECTED PLAN (TSP)

The Tentatively selected plan (TSP) is Alterative 5 - Caminada Headland and Alternative 1 Shell Island.

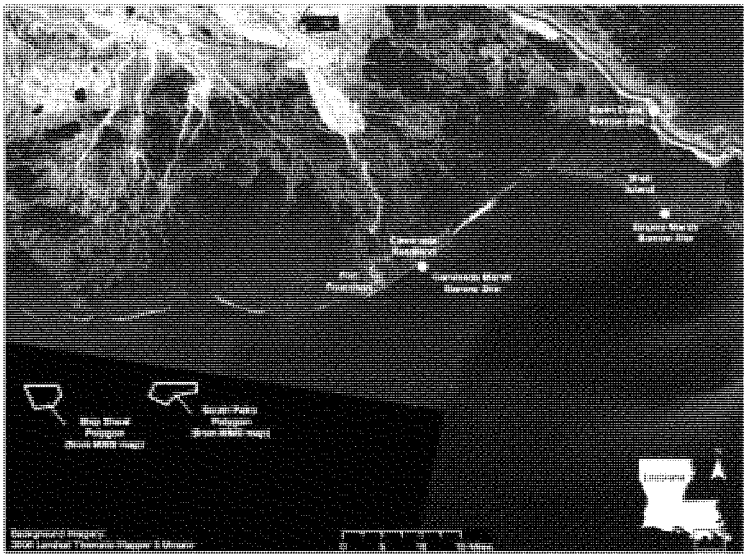

Figure 4: Project Area

6.1 Caminada Headland Alternative 5 – Preferred Dune with Expanded Marsh.

Alternative 5 creates 880 acres of dune/beach and 1186 acres of saline marsh. Figure 4 shows the plan view of Alternatives 5, 6, and 7. Alternative 5 proposes the following:

- Dune heights of +7 feet NAVD with a dune crest width of 290 feet.
- A landward beach and dune component in order to maximize acreage and longevity.
- Landward and seaward slopes are set 20 horizontal to 1 vertical.
- Marsh fill on the landward side of the dune at an elevation of +2.0 feet NAVD.

Fill quantities for the dune and marsh fills are 5.1 and 5.4 million cubic yards, respectively.

6.1.1 Caminada Headland Project Features:

Models applied to determine the benefits of implementing the Alternative 5 include the Barrier Headland model which was applied to the beach and dune components and the Saline Marsh Wetland Value Assessment model (WVA) which was applied to the remainder of the project area (Attachment B).

The direct project boundary for Alternative 5 includes approximately 1,361 acres of existing marsh, dune, supratidal, and gulf intertidal habitats at target year zero. Project construction includes approximately 878 acres of new marsh, dune, supratidal and gulf intertidal habitats for a total of approximately 1582 acres at TY1 with approximately 26 acres of these habitats left at TY50. It should be noted that the newly created acres will cover most of the existing acres in the direct project footprints. There is no renourishment of dune or marsh plan for alternative 5.

Alternative 5	TY 0	TY 1	TY 50
Marsh, supratidal Gulf intertidal habitat	1,361 acres	2,239 acres	26 acres

The 77 acres of existing upland habitat in the indirect project boundary would remain through the fifty year project life.

A significant majority of the marsh acreage is anticipated to disappear through natural subsidence (estimated to be 0.025 feet per year) over the project life.

Dune/Beach Component:

The proposed alternative designs that were moved forward for WVA analysis would include a continuous beach and dune restoration component. The alternatives evaluated have a landward beach and dune component with in order to maximize acreage and longevity. All dune restoration components would also include sand fencing and plantings of native vegetation that is anticipated to promote additional dune elevation growth by capturing Aeolian sands.

The proposed dune height would be designed to +7 feet NAVD which is slightly higher than the existing dune elevation in the area of +3.4 feet NAVD. The proposed dune width would be 290 feet. The majority of the dune is sited landward over existing higher elevations, maximizing acreage and longevity. The advanced fill quantities account for initial losses due to shoreline equilibrium. The landward and seaward slopes are set at a 1-foot vertical to 20-foot horizontal slope (1V:20H). The beach fill template has a 65 ft wide seaward berm at an elevation of +4.5 feet NAVD and a marsh fill template is proposed on the landward side of the dune at an elevation of +2.0 feet NAVD. Approximately 13 miles of dune will be created. Fill quantities for the beach/dune and marsh fills are 6.3 million and 5.4 million cubic yards respectively.

The dune restoration component includes sand fencing and plantings of native vegetation that is anticipated to promote additional dune elevation growth by capturing Aeolian sands

Marsh Component: Alternative 5 includes restoration/creation of a marsh platform contiguous with the Chevron Canal on its northern boundary and the beach and dune fill component along its southern boundary. A constructed marsh elevation of +2.0 feet

NAVD would be used to create a functioning intertidal marsh with no renourishment planned for the 50-year project life. The native marsh elevation for the back-barrier marsh is 0.94 feet NAVD. Mean high water is 1.53 feet NAVD and mean low water is

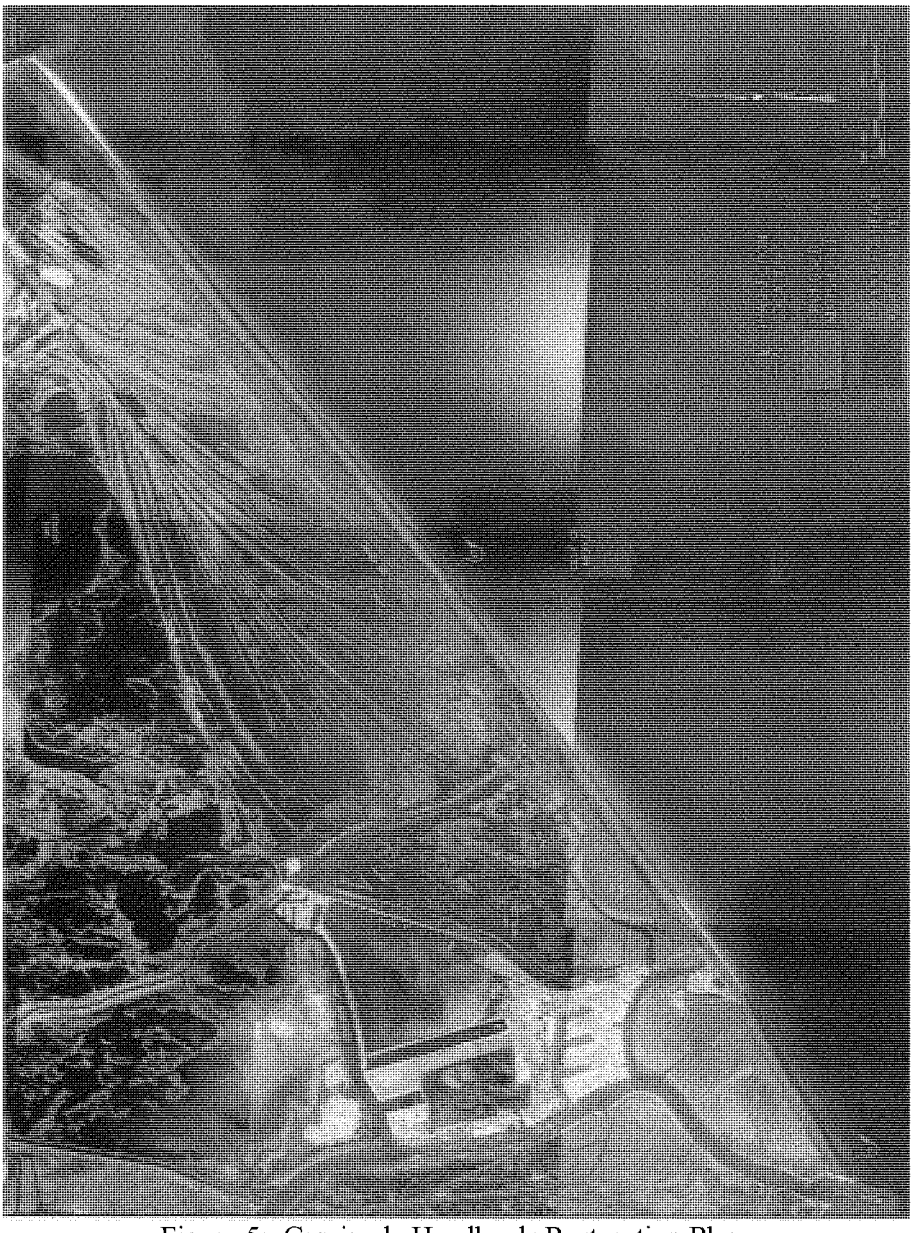

Figure 5: Caminada Headlands Restoration Plan

0.48 feet NAVD and increases over time due to an eustatic sea level rise, demonstrating that the existing marsh is inundated during the tidal cycle.

Neighboring CWPPRA projects (Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration BA-35, Chaland Headland Restoration BA-38, and East and West Grand Terre Island Restoration BA-30) were used to estimate settlement and consolidation of fill material. A sea level rise rate of 2.5 feet per century was used for this analysis.

Temporary containment dikes would be constructed to contain the marsh fill material during construction. The fill material for dike construction would be dredged from within the footprint of the marsh so that the excavated area is filled during construction. The dike volume is included within the marsh fill volume. The marsh fill is proposed on the landward side of the beach and dune. The marsh platform would be planted with appropriate vegetation.

Caminada Headland Alternatives	
	Alt 5 preferred dune w/ expanded marsh
Dune Elevation	+ 7 feet
Dune width	290 feet
Beach width	Advance fill at elevation of +4.5 feet
Beach/dune length	13 miles
Beach/dune quantity fill material	6.3 million cubic yards
Beach/dune renourishment cycle	none
Marsh elevation	+2.0 feet
Marsh quantity fill material	5.4 million cy
Existing marsh, dune, supratidal, & gulf intertidal	1361 acres
New (TY1) marsh, dune, supra, & gulf intertidal	878 acres
Net acres (at TY 50)	26 acres of marsh

Borrow Areas: Material for the dune and beach construction would be borrowed from the South Pelto Block of Ship Shoal. (see Figure 6). Ship Shoal is a large offshore submerged sand body in the Gulf located approximately 50 miles southwest of Belle Pass. A suitability analysis was conducted comparing Caminada sediments to South Pelto Block sediments. The sediments from South Pelto Block were concluded to be suitable for beach and dune restoration. It is recommended that an overfill ratio of 1.08 be used in design volume analysis.

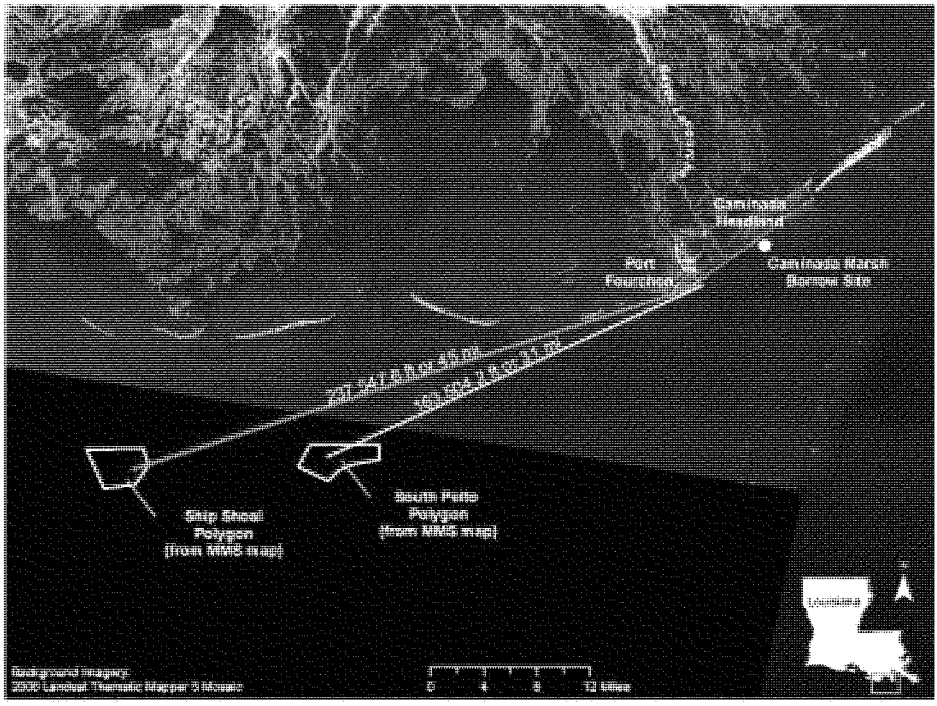

Figure 6: Borrow Areas

6.2 Shell Island Alternative 1: Two Islands with No Re-nourishment

Alternative 1 would restore the Shell Island reach as two islands (Shell Island East and Shell Island West) (Figure 7). Each island would include shoreface, dune ridge, and marsh platform features. The general alignment and configuration of this alternative is based on the restoration feature identified in the LCA Main Report, adapted for current conditions and constraints. Based on cross-shore transport modeling using the SBEACH program, it was determined that the minimum dimensions for the shoreline profile must include a dune crest elevation of at least +5.75 feet and a dune crest width of at least 100 feet. This profile configuration was determined to provide effective barrier island function for the shoreline reach throughout a 50-year evaluation period, assuming that a 50-year storm event would occur during the evaluation period, and a 20-year storm event would occur at the end of the evaluation period. Periodic re-nourishment is not included in this alternative

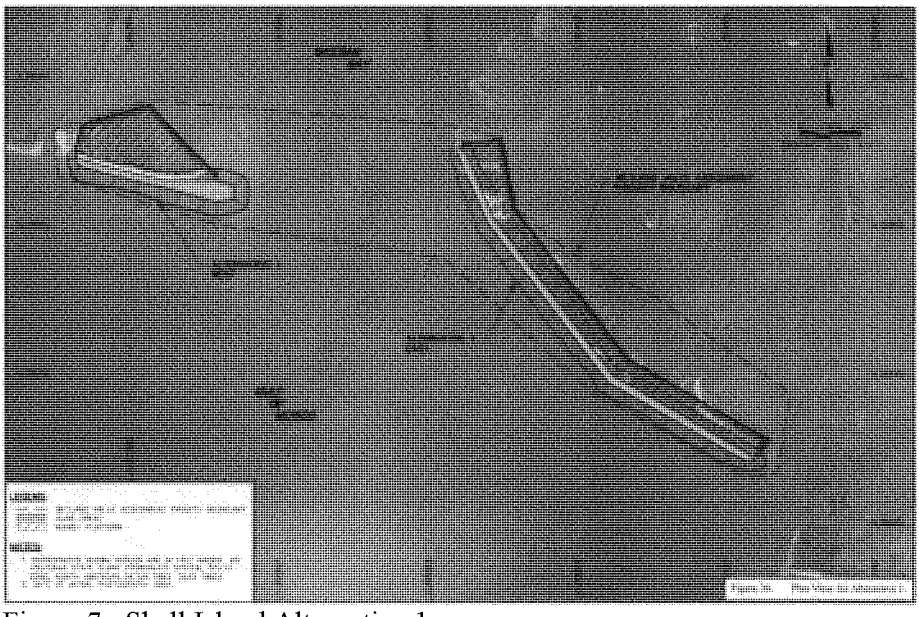

Figure 7: Shell Island Alternative 1

6.2.1 **Shell Island Alternative 1, Shell Island East**

The Shell Island East As-built, TY1 configuration is anticipated to create 126 acres of dune, 297 acres of supratidal, and 47 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 11 acres of as-built dune area.
Alternative 1 includes the following:

- Dune heights of +6 NAVD with dune crest width of 281 feet.
- Crest width would be uniform along the restored shoreline.
- Shoreline would be 15,400 feet in length.
- Landward edge of dune crest for Shell Island East would be located along the mean high water line of the remaining islands. With this alignment, the majority of the sand fill would be placed in front of the existing remnant islands.
- Marsh width would be 525 feet, widening along the northernmost 2,400 feet of the island to just over 1,200 feet wide.

This alignment ensures that the entire active profile height of the shoreface, beach and dune ridge is armored with sand. By preventing the exposure of the mixed sediment of the existing island to wave and storm processes, the rate of shoreline retreat rates will be reduced significantly from current trends.

The shoreline recession rates are 12.4 feet/year for Shell Island East. Subtidal acreage decreases following construction because parts of the subtidal acreage are located within the construction footprint

6.2.2 **Shell Island Alternative 1, Shell Island West**

The Shell Island West As-built, TY1 configuration is anticipated to create 51 acres of dune, 192 acres of supratidal, and 21 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 8 acres of as-built dune area. All of the beach and marsh fill placed during construction of Shell Island West will have eroded in 23 years (TY25), leaving pre-construction conditions. By TY25 Shell Island West will have receded to the point where there is no supratidal acreage. Once the supratidal acreage is lost, it was assumed that the marsh would be exposed to wave action from the Gulf and that the marsh would recede at the gulf retreat rate.

The shoreline recession rates are 34.9 feet/year for Shell Island West. Subtidal acreage decreases following construction because parts of the subtidal acreage are located within the construction footprint.

The volume of sand that could be lost into Coupe Bob every year from the two-island option is approximately 101,000 cubic yards. At this rate it would take Coupe Bob approximately 33 years to reach its accommodation volume of 3.3 million cubic yards. It is unlikely that Coupe Bob will reach its accommodation volume given that the total volume of sand fill placed in Alternative 1 is 4.1 million cubic yards but it does suggest that little natural bypassing of sand should be expected across Coup Bob.

- Dune heights of +6 NAVD with dune crest width of 250 feet.
- Shoreline restoration would extend partially into Coupe Bob, extending the length of the barrier shoreline provided by existing islands.
- Marsh platform extends along 4,500 feet of shoreline, with a maximum width of 2,300 feet. Shell Island west follows the restoration feature outline described in the LCA Main Report.

The post-construction marsh volumes are calculated based on the post-construction elevation of +2.5 feet NAVD. Settlement of the marsh material will lower the marsh elevation to the upper elevation of the bay intertidal range of +2 feet within one year.

Constructing the marsh elevation at an elevation of +2.5 feet NAVD will result in a marsh that will become bay intertidal during TY2 (2011) and remain bay intertidal until TY50 (2059). The marsh will be continually submerged (average elevation below mean low water) after TY34 (2043). The long term goal of maintaining the marsh elevation above elevation 0 feet NAVD at TY50 can only be achieved by increasing the construction elevation above +2.6 feet NAVD but this increases the time required for the marsh to subside to the mean high water level, and so reduces project benefits in the near term. Total fill quantities for the beach/dune and marsh fill are 4.1 million cubic yards of sand and 1.9 million cubic yards of sediment respectively.

Dune/Beach Component: The alternatives include a beach and dune fill to reestablish a sustainable barrier island shoreline system, thus restoring the geomorphic function and increasing the habitat utilization by fish and wildlife species. The construction cross-section was based on templates used for projects previously constructed in Louisiana. The dune design is to +6feet, NAVD with a back- and fore-slopes of 1V:45H. The dune crest width varies by alternative. Other barrier island projects in Louisiana have used a steeper construction slope (1V:30H) on the bayward side because these islands have been relatively intact and the island provides a means of fill retention, allowing steeper slopes to be constructed. Most of Shell Island will be constructed in open water or on scattered island remnants. The +6.0 feet, NAVD dune elevation is above the 20-year return period surge elevation (+5.9 feet, NAVD).

The crest width of the dune is a function of the purpose of the individual alternatives. The dune width for Alternative 1 is based on a cost and target acreage goals that dictate the volume and cross-section width. Alternative 2 through 8 will be based on a design width plus various advanced nourishment width.

The beach profile equilibration process assumes that there is only cross-shore redistribution of sediment and that sand volume is conserved. It is estimated that the mean high water shoreline will retreat approximately 20 feet due to profile equilibration.

Construction of sand fencing and planting of vegetation along the dune will promote additional elevation growth of the dune by holding the blowing sand. A 5-foot wide +9 feet NAVD additional dune element was added to the top of the construction template to simulate this increase in dune elevation. It was assumed that this additional dune feature would take approximately 1 year to form.

A beach nourishment cross-section consist of two primary components: 1) the design section, which is the fill volume required at TY50 to meet applicable project goals, and 2) advanced nourishment, which is the sacrificial portion of the fill that will erode over the 50-year project life. Sufficient advanced nourishment can be added during construction or replaced periodically during renourishment projects. Advanced fill is distributed non-uniformly to account for diffusion losses, longshore losses, and tidal inlet losses, that vary along the project length.

Marsh Component: The proposed marsh construction elevations were based on developing an intertidal marsh over the life of the 50-year project, considering the rate of relative sea level rise, and consolidation of placed and subgrade sediments. The average elevation of the existing marsh platform on Shell Island was determined to be approximately +1.1 feet, NAVD. This elevation is comparable to other marsh platforms in the area such as East Grand Terre, Chaland Headland, and Pelican Island. The 2005 mean high water and mean low water elevations are +1.63 feet and +0.58 feet, NAVD respectively, demonstrating that the existing marsh is inundated during the tidal cycle.

The proposed marsh platform has a 50-year project life. The critical goal is to construct a marsh platform that maintains an elevation between mean high water and mean low water through TY50. With an assumed start date of 2009, the mean high water and mean low water elevations will rise from +1.64 feet to +2.26 feet, NAVD and +0.58 feet to 1.23 feet, NAVD, respectively.

This is due to an average eustatic sea level rise of 0.013 feet/year. Therefore, the marsh was designed to obtain a marsh elevation above +1.2 feet, NAVD at TY50. The marsh platform will have to be renourished periodically over the life of the project so that it remains within the tidal zone.

Temporary containment dikes are proposed to contain the marsh fill material during construction. The material for dike construction will be dredged from within the footprint of the marsh so that the excavated area is filled during construction. The dike volume is included within the marsh fill volume.

Borrow Areas: It is expected that two borrow sources will be used for this project: a high-quality sand source for the beach-dune portion of the project and an offshore mixed-sediment deposit to be used for the marsh construction. It was assumed that the Mississippi River is the source of high-quality sand that would be used for this project. The Empire borrow area is assumed to be used for the marsh construction. The Empire borrow area was previously evaluated and is expected to be used for the Pelican Island Restoration Project. This will leave the borrow needs for this project short. It is expected that more sediment is out there and further investigations are needed.

Several other borrow areas were suggested for investigations for use of mixed sediments for marsh restoration, primarily including Empire, Quatre Bayou deep (will be partially used for the restoration of Chaland Headland), Quatre Bayou D2, and Sandy Point (farthest away). Others were discussed and further investigation is recommended to find the closest mixed sediment source for marsh restoration. Ship Shoal was also discussed as another source of high quality sands for beach-dune creation. However, the distance to the project site makes this sand source prohibitively expensive.

As-built Conditions: On both Shell Island East and West approximately 336 acres of the TY1 supratidal acres are marsh platform areas that will be above +2.0 feet immediately after construction. Based on settlement curves and elevations of existing marsh, it is projected that all of the marsh platform will settle to intertidal range by TY3.

Shell Island East - As-built, TY1 configuration is anticipated to create 126 acres of dune, 297 acres of supratidal, and 47 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 11 acres of as-built dune area.

Shell Island West - As-built, TY1 configuration is anticipated to create 51 acres of dune, 192 acres of supratidal, and 21 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 8 acres of as-built dune area. All of the beach and marsh fill placed during construction of Shell Island West will have eroded in 23 years (TY25), leaving pre-construction conditions. By TY25 Shell Island West will have receded to the point where there is no supratidal acreage. Once the supratidal acreage is lost, it was assumed that the marsh would be exposed to wave action from the Gulf and that the marsh would recede at the gulf retreat rate.

The shoreline recession rates are 34.9 feet/year for Shell Island West and 12.4 feet/year for Shell Island East. Subtidal acreage decreases following construction because parts of the subtidal acreage are located within the construction footprint.

The volume of sand that could be lost into Coupe Bob every year from the two-island option is approximately 101,000 cubic yards. At this rate it would take Coupe Bob approximately 33 years to reach its accommodation volume of 3.3 million cubic yards. It is unlikely that Coupe Bob will reach its accommodation volume given that the total volume of sand fill placed in Alternative 1 is 4.1 million cubic yards, but it does suggest that little natural bypassing of sand should be expected across Coupe Bob.

6.3 Restoration Features Common to Both Action Alternatives.

In addition to the specifics discussed above, all of the alternative plans for the Caminada and Shell Island reaches include various scales of dune and marsh planting, as well as sand fencing as separable elements to be incorporated into the alternative plans.

6.3.1 Dune and Marsh Plantings

Dune plantings will promote the growth of dunes by capturing Aeolian sand. In the marsh, the plants' roots will stabilize soils quickly to help consolidate the marsh creation areas. Plantings will also accelerate the restoration of the habitats. The types of plants used for dune and marsh planting should offer some degree of vegetative diversity, including woody vegetation (e.g., mangroves, wax myrtle, maritime live oaks) and grasses. Dune plants will consist of a variety of dune species, including bitter panicum (*Panicum amarum* var amarum "Fourchon"), sea oats (*Uniola paniculata* "Caminada"), marshhay cordgrass (*Spartina patens* "Gulf Coast"), and gulf cordgrass (*Spartina spartinae*). Marsh plants will consist of mainly smooth cordgrass (*Spartina alterniflora* "Vermilion") and black mangrove (*Avicennia germinans* "Pelican"). Other plants that should be considered to add diversity include seacoast bluestem (*Schizachyrium maritimum*), seashore dropseed (*Sporobolous virginicus*), and salt grass (*Distichlis spicata*). At the end of the proposed construction, key species will be planted and grasses will be seeded.

6.3.2 Sand Fencing

Construction of sand fencing will promote the growth of the dunes by capturing Aeolian sand. One shore-parallel fence will be installed approximately 50 feet north of the southern toe of the dune to continue the capture of transported sand until the surface is vegetated. The sand fence will extend along the total length of the constructed dune. Sand fences will be installed in sequences/phases. The installation should start from the southern side of the dune so as to build dune towards the Gulf and proceed north. Additional rows of sand fencing may be added once the existing sand fence is full (i.e., sand is stacked up to the top of the fence).

A detailed description of the TSP is included in **Chapter 2 Alternatives** of the integrated feasibility and EIS report. Historic and existing conditions for significant resources are discussed in **Chapter 3 Affected Environment** of the report. The future without conditions and the direct, indirect, and cumulative impacts of those plans carried over for detailed analysis, including the TSP, are discussed in **Chapter 4 Environmental Consequences** of the integrated report.

7.0 DESCRIPTION OF SPECIES AND STATUS WITHIN THE PROPOSED ACTION AREA

There are 25 animal and 3 plant species, under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS), presently classified as threatened or endangered within the state of Louisiana. The USFWS and NMFS share jurisdictional responsibility for sea turtles and the gulf sturgeon. Of the 12 species listed, only two are likely to be observed within the project area: the piping plover (Charadrius melodus) and brown pelican (Pelecanus occidentalis)

Table 4. Threatened (T) and Endangered (E) Species potentially in LaFourche Parish

Common Name	Scientific name	Federal Status	State Status
Bald eagle	*Haliaeetus leucocephalus*	P	P
Brown Pelican	*Pelecanus occidentalis*	E	E
Green sea turtle	*Chelonia mydas*	T	T
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	E
Leatherback sea turtle	*Dermochelys coriacea*	E	E
Loggerhead sea turtle	*Caretta caretta*	T	T
Piping plover	*Charadrius melodus*	T; Critical Habitat	T

Source: United States Fish and Wildlife Service (USFWS; April 2003).
(P = protected; T = Threatened; E = Endangered)

7.1 Bald Eagle.

The bald eagle is the only species of sea eagle native to North America. Adults are black with a snow-white head and tail. Sub adults are mottled brown and black and lack the

distinctive white head and tail. Wingspan is 6 to 7 feet with females weighing between 10-14 lbs. and males weighing between 8-10 lbs.

Bald eagles nest in Louisiana from October through mid-May, primarily in cypress snags in swamps or near fresh to intermediate marshes or open water in the southeastern parishes. Bald eagles will often return to the same nest for a number of years; however, they may also use alternate nests within the vicinity. Shoreline trees that provide a clear view of the water to locate aquatic prey are often chosen as nest sites. Bald eagles primarily feed on fish, but are opportunistic and will eat a variety of mammals, amphibians, crustaceans, and birds. Wintering habitat used by bald eagles in Louisiana is characterized by abundant, readily available food sources. Most wintering areas are associated with open water where eagles feed on fish or waterfowl.

The USFWS has indicated that there are no known bald eagle nests in the vicinity of the project area (Walther, 2007). In addition, neither the LDWF nor the National Audubon Society Christmas Bird Count has reported any sightings of the bald eagle in the project area. If a bald eagle nest is found within 1,500 feet of the project area, the USFWS would need to be contacted to develop measures (e.g., spatial restrictions around active bald eagle nests) to avoid impacts on this species.

7.2 Green Sea Turtle (*Chelonia mydas*).

Breeding populations of the green sea turtle in Florida and the Pacific coast of Mexico are listed as endangered, all others are listed as threatened under the Endangered Species Act of 1973, as amended, on July 28, 1978 (43 FR 32800). Critical habitat for the green sea turtle was designated on September 2, 1998 (63 FR 46701); critical habitat was redesignated and amended on March 23, 1999 (64 FR 14067). Critical habitat has also been designated for waters surrounding Culebra Island, Puerto Rico (50 CFR 226.208).

Although green sea turtles are found worldwide in oceans and gulfs with water temperatures greater than 68°F (20°C), their distribution can be correlated to grassbed distribution, location of nesting beaches, and associated ocean currents (Hirth 1971; Perrine 2003; Spotila 2004). Long migrations are often made between feeding and nesting grounds (Carr and Hirth 1962). Within Louisiana waters, these turtles probably occur all along the coast and may nest on the Chandeleur Islands (Dundee and Rossman 1989). Population decline has been attributed to heavy fishing pressure and human nest predation (Dundee and Rossman 1989; Perrine 2003; Spotila 2004). Historically, green sea turtles were fished off the Louisiana coast, especially the Chandeleur Islands (Rebel 1974; http://www.wlf.state.la.us/apps/netgear/index.asp?cn=lawlf&pid=703). Exploitation and incidental drowning in shrimp trawls has contributed to the decline of this species and its eventual listing (King 1981). During their first year of life, green sea turtles are primarily carnivorous, feeding mainly on invertebrates. Green turtles are the only sea turtles that eat large amounts of plants, feeding in shallow water areas with abundant seagrasses or algae (Fritts et al. 1983; Spotila 2004). Green sea turtles also feed on invertebrates and carrion (Dundee and Rossman 1989). The green sea turtle grows to

the second largest size of any sea turtle, with a maximum shell length of 55 inches (140 cm) and a maximum weight of 517 lbs (235 kg), but most are considerably smaller (Perrine 2003).

The turtles migrate from nesting areas to feeding grounds, which are sometimes several thousand miles away. Most turtles migrate along the coasts, but some populations are known to migrate across the ocean from nesting area to feeding grounds. The major nesting beaches are always found in places where the seawater temperature is greater than 77°F (25°C). As a species that migrates long distances, these turtles face special problems associated with differing attitudes toward conservation in different countries. Green turtles are the only sea turtles known to come ashore for purposes other than nesting. Both immature and adult green sea turtles are known to bask (Perrine 2003).

In the southeastern United States, green sea turtles are found around the U.S. Virgin Islands, Puerto Rico, and the continental U.S. from Texas to Massachusetts. Important feeding grounds in Florida include Indian River Lagoon, the Florida Keys, Florida Bay, Homosassa, Crystal River and Cedar Key. The primary nesting sites in U.S. Atlantic waters are along the east coast of Florida, with additional sites in the U.S. Virgin Islands and Puerto Rico.

Green sea turtles are also found throughout the North Pacific, ranging as far north as Eliza Harbor, Admiralty Island, Alaska, and Ucluelet, British Columbia. In the eastern North Pacific, green sea turtles have been sighted from Baja California to southern Alaska. In the central Pacific, green sea turtles can be found at most tropical islands. In U.S. Hawaiian waters, green sea turtles are found around most of the islands in the Hawaiian Archipelago. The primary nesting site is at French Frigate Shoals (http://www.nmfs.noaa.gov/prot_res/species/turtles/green.html).

Female green sea turtles lay one to seven clutches of eggs in a single nesting season with each clutch contains an average of 110 eggs (Spotila 2004). The number of nests has been estimated to be between 350 to 2,300 nests annually. Green sea turtles nest at 2-, 3-, or 4-year intervals. This nesting activity indicates a population of less than 1,000 females in the breeding population of Florida and Mexico. It takes longer for a green turtle to reach maturity than any other sea turtle, typically living 45-59 years (Spotila 2004).

The USFWS web site (http://ecos.fws.gov/species_profile/servlet/gov.doi.species_profile.servlets.SpeciesProfile?spcode=C00S) and the NMFS web site (http://www.nmfs.noaa.gov/prot_res/species/turtles/green.html) provides a species account of the green sea turtle. Additional information on green sea turtles is provided by Carr (1952), Carr and Hirth (1962), Hirth (1971; 1980), Rebel (1974), Dundee and Rossman (1989), Perrine (2003) and Spotila (2004) provide recent summaries of green sea turtle biology, behavior and conservation.

7.3 Hawksbill Sea Turtle (*Eretmochelys imbricata*).

The endangered Hawksbill Sea Turtle is one of seven species of sea turtles found throughout the world. One of the smaller sea turtles, it has overlapping scutes (plates) that are thicker than those of other sea turtles. This protects them from being battered against sharp coral and rocks during storm events. Adults range in size from 30 to 36 inches (0.8-1.0 meters) carapace length, and weigh 100 to 200 pounds (45-90 kilograms). Its carapace (upper shell) is an attractive dark brown with faint yellow streaks and blotches and a yellow plastron (under shell). The name "hawksbill" refers to the turtle's prominent hooked beak.

The hawksbill sea turtle is one of the most infrequently encountered sea turtles in offshore Louisiana. However, a hawksbill was reported near Calcasieu Lake in 1986 (Fuller *et al.*, 1987). Hawksbills generally inhabit coastal reefs, bays, rocky areas, passes, estuaries, and lagoons, where they are found at depths of less than 70 feet. Nesting occurs on undisturbed, deep-sand beaches, from high-energy ocean beaches to tiny pocket beaches several meters wide bounded by crevices of cliff walls; these beaches are typically low-energy, with woody vegetation near the waterline. In the continental United States, nesting sites are restricted to Florida where nesting is sporadic at best (NOAA Fisheries/USFWS, 1993). Due to the lack of suitable foraging and nesting habitats, there is a low probability of this species occurring within the project area.

7.4 Kemp's Ridley Sea Turtle (*Lepidochelys kempii*).

On December 2, 1970 the Kemp's ridley sea turtle was designated as endangered across its entire range (35 FR 18319). Critical habitat has been proposed (October 4, 1978 (43 FR 45905); November 29, 1978 (43 FR 55806)) but has not been finalized to date. This species has continued to decline in Louisiana (USFWS 1990). The Kemp's ridley is the rarest, most endangered, and enigmatic of all sea turtles (Perrine 2003; Spotila 2004). However, this small sea turtle is believed to be the most frequently encountered (Dundee and Rossman 1989), if not the most abundant sea turtle, off the Louisiana coast (Viosca 1961).

The Kemp's ridley has the most limited distribution of any sea turtles except the Australian flatback (Perrine 2003). For the most part, breeding is confined to a limited stretch of beach on the Gulf coast of Mexico. The known range of this species includes the Gulf of Mexico and the Atlantic Ocean. The current range for Kemp's ridley in the United States includes marine habitat of the following coastal states: Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas.

Inshore areas of the Gulf of Mexico appear to be important habitat for Kemp's ridleys, as they tend to concentrate around the mouths of major rivers (Frazier 1980). Members of this genus are characteristically found in waters of low salinity and high turbidity and organic content, where shrimp are abundant (Zwinenberg 1977; Hughes 1972 as cited in Frazier 1980;). Kemp's ridleys have been collected in Louisiana from Lake Borgne,

Barataria and Terrebonne Bays, and near Calcasieu Pass (Dundee and Rossman 1989). Occurrence of these sea turtles in bays and estuaries along the Louisiana coast would not be unexpected, as many of their primary food items occur there. Stomach analyses of specimens collected in shrimp trawls off Louisiana revealed crabs, gastropods, and clams (Dobie et al. 1961). Although Kemp's ridleys are considered primarily carnivorous benthic feeders (Ernst and Barbour 1972), jellyfish as well as by-catch from shrimp trawlers have been reported as part of their diet (Landry 1986).

The USFWS web site (http://ecos.fws.gov/species_profile/SpeciesProfile?spcode=C00O) and the NMFS web site (http://www.nmfs.noaa.gov/pr/species/turtles/kemps.html) provide a species account of the Kemp's ridley sea turtle. Additional information on the Kemp's ridley sea turtle includes Hughes (1972), Pritchard and Marquez (1973), Zwinenberg (1977), Fuller (1978), Carr (1980), and Fuller and Tappen (1986). More recently, Perrine (2003) and Spotila (2004) provide summaries of Kemp's ridley sea turtle biology, behavior and conservation.

7.5 Leatherback Sea Turtle (*Dermochelys coriacea*).

The leatherback sea turtle was listed as an endangered species throughout its range on June 2, 1970 (35 FR 8491). Critical habitat was designated on September 26, 1978 (43 FR 43688), March 23, 1979 (44 FR 17710), and March 23, 1999 (64 FR 14051). Critical habitat has been designated for shoreline and adjacent waters of the U.S. Virgin Islands (50 CFR 17.95; 50 CFR 226.207). The leatherback is found throughout the tropical waters of the Atlantic, Pacific, and Indian Oceans (Ernst and Barbour 1972), the Gulf of Mexico, and the Caribbean (Carr 1952). Critical habitat for the leatherback includes the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands, up to and inclusive of the waters from the hundred fathom curve shoreward to the level of mean high tide with boundaries at 17°42'12" N and 64°50'00" W. This turtle exhibits seasonal fluctuations in distribution in response to the Gulf Stream and other warm water features (Pritchard 1971; Hirth 1980; Fritts et al. 1983). During the summer, leatherbacks tend to be found along the east coast of the U.S. from the Gulf of Maine south to mid-Florida.

Nesting occurs from February through July at sites located from Georgia to the U.S. Virgin Islands. Nesting leatherbacks occur along beaches in Florida, Nicaragua, and islands in the West Indies; however, no nesting has been reported in Louisiana (Gunter 1981, Dundee and Rossman 1989). In Louisiana, leatherbacks are believed to occur offshore in deep waters; however, they have been collected from or sighted in Cameron Parish, Atchafalaya Bay, Timbalier Bay, and Chandeleur Sound (Dundee and Rossman 1989).

The USFWS web site (http://ecos.fws.gov/species_profile/servlet/gov.doi.species_profile.servlets.SpeciesProfile?spcode=C00F) and the NMFS web site (http://www.nmfs.noaa.gov/pr/species/turtles/leatherback.html /) provide a species account of the leatherback sea turtle. Additional information on the leatherback sea turtle

includes Pritchard (1971), Earnst and Barbour (1972), and Fritts et al. (1983). Perrine (2003) and Spotila (2004) provide recent summaries of leatherback sea turtle biology, behavior and conservation.

Leatherback turtles are omnivorous but feed primarily on jellyfish and other cnidarians, and have been associated with large schools of cabbage head jellyfish *(Stomolophus meleagris)*. Fritts et al. (1983) reported that these turtles also ingest plastic, apparently mistaking it for food.

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Leatherbacks are seriously declining at all major nesting beaches throughout the Pacific. The decline is dramatic along the Pacific coasts of Mexico, Costa Rica and Malaysia. Nesting along the Pacific coast of Mexico declined at an annual rate of 22 percent over the last 12 years, and the Malaysian population represents 1 percent of the levels recorded in the 1950s. The collapse of those nesting populations was precipitated by a tremendous over-harvest of eggs, direct harvest of adults, and incidental mortality from fishing. In the Atlantic and Caribbean, the largest nesting assemblages are found in the U.S. Virgin Islands, Puerto Rico, and Florida. Nesting data for these locations have been collected since the early 1980s and indicate that the annual number of nests is likely stable; however, information regarding the status of the entire leatherback population in the Atlantic is lacking. Nesting activity has also declined in French Guiana due to erosion of nesting beaches. The population appears to have shifted to Surinam, where annual numbers of nests rose from less than 100 in 1967 to 5,565 in 1977 and 9,816 in 1987. Current estimates are that 20,000 to 30,000 female leatherbacks exist worldwide.

7.6 LOGGERHEAD SEA TURTLE (*Caretta caretta*).

The loggerhead sea turtle was listed as a threatened species on July 28, 1978 (43 FR 32800). Critical habitat has been proposed (October 4, 1978 (43 FR 45905); November 29, 1978 (43 FR 55806); and March 19, 1980 (45 FR 17588)) but has not been finalized. Loggerheads are circumglobal, inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. In the Atlantic, the loggerhead turtle's range extends from Newfoundland to as far south as Argentina. During the summer, nesting occurs in the lower latitudes. The primary Atlantic nesting sites are along the east coast of Florida, with additional sites in Georgia, and the Carolinas; some nesting also occurs on the Gulf Coast of Florida. In the eastern Pacific, loggerheads are reported as far north as Alaska, and as far south as Chile. Occasional sightings are also reported from the coast of Washington, but most records are of juveniles off the coast of California. Southern Japan is the only known breeding area in the north Pacific (http://www.nmfs.noaa.gov/prot_res/species/turtles/loggerhead.html).

The loggerhead sea turtle has continued to decline in Louisiana (USFWS 1990). Perrine (2003) and Spotila (2004) provide recent summaries of loggerhead sea turtle biology, behavior and conservation. Loggerheads are capable of living in a variety of environments, such as in brackish waters of coastal lagoons and river mouths. During the winter, they may remain dormant, buried in the mud at the bottom of sounds, bays, and estuaries. The major nesting beaches are located in the southeastern United States, primarily along the Atlantic coast of Florida, North Carolina, South Carolina, and Georgia. Only minor and solitary nesting has been recorded along the coasts of the Gulf of Mexico.

The largest of the hard-shell sea turtles, the loggerhead is distributed worldwide in temperate and tropical bays and open oceans. Loggerheads probably range all along the Louisiana coast; however, Dundee and Rossman (1989) reported specimens only from Chandeleur Sound, Barataria Bay, and Cameron Parish. The population decline of loggerheads can be attributed to egg and nestling predation by mammals and birds (Dundee and Rossman 1989).

Nesting on the Gulf Coast occurs between the months of April and August, with 90 percent of the nesting effort occurring on the south-central Gulf Coast of Florida (Hildebrand 1981). Although loggerheads have been documented as nesting on the Chandeleurs in 1962 and Grand Isle in the 1930s, it is doubtful whether this species currently successfully nests on the Louisiana coast (Hildebrand 1981, Dundee and Rossman 1989). The loggerhead's diet includes marine invertebrates such as mollusks, shrimp, crabs, sponges, jellyfish, squid, sea urchins, and basket stars (Caldwell et al. 1955, Hendrickson 1980, Nelson 1986). Landry (1986) suggested that these turtles may also feed on discarded by-catch from shrimp trawling. Adult loggerheads feed in waters less than 50 meters deep, while the primary foraging areas for juveniles appears to be in estuaries and bays (Nelson 1986, Rabalais and Rabalais 1980).

The USFWS web site (http://ecos.fws.gov/species_profile/servlet/gov.doi.species_profile.servlets.SpeciesProfile?spcode=C00U) and the NMFS web site

(http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.html) provide a species account of the loggerhead sea turtle. Additional information on the loggerhead sea turtle includes Caldwell et al. (1955), Hendrickson (1980), Hildebrand (1981), Landry (9186), and Nelson (1986).

7.7 GULF STURGEON (*Acipenser oxyrhynchus desotoi*)

A Federally listed as a threatened species, is an anadromous fish that occurs in many rivers, streams, and estuarine waters along the northern Gulf coast between the Mississippi River and the Suwannee River, Florida. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Adults and sub-adults may be found in those rivers and streams until November and in estuarine or marine waters during the remainder of the year. Sturgeon less than two years old appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations such as those caused by water control structures that limit and prevent spawning, poor water quality, and over-fishing have negatively affected this species.

Based on distribution information from the NOAA Fisheries (2007), the present range of the Gulf sturgeon extends from Lake Pontchartrain and the Pearl River system in eastern Louisiana and western Mississippi east to the Suwannee River is Florida. The project area is not within the current range of the Gulf sturgeon.

7.8 SPECIES OBSERVED IN THE STUDY AREA

7.8.1 Piping Plover (Charadrius melodus)

7.8.1.1 Description of Species.

The piping plover, *(Charadrius melodus),* is a small shorebird approximately 7 inches in length with a wingspan of approximately 15 inches and weighs from 1.5 to 2 ounces. It is sand-colored on the back with white undersides. The piping plover is distinguished from similar species by its bright orange legs. During the breeding season, the plover has a single black band across its breast and forehead, which are absent during the winter.

The piping plover is named for its melodic mating call. It is a small, pale-colored North American shorebird. The bird's light sand-colored plumage blends in with sandy beaches and shorelines. There are three populations of piping plovers in the United States. The most endangered is the Great Lakes breeding population, which encompasses only 32 breeding pairs. The Northern Great Plains and Atlantic Coast populations are classified as threatened and include 1398 and 1372 breeding pairs, respectively. All piping plovers winter along the southeast and Gulf coasts and are classified as threatened in their wintering habitat (USFWS, 2000). Major threats to the piping plover include the loss and

degradation of habitat due to development, disturbance by humans and pets, and predation.

7.8.1.2 Distribution of Species.

The historical breeding range in North America of the piping plover included the Atlantic coastal beaches from Newfoundland to South Carolina; beaches of the Great Lakes; and the northern Great Plains region from Alberta to Ontario and south to Nebraska (USFWS, 1988). These populations were reported to winter along the Gulf of Mexico, the Atlantic coast from North Carolina to Florida, eastern Mexico, and in the Caribbean Islands (Haig and Oring, 1985). Approximately 35 percent of the total breeding piping plover population winters along the Gulf coast from Florida to Texas and represents 56 percent of the Great Lakes/Great Plains population (Natureserve 2002, 2003)

The population potentially occurring within the proposed project area is the Great Lakes population. They arrive from their northern breeding grounds as early as late July and may be present for 8 to 10 months of the year.

Northward migration to the breeding grounds occurs during late February, March, and early April (Patterson 1988, MacIvor 1990). Plovers will breed at 1 year of age (MacIvor 1990, Strauss 1990, Haig 1992) and are monogamous, but usually shift mates between years (Wilcox 1959, Haig and Oring 1988, MacIvor 1990).

Southward migration to the wintering grounds along the southern Atlantic coast and Gulf of Mexico shoreline extends from late July through September. Individuals can be found on their wintering grounds throughout the year but sightings are rare in May, June, and early July (USFWS 2001a).

7.8.1.3 Habitat.

Ideal wintering habitat for the piping plover on the Gulf of Mexico coast would contain large sand flats or sand-mud flats adjacent to a tidal pass or tidal inlet (Haig 1985, Nicholls 1989). A thin layer of mud covering the sand seems to attract plovers, due to possible food or refuge association (Nicholls 1989). Nicholls observed that barrier beaches with over wash areas or sections of old marshes also attract plovers. A gulf-facing beach having a very low gradient, thus an increased intertidal zone, offers an

almost equally attractive area (Haig 1985). Also piping plovers will inhabit spoil islands on the Gulf Intercoastal Waterway on both Atlantic and Gulf Coasts. Birds are frequently associated with bays, lagoons and inlets. Winter 2001 census observations were in the following habitat types: mudflats (36.3%), sandy beaches (33.2%), sand/salt flats (23.1%) algal mats (2.8%), oyster reefs (1.0%) and gravel shores (0.1%; Haig 2004).

In July of 2001, the USFWS designated specific areas in the United States as critical habitat for wintering piping plovers (Federal Register / Vol. 66, No. 132, 10 July 2001). Piping plover critical habitat is defined by the USFWS as "those elements essential for the primary biological needs of foraging, sheltering, roosting, and the physical features necessary for maintaining the natural processes that support those habitat components." The USFWS also indicated that constituent elements are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide. Important primary constituent elements of intertidal flats include sand and/or mud flats with no or very sparsely emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting plovers. The USFWS designated a total of 1,798 miles (165,211 acres) of shoreline along the Gulf of Mexico and Atlantic coasts as critical wintering habitat. Critical habitat in Louisiana encompasses 24,950 acres along 342.5 miles of shoreline, which is most of the coast of Louisiana including the island of Grand Isle. The critical habitat designation within Louisiana include:

- **Unit LA-1**: Texas/Louisiana border to Cheniere au Tigre. 2,650 ha (6,548 ac) in Cameron andVermilion Parishes
- **Unit LA-2**: Atchafalaya River Delta. 921 ha (2,276 ac) in St. Mary Parish, LA
- **Unit LA-3**: Point Au Fer Island. 195 ha (482 ac) in Terrebonne Parish.
- **Unit LA-4**: Isles Dernieres. 795 ha (1,964 ac) in Terrebonne Parish
- **Unit LA-5**: Timbalier Island to East Grand Terre Island. 2,321 ha (5,735 ac) in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes.
- **Unit LA-6**: Mississippi River Delta. 105 ha (259 ac) in Plaquemines Parish, LA.
- **Unit LA-7**: Breton Islands and Chandeleur Island Chain. 3,116 ha (7,700 ac) in Plaquemines and St. Bernard Parishes, LA

The proposed project occurs within critical habitat designation Unit LA-5 (Figure 8). Unit LA-5 includes:

> Timbalier Island to East Grand Terre Island. 2,321 ha (5,735 ac) in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes: All of Timbalier Island where primary constituent elements occur to the MLLW [mean low low water], all of Belle Pass West [the "peninsula" extending north/northwest approximately 4.8 km (3.0 mi) from the west side of Belle Pass] where primary constituent elements occur to MLLW; the Gulf shoreline extending approximately 11 km (6.8 mi) east from the east side of Belle Pass bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover,

begins and where the constituent elements no longer occur; all of Elmers Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmers Island to approximately 0.9 km (0.56 mi) west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; the Gulf shoreline of Grand Isle from the Gulf side of the hurricane protection levee to MLLW; and all of East Grand Terre Island where primary constituent elements occur to the MLLW.

Critical habitat within the project area for the piping plover is found only along the Caminada Headland portion of the proposed project area, from West Belle Pass to Elmer's Island peninsula (Figure 9). The Shell Island area does not contain designated critical habitat for the piping plover.

Foraging habitat in winter is fairly consistent among numerous Gulf and Atlantic coast sites. On Dauphin Island, AL: protected mudflats or sandflats exposed at low tide; at Texas sites: primarily bayshore sand and algal flats. Comparison among 36 Atlantic winter sites (222 birds observed once each) and 75 Gulf sites (1,508 birds observed once each) indicates foraging activity most often associated with mudflats (25.6% of observations), sandflats (25.1%), and sandy mudflats (31.8%; *Haige, 2004).*

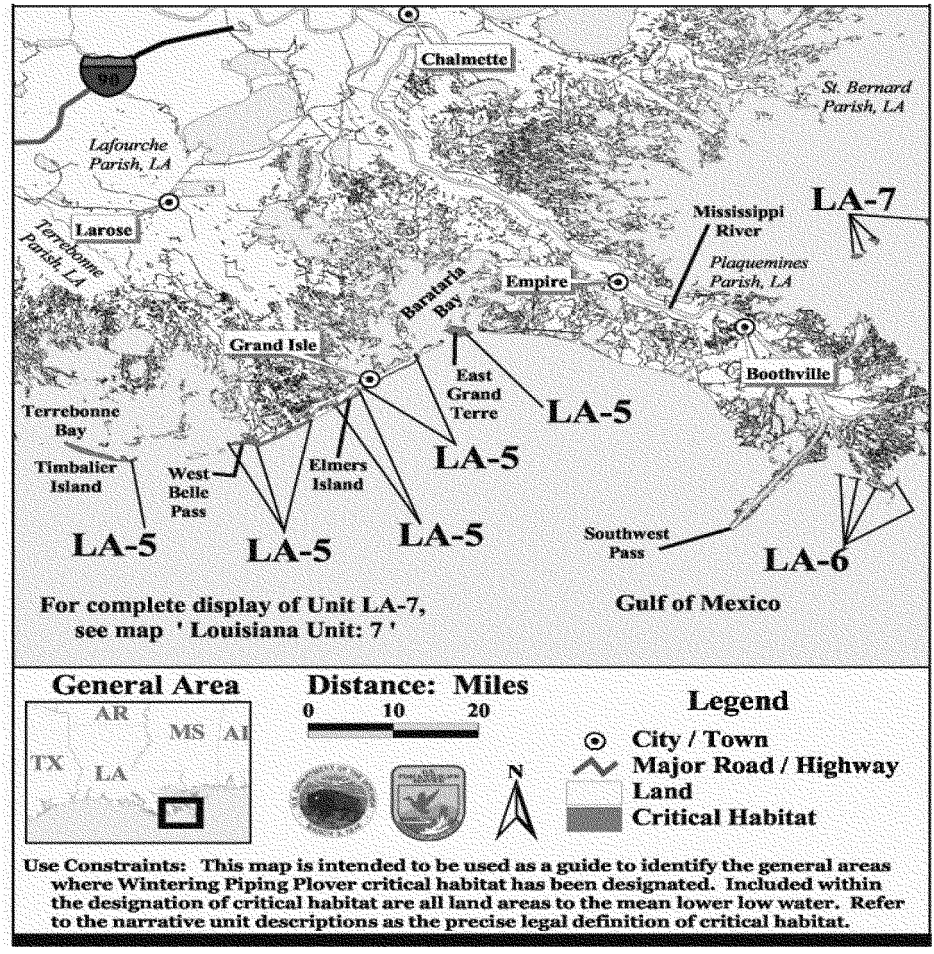


Figure 8. Critical Habitat Designation Unit LA-5

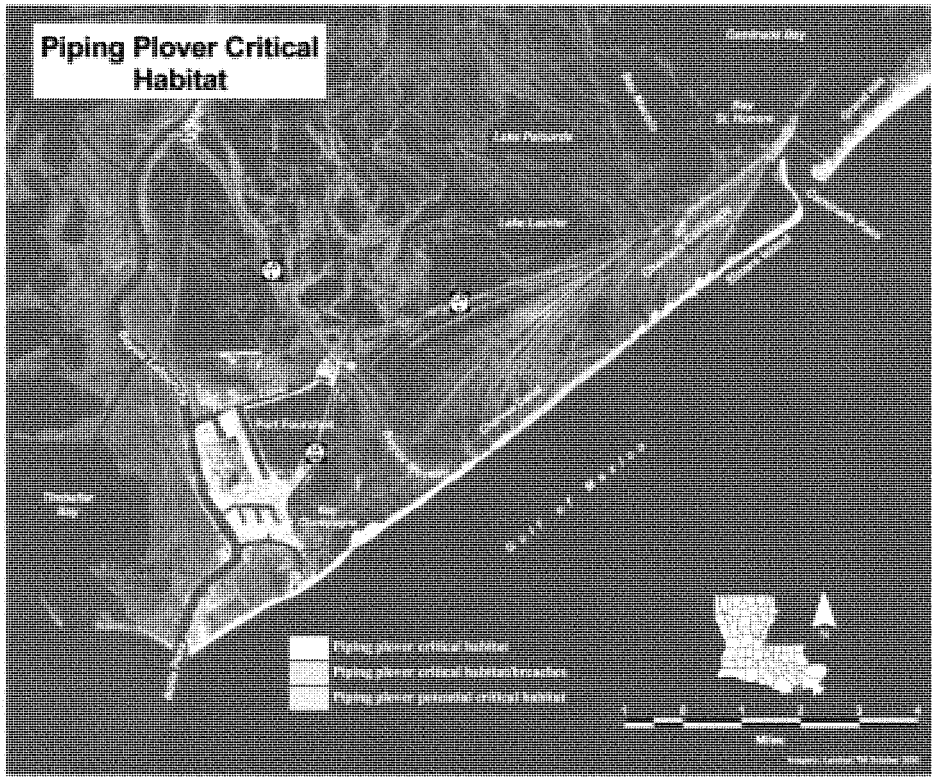


Figure 9. Critical Habitat Designation with proposed project area.

In general, wintering piping plovers feed extensively on intertidal beaches, mudflats, sand flats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting (USFWS 2002).

The piping plover feeds on insects and invertebrates along the waterline. Like other plovers this species runs a few feet and then stops, scans, and pecks at the prey it locates. It also hunts for insects on higher beach near roosting site areas.

7.8.1.4 Cause of Decline.

Hunting in the early 1900s resulted in a drastic reduction of the piping plover population. Ongoing destruction of historical nesting sites further reduced plover populations (USFWS 1988). Loss of breeding habitat has resulted from recreation and commercial development of sandy beaches on the Great Lakes, Atlantic Coast, and Gulf of Mexico.

Where breeding does occur on coastal beaches, inland lakes, and river sites, reproductive success has been reduced by disturbance from humans and pets. Additional habitat has been lost due to construction and operation of reservoirs and river channelization.

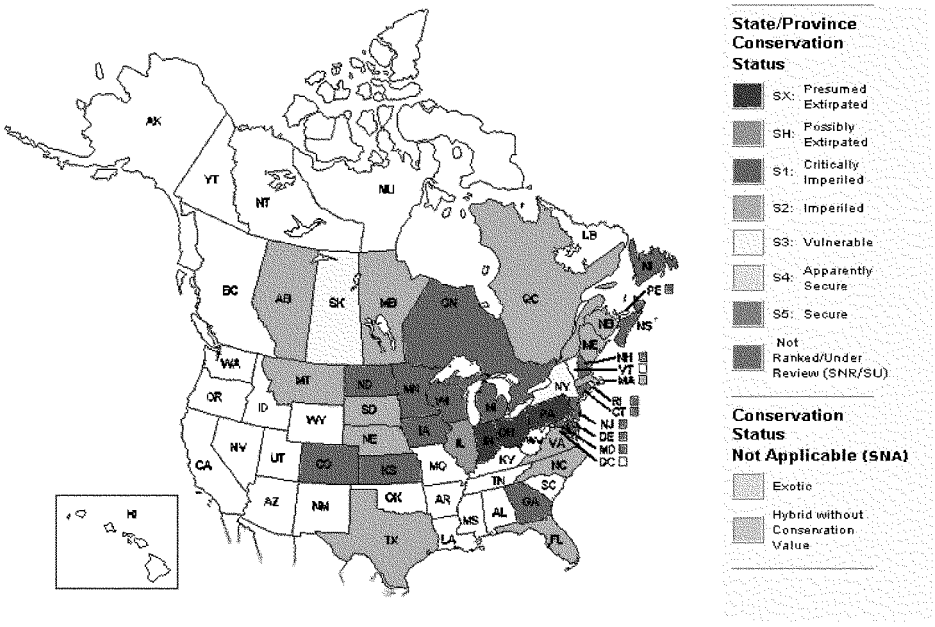
Dune stabilization projects that result in steep beach slopes, narrower beach widths, or increased vegetation to the water's edge, reduce piping plover habitat (Haig 1985). In at least one instance, stabilization of the backside of the dune on Padre Island, Texas, resulted in the destruction of essential sand flat habitat (USFWS ESIS). Additionally, increased urbanization has led to an increase in predation on the piping plover population (USFWS 1988). Recreational activities in localized areas along the gulf coast have been correlated with a decrease in piping plover use of those areas (Nicholls 1989).

The primary threats to the piping plover are habitat modification and destruction, and human disturbance to nesting adults and flightless chicks. A lack of undisturbed habitat has been cited as a reason for the decline of other shorebirds such as the black skimmer and least tern (COE, 2001).

7.8.1.5 Status of Species.

The USFWS determined the piping plover to be endangered and threatened in accordance with the Endangered Species Act of 1973, as amended, on December 11, 1985 (Federal Register Volume 50, No. 238). Endangered status was determined for the plover in the watershed of the Great Lakes (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario). It was determined to be threatened in the remainder of its range: northern Great Plains (Iowa, northwestern Minnesota, Montana, Nebraska, North Dakota, South Dakota, Alberta, Manitoba, and Saskatchewan); Atlantic coast (Quebec, Newfoundland, Maritime Provinces, and states from Maine to Florida); Gulf coast (Florida to Mexico); Bahamas; and West Indies.

Population trend data for this species is sparse. In the early 1900's, it was generally considered to be common. Early 20th century accounts report that hunting caused the first known major decline of the piping plover along the Atlantic coast (Brent, 1929; Hall, 1960). With passage of the Migratory Bird Treaty Act in 1918, plover populations recovered only to decline again in the recent times.



The Draft Piping Plover Recovery Plan (USFWS 1987) states that, "... the quality or quantity of winter habitat may be a factor limiting recovery of the species." Johnson (1987) stated that because piping plovers return to the same wintering area each year "the availability of nearby alternate sites may affect survival during severe weather conditions" when wintering sites are destroyed. Johnson (1987) also states that further destruction of winter-feeding areas may decrease plover numbers substantially. With the continuing erosion of Louisiana's coastline, further reductions in piping plover wintering habitat are anticipated.

Piping plovers winter along the southern Atlantic coast and the Gulf of Mexico. In 1996, the international piping plover winter census found that 89 percent of wintering piping plovers were found along the Gulf of Mexico coast, and eight percent were found along the Atlantic coast. In 2001, a piping plover winter census was conducted throughout the eastern United States and portions of Canada. The International Piping Plover Coordination Group coordinated the census with over 1,400 participants visiting 1,892 sites. The participants observed a total of 5,945 pairs of breeding plovers at 777 sites (Ferland and Haig 2002). The results of the census showed that the piping plovers were found primarily on islands (73.4 percent), mudflats (36.3 percent), sandy beaches (33.2 percent), and sand/salt flats (23.1 percent) (Ferland and Haig 2002).

Most of the piping plovers wintering along the shores of the Gulf of Mexico nest in the Great Lakes and Northern Great Plains region of the United States and Canada (USFWS 1988). Piping plover populations have increased steadily along the Atlantic Coast from

957 pairs of plover in 1989 to 1,676 pairs in 2003 (USFWS 2004). Preliminary 2005 Atlantic Coast piping plover abundance estimate was 1,632 nesting pairs (http://www.fws.gov/northeast/pipingplover/status/preliminary.05.pdf).

Midwinter surveys conducted near the project area during the Audubon Society's annual Christmas Survey from 1997 through 2008 indicate that numbers declined by approximately 50% in 1998 with only two birds sighted in 2005. Numbers returned to 1997 counts in 2006 with a slight increase in 2007 (Table 5).

Year	Number sighted
1997	23
1998	9
2005	2
2006	23
2007	33
2008	22

Table 5. Midwinter Piping Plover Surveys Near Project Area, 1997-2008

Source: National Audubon Society (2002). The Christmas Bird Count Historical Results [Online]. Available http://www.audubon.org/bird/cbc [June7, 2007].

More recent surveys were undertaken by the Avian Non-Game Program of the Louisiana Department of Wildlife and Fisheries are shown below in Table 6.

Table 6: LOUISIANA 2007-2008 PIPL Census Summary

Parish	Site Name	# of Surveys at site in 2007	PIPL 2007	# of Surveys at site in 2008	PIPL 2008
LaFourche	Belle Pass, west	1	0	1	13
LaFourche	East Timbalier Island	0	0	2	0
LaFourche	Fourchon Beach, east	1	5	1	41
LaFourche	Fourchon Beach, west	1	0	0	0
LaFourche	Unnamed Islands	0	0	0	0

According to the 2008 surveys, 41 piping plovers were sited along the Fourchon Beach east and 13 were sited along Belle Pass west.

7.8.2 Brown Pelican (*Pelecanus occidentalis*)

7.8.2.1 Description of Species.

Hingtgen (1985) provides a life history summary and a habitat suitability index model for the eastern brown pelican. The brown pelican is a large marine bird that can be found year around along the Gulf of Mexico coastal waters from Texas to Florida. The brown pelican is one of two species of pelican in North America, the other being the white pelican (*Pelecanus erythrorhynchos*). Adult brown pelicans are dark gray-brown with white about the head and neck. Immature brown pelicans are gray-brown on their head and neck with white underparts. The brown pelican weighs up to 8 lbs (3.6 kg) and larger individuals have wingspans of up to about 7 feet (2.1 m). They spend their entire life cycle in or near marine and estuarine waters, seldom venturing more than 20 miles (32.2 km) out to sea.

7.8.2.2 Distribution of Species.

In the United States, the brown pelican is found along the California coast, and from North Carolina to Texas. It is also found in Mexico, the West Indies and many Caribbean Islands, and as far south as Guyana and Venezuela in South America (USFWS 1995). Brown pelicans were extirpated from the Louisiana coast during the 1960s, but were reintroduced from Florida in 1968. Extensive use of pesticides, which were ultimately ingested by brown pelicans, has been noted as the primary cause of decline of the species (USFWS 1989b). This threat has been essentially eliminated, resulting in delisting of the species in Alabama and Florida, and stable populations in Louisiana, Mississippi, and Texas coastal regions.

Historically, brown pelicans used the Shell Keys NWR in south-central Louisiana (Emmons 1990). Refuge Staff at the Delta NWR, located in Plaquemines Parish, Louisiana, have noted that brown pelicans tend to use the refuge more during the winter months and the coastal barrier islands during the spring. They suspect that the majority of the pelicans that use that refuge are immature and non-breeding birds (Wigginton 1990). Brown pelicans use the area around Breton NWR in St. Bernard and Plaquemines Parishes, Louisiana, as loafing, feeding, and nesting areas. Flocks typically containing 50 to 100 birds are routinely observed by refuge staff on or near all islands in the Breton and Chandeleur Sounds (Wigginton 1990, Guidry 1994).

The Louisiana population numbered as many as 50,000 birds in the 1930s. By 1963, brown pelicans had completely disappeared from Louisiana. The LDWF and Florida Game and Fresh Water Fish Commission jointly implemented a restoration project from 1968 to 1980, and a total of 1,276 pelicans were reintroduced at three release sites in southeastern Louisiana. Restored nesting populations were established at North Island in the Chandeleur Island chain and at Queen Bess/Camp Island in Barataria Bay. North Island production was 909 fledglings between 1974 and 1979, and first nested successfully when the birds were 2 years of age. Reintroduced birds at the Queen Bess/Camp Island site first nested successfully at 3 years of age (McNease and Joanen 1984).

The 13-year reintroduction project suffered a setback in 1975 when approximately 40 percent of the population was killed by a pesticide incident, but the subsequent trend in numbers of nesting pairs continued a generally upward trend. In 1983, the estimated number of nesting pairs in Louisiana was 602. Louisiana had approximately 1,333 successful nests in 1990 (personal communication, 1991, Mr. Larry McNease, LDWF). In 1997, the LDWF estimated there were approximately 10,000 pelican nests with 25,000 adults nesting in Louisiana, primarily on the Chandeleur Islands (personal communication 2004, Ms. Brigette Firmin, USFWS). During the 2000 nesting season, a substantial portion of the Chandeleur Island nesting population relocated to an island created by dredge material at the mouth of Baptiste Collette Pass, but the birds returned to the Chandeleur Islands for the 2001 nesting season (personal communication 2004, Ms. Brigette Firmin USFWS).

Other brown pelican nesting areas in Louisiana include Raccoon and Wine Islands in the Isles Dernieres barrier island system, Queen Bess Island in Barataria Bay, West Breton Island in Breton Sound, and most recently, Rabbit Island in Calcasieu Lake.

7.8.2.3 Habitat.

Brown pelicans feed along the Louisiana coast in shallow estuarine waters. Brown pelicans feed mainly on fish, including menhaden, mullet, sardines, and pinfish, which they capture by plunge diving (USFWS 1989b).

Preferred nesting sites are small coastal islands, which provide protection from mammalian predators (mainly raccoons), and have sufficient elevation to prevent widespread flooding of nests. The nests are usually built in available vegetation (e.g., black mangroves), but ground nesting may also occur. Ground nests vary from practically nothing to well built nests of sticks, reeds, straw, palmetto leaves, and grasses. Tree nests are made of similar materials, only they are more firmly constructed. Sand spits and offshore sandbars are used extensively as daily loafing and nocturnal roost areas.

Brown pelican breeding activity in Louisiana can vary from as early as February to as late as September. They nest in colonies on small coastal islands in salt and brackish waters. Nesting islands are often chosen near channels where shipping and shrimping operations make fish easily available to nesting pairs. Normal clutch size is three eggs, and both parents share incubation and rearing of the young. The species is considered to be long-lived; one pelican captured in Edgewater, Florida, in November 1964 was banded in September 1933.

7.8.2.4 Causes of Decline.

The brown pelican is extremely susceptible to disturbance and habitat alteration in key nesting areas. It is, therefore, important to prevent disturbance to nesting colonies (e.g., by low-flying aircraft, noise disturbance from project-related activities, etc.) that could

cause nest desertion and egg losses, as well as the control of pesticide use and other types of environmental pollution. Consequently, regular surveying occurs in Louisiana. Protective measures for the species consist mainly of legal and regulatory procedures and habitat protection and improvement. The brown pelican is currently protected by Federal and state laws, which are enforced by the USFWS and the LDWF, respectively. Nest sites are also protected under management programs on Federal lands (i.e., NWRs).

7.8.2.5 Status of Species.

The brown pelican was listed as endangered first on June 2, 1970, amended on October 13, 1970, and included in the Endangered Species Act of 1973 (35 FR 16047). On February 4, 1985 (50 FR 4938), the USFWS removed the brown pelican from the list of endangered and threatened wildlife in Alabama, Florida, Georgia, South Carolina, North Carolina, and points northward along the Atlantic coast. The brown pelican remains endangered throughout the remainder of its range, which includes Louisiana, Mississippi, Texas, California, Mexico, Central and South America, and the West Indies. No critical habitat is designated for the brown pelican within Louisiana. The brown pelican was designated as "Under Review in the Candidate or Petition Process" in the Louisiana population.

8.0 ANTICIPATED EFFECTS OF THE PROPOSED ACTION

8.1 Piping Plover (Charadrius melodus)

Wintering piping plovers arrive from the breeding grounds as early as July and depart for the breeding grounds during late March and early April. By May, most birds have left the wintering grounds (http://www.fws.gov/plover/facts.html). Breeding and wintering plovers feed on exposed wet sand in wash zones; intertidal ocean beach; wrack lines; washover passes; mud-, sand-, and algal flats; and shorelines of streams, ephemeral ponds, lagoons, and salt marshes by probing for invertebrates at or just below the surface. They use beaches adjacent to foraging areas for roosting and preening. Small sand dunes, debris, and sparse vegetation within adjacent beaches provide shelter from wind and extreme temperatures. Availability of quality foraging and roosting habitat in the wintering grounds is necessary in order to ensure that an adequate number of adults survive to migrate back to breeding sites and successfully nest (http://www.fws.gov/plover/facts.html).

The proposed project would restore 1206 acres of dune/beach and 1582 acres of saline marsh; however, restoration of these vital habitats would temporarily adversely impact critical habitat within the Caminada Headland area.

Approximately 485 acres of critical habitat within Unit 5 would be temporarily adversely impacted (356 acres supratidal, 29 acres dune, 100 Gulf intertidal). Unavoidable short-term adverse impacts to piping plover critical habitat would result from the placement of

sediments onto existing beach and dune habitats during construction of the proposed barrier headland restoration measures. Prey species smothered by dune and beach nourishment activities would recolonize in the project area within 6 months to 2 years once construction activities cease. Any impacts that would occur to existing designated critical habitat would be temporary, and would provide for the long-term maintenance and/or enhancement of critical habitat within the project area. Suitable critical habitat (e.g., West Belle Pass, Grand Isle, etc.) exists within the vicinity and is anticipated to be available during and after construction. There would be no permanent impacts to critical habitat that would change the ecological processes that maintain it.

Beneficial impacts to the piping plover and its critical habitat from the proposed action include the restoration of habitat and prolonged life of existing barrier islands, as well as creating new barriers or structures that would function to protect the barrier islands and critical habitat. Much of the existing system is sediment-starved, and the proposed project would introduce sediment into the system that would be re-worked and redistributed through future storm events, thus maintaining and/or enhancing the features of critical habitat that are essential to piping plover conservation.

Potential adverse impacts to piping plovers would be temporary displacement during construction activities to restore the barrier islands. Potential impacts to piping plovers could be avoided by conducting proposed construction activities outside the wintering season; however, construction of the project is likely to occur while plovers are present. Due to their mobility, piping plovers would be able to avoid areas of temporary disturbance, and would have an abundance of suitable foraging and roosting areas available adjacent to the project area throughout project construction.

Therefore it is the Corps' determination that the proposed action may affect, but is not likely to adversely affect the piping plover and its critical habitat. Rather, the proposed action would restore and enhance critical habitat.

8.2 Brown Pelican (*Pelecanus occidentalis)*

Suitable brown pelican feeding and/or nesting habitat occurs along the barrier islands, sand spits, and mud lumps throughout the coastal Louisiana area. Pelican nest sites (i.e., Rabbit Island in Calcasieu Lake, Raccoon Point on Isles Dernieres, Queen Bess Island, Plover Island [Baptiste Collette], Wine Island, and islands in the Chandeleur chain) and the birds themselves may be impacted by barrier island restoration activities or noise disturbance from work activities. Impacts to nesting brown pelicans can be avoided by preventing any work activities from encroaching within 2,000 feet of a nesting area during the nesting season. Although suitable nesting habitat may currently exist within the project areas, there are no known nesting sites for brown pelicans within 2,000 feet of the project areas. Furthermore, the proposed barrier island restoration activities on Caminada Headland and Shell Island are likely to create new nesting habitat and prolong the life of existing suitable nesting habitat. In addition, restoration of barrier habitat and salt marsh would provide nursery and grow-out areas for the aquatic life upon which pelicans feed.

The dune and beach system within the project area have been impacted by storm erosion, resulting in the loss of dune material and intertidal beach area. The proposed project would restore 1206 acres of dune/beach and 1582 acres of saline marsh. Temporary impacts to brown pelicans foraging or roosting in or near the project area may occur during construction activities. These impacts would be limited to those associated with noise or increased human activity in the area. Once construction activities are complete any birds disturbed by the activities are expected to return to the area.

Any noise disturbance to pelicans foraging or loafing within the proposed action area would be temporary and would be minimized by appropriate construction activity windows during the non-breeding season. Changes or impacts in coastal open water habitats providing suitable feeding and/or loafing areas would be temporary, and there is an abundance of suitable habitat available nearby should the birds be temporarily displaced. Changes in hydrology by measures to preserve existing marsh, create additional wetlands, and restore barrier islands would potentially enhance suitable feeding and/or loafing habitat for pelicans by enhancing the stability of those areas and the aquatic life upon which pelicans feed. Therefore, the proposed project is not likely to adversely affect the threatened brown pelican.

8.3 Green Sea Turtle (*Chelonia mydas*).

Due to the lack of extensive seagrass beds throughout much of coastal Louisiana, and the low incidence of sightings and strandings, the proposed action is not expected to adversely impact the green sea turtle population.

8.4 Hawksbill Sea Turtle (*Eretmochelys imbricata*).

The effects of the proposed action to hawksbill populations are likely to be negligible due to its rarity along the Louisiana coast.

8.5 Kemp's Ridley Sea Turtle (*Lepidochelys kempii*).

Potential impacts are not likely to include adverse effects on Kemp's ridley sea turtle populations. The proposed restoration features would provide more suitable inshore habitat (characterized by lower salinity and high turbidity and organic content, where shrimp and blue crabs are abundant) utilized by this species when foraging.

8.6 Leatherback Sea Turtle (*Dermochelys coriacea*).

Any potential project impact would have no effect on populations of the leatherback sea turtle. This pelagic species typically occupies oceanic waters of more than 160 feet (50 m) in depth.

8.7 Loggerhead Sea Turtle (*Caretta caretta*).

The restoration of the Terrebonne and Grand Isle barrier island chains would occur in Subprovinces 2 and 3 with the proposed action. Nesting loggerhead sea turtles have historically used barrier islands; however, it is doubtful that loggerhead sea turtles nest anywhere on the Louisiana coast. The restoration of barrier islands may or may not provide suitable nesting habitat, but suitable nesting habitat is nearly nonexistent due to the current degraded state of those islands. The TSP would not negatively affect loggerheads, and may provide some benefit to the species by restoring nesting habitat.

9.0 References:

Haig, S.M. 1992. Piping Plover(*Charadrius melodus*). In The Birds of North America, No. 2 (A. Poole and F. Gill, eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C:The American Ornithologists' Union.

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Kaufman, Kenn.1996. Lives of North American Birds. Houghton Mifflin Company, New York.

APPENDIX A

APPENDIX B

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

May 11, 2009

Ms. Joan Exnicios
Acting Chief
Environmental Planning and Compliance Branch
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

SUBJECT: Biological Assessment (BA) of the Louisiana Coastal Area (LCA) – Barataria Basin Barrier Shoreline Restoration Feasibility Study for the Caminada Headland and Shell Island Restoration Project, in Jefferson, Lafourche, and Plaquemines Parishes, Louisiana

Dear Ms. Exnicios:

Please reference your May 1, 2009, letter requesting our review of and concurrence with the U.S. Army Corps of Engineers' (Corps) determination that the proposed Caminada Headland and Shell Island Restoration project is not likely to adversely the endangered brown pelican (*Pelecanus occidentalis*) and the threatened piping plover (*Charadrius melodus*), or its designated critical habitat. The proposed project would involve restoring the 13-mile-long Caminada barrier headland between Belle Pass and Caminada Pass in Jefferson and Lafourche Parishes, Louisiana, and remnants of Shell Island between Fontanelle Pass and Grand Bayou Pass in Plaquemines Parish, Louisiana. Those areas together make up a large portion of the Barataria Basin Barrier Shoreline Complex. The U.S. Fish and Wildlife Service (Service) has reviewed the information you provided, and offers the following comments in accordance with provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), and the Migratory Bird Treaty Act (MBTA) (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.).

In Louisiana, barrier island and barrier headland erosion is attributable to increasing tidal prism, insufficient volumes of sediment supplied by littoral currents, land subsidence, and sea-level rise (Boesch 1982). Although increases in the tidal prism may be primarily responsible for enlargement of tidal passes, the insufficient supply of sand available to rebuild eroded areas has also contributed to increased tidal pass widths and shoreline retreat (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1999). Where insufficient supplies of sand prevail, measures to maximize sand

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retention, such as sand fencing and vegetative planting, are needed to effectively rebuild and maintain these eroded areas.

The Caminada barrier headland is the principal feature of the Bayou Lafourche barrier system; it includes flanking islands and the retreating headland of Bayou Lafourche along the southwestern portion of the Barataria Basin. The headland maintains the integrity of the Gulf shoreline and helps to protect interior coastal wetlands from further deterioration. It also protects Port Fourchon, which furnishes between 15 and 18 percent of the United States' entire oil supply and services over 90 percent of the Gulf of Mexico's deepwater oil production (http://www.portfourchon.com/explore.cfm/aboutus/portfacts). The Caminada Headland consists of narrow and low-lying sand dunes and beach berm, barrier marshes, chenier ridges interspersed with mangrove thickets, coastal dune shrub thickets, lagoons, and small bayous. According to the BA, the average dune elevation is estimated to be 3.4 feet North American Vertical Datum of 1988 (NAVD) and the back-barrier marsh is approximately 0.94 feet NAVD. The headland has historically suffered loss of habitat value and diminished function due to storm overtopping and breaching, saltwater intrusion, wind and wave induced erosion, sea level rise, subsidence, and man-made structures. The observed average shoreline erosion rate at the Caminada Headland is approximately 45 feet per year, and increased stress on the fish and wildlife in the area is expected as habitats continue to be lost.

According to the BA, the Corps proposes to construct 880 acres of dune/beach complex and 1,186 acres of saline marsh along the Caminada Headland using offshore sand from the South Pelto Block of Ship Shoal. The dune would be constructed to an elevation of 7 feet NAVD with a crest width of 290 feet. The majority of the dune component is sited landward over existing higher elevations to maximize the acreage and increase the longevity of the project. Native dune plant species would be planted along the constructed dune, and sand fences would also be installed to capture Aeolian sand. Sand fences would be installed in phases to optimize growth of the dune toward the Gulf. The proposed beach design is a 65-foot-wide seaward berm at an elevation of 4.5 feet NAVD. Landward and seaward slopes of both the dune and beach would be 20 feet horizontal to 1 foot vertical. The Corps proposes to place advanced fill quantities to account for some initial loss of material due to shoreline equilibrium (roughly the first 6 to 9 months post-construction), as well as to prevent the need for future renourishment activities. The proposed marsh design is a marsh platform at an elevation of 2 feet NAVD to be constructed on the landward side of the dune for the length of the project. A mixture of native plant species would also be planted on the marsh platform. The Corps anticipates that construction activities would require approximately 30 months, pending local weather conditions.

The Shell Island reach is within the Plaquemines barrier system along the southeastern portion of the Barataria Basin. Prior to Hurricane Bob in 1979, Shell Island was a continuous barrier island that helped to protect the interior coastal wetlands of the Barataria Basin. According to the BA, the Empire Jetties built in 1950 along Fontanelle Pass increased shoreline recession approximately 10 feet per year along the easternmost 5,000 to 8,000 feet of Shell Island. Currently, the Shell Island reach includes two remnant barrier islands, shoals, and spits which now only partially enclose shallow bays (e.g., Shell Island Bay and Bastian Bay) along the southern portion of the Barataria Basin. Shoreline recession rates in this area are approximately 34.9 feet per year. The eastern portion of Shell Island extends for approximately 2.54 miles

between Coupe Bob and Fontanelle Pass. The western portion of Shell Island extends for approximately 1.41 miles between Grand Bayou Pass and Coupe Bob. Those remnants of the original Shell Island are expected to continue losing habitat value and function at the current erosion rate without the proposed project.

According to the BA, the Corps proposes to construct two islands for a total of 126 acres of dune, 297 acres of supratidal, and 47 acres of intertidal areas along the Shell Island reach using high quality sand from the Mississippi River for the dune/beach portion and mixed sediment deposits from the Empire borrow area for the marsh portion of the project. The design for Shell Island East consists of 15,400 linear feet of dune constructed to an elevation of 6 feet NAVD with a crest width of 281, and a marsh platform starting at 525 feet in width and widening to 1,200 feet along the northernmost portion of the remnant island. The design for Shell Island West consists of 4,500 linear feet of dune constructed to an elevation of 6 feet NAVD with a crest width of 250 feet, and a marsh platform with a maximum width of 2,300 feet. For both islands, dune slopes would be 45 feet horizontal:1 foot vertical, and marsh platforms would be constructed to an elevation of 1.2 feet NAVD. Sand fences would be installed on the two Shell Islands as described above for the Caminada Headland portion of the project, and the appropriate mixture of native plant species would be planted on both the dunes and the marsh platforms of the islands.

Brown pelicans are currently known to nest on Raccoon Point on Isles Dernieres, as well as Queen Bess Island, Plover Island (Baptiste Collette), Wine Island, Rabbit Island in Calcasieu Lake, and islands in the Chandeleur chain. Pelicans change nesting sites as habitat changes occur; thus, they may also be found nesting on mud lumps at the mouth of South Pass (Mississippi River Delta) and on small islands in St. Bernard Parish. In spring and summer, nests are built in mangrove trees or other shrubby vegetation, although ground nesting may also occur. Brown pelicans feed along the Louisiana coast in shallow estuarine waters, using sand spits and offshore sand bars as rest and roost areas. Major threats to this species include chemical pollutants, colony site erosion, disease, and human disturbance.

Based on our records, there are no known nesting colonies of brown pelicans located within 2,000 feet of the proposed project areas. Brown pelicans do, however, forage and loaf within the project areas throughout the year and are generally accustomed to boat traffic along the Louisiana Gulf coast related to oil and gas activities as well as recreational and commercial fishing. Because pelicans are highly mobile, they could easily relocate to nearby suitable foraging and loafing habitat during project construction. The proposed activities would neither permanently exclude birds from utilizing the project areas nor introduce new forms of disturbance. Project effects on brown pelicans would result in temporary displacement to nearby suitable areas. Based on that information, the Service concurs with the Corps' determination that the proposed project is not likely to adversely affect the brown pelican.

Piping plovers winter in Louisiana, and may be present for 8 to 10 months; they arrive from the breeding grounds as early as late July and remain until late March or April. Piping plovers feed extensively on intertidal beaches, mudflats, sand flats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting. Roosting areas may have debris, detritus, or micro-topographic relief offering refuge to

plovers from high winds and cold weather. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape, because the suitability of a particular site for foraging or roosting is dependant on local weather and tidal conditions. Plovers move among sites as environmental conditions change, and studies have indicated that they generally remain within a 2-mile area. Major threats to this species include the loss and degradation of habitat due to development, disturbance by humans and pets, and predation.

Our records indicate that piping plovers regularly use the beach habitat along the Caminada Headland, especially the sand spit along the eastern end of the headland, but we have no observation records of piping plovers using the remnant islands of the Shell Island reach. According to the BA, the proposed activities for the Caminada Headland would likely occur while piping plovers are present. Potential project effects to the piping plover would consist of temporary displacement to nearby suitable habitats and temporary loss of benthic prey species within the project area. There is an abundance of nearby suitable habitat into which plovers can disperse, including Belle Pass West, the easternmost sand spit of Elmer's Island (which is not included in the current project footprint), Grand Isle, and East Grand Terre Island. The benthic prey species smothered by the additional sediment in the project area would naturally re-colonize the area within 6 months to 2 years post-construction. Because such effects are temporary, discountable, and insignificant in nature, and because plovers would not be permanently excluded from using the area, the Service also concurs with the Corps' determination that the proposed action is not likely to adversely affect the piping plover.

On July 10, 2001, the Service designated critical habitat for wintering piping plovers (Federal Register Volume 66, No. 132). Designated critical habitat for the piping plover identifies specific areas that are essential to the conservation of the species. At the time of designation approximately 24,964 acres of wintering habitat were designated in Louisiana, and Unit LA-5 consisted of approximately 5,735 acres of that total. Approximately 10.25 miles of the Caminada Headland-portion of the proposed project is also located within Unit LA-5 of piping plover critical habitat. The Shell Island reach is not located within designated critical habitat; therefore, that portion of the proposed action would not affect it.

The primary constituent elements (PCEs) for piping plover wintering habitat are those habitat components that support foraging, roosting, and sheltering, and the physical features necessary for maintaining the natural processes that support those habitat components. Designated piping plover critical habitat along the Caminada Headland specifically includes ". . . the Gulf shoreline extending approximately 6.8 miles east from the east side of Belle Pass bounded on the seaward side by MLLW [mean low low water] and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the primary constituent elements no longer occur; all of Elmer's Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmer's Island to approximately 0.56-mile west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the primary constituent elements no longer occur. . ." (Federal Register, Volume 66, No. 132, Page 36127).

According to the BA, approximately 485 acres (29 acres dune, 356 acres supratidal, and 100 acres Gulf intertidal) of critical habitat within Unit LA-5 would be temporarily affected by the

proposed action. Based on conversations with the Service's coastal restoration biologist working directly with the Corps on this project, the dune, supratidal, and intertidal habitat designations are defined as: (1) dune includes any elevations within the project footprint at or above 5 feet NAVD; (2) supratidal includes any elevations within the project footprint at or between 2 and 4.9 feet NAVD; and (3) Gulf intertidal includes any elevations within the project footprint between zero and 2 feet NAVD. Based on the Service's scrutiny of 2005 and 2007 digital orthophoto quarter quadrangle (DOQQ) imagery, light detection and ranging (LIDAR) imagery, and a January 2009 site visit, we have determined that the above described habitat designations are more specifically described as follows:

1. The existing dune habitat within the project footprint consists of clumps of remnant dune generally dispersed throughout the high marsh/high beach interface. Those 29 acres of dune should not be considered as suitable piping plover habitat because those areas are densely vegetated and do not exhibit features of suitable piping plover habitat as described above.

2. The supratidal habitat classification includes both the high marsh on the landward side and the high beach along the Gulf side of the remnant dune within the project footprint. The high marsh consists of densely vegetated areas that are not suitable for the piping plover, and are specifically excluded from designated critical habitat as described above. The high beach consists of bare or sparsely vegetated sand flats above the high tide mark. We believe that no more than half (i.e., 178 acres) of the supratidal habitat classification acreage actually consists of high beach that is suitable roosting habitat for the piping plover.

3. The 100 acres of Gulf intertidal habitat does consist of suitable foraging habitat for the piping plover. That acreage is inclusive of tidal fluctuations throughout the year.

Based on the above information, approximately 278 acres (178 acres high beach and 100 acres Gulf intertidal) of designated critical habitat would be affected by the Caminada Headland-portion of the proposed project. That acreage is approximately 1.1 percent and 4.8 percent of the total acreage of wintering habitat in Louisiana and Unit LA-5, respectively. Temporary project effects to designated critical habitat would include construction activities (e.g., bulldozers, marsh buggies, discharge pipeline, etc.) within roosting and foraging habitat and smothering of the benthic community within foraging habitat. Pending the construction contract(s) awarded for the project, the most likely construction method would be to start at one end and continue moving along the shoreline in a linear fashion; construction duration would be approximately 2.5 years, pending local weather conditions. The benthic community is expected to recover within 6 months to 2 years post-construction; therefore, it is conceivable that the benthic community would begin re-colonizing the initial construction area before construction is completed at the opposite end. In addition, nearby critical habitat (i.e., Belle Pass West, easternmost sand spit of Elmer's Island, Grand Isle, East Grand Terre Island) would be available for piping plovers during construction and until the benthic community recovers.

The addition of sediment to the system is considered a long-term effect to the project area; however, it would be a beneficial effect to critical habitat by increasing the acreage and longevity

of roosting and foraging habitat. The Corps anticipates that the additional sediment would continually be re-worked and transported throughout the sediment-starved system for the 50-year project life and would, therefore, help to support and sustain the natural ecological processes that maintain piping plover critical habitat. Without the additional sediment, critical habitat within the project area would continue to be lost to erosional forces until only a vegetated shoreline, which is not suitable for the piping plover, would remain. The Corps also proposes to place advance fill quantities to prevent the need for renourishment during the project life, which would reduce future potential temporary effects due to renourishment actions as well as provide for additional sediment that could be re-worked and transported during storm and overwash events in the near-term to create additional sand flats for piping plover use. Because the effects to critical habitat would be temporary, discountable, and insignificant in nature, and because the proposed project would ultimately benefit critical habitat by increasing, restoring, and prolonging the existence of suitable habitat for piping plovers, the Service also concurs with the Corps' determination that the proposed project is not likely to adversely affect piping plover critical habitat within Unit LA-5.

No further ESA consultation with the Service for the brown pelican, the piping plover, or its designated critical habitat will be necessary for the proposed action, unless there are changes in the scope or location of the proposed project or the project has not been initiated within 1 year of this letter. Due to the length of the Corps' project development, implementation, and construction processes, and because our species information is updated annually, the Corps should re-initiate consultation with this office on an annual basis until construction begins, or at any time if there are changes in the scope or location of the proposed action that would produce project effects not considered in the subject BA or this letter.

Based on our records, colonial nesting shorebirds historically nested on the remnant islands within the Shell Island reach. To minimize disturbance to colonial nesting birds, all activity occurring within 650 feet of a rookery containing nesting gulls, terns, and/or black skimmers should be restricted to the non-nesting period (i.e., September 16 through April 1, depending on species present). Please be aware that the Shell Island project area should be surveyed for nesting shorebirds prior to construction to avoid disturbance to those species. In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

We appreciate the Corps' continued excellent coordination and cooperation in the conservation of threatened and endangered species, their critical habitats, and colonial nesting shorebirds. If you require further assistance regarding ESA coordination, or have questions regarding the content of this letter, please contact Ms. Brigette Firmin (337/291-3108) of this office.

Sincerely,

Brad S. Rieck
Deputy Supervisor
Louisiana Field Office

cc: FWS, Panama City, FL (Attn: Patty Kelly)
NMFS, St. Petersburg, FL
LDWF, Natural Heritage Program, Baton Rouge, LA (Attn: Michael Seymour)

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Boesch, D. F., ed. 1982. Proceedings of the conference on coastal erosion and wetland modification in Louisiana: causes, consequences, and options. U.S. Fish and Wildlife Service, Biological Services Program, Washington, D.C. FWS/OBS-82/59. 256 pp.

Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. 1999. Coast 2050: toward a sustainable coastal Louisiana, the appendices. Appendix E - region 3 supplemental information. Louisiana Department of Natural Resources. Baton Rouge, LA. 173 pp.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
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Lafayette, Louisiana 70506

October 2, 2009

Colonel Alvin B. Lee
District Commander
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Lee,

Please reference a September 2, 2009, memorandum requesting concurrence with the U.S. Army Corps of Engineers' (Corps) determination that the proposed maintenance dredging and material disposal in the Federally-maintained Port Fourchon Navigation Channel, Lafourche Parish, Louisiana is not likely adversely impact any threatened or endangered species or their critical habitat. The U.S. Fish and Wildlife Service (Service) offer the following comments pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), Migratory Bird Treaty Act (MBTA) (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.), and the National Environmental Policy Act of 1969 (83 Stat. 852, as amended; 42 U.S.C. 4321- 4347).

The Corps proposes to dredge the Port Fourchon Navigation Channel from Mile 0.5 to Mile -1.8 for navigation safety for commercial and recreational vessels. The excavated material would be discharged between 100 and 300 feet offshore on either side of the channel opening for beach nourishment.

The Service supports the beneficial use of dredged material to restore this section of Gulf of Mexico beach shoreline habitat for fish and wildlife resources.

As indicated in the memorandum, the piping plover and its designated critical habitat are known to occur on the beaches adjacent to the proposed dredged material disposal area. The project is also located in an area where waterbird nesting colonies are known to occur, and where the endangered West Indian Manatee (*Trichechus manatus*) and the endangered Brown Pelican (*Pelecanus occidentalis*) may be present.

Federally listed as a threatened species, the piping plover (*Charadrius melodus*), as well as its designated critical habitat, occur along the Louisiana coast. Piping plovers winter in Louisiana, and may be present for 8 to 10 months annually (late July through late March or April). Piping plovers feed extensively on intertidal beaches, mudflats, sand flats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting. Roosting areas may have debris, detritus, or micro-topographic relief offering refuge to plovers from high winds and cold weather. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape, because the suitability of a particular site for foraging or

roosting is dependant on local weather and tidal conditions. Plovers move among sites as environmental conditions change, and studies have indicated that they generally remain within a 2-mile area.

On July 10, 2001, the Service designated critical habitat for wintering piping plovers (Federal Register Volume 66, No. 132). Their designated critical habitat identifies specific areas that are essential to the conservation of the species. The primary constituent elements (PCE) for piping plover wintering habitat are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support those habitat components. Constituent elements are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide. Important components (or primary constituent elements) of intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting plovers.

According to the memorandum, the dredged material would be discharged at least 100 feet gulfward from the shoreline and would have temporary, if any, impacts to piping plover critical habitat. The project activity would only temporarily displace piping plovers to nearby suitable foraging and loafing habitat. The dredged material is expected to be reworked by wave action and be added to the existing beaches, potentially increasing critical habitat area.

The Corps has also included specifications in their plans to protect nesting migratory birds, including the endangered brown pelican. Those measures include insuring that construction activities are located more than 650 feet and 1,000 feet away from black skimmers and colonial nesting birds, respectively and 2,000 feet or more from nesting brown pelicans. Additionally, the Service recommends that until a new, comprehensive coast-wide survey is conducted to determine the location of newly-established nesting colonies, a qualified biologist inspect the proposed work site for the presence of undocumented nesting colonies during the nesting season. The Corps has also included measures in their plans instructing all work personnel to be observant for the presence of manatees to avoid impacts. Therefore, the Service concurs with the Corps determination that the proposed action is not likely to adversely affect federally-listed threatened or endangered species or their critical habitat.

No further ESA consultation with the Service will be required for the proposed project unless there are changes in the scope or location of the project elements, or the project has not been initiated within one year.

We appreciate the Corps' continued cooperation in the conservation of threatened species and their designated critical habitat. If you require further assistance or have questions regarding this letter, please contact David Castellanos (337/291-3112) of this office.

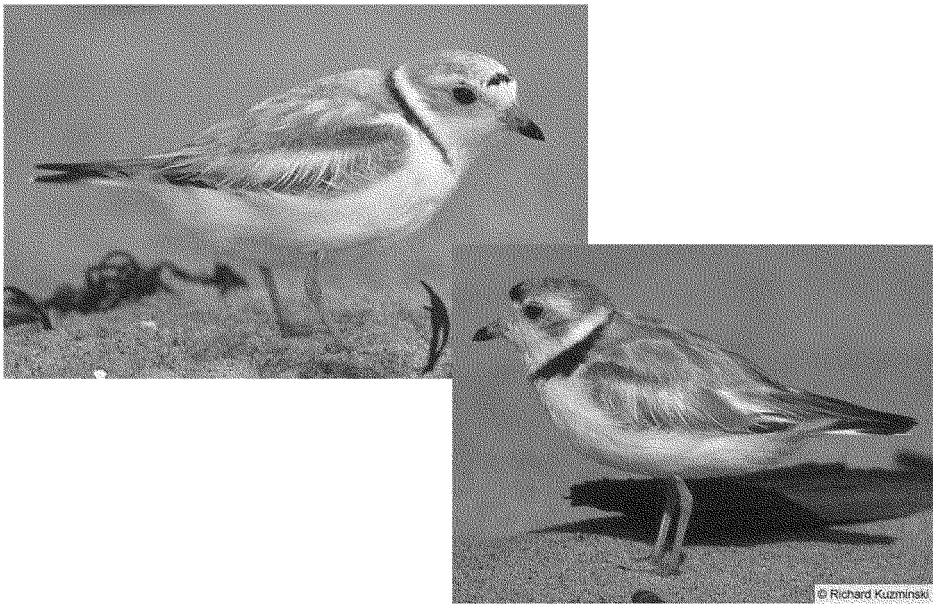
Sincerely,

David A. Wall

James F. Boggs
Supervisor
Louisiana Field Office

SUPPLEMENTAL BIOLOGICAL ASSESSMENT

Louisiana Coastal Area (LCA)
Barataria Basin Barrier Shoreline Restoration Feasibility Study
Caminada Headland and Shell Island Restoration



August 9, 2010

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1.0 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, requires that *"Each Federal agency shall, in consultation with and with the assistance of the secretary, insure that any action authorized, funded, or carried out by such agency....Is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species..."*

This Supplemental Biological Assessment (SBA) provides the information required pursuant to the ESA and implementing regulation (50 CFR 402.14), to comply with the ESA. Additional jurisprudence includes the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. section 4321, et seq.; the Fish and Wildlife Conservation Act of 1958 (PL 85-624; 16 U.S.C. 661 et seq.); the Marine Mammal Protection Act of 1972; and the Bald Eagle Protection Act of 1940. This SBA evaluates the potential impacts from changes made to the Tentatively Selected Plan (TSP) of the Caminada Headland and Shell Island Study on Federally-listed and proposed threatened and endangered species, designated and proposed critical habitat, and determines whether any such species or habitat are likely to be adversely affected by implementing the TSP.

A BA was prepared for the TSP and submitted to the United States Fish and Wildlife Service (USFWS) Lafayette Louisiana Office on May 1, 2009. The USFWS responded with a letter dated May 11, 2009 stating that they concurred with our determination that the TSP (as presented) would not likely adversely affect any threatened or endangered species or its designated critical habitat.

We are providing this SBA to re-initiate consultation, supplement the May1, 2009 BA for changes that have occurred to the scope of the TSP, and to evaluate any additional effects these changes not considered in the original BA will have on threatened and endangered species. The TSP contains all proposed actions presented in the preceding BA along with the additional features presented in this document. Therefore, the May 1, 2009 version of the BA is referred to extensively in the preparation of this document, and is thereby incorporated by reference. A copy of this BA is attached in **Appendix A**.

2.0 THREATENED, ENDANGERED, PROPOSED THREATENED OR PROPOSED ENDANGERED SPECIS

Piping Plover (*Charadrius melodus*), was listed as threatened and endangered on December 11, 1985 (50 FR, 50720-50734). Critical habitat was designated on July 6, 2000 (50 FR, 41782-41812)

Green Sea Turtle (*Chelonia mydas*), was listed as threatened in U.S. waters, except for the Florida breeding population which was listed as endangered, on July 28, 1978 (43 FR 32800 32811)

Kemp's Ridley Sea Turtle (*Lepidochelys kempii*), was listed as endangered throughout its range, on December 2, 1970 (35 FR, 18320)

Loggerhead Sea Turtle (*Caretta caretta*) was listed as threatened throughout its range on July 28, 1978 (43 FR 32800 32811)

Hawksbill Sea Turtle (*Eretmochelys imbricata*), was listed as endangered throughout its range, on June 2, 1970 (35 FR, 8491)

Leatherback Sea Turtle (*Dermochylys coriacea*), was listed as endangered throughout its range, on December 2, 1970 (35 FR, 8491)

3.0 CANDIDATE SPECIES

No candidate species are found in the project area.

4.0 SENSITIVE SPECIES AND SPECIES OF CONCERN

Bald Eagle (*Haliaeetus leucocephalus*), was de-listed on August 9, 2007 (72 FR 37345 37372)

Brown Pelican (*Pelecanus occidentalis*), was de-listed on November 17, 2009 (74 FR 59443 59472)

Colonial Nesting Birds including cormorants, herons, egrets, ibises, gulls, skimmers, and the Least Tern (*Sterna antillarum*). The interior least tern (*Sterna antillarum athalassos)* was listed as endangered throughout its range, except for within 50 miles of the coast, on June 27, 1985 (50 FR 21784-21792)

5.0 CRITICAL HABITAT

Critical habitat unit LA-5 for the piping plover is designated in the project area. Detailed discussion of critical habitat within the project area can be found in **Appendix A**.

6.0 CURRENT MANAGEMENT DIRECTION

The 2004 LCA Report developed 3 hydrogeomorphic objectives. These objectives, listed in Section 3.2.2 (MR 3-11), include maintaining salinity gradients, increasing sediment input from sources outside the estuarine basins, and maintaining or establishing natural landscape features and hydrologic processes that are critical to sustainable ecosystem structure and function. The TSP provides this geomorphic form and function by separating the Gulf of Mexico from the interior estuaries and helping to regulate salinity gradients important to the range of estuarine and freshwater wetland species for the period of analysis. The geomorphic structures prevent open Gulf of Mexico wave energy from impacting the interior estuary and provide hydrodynamic stability to the system.

Loss of these functions would have impacts beyond the project footprint. Modeling conducted, which excluded the BBBS project in its future projections, estimated that by 2060, 75% of the land between the Caminada Headland and the Larose to Golden Meadow Hurricane Risk Reduction levees would be lost. The barrier islands in Plaquemines Parish, including Shell

Island, will have disappeared as well as the marshes between the islands and the Mississippi River levees. Salinity modeling reflecting a without project condition demonstrates the function of the barrier islands in separating the marine from the estuarine environments. On the eastern side of the basin, in areas where the barrier islands are severely eroded, the salinity fields grow proportionally larger.

Per ER 1105-2-100 Section E-30, "The objective of Civil Works ecosystem restoration is to restore degraded significant ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. However, partial restoration may be possible, with significant and valuable improvement made to degraded ecological resources." The Caminada Headland and Shell Island provide important geomorphic, hydrologic, and habitat functions in the Barataria basin.

Modeling results have shown that barrier islands decreased wave energy landward of the island during tropical events. When the barrier islands were degraded in the models, the modeled wave heights increased, thus heightening the potential for overtopping levees and inundation of protected areas. Sustaining the geomorphic form of the barrier islands will provide storm surge protection for the interior wetlands and the surrounding coastal communities. The TSP will prevent the fragmentation of the Caminada Headland and greatly ameliorate impacts on several important socio-economic sectors such as: Port Fourchon, the largest base for offshore oil and gas operations in coastal Louisiana and the largest coastal fishing port; major oil and gas infrastructure, such as regional transportation and storage facilities, the LOOP, and the Mars pipeline; and the regional hurricane evacuation route serving residents of southern Lafourche Parish, the community of Grand Isle and approximately 6,000 workers stationed at offshore facilities in the central Gulf of Mexico. By decreasing the rate of erosion and preventing the splintering of the headland, the investment in infrastructure located at Port Fourchon will be less vulnerable to storm surges. Oil and gas pipelines and Louisiana Highway 1 maintenance requirements will lessen compared to the future without project conditions.

7.0 DESCRIPTION OF THE PROPOSED ACTION

The TSP described in this section also contains all project features detailed in the preceding BA. As stated in ER 1105-2-100, Appendix E, Section E-30, "Because self-regulation is a key goal of ecosystem restoration, it is generally more desirable to pursue ecosystem restoration projects that have limited maintenance requirements." The TSP would place external sediment into a sediment starved ecosystem, and then let the ecosystem "self-regulate," letting the natural shoreline processes take over. The initial construction will create 2,066 acres and 269.1 AAHUs on the Caminada Headland. Based on the sediment budget prepared for the Caminada Headland, the loss of sediment from the headland, which is derived from the total gulf shoreline erosion loss minus the total overwash accumulation, is estimated to be 379,000 cubic yards per year.

Operations and maintenance of the headland would include the beneficial placement of dredged material from operations and maintenance dredging of the bar channel of Bayou Lafourche, Louisiana (Belle Pass) in a beach nourishment disposal area. Dredging of the pass

yields between 400,000 and 750,000 cubic yards (cys) of which approximately 500,000 cubic yards of material will be used for renourishment every 1.5 to 2 years. Attached in **Appendix B** are Gradation Curves which reflect the percent composition of sand, silt, and clay of the material that is removed during maintenance dredging. Historically this material has been placed east and west of the jetties at beach nourishment disposal sites. As part of the adaptive management plan, shoreline imagery will be evaluated to determine the renourishment approach. One of two basic approaches will be used, based on shoreline conditions:

a. When monitoring data indicate that the shoreline is relatively intact, with no breaches created by storm surge or wave action, the TSP proposes that the dredged material from Belle Pass will be placed in the littoral drift south of Bayou Moreau where the sediment budget indicates that the long shore transport of material splits going east and west (Figure 1). Placement of material at this location sustains the project by building out the shoreline at the nodal point, which is an area of more rapid shoreline erosion, and by feeding material along the entire reach through existing longshore transport patterns. Approximately 500,000 cys would be placed unconfined between 100 and 300 feet from the mean high water (MHW) mark, allowing the long shore transport and wave action to move and place the sediment along the headland. There would be no direct placement of sediment onto the beach during the renourishment events. All beach fill would be placed seaward of Mean Low Low Water (MLLW) (horizontal) and at or below MLLW (vertical). The material would be pumped in an area approximately 13,000 feet in length offshore of the nodal point. The Caminada Headland is a high energy wave environment that is very dynamic. The material would be stacked no higher than + 6 feet MLG, but would be quickly reworked by the wind and waves. The pumping of the material would take approximately 35 days, with placement and removal of the pipeline taking a total of approximately 70 days. The pipe will be placed offshore. The material would be dredged from a federal navigation channel which previously received NEPA clearance for the maintenance dredging of the Bayou Lafourche channel. Over each 10 year period, an estimated 2 million cubic yards of material would be returned to the headland. A total of 10 million cys would be placed over the period of analysis replacing 53 percent of the sediment lost from the headland.

a. When monitoring data indicate that the shoreline reach has been breached or severely damaged by overwash and/or other erosion, dredged material will be beneficially placed to repair breaches and/or other highly eroded areas of the shoreline reach. The material will be placed in a manner which restores the shoreline to conditions similar to what existed prior to breaching. Each breach or overwash restoration action will be coordinated on a case by case basis. If the volume of material available is greater than the quantity required to address breaches and erosional hot spots, then the remaining material will be placed at the nodal point of the shoreline reach.

Approximately every fifth dredging cycle would be placed west of the Belle Pass jetties. Material placed during the Belle Pass maintenance event would follow disposal guidelines established under preceding coordination with Federal agencies. Timing of the renourishment will be dependent upon the maintenance dredging requirements of the Bayou Lafourche, Louisiana project.

O&M would also include repair and/or maintenance of sand fencing. The maintenance estimate for sand fencing includes complete replacement in year 5 with 20 percent replacement every 5 years until the end of the period of analysis. In addition to this task, the non-Federal sponsor would monitor the project area and enforce the restrictions of the easements through inspections of the project area. Sufficient land rights will be obtained to perform operations and maintenance for the period of analysis.

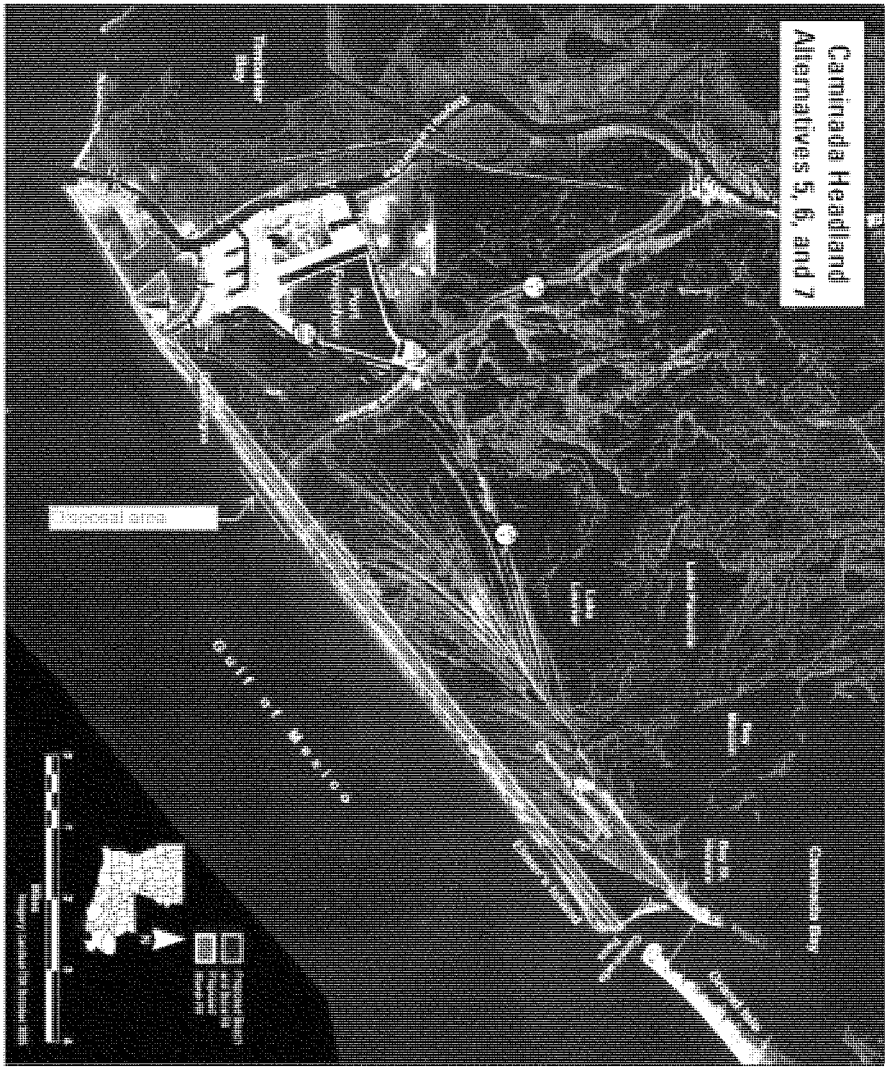

Figure 1: Nourishment Placement Locatiou

The Coastal Engineering Manual (CEM) (USACE, 2006) describes feeder beaches as finite-length berms placed along a beach, usually at the updrift end of a littoral cell that has strong unidirectional shore-parallel transport. They can also be placed at a nodal "hot spot,"

where shore-parallel transport divides, thus moving sediment in both directions away from the node. This concept involves placing a large volume of sediment in a limited area and relying on littoral processes to move it down the beach, thus gradually renourishing the beach at a distance from the placement site. The CEM describes feeder beaches in the same terms as regular or normal beach restoration projects, with the sediment placed on the beach face, but not necessarily "...the same degree of alongshore uniformity as that provided by placing fill in a prescribed manner throughout the project area." The feeder beach concept has been expanded to include subsurface placement of sediment to create a "feeder bar," which relies on coastal processes to move the sediment onto the beach face naturally. A sub-tidally placed feeder beach that nourishes the beach profile without need for heavy grading machinery and/or disturbance to environmentally sensitive habitats can be more desirable and is typically less expensive than one that is conventionally constructed. In addition, as wave action carries fine sediment onto the beach face and deposits it, an opportunity is afforded for aeolian transport to move it up the beach and onto the dune, nourishing the system.

8.0 EXISTING ENVIRONMENT

The Caminada Headland has been said to be one of the most rapidly eroding shorelines in the United States (McBride et al. 1992). The total net gulf shoreline erosion loss is approximately 926,000 cubic yards per year (cy/yr), with an overwash rate of 547,000 cy/yr. The overwash is captured in the back barrier marsh. Consequently, approximately 60% of the sand is retained in the marshes behind the beach and dunes. Of the remaining 379,000 cy, approximately 300,000 cy/yr is lost to Belle Pass, while the remaining is lost to the east towards Grand Isle.

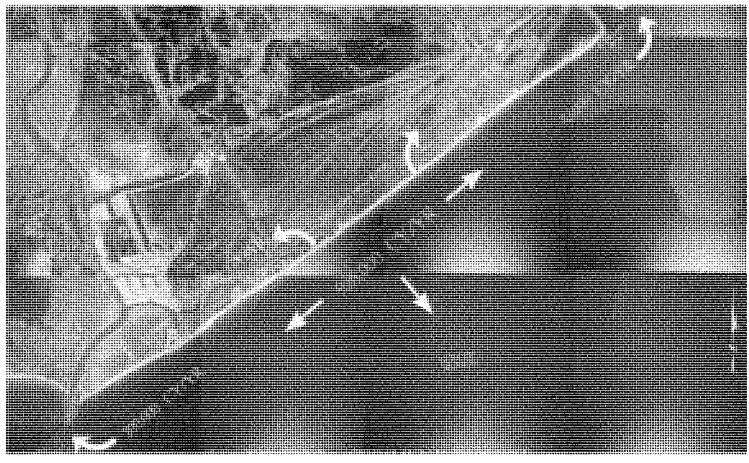

Figure 2: Sediment Budget

Oil Spill-related Impacts to Environmental Baseline:

The impacts of the Deepwater Horizon oil spill on coastal Louisiana are uncertain at this time (August 2010). The impacts of the oil spill as well as the various emergency actions taken to address oil spill impacts (e.g., use of oil dispersants, creation of sand berms, use of Hesco baskets, rip-rap, sheet piling and other actions) could potentially impact USACE water resources

projects and studies within the Louisiana coastal area, including the BBBS project. Potential impacts could include factors such as changes to existing, future-without, and future-with-project conditions, as well as increased project costs and implementation delays. The USACE will continue to monitor and closely coordinate with other Federal and state resource agencies and local sponsors in determining how to best address any potential problems associated with the oil spill that may adversely impact project implementation. Supplemental planning and environmental documentation may be required as information becomes available. If at any time petroleum or crude oil is discovered on project lands, all efforts will be taken to seek clean up by the responsible parties, pursuant to the Oil Pollution Act of 1990 (33 U.S.C. 2701 et seq.).

The Deepwater Horizon was an ultra-deepwater offshore rig that was conducting exploratory drilling off the Coast of Louisiana. On April 20, 2010, the drill breached a pocket of high pressure methane gas which ignited and created an explosion on the platform. The explosion and ensuing fire caused eleven deaths and eventually capsized the rig, creating a massive oil spill in the Gulf of Mexico. The sunken rig is located approximately 125 miles southeast of Timbalier Island. Since the spill, oil has been found on the gulfward shorelines of the Shell Island, Grand Isle, Grand Terre Island, Beauregard Island, the Caminada Headland, and each island in the Isle Dernieres and Timbalier Island reaches. The quantity of oil washed on to the shorelines can be viewed using NOAA's Shoreline Cleanup Assessment Technique (SCAT) data on their website (NOAA, 2010).

Oil has also been found on the Caminada Headland and all the Barataria Barrier Islands, all of which support critical habitat in the project area. Potential piping plover impacts associated with the oil spill primarily consist of a reduction in available food supply. Piping plovers primarily feed on benthic organisms found in intertidal beaches, mudflats, sand flats, algal flats, and washover passes. The effects of oil on the health of benthic communities can be both acute and chronic in nature. According to the USFWS, oil can be directly toxic to these organisms or impact them through physical smothering, altering metabolic and feeding rates, and altering shell formation. Intertidal benthic communities may be particularly vulnerable when oil becomes highly concentrated in narrow bands along the shoreline (USFWS, 2004). Barnacles and other sessile species are vulnerable to smothering by heavy oils while the physiological effects of the hydrocarbons can considerably reduce the mobility of the more mobile species (University of Delaware, 2010). Additionally, sediments can become reservoirs for the spilled petroleum. Some benthic invertebrates can survive the initial exposure, but may accumulate high levels of contaminants in their bodies that can be passed on to predators (USFWS, 2004).

The magnitude of the impacts is also a function of the characteristics of oil spilled. For example, a study conducted on the Amoco Cadiz spill in 1978 revealed that "light oil" resulted in considerable detrimental impacts to the benthic communities. However, a separate study revealed that the benthic organisms were contaminated, but were not adversely impact, from a spill of heavy crude (University of Delaware, 2010). In 2003, Donlan et al. assessed the impacts of the North Cape oil spill on communities of piping plover in Rhode Island. The study first examined the abundance of prey species on Moonstone Beach (the oiled island) and compared it to that of an adjacent, un-oiled beach (Goosewing). Although the abundance of benthic organisms was not significantly different between the two beaches, the species composition was considerably dissimilar. For example, only two Amphilporeia were found in the sampling station on Moonstone, compared to 456 at Goosewing. This reinforced the common belief that amphipods are the first group of organisms to disappear and one of the last to recolonize once

exposed to oil. Based on this information, the authors concluded that the piping plovers' food supply may have been reduced because of the oil spill. The authors also noted a decline in the number of fledgings produced per nesting pair between 1995 and 1996 (the year of the spill). This reduction was attributed to the lack of available prey species in the intertidal zone, which caused plovers to travel longer distances and expend more energy when feeding (Donlan et al., 2003). Between 1990 and 1995, Jewett et al. assessed the impacts of the Exxon Valdez oil spill on the benthic communities in Prince Williams Sound, Alaska. The metrics of the study included concentrations of hydrocarbons and benthic community composition, diversity, biomass, and abundance. These metrics were compared between a number of reference sites and oiled sites.

The comparison was conducted in 1990 (approximately 16 months after the spill), 1991, 1993, and 1995. According to the authors, the "total abundance and biomass of epifauna were generally higher at oiled sites, primarily because of higher densities of epifaunal bivalves. Otherwise, there were few consistent community-wide responses to oiling in diversity, richness, total abundance, total biomass, or the abundances of major taxonomic groups (e.g. polychaetes or bivalves)." The lack of a stronger community-wide response was attributed to the varying sensitivities of benthic organisms. For example, oil-sensitive amphipods such as Isaeidaes and Phoxocephalidaes were found in lower concentrations at the oiled sites. These impacts were evident throughout the duration of the study (i.e. 6 years after the spill). However, stress-tolerant and opportunistic organisms such as polychaetes were found in higher concentrations at the oiled sites due to organic enrichment. The study also revealed that hydrocarbon concentrations in the sediment were high (up to 15,300 ng/g) in eel grass beds immediately adjacent to the oiled shorelines, but sharply declined after 1990 (Jewett et all, 1999). Although the benthic organisms and habitat types within Prince Williams Sound vary from that of the Project Area (eelgrass beds versus sand beds and mud flats), the study does provide an indication of the resiliency and recovery rates of benthic communities as a whole. Furthermore, the results of the study indicate that the species composition of the benthic communities is expected to shift as a result of the Deepwater Horizon oil spill. For example, amphipods, which are favored by the piping plover, are expected to decrease in number while other less-favorable species may increase. As previously stated in the prior BA the construction of the beach and dune restoration component will likely impact benthic communities by smothering them during fill placement. In the short term, this could further stress the oil-impacted benthic organisms that are currently on the island. However, sediment used for fill placement would be tested to ensure that it is free of oil before it is placed in the project area. Placement of clean sediment in the project area could potentially improve the quality of the benthic habitat by diluting concentrations of oil in the project area's intertidal zone. Typically feeder berms will slowly allow sediment to gradually move its way on to the beach. This gradual movement could, in turn, speed up the recovery time of the oil-impacted benthic communities.

9.0 DESCRIPTION OF SPECIES

Supplemental biological data relevant to changes made to the TSP or existing conditions are presented below. The Green, Hawksbill, Kemp's Ridley, Loggerhead, and Leatherback Sea Turtles and the Gulf Sturgeon, Brown Pelican, and the Bald Eagle will not be discussed within this document. The changes made to the TSP will not result in any new impacts not previously

discussed in the prior BA. Detailed biological data and impacts discussion for these threatened and endangered species can be found in **Appendix A**.

9.1 Piping Plover (*Charadrius melodus*)

Foraging Habitat, Feeding Habits, and Diet:

Ideal wintering habitat for the piping plover on the Gulf of Mexico coast would contain large sand flats or sand-mud flats adjacent to a tidal pass or tidal inlet (Haig 1985, Nicholls 1989). A thin layer of mud covering the sand seems to attract plovers, due to possible food or refuge association (Nicholls 1989). Nicholls observed that barrier beaches with over wash areas or sections of old marshes also attract plovers. A gulf-facing beach having a very low gradient, thus an increased intertidal zone, offers an almost equally attractive area (Haig 1985). Also piping plovers will inhabit spoil islands on the Gulf Intercoastal Waterway on both Atlantic and Gulf Coasts. Birds are frequently associated with bays, lagoons and inlets. Winter 2001 census observations were in the following habitat type: mudflats (36.3%), sandy beaches (33.2%), sand/salt flats (23.1%) algal mats (2.8%), oyster reefs (1.0%) and gravel shores (0.1%) (Haig 2004). Foraging habitat in winter is fairly consistent among numerous Gulf and Atlantic coast sites.

Main Foods taken: Freshwater and marine invertebrates washed up on shore, and terrestrial invertebrates

Microhabitat for foraging: Varies greatly among habitats and stage of the annual cycle. In winter, foraging habitat fairly consistent among numerous Gulf and Atlantic coast sites. On Dauphine Island, Al: protected mudflats or sandflats exposed at low tide; Padre Island, TX: moist sand substrates. Comparison among 36 Atlantic winter sites (222 birds observed once each) and 75 Gulf sites (1,508 birds observed once each) indicates foraging activity most often associated with mudflats (25.6 % of observations) sandflats (25.1%), and sand mudflats (31.8%) (Haig, 1992)

Diet: Threatened/ endangered status prohibits collecting; sensitivity to human disturbance makes sampling food on territories while birds are present difficult and possibly unwise. Nevertheless, stomach contents of four wintering piping plovers from Alabama included marine worms, insects (fly larvae and beetles), crustaceans, mollusks, and other small marine animals (and their eggs). Fecal samples (n=24) collected from birds wintering in the Gulf of Mexico indicated species from the following phyla: Mollusca, Annelida, Arthropoda, Crustacea, and Nematoda (Haig, 1992).

10.0 ANTICIPATE EFFECTS OF THE PROPOSED ACTION

The use of a feeder beach as a shore protection measure provides considerable environmental benefit. Subtropical sandy beaches support a broad range of organisms, from microscopic infauna to reptiles, birds, and mammals, and the varied plants that stabilize the berm and dune and shelter its inhabitants. Of particular importance throughout the Gulf of Mexico is the berm nesting activity of sea turtles (for which there is an extensive body of literature, see

Trindell, et al., 1998), the berm and dune nesting activities of several species of shorebirds, and the foraging activities of both shorebirds and transient migratory neotropical birds. The ecology of this assemblage of organisms is quite complex, but the lack of cover has led to adaptations for burrowing and crepuscular and nocturnal activity patterns, thus there is little daylight evidence of the diversity of the assemblage. The burrowing creatures range from polychaete worms, snails and bivalve mollusks, a broad range of arthropods, including insects, to mammals like beach mice. The major predators on many of the burrowing creatures are shore birds and wading birds, some of which also nest in the beach/dune system. The nearshore and surf zones are prime foraging areas for pelicans, skimmers, terns, and gulls, with the latter three also congregating on the beach face in large flocks. Many of the plants and animals are quite resilient, and able to recover from routine tidal inundation and sediment overwash. However, storm surges can devastate some populations: a 1979 hurricane overwash wiped out an endangered beach mouse population on Perdido Key, Florida prior to their restoration project (Dean, 2002) and there are numerous accounts of similar events destroying the majority of sea turtle nests on Gulf of Mexico beaches. It follows that a restored and periodically renourished beach berm and dune system affords more protection than one that continues to erode. (Poff Memorandum, 2010)

The qualitative benefits of feeder beaches are well documented in the literature; several pertinent sources are provided below. Dean and Browder (2000) found that along Perdido Key, Florida a 2 meter thick shore-parallel bar or berm, placed at a depth of -6 m, essentially remained in place, even when impacted by passage of several hurricanes. Pendleton, et al., (2003) observed that the adjacent Perdido Key beach, nourished concurrently (1989-1990) with the berm construction, retained 56% of the restored sand after eight years, which translated into 53 m of additional beach width. Work and Otay (1996) studied the role of the berm in stabilizing that restored beach. They reported that the sand loss from the unprotected beach was 50 m3/m/year, but only 15 m3/m/year from the area protected by the shore-parallel berm. (Poff Memorandum, 2010)

Since the mid-1980's, the City of Naples, Florida has been dredging an inlet, Doctors Pass, at an approximate interval of every five years, and placing the sediment in the nearshore downdrift of the inlet. The dredge material has been pumped parallel to shore in depths of less than -2 m, to above MHW, and subsequently transported onto the beach face within a few months by coastal processes. The dredged volumes were on the order of 50,000 CY and the material made such a noticeable difference in the beach profile that the design template was adjusted (reduced) during the City's most recent beach renourishment in 2006 to account for the beneficial effects of the maintenance dredge sediment (J. Staiger, personal communication).

Palm Beach County and the State of Florida are planning a feeder beach at the Town of Palm Beach, to combat erosion resulting from an inlet-related sediment deficit (Bureau of Beaches and Coastal Systems, 2008). Other beach renourishment projects have incidentally served as feeder beaches for adjacent shorelines, both up- and downdrift. The Delray Beach, Florida beach, which has been successfully renourished multiple times, has contributed significantly to neighboring beaches to the north and south (Beachler, 1993). A Danish study comparing beach and shoreface nourishment concluded that the shoreface nourishment (i.e. subtidal feeder bar) provided more long-term benefit that the initial beach nourishment, and was more cost-effective (Laustrup, et al., 1996). A similar study from the Netherlands (Hoekstra, et

al., 1996) concluded that the success of the shoreface feeder berm was a combination of it performing as a feeder and also as a submerged breakwater, reducing wave impact on the shoreline. Coastal Engineering Consultants Inc. (CECI) team has personal experience with feeder beaches that have also been successfully incorporated into beach renourishment projects including Captiva Island, Florida; St. Petersburg, Florida; Jones Beach Barrier Island, New York; and Corpus Christi Bay, Texas. The volumes of sediment involve in these projects ranged from 50,000 to over 700,000 CY (Poff, 2010).

10.1 Piping Plover (*Charadrius melodus*)

Quantifying the impacts that a feeder bar will have on the piping plover's critical habitat, required additional modeling. CECI performed an SBEACH modeling analysis to assess the proposed shoreline impacts. There processes and results are as follows:

For the current model run CECI performed an SBEACH model. The SBEACH model is a widely accepted cross-shore sediment transport model utilized for predicting storm-induced beach and dune erosion. CECI developed the SBEACH input profile from the design template for the TSP at Transect D located within the nodal zone (**Figure 5 in Appendix A**). The assumed construction start date was 2012. The equilibrium and advanced fill was removed and two years of background erosion were applied to yield the projected profile at 2014 equivalent to the first renourishment event designated as the Initial Profile. The feeder beach template at 2014 was then derived as follows.

Step 1. CECI conducted a compatibility analysis of the Belle Pass dredge material with the native beach. In this case it will be Ship Shoal sand since the renourishment occurs after the Headland is restored full length using the Ship Shoal borrow area. Input data were the Belle Pass sediment data provided to CECI by the USACE via email of July 14, 2010 and native beach and Ship Shoal grain size data which were presented in CEC's Caminada Headland Engineering Appendix (CEC and SJB, 2008); none of which are presented herein for brevity. Rather, we reference Annex C-2 of the Engineering Appendix within the EIS for the native beach and Ship Shoal

– South Pelto Blocks 12 and 13 sediment data. The average mean grain size of the dredge material was computed to be 0.06 mm. The post-restoration average mean grain size of the Headland is predicted to be approximately 0.18 mm based on the native beach and Ship sediment data. Thus the dredge material contains a significant greater percentage of fines requiring additional analyses to determine the effective volume that will be yielded from the renourishment strategy and contribute to the littoral system as a feeder beach.

Step 2. CECI determined the overfill ratio proposed by Dean (1986) to identify the "fine" percentage of the Belle Pass dredge material which will be lost in profile equilibration / cross-shore losses and will not contribute to the littoral system. The analysis yielded an overfill ratio of 4.6.

Step 3. CECI determined the total dredge volume by multiplying the established volume of 500,000 CY by the average ratio of the gross volume to pay volume, computed to be 1.2, equal to 620,000 CY. The gross and pay volumes were extracted from the historical dredge records provided to CECI via email on July 19, 2010 by CEMVN.

Step 4. CECI subtracted the volume of "fine" sediment lost in profile equilibration / cross-shore losses from the total dredge volume to yield the effective volume of 135,000 CY that will contribute to the littoral system as a feeder beach. This "stable" volume will have an approximate mean grain size of 0.18 mm by virtue of the process completed above.

Step 5. CECI established the feeder beach design template parameters. The berm elevation was chosen as MHW, equal to +1.5 NAVD88. The seaward slope was set equal to 1:20 consistent with the TSP design template. The length of shoreline was set equal to 6,800 feet based on the Caminada Headland Renourishment Location Map provided to CEC by the USACE via email on July 20, 2010. Based on the effective volume, the average berm width was computed to be 125 feet.

Figure 3 depicts the SBEACH results for the Without Feeder Beach (WOFB) and With Feeder Beach (WFB) model runs. The positive benefit of the feeder beach is observed in the upland portion of the beach profile as the feeder beach attenuates the wave run-up and reduces erosion of the Headland. To quantify these benefits, volume change above MHW and shoreline change measured at +4 feet NAVD88 for the WOFB and WFB were computed, the results of which are presented in **Table 1**.

	Volume of Change above MHW, cy		
Hurricane Event	WOFB	WFB	%Decrease
Juan 1985	-11.3	-3.6	68%
Andrew 1992	-8.4	-1.6	81%
Danny 1997	-4.1	-1.4	90%
Isidore & Lily 2002	-15.6	-7.2	54%

	Shoreline Change at +4 NAVD88, ft		
Hurricane Event	WOFB	WFB	% Decrease
Juan 1985	-76	-31	59%
Andrew 1992	-43	-8	81%
Danny 1997	-24	-9	63%
Isidore & Lily 2002	-70	-36	49%

Table 1. Volume and Shoreline Change Results for WOFB and WFB

The percent reduction in volume losses from the design storms attributed to the feeder beach ranged from 54 percent to 90 percent and the percent reduction in berm/dune erosion

ranged from 49 percent to 81 percent. While the storm damage to the Headland remains significant from storms of these magnitudes, the feeder beach does provide a quantifiable benefit for storm damage reduction. It is noted that these model results should be interpreted carefully for several reasons. First, the material will be placed as unconfined disposal thus the profile shape may vary significantly from the assumed berm configuration. Further, lateral diffusion will occur relatively quickly reducing the "density" of the feeder beach along the placement area. Lastly, the storm damage reduction benefit will be localized to the nodal zone and adjacent beaches as the fill diffuses, which is a relatively minor percentage of the entire Caminada Headland shoreline.

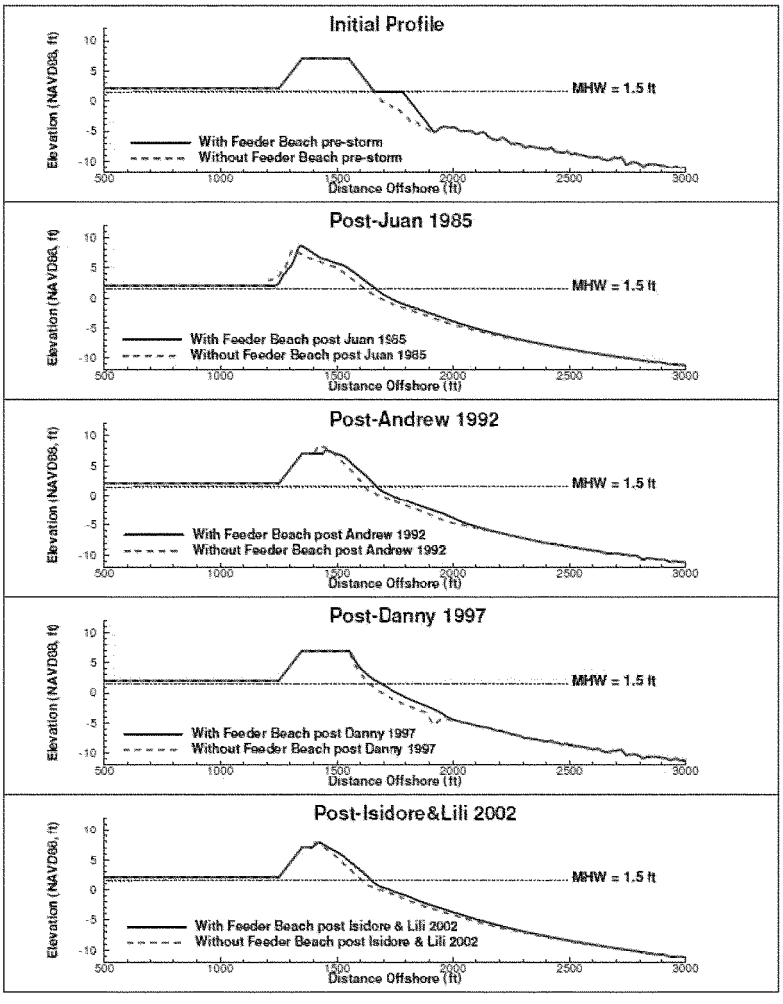

Figure 3: Storm Induced Erosion Computed by SBEACH for Several Hurricane Events.

Another alternative for evaluating the benefits from a feeder beach is to examine the nourishment that would occur on the Headland as longshore transport processes spread the sand to the east and west as the feeder beach diffuses over time. CECI selected the GENESIS Model (Hanson 1987, 1989; Hanson and Kraus 1989) which is a widely accepted longshore sediment transport model utilized for predicting long-term platform evolution of a beach in response to imposed wave conditions as well as simulating beach fill diffusion and response to coastal structures. The model's use is considered standard practice both in the United States and internationally as evidenced by the many documented applications in professional journals and conference proceedings. The model description utilized in the previous modeling program, documented in CECI's Caminada Headland Engineering Appendix (CECI and SJB, 2008), was adopted for the current model runs. For brevity the model description and setup are not repeated here; please reference Annex C-3 of the Engineering Appendix within the EIS for these items.

For the current model run CECI performed the GENESIS model. The initial GENESIS shoreline was developed from the design template for the TSP. The assumed construction start date was 2012. The equilibrium and advanced fill was removed and two years of background erosion were applied to yield the shoreline position at 2014 equivalent to the first renourishment event. The feeder beach template at 2014 was derived as described in the previous section. The shoreline was advanced 125 feet seaward along the 6,800 foot long renourishment location described in the previous section. Two 2-year long GENESIS simulations were performed, without and with the feeder beach. Wave data used in the model were obtained from hindcasts at WIS Station 130 (Hubertz, 1992). The data were analyzed to identify 172 different wave height, period, and direction combinations that represented wave conditions along the project area.

A pinned boundary condition was imposed on the east end of the shoreline near Caminada Pass due to time constraints. This boundary condition does not allow shoreline change at the boundary. On the west end, a gated groin boundary condition was imposed to represent the Belle Pass jetty. The following parameters were used in the GENESIS simulations:

Configuration:

- Start date = January 1, 1995
- End date = December 31, 1996
- Time step = 1 hour
- Recording time step = 240 hours

Sand, beach, and transport:

- Effective grain size = 0.176 mm
- Average berm height = 1.4 m (4.5 ft)
- Closure depth = 3.65 m (12 ft)
- Longshore sand transport coefficients K1=0.075, K2=0.05

Boundary conditions:

- Wave model – external
- Number of wave components = 1
- Ratio of shoreline cells to wave model cells = 5
- Height amplification factor = 1
- Angle amplification factor = 1
- Angle offset = 0
- Lateral BC – pinned (east), gated groin (west)

Figure 4 and **Figure 5** present comparisons of initial and final shorelines for the WOFB and WFB model runs, respectively. The results indicate that at the end of the 2-year period the feeder

beach diffuses to the east and west of its initial placement by approximately 2,000 feet.

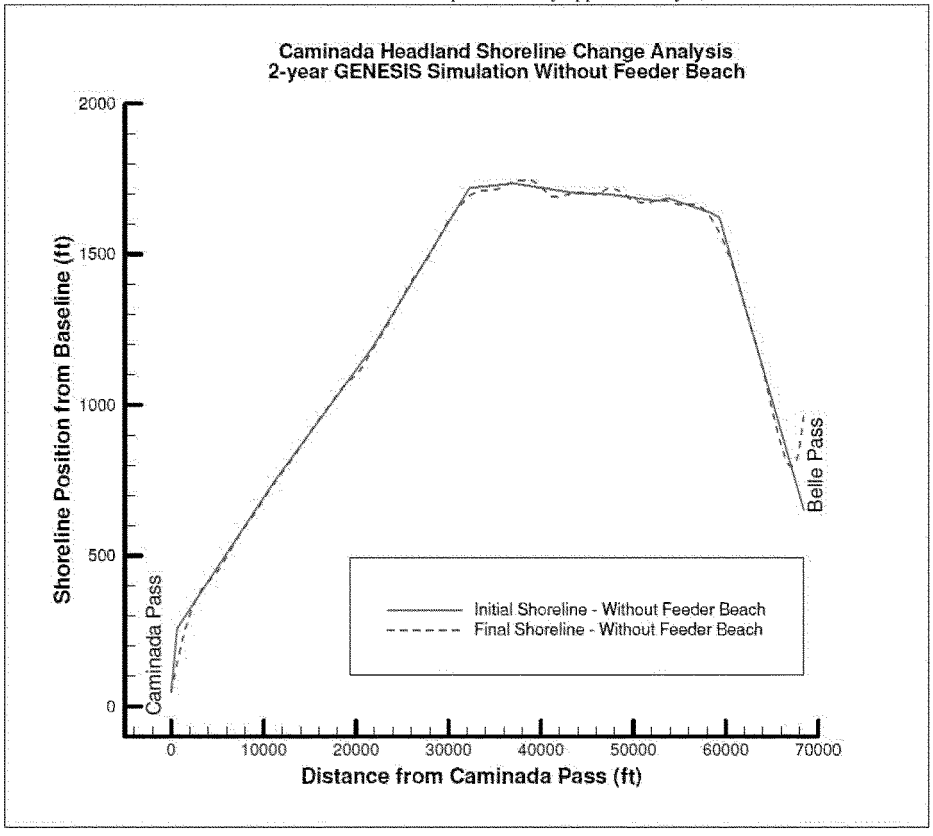

Figure 4. Initial vs. Final GENESIS Shoreline Comparison for WOFB Run.

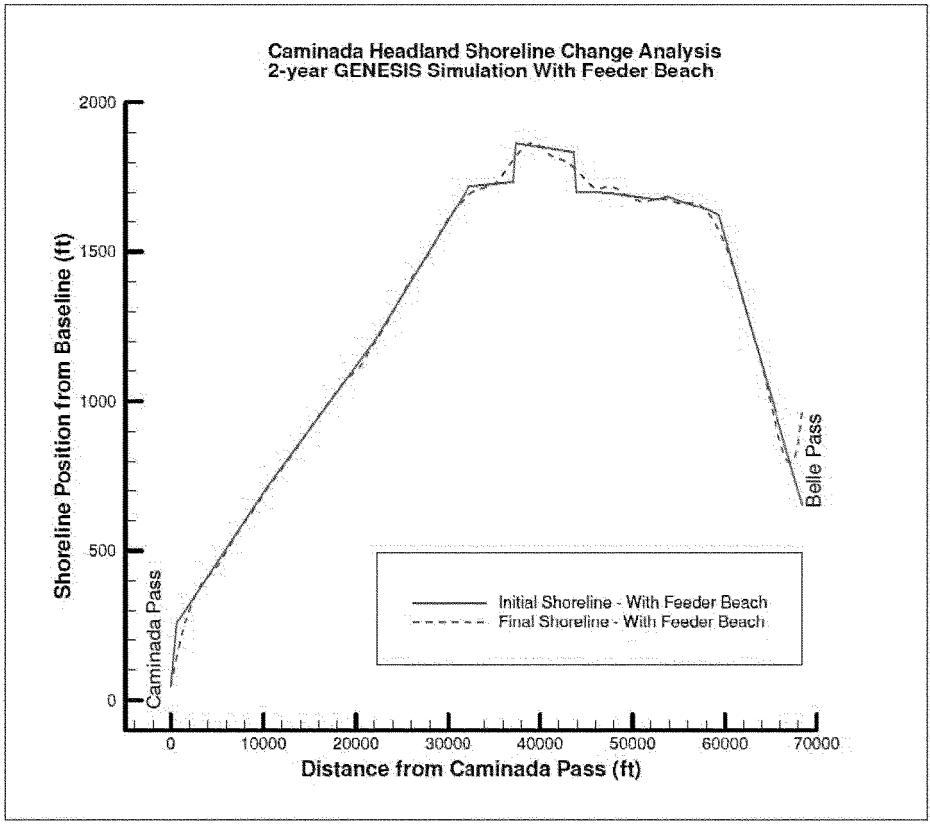

Figure 5. Initial vs. Final GENESIS Shoreline Comparison for WFB Run.

It is understood that habitat management to increase piping plover populations can be accomplished in two ways. First, areas in which overwash and succession could be allowed to proceed naturally can be identified and protected. Second, where property protection precludes allowing natural processes to occur, piping plover habitat can be artificially created. It has long been known that piping plovers will utilize sand or gravel that has been worked by humans (Cohen et al 2007). The creation of a feeder berm along the Caminada Headland, at the location where longshore transport splits going east and west, will allow for the gradual replacement of some of the material that is being rapidly lost from the shoreline. With modeling projections showing that extensive tracts of land, 75 percent of the land between the Caminada Headland and the Larose to Golden Meadow Hurricane Risk Reduction levees, would be lost by 2060 without

the implementation of the BBBS project; Replenishing some of the sediment lost and slowing the rate of habitat degradation will afford greater protection for the piping plover and their critical habitat than allowing shoreline erosion and breaching to continue unfettered. Cohen et al 2007 showed that foraging habitat created by storm-related overwashes or breaches can remain suitable for years after the breach is artificially filled.

The proposed nourishment action will follow the same operational protocol as the restoration/nourishment events that have been conducted on the Eastern and Western Jetties of Bayou Lafourche (Belle Pass). The beneficial placement of dredge material in the beach nourishment sites has occurred 5 times starting in December of 2002, then on December 2004, April-May 2006, March-April 2007, and lastly October 2008. On August 11th, 2009 a site visit conducted by Thomas Parker and Ed Creef with the US Army Corps of Engineers New Orleans District (CEMVN) documented three piping plovers utilizing the recently placed beach nourishment material (see **Figures 6).**

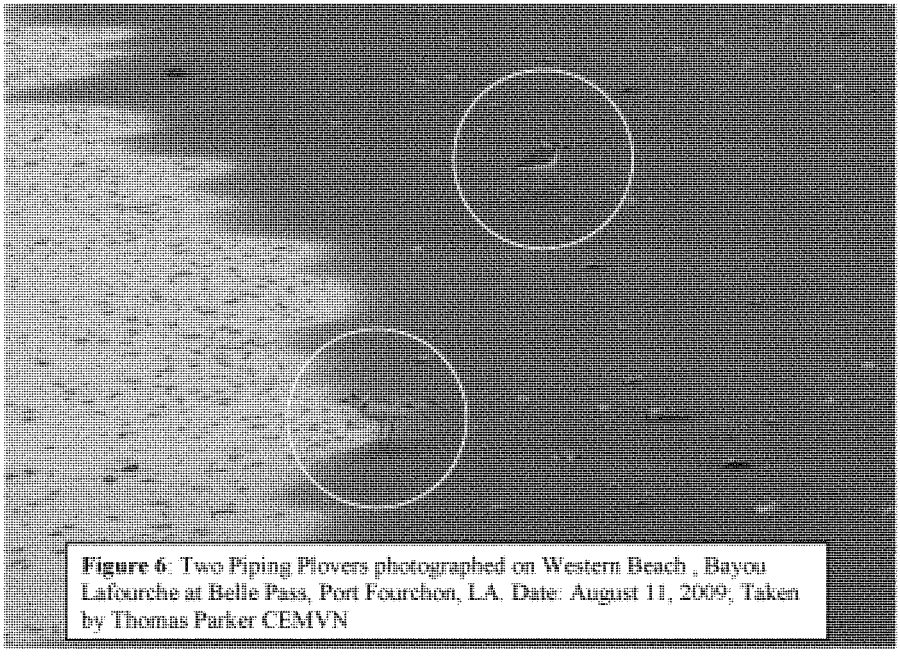

Figure 6: Two Piping Plovers photographed on Western Beach , Bayou Lafourche at Belle Pass, Port Fourchon, LA. Date: August 11, 2009; Taken by Thomas Parker CEMVN

On October 2, 2009 CEMVN received a letter from the USFWS Lafayette office regarding beach nourishment on the East and West of the Belle Pass Jetties. The following is an excerpt from that letter regarding threatened and endangered species impacts.

> "On July 10, 2001, the service designated critical habitat for wintering piping plovers (Federal Register Volume 66, No. 132). Their designated critical habitat identifies specific areas that are essential to the conservation of the species. The

> primary constituent elements (PCE) for piping plover wintering habitat are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support those habitat components. Constituent elements are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide. Important components (or primary constituent elements) of intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. Adjacent un vegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting plovers.
>
> According to the memorandum, the dredged material would be discharged at least 100 feet gulfward from the shoreline and would have temporary, if any impacts to piping plover critical habitat. The project would only temporarily displace piping plovers to nearby suitable foraging and loafing habitat. The dredged material is expected to be reworked by wave action and be added to the existing beaches, potentially increasing critical habitat area...Therefore, the Service concurs with the Corps determination that the proposed action is not likely to adversely affect federally-listed threatened and endangered species or their critical habitat"

Impacts to the piping plover from the proposed action have been compounded from recent events. When clearance for this project was received from the USFWS other restoration projects within the vicinity of this project were not expected to occur during the same time frame as the proposed action. It is estimated that construction of the TSP would begin in January of 2012. The Shell Island and the Caminada Headland components will both begin construction during this time. Construction is estimated to last for approximately two years but will be divided into sections so that regions of the Caminada Headland remain available to the piping plover. The Terrebonne Basin Barrier Shoreline (TBBS) Project is expected to begin construction during this time. The construction activities associated with the TBBS project will remove some areas that would have been available for piping plovers to displace to. The concurrent construction activities will limit the habitat that the piping plover would have available during this construction window. Another significant impact is that of the Deepwater Horizon incident. With the contamination of a majority of the critical habitat for the piping plover within the project area with oil, there is expected to be compositional changes and possibly an overall reduction in abundance of the benthic community which is the piping plovers prey base. There is potential for some of the borrow material placed in this feeder bar to be contaminated with hydrocarbons. If the borrow material does contain some oiled sand by the time of project implementation, there is a high likelihood that the oil would be highly weathered and the proposed dredging and pumping of these sediments would further weather and break-up/disperse the oil for microbial action to take effect on the oil particles. As mentioned earlier if it is determined that there is a high probability of contamination of the borrow material, then testing of the borrow material will be conducted. The feeder berm is not anticipated to further compound these negative impacts. The fine grained sediment that will be placed in the subtidal feeder bar would move onto the beach face in a gradual manner; consequently the feeder berm is not expected to cause extensive stacking of sediment on the beach which could smother the

benthos and contribute additional stress to the remaining benthic community within the piping plover's critical habitat.

Beneficial impacts to the piping plover and its critical habitat include the restoration of habitat and the prolonged life of the Caminada Headlands. Much of the existing system is sediment-starved, and the proposed action would introduce sediment into that system that would be reworked and redistributed through natural processes, thus maintaining and/or enhancing the features of critical habitat. The restoration and maintenance of intertidal habitat is important for the restoration of the piping plover population to healthy levels. "Piping plover habitat is constantly changing in quality and quantity owing to factors such as climate, weather conditions, land use, vegetation encroachment, floods and high tides. Given this constant fluctuation, it is important that all piping plover habitat be protected (Goossen et al. 2002)". Caminada Headlands are currently undergoing extensive shoreline retreat and when these losses are combined with the cumulative loss of large tracks of Barrier Island habitat throughout the state, it becomes clear that preventing additional piping plover critical habitat from disappearing is very important for the conservation of the species.

11.0 CONCLUSION AND DETERMINATION

The feeder beach will benefit the Headland both to the east and west as longshore transport nourishes the beach face profile and adds width to the shoreline. The added width will afford some undetermined level of protection to the uplands by attenuating wave run-up and thus reducing storm damage. In addition, Aeolian transport will move finer sediment into the dune system. This will result in benefits to the flora and fauna species and habitats and will reduce the rate of erosion occurring along the piping plover's critical habitat. CEMVN understands that though the proposed feeder beach renourishment component of the Barataria Basin Barrier Shoreline project will likely benefit the piping plover critical habitat as is shown from our past experiences with dredge and nourishment placement around Bayou Lafourche (Belle Pass), our literature review, and our benefits analysis. But because of impacts to critical habitat from the Deepwater Horizon and because this project will be occurring concurrently with other restoration projects in the project area that the original determination for the piping plover *"Not Likely to Adversely Affect"* is now more appropriately a *"likely to adversely Affect"* determination. With this new information we request the initiation of Formal consultation for the BBBS project and request that the USFWS prepare a Biological Opinion.

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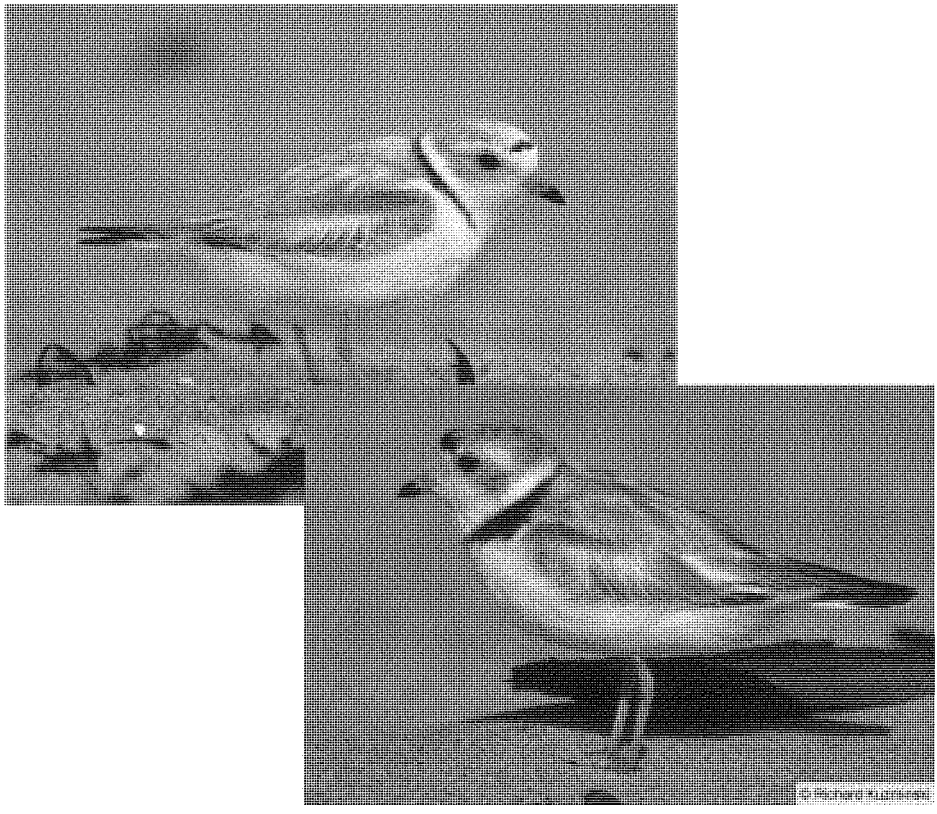
APPENDIX A

BIOLOGICAL ASSESSMENT

Louisiana Coastal Area (LCA)
Barataria Basin Barrier Shoreline Restoration Feasibility Study
Caminada Headland and Shell Island Restoration



APRIL 24, 2009

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BIOLOGICAL ASSESSMENT

Louisiana Coastal Area (LCA)
Barataria Basin Barrier Shoreline Restoration Feasibility Study
Caminada Headland and Shell Island Restoration

1.0 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, requires that, *"Each Federal agency shall, in consultation with and with the assistance of the secretary, insure that any action authorized, funded, or carried, out by such agency.... Is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species..."*

This Biological Assessment (BA) provides the information required pursuant to the ESA and implementing regulation (50 CFR 402.14), to comply with the ESA. Additional jurisprudence includes the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. section 4321, *et seq.;* the Fish and Wildlife Conservation Act of 1958 (PL 85-624; 16 U.S.C. 661 *et seq.*); the Marine Mammal Protection Act of 1972; and the Bald Eagle Protection Act of 1940. This BA evaluates the potential impacts of the proposed restoration of the Caminada Headland and Shell Island Study on Federally-listed and proposed threatened and endangered species, designated and proposed critical habitat, and determines whether any such species or habitat are likely to be adversely affected by implementing the tentatively selected plan (TSP).

A programmatic BA was prepared in 2004 for the LCA Ecosystem Restoration Study (USACE 2004). This proposed action is an outgrowth of the LCA comprehensive programmatic restoration study. The 2004 programmatic BA is thereby incorporated by reference (Appendix A).

2.0 PURPOSE AND NEED FOR ACTION

The purpose of the study is to restore the geomorphic function and unique critical and essential fish and wildlife habitats of the Caminada Headland's barrier system and reverse the current trend of degradation in the Caminada Headland and Shell Island reaches. Restoration efforts would target ecologically distinct, critical, high priority areas that would increase sustainability with essential form and function of the natural barrier ecosystem.

3.0 PROPOSED ACTION

The proposed action is the restoration of the Caminada Headland and Shell Island reaches o f the Barataria barrier system.

The study considers mining offshore, nearshore, riverine, and other sediment sources to re-establish a sustainable barrier system (e.g. barrier islands, shorelines, and headlands) at the Caminada Headland and Shell Island reaches of the Barataria Barrier System. The study considers all reasonable alternatives including:

- Build on alternatives considered under the LCA Barrier Shoreline Restoration Study and the LCA Wetland Restoration/Creation Study.
- Borrow sources considered included: offshore, nearshore, riverine, and other sources.
- Consider varying widths and configurations of barrier shorelines as well as varying heights of restored dunes.
- Consider marsh restoration as a platform for barrier shoreline rollover.
- Recommendations from interested parties submitted during scoping and public meetings, and meetings with stakeholders.

The Ecosystem Objective is to sustain productive and diverse fish and wildlife habitats. The Hydrogeomorphic Objective is to maintain or establish natural landscape features and hydrologic processes.

4.0 DESCRIPTION OF THE STUDY AREA

The study area is part of the 300-mile long Louisiana barrier system. The Caminada Headland and Shell Island reaches are located along the Barataria barrier shoreline comprising the area designated as Subprovince 2 in the LCA study (USACE 2004). Subprovince 2 is defined by the hydrologic boundary of the Barataria Basin, which is approximately 2,446 square miles and the western portion of the lower Mississippi River Delta. The basin is separated from the Gulf of Mexico by a chain of barrier islands, which serve as a natural barrier to storm events and reduce marine influences on interior wetlands within the basin (**figure 1**).

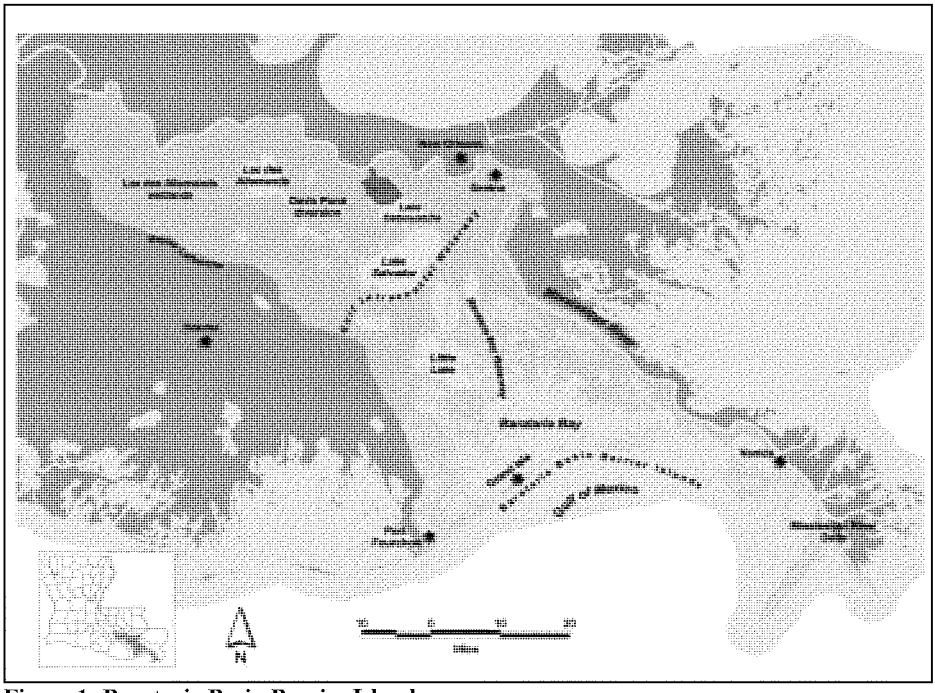

Figure 1: Barataria Basin Barrier Islands

5.0 DETAILED DESCRIPTION OF EACH PROJECT REACH

5.1 CAMINADA HEADLANDS REACH

The Caminada barrier headland (also known as the Caminada-Moreau headland) is the predominant feature of the Bayou Lafourche barrier system that includes flanking islands and the retreating headland of the Bayou Lafourche distributary of the Mississippi River (**figure 2**). It is one of the most rapidly eroding shorelines in the United States (McBride et al. 1992; Connor 2004). The southwest to northwest-oriented Caminada-Moreau headland extends approximately 13.18 miles (21.21 km) between Belle Pass in the west and Caminada Pass in the east. Historic maps show that the west end of the Caminada-Moreau headland is retreating more rapidly than the east end of the headland (Williams et al. 1992). Hundreds of offshore drilling rigs in the Gulf of Mexico send gas and oil to the mainland through Port Fourchon.

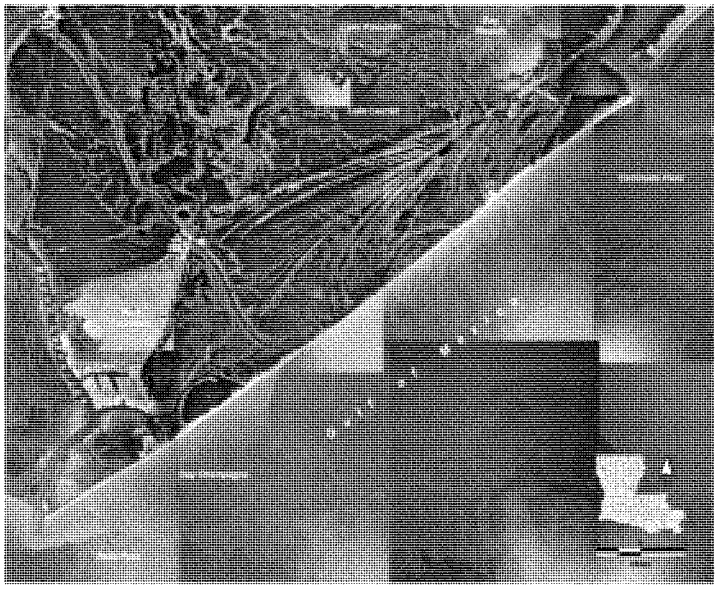

Figure 2: Caminada Headlands

5.1.1 Caminada Headland Reach Purpose:

The purpose of the proposed action is to restore the geomorphic function and unique critical and essential fish and wildlife habitats of the Caminada Headland's barrier system. The study period is fifty years.

The goals and objectives for restoring the Caminada Headland Reach include:

- Sustain and improve shoreline, dune, and interior marsh habitat for essential fish and wildlife species
- Reduce wave energy transmission by providing a natural storm protective buffer for interior marsh and chenier ridge habitats north of Caminada Headland
- Address the severity of erosion along the gulf-front shoreline
- Close the breaches that have occurred due to recent storm and hurricane damage and prevent breaching during the design life
- Vegetate newly created marsh and dune areas
- Provide compatible sediments for marsh, beach and dune restoration
- Avoid impacts to adjacent shorelines from borrow area excavation
- Maintain the Caminada Headland without disrupting the natural hydrologic regime

5.1.2 Caminada Headland Project Area:

The project area lies within the Barataria Basin, which comprises the area between the Mississippi River and Bayou Lafourche. The 13-miles long Caminada Headland located in Lafourche and Jefferson Parishes extends from the Belle Pass jetties at the mouth of Bayou Lafourche on the western end of the headland to Caminada Pass on the eastern end of the headland. The project area is bounded by the Gulf of Mexico to the south and approximately 2250 feet north of the Gulf to the North. The headland maintains the integrity of the gulf shoreline and protects the interior coast from further deterioration. The Caminada Headland consists of narrow and low-lying sand dune and beach berm, barrier marshes, and chenier ridges interspersed with mangrove thickets, coastal dune shrub thickets, lagoons and small bayous. The average dune elevation is estimated to be +3.5 feet North American Vertical Datum of 1988 (NAVD)and the back-barrier marsh was determined to be 0.94 feet NAVD.

5.1.3 Caminada Headland Needs:

The erosional Caminada Headland has historically suffered loss of wetland habitat and diminished function within the gulf shoreline. The marsh, beach, and dune habitats within the project area have undergone significant loss due to storm overtopping and breaching, saltwater intrusion, wind and wave induced erosion, sea level rise, subsidence, and man-made structures. The observed long-term (100 years) average shoreline erosion rate at the Caminada Headland, approximately 45 feet per year, would likely continue for the foreseeable future. The beach has eroded and the dune ridge has been breached by overwash from storm surges at several locations, including multiple shoreline breaches during the 2002, 2004 and 2005 hurricane seasons. Increased stress on the fish and wildlife is expected as various fish and wildlife nursery, feeding, nesting and roosting habitats continue to be lost.

A coastal Louisiana land loss model presented in the LCA Study (USACE 2004) indicates that with no intervention, the Caminada Headland will experience a projected land loss of 3,750 acres from the Headland and 14,780 acres from the area to the north from 2000 to 2050. Only a skeletal framework of natural barrier ridges and spoil banks would remain in 2050. Port Fourchon would be further isolated from the remaining mainland, and could become a detached small barrier island.

5.2 SHELL ISLAND

The Shell Island reach (formerly Lanaux Island) is part of the 24.8-mile long (40-km long) Plaquemines barrier system and is characterized as rapidly retreating remnant barrier islands and spits which enclose shallow bays such as Shell Island Bay and Bastian Bay (**figure 3**). The Shell Island reach extends approximately 5.24 miles (8.43 km) between Grand Bayou Pass on the west to Fontanelle Pass and the Empire jetties on the east. The approximately 1.41-mile long (2.27 km) Shell Island (west) extends from Grand Bayou Pass to Coupe Bob, and is composed primarily of reworked oyster shells

that formed into ridges and swales produced by waves refracting into the entrance to Grand Bayou Pass. Shell Island (east) is approximately 2.54 miles long (4.09 km) and extends from Coupe Bob to Fontanelle Pass. These rapidly retreating barrier islands are becoming increasingly narrower and separated from the remnants of Plaquemines interior marshes.

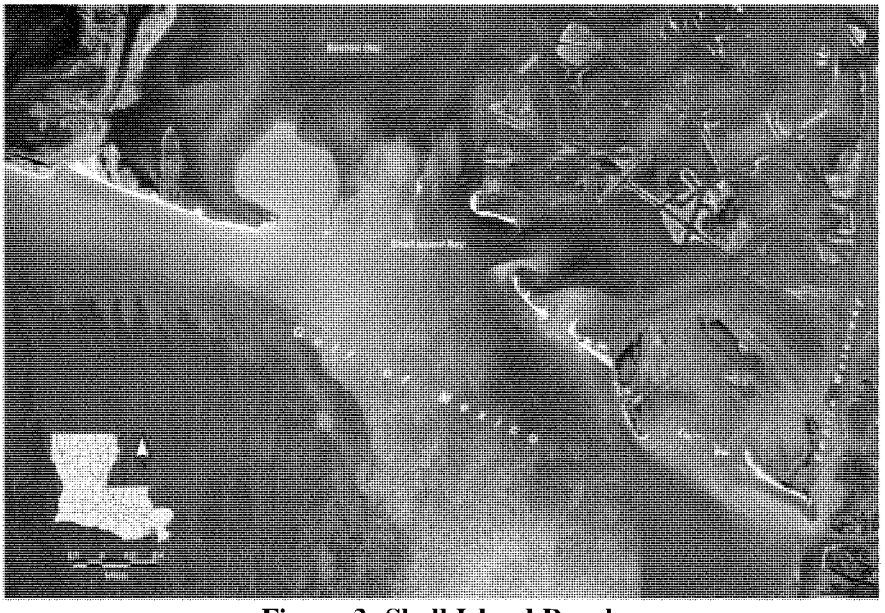

Figure 3: Shell Island Reach

5.2.1 Shell Island Reach Purpose:

The objectives of this project are to reestablish a barrier(s) between a threatened estuarine ecosystem and the Gulf of Mexico, increase the sustainability of the barrier island shoreline system, restore the geomorphic function of the barrier shoreline in the vicinity of Shell Island, restore shoreline, dune, and back-barrier marsh to increase habitat utilization by essential fish and wildlife species both on the barrier island and in the consequently developed quiescent bays.

The goals and objectives for restoring the Shell Island Reach include:

- Achieve 158 acres of dune and supratidal acreage on Shell Island West.
- Achieve 74 acres of marsh (intertidal acreage) on Shell Island West.
- Achieve 223 acres of dune and supratidal acreage on Shell Island East.
- Achieve 191 acres of marsh (intertidal acreage) on Shell Island East.

5.2.2 Shell Island Reach Project Area:

The Barataria/Plaquemines barrier island complex lays approximately 49 miles south-southeast of New Orleans, Louisiana. Tidal creeks, man-made canals, marshlands, sandy barrier islands, and several bays characterize the barrier island complex. The remnants of Shell Island are located between Fontanelle Pass (Empire Jetties) and Grand Bayou Pass. Shell Island used to enclose both Bastian Bay and Shell Island Bay but has since disintegrated into several smaller islands and shoals. The project area is located in Plaquemines Parish.

The project boundaries were defined based on the outer edges of the landmasses digitized from the 2004 DOQQ's. The west end of Shell Island West was included within the project boundary as it was anticipated that area could be affected by construction of any alternative. Existing Shell Island remnants were included within the boundary to incorporate the without project conditions.

5.2.3 Shell Island Reach Needs:

Shoreline recession and erosion have resulted in the disintegration of Shell Island. The few remaining islands and shoal remnants provide limited protection to the back barrier environment from waves and flooding. The construction of the Empire Jetties restricted the east to west long-shore transport and increased the loss rates of Shell Island. Hurricane Bob in 1979 created a new inlet (Coupe Bob) that accelerated retreat and sediment loss.

The average wave height is 2.7 feet. The rate of relative sea level rise is treated as a constant over the 50-year project life, equal to 0.0430 feet/year. Hurricane Bob occurred in 1979. The formation of Coupe Bob caused a quadrupling of the retreat rates of Shell Island and is the major reason for the disintegration of the island. The Empire Jetties were constructed in 1950. The Empire Jetties increased shoreline recession approximately 10 feet/year along the easternmost 5,000 to 8,000 feet of the island

6.0 TENTATIVELY SELECTED PLAN (TSP)

The Tentatively selected plan (TSP) is Alterative 5 - Caminada Headland and Alternative 1 Shell Island.

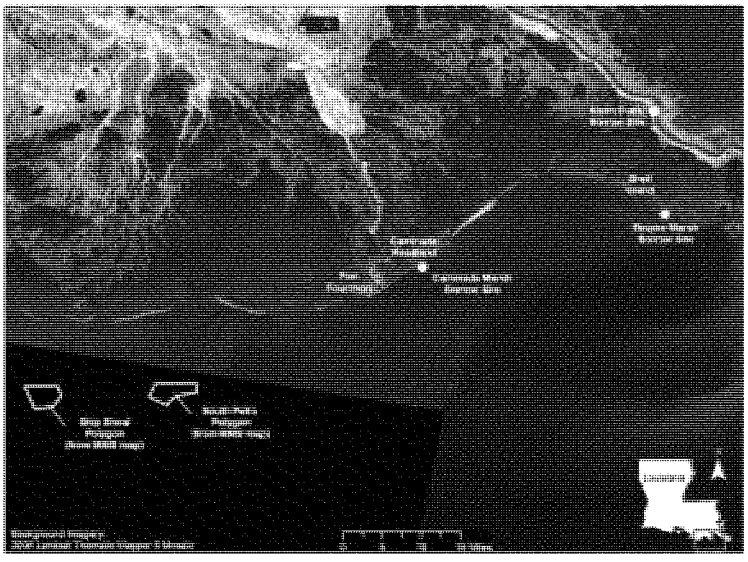

Figure 4: Project Area

6.1 Caminada Headland Alternative 5 – Preferred Dune with Expanded Marsh.

Alternative 5 creates 880 acres of dune/beach and 1186 acres of saline marsh. Figure 4 shows the plan view of Alternatives 5, 6, and 7. Alternative 5 proposes the following:

- Dune heights of +7 feet NAVD with a dune crest width of 290 feet.
- A landward beach and dune component in order to maximize acreage and longevity.
- Landward and seaward slopes are set 20 horizontal to 1 vertical.
- Marsh fill on the landward side of the dune at an elevation of +2.0 feet NAVD.

Fill quantities for the dune and marsh fills are 5.1 and 5.4 million cubic yards, respectively.

6.1.1 Caminada Headland Project Features:

Models applied to determine the benefits of implementing the Alternative 5 include the Barrier Headland model which was applied to the beach and dune components and the Saline Marsh Wetland Value Assessment model (WVA) which was applied to the remainder of the project area (Attachment B).

The direct project boundary for Alternative 5 includes approximately 1,361 acres of existing marsh, dune, supratidal, and gulf intertidal habitats at target year zero. Project construction includes approximately 878 acres of new marsh, dune, supratidal and gulf intertidal habitats for a total of approximately 1582 acres at TY1 with approximately 26 acres of these habitats left at TY50. It should be noted that the newly created acres will cover most of the existing acres in the direct project footprints. There is no renourishment of dune or marsh plan for alternative 5.

Alternative 5	TY 0	TY 1	TY 50
Marsh, supratidal Gulf intertidal habitat	1,361 acres	2,239 acres	26 acres

The 77 acres of existing upland habitat in the indirect project boundary would remain through the fifty year project life.

A significant majority of the marsh acreage is anticipated to disappear through natural subsidence (estimated to be 0.025 feet per year) over the project life.

Dune/Beach Component:

The proposed alternative designs that were moved forward for WVA analysis would include a continuous beach and dune restoration component. The alternatives evaluated have a landward beach and dune component with in order to maximize acreage and longevity. All dune restoration components would also include sand fencing and plantings of native vegetation that is anticipated to promote additional dune elevation growth by capturing Aeolian sands.

The proposed dune height would be designed to +7 feet NAVD which is slightly higher than the existing dune elevation in the area of +3.4 feet NAVD. The proposed dune width would be 290 feet. The majority of the dune is sited landward over existing higher elevations, maximizing acreage and longevity. The advanced fill quantities account for initial losses due to shoreline equilibrium. The landward and seaward slopes are set at a 1-foot vertical to 20-foot horizontal slope (1V:20H). The beach fill template has a 65 ft wide seaward berm at an elevation of +4.5 feet NAVD and a marsh fill template is proposed on the landward side of the dune at an elevation of +2.0 feet NAVD. Approximately 13 miles of dune will be created. Fill quantities for the beach/dune and marsh fills are 6.3 million and 5.4 million cubic yards respectively.

The dune restoration component includes sand fencing and plantings of native vegetation that is anticipated to promote additional dune elevation growth by capturing Aeolian sands

Marsh Component: Alternative 5 includes restoration/creation of a marsh platform contiguous with the Chevron Canal on its northern boundary and the beach and dune fill component along its southern boundary. A constructed marsh elevation of +2.0 feet

NAVD would be used to create a functioning intertidal marsh with no renourishment planned for the 50-year project life. The native marsh elevation for the back-barrier marsh is 0.94 feet NAVD. Mean high water is 1.53 feet NAVD and mean low water is

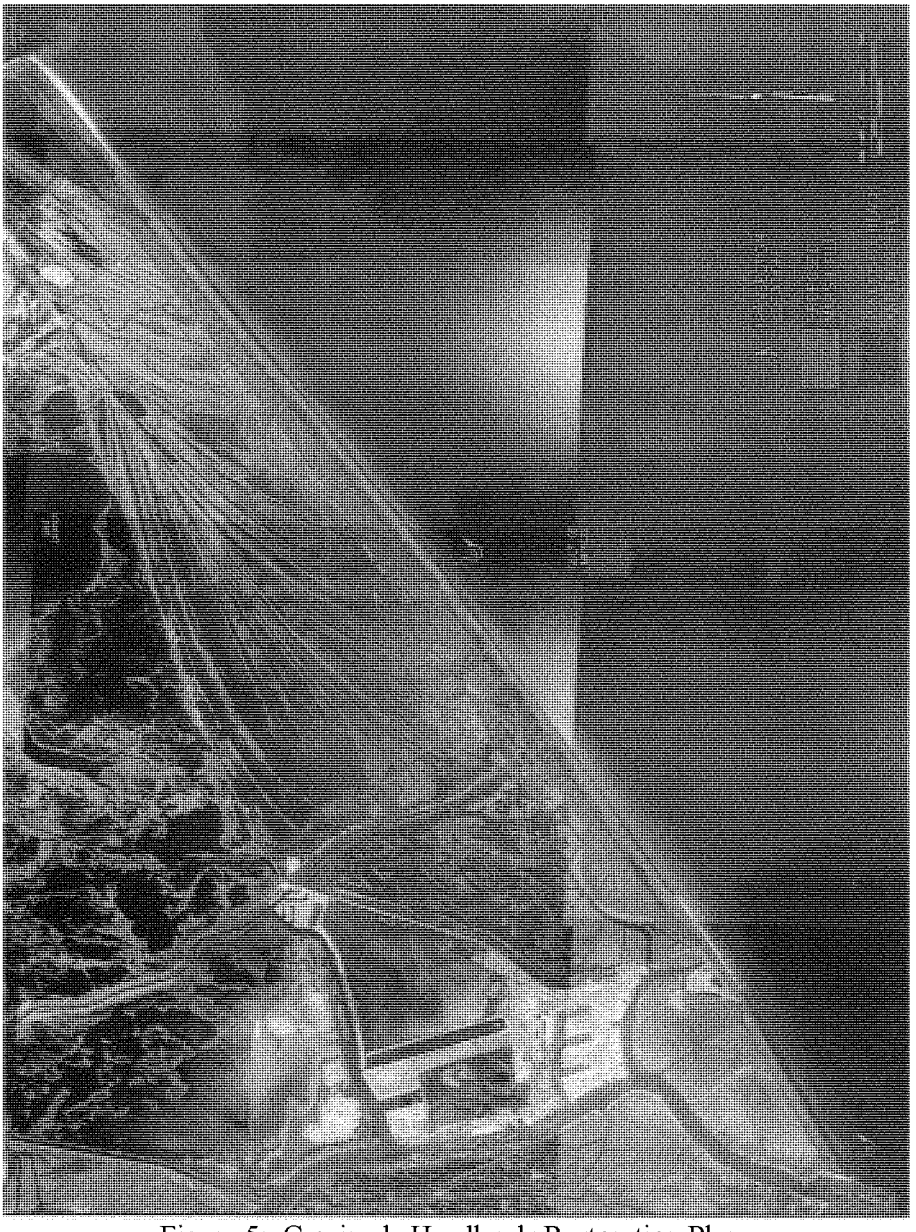

Figure 5: Caminada Headlands Restoration Plan

0.48 feet NAVD and increases over time due to an eustatic sea level rise, demonstrating that the existing marsh is inundated during the tidal cycle.

Neighboring CWPPRA projects (Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration BA-35, Chaland Headland Restoration BA-38, and East and West Grand Terre Island Restoration BA-30) were used to estimate settlement and consolidation of fill material. A sea level rise rate of 2.5 feet per century was used for this analysis.

Temporary containment dikes would be constructed to contain the marsh fill material during construction. The fill material for dike construction would be dredged from within the footprint of the marsh so that the excavated area is filled during construction. The dike volume is included within the marsh fill volume. The marsh fill is proposed on the landward side of the beach and dune. The marsh platform would be planted with appropriate vegetation.

Caminada Headland Alternatives	
	Alt 5 preferred dune w/ expanded marsh
Dune Elevation	+ 7 feet
Dune width	290 feet
Beach width	Advance fill at elevation of +4.5 feet
Beach/dune length	13 miles
Beach/dune quantity fill material	6.3 million cubic yards
Beach/dune renourishment cycle	none
Marsh elevation	+2.0 feet
Marsh quantity fill material	5.4 million cy
Existing marsh, dune, supratidal, & gulf intertidal	1361 acres
New (TY1) marsh, dune, supra, & gulf intertidal	878 acres
Net acres (at TY 50)	26 acres of marsh

Borrow Areas: Material for the dune and beach construction would be borrowed from the South Pelto Block of Ship Shoal. (see Figure 6). Ship Shoal is a large offshore submerged sand body in the Gulf located approximately 50 miles southwest of Belle Pass. A suitability analysis was conducted comparing Caminada sediments to South Pelto Block sediments. The sediments from South Pelto Block were concluded to be suitable for beach and dune restoration. It is recommended that an overfill ratio of 1.08 be used in design volume analysis.

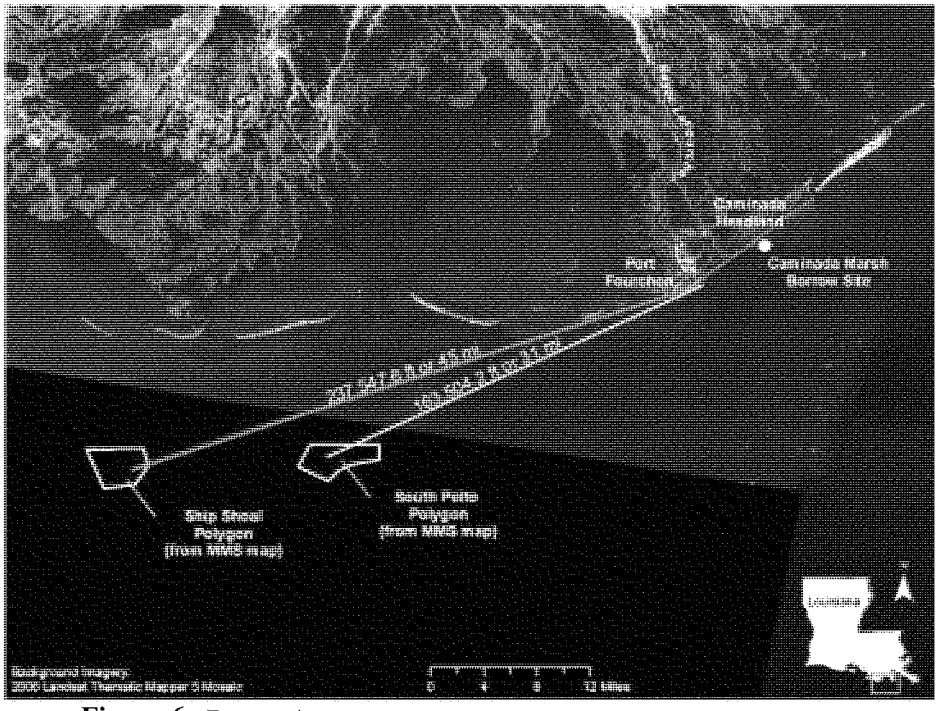

Figure 6: Borrow Areas

6.2 Shell Island Alternative 1: Two Islands with No Re-nourishment

Alternative 1 would restore the Shell Island reach as two islands (Shell Island East and Shell Island West) (Figure 7). Each island would include shoreface, dune ridge, and marsh platform features. The general alignment and configuration of this alternative is based on the restoration feature identified in the LCA Main Report, adapted for current conditions and constraints. Based on cross-shore transport modeling using the SBEACH program, it was determined that the minimum dimensions for the shoreline profile must include a dune crest elevation of at least +5.75 feet and a dune crest width of at least 100 feet. This profile configuration was determined to provide effective barrier island function for the shoreline reach throughout a 50-year evaluation period, assuming that a 50-year storm event would occur during the evaluation period, and a 20-year storm event would occur at the end of the evaluation period. Periodic re-nourishment is not included in this alternative

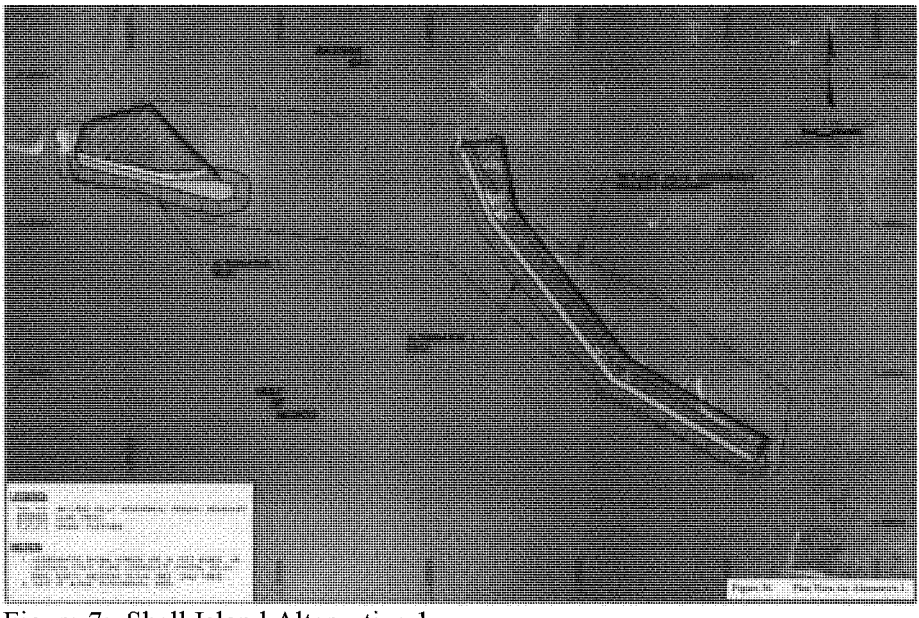

Figure 7: Shell Island Alternative 1

6.2.1 **Shell Island Alternative 1, Shell Island East**

The Shell Island East As-built, TY1 configuration is anticipated to create 126 acres of dune, 297 acres of supratidal, and 47 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 11 acres of as-built dune area.
Alternative 1 includes the following:

- Dune heights of +6 NAVD with dune crest width of 281 feet.
- Crest width would be uniform along the restored shoreline.
- Shoreline would be 15,400 feet in length.
- Landward edge of dune crest for Shell Island East would be located along the mean high water line of the remaining islands. With this alignment, the majority of the sand fill would be placed in front of the existing remnant islands.
- Marsh width would be 525 feet, widening along the northernmost 2,400 feet of the island to just over 1,200 feet wide.

This alignment ensures that the entire active profile height of the shoreface, beach and dune ridge is armored with sand. By preventing the exposure of the mixed sediment of the existing island to wave and storm processes, the rate of shoreline retreat rates will be reduced significantly from current trends.

The shoreline recession rates are 12.4 feet/year for Shell Island East. Subtidal acreage decreases following construction because parts of the subtidal acreage are located within the construction footprint

6.2.2 **Shell Island Alternative 1, Shell Island West**

The Shell Island West As-built, TY1 configuration is anticipated to create 51 acres of dune, 192 acres of supratidal, and 21 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 8 acres of as-built dune area. All of the beach and marsh fill placed during construction of Shell Island West will have eroded in 23 years (TY25), leaving pre-construction conditions. By TY25 Shell Island West will have receded to the point where there is no supratidal acreage. Once the supratidal acreage is lost, it was assumed that the marsh would be exposed to wave action from the Gulf and that the marsh would recede at the gulf retreat rate.

The shoreline recession rates are 34.9 feet/year for Shell Island West. Subtidal acreage decreases following construction because parts of the subtidal acreage are located within the construction footprint.

The volume of sand that could be lost into Coupe Bob every year from the two-island option is approximately 101,000 cubic yards. At this rate it would take Coupe Bob approximately 33 years to reach its accommodation volume of 3.3 million cubic yards. It is unlikely that Coupe Bob will reach its accommodation volume given that the total volume of sand fill placed in Alternative 1 is 4.1 million cubic yards but it does suggest that little natural bypassing of sand should be expected across Coup Bob.

- Dune heights of +6 NAVD with dune crest width of 250 feet.
- Shoreline restoration would extend partially into Coupe Bob, extending the length of the barrier shoreline provided by existing islands.
- Marsh platform extends along 4,500 feet of shoreline, with a maximum width of 2,300 feet. Shell Island west follows the restoration feature outline described in the LCA Main Report.

The post-construction marsh volumes are calculated based on the post-construction elevation of +2.5 feet NAVD. Settlement of the marsh material will lower the marsh elevation to the upper elevation of the bay intertidal range of +2 feet within one year.

Constructing the marsh elevation at an elevation of +2.5 feet NAVD will result in a marsh that will become bay intertidal during TY2 (2011) and remain bay intertidal until TY50 (2059). The marsh will be continually submerged (average elevation below mean low water) after TY34 (2043). The long term goal of maintaining the marsh elevation above elevation 0 feet NAVD at TY50 can only be achieved by increasing the construction elevation above +2.6 feet NAVD but this increases the time required for the marsh to subside to the mean high water level, and so reduces project benefits in the near term. Total fill quantities for the beach/dune and marsh fill are 4.1 million cubic yards of sand and 1.9 million cubic yards of sediment respectively.

Dune/Beach Component: The alternatives include a beach and dune fill to reestablish a sustainable barrier island shoreline system, thus restoring the geomorphic function and increasing the habitat utilization by fish and wildlife species. The construction cross-section was based on templates used for projects previously constructed in Louisiana. The dune design is to +6feet, NAVD with a back- and fore-slopes of 1V:45H. The dune crest width varies by alternative. Other barrier island projects in Louisiana have used a steeper construction slope (1V:30H) on the bayward side because these islands have been relatively intact and the island provides a means of fill retention, allowing steeper slopes to be constructed. Most of Shell Island will be constructed in open water or on scattered island remnants. The +6.0 feet, NAVD dune elevation is above the 20-year return period surge elevation (+5.9 feet, NAVD).

The crest width of the dune is a function of the purpose of the individual alternatives. The dune width for Alternative 1 is based on a cost and target acreage goals that dictate the volume and cross-section width. Alternative 2 through 8 will be based on a design width plus various advanced nourishment width.

The beach profile equilibration process assumes that there is only cross-shore redistribution of sediment and that sand volume is conserved. It is estimated that the mean high water shoreline will retreat approximately 20 feet due to profile equilibration.

Construction of sand fencing and planting of vegetation along the dune will promote additional elevation growth of the dune by holding the blowing sand. A 5-foot wide +9 feet NAVD additional dune element was added to the top of the construction template to simulate this increase in dune elevation. It was assumed that this additional dune feature would take approximately 1 year to form.

A beach nourishment cross-section consist of two primary components: 1) the design section, which is the fill volume required at TY50 to meet applicable project goals, and 2) advanced nourishment, which is the sacrificial portion of the fill that will erode over the 50-year project life. Sufficient advanced nourishment can be added during construction or replaced periodically during renourishment projects. Advanced fill is distributed non-uniformly to account for diffusion losses, longshore losses, and tidal inlet losses, that vary along the project length.

Marsh Component: The proposed marsh construction elevations were based on developing an intertidal marsh over the life of the 50-year project, considering the rate of relative sea level rise, and consolidation of placed and subgrade sediments. The average elevation of the existing marsh platform on Shell Island was determined to be approximately +1.1 feet, NAVD. This elevation is comparable to other marsh platforms in the area such as East Grand Terre, Chaland Headland, and Pelican Island. The 2005 mean high water and mean low water elevations are +1.63 feet and +0.58 feet, NAVD respectively, demonstrating that the existing marsh is inundated during the tidal cycle.

The proposed marsh platform has a 50-year project life. The critical goal is to construct a marsh platform that maintains an elevation between mean high water and mean low water through TY50. With an assumed start date of 2009, the mean high water and mean low water elevations will rise from +1.64 feet to +2.26 feet, NAVD and +0.58 feet to 1.23 feet, NAVD, respectively.

This is due to an average eustatic sea level rise of 0.013 feet/year. Therefore, the marsh was designed to obtain a marsh elevation above +1.2 feet, NAVD at TY50. The marsh platform will have to be renourished periodically over the life of the project so that it remains within the tidal zone.

Temporary containment dikes are proposed to contain the marsh fill material during construction. The material for dike construction will be dredged from within the footprint of the marsh so that the excavated area is filled during construction. The dike volume is included within the marsh fill volume.

Borrow Areas: It is expected that two borrow sources will be used for this project: a high-quality sand source for the beach-dune portion of the project and an offshore mixed-sediment deposit to be used for the marsh construction. It was assumed that the Mississippi River is the source of high-quality sand that would be used for this project. The Empire borrow area is assumed to be used for the marsh construction. The Empire borrow area was previously evaluated and is expected to be used for the Pelican Island Restoration Project. This will leave the borrow needs for this project short. It is expected that more sediment is out there and further investigations are needed.

Several other borrow areas were suggested for investigations for use of mixed sediments for marsh restoration, primarily including Empire, Quatre Bayou deep (will be partially used for the restoration of Chaland Headland), Quatre Bayou D2, and Sandy Point (farthest away). Others were discussed and further investigation is recommended to find the closest mixed sediment source for marsh restoration. Ship Shoal was also discussed as another source of high quality sands for beach-dune creation. However, the distance to the project site makes this sand source prohibitively expensive.

As-built Conditions: On both Shell Island East and West approximately 336 acres of the TY1 supratidal acres are marsh platform areas that will be above +2.0 feet immediately after construction. Based on settlement curves and elevations of existing marsh, it is projected that all of the marsh platform will settle to intertidal range by TY3.

Shell Island East - As-built, TY1 configuration is anticipated to create 126 acres of dune, 297 acres of supratidal, and 47 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 11 acres of as-built dune area.

Shell Island West - As-built, TY1 configuration is anticipated to create 51 acres of dune, 192 acres of supratidal, and 21 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 8 acres of as-built dune area. All of the beach and marsh fill placed during construction of Shell Island West will have eroded in 23 years (TY25), leaving pre-construction conditions. By TY25 Shell Island West will have receded to the point where there is no supratidal acreage. Once the supratidal acreage is lost, it was assumed that the marsh would be exposed to wave action from the Gulf and that the marsh would recede at the gulf retreat rate.

The shoreline recession rates are 34.9 feet/year for Shell Island West and 12.4 feet/year for Shell Island East. Subtidal acreage decreases following construction because parts of the subtidal acreage are located within the construction footprint.

The volume of sand that could be lost into Coupe Bob every year from the two-island option is approximately 101,000 cubic yards. At this rate it would take Coupe Bob approximately 33 years to reach its accommodation volume of 3.3 million cubic yards. It is unlikely that Coupe Bob will reach its accommodation volume given that the total volume of sand fill placed in Alternative 1 is 4.1 million cubic yards, but it does suggest that little natural bypassing of sand should be expected across Coupe Bob.

6.3 Restoration Features Common to Both Action Alternatives.

In addition to the specifics discussed above, all of the alternative plans for the Caminada and Shell Island reaches include various scales of dune and marsh planting, as well as sand fencing as separable elements to be incorporated into the alternative plans.

6.3.1 Dune and Marsh Plantings

Dune plantings will promote the growth of dunes by capturing Aeolian sand. In the marsh, the plants' roots will stabilize soils quickly to help consolidate the marsh creation areas. Plantings will also accelerate the restoration of the habitats. The types of plants used for dune and marsh planting should offer some degree of vegetative diversity, including woody vegetation (e.g., mangroves, wax myrtle, maritime live oaks) and grasses. Dune plants will consist of a variety of dune species, including bitter panicum (*Panicum amarum* var amarum "Fourchon"), sea oats (*Uniola paniculata* "Caminada"), marshhay cordgrass (*Spartina patens* "Gulf Coast"), and gulf cordgrass (*Spartina spartinae*). Marsh plants will consist of mainly smooth cordgrass (*Spartina alterniflora* "Vermilion") and black mangrove (*Avicennia germinans* "Pelican"). Other plants that should be considered to add diversity include seacoast bluestem (*Schizachyrium maritimum*), seashore dropseed (*Sporobolous virginicus*), and salt grass (*Distichlis spicata*). At the end of the proposed construction, key species will be planted and grasses will be seeded.

6.3.2 Sand Fencing

Construction of sand fencing will promote the growth of the dunes by capturing Aeolian sand. One shore-parallel fence will be installed approximately 50 feet north of the southern toe of the dune to continue the capture of transported sand until the surface is vegetated. The sand fence will extend along the total length of the constructed dune. Sand fences will be installed in sequences/phases. The installation should start from the southern side of the dune so as to build dune towards the Gulf and proceed north. Additional rows of sand fencing may be added once the existing sand fence is full (i.e., sand is stacked up to the top of the fence).

A detailed description of the TSP is included in **Chapter 2 Alternatives** of the integrated feasibility and EIS report. Historic and existing conditions for significant resources are discussed in **Chapter 3 Affected Environment** of the report. The future without conditions and the direct, indirect, and cumulative impacts of those plans carried over for detailed analysis, including the TSP, are discussed in **Chapter 4 Environmental Consequences** of the integrated report.

7.0 DESCRIPTION OF SPECIES AND STATUS WITHIN THE PROPOSED ACTION AREA

There are 25 animal and 3 plant species, under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS), presently classified as threatened or endangered within the state of Louisiana. The USFWS and NMFS share jurisdictional responsibility for sea turtles and the gulf sturgeon. Of the 12 species listed, only two are likely to be observed within the project area: the piping plover (Charadrius melodus) and brown pelican (Pelecanus occidentalis)

Table 4. Threatened (T) and Endangered (E) Species potentially in LaFourche Parish

Common Name	Scientific name	Federal Status	State Status
Bald eagle	*Haliaeetus leucocephalus*	P	P
Brown Pelican	*Pelecanus occidentalis*	E	E
Green sea turtle	*Chelonia mydas*	T	T
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	E
Leatherback sea turtle	*Dermochelys coriacea*	E	E
Loggerhead sea turtle	*Caretta caretta*	T	T
Piping plover	*Charadrius melodus*	T; Critical Habitat	T

Source: United States Fish and Wildlife Service (USFWS; April 2003).
(P = protected; T = Threatened; E = Endangered)

7.1 Bald Eagle.

The bald eagle is the only species of sea eagle native to North America. Adults are black with a snow-white head and tail. Sub adults are mottled brown and black and lack the

distinctive white head and tail. Wingspan is 6 to 7 feet with females weighing between 10-14 lbs. and males weighing between 8-10 lbs.

Bald eagles nest in Louisiana from October through mid-May, primarily in cypress snags in swamps or near fresh to intermediate marshes or open water in the southeastern parishes. Bald eagles will often return to the same nest for a number of years; however, they may also use alternate nests within the vicinity. Shoreline trees that provide a clear view of the water to locate aquatic prey are often chosen as nest sites. Bald eagles primarily feed on fish, but are opportunistic and will eat a variety of mammals, amphibians, crustaceans, and birds. Wintering habitat used by bald eagles in Louisiana is characterized by abundant, readily available food sources. Most wintering areas are associated with open water where eagles feed on fish or waterfowl.

The USFWS has indicated that there are no known bald eagle nests in the vicinity of the project area (Walther, 2007). In addition, neither the LDWF nor the National Audubon Society Christmas Bird Count has reported any sightings of the bald eagle in the project area. If a bald eagle nest is found within 1,500 feet of the project area, the USFWS would need to be contacted to develop measures (e.g., spatial restrictions around active bald eagle nests) to avoid impacts on this species.

7.2 Green Sea Turtle (*Chelonia mydas*).

Breeding populations of the green sea turtle in Florida and the Pacific coast of Mexico are listed as endangered, all others are listed as threatened under the Endangered Species Act of 1973, as amended, on July 28, 1978 (43 FR 32800). Critical habitat for the green sea turtle was designated on September 2, 1998 (63 FR 46701); critical habitat was redesignated and amended on March 23, 1999 (64 FR 14067). Critical habitat has also been designated for waters surrounding Culebra Island, Puerto Rico (50 CFR 226.208).

Although green sea turtles are found worldwide in oceans and gulfs with water temperatures greater than 68°F (20°C), their distribution can be correlated to grassbed distribution, location of nesting beaches, and associated ocean currents (Hirth 1971; Perrine 2003; Spotila 2004). Long migrations are often made between feeding and nesting grounds (Carr and Hirth 1962). Within Louisiana waters, these turtles probably occur all along the coast and may nest on the Chandeleur Islands (Dundee and Rossman 1989). Population decline has been attributed to heavy fishing pressure and human nest predation (Dundee and Rossman 1989; Perrine 2003; Spotila 2004). Historically, green sea turtles were fished off the Louisiana coast, especially the Chandeleur Islands (Rebel 1974; http://www.wlf.state.la.us/apps/netgear/index.asp?cn=lawlf&pid=703). Exploitation and incidental drowning in shrimp trawls has contributed to the decline of this species and its eventual listing (King 1981). During their first year of life, green sea turtles are primarily carnivorous, feeding mainly on invertebrates. Green turtles are the only sea turtles that eat large amounts of plants, feeding in shallow water areas with abundant seagrasses or algae (Fritts et al. 1983; Spotila 2004). Green sea turtles also feed on invertebrates and carrion (Dundee and Rossman 1989). The green sea turtle grows to

the second largest size of any sea turtle, with a maximum shell length of 55 inches (140 cm) and a maximum weight of 517 lbs (235 kg), but most are considerably smaller (Perrine 2003).

The turtles migrate from nesting areas to feeding grounds, which are sometimes several thousand miles away. Most turtles migrate along the coasts, but some populations are known to migrate across the ocean from nesting area to feeding grounds. The major nesting beaches are always found in places where the seawater temperature is greater than 77°F (25°C). As a species that migrates long distances, these turtles face special problems associated with differing attitudes toward conservation in different countries. Green turtles are the only sea turtles known to come ashore for purposes other than nesting. Both immature and adult green sea turtles are known to bask (Perrine 2003).

In the southeastern United States, green sea turtles are found around the U.S. Virgin Islands, Puerto Rico, and the continental U.S. from Texas to Massachusetts. Important feeding grounds in Florida include Indian River Lagoon, the Florida Keys, Florida Bay, Homosassa, Crystal River and Cedar Key. The primary nesting sites in U.S. Atlantic waters are along the east coast of Florida, with additional sites in the U.S. Virgin Islands and Puerto Rico.

Green sea turtles are also found throughout the North Pacific, ranging as far north as Eliza Harbor, Admiralty Island, Alaska, and Ucluelet, British Columbia. In the eastern North Pacific, green sea turtles have been sighted from Baja California to southern Alaska. In the central Pacific, green sea turtles can be found at most tropical islands. In U.S. Hawaiian waters, green sea turtles are found around most of the islands in the Hawaiian Archipelago. The primary nesting site is at French Frigate Shoals (http://www.nmfs.noaa.gov/prot_res/species/turtles/green.html).

Female green sea turtles lay one to seven clutches of eggs in a single nesting season with each clutch contains an average of 110 eggs (Spotila 2004). The number of nests has been estimated to be between 350 to 2,300 nests annually. Green sea turtles nest at 2-, 3-, or 4-year intervals. This nesting activity indicates a population of less than 1,000 females in the breeding population of Florida and Mexico. It takes longer for a green turtle to reach maturity than any other sea turtle, typically living 45-59 years (Spotila 2004).

The USFWS web site (http://ecos.fws.gov/species_profile/servlet/gov.doi.species_profile.servlets.SpeciesProfile?spcode=C00S) and the NMFS web site (http://www.nmfs.noaa.gov/prot_res/species/turtles/green.html) provides a species account of the green sea turtle. Additional information on green sea turtles is provided by Carr (1952), Carr and Hirth (1962), Hirth (1971; 1980), Rebel (1974), Dundee and Rossman (1989), Perrine (2003) and Spotila (2004) provide recent summaries of green sea turtle biology, behavior and conservation.

7.3 Hawksbill Sea Turtle (*Eretmochelys imbricata*).

The endangered Hawksbill Sea Turtle is one of seven species of sea turtles found throughout the world. One of the smaller sea turtles, it has overlapping scutes (plates) that are thicker than those of other sea turtles. This protects them from being battered against sharp coral and rocks during storm events. Adults range in size from 30 to 36 inches (0.8-1.0 meters) carapace length, and weigh 100 to 200 pounds (45-90 kilograms). Its carapace (upper shell) is an attractive dark brown with faint yellow streaks and blotches and a yellow plastron (under shell). The name "hawksbill" refers to the turtle's prominent hooked beak.

The hawksbill sea turtle is one of the most infrequently encountered sea turtles in offshore Louisiana. However, a hawksbill was reported near Calcasieu Lake in 1986 (Fuller *et al.*, 1987). Hawksbills generally inhabit coastal reefs, bays, rocky areas, passes, estuaries, and lagoons, where they are found at depths of less than 70 feet. Nesting occurs on undisturbed, deep-sand beaches, from high-energy ocean beaches to tiny pocket beaches several meters wide bounded by crevices of cliff walls; these beaches are typically low-energy, with woody vegetation near the waterline. In the continental United States, nesting sites are restricted to Florida where nesting is sporadic at best (NOAA Fisheries/USFWS, 1993). Due to the lack of suitable foraging and nesting habitats, there is a low probability of this species occurring within the project area.

7.4 Kemp's Ridley Sea Turtle (*Lepidochelys kempii*).

On December 2, 1970 the Kemp's ridley sea turtle was designated as endangered across its entire range (35 FR 18319). Critical habitat has been proposed (October 4, 1978 (43 FR 45905); November 29, 1978 (43 FR 55806)) but has not been finalized to date. This species has continued to decline in Louisiana (USFWS 1990). The Kemp's ridley is the rarest, most endangered, and enigmatic of all sea turtles (Perrine 2003; Spotila 2004). However, this small sea turtle is believed to be the most frequently encountered (Dundee and Rossman 1989), if not the most abundant sea turtle, off the Louisiana coast (Viosca 1961).

The Kemp's ridley has the most limited distribution of any sea turtles except the Australian flatback (Perrine 2003). For the most part, breeding is confined to a limited stretch of beach on the Gulf coast of Mexico. The known range of this species includes the Gulf of Mexico and the Atlantic Ocean. The current range for Kemp's ridley in the United States includes marine habitat of the following coastal states: Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas.

Inshore areas of the Gulf of Mexico appear to be important habitat for Kemp's ridleys, as they tend to concentrate around the mouths of major rivers (Frazier 1980). Members of this genus are characteristically found in waters of low salinity and high turbidity and organic content, where shrimp are abundant (Zwinenberg 1977; Hughes 1972 as cited in Frazier 1980;). Kemp's ridleys have been collected in Louisiana from Lake Borgne,

Barataria and Terrebonne Bays, and near Calcasieu Pass (Dundee and Rossman 1989). Occurrence of these sea turtles in bays and estuaries along the Louisiana coast would not be unexpected, as many of their primary food items occur there. Stomach analyses of specimens collected in shrimp trawls off Louisiana revealed crabs, gastropods, and clams (Dobie et al. 1961). Although Kemp's ridleys are considered primarily carnivorous benthic feeders (Ernst and Barbour 1972), jellyfish as well as by-catch from shrimp trawlers have been reported as part of their diet (Landry 1986).

The USFWS web site (http://ecos.fws.gov/species_profile/SpeciesProfile?spcode=C00O) and the NMFS web site (http://www.nmfs.noaa.gov/pr/species/turtles/kemps.html) provide a species account of the Kemp's ridley sea turtle. Additional information on the Kemp's ridley sea turtle includes Hughes (1972), Pritchard and Marquez (1973), Zwinenberg (1977), Fuller (1978), Carr (1980), and Fuller and Tappen (1986). More recently, Perrine (2003) and Spotila (2004) provide summaries of Kemp's ridley sea turtle biology, behavior and conservation.

7.5 Leatherback Sea Turtle (*Dermochelys coriacea*).

The leatherback sea turtle was listed as an endangered species throughout its range on June 2, 1970 (35 FR 8491). Critical habitat was designated on September 26, 1978 (43 FR 43688), March 23, 1979 (44 FR 17710), and March 23, 1999 (64 FR 14051). Critical habitat has been designated for shoreline and adjacent waters of the U.S. Virgin Islands (50 CFR 17.95; 50 CFR 226.207). The leatherback is found throughout the tropical waters of the Atlantic, Pacific, and Indian Oceans (Ernst and Barbour 1972), the Gulf of Mexico, and the Caribbean (Carr 1952). Critical habitat for the leatherback includes the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands, up to and inclusive of the waters from the hundred fathom curve shoreward to the level of mean high tide with boundaries at 17°42'12" N and 64°50'00" W. This turtle exhibits seasonal fluctuations in distribution in response to the Gulf Stream and other warm water features (Pritchard 1971; Hirth 1980; Fritts et al. 1983). During the summer, leatherbacks tend to be found along the east coast of the U.S. from the Gulf of Maine south to mid-Florida.

Nesting occurs from February through July at sites located from Georgia to the U.S. Virgin Islands. Nesting leatherbacks occur along beaches in Florida, Nicaragua, and islands in the West Indies; however, no nesting has been reported in Louisiana (Gunter 1981, Dundee and Rossman 1989). In Louisiana, leatherbacks are believed to occur offshore in deep waters; however, they have been collected from or sighted in Cameron Parish, Atchafalaya Bay, Timbalier Bay, and Chandeleur Sound (Dundee and Rossman 1989).

The USFWS web site (http://ecos.fws.gov/species_profile/servlet/gov.doi.species_profile.servlets.SpeciesProfile?spcode=C00F) and the NMFS web site (http://www.nmfs.noaa.gov/pr/species/turtles/leatherback.html /) provide a species account of the leatherback sea turtle. Additional information on the leatherback sea turtle

includes Pritchard (1971), Earnst and Barbour (1972), and Fritts et al. (1983). Perrine (2003) and Spotila (2004) provide recent summaries of leatherback sea turtle biology, behavior and conservation.

Leatherback turtles are omnivorous but feed primarily on jellyfish and other cnidarians, and have been associated with large schools of cabbage head jellyfish *(Stomolophus meleagris)*. Fritts et al. (1983) reported that these turtles also ingest plastic, apparently mistaking it for food.

The leatherback is found throughout the tropical waters of the Atlantic, Pacific, and Indian Oceans (Ernst and Barbour 1972), the Gulf of Mexico, and the Caribbean (Carr 1952). Critical habitat for the leatherback includes the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands, up to and inclusive of the waters from the hundred fathom curve shoreward to the level of mean high tide with boundaries at 17°42'12" N and 64°50'00" W. This turtle exhibits seasonal fluctuations in distribution in response to the Gulf Stream and other warm water features (Pritchard 1971; Hirth 1980; Fritts et al. 1983). During the summer, leatherbacks tend to be found along the east coast of the U.S. from the Gulf of Maine south to mid-Florida.

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Leatherbacks are seriously declining at all major nesting beaches throughout the Pacific. The decline is dramatic along the Pacific coasts of Mexico, Costa Rica and Malaysia. Nesting along the Pacific coast of Mexico declined at an annual rate of 22 percent over the last 12 years, and the Malaysian population represents 1 percent of the levels recorded in the 1950s. The collapse of those nesting populations was precipitated by a tremendous over-harvest of eggs, direct harvest of adults, and incidental mortality from fishing. In the Atlantic and Caribbean, the largest nesting assemblages are found in the U.S. Virgin Islands, Puerto Rico, and Florida. Nesting data for these locations have been collected since the early 1980s and indicate that the annual number of nests is likely stable; however, information regarding the status of the entire leatherback population in the Atlantic is lacking. Nesting activity has also declined in French Guiana due to erosion of nesting beaches. The population appears to have shifted to Surinam, where annual numbers of nests rose from less than 100 in 1967 to 5,565 in 1977 and 9,816 in 1987. Current estimates are that 20,000 to 30,000 female leatherbacks exist worldwide.

7.6 LOGGERHEAD SEA TURTLE (*Caretta caretta*).

The loggerhead sea turtle was listed as a threatened species on July 28, 1978 (43 FR 32800). Critical habitat has been proposed (October 4, 1978 (43 FR 45905); November 29, 1978 (43 FR 55806); and March 19, 1980 (45 FR 17588)) but has not been finalized. Loggerheads are circumglobal, inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. In the Atlantic, the loggerhead turtle's range extends from Newfoundland to as far south as Argentina. During the summer, nesting occurs in the lower latitudes. The primary Atlantic nesting sites are along the east coast of Florida, with additional sites in Georgia, and the Carolinas; some nesting also occurs on the Gulf Coast of Florida. In the eastern Pacific, loggerheads are reported as far north as Alaska, and as far south as Chile. Occasional sightings are also reported from the coast of Washington, but most records are of juveniles off the coast of California. Southern Japan is the only known breeding area in the north Pacific (http://www.nmfs.noaa.gov/prot_res/species/turtles/loggerhead.html).

The loggerhead sea turtle has continued to decline in Louisiana (USFWS 1990). Perrine (2003) and Spotila (2004) provide recent summaries of loggerhead sea turtle biology, behavior and conservation. Loggerheads are capable of living in a variety of environments, such as in brackish waters of coastal lagoons and river mouths. During the winter, they may remain dormant, buried in the mud at the bottom of sounds, bays, and estuaries. The major nesting beaches are located in the southeastern United States, primarily along the Atlantic coast of Florida, North Carolina, South Carolina, and Georgia. Only minor and solitary nesting has been recorded along the coasts of the Gulf of Mexico.

The largest of the hard-shell sea turtles, the loggerhead is distributed worldwide in temperate and tropical bays and open oceans. Loggerheads probably range all along the Louisiana coast; however, Dundee and Rossman (1989) reported specimens only from Chandeleur Sound, Barataria Bay, and Cameron Parish. The population decline of loggerheads can be attributed to egg and nestling predation by mammals and birds (Dundee and Rossman 1989).

Nesting on the Gulf Coast occurs between the months of April and August, with 90 percent of the nesting effort occurring on the south-central Gulf Coast of Florida (Hildebrand 1981). Although loggerheads have been documented as nesting on the Chandeleurs in 1962 and Grand Isle in the 1930s, it is doubtful whether this species currently successfully nests on the Louisiana coast (Hildebrand 1981, Dundee and Rossman 1989). The loggerhead's diet includes marine invertebrates such as mollusks, shrimp, crabs, sponges, jellyfish, squid, sea urchins, and basket stars (Caldwell et al. 1955, Hendrickson 1980, Nelson 1986). Landry (1986) suggested that these turtles may also feed on discarded by-catch from shrimp trawling. Adult loggerheads feed in waters less than 50 meters deep, while the primary foraging areas for juveniles appears to be in estuaries and bays (Nelson 1986, Rabalais and Rabalais 1980).

The USFWS web site (http://ecos.fws.gov/species_profile/servlet/gov.doi.species_profile.servlets.SpeciesProfile?spcode=C00U) and the NMFS web site

(http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.html) provide a species account of the loggerhead sea turtle. Additional information on the loggerhead sea turtle includes Caldwell et al. (1955), Hendrickson (1980), Hildebrand (1981), Landry (9186), and Nelson (1986).

7.7 GULF STURGEON (*Acipenser oxyrhynchus desotoi*)

A Federally listed as a threatened species, is an anadromous fish that occurs in many rivers, streams, and estuarine waters along the northern Gulf coast between the Mississippi River and the Suwannee River, Florida. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Adults and sub-adults may be found in those rivers and streams until November and in estuarine or marine waters during the remainder of the year. Sturgeon less than two years old appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations such as those caused by water control structures that limit and prevent spawning, poor water quality, and over-fishing have negatively affected this species.

Based on distribution information from the NOAA Fisheries (2007), the present range of the Gulf sturgeon extends from Lake Pontchartrain and the Pearl River system in eastern Louisiana and western Mississippi east to the Suwannee River is Florida. The project area is not within the current range of the Gulf sturgeon.

7.8 SPECIES OBSERVED IN THE STUDY AREA

7.8.1 Piping Plover (Charadrius melodus)

7.8.1.1 Description of Species.

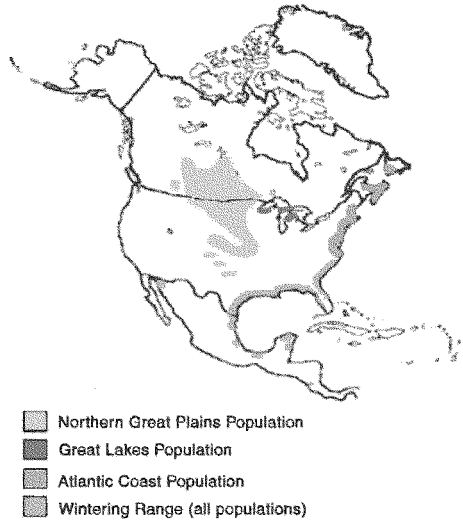
The piping plover, (*Charadrius melodus),* is a small shorebird approximately 7 inches in length with a wingspan of approximately 15 inches and weighs from 1.5 to 2 ounces. It is sand-colored on the back with white undersides. The piping plover is distinguished from similar species by its bright orange legs. During the breeding season, the plover has a single black band across its breast and forehead, which are absent during the winter.

The piping plover is named for its melodic mating call. It is a small, pale-colored North American shorebird. The bird's light sand-colored plumage blends in with sandy beaches and shorelines. There are three populations of piping plovers in the United States. The most endangered is the Great Lakes breeding population, which encompasses only 32 breeding pairs. The Northern Great Plains and Atlantic Coast populations are classified as threatened and include 1398 and 1372 breeding pairs, respectively. All piping plovers winter along the southeast and Gulf coasts and are classified as threatened in their wintering habitat (USFWS, 2000). Major threats to the piping plover include the loss and

degradation of habitat due to development, disturbance by humans and pets, and predation.

7.8.1.2 Distribution of Species.

The historical breeding range in North America of the piping plover included the Atlantic coastal beaches from Newfoundland to South Carolina; beaches of the Great Lakes; and the northern Great Plains region from Alberta to Ontario and south to Nebraska (USFWS, 1988). These populations were reported to winter along the Gulf of Mexico, the Atlantic coast from North Carolina to Florida, eastern Mexico, and in the Caribbean Islands (Haig and Oring, 1985). Approximately 35 percent of the total breeding piping plover population winters along the Gulf coast from Florida to Texas and represents 56 percent of the Great Lakes/Great Plains population (Natureserve 2002, 2003)



The population potentially occurring within the proposed project area is the Great Lakes population. They arrive from their northern breeding grounds as early as late July and may be present for 8 to 10 months of the year.

Northward migration to the breeding grounds occurs during late February, March, and early April (Patterson 1988, MacIvor 1990). Plovers will breed at 1 year of age (MacIvor 1990, Strauss 1990, Haig 1992) and are monogamous, but usually shift mates between years (Wilcox 1959, Haig and Oring 1988, MacIvor 1990).

Southward migration to the wintering grounds along the southern Atlantic coast and Gulf of Mexico shoreline extends from late July through September. Individuals can be found on their wintering grounds throughout the year but sightings are rare in May, June, and early July (USFWS 2001a).

7.8.1.3 Habitat.

Ideal wintering habitat for the piping plover on the Gulf of Mexico coast would contain large sand flats or sand-mud flats adjacent to a tidal pass or tidal inlet (Haig 1985, Nicholls 1989). A thin layer of mud covering the sand seems to attract plovers, due to possible food or refuge association (Nicholls 1989). Nicholls observed that barrier beaches with over wash areas or sections of old marshes also attract plovers. A gulf-facing beach having a very low gradient, thus an increased intertidal zone, offers an

almost equally attractive area (Haig 1985). Also piping plovers will inhabit spoil islands on the Gulf Intercoastal Waterway on both Atlantic and Gulf Coasts. Birds are frequently associated with bays, lagoons and inlets. Winter 2001 census observations were in the following habitat types: mudflats (36.3%), sandy beaches (33.2%), sand/salt flats (23.1%) algal mats (2.8%), oyster reefs (1.0%) and gravel shores (0.1%; Haig 2004).

In July of 2001, the USFWS designated specific areas in the United States as critical habitat for wintering piping plovers (Federal Register / Vol. 66, No. 132, 10 July 2001). Piping plover critical habitat is defined by the USFWS as "those elements essential for the primary biological needs of foraging, sheltering, roosting, and the physical features necessary for maintaining the natural processes that support those habitat components." The USFWS also indicated that constituent elements are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide. Important primary constituent elements of intertidal flats include sand and/or mud flats with no or very sparsely emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting plovers. The USFWS designated a total of 1,798 miles (165,211 acres) of shoreline along the Gulf of Mexico and Atlantic coasts as critical wintering habitat. Critical habitat in Louisiana encompasses 24,950 acres along 342.5 miles of shoreline, which is most of the coast of Louisiana including the island of Grand Isle. The critical habitat designation within Louisiana include:

- **Unit LA-1**: Texas/Louisiana border to Cheniere au Tigre. 2,650 ha (6,548 ac) in Cameron andVermilion Parishes
- **Unit LA-2**: Atchafalaya River Delta. 921 ha (2,276 ac) in St. Mary Parish, LA
- **Unit LA-3**: Point Au Fer Island. 195 ha (482 ac) in Terrebonne Parish.
- **Unit LA-4**: Isles Dernieres. 795 ha (1,964 ac) in Terrebonne Parish
- **Unit LA-5**: Timbalier Island to East Grand Terre Island. 2,321 ha (5,735 ac) in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes.
- **Unit LA-6**: Mississippi River Delta. 105 ha (259 ac) in Plaquemines Parish, LA.
- **Unit LA-7**: Breton Islands and Chandeleur Island Chain. 3,116 ha (7,700 ac) in Plaquemines and St. Bernard Parishes, LA

The proposed project occurs within critical habitat designation Unit LA-5 (Figure 8). Unit LA-5 includes:

> Timbalier Island to East Grand Terre Island. 2,321 ha (5,735 ac) in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes: All of Timbalier Island where primary constituent elements occur to the MLLW [mean low low water], all of Belle Pass West [the "peninsula" extending north/northwest approximately 4.8 km (3.0 mi) from the west side of Belle Pass] where primary constituent elements occur to MLLW; the Gulf shoreline extending approximately 11 km (6.8 mi) east from the east side of Belle Pass bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover,

begins and where the constituent elements no longer occur; all of Elmers Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmers Island to approximately 0.9 km (0.56 mi) west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; the Gulf shoreline of Grand Isle from the Gulf side of the hurricane protection levee to MLLW; and all of East Grand Terre Island where primary constituent elements occur to the MLLW.

Critical habitat within the project area for the piping plover is found only along the Caminada Headland portion of the proposed project area, from West Belle Pass to Elmer's Island peninsula (Figure 9). The Shell Island area does not contain designated critical habitat for the piping plover.

Foraging habitat in winter is fairly consistent among numerous Gulf and Atlantic coast sites. On Dauphin Island, AL: protected mudflats or sandflats exposed at low tide; at Texas sites: primarily bayshore sand and algal flats. Comparison among 36 Atlantic winter sites (222 birds observed once each) and 75 Gulf sites (1,508 birds observed once each) indicates foraging activity most often associated with mudflats (25.6% of observations), sandflats (25.1%), and sandy mudflats (31.8%; *Haige, 2004).*

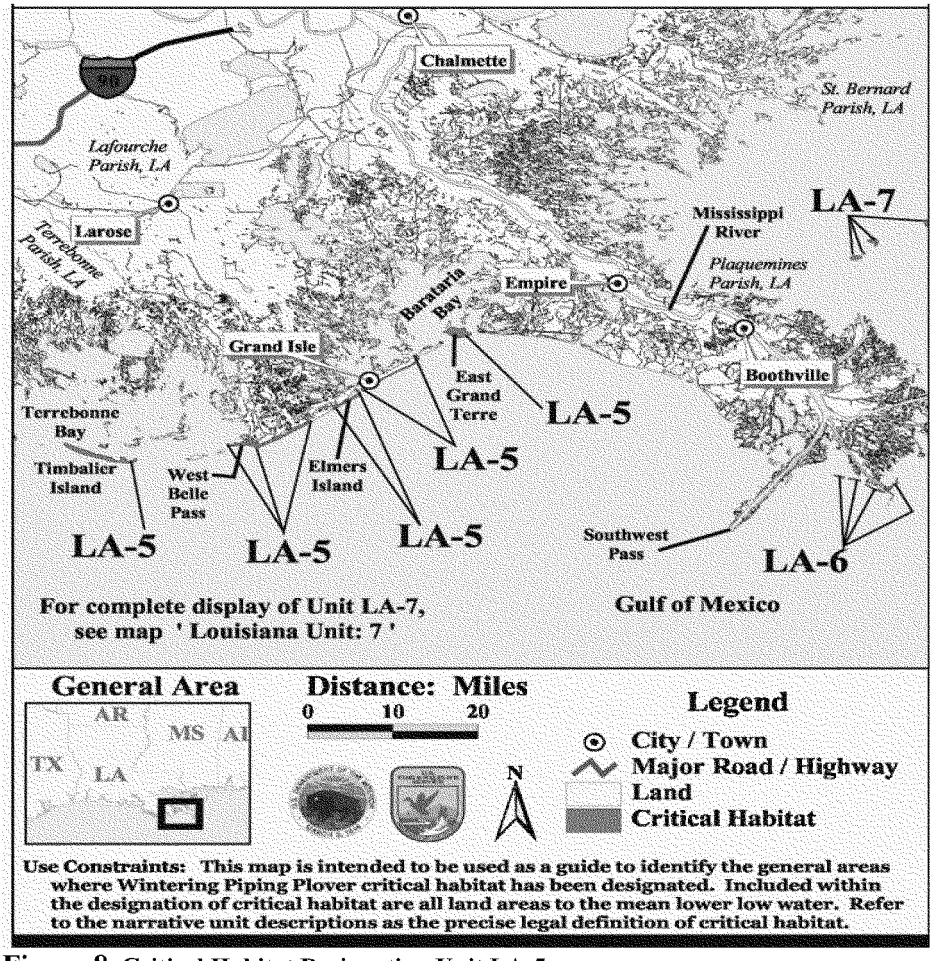


Figure 8. Critical Habitat Designation Unit LA-5

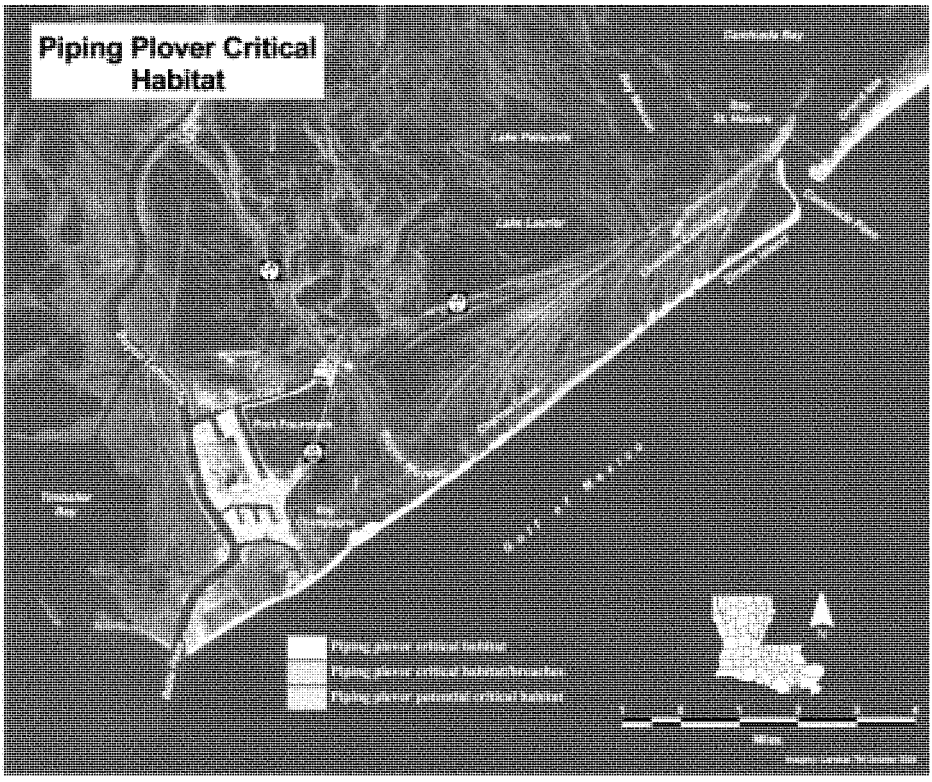


Figure 9. Critical Habitat Designation with proposed project area.

In general, wintering piping plovers feed extensively on intertidal beaches, mudflats, sand flats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting (USFWS 2002).

The piping plover feeds on insects and invertebrates along the waterline. Like other plovers this species runs a few feet and then stops, scans, and pecks at the prey it locates. It also hunts for insects on higher beach near roosting site areas.

7.8.1.4 Cause of Decline.

Hunting in the early 1900s resulted in a drastic reduction of the piping plover population. Ongoing destruction of historical nesting sites further reduced plover populations (USFWS 1988). Loss of breeding habitat has resulted from recreation and commercial development of sandy beaches on the Great Lakes, Atlantic Coast, and Gulf of Mexico.

Where breeding does occur on coastal beaches, inland lakes, and river sites, reproductive success has been reduced by disturbance from humans and pets. Additional habitat has been lost due to construction and operation of reservoirs and river channelization.

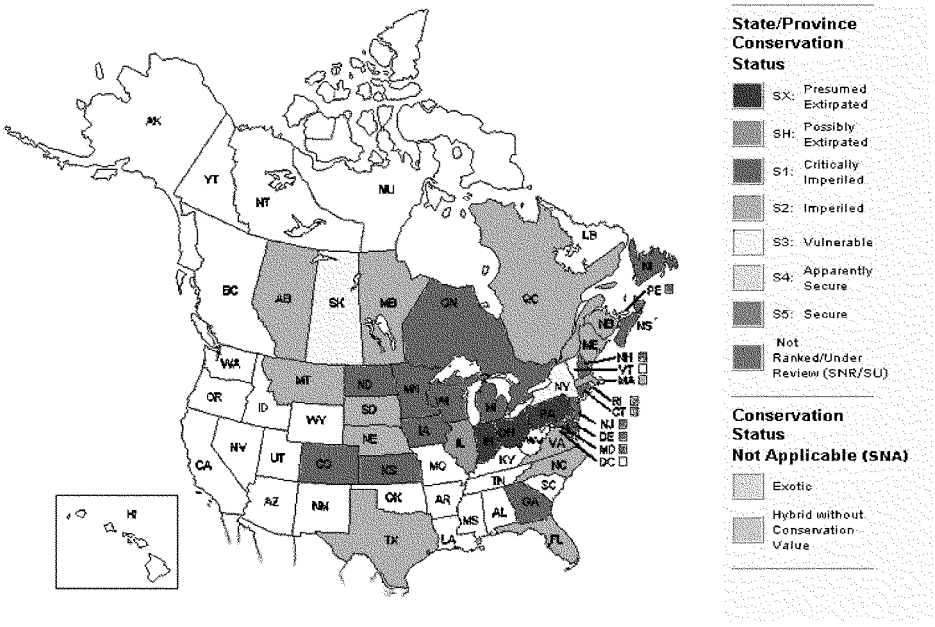
Dune stabilization projects that result in steep beach slopes, narrower beach widths, or increased vegetation to the water's edge, reduce piping plover habitat (Haig 1985). In at least one instance, stabilization of the backside of the dune on Padre Island, Texas, resulted in the destruction of essential sand flat habitat (USFWS ESIS). Additionally, increased urbanization has led to an increase in predation on the piping plover population (USFWS 1988). Recreational activities in localized areas along the gulf coast have been correlated with a decrease in piping plover use of those areas (Nicholls 1989).

The primary threats to the piping plover are habitat modification and destruction, and human disturbance to nesting adults and flightless chicks. A lack of undisturbed habitat has been cited as a reason for the decline of other shorebirds such as the black skimmer and least tern (COE, 2001).

7.8.1.5 Status of Species.

The USFWS determined the piping plover to be endangered and threatened in accordance with the Endangered Species Act of 1973, as amended, on December 11, 1985 (Federal Register Volume 50, No. 238). Endangered status was determined for the plover in the watershed of the Great Lakes (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario). It was determined to be threatened in the remainder of its range: northern Great Plains (Iowa, northwestern Minnesota, Montana, Nebraska, North Dakota, South Dakota, Alberta, Manitoba, and Saskatchewan); Atlantic coast (Quebec, Newfoundland, Maritime Provinces, and states from Maine to Florida); Gulf coast (Florida to Mexico); Bahamas; and West Indies.

Population trend data for this species is sparse. In the early 1900's, it was generally considered to be common. Early 20th century accounts report that hunting caused the first known major decline of the piping plover along the Atlantic coast (Brent, 1929; Hall, 1960). With passage of the Migratory Bird Treaty Act in 1918, plover populations recovered only to decline again in the recent times.



The Draft Piping Plover Recovery Plan (USFWS 1987) states that, "... the quality or quantity of winter habitat may be a factor limiting recovery of the species." Johnson (1987) stated that because piping plovers return to the same wintering area each year "the availability of nearby alternate sites may affect survival during severe weather conditions" when wintering sites are destroyed. Johnson (1987) also states that further destruction of winter-feeding areas may decrease plover numbers substantially. With the continuing erosion of Louisiana's coastline, further reductions in piping plover wintering habitat are anticipated.

Piping plovers winter along the southern Atlantic coast and the Gulf of Mexico. In 1996, the international piping plover winter census found that 89 percent of wintering piping plovers were found along the Gulf of Mexico coast, and eight percent were found along the Atlantic coast. In 2001, a piping plover winter census was conducted throughout the eastern United States and portions of Canada. The International Piping Plover Coordination Group coordinated the census with over 1,400 participants visiting 1,892 sites. The participants observed a total of 5,945 pairs of breeding plovers at 777 sites (Ferland and Haig 2002). The results of the census showed that the piping plovers were found primarily on islands (73.4 percent), mudflats (36.3 percent), sandy beaches (33.2 percent), and sand/salt flats (23.1 percent) (Ferland and Haig 2002).

Most of the piping plovers wintering along the shores of the Gulf of Mexico nest in the Great Lakes and Northern Great Plains region of the United States and Canada (USFWS 1988). Piping plover populations have increased steadily along the Atlantic Coast from

957 pairs of plover in 1989 to 1,676 pairs in 2003 (USFWS 2004). Preliminary 2005 Atlantic Coast piping plover abundance estimate was 1,632 nesting pairs (http://www.fws.gov/northeast/pipingplover/status/preliminary.05.pdf).

Midwinter surveys conducted near the project area during the Audubon Society's annual Christmas Survey from 1997 through 2008 indicate that numbers declined by approximately 50% in 1998 with only two birds sighted in 2005. Numbers returned to 1997 counts in 2006 with a slight increase in 2007 (Table 5).

Year	Number sighted
1997	23
1998	9
2005	2
2006	23
2007	33
2008	22

Table 5. Midwinter Piping Plover Surveys Near Project Area, 1997-2008

Source: National Audubon Society (2002). The Christmas Bird Count Historical Results [Online]. Available http://www.audubon.org/bird/cbc [June7, 2007].

More recent surveys were undertaken by the Avian Non-Game Program of the Louisiana Department of Wildlife and Fisheries are shown below in Table 6.

Table 6: LOUISIANA 2007-2008 PIPL Census Summary

Parish	Site Name	# of Surveys at site in 2007	PIPL 2007	# of Surveys at site in 2008	PIPL 2008
LaFourche	Belle Pass, west	1	0	1	13
LaFourche	East Timbalier Island	0	0	2	0
LaFourche	Fourchon Beach, east	1	5	1	41
LaFourche	Fourchon Beach, west	1	0	0	0
LaFourche	Unnamed Islands	0	0	0	0

According to the 2008 surveys, 41 piping plovers were sited along the Fourchon Beach east and 13 were sited along Belle Pass west.

7.8.2 Brown Pelican (*Pelecanus occidentalis*)

7.8.2.1 Description of Species.

Hingtgen (1985) provides a life history summary and a habitat suitability index model for the eastern brown pelican. The brown pelican is a large marine bird that can be found year around along the Gulf of Mexico coastal waters from Texas to Florida. The brown pelican is one of two species of pelican in North America, the other being the white pelican (*Pelecanus erythrorhynchos*). Adult brown pelicans are dark gray-brown with white about the head and neck. Immature brown pelicans are gray-brown on their head and neck with white underparts. The brown pelican weighs up to 8 lbs (3.6 kg) and larger individuals have wingspans of up to about 7 feet (2.1 m). They spend their entire life cycle in or near marine and estuarine waters, seldom venturing more than 20 miles (32.2 km) out to sea.

7.8.2.2 Distribution of Species.

In the United States, the brown pelican is found along the California coast, and from North Carolina to Texas. It is also found in Mexico, the West Indies and many Caribbean Islands, and as far south as Guyana and Venezuela in South America (USFWS 1995). Brown pelicans were extirpated from the Louisiana coast during the 1960s, but were reintroduced from Florida in 1968. Extensive use of pesticides, which were ultimately ingested by brown pelicans, has been noted as the primary cause of decline of the species (USFWS 1989b). This threat has been essentially eliminated, resulting in delisting of the species in Alabama and Florida, and stable populations in Louisiana, Mississippi, and Texas coastal regions.

Historically, brown pelicans used the Shell Keys NWR in south-central Louisiana (Emmons 1990). Refuge Staff at the Delta NWR, located in Plaquemines Parish, Louisiana, have noted that brown pelicans tend to use the refuge more during the winter months and the coastal barrier islands during the spring. They suspect that the majority of the pelicans that use that refuge are immature and non-breeding birds (Wigginton 1990). Brown pelicans use the area around Breton NWR in St. Bernard and Plaquemines Parishes, Louisiana, as loafing, feeding, and nesting areas. Flocks typically containing 50 to 100 birds are routinely observed by refuge staff on or near all islands in the Breton and Chandeleur Sounds (Wigginton 1990, Guidry 1994).

The Louisiana population numbered as many as 50,000 birds in the 1930s. By 1963, brown pelicans had completely disappeared from Louisiana. The LDWF and Florida Game and Fresh Water Fish Commission jointly implemented a restoration project from 1968 to 1980, and a total of 1,276 pelicans were reintroduced at three release sites in southeastern Louisiana. Restored nesting populations were established at North Island in the Chandeleur Island chain and at Queen Bess/Camp Island in Barataria Bay. North Island production was 909 fledglings between 1974 and 1979, and first nested successfully when the birds were 2 years of age. Reintroduced birds at the Queen Bess/Camp Island site first nested successfully at 3 years of age (McNease and Joanen 1984).

The 13-year reintroduction project suffered a setback in 1975 when approximately 40 percent of the population was killed by a pesticide incident, but the subsequent trend in numbers of nesting pairs continued a generally upward trend. In 1983, the estimated number of nesting pairs in Louisiana was 602. Louisiana had approximately 1,333 successful nests in 1990 (personal communication, 1991, Mr. Larry McNease, LDWF). In 1997, the LDWF estimated there were approximately 10,000 pelican nests with 25,000 adults nesting in Louisiana, primarily on the Chandeleur Islands (personal communication 2004, Ms. Brigette Firmin, USFWS). During the 2000 nesting season, a substantial portion of the Chandeleur Island nesting population relocated to an island created by dredge material at the mouth of Baptiste Collette Pass, but the birds returned to the Chandeleur Islands for the 2001 nesting season (personal communication 2004, Ms. Brigette Firmin USFWS).

Other brown pelican nesting areas in Louisiana include Raccoon and Wine Islands in the Isles Dernieres barrier island system, Queen Bess Island in Barataria Bay, West Breton Island in Breton Sound, and most recently, Rabbit Island in Calcasieu Lake.

7.8.2.3 Habitat.

Brown pelicans feed along the Louisiana coast in shallow estuarine waters. Brown pelicans feed mainly on fish, including menhaden, mullet, sardines, and pinfish, which they capture by plunge diving (USFWS 1989b).

Preferred nesting sites are small coastal islands, which provide protection from mammalian predators (mainly raccoons), and have sufficient elevation to prevent widespread flooding of nests. The nests are usually built in available vegetation (e.g., black mangroves), but ground nesting may also occur. Ground nests vary from practically nothing to well built nests of sticks, reeds, straw, palmetto leaves, and grasses. Tree nests are made of similar materials, only they are more firmly constructed. Sand spits and offshore sandbars are used extensively as daily loafing and nocturnal roost areas.

Brown pelican breeding activity in Louisiana can vary from as early as February to as late as September. They nest in colonies on small coastal islands in salt and brackish waters. Nesting islands are often chosen near channels where shipping and shrimping operations make fish easily available to nesting pairs. Normal clutch size is three eggs, and both parents share incubation and rearing of the young. The species is considered to be long-lived; one pelican captured in Edgewater, Florida, in November 1964 was banded in September 1933.

7.8.2.4 Causes of Decline.

The brown pelican is extremely susceptible to disturbance and habitat alteration in key nesting areas. It is, therefore, important to prevent disturbance to nesting colonies (e.g., by low-flying aircraft, noise disturbance from project-related activities, etc.) that could

cause nest desertion and egg losses, as well as the control of pesticide use and other types of environmental pollution. Consequently, regular surveying occurs in Louisiana. Protective measures for the species consist mainly of legal and regulatory procedures and habitat protection and improvement. The brown pelican is currently protected by Federal and state laws, which are enforced by the USFWS and the LDWF, respectively. Nest sites are also protected under management programs on Federal lands (i.e., NWRs).

7.8.2.5 Status of Species.

The brown pelican was listed as endangered first on June 2, 1970, amended on October 13, 1970, and included in the Endangered Species Act of 1973 (35 FR 16047). On February 4, 1985 (50 FR 4938), the USFWS removed the brown pelican from the list of endangered and threatened wildlife in Alabama, Florida, Georgia, South Carolina, North Carolina, and points northward along the Atlantic coast. The brown pelican remains endangered throughout the remainder of its range, which includes Louisiana, Mississippi, Texas, California, Mexico, Central and South America, and the West Indies. No critical habitat is designated for the brown pelican within Louisiana. The brown pelican was designated as "Under Review in the Candidate or Petition Process" in the Louisiana population.

8.0 ANTICIPATED EFFECTS OF THE PROPOSED ACTION

8.1 Piping Plover (Charadrius melodus)

Wintering piping plovers arrive from the breeding grounds as early as July and depart for the breeding grounds during late March and early April. By May, most birds have left the wintering grounds (http://www.fws.gov/plover/facts.html). Breeding and wintering plovers feed on exposed wet sand in wash zones; intertidal ocean beach; wrack lines; washover passes; mud-, sand-, and algal flats; and shorelines of streams, ephemeral ponds, lagoons, and salt marshes by probing for invertebrates at or just below the surface. They use beaches adjacent to foraging areas for roosting and preening. Small sand dunes, debris, and sparse vegetation within adjacent beaches provide shelter from wind and extreme temperatures. Availability of quality foraging and roosting habitat in the wintering grounds is necessary in order to ensure that an adequate number of adults survive to migrate back to breeding sites and successfully nest (http://www.fws.gov/plover/facts.html).

The proposed project would restore 1206 acres of dune/beach and 1582 acres of saline marsh; however, restoration of these vital habitats would temporarily adversely impact critical habitat within the Caminada Headland area.

Approximately 485 acres of critical habitat within Unit 5 would be temporarily adversely impacted (356 acres supratidal, 29 acres dune, 100 Gulf intertidal). Unavoidable short-term adverse impacts to piping plover critical habitat would result from the placement of

sediments onto existing beach and dune habitats during construction of the proposed barrier headland restoration measures. Prey species smothered by dune and beach nourishment activities would recolonize in the project area within 6 months to 2 years once construction activities cease. Any impacts that would occur to existing designated critical habitat would be temporary, and would provide for the long-term maintenance and/or enhancement of critical habitat within the project area. Suitable critical habitat (e.g., West Belle Pass, Grand Isle, etc.) exists within the vicinity and is anticipated to be available during and after construction. There would be no permanent impacts to critical habitat that would change the ecological processes that maintain it.

Beneficial impacts to the piping plover and its critical habitat from the proposed action include the restoration of habitat and prolonged life of existing barrier islands, as well as creating new barriers or structures that would function to protect the barrier islands and critical habitat. Much of the existing system is sediment-starved, and the proposed project would introduce sediment into the system that would be re-worked and redistributed through future storm events, thus maintaining and/or enhancing the features of critical habitat that are essential to piping plover conservation.

Potential adverse impacts to piping plovers would be temporary displacement during construction activities to restore the barrier islands. Potential impacts to piping plovers could be avoided by conducting proposed construction activities outside the wintering season; however, construction of the project is likely to occur while plovers are present. Due to their mobility, piping plovers would be able to avoid areas of temporary disturbance, and would have an abundance of suitable foraging and roosting areas available adjacent to the project area throughout project construction.

Therefore it is the Corps' determination that the proposed action may affect, but is not likely to adversely affect the piping plover and its critical habitat. Rather, the proposed action would restore and enhance critical habitat.

8.2 Brown Pelican (*Pelecanus occidentalis)*

Suitable brown pelican feeding and/or nesting habitat occurs along the barrier islands, sand spits, and mud lumps throughout the coastal Louisiana area. Pelican nest sites (i.e., Rabbit Island in Calcasieu Lake, Raccoon Point on Isles Dernieres, Queen Bess Island, Plover Island [Baptiste Collette], Wine Island, and islands in the Chandeleur chain) and the birds themselves may be impacted by barrier island restoration activities or noise disturbance from work activities. Impacts to nesting brown pelicans can be avoided by preventing any work activities from encroaching within 2,000 feet of a nesting area during the nesting season. Although suitable nesting habitat may currently exist within the project areas, there are no known nesting sites for brown pelicans within 2,000 feet of the project areas. Furthermore, the proposed barrier island restoration activities on Caminada Headland and Shell Island are likely to create new nesting habitat and prolong the life of existing suitable nesting habitat. In addition, restoration of barrier habitat and salt marsh would provide nursery and grow-out areas for the aquatic life upon which pelicans feed.

The dune and beach system within the project area have been impacted by storm erosion, resulting in the loss of dune material and intertidal beach area. The proposed project would restore 1206 acres of dune/beach and 1582 acres of saline marsh. Temporary impacts to brown pelicans foraging or roosting in or near the project area may occur during construction activities. These impacts would be limited to those associated with noise or increased human activity in the area. Once construction activities are complete any birds disturbed by the activities are expected to return to the area.

Any noise disturbance to pelicans foraging or loafing within the proposed action area would be temporary and would be minimized by appropriate construction activity windows during the non-breeding season. Changes or impacts in coastal open water habitats providing suitable feeding and/or loafing areas would be temporary, and there is an abundance of suitable habitat available nearby should the birds be temporarily displaced. Changes in hydrology by measures to preserve existing marsh, create additional wetlands, and restore barrier islands would potentially enhance suitable feeding and/or loafing habitat for pelicans by enhancing the stability of those areas and the aquatic life upon which pelicans feed. Therefore, the proposed project is not likely to adversely affect the threatened brown pelican.

8.3 Green Sea Turtle (*Chelonia mydas*).

Due to the lack of extensive seagrass beds throughout much of coastal Louisiana, and the low incidence of sightings and strandings, the proposed action is not expected to adversely impact the green sea turtle population.

8.4 Hawksbill Sea Turtle (*Eretmochelys imbricata*).

The effects of the proposed action to hawksbill populations are likely to be negligible due to its rarity along the Louisiana coast.

8.5 Kemp's Ridley Sea Turtle (*Lepidochelys kempii*).

Potential impacts are not likely to include adverse effects on Kemp's ridley sea turtle populations. The proposed restoration features would provide more suitable inshore habitat (characterized by lower salinity and high turbidity and organic content, where shrimp and blue crabs are abundant) utilized by this species when foraging.

8.6 Leatherback Sea Turtle (*Dermochelys coriacea*).

Any potential project impact would have no effect on populations of the leatherback sea turtle. This pelagic species typically occupies oceanic waters of more than 160 feet (50 m) in depth.

8.7 Loggerhead Sea Turtle (*Caretta caretta*).

The restoration of the Terrebonne and Grand Isle barrier island chains would occur in Subprovinces 2 and 3 with the proposed action. Nesting loggerhead sea turtles have historically used barrier islands; however, it is doubtful that loggerhead sea turtles nest anywhere on the Louisiana coast. The restoration of barrier islands may or may not provide suitable nesting habitat, but suitable nesting habitat is nearly nonexistent due to the current degraded state of those islands. The TSP would not negatively affect loggerheads, and may provide some benefit to the species by restoring nesting habitat.

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United States Department of the Interior

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May 11, 2009

Ms. Joan Exnicios
Acting Chief
Environmental Planning and Compliance Branch
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

SUBJECT: Biological Assessment (BA) of the Louisiana Coastal Area (LCA) – Barataria Basin Barrier Shoreline Restoration Feasibility Study for the Caminada Headland and Shell Island Restoration Project, in Jefferson, Lafourche, and Plaquemines Parishes, Louisiana

Dear Ms. Exnicios:

Please reference your May 1, 2009, letter requesting our review of and concurrence with the U.S. Army Corps of Engineers' (Corps) determination that the proposed Caminada Headland and Shell Island Restoration project is not likely to adversely the endangered brown pelican (*Pelecanus occidentalis*) and the threatened piping plover (*Charadrius melodus*), or its designated critical habitat. The proposed project would involve restoring the 13-mile-long Caminada barrier headland between Belle Pass and Caminada Pass in Jefferson and Lafourche Parishes, Louisiana, and remnants of Shell Island between Fontanelle Pass and Grand Bayou Pass in Plaquemines Parish, Louisiana. Those areas together make up a large portion of the Barataria Basin Barrier Shoreline Complex. The U.S. Fish and Wildlife Service (Service) has reviewed the information you provided, and offers the following comments in accordance with provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), and the Migratory Bird Treaty Act (MBTA) (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.).

In Louisiana, barrier island and barrier headland erosion is attributable to increasing tidal prism, insufficient volumes of sediment supplied by littoral currents, land subsidence, and sea-level rise (Boesch 1982). Although increases in the tidal prism may be primarily responsible for enlargement of tidal passes, the insufficient supply of sand available to rebuild eroded areas has also contributed to increased tidal pass widths and shoreline retreat (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1999). Where insufficient supplies of sand prevail, measures to maximize sand

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retention, such as sand fencing and vegetative planting, are needed to effectively rebuild and maintain these eroded areas.

The Caminada barrier headland is the principal feature of the Bayou Lafourche barrier system; it includes flanking islands and the retreating headland of Bayou Lafourche along the southwestern portion of the Barataria Basin. The headland maintains the integrity of the Gulf shoreline and helps to protect interior coastal wetlands from further deterioration. It also protects Port Fourchon, which furnishes between 15 and 18 percent of the United States' entire oil supply and services over 90 percent of the Gulf of Mexico's deepwater oil production (http://www.portfourchon.com/explore.cfm/aboutus/portfacts). The Caminada Headland consists of narrow and low-lying sand dunes and beach berm, barrier marshes, chenier ridges interspersed with mangrove thickets, coastal dune shrub thickets, lagoons, and small bayous. According to the BA, the average dune elevation is estimated to be 3.4 feet North American Vertical Datum of 1988 (NAVD) and the back-barrier marsh is approximately 0.94 feet NAVD. The headland has historically suffered loss of habitat value and diminished function due to storm overtopping and breaching, saltwater intrusion, wind and wave induced erosion, sea level rise, subsidence, and man-made structures. The observed average shoreline erosion rate at the Caminada Headland is approximately 45 feet per year, and increased stress on the fish and wildlife in the area is expected as habitats continue to be lost.

According to the BA, the Corps proposes to construct 880 acres of dune/beach complex and 1,186 acres of saline marsh along the Caminada Headland using offshore sand from the South Pelto Block of Ship Shoal. The dune would be constructed to an elevation of 7 feet NAVD with a crest width of 290 feet. The majority of the dune component is sited landward over existing higher elevations to maximize the acreage and increase the longevity of the project. Native dune plant species would be planted along the constructed dune, and sand fences would also be installed to capture Aeolian sand. Sand fences would be installed in phases to optimize growth of the dune toward the Gulf. The proposed beach design is a 65-foot-wide seaward berm at an elevation of 4.5 feet NAVD. Landward and seaward slopes of both the dune and beach would be 20 feet horizontal to 1 foot vertical. The Corps proposes to place advanced fill quantities to account for some initial loss of material due to shoreline equilibrium (roughly the first 6 to 9 months post-construction), as well as to prevent the need for future renourishment activities. The proposed marsh design is a marsh platform at an elevation of 2 feet NAVD to be constructed on the landward side of the dune for the length of the project. A mixture of native plant species would also be planted on the marsh platform. The Corps anticipates that construction activities would require approximately 30 months, pending local weather conditions.

The Shell Island reach is within the Plaquemines barrier system along the southeastern portion of the Barataria Basin. Prior to Hurricane Bob in 1979, Shell Island was a continuous barrier island that helped to protect the interior coastal wetlands of the Barataria Basin. According to the BA, the Empire Jetties built in 1950 along Fontanelle Pass increased shoreline recession approximately 10 feet per year along the easternmost 5,000 to 8,000 feet of Shell Island. Currently, the Shell Island reach includes two remnant barrier islands, shoals, and spits which now only partially enclose shallow bays (e.g., Shell Island Bay and Bastian Bay) along the southern portion of the Barataria Basin. Shoreline recession rates in this area are approximately 34.9 feet per year. The eastern portion of Shell Island extends for approximately 2.54 miles

between Coupe Bob and Fontanelle Pass. The western portion of Shell Island extends for approximately 1.41 miles between Grand Bayou Pass and Coupe Bob. Those remnants of the original Shell Island are expected to continue losing habitat value and function at the current erosion rate without the proposed project.

According to the BA, the Corps proposes to construct two islands for a total of 126 acres of dune, 297 acres of supratidal, and 47 acres of intertidal areas along the Shell Island reach using high quality sand from the Mississippi River for the dune/beach portion and mixed sediment deposits from the Empire borrow area for the marsh portion of the project. The design for Shell Island East consists of 15,400 linear feet of dune constructed to an elevation of 6 feet NAVD with a crest width of 281, and a marsh platform starting at 525 feet in width and widening to 1,200 feet along the northernmost portion of the remnant island. The design for Shell Island West consists of 4,500 linear feet of dune constructed to an elevation of 6 feet NAVD with a crest width of 250 feet, and a marsh platform with a maximum width of 2,300 feet. For both islands, dune slopes would be 45 feet horizontal:1 foot vertical, and marsh platforms would be constructed to an elevation of 1.2 feet NAVD. Sand fences would be installed on the two Shell Islands as described above for the Caminada Headland portion of the project, and the appropriate mixture of native plant species would be planted on both the dunes and the marsh platforms of the islands.

Brown pelicans are currently known to nest on Raccoon Point on Isles Dernieres, as well as Queen Bess Island, Plover Island (Baptiste Collette), Wine Island, Rabbit Island in Calcasieu Lake, and islands in the Chandeleur chain. Pelicans change nesting sites as habitat changes occur; thus, they may also be found nesting on mud lumps at the mouth of South Pass (Mississippi River Delta) and on small islands in St. Bernard Parish. In spring and summer, nests are built in mangrove trees or other shrubby vegetation, although ground nesting may also occur. Brown pelicans feed along the Louisiana coast in shallow estuarine waters, using sand spits and offshore sand bars as rest and roost areas. Major threats to this species include chemical pollutants, colony site erosion, disease, and human disturbance.

Based on our records, there are no known nesting colonies of brown pelicans located within 2,000 feet of the proposed project areas. Brown pelicans do, however, forage and loaf within the project areas throughout the year and are generally accustomed to boat traffic along the Louisiana Gulf coast related to oil and gas activities as well as recreational and commercial fishing. Because pelicans are highly mobile, they could easily relocate to nearby suitable foraging and loafing habitat during project construction. The proposed activities would neither permanently exclude birds from utilizing the project areas nor introduce new forms of disturbance. Project effects on brown pelicans would result in temporary displacement to nearby suitable areas. Based on that information, the Service concurs with the Corps' determination that the proposed project is not likely to adversely affect the brown pelican.

Piping plovers winter in Louisiana, and may be present for 8 to 10 months; they arrive from the breeding grounds as early as late July and remain until late March or April. Piping plovers feed extensively on intertidal beaches, mudflats, sand flats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting. Roosting areas may have debris, detritus, or micro-topographic relief offering refuge to

plovers from high winds and cold weather. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape, because the suitability of a particular site for foraging or roosting is dependant on local weather and tidal conditions. Plovers move among sites as environmental conditions change, and studies have indicated that they generally remain within a 2-mile area. Major threats to this species include the loss and degradation of habitat due to development, disturbance by humans and pets, and predation.

Our records indicate that piping plovers regularly use the beach habitat along the Caminada Headland, especially the sand spit along the eastern end of the headland, but we have no observation records of piping plovers using the remnant islands of the Shell Island reach. According to the BA, the proposed activities for the Caminada Headland would likely occur while piping plovers are present. Potential project effects to the piping plover would consist of temporary displacement to nearby suitable habitats and temporary loss of benthic prey species within the project area. There is an abundance of nearby suitable habitat into which plovers can disperse, including Belle Pass West, the easternmost sand spit of Elmer's Island (which is not included in the current project footprint), Grand Isle, and East Grand Terre Island. The benthic prey species smothered by the additional sediment in the project area would naturally re-colonize the area within 6 months to 2 years post-construction. Because such effects are temporary, discountable, and insignificant in nature, and because plovers would not be permanently excluded from using the area, the Service also concurs with the Corps' determination that the proposed action is not likely to adversely affect the piping plover.

On July 10, 2001, the Service designated critical habitat for wintering piping plovers (Federal Register Volume 66, No. 132). Designated critical habitat for the piping plover identifies specific areas that are essential to the conservation of the species. At the time of designation approximately 24,964 acres of wintering habitat were designated in Louisiana, and Unit LA-5 consisted of approximately 5,735 acres of that total. Approximately 10.25 miles of the Caminada Headland-portion of the proposed project is also located within Unit LA-5 of piping plover critical habitat. The Shell Island reach is not located within designated critical habitat; therefore, that portion of the proposed action would not affect it.

The primary constituent elements (PCEs) for piping plover wintering habitat are those habitat components that support foraging, roosting, and sheltering, and the physical features necessary for maintaining the natural processes that support those habitat components. Designated piping plover critical habitat along the Caminada Headland specifically includes ". . . the Gulf shoreline extending approximately 6.8 miles east from the east side of Belle Pass bounded on the seaward side by MLLW [mean low low water] and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the primary constituent elements no longer occur; all of Elmer's Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmer's Island to approximately 0.56-mile west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the primary constituent elements no longer occur. . ." (Federal Register, Volume 66, No. 132, Page 36127).

According to the BA, approximately 485 acres (29 acres dune, 356 acres supratidal, and 100 acres Gulf intertidal) of critical habitat within Unit LA-5 would be temporarily affected by the

proposed action. Based on conversations with the Service's coastal restoration biologist working directly with the Corps on this project, the dune, supratidal, and intertidal habitat designations are defined as: (1) dune includes any elevations within the project footprint at or above 5 feet NAVD; (2) supratidal includes any elevations within the project footprint at or between 2 and 4.9 feet NAVD; and (3) Gulf intertidal includes any elevations within the project footprint between zero and 2 feet NAVD. Based on the Service's scrutiny of 2005 and 2007 digital orthophoto quarter quadrangle (DOQQ) imagery, light detection and ranging (LIDAR) imagery, and a January 2009 site visit, we have determined that the above described habitat designations are more specifically described as follows:

1. The existing dune habitat within the project footprint consists of clumps of remnant dune generally dispersed throughout the high marsh/high beach interface. Those 29 acres of dune should not be considered as suitable piping plover habitat because those areas are densely vegetated and do not exhibit features of suitable piping plover habitat as described above.

2. The supratidal habitat classification includes both the high marsh on the landward side and the high beach along the Gulf side of the remnant dune within the project footprint. The high marsh consists of densely vegetated areas that are not suitable for the piping plover, and are specifically excluded from designated critical habitat as described above. The high beach consists of bare or sparsely vegetated sand flats above the high tide mark. We believe that no more than half (i.e., 178 acres) of the supratidal habitat classification acreage actually consists of high beach that is suitable roosting habitat for the piping plover.

3. The 100 acres of Gulf intertidal habitat does consist of suitable foraging habitat for the piping plover. That acreage is inclusive of tidal fluctuations throughout the year.

Based on the above information, approximately 278 acres (178 acres high beach and 100 acres Gulf intertidal) of designated critical habitat would be affected by the Caminada Headland-portion of the proposed project. That acreage is approximately 1.1 percent and 4.8 percent of the total acreage of wintering habitat in Louisiana and Unit LA-5, respectively. Temporary project effects to designated critical habitat would include construction activities (e.g., bulldozers, marsh buggies, discharge pipeline, etc.) within roosting and foraging habitat and smothering of the benthic community within foraging habitat. Pending the construction contract(s) awarded for the project, the most likely construction method would be to start at one end and continue moving along the shoreline in a linear fashion; construction duration would be approximately 2.5 years, pending local weather conditions. The benthic community is expected to recover within 6 months to 2 years post-construction; therefore, it is conceivable that the benthic community would begin re-colonizing the initial construction area before construction is completed at the opposite end. In addition, nearby critical habitat (i.e., Belle Pass West, easternmost sand spit of Elmer's Island, Grand Isle, East Grand Terre Island) would be available for piping plovers during construction and until the benthic community recovers.

The addition of sediment to the system is considered a long-term effect to the project area; however, it would be a beneficial effect to critical habitat by increasing the acreage and longevity

of roosting and foraging habitat. The Corps anticipates that the additional sediment would continually be re-worked and transported throughout the sediment-starved system for the 50-year project life and would, therefore, help to support and sustain the natural ecological processes that maintain piping plover critical habitat. Without the additional sediment, critical habitat within the project area would continue to be lost to erosional forces until only a vegetated shoreline, which is not suitable for the piping plover, would remain. The Corps also proposes to place advance fill quantities to prevent the need for renourishment during the project life, which would reduce future potential temporary effects due to renourishment actions as well as provide for additional sediment that could be re-worked and transported during storm and overwash events in the near-term to create additional sand flats for piping plover use. Because the effects to critical habitat would be temporary, discountable, and insignificant in nature, and because the proposed project would ultimately benefit critical habitat by increasing, restoring, and prolonging the existence of suitable habitat for piping plovers, the Service also concurs with the Corps' determination that the proposed project is not likely to adversely affect piping plover critical habitat within Unit LA-5.

No further ESA consultation with the Service for the brown pelican, the piping plover, or its designated critical habitat will be necessary for the proposed action, unless there are changes in the scope or location of the proposed project or the project has not been initiated within 1 year of this letter. Due to the length of the Corps' project development, implementation, and construction processes, and because our species information is updated annually, the Corps should re-initiate consultation with this office on an annual basis until construction begins, or at any time if there are changes in the scope or location of the proposed action that would produce project effects not considered in the subject BA or this letter.

Based on our records, colonial nesting shorebirds historically nested on the remnant islands within the Shell Island reach. To minimize disturbance to colonial nesting birds, all activity occurring within 650 feet of a rookery containing nesting gulls, terns, and/or black skimmers should be restricted to the non-nesting period (i.e., September 16 through April 1, depending on species present). Please be aware that the Shell Island project area should be surveyed for nesting shorebirds prior to construction to avoid disturbance to those species. In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

We appreciate the Corps' continued excellent coordination and cooperation in the conservation of threatened and endangered species, their critical habitats, and colonial nesting shorebirds. If you require further assistance regarding ESA coordination, or have questions regarding the content of this letter, please contact Ms. Brigette Firmin (337/291-3108) of this office.

Sincerely,

Brad S. Rieck
Deputy Supervisor
Louisiana Field Office

cc: FWS, Panama City, FL (Attn: Patty Kelly)
NMFS, St. Petersburg, FL
LDWF, Natural Heritage Program, Baton Rouge, LA (Attn: Michael Seymour)

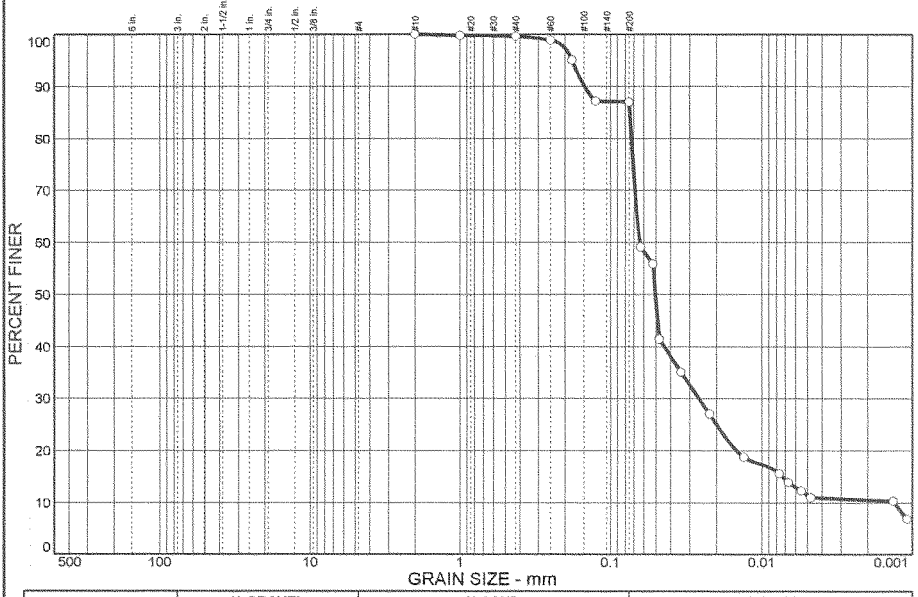
Literature Cited

Boesch, D. F., ed. 1982. Proceedings of the conference on coastal erosion and wetland modification in Louisiana: causes, consequences, and options. U.S. Fish and Wildlife Service, Biological Services Program, Washington, D.C. FWS/OBS-82/59. 256 pp.

Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. 1999. Coast 2050: toward a sustainable coastal Louisiana, the appendices. Appendix E - region 3 supplemental information. Louisiana Department of Natural Resources. Baton Rouge, LA. 173 pp.

APPENDIX B

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.4	12.6	75.5	11.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#18	99.8		
#40	99.6		
#60	98.9		
#80	95.1		
#120	87.1		
#200	87.0		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0743 D_{60}= 0.0639 D_{50}= 0.0503
D_{30}= 0.0260 D_{15}= 0.0073 D_{10}= 0.0013
C_u= 48.32 C_c= 7.99

Classification

USCS= ML AASHTO=

Remarks

Yi, Hon-Kyu

Sample No.: 1 **Source of Sample:** **Date:** 15 Nov 2006

Location: Port Fourchon Navigation Channel, CUTTERHEAD DREDGE, Lafourche Parish **Elev./Depth:**

US Army Corps of Engineers

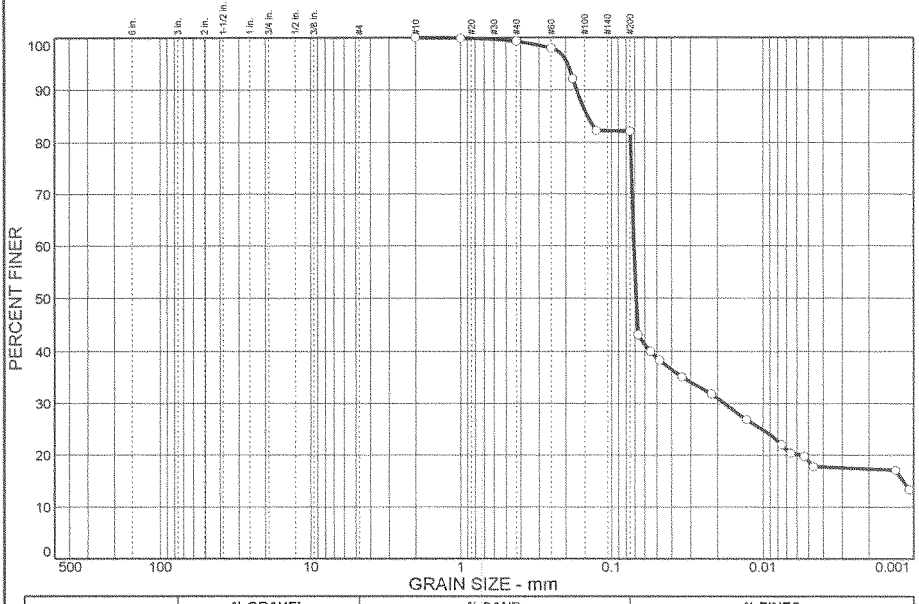
New Orleans District

Client: U.S. Army Corps of Engineers, New Orleans District.

Project: Port Fourchon Navigation Channel, CUTTERHEAD DREDGE, Lafourche Parish, LOUISIANA.

Project No: W912P8-06-C-0125 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.7	17.2	63.3	18.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#18	99.9		
#40	99.3		
#60	98.0		
#80	92.2		
#120	82.2		
#200	82.1		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.143 D_{60}= 0.0708 D_{50}= 0.0686
D_{30}= 0.0179 D_{15}= 0.0012 D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

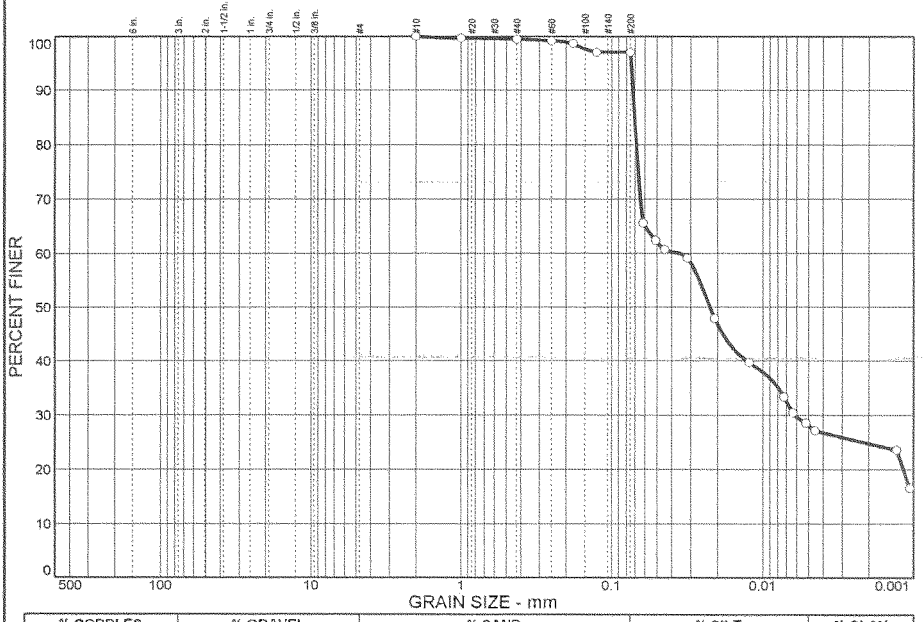
Remarks

Yi, Hon-Kyu

Sample No.: 2 **Source of Sample:** **Date:** 15 Nov 2006
Location: WEST TOE STATION, Port Fourchon Navigation Channel. **Elev./Depth:**

US Army Corps of Engineers New Orleans District	**Client:** U.S. Army Corps of Engineers, New Orleans District. **Project:** Port Fourchon Navigation Channel, CUTTERHEAD DREDGE, Lafourche Parish, LOUISIANA. **Project No:** W912P8-06-C-0125 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	2.9	69.0	28.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#18	99.7		
#40	99.5		
#60	99.2		
#80	98.7		
#120	97.1		
#200	97.1		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0705 D_{60}= 0.0353 D_{50}= 0.0223
D_{30}= 0.0062 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

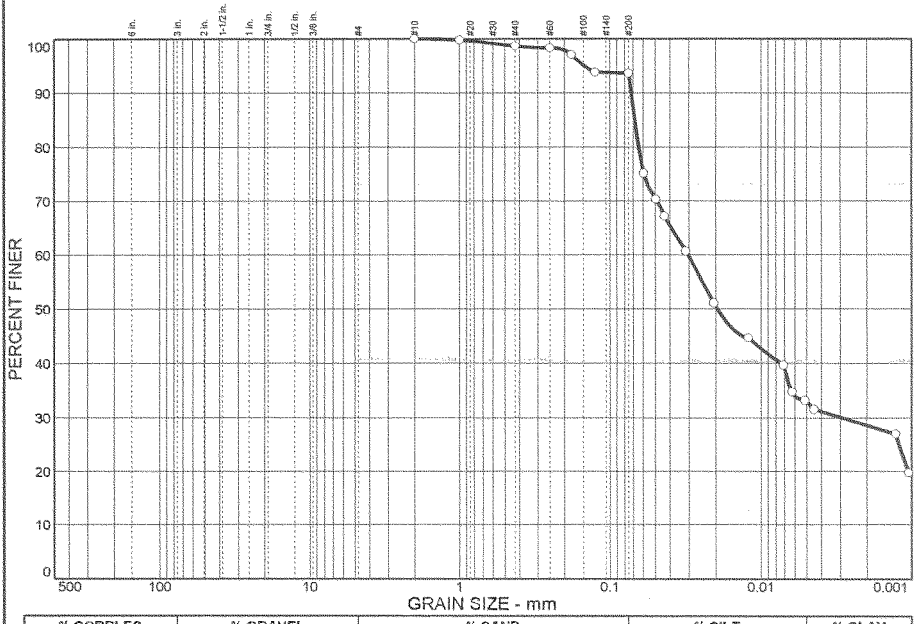
Remarks

Yi, Hon-Kyu

Sample No.: BD-3 **Source of Sample:** **Date:** 17 Nov 2006
Location: WEST TOE STATION, Port Fourchon Navigation Channel, 280+00(EAST TOE) **Elev./Depth:**

US Army Corps of Engineers New Orleans District	**Client:** U.S. Army Corps of Engineers, New Orleans District. **Project:** Port Fourchon Navigation Channel, CUTTERHEAD DREDGE, Lafourche Parish, LOUISIANA. **Project No:** W912P8-06-C-0125 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	6.4	60.6	33.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#18	99.8		
#40	98.7		
#60	98.3		
#80	97.1		
#120	93.8		
#200	93.6		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0683 D_{60}= 0.0304 D_{50}= 0.0194
D_{30}= 0.0029 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Yi, Hon-Kyu

Sample No.: BD-4 **Source of Sample:** **Date:** 17 Nov 2006
Location: WEST TOE STATION, Port Fourchon Navigation Channel, 310+00(WEST TOE) **Elev./Depth:**

US Army Corps of Engineers
New Orleans District

Client: U.S. Army Corps of Engineers, New Orleans District.
Project: Port Fourchon Navigation Channel, CUTTERHEAD DREDGE, Lafourche Parish, LOUISIANA.
Project No: W912P8-06-C-0125 **Plate**

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF

August 10, 2010

Regional Planning and
Environmental Division South
New Orleans Environmental Branch

James F. Boggs
US Fish and Wildlife Service
646 Cajundome Blvd., Suite 400
Lafayette, LA 70506
Fax: (337) 291-3139

Dear Mr. Boggs:

The US Army Corps of Engineers, New Orleans District (CEMVN) is requesting the re-initiation of consultation for potential impacts to the piping plover, West Indian manatee and five species of sea turtle (Kemp's Ridley, green, hawksbill, loggerhead, and the leatherback) under Section 7 of the Endangered Species Act for the changes made to the proposed LCA Barataria Basin Barrier Shoreline Restoration (BBBS) project. We are providing a supplemental Biological Assessment (BA, enclosure 1) to re-initiate consultation, which will supplement the May 1, 2009 BA for changes that have occurred to the scope of the tentatively selected plan (TSP), and to evaluate any additional effects these changes, not considered in the original BA, will have on threatened and endangered species. The TSP contains all proposed actions presented in the preceding BA along with the additional features presented in the enclosed SBA. The purpose of the study is to restore the geomorphic function and unique critical and essential fish and wildlife habitats of the Caminada Headland's barrier system and reverse the current trend of degradation in the Caminada Headland and Shell Island reaches. Restoration efforts would target ecologically distinct, critical, high priority areas that would increase sustainability with essential form and function of the natural barrier ecosystem.

A renourishment component has been added to the TSP presented in the May 1, 2009 BA. The proposed renourishment component would include the beneficial placement of dredged material from operations and maintenance dredging of the bar channel of Bayou Lafourche, Louisiana (Belle Pass) in a beach nourishment disposal area. Dredging of the pass yields between 400,000 and 750,000 cubic yards (cys) of which approximately 500,000 cubic yards of material will be used for nourishment every 1.5 to 2 years. Historically this material has been placed east and west of the jetties at beach nourishment disposal sites. As part of the adaptive management plan, shoreline imagery will be evaluated to determine the renourishment approach. One of two basic approaches will be used, based on shoreline conditions:

a. When monitoring data indicate that the shoreline is relatively intact, with no breaches created by storm surge or wave action, the TSP proposes that the dredged material from Belle Pass will be placed in the littoral drift south of Bayou Moreau where the sediment budget indicates that the long shore transport of material splits going east and west (Figure 1). Placement of material at this location sustains the project by building out the shoreline at the nodal point, which is an area of more rapid shoreline erosion, and by feeding material along the entire reach through existing longshore transport patterns. Approximately 500,000 cys would be placed unconfined between 100 and 300 feet from the top of bank, allowing the long shore transport and wave action to move and place the sediment along the headland. The material would be pumped in an area approximately 13,000 feet in length offshore of the nodal point. The Caminada Headland is a high energy wave environment that is very dynamic. The material would be stacked no higher than + 6 feet MLG, but would be quickly reworked by the wind and waves. The pumping of the material would take approximately 35 days, with placement and removal of the pipeline taking a total of approximately 70 days. The pipe will be placed offshore. The material would be dredged from a federal navigation channel which previously received NEPA clearance for the maintenance dredging of the Bayou Lafourche channel. Over each 10 year period, an estimated 2 million cubic yards of material would be returned to the headland. A total of 10 million cys would be placed over the period of analysis replacing 53 percent of the sediment lost from the headland.

b. When monitoring data indicate that the shoreline reach has been breached or severely damaged by overwash or other erosion, dredged material will be beneficially placed to repair breaches and other highly eroded areas of the shoreline reach. The material will be placed 100 to 300 feet offshore, similar to the placement at the nodal point. If the volume of material available is greater than the quantity required to address breaches and erosional hot spots, then the remaining material will be placed at the nodal point of the shoreline reach.

Approximately every fifth dredging cycle would be placed west of the Belle Pass jetties. Timing of the renourishment will be dependent upon the maintenance dredging requirements of the Bayou Lafourche, Louisiana project.

The feeder beach will benefit the Headland both to the east and west as longshore transport nourishes the beach face profile and adds width to the shoreline. The added width will afford some undetermined level of protection to the uplands by attenuating wave run-up and thus reducing storm damage. In addition, Aeolian transport will move finer sediment into the dune system. This will result in benefits to the flora and fauna species and habitats and will reduce the rate of erosion occurring along the piping plover's critical habitat. CEMVN understands that though the proposed feeder beach renourishment component of the Barataria Basin Barrier Shoreline project will likely benefit the piping plover critical habitat as is shown from our past experiences with dredge and nourishment placement around Bayou Lafourche (Belle Pass), our literature review, and our benefits analysis, that because of impacts to critical habitat from the Deepwater Horizon and because this project will be occurring concurrently with other restoration projects in the project area that our original determination for the piping plover "*Not Likely to Adversely Affect*" is now more appropriately a "*likely to adversely Affect*" determination. With this new information we request the initiation of Formal consultation for the BBBS project and request that the USFWS prepare a Biological Opinion.

Please review the enclosed biological assessment which addresses piping plover, West Indian manatee, five species of sea turtle (Kemp's Ridley, green, hawksbill, loggerhead, and the leatherback) and other sensitive species, and provide us with your biological opinion. If any questions or issues arise, please contact Mr. Thomas Parker of my staff at (504) 862-2526 or by email at Thomas.w.parker@usace.army.mil.

Sincerely,

FOR Joan M. Exnicios
Chief, New Orleans Environmental Branch

Enclosure

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF

December 6, 2010

Regional Planning and
Environmental Division South
New Orleans Environmental Branch

James F. Boggs
US Fish and Wildlife Service
646 Cajundome Blvd., Suite 400
Lafayette, LA 70506
Fax: (337) 291-3139

Dear Mr. Boggs:

The US Army Corps of Engineers, New Orleans District (CEMVN) is requesting that Formal Consultation for the Louisiana Coastal Area (LCA) Barataria Basin Barrier Shoreline (BBBS) project be suspended at this time. Due to significant changes to the project CEMVN must re-evaluate impacts related to the implementation of the proposed action. Instead we wish to request the initiation of early consultation for potential impacts to the piping plover, West Indian manatee and five species of sea turtle (Kemp's Ridley, green, hawksbill, loggerhead, and the leatherback) under Section 7 of the Endangered Species Act. Revisions to the draft EIS are currently being made. CEMVN anticipates the revised EIS to be released for public comment on March 26, 2011. If the service is in agreement, CEMVN would like to have a draft biological opinion available at this time. As part of the early consultation process the draft biological opinion would be released with the draft EIS during the comment period. Following the end of the 45 day comment period and subsequent comment resolution; if no significant changes are made to the document that would affect the determination of the draft biological opinion, then CEMVN would request confirmation in writing from the service validating the conclusions of the biological opinion, therefore finalizing consultation. We are providing a supplemental Biological Assessment (enclosure 1) with this request for the initiation of early consultation, which will supplement the May 1, 2009 BA for changes that have occurred to the scope of the tentatively selected plan (TSP) for the BBBS project, and to evaluate any additional effects these changes, not considered in the original biological assessment, will have on threatened and endangered species.

If any questions or issues arise, please contact Mr. Thomas Parker of my staff at (504) 862-2526 or by email at Thomas.w.parker@usace.army.mil.

Sincerely,

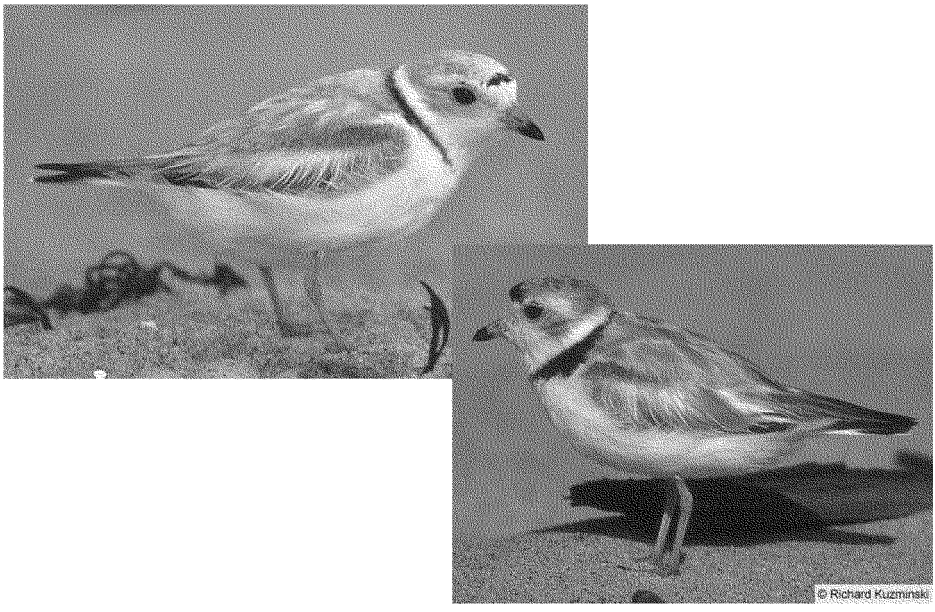
Joan M Exnicios

Joan M. Exnicios
Chief, New Orleans Environmental Branch

Enclosure

SUPPLEMENTAL BIOLOGICAL ASSESSMENT

Louisiana Coastal Area (LCA)
Barataria Basin Barrier Shoreline Restoration Feasibility Study
Caminada Headland and Shell Island Restoration



August 9, 2010

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1.0 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, requires that *"Each Federal agency shall, in consultation with and with the assistance of the secretary, insure that any action authorized, funded, or carried out by such agency....Is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species..."*

This Supplemental Biological Assessment (SBA) provides the information required pursuant to the ESA and implementing regulation (50 CFR 402.14), to comply with the ESA. Additional jurisprudence includes the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. section 4321, et seq.; the Fish and Wildlife Conservation Act of 1958 (PL 85-624; 16 U.S.C. 661 et seq.); the Marine Mammal Protection Act of 1972; and the Bald Eagle Protection Act of 1940. This SBA evaluates the potential impacts from changes made to the Tentatively Selected Plan (TSP) of the Caminada Headland and Shell Island Study on Federally-listed and proposed threatened and endangered species, designated and proposed critical habitat, and determines whether any such species or habitat are likely to be adversely affected by implementing the TSP.

A BA was prepared for the TSP and submitted to the United States Fish and Wildlife Service (USFWS) Lafayette Louisiana Office on May 1, 2009. The USFWS responded with a letter dated May 11, 2009 stating that they concurred with our determination that the TSP (as presented) would not likely adversely affect any threatened or endangered species or its designated critical habitat.

We are providing this SBA to re-initiate consultation, supplement the May1, 2009 BA for changes that have occurred to the scope of the TSP, and to evaluate any additional effects these changes not considered in the original BA will have on threatened and endangered species. The TSP contains all proposed actions presented in the preceding BA, unless specifically stated in this document. Therefore, the May 1, 2009 version of the BA is referred to extensively in the preparation of this document, and is thereby incorporated by reference. A copy of this BA is attached in **Appendix A**.

2.0 THREATENED, ENDANGERED, PROPOSED THREATENED OR PROPOSED ENDANGERED SPECIS

Piping Plover (*Charadrius melodus*), was listed as threatened and endangered on December 11, 1985 (50 FR, 50720-50734). Critical habitat was designated on July 6, 2000 (50 FR, 41782-41812)

Green Sea Turtle (*Chelonia mydas*), was listed as threatened in U.S. waters, except for the Florida breeding population which was listed as endangered, on July 28, 1978 (43 FR 32800 32811)

Kemp's Ridley Sea Turtle (*Lepidochelys kempii*), was listed as endangered throughout its range, on December 2, 1970 (35 FR, 18320)

Loggerhead Sea Turtle (*Caretta caretta*) was listed as threatened throughout its range on July 28, 1978 (43 FR 32800 32811)

Hawksbill Sea Turtle (*Eretmochelys imbricata*), was listed as endangered throughout its range, on June 2, 1970 (35 FR, 8491)

Leatherback Sea Turtle (*Dermochylys coriacea*), was listed as endangered throughout its range, on December 2, 1970 (35 FR, 8491)

3.0 CANDIDATE SPECIES

No candidate species are found in the project area.

4.0 SENSITIVE SPECIES AND SPECIES OF CONCERN

Bald Eagle (*Haliaeetus leucocephalus*), was de-listed on August 9, 2007 (72 FR 37345 37372)

Brown Pelican (*Pelecanus occidentalis*), was de-listed on November 17, 2009 (74 FR 59443 59472)

Colonial Nesting Birds including cormorants, herons, egrets, ibises, gulls, skimmers, and the Least Tern (*Sterna antillarum*). The interior least tern (*Sterna antillarum athalassos)* was listed as endangered throughout its range, except for within 50 miles of the coast, on June 27, 1985 (50 FR 21784-21792)

5.0 CRITICAL HABITAT

Critical habitat unit LA-5 for the piping plover is designated in the project area. Detailed discussion of critical habitat within the project area can be found in **Appendix A**.

6.0 CURRENT MANAGEMENT DIRECTION

The 2004 LCA Report developed 3 hydrogeomorphic objectives. These objectives include maintaining salinity gradients, increasing sediment input from sources outside the estuarine basins, and maintaining or establishing natural landscape features and hydrologic processes that are critical to sustainable ecosystem structure and function. The TSP provides this geomorphic form and function by separating the Gulf of Mexico from the interior estuaries and helping to regulate salinity gradients important to the range of estuarine and freshwater wetland species for the period of analysis. The geomorphic structures prevent open Gulf of Mexico wave energy from impacting the interior estuary and provide hydrodynamic stability to the system.

Loss of these functions would have impacts beyond the project footprint. Modeling conducted, which excluded the BBBS project in its future projections, estimated that by 2060, 75% of the land between the Caminada Headland and the Larose to Golden Meadow Hurricane Risk Reduction levees would be lost. The barrier islands in Plaquemines Parish, including Shell Island, will have disappeared as well as the marshes between the islands and the Mississippi

River levees. Salinity modeling reflecting a without project condition demonstrates the function of the barrier islands in separating the marine from the estuarine environments. On the eastern side of the basin, in areas where the barrier islands are severely eroded, the salinity fields grow proportionally larger.

Per ER 1105-2-100 Section E-30, "The objective of Civil Works ecosystem restoration is to restore degraded significant ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. However, partial restoration may be possible, with significant and valuable improvement made to degraded ecological resources." The Caminada Headland and Shell Island provide important geomorphic, hydrologic, and habitat functions in the Barataria basin.

Modeling results have shown that barrier islands decreased wave energy landward of the island during tropical events. When the barrier islands were degraded in the models, the modeled wave heights increased, thus heightening the potential for overtopping levees and inundation of protected areas. Sustaining the geomorphic form of the barrier islands will provide storm surge protection for the interior wetlands and the surrounding coastal communities. The TSP will prevent the fragmentation of the Caminada Headland and greatly ameliorate impacts on several important socio-economic sectors such as: Port Fourchon, the largest base for offshore oil and gas operations in coastal Louisiana and the largest coastal fishing port; major oil and gas infrastructure, such as regional transportation and storage facilities, the LOOP, and the Mars pipeline; and the regional hurricane evacuation route serving residents of southern Lafourche Parish, the community of Grand Isle and approximately 6,000 workers stationed at offshore facilities in the central Gulf of Mexico. By decreasing the rate of erosion and preventing the splintering of the headland, the investment in infrastructure located at Port Fourchon will be less vulnerable to storm surges. Oil and gas pipelines and Louisiana Highway 1 maintenance requirements will lessen compared to the future without project conditions.

7.0 DESCRIPTION OF THE PROPOSED ACTION

7.1 Caminada Headland

Caminada Headland Alternative 5 proposes a dune height of +7 feet NAVD88 with a dune width of 290 feet. Alternative 5 also proposes a landward beach and dune component in order to maximize acreage and longevity. The landward and seaward slopes would be set 20 horizontal to 1 vertical. The marsh fill is proposed on the landward side of the dune at an elevation of +2.0 feet NAVD88. Approximately 880 acres of beach/dune and 1,186 acres of marsh would be created, resulting in a total of 2,066 acres. Fill quantities for the dune and marsh fills would be 5.1 million and 5.36 million cubic yards, respectively. For the dune area, the material would be pumped from the dredge to the beach. The material would then be worked on the beach by bulldozers and front-end loaders. Points of direct access to the project area are Louisiana Highway 3090 and a beach road at Elmer's Island on the eastern end. For the marsh area, the material would be pumped from the offshore borrow site. The dune would serve as the southern dike for the marsh fill. Additional dikes would be constructed around the remaining

perimeter. These operations would be completed in a manner that would minimize turbidity of the water at the dredge site and the discharge site. **Figure 1** shows the plan view of alternative 5.

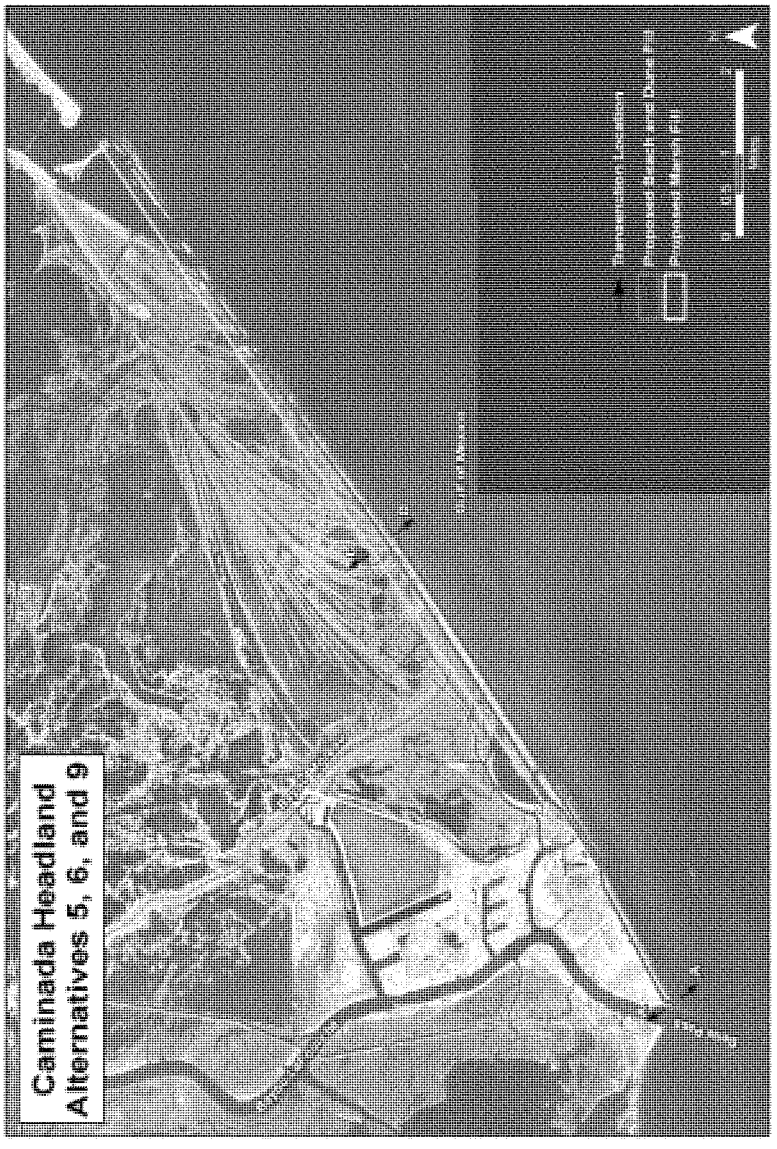


Figure 1: Caminada Headland Alternative 5

The borrow area identified for the beach/dune restoration is Ship Shoal, a large submerged sand body in the Gulf of Mexico located offshore in south-central Louisiana. The shoal is about 31 miles long and 7 miles wide, lying in water depths of 9 feet to 30 feet. Preliminary studies have shown it is the remaining seaward shoal from one of the older, abandoned Mississippi River deltas. It is composed of well-graded quartz sand and is suitable for use in restoring the Caminada Headland since its grain size is similar to the sand found on the headland. The sediment is to originate from South Pelto, Blocks 12 and 13, which is approximately 40 miles from the project site. The borrow site for the marsh restoration would be located approximately 1.5 miles south of the central portion of the Caminada Headland, and 4.7 miles southwest of Caminada Pass. The estimated duration of construction is 939 days. It is estimated that the duration of plantings would be 750 days over a 3-year period.

Approximately 71,500 feet of sand fencing would be installed. The sand fences would be porous barriers that would reduce wind speed along the coast such that sand being transported by the wind accumulates on the downwind side of the fence. The sand fences would promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings. Vegetative plantings would include a variety of native species. The recommended planting density is no greater than 8-foot centers. O&M of the project includes repair and/or maintenance of sand fencing. The maintenance estimate for sand fencing includes complete replacement in year 5 with 20 percent replacement every 5 years until the end of the 50 year period of analysis.

As stated in ER 1105-2-100, Appendix E, Section E-30, "Because self-regulation is a key goal of ecosystem restoration, it is generally more desirable to pursue ecosystem restoration projects that have limited maintenance requirements." The TSP would place external sediment into a sediment starved ecosystem, and then let the ecosystem "self-regulate," letting the natural shoreline processes take over. Based on the sediment budget prepared for the Caminada Headland, the loss of sediment from the headland, which is derived from the total gulf shoreline erosion loss minus the total overwash accumulation, is estimated to be 379,000 cubic yards per year. The TSP would include renourishment of the Caminada Headland per the 2004 LCA report which included near-shore recovery of 2 million cubic yards of sand every 10 years. USACE operations and maintenance dredging of the Bayou Lafourche, Louisiana (Belle Pass) navigation project yields on average approximately 650,000 cubic yards of material every 1.5 to 2 years. Of this material, 500,000 cubic yards will be placed in the littoral drift south of Bayou Moreau where the long shore transport of material splits going east and west. The renouishment will create a feeder beach along this nodal zone of the Caminada Headland. The nodal point is a "hot spot" due to bifurcation of the sediment transport, thus it breaches more frequently than other locations on the Headland. By placing the material at the nodal point, the entire Headland will benefit by reducing breaching. The material will be placed, allowing the long shore transport and wave action to move and place the sediment along the headland. Over each 10 year period, an estimated 2 million cubic yards of material will be returned to the headland, replacing 53% of the sediment lost from the headland. Approximately every fifth dredging cycle would be placed west of the Belle Pass jetties. Material placed during the Belle Pass maintenance event would follow disposal guidelines established under preceding coordination with Federal agencies. Timing of the renourishment will be dependent upon the maintenance dredging requirements of the Bayou Lafourche, Louisiana project. The Gradation Curves which

reflect the percent composition of sand, silt, and clay of the material that is removed during maintenance dredging are attached in **Appendix B.**

Historically material removed during maintenance dredging has been placed east and west of the jetties at beach nourishment disposal sites. As part of the adaptive management plan, shoreline imagery will be evaluated to determine the renourishment approach. One of two basic approaches will be used, based on shoreline conditions:

a. When monitoring data indicates that the shoreline is relatively intact, with no breaches created by storm surge or wave action, the TSP proposes that the dredged material from Belle Pass will be placed in the littoral drift south of Bayou Moreau where the sediment budget indicates that the long shore transport of material splits going east and west (**Figure 2**). Placement of material at this location sustains the project by building out the shoreline at the nodal point, which is an area of more rapid shoreline erosion, and by feeding material along the entire reach through existing longshore transport patterns. Approximately 500,000 cys would be placed unconfined between 100 and 300 feet from the mean high water (MHW) mark, allowing the long shore transport and wave action to move and place the sediment along the headland. There would be no direct placement of sediment onto the beach during the renourishment events. All beach fill would be placed seaward of Mean Low Low Water (MLLW) (horizontal) and at or below MLLW (vertical). The material would be pumped in an area approximately 13,000 feet in length offshore of the nodal point. The Caminada Headland is a high energy wave environment that is very dynamic. The material would be stacked no higher than + 6 feet MLG, but would be quickly reworked by the wind and waves. The pumping of the material would take approximately 35 days, with placement and removal of the pipeline taking a total of approximately 70 days. The pipe will be placed offshore. The material would be dredged from a federal navigation channel which previously received NEPA clearance for the maintenance dredging of the Bayou Lafourche channel.

b. When monitoring data indicate that the shoreline reach has been breached or severely damaged by overwash and/or other erosion, dredged material will be beneficially placed to repair breaches and/or other highly eroded areas of the shoreline reach. The material will be placed in a manner which restores the shoreline to conditions similar to what existed prior to breaching. Each breach or overwash restoration action will be coordinated on a case by case basis. If the volume of material available is greater than the quantity required to address breaches and erosional hot spots, then the remaining material will be placed at the nodal point of the shoreline reach.

The Coastal Engineering Manual (CEM) (USACE, 2006) describes feeder beaches as finite-length berms placed along a beach, usually at the updrift end of a littoral cell that has strong unidirectional shore-parallel transport. They can also be placed at a nodal "hot spot," where shore-parallel transport divides, thus moving sediment in both directions away from the node. This concept involves placing a large volume of sediment in a limited area and relying on littoral processes to move it down the beach, thus gradually renourishing the beach at a distance from the placement site. The CEM describes feeder beaches in the same terms as regular or normal beach restoration projects, with the sediment placed on the beach face, but not necessarily "...the same degree of alongshore uniformity as that provided by placing fill in a prescribed manner throughout the project area." The feeder beach concept has been expanded to

include subsurface placement of sediment to create a "feeder bar," which relies on coastal processes to move the sediment onto the beach face naturally. A sub-tidally placed feeder beach that nourishes the beach profile without need for heavy grading machinery and/or disturbance to environmentally sensitive habitats can be more desirable and is typically less expensive than one that is conventionally constructed. In addition, as wave action carries fine sediment onto the beach face and deposits it, an opportunity is afforded for aeolian transport to move it up the beach and onto the dune, nourishing the system.

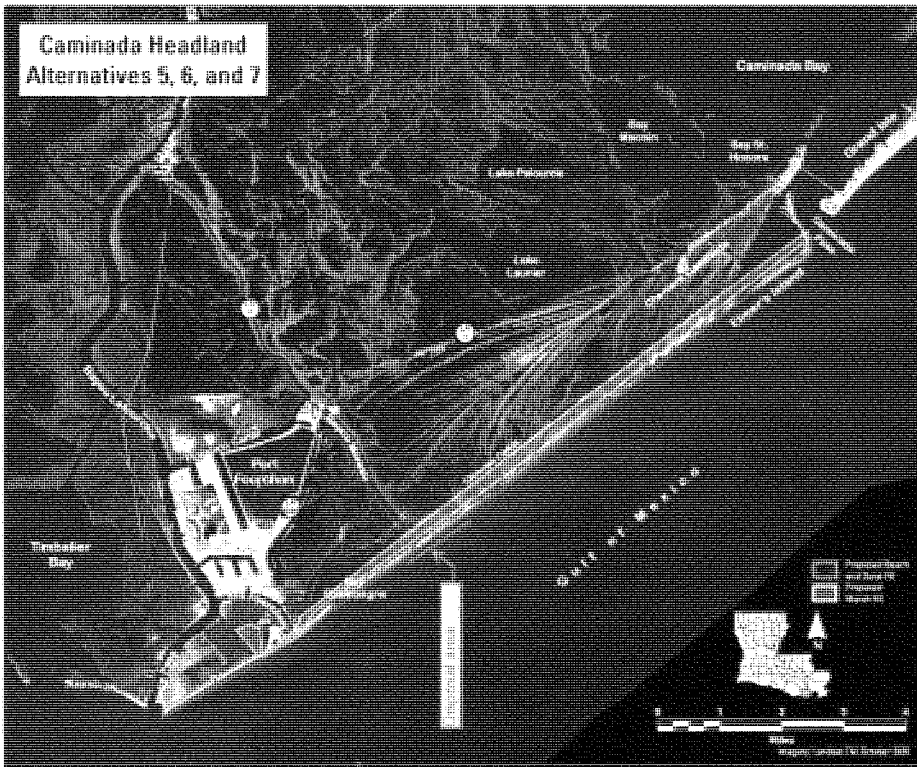


Figure 2: Nourishment Placement Location

7.2 Shell Island:

Alternative 5 has replaced alternative 1 as the selected alternative for the Shell Island component. Under alternative 5, the Shell Island component would be restored as one island. The island would include shoreface, dune, and marsh platform features. This alternative would restore Shell Island to a form similar to its pre-Hurricane Bob (1979) condition. The proposed island follows the shortest and shallowest route across Coupe Bob. The landward edge of the

dune of alternative 5 would be located seaward of the existing shoreline. The west end of the alternative 5 single island would be terminated approximately 0.5 miles before Grand Bayou. It is anticipated that the closure of Coupe Bob would return the tidal prism to its pre-1979 path—flowing through Grand Bayou, with Grand Bayou increasing in size in response to the altered tidal flow pattern. The west end of alternative 5 is close to the western limit of Shell Island that was observed in 1973, prior to the opening of Coupe Bob. The proposed island follows the shortest and shallowest route across Coupe Bob. The east end of the island would then follow the remnants of Shell Island East, but has a concave shape towards land. This would be required to maintain a smooth shoreline. The eastern end of the island would be located near the Empire Waterway. The constructed dune would have a uniform width of 189 feet along the length of the restored barrier island. Louisiana barrier islands have typical widths in the region of 1,000 feet to 1,500 feet wide from the gulf shoreline to the bayward limit of the marsh. A uniform marsh width of 735 feet was chosen to construct an island that is approximately 1,240 feet wide following equilibration of the shoreline fill. The fill source for dike construction was located within the marsh fill footprint where the existing bathymetry is relatively shallow (less than -2.0 feet). However, in deeper water (bathymetry below -3.0 feet), it is not feasible to construct the marsh section with only marsh sediments, as the marsh would settle too rapidly and nonuniformly to perform its intended purpose effectively. Instead it is recommended to construct a sand base across Coupe Bob, at -3.0 feet, using shoreline fill material. The marsh can then be constructed on top of this base, which would reduce settlement of the marsh material. A second option is to install a geotextile tube for containment of the marsh fill where the -3 feet NAVD sand base is constructed. The geotextile tube could be filled with sand from the sand base. The one island alternative would restore a total of 783 acres. This would include 317 acres of beach/dune and 466 acres of marsh on Shell Island. It is estimated that 5.6 million cubic yards of shoreline fill would be required to construct 317 acres of shoreline/dune area (area above +2 feet, NAVD) and 2.1 million cubic yards of marsh fill would be required to construct 466 acres of marsh. It is estimated that duration for construction would be 635 days. It is estimated that the duration for the plantings would be 420 days over a period of 3 years. **Figure 3** shows alternative 5 for the Shell Island feature.

The borrow source for the dune/beach would be a large sand deposit near Nairn in the Mississippi River between mile markers 32 and 34, approximately 11 miles north of the project area. The borrow site is located in a river meander where greater sediment thickness is anticipated due to the presence of relict (vertically stacked) sand bars. USACE boring date indicates sand thickness of at least 70 feet. Based on samples obtained from vibracores, the sand grain size is comparable to the sand at the project site. The dredged material would be pumped from the Mississippi River via pipeline. The borrow source for the marsh restoration would be the Empire deposit, approximately 1.5 miles from the Empire Jetties. Water depths in the borrow area are from 16 feet to 20 feet. The borrow area occupies about 207 acres and total mixed sediment volumes range from 5.5 million to 6.6 million cubic yards for 15 foot and 20 foot cut depths, respectively. The sedimentary characteristics indicate a silt content of about 40 percent, a clay content of about 22 percent and sand content of about 38.percent.

Shell Island would be re-nourished 20 years and 40 years after initial construction to the original template of 317 beach/dune acres. The marsh fill for alternative 5 would also be re-nourished to its original construction template at this time interval. Approximately 1.5 million

cubic yards of beach fill would be required for re-nourishment cycles in years 20 and 40. In year 20, approximately 907,200 cubic yards of marsh fill would be required and in year 40, 604,700 cubic yards would be required for re-nourishment.

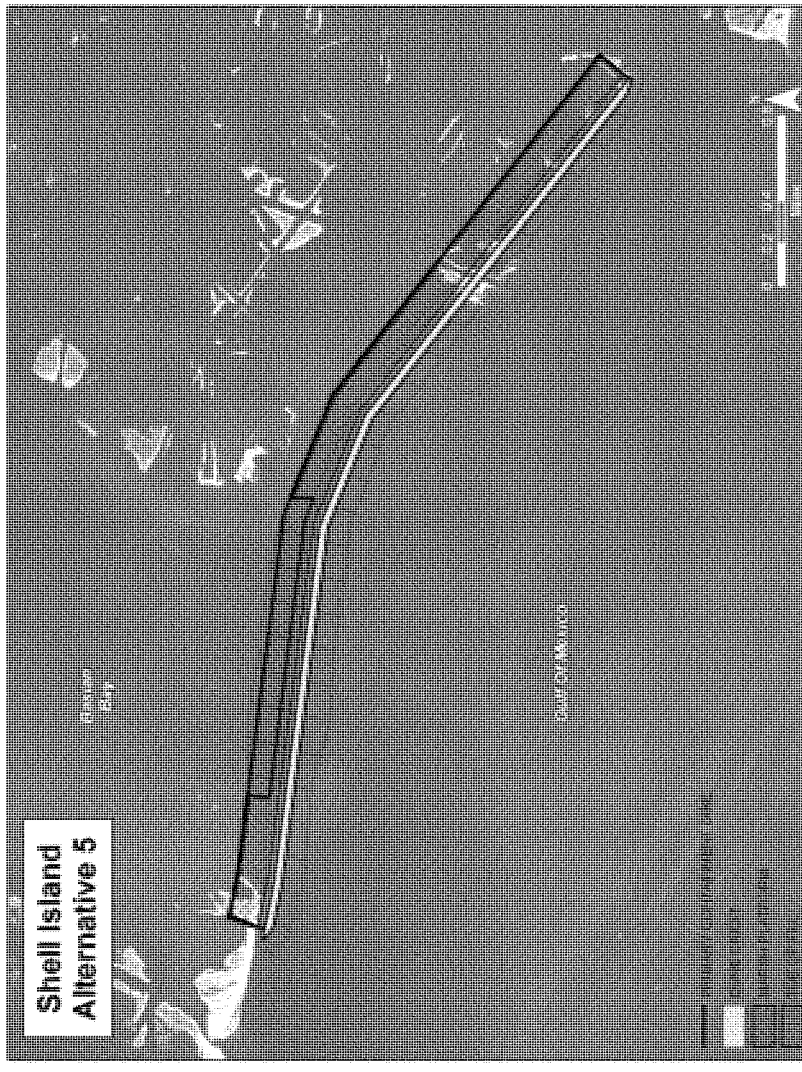


Figure 3: Shell Island 5

8.0 EXISTING ENVIRONMENT

The Caminada Headland has been said to be one of the most rapidly eroding shorelines in the United States (McBride et al. 1992). The total net gulf shoreline erosion loss is approximately 926,000 cubic yards per year (cy/yr), with an overwash rate of 547,000 cy/yr. The overwash is captured in the back barrier marsh. Consequently, approximately 60% of the sand is retained in the marshes behind the beach and dunes. Of the remaining 379,000 cy, approximately 300,000 cy/yr is lost to Belle Pass, while the remaining is lost to the east towards Grand Isle. **Figure 4** shows the sediment budget for the Caminada Headland.

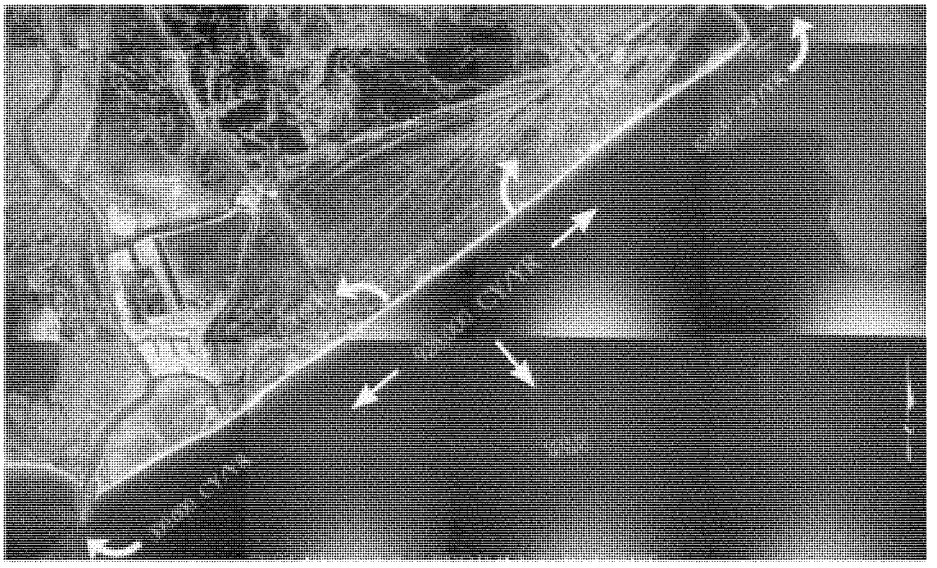


Figure 4: Sediment Budget

8.1 Oil Spill-related Impacts to Environmental Baseline:

The impacts of the Deepwater Horizon oil spill on coastal Louisiana are uncertain at this time (December 2010). The impacts of the oil spill as well as the various emergency actions taken to address oil spill impacts (e.g., use of oil dispersants, creation of sand berms, use of Hesco baskets, rip-rap, sheet piling and other actions) could potentially impact USACE water resources projects and studies within the Louisiana coastal area, including the BBBS project. Potential impacts could include factors such as changes to existing, future-without, and future-with-project conditions, as well as increased project costs and implementation delays. The USACE will continue to monitor and closely coordinate with other Federal and state resource agencies and local sponsors in determining how to best address any potential problems associated with the oil spill that may adversely impact project implementation. Supplemental planning and environmental documentation may be required as information becomes available.

If at any time petroleum or crude oil is discovered on project lands, all efforts will be taken to seek clean up by the responsible parties, pursuant to the Oil Pollution Act of 1990 (33 U.S.C. 2701 et seq.).

The Deepwater Horizon was an ultra-deepwater offshore rig that was conducting exploratory drilling off the Coast of Louisiana. On April 20, 2010, the drill breached a pocket of high pressure methane gas which ignited and created an explosion on the platform. The explosion and ensuing fire caused eleven deaths and eventually capsized the rig, creating a massive oil spill in the Gulf of Mexico. The sunken rig is located approximately 125 miles southeast of Timbalier Island. Since the spill, oil has been found on the gulfward shorelines of the Shell Island, Grand Isle, Grand Terre Island, Beauregard Island, the Caminada Headland, and each island in the Isle Dernieres and Timbalier Island reaches. The quantity of oil washed on to the shorelines can be viewed using NOAA's Shoreline Cleanup Assessment Technique (SCAT) data on their website (NOAA, 2010).

Oil has also been found on the Caminada Headland and all the Barataria Barrier Islands, all of which support critical habitat in the project area. Potential piping plover impacts associated with the oil spill primarily consist of a reduction in available food supply. Piping plovers primarily feed on benthic organisms found in intertidal beaches, mudflats, sand flats, algal flats, and washover passes. The effects of oil on the health of benthic communities can be both acute and chronic in nature. According to the USFWS, oil can be directly toxic to these organisms or impact them through physical smothering, altering metabolic and feeding rates, and altering shell formation. Intertidal benthic communities may be particularly vulnerable when oil becomes highly concentrated in narrow bands along the shoreline (USFWS, 2004). Barnacles and other sessile species are vulnerable to smothering by heavy oils while the physiological effects of the hydrocarbons can considerably reduce the mobility of the more mobile species (University of Delaware, 2010). Additionally, sediments can become reservoirs for the spilled petroleum. Some benthic invertebrates can survive the initial exposure, but may accumulate high levels of contaminants in their bodies that can be passed on to predators (USFWS, 2004).

The magnitude of the impacts is also a function of the characteristics of oil spilled. For example, a study conducted on the Amoco Cadiz spill in 1978 revealed that "light oil" resulted in considerable detrimental impacts to the benthic communities. However, a separate study revealed that the benthic organisms were contaminated, but were not adversely impacted, from a spill of heavy crude (University of Delaware, 2010). In 2003, Donlan et al. assessed the impacts of the North Cape oil spill on communities of piping plover in Rhode Island. The study first examined the abundance of prey species on Moonstone Beach (the oiled island) and compared it to that of an adjacent, un-oiled beach (Goosewing). Although the abundance of benthic organisms was not significantly different between the two beaches, the species composition was considerably dissimilar. For example, only two Amphilporeia were found in the sampling station on Moonstone, compared to 456 at Goosewing. This reinforced the common belief that amphipods are the first group of organisms to disappear and one of the last to recolonize once exposed to oil. Based on this information, the authors concluded that the piping plovers' food supply may have been reduced because of the oil spill. The authors also noted a decline in the number of fledgings produced per nesting pair between 1995 and 1996 (the year of the spill). This reduction was attributed to the lack of available prey species in the intertidal zone, which

caused plovers to travel longer distances and expend more energy when feeding (Donlan et al., 2003). Between 1990 and 1995, Jewett et al. assessed the impacts of the Exxon Valdez oil spill on the benthic communities in Prince Williams Sound, Alaska. The metrics of the study included concentrations of hydrocarbons and benthic community composition, diversity, biomass, and abundance. These metrics were compared between a number of reference sites and oiled sites.

The comparison was conducted in 1990 (approximately 16 months after the spill), 1991, 1993, and 1995. According to the authors, the "total abundance and biomass of epifauna were generally higher at oiled sites, primarily because of higher densities of epifaunal bivalves. Otherwise, there were few consistent community-wide responses to oiling in diversity, richness, total abundance, total biomass, or the abundances of major taxonomic groups (e.g. polychaetes or bivalves)." The lack of a stronger community-wide response was attributed to the varying sensitivities of benthic organisms. For example, oil-sensitive amphipods such as Isaeidaes and Phoxocephalidaes were found in lower concentrations at the oiled sites. These impacts were evident throughout the duration of the study (i.e. 6 years after the spill). However, stress-tolerant and opportunistic organisms such as polychaetes were found in higher concentrations at the oiled sites due to organic enrichment. The study also revealed that hydrocarbon concentrations in the sediment were high (up to 15,300 ng/g) in eel grass beds immediately adjacent to the oiled shorelines, but sharply declined after 1990 (Jewett et all, 1999). Although the benthic organisms and habitat types within Prince Williams Sound vary from that of the Project Area (eelgrass beds versus sand beds and mud flats), the study does provide an indication of the resiliency and recovery rates of benthic communities as a whole. Furthermore, the results of the study indicate that the species composition of the benthic communities is expected to shift as a result of the Deepwater Horizon oil spill. For example, amphipods, which are favored by the piping plover, are expected to decrease in number while other less-favorable species may increase. As previously stated in the prior BA the construction of the beach and dune restoration component will likely impact benthic communities by smothering them during fill placement. In the short term, this could further stress the oil-impacted benthic organisms that are currently on the island. However, sediment used for fill placement would be tested to ensure that it is free of oil before it is placed in the project area. Placement of clean sediment in the project area could potentially improve the quality of the benthic habitat by diluting concentrations of oil in the project area's intertidal zone. Typically feeder berms will slowly allow sediment to gradually move its way on to the beach. This gradual movement could, in turn, speed up the recovery time of the oil-impacted benthic communities.

In response to the Deepwater Horizon spill the barrier berm project was initiated in an attempt to protect Louisiana's coastal marshes from being severely impacted by oil. In the vicinity of the Shell Island component; berm number W8 has currently received approximately 1.3 million cubic yards of sandy fill material. This material is placed in a liniar fashion and is stacked with a slope of approximately 25:1. Impacts to the existing conditions are not known at this time. As this sandy berm is reworked by tidal forces impacts to water depth or sediment composition could result in the project area. CEMVN continues to monitor the impacts from the sand berm and would incorporate new environmental data into the project design when this project enters the PED phase.

9.0 DESCRIPTION OF SPECIES

Supplemental biological data relevant to changes made to the TSP or existing conditions are presented below. Species descriptions for the piping plover, Five species of sea turtle (Green, Hawksbill, Kemp's Ridley, Loggerhead, and Leatherback), and the Gulf Sturgeon can be found in **Appendix A**. The changes made to the TSP will not result in any additional impacts to the Five species of sea turtle (Green, Hawksbill, Kemp's Ridley, Loggerhead, and Leatherback), or the Gulf Sturgeon. As such our determination from the preceding BA for these species will not change and these species will not be discussed further within this document. Detailed biological data and impacts discussion for these threatened and endangered species can be found in **Appendix A**.

10.0 ANTICIPATE EFFECTS OF THE PROPOSED ACTION

Barrier system restoration, including interior marsh restoration features, would likely alter the tidal prism, thereby reducing formation of any additional tidal passes as well as "healing" (closing or narrowing) existing tidal passes and overwash areas. This would have an undetermined impact on retarding saltwater intrusion into more northern portions of the Barataria Basin. Restoration of the Caminada Headland and Shell Island would provide an undetermined level of natural storm buffering, reduction of storm surge heights, and would provide protection for the interior wetlands, bays, and estuaries. Additional indirect impacts would include:

- Restore critical piping plover shoreline habitat (discussed later in section 10);
- Restore the beach ecotone (i.e., the transition zone between the land and sea);
- Restore important estuarine and marine transitional EFH; and
- Restore essential spawning, nursery, nesting, and feeding habitat for many different fish and wildlife species that presently must compete for these scarce barrier shoreline, headland, and island resources.

10.1 Caminada Headland:

The use of a feeder beach as a shore protection measure provides considerable environmental benefit. Subtropical sandy beaches support a broad range of organisms, from microscopic infauna to reptiles, birds, and mammals, and the varied plants that stabilize the berm and dune and shelter its inhabitants. Of particular importance throughout the Gulf of Mexico is the berm nesting activity of sea turtles (for which there is an extensive body of literature, see Trindell, et al., 1998), the berm and dune nesting activities of several species of shorebirds, and the foraging activities of both shorebirds and transient migratory neotropical birds. The ecology of this assemblage of organisms is quite complex, but the lack of cover has led to adaptations for burrowing and crepuscular and nocturnal activity patterns, thus there is little daylight evidence of the diversity of the assemblage. The burrowing creatures range from polychaete worms, snails and bivalve mollusks, a broad range of arthropods, including insects, to mammals like beach mice. The major predators on many of the burrowing creatures are shore birds and wading birds, some of which also nest in the beach/dune system. The nearshore and surf zones are prime foraging areas for pelicans, skimmers, terns, and gulls, with the latter three also congregating on the beach face in large flocks. Many of the plants and animals are quite resilient, and able to

recover from routine tidal inundation and sediment overwash. However, storm surges can devastate some populations: a 1979 hurricane overwash wiped out an endangered beach mouse population on Perdido Key, Florida prior to their restoration project (Dean, 2002) and there are numerous accounts of similar events destroying the majority of sea turtle nests on Gulf of Mexico beaches. It follows that a restored and periodically renourished beach berm and dune system affords more protection than one that continues to erode. (Poff Memorandum, 2010)

The qualitative benefits of feeder beaches are well documented in the literature; several pertinent sources are provided below. Dean and Browder (2000) found that along Perdido Key, Florida a 2 meter thick shore-parallel bar or berm, placed at a depth of -6 m, essentially remained in place, even when impacted by passage of several hurricanes. Pendleton, et al., (2003) observed that the adjacent Perdido Key beach, nourished concurrently (1989-1990) with the berm construction, retained 56% of the restored sand after eight years, which translated into 53 m of additional beach width. Work and Otay (1996) studied the role of the berm in stabilizing that restored beach. They reported that the sand loss from the unprotected beach was 50 m3/m/year, but only 15 m3/m/year from the area protected by the shore-parallel berm. (Poff Memorandum, 2010)

Since the mid-1980's, the City of Naples, Florida has been dredging an inlet, Doctors Pass, at an approximate interval of every five years, and placing the sediment in the nearshore downdrift of the inlet. The dredge material has been pumped parallel to shore in depths of less than -2 m, to above MHW, and subsequently transported onto the beach face within a few months by coastal processes. The dredged volumes were on the order of 50,000 CY and the material made such a noticeable difference in the beach profile that the design template was adjusted (reduced) during the City's most recent beach renourishment in 2006 to account for the beneficial effects of the maintenance dredge sediment (Poff Memorandum, 2010).

Palm Beach County and the State of Florida are planning a feeder beach at the Town of Palm Beach, to combat erosion resulting from an inlet-related sediment deficit (Bureau of Beaches and Coastal Systems, 2008). Other beach renourishment projects have incidentally served as feeder beaches for adjacent shorelines, both up- and downdrift. The Delray Beach, Florida beach, which has been successfully renourished multiple times, has contributed significantly to neighboring beaches to the north and south (Beachler, 1993). A Danish study comparing beach and shoreface nourishment concluded that the shoreface nourishment (i.e. subtidal feeder bar) provided more long-term benefit that the initial beach nourishment, and was more cost-effective (Laustrup, et al., 1996). A similar study from the Netherlands (Hoekstra, et al., 1996) concluded that the success of the shoreface feeder berm was a combination of it performing as a feeder and also as a submerged breakwater, reducing wave impact on the shoreline. Coastal Engineering Consultants Inc. (CECI) team has personal experience with feeder beaches that have also been successfully incorporated into beach renourishment projects including Captiva Island, Florida; St. Petersburg, Florida; Jones Beach Barrier Island, New York; and Corpus Christi Bay, Texas. The volumes of sediment involve in these projects ranged from 50,000 to over 700,000 CY (Poff Memorandum, 2010).

10.2 Shell Island:

For the rare species found in Louisiana, the loss of barrier island habitat has contributed to the decline of listed species; because these islands provide protected, isolated habitats that cannot be found elsewhere along the coast. The link between species at risk and barrier islands is reflected in the fact that of the 8 currently federally threatened and endangered species, and two recently delisted federally threatened and endangered species that occur in coastal Louisiana, eight have direct ties to barrier island habitats (**Table 1**).

Table 1: Federally threatened and endangered species found in coastal Louisiana that are dependent on or use barrier island habitats

Common Name (Scientific Name)	Federal Status	Dependence on Barrier Islands
Gulf Sturgeon (Acipenser *oxyrinchus* desotoi)	Threatened	Feeds in shallow water habitats associated with barrier islands, particularly passes
Brown Pelican (*Pelecanus occidentalis*)	Now de-listed	Uses barrier islands for nesting and nearby aquatic habitats for feeding
Piping Plover (*Charadrius melodus*)	Threatened	Uses barrier islands as wintering habitats because of reduced predation pressure
Hawksbill sea turtle (*Eretomchelys imbricata*)	Endangered	Needs warm, shallow aquatic habitats for feeding
Kemp's Ridley sea turtle (*lepidochelys kempi*)	Endangered	Needs warm, shallow aquatic habitats for feeding
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	Needs warm, shallow aquatic habitats for feeding
Green sea turtle (*Chelonia mydas*)	Threatened	Needs warm, shallow aquatic habitats for feeding
Loggerhead sea turtle (*Caretta caretta*)	Threatened	Nests on barrier islands; needs warm, shallow aquatic habitats for feeding
Bald Eagle (*Haliaeetus leucocephalus*)	Now de-listed	Not dependent on barrier islands but will use terrestrial habitats on islands for nesting
West Indian Manatee (*Trichechus manatus*)	Endangered	Not dependent on barrier islands but will use warm, shallow aquatic habitats for feeding.

If barrier islands are lost because of anthropogenic alteration or lack of sufficient sand input over the next century, these are the eight species that will be most negatively

affected because they rely on barrier islands for nesting, breeding, and feeding. (O'Connell et al., 2005).

Shell Island Alternative 5 would restore the Shell Island to a pre-Coupe Bob condition and would provide a more robust barrier island separating Bastian Bay from the Gulf of Mexico's influences. This would increase the availability of the unique habitat available on barrier islands to threatened and endangered species in the region. Since a majority of shell islands historic surface area has been lost to natural and anthropogenic processes, increasing the proposed actions restoration efforts in the region would provide more sub-aerial land in areas where it no longer exists. **Tables 2** show the projected differences between Shell Island Alternative 1 and the selected Shell Island alternative 5.

Alternative	Caminada Dune Acres	Caminada Marsh Acres	Shell Island Dune Acres	Shell Island Marsh Acres	Total Acres
C5/S1	880	1186	332	351	2749
C5/S5	880	1186	317	466	2849

Table 2: Acreage Comparison

By selecting Shell Island alternative 5, the proposed action would provide an additional 15 acres of dune and 105 acres of marsh in the project area. The increase restoration footprint for alternative 5 would provide additional wildlife shelter, foraging, roosting, nesting, and cover for the listed species that rely on barrier islands in the project area.

10.3 Piping Plover (*Charadrius melodus*)

On May 11, 2009 USFWS concurred with our determination of "not likely to adversely affect" for the BBBS project. Since this time impacts to the piping plover from the proposed action have been increased by project changes and recent events. In order to quantify the additional impacts that the feeder beach and shell island alternative 5 would have on the piping plover and its critical habitat, required additional modeling was necessary. CECI performed an SBEACH and GENESIS modeling analysis to assess the proposed shoreline impacts. The modeling process, results, and analysis are as follows.

For the current model run CECI performed an SBEACH model. The SBEACH model is a widely accepted cross-shore sediment transport model utilized for predicting storm-induced beach and dune erosion. CECI developed the SBEACH input profile from the design template for the TSP at Transect D located within the nodal zone (**Figure 5 in Appendix A**). The assumed construction start date was 2012. The equilibrium and advanced fill was removed and two years of background erosion were applied to yield the projected profile at 2014 equivalent to the first

renourishment event designated as the Initial Profile. The feeder beach template at 2014 was then derived as follows.

Step 1. CECI conducted a compatibility analysis of the Belle Pass dredge material with the native beach. In this case it will be Ship Shoal sand since the renourishment occurs after the Headland is restored full length using the Ship Shoal borrow area. Input data were the Belle Pass sediment data provided to CECI by the USACE via email of July 14, 2010 and native beach and Ship Shoal grain size data which were presented in CECI's Caminada Headland Engineering Appendix (CEC and SJB, 2008); none of which are presented herein for brevity. Rather, we reference Annex C-2 of the Engineering Appendix within the EIS for the native beach and Ship Shoal

– South Pelto Blocks 12 and 13 sediment data. The average mean grain size of the dredge material was computed to be 0.06 mm. The post-restoration average mean grain size of the Headland is predicted to be approximately 0.18 mm based on the native beach and Ship sediment data. Thus the dredge material contains a significant greater percentage of fines requiring additional analyses to determine the effective volume that will be yielded from the renourishment strategy and contribute to the littoral system as a feeder beach.

Step 2. CECI determined the overfill ratio proposed by Dean (1986) to identify the "fine" percentage of the Belle Pass dredge material which will be lost in profile equilibration / cross-shore losses and will not contribute to the littoral system. The analysis yielded an overfill ratio of 4.6.

Step 3. CECI determined the total dredge volume by multiplying the established volume of 500,000 CY by the average ratio of the gross volume to pay volume, computed to be 1.2, equal to 620,000 CY. The gross and pay volumes were extracted from the historical dredge records provided to CECI via email on July 19, 2010 by CEMVN.

Step 4. CECI subtracted the volume of "fine" sediment lost in profile equilibration / cross-shore losses from the total dredge volume to yield the effective volume of 135,000 CY that will contribute to the littoral system as a feeder beach. This "stable" volume will have an approximate mean grain size of 0.18 mm by virtue of the process completed above.

Step 5. CECI established the feeder beach design template parameters. The berm elevation was chosen as MHW, equal to +1.5 NAVD88. The seaward slope was set equal to 1:20 consistent with the TSP design template. The length of shoreline was set equal to 6,800 feet based on the Caminada Headland Renourishment Location Map provided to CEC by the USACE via email on July 20, 2010. Based on the effective volume, the average berm width was computed to be 125 feet.

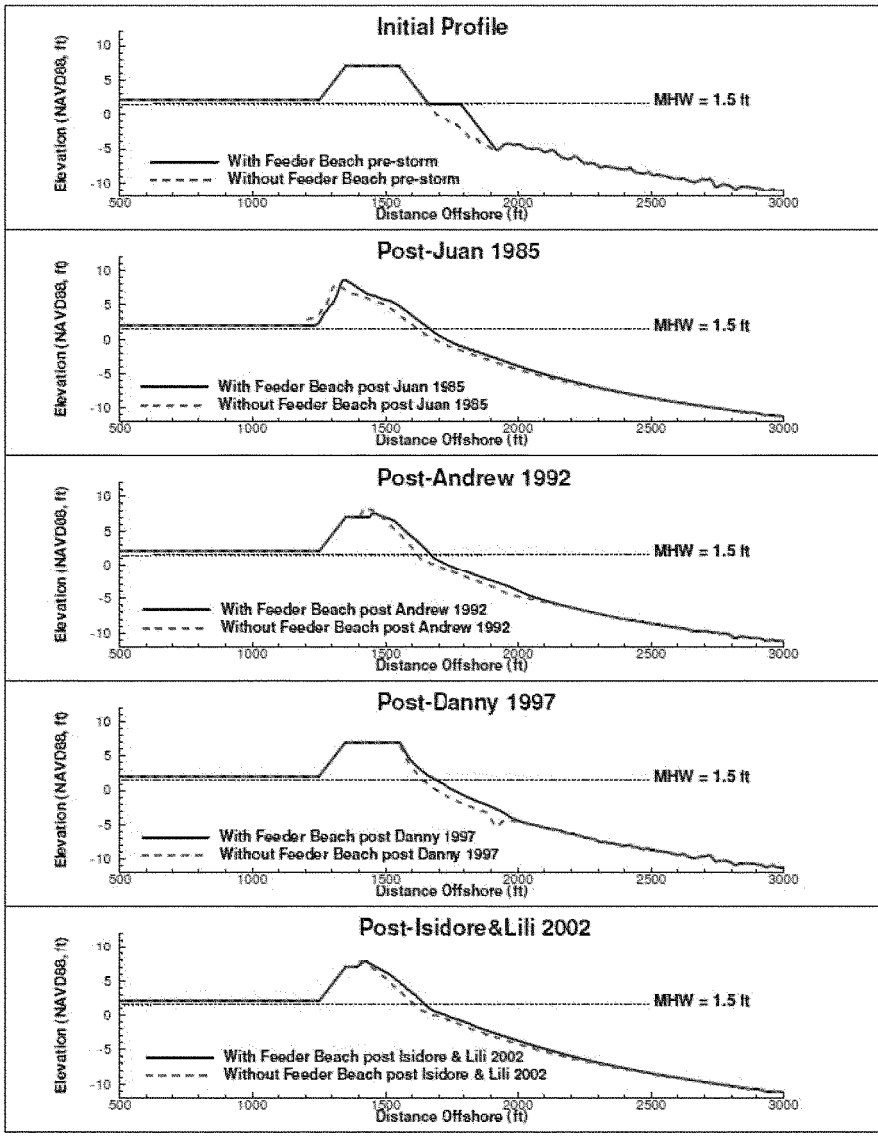
The SBEACH results for the Without Feeder Beach (WOFB) and With Feeder Beach (WFB) model runs are depicted in **Table 3, 4** and **Figure 3**. The positive benefit of the feeder beach is observed in the upland portion of the beach profile as the feeder beach attenuates the wave run-up and reduces erosion of the Headland. To quantify these benefits, volume change above MHW and shoreline change measured at +4 feet NAVD88 for the WOFB and WFB were computed.

Hurricane Event	Volume of Change above MHW, cy		% Decrease
	WOFB	WFB	
Juan 1985	-11.3	-3.6	68%
Andrew 1992	-8.4	-1.6	81%
Danny 1997	-4.1	-1.4	90%
Isidore & Lily 2002	-15.6	-7.2	54%

Table 3. Volume Results for WOFB and WFB

Hurricane Event	Shoreline Change at +4 NAVD88, ft		% Decrease
	WOFB	WFB	
Juan 1985	-76	-31	59%
Andrew 1992	-43	-8	81%
Danny 1997	-24	-9	63%
Isidore & Lily 2002	-70	-36	49%

Table 4. Shoreline Change Results for WOFB and WFB



* This SBEACH model calibration was based on a Grand Isle Study by the USACE (CECI and SJB, 2008), it is recommended in PED that the modeling program and determination of the effective volume be refined through additional model calibration and verification and an equilibrium profile analysis, respectively, to improve quantifying the benefits from the feeder beach.

Figure 5: Storm Induced Erosion Computed by SBEACH for Several Hurricane Events.

The percent reduction in volume losses from the design storms attributed to the feeder beach ranged from 54 percent to 90 percent and the percent reduction in berm/dune erosion ranged from 49 percent to 81 percent. While the storm damage to the Headland remains significant from storms of these magnitudes, the feeder beach does provide a quantifiable benefit for storm damage reduction. It is noted that these model results should be interpreted carefully for several reasons. First, the material will be placed as unconfined disposal thus the profile shape may vary significantly from the assumed berm configuration. Further, lateral diffusion will occur relatively quickly reducing the "density" of the feeder beach along the placement area. Lastly, the storm damage reduction benefit will be localized to the nodal zone and adjacent beaches as the fill diffuses, which is a relatively minor percentage of the entire Caminada Headland shoreline.

Another alternative for evaluating the benefits from a feeder beach is to examine the nourishment that would occur on the Headland as longshore transport processes spread the sand to the east and west as the feeder beach diffuses over time. CECI selected the GENESIS Model (Hanson 1987, 1989; Hanson and Kraus 1989) which is a widely accepted longshore sediment transport model utilized for predicting long-term platform evolution of a beach in response to imposed wave conditions as well as simulating beach fill diffusion and response to coastal structures. The model's use is considered standard practice both in the United States and internationally as evidenced by the many documented applications in professional journals and conference proceedings. The model description utilized in the previous modeling program, documented in CECI's Caminada Headland Engineering Appendix (CECI and SJB, 2008), was adopted for the current model runs. For brevity the model description and setup are not repeated here; please reference Annex C-3 of the Engineering Appendix within the EIS for these items.

For the current model run CECI performed the GENESIS model. The initial GENESIS shoreline was developed from the design template for the TSP. The assumed construction start date was 2012. The equilibrium and advanced fill was removed and two years of background erosion were applied to yield the shoreline position at 2014 equivalent to the first renourishment event. The feeder beach template at 2014 was derived as described in the previous section. The shoreline was advanced 125 feet seaward along the 6,800 foot long renourishment location described in the previous section. Two 2-year long GENESIS simulations were performed, without and with the feeder beach. Wave data used in the model were obtained from hindcasts at WIS Station 130 (Hubertz, 1992). The data were analyzed to identify 172 different wave height, period, and direction combinations that represented wave conditions along the project area.

A pinned boundary condition was imposed on the east end of the shoreline near Caminada Pass due to time constraints. This boundary condition does not allow shoreline change at the boundary. On the west end, a gated groin boundary condition was imposed to represent the Belle Pass jetty. The following parameters were used in the GENESIS simulations:

Configuration:

- Start date = January 1, 1995
- End date = December 31, 1996
- Time step = 1 hour
- Recording time step = 240 hours

Sand, beach, and transport:

- Effective grain size = 0.176 mm
- Average berm height = 1.4 m (4.5 ft)
- Closure depth = 3.65 m (12 ft)
- Longshore sand transport coefficients K1=0.075, K2=0.05

Boundary conditions:

- Wave model – external
- Number of wave components = 1
- Ratio of shoreline cells to wave model cells = 5
- Height amplification factor = 1
- Angle amplification factor = 1
- Angle offset = 0
- Lateral BC – pinned (east), gated groin (west)

Figure 6 presents a comparison of initial and final shoreline profiles for the WOFB and WFB model runs, respectively. The results indicate that at the end of the 2-year period the feeder beach diffuses to the east and west of its initial placement by approximately 2,000 feet.

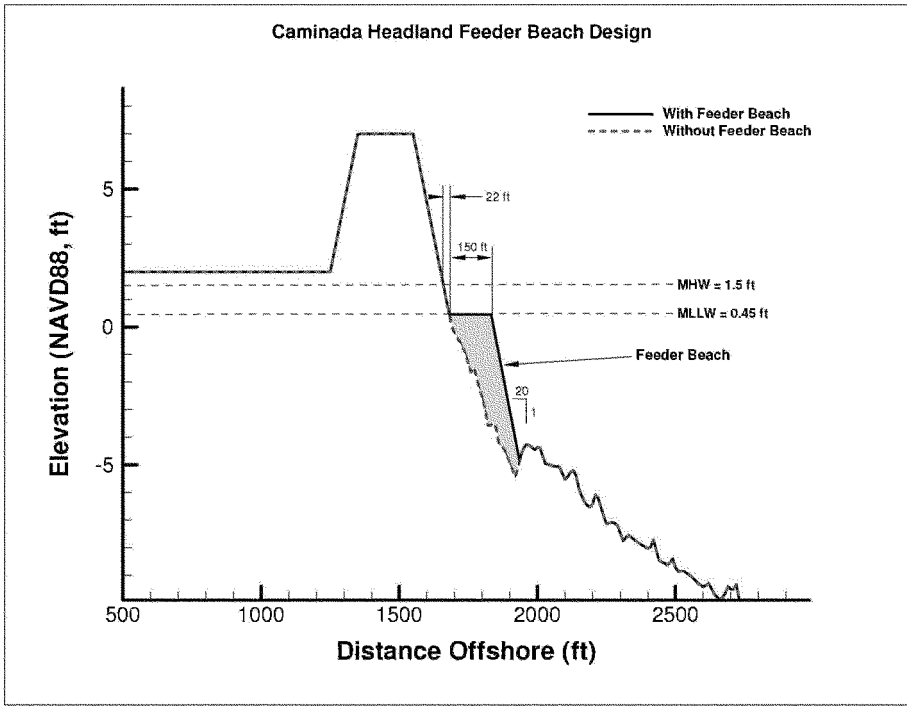


Figure 6: Initial vs. Final GENESIS Shoreline Comparison for WFB and WOFB.

It is understood that habitat management to increase piping plover populations can be accomplished in two ways. First, areas in which overwash and succession could be allowed to proceed naturally can be identified and protected. Second, where property protection precludes allowing natural processes to occur, piping plover habitat can be artificially created. It has long been known that piping plovers will utilize sand or gravel that has been worked by humans (Cohen et al 2007). The creation of a feeder berm along the Caminada Headland, at the location where longshore transport splits going east and west, will gradual replacement some of the material that is being rapidly lost from the shoreline and thereby slowing shoreline retreat. With modeling projections showing that extensive tracts of land, 75 percent of the land between the Caminada Headland and the Larose to Golden Meadow Hurricane Risk Reduction levees, would be lost by 2060 without the implementation of the BBBS project. Replenishing some of the sediment lost and slowing the rate of habitat degradation would afford greater protection for the piping plover and their critical habitat than allowing shoreline erosion and breaching to continue unfettered.

Modeling for the Caminada Headland shows the expected evolution of acres over time for the future with and without the feeder beach. **Appendix C** models the expected habitat trends for the FWOP and the FWP conditions.

Figure 7: Evolution of Acres over Time for FWOP (Direct & Indirect Boundaries) Caminada Headland (BBBS)

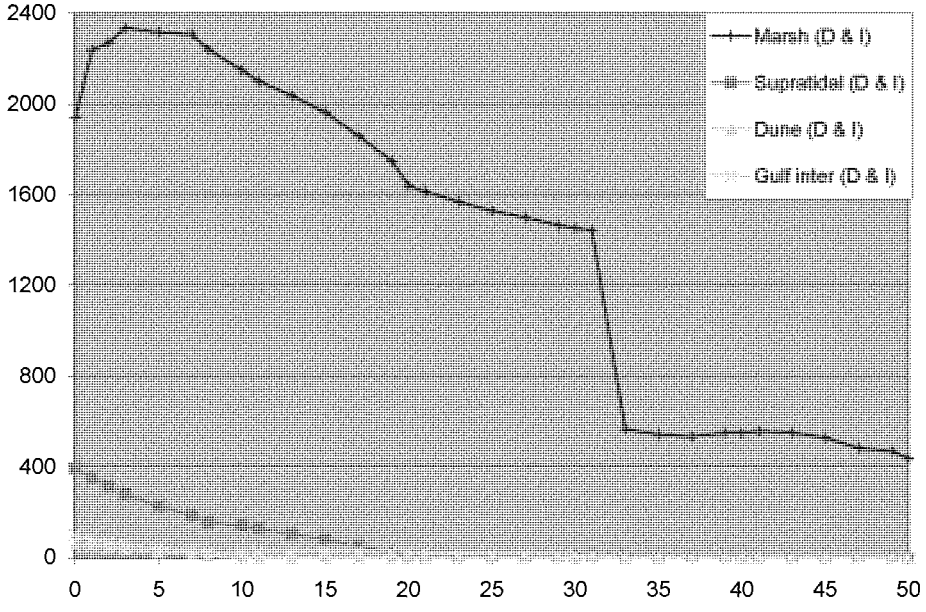
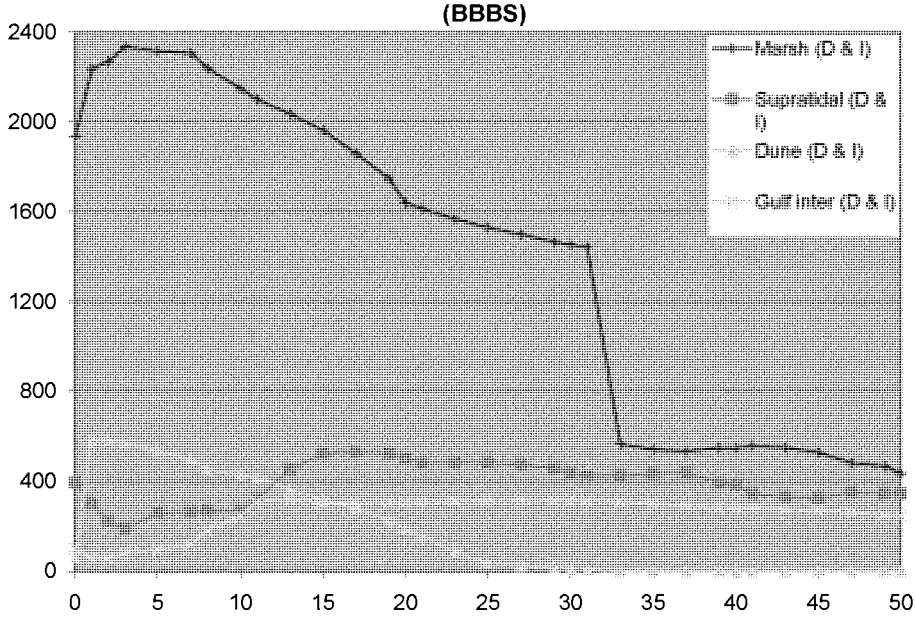


Figure 8: Evolution of Acres over Time for FWP With Feeder Beach (Direct & Indirect Boundaries) Caminada Headland (BBBS)



* At 31 years following the start of the period of analysis you see a large decrease in marsh availability for the FWP and FWOP conditions. This is because a large quantity of the existing marsh finally succumbs to the projected sea level rise and subsidence at this time. If subtidal acreages were graphed you would see an inverse relationship between marsh and subtidal acreages. Fluctuations in these values will result in higher/lower marsh loss rates.

As **Figures** 7 and **8** illustrate, the proposed feeder beach will not only increase the area of intertidal habitat which is essential for piping plover foraging, but will restore the supratidal, dune, and marsh habitat within the project area. Much of the existing system is sediment-starved, and the proposed action would introduce sediment into that system that would be reworked and redistributed through natural processes, thus maintaining and/or enhancing the features of critical habitat. The restoration and maintenance of intertidal habitat is important for the restoration of the piping plover population to healthy levels. "Piping plover habitat is constantly changing in quality and quantity owing to factors such as climate, weather conditions, land use, vegetation encroachment, floods and high tides. Given this constant fluctuation, it is important that all piping plover habitat be protected (Goossen et al. 2002)". Caminada Headlands are currently undergoing extensive shoreline retreat and when these losses are combined with the cumulative loss of large tracks of Barrier Island habitat throughout the state, it becomes clear that preventing additional piping plover critical habitat from disappearing is very important for the conservation of the species.

In the July 10, 2001, Federal Register, the USFWS described the primary constituent elements essential for the conservation of the piping plover. Below are the primary constituent elements used to designate critical habitat for the species (USFWS 2001).

> Based upon the behavioral characteristics of wintering piping plovers, we have determined that the primary constituent elements essential for the conservation of wintering piping plovers are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. The primary constituent elements are found in geologically dynamic coastal areas that support intertidal beaches and flats (between annual low tide and annual high tide) and associated dune systems and flats above annual high tide.
>
> Important components (primary constituent elements) of intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. In some cases, these flats may be covered or partially covered by a mat of bluegreen algae. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting piping plovers. Such sites may have debris, detritus (decaying organic matter), or microtopographic relief (less than 50 cm above substrate surface) offering refuge from high winds and cold weather. Important components of the beach/dune ecosystem include surf-cast algae for feeding of prey, sparsely vegetated backbeach (beach area above mean high tide seaward of the dune line, or in cases where no dunes exist, seaward of a delineating feature such as a vegetation line, structure, or road) for roosting and refuge during storms, spits (a small point of land, especially sand, running into water) for feeding and roosting, salterns (bare sand flats in the center of mangrove ecosystems that are found above mean high water and are only irregularly flushed with sea water (Myers and Ewel 1990)) (biologists have documented use of salterns by piping plovers in southwest Florida) and washover areas for feeding and roosting. Washover areas are broad, unvegetated zones with little or no topographic relief, that are formed and maintained by the action of hurricanes, storm surge, or other extreme wave action. Several of these components (sparse vegetation, little or no topographic relief) are mimicked in artificial habitat types used less commonly by piping plovers, but that are considered critical habitat (e.g., dredge spoil sites).
>
> These habitat components are a result of the dynamic geological processes that dominate coastal landforms throughout the wintering range of piping plovers. These geologically dynamic coastal regions are controlled by processes of erosion, accretion, succession, and sea level change. The integrity of the habitat components depends upon daily tidal events and regular sediment transport processes, as well as episodic, high magnitude storm events; these processes are associated with the formation and movement of barrier islands, inlets, and other coastal landforms. By their nature, these features are in a constant state of change; they may disappear, only to be replaced nearby as coastal processes act on these habitats. Given that piping plovers evolved in this dynamic system, and

> that they are dependent upon these ever-changing features for their continued survival and eventual recovery, our critical habitat boundaries incorporate sites that experience these natural processes and include sites that may lose and later develop appropriate habitat components.
> In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape. The annual, daily, and even hourly availability of the habitat patches is dependent on local weather and tidal conditions. For example, a single piping plover may leave a site if it becomes inundated by a high tide or storm event, or if high winds or cold temperatures make the site unsuitable for foraging or roosting. This bird will move to other patches within the landscape mosaic that might provide refuge from inclement weather conditions, or that simply provide a roosting site until conditions become favorable to resume foraging.

Activities that may destroy or adversely modify critical habitat as it is defined directly above are those that modify primary constituent elements to the extent that the quality of the piping plover critical habitat is reduced. The following seven items are activities that may destroy or modify critical habitat for the piping plover (USFWS 2001).

#1: Significantly and detrimentally altering the hydrology of tidal flats.

Response: The implementation of the TSP will not alter the hydrology of tidal flats, but will increase the acreage of sandy intertidal habitat, which is a preferred foraging habitat.

#2: Significantly and detrimentally altering inputs of sediment and nutrients necessary for the maintenance of geomorphic and biologic processes that insure appropriately configured and productive systems.

Response: The implementation of the TSP will add fine sediments from offshore borrow sites and sandy sediments from Bayou Lafourche into a sediment starved system in order to help maintain the geomorphic and biological processes of the project area.

#3: Introducing significant amounts of emergent vegetation (either through actions such as marsh restoration on naturally unvegetated sites, or through changes in hydrology such as severe rutting or changes in storm or wastewater discharges).

Response: The implementation of the TSP will introduce significant amounts of emergent vegetation to the study area through marsh restoration. However, the areas where the marsh restoration will take place are not available to piping plover, as they are too deep to provide foraging areas. Sandy intertidal areas along the Gulf of Mexico shoreline will either remain untouched or would be nourished with sandy sediment from bayou lafourche. Additionally, the implementation of the TSP will protect the integrity of the Caminada Headland and Shell Island, better maintaining it for the 50-year study period.

#4: Significantly and detrimentally altering the topography of a site (such alteration may affect the hydrology of an area or may render an area unsuitable for roosting).

Response: The implementation of the TSP will not alter the topography of the study area such that it would become unsuitable for roosting or foraging.

#5: Reducing the value of a site by significantly disturbing plovers from activities such as foraging and roosting (including levels of human presence significantly greater than those currently experienced).

Response: While the construction of the TSP will temporarily displace wildlife from the areas of activity, this impact will be temporary, and no long-term increase in human activity or other conditions that would preclude the use by piping plover are expected. The use of recommended primary activity exclusion zones and timing restrictions would be utilized, to the maximum extent practicable, to avoid project construction impacts to piping plover and their critical habitat within the study area.

#6: Significantly and detrimentally altering water quality, that may lead to decreased diversity or productivity of prey organisms or may have direct detrimental effects on piping plovers (as in the case of an oil spill).

Response: The implementation of the TSP is not expected to alter water quality.

#7: Impeding natural processes that create and maintain washover passes and sparsely vegetated intertidal feeding habitats.

Response: The implementation of the TSP will increase the amount of this habitat available by restoring beach and intertidal habitat, which is expected to be sparsely vegetated. Breaches in the Caminada Headland will be renourished on a site specific basis. The natural processes that create and maintain washover passes will be maintained but shoreline stabilization will reduce the rate in which these overwash gaps occur.

The latest 5-Year Review published by the USFWS (2009) indicated that all three piping plover recovery plans stated that shoreline development throughout the wintering range poses a threat to all populations of piping plovers. The recovery plans further stated that beach maintenance and nourishment can eliminate wintering areas and alter sedimentation patterns leading to the loss of nearby habitat. The piping plover recovery plan by Goosen, et al., recognizes the need to ensure habitat availability; since piping plover habitat is constantly changing in quality and quantity owing to factors such as climate, weather conditions, land use, vegetation encroachment, floods and high tides, it is important that all piping plover habitat be protected. By choosing to restore the Caminada Headland and Shell Island the CEMVN understands that there would be the potential for temporary project-induced impacts that may result during construction activities, but our modeling projects indicate that the initial construction and supplemental nourishment impacts will be significantly less than the detrimental impacts of allowing the unique habitat features within the project area to continue to degrade. The MVN has determined that approximately 485 acres (29 acres of dune, 356 acres of supratidal, and 100 acres of gulf intertidal) of critical habitat on the Caminada Headland within designated Unit LA -5 could be temporarily affected by the TSP. Temporary project induced

impacts to designated critical habitat would include construction activities within roosting and foraging habitat and smothering of the benthic community within foraging habitat. The temporary project-induced impacts of implementing alternative C5/S5 would be offset by restoration of a total of 2,849 acres including 1,197 acres of dune and supratidal habitat and 1,652 acres of bayside intertidal marsh habitat on the Caminada Headlands and Shell Island.

Nourishment will follow the same operational protocol as the restoration/nourishment events that have been conducted in the project area, on the Eastern and Western Jetties of Bayou Lafourche (Belle Pass). The beneficial placement of dredge material in the beach nourishment sites has occurred 5 times starting in December of 2002, then on December 2004, April-May 2006, March-April 2007, and lastly October 2008. On August 11th, 2009 a site visit conducted by Thomas Parker and Ed Creef with the US Army Corps of Engineers New Orleans District (CEMVN) documented three piping plovers utilizing the recently placed beach nourishment material (see **Figures 9).**

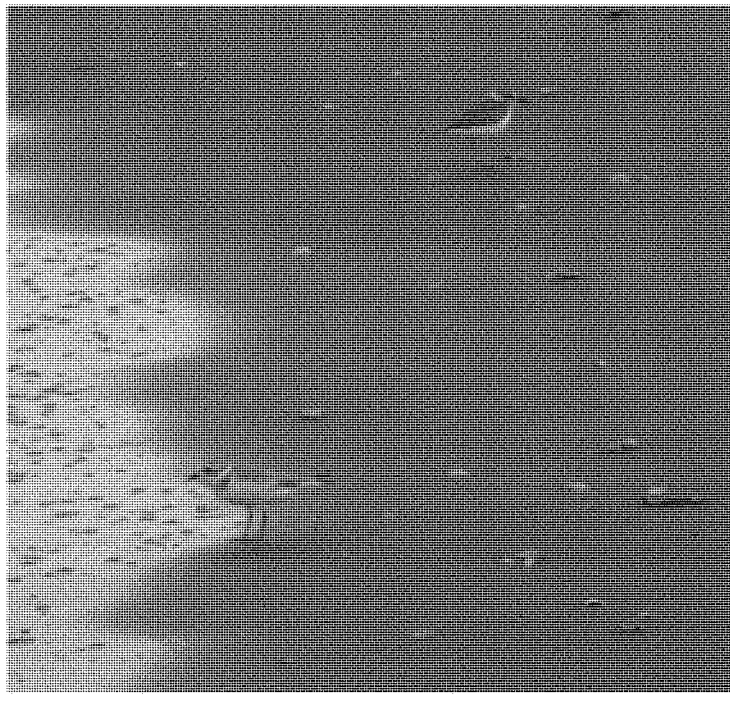


Figure 9: Piping Plover and Semipalmated Plover photographed on Western Beach, Bayou Lafourche at Belle Pass, Port Fourchon, LA. Date: August 11, 2009

Since **Figure 9** was taken the project area was impacted by the Deepwater Horizon incident. With a majority of the critical habitat for the piping plover within the project area being contaminated with oil, compositional changes and possibly an overall reduction in abundance of the benthic community are expected. In an effort to document more current

environmental conditions CEMVN personnel along with members of the USFWS Lafayette office performed a site visit on August 23, 2010. During this visit heavy oil clean up activity had severely impacted the beach along the Caminada Headland. The team documented oiled sediments along the intertidal zone along the Gulf. In spite of the heavy traffic and oil contamination, the team documented 16 piping plovers utilizing the Caminada Headland and its associated over wash areas. **Figure 10** shows one of sixteen piping plover identified on the Caminada Headland. The piping plover is standing to the right of a sanderling (*Calidris alba*).

Figure 10: Piping plover on Caminada Headland on August 23, 2010

Oil contamination within the area also increases the potential for some of the borrow material, utilized during the construction of the feeder bar, to be contaminated with hydrocarbons. If the borrow material does contain some oiled sand by the time of project implementation, there is a high likelihood that the oil would be highly weathered and the proposed dredging and pumping of these sediments would further weather and break-up/disperse the oil for microbial action to take effect on the oil particles. If it is determined that there is a high probability of contamination of the borrow material, then testing of the borrow material will be conducted. The fine grained sediment that will be placed in the subtidal feeder bar would move onto the beach face in a gradual manner; consequently the feeder berm is not expected to cause extensive stacking of sediment on the beach which could smother the benthos and

contribute additional stress to the remaining benthic community within the piping plover's critical habitat.

As stated earlier, it is estimated that construction of the Shell Island and the Caminada Headland components will both begin construction in January of 2012, which is concurrent with the construction timeline of the Terrebonne Basin Barrier Shoreline (TBBS) Project. Construction is estimated to last for approximately two years pending local weather conditions. Since piping plovers rely on these barrier landscapes for 8 to 10 months out of the year while overwintering in Louisiana; the use of recommended primary activity exclusion zones and timing restrictions would be utilized, to the maximum extent practicable, to avoid further impacts to piping plover and their critical habitat within the study area. Piping plovers are known to regularly use the beach habitat along the Caminada Headland; however, there are no records of piping plovers using the remnant Shell Island. Potential project-induced direct impacts would consist of temporary displacement to nearby suitable habitats and temporary loss of benthic prey species smothered within the project footprint during construction activities. However, there are suitable habitats nearby into which piping plovers can disperse, including Belle Pass West, the easternmost sand spit of Elmer's Island, Grand Isle, and East Grand Terre Island. Impact from the proposed action would be temporary and would help to stabilize the rapidly retreating and eroding Caminada Headland.

11.0 CONCLUSION AND DETERMINATION

CEMVN understands that though the proposed feeder beach renourishment on the Caminada Headland and the larger Shell Island alternative components of the BBBS project will likely benefit the piping plover and its critical habitat, the temporary impacts to plover habitat and it's critical habitat, will temporarily adversely impact the species. Because of impacts from the Deepwater Horizon and because this project will be occurring concurrently with other restoration projects in the project area our original determination for this project of *"Not Likely to Adversely Affect"* has been changed to a *"likely to adversely Affect"* determination. With this new information we request the initiation of Early Consultation for the BBBS project and request that the USFWS prepare a Biological Opinion regarding this project.

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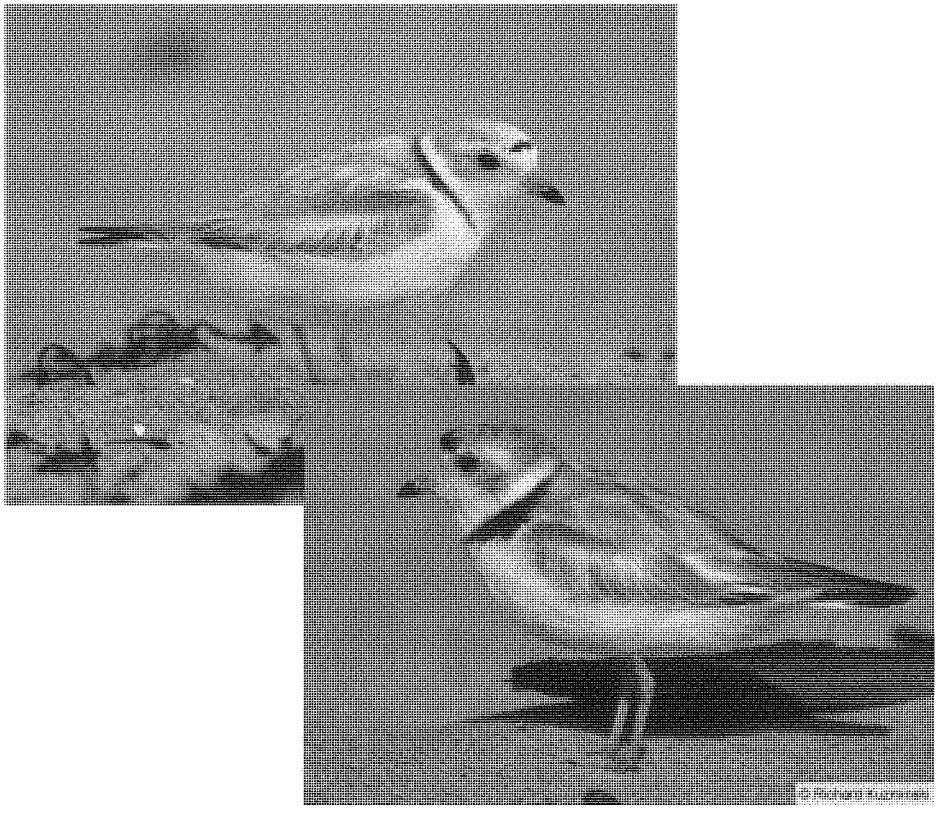
APPENDIX A

BIOLOGICAL ASSESSMENT

Louisiana Coastal Area (LCA)
Barataria Basin Barrier Shoreline Restoration Feasibility Study
Caminada Headland and Shell Island Restoration



APRIL 24, 2009

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BIOLOGICAL ASSESSMENT

Louisiana Coastal Area (LCA)
Barataria Basin Barrier Shoreline Restoration Feasibility Study
Caminada Headland and Shell Island Restoration

1.0 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, requires that, *"Each Federal agency shall, in consultation with and with the assistance of the secretary, insure that any action authorized, funded, or carried, out by such agency.... Is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species..."*

This Biological Assessment (BA) provides the information required pursuant to the ESA and implementing regulation (50 CFR 402.14), to comply with the ESA. Additional jurisprudence includes the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. section 4321, *et seq.;* the Fish and Wildlife Conservation Act of 1958 (PL 85-624; 16 U.S.C. 661 *et seq.*); the Marine Mammal Protection Act of 1972; and the Bald Eagle Protection Act of 1940. This BA evaluates the potential impacts of the proposed restoration of the Caminada Headland and Shell Island Study on Federally-listed and proposed threatened and endangered species, designated and proposed critical habitat, and determines whether any such species or habitat are likely to be adversely affected by implementing the tentatively selected plan (TSP).

A programmatic BA was prepared in 2004 for the LCA Ecosystem Restoration Study (USACE 2004). This proposed action is an outgrowth of the LCA comprehensive programmatic restoration study. The 2004 programmatic BA is thereby incorporated by reference (Appendix A).

2.0 PURPOSE AND NEED FOR ACTION

The purpose of the study is to restore the geomorphic function and unique critical and essential fish and wildlife habitats of the Caminada Headland's barrier system and reverse the current trend of degradation in the Caminada Headland and Shell Island reaches. Restoration efforts would target ecologically distinct, critical, high priority areas that would increase sustainability with essential form and function of the natural barrier ecosystem.

3.0 PROPOSED ACTION

The proposed action is the restoration of the Caminada Headland and Shell Island reaches o f the Barataria barrier system.

The study considers mining offshore, nearshore, riverine, and other sediment sources to re-establish a sustainable barrier system (e.g. barrier islands, shorelines, and headlands) at the Caminada Headland and Shell Island reaches of the Barataria Barrier System. The study considers all reasonable alternatives including:

- Build on alternatives considered under the LCA Barrier Shoreline Restoration Study and the LCA Wetland Restoration/Creation Study.
- Borrow sources considered included: offshore, nearshore, riverine, and other sources.
- Consider varying widths and configurations of barrier shorelines as well as varying heights of restored dunes.
- Consider marsh restoration as a platform for barrier shoreline rollover.
- Recommendations from interested parties submitted during scoping and public meetings, and meetings with stakeholders.

The Ecosystem Objective is to sustain productive and diverse fish and wildlife habitats. The Hydrogeomorphic Objective is to maintain or establish natural landscape features and hydrologic processes.

4.0 DESCRIPTION OF THE STUDY AREA

The study area is part of the 300-mile long Louisiana barrier system. The Caminada Headland and Shell Island reaches are located along the Barataria barrier shoreline comprising the area designated as Subprovince 2 in the LCA study (USACE 2004). Subprovince 2 is defined by the hydrologic boundary of the Barataria Basin, which is approximately 2,446 square miles and the western portion of the lower Mississippi River Delta. The basin is separated from the Gulf of Mexico by a chain of barrier islands, which serve as a natural barrier to storm events and reduce marine influences on interior wetlands within the basin (**figure 1**).

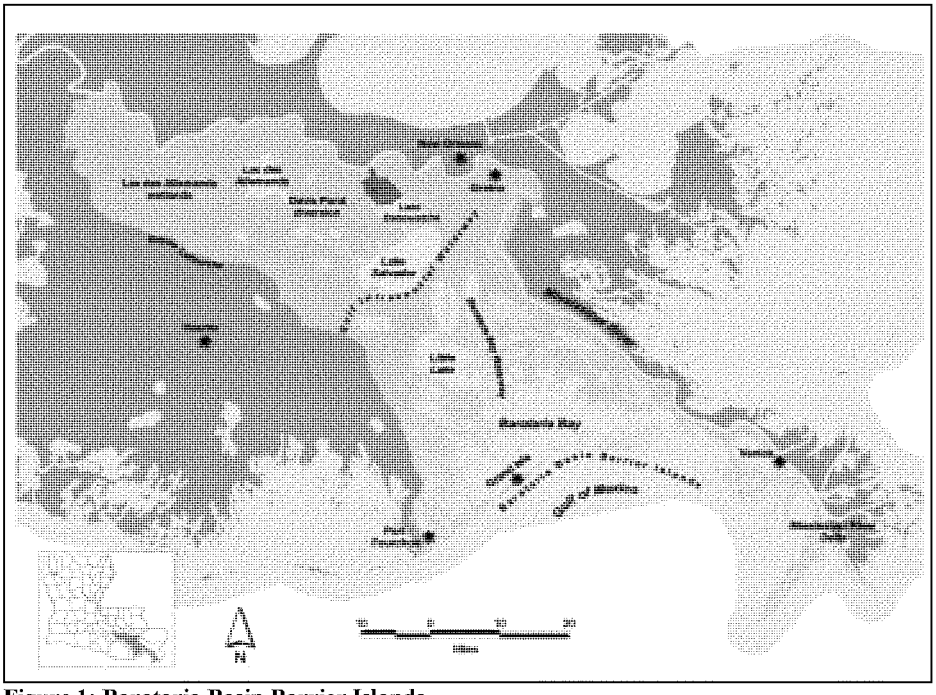

Figure 1: Barataria Basin Barrier Islands

5.0 DETAILED DESCRIPTION OF EACH PROJECT REACH

5.1 CAMINADA HEADLANDS REACH

The Caminada barrier headland (also known as the Caminada-Moreau headland) is the predominant feature of the Bayou Lafourche barrier system that includes flanking islands and the retreating headland of the Bayou Lafourche distributary of the Mississippi River (**figure 2**). It is one of the most rapidly eroding shorelines in the United States (McBride et al. 1992; Connor 2004). The southwest to northwest-oriented Caminada-Moreau headland extends approximately 13.18 miles (21.21 km) between Belle Pass in the west and Caminada Pass in the east. Historic maps show that the west end of the Caminada-Moreau headland is retreating more rapidly than the east end of the headland (Williams et al. 1992). Hundreds of offshore drilling rigs in the Gulf of Mexico send gas and oil to the mainland through Port Fourchon.

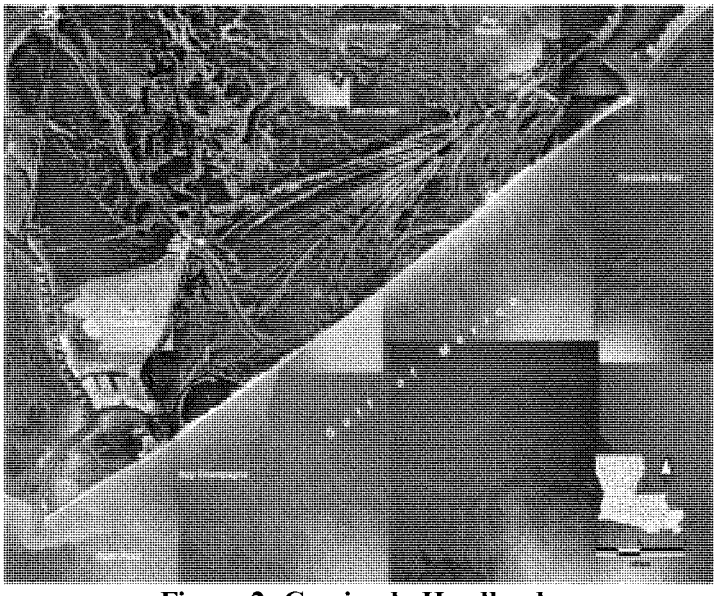

Figure 2: Caminada Headlands

5.1.1 Caminada Headland Reach Purpose:

The purpose of the proposed action is to restore the geomorphic function and unique critical and essential fish and wildlife habitats of the Caminada Headland's barrier system. The study period is fifty years.

The goals and objectives for restoring the Caminada Headland Reach include:

- Sustain and improve shoreline, dune, and interior marsh habitat for essential fish and wildlife species
- Reduce wave energy transmission by providing a natural storm protective buffer for interior marsh and chenier ridge habitats north of Caminada Headland
- Address the severity of erosion along the gulf-front shoreline
- Close the breaches that have occurred due to recent storm and hurricane damage and prevent breaching during the design life
- Vegetate newly created marsh and dune areas
- Provide compatible sediments for marsh, beach and dune restoration
- Avoid impacts to adjacent shorelines from borrow area excavation
- Maintain the Caminada Headland without disrupting the natural hydrologic regime

5.1.2 Caminada Headland Project Area:

The project area lies within the Barataria Basin, which comprises the area between the Mississippi River and Bayou Lafourche. The 13-miles long Caminada Headland located in Lafourche and Jefferson Parishes extends from the Belle Pass jetties at the mouth of Bayou Lafourche on the western end of the headland to Caminada Pass on the eastern end of the headland. The project area is bounded by the Gulf of Mexico to the south and approximately 2250 feet north of the Gulf to the North. The headland maintains the integrity of the gulf shoreline and protects the interior coast from further deterioration. The Caminada Headland consists of narrow and low-lying sand dune and beach berm, barrier marshes, and chenier ridges interspersed with mangrove thickets, coastal dune shrub thickets, lagoons and small bayous. The average dune elevation is estimated to be +3.5 feet North American Vertical Datum of 1988 (NAVD)and the back-barrier marsh was determined to be 0.94 feet NAVD.

5.1.3 Caminada Headland Needs:

The erosional Caminada Headland has historically suffered loss of wetland habitat and diminished function within the gulf shoreline. The marsh, beach, and dune habitats within the project area have undergone significant loss due to storm overtopping and breaching, saltwater intrusion, wind and wave induced erosion, sea level rise, subsidence, and man-made structures. The observed long-term (100 years) average shoreline erosion rate at the Caminada Headland, approximately 45 feet per year, would likely continue for the foreseeable future. The beach has eroded and the dune ridge has been breached by overwash from storm surges at several locations, including multiple shoreline breaches during the 2002, 2004 and 2005 hurricane seasons. Increased stress on the fish and wildlife is expected as various fish and wildlife nursery, feeding, nesting and roosting habitats continue to be lost.

A coastal Louisiana land loss model presented in the LCA Study (USACE 2004) indicates that with no intervention, the Caminada Headland will experience a projected land loss of 3,750 acres from the Headland and 14,780 acres from the area to the north from 2000 to 2050. Only a skeletal framework of natural barrier ridges and spoil banks would remain in 2050. Port Fourchon would be further isolated from the remaining mainland, and could become a detached small barrier island.

5.2 SHELL ISLAND

The Shell Island reach (formerly Lanaux Island) is part of the 24.8-mile long (40-km long) Plaquemines barrier system and is characterized as rapidly retreating remnant barrier islands and spits which enclose shallow bays such as Shell Island Bay and Bastian Bay (**figure 3**). The Shell Island reach extends approximately 5.24 miles (8.43 km) between Grand Bayou Pass on the west to Fontanelle Pass and the Empire jetties on the east. The approximately 1.41-mile long (2.27 km) Shell Island (west) extends from Grand Bayou Pass to Coupe Bob, and is composed primarily of reworked oyster shells

that formed into ridges and swales produced by waves refracting into the entrance to Grand Bayou Pass. Shell Island (east) is approximately 2.54 miles long (4.09 km) and extends from Coupe Bob to Fontanelle Pass. These rapidly retreating barrier islands are becoming increasingly narrower and separated from the remnants of Plaquemines interior marshes.

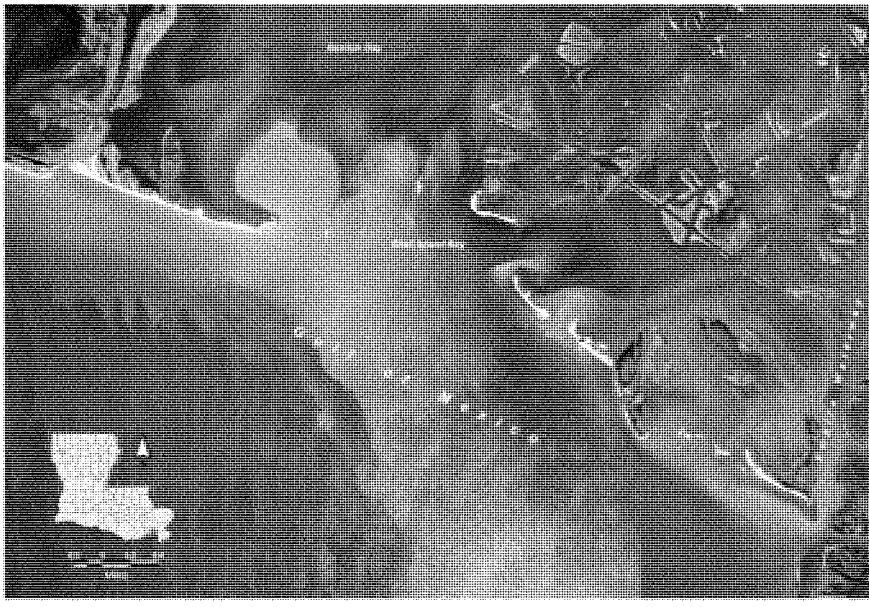

Figure 3: Shell Island Reach

5.2.1 Shell Island Reach Purpose:

The objectives of this project are to reestablish a barrier(s) between a threatened estuarine ecosystem and the Gulf of Mexico, increase the sustainability of the barrier island shoreline system, restore the geomorphic function of the barrier shoreline in the vicinity of Shell Island, restore shoreline, dune, and back-barrier marsh to increase habitat utilization by essential fish and wildlife species both on the barrier island and in the consequently developed quiescent bays.

The goals and objectives for restoring the Shell Island Reach include:

- Achieve 158 acres of dune and supratidal acreage on Shell Island West.
- Achieve 74 acres of marsh (intertidal acreage) on Shell Island West.
- Achieve 223 acres of dune and supratidal acreage on Shell Island East.
- Achieve 191 acres of marsh (intertidal acreage) on Shell Island East.

5.2.2 Shell Island Reach Project Area:

The Barataria/Plaquemines barrier island complex lays approximately 49 miles south-southeast of New Orleans, Louisiana. Tidal creeks, man-made canals, marshlands, sandy barrier islands, and several bays characterize the barrier island complex. The remnants of Shell Island are located between Fontanelle Pass (Empire Jetties) and Grand Bayou Pass. Shell Island used to enclose both Bastian Bay and Shell Island Bay but has since disintegrated into several smaller islands and shoals. The project area is located in Plaquemines Parish.

The project boundaries were defined based on the outer edges of the landmasses digitized from the 2004 DOQQ's. The west end of Shell Island West was included within the project boundary as it was anticipated that area could be affected by construction of any alternative. Existing Shell Island remnants were included within the boundary to incorporate the without project conditions.

5.2.3 Shell Island Reach Needs:

Shoreline recession and erosion have resulted in the disintegration of Shell Island. The few remaining islands and shoal remnants provide limited protection to the back barrier environment from waves and flooding. The construction of the Empire Jetties restricted the east to west long-shore transport and increased the loss rates of Shell Island. Hurricane Bob in 1979 created a new inlet (Coupe Bob) that accelerated retreat and sediment loss.

The average wave height is 2.7 feet. The rate of relative sea level rise is treated as a constant over the 50-year project life, equal to 0.0430 feet/year. Hurricane Bob occurred in 1979. The formation of Coupe Bob caused a quadrupling of the retreat rates of Shell Island and is the major reason for the disintegration of the island. The Empire Jetties were constructed in 1950. The Empire Jetties increased shoreline recession approximately 10 feet/year along the easternmost 5,000 to 8,000 feet of the island

6.0 TENTATIVELY SELECTED PLAN (TSP)

The Tentatively selected plan (TSP) is Alterative 5 - Caminada Headland and Alternative 1 Shell Island.

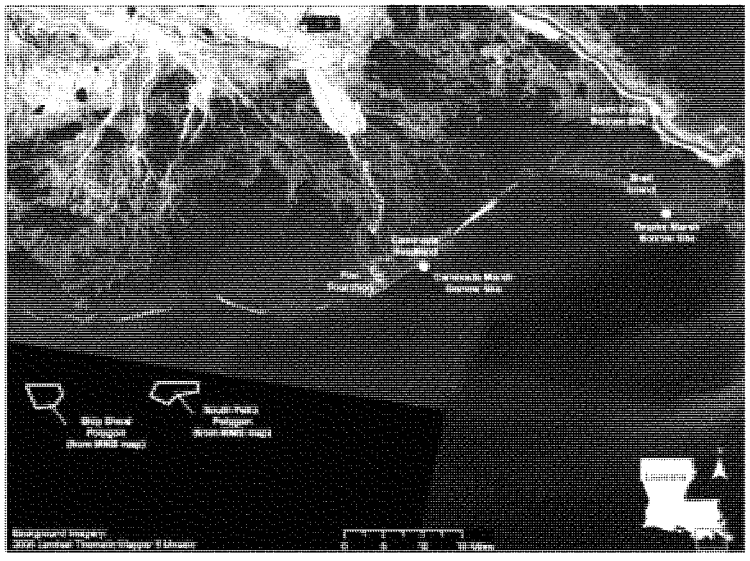

Figure 4: Project Area

6.1 Caminada Headland Alternative 5 – Preferred Dune with Expanded Marsh.

Alternative 5 creates 880 acres of dune/beach and 1186 acres of saline marsh. Figure 4 shows the plan view of Alternatives 5, 6, and 7. Alternative 5 proposes the following:

- Dune heights of +7 feet NAVD with a dune crest width of 290 feet.
- A landward beach and dune component in order to maximize acreage and longevity.
- Landward and seaward slopes are set 20 horizontal to 1 vertical.
- Marsh fill on the landward side of the dune at an elevation of +2.0 feet NAVD.

Fill quantities for the dune and marsh fills are 5.1 and 5.4 million cubic yards, respectively.

6.1.1 Caminada Headland Project Features:

Models applied to determine the benefits of implementing the Alternative 5 include the Barrier Headland model which was applied to the beach and dune components and the Saline Marsh Wetland Value Assessment model (WVA) which was applied to the remainder of the project area (Attachment B).

The direct project boundary for Alternative 5 includes approximately 1,361 acres of existing marsh, dune, supratidal, and gulf intertidal habitats at target year zero. Project construction includes approximately 878 acres of new marsh, dune, supratidal and gulf intertidal habitats for a total of approximately 1582 acres at TY1 with approximately 26 acres of these habitats left at TY50. It should be noted that the newly created acres will cover most of the existing acres in the direct project footprints. There is no renourishment of dune or marsh plan for alternative 5.

Alternative 5	TY 0	TY 1	TY 50
Marsh, supratidal Gulf intertidal habitat	1,361 acres	2,239 acres	26 acres

The 77 acres of existing upland habitat in the indirect project boundary would remain through the fifty year project life.

A significant majority of the marsh acreage is anticipated to disappear through natural subsidence (estimated to be 0.025 feet per year) over the project life.

Dune/Beach Component:

The proposed alternative designs that were moved forward for WVA analysis would include a continuous beach and dune restoration component. The alternatives evaluated have a landward beach and dune component with in order to maximize acreage and longevity. All dune restoration components would also include sand fencing and plantings of native vegetation that is anticipated to promote additional dune elevation growth by capturing Aeolian sands.

The proposed dune height would be designed to +7 feet NAVD which is slightly higher than the existing dune elevation in the area of +3.4 feet NAVD. The proposed dune width would be 290 feet. The majority of the dune is sited landward over existing higher elevations, maximizing acreage and longevity. The advanced fill quantities account for initial losses due to shoreline equilibrium. The landward and seaward slopes are set at a 1-foot vertical to 20-foot horizontal slope (1V:20H). The beach fill template has a 65 ft wide seaward berm at an elevation of +4.5 feet NAVD and a marsh fill template is proposed on the landward side of the dune at an elevation of +2.0 feet NAVD. Approximately 13 miles of dune will be created. Fill quantities for the beach/dune and marsh fills are 6.3 million and 5.4 million cubic yards respectively.

The dune restoration component includes sand fencing and plantings of native vegetation that is anticipated to promote additional dune elevation growth by capturing Aeolian sands

Marsh Component: Alternative 5 includes restoration/creation of a marsh platform contiguous with the Chevron Canal on its northern boundary and the beach and dune fill component along its southern boundary. A constructed marsh elevation of +2.0 feet

NAVD would be used to create a functioning intertidal marsh with no renourishment planned for the 50-year project life. The native marsh elevation for the back-barrier marsh is 0.94 feet NAVD. Mean high water is 1.53 feet NAVD and mean low water is

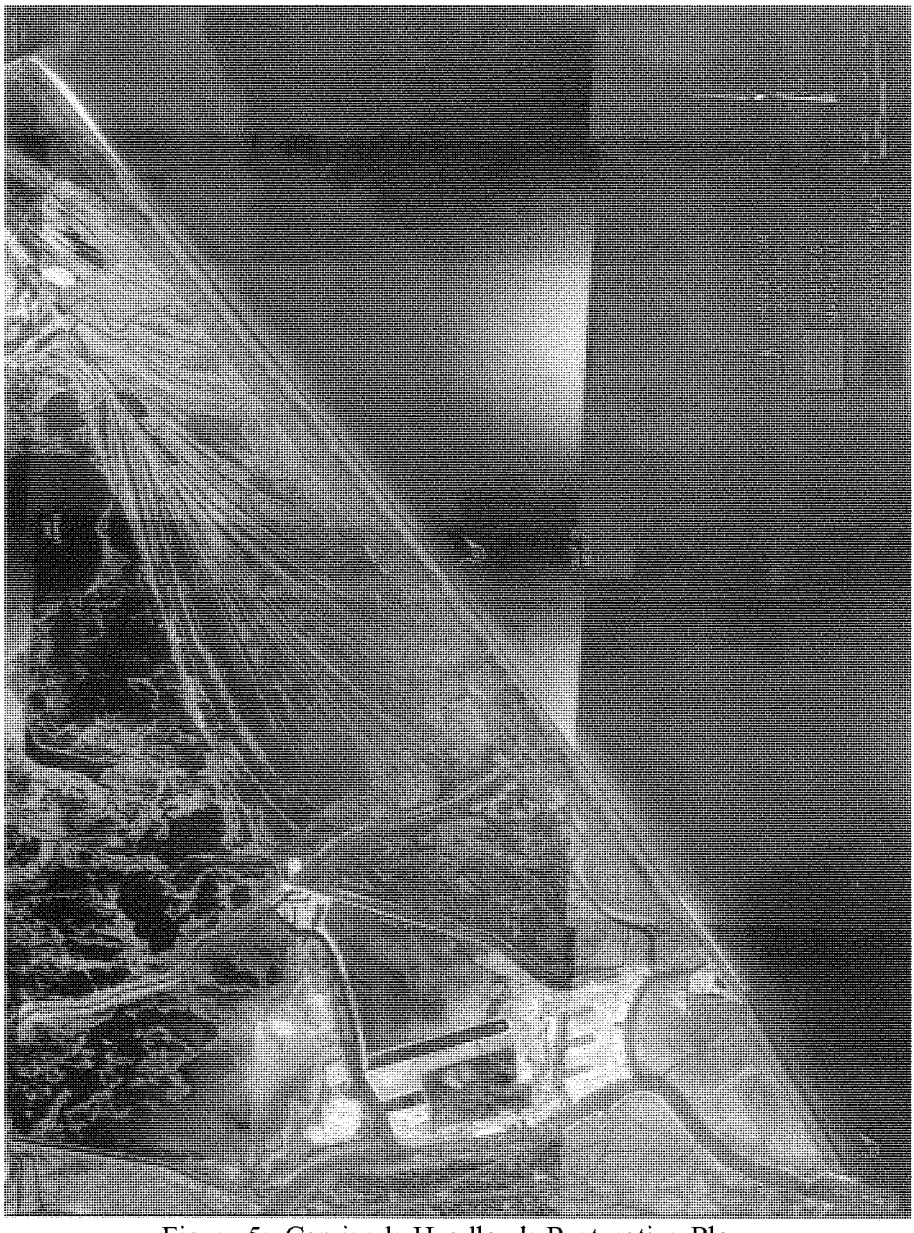

Figure 5: Caminada Headlands Restoration Plan

0.48 feet NAVD and increases over time due to an eustatic sea level rise, demonstrating that the existing marsh is inundated during the tidal cycle.

Neighboring CWPPRA projects (Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration BA-35, Chaland Headland Restoration BA-38, and East and West Grand Terre Island Restoration BA-30) were used to estimate settlement and consolidation of fill material. A sea level rise rate of 2.5 feet per century was used for this analysis.

Temporary containment dikes would be constructed to contain the marsh fill material during construction. The fill material for dike construction would be dredged from within the footprint of the marsh so that the excavated area is filled during construction. The dike volume is included within the marsh fill volume. The marsh fill is proposed on the landward side of the beach and dune. The marsh platform would be planted with appropriate vegetation.

Caminada Headland Alternatives	
	Alt 5 preferred dune w/ expanded marsh
Dune Elevation	+ 7 feet
Dune width	290 feet
Beach width	Advance fill at elevation of +4.5 feet
Beach/dune length	13 miles
Beach/dune quantity fill material	6.3 million cubic yards
Beach/dune renourishment cycle	none
Marsh elevation	+2.0 feet
Marsh quantity fill material	5.4 million cy
Existing marsh, dune, supratidal, & gulf intertidal	1361 acres
New (TY1) marsh, dune, supra, & gulf intertidal	878 acres
Net acres (at TY 50)	26 acres of marsh

Borrow Areas: Material for the dune and beach construction would be borrowed from the South Pelto Block of Ship Shoal. (see Figure 6). Ship Shoal is a large offshore submerged sand body in the Gulf located approximately 50 miles southwest of Belle Pass. A suitability analysis was conducted comparing Caminada sediments to South Pelto Block sediments. The sediments from South Pelto Block were concluded to be suitable for beach and dune restoration. It is recommended that an overfill ratio of 1.08 be used in design volume analysis.

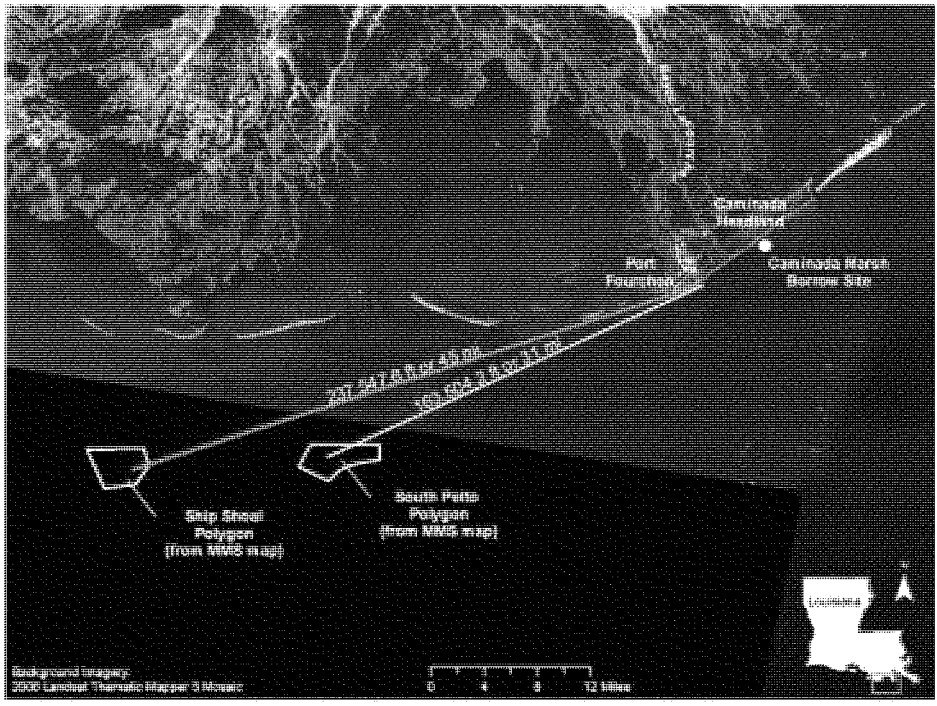

Figure 6: Borrow Areas

6.2 Shell Island Alternative 1: Two Islands with No Re-nourishment

Alternative 1 would restore the Shell Island reach as two islands (Shell Island East and Shell Island West) (Figure 7). Each island would include shoreface, dune ridge, and marsh platform features. The general alignment and configuration of this alternative is based on the restoration feature identified in the LCA Main Report, adapted for current conditions and constraints. Based on cross-shore transport modeling using the SBEACH program, it was determined that the minimum dimensions for the shoreline profile must include a dune crest elevation of at least +5.75 feet and a dune crest width of at least 100 feet. This profile configuration was determined to provide effective barrier island function for the shoreline reach throughout a 50-year evaluation period, assuming that a 50-year storm event would occur during the evaluation period, and a 20-year storm event would occur at the end of the evaluation period. Periodic re-nourishment is not included in this alternative

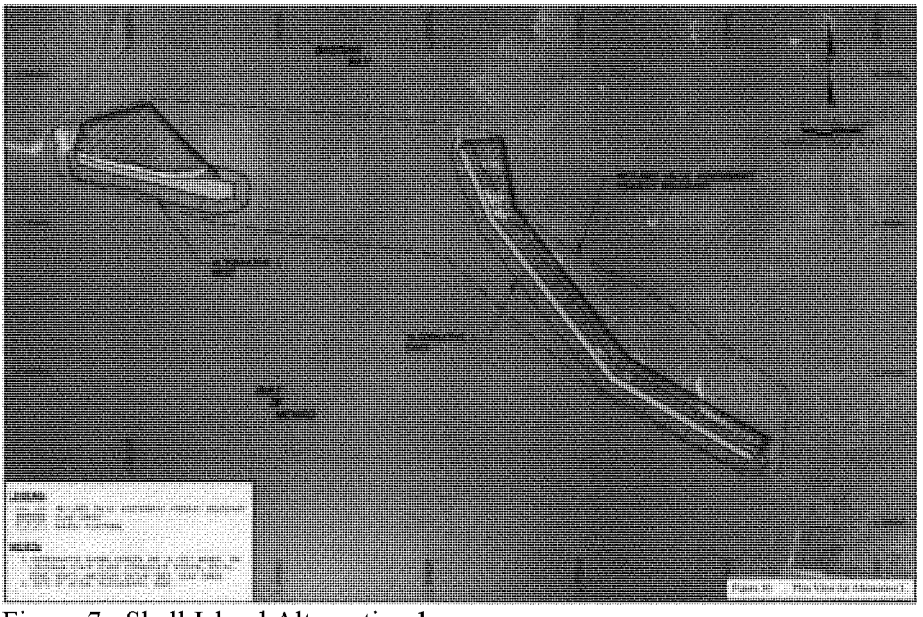

Figure 7: Shell Island Alternative 1

6.2.1 **Shell Island Alternative 1, Shell Island East**

The Shell Island East As-built, TY1 configuration is anticipated to create 126 acres of dune, 297 acres of supratidal, and 47 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 11 acres of as-built dune area.
Alternative 1 includes the following:

- Dune heights of +6 NAVD with dune crest width of 281 feet.
- Crest width would be uniform along the restored shoreline.
- Shoreline would be 15,400 feet in length.
- Landward edge of dune crest for Shell Island East would be located along the mean high water line of the remaining islands. With this alignment, the majority of the sand fill would be placed in front of the existing remnant islands.
- Marsh width would be 525 feet, widening along the northernmost 2,400 feet of the island to just over 1,200 feet wide.

This alignment ensures that the entire active profile height of the shoreface, beach and dune ridge is armored with sand. By preventing the exposure of the mixed sediment of the existing island to wave and storm processes, the rate of shoreline retreat rates will be reduced significantly from current trends.

The shoreline recession rates are 12.4 feet/year for Shell Island East. Subtidal acreage decreases following construction because parts of the subtidal acreage are located within the construction footprint

6.2.2 Shell Island Alternative 1, Shell Island West

The Shell Island West As-built, TY1 configuration is anticipated to create 51 acres of dune, 192 acres of supratidal, and 21 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 8 acres of as-built dune area. All of the beach and marsh fill placed during construction of Shell Island West will have eroded in 23 years (TY25), leaving pre-construction conditions. By TY25 Shell Island West will have receded to the point where there is no supratidal acreage. Once the supratidal acreage is lost, it was assumed that the marsh would be exposed to wave action from the Gulf and that the marsh would recede at the gulf retreat rate.

The shoreline recession rates are 34.9 feet/year for Shell Island West. Subtidal acreage decreases following construction because parts of the subtidal acreage are located within the construction footprint.

The volume of sand that could be lost into Coupe Bob every year from the two-island option is approximately 101,000 cubic yards. At this rate it would take Coupe Bob approximately 33 years to reach its accommodation volume of 3.3 million cubic yards. It is unlikely that Coupe Bob will reach its accommodation volume given that the total volume of sand fill placed in Alternative 1 is 4.1 million cubic yards but it does suggest that little natural bypassing of sand should be expected across Coup Bob.

- Dune heights of +6 NAVD with dune crest width of 250 feet.
- Shoreline restoration would extend partially into Coupe Bob, extending the length of the barrier shoreline provided by existing islands.
- Marsh platform extends along 4,500 feet of shoreline, with a maximum width of 2,300 feet. Shell Island west follows the restoration feature outline described in the LCA Main Report.

The post-construction marsh volumes are calculated based on the post-construction elevation of +2.5 feet NAVD. Settlement of the marsh material will lower the marsh elevation to the upper elevation of the bay intertidal range of +2 feet within one year.

Constructing the marsh elevation at an elevation of +2.5 feet NAVD will result in a marsh that will become bay intertidal during TY2 (2011) and remain bay intertidal until TY50 (2059). The marsh will be continually submerged (average elevation below mean low water) after TY34 (2043). The long term goal of maintaining the marsh elevation above elevation 0 feet NAVD at TY50 can only be achieved by increasing the construction elevation above +2.6 feet NAVD but this increases the time required for the marsh to subside to the mean high water level, and so reduces project benefits in the near term. Total fill quantities for the beach/dune and marsh fill are 4.1 million cubic yards of sand and 1.9 million cubic yards of sediment respectively.

Dune/Beach Component: The alternatives include a beach and dune fill to reestablish a sustainable barrier island shoreline system, thus restoring the geomorphic function and increasing the habitat utilization by fish and wildlife species. The construction cross-section was based on templates used for projects previously constructed in Louisiana. The dune design is to +6feet, NAVD with a back- and fore-slopes of 1V:45H. The dune crest width varies by alternative. Other barrier island projects in Louisiana have used a steeper construction slope (1V:30H) on the bayward side because these islands have been relatively intact and the island provides a means of fill retention, allowing steeper slopes to be constructed. Most of Shell Island will be constructed in open water or on scattered island remnants. The +6.0 feet, NAVD dune elevation is above the 20-year return period surge elevation (+5.9 feet, NAVD).

The crest width of the dune is a function of the purpose of the individual alternatives. The dune width for Alternative 1 is based on a cost and target acreage goals that dictate the volume and cross-section width. Alternative 2 through 8 will be based on a design width plus various advanced nourishment width.

The beach profile equilibration process assumes that there is only cross-shore redistribution of sediment and that sand volume is conserved. It is estimated that the mean high water shoreline will retreat approximately 20 feet due to profile equilibration.

Construction of sand fencing and planting of vegetation along the dune will promote additional elevation growth of the dune by holding the blowing sand. A 5-foot wide +9 feet NAVD additional dune element was added to the top of the construction template to simulate this increase in dune elevation. It was assumed that this additional dune feature would take approximately 1 year to form.

A beach nourishment cross-section consist of two primary components: 1) the design section, which is the fill volume required at TY50 to meet applicable project goals, and 2) advanced nourishment, which is the sacrificial portion of the fill that will erode over the 50-year project life. Sufficient advanced nourishment can be added during construction or replaced periodically during renourishment projects. Advanced fill is distributed non-uniformly to account for diffusion losses, longshore losses, and tidal inlet losses, that vary along the project length.

Marsh Component: The proposed marsh construction elevations were based on developing an intertidal marsh over the life of the 50-year project, considering the rate of relative sea level rise, and consolidation of placed and subgrade sediments. The average elevation of the existing marsh platform on Shell Island was determined to be approximately +1.1 feet, NAVD. This elevation is comparable to other marsh platforms in the area such as East Grand Terre, Chaland Headland, and Pelican Island. The 2005 mean high water and mean low water elevations are +1.63 feet and +0.58 feet, NAVD respectively, demonstrating that the existing marsh is inundated during the tidal cycle.

The proposed marsh platform has a 50-year project life. The critical goal is to construct a marsh platform that maintains an elevation between mean high water and mean low water through TY50. With an assumed start date of 2009, the mean high water and mean low water elevations will rise from +1.64 feet to +2.26 feet, NAVD and +0.58 feet to 1.23 feet, NAVD, respectively.

This is due to an average eustatic sea level rise of 0.013 feet/year. Therefore, the marsh was designed to obtain a marsh elevation above +1.2 feet, NAVD at TY50. The marsh platform will have to be renourished periodically over the life of the project so that it remains within the tidal zone.

Temporary containment dikes are proposed to contain the marsh fill material during construction. The material for dike construction will be dredged from within the footprint of the marsh so that the excavated area is filled during construction. The dike volume is included within the marsh fill volume.

Borrow Areas: It is expected that two borrow sources will be used for this project: a high-quality sand source for the beach-dune portion of the project and an offshore mixed-sediment deposit to be used for the marsh construction. It was assumed that the Mississippi River is the source of high-quality sand that would be used for this project. The Empire borrow area is assumed to be used for the marsh construction. The Empire borrow area was previously evaluated and is expected to be used for the Pelican Island Restoration Project. This will leave the borrow needs for this project short. It is expected that more sediment is out there and further investigations are needed.

Several other borrow areas were suggested for investigations for use of mixed sediments for marsh restoration, primarily including Empire, Quatre Bayou deep (will be partially used for the restoration of Chaland Headland), Quatre Bayou D2, and Sandy Point (farthest away). Others were discussed and further investigation is recommended to find the closest mixed sediment source for marsh restoration. Ship Shoal was also discussed as another source of high quality sands for beach-dune creation. However, the distance to the project site makes this sand source prohibitively expensive.

As-built Conditions: On both Shell Island East and West approximately 336 acres of the TY1 supratidal acres are marsh platform areas that will be above +2.0 feet immediately after construction. Based on settlement curves and elevations of existing marsh, it is projected that all of the marsh platform will settle to intertidal range by TY3.

Shell Island East - As-built, TY1 configuration is anticipated to create 126 acres of dune, 297 acres of supratidal, and 47 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 11 acres of as-built dune area.

Shell Island West - As-built, TY1 configuration is anticipated to create 51 acres of dune, 192 acres of supratidal, and 21 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 8 acres of as-built dune area. All of the beach and marsh fill placed during construction of Shell Island West will have eroded in 23 years (TY25), leaving pre-construction conditions. By TY25 Shell Island West will have receded to the point where there is no supratidal acreage. Once the supratidal acreage is lost, it was assumed that the marsh would be exposed to wave action from the Gulf and that the marsh would recede at the gulf retreat rate.

The shoreline recession rates are 34.9 feet/year for Shell Island West and 12.4 feet/year for Shell Island East. Subtidal acreage decreases following construction because parts of the subtidal acreage are located within the construction footprint.

The volume of sand that could be lost into Coupe Bob every year from the two-island option is approximately 101,000 cubic yards. At this rate it would take Coupe Bob approximately 33 years to reach its accommodation volume of 3.3 million cubic yards. It is unlikely that Coupe Bob will reach its accommodation volume given that the total volume of sand fill placed in Alternative 1 is 4.1 million cubic yards, but it does suggest that little natural bypassing of sand should be expected across Coupe Bob.

6.3 Restoration Features Common to Both Action Alternatives.

In addition to the specifics discussed above, all of the alternative plans for the Caminada and Shell Island reaches include various scales of dune and marsh planting, as well as sand fencing as separable elements to be incorporated into the alternative plans.

6.3.1 Dune and Marsh Plantings

Dune plantings will promote the growth of dunes by capturing Aeolian sand. In the marsh, the plants' roots will stabilize soils quickly to help consolidate the marsh creation areas. Plantings will also accelerate the restoration of the habitats. The types of plants used for dune and marsh planting should offer some degree of vegetative diversity, including woody vegetation (e.g., mangroves, wax myrtle, maritime live oaks) and grasses. Dune plants will consist of a variety of dune species, including bitter panicum (*Panicum amarum* var amarum "Fourchon"), sea oats (*Uniola paniculata* "Caminada"), marshhay cordgrass (*Spartina patens* "Gulf Coast"), and gulf cordgrass (*Spartina spartinae*). Marsh plants will consist of mainly smooth cordgrass (*Spartina alterniflora* "Vermilion") and black mangrove (*Avicennia germinans* "Pelican"). Other plants that should be considered to add diversity include seacoast bluestem (*Schizachyrium maritimum*), seashore dropseed (*Sporobolous virginicus*), and salt grass (*Distichlis spicata*). At the end of the proposed construction, key species will be planted and grasses will be seeded.

6.3.2 Sand Fencing

Construction of sand fencing will promote the growth of the dunes by capturing Aeolian sand. One shore-parallel fence will be installed approximately 50 feet north of the southern toe of the dune to continue the capture of transported sand until the surface is vegetated. The sand fence will extend along the total length of the constructed dune. Sand fences will be installed in sequences/phases. The installation should start from the southern side of the dune so as to build dune towards the Gulf and proceed north. Additional rows of sand fencing may be added once the existing sand fence is full (i.e., sand is stacked up to the top of the fence).

A detailed description of the TSP is included in **Chapter 2 Alternatives** of the integrated feasibility and EIS report. Historic and existing conditions for significant resources are discussed in **Chapter 3 Affected Environment** of the report. The future without conditions and the direct, indirect, and cumulative impacts of those plans carried over for detailed analysis, including the TSP, are discussed in **Chapter 4 Environmental Consequences** of the integrated report.

7.0 DESCRIPTION OF SPECIES AND STATUS WITHIN THE PROPOSED ACTION AREA

There are 25 animal and 3 plant species, under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS), presently classified as threatened or endangered within the state of Louisiana. The USFWS and NMFS share jurisdictional responsibility for sea turtles and the gulf sturgeon. Of the 12 species listed, only two are likely to be observed within the project area: the piping plover (Charadrius melodus) and brown pelican (Pelecanus occidentalis)

Table 4. Threatened (T) and Endangered (E) Species potentially in LaFourche Parish

Common Name	Scientific name	Federal Status	State Status
Bald eagle	*Haliaeetus leucocephalus*	P	P
Brown Pelican	*Pelecanus occidentalis*	E	E
Green sea turtle	*Chelonia mydas*	T	T
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	E
Leatherback sea turtle	*Dermochelys coriacea*	E	E
Loggerhead sea turtle	*Caretta caretta*	T	T
Piping plover	*Charadrius melodus*	T; Critical Habitat	T

Source: United States Fish and Wildlife Service (USFWS; April 2003).
(P = protected; T = Threatened; E = Endangered)

7.1 Bald Eagle.

The bald eagle is the only species of sea eagle native to North America. Adults are black with a snow-white head and tail. Sub adults are mottled brown and black and lack the

distinctive white head and tail. Wingspan is 6 to 7 feet with females weighing between 10-14 lbs. and males weighing between 8-10 lbs.

Bald eagles nest in Louisiana from October through mid-May, primarily in cypress snags in swamps or near fresh to intermediate marshes or open water in the southeastern parishes. Bald eagles will often return to the same nest for a number of years; however, they may also use alternate nests within the vicinity. Shoreline trees that provide a clear view of the water to locate aquatic prey are often chosen as nest sites. Bald eagles primarily feed on fish, but are opportunistic and will eat a variety of mammals, amphibians, crustaceans, and birds. Wintering habitat used by bald eagles in Louisiana is characterized by abundant, readily available food sources. Most wintering areas are associated with open water where eagles feed on fish or waterfowl.

The USFWS has indicated that there are no known bald eagle nests in the vicinity of the project area (Walther, 2007). In addition, neither the LDWF nor the National Audubon Society Christmas Bird Count has reported any sightings of the bald eagle in the project area. If a bald eagle nest is found within 1,500 feet of the project area, the USFWS would need to be contacted to develop measures (e.g., spatial restrictions around active bald eagle nests) to avoid impacts on this species.

7.2 Green Sea Turtle (*Chelonia mydas*).

Breeding populations of the green sea turtle in Florida and the Pacific coast of Mexico are listed as endangered, all others are listed as threatened under the Endangered Species Act of 1973, as amended, on July 28, 1978 (43 FR 32800). Critical habitat for the green sea turtle was designated on September 2, 1998 (63 FR 46701); critical habitat was redesignated and amended on March 23, 1999 (64 FR 14067). Critical habitat has also been designated for waters surrounding Culebra Island, Puerto Rico (50 CFR 226.208).

Although green sea turtles are found worldwide in oceans and gulfs with water temperatures greater than 68°F (20°C), their distribution can be correlated to grassbed distribution, location of nesting beaches, and associated ocean currents (Hirth 1971; Perrine 2003; Spotila 2004). Long migrations are often made between feeding and nesting grounds (Carr and Hirth 1962). Within Louisiana waters, these turtles probably occur all along the coast and may nest on the Chandeleur Islands (Dundee and Rossman 1989). Population decline has been attributed to heavy fishing pressure and human nest predation (Dundee and Rossman 1989; Perrine 2003; Spotila 2004). Historically, green sea turtles were fished off the Louisiana coast, especially the Chandeleur Islands (Rebel 1974; http://www.wlf.state.la.us/apps/netgear/index.asp?cn=lawlf&pid=703). Exploitation and incidental drowning in shrimp trawls has contributed to the decline of this species and its eventual listing (King 1981). During their first year of life, green sea turtles are primarily carnivorous, feeding mainly on invertebrates. Green turtles are the only sea turtles that eat large amounts of plants, feeding in shallow water areas with abundant seagrasses or algae (Fritts et al. 1983; Spotila 2004). Green sea turtles also feed on invertebrates and carrion (Dundee and Rossman 1989). The green sea turtle grows to

the second largest size of any sea turtle, with a maximum shell length of 55 inches (140 cm) and a maximum weight of 517 lbs (235 kg), but most are considerably smaller (Perrine 2003).

The turtles migrate from nesting areas to feeding grounds, which are sometimes several thousand miles away. Most turtles migrate along the coasts, but some populations are known to migrate across the ocean from nesting area to feeding grounds. The major nesting beaches are always found in places where the seawater temperature is greater than 77°F (25°C). As a species that migrates long distances, these turtles face special problems associated with differing attitudes toward conservation in different countries. Green turtles are the only sea turtles known to come ashore for purposes other than nesting. Both immature and adult green sea turtles are known to bask (Perrine 2003).

In the southeastern United States, green sea turtles are found around the U.S. Virgin Islands, Puerto Rico, and the continental U.S. from Texas to Massachusetts. Important feeding grounds in Florida include Indian River Lagoon, the Florida Keys, Florida Bay, Homosassa, Crystal River and Cedar Key. The primary nesting sites in U.S. Atlantic waters are along the east coast of Florida, with additional sites in the U.S. Virgin Islands and Puerto Rico.

Green sea turtles are also found throughout the North Pacific, ranging as far north as Eliza Harbor, Admiralty Island, Alaska, and Ucluelet, British Columbia. In the eastern North Pacific, green sea turtles have been sighted from Baja California to southern Alaska. In the central Pacific, green sea turtles can be found at most tropical islands. In U.S. Hawaiian waters, green sea turtles are found around most of the islands in the Hawaiian Archipelago. The primary nesting site is at French Frigate Shoals (http://www.nmfs.noaa.gov/prot_res/species/turtles/green.html).

Female green sea turtles lay one to seven clutches of eggs in a single nesting season with each clutch contains an average of 110 eggs (Spotila 2004). The number of nests has been estimated to be between 350 to 2,300 nests annually. Green sea turtles nest at 2-, 3-, or 4-year intervals. This nesting activity indicates a population of less than 1,000 females in the breeding population of Florida and Mexico. It takes longer for a green turtle to reach maturity than any other sea turtle, typically living 45-59 years (Spotila 2004).

The USFWS web site (http://ecos.fws.gov/species_profile/servlet/gov.doi.species_profile.servlets.SpeciesProfile?spcode=C00S) and the NMFS web site (http://www.nmfs.noaa.gov/prot_res/species/turtles/green.html) provides a species account of the green sea turtle. Additional information on green sea turtles is provided by Carr (1952), Carr and Hirth (1962), Hirth (1971; 1980), Rebel (1974), Dundee and Rossman (1989), Perrine (2003) and Spotila (2004) provide recent summaries of green sea turtle biology, behavior and conservation.

7.3 Hawksbill Sea Turtle (*Eretmochelys imbricata*).

The endangered Hawksbill Sea Turtle is one of seven species of sea turtles found throughout the world. One of the smaller sea turtles, it has overlapping scutes (plates) that are thicker than those of other sea turtles. This protects them from being battered against sharp coral and rocks during storm events. Adults range in size from 30 to 36 inches (0.8-1.0 meters) carapace length, and weigh 100 to 200 pounds (45-90 kilograms). Its carapace (upper shell) is an attractive dark brown with faint yellow streaks and blotches and a yellow plastron (under shell). The name "hawksbill" refers to the turtle's prominent hooked beak.

The hawksbill sea turtle is one of the most infrequently encountered sea turtles in offshore Louisiana. However, a hawksbill was reported near Calcasieu Lake in 1986 (Fuller *et al.*, 1987). Hawksbills generally inhabit coastal reefs, bays, rocky areas, passes, estuaries, and lagoons, where they are found at depths of less than 70 feet. Nesting occurs on undisturbed, deep-sand beaches, from high-energy ocean beaches to tiny pocket beaches several meters wide bounded by crevices of cliff walls; these beaches are typically low-energy, with woody vegetation near the waterline. In the continental United States, nesting sites are restricted to Florida where nesting is sporadic at best (NOAA Fisheries/USFWS, 1993). Due to the lack of suitable foraging and nesting habitats, there is a low probability of this species occurring within the project area.

7.4 Kemp's Ridley Sea Turtle (*Lepidochelys kempii*).

On December 2, 1970 the Kemp's ridley sea turtle was designated as endangered across its entire range (35 FR 18319). Critical habitat has been proposed (October 4, 1978 (43 FR 45905); November 29, 1978 (43 FR 55806)) but has not been finalized to date. This species has continued to decline in Louisiana (USFWS 1990). The Kemp's ridley is the rarest, most endangered, and enigmatic of all sea turtles (Perrine 2003; Spotila 2004). However, this small sea turtle is believed to be the most frequently encountered (Dundee and Rossman 1989), if not the most abundant sea turtle, off the Louisiana coast (Viosca 1961).

The Kemp's ridley has the most limited distribution of any sea turtles except the Australian flatback (Perrine 2003). For the most part, breeding is confined to a limited stretch of beach on the Gulf coast of Mexico. The known range of this species includes the Gulf of Mexico and the Atlantic Ocean. The current range for Kemp's ridley in the United States includes marine habitat of the following coastal states: Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas.

Inshore areas of the Gulf of Mexico appear to be important habitat for Kemp's ridleys, as they tend to concentrate around the mouths of major rivers (Frazier 1980). Members of this genus are characteristically found in waters of low salinity and high turbidity and organic content, where shrimp are abundant (Zwinenberg 1977; Hughes 1972 as cited in Frazier 1980;). Kemp's ridleys have been collected in Louisiana from Lake Borgne,

Barataria and Terrebonne Bays, and near Calcasieu Pass (Dundee and Rossman 1989). Occurrence of these sea turtles in bays and estuaries along the Louisiana coast would not be unexpected, as many of their primary food items occur there. Stomach analyses of specimens collected in shrimp trawls off Louisiana revealed crabs, gastropods, and clams (Dobie et al. 1961). Although Kemp's ridleys are considered primarily carnivorous benthic feeders (Ernst and Barbour 1972), jellyfish as well as by-catch from shrimp trawlers have been reported as part of their diet (Landry 1986).

The USFWS web site (http://ecos.fws.gov/species_profile/SpeciesProfile?spcode=C00O) and the NMFS web site (http://www.nmfs.noaa.gov/pr/species/turtles/kemps.html) provide a species account of the Kemp's ridley sea turtle. Additional information on the Kemp's ridley sea turtle includes Hughes (1972), Pritchard and Marquez (1973), Zwinenberg (1977), Fuller (1978), Carr (1980), and Fuller and Tappen (1986). More recently, Perrine (2003) and Spotila (2004) provide summaries of Kemp's ridley sea turtle biology, behavior and conservation.

7.5 Leatherback Sea Turtle (*Dermochelys coriacea*).

The leatherback sea turtle was listed as an endangered species throughout its range on June 2, 1970 (35 FR 8491). Critical habitat was designated on September 26, 1978 (43 FR 43688), March 23, 1979 (44 FR 17710), and March 23, 1999 (64 FR 14051). Critical habitat has been designated for shoreline and adjacent waters of the U.S. Virgin Islands (50 CFR 17.95; 50 CFR 226.207). The leatherback is found throughout the tropical waters of the Atlantic, Pacific, and Indian Oceans (Ernst and Barbour 1972), the Gulf of Mexico, and the Caribbean (Carr 1952). Critical habitat for the leatherback includes the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands, up to and inclusive of the waters from the hundred fathom curve shoreward to the level of mean high tide with boundaries at 17°42'12" N and 64°50'00" W. This turtle exhibits seasonal fluctuations in distribution in response to the Gulf Stream and other warm water features (Pritchard 1971; Hirth 1980; Fritts et al. 1983). During the summer, leatherbacks tend to be found along the east coast of the U.S. from the Gulf of Maine south to mid-Florida.

Nesting occurs from February through July at sites located from Georgia to the U.S. Virgin Islands. Nesting leatherbacks occur along beaches in Florida, Nicaragua, and islands in the West Indies; however, no nesting has been reported in Louisiana (Gunter 1981, Dundee and Rossman 1989). In Louisiana, leatherbacks are believed to occur offshore in deep waters; however, they have been collected from or sighted in Cameron Parish, Atchafalaya Bay, Timbalier Bay, and Chandeleur Sound (Dundee and Rossman 1989).

The USFWS web site (http://ecos.fws.gov/species_profile/servlet/gov.doi.species_profile.servlets.SpeciesProfile?spcode=C00F) and the NMFS web site (http://www.nmfs.noaa.gov/pr/species/turtles/leatherback.html /) provide a species account of the leatherback sea turtle. Additional information on the leatherback sea turtle

includes Pritchard (1971), Earnst and Barbour (1972), and Fritts et al. (1983). Perrine (2003) and Spotila (2004) provide recent summaries of leatherback sea turtle biology, behavior and conservation.

Leatherback turtles are omnivorous but feed primarily on jellyfish and other cnidarians, and have been associated with large schools of cabbage head jellyfish *(Stomolophus meleagris)*. Fritts et al. (1983) reported that these turtles also ingest plastic, apparently mistaking it for food.

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Leatherbacks are seriously declining at all major nesting beaches throughout the Pacific. The decline is dramatic along the Pacific coasts of Mexico, Costa Rica and Malaysia. Nesting along the Pacific coast of Mexico declined at an annual rate of 22 percent over the last 12 years, and the Malaysian population represents 1 percent of the levels recorded in the 1950s. The collapse of those nesting populations was precipitated by a tremendous over-harvest of eggs, direct harvest of adults, and incidental mortality from fishing. In the Atlantic and Caribbean, the largest nesting assemblages are found in the U.S. Virgin Islands, Puerto Rico, and Florida. Nesting data for these locations have been collected since the early 1980s and indicate that the annual number of nests is likely stable; however, information regarding the status of the entire leatherback population in the Atlantic is lacking. Nesting activity has also declined in French Guiana due to erosion of nesting beaches. The population appears to have shifted to Surinam, where annual numbers of nests rose from less than 100 in 1967 to 5,565 in 1977 and 9,816 in 1987. Current estimates are that 20,000 to 30,000 female leatherbacks exist worldwide.

7.6 LOGGERHEAD SEA TURTLE (*Caretta caretta*).

The loggerhead sea turtle was listed as a threatened species on July 28, 1978 (43 FR 32800). Critical habitat has been proposed (October 4, 1978 (43 FR 45905); November 29, 1978 (43 FR 55806); and March 19, 1980 (45 FR 17588)) but has not been finalized. Loggerheads are circumglobal, inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. In the Atlantic, the loggerhead turtle's range extends from Newfoundland to as far south as Argentina. During the summer, nesting occurs in the lower latitudes. The primary Atlantic nesting sites are along the east coast of Florida, with additional sites in Georgia, and the Carolinas; some nesting also occurs on the Gulf Coast of Florida. In the eastern Pacific, loggerheads are reported as far north as Alaska, and as far south as Chile. Occasional sightings are also reported from the coast of Washington, but most records are of juveniles off the coast of California. Southern Japan is the only known breeding area in the north Pacific (http://www.nmfs.noaa.gov/prot_res/species/turtles/loggerhead.html).

The loggerhead sea turtle has continued to decline in Louisiana (USFWS 1990). Perrine (2003) and Spotila (2004) provide recent summaries of loggerhead sea turtle biology, behavior and conservation. Loggerheads are capable of living in a variety of environments, such as in brackish waters of coastal lagoons and river mouths. During the winter, they may remain dormant, buried in the mud at the bottom of sounds, bays, and estuaries. The major nesting beaches are located in the southeastern United States, primarily along the Atlantic coast of Florida, North Carolina, South Carolina, and Georgia. Only minor and solitary nesting has been recorded along the coasts of the Gulf of Mexico.

The largest of the hard-shell sea turtles, the loggerhead is distributed worldwide in temperate and tropical bays and open oceans. Loggerheads probably range all along the Louisiana coast; however, Dundee and Rossman (1989) reported specimens only from Chandeleur Sound, Barataria Bay, and Cameron Parish. The population decline of loggerheads can be attributed to egg and nestling predation by mammals and birds (Dundee and Rossman 1989).

Nesting on the Gulf Coast occurs between the months of April and August, with 90 percent of the nesting effort occurring on the south-central Gulf Coast of Florida (Hildebrand 1981). Although loggerheads have been documented as nesting on the Chandeleurs in 1962 and Grand Isle in the 1930s, it is doubtful whether this species currently successfully nests on the Louisiana coast (Hildebrand 1981, Dundee and Rossman 1989). The loggerhead's diet includes marine invertebrates such as mollusks, shrimp, crabs, sponges, jellyfish, squid, sea urchins, and basket stars (Caldwell et al. 1955, Hendrickson 1980, Nelson 1986). Landry (1986) suggested that these turtles may also feed on discarded by-catch from shrimp trawling. Adult loggerheads feed in waters less than 50 meters deep, while the primary foraging areas for juveniles appears to be in estuaries and bays (Nelson 1986, Rabalais and Rabalais 1980).

The USFWS web site (http://ecos.fws.gov/species_profile/servlet/gov.doi.species_profile.servlets.SpeciesProfile?spcode=C00U) and the NMFS web site

(http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.html) provide a species account of the loggerhead sea turtle. Additional information on the loggerhead sea turtle includes Caldwell et al. (1955), Hendrickson (1980), Hildebrand (1981), Landry (9186), and Nelson (1986).

7.7 GULF STURGEON (*Acipenser oxyrhynchus desotoi*)

A Federally listed as a threatened species, is an anadromous fish that occurs in many rivers, streams, and estuarine waters along the northern Gulf coast between the Mississippi River and the Suwannee River, Florida. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Adults and sub-adults may be found in those rivers and streams until November and in estuarine or marine waters during the remainder of the year. Sturgeon less than two years old appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations such as those caused by water control structures that limit and prevent spawning, poor water quality, and over-fishing have negatively affected this species.

Based on distribution information from the NOAA Fisheries (2007), the present range of the Gulf sturgeon extends from Lake Pontchartrain and the Pearl River system in eastern Louisiana and western Mississippi east to the Suwannee River is Florida. The project area is not within the current range of the Gulf sturgeon.

7.8 SPECIES OBSERVED IN THE STUDY AREA

7.8.1 Piping Plover (Charadrius melodus)

7.8.1.1 Description of Species.

The piping plover, (*Charadrius melodus),* is a small shorebird approximately 7 inches in length with a wingspan of approximately 15 inches and weighs from 1.5 to 2 ounces. It is sand-colored on the back with white undersides. The piping plover is distinguished from similar species by its bright orange legs. During the breeding season, the plover has a single black band across its breast and forehead, which are absent during the winter.

The piping plover is named for its melodic mating call. It is a small, pale-colored North American shorebird. The bird's light sand-colored plumage blends in with sandy beaches and shorelines. There are three populations of piping plovers in the United States. The most endangered is the Great Lakes breeding population, which encompasses only 32 breeding pairs. The Northern Great Plains and Atlantic Coast populations are classified as threatened and include 1398 and 1372 breeding pairs, respectively. All piping plovers winter along the southeast and Gulf coasts and are classified as threatened in their wintering habitat (USFWS, 2000). Major threats to the piping plover include the loss and

degradation of habitat due to development, disturbance by humans and pets, and predation.

7.8.1.2 Distribution of Species.

The historical breeding range in North America of the piping plover included the Atlantic coastal beaches from Newfoundland to South Carolina; beaches of the Great Lakes; and the northern Great Plains region from Alberta to Ontario and south to Nebraska (USFWS, 1988). These populations were reported to winter along the Gulf of Mexico, the Atlantic coast from North Carolina to Florida, eastern Mexico, and in the Caribbean Islands (Haig and Oring, 1985). Approximately 35 percent of the total breeding piping plover population winters along the Gulf coast from Florida to Texas and represents 56 percent of the Great Lakes/Great Plains population (Natureserve 2002, 2003)

The population potentially occurring within the proposed project area is the Great Lakes population. They arrive from their northern breeding grounds as early as late July and may be present for 8 to 10 months of the year.

Northward migration to the breeding grounds occurs during late February, March, and early April (Patterson 1988, MacIvor 1990). Plovers will breed at 1 year of age (MacIvor 1990, Strauss 1990, Haig 1992) and are monogamous, but usually shift mates between years (Wilcox 1959, Haig and Oring 1988, MacIvor 1990).

Southward migration to the wintering grounds along the southern Atlantic coast and Gulf of Mexico shoreline extends from late July through September. Individuals can be found on their wintering grounds throughout the year but sightings are rare in May, June, and early July (USFWS 2001a).

7.8.1.3 Habitat.

Ideal wintering habitat for the piping plover on the Gulf of Mexico coast would contain large sand flats or sand-mud flats adjacent to a tidal pass or tidal inlet (Haig 1985, Nicholls 1989). A thin layer of mud covering the sand seems to attract plovers, due to possible food or refuge association (Nicholls 1989). Nicholls observed that barrier beaches with over wash areas or sections of old marshes also attract plovers. A gulf-facing beach having a very low gradient, thus an increased intertidal zone, offers an

almost equally attractive area (Haig 1985). Also piping plovers will inhabit spoil islands on the Gulf Intercoastal Waterway on both Atlantic and Gulf Coasts. Birds are frequently associated with bays, lagoons and inlets. Winter 2001 census observations were in the following habitat types: mudflats (36.3%), sandy beaches (33.2%), sand/salt flats (23.1%) algal mats (2.8%), oyster reefs (1.0%) and gravel shores (0.1%; Haig 2004).

In July of 2001, the USFWS designated specific areas in the United States as critical habitat for wintering piping plovers (Federal Register / Vol. 66, No. 132, 10 July 2001). Piping plover critical habitat is defined by the USFWS as "those elements essential for the primary biological needs of foraging, sheltering, roosting, and the physical features necessary for maintaining the natural processes that support those habitat components." The USFWS also indicated that constituent elements are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide. Important primary constituent elements of intertidal flats include sand and/or mud flats with no or very sparsely emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting plovers. The USFWS designated a total of 1,798 miles (165,211 acres) of shoreline along the Gulf of Mexico and Atlantic coasts as critical wintering habitat. Critical habitat in Louisiana encompasses 24,950 acres along 342.5 miles of shoreline, which is most of the coast of Louisiana including the island of Grand Isle. The critical habitat designation within Louisiana include:

- **Unit LA-1**: Texas/Louisiana border to Cheniere au Tigre. 2,650 ha (6,548 ac) in Cameron andVermilion Parishes
- **Unit LA-2**: Atchafalaya River Delta. 921 ha (2,276 ac) in St. Mary Parish, LA
- **Unit LA-3**: Point Au Fer Island. 195 ha (482 ac) in Terrebonne Parish.
- **Unit LA-4**: Isles Dernieres. 795 ha (1,964 ac) in Terrebonne Parish
- **Unit LA-5**: Timbalier Island to East Grand Terre Island. 2,321 ha (5,735 ac) in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes.
- **Unit LA-6**: Mississippi River Delta. 105 ha (259 ac) in Plaquemines Parish, LA.
- **Unit LA-7**: Breton Islands and Chandeleur Island Chain. 3,116 ha (7,700 ac) in Plaquemines and St. Bernard Parishes, LA

The proposed project occurs within critical habitat designation Unit LA-5 (Figure 8). Unit LA-5 includes:

> Timbalier Island to East Grand Terre Island. 2,321 ha (5,735 ac) in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes: All of Timbalier Island where primary constituent elements occur to the MLLW [mean low low water], all of Belle Pass West [the "peninsula" extending north/northwest approximately 4.8 km (3.0 mi) from the west side of Belle Pass] where primary constituent elements occur to MLLW; the Gulf shoreline extending approximately 11 km (6.8 mi) east from the east side of Belle Pass bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover,

begins and where the constituent elements no longer occur; all of Elmers Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmers Island to approximately 0.9 km (0.56 mi) west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; the Gulf shoreline of Grand Isle from the Gulf side of the hurricane protection levee to MLLW; and all of East Grand Terre Island where primary constituent elements occur to the MLLW.

Critical habitat within the project area for the piping plover is found only along the Caminada Headland portion of the proposed project area, from West Belle Pass to Elmer's Island peninsula (Figure 9). The Shell Island area does not contain designated critical habitat for the piping plover.

Foraging habitat in winter is fairly consistent among numerous Gulf and Atlantic coast sites. On Dauphin Island, AL: protected mudflats or sandflats exposed at low tide; at Texas sites: primarily bayshore sand and algal flats. Comparison among 36 Atlantic winter sites (222 birds observed once each) and 75 Gulf sites (1,508 birds observed once each) indicates foraging activity most often associated with mudflats (25.6% of observations), sandflats (25.1%), and sandy mudflats (31.8%; *Haige, 2004).*

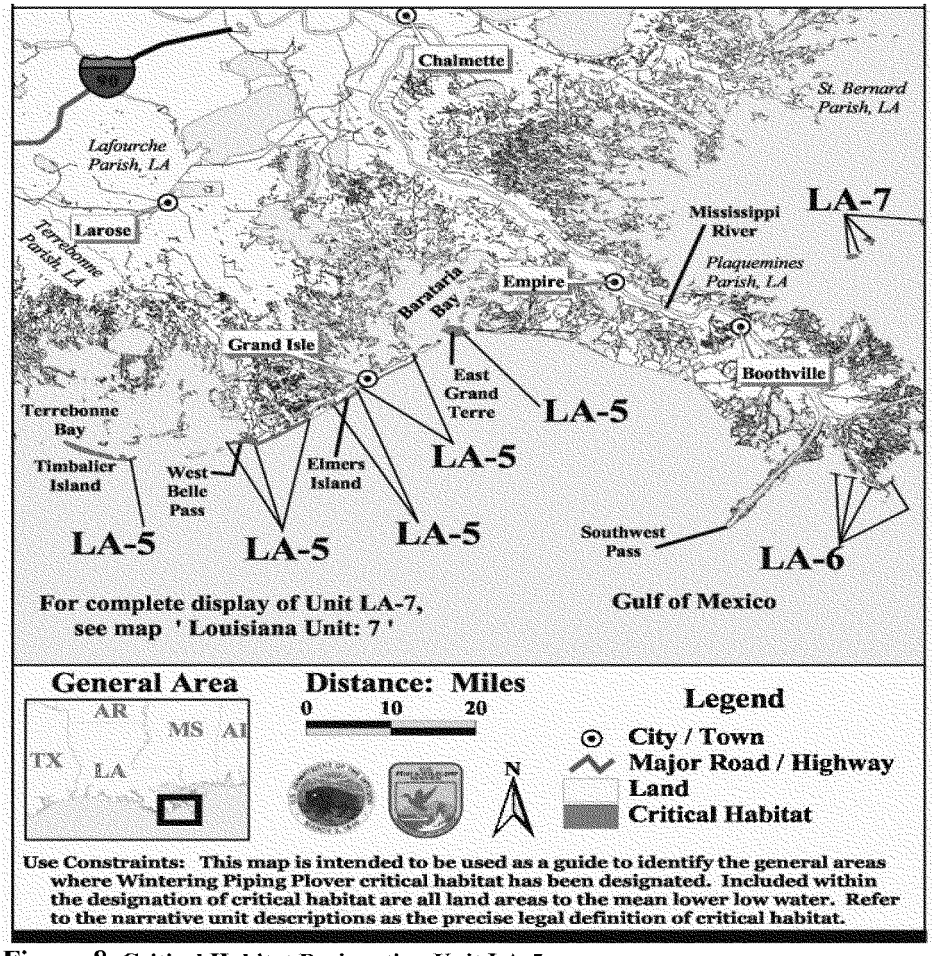


Figure 8. Critical Habitat Designation Unit LA-5

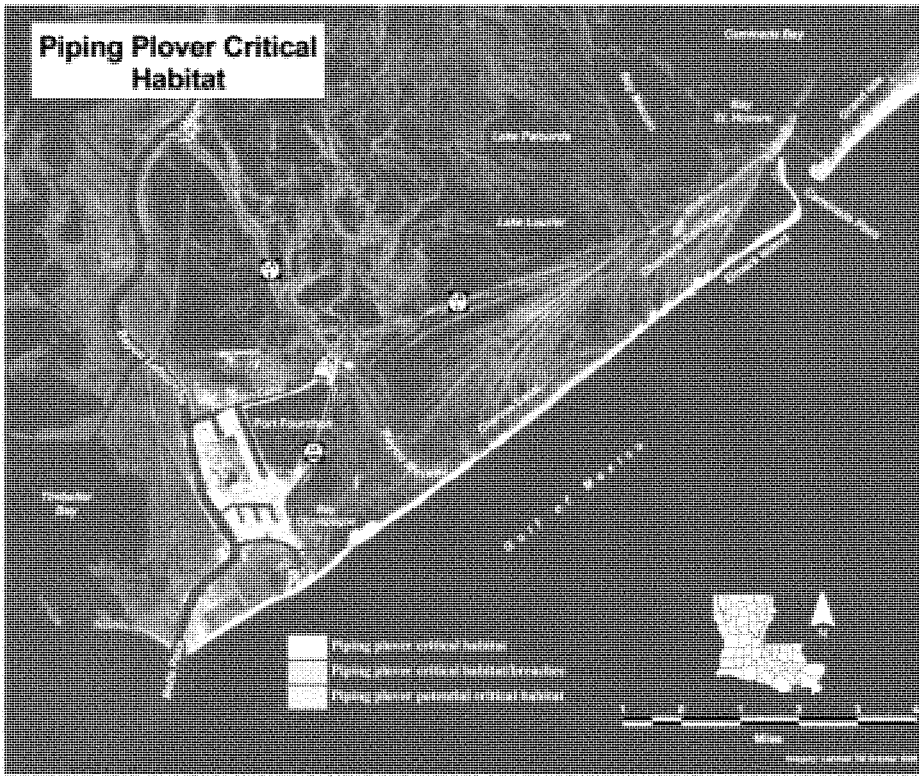


Figure 9. Critical Habitat Designation with proposed project area.

In general, wintering piping plovers feed extensively on intertidal beaches, mudflats, sand flats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting (USFWS 2002).

The piping plover feeds on insects and invertebrates along the waterline. Like other plovers this species runs a few feet and then stops, scans, and pecks at the prey it locates. It also hunts for insects on higher beach near roosting site areas.

7.8.1.4 Cause of Decline.

Hunting in the early 1900s resulted in a drastic reduction of the piping plover population. Ongoing destruction of historical nesting sites further reduced plover populations (USFWS 1988). Loss of breeding habitat has resulted from recreation and commercial development of sandy beaches on the Great Lakes, Atlantic Coast, and Gulf of Mexico.

Where breeding does occur on coastal beaches, inland lakes, and river sites, reproductive success has been reduced by disturbance from humans and pets. Additional habitat has been lost due to construction and operation of reservoirs and river channelization.

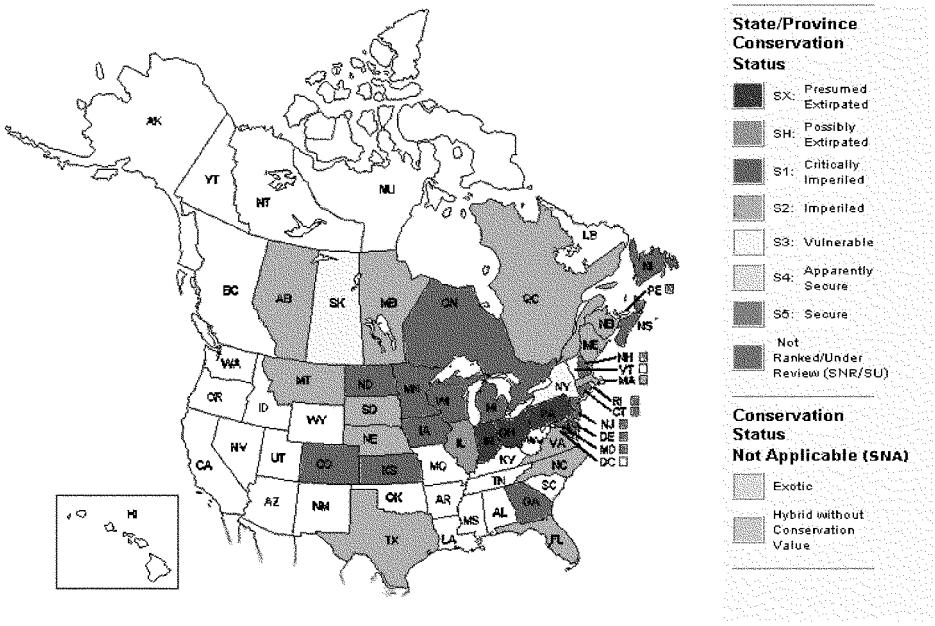
Dune stabilization projects that result in steep beach slopes, narrower beach widths, or increased vegetation to the water's edge, reduce piping plover habitat (Haig 1985). In at least one instance, stabilization of the backside of the dune on Padre Island, Texas, resulted in the destruction of essential sand flat habitat (USFWS ESIS). Additionally, increased urbanization has led to an increase in predation on the piping plover population (USFWS 1988). Recreational activities in localized areas along the gulf coast have been correlated with a decrease in piping plover use of those areas (Nicholls 1989).

The primary threats to the piping plover are habitat modification and destruction, and human disturbance to nesting adults and flightless chicks. A lack of undisturbed habitat has been cited as a reason for the decline of other shorebirds such as the black skimmer and least tern (COE, 2001).

7.8.1.5 Status of Species.

The USFWS determined the piping plover to be endangered and threatened in accordance with the Endangered Species Act of 1973, as amended, on December 11, 1985 (Federal Register Volume 50, No. 238). Endangered status was determined for the plover in the watershed of the Great Lakes (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario). It was determined to be threatened in the remainder of its range: northern Great Plains (Iowa, northwestern Minnesota, Montana, Nebraska, North Dakota, South Dakota, Alberta, Manitoba, and Saskatchewan); Atlantic coast (Quebec, Newfoundland, Maritime Provinces, and states from Maine to Florida); Gulf coast (Florida to Mexico); Bahamas; and West Indies.

Population trend data for this species is sparse. In the early 1900's, it was generally considered to be common. Early 20th century accounts report that hunting caused the first known major decline of the piping plover along the Atlantic coast (Brent, 1929; Hall, 1960). With passage of the Migratory Bird Treaty Act in 1918, plover populations recovered only to decline again in the recent times.



The Draft Piping Plover Recovery Plan (USFWS 1987) states that, "... the quality or quantity of winter habitat may be a factor limiting recovery of the species." Johnson (1987) stated that because piping plovers return to the same wintering area each year "the availability of nearby alternate sites may affect survival during severe weather conditions" when wintering sites are destroyed. Johnson (1987) also states that further destruction of winter-feeding areas may decrease plover numbers substantially. With the continuing erosion of Louisiana's coastline, further reductions in piping plover wintering habitat are anticipated.

Piping plovers winter along the southern Atlantic coast and the Gulf of Mexico. In 1996, the international piping plover winter census found that 89 percent of wintering piping plovers were found along the Gulf of Mexico coast, and eight percent were found along the Atlantic coast. In 2001, a piping plover winter census was conducted throughout the eastern United States and portions of Canada. The International Piping Plover Coordination Group coordinated the census with over 1,400 participants visiting 1,892 sites. The participants observed a total of 5,945 pairs of breeding plovers at 777 sites (Ferland and Haig 2002). The results of the census showed that the piping plovers were found primarily on islands (73.4 percent), mudflats (36.3 percent), sandy beaches (33.2 percent), and sand/salt flats (23.1 percent) (Ferland and Haig 2002).

Most of the piping plovers wintering along the shores of the Gulf of Mexico nest in the Great Lakes and Northern Great Plains region of the United States and Canada (USFWS 1988). Piping plover populations have increased steadily along the Atlantic Coast from

957 pairs of plover in 1989 to 1,676 pairs in 2003 (USFWS 2004). Preliminary 2005 Atlantic Coast piping plover abundance estimate was 1,632 nesting pairs (http://www.fws.gov/northeast/pipingplover/status/preliminary.05.pdf).

Midwinter surveys conducted near the project area during the Audubon Society's annual Christmas Survey from 1997 through 2008 indicate that numbers declined by approximately 50% in 1998 with only two birds sighted in 2005. Numbers returned to 1997 counts in 2006 with a slight increase in 2007 (Table 5).

Year	Number sighted
1997	23
1998	9
2005	2
2006	23
2007	33
2008	22

Table 5. Midwinter Piping Plover Surveys Near Project Area, 1997-2008

Source: National Audubon Society (2002). The Christmas Bird Count Historical Results [Online]. Available http://www.audubon.org/bird/cbc [June7, 2007].

More recent surveys were undertaken by the Avian Non-Game Program of the Louisiana Department of Wildlife and Fisheries are shown below in Table 6.

Table 6: LOUISIANA 2007-2008 PIPL Census Summary

Parish	Site Name	# of Surveys at site in 2007	PIPL 2007	# of Surveys at site in 2008	PIPL 2008
LaFourche	Belle Pass, west	1	0	1	13
LaFourche	East Timbalier Island	0	0	2	0
LaFourche	Fourchon Beach, east	1	5	1	41
LaFourche	Fourchon Beach, west	1	0	0	0
LaFourche	Unnamed Islands	0	0	0	0

According to the 2008 surveys, 41 piping plovers were sited along the Fourchon Beach east and 13 were sited along Belle Pass west.

7.8.2 Brown Pelican (*Pelecanus occidentalis*)

7.8.2.1 Description of Species.

Hingtgen (1985) provides a life history summary and a habitat suitability index model for the eastern brown pelican. The brown pelican is a large marine bird that can be found year around along the Gulf of Mexico coastal waters from Texas to Florida. The brown pelican is one of two species of pelican in North America, the other being the white pelican (*Pelecanus erythrorhynchos*). Adult brown pelicans are dark gray-brown with white about the head and neck. Immature brown pelicans are gray-brown on their head and neck with white underparts. The brown pelican weighs up to 8 lbs (3.6 kg) and larger individuals have wingspans of up to about 7 feet (2.1 m). They spend their entire life cycle in or near marine and estuarine waters, seldom venturing more than 20 miles (32.2 km) out to sea.

7.8.2.2 Distribution of Species.

In the United States, the brown pelican is found along the California coast, and from North Carolina to Texas. It is also found in Mexico, the West Indies and many Caribbean Islands, and as far south as Guyana and Venezuela in South America (USFWS 1995). Brown pelicans were extirpated from the Louisiana coast during the 1960s, but were reintroduced from Florida in 1968. Extensive use of pesticides, which were ultimately ingested by brown pelicans, has been noted as the primary cause of decline of the species (USFWS 1989b). This threat has been essentially eliminated, resulting in delisting of the species in Alabama and Florida, and stable populations in Louisiana, Mississippi, and Texas coastal regions.

Historically, brown pelicans used the Shell Keys NWR in south-central Louisiana (Emmons 1990). Refuge Staff at the Delta NWR, located in Plaquemines Parish, Louisiana, have noted that brown pelicans tend to use the refuge more during the winter months and the coastal barrier islands during the spring. They suspect that the majority of the pelicans that use that refuge are immature and non-breeding birds (Wigginton 1990). Brown pelicans use the area around Breton NWR in St. Bernard and Plaquemines Parishes, Louisiana, as loafing, feeding, and nesting areas. Flocks typically containing 50 to 100 birds are routinely observed by refuge staff on or near all islands in the Breton and Chandeleur Sounds (Wigginton 1990, Guidry 1994).

The Louisiana population numbered as many as 50,000 birds in the 1930s. By 1963, brown pelicans had completely disappeared from Louisiana. The LDWF and Florida Game and Fresh Water Fish Commission jointly implemented a restoration project from 1968 to 1980, and a total of 1,276 pelicans were reintroduced at three release sites in southeastern Louisiana. Restored nesting populations were established at North Island in the Chandeleur Island chain and at Queen Bess/Camp Island in Barataria Bay. North Island production was 909 fledglings between 1974 and 1979, and first nested successfully when the birds were 2 years of age. Reintroduced birds at the Queen Bess/Camp Island site first nested successfully at 3 years of age (McNease and Joanen 1984).

The 13-year reintroduction project suffered a setback in 1975 when approximately 40 percent of the population was killed by a pesticide incident, but the subsequent trend in numbers of nesting pairs continued a generally upward trend. In 1983, the estimated number of nesting pairs in Louisiana was 602. Louisiana had approximately 1,333 successful nests in 1990 (personal communication, 1991, Mr. Larry McNease, LDWF). In 1997, the LDWF estimated there were approximately 10,000 pelican nests with 25,000 adults nesting in Louisiana, primarily on the Chandeleur Islands (personal communication 2004, Ms. Brigette Firmin, USFWS). During the 2000 nesting season, a substantial portion of the Chandeleur Island nesting population relocated to an island created by dredge material at the mouth of Baptiste Collette Pass, but the birds returned to the Chandeleur Islands for the 2001 nesting season (personal communication 2004, Ms. Brigette Firmin USFWS).

Other brown pelican nesting areas in Louisiana include Raccoon and Wine Islands in the Isles Dernieres barrier island system, Queen Bess Island in Barataria Bay, West Breton Island in Breton Sound, and most recently, Rabbit Island in Calcasieu Lake.

7.8.2.3 Habitat.

Brown pelicans feed along the Louisiana coast in shallow estuarine waters. Brown pelicans feed mainly on fish, including menhaden, mullet, sardines, and pinfish, which they capture by plunge diving (USFWS 1989b).

Preferred nesting sites are small coastal islands, which provide protection from mammalian predators (mainly raccoons), and have sufficient elevation to prevent widespread flooding of nests. The nests are usually built in available vegetation (e.g., black mangroves), but ground nesting may also occur. Ground nests vary from practically nothing to well built nests of sticks, reeds, straw, palmetto leaves, and grasses. Tree nests are made of similar materials, only they are more firmly constructed. Sand spits and offshore sandbars are used extensively as daily loafing and nocturnal roost areas.

Brown pelican breeding activity in Louisiana can vary from as early as February to as late as September. They nest in colonies on small coastal islands in salt and brackish waters. Nesting islands are often chosen near channels where shipping and shrimping operations make fish easily available to nesting pairs. Normal clutch size is three eggs, and both parents share incubation and rearing of the young. The species is considered to be long-lived; one pelican captured in Edgewater, Florida, in November 1964 was banded in September 1933.

7.8.2.4 Causes of Decline.

The brown pelican is extremely susceptible to disturbance and habitat alteration in key nesting areas. It is, therefore, important to prevent disturbance to nesting colonies (e.g., by low-flying aircraft, noise disturbance from project-related activities, etc.) that could

cause nest desertion and egg losses, as well as the control of pesticide use and other types of environmental pollution. Consequently, regular surveying occurs in Louisiana. Protective measures for the species consist mainly of legal and regulatory procedures and habitat protection and improvement. The brown pelican is currently protected by Federal and state laws, which are enforced by the USFWS and the LDWF, respectively. Nest sites are also protected under management programs on Federal lands (i.e., NWRs).

7.8.2.5 Status of Species.

The brown pelican was listed as endangered first on June 2, 1970, amended on October 13, 1970, and included in the Endangered Species Act of 1973 (35 FR 16047). On February 4, 1985 (50 FR 4938), the USFWS removed the brown pelican from the list of endangered and threatened wildlife in Alabama, Florida, Georgia, South Carolina, North Carolina, and points northward along the Atlantic coast. The brown pelican remains endangered throughout the remainder of its range, which includes Louisiana, Mississippi, Texas, California, Mexico, Central and South America, and the West Indies. No critical habitat is designated for the brown pelican within Louisiana. The brown pelican was designated as "Under Review in the Candidate or Petition Process" in the Louisiana population.

8.0 ANTICIPATED EFFECTS OF THE PROPOSED ACTION

8.1 Piping Plover (Charadrius melodus)

Wintering piping plovers arrive from the breeding grounds as early as July and depart for the breeding grounds during late March and early April. By May, most birds have left the wintering grounds (http://www.fws.gov/plover/facts.html). Breeding and wintering plovers feed on exposed wet sand in wash zones; intertidal ocean beach; wrack lines; washover passes; mud-, sand-, and algal flats; and shorelines of streams, ephemeral ponds, lagoons, and salt marshes by probing for invertebrates at or just below the surface. They use beaches adjacent to foraging areas for roosting and preening. Small sand dunes, debris, and sparse vegetation within adjacent beaches provide shelter from wind and extreme temperatures. Availability of quality foraging and roosting habitat in the wintering grounds is necessary in order to ensure that an adequate number of adults survive to migrate back to breeding sites and successfully nest (http://www.fws.gov/plover/facts.html).

The proposed project would restore 1206 acres of dune/beach and 1582 acres of saline marsh; however, restoration of these vital habitats would temporarily adversely impact critical habitat within the Caminada Headland area.

Approximately 485 acres of critical habitat within Unit 5 would be temporarily adversely impacted (356 acres supratidal, 29 acres dune, 100 Gulf intertidal). Unavoidable short-term adverse impacts to piping plover critical habitat would result from the placement of

sediments onto existing beach and dune habitats during construction of the proposed barrier headland restoration measures. Prey species smothered by dune and beach nourishment activities would recolonize in the project area within 6 months to 2 years once construction activities cease. Any impacts that would occur to existing designated critical habitat would be temporary, and would provide for the long-term maintenance and/or enhancement of critical habitat within the project area. Suitable critical habitat (e.g., West Belle Pass, Grand Isle, etc.) exists within the vicinity and is anticipated to be available during and after construction. There would be no permanent impacts to critical habitat that would change the ecological processes that maintain it.

Beneficial impacts to the piping plover and its critical habitat from the proposed action include the restoration of habitat and prolonged life of existing barrier islands, as well as creating new barriers or structures that would function to protect the barrier islands and critical habitat. Much of the existing system is sediment-starved, and the proposed project would introduce sediment into the system that would be re-worked and redistributed through future storm events, thus maintaining and/or enhancing the features of critical habitat that are essential to piping plover conservation.

Potential adverse impacts to piping plovers would be temporary displacement during construction activities to restore the barrier islands. Potential impacts to piping plovers could be avoided by conducting proposed construction activities outside the wintering season; however, construction of the project is likely to occur while plovers are present. Due to their mobility, piping plovers would be able to avoid areas of temporary disturbance, and would have an abundance of suitable foraging and roosting areas available adjacent to the project area throughout project construction.

Therefore it is the Corps' determination that the proposed action may affect, but is not likely to adversely affect the piping plover and its critical habitat. Rather, the proposed action would restore and enhance critical habitat.

8.2 Brown Pelican (*Pelecanus occidentalis)*

Suitable brown pelican feeding and/or nesting habitat occurs along the barrier islands, sand spits, and mud lumps throughout the coastal Louisiana area. Pelican nest sites (i.e., Rabbit Island in Calcasieu Lake, Raccoon Point on Isles Dernieres, Queen Bess Island, Plover Island [Baptiste Collette], Wine Island, and islands in the Chandeleur chain) and the birds themselves may be impacted by barrier island restoration activities or noise disturbance from work activities. Impacts to nesting brown pelicans can be avoided by preventing any work activities from encroaching within 2,000 feet of a nesting area during the nesting season. Although suitable nesting habitat may currently exist within the project areas, there are no known nesting sites for brown pelicans within 2,000 feet of the project areas. Furthermore, the proposed barrier island restoration activities on Caminada Headland and Shell Island are likely to create new nesting habitat and prolong the life of existing suitable nesting habitat. In addition, restoration of barrier habitat and salt marsh would provide nursery and grow-out areas for the aquatic life upon which pelicans feed.

The dune and beach system within the project area have been impacted by storm erosion, resulting in the loss of dune material and intertidal beach area. The proposed project would restore 1206 acres of dune/beach and 1582 acres of saline marsh. Temporary impacts to brown pelicans foraging or roosting in or near the project area may occur during construction activities. These impacts would be limited to those associated with noise or increased human activity in the area. Once construction activities are complete any birds disturbed by the activities are expected to return to the area.

Any noise disturbance to pelicans foraging or loafing within the proposed action area would be temporary and would be minimized by appropriate construction activity windows during the non-breeding season. Changes or impacts in coastal open water habitats providing suitable feeding and/or loafing areas would be temporary, and there is an abundance of suitable habitat available nearby should the birds be temporarily displaced. Changes in hydrology by measures to preserve existing marsh, create additional wetlands, and restore barrier islands would potentially enhance suitable feeding and/or loafing habitat for pelicans by enhancing the stability of those areas and the aquatic life upon which pelicans feed. Therefore, the proposed project is not likely to adversely affect the threatened brown pelican.

8.3 Green Sea Turtle (*Chelonia mydas*).

Due to the lack of extensive seagrass beds throughout much of coastal Louisiana, and the low incidence of sightings and strandings, the proposed action is not expected to adversely impact the green sea turtle population.

8.4 Hawksbill Sea Turtle (*Eretmochelys imbricata*).

The effects of the proposed action to hawksbill populations are likely to be negligible due to its rarity along the Louisiana coast.

8.5 Kemp's Ridley Sea Turtle (*Lepidochelys kempii*).

Potential impacts are not likely to include adverse effects on Kemp's ridley sea turtle populations. The proposed restoration features would provide more suitable inshore habitat (characterized by lower salinity and high turbidity and organic content, where shrimp and blue crabs are abundant) utilized by this species when foraging.

8.6 Leatherback Sea Turtle (*Dermochelys coriacea*).

Any potential project impact would have no effect on populations of the leatherback sea turtle. This pelagic species typically occupies oceanic waters of more than 160 feet (50 m) in depth.

8.7 Loggerhead Sea Turtle (*Caretta caretta*).

The restoration of the Terrebonne and Grand Isle barrier island chains would occur in Subprovinces 2 and 3 with the proposed action. Nesting loggerhead sea turtles have historically used barrier islands; however, it is doubtful that loggerhead sea turtles nest anywhere on the Louisiana coast. The restoration of barrier islands may or may not provide suitable nesting habitat, but suitable nesting habitat is nearly nonexistent due to the current degraded state of those islands. The TSP would not negatively affect loggerheads, and may provide some benefit to the species by restoring nesting habitat.

9.0 References:

Haig, S.M. 1992. Piping Plover(*Charadrius melodus*). In The Birds of North America, No. 2 (A. Poole and F. Gill, eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C:The American Ornithologists' Union.

Hecker, S. 2006. Piping Plover Fact Sheet. National Audubon Society, Audubon Coastal Bird Conservation Program.

Kaufman, Kenn.1996. Lives of North American Birds. Houghton Mifflin Company, New York.

APPENDIX A

APPENDIX B

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

May 11, 2009

Ms. Joan Exnicios
Acting Chief
Environmental Planning and Compliance Branch
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

SUBJECT: Biological Assessment (BA) of the Louisiana Coastal Area (LCA) – Barataria Basin Barrier Shoreline Restoration Feasibility Study for the Caminada Headland and Shell Island Restoration Project, in Jefferson, Lafourche, and Plaquemines Parishes, Louisiana

Dear Ms. Exnicios:

Please reference your May 1, 2009, letter requesting our review of and concurrence with the U.S. Army Corps of Engineers' (Corps) determination that the proposed Caminada Headland and Shell Island Restoration project is not likely to adversely the endangered brown pelican (*Pelecanus occidentalis*) and the threatened piping plover (*Charadrius melodus*), or its designated critical habitat. The proposed project would involve restoring the 13-mile-long Caminada barrier headland between Belle Pass and Caminada Pass in Jefferson and Lafourche Parishes, Louisiana, and remnants of Shell Island between Fontanelle Pass and Grand Bayou Pass in Plaquemines Parish, Louisiana. Those areas together make up a large portion of the Barataria Basin Barrier Shoreline Complex. The U.S. Fish and Wildlife Service (Service) has reviewed the information you provided, and offers the following comments in accordance with provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), and the Migratory Bird Treaty Act (MBTA) (40 Stat. 755, as amended; 16 U.S.C. 703 et seq.).

In Louisiana, barrier island and barrier headland erosion is attributable to increasing tidal prism, insufficient volumes of sediment supplied by littoral currents, land subsidence, and sea-level rise (Boesch 1982). Although increases in the tidal prism may be primarily responsible for enlargement of tidal passes, the insufficient supply of sand available to rebuild eroded areas has also contributed to increased tidal pass widths and shoreline retreat (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1999). Where insufficient supplies of sand prevail, measures to maximize sand

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retention, such as sand fencing and vegetative planting, are needed to effectively rebuild and maintain these eroded areas.

The Caminada barrier headland is the principal feature of the Bayou Lafourche barrier system; it includes flanking islands and the retreating headland of Bayou Lafourche along the southwestern portion of the Barataria Basin. The headland maintains the integrity of the Gulf shoreline and helps to protect interior coastal wetlands from further deterioration. It also protects Port Fourchon, which furnishes between 15 and 18 percent of the United States' entire oil supply and services over 90 percent of the Gulf of Mexico's deepwater oil production (http://www.portfourchon.com/explore.cfm/aboutus/portfacts). The Caminada Headland consists of narrow and low-lying sand dunes and beach berm, barrier marshes, chenier ridges interspersed with mangrove thickets, coastal dune shrub thickets, lagoons, and small bayous. According to the BA, the average dune elevation is estimated to be 3.4 feet North American Vertical Datum of 1988 (NAVD) and the back-barrier marsh is approximately 0.94 feet NAVD. The headland has historically suffered loss of habitat value and diminished function due to storm overtopping and breaching, saltwater intrusion, wind and wave induced erosion, sea level rise, subsidence, and man-made structures. The observed average shoreline erosion rate at the Caminada Headland is approximately 45 feet per year, and increased stress on the fish and wildlife in the area is expected as habitats continue to be lost.

According to the BA, the Corps proposes to construct 880 acres of dune/beach complex and 1,186 acres of saline marsh along the Caminada Headland using offshore sand from the South Pelto Block of Ship Shoal. The dune would be constructed to an elevation of 7 feet NAVD with a crest width of 290 feet. The majority of the dune component is sited landward over existing higher elevations to maximize the acreage and increase the longevity of the project. Native dune plant species would be planted along the constructed dune, and sand fences would also be installed to capture Aeolian sand. Sand fences would be installed in phases to optimize growth of the dune toward the Gulf. The proposed beach design is a 65-foot-wide seaward berm at an elevation of 4.5 feet NAVD. Landward and seaward slopes of both the dune and beach would be 20 feet horizontal to 1 foot vertical. The Corps proposes to place advanced fill quantities to account for some initial loss of material due to shoreline equilibrium (roughly the first 6 to 9 months post-construction), as well as to prevent the need for future renourishment activities. The proposed marsh design is a marsh platform at an elevation of 2 feet NAVD to be constructed on the landward side of the dune for the length of the project. A mixture of native plant species would also be planted on the marsh platform. The Corps anticipates that construction activities would require approximately 30 months, pending local weather conditions.

The Shell Island reach is within the Plaquemines barrier system along the southeastern portion of the Barataria Basin. Prior to Hurricane Bob in 1979, Shell Island was a continuous barrier island that helped to protect the interior coastal wetlands of the Barataria Basin. According to the BA, the Empire Jetties built in 1950 along Fontanelle Pass increased shoreline recession approximately 10 feet per year along the easternmost 5,000 to 8,000 feet of Shell Island. Currently, the Shell Island reach includes two remnant barrier islands, shoals, and spits which now only partially enclose shallow bays (e.g., Shell Island Bay and Bastian Bay) along the southern portion of the Barataria Basin. Shoreline recession rates in this area are approximately 34.9 feet per year. The eastern portion of Shell Island extends for approximately 2.54 miles

between Coupe Bob and Fontanelle Pass. The western portion of Shell Island extends for approximately 1.41 miles between Grand Bayou Pass and Coupe Bob. Those remnants of the original Shell Island are expected to continue losing habitat value and function at the current erosion rate without the proposed project.

According to the BA, the Corps proposes to construct two islands for a total of 126 acres of dune, 297 acres of supratidal, and 47 acres of intertidal areas along the Shell Island reach using high quality sand from the Mississippi River for the dune/beach portion and mixed sediment deposits from the Empire borrow area for the marsh portion of the project. The design for Shell Island East consists of 15,400 linear feet of dune constructed to an elevation of 6 feet NAVD with a crest width of 281, and a marsh platform starting at 525 feet in width and widening to 1,200 feet along the northernmost portion of the remnant island. The design for Shell Island West consists of 4,500 linear feet of dune constructed to an elevation of 6 feet NAVD with a crest width of 250 feet, and a marsh platform with a maximum width of 2,300 feet. For both islands, dune slopes would be 45 feet horizontal:1 foot vertical, and marsh platforms would be constructed to an elevation of 1.2 feet NAVD. Sand fences would be installed on the two Shell Islands as described above for the Caminada Headland portion of the project, and the appropriate mixture of native plant species would be planted on both the dunes and the marsh platforms of the islands.

Brown pelicans are currently known to nest on Raccoon Point on Isles Dernieres, as well as Queen Bess Island, Plover Island (Baptiste Collette), Wine Island, Rabbit Island in Calcasieu Lake, and islands in the Chandeleur chain. Pelicans change nesting sites as habitat changes occur; thus, they may also be found nesting on mud lumps at the mouth of South Pass (Mississippi River Delta) and on small islands in St. Bernard Parish. In spring and summer, nests are built in mangrove trees or other shrubby vegetation, although ground nesting may also occur. Brown pelicans feed along the Louisiana coast in shallow estuarine waters, using sand spits and offshore sand bars as rest and roost areas. Major threats to this species include chemical pollutants, colony site erosion, disease, and human disturbance.

Based on our records, there are no known nesting colonies of brown pelicans located within 2,000 feet of the proposed project areas. Brown pelicans do, however, forage and loaf within the project areas throughout the year and are generally accustomed to boat traffic along the Louisiana Gulf coast related to oil and gas activities as well as recreational and commercial fishing. Because pelicans are highly mobile, they could easily relocate to nearby suitable foraging and loafing habitat during project construction. The proposed activities would neither permanently exclude birds from utilizing the project areas nor introduce new forms of disturbance. Project effects on brown pelicans would result in temporary displacement to nearby suitable areas. Based on that information, the Service concurs with the Corps' determination that the proposed project is not likely to adversely affect the brown pelican.

Piping plovers winter in Louisiana, and may be present for 8 to 10 months; they arrive from the breeding grounds as early as late July and remain until late March or April. Piping plovers feed extensively on intertidal beaches, mudflats, sand flats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting. Roosting areas may have debris, detritus, or micro-topographic relief offering refuge to

plovers from high winds and cold weather. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape, because the suitability of a particular site for foraging or roosting is dependant on local weather and tidal conditions. Plovers move among sites as environmental conditions change, and studies have indicated that they generally remain within a 2-mile area. Major threats to this species include the loss and degradation of habitat due to development, disturbance by humans and pets, and predation.

Our records indicate that piping plovers regularly use the beach habitat along the Caminada Headland, especially the sand spit along the eastern end of the headland, but we have no observation records of piping plovers using the remnant islands of the Shell Island reach. According to the BA, the proposed activities for the Caminada Headland would likely occur while piping plovers are present. Potential project effects to the piping plover would consist of temporary displacement to nearby suitable habitats and temporary loss of benthic prey species within the project area. There is an abundance of nearby suitable habitat into which plovers can disperse, including Belle Pass West, the easternmost sand spit of Elmer's Island (which is not included in the current project footprint), Grand Isle, and East Grand Terre Island. The benthic prey species smothered by the additional sediment in the project area would naturally re-colonize the area within 6 months to 2 years post-construction. Because such effects are temporary, discountable, and insignificant in nature, and because plovers would not be permanently excluded from using the area, the Service also concurs with the Corps' determination that the proposed action is not likely to adversely affect the piping plover.

On July 10, 2001, the Service designated critical habitat for wintering piping plovers (Federal Register Volume 66, No. 132). Designated critical habitat for the piping plover identifies specific areas that are essential to the conservation of the species. At the time of designation approximately 24,964 acres of wintering habitat were designated in Louisiana, and Unit LA-5 consisted of approximately 5,735 acres of that total. Approximately 10.25 miles of the Caminada Headland-portion of the proposed project is also located within Unit LA-5 of piping plover critical habitat. The Shell Island reach is not located within designated critical habitat; therefore, that portion of the proposed action would not affect it.

The primary constituent elements (PCEs) for piping plover wintering habitat are those habitat components that support foraging, roosting, and sheltering, and the physical features necessary for maintaining the natural processes that support those habitat components. Designated piping plover critical habitat along the Caminada Headland specifically includes ". . . the Gulf shoreline extending approximately 6.8 miles east from the east side of Belle Pass bounded on the seaward side by MLLW [mean low low water] and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the primary constituent elements no longer occur; all of Elmer's Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmer's Island to approximately 0.56-mile west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the primary constituent elements no longer occur. . ." (Federal Register, Volume 66, No. 132, Page 36127).

According to the BA, approximately 485 acres (29 acres dune, 356 acres supratidal, and 100 acres Gulf intertidal) of critical habitat within Unit LA-5 would be temporarily affected by the

proposed action. Based on conversations with the Service's coastal restoration biologist working directly with the Corps on this project, the dune, supratidal, and intertidal habitat designations are defined as: (1) dune includes any elevations within the project footprint at or above 5 feet NAVD; (2) supratidal includes any elevations within the project footprint at or between 2 and 4.9 feet NAVD; and (3) Gulf intertidal includes any elevations within the project footprint between zero and 2 feet NAVD. Based on the Service's scrutiny of 2005 and 2007 digital orthophoto quarter quadrangle (DOQQ) imagery, light detection and ranging (LIDAR) imagery, and a January 2009 site visit, we have determined that the above described habitat designations are more specifically described as follows:

1. The existing dune habitat within the project footprint consists of clumps of remnant dune generally dispersed throughout the high marsh/high beach interface. Those 29 acres of dune should not be considered as suitable piping plover habitat because those areas are densely vegetated and do not exhibit features of suitable piping plover habitat as described above.

2. The supratidal habitat classification includes both the high marsh on the landward side and the high beach along the Gulf side of the remnant dune within the project footprint. The high marsh consists of densely vegetated areas that are not suitable for the piping plover, and are specifically excluded from designated critical habitat as described above. The high beach consists of bare or sparsely vegetated sand flats above the high tide mark. We believe that no more than half (i.e., 178 acres) of the supratidal habitat classification acreage actually consists of high beach that is suitable roosting habitat for the piping plover.

3. The 100 acres of Gulf intertidal habitat does consist of suitable foraging habitat for the piping plover. That acreage is inclusive of tidal fluctuations throughout the year.

Based on the above information, approximately 278 acres (178 acres high beach and 100 acres Gulf intertidal) of designated critical habitat would be affected by the Caminada Headland-portion of the proposed project. That acreage is approximately 1.1 percent and 4.8 percent of the total acreage of wintering habitat in Louisiana and Unit LA-5, respectively. Temporary project effects to designated critical habitat would include construction activities (e.g., bulldozers, marsh buggies, discharge pipeline, etc.) within roosting and foraging habitat and smothering of the benthic community within foraging habitat. Pending the construction contract(s) awarded for the project, the most likely construction method would be to start at one end and continue moving along the shoreline in a linear fashion; construction duration would be approximately 2.5 years, pending local weather conditions. The benthic community is expected to recover within 6 months to 2 years post-construction; therefore, it is conceivable that the benthic community would begin re-colonizing the initial construction area before construction is completed at the opposite end. In addition, nearby critical habitat (i.e., Belle Pass West, easternmost sand spit of Elmer's Island, Grand Isle, East Grand Terre Island) would be available for piping plovers during construction and until the benthic community recovers.

The addition of sediment to the system is considered a long-term effect to the project area; however, it would be a beneficial effect to critical habitat by increasing the acreage and longevity

of roosting and foraging habitat. The Corps anticipates that the additional sediment would continually be re-worked and transported throughout the sediment-starved system for the 50-year project life and would, therefore, help to support and sustain the natural ecological processes that maintain piping plover critical habitat. Without the additional sediment, critical habitat within the project area would continue to be lost to erosional forces until only a vegetated shoreline, which is not suitable for the piping plover, would remain. The Corps also proposes to place advance fill quantities to prevent the need for renourishment during the project life, which would reduce future potential temporary effects due to renourishment actions as well as provide for additional sediment that could be re-worked and transported during storm and overwash events in the near-term to create additional sand flats for piping plover use. Because the effects to critical habitat would be temporary, discountable, and insignificant in nature, and because the proposed project would ultimately benefit critical habitat by increasing, restoring, and prolonging the existence of suitable habitat for piping plovers, the Service also concurs with the Corps' determination that the proposed project is not likely to adversely affect piping plover critical habitat within Unit LA-5.

No further ESA consultation with the Service for the brown pelican, the piping plover, or its designated critical habitat will be necessary for the proposed action, unless there are changes in the scope or location of the proposed project or the project has not been initiated within 1 year of this letter. Due to the length of the Corps' project development, implementation, and construction processes, and because our species information is updated annually, the Corps should re-initiate consultation with this office on an annual basis until construction begins, or at any time if there are changes in the scope or location of the proposed action that would produce project effects not considered in the subject BA or this letter.

Based on our records, colonial nesting shorebirds historically nested on the remnant islands within the Shell Island reach. To minimize disturbance to colonial nesting birds, all activity occurring within 650 feet of a rookery containing nesting gulls, terns, and/or black skimmers should be restricted to the non-nesting period (i.e., September 16 through April 1, depending on species present). Please be aware that the Shell Island project area should be surveyed for nesting shorebirds prior to construction to avoid disturbance to those species. In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

We appreciate the Corps' continued excellent coordination and cooperation in the conservation of threatened and endangered species, their critical habitats, and colonial nesting shorebirds. If you require further assistance regarding ESA coordination, or have questions regarding the content of this letter, please contact Ms. Brigette Firmin (337/291-3108) of this office.

Sincerely,

Brad S. Rieck
Deputy Supervisor
Louisiana Field Office

cc: FWS, Panama City, FL (Attn: Patty Kelly)
NMFS, St. Petersburg, FL
LDWF, Natural Heritage Program, Baton Rouge, LA (Attn: Michael Seymour)

Literature Cited

Boesch, D. F., ed. 1982. Proceedings of the conference on coastal erosion and wetland modification in Louisiana: causes, consequences, and options. U.S. Fish and Wildlife Service, Biological Services Program, Washington, D.C. FWS/OBS-82/59. 256 pp.

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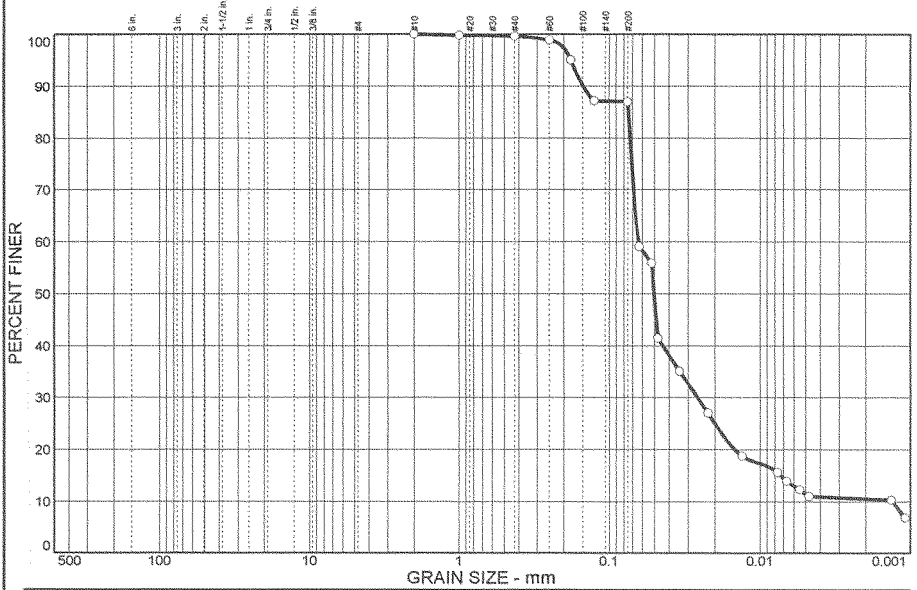
APPENDIX B

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.4	12.6	75.5	11.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#18	99.8		
#40	99.6		
#60	98.9		
#80	95.1		
#120	87.1		
#200	87.0		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0743 D_{60}= 0.0639 D_{50}= 0.0503
D_{30}= 0.0260 D_{15}= 0.0073 D_{10}= 0.0013
C_u= 48.32 C_c= 7.99

Classification

USCS= ML AASHTO=

Remarks

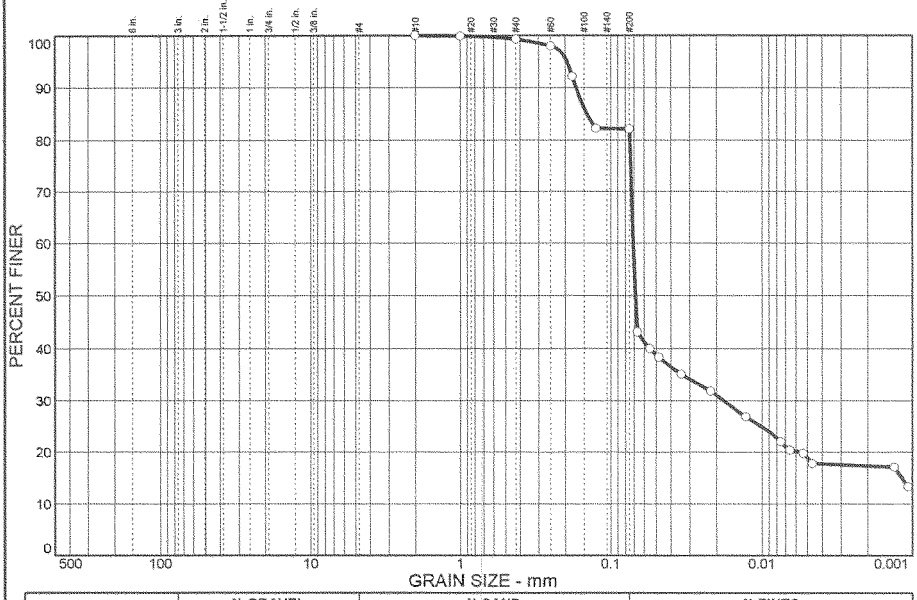
Yi, Hon-Kyu

Sample No.: 1 **Source of Sample:** **Date:** 15 Nov 2006
Location: Port Fourchon Navigation Channel, CUTTERHEAD DREDGE, Lafourche Parish **Elev./Depth:**

US Army Corps of Engineers
New Orleans District

Client: U.S. Army Corps of Engineers, New Orleans District.
Project: Port Fourchon Navigation Channel, CUTTERHEAD DREDGE, Lafourche Parish, LOUISIANA.
Project No: W912P8-06-C-0125 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.7	17.2	63.3	18.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#18	99.9		
#40	99.3		
#60	98.0		
#80	92.2		
#120	82.2		
#200	82.1		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.143 D_{60}= 0.0708 D_{50}= 0.0686
D_{30}= 0.0179 D_{15}= 0.0012 D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

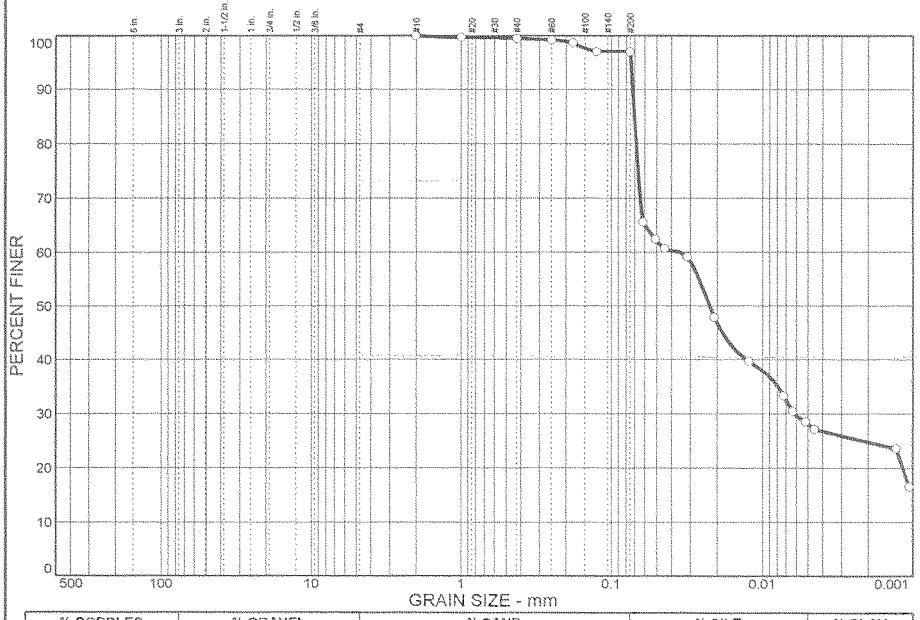
Yi, Hon-Kyu

Sample No.: 2 **Source of Sample:** **Date:** 15 Nov 2006
Location: WEST TOE STATION, Port Fourchon Navigation Channel. **Elev./Depth:**

US Army Corps of Engineers
New Orleans District

Client: U.S. Army Corps of Engineers, New Orleans District.
Project: Port Fourchon Navigation Channel, CUTTERHEAD DREDGE, Lafourche Parish, LOUISIANA.
Project No: W912P8-06-C-0125 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	2.9	69.0	28.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#18	99.7		
#40	99.5		
#60	99.2		
#80	98.7		
#120	97.1		
#200	97.1		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0705 D_{60}= 0.0353 D_{50}= 0.0223
D_{30}= 0.0062 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

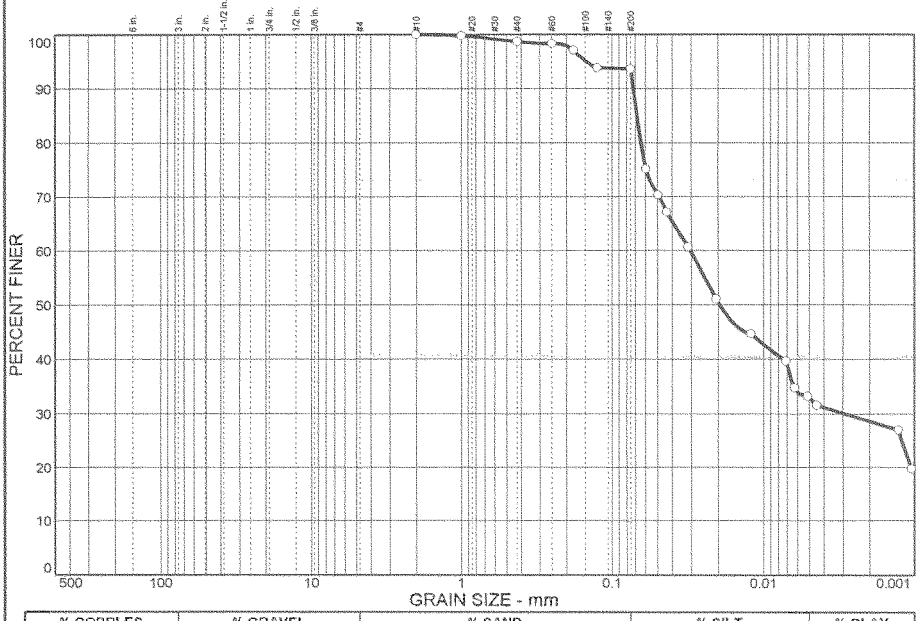
Yi, Hon-Kyu

Sample No.: BD-3 **Source of Sample:** **Date:** 17 Nov 2006
Location: WEST TOE STATION, Port Fourchon Navigation Channel, 280+00(EAST TOE) **Elev./Depth:**

US Army Corps of Engineers
New Orleans District

Client: U.S. Army Corps of Engineers, New Orleans District.
Project: Port Fourchon Navigation Channel, CUTTERHEAD DREDGE, Lafourche Parish, LOUISIANA.
Project No: W912P8-06-C-0125 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	6.4	60.6	33.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#18	99.8		
#40	98.7		
#60	98.3		
#80	97.1		
#120	93.8		
#200	93.6		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0683 D_{60}= 0.0304 D_{50}= 0.0194
D_{30}= 0.0029 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Yi, Hon-Kyu

Sample No.: BD-4 **Source of Sample:** **Date:** 17 Nov 2006
Location: WEST TOE STATION, Port Fourchon Navigation Channel, 310+00(WEST TOE) **Elev./Depth:**

US Army Corps of Engineers
New Orleans District

Client: U.S. Army Corps of Engineers, New Orleans District.
Project: Port Fourchon Navigation Channel, CUTTERHEAD DREDGE, Lafourche Parish, LOUISIANA.
Project No: W912P8-06-C-0125 **Plate**

APPENDIX C

Direct Boundary FWOP	TY0	TY1	TY2	TY3	TY5	TY7	TY9	TY10	TY11	TY13	TY15	TY17	TY19
OPEN WATER	413	414	416	419	410	397	378	366	349	263	157	79	31
MARSH	876	868	844	821	763	701	637	580	507	329	219	137	67
SUPRATIDAL	356	316	281	247	195	155	125	113	102	82	63	42	16
DUNE	29	25	21	17	11	6	2	0	0	0	0	0	0
GULF INTERTIDAL	100	78	65	53	35	23	17	15	14	12	10	8	4
GULF SUBTIDAL	512	587	660	730	873	1005	1128	1214	1315	1601	1838	2021	2169
TOTAL	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286

Indirect Boundary FWOP	TY0	TY1	TY2	TY3	TY5	TY7	TY9	TY10	TY11	TY13	TY15	TY17	TY19
MARSH	1061	1051	1039	1027	1001	975	952	945	938	928	910	880	835
DUNE	32	28	24	20	14	9	5	0	0	0	0	0	0
SUPRATIDAL	37	35	33	32	31	30	29	28	26	21	16	8	5
GULF INTERTIDAL	0	0	0	2	5	6	7	8	10	14	17	19	21
Open water	536	551	570	585	615	646	673	684	692	703	723	759	805

Total (Dir & Ind) FWOP	TY0	TY1	TY2	TY3	TY5	TY7	TY9	TY10	TY11	TY13	TY15	TY17	TY19
MARSH	1937	1920	1883	1848	1764	1676	1589	1526	1445	1257	1129	1017	902
DUNE	61	53	45	37	25	15	7	0	0	0	0	0	0
SUPRATIDAL	393	351	314	279	226	185	154	141	128	103	79	50	21
GULF INTERTIDAL	100	78	65	55	40	29	24	23	24	26	27	27	25
Marsh + Gulf Inter	977	946	909	876	803	730	661	603	531	355	246	164	92
Open Water	413	414	416	419	410	397	378	366	349	263	157	79	31

NOTES
1. Open Water and Gulf Subtidal Habitat Zones were not computed for the Indirect Boundary.

TY20
22
43
0
0
0
2222
2286

TY20
805
0
3
22
835

TY20
849
0
3
22
65
22

TY21	TY23	TY25	TY27	TY29	TY30	TY31	TY33	TY35	TY37	TY39	TY40	TY41	TY43	TY45	TY47	TY49
20	19	18	17	16	16	15	14	13	12	11	11	10	9	8	7	6
39	36	34	33	32	31	30	29	28	26	25	24	24	23	23	22	22
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2228	2232	2235	2237	2239	2240	2242	2244	2246	2249	2251	2252	2253	2255	2256	2258	2259
2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286

TY21	TY23	TY25	TY27	TY29	TY30	TY31	TY33	TY35	TY37	TY39	TY40	TY41	TY43	TY45	TY47	TY49
772	690	589	474	352	289	229	123	51	37	34	32	30	24	18	14	13
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3	3	3	3	3	2	0	0	0	0	0	0	0	0	0	0
20	18	17	16	13	10	4	0	0	0	0	0	0	0	0	0	0
871	955	1057	1173	1298	1364	1431	1543	1615	1629	1632	1634	1636	1642	1648	1652	1653

TY21	TY23	TY25	TY27	TY29	TY30	TY31	TY33	TY35	TY37	TY39	TY40	TY41	TY43	TY45	TY47	TY49
811	726	623	507	384	320	259	152	79	63	59	56	54	47	41	36	35
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3	3	3	3	3	2	0	0	0	0	0	0	0	0	0	0
20	18	17	16	13	10	4	0	0	0	0	0	0	0	0	0	0
59	54	51	49	45	41	34	29	28	26	25	24	24	23	23	22	22
20	19	18	17	16	16	15	14	13	12	11	11	10	9	8	7	6

TY50
5
22
0
0
0
2260
2286

TY50
12
0
0
0
1654

TY50
34
0
0
0
22
5

Direct Boundary FWP With Feeder Beach	TY0	TY1	TY2	TY3	TY5	TY7	TY9	TY10	TY11	TY13	TY15	TY17	TY19	TY20
OPEN WATER	413	0	0	0	0	0	0	0	0	0	0	0	0	0
MARSH	876	1186	1186	1186	1071	1022	957	924	900	827	754	653	551	517
SUPRATIDAL	356	266	179	135	187	184	180	175	206	277	315	289	252	235
DUNE	29	554	554	541	496	449	381	350	329	276	230	208	181	150
GULF INTERTIDAL	100	58	58	80	96	118	139	140	160	160	159	159	160	158
GULF SUBTIDAL	512	223	309	344	435	513	628	697	691	745	828	977	1142	1225
TOTAL	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286

Indirect Boundary FWP With Feeder Beach	TY0	TY1	TY2	TY3	TY5	TY7	TY9	TY10	TY11	TY13	TY15	TY17	TY19	TY20
MARSH	1061	1051	1082	1149	1244	1284	1281	1224	1200	1208	1208	1206	1196	1121
DUNE	32	28	29	31	38	51	73	81	87	90	86	70	48	38
SUPRATIDAL	37	35	44	54	73	81	90	94	115	175	209	243	271	268
GULF INTERTIDAL	0	0	0	0	0	0	43	105	149	159	144	148	149	149
Open water	536	552	511	432	311	250	179	162	115	35	19	0	2	90

Total (Dir & Ind) FWP With Feeder Beach	TY0	TY1	TY2	TY3	TY5	TY7	TY9	TY10	TY11	TY13	TY15	TY17	TY19	TY20
MARSH	1937	2237	2268	2335	2315	2306	2239	2148	2100	2035	1962	1859	1747	1638
DUNE	61	582	583	572	534	500	454	431	416	366	316	278	229	188
SUPRATIDAL	393	301	224	189	260	265	270	270	321	452	524	532	524	503
GULF INTERTIDAL	100	58	58	80	96	118	182	244	309	318	303	307	308	307
Marsh + Gulf Inter	977	1244	1244	1266	1167	1140	1140	1168	1209	1145	1057	959	859	824
Open Water	413	0	0	0	0	0	0	0	0	0	0	0	0	0

Target Years	0	1	2	3	5	7	8	10	11	13	15	17	19	20

NOTES

1. Open Water and Gulf Subtidal Habitat Zones were not computed for the Indirect Boundary.

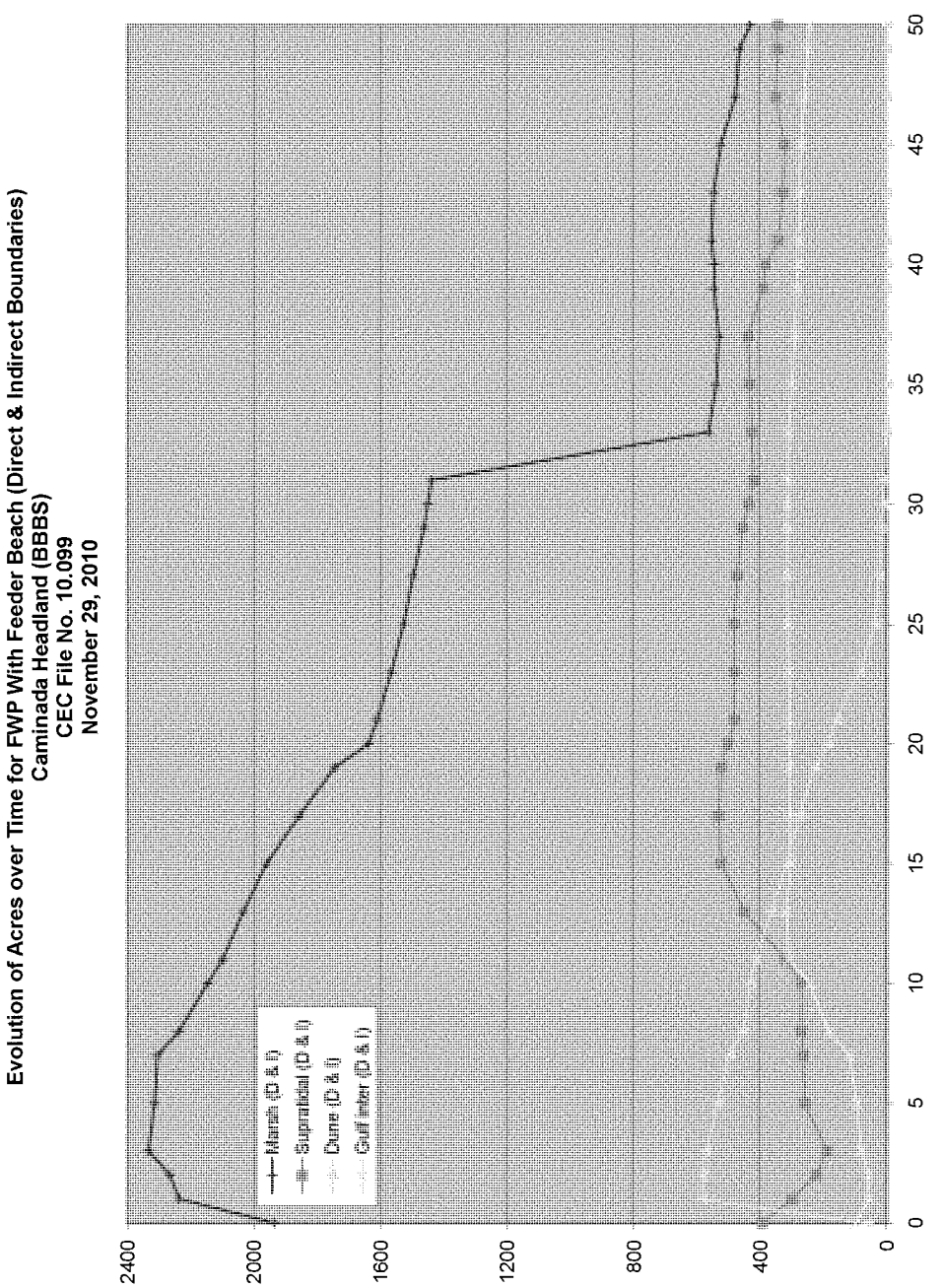
TY21	TY23	TY25	TY27	TY29	TY30	TY31	TY33	TY35	TY37	TY39	TY40	TY41	TY43	TY45	TY47	TY49	TY50
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
501	472	450	437	417	413	409	399	379	362	337	331	325	304	271	244	219	201
216	193	169	146	120	112	102	88	74	66	47	40	31	17	11	6	1	0
132	75	34	22	17	12	8	2	0	0	0	0	0	0	0	0	0	0
139	141	143	144	144	145	126	126	126	126	123	121	100	96	92	83	72	66
1296	1404	1490	1536	1587	1603	1641	1670	1707	1732	1779	1794	1830	1869	1912	1953	1994	2019
2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286	2286

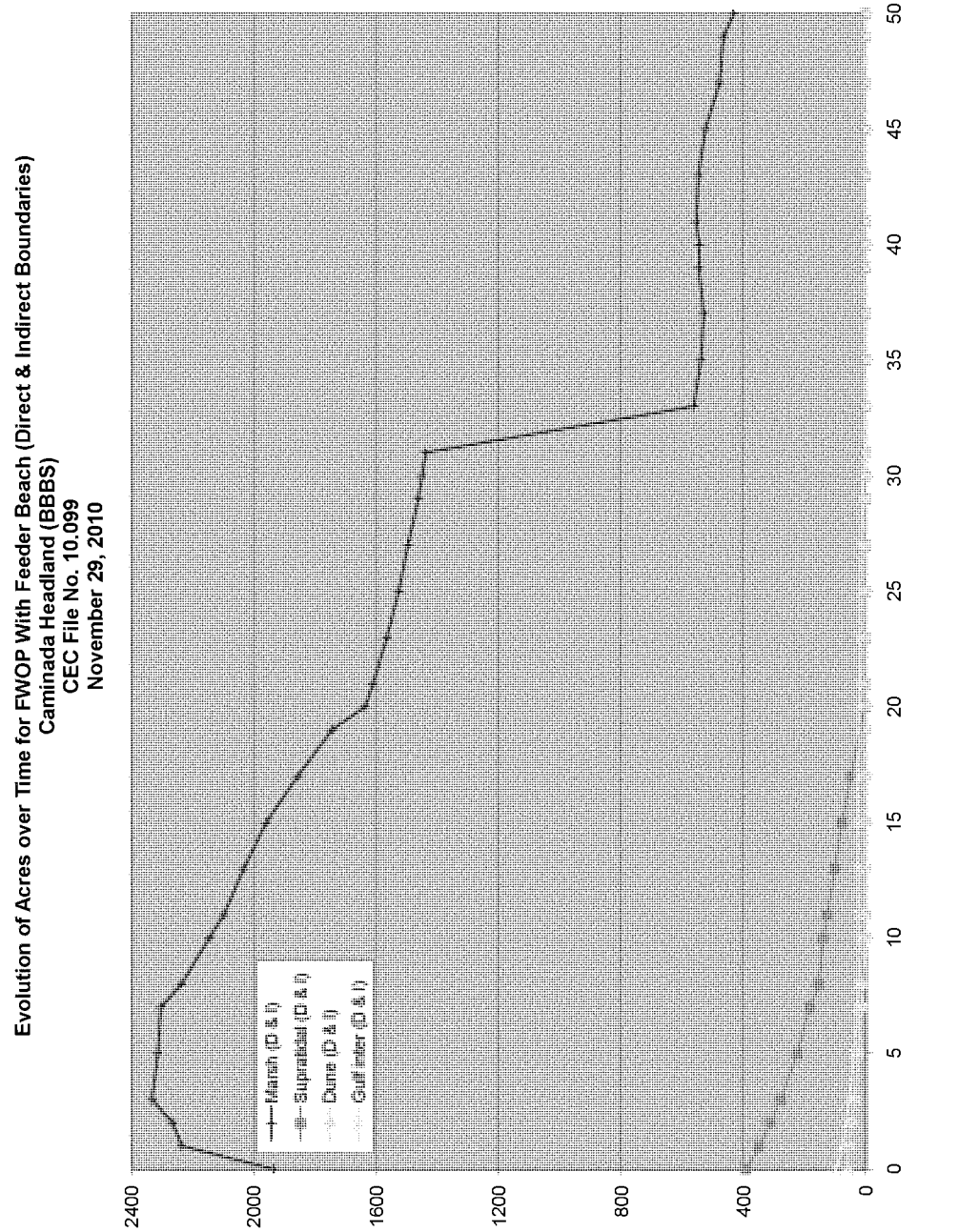
TY21	TY23	TY25	TY27	TY29	TY30	TY31	TY33	TY35	TY37	TY39	TY40	TY41	TY43	TY45	TY47	TY49	TY50
1111	1095	1078	1062	1047	1038	1032	165	162	170	211	216	231	245	256	236	248	232
27	11	3	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0
265	289	313	328	337	326	319	340	360	373	346	345	314	314	314	345	345	345
168	169	169	169	168	168	187	184	175	166	162	160	179	179	179	179	179	179
95	102	103	105	112	133	128	978	969	958	948	946	942	928	917	906	894	910

TY21	TY23	TY25	TY27	TY29	TY30	TY31	TY33	TY35	TY37	TY39	TY40	TY41	TY43	TY45	TY47	TY49	TY50
1612	1567	1528	1499	1464	1452	1441	564	541	532	548	547	556	549	527	480	467	433
159	86	36	25	18	13	9	2	0	0	0	0	0	0	0	0	0	0
482	483	483	474	458	437	421	427	434	439	393	385	345	330	325	351	346	345
307	310	312	313	312	313	313	310	301	291	284	281	279	275	271	262	251	245
809	783	762	750	730	727	721	709	680	653	621	612	603	579	541	506	470	446
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

21 23 25 27 29 30 31 33 35 37 39 40 41 43 45 47 49 50

TOTAL TY50 1023


Evolution of Acres over Time for FWP With Feeder Beach (Direct & Indirect Boundaries)
Caminada Headland (BBBS)
CEC File No. 10.099
November 29, 2010
Marsh (D & I)
Supratidal (D & I)
Dune (D & I)
Gulf Inter (D & I)
2400
2000
1600
1200
800
400
0
0
5
10
15
20
25
30
35
40
45
50


Evolution of Acres over Time for FWOP With Feeder Beach (Direct & Indirect Boundaries)
Caminada Headland (BBBS)
CEC File No. 10.099
November 29, 2010
Marsh (D & I)
Supratidal (D & I)
Dune (D & I)
Gulf inter (D & I)
2400
2000
1600
1200
800
400
0
0
5
10
15
20
25
30
35
40
45
50

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF

December 15, 2010

Regional Planning and
Environmental Division South
New Orleans Environmental Branch

James F. Boggs
US Fish and Wildlife Service
646 Cajundome Blvd., Suite 400
Lafayette, LA 70506
Fax: (337) 291-3139

Dear Mr. Boggs:

This letter references our letter dated November 16, 2010 regarding the LCA Point Au Fer Island (PAFI) project. In that letter we requested the initiation of formal consultation for impacts to the threatened and endangered species from the proposed action. We wish to change our request for "formal consultation" to "early consultation" so that a draft Biological Opinion can be incorporated into our draft integrated report when it is sent out for public review on April 15, 2011.

Please review the biological assessment, which was attached to the November 16, 2010 letter, addressing piping plover, West Indian manatee, five species of sea turtle (Kemp's Ridley, green, hawksbill, loggerhead, and the leatherback) and provide us with your biological opinion. If any questions regarding this change or if any issues arise, please contact Mr. Thomas Parker of my staff at (504) 862-2526 or by email at thomas.w.parker@usace.army.mil.

Sincerely,

Joan M. Exnicios

Joan M. Exnicios
Chief, New Orleans Environmental Branch

Enclosure

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

January 6, 2011

Ms. Joan M. Exnicios, Chief
Environmental Branch
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Ms. Exnicios:

This letter acknowledges that the U.S. Fish and Wildlife Service (Service) received your December 6, 2010, letter and revised supplemental biological assessment (SBA) on December 10, 2010. Your letter requests to discontinue formal consultation and to initiate early consultation under section 7 of the Endangered Species Act (Act) of 1973, as amended (16 United States Code [U.S.C.] 1531 *et seq.*). The consultation regards the possible effects of the U.S. Army Corps of Engineers' (Corps) proposed Louisiana Coastal Area (LCA) – Barataria Basin Barrier Shoreline Restoration (BBBS) project in Lafourche and Plaquemines Parishes, Louisiana, on the endangered West Indian manatee (*Trichechus manatus*), the threatened piping plover (*Charadrius melodus*) and its designated critical habitat, and five listed species of sea turtles.

All information required of the Corps to initiate consultation was included in the SBA attached to your letter. We have assigned log number 43440-2010-R-2889 to this consultation. Please refer to that number in future correspondence on this consultation. Section 7 allows the Service up to 90 calendar days to conclude early consultation with your agency and an additional 45 calendar days to prepare our preliminary biological opinion. Therefore, we expect to provide you with our preliminary biological opinion no later than April 24, 2011. However, we recognize that the legislative mandated study schedule was developed to respond to the significant and ongoing rapid loss of coastal habitats; therefore, we remain committed to working closely with the Corps and we will strive to meet those deadlines (e.g., March 26, 2011). Prior to issuance of a final Environmental Impact Statement, the Corps should request confirmation of the preliminary biological opinion. The Service then has 45 days to provide a written response to the Corps to finalize the biological opinion.

As a reminder, the Act requires that after initiation of early consultation, the Federal action agency may not make any irreversible or irretrievable commitment of resources that limits future options. This practice ensures agency actions do not preclude the formulation or implementation of reasonable and prudent alternatives that avoid jeopardizing the continued existence of endangered or threatened species or destroying or modifying their critical habitats.

TAKE PRIDE IN AMERICA

If you have any questions or concerns about this consultation or the early consultation process in general, please contact Ms. Brigette Firmin (337/291-3108) of this office.

Sincerely,

James F. Boggs
Supervisor
Louisiana Field Office

cc: LDWF, Natural Heritage Program, Baton Rouge, LA (Attn: Michael Seymour)

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF

February 2, 2011

Regional Planning and
Environmental Division South
New Orleans Environmental Branch

David Bernhart
NMFS – Protected Species Division
263 13th Avenue South
St. Petersburg, FL 33701

Dear Mr. Bernhart:

The US Army Corps of Engineers, New Orleans District (CEMVN) is requesting the initiation of informal consultation under Section 7 of the Endangered Species Act for the proposed LCA Barataria Basin Barrier Shoreline Restoration (BBBS) project. We are providing a Biological Assessment (BA, enclosure 1) which evaluated the potential for impacts to the West Indian manatee, piping plover, and five species of sea turtle (Kemp's Ridley, green, hawksbill, loggerhead, and the leatherback) from the proposed action. It was CEMVN's determination that the proposed action is "not likely to adversely affect" any of the protected species under your purview. CEMVN requests concurrence from the NMFS regarding our determination for the proposed action.

The proposed source of borrow sand for all action alternatives at Caminada Headland is Ship Shoal, a sand body in the Gulf of Mexico located approximately 40 miles southwest of Belle Pass. Ship Shoal is approximately 31 miles long and 7 miles wide, lying in a water depth of 9 feet to 30 feet. It is the remaining seaward shoal from one of the older abandoned Mississippi River deltas. Ship Shoal is composed of well-graded quartz sand and is ideal for use in restoring the Caminada Headland since its grain size is slightly larger than the sand found at the headland. Coarser grain sand is more resistant to erosion. Ship Shoal is the nearest, accessible sand source that contains material of a similar or coarser grain size to the sand found on the Caminada Headland (Enclosure 1).

The proposed sources of borrow sand for the Shell Island shoreline/dune fill is the Mississippi River. The two primary potential sources considered are located at Nairn and Empire. The Nairn deposit is located 2 miles to 4 miles upriver from Empire between Mile Marker (MM) 32 and MM 34, and about 11 miles from the center of Shell Island. The deposit is located in a river meander where greater sediment thickness may be anticipated due to the presence of relict (vertically stacked) sand bars. The deposit at Empire is located between MM 25 and MM 30. The Nairn deposit has been tentatively selected for this project. The borrow site for the marsh restoration is located offshore, near the southern end of the Empire Waterway (Enclosure 1).

The proposed action also includes a renourishment component along the Caminada Headland which would include the beneficial placement of dredged material from operations and maintenance dredging of the bar channel of Bayou Lafourche, Louisiana (Belle Pass) in a beach nourishment disposal area. Dredging of the pass yields between 400,000 and 750,000 cubic yards (cys) of which approximately 500,000 cubic yards of material will be used for nourishment every 1.5 to 2 years. Historically this material has been placed east and west of the jetties at beach nourishment disposal sites.

The TSP would not adversely affect green, hawksbill, Kemp's ridley, leatherback, or loggerhead sea turtle populations. Most of these species are either rare along the Louisiana Gulf coast or feed in nearby waters. Please review the enclosed biological assessment and provide us with your concurrence. If any questions or issues arise, please contact Mr. Thomas Parker of my staff at (504) 862-2526 or by email at Thomas.w.parker@usace.army.mil.

Sincerely,

Joan M Exnicios

Joan M. Exnicios
Chief, New Orleans Environmental Branch

Enclosures

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF

February 2, 2011

Regional Planning and
Environmental Division South
New Orleans Environmental Branch

David Bernhart
NMFS – Protected Species Division
263 13th Avenue South
St. Petersburg, FL 33701

Dear Mr. Bernhart:

The US Army Corps of Engineers, New Orleans District (CEMVN) is requesting the initiation of informal consultation under Section 7 of the Endangered Species Act for the proposed LCA Caillou Lake Land Bridge (CLLB) project. We are providing a Biological Assessment (BA, enclosure 1) which evaluated the potential for impacts to the West Indian manatee and five species of sea turtle (Kemp's Ridley, green, hawksbill, loggerhead, and the leatherback) from the proposed action. It was CEMVN's determination that the proposed action is "not likely to adversely affect" any of the protected species that occur in the project area. CEMVN requests concurrence from the NMFS regarding our determination for the proposed action.

The TSP would create and nourish wetlands and provide shoreline protection along the Gulf of Mexico/Caillou Lake land bridge thereby preserving its integrity. The TSP would also contribute to the overall goals of hurricane protection and wetlands restoration in southeast Louisiana, and foster advancing salinity reduction goals.

A total of 1,025 acres of land, 569 acres of water (excluding borrow areas), and 209 acres of state water bottoms (excluding borrow areas) will be impacted in the project area by excavation or the placement of marsh fill material or rock. A total of 52 acres of state water bottoms will be temporarily excavated during construction to facilitate equipment access (9 acres) and flotation (43 acres). The volume of material dredged for access and flotation during construction is 280,306 cubic yards. These areas will be backfilled at the end of construction. A total of 52 acres of state water bottoms will be temporarily excavated during maintenance events (four events during the 50-year project life) to facilitate equipment access (9 acres) and flotation (43 acres). The volume of material dredged for flotation access during maintenance is 280,306 cubic yards. These areas will be backfilled at the end of each maintenance event. A total of 1,620 acres will be impacted in the borrow areas. The volume of material to be dredged from the borrow areas is 12,600,000 cubic yards. The minimum proposed distance from the borrow area to the shoreline is 5,800 ft. The footprint for the shoreline protection feature (segmented revetment) is 5 acres. A total of 10,598 linear feet of shoreline will be protected by segmented revetment. A total of 68,053 tons of stone

Louisiana Coastal Area
Barataria Basin Barrier Shoreline Restoration Project
Jefferson, Lafourche, and Plaquemines Parishes, Louisiana

43440-2010-R-2889
Preliminary Biological Opinion
March 28, 2011

Prepared by:
U.S. Fish and Wildlife Service
646 Cajundome Boulevard, Suite 400
Lafayette, LA

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Acronyms

Act	Endangered Species Act
ATV	All-terrain vehicle
BA	Biological Assessment
BBBSR	Barataria Basin Barrier Shoreline Restoration
BO	Biological Opinion
CCSP	Climate Change Science Program
CEM	Coastal Engineering Manual
Corps	U.S. Army Corps of Engineers
CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Act
cm	centimeters
cy	Cubic yards
LDNR	Louisiana Department of Natural Resources
DPS	Distinct Population Segment
EPA	Environmental Protection Agency
FDEP	Florida Department of Environmental Protection
FR	Federal Register
IPPC	International Piping Plover Census
km	kilometers
LCA	Louisiana Coastal Area
LDWF	Louisiana Department of Wildlife and Fisheries
m	meters
MBTA	Migratory Bird Treaty Act
MHW	Mean High Water
MLW	Mean Low Water
MLLW	Mean Low Low Water
NAVD	North American Vertical Datum 1988
NMFS	National Marine Fisheries Service
NPS	National Park Service
NRA	Natural Resource Advisor
NRDAR	Natural Resource Damage Assessment and Restoration
O&M	Operations and maintenance
ORV	Off-road vehicle
PCB	Polychlorinated Biphenol
PCE	Primary Constituent Element
SCAT	Shoreline Cleanup Assessment Team
Service	U.S. Fish and Wildlife Service
TSP	Tentatively Selected Plan
TY	Target Year
U.S.	United States
USC	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

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March 25, 2011

Colonel Edward R. Fleming
District Commander
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Fleming:

This document transmits the U.S. Fish and Wildlife Service's (Service) preliminary biological opinion based on our review of the U.S. Army Corps of Engineers' (Corps) proposed Louisiana Coastal Area (LCA) – Barataria Basin Barrier Shoreline Restoration (BBBSR) project that would be located in Jefferson, Lafourche, and Plaquemines Parishes, Louisiana, and its effects on the threatened piping plover (*Charadrius melodus*) and its designated critical habitat, in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 United States Code [U.S.C.] 1531 *et seq.*). Your December 6, 2010, request for early (preliminary) consultation was received via mail on December 10, 2010.

This preliminary biological opinion is based on information provided in the Corps' August 9, 2010, supplemental biological assessment (BA); the Corps' April 24, 2009, BA; meetings; telephone conversations; electronic mails; field investigations; and other sources of information. A complete administrative record of this consultation (Service Log No. 43440-2010-R-2889) is on file at the Service's Louisiana Ecological Services Office.

The Service concurs with the Corps' determination that the proposed project is not likely to adversely affect the endangered West Indian manatee (*Trichechus manatus*) because: (1) the project area does not contain suitable foraging habitat for that species; and (2) the Corps would implement, as part of the project construction plan, standard conditions for in-water work in the presence of manatees (Appendix C). Federally listed sea turtles (i.e., Kemp's ridley, Hawksbill, Loggerhead, Leatherback, and Green sea turtles) are not currently known to nest in Louisiana. It is our understanding that the Corps has conducted a separate consultation with the National Marine Fisheries Service (NMFS) regarding project-related effects to sea turtles offshore. Accordingly, none of the species mentioned in this paragraph will be discussed further in this biological opinion.

Table 1. Species and critical habitat evaluated for effects from the proposed action but not discussed further in this biological opinion.

Species or Critical Habitat	Present in Action Area	Present in Action Area but "Not Likely to Adversely Affect"
West Indian manatee	Yes	Yes

Consultation History

On September 26, 2003, the Service provided the Corps with a detailed list of and habitat descriptions for federally threatened and endangered species, their critical habitat, and migratory birds that may be found in or near the study area for the draft LCA Comprehensive Study. On May 2, 2005, the Service provided a project-specific list of federally threatened and endangered species to the Corps in response to their request for our comments and participation as a cooperating agency in the preparation of their Draft Environmental Impact Statement for the BBBSR project.

On May 18, 2006, the Service and the Corps conducted a site visit to discuss potential project-related effects to the piping plover and its critical habitat. On July 11, 2006, the Service provided the Corps with additional specific biological information for the piping plover for preparation of their draft BA.

On May 11, 2009, the Service concurred with the Corps' determination that the originally proposed project as described in their April 24, 2009, BA, was not likely to adversely affect the piping plover or its designated critical habitat.

Proposed project modifications were presented to the Service via meetings, telephone calls, and ongoing coordination between the Service and the Corps in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). On August 5, 2010, the Service provided a supplemental letter to our April 30, 2009, draft Fish and Wildlife Coordination Act Report regarding the Corps' proposed changes in the Tentatively Selected Plan (TSP) for the BBBSR project. That letter recommended that the Corps re-initiate section 7 consultation due to the changes in the project scope and location.

On August 11, 2010, the Corps provided the Service with their August 9, 2010, supplemental BA regarding the proposed changes in the scope and location of the BBBSR project, as well as detailed information regarding a change in the environmental baseline due to the impacts to the project area as a result of the Deepwater Horizon Mississippi Canyon Well #252 oil spill. Due to the nature of the project changes and the change in the project-area environmental baseline, the Corps requested to initiate formal consultation. On August 19, 2010, the Service provided confirmation to the Corps that all information had been received and that a biological opinion would be issued no later than December 24, 2010.

On August 23, 2010, the Service and the Corps conducted a site visit to discuss the changes in the proposed project and its potential effects to existing piping plover habitat, as well as the effects to existing habitat related to the Deepwater Horizon oil spill. On September 16, 2010, the Corps provided the Service with additional clarification of the proposed project changes specifically regarding the proposed location and placement of the feeder beach berm.

On October 7, 2010, the Corps informed the Service that the project plan had changed once again and that the Corps would be rescinding its request for formal consultation. On December 6, 2010, the Corps rescinded its request for formal consultation and instead requested early consultation; that request also contained the recently revised version of their August 9, 2010, supplemental BA. On January 6, 2011, the Service provided confirmation to the Corps that all information had been received and that a draft biological opinion would be issued no later than April 24, 2011.

PRELIMINARY BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Corps' 2004 LCA Report developed 3 hydrogeomorphic objectives: (1) maintaining salinity gradients; (2) increasing sediment input from sources outside the estuarine basins; and (3) maintaining or establishing natural landscape features and hydrologic processes that are critical to sustainable ecosystem structure and function. Accordingly, the goals of the proposed BBBSR project are: (1) to restore the geomorphic function and unique fish and wildlife habitats of the Caminada headland barrier system; and (2) to reverse the current trend of degradation in the Caminada headland and Shell Island reaches of the Barataria Basin (Figure 1) for a 50-year period (Corps 2009a). The Tentatively Selected Plan (TSP) consists of Caminada Headland Alternative 5 – Preferred Dune with Expanded Marsh and Subtidal Feeder Bar, and Shell Island Alternative 5 – One Island with Two Renourishments. The TSP provides geomorphic form and function by separating the Gulf of Mexico from the interior estuaries and helping to regulate salinity gradients important to the range of estuarine and freshwater wetland species for the period of analysis. The geomorphic structures prevent open Gulf of Mexico wave energy from impacting the interior estuary and provide hydrodynamic stability to the system. Loss of those functions would have impacts beyond the project footprint. The Corps anticipates beginning construction of the TSP in January 2012. For details on specific project features (i.e., dredging, sand fencing, planting) common to each project component, please refer to the **Restoration features common to the entire project** section of the project description on page 7.

Caminada Headland Alternative 5: Restored Dune with Created Marsh and Subtidal Feeder Bar

The initial construction on the Caminada Headland will create 1,186 acres of saline marsh and 880 acres of dune/beach complex, for a total of 2,066 acres at target year (TY) 1. The newly created acres will cover much of the existing habitat acreages in the direct project footprint. Borrow material for construction would be used from the South Pelto Block of Ship Shoal located approximately 40 miles offshore, southwest of Belle Pass. The duration for dredging for the Caminada portion of the project would be approximately 2.5 years. Onshore construction activities would occur concurrently with dredging operations but may extend for another 6 months after dredging is completed. Planting of native vegetation would require approximately 750 days over a 3-year period once all construction is completed.

Dune/Beach Complex

The dune height would be constructed to +7 feet (2.13 meters [m]) North American Vertical Datum 1988 (NAVD) which is higher than the existing (degraded) dune elevation of +3.4 feet (1.04 m) NAVD. The proposed dune width would be 290 feet (88.29 m). The majority of the dune would be located landward over existing higher elevations to maximize project acreage and longevity. The landward and seaward slopes are set at a 20-foot horizontal to 1-foot vertical slope (20H:1V). The beach fill design has a 65-foot-wide (19.81 m) seaward berm at an elevation of +4.5 feet (1.37 m) NAVD. Approximately 13 miles of dune and beach will be created. Fill quantity for the beach/dune complex is 5.1 million cubic yards (cy). Vegetative plantings will include a variety of native dune grass species. Sand fencing will be installed to promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings.

The dune/beach complex feature of the Caminada headland would include repair and/or maintenance of sand fencing. The maintenance estimate for sand fencing includes complete replacement in TY5

with 20 percent replacement every 5 years for the 50-year period of analysis. In addition to this task, the non-Federal sponsor would monitor the project area and enforce the restrictions of the easements through yearly inspections of the project area. Sufficient land rights will be obtained to perform operations and maintenance (O&M) over 50 years.

Marsh Creation

The expanded marsh feature includes restoration and creation of a marsh platform located between the Chevron Canal to the north and the beach/dune component to the south (Figure 2). Approximately 5.36 million cy would be used to construct a marsh elevation of +2.0 feet (0.61 m) NAVD that would create a functioning intertidal marsh with no renourishment planned for the 50-year project life. The native marsh elevation for the back-barrier marsh is 0.94 feet (0.29 m) NAVD. The marsh platform would be planted with various native marsh grasses, and would provide substrate for overwash splays and northward dune/beach migration.

Subtidal Feeder Bar

The Corps' Coastal Engineering Manual (CEM) (Corps 2006) describes feeder beaches as finite-length berms placed along a beach, usually at the up-drift end of a littoral cell that has strong unidirectional shore-parallel transport. They can also be placed at a nodal "hot spot" where shore-parallel transport divides, thus moving sediment in both directions away from the node. This concept involves placing a large volume of sediment in a limited area and relying on littoral processes to move it down the beach, thus gradually renourishing the beach at a distance from the placement site. The CEM describes feeder beaches in the same terms as normal beach restoration projects, with the sediment placed on the beach face, but not necessarily "...the same degree of along-shore uniformity as that provided by placing fill in a prescribed manner throughout the project area" (Corps 2006). The feeder beach concept has been expanded to include subsurface placement of sediment to create a "feeder bar," which relies on coastal processes to move the sediment onto the beach face naturally. A sub-tidally placed feeder bar that nourishes the beach profile without need for heavy grading machinery and/or disturbance to environmentally sensitive habitats can be more desirable and is typically less expensive than a conventional feeder beach. In addition, as wave action carries fine sediment onto the beach face and deposits it, an opportunity is afforded for Aeolian transport to move fine sands up the beach and onto the dune, thus, nourishing the system. The fine grained sediment that will be placed in the subtidal feeder bar would move onto the beach face in a gradual manner; consequently the feeder bar is not expected to cause extensive stacking of sediment on the beach which could smother the benthic fauna and contribute additional stress to the remaining benthic community within piping plover critical habitat.

Modeling was used to compare initial and final shorelines with and without the feeder bar. The results indicate that, by the end of the 2-year period between material placement events, the feeder bar diffuses to the east and west of its initial placement by approximately 2,000 feet (609.6 m). The percent reduction in volume losses from the modeled design storms that were attributed to the feeder bar ranged from 54 percent to 90 percent and the percent reduction in beach/dune erosion ranged from 49 percent to 81 percent. While the storm damage to the headland remains significant from storms of these magnitudes, the feeder bar does provide a quantifiable benefit for storm damage reduction. It is noted that these model results should be interpreted carefully for several reasons. First, the material will be placed as unconfined disposal thus the profile shape may vary significantly from the assumed bar configuration. Second, lateral diffusion will occur relatively quickly reducing the "density" of the feeder bar along the placement area. Third, the storm damage reduction benefit will be localized to the

nodal zone and adjacent beaches as the feeder bar diffuses, which is approximately 13 percent of the entire Caminada Headland shoreline.

Based on the sediment budget prepared for the Caminada headland, the loss of sediment from the headland is estimated to be 379,000 cy per year. Thus, maintenance of the headland would include the beneficial placement of dredged material from O&M dredging of the bar channel of Bayou Lafourche, Louisiana (i.e., Belle Pass) in a feeder bar disposal area (Corps 2010). Dredging of Belle Pass yields between 400,000 cy and 750,000 cy, of which approximately 500,000 cy of material would be used for the feeder bar every 1.5 to 2 years. Historically this material has been placed immediately east and west of the jetties at beach nourishment disposal sites. As part of the adaptive management plan, shoreline imagery will be evaluated to determine the renourishment approach. Based on shoreline conditions one of two basic approaches will be used:

1. When monitoring data indicate that the shoreline is relatively intact (i.e., no breaches), the dredged material from Belle Pass will be placed at the feeder bar disposal area located in the littoral drift south of Bayou Moreau (Figure 2) where the sediment budget indicates that the long-shore transport of material splits going east and west (Figure 4). Placement of material at this location sustains the project by building out the shoreline at the nodal point, which is an area of more rapid shoreline erosion, and by feeding material along the entire reach through existing long-shore transport patterns. Approximately 500,000 cy would be placed unconfined for a length of 13,000 feet (3,962.4 m) located between 100 and 300 feet (30.48 and 91.44 m, respectively) from the mean high water (MHW) mark to allow long-shore transport and wave action to move and place the sediment along the headland. There would be no direct placement of sediment onto the beach during the dredged material placement events. All dredged material for the feeder bar would be placed seaward of mean low low water (MLLW) (horizontal) and at, or below, MLLW (vertical) located offshore of the nodal point. The material would be stacked no higher than + 6 feet (1.83 m) mean low grade, but would be quickly reworked by the wind and waves (due to the high energy environment of that area). The pumping of the material would take approximately 35 days, with placement and removal of the pipeline taking a total of approximately 70 days. The pipe would be placed offshore. The material would be dredged from the Bayou Lafourche channel (a federal navigation channel) which previously received clearance under the National Environmental Policy Act for maintenance dredging. Over each 10 year period, an estimated 2 million cy of material would be returned to the headland. A total of 10 million cy would be placed within the feeder bar disposal area over the 50-year project life, thereby, replacing 53 percent of the sediment that is naturally lost from the headland.

2. When monitoring data indicate that the shoreline has been breached or severely damaged by overwash and/or other erosion, dredged material would be beneficially placed to repair breaches and/or other highly eroded areas. The material would be placed in a manner which restores the shoreline to conditions similar to what existed prior to breaching. Each breach or overwash restoration action would be coordinated with the Service on a case by case basis. If the volume of material available is greater than the quantity required to repair breaches and erosional hot spots, then the remaining material will be placed in the feeder bar disposal area at the nodal point of the shoreline.

At approximately every fifth dredging cycle (i.e., every 10 years), dredged material would be placed immediately west of the Belle Pass jetties as is currently done for O&M of Belle Pass. Timing of the renourishment will be dependent upon the maintenance dredging requirements of the Bayou Lafourche, Louisiana project.

Shell Island Alternative 5: One Island with Two Renourishments

Shell Island Alternative 5 would restore the Shell Island reach as a 783-acre island (Figure 3), including a beach berm, dune ridge, and saline marsh platform. The east end of the new island would be located near the Empire waterway, and the west end would be terminated approximately 0.5-mile before Grand Bayou. The alternative would attempt to restore existing island remnants to a pre-Hurricane Bob (1979) condition, and the shortest and shallowest route across Coupe Bob would be utilized. The Corps anticipates that the closure of Coupe Bob would return the tidal prism to its pre-1979 path which flowed through Grand Bayou; thus, Grand Bayou would increase in size in response to the altered tidal flow pattern. The borrow source for the dune/beach complex would be a large sand deposit in the Mississippi River near Nairn between mile markers 32 and 34, which is located approximately 11 miles north of the Shell Island reach. The sand, which is comparable in grain size to sand found at the project site, would be pumped to the project area via pipeline. The borrow source for marsh creation would be the Empire deposit located 1.5 miles from the Empire jetties; that site contains material more suitable for marsh construction.

The duration for construction activities for the Shell Island reach is approximately 2.17 years. Onshore construction activities would occur concurrently with dredging operations but may extend for another 6 months after dredging is completed. Planting of native vegetation would require approximately 360 days over a 3-year period once all construction is completed. Periodic renourishment would be implemented at TY 20 and TY 40. The Corps estimates that approximately 1.5 million cy of beach fill would be needed for each renourishment cycle in TY 20 and TY 40, approximately 907,200 cy of marsh fill would be needed for renourishment in TY20, and 604,700 cy of marsh fill would be needed in TY 40.

Dune/Beach Complex

The landward edge of the dune would be located seaward of the existing shoreline. The dune height would be constructed to +6 feet (1.83 m) NAVD and dune width would be 189 feet (57.6 m). The landward and seaward slopes are set at a 45-foot horizontal to 1-foot vertical slope (45H:1V). The beach fill design has not yet been selected, and would vary as a non-uniform 300-foot-wide (91.44 m) seaward berm at an elevation of greater than +2 feet (0.61 m) and less than +4.5 feet (1.37 m) NAVD. Approximately 317 acres of shoreline/dune (area above +2 feet NAVD) would be created. The anticipated fill quantity for the beach/dune complex is 5.6 million cy. Vegetative plantings will include a variety of native dune grass species. Sand fencing will be installed to promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings.

Marsh Creation

The marsh feature includes creation of a marsh platform located north of the beach/dune component. However, in deeper water (bathymetry below -3 feet NAVD, as found across Coupe Bob) marsh fill cannot be used because as the material de-waters there would be rapid and non-uniform settling, which would preclude marsh creation. Therefore, at depths of -3 feet and deeper (i.e., across Coupe Bob), a sand base would be constructed and a sand-filled geotextile tube would be used as containment prior to placement of marsh fill material. For areas in shallow water (bathymetry up to -2 or -3 feet NAVD) there is no need for a sand base, and containment dikes would be constructed with waterbottom material within the marsh fill footprint. A uniform marsh width of 735 feet (224 m) would be constructed to result in an island width of approximately 1,240 feet (377.95 m) following equilibration

of the shoreline. Approximately 2.1 million cy would be used to construct 466 acres of marsh to an elevation of +2.0 feet (0.61 m) NAVD, which would result in a functioning intertidal marsh. The marsh platform would be planted with various native marsh grasses, and would provide substrate for over-wash splays and northward dune/beach migration.

Restoration features common to the entire project

Dredging of all offshore borrow areas would be conducted using a hydraulic cutter-head dredge, for which the Corps has already conducted section 7 consultation with the NMFS. The dredged material would be transported to an island or headland using a booster pump(s), if needed, and submerged sediment pipeline. Borrow locations are located sufficient distance from the restoration sites that they will not impact littoral drift or project longevity. The following construction actions would be implemented for all of the above-listed alternative features:

a) For the dune areas, the dredged material would be deposited on the beach and re-worked by bulldozers and front-end loaders.
b) For the marsh creation areas, temporary containment dikes would be constructed to contain the marsh fill material during construction. The material for dike construction will be dredged from within the footprint of the marsh creation area so that the excavated area is filled during construction. The dike volume is included within the marsh fill volume. (A second option for the Shell Island reach only is to contain marsh fill using a sand-filled geotextile tube along the perimeter of the constructed sand base in areas where water depths are deeper than -3 feet NAVD.)
c) All dredging and discharge operations will be completed in a manner that will minimize turbidity of the water at the dredge and discharge sites.
d) Sand fencing will be installed to promote capture of Aeolian sand. One shore-parallel fence will be installed approximately 50 feet (15.24 m) north of the southern toe of the dune to continue the capture of transported sand until the surface is vegetated. The sand fence will extend along the total length of the constructed dune. Sand fences will be installed in sequences/phases. The installation would start from the southern side of the dune so as to build dune towards the Gulf and proceed north. Additional rows of sand fencing may be added once the sand is stacked almost to the top of the fence.
e) Vegetative plantings will include a variety of native dune and marsh grass species, and the recommended planting density is no greater than 8-foot centers.

Project effects would occur along the entire length of the Caminada headland and the Shell Island reach due to the dynamic nature of coastal processes and the long-shore transport of sediments within the Barataria Basin barrier system. The Shell Island reach is not designated as critical habitat for the piping plover; however, it does consist of suitable habitat for the species. Portions of the Caminada headland are included in critical habitat Unit LA-5 (described in detail in the **Species/critical habitat description** and **Status of the species within the action area** sections of this document). The Service has described the action area to include all of the Caminada headland and Shell Island reach, and their associated sand and mud flats, for reasons that will be explained and discussed in detail in the **EFFECTS OF THE ACTION** section of this consultation.

STATUS OF THE SPECIES/CRITICAL HABITAT

Species/critical habitat description

The piping plover is a small (7 inches [17.78 centimeters (cm)] long), pale, sand-colored shorebird with a wingspan of 15 inches (38.1 cm) (Palmer 1967). On January 10, 1986, the piping plover was listed as endangered in the Great Lakes watershed and threatened elsewhere within its range, including migratory routes outside of the Great Lakes watershed and wintering grounds (Service 1985). Piping plovers were listed principally because of habitat destruction and degradation, predation, and human disturbance. Protection of the species under the Act reflects the species' precarious status range-wide. Three separate breeding populations have been identified, each with its own recovery criteria: the northern Great Plains (threatened), the Great Lakes (endangered), and the Atlantic Coast (threatened). The piping plover winters in coastal areas of the United States (U.S.) from North Carolina to Texas, and along the coast of eastern Mexico and on Caribbean islands from Barbados to Cuba and the Bahamas (Haig and Elliott-Smith 2004). Piping plover subspecies are phenotypically indistinguishable, and most studies in the nonbreeding range report results without regard to breeding origin. Although a recent analysis shows strong patterns in the wintering distribution of piping plovers from different breeding populations, partitioning is not complete and major information gaps persist. Therefore, information summarized here pertains to the species as a whole (i.e., all three breeding populations), except where a particular breeding population is specified (Figure 6).

The Service has designated critical habitat for the piping plover on three occasions. Two of these designations protected different breeding populations. Critical habitat for the Great Lakes breeding population was designated May 7, 2001 (66 Federal Register (FR) 22938; Service 2001a), and critical habitat for the northern Great Plains breeding population was designated September 11, 2002 (67 FR 57637; Service 2002). The Service designated critical habitat for wintering piping plovers on July 10, 2001 (66 FR 36038; Service 2001b). Wintering piping plovers may include individuals from the Great Lakes and northern Great Plains breeding populations as well as birds that nest along the Atlantic coast.

Designated wintering piping plover critical habitat originally included 142 areas (the rule states 137 units; this is in error) encompassing about 1,793 miles of mapped shoreline and 165,211 acres of mapped areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. Since the designation of wintering critical habitat, 19 units (TX-3,4,7-10, 14-19, 22, 23, 27,28, and 31-33) in Texas have been vacated and remanded back to the Service for reconsideration by Court order (Texas General Land Office v. U.S. Department of Interior, Case No. V-06-CV-00032). On May 19, 2009, the Service published a final rule designating 18 revised critical habitat units in Texas, totaling approximately 139,029 acres (74 FR 23476). The Courts also vacated and remanded back to the Service for reconsideration, four units in North Carolina (Cape Hatteras Access Preservation Alliance v. U.S. Department of Interior, 344 F. Supp. 2d 108 (D.D.C. 2004)). The four critical habitat units vacated were NC-1, 2, 4, and 5, and all occurred within Cape Hatteras National Seashore (CAHA). A revised designation for these four units was published on October 21, 2008 (73 FR 62816).

The primary constituent elements (PCEs) for piping plover wintering habitat are those biological and physical features that are essential to the conservation of the species. The PCEs are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. These areas typically include coastal areas that support intertidal beaches and flats and associated dune systems and flats above

annual high tide (Service 2001a). PCEs of wintering piping plover critical habitat include sand or mud flats (or both) with no or sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting piping plovers (Service 2001a). Important components of the beach/dune ecosystem include surf-cast algae, sparsely vegetated back beach and salterns, spits, and washover areas. Washover areas are broad, unvegetated zones, with little or no topographic relief, that are formed and maintained by the action of hurricanes, storm surge, or other extreme wave action. The units designated as critical habitat are those areas that have consistent use by piping plovers and that best meet the biological needs of the species. The amount of wintering habitat included in the designation appears sufficient to support future recovered populations, and the existence of this habitat is essential to the conservation of the species. Additional information on each specific unit included in the designation can be found at 66 FR 36038 (Service 2001a).

Activities that affect PCEs include those that directly or indirectly alter, modify, or destroy the processes that are associated with the formation and movement of barrier islands, inlets, and other coastal landforms. Those processes include erosion, accretion, succession, and sea-level change. The integrity of the habitat components also depends upon daily tidal events and regular sediment transport processes, as well as episodic, high-magnitude storm events (Service 2001b).

Life History

Piping plovers live an average of five years, although studies have documented birds as old as 11 (Wilcox 1959) and 15 years. Breeding activity begins in mid-March when birds begin returning to their nesting areas (Coutu et al. 1990; Cross 1990; Goldin et al. 1990; MacIvor 1990; Hake 1993). Plovers are known to begin breeding as early as one year of age (MacIvor 1990; Haig 1992); however, the percentage of birds that breed in their first adult year is unknown. Piping plovers generally fledge only a single brood per season, but may re-nest several times if previous nests are lost.

The most consistent finding in the various population viability analyses conducted for piping plovers indicates that even small declines in adult and juvenile survival rates will cause very substantial increases in extinction risk (Ryan et al. 1993; Melvin and Gibbs 1996; Plissner and Haig 2000; Wemmer et al. 2001; Larson et al. 2002; Amirault et al. 2005; Calvert et al. 2006; Brault 2007). A banding study conducted between 1998 and 2004 in Atlantic Canada found lower return rates of juvenile (first year) birds to the breeding grounds than was documented for Massachusetts (Melvin and Gibbs 1994; Service 1996), Maryland (Loegering 1992), and Virginia (Cross 1996) breeding populations in the mid-1980s and very early 1990s. This is consistent with failure of the Atlantic Canada population to increase in abundance despite very high productivity (relative to other breeding populations) and extremely low rates of dispersal to the U.S. over the last 15 plus years (Amirault et al. 2005). Simply stated, this suggests that maximizing productivity does not ensure population increases.

Efforts to partition survival within the annual cycle are beginning to receive more attention, but current information remains limited. Drake et al. (2001) observed no mortality among 49 radio-marked piping plovers (total of 2,704 transmitter days) in Texas in 2007-2008. Cohen et al. (2008a) documented no mortality of 7 radio-tracked wintering piping plovers at Oregon Inlet from December 2005 to March 2006. They speculate their high survival rate was attributed to plover food availability much of the day as well as the low occurrence of days below freezing and infrequent wet weather. Analysis of South Carolina resighting data for 87 banded piping plovers (78 percent Great Lakes breeders) in 2006-2007

and 2007-2008 found 100 percent survival from December to April[1] (J. Cohen, Virginia Polytechnic Institute and State University, pers. comm. 2009). Noel et al. (2007) inferred two winter (November to February) mortalities[2] among 21 banded (but not radio-tagged) overwintering piping plovers in 2003-2004 and 9 mortalities among 19 overwintering birds during the winter of 2004-2005 at Little St. Simons Island, Georgia. LeDee (2008) found higher apparent survival[3] rates during breeding and southward migration than during winter and northward migration for 150 adult (i.e., after-hatch year) Great Lakes piping plovers.

Mark-recapture analysis of resightings of uniquely banded piping plovers from seven breeding areas by Roche et al. (2010) found that apparent adult survival declined in four populations and increased in none over the life of the studies[4]. Some evidence of correlation in year-to-year fluctuations in annual survival of Great Lakes and eastern Canada populations, both of which winter primarily along the southeastern U.S. Atlantic Coast, suggests that shared over-wintering and/or migration habitats may influence annual variation in survival. Further concurrent mark-resighting analysis of color-banded individuals across piping plover breeding populations has the potential to shed light on threats that affect survival in the migration and wintering range. However, very little to no information exists specifically for birds wintering along the northern Gulf of Mexico. An ongoing Natural Resource Damage Assessment and Restoration (NRDAR) study of piping plovers that are potentially affected by the 2010 Deepwater Horizon oil spill may provide such information once the data gathered are eligible for release to the public.

Migration

Plovers depart their breeding grounds for their wintering grounds from July through late August, but southward migration extends through November. Piping plovers spend up to 10 months of their life cycle on their migration and winter grounds, generally July 15 through as late as May 15. Piping plovers migrate through and winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean. Both spring and fall migration routes of Atlantic Coast breeders are believed to occur primarily within a narrow zone along the Atlantic Coast (Service 1996). The pattern of both fall and spring counts at many Atlantic Coast sites demonstrates that many piping plovers make intermediate stopovers lasting from a few days up to one month during their migrations (Noel et al. 2005; Stucker and Cuthbert 2006). Some mid-continent breeders travel up or down the Atlantic Coast before or after their overland movements (Stucker and Cuthbert 2006). Use of inland stopovers during migration is also documented (Pompei and Cuthbert 2004). The source breeding population of a given wintering individual cannot be determined in the field unless it has been banded or otherwise marked. Information from observation of color-banded piping plovers indicates that the winter ranges of the breeding populations overlap to a significant degree. See the **Status and Distribution** section for additional information pertaining to population distribution on the wintering grounds. While piping plover migration patterns and needs remain poorly understood and occupancy of a particular habitat may involve shorter periods relative to wintering, information about the energetics of avian migration indicates that this might be a particularly critical time in the species' life cycle.

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[1] Of those birds, one unique and one non-uniquely banded piping plover were seen in the first winter and were resighted multiple times in the second fall at the same location but were not seen during the second winter; whether these two birds died in the fall or shifted their wintering location is unknown (Maddock et al. 2009).
[2] Noel et al. (2007) inferred mortality if a uniquely banded piping plover with multiple November to February sightings on the survey site disappeared during that time and was never observed again in either it's nonbreeding or breeding range. Note that most of these birds were from the Great Lakes breeding population, where detectability during the breeding season is very high.
[3] "Apparent survival" does not account for permanent emigration. If marked individuals leave a survey site, apparent survival rates will be lower than true survival. If a survey area is sufficiently large, such that emigration out of the site is unlikely, apparent survival will approach true survival.
[4] Data were analyzed for 3 to 11 years per breeding area, all between 1998 and 2008.

Foraging (nonbreeding portion of annual cycle)

Behavioral observation of piping plovers on the wintering grounds suggests that they spend the majority of their time foraging (Nicholls and Baldassarre 1990a; Drake 1999a, 1999b). Feeding activities may occur during all hours of the day and night (Staine and Burger 1994; Zonick 1997), and at all stages in the tidal cycle (Goldin 1993; Hoopes 1993). Wintering plovers primarily feed on invertebrates such as polychaete marine worms, various crustaceans, fly larvae, beetles, and occasionally bivalve mollusks (Bent 1929; Nicholls 1989; Zonick and Ryan 1995). They peck these invertebrates on top of the soil or just beneath the surface. Plovers forage on moist substrate features such as intertidal portions of ocean beaches, washover areas, mudflats, sand flats, algal flats, shoals, wrack lines, sparse vegetation, shorelines of coastal ponds, lagoons, ephemeral pools and adjacent to salt marshes (Gibbs 1986; Zivojnovich 1987; Nichols 1989; Nicholls and Baldassarre 1990a; Nicholls and Baldassarre 1990b; Coutu et al. 1990; Hoopes et al. 1992; Loegering 1992; Goldin 1993; Elias-Gerken 1994; Wilkinson and Spinks 1994; Zonick 1997; Service 2001a). Studies from the coastal breeding range have shown that the relative importance of various feeding habitat types may vary by site (Gibbs 1986; Coutu et al. 1990; McConnaughey et al. 1990; Loegering 1992; Goldin 1993; Hoopes 1993). Cohen et al. (2006) documented more abundant prey items and biomass on sound island and sound beaches than the ocean beach. On the wintering grounds, Ecological Associates, Inc. (2009) observed that during piping plover surveys at St. Lucie Inlet, Martin County, Florida, intertidal mudflats and/or shallow subtidal grass flats appear to have greater value as foraging habitat than the unvegetated intertidal areas of a flood shoal.

Roosting

Several studies identified wrack (organic material including seaweed, seashells, driftwood, and other materials deposited on beaches by tidal action) as an important component of roosting habitat for nonbreeding piping plovers. Lott et al. (2009) found greater than 90 percent of roosting piping plovers in southwest Florida in old wrack with the remainder roosting on dry sand. In South Carolina, 45 percent of roosting piping plovers were in old wrack, and 18 percent were in fresh wrack. The remainder of roosting birds used intertidal habitat (22 percent), backshore (defined as zone of dry sand, shell, cobble and beach debris from mean high water line up to the toe of the dune)(8 percent), washover and ephemeral pools 2 percent and 1 percent respectively (Maddock et al. 2009). Thirty percent of roosting piping plovers in northwest Florida were observed in wrack substrates with 49 percent on dry sand and 20 percent using intertidal habitat (Smith 2007). In Texas, sea grass debris (bay-shore wrack) was an important feature of piping plover roost sites (Drake 1999b). Mean abundance of two other plover species in California, including the listed western snowy plover (*Charadrius alexandrinus nivosus*), was positively correlated with abundance of wrack during the nonbreeding season (Dugan et al. 2003).

Natural protection

Cryptic coloration is a primary defense mechanism for this species. Nests, adults, and chicks all blend in with their typical beach surroundings. Piping plovers on wintering and migration grounds respond to intruders (pedestrian, avian and mammalian) usually by squatting, running, and flushing (flying).

Wintering habitat

Wintering piping plovers prefer coastal habitat that include sand spits, islets (small islands), tidal flats, shoals (usually flood tidal deltas), and sandbars that are often associated with inlets (Harrington 2008). Sandy mud flats, ephemeral pools, and overwash areas are also considered primary foraging habitats. These substrate types have a richer infauna than the foreshore of high energy beaches and often attract large numbers of shorebirds (Cohen et al. 2006). Wintering plovers are dependent on a mosaic of habitat patches and move among these patches depending on local weather and tidal conditions (Nicholls and Baldassarre 1990a).

Recent study results in North Carolina, South Carolina, and Florida complement information from earlier investigations in Texas and Alabama (summarized in the 1996 Atlantic Coast and 2003 Great Lakes Recovery Plans) regarding habitat use patterns of piping plovers in their coastal migration and wintering range. Maddock et al. (2009) observed shifts to roosting habitats and behaviors during high-tide periods in South Carolina. In South Carolina, exposed intertidal areas were the dominant foraging substrate (accounting for 94 percent of observed foraging piping plovers; Maddock et al. 2009). As observed in Texas studies, Lott et al. (2009) identified bay beaches (bay shorelines as opposed to ocean-facing beaches) as the most common landform used by foraging piping plovers in southwest Florida. In northwest Florida, however, Smith (2007) reported landform use by foraging piping plovers about equally divided between Gulf of Mexico (ocean-facing) and bay beaches. Exposed intertidal areas were the dominant foraging substrate in South Carolina (accounting for 94 percent of observed foraging piping plovers; Maddock et al. 2009) and in northwest Florida (96 percent of foraging observations; Smith 2007). In southwest Florida, Lott et al. (2009) found approximately 75 percent of foraging piping plovers on intertidal substrates.

Atlantic Coast and Florida studies highlighted the importance of inlets for non-breeding piping plovers. Almost 90 percent of observations of roosting piping plovers at ten coastal sites in southwest Florida were on inlet shorelines (Lott et al. 2009). Piping plovers were among seven shorebird species found more often than expected ($p = 0.0004$; Wilcoxon Scores test) at inlet locations versus non-inlet locations in an evaluation of 361 International Shorebird Survey sites from North Carolina to Florida (Harrington 2008).

Recent geographic analysis of piping plover distribution on the upper Texas coast noted major concentration areas at the mouths of rivers and washover passes (low, sparsely vegetated barrier island habitats created and maintained by temporary, storm-driven water channels) into major bay systems (Arvin 2008). Earlier studies in Texas have drawn attention to washover passes, which are commonly used by piping plovers during periods of high bay-shore tides and during the spring migration period (Zonick 1997; Zonick 2000). Cobb (*in* Elliott-Smith et al. 2009) reported piping plover concentrations on exposed sea grass beds and oyster reefs during seasonal low water periods in 2006.

The effects of dredge-material deposition merit further study. Drake et al. (2001) concluded that conversion of southern Texas mainland bay-shore tidal flats to dredged material impoundments results in a net loss of habitat for wintering piping plovers, because impoundments eventually convert to upland habitat not used by piping plovers. Zonick et al. (1998) reported that dredged material placement areas along the Intracoastal Waterway in Texas were rarely used by piping plovers, and noted concern that dredge islands block wind-driven water flows, which are critical to maintaining important shorebird habitats. By contrast, most of the sound islands used by foraging piping plovers at Oregon Inlet, North Caroline, were created by the Corps by deposition of dredged material in the

subtidal bay bottom, with the most recent deposition ranging from 28 to less than 10 years prior to the study (Cohen et al. 2008a).

Mean home range size (95 percent of locations) for 49 radio-marked piping plovers in southern Texas in 1997-98 was 12.6 square-kilometers (km^2) (3,113 acres), mean core area (50 percent of locations) was 2.9 km^2 (717 acres), and mean linear distance moved between successive locations (1.97 ± 0.04 days apart), averaged across seasons, was 3.3 km (2.1 miles) (Drake 1999b; Drake et al. 2001). Seven radio-tagged piping plovers used a 20.1 km^2 (4,967 acres) area (100 percent minimum convex polygon) at Oregon Inlet in 2005-2006, and piping plover activity was concentrated in 12 areas totaling 2.2 km^2 (544 acres) (Cohen et al. 2008a). Noel and Chandler (2008) observed high fidelity of banded piping plovers to 1 km to 4.5 km (0.62 to 2.8 miles) sections of beach on Little St. Simons Island, Georgia.

Population dynamics

The 2006 Piping Plover Breeding Census, the last comprehensive survey throughout the breeding grounds, documented 3,497 breeding pairs with a total of 8,065 birds throughout Canada and U.S (Elliott-Smith et al. 2009).

Northern Great Plains Population

The Northern Great Plains plover breeds from Alberta to Manitoba, Canada, and south to Nebraska; although some nesting has recently occurred in Oklahoma. Currently the most westerly breeding piping plovers in the United States occur in Montana and Colorado. The decline of piping plovers on rivers in the Northern Great Plains has been largely attributed to the loss of sandbar island habitat and forage base due to dam construction and operation. Nesting occurs on sand flats or bare shorelines of rivers and lakes, including sandbar islands in the upper Missouri River system, and patches of sand, gravel, or pebbly-mud on the alkali lakes of the northern Great Plains. Plovers do nest on shorelines of reservoirs created by the dams, but reproductive success is often low and reservoir habitat is not available in many years due to high water levels or vegetation. Dams operated with steady constant flows allow vegetation to grow on potential nesting islands, making these sites unsuitable for nesting. Population declines in alkali wetlands are attributed to wetland drainage, contaminants, and predation.

The International Piping Plover Census (IPPC), conducted every five years, also estimates the number of piping plover pairs in the Northern Great Plains. As illustrated in Table 2 (next page), none of the IPPC estimates of the number of pairs in the U.S. suggests that the Northern Great Plains population has yet satisfied the recovery criterion of 2,300 pairs (Plissner and Haig 1997; Ferland and Haig 2002; Elliot-Smith et al. 2009). The IPPC count in prairie Canada reported 1,703 adult birds in 2006, which is also short of the goal of 2,500 adult piping plover as stated in the Service's Recovery Plan (Service 1988).

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Table 2. The number of adult piping plovers and breeding pairs reported in the U.S. Northern Great Plains by the IPPC efforts (Plissner and Haig 1997; Ferland and Haig 2002; Elliot-Smith et al. 2009).

Year	Adults	Pairs Reported by the Census
1991	2,023	891
1996	1,599	586
2001	1,981	899
2006	2,959	1,212

The IPPC indicates that the U.S. population decreased between 1991 and 1996, then increased in 2001 and 2006. The Canadian population showed the reverse trend for the first three censuses, increasing slightly as the U.S. population decreased, and then decreasing in 2001. Combined, the IPPC numbers suggest that the population declined from 1991 through 2001, then increased almost 58 percent between 2001 and 2006 (Elliott-Smith et al. 2009).

The increase in 2006 is likely due in large part to a multi-year drought across much of the region starting in 2001 that exposed thousands of acres of nesting habitat. The Corps ran low flows on the riverine stretches of the Missouri River for most of the years between censuses, allowing more habitat to be exposed and resulting in relatively high fledging ratios (Corps 2009b). The Corps also began to construct habitat using mechanical means (dredging sand from the riverbed) on the Missouri River in 2004, providing some new nesting and foraging habitat. The drought also caused reservoir levels to drop on many reservoirs throughout the Northern Great Plains (e.g., Missouri River Reservoirs in North and South Dakota, and Lake McConaughey in Nebraska), providing previously unavailable shoreline habitat. The population increase may also be partially due to more intensive management activities on the alkali lakes, with increased management actions to improve habitat and reduce predation pressures.

While the IPPC provides an index to the piping plover population, the design does not always provide sufficient information to understand the population's dynamics. The five-year time interval between IPPC efforts may be too long to allow managers to get a clear picture of what the short-term population trends are and to respond accordingly if needed. As noted above, the first three IPPCs (1991, 1996, and 2001) showed a declining population, while the fourth (2006) indicated a dramatic population rebound of almost 58 percent for the combined U.S. and Canada Northern Great Plains population between 2001 and 2006. With only four data points over 15 years, it is impossible to determine if and to what extent the apparent upswing reflects a real population trend versus error(s) in the 2006 census count and/or a previous IPPC. The 2006 IPPC included a detectability component, in which a number of pre-selected sites were visited twice by the same observer(s) during the two-week window to get an estimate of error rate. This study found an approximately 76 percent detectability rate through the entire breeding area, with a range of between 39 percent to 78 percent detectability among habitat types in the Northern Great Plains.

Such a reported large increase in population may indeed indicate a positive population trend, but with the limited data available, it is impossible to determine how much. Furthermore, with the next IPPC not scheduled until 2011, there is limited feedback in many areas on whether this increase is being maintained or if the population is declining in the interim. Additionally, the results from the IPPC

have been slow to be released, adding to the time lag between data collection and possible management response.

Great Lakes Population

The Great Lakes plovers once nested on Great Lakes beaches in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario. Great Lakes piping plovers nest on wide, flat, open, sandy or cobble shoreline with very little grass or other vegetation. Reproduction is adversely affected by human disturbance of nesting areas and predation by foxes, gulls, crows and other avian species. Shoreline development, such as the construction of marinas, breakwaters, and other navigation structures, has adversely affected nesting and brood rearing.

The Recovery Plan (Service 2003) sets a population goal of at least 150 pairs (300 individuals), for at least 5 consecutive years, with at least 100 breeding pairs (200 individuals) in Michigan and 50 breeding pairs (100 individuals) distributed among sites in other Great Lakes states.

The Great Lakes piping plover population, which has been traditionally represented as the number of breeding pairs, has increased since the completion of the recovery plan in 2003 (Cuthbert and Roche 2007; 2006; Westbrock et al. 2005; Stucker and Cuthbert 2004; Stucker et al. 2003). The Great Lakes piping plover recovery plan documents the 2002 population at 51 breeding pairs (Service 2003). The census conducted in 2008 found 63 breeding pairs, an increase of approximately 23 percent. Of these, 53 pairs were found nesting in Michigan, while 10 were found outside the state, including six pairs in Wisconsin and four in Ontario, Canada. The 53 nesting pairs in Michigan represent approximately 50 percent of the recovery criterion. The 10 breeding pairs outside Michigan in the Great Lakes basin, represents 20 percent of the goal, albeit the number of breeding pairs outside Michigan has continued to increase over the past five years. The single breeding pair discovered in 2007 in the Great Lakes region of Canada represented the first confirmed piping plover nest there in over 30 years, and in 2008 the number of nesting pairs further increased to four. Breeding pairs increased to 71 in 2009, but fell to 61 pairs in 2010. The decline from 2009 to 2010 is of particular concern because productivity of the Great Lakes population in 2008 and 2009 was very close to rates associated with earlier population growth.

In addition, the number of non-nesting individuals has increased annually since 2003. Between 2003-2008 an annual average of approximately 26 non-nesting piping plovers were observed, based on limited data from 2003, 2006, 2007, and 2008. Although there was some fluctuation in the total population from 2002 to 2008 the overall increase from 51 to 63 pairs combined with the increased observance of non-breeding individuals indicates the population is increasing.

Atlantic Coast Population

The Atlantic Coast piping plover breeds on coastal beaches from Newfoundland and southeastern Quebec to North Carolina. Historical population trends for the Atlantic Coast piping plover have been reconstructed from scattered, largely qualitative records. Nineteenth-century naturalists, such as Audubon and Wilson, described the piping plover as a common summer resident on Atlantic Coast beaches (Haig and Oring 1987). However, by the beginning of the 20th Century, egg collecting and uncontrolled hunting, primarily for the millinery trade, had greatly reduced the population, and in some areas along the Atlantic Coast, the piping plover was close to extirpation. Following passage of the Migratory Bird Treaty Act (40 Stat. 775; 16 U.S.C. 703-712) in 1918, and changes in the fashion

industry that no longer exploited wild birds for feathers, piping plover numbers recovered to some extent (Haig and Oring 1985).

Available data suggest that the most recent population decline began in the late 1940s or early 1950s (Haig and Oring 1985). Reports of local or statewide declines between 1950 and 1985 are numerous, and many are summarized by Cairns and McLaren (1980) and Haig and Oring (1985). While Wilcox (1939) estimated more than 500 pairs of piping plovers on Long Island, New York, the 1989 population estimate was 191 pairs (Service 1996). There was little focus on gathering quantitative data on piping plovers in Massachusetts through the late 1960s because the species was commonly observed and presumed to be secure. However, numbers of piping plover breeding pairs declined 50 to 100 percent at seven Massachusetts sites between the early 1970s and 1984 (Griffin and Melvin 1984). Piping plover surveys in the early years of the recovery effort found that counts of these cryptically colored birds sometimes went up with increased census effort, suggesting that some historic counts of piping plovers by one or a few observers may have underestimated the piping plover population. Thus, the magnitude of the species decline may have been more severe than available numbers imply.

Annual estimates of breeding pairs of Atlantic Coast piping plovers are based on multiple surveys at most occupied sites. Sites that cannot be monitored repeatedly in May and June (primarily sites with few pairs or inconsistent occupancy) are surveyed at least once during a standard nine-day count period (Hecht and Melvin 2009).

Since its 1986 listing under the ESA, the Atlantic Coast population estimate (Service 2011) has increased 234 percent, from approximately 790 pairs to an estimated 1,849 pairs in 2009, and the U.S. portion of the population has almost tripled, from approximately 550 pairs to an estimated 1,597 pairs. Even discounting apparent increases in New York, New Jersey, and North Carolina between 1986 and 1989, which likely were due in part to increased census effort (Service 1996), the population nearly doubled between 1989 and 2008. The largest population increase between 1989 and 2009 has occurred in New England (266 percent), followed by New York-New Jersey (70 percent). In the Southern (DE-MD-VA-NC) Recovery Unit, net growth between 1989 and 2009 was 52 percent, but almost all of this increase occurred in two years, 2003 to 2005. The eastern Canada population fluctuated from year to year, with increases often quickly eroded in subsequent years; net growth between 1989 and 2009 was 8 percent.

The overall population growth pattern was tempered by periodic rapid declines in the Southern and Eastern Canada Recovery Units. The eastern Canada population decreased 21 percent in just three years (2002 to 2005), and the population in the southern half of the Southern Recovery Unit declined 68 percent in seven years (1995 to 2001). The recent 64 percent decline in the Maine population, from 66 pairs in 2002 to 24 pairs in 2008, following only a few years of decreased productivity, provides another example of the continuing risk of rapid and precipitous reversals in population growth.

Status and distribution

Nonbreeding (migrating and wintering) Range

Piping plovers spend up to 10 months of their life cycle on their migration and winter grounds, generally July 15 through as late as May 15. Piping plover migration routes and habitats overlap breeding and wintering habitats, and, unless banded, migrants passing through a site usually are indistinguishable from breeding or wintering piping plovers. Migration stopovers by banded piping plovers from the Great Lakes have been documented in New Jersey, Maryland, Virginia, and North

Carolina (Stucker and Cuthbert 2006). Migrating breeders from eastern Canada have been observed in Massachusetts, New Jersey, New York, and North Carolina (Amirault et al. 2005). As many as 85 staging piping plovers have been tallied at various sites in the Atlantic breeding range (Perkins 2008 pers. communication), but the composition (e.g., adults that nested nearby and their fledged young of the year versus migrants moving to or from sites farther north), stopover duration, and local movements are unknown. Review of published records of piping plover sightings throughout North America by Pompei and Cuthbert (2004) found more than 3,400 fall and spring stopover records at 1,196 sites. Published reports indicated that piping plovers do not concentrate in large numbers at inland sites and that they seem to stop opportunistically. In most cases, reports of birds at inland sites were single individuals. In general, distance between stopover locations and duration of stopovers throughout the coastal migration range remains poorly understood.

Piping plovers migrate through and winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean. Four range-wide, mid-winter (late January to early February) population surveys, conducted at five-year intervals starting in 1991, are summarized in Table 3. Total numbers have fluctuated over time, with some areas experiencing increases and others decreases. In 2001, 2,389 piping plovers were located during a winter census, accounting for only 40 percent of the known breeding birds recorded during a breeding census (Ferland and Haig 2002). About 89 percent of birds that are known to winter in the U.S. do so along the Gulf Coast (Texas to Florida), while 8 percent winter along the Atlantic Coast (North Carolina to Florida).

Table 3. Results of the 1991, 1996, 2001, and 2006 International Piping Plover Winter Censuses (Haig et al. 2005, Elliott-Smith et al. 2009).

Location	1991	1996	2001	2006
Virginia	not surveyed (NS)	NS	NS	1
North Carolina	20	50	87	84
South Carolina	51	78	78	100
Georgia	37	124	111	212
Florida	551	375	416	454
-Atlantic	*70*	*31*	*111*	*133*
-Gulf	*481*	*344*	*305*	*321*
Alabama	12	31	30	29
Mississippi	59	27	18	78
Louisiana	750	398	511	226
Texas	1,904	1,333	1,042	2,090
Puerto Rico	0	0	6	NS
U.S. Total	3,384	2,416	2,299	3,355
Mexico	27	16	NS	76
Bahamas	29	17	35	417
Cuba	11	66	55	89
Other Caribbean Islands	0	0	0	28
GRAND TOTAL	3,451	2,515	2,389	3,884
Percent of Total International Piping Plover Breeding Census	62.9%	42.4%	40.2%	48.2%

Regional and local fluctuations may reflect the quantity and quality of suitable foraging and roosting habitat, which vary over time in response to natural coastal formation processes as well as anthropogenic habitat changes (e.g., inlet relocation, dredging of shoals and spits). See, for example,

discussions of survey number changes in Mississippi, Louisiana, and Texas by Winstead, Baka, and Cobb, respectively, *in* Elliott-Smith et al. (2009). Fluctuations may also represent localized weather conditions (especially wind) during surveys, or unequal survey coverage. For example, airboats facilitated first-time surveys of several central Texas sites in 2006 (Cobb *in* Elliott-Smith et al. 2009). Similarly, the increase in the 2006 numbers in the Bahamas is attributed to greatly increased census efforts; the extent of additional habitat not surveyed remains undetermined (Maddock and Wardle *in* Elliott-Smith et al. 2009). Changes in wintering numbers may also be influenced by growth or decline in the particular breeding populations that concentrate their wintering distribution in a given area. Major opportunities to locate previously unidentified wintering sites are concentrated in the Caribbean and Mexico (see pertinent sections in Elliott-Smith et al. 2009). Further surveys and assessment of seasonally emergent habitats (e.g., sea grass beds, mudflats, oyster reefs) within bays lying between the mainland and barrier islands in Texas are also needed.

Mid-winter surveys may substantially underestimate the abundance of nonbreeding piping plovers using a site or region during other months. In late September 2007, 104 piping plovers were counted at the south end of Ocracoke Island, North Carolina (NPS 2007), where none were seen during the 2006 International Piping Plover Winter Census (Elliott-Smith et al. 2009). Noel et al. (2007) observed up to 100 piping plovers during peak migration at Little St. Simons Island, Georgia, where approximately 40 piping plovers wintered in 2003 to 2005. Differences among fall, winter, and spring counts in South Carolina were less pronounced, but inter-year fluctuations (e.g., 108 piping plovers in spring 2007 versus 174 piping plovers in spring 2008) at 28 sites were striking (Maddock et al. 2009). Even as far south as the Florida Panhandle, monthly counts at Phipps Preserve in Franklin County ranged from a mid-winter low of four piping plovers in December 2006 to peak counts of 47 in October 2006 and March 2007 (Smith 2007). Pinkston (2004) observed much heavier use of Texas Gulf Coast (ocean-facing) beaches between early September and mid-October (approximately 16 birds per mile) than during December to March (approximately two birds per mile).

Local movements of nonbreeding piping plovers may also affect abundance estimates. At Deveaux Bank, one of South Carolina's most important piping plover sites, five counts at approximately 10-day intervals between August 27 and October 7, 2006, oscillated from 28 to 14 to 29 to 18 to 26 (Maddock et al. 2009). Noel and Chandler (2008) detected banded Great Lakes piping plovers known to be wintering on their Georgia study site in 73.8 $\pm$ 8.1 percent of surveys over three years.

Abundance estimates for nonbreeding piping plovers may also be affected by the number of surveyor visits to the site. Preliminary analysis of detection rates by Maddock et al. (2009) found 87 percent detection during the mid-winter period on core sites surveyed three times a month during fall and spring and one time per month during winter, compared with 42 percent detection on sites surveyed three times per year (Cohen 2009 pers. communication).

Gratto-Trevor et al. (2009; Figure 7) found strong patterns (but no exclusive partitioning) in winter distribution of uniquely banded piping plovers from four breeding populations. All eastern Canada and 94 percent of Great Lakes birds wintered from North Carolina to southwest Florida. However, eastern Canada birds were more heavily concentrated in North Carolina, and a larger proportion of Great Lakes piping plovers were found in South Carolina and Georgia. Northern Great Plains populations were primarily seen farther west and south, especially on the Texas Gulf Coast. Although the great majority of Prairie Canada individuals were observed in Texas, particularly southern Texas, individuals from the U.S. Great Plains were more widely distributed on the Gulf Coast from Florida to Texas.

The findings of Gratto-Trevor et al. (2009) provide evidence of differences in the wintering distribution of piping plovers from these four breeding areas. However, the distribution of birds by breeding origin during migration remains largely unknown. Other major information gaps include the wintering locations of the U.S. Atlantic Coast breeding population (banding of U.S. Atlantic Coast piping plovers has been extremely limited) and the breeding origin of piping plovers wintering on the Caribbean islands and in much of Mexico. Banded piping plovers from the Great Lakes, Northern Great Plains, and eastern Canada breeding populations showed similar patterns of seasonal abundance at Little St. Simons Island, Georgia (Noel et al. 2007). However, the number of banded plovers originating from the latter two populations was relatively small at this study area.

This species exhibits a high degree of intra- and inter-annual wintering site fidelity (Nicholls and Baldassarre 1990a; Drake et al. 2001; Noel et al. 2005; Stucker and Cuthbert 2006). Gratto-Trevor et al. (2009) reported that six of 259 banded piping plovers observed more than once per winter moved across boundaries of the seven U.S. regions. Of 216 birds observed in different years, only eight changed regions between years, and several of these shifts were associated with late summer or early spring migration periods (Gratto-Trevor et al. 2009; Figure 7).
Local movements are more common. In South Carolina, Maddock et al. (2009) documented many cross-inlet movements by wintering banded piping plovers as well as occasional movements of up to 18 km (11 miles) by approximately 10 percent of the banded population; larger movements within South Carolina were seen during fall and spring migration. Similarly, eight banded piping plovers that were observed in two locations during 2006-2007 surveys in Louisiana and Texas were all in close proximity to their original location, such as on the bay and ocean side of the same island or on adjoining islands (Maddock 2008).

The 2004 and 2005 hurricane seasons affected a substantial amount of habitat along the Gulf Coast. Habitats such as those along Gulf Islands National Seashore have benefited from increased washover events, which created optimal habitat conditions for piping plovers. Conversely, hard shoreline structures put into place following storms throughout the species range to prevent such shoreline migration prevent habitat creation. Four hurricanes between 2002 and 2005 are often cited in reference to rapid erosion of the Chandeleur Islands, a chain of low-lying islands in Louisiana where the 1991 IPPC tallied more than 350 piping plovers. Those same storms, however, created habitats such as overwash fans and sand spits on barrier islands and headlands in other portions of Louisiana. (See the Storm events section below for more details on their effects to habitat.)

The Service is aware of the following site-specific conditions that benefit several habitats piping plover use while wintering and migrating, including critical habitat units. In Texas, one critical habitat unit was afforded greater protection due to the acquisition of adjacent upland properties by the local Audubon chapter. In another unit in Texas, vehicles were removed from a portion of the beach decreasing the likelihood of automobile disturbance to plovers. Exotic plant removal that threatens to invade suitable piping plover habitat is occurring in a critical habitat unit in South Florida. The Service and other government agencies remain in a contractual agreement with the U.S. Department of Agriculture (USDA) for predator control within limited coastal areas in the Florida panhandle, including portions of some critical habitat units. Continued removal of potential terrestrial predators is likely to enhance survivorship of wintering and migrating piping plovers. In North Carolina, one critical habitat unit was afforded greater protection when the local Audubon chapter agreed to manage the area specifically for piping plovers and other shorebirds following the relocation of the nearby inlet channel.

Recovery criteria

Northern Great Plains Population (Service 1988, 1994)

1. Increase the number of birds in the U.S. northern Great Plains states to 2,300 pairs (Service 1994).
2. Increase the number of birds in the prairie region of Canada to 2,500 adult piping plovers (Service 1988).
3. Secure long term protection of essential breeding and wintering habitat (Service 1994).

Great Lakes Population (Service 2003)

1. At least 150 pairs (300 individuals), for at least 5 consecutive years, with at least 100 breeding pairs (200 individuals) in Michigan and 50 breeding pairs (100 individuals) distributed among sites in other Great Lakes states.
2. Five-year average fecundity within the range of 1.5-2.0 fledglings per pair, per year, across the breeding distribution, and ten-year population projections indicate the population is stable or continuing to grow above the recovery goal.
3. Protection and long-term maintenance of essential breeding and wintering habitat is ensured, sufficient in quantity, quality, and distribution to support the recovery goal of 150 pairs (300 individuals).
4. Genetic diversity within the population is deemed adequate for population persistence and can be maintained over the long-term.
5. Agreements and funding mechanisms are in place for long-term protection and management activities in essential breeding and wintering habitat.

Atlantic Coast Population (Service 1996)

1. Increase and maintain for 5 years a total of 2,000 breeding pairs, distributed among 4 recovery units.

Recovery Unit	Minimum Subpopulation
Atlantic (eastern) Canada	400 pairs
New England	625 pairs
New York-New Jersey	575 pairs
Southern (DE-MD-VA-NC)	400 pairs

2. Verify the adequacy of a 2,000 pair population of piping plovers to maintain heterozygosity and allelic diversity over the long term.
3. Achieve a 5-year average productivity of 1.5 fledged chicks per pair in each of the 4 recovery units described in criterion 1, based on data from sites that collectively support at least 90 percent of the recover unit's population.
4. Institute long-term agreements to assure protection and management sufficient to maintain the population targets and average productivity in each recovery unit.
5. Ensure long-term maintenance of wintering habitat, sufficient in quantity, quality, and distribution to maintain survival rates for a 2,000-pair population.

Threats to piping plovers/critical habitat

In the following sections, we provide an analysis of threats to piping plovers in their migration and wintering range. We update information obtained since the 1985 listing rule, the 1991 and 2009 status reviews, and the three breeding population recovery plans. Both previously identified and new threats are discussed. With minor exceptions, this analysis is focused on threats to piping plovers within the

continental U.S. portion of their migration and wintering range. Threats in the Caribbean and Mexico remain largely unknown.

Present or threatened destruction, modification, or curtailment of its habitat or range

The status of piping plovers on winter and migration grounds is difficult to assess, but threats to piping plover habitat used during winter and migration (identified by the Service during its designation of critical habitat) continue to affect the species. Unregulated motorized and pedestrian recreational use, inlet and shoreline stabilization projects, beach maintenance and nourishment, and pollution affect most winter and migration areas. Conservation efforts at some locations have likely resulted in the enhancement of wintering habitat.

The 1985 final listing rule stated that the number of piping plovers on the Gulf of Mexico coastal wintering grounds might be declining as indicated by preliminary analysis of Christmas Bird Count data. Independent counts of piping plovers on the Alabama coast indicated a decline in numbers between the 1950s and early 1980s. At the time of listing, the Texas Parks and Wildlife Department stated that 30 percent of wintering habitat in Texas had been lost over the previous 20 years. The final rule also stated that in addition to extensive breeding area problems, the loss and modification of wintering habitat was a significant threat to the piping plover.

The three recovery plans state that shoreline development throughout the wintering range poses a threat to all populations of piping plovers. The plans further state that beach maintenance and nourishment, inlet dredging, and artificial structures, such as jetties and groins, could eliminate wintering areas and alter sedimentation patterns leading to the loss of nearby habitat. Priority 1 actions in the 1996 Atlantic Coast and 2003 Great Lakes Recovery Plans identify tasks to protect natural processes that maintain coastal ecosystems and quality wintering piping plover habitat and to protect wintering habitat from shoreline stabilization and navigation projects. The 1988 Northern Great Plains Recovery Plan states that, as winter habitat is identified, current and potential threats to each site should be determined.

Important components of ecologically sound barrier beach management include perpetuation of natural dynamic coastal formation processes. Structural development along the shoreline or manipulation of natural inlets upsets the dynamic processes and results in habitat loss or degradation (Melvin et al. 1991). Throughout the range of migrating and wintering piping plovers, inlet and shoreline stabilization, inlet dredging, beach maintenance and nourishment activities, and seawall installations continue to constrain natural coastal processes. Dredging of inlets can affect spit formation adjacent to inlets and directly remove or affect ebb and flood tidal shoal formation. Jetties, which stabilize an island, cause island widening and subsequent growth of vegetation on inlet shores. Seawalls restrict natural island movement and exacerbate erosion. As discussed in more detail below, all these efforts result in loss of piping plover habitat. Construction of these projects during months when piping plovers are present also causes disturbance that disrupts the birds' foraging efficiency and hinders their ability to build fat reserves over the winter and in preparation for migration, as well as their recuperation from migratory flights. Additional investigation is needed to determine the extent to which these factors cumulatively affect piping plover survival and how they may impede conservation efforts for the species.

Any assessment of threats to piping plovers from loss and degradation of habitat must recognize that up to 24 shorebird species migrate or winter along the Atlantic Coast and almost 40 species of shorebirds are present during migration and wintering periods in the Gulf of Mexico region (Helmers

1992). Continual degradation and loss of habitats used by wintering and migrating shorebirds may cause an increase in intra-specific and inter-specific competition for remaining food supplies and roosting habitats. In Florida, for example, approximately 825 miles of coastline and parallel bayside flats (unspecified amount) were present prior to the advent of high human densities and beach stabilization projects. We estimate that only about 35 percent of the Florida coastline continues to support natural coastal formation processes, thereby concentrating foraging and roosting opportunities for all shorebird species and forcing some individuals into suboptimal habitats. Thus, intra- and inter-specific competition most likely exacerbates threats from habitat loss and degradation.

Sand placement projects

In the wake of episodic storm events, managers of lands under public, private, and county ownership often protect coastal structures using emergency storm berms; this is frequently followed by beach nourishment or renourishment activities (nourishment projects are considered "soft" stabilization versus "hard" stabilization such as seawalls). Berm placement and beach nourishment deposit substantial amounts of sand along Gulf of Mexico and Atlantic beaches to protect local property in anticipation of preventing erosion and what otherwise will be considered natural processes of overwash and island migration (Schmitt and Haines 2003). On unpopulated islands, the addition of sand and creation of marsh are sometimes used to counteract the loss of roosting and nesting habitat for shorebirds and wading birds as a result of erosional storm events.

Past and ongoing stabilization projects may fundamentally alter the naturally dynamic coastal processes that create and maintain beach strand and bayside habitats, including those habitat components that piping plovers rely upon. Although impacts may vary depending on a range of factors, stabilization projects may directly degrade or destroy piping plover roosting and foraging habitat in several ways. Front beach habitat may be used to construct an artificial berm that is densely planted in grass, which can directly reduce the availability of roosting habitat. Over time, if the beach narrows due to erosion, additional roosting habitat between the berm and the water can be lost. Berms can also prevent or reduce the natural overwash that creates roosting habitats by converting vegetated areas to open sand areas. The vegetation growth caused by impeding natural overwash can also reduce the maintenance and creation of bayside intertidal feeding habitats. In addition, stabilization projects may indirectly encourage further development of coastal areas and increase the threat of disturbance.

At least 668 of 2,340 coastal shoreline miles (29 percent of beaches throughout the piping plover winter and migration range in the U.S.) are bermed, nourished, or renourished, generally for recreational purposes and to protect commercial and private infrastructure (Table 4, next page). However, only approximately 54 miles or 2.31 percent of these impacts have occurred within critical habitat.

Table 4. Summary of the extent of nourished beaches in piping plover wintering and migrating habitat within the conterminous United States. Data extracted from Service unpublished data (project files, gray literature, and field observations) as of 2009.

State	Sandy beach shoreline miles available	Sandy beach shoreline miles nourished to date (within CH[g] units)	Percent of sandy beach shoreline affected (within CH[g] units)
North Carolina	301[a]	117[e] (unknown)	39 (unknown)
South Carolina	187[a]	56 (0.6)	30 (0.32))
Georgia	100[a]	8 (0.4)	8 (0.40)
Florida	825[b]	404 (6)[f]	49 (0.72)
Alabama	53[a]	12 (2)	23 (3.77)
Mississippi	110[c]	≥6 (0)	5 (0)
Louisiana	397[a]	Unquantified (generally restoration-oriented)	Unknown
Texas	367[d]	65 (45)	18 (12.26)
Overall Total	2,340 (does not include Louisiana)	≥668 does not include Louisiana (54 in CH)	29% (≥2.31% in CH)

(a) Data from www.50states.com; (b) Clark 1993; (c) N. Winstead, Mississippi Museum of Natural Science, in litt. 2008; (d) www.Surfrider.org; (e) H. Hall, Service, pers. comm. 2009; (f) Partial data from Lott et al. (2007 in review); (g) CH = critical habitat.

In Louisiana, the sustainability of the coastal ecosystem is threatened by the inability of the barrier islands to maintain geomorphologic functionality (Corps 2010). Consequently, most of the planned sediment placement projects are conducted as environmental restoration projects by various Federal and State agencies because without the sediment many areas would erode below sea level since the Louisiana coastal systems are starved for sediment sources. Agencies conducting coastal restoration projects aim to design projects that mimic the natural existing elevations of coastal habitats (e.g., beach, dune, and marsh) in order to allow their projects to work within and be sustained by the natural ecosystem processes that maintain those coastal habitats. Due to the low elevation of barrier islands and coastal headlands, placement of additional sediment in those areas generally does not reach an elevation that would prevent the formation of washover areas or impede natural coastal processes, especially during storm events. Such careful design of these restoration projects allows daily tidal processes or storm events to re-work the sediments to reform the Gulf/beach interface and create washover areas, sand flats, and mud flats on the bay-side of the islands, as well as sand spits on the ends of the islands; thus, the added sediment aids in sustaining the barrier island system.

Sediment placement also temporarily affects the benthic fauna found in intertidal systems by covering them with a layer of sediment. Some benthic species can burrow through a thin layer (varies from 15 to 35 inches for different species) of additional sediment since they are adapted to the turbulent environment of the intertidal zone; however, thicker layers (i.e., greater than 40 inches) of sediment are likely to smother the benthic fauna (Greene 2002). Various studies of such effects indicate that the recovery of benthic fauna after beach renourishment or sediment placement can take anywhere from 6 months to 2 years (Rakocinski et al. 1996; Peterson et al. 2000; Peterson et al. 2006). Such delayed recovery of benthic prey species temporarily affects the quality of piping plover foraging habitat.

Inlet stabilization/relocation

Many navigable mainland or barrier island tidal inlets along the Atlantic and Gulf of Mexico coasts are stabilized with jetties, groins, or by seawalls and/or adjacent industrial or residential development. Jetties are structures built perpendicular to the shoreline that extend through the entire nearshore zone and past the breaker zone to prevent or decrease sand deposition in the channel (Hayes and Michel 2008). Inlet stabilization with rock jetties and associated channel dredging for navigation alter the dynamics of long-shore sediment transport and affect the location and movement rate of barrier islands (Camfield and Holmes 1995), typically causing down-drift erosion. Sediment is then dredged and added back to the islands which are subsequently widened. Once the island becomes stabilized, vegetation encroaches on the bayside habitat, thereby diminishing and eventually destroying its value to piping plovers. Accelerated erosion may compound future habitat loss, depending on the degree of sea-level rise. Unstabilized inlets naturally migrate, re-forming important habitat components, whereas jetties often trap sand and cause significant erosion of the down-drift shoreline. These combined actions affect the availability of piping plover habitat (Cohen et al. 2008b).

Using Google Earth© (accessed April 2009), Service biologists visually estimated the number of navigable mainland or barrier island tidal inlets throughout the wintering range of the piping plover in the conterminous U.S. that have some form of hardened structure. This includes seawalls or adjacent development, which lock the inlets in place (Table 5).

Table 5. Visually estimated numbers of navigable mainland and barrier island inlets and hardened inlets by state.

State	Number of navigable mainland and barrier island inlets	Number of hardened inlets	Percent of inlets affected
North Carolina	20	2.5*	12.5%
South Carolina	34	3.5*	10.3%
Georgia	26	2	7.7%
Florida	82	41	50%
Alabama	14	6	42.9%
Mississippi	16	7	43.8%
Louisiana	40	9	22.5%
Texas	17	10	58.8%
Overall Total	249	81	32.5%

*An inlet at the state line is considered to be half an inlet counted in each state.

Tidal inlet relocation can cause loss and/or degradation of piping plover habitat; although less permanent than construction of hard structures, effects can persist for years. For example, a project on Kiawah Island, South Carolina, degraded one of the most important piping plover habitats in the State by reducing the size and physical characteristics of an active foraging site, changing the composition of the benthic community, decreasing the tidal lag in an adjacent tidal lagoon, and decreasing the exposure time of the associated sand flats (Service and Town of Kiawah Island 2006). In 2006, pre-project piping plover numbers in the project area recorded during four surveys conducted at low tide averaged 13.5 piping plovers. This contrasts with a post-project average of 7.1 plovers during eight surveys (four in 2007 and four in 2008) conducted during the same months (Service and Town of Kiawah Island 2006), indicating that habitat quality was reduced. Service biologists are aware of at

least seven inlet relocation projects (two in North Carolina, three in South Carolina, two in Florida), but this number likely under-represents the extent of this activity.

Sand mining/dredging

Sand mining, the practice of extracting (dredging) sand from sand bars, shoals, and inlets in the nearshore zone, is a less expensive source of sand than obtaining sand from offshore shoals for beach nourishment. Sand bars and shoals are sand sources that move onshore over time and act as natural breakwaters. Inlet dredging reduces the formation of exposed ebb and flood tidal shoals considered to be primary or optimal piping plover roosting and foraging habitat. Removing these sand sources can alter depth contours and change wave refraction as well as cause localized erosion (Hayes and Michel 2008). Exposed shoals and sandbars are also valuable to piping plovers, as they tend to receive less human recreational use (because they are only accessible by boat) and therefore provide relatively less disturbed habitats for birds. We do not have a good estimate of the amount of sand mining that occurs across the piping plover wintering range, nor do we have a good estimate of the number of inlet dredging projects that occur. This number is likely greater than the number of total jettied inlets shown in Table 5, since most jettied inlets need maintenance dredging, but non-hardened inlets are often dredged as well.

Groins

Groins (structures made of concrete, rip rap, wood, or metal built perpendicular to the beach in order to trap sand) are typically found on developed beaches with severe erosion. Although groins can be individual structures, they are often clustered along the shoreline. Groins can act as barriers to long-shore sand transport and cause down-drift erosion (Hayes and Michel 2008), which prevents piping plover habitat creation by limiting sediment deposition and accretion. These structures are found throughout the southeastern Atlantic Coast, and although most were in place prior to the piping plover's 1986 listing under the Act, installation of new groins continues to occur.

Seawalls and revetments

Seawalls and revetments are vertical hard structures built parallel to the beach in front of buildings, roads, and other facilities to protect them from erosion. However, these structures often accelerate erosion by causing scouring in front of and down-drift from the structure (Hayes and Michel 2008), which can eliminate intertidal foraging habitat and adjacent roosting habitat. Physical characteristics that determine microhabitats and biological communities can be altered after installation of a seawall or revetment, thereby depleting or changing composition of benthic communities that serve as the prey base for piping plovers. At four California study sites, each comprised of an unarmored segment and a segment seaward of a seawall, Dugan and Hubbard (2006) found that armored segments had narrower intertidal zones, smaller standing crops of macrophyte wrack, and lower shorebird abundance and species richness. Geotubes (long cylindrical bags made of high-strength permeable fabric and filled with sand) are softer alternatives, but act as barriers by preventing overwash. We did not find any sources that summarize the linear extent of seawall, revetment, and geotube installation projects that have occurred across the piping plover's wintering and migration habitat.

Exotic/invasive vegetation

A recently identified threat to piping plover habitat, not described in the listing rule or recovery plans, is the spread of coastal invasive plants into suitable piping plover habitat. Like most invasive species,

coastal exotic plants reproduce and spread quickly and exhibit dense growth habits, often outcompeting native plant species. If left uncontrolled, invasive plants cause a habitat shift from open or sparsely vegetated sand to dense vegetation, resulting in the loss or degradation of piping plover roosting habitat, which is especially important during high tides and migration periods.

Beach vitex (*Vitex rotundifolia*) is a woody vine introduced into the southeastern U.S. as a dune stabilization and ornamental plant (Westbrooks and Madsen 2006). It currently occupies a very small percentage of its potential range in the U.S.; however, it is expected to grow well in coastal communities throughout the southeastern U.S. from Virginia to Florida, and west to Texas (Westbrooks and Madsen 2006). In 2003, the plant was documented in New Hanover, Pender, and Onslow counties in North Carolina, and at 125 sites in Horry, Georgetown, and Charleston counties in South Carolina. One Chesapeake Bay site in Virginia was eradicated, and another site on Jekyll Island, Georgia, is about 95 percent controlled (Suiter 2009 pers. communication). Beach vitex has been documented from two locations in northwest Florida, but one site disappeared after erosional storm events. The landowner of the other site has indicated an intention to eradicate the plant, but follow through is unknown (Farley 2009 pers. communication). The task forces formed in North and South Carolina in 2004 and 2005 have made great strides to remove this plant from their coasts. To date, about 200 sites in North Carolina have been treated, with 200 additional sites in need of treatment. Similar efforts are underway in South Carolina.
Unquantified amounts of crowfoot grass (*Dactyloctenium aegyptium*) grow invasively along portions of the Florida coastline. It forms thick bunches or mats that may change the vegetative structure of coastal plant communities and alter shorebird habitat. The Australian pine (*Casuarina equisetifolia*) also changes the vegetative structure of the coastal community in south Florida and islands within the Bahamas. Shorebirds prefer foraging in open areas where they are able to see potential predators, and tall trees provide good perches for avian predators. Australian pines potentially impact shorebirds, including the piping plover, by reducing attractiveness of foraging habitat and/or increasing avian predation.

The propensity of these exotic species to spread, and their tenacity once established, make them a persistent threat, partially countered by increasing landowner awareness and willingness to undertake eradication activities.

Wrack removal and beach cleaning

Wrack on beaches and baysides provides important foraging and roosting habitat for piping plovers (Drake 1999a; Smith 2007; Maddock et al. 2009; Lott et al. 2009) and many other shorebirds on their winter, breeding, and migration grounds. Because shorebird numbers are positively correlated with wrack cover and biomass of their invertebrate prey that feed on wrack (Tarr and Tarr 1987; Hubbard and Dugan 2003; Dugan et al. 2003), beach grooming will lower bird numbers (Defeo et al. 2009).

There is increasing popularity along developed beaches in the Southeast, especially in Florida, for beach communities to carry out "beach cleaning" and "beach raking" actions. Beach cleaning occurs on private beaches, where piping plover use is not well documented, and on some municipal or county beaches that are used by piping plovers. Most wrack removal on state and federal lands is limited to post-storm cleanup and does not occur regularly.

Man-made beach cleaning and raking machines effectively remove seaweed, fish, glass, syringes, plastic, cans, cigarettes, shells, stone, wood, and virtually any unwanted debris (Barber Beach Cleaning Equipment 2009). These efforts remove accumulated wrack, topographic depressions, and sparse

vegetation nodes used by roosting and foraging piping plovers. Removal of wrack also eliminates a beach's natural sand-trapping abilities, further destabilizing the beach. In addition, sand adhering to seaweed and trapped in the cracks and crevices of wrack is removed from the beach. Although the amount of sand lost due to single sweeping actions may be small, it adds up considerably over a period of years (Nordstrom et al. 2006; Neal et al. 2007). Beach cleaning or grooming can result in abnormally broad unvegetated zones that are inhospitable to dune formation or plant colonization, thereby enhancing the likelihood of erosion (Defeo et al. 2009).

Currently, the Florida Department of Environmental Protection's Beaches and Coastal Management Systems section has issued 117 permits for beach raking or cleaning to multiple entities. We estimate that 240 of 825 miles (29 percent) of sandy beach shoreline in Florida are cleaned or raked on various schedules (i.e., daily, weekly, monthly) (FDEP 2008). Service biologists estimate that South Carolina mechanically cleans approximately 34 of its 187 shoreline miles (18 percent), and Texas mechanically cleans approximately 20 of its 367 shoreline miles (5.4 percent). In Louisiana, beach raking occasionally occurs on Grand Isle (the state's only inhabited island) along approximately 8 miles of shoreline, roughly 2 percent of the state's 397 sandy shoreline miles. We are not aware of what percentage of mechanical cleaning occurs elsewhere in piping plover critical habitat.

Tilling beaches to reduce soil compaction, as sometimes required by the Service for sea turtle protection after beach nourishment activities, also has similar impacts. Recently, the Service improved sea turtle protection provisions in Florida; these provisions now require tilling, when needed, to be above the primary wrack line, not within it.

Disease

Neither the final listing rule nor the recovery plans state that disease is an issue for the species, and no plan assigns recovery actions to this threat factor. Based on information available to date, West Nile virus and avian influenza are a minor threat to piping plovers (Service 2009a).

Predation

The impact of predation on migrating or wintering piping plovers remains largely undocumented. Except for one incident reported in 2007 by the New York Times involving a cat in Texas, no depredation of piping plovers during winter or migration has been noted, although it would be difficult to document. Avian and mammalian predators are common throughout the species' wintering range. Predatory birds are relatively common during fall and spring migration, and it is possible that raptors occasionally take piping plovers (Drake et al. 2001). It has been noted, however, that the behavioral response of crouching when in the presence of avian predators may minimize avian predation on piping plovers (Morrier and McNeil 1991; Drake 1999a; Drake et al. 2001).

The 1996 Atlantic Coast Recovery Plan summarized evidence that human activities affect types, numbers, and activity patterns of some predators, thereby exacerbating natural predation on breeding piping plovers. Nonbreeding piping plovers may reap some collateral benefits from predator management conducted for the primary benefit of other species. In 1997, the USDA implemented a public lands predator control partnership in northwest Florida that included the Department of Defense, National Park Service (NPS), the State of Florida (state park lands) and Service (National Wildlife Refuges and Ecological Services). The program continues with all partners except Florida – in 2008, lack of funding precluded inclusion of Florida state lands (although Florida Department of

Environmental Protection staff conduct occasional predator trapping on state lands, trapping is not implemented consistently).

The NPS and individual state park staff in North Carolina participate in predator control programs (Rabon 2009 pers. communication). The Service issued permit conditions for raccoon eradication to Indian River County staff in Florida as part of a coastal Habitat Conservation Plan (Adams 2009 pers. communication). Destruction of turtle nests by dogs or coyotes in the Indian River area justified the need to amend the permit to include an education program targeting dog owners regarding the appropriate means to reduce impacts to coastal species caused by their pets. The Service partnered with Texas Audubon and the Coastal Bend Bays and Estuaries Program in Texas to implement predator control efforts on colonial waterbird nesting islands (Cobb 2009 pers. communication). Some of these predator control programs may provide very limited protection to piping plovers, should they use these areas for roosting or foraging. Table 6 summarizes predator control actions on a state-by-state basis. The Service is not aware of any current predator control programs targeting protection of coastal species in Georgia, Alabama, Mississippi, or Louisiana.

Regarding predation, the magnitude of this threat to nonbreeding piping plovers remains unknown, but given the pervasive, persistent, and serious impacts of predation on other coastal reliant species, it remains a potential threat. Focused research to confirm impacts as well as to ascertain effectiveness of predator control programs may be warranted, especially in areas frequented by Great Lakes birds during migration and wintering months. We consider predator control on their wintering and migration grounds to be a low priority at this time.[5]

Table 6. Summary of predator control programs that may benefit piping plovers on winter and migration grounds (as of 2009).

State	Entities with Predator Control Programs
North Carolina	State Parks, Cape Lookout and Cape Hatteras National Seashores.
South Carolina	As needed throughout the state, targets raccoons and coyotes.
Georgia	No programs known.
Florida	Merritt Island NWR, Cape Canaveral AFS, Indian River County, Eglin AFB, Gulf Islands NS, northwest Florida state parks (up until 2008), St. Vincent NWR, Tyndall AFB.
Alabama	Late 1990's Gulf State Park and Orange Beach for beach mice, no current programs known.
Mississippi	No programs known.
Louisiana	No programs known.
Texas	Aransas NWR (hog control for habitat protection), Audubon (mammalian predator control on colonial waterbird islands that have occasional piping plover use).

[5] The threat of direct predation should be distinguished from the threat of disturbance to roosting and feeding piping plovers posed by dogs off leash.

Recreational disturbance

Intense human disturbance in shorebird winter habitat can be functionally equivalent to habitat loss if the disturbance prevents birds from using an area (Goss-Custard et al. 1996), which can lead to roost abandonment and local population declines (Burton et al. 1996). Pfister et al. (1992) implicate anthropogenic disturbance as a factor in the long-term decline of migrating shorebirds at staging areas. Disturbance (i.e., human and pet presence that alters bird behavior) disrupts piping plovers as well as other shorebird species. Disturbance can cause shorebirds to spend less time roosting or foraging and more time in alert postures or fleeing from the disturbances (Johnson and Baldassarre 1988; Burger 1991; Burger 1994; Elliott and Teas 1996; Lafferty 2001a, 2001b; Thomas et al. 2002), which limits the local abundance of piping plovers (Zonick and Ryan 1995; Zonick 2000). Shorebirds that are repeatedly flushed in response to disturbance expend energy on costly short flights (Nudds and Bryant 2000).

Shorebirds are more likely to flush from the presence of dogs than people, and birds react to dogs from farther distances than people (Lafferty 2001a, 2001b; Thomas et al. 2002). Dogs off leash are more likely to flush piping plovers from farther distances than are dogs on leash; nonetheless, dogs both on and off leashes disturb piping plovers (Hoopes 1993). Pedestrians walking with dogs often go through flocks of foraging and roosting shorebirds; some even encourage their dogs to chase birds.

Off-road vehicles can significantly degrade piping plover habitat (Wheeler 1979) or disrupt the birds' normal behavior patterns (Zonick 2000). The 1996 Atlantic Coast Recovery Plan cites tire ruts crushing wrack into the sand, making it unavailable as cover or as foraging substrate (Hoopes 1993; Goldin 1993). The plan also notes that the magnitude of the threat from off-road vehicles is particularly significant, because vehicles extend impacts to remote stretches of beach where human disturbance will otherwise be very slight. Godfrey et al. (1978, 1980 as cited *in* Lamont et al. 1997) postulated that vehicular traffic along the beach may compact the substrate and kill marine invertebrates that are food for the piping plover. Zonick (2000) found that the density of off-road vehicles negatively correlated with abundance of roosting piping plovers on the ocean beach. Cohen et al. (2008a) found that radio-tagged piping plovers using ocean beach habitat at Oregon Inlet in North Carolina were far less likely to use the north side of the inlet where off-road vehicle use is allowed, and recommended controlled management experiments to determine if recreational disturbance drives roost site selection. Ninety-six percent of piping plover detections was on the south side of the inlet even though it was farther away from foraging sites (1.8 km from the sound side foraging site to the north side of the inlet versus 0.4 km from the sound side foraging site to the north side of the inlet (Cohen et al. 2008a).

Based on surveys with land managers and biologists, knowledge of local site conditions, and other information, the Service has estimated the levels of eight types of disturbance at sites in the U.S. with wintering piping plovers. Table 7 (next page) summarizes the disturbance analysis results (Service 2009b). Data are not available on human disturbance at wintering sites in the Bahamas, other Caribbean countries, or Mexico. There are few areas used by wintering piping plovers that are devoid of human presence, and just under half have leashed and unleashed dog presence (Smith 2007; Lott et al. 2009, Service unpublished data 2009; Maddock and Bimbi unpublished data).

Table 7. Percent of known piping plover winter and migration habitat locations, by state, where various types of anthropogenic disturbance have been reported.

	Percent by State							
Disturbance Type	AL	FL	GA	LA	MS	NC	SC	TX
Pedestrians	67	92	94	25	100	100	88	54
Dogs on leash	67	69	31	25	73	94	25	25
Dogs off leash	67	81	19	25	73	94	66	46
Bikes	0	19	63	25	0	0	28	19
ATVs[a]	0	35	0	25	0	17	25	30
ORVs[b]	0	21	0	25	0	50	31	38
Boats	33	65	100	100	0	78	63	44
Kite surfing	0	10	0	0	0	33	0	0

(a) ATV = all terrain vehicle; (b) ORV = off-road vehicle

Although the timing, frequency, and duration of human and dog presence throughout the wintering range are unknown, studies in Alabama and South Carolina suggest that most disturbances to piping plovers occurs during periods of warmer weather, which coincides with piping plover migration (Johnson and Baldassarre 1988; Lott et al. 2009; Maddock et al. 2009). Smith (2007) documents varying disturbance levels throughout the nonbreeding season at northwest Florida sites.

LeDee et al. (2010) collected survey responses in 2007 from 35 managers (located in seven states) at sites that were designated as critical habitat for wintering piping plovers. Ownership included federal, state, and local governmental agencies and non-governmental organizations managing national wildlife refuges; national, state, county, and municipal parks; state and estuarine research reserves; state preserves; state wildlife management areas; and other types of managed lands. Of 43 reporting sites, 88 percent allowed public beach access year-round and four sites were closed to the public. Sixty-two percent of site managers reported greater than 10,000 visitors from September through March, and 31 percent reported greater than 100,000 visitors. Restrictions on visitor activities on the beach included automobiles (at 81 percent of sites), all-terrain vehicles (89 percent), and dogs during the winter season (50 percent). Half of the survey respondents reported funding as a primary limitation in managing piping plovers and other threatened and endangered species at their sites. Other limitations included "human resource capacity" (24 percent), conflicting management priorities (12 percent), and lack of research (3 percent).

Disturbance can be addressed by implementing recreational management techniques such as vehicle and pet restrictions and symbolic fencing (usually sign posts and string) of roosting and feeding habitats. In implementing conservation measures, managers need to consider a range of site-specific factors, including the extent and quality of roosting and feeding habitats and the types and intensity of recreational use patterns. In addition, educational materials such as informational signs or brochures can provide valuable information so that the public understands the need for conservation measures.

In summary, although there is some variability among states, disturbance from human beach recreation and pets poses a moderate to high and escalating threat to migrating and wintering piping plovers. Systematic review of recreation policy and beach management across the nonbreeding range will assist in better understanding cumulative impacts. Site-specific analysis and implementation of conservation measures should be a high priority at piping plover sites that have moderate or high levels of disturbance. The Service and state wildlife agencies should increase technical assistance to land managers to implement management strategies and monitor their effectiveness.

Military Actions

Twelve coastal military bases are located in the Southeast. To date, five bases have consulted with the Service under section 7 of the Act, on military activities on beaches and baysides that may affect piping plovers or their habitat (Table 8). Camp Lejeune in North Carolina consulted formally with the Service in 2002 on troop activities, dune stabilization efforts, and recreational use of Onslow Beach. The permit conditions require twice-monthly piping plover surveys and use of buffer zones and work restrictions within buffer zones. Naval Station Mayport in Duval County, Florida, consulted with the Service on Marine Corps training activities that included beach exercises and use of amphibious assault vehicles. The area of impact was not considered optimal for piping plovers, and the consultation was concluded informally. Similar informal consultations have occurred with Tyndall Air Force Base (Bay County) and Eglin Air Force Base (Okaloosa and Santa Rosa counties) in northwest Florida. Both consultations dealt with occasional use of motorized equipment on the beaches and associated baysides. Tyndall Air Force Base has minimal on-the-ground use, and activities, when conducted, occur on the Gulf of Mexico beach, which is not considered the optimal area for piping plovers within this region. Eglin Air Force Base conducts bi-monthly surveys for piping plovers, and habitats consistently documented with piping plover use are posted with avoidance requirements to minimize direct disturbance from troop activities. A 2001 consultation with the Navy for one-time training and retraction operations on Peveto Beach, in Cameron Parish, Louisiana, concluded informally.

Table 8. Military bases that occur within the wintering/migration range of piping plovers and contain piping plover habitat.

State	Coastal Military Bases
North Carolina	Camp Lejeune*
South Carolina	No coastal beach bases
Georgia	Kings Bay Naval Base
Florida	Key West Base, Naval Station Mayport*, Cape Canaveral Air Force Station, Patrick AFB, MacDill AFB, Eglin AFB*, Tyndall AFB*
Alabama	No coastal beach bases
Mississippi	Keesler AFB
Louisiana	No coastal beach bases
Texas	Corpus Christi Naval Air Station

*Bases which conduct activities that may affect piping plovers or their habitat.

Overall, project avoidance and minimization actions currently reduce threats from military activities to wintering and migrating piping plovers to a minimal threat level. However, prior to removal of the piping plover from protection under the Act, Integrated Resource Management Plans or other agreements should clarify if and how a change in legal status would affect plover protections.

Contaminants

Contaminants have the potential to cause direct toxicity to individual birds or negatively affect their invertebrate prey base (Rattner and Ackerson 2008). Depending on the type and degree of contact, contaminants can have lethal and sub-lethal effects on birds, including behavioral impairment, deformities, and impaired reproduction (Rand and Petrocelli 1985; Gilbertson et al. 1991; Hoffman et al. 1996).

The Great Lakes Recovery Plan states that concentration levels of polychlorinated biphenol (PCB) detected in Michigan piping plover eggs have the potential to cause reproductive harm. They further state that analysis of prey available to piping plovers at representative Michigan breeding sites indicated that breeding areas along the upper Great Lakes region are not likely the major source of contaminants to this population.

Petroleum products are the contaminants of primary concern, as opportunities exist for petroleum to pollute intertidal habitats that provide foraging substrate. Impacts to piping plovers from oil spills have been documented throughout their life cycle (Chapman 1984; Service 1996; Burger 1997; Massachusetts Audubon 2003; Amirault-Langlais et al. 2007; Amos 2009 pers. communication). This threat persists due to the high volume of shipping vessels (from which most documented spills have originated) traveling offshore and within connected bays along the Atlantic Coast and the Gulf of Mexico. Additional risks exist for leaks or spills from offshore oil rigs, associated undersea pipelines, and onshore facilities such as petroleum refineries and petrochemical plants. Beach-stranded 55-gallon barrels and smaller containers, which may fall from moving cargo ships or offshore rigs and are not uncommon on the Texas coast, contain primarily oil products (gasoline or diesel), as well as other chemicals such as methanol, paint, organochlorine pesticides, and detergents (Lee 2009 pers. communication). Federal and state land managers have protective provisions in place to secure and remove the barrels, thus reducing the likelihood of contamination.

Lightly oiled piping plovers have survived and successfully reproduced (Chapman 1984; Amirault-Langlais et al. 2007; Amos pers. comm. 2009). Chapman (1984) noted shifts in habitat use as piping plovers moved out of spill areas. This behavioral change was believed to be related to the demonstrated decline in benthic infauna (prey items) in the intertidal zone and may have decreased the direct impact to the species. To date, no plover mortality has been attributed to oil contamination outside the breeding grounds, but latent effects would be difficult to prove.

Deepwater Horizon Mississippi Canyon Well #252 Oil Spill

The Deepwater Horizon Mississippi Canyon Well #252 oil spill, which started April 20, 2010, discharged into the Gulf of Mexico through July 15, 2010. According to government estimates, the leak released between 100 and 200 million gallons of oil into the Gulf of Mexico due to the Deepwater Horizon accident. The U.S. Coast Guard (USCG) estimates that more than 50 million gallons of oil have been removed from the Gulf, or roughly a quarter of the spill amount. Additional impacts to natural resources may also be attributed to the 1.84 million gallons of dispersant that were utilized during the spill. The USCG, the states, and responsible parties that form the Unified Area Command (with advice from federal and state natural resource agencies) initiated protective measures and clean-up efforts per prepared contingency plans to deal with petroleum and other hazardous chemical spills for each state's coastline. The contingency plans identify sensitive habitats, including all federally listed species' habitats, which receive a higher priority for response actions. Those plans allow for immediate habitat protective measures for clean-up activities in response to large contaminant spills. While such plans usually ameliorate the threat to piping plovers, they will not likely provide much improvement in this case given the breadth of the impacts associated with the Deepwater Horizon incident.

As of October 6, 2010, approximately 104 miles of Gulf of Mexico shoreline were affected by moderate to heavy oil (approximately 95 miles in Louisiana, 9 miles in Mississippi, and 1 mile in Florida) and approximately 485 miles of shoreline were affected by light to trace amounts of oil (approximately 224 miles in Louisiana, 81 miles in Mississippi, 60 miles in Alabama, and 114 miles in

Florida) (October 6, 2010, Unified Area Command Weekly Update, www.RestoreTheGulf.gov). Those numbers reflect a daily snapshot of shoreline experiencing impacts from oil; they do not include cumulative impacts to date, or shoreline that has already been cleaned. The Operational Science Advisory Team (OSAT-2) of the Gulf Coast Incident Management Team published the *Summary Report for Fate and Effects of Remnant Oil Remaining in the Beach Environment* on February 10, 2011. The OSAT-2 report indicates that:

> "Much of the oil residue on and near the shoreline has been cleaned during the Response phase of the oil spill. As the Gulf shoreline is a dynamic environment, oil residue that is uncovered or moved onto beaches (for example, tar residue balls) will continue to be removed as part of the Monitoring and Maintenance phase of the recovery. Three types of located oil residue were identified as particularly challenging, or potentially damaging to the environment if removed. These three types are the following: supratidal buried oil (SBO), small surface residual balls (SSRBs), and surf zone submerged oil mats (SOM). Previous oil spills have demonstrated that removing oil residue from shoreline environments can cause more harm to the ecosystem than leaving the residue in place."

Thus, specific guidelines for the Monitoring and Maintenance phase of recovery are being developed to determine whether certain oiled habitats warrant further cleaning depending upon the anticipated damage to the environment by oil removal activities. In addition, NRDAR studies regarding potential effects to fish and wildlife resources are currently being conducted along the northern Gulf of Mexico coast.

Throughout the 2010-2011 wintering season piping plovers have been observed along the northern Gulf of Mexico coast. Casual observations from local birders and surveys conducted by oil spill responders have reported visibly oiled piping plovers at various locations in Louisiana. However, exact numbers of oiled piping plovers documented from this spill and the potential expanse of effects to those birds are currently being assessed through specific NRDAR studies; those results have yet to be analyzed or released to the public. Impacts to the species and its habitat are expected but the extent of those impacts remains hard to predict. Based on all available data prior to the Deepwater Horizon oil spill, the risk of impacts from contamination to piping plovers and their habitat was recognized, but the safety contingency plans were considered adequate to alleviate most of these concerns. The Deepwater Horizon incident has brought heightened awareness of the intensity and extent to fish and wildlife habitat from large-scale releases. In addition to potential direct habitat degradation from oiling of intertidal habitats and retraction of stranded boom, impacts to piping plovers may occur from ingestion of oiled benthic prey, loss of benthic prey from shoreline/beach cleaning, and the prolonged human disturbance associated with boom deployment and retraction, clean-up activities, wildlife response, and damage assessment crews working along affected shorelines.

Pesticides

In 2000, mortality of large numbers of wading birds and shorebirds, including one piping plover, at Audubon's Rookery Bay Sanctuary on Marco Island, Florida, occurred following the county's aerial application of the organophosphate pesticide Fenthion for mosquito control purposes (Williams 2001). Fenthion, a known toxin to birds, was registered for use as an avicide by Bayer, a chemical manufacturer. Subsequent to a lawsuit being filed against the Environmental Protection Agency (EPA) in 2002, the manufacturer withdrew Fenthion from the market, and EPA declared all uses of the chemical were to end by November 30, 2004 (American Bird Conservancy 2007). All other counties

in the U.S. now use less toxic chemicals for mosquito control. It is unknown whether pesticides are a threat for piping plovers wintering in the Bahamas, other Caribbean countries, or Mexico.

Climate Change (sea-level rise)

Over the past 100 years, the globally averaged sea level has risen approximately 10 to 25 centimeters (cm) (Rahmstorf et al. 2007), a rate that is an order of magnitude greater than that seen in the past several thousand years (Douglas et al. 2001 as cited in Hopkinson et al. 2008). The IPCC suggests that by 2080 sea-level rise could convert as much as 33 percent of the world's coastal wetlands to open water (IPCC 2007). Although rapid changes in sea level are predicted, estimated time frames and resulting water levels vary due to the uncertainty about global temperature projections and the rate of ice sheets melting and slipping into the ocean (IPCC 2007; CCSP 2008).

Potential effects of sea-level rise on coastal beaches may vary regionally due to subsidence or uplift as well as the geological character of the coast and nearshore (CCSP 2009; Galbraith et al. 2002). In the last century, for example, sea-level rise along the U.S. Gulf Coast exceeded the global average by 13 to 15 cm, because coastal lands west of Florida are subsiding (EPA 2009). Sediment compaction and oil and gas extraction compound tectonic subsidence (Penland and Ramsey 1990; Morton et al. 2003; Hopkinson et al. 2008). Low elevations and proximity to the coast make all nonbreeding coastal piping plover foraging and roosting habitats vulnerable to the effects of rising sea level. Furthermore, areas with small astronomical tidal ranges (e.g., portions of the Gulf Coast where intertidal range is less than 1 meter) are the most vulnerable to loss of intertidal wetlands and flats induced by sea-level rise (EPA 2009). Sea-level rise was cited as a contributing factor in the 68 percent decline in tidal flats and algal mats in the Corpus Christi area (i.e., Lamar Peninsula to Encinal Peninsula) in Texas between the 1950s and 2004 (Tremblay et al. 2008). Mapping by Titus and Richman (2001) showed that more than 80 percent of the lowest land along the Atlantic and Gulf coasts was in Louisiana, Florida, Texas, and North Carolina, where 73.5 percent of all wintering piping plovers were tallied during the 2006 IPPC (Elliott-Smith et al. 2009).

Inundation of piping plover habitat by rising seas could lead to permanent loss of habitat if natural coastal dynamics are impeded by numerous structures or roads, especially if those shorelines are also armored with hardened structures. Without development or armoring, low undeveloped islands can migrate toward the mainland, pushed by the over-washing of sand eroding from the seaward side and being re-deposited in the bay (Scavia et al. 2002). Overwash and sand migration are impeded on developed portions of islands. Instead, as sea-level increases, the ocean-facing beach erodes and the resulting sand is deposited offshore. The buildings and the sand dunes then prevent sand from washing back toward the lagoons, and the lagoon side becomes increasingly submerged during extreme high tides (Scavia et al. 2002), diminishing both barrier beach shorebird habitat and protection for mainland developments.

Modeling for three sea-level rise scenarios (reflecting variable projections of global temperature rise) at five important U.S. shorebird staging and wintering sites predicted loss of 20 to 70 percent of current intertidal foraging habitat (Galbraith et al. 2002). These authors estimated probabilistic sea-level changes for specific sites partially based on historical rates of sea-level change (from tide gauges at or near each site); they then superimposed this on projected 50 percent and 5 percent probability of global sea-level changes by 2100 of 34 cm and 77 cm, respectively. The 50 percent and 5 percent probability sea level change projections were based on assumed global temperature increases of 2° C (50 percent probability) and 4.7° C (5 percent probability). The most severe losses were projected at sites where the coastline is unable to move inland due to steep topography or seawalls. The Galbraith

et al. (2002) Gulf Coast study site at Bolivar Flats, Texas, is a designated critical habitat unit known to host high numbers of piping plovers during migration and throughout the winter (e.g., 275 individuals were tallied during the 2006 IPPC) (Elliott-Smith et al. 2009). Under the 50 percent likelihood scenario for sea-level rise, Galbraith et al. (2002) projected approximately 38 percent loss of intertidal flats at Bolivar Flats by 2050; however, after initially losing habitat, the area of tidal flat habitat was predicted to slightly increase by the year 2100, because Bolivar Flats lacks armoring, and the coastline at this site can thus migrate inland. Although habitat losses in some areas are likely to be offset by gains in other locations, Galbraith et al. (2002) noted that time lags may exert serious adverse effects on shorebird populations. Furthermore, even if piping plovers are able to move their wintering locations in response to accelerated habitat changes, there could be adverse effects on the birds' survival rates or reproductive fitness.

Table 9 displays the potential for adjacent development and/or hardened shorelines to impede response of habitat to sea-level rise in the eight states supporting wintering piping plovers. Although complete linear shoreline estimates are not readily obtainable, almost all known piping plover wintering sites in the U.S. were surveyed during the 2006 IPPC. To estimate effects at the census sites, as well as additional areas where piping plovers have been found outside of the census period, Service biologists reviewed satellite imagery and spoke with other biologists familiar with the sites. Of 406 sites, 204 (50 percent) have adjacent structures that may prevent the creation of new habitat if existing habitat were to become inundated. These threats will be perpetuated in places where damaged structures are repaired and replaced, and exacerbated where the height and strength of structures are increased. Data do not exist on the amount or types of hardened structures at wintering sites in the Bahamas, other Caribbean countries, or Mexico.

Table 9. Number of sites surveyed during the 2006 winter IPPC with hardened or developed structures adjacent to the shoreline. Those marked with an asterisk (*) are additional sites that were not surveyed in the 2006 IPPC.

State	Number of sites surveyed during the 2006 winter Census	Number of sites with some armoring or development	Percent of sites affected
North Carolina	37 (+2)*	20	51
South Carolina	39	18	46
Georgia	13	2	15
Florida	188	114	61
Alabama	4 (+2)*	3	50
Mississippi	16	7	44
Louisiana	25 (+2)*	9	33
Texas	78	31	40
Overall Total	406	204	50

Sea-level rise poses a significant threat to all piping plover populations during the migration and wintering portion of their life cycle. Ongoing coastal stabilization activities may strongly influence the effects of sea-level rise on piping plover habitat. Improved understanding of how sea-level rise will affect the quality and quantity of habitat for migrating and wintering piping plovers is an urgent need.

Storm events

Although coastal piping plover habitats are storm-created and maintained, the 1996 Atlantic Coast Recovery Plan also notes that storms and severe cold weather may take a toll on piping plovers, and the 2003 Great Lakes Recovery Plan postulates that loss of habitats, such as overwash passes or wrack, where birds shelter during harsh weather, poses a threat. Storms are a component of the natural processes that form coastal habitats used by migrating and wintering piping plovers, and positive effects of storm-induced overwash and vegetation removal have been noted in portions of the wintering range. For example, Gulf Islands National Seashore habitats in Florida benefited from increased washover events that created optimal habitat conditions during the 2004 and 2005 hurricane seasons, with biologists reporting piping plover use of these habitats within six months of the storms (Nicholas 2005 pers. communication). Hurricane Katrina (2005) over-washed the mainland beaches of Mississippi, creating many tidal flats where piping plovers were subsequently observed (Winstead 2008). Hurricane Katrina also created a new inlet and improved habitat conditions on some areas of Dauphin Island, Alabama (LeBlanc 2009 pers. communication). Conversely, localized storms, since Katrina, have induced habitat losses on Dauphin Island (LeBlanc 2009 pers. communication).

Noel et al. (2005) suspect that changes in habitat caused by multiple hurricanes along the Georgia coastline altered the spatial distribution of piping plovers and may have contributed to mortality of three Great Lakes piping plovers wintering along the Georgia coastline. Following Hurricane Ike in 2008, Arvin (2009) reported decreased numbers of piping plovers at some heavily eroded Texas beaches in the center of the storm impact area and increases in plover numbers at sites about 100 miles to the southwest. However, piping plovers were observed later in the season using tidal lagoons and pools that Ike created behind the eroded beaches (Arvin 2009).

The adverse effects on piping plovers attributed to storms are sometimes due to a combination of storms and other environmental changes or human use patterns. For example, four hurricanes between 2002 and 2005 are often cited in reference to rapid erosion of the Chandeleur Islands, a chain of low-lying islands in Louisiana where the 1991 IPPC tallied more than 350 piping plovers. Comparison of imagery taken three years before and several days after Hurricane Katrina found that the Chandeleur Islands lost 82 percent of their surface area (Sallenger et al. 2009), and a review of aerial photography prior to the 2006 IPPC suggested little piping plover habitat remained (Elliott-Smith et al. 2009). However, Sallenger et al. (2009) noted that habitat changes in the Chandeleur Islands stem not only from the effects of these storms but rather from the combined effects of the storms, long-term (i.e., greater than 1,000 years) diminishing sand supply, and sea-level rise relative to the land. Sallenger et al. (2009) went on to explain that although the marsh platform of the Chandeleur Islands continued to erode for 22 months post-Katrina, some sand was released from the marsh sediments which in turn created beaches, spits, and welded swash bars that advanced the shoreline seaward. Thus, although intense erosional forces have affected the Chandeleur Islands, they are still providing high quality shorebird habitat in the form of sand flats, spits, and beaches, until they are eroded below sea level. On January 18 and 19, 2011, piping plover surveys of the Chandeleur Islands were conducted by the piping plover NRDAR study team. Catlin et al. (2011) observed 194 piping plovers utilizing the Chandeleur Islands, and the birds were not distributed uniformly across the islands but were clumped mostly in three locations. Because the survey was conducted within a two-day window, Catlin et al. (2011) believe that higher numbers of piping plovers are likely using the islands during spring and fall migration.

Other storm-induced adverse effects include post-storm acceleration of human activities such as beach nourishment, sand scraping, and berm and seawall construction. Such stabilization activities can result

in the loss and degradation of feeding and resting habitats. Storms also can cause widespread deposition of debris along beaches. Removal of debris often requires large machinery, which can cause extensive disturbance and adversely affect habitat elements such as wrack. Another example of indirect adverse effects linked to a storm event is the increased access to Pelican Island (LeBlanc 2009 pers. communication) due to merging with Dauphin Island following a 2007 storm (Gibson et al. 2009).

Recent climate change studies indicate a trend toward increasing hurricane numbers and intensity (Emanuel 2005; Webster et al. 2005). When combined with predicted effects of sea-level rise, there may be increased cumulative impacts from future storms. Storms can create or enhance piping plover habitat while causing localized losses elsewhere in the wintering and migration range. Available information suggests that some birds may have resiliency to storms and move to unaffected areas without harm, while other reports suggest birds may perish from storm events. Significant concerns include disturbance to piping plovers and habitats during cleanup of debris along shorelines and post-storm acceleration of shoreline stabilization activities, which can cause persistent habitat degradation and loss.

Threats Summary

Habitat loss and degradation on winter and migration grounds from shoreline and inlet stabilization efforts, both within and outside of designated critical habitat, remain a serious threat to all piping plover populations. Modeling strongly suggests that the population is very sensitive to adult and juvenile survival. Therefore, while there is a great deal of effort extended to improve breeding success, and thus improve and maintain a higher population over time, it is also necessary to ensure that the wintering habitat, where birds spend most of their time, is secure. On some of the wintering grounds, the shoreline areas used by wintering piping plovers are being developed, stabilized, or otherwise altered, generally making the habitat unsuitable. Even in areas where habitat conditions are appropriate, human disturbance on beaches may negatively impact piping plovers' energy budget, as they may spend more time being vigilant and less time in foraging and roosting behavior. In many cases, the disturbance is severe enough that piping plovers appear to avoid some areas altogether. In addition, natural events (e.g., climate change, hurricanes, etc.) can pose a potential threat to piping plover habitat on an irregular basis. Threats on the wintering grounds may impact piping plovers' breeding success if they start migration or arrive at the breeding grounds with a poor body condition.

Analysis of the species/critical habitat likely to be affected

The proposed action has the potential to adversely affect wintering piping plovers and their habitat, including designated critical habitat in Unit LA-5, within the action area. The construction activities may lead to temporarily diminished quantity and quality of intertidal foraging and roosting habitats within the project area and action area, resulting in decreased survivorship of migrating and wintering plovers and temporary adverse affects to critical habitat. The length of construction activities (which varies from 2 to 3 years) may delay the recovery of benthic species due to the prolonged disturbance of the benthic fauna. Ultimately, the project goal is to restore the diversity of coastal barrier headland and island habitats, but the temporary effects of construction will require time for natural recovery and would extend beyond one wintering season. The detailed effects of the proposed action on piping plovers and critical habitat will be considered further in the remaining sections of this opinion.

ENVIRONMENTAL BASELINE

Louisiana's loss of wetlands and barrier islands to open water is now a well-documented fact in numerous studies. Since the 1930s Louisiana has lost 1,900 square miles of land (approximately 1.2 million acres). From 1990 to 2000, approximately 24 square miles of coastal land were lost each year. The 2004 Louisiana Coastal Area Ecosystem Restoration Study projected that 513 square miles of land would disappear by 2050, including a gain of 161 square miles from projects constructed under the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) (Corps 2004). In Louisiana, barrier headland and island erosion is attributable to increasing tidal prism, insufficient volumes of sediment supplied by littoral currents, land subsidence, and sea-level rise (Boesch 1982). Although increases in the tidal prism may be primarily responsible for enlargement of tidal passes, the insufficient supply of sand available to rebuild eroded areas has also contributed to increased tidal pass widths and shoreline retreat (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1999). Where insufficient supplies of sand prevail, measures to maximize sand retention, such as sand fencing and vegetative planting, are used to effectively rebuild and maintain such eroded areas.

Louisiana barrier headlands and islands are part of a complex and dynamic coastal system that continually respond to tidal passes, tides, wind, waves, erosion and deposition, long-shore sediment transport and depletion, fluctuations in sea level, and weather events. During storm events, overwash is common across the barrier islands and headlands, depositing sediments on the bay-side or landward side, clearing vegetation and increasing the amount of open, sand flat habitat ideal for shoreline dependent shorebirds. Winds move sediment across the dry beaches forming low dunes. The natural communities contain plants and animals that are subject to shoreline erosion and deposition, salt spray, wind, drought conditions, and sandy soils. Vegetative communities include fore dunes, occasional primary dunes, salt marsh, and black mangroves.

The Caminada headland and Shell Island provide important geomorphic, hydrologic and habitat functions in the Barataria basin. The Corps' modeling results have shown that barrier islands decrease wave energy landward of the island during tropical events. When the barrier islands were degraded in the models, the modeled wave heights increased, thus heightening the potential for overtopping levees and inundation of protected areas. Sustaining the geomorphic form of the barrier islands will provide storm surge protection for the interior wetlands and the surrounding coastal communities. Modeling (which excluded the BBBSR project in its future projections) also estimated that by 2060, 75 percent of the land between the Caminada headland and the Larose to Golden Meadow Hurricane Risk Reduction levees would be lost. In addition, the barrier islands in Plaquemines Parish, including Shell Island, will have disappeared as well as the marshes between the islands and the Mississippi River levees. Salinity modeling reflecting a without-project condition demonstrates the function of the barrier islands in separating the marine from the estuarine environments. On the eastern side of the basin, in areas where the barrier islands are severely eroded (e.g., the Shell Island reach), the salinity fields grow proportionally larger.

The Caminada barrier headland is the predominant feature of the Bayou Lafourche barrier system that includes flanking islands and the retreating headland of the Bayou Lafourche distributary of the Mississippi River (Figure 2) along the southwestern portion of the Barataria Basin. The southwest to northwest-oriented Caminada headland extends approximately 13.18 miles (21.21 km) between Belle Pass to the west and Caminada Pass to the east. Historic maps show that the west end of the Caminada headland is retreating more rapidly than the east end of the headland (Williams et al. 1992). It is one of the most rapidly eroding shorelines in the United States (McBride et al. 1992; Connor et al. 2004).

The headland has historically suffered loss of wildlife habitat value and diminished function due to storm overtopping and breaching, saltwater intrusion, wind and wave induced erosion, sea level rise, subsidence, and man-made structures. The observed average shoreline erosion rate at the Caminada Headland is approximately 45 feet per year, and increased stress on the fish and wildlife in the area is expected as habitats continue to be lost.

The Caminada headland consists of narrow and low-lying sand dunes and beaches, barrier marshes, chenier ridges interspersed with mangrove thickets, coastal dune shrub thickets, lagoons, and small bayous. The Corps estimates the average dune elevation to be 3.4 feet NAVD and the back-barrier marsh is approximately 0.94 feet NAVD. Port Fourchon and a Chevron oil and gas facility are located at the western end of the headland and north of the action area. Several marsh restoration projects have occurred on the landward side of the dune along portions of the headland, and multiple sand fencing projects have occurred on the remnant dunes along much of the headland. An existing shoreline protection project consisting of cement-filled geotextile tubing and submarine cement mats extends from the east jetty of Belle Pass to Bay Champagne. That project was constructed in the early-1980s, prior to the piping plover's listing as a threatened species, and the Port Commission along with the local parish government plan to restore it as a result of damage from the 2005 and 2008 hurricane seasons. The Corps also conducts maintenance dredging every 2 years (if needed) within Belle Pass, and deposits material every other cycle along the Caminada headland adjacent to the east jetty. That material is placed unconfined, no closer than 100 feet from the top-of-bank (i.e., in the surf zone), and to an elevation of +6 feet Mean Low Gulf (MLG) (approximately +5 feet NAVD). The linear distance of shoreline nourished varies for each event, and the material is allowed to be naturally re-worked by wind and wave action. Once the BBBSR project is implemented that material would no longer be placed adjacent to the east jetty but would be used for the sub-tidal feeder bar.

Although much of the headland is privately owned, the beaches are easily accessible by vehicle, foot, or boat, and are generally open to the public for recreation, birding, and fishing. The eastern end of the Caminada headland consists of Elmer's Island which is partially owned by the State, actively managed by LDWF, and is separated from Grand Isle (the State's only inhabited island) by Caminada Pass. That beach is also accessible by vehicle, foot, or boat and open to the general public for recreation, birding, and fishing. As a result of the Deepwater Horizon oil spill and since May 2010, the State and private landowners along the Caminada headland have restricted public access as cleanup and O&M activities continue.

The Shell Island reach is part of the Plaquemines barrier system along the southeastern portion of the Barataria Basin. Prior to Hurricane Bob in 1979, Shell Island (formerly Lanaux Island) was a continuous barrier island that helped to protect the interior coastal wetlands of the eastern Barataria Basin. The Corps estimates a shoreline recession rate of approximately 10 feet per year along the easternmost 5,000 to 8,000 feet of Shell Island, and indicates that rate is most likely due to installation of the Empire jetties (built in 1950) at the mouth of Fontanelle Pass. Shell Island is now characterized as an undeveloped, rapidly retreating, remnant barrier island (and associated spits and shoals) which partially encloses shallow bays such as Shell Island Bay and Bastian Bay (Figure 3). The Shell Island reach extends approximately 5.24 miles (8.43 km) between Grand Bayou Pass to the west and the Empire jetties to the east. The remnant island along the western edge of the Shell Island reach is approximately 1.41 (2.27 km) miles long and extends from Grand Bayou Pass to Coupe Bob; it is composed primarily of reworked oyster shells that formed into ridges and swales produced by waves refracting into the entrance to Grand Bayou Pass. The remnant island along the eastern edge of the Shell Island reach is approximately 2.54 miles long (4.09 km) and extends from Coupe Bob to Fontanelle Pass; it consists of marsh with a narrow strip of beach along its Gulf-ward side. These

rapidly retreating barrier islands are becoming increasingly narrower and are completely separated from the remnants of Plaquemines Parish interior marshes.

Any exposed land (i.e., land above mean high tide) within the Shell Island reach is likely to be privately owned; however, much of the reach has been severely eroded and claimed as State water bottoms. Access to the area is by boat only; thus, human disturbance in the area generally consists of nearby recreational and commercial fishing, occasional oil and gas activity, and annual aerial surveys of nesting shorebird colonies conducted by LDWF. Since the Deepwater Horizon oil spill in April 2010, human activity in the area has increased due to cleanup and O&M activities, as well as construction of 8,439 linear feet (to an elevation of +6 NAVD) of a protective sand berm (as part of the emergency response) along the eastern end of the reach.

The Corps anticipates that the TSP would prevent the fragmentation of the Caminada headland and greatly ameliorate impacts on several important socio-economic sectors such as: Port Fourchon, the largest base for offshore oil and gas operations in coastal Louisiana and the largest coastal fishing port; major oil and gas infrastructure, such as regional transportation and storage facilities, the LOOP, and the Mars pipeline; and the regional hurricane evacuation route serving residents of southern Lafourche Parish, the community of Grand Isle, and approximately 6,000 workers stationed at offshore facilities in the central Gulf of Mexico. By decreasing the rate of erosion and preventing the splintering of the headland, the investment in infrastructure located at Port Fourchon will be less vulnerable to storm surges. Oil and gas pipelines and Louisiana Highway 1 maintenance requirements will lessen compared to the future-without-project conditions. Closure of the Shell Island reach would also aid in protection of interior marshes within the eastern Barataria Basin and restoration of the tidal prism through Grand Bayou, Bastian Bay, and Shell Island Bay.

Status of the species within the action area

Assessing the number of piping plovers within the action area during winter is difficult because the number of birds utilizing the area varies from year to year and throughout each wintering season. Because winter generally produces inclement weather conditions, daily surveys over any length of time during the wintering season are also difficult to coordinate. Consequently, surveys for non-breeding (e.g., over-wintering and migrating) plovers within the action area have been sporadic in the past. Because the 2005 hurricane season severely damaged much of the piping plover critical habitat across the state, the Service provided funding to the LDWF to conduct post-hurricane impact assessments of piping plovers and their habitat across the Louisiana coast for a three-year period. The LDWF conducted annual, one-day-count piping plover surveys between January 1 and February 18 from 2007 through 2010 (they were able to add a fourth year with the funding provided). Due to lack of manpower and inclement weather (e.g., dangerous boating conditions) LDWF was unable to survey the Shell Island reach in 2007, 2008, and 2009. For surveys that have been successful, results indicate that piping plovers utilize any non-vegetated or sparsely vegetated portions of the subject barrier headlands and islands. Such habitat consists of sand beaches, spits, and flats, mud flats, shell beaches, and oyster reefs associated with both the Gulf- and bay-sides of the headlands and islands, as well as wash-over areas created by storm events. We have also recently gained access to preliminary survey data related to the Deepwater Horizon oil spill[6]. Survey results from the past 20 years are depicted in Table 10 and include the highest number of piping plovers seen during a survey for a given site.

[6] The data depicted in Table 10 for the Deepwater Horizon oil spill were collected from three sources: (1) deployed Service biologists, (2) contracted Natural Resource Advisors (NRAs), or (3) the NRDAR study team. The NRDAR study team followed specific survey protocols and surveys were conducted on a regular basis, as weather permitted. Surveys conducted by the Service or NRAs were done on an irregular basis, although daily surveys were attempted for some areas, and no specific survey methodology was

Table 10. Piping plover survey results from within the action area and nearby beaches and headlands.

	Fourchon Beach and/or Bay Champagne[a]	Elmer's Island[a]	Shell Island[a]	West Belle Pass[b]	Chaland Beach[c]
1991 IPPC[d] Winter Survey	42	1	NS	NS[g]	NS
1996 IPPC Winter Survey	0	0	NS	15	NS
2001 IPPC Winter Survey	0	19	NS	18	NS
2006 IPPC Winter Survey	21	15	NS	1	NS
2006/2007 CWS[e] Winter Survey	38	5	NS	0	NS
2007 LDWF[f] Winter Survey	0	14	NS	0	NS
2008 LDWF Winter Survey	41	17	NS	13	NS
2009 LDWF Winter Survey	13	23	NS	25	NS
2010 LDWF Winter Survey	13	38	6	46	6
2010 MC252 Fall Surveys	11	25	1	30	7
2011 MC252 Winter Surveys	20	51	NS	42	NS

(a) Beaches within the action area; (b) West Belle Pass is the small remnant strip of headland on the west side of Belle Pass (just west of the Caminada headland); (c) Chaland Beach is the headland west of Shell Island and Grand Bayou; (d) IPPC = International Piping Plover Census; (e) CWS = Canadian Wildlife Service, Maddock 2008; (f) LDWF = Louisiana Department of Wildlife and Fisheries-Natural Heritage Program; (g) NS = Not Surveyed.

The survey results depicted in Table 10 show consistent use by piping plovers of suitable habitat within the proposed project area and adjacent headlands and islands, especially in recent years. The Service also reviewed digital aerial photography dating from 1998 to 2010 to determine potential changes in habitat suitability within the proposed project area and the adjacent coastal areas listed in Table 10. Aerial photography can indicate where erosion has caused changes in the availability of suitable habitat on barrier headlands and islands, such as the creation of habitat (e.g., over-wash fans) by storm events or loss of habitat through land loss. In 1998, 2000, 2001, and 2002, there was less suitable habitat available at all sites. More suitable habitat was available on Fourchon Beach/Bay Champagne and Elmer's Island in 2004, 2008, and 2010. In addition, aerial photography indicates that the West Belle Pass headland continues to erode and create smaller islands and flats of lower elevations that become more and more suitable for piping plovers as the remnants of the headland lose their vegetation. Because there have been both habitat losses and gains within the action area, it would be difficult to determine effects of those habitat changes on overall numbers of piping plovers using the action area and that relationship merits further study.

used. Therefore, the survey methodologies used in collecting the oil spill data are not the same as the survey methodology used in the IPPC or LDWF winter surveys. Any data comparisons should carefully note differences in survey methodologies before any conclusions can be drawn from such comparisons.

The Final Determinations of Critical Habitat for Wintering Piping Plovers (Service 2001b) describes critical habitat within the project action area as:

> ". . . the Gulf shoreline extending approximately 11 km (6.8 miles) east from the east side of Belle Pass bounded on the seaward side by MLLW [mean low low water] and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; all of Elmer's Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmer's Island to approximately 0.9-km (0.56-mile) west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur . . ."

At the time of designation approximately 24,964 acres of wintering habitat were designated in Louisiana, and Unit LA-5 consisted of approximately 5,735 acres of that total. Within Unit LA-5 approximately 1,558 acres of the Caminada barrier headland consisted of sparsely or non-vegetated habitat suitable for piping plovers (based upon 1998 aerial photography), of which approximately 370 acres existed on Elmer's Island and the remaining 1,188 acres existed on Fourchon Beach/Bay Champagne. The Shell Island reach is not included in designated piping plover critical habitat; however, it does provide a small amount of suitable habitat for piping plovers. The current acreage of the exposed land along the Shell Island reach has not been estimated; however, 8,439 linear feet (elevation of +6 NAVD) of a protective sand berm has been constructed along the eastern remnant island of the reach as a result of the Deepwater Horizon oil spill. Until that sand berm is eroded below sea level, it will provide suitable habitat for piping plovers.

Based on 2008 aerial photography, the Corps estimates that approximately 485 acres (29 acres dune, 356 acres supratidal, and 100 acres Gulf intertidal) of critical habitat currently exist within the proposed project footprint on the Caminada headland. According to conversations with the Service's coastal restoration biologist working directly with the Corps on this project, the dune, supratidal, and intertidal habitat designations were defined by the Corps during habitat assessments as follows: (1) dune habitat includes any elevations within the project footprint at or above 5 feet NAVD; (2) supratidal habitat includes any elevations within the project footprint at or between 2 and 4.9 feet NAVD; and (3) Gulf intertidal habitat includes any elevations within the project footprint between zero and 2 feet NAVD. Based on evaluations of digital orthophoto quarter quadrangle (DOQQ) imagery dating from 2005 to 2010, light detection and ranging (LIDAR) imagery, and January 2009 and August 2010 site visits, the Service determined that the Corps' habitat acreages need to be defined in terms of suitable piping plover habitat instead of in terms of habitat designations for wetland value assessments. In order to interpret the Corps' habitat designations in terms of suitable habitat for piping plovers, the Service describes the Corps' habitat designations more specifically as follows:

1. The existing dune habitat within the project footprint consists of clumps of remnant dune generally dispersed throughout the high marsh/high beach interface. Those 29 acres of dune should not be considered as suitable piping plover habitat because those areas are densely vegetated and do not exhibit features of suitable piping plover habitat as described above.

2. The supratidal habitat classification includes both the high marsh on the landward side and the high beach along the Gulf side of the remnant dune within the project footprint (i.e., 356 acres). The high marsh consists of densely vegetated areas that are not suitable for the piping plover and are specifically excluded from designated critical habitat as described above. The high beach consists of bare or sparsely vegetated sand flats above the high tide mark. Because the

supratidal habitat area is roughly divided along the centerline of the remnant dune, we believe that no more than half (i.e., 178 acres) of the supratidal habitat classification acreage actually consists of high beach that is suitable roosting habitat for the piping plover.

3. The 100 acres of Gulf intertidal habitat does consist of suitable foraging habitat for the piping plover and is included within the critical habitat designation. That acreage is inclusive of tidal fluctuations throughout the year.

Based on the above information, the Service estimates that approximately 278 acres (178 acres of high beach and 100 acres of Gulf intertidal habitat) of designated critical habitat would be affected by the Caminada Headland-portion of the proposed project. That acreage is approximately 1.1 percent and 4.8 percent of the total acreage of wintering habitat in Louisiana and Unit LA-5, respectively.

Factors affecting species environment within the action area

As mentioned previously, the Caminada headland is the southernmost edge of the mainland and is easily accessed by the public via foot, vehicle, or boat. Only a portion of Elmer's Island (the eastern edge of the headland) is actively managed by LDWF. Port Fourchon and a Chevron facility are located adjacent to the action area on the northwestern portion of the headland. The entire headland receives regular visitors for fishing and bird watching year round and has persistent boat and helicopter traffic to and from the port and nearby support facilities for offshore oil and gas structures. In contrast, the Shell Island reach remains undeveloped and is isolated from the mainland. Any exposed land is afforded protection from major disturbance activities solely due to its remoteness since it is only accessible by boat. Other than infrequent bird surveys (usually conducted from helicopter or fixed-wing aircraft) and nearby boat traffic from fishing and offshore oil and gas activities, the remnant islands within the Shell Island reach do not receive regular visitors.

Mammalian predators (e.g., raccoons, coyotes) occur throughout the Caminada headland, but have limited access to the Shell Island reach. Mammalian predators may swim back and forth to the remnant islands of the Shell Island reach from the nearest mainland, but the islands do not provide enough shelter or forage to sustain a constant predator population. Somewhat regular storm events (e.g., flooding) also tend to discourage mammals from persisting on the remnant islands. Avian predators may also be present within both portions of the action area throughout the year but likely peak during fall and spring migration periods.

The Deepwater Horizon Mississippi Canyon Well #252 oil spill, which started April 20, 2010, discharged into the Gulf of Mexico through July 15, 2010. In May and early June 2010, the presence of oil was confirmed on the Caminada headland and Shell Island reach; those areas were oiled repeatedly throughout the summer months until the damaged oil well was sealed. Shoreline Cleanup Assessment Team (SCAT) reports throughout the duration of the spill documented various degrees of oiling along each of those areas (Table 11). At the time this document is being written, oil spill response efforts are ongoing in the form of continued SCAT surveys, Stage III cleanup efforts, Stage IV maintenance and monitoring efforts, and NRDAR surveys and data collection.

Table 11. Results of the SCAT reports for the Deepwater Horizon Mississippi Canyon Well #252 oil spill and cleanup activities along the Caminada headland and Shell Island reach.

Location	Extent of Oil	Cleanup Actions Proposed or Implemented
Elmer's Island	Tar balls; small pools of oil; 11 major tar mats; mousse	Mechanical cleanup with heavy machinery; removal of oiled wrack; beach tilling
Fourchon Beach	Tar balls; tar mats; surface oil residue; partially buried oiled seaweed; oil onshore	Mechanical cleanup with heavy machinery; removal of oiled wrack; beach tilling
West Bay Champagne	10 to 12 discreet patches of oil; tar patties	Mechanical cleanup with heavy machinery; removal of oiled wrack; beach tilling
Shell Island reach (Lanaux Island)	Tar balls; mousse on sand beaches and in marsh areas	Manual cleanup with shovels; removal of oiled wrack

At this time, it is unknown if there are any current or lasting effects to piping plovers migrating or wintering within the action area (i.e., the number of oiled piping plovers observed during NRDAR studies has not yet been released) or to the inter-tidal invertebrate food source used by piping plovers from either oil or oil dispersants and resulting cleanup activities within the action area. A greater impact to the piping plover and its habitat might be the prolonged human disturbance associated with ongoing cleanup activities, wildlife response, and damage assessment crews highly visible on the shorelines, as well as ongoing SCAT surveys.

EFFECTS OF THE ACTION

The proposed action includes marsh creation and dune and beach restoration along 13.18 miles of headland and 5.24 miles of mixed open water and remnant barrier islands. The proposed project intends to lengthen and widen the Gulf shorelines of the Caminada headland and Shell Island reach in order to add much-needed sediment to the barrier coastal system of the Barataria Basin, prolong the existence of those land features, and restore barrier headland and island habitat, function, and morphology. Much of the proposed project would occur in habitat that is used regularly by piping plovers and designated as critical habitat for the species. Construction of the fully proposed TSP will overlap with multiple piping plover wintering seasons for both portions of the project. Short-term and temporary construction impacts to piping plovers will occur when the birds are roosting and feeding in the area. The deposition of sand and marsh material will temporarily deplete the intertidal food base along the Gulf beach and bay-side flats, respectively, and temporarily disturb foraging and roosting birds during project construction on the islands. The shaping and grading of the restored beach and dune would remove wrack that has accumulated on the Gulf-side of the headland and remnant islands. This would affect feeding and roosting habitat for piping plovers, since they often use wrack for cover and foraging. The construction of the marsh creation area will cover any existing bay-side flats used by foraging plovers and will render that area unusable until natural processes re-work the sediments and overwash areas are again created by tidal and storm events and benthic prey species re-colonize the washover areas. Similar effects will occur again during renourishment periods (see project plan descriptions on pages 3 through 7 for target years) and benthic effects would extend for up to 2 years beyond the renourishment period until the benthic fauna recovers. The temporary increase in human presence and construction activity on the islands may also disturb piping plovers from utilizing adjacent areas outside of the project footprints, such as nearby sand spits and over-wash areas.

The geomorphic characteristics of barrier headlands and islands, dunes, over-wash fans, and inlets are critical to a variety of natural resources and influence a barrier system's ability to respond to wave action, including storm overwash and sediment transport. The protection or persistence of these important natural processes and wildlife resources are part of the goal of this restoration project. The newly created beach, dune, and marsh will not impede overwash but may temporarily consist of less optimal roosting and foraging habitat until natural wrack is restored, the benthic prey base is able to recover from the construction activities, and overwash areas are again created by natural tidal and weather events. The newly added sediment will be reworked by natural wind and wave processes which will, given time, create sand spits and flats on the ends and bay-sides of the islands, or as sediment is lost from one island, it will be carried by long-shore transport to another island. Thus, piping plover foraging, roosting, and critical habitat will continue to be lost and created through the natural processes associated with daily tidal events and future storm events.

Factors to be considered

Proximity of the action

Lack of regular surveys, fluctuation of use by piping plovers from year to year, and differences in numbers of birds migrating through versus those over-wintering, make it difficult to estimate the number of birds actually using any particular area (headland or island, Gulf- or bay-side) within the action area. Based on survey data depicted in Table 10 (page 41), numbers of piping plovers over-wintering within the action area can range anywhere from one to 51 birds scattered along the Caminada headland (i.e., Fourchon Beach, Bay Champagne, Elmer's Island) and from one to six birds scattered along the remnants of Shell Island; those estimates do not include migrating piping plovers. We expect direct short-term effects in the form of: (1) disturbance during sediment placement, dune/beach construction, marsh creation, and vegetative planting; and (2) a temporary loss of food base within the project footprint on each island for up to 2 years following completion of sediment placement until the benthic community re-colonizes the project area. Within the Caminada headland portion of the project, 278 acres is included within critical habitat Unit LA-5. West Belle Pass and East Timbalier Island located west of the Caminada headland and Chaland Beach located west of the Shell Island reach would not be included within any portions of the action area and all of those areas would provide available habitat during project construction. However, a CWPPRA restoration project has been planned for the West Belle Pass headland. Construction funding was allocated in late 2009, and construction was proposed to begin in fall 2010; however, the Deepwater Horizon oil spill has delayed permit acquisitions and construction until late summer or fall 2011. If it remains on schedule through its construction, the restoration of the West Belle Pass headland should be completed and fully available to piping plovers prior to the initiation of the BBBSR project

Distribution

The Corps proposes project construction activities on the Gulf- and protected-sides of the Caminada headland within Lafourche and Jefferson Parishes and the entire Shell Island reach in Plaquemines Parish. We expect direct effects to wintering piping plovers along existing sand beaches, spits, and flats, mud flats, shell beaches, oyster reefs, and washover areas associated with the Gulf shoreline of the headland and the entire Shell Island reach as a result of human activity and ground disturbance in those areas. Similar temporary disturbance would occur again during a renourishment cycle on the Gulf-side of Shell Island only. Renourishment for the Caminada headland would occur as a result of the replenished sub-tidal feeder bar located just offshore of the headland at its nodal point near the

mouth of Bayou Moreau (Figure 2), which would not require any onshore activities during each replenishment of the feeder bar.

Timing

Construction of the TSP will overlap with multiple piping plover wintering/migrating seasons (mid-July to late April) and with construction of several other barrier headland and island restoration projects along the Louisiana coast.

Nature of the adverse effect

The effects to piping plover may be direct, indirect, and short-term. We anticipate a temporary (i.e., up to 2 years post-construction) decrease in benthic prey species within existing piping plover foraging habitat as a result of sand and marsh material placement. A decrease in survival of birds on migrating or wintering grounds due to lack of optimal habitat contributes to decreased survival rates, decreased productivity on the breeding grounds, and therefore increased vulnerability to any of the three piping plover populations. We expect short-term impacts from human disturbance during project construction to both the bird and its habitat. Activities that impact or alter the use of optimal habitat or increase disturbance to the species may decrease the survival and recovery potential of the piping plover by limiting the ability for birds to rest and replenish their fat preserves for spring migration.

The effects to 278 acres of critical habitat in Unit LA-5 are activities that impact or alter the PCEs (disturbance to the species) which may decrease the survival and recovery potential of the piping plover. Such effects consist of temporary reductions in the value of the unit from disturbance to foraging and roosting piping plovers due to human activity during construction, a temporary decrease in benthic prey species due to sand placement along the Gulf shoreline, and vegetative planting of newly created dune. In addition, existing over-wash areas would be covered by placement of new material until natural coastal processes (e.g., daily tidal events, storm events, etc.) are allowed to re-work the additional sediment to create new over-wash areas on Caminada and new sand and mud flats on Shell Island. That acreage (i.e., 278 acres) is approximately 1.1 percent and 4.8 percent of the total acreage of wintering habitat in Louisiana and Unit LA-5, respectively.

Duration

For the TSP initial construction would be completed in approximately 2 to 3 years, with additional time (see project details on pages 3 through 7 for exact timelines) for vegetative planting following dewatering and settlement of the newly placed material. The activities associated with construction of the marsh creation are a one-time occurrence for each portion of the project. Construction of the dune and beach would initially occur at TY1 for the headland and the island; however, two renourishment events (TY20 and TY40) would occur for Shell Island. Each activity may vary in duration depending on the amount of work needed, weather conditions, and equipment mobilization and maintenance. The Corps anticipates beginning construction on the TSP in April 2013. We do not expect long-term, permanent alteration of the natural coastal processes, and the two renourishment events would result in a pulse effect that would temporarily disturb the Gulf-side of the restored Shell Island while the bay-side of the island would remain untouched after initial construction. The initial addition of sand material on 278 acres of critical habitat Unit LA-5 is expected to decrease the quality of foraging habitat from 6 months up to 2 years until the intertidal benthic fauna recovers to normal population levels and natural wrack returns to the shoreline. The sub-tidal feeder bar along the Caminada

headland would be reworked by natural processes and would not be placed directly within piping plover foraging habitat.

Disturbance frequency, intensity, and severity

We expect short-term disturbance from construction activities and short-term effects of sand and marsh material placement. Direct effects to 278 acres of critical habitat Unit LA-5 would include temporary smothering of intertidal benthic prey species at TY1 on the Gulf shoreline of the Caminada headland. We anticipate construction activities to have short-term and temporary effects on piping plover populations. We anticipate that piping plovers located within the construction area would move outside of the construction zone due to disturbance. We anticipate that the intertidal benthic fauna would recover within 6 months to 2 years of each initial disturbance event and the two renourishment events on Shell Island. We do not anticipate any permanent adverse changes to barrier headland and island morphology because initial construction elevations and follow-up renourishment elevations would not prevent island washover during storm events and the created marsh platforms would allow for natural headland and island retreat or "rollover." There would not be any increased or continual disturbance within critical habitat Unit LA-5 as a result of the BBBSR project. Over the long-term the additional sediment would allow for creation of piping plover habitat on the Caminada headland and Shell Island as natural processes re-work the sediment to create over-wash areas, sand flats, mud flats, and sand spits.

Analysis for the effects of the action

Direct effects

Direct effects are those direct or immediate effects of a project on the species or its habitat. The construction window (i.e., disposal of sand and marsh material) will extend through several piping plover migration and wintering seasons for the proposed TSP. Heavy machinery and equipment (e.g., ORVs and bulldozers operating on project area beaches and bay-side sand and mud flats, the placement of the dredge pipeline along the beach, and sand and marsh material disposal) may adversely affect migrating and wintering piping plovers in the project area by disturbance and disruption of normal activities such as roosting and feeding, and possibly forcing birds to expend valuable energy reserves to seek available habitat elsewhere.

Burial and suffocation of invertebrate intertidal prey species will occur during sand and marsh material placement throughout the entire project area and follow-up renourishment events on Shell Island only. Impacts will affect the project footprint on both the Caminada headland and the remnant islands of the Shell Island reach, as well as some down-drift areas. Timeframes projected for benthic recruitment and re-establishment following sand and marsh material placement are from 6 months up to 2 years. Due to the duration of project construction and depending on actual recovery rates, impacts will occur even if renourishment events occur outside the plover migration and wintering seasons.

Direct effects to critical habitat Unit LA-5 consist of sand and marsh material placement over 278 acres of existing habitat on the Gulf shoreline of the Caminada headland at TY1, temporary loss of washover areas, vegetative plantings, and burial and suffocation of intertidal benthic prey species.

Indirect effects

Indirect effects are those that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Reducing the potential for the formation of optimal habitats (such as over-wash or ephemeral pool formations), long-term increased human disturbance, and construction of new infrastructure are possible indirect effects.

The piping plover's rapid response (within 6 months) to habitats formed by over-wash areas demonstrates the importance of over-wash created sand and mud flats for wintering and migrating piping plovers. Implementation of the proposed project will temporarily cover existing over-wash habitat within the entire action area. Given time, the intertidal zone along the Caminada headland and Shell Island reach will re-establish and with daily tidal processes and occasional storm events natural over-wash and ephemeral pool habitat would again be created throughout the action area.

The project life and expected future re-nourishment activities do not increase the likelihood of long-term increased human disturbance on Elmer's Island or Shell Island, or that the LDWF or other local entities would initiate construction of new infrastructure on those islands. The LDWF is committed to managing and maintaining Elmer's Island as a public recreation area for enjoying wildlife and fishing, as well as improving shorebird nesting, roosting, and foraging habitats with minimal human disturbance. Similarly, Shell Island's remote location and limited access from the mainland discourages regular use of the island. Because the remaining portions of the Caminada headland (i.e., Fourchon Beach/Bay Champange) are privately owned, it is unknown whether the increased likelihood of long-term increased human disturbance within those areas would occur due to construction of new infrastructure or upgrading of existing facilities, such as camps or oil and gas infrastructure.

Beneficial effects

The Corps has estimated that without the project there would be little or no piping plover critical habitat remaining on the Caminada headland and the remnants of Shell Island would erode below sea level within the 50-year period of analysis. With the project, 880 acres of dune and beach complex would be created along the Caminada headland, and 317 acres of dune and beach complex would be restored along the Shell Island reach (Corps 2010).

Beneficial effects are wholly positive without any adverse effects. We expect the prolonged existence and restoration/creation of foraging and roosting habitat for piping plovers along the Shell Island reach and within critical habitat Unit LA-5 along the Caminada headland as an overall result of the proposed BBBSR project. Much of the existing system is sediment-starved, and the proposed action would introduce sediment into that system that would be reworked and redistributed through natural processes, thus maintaining and/or enhancing the features of critical habitat. The additional sediment (within the sediment-starved Barataria Basin barrier system) would be re-worked by wind and wave action and storm events to allow for natural shoreline nourishment and repair along the Caminada headland and natural island "rollover" on Shell Island, all of which should result in the natural reformation of optimal piping plover habitat in the form of over-wash areas, sand flats, mud flats, and sand spits. The restoration and maintenance of intertidal habitat is important for the restoration of the piping plover population to healthy levels.

Species response to the proposed action

This biological opinion is based on direct and indirect effects that are anticipated to wintering and migrating piping plovers and designated critical habitat as a result of restoring beach, dune, and marsh on the Caminada headland and the remnants of Shell Island, as well as the temporary disruption of existing plover foraging and roosting habitat for the long-term benefit of maintaining existing barrier headland and island habitat. Although survey data from Table 10 (page 41) indicate that anywhere from 1 to 51 piping plovers could be using any portion of the action area in any given year, it is difficult for the Service to estimate the number of birds migrating through or wintering within the proposed action area because piping plover numbers fluctuate from year to year. Therefore, the Service anticipates that an unspecified number of migrating and wintering piping plovers utilizing the remnants of Shell Island and the Gulf shoreline of the Caminada headland (i.e., a total of 18.42 miles [29.64 km] of shoreline), and up to 278 acres of existing critical habitat will be impacted by: (1) construction disturbance within the action area; and (2) temporary habitat loss within the project footprint along on each barrier shoreline for the duration of construction activities (2 to 3 years for each project feature) and up to 2 years post construction for the recovery of intertidal benthic prey species.

The Service anticipates temporary adverse affects to piping plovers and their critical habitat throughout the action area from increased human activity during construction. The nearest suitable habitats to the Caminada headland into which piping plovers can disperse are located on East Timbalier Island (located between Timbalier Island and the West Belle Pass headland), the West Belle Pass headland (located immediately west of Belle Pass), and Grand Isle (located immediately east of Elmer's Island and Caminada Pass). The next closest suitable habitat areas to the Caminada headland consist of the Isles Dernieres (critical habitat Unit LA-4) to the west and the Grand Terre Islands (critical habitat Unit LA-5) to the east; both of which are greater than 10 miles away from that portion of the action area. The nearest suitable habitat areas to the Shell Island reach are Chaland Beach (located immediately west of Grand Bayou) and Pelican and Scofield Islands (located immediately east of the Empire jetties). The next closest suitable habitat areas to the Shell Island reach are the Grand Terre Islands to the west, and the mud lumps at mouth of the South Pass of the Mississippi River to the east; both of which are greater than 10 miles away from that portion of the action area. However, all of those areas have been impacted by the Deepwater Horizon oil spill, and foraging and roosting habitat in those areas are recovering from ongoing oil spill cleanup activities and NRDAR surveys and data collection. The duration of disturbance from the oil spill is ongoing for an unknown period of time. In addition, several other coastal restoration projects on the Isles Dernieres, West Belle Pass headland, Scofield Island, and Pelican Island will be constructed before, during, or within 2 years of the construction time frame for the BBBSR project.

The closest non-oiled habitat would be the Atchafalaya River Delta which is located greater than 70 miles west of the action area along the Caminada headland; there is no non-oiled habitat located east of either portion of the BBBSR project. Critical habitat Unit LA-2 consists of the deltaic splay and the dredge disposal islands occurring east and southeast of the main navigation channel of the Atchafalaya River. At this time, there have been no reported impacts to those areas as a result of the Deepwater Horizon oil spill. Table 12 depicts the results of sporadic winter surveys of the Atchafalaya River Delta over the last 19 years.

Table 12. Piping plover numbers from winter surveys within the Atchafalaya River Delta.

Location	1991 IPPC[a] Survey	1996 IPPC Survey	2001 IPPC Survey	2006 IPPC Survey	2006/2007 CWS[b] Survey	2007 LDWF[c] Survey	2008 LDWF Survey	2009 LDWF Survey	2010 LDWF Survey
Atchafalaya River Delta	27	0	21	6	NS[d]	NS	27	0	NS

(a) IPPC = International Piping Plover Census; (b) CWS = Canadian Wildlife Service, Maddock 2008; (c) LDWF = Louisiana Department of Wildlife and Fisheries-Natural Heritage Program; (d) NS = Not Surveyed.

Disturbance reduces the time migrating shorebirds spend foraging (Burger 1991). Pfister et al. (1992) implicate disturbance as a factor in the long-term decline of migrating shorebirds at staging areas. Elliott and Teas (1996) found a significant difference in actions between piping plovers encountering pedestrians and those not encountering pedestrians. Piping plovers encountering pedestrians spend proportionately more time in non-foraging behavior. This study suggests that interactions with pedestrians on beaches cause birds to shift their activities from calorie acquisition to calorie expenditure. In wintering and migration sites, human disturbance continues to decrease the amount of undisturbed habitat and appears to limit local piping plover abundance (Zonick and Ryan 1995). While piping plover migration patterns and needs remain poorly understood and occupancy of a particular habitat may involve shorter periods relative to the wintering season, information about the energetics of avian migration indicates that this might be a particularly critical time in the species' life cycle.

Critical habitat within the action area is experiencing ongoing disturbance by oil spill cleanup activities, and such disturbance will continue for an unknown period of time. The proposed action would involve anywhere from 2 to 3 years of disturbance activities for the construction period, plus an additional 2 years of recovery for the intertidal benthic community following TY1. The project would not, however, result in permanent changes to the natural processes that maintain the PCEs of critical habitat. Daily tidal processes and occasional storm events would re-work the additional sediment to recreate overwash areas, sand and mud flats, and sand spits. Without the additional sediment from the project, critical habitat on the headland would eventually erode below sea level.

Although restoration of the Caminada headland and Shell Island reach would follow on the heels of the Deepwater Horizon oil spill and would result in temporary disturbance within the action area, in time the proposed action would ultimately benefit the piping plover and its critical habitat by restoring diverse barrier headland and island habitats used by the piping plover. The proposed action would also allow for the continued existence and creation of habitat within critical habitat Unit LA-5 throughout the project life.

CUMULATIVE EFFECTS

The proposed project would occur on privately owned and State-owned lands and/or State-owned water bottoms. Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

It is unknown how much influence the proposed project would contribute to increased human disturbance along the privately owned portions of the Caminada headland. However, the remoteness of Shell Island and the LDWF's management of Elmer's Island help to control human disturbance

levels within those portions of the action area. Overall recreational use of the Caminada headland (including Elmer's Island) is generally in the form of bird watching and fishing, and because of its remoteness, there is little human disturbance on Shell Island. Any future proposed actions that are within endangered or threatened species habitat will require section 7 or 10 permitting from the Service to be covered under the Act.

Impacts to the action area from the Deepwater Horizon Mississippi Canyon Well #252 oil spill includes Stage III cleanup actions for weathered oil, tar balls, tar mats, tar patties, oil mousse, oiled wrack, Stage IV monitoring and maintenance activities, ongoing NRDAR surveys and studies, dispersants in the water, and increased human disturbance from those cleanup and monitoring activities. The final breadth of the oil spill impacts to the shoreline and shoreline-dependent species remains unknown; however, at the conclusion of the emergency event, section 7 consultation will be completed with the lead Federal agency, the U.S. Coast Guard.

PRELIMINARY CONCLUSION

The survival and recovery of all breeding populations of piping plovers are fundamentally dependent on the continued availability of sufficient habitat in their coastal migration and wintering range, where the species spends more than two-thirds of its annual cycle. All piping plover populations are inherently vulnerable to even small declines in their most sensitive vital rates (i.e., survival of adults and fledged juveniles). Mark-recapture analysis of resightings of uniquely banded piping plovers from seven breeding areas by Roche et al. (2010) found that apparent adult survival declined in four populations and increased in none over the life of the studies. Some evidence of correlation in year-to-year fluctuations in annual survival of Great Lakes and eastern Canada populations, both of which winter primarily along the southeastern U.S. Atlantic Coast, suggests that shared over-wintering and/or migration habitats may influence annual variation in survival. Further concurrent mark-resighting analysis of color-banded individuals across piping plover breeding populations has the potential to shed light on threats that affect survival in the migration and wintering range. Progress towards recovery (which is attained primarily through intensive protections to increase productivity on the breeding grounds) would be quickly slowed or reversed by even small sustained decreases in survival rates during migration and wintering.

Implementation of the proposed action is not likely to directly kill any piping plovers since the birds are highly mobile and can quickly move out of harm's way. The increased disturbance to normal foraging and roosting behavior, as well as to suitable foraging and roosting habitat, is likely to result in indirect effects via increased energy expenditure and a potential lack of adequate food supplies which can then lead to temporarily reduced fitness, fecundity, and over-wintering survival. However, such effects would be temporary for those birds wintering in or migrating through the action area over the course of two or three wintering seasons. After reviewing the current status of the piping plover wintering population of the northern Great Plains, the Great Lakes, and the Atlantic Coast; the environmental baseline for the action area; the effects of the proposed BBBSR project; and cumulative effects, it is the Service's preliminary biological opinion that implementation of the BBBSR project, as proposed, is not likely to jeopardize the continued existence of non-breeding piping plover. As noted previously, the overall status of the listed species is stable, if not increasing.

Critical Habitat

Critical habitat for this species has been designated within the project area and the action area. The project has been designed to mimic natural barrier headland habitat and, in the long-term, would aid

natural processes in creating and maintaining the PCEs of critical habitat on the headland by providing sediment within the sediment-starved barrier headland system. The amount of critical habitat in Unit LA-5 directly affected from the project is approximately 278 acres of sparsely and non-vegetated barrier headland shoreline habitat. The project area would be temporarily disturbed during construction activities which would impede piping plovers attempting to roost and forage in the area during the migration and wintering months that coincide with construction. Temporary disturbance to 278 acres of Unit LA-5 equates to 1.1 percent of designated critical habitat in Louisiana and 0.16 percent of all designated critical habitat throughout the Southeast (i.e., North Carolina to Texas). Because the effects to critical habitat would be temporary in nature and the overall project would be beneficial in the long-term, it is the Service's preliminary biological opinion that implementation of the BBBSR project is not likely to destroy or adversely modify designated critical habitat in Unit LA-5.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Corps so that they become binding conditions of any contract, grant, or permit issued to the Corps' contractor, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require its contractor to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the contract, grant, or permit document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps and/or its contractor must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 Code of Federal Regulations (CFR) §402.14(I) (3)].

AMOUNT OR EXTENT OF TAKE ANTICIPATED

Although wintering bird survey data indicate that anywhere from 1 to 51 piping plovers could be using any portion of the action area at any point in time, it is difficult for the Service to estimate the exact number of birds that could be migrating through or wintering within the proposed action area at any one point in time or place during project construction. Therefore, the Service considers the disturbance to shoreline miles as a measurable way to estimate take because disturbance to suitable habitat within the action area would affect the ability of any given number of piping plovers to find foraging and roosting habitat throughout the migrating and wintering periods of any given year. The Service anticipates that directly and indirectly an unspecified number of piping plovers along 18.42 miles of

Gulf shoreline, of which 278 acres is designated critical habitat, could be taken in the form of harm and harassment as a result of the proposed action. Incidental take of piping plovers will be difficult to detect for the following reasons:

1. The number of birds within the action area for the duration of project construction and intertidal benthic recovery is difficult to detect because wintering piping plover numbers within the action area vary from year to year, and migrating piping plover numbers vary between both fall and spring migrations and year to year.
2. Harassment to the level of harm may only be apparent on the breeding grounds the following year as a result of reduced fitness or fecundity, or as lack of over-wintering survival.
3. Over-wintering survival would be difficult to detect because it is difficult to detect birds that do not survive migration back to the breeding grounds.
4. Dead plovers may be carried away by waves or predators.

The level (i.e., all piping plovers using the 18.42 miles of Gulf shoreline) of take of this species can be anticipated by the proposed activities because:

1. Piping plovers are known to winter in and migrate through the action area.
2. The placement of sand and marsh material is expected to temporarily affect (e.g., in the form of increased human disturbance during construction, temporary loss of benthic prey, and temporary loss of wrack) 18.42 miles of Gulf shoreline over multiple migrating and wintering seasons until construction is complete and until the benthic fauna recover.
3. Temporarily increased levels of human disturbance are expected for the duration of construction activities which would make the 18.42 miles of Gulf shoreline less desirable habitat for piping plovers and may cause increased energy expenditure as birds move away from construction activities.
4. A temporary reduction of food base will occur due to sand and marsh material placement which would affect the piping plover's ability to forage and store enough fat reserves for migration back to the breeding grounds for multiple wintering seasons. Such an effect could result in reduced fitness or fecundity.

The Service has reviewed the biological information and other information relevant to this action. The take is expected in the form of harm and harassment because of: (1) temporarily decreased fitness and survivorship of wintering piping plovers; and (2) temporarily decreased fitness and survivorship of piping plovers attempting to migrate to breeding grounds, due to temporary loss of and disturbance to foraging and roosting habitat. Incidental take covers take of the species within the action area. If the Corps expands the action outside of the action area then consultation must be reinitiated.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the piping plover species or destruction or adverse modification of its critical habitat. Incidental take of an unspecified number of piping plovers is anticipated to occur along 18.42 miles of barrier headland and island habitat during project construction and up to 2 years following construction until the intertidal benthic community recovers.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize take on non-breeding piping plovers during implementation of the proposed BBBSR project within the action area.

1. The Corps should carefully mark and stake the boundaries of the project footprint on both the Caminada headland and Shell Island and ensure that those markers are maintained for the duration of project construction activities. Should the project extend outside of those boundary markers, then the level (i.e., all piping plovers using the 18.42 miles of Gulf shoreline) of incidental take for this project would be exceeded and the Corps should reinitiate section 7 consultation with the Service as soon as possible.
2. A baseline piping plover survey should be conducted within the migrating and wintering season immediately prior to initial construction in order to determine the piping plover's preferred habitat use within the action area. Such information could then be used as an aid to determine whether specific project actions require slight modifications in order to minimize the effects of the take for future migrating and wintering seasons. For example, initial bird surveys may aid in locating and marking appropriate ingress and egress routes for ORVs and other work-related equipment, as well as equipment staging areas, in order to reduce disturbance to foraging and roosting birds to the maximum extent practicable.
3. A simple diversity and abundance survey of the intertidal benthic prey species community should be conducted within the migrating and wintering season immediately prior to initial construction (preferably at the same time as the plover distribution surveys) in order to establish a baseline of benthic prey species diversity and abundance. Again, such information could then be used as an aid to determine whether specific project actions require slight modifications in order to minimize the effects of the take for future migrating and wintering seasons. For example, initial surveys could locate areas of abundant benthic prey where birds may tend to congregate for foraging, and those areas could be flagged for avoidance by regular personnel traffic to reduce disturbance to foraging plovers.
4. Piping plover monitoring surveys should be conducted during the migrating and wintering seasons throughout initial project construction and three consecutive years following completion of initial construction in order to determine whether ingress and egress routes are working or whether they need to be adjusted.
5. To determine length of time needed for recovery of suitable foraging habitat for migrating and wintering plovers, monitoring surveys of the intertidal benthic prey species community should be conducted each year following completion of initial construction for three consecutive years. Such information could then be used as an aid to determine whether specific project actions require slight modifications in order to minimize the effects of the take for future project renourishment and/or maintenance events.
6. At least six months prior to mobilization, the Service should be notified in writing when renourishment events (i.e., renourishment of the subtidal feeder bar and of Shell Island) will occur within the action area so that the Corps and the Service can coordinate and exchange updated information to ensure that reinitiation of consultation is not necessary.
7. A comprehensive report describing the actions taken to implement the RPMs and terms and conditions associated with this incidental take statement shall be submitted to the Service by June 30 of the year following completion of all required surveys.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps shall execute the following terms and conditions, which implement the RPMs described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

Marking Project Boundaries

1. The Corps should carefully survey and mark the boundaries of the project footprint on the Caminada headland and Shell Island.
2. Boundary markers should be semi-permanent such that they should be maintained throughout construction activities and should persist until all construction-related activities are completed.
3. The Service's Louisiana Ecological Services Office (337/291-3108) should be notified immediately if any work or project-related actions exceed the boundary markers so that reinitiation of section 7 consultation can proceed as quickly and efficiently as possible to avoid delay in the project schedule.

Monitoring Requirements

1. Requirements for piping plover surveys
   a) A survey schedule (with dates) is listed in Appendix B and the recommendation is for at least 3 survey dates per month; this schedule should be followed as closely as possible. The Service recognizes that given the remoteness of the project area and the potential for inclement weather conditions during the piping plover wintering season, three survey dates per month may be difficult to achieve in Louisiana. If conditions require a deviation from the recommended survey schedule, such information should be carefully documented, including an explanation why any deviation from the recommended schedule was deemed necessary.
   b) Piping plover identification, especially when in non-breeding plumage, can be difficult. Qualified professionals with shorebird/habitat survey experience must conduct the required survey work. Piping plover monitors must be capable of detecting and recording locations of roosting and foraging plovers, and documenting observations in legible, complete field notes. Aptitude for monitoring includes keen powers of observation, familiarity with avian biology and behavior, experience observing birds or other wildlife for sustained periods, tolerance for adverse weather, experience in data collection and management, and patience.
   c) Binoculars, a global positioning system (GPS) unit, a 10-60x spotting scope with a tripod, and the Service datasheet (Appendix B) must be used to conduct the surveys.
   d) Negative (i.e., no plovers seen) and positive survey data shall be recorded and reported.
   e) Piping plover locations shall be recorded with a GPS unit set to record in decimal degrees in universal transverse mercator (UTM) North American Datum 1983 (NAD83).
   f) Habitat, landscape, and substrate features used by piping plovers when seen shall be recorded. Such features are outlined on the Service data sheet in Appendix B.
   g) Behavior of piping plovers (e.g., foraging, roosting, preening, bathing, flying, aggression, walking) shall be documented on the Service data sheet in Appendix B.
   h) Color-bands seen on piping plovers shall also be carefully documented, and should also be reported according to the information found at the following websites. Information regarding color-band observations can be found at:
   http://www.fishwild.vt.edu/piping_plover/Protocols_final_draft.pdf,
   http://www.waterbirds.umn.edu/Piping_Plovers/piping2.htm, and
   http://www.fws.gov/northeast/pipingplover/pdf/BahamasBandReporting2010.pdf.

2. Requirements for surveying benthic prey species
   a) A qualified professional with sediment/macroinvertebrate sampling experience must conduct the benthic prey species surveys.
   b) A baseline macroinvertebrate survey will be conducted at the same time of the initial piping plover survey during the migrating/wintering season immediately prior to construction. Additional surveys will be conducted during the migrating/wintering season each year post-construction for three consecutive years to determine benthic prey species recovery. Such surveys should be conducted at the same time as the plover surveys.
   c) Sampling will be conducted using a basic before and after control and impact design method. Sampling will be coordinated with piping plover foraging observations based on low tide surveys.
   d) In addition to recording benthic species abundance and diversity, a qualitative measure of sediment characteristics (sand, shell, mud) should also be recorded.
   e) A detailed sampling methodology should be developed in coordination with the Service prior to initiating surveys.

Reporting Requirements

1. Incorporate all data collected into an appropriate database, preferably one for piping plovers and one for benthic prey species.
2. Annual update reports should be provided to the Service by June 30 of each calendar year once construction begins. Annual update reports should include data sheets, maps, a copy of the database, and the progress and initial findings of piping plover and benthic community surveys, as well as any problematic issues that may hinder future survey efforts.
3. If the Corps foresees any problematic issues that would require a change in the recommended survey schedule due to work conditions or project delays, the Corps should immediately notify the Service so that we can resolve/correct any such issues.
4. A final comprehensive report should be provided to the Service by June 30 following the third year of surveys. That final report should include an analysis of all data results from the piping plover and benthic community surveys.
5. At least six months prior to mobilization, the Corps should notify the Service in writing prior to each proposed renourishment event. That notification should include whether there are any changes in the proposed amount of renourishment per island or changes in anticipated project footprints.

Upon locating a dead or injured piping plover that may have been harmed or destroyed as a direct or indirect result of the proposed project, the Corps and/or contractor shall be responsible for notifying the Service's Lafayette, Louisiana, Field Office (337/291-3100) and the LDWF's Natural Heritage Program (225/765-2821). Care shall be taken in handling an injured piping plover to ensure effective treatment or disposition and in handling dead specimens to preserve biological materials in the best possible state for later analysis.

COORDINATION OF INCIDENTAL TAKE STATEMENT WITH OTHER LAWS, REGULATIONS, AND POLICIES

Migratory Bird Treaty Act (MBTA)

The MBTA implements various treaties and conventions between the U.S., Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the provisions of the MBTA

it is unlawful "by any means or manner to pursue, hunt, take, capture or kill any migratory bird except as permitted by regulations issued by the Fish and Wildlife Service. The term "take" is not defined in the MBTA, but the Service has defined it by regulation to mean to pursue, hunt, shoot, wound, kill, trap, capture or collect any migratory bird, or any part, nest or egg or any migratory bird covered by the conventions or to attempt those activities.

In order to comply with the MBTA and potential for this project to impact nesting shorebirds, the Corps should follow the Service and LDWF's guidelines (Appendix D) to protect against impacts to nesting shorebirds during implementation of this project.

The Fish and Wildlife Service will not refer the incidental take of piping plovers for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712), if such take is in compliance with the terms and conditions specified here.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. The Corps should consider retro-fitting all sand fencing poles with pointy tops or caps to reduce avian predation.

2. We encourage the Corps to take a proactive approach in coordinating with the Service regarding programmatic-level section 7 consultations for implementation of landscape-scale coastal protection and restoration programs in Louisiana. Programmatic-level planning and consultation may further reduce and minimize cumulative effects to listed species (e.g., piping plover, pallid sturgeon, West Indian manatee, sea turtles) resulting from implementation of multiple types of coastal protection and restoration projects, including, but not limited to those projects associated with the LCA Study, CWPPRA, and hurricane protection actions.

3. We encourage the Corps to continue to coordinate with the Service during the pre-planning phases of future coastal protection and restoration projects (including any sand placement projects) within piping plover designated critical habitat.

4. We encourage the Corps to participate in and/or fund a benthic study (or studies) along coastal Louisiana, west of the Mississippi River. Information is needed regarding the effects of sand placement and dredging projects on benthic prey species and their potential recovery time following such actions. That information would benefit our knowledge regarding piping plover foraging biology and aid in future section 7 consultation during project planning for future coastal restoration actions.

In order for the Service to be kept informed of actions that minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes early consultation on the proposed action. The Corps may ask the Service to confirm this preliminary biological opinion as a final biological opinion on the proposed action once the forthcoming draft Environmental Impact Statement has been reviewed by the public and the proposed project features have been confirmed and finalized. The request must be in writing. If the Service reviews the proposed action and finds that there are no significant changes in the action as planned or in the information used during the early consultation, we will confirm the preliminary biological opinion as the final biological opinion.

As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take (i.e., the 18.42 miles of Gulf shoreline described herein) is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take shall cease pending reinitiation.

If the Service does not confirm this preliminary biological opinion as a final biological opinion on the proposed action, the Corps is required to initiate formal consultation with the Service. If you have any questions about this preliminary biological opinion, please contact Ms. Brigette Firmin of this office at 337/291-3108.

Sincerely,

Darryl Clark
Acting Supervisor
Louisiana Ecological Services Office

cc: FWS, Atlanta, GA (Attn: Ken Graham)
FWS, Panama City, FL (Attn: Patty Kelly)
LDWF, Baton Rouge, LA
LDWF, Natural Heritage Program, Baton Rouge, LA

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APPENDIX A

FIGURES

Figure 1. The proposed action would be located along the barrier shoreline of the Barataria Basin in Lafourche and Plaquemines Parishes, Louisiana (http://www.lca.gov/Projects/4/Default.aspx).

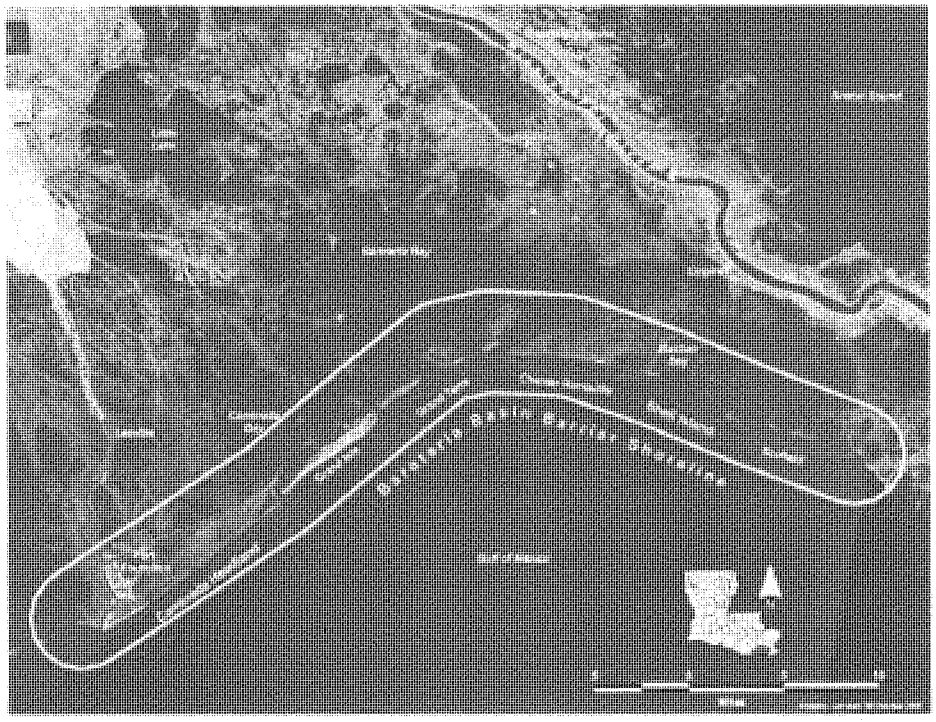


Figure 2. Caminada Headland Alternative 5 – Preferred Dune with Expanded Marsh and Subtidal Feeder Bar (Corps 2010).

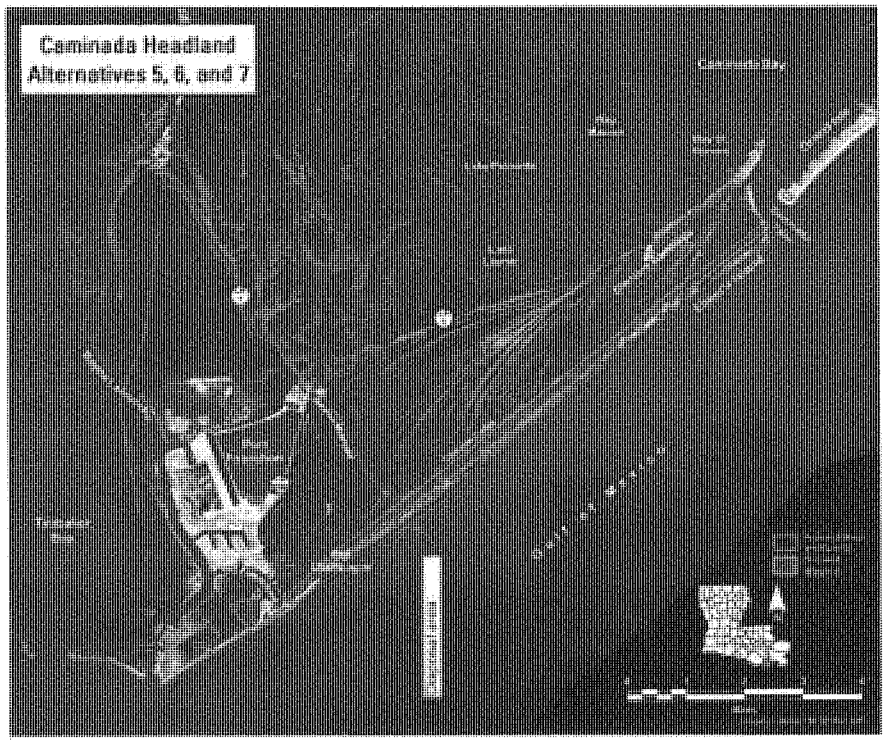


Figure 3. Shell Island Alternative 5 – One Island with Two Renourishments (Corps 2010).

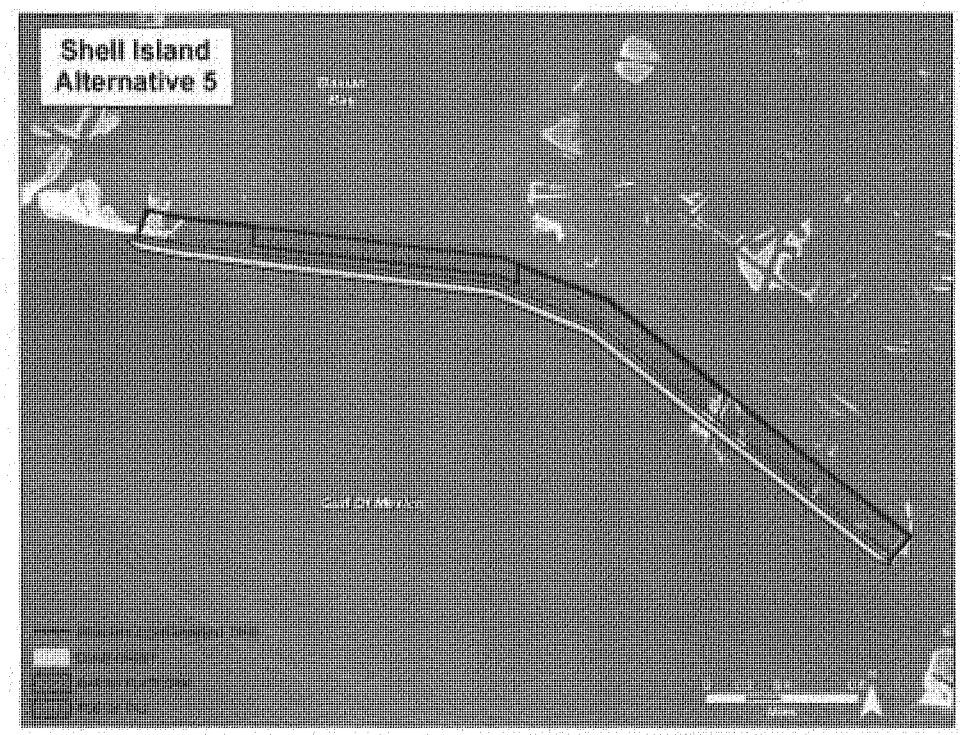


Figure 4. The estimated sediment budget for the Caminada Headland barrier shoreline system (Corps 2010).

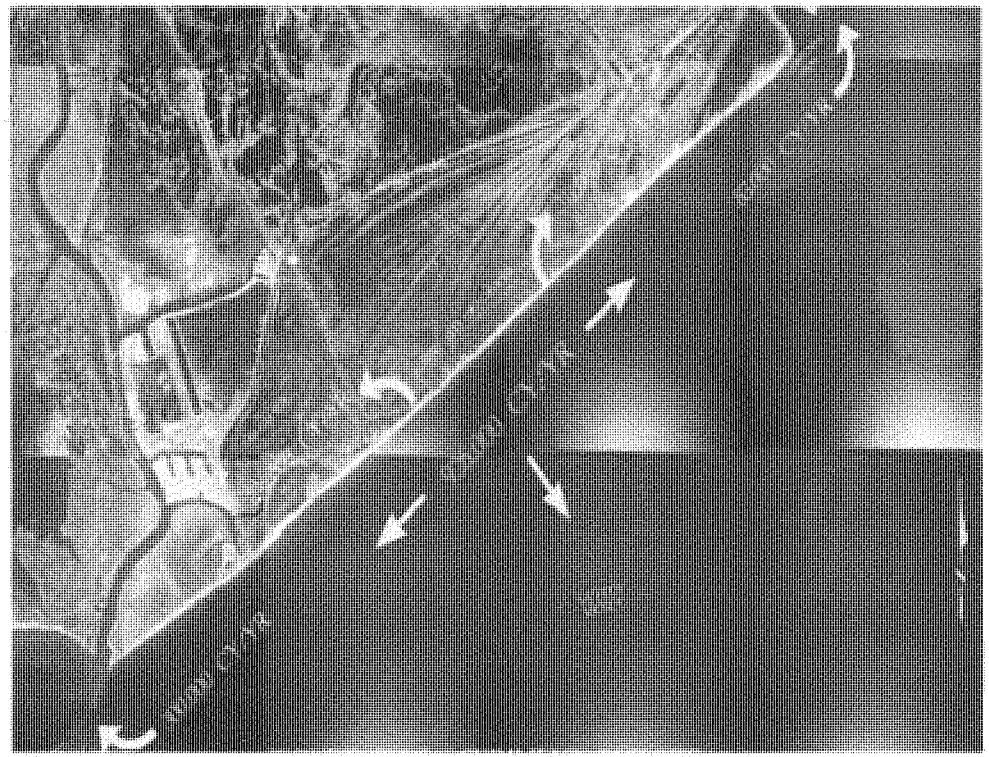


Figure 5. Distribution and range of piping plovers (base map from Haig and Elliott-Smith 2004). Conceptual presentation of subspecies and distinct population segments (DPS) ranges are not intended to convey precise boundaries.

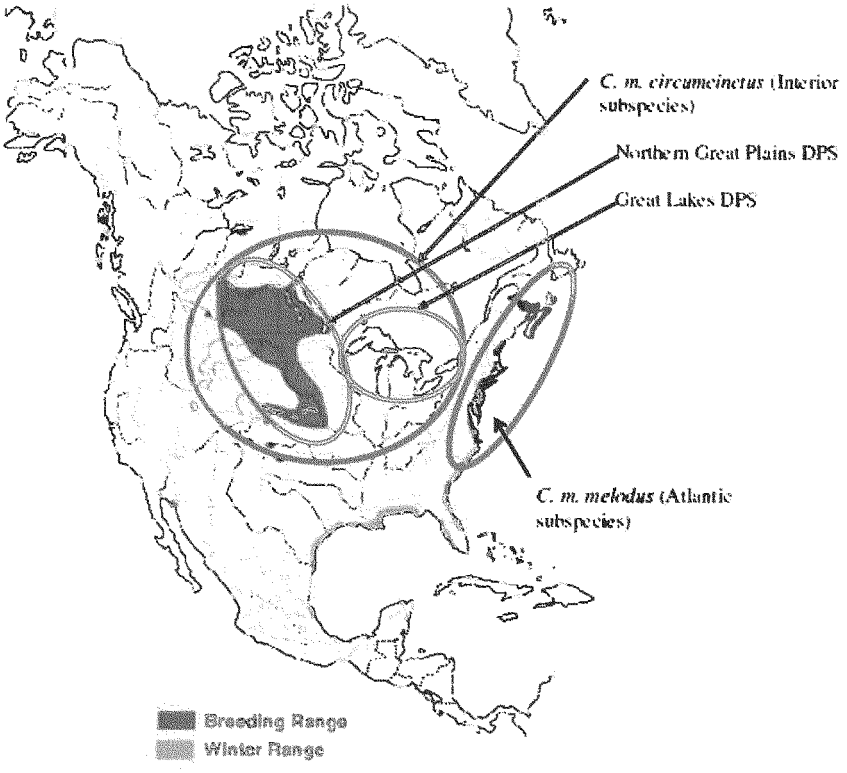
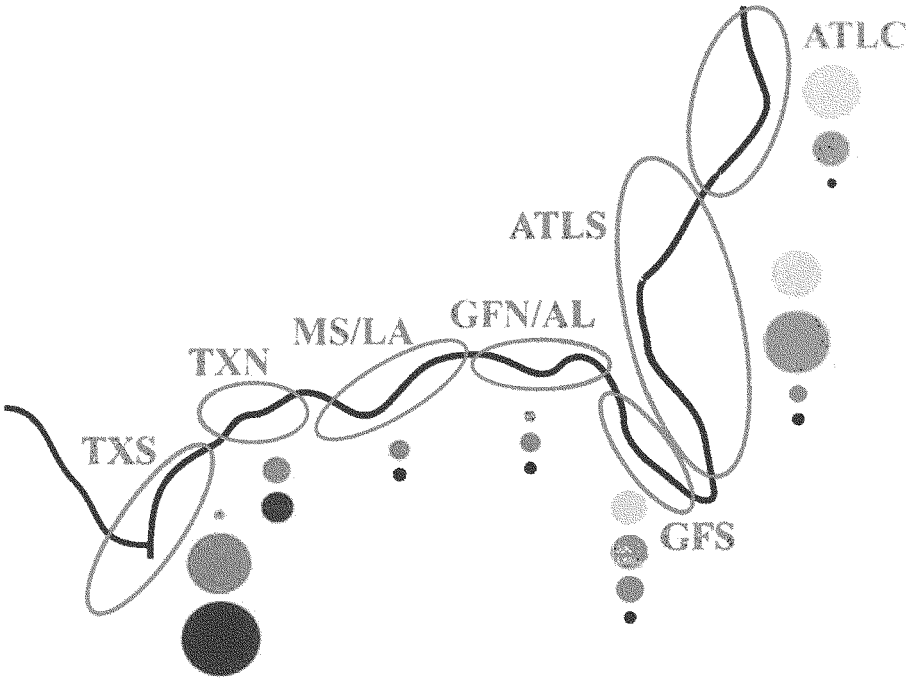


Figure 6. Breeding population distribution* in the wintering/migration range (from Gratto-Trevor et al. 2009, reproduced by permission).



*Regions: ATLC=Atlantic (eastern) Canada; ATLS=Atlantic U.S.; GFS=Gulf Coast of southern Florida; GFN=Gulf Coast of north Florida; AL=Alabama; MS/LA=Mississippi and Louisiana; TXN=northern Texas; and TXS=southern Texas. For each breeding population, circles represent the percentage of individuals reported wintering along the eastern coast of the U.S. from the central Atlantic to southern Texas/Mexico up to December 2008. Each individual was counted only once. Grey circles represent Eastern Canada birds, orange circles for U.S. Great Lakes, green circles for the U.S. Great Plains, and black circles for Prairie Canada. The relative size of the circle represents the percentage from a specific breeding area seen in that winter region. Total number of individuals observed on the wintering grounds was 46 for Eastern Canada, 150 for the U.S. Great Lakes, 169 for the U.S. Great Plains, and 356 for Prairie Canada.

APPENDIX B

Non-breeding Piping Plover Survey Guidelines

U.S. Fish and Wildlife Service
Ecological Services Office
Lafayette, Louisiana

Louisiana Piping Plover Non-Breeding Season Survey Guidelines

The purpose of these guidelines is to assess and/or monitor piping plover use of coastal restoration features related to the Barataria Basin Barrier Shoreline Restoration Project. Survey locations should include the coastal restoration features plus adjacent suitable shorebird habitat (i.e., intertidal beaches, mud flats, sand flats, algal flats, wash-over passes, and associated dunes and flats above annual high tide). Monitoring should be conducted July 15 through May 15 to follow the International Shorebird Survey (ISS) census dates listed below. The ISS schedule usually results in three surveys per month. If this is not feasible, try to do at least two surveys per month on the ISS census dates. Surveys should be conducted on ISS dates plus or minus two days. For example, a survey scheduled for the 15th could be conducted on any day between the 13th through the 17th of that month.

Spring Migration	Fall Migration	Winter
February 25	July 15	October 15
March 5	July 25	October 25
March 25	August 5	November 5
April 5	August 15	November 15
April 15	August 25	November 25
April 25	September 5	December 5
May 5	September 15	December 15
May 15	September 25	December 25
	October 5	January 5
		January 15
		January 25
		February 5
		February 15

To the extent possible, surveys should be conducted when birds are foraging. The best time is at low tide, but surveys can also be conducted on a falling or rising tide provided that the foraging areas are not completely covered. During high tide, birds will be roosting. Although piping plovers often roost near foraging areas, the birds will be more difficult to locate. Avoid conducting surveys during poor weather conditions (e.g., high winds, rain).

Methods

In most cases surveys will be conducted by foot. All terrain vehicles (ATVs) may be used to expedite the transport of observers over long stretches of liner routes ("leapfrogging" teams down a beach in 0.5 to 1 mile increments), but all bird counting will be conducted while walking. **[Driving on vegetated areas shall not be permitted. Any ATV use should be coordinated with the Louisiana Department of Wildlife and Fisheries' Isles Dernieres Wildlife Refuge management staff.]** Birds on exposed mudflats that may be inaccessible by foot should be counted from boats. Each survey crew should use their best professional judgment on the most efficient way to conduct the survey and should document in detail if any deviations to these guidelines are deemed necessary.

U.S. Fish and Wildlife Service
Ecological Services Office
Lafayette, Louisiana

Observers should work in teams of two to four people, depending on the width of the beach and beach/tidal interface. Wide coastal beaches will require a greater number of observers in order to assure that birds are not missed on the back (aft) side of the dune. Observers working on beaches that contain moderate to high dunes should climb them every 0.5 to 1 mile and look for wash-over flats and pools that may not be visible from the beach. Coastal islands will be surveyed on both the Gulf and bay sides (this may require multiple teams of observers in order to finish the surveys in a timely manner).

Piping plover locations will be recorded with global positioning system (GPS) units. GPS locations will be recorded in universal transverse mercator (UTM) map datum NAD 83 CONUS. Each survey team should carry aerial photography of the survey route so that new breaks (cuts) in the beach or island can be noted on the survey maps. Habitat data will also be collected and will include foraging substrate, portion of the beach used and side of the island on which the birds are found (see attached data sheet). These habitat criteria have been adapted from the 2006 International Winter Piping Plover Census organized by the U.S. Geological Survey. Behavioral data (e.g., foraging, roosting, preening, bathing, flying, aggression, walking) of piping plovers when seen should also be documented.

Negative data is as important as positive data. Indicate when surveys have been done and no birds were observed. Although piping plovers are the target species, any additional observations of other species would help the U.S. Fish and Wildlife Service to identify shorebird concentration areas and management needs.

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Ecological Services Office
Lafayette, Louisiana

Louisiana Piping Plover Survey Form
(Note: Most criteria adopted from the 2006 Wintering Piping Plover Census Form)

A. Total # Piping Plovers Observed: _____

B. Location Description (Name): _____
1. Parish: _____
2. UTM location NAD 83 CONUS (center):
Northing_____ Easting_____
3. Land Ownership:
___Federal ___State ___Municipal ___Private ___County ___Tribal

C. Date of survey:_____ Time survey conducted: _____to _____

D. Weather Conditions:
1. Tide stage(s): ___Low ___Mid ___High (___Rising / ___Falling)
2. General weather: ___Sunny ___Partly cloudy ___Overcast ___Rain ___Fog
___Other (describe):_____
3. Approximate temperature: _____Celsius / Fahrenheit (circle one)
4. Wind speed: _____miles/hr Wind direction:_____

E. Description of Habitat Surveyed (check as many as apply). The Code designation will be used in Section F table below:

- **Body of Water Type**:
____I. Ocean ____II. Protected bay, harbor, cove, lagoon ____III. Gulf of Mexico
____IV. Ocean Inlet ____V. Other (describe)_____

- **Shoreline Type**:
____A. Mainland ____B. Barrier Island ____C. Spoil Island ____D. Bar
____E. Other Island ____F. Washover area ____G. Other (describe)_____

- **Specific Description**:
____1. Sand beach ____2. Sand spit ____3. Sand flat ____4. Sand bar
____5. Salt flat ____6. Gravel shore ____7. Oyster reef ____8. Mudflat
____9. Vegetation (algal) mat ____10. Vegetated shoreline
____11. Other (describe)_____

- **Location Description** (criteria for islands only):
____ i. Gulf-side of island ____ii. Bay-side of island
____a. Tidal interface ____b. Fore dune ____c. Top of dune ____d. Aft dune

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Ecological Services Office
Lafayette, Louisiana

F. Numbers, behaviors, habitat types, and GPS location(s) of piping plovers observed (mark on map if possible).

Number of Plovers Observed	**Behavior Displayed** *(e.g., foraging, roosting, preening, walking, flying, aggression, etc.)*	**Habitat Type where Plovers were found** *(use designations from Section E above, e.g., IIC8ii, IIIB9ia)*	**UTM location NAD 83 CONUS**	
			Northing	*Easting*

G. Mode(s) of transportation:
____Foot ____Car/Truck ____ATV ____Boat ____Airboat ____Other_____

H. Habitat (shoreline) covered: _____miles (please calculate using aerial photograph's scale)

I. Observers: _____

_____

_____

J. Additional comments or notes:_____

_____

_____

_____

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Ecological Services Office
Lafayette, Louisiana

K. Additional species encountered (for flying flocks lump as peeps and estimate number). Species of special interest are listed below; please add any additional species.

OTHER SPECIES	TOTAL#	OTHER SPECIES	TOTAL#
Reddish Egret			
Marbled Godwit			
Red Knot			
Western Sandpiper			
Stilt Sandpiper			
Short-billed Dowitcher			
Snowy Plover			
Wilson's Plover			
Long-billed Curlew			
American Oystercatcher			

APPENDIX C

Standard Conditions for In-water Work in the Presence of Manatees

Guidelines for Activities in Proximity to Manatees and Their Habitat

A. All personnel associated with the project should be informed of the potential presence of manatees, manatee speed zones, and the need to avoid collisions with and injury to manatees. Such personnel instruction should also include a discussion of the civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973.

B. All contract and/or construction personnel are responsible for observing water-related activities for the presence of manatee(s).

C. Temporary signs should be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area), and at least one sign should be placed where it is visible to the vessel operator.

D. Siltation barriers, if used, should be made of material in which manatees could not become entangled, and should be properly secured and regularly monitored. Barriers should not impede manatee movement.

E. If a manatee is sighted within 100 yards of the active work zone, special operating conditions should be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels should operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, should be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions are no longer necessary, but careful observations would be resumed.

F. Any manatee sighting should be immediately reported to the U.S. Fish and Wildlife Service's (Service) Lafayette, Louisiana, Field Office (337/291-3100) and the Louisiana Department of Wildlife and Fisheries (LDWF), Natural Heritage Program (225/765-2821).

APPENDIX D

Louisiana Guidelines for Minimizing Disturbance to Colonial Nesting Birds

U.S. Fish and Wildlife Service
Ecological Services Office
Lafayette, Louisiana

Louisiana Guidelines for Minimizing Disturbance to Colonial Nesting Birds

Nesting colonies may be present that are not currently listed in the database maintained by the Louisiana Department of Wildlife and Fisheries (LDWF). That database is updated primarily by monitoring the colony sites that were previously surveyed during the 1980s. Until a new, comprehensive coast-wide survey is conducted to determine the location of newly-established nesting colonies, we recommend that a qualified biologist inspect the proposed work site for the presence of undocumented nesting colonies during the nesting season. In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

To minimize disturbance to colonial nesting birds, the following restrictions on activity should be observed:

1. For colonies containing nesting brown pelicans, all activity occurring within 2,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 15 through March 31). Nesting periods vary considerably among Louisiana's brown pelican colonies, however, so it is possible that this activity window could be altered based upon the dynamics of the individual colony. The Louisiana Department of Wildlife and Fisheries' Fur and Refuge Division should be contacted to obtain the most current information about the nesting chronology of individual brown pelican colonies. Brown pelicans are known to nest on barrier islands and other coastal islands in St. Bernard, Plaquemines, Jefferson, Lafourche, and Terrebonne Parishes, and on Rabbit Island in lower Calcasieu Lake, in Cameron Parish.

2. For colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary within this window depending on species present).

3. For colonies containing nesting gulls, terns, and/or black skimmers, all activity occurring within 650 feet of a rookery should be restricted to the non-nesting period (i.e., September 16 through April 1, exact dates may vary within this window depending on species present).

Below is a table explaining the nesting chronology of species that are known to nest in Louisiana. The table is an excerpt from page 31 of:

Martin, R.P., and G.D. Lester. 1990. The Atlas and Census of Wading Bird and Seabird Nesting Colonies of Louisiana: 1990. Louisiana Department of Wildlife and Fisheries – Louisiana Natural Heritage Program. Special Publication No. 3 for the U.S. Department of Interior – Fish and Wildlife Service. Contract No. 14-16-0004-89-963.

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Ecological Services Office
Lafayette, Louisiana

Table 8. Nesting chronology for colonial-nesting waterbirds in Louisiana with suggested activity windows.[a]

Species	Incubation Season	Incubation Period (days)	Days to Fledging	Activity[b] Window
Brown Pelican	1 Nov to 15 Jun	28-30	74-76	1 Aug to 31 Oct
Olivaceous Cormorant	15 Mar to 15 Apr	23-26	35-42	1 Jul to 1 Mar
American Anhinga	15 Mar to 15 Apr	25-28	?	1 Jul to 1 Mar
Great Blue Heron	1 Mar to 30 Apr	25-29	58-62	1 Aug to 15 Feb
Great Egret	1 Mar to 31 May	23-24	40-44	1 Aug to 15 Feb
Snowy Egret	16 Mar to 15 Jun	17-19	20-25	1 Aug to 1 Mar
Little Blue Heron	16 Mar to 15 Jun	22-24	28-32	1 Aug to 1 Mar
Tricolored Heron	16 Mar to 15 Jun	20-22	?	1 Aug to 1 Mar
Reddish Egret	16 Mar to 15 Jun	23-26	?	1 Aug to 1 Mar
Cattle Egret	16 Apr to 30 Jun	21-24	35-40	1 Sep to 1 Apr
Green-backed Heron	1 Apr to 30 Jun	19-21	16-17	1 Sep to 15 Mar
Black-crowned Night-Heron	16 Mar to 15 Jun	24-26	40-42	1 Sep to 1 Mar
Yellow-crowned Night-Heron	1 Apr to 15 Jun	?	?	1 Sep to 15 Mar
White Ibis	16 Apr to 30 Jun	21-23	35-42	1 Sep to 1 Apr
Glossy/White-faced Ibis	16 Apr to 30 Jun	21-23	42-49	1 Sep to 1 Apr
Roseate Spoonbill	16 Apr to 15 Jun	23-24	49-56	1 Aug to 1 Apr
Laughing Gull	16 Apr to 15 Jun	23-25	35-45	1 Aug to 1 Apr
Gull-billed Tern	16 May to 15 Jul	22-23	28-35	16 Sep to 1 May
Caspian Tern	1 May to 15 Jul	26-28	36-48	16 Sep to 15 Apr
Royal Tern	1 May to 15 Jul	28-31	36-48	16 Sep to 15 Apr
Sandwich Tern	1 May to 15 Jul	23-25	22-33	16 Sep to 15 Apr
Common Tern	1 May to 15 Jul	21-25	23-27	16 Sep to 15 Apr
Forster's Tern	1 Apr to 31 May	25-29	23-27	1 Aug to 15 Mar
Least Tern	1 May to 15 Jul	20-25	19-23	16 Sep to 15 Apr
Sooty Tern	16 May to 15 Jul	22-23	30-35	16 Sep to 15 Apr
Black Skimmer	16 May to 15 Jul	22-23	30-35	16 Sep to 1 May

[a] Data are compiled from Bent (1921), Bent (1926), Palmer (1962), Harrison (1975), Portnoy (1977) and Terres (1980).

[b] Suggested project initiation and completion dates to minimize disturbance to nesting birds.

The U.S. Fish and Wildlife Service (Service) realizes that the proposed barrier headland and island restoration work most likely would be constructed during one or more colonial waterbird nesting seasons because construction would extend over 2 or more years. In order to minimize disturbance to nesting gulls, terns, and/or black skimmers, the Service would like to coordinate with the Corps to develop a migratory bird abatement plan. Please contact Ms. Patti Holland (337/291-3121) of the Louisiana Ecological Services Office for further information and coordination associated with the development of a migratory bird abatement plan.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF

JUN 0 1 2011

Regional Planning and
Environmental Division South
New Orleans Environmental Branch

Carrie Thompson
US Fish and Wildlife Service
646 Cajundome Blvd., Suite 400
Lafayette, LA 70506
Fax: (337) 291-3139

Dear Mrs. Thompson:

The U.S. Army Corps of Engineers, New Orleans District (CEMVN), is formally submitting information regarding modifications to the proposed action of the Louisiana Coastal Area (LCA) Barataria Basin Barrier Shoreline (BBBS) project, that will require modification to the preliminary Biological Opinion (BO) provided by your office on March 28, 2011 during Formal Consultation as per the requirements of Section 7(a)(2) of the Endangered Species Act of 1973, as amended. We are providing additional information detailing changes made to the operation and maintenance expected on the Caminada Headland. Please review the below information which details changes that have occurred to the scope of the tentatively selected plan (TSP) for the BBBS project, and evaluate any additional effects these changes, not considered in your BO, will have on threatened and endangered species and provide us a revised BO.

Changes were made to the frequency and quantity of renourishment to the Caminada Headland. Originally the proposed action planned to use 500,000 cy of the 650,000 cy of material removed every 1.5 to 2 years during maintenance dredging of Bayou Lafourche. To increase the sustainability of the proposed action; all material removed from maintenance dredging of bayou Lafourche will be placed in the littoral drift south of Bayou Moreau where the long shore transport of material splits going east and west. The additional material will increase the quantity of material placed in the feeder berm from 2 mcy every ten year period to 3.9 mcy every 10 year period. The renourishment frequency would also increase; resulting in material being placed along the feeder bar 6 times over a 10 year period rather than 4 times over a 10 year period. The increase in renourishment will help to stabilize the Caminada Headland which currently loses 379,000 cy of material every year or 18.95 mcy over 50 years. By increasing the total quantity of material placed over the 50 year period of analysis, we would increase the sustainability of the Caminada Headland. The increase in renourishment to 3.9 every ten years will allow the quantity of sediment placed within the feeder bar to be greater than the projected sediment loss of 3.79 mcy every 10 years as projected by the sediment budget. The location, method, size of renourishment remain as previously discussed. The only change involves a decrease in time between renourishment events

and an increase in quantity placed during renourishment events. The current plan will use all or almost all of the material that is dredged from the bayou Lafourche channel. Placement will be every 1.5 to 2 years, depending upon the dredging schedule. These estimates are based on the long term dredging averages provided by Operations Division. With this additional material we should be able to maintain the construction footprint (2,066 acres) on the Caminada Headland.

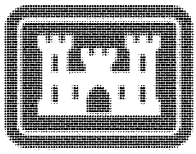
If any questions or issues arise, please contact Mr. Thomas Parker of my staff at (504) 862-2526 or by email at thomas.w.parker@usace.army.mil.

Sincerely,

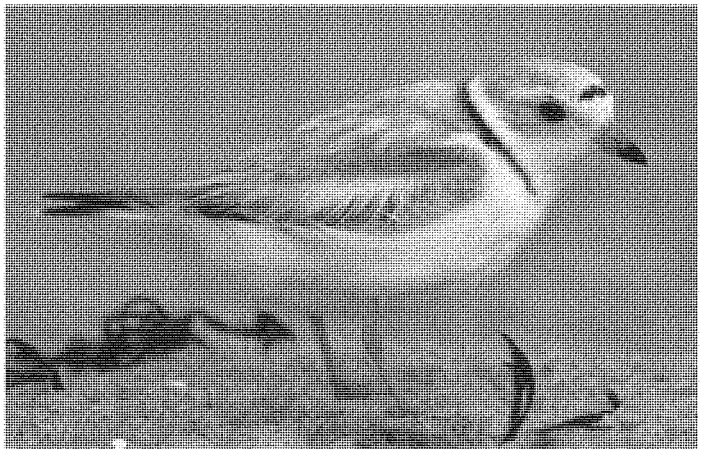
Joan M. Exnicios

Joan M. Exnicios
Chief, New Orleans Environmental Branch

Enclosure



US ARMY CORPS
OF ENGINEERS
NEW ORLEANS DISTRICT



June 3, 2011

BIOLOGICAL ASSESSMENT: Louisiana Coastal Area (LCA)
Barataria Basin Barrier Shoreline Restoration Feasibility Study
Caminada Headland and Shell Island Restoration

Prepared by:

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1.0 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, requires that *"Each Federal agency shall, in consultation with and with the assistance of the secretary, insure that any action authorized, funded, or carried out by such agency....Is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species..."*

This Biological Assessment (BA) provides the information required pursuant to the ESA and implementing regulation (50 CFR 402.14), to comply with the ESA. Additional jurisprudence includes the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. section 4321, *et seq.;* the Fish and Wildlife Conservation Act of 1958 (PL 85-624; 16 U.S.C. 661 *et seq.*); the Marine Mammal Protection Act of 1972; the Migratory Bird Treaty Act of 1918; and the Bald Eagle Protection Act of 1940. This BA evaluates the potential impacts of the proposed restoration of the Caminada Headland and Shell Island Study on Federally-listed and proposed threatened and endangered species, designated and proposed critical habitat, and determines whether any such species or habitat are likely to be adversely affected by implementing the tenttively selected plan (TSP).

A programmatic BA was prepared in 2004 for the LCA Ecosystem Restoration Study (USACE 2004). This proposed action is an outgrowth of the LCA comprehensive programmatic restoration study.

A BA was prepared for the TSP and submitted to the United States Fish and Wildlife Service (USFWS) Lafayette Louisiana Office on May 1, 2009. The USFWS responded with a letter dated May 11, 2009 stating that they concurred with our determination that the TSP (as presented) would not likely adversely affect any threatened or endangered species or its designated critical habitat.

We subsequently provided a Supplement to the May 1, 2009 BA to re-initiate consultation, which supplemented the May 1, 2009 BA for changes that occurred to the scope of the TSP, and to evaluate any additional effects these changes not considered in the original BA would have on threatened and endangered species.

In response to policy comments the TSP has once again been modified to increase the sustainability of the project. This BA contains a detailed account of the TSP as it was presented in these preceding BA, with additional analysis regarding impacts. This BA has been prepared to substitute our prior Bas and to clearly document impacts from the TSP on the protected species within the region.

2.0 PURPOSE AND NEED FOR ACTION

The purpose of the study is to restore the geomorphic function and unique critical and essential fish and wildlife habitats of the Caminada Headland's barrier system and reverse the current trend of degradation in the Caminada Headland and Shell Island reaches. Restoration efforts would target ecologically distinct, critical, high priority areas that would increase sustainability with essential form and function of the natural barrier ecosystem.

3.0 THREATENED, ENDANGERED, PROPOSED THREATENED OR PROPOSED ENDANGERED SPECIS

Piping Plover (*Charadrius melodus*), was listed as threatened and endangered on December 11, 1985 (50 FR, 50720-50734). Critical habitat was designated on July 6, 2000 (50 FR, 41782-41812)

Green Sea Turtle (*Chelonia mydas*), was listed as threatened in U.S. waters, except for the Florida breeding population which was listed as endangered, on July 28, 1978 (43 FR 32800 32811)

Hawksbill Sea Turtle (*Eretmochelys imbricata*), was listed as endangered throughout its range, on June 2, 1970 (35 FR, 8491)

Kemp's Ridley Sea Turtle (*Lepidochelys kempii*), was listed as endangered throughout its range, on December 2, 1970 (35 FR, 18320)

Leatherback Sea Turtle (*Dermochylys coriacea*), was listed as endangered throughout its range, on December 2, 1970 (35 FR, 8491)

Loggerhead Sea Turtle (*Caretta caretta*) was listed as threatened throughout its range on July 28, 1978 (43 FR 32800 32811)

West Indian Manatee (*Trichechus manatus*), was listed as endangered on June 2, 1970 (35 FR 8491, Appendix A)

4.0 CANDIDATE SPECIES

No candidate species are found in the project area.

5.0 SENSITIVE SPECIES AND SPECIES OF CONCERN

Bald Eagle (*Haliaeetus leucocephalus*), was de-listed on August 9, 2007 (72 FR 37345 37372)

Brown Pelican (*Pelecanus occidentalis*), was de-listed on November 17, 2009 (74 FR 59443 59472)

Colonial Nesting Birds including cormorants, herons, egrets, ibises, gulls, skimmers, and the Least Tern (*Sterna antillarum*). The interior least tern (*Sterna antillarum athalassos)* was listed as endangered throughout its range, except for within 50 miles of the coast, on June 27, 1985 (50 FR 21784-21792)

6.0 CRITICAL HABITAT

Critical habitat unit LA-5 for the piping plover is designated in the project area. Detailed discussion of critical habitat within the project area can be found in piping plover section 11.2.

7.0 CURRENT MANAGEMENT DIRECTION

The 2004 LCA Report developed 3 hydrogeomorphic objectives. These objectives include maintaining salinity gradients, increasing sediment input from sources outside the estuarine basins, and maintaining or establishing natural landscape features and hydrologic processes that are critical to sustainable ecosystem structure and function. The TSP provides this geomorphic form and function by separating the Gulf of Mexico from the interior estuaries and helping to regulate salinity gradients important to the range of estuarine and freshwater wetland species for the period of analysis. The geomorphic structures prevent open Gulf of Mexico wave energy from impacting the interior estuary and provide hydrodynamic stability to the system.

Loss of these functions would have impacts beyond the project footprint. Modeling conducted, which excluded the BBBS project in its future projections, estimated that by 2060, 75% of the land between the Caminada Headland and the Larose to Golden Meadow Hurricane Risk Reduction levees would be lost. The barrier islands in Plaquemines Parish, including Shell Island, will have disappeared as well as the marshes between the islands and the Mississippi River levees. Salinity modeling reflecting a without project condition demonstrates the function of the barrier islands in separating the marine from the estuarine environments. On the eastern

side of the basin, in areas where the barrier islands are severely eroded, the salinity fields grow proportionally larger.

Per ER 1105-2-100 Section E-30, "The objective of Civil Works ecosystem restoration is to restore degraded significant ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. However, partial restoration may be possible, with significant and valuable improvement made to degraded ecological resources." The Caminada Headland and Shell Island provide important geomorphic, hydrologic, and habitat functions in the Barataria basin.

Modeling results have shown that barrier islands decreased wave energy landward of the island during tropical events. When the barrier islands were degraded in the models, the modeled wave heights increased, thus heightening the potential for overtopping levees and inundation of protected areas. Sustaining the geomorphic form of the barrier islands will provide storm surge protection for the interior wetlands and the surrounding coastal communities. The TSP will prevent the fragmentation of the Caminada Headland and greatly ameliorate impacts on several important socio-economic sectors such as: Port Fourchon, the largest base for offshore oil and gas operations in coastal Louisiana and the largest coastal fishing port; major oil and gas infrastructure, such as regional transportation and storage facilities, the LOOP, and the Mars pipeline; and the regional hurricane evacuation route serving residents of southern Lafourche Parish, the community of Grand Isle and approximately 6,000 workers stationed at offshore facilities in the central Gulf of Mexico. By decreasing the rate of erosion and preventing the splintering of the headland, the investment in infrastructure located at Port Fourchon will be less vulnerable to storm surges. Oil and gas pipelines and Louisiana Highway 1 maintenance requirements will lessen compared to the future without project conditions.

8.0 DESCRIPTION OF THE STUDY AREA

The study area is part of the 300-mile long Louisiana barrier system. The Caminada Headland and Shell Island reaches are located along the Barataria barrier shoreline comprising the area designated as Subprovince 2 in the LCA study (USACE 2004). Subprovince 2 is defined by the hydrologic boundary of the Barataria Basin, which is approximately 2,446 square miles and the western portion of the lower Mississippi River Delta. The basin is separated from the Gulf of Mexico by a chain of barrier islands, which serve as a natural barrier to storm events and reduce marine influences on interior wetlands within the basin (**figure 1**).

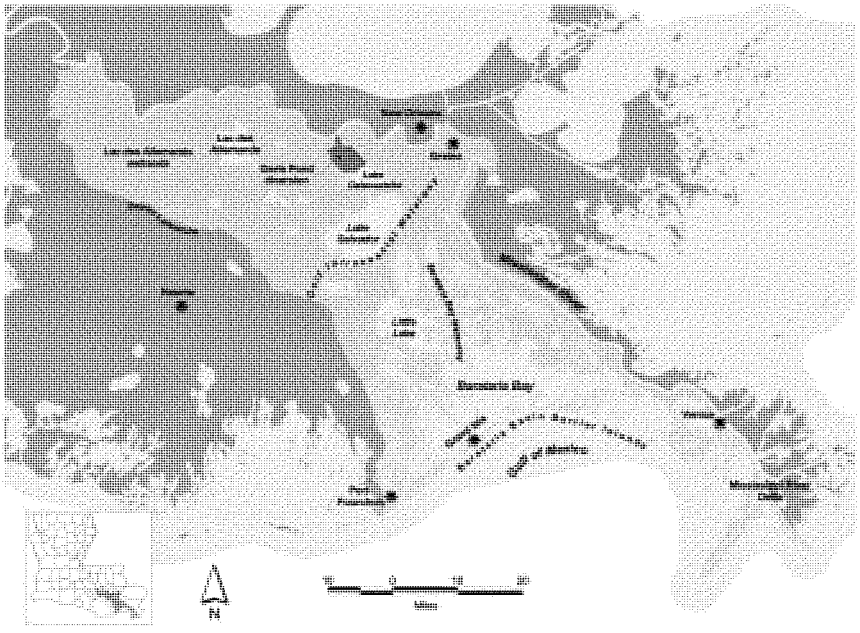


Figure 1: Barataria Basin Barrier Islands

9.0 DESCRIPTION OF THE PROPOSED ACTION

9.1 Caminada Headland

The Caminada barrier headland (also known as the Caminada-Moreau headland) is the predominant feature of the Bayou Lafourche barrier system that includes flanking islands and the retreating headland of the Bayou Lafourche distributary of the Mississippi River. It is one of the most rapidly eroding shorelines in the United States (McBride et al. 1992; Connor 2004). The southwest to northwest-oriented Caminada-Moreau headland extends approximately 13.18 miles (21.21 km) between Belle Pass in the west and Caminada Pass in the east. Historic maps show that the west end of the Caminada- Moreau headland is retreating more rapidly than the east end of the headland (Williams et al. 1992). Hundreds of offshore drilling rigs in the Gulf of Mexico send gas and oil to the mainland through Port Fourchon, located on this western end.

9.1.1 Caminada Headland Restoration Purpose

The purpose of the proposed action is to restore the geomorphic function and unique critical and essential fish and wildlife habitats of the Caminada Headland's barrier system. The study period is fifty years. The goals and objectives for restoring the Caminada Headland Reach include:

- Sustain and improve shoreline, dune, and interior marsh habitat for essential fish and wildlife species
- Reduce wave energy transmission by providing a natural storm protective buffer for interior marsh and chenier ridge habitats north of Caminada Headland
- Address the severity of erosion along the gulf-front shoreline
- Close the breaches that have occurred due to recent storm and hurricane damage and prevent breaching during the design life
- Vegetate newly created marsh and dune areas
- Provide compatible sediments for marsh, beach and dune restoration
- Avoid impacts to adjacent shorelines from borrow area excavation
- Maintain the Caminada Headland without disrupting the natural hydrologic regime

9.1.2 Caminada Headland Needs

The erosional Caminada Headland has historically suffered loss of wetland habitat and diminished function within the gulf shoreline. The marsh, beach, and dune habitats within the project area have undergone significant loss due to storm overtopping and breaching, saltwater intrusion, wind and wave induced erosion, sea level rise, subsidence, and man-made structures. The observed long-term (100 years) average shoreline erosion rate at the Caminada Headland, approximately 45 feet per year, would likely continue for the foreseeable future. The beach has eroded and the dune ridge has been breached by overwash from storm surges at several locations, including multiple shoreline breaches during the 2002, 2004 and 2005 hurricane seasons. Increased stress on the fish and wildlife is expected as various fish and wildlife nursery, feeding, nesting and roosting habitats continue to be lost.

A coastal Louisiana land loss model presented in the LCA Study (USACE 2004) indicates that with no intervention, the Caminada Headland will experience a projected land loss of 3,750 acres from the Headland and 14,780 acres from the area to the north from 2000 to 2050. Only a skeletal framework of natural barrier ridges and spoil banks would remain in 2050. Port Fourchon would be further isolated from the remaining mainland, and could become a detached small barrier island.

9.1.3 Caminada Headland TSP Initial Construction

Caminada Headland Alternative 5 proposes a dune height of +7 feet NAVD88 with a dune width of 290 feet. Alternative 5 also proposes a landward beach and dune component in order to maximize acreage and longevity. The landward and seaward slopes would be set 20 horizontal to 1 vertical. The marsh fill is proposed on the landward side of the dune at an elevation of +2.0

feet NAVD88. Approximately 880 acres of beach/dune and 1,186 acres of marsh would be created, resulting in a total of 2,066 acres. Fill quantities for the dune and marsh fills would be 5.1 million and 5.36 million cubic yards, respectively. For the dune area, the material would be pumped from the dredge to the beach. The material would then be worked on the beach by bulldozers and front-end loaders. Points of direct access to the project area are Louisiana Highway 3090 and a beach road at Elmer's Island on the eastern end. For the marsh area, the material would be pumped from the offshore borrow site. The dune would serve as the southern dike for the marsh fill. Additional dikes would be constructed around the remaining perimeter. These operations would be completed in a manner that would minimize turbidity of the water at the dredge site and the discharge site. The estimated duration of construction is 939 days.

The borrow area identified for the beach/dune restoration is Ship Shoal, a large submerged sand body in the Gulf of Mexico located offshore in south-central Louisiana. The shoal is about 31 miles long and 7 miles wide, lying in water depths of 9 feet to 30 feet. Preliminary studies have shown it is the remaining seaward shoal from one of the older, abandoned Mississippi River deltas. It is composed of well-graded quartz sand and is suitable for use in restoring the Caminada Headland since its grain size is similar to the sand found on the headland. The sediment is to originate from South Pelto, Blocks 12 and 13, which is approximately 40 miles from the project site. The borrow site for the marsh restoration would be located approximately 1.5 miles south of the central portion of the Caminada Headland, and 4.7 miles southwest of Caminada Pass. See **Figure 2** for a map of the borrow sites.

Approximately 71,500 feet of sand fencing would be installed. The sand fences would be porous barriers that would reduce wind speed along the coast such that sand being transported by the wind accumulates on the downwind side of the fence. The sand fences would promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings. Vegetative plantings would include a variety of native species. The recommended planting density is no greater than 8-foot centers. O&M of the project includes repair and/or maintenance of sand fencing. The maintenance estimate for sand fencing includes complete replacement in year 5 with 20 percent replacement every 5 years until the end of the 50 year period of analysis. It is estimated that the duration of plantings would be 750 days over a 3-year period.

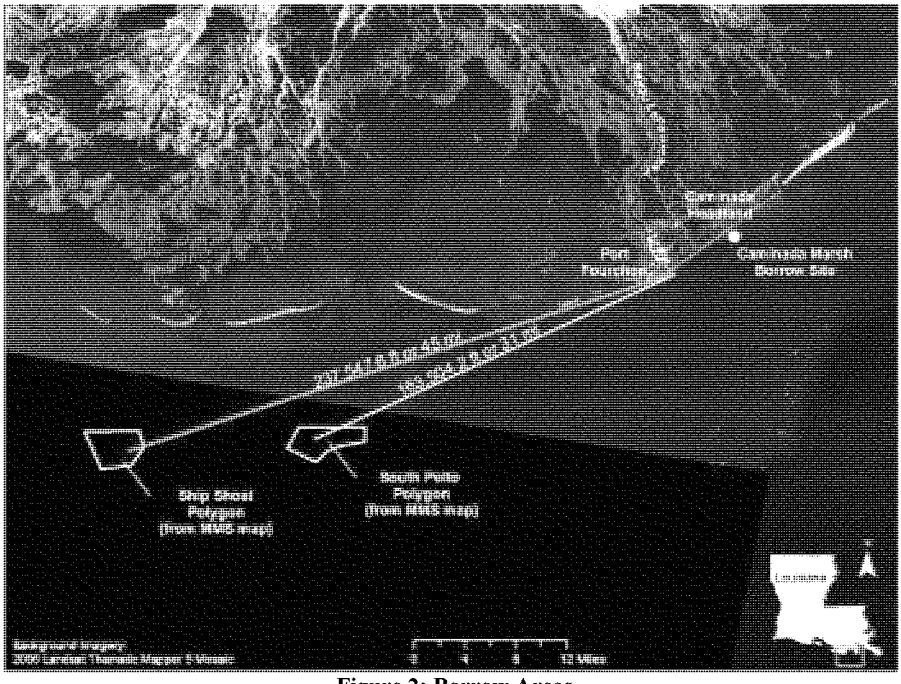


Figure 2: Borrow Areas

9.1.4 Caminada Headland Shoreline Construction Method

The method of construction to be used by the contractor is not specified beforehand in the draft contract specifications. However, based on previous beach fill construction along the Gulf shoreline, it is anticipated that the contractor would use a hopper dredge system for excavation of material from the offshore borrow site. The material would then be pumped from the hopper discharge by an appropriate method to the beach through a submerged pipeline. Once on the beach the pipeline would run parallel to the shoreline close to the proposed dune line. The material would then be worked on the beach by bulldozers and front-end loaders that are equipped with grapple arms to handle pipeline. Miscellaneous equipment to be stored on the beach may include a light tower, fuel tanks with containment, welding machine and temporary shanty for personnel.

Construction methods may vary but it is anticipated that fill placement along the beach would be controlled by advancing a temporary sand dike several hundred feet parallel to shore ahead of the discharge terminus. This aids in reducing initial fill losses offshore and helps control temporary turbidity that may result from the fill operation. In all cases water drainage and discharges would be directed offshore into the Gulf. Also, it is expected that most of the work in conjunction with

the beach fill construction would be done offshore or using waterfront access to the beach. The required grading equipment would be transported via local roads in accordance with State and local regulations including a traffic control plan. Exact access to the beach would be determined and coordinated during the plans and specifications phase and would include the necessary easements. However, the contractor would need to access the beach/dune and marsh areas with equipment such as graders, loaders, dozers, marsh buggy backhoes, etc. to shape beach and dune features and contain dredge materials. Two potential points of direct access include Highway 3090 on the western end of the Headland and a beach road at Elmer's Island on the eastern end.

9.1.5 Caminada Headland Back Barrier Marsh Construction Method

The method of construction to be used by the contractor is not specified beforehand in the draft contract specifications. However, based on previous marsh construction along the Gulf shoreline, it is anticipated that the contractor would use a hydraulic dredge with direct pump for excavation of material from the designated offshore borrow site. The back-barrier marsh component requires dredging and filling operations to place material for construction of a marsh platform. The dune would serve as the southern dike for the marsh fill, with a system of additional dikes to be constructed around the remaining perimeter for containment of hydraulic fill with sediment suitable for the marsh system. These operations would be done in a manner that would minimize turbidity of the water at each dredge site and at the discharge sites from the marsh fills. Discharge and dewatering from the fill sites shall be directed towards the Gulf. To achieve gulf-side discharge, the contractor would be required to orient discharge pipes such that the hydraulic flows move in a gulfward direction. They would also be required to locate any dewatering structures on the gulf side of the Project area. The contractor may employ other methods such as building the north side first, creating a drainage gradient towards the gulf. Regardless of the construction methods used, the contractor would be required by the contract specifications to dewater towards the gulf. No discharge would be allowed to the North of the Project area. If excess turbidity occurs, the contractor would be directed to change the operating procedure to reduce the degree of turbidity. Also, the contractor would be required to provide a construction access plan for the back-barrier marsh component. The back-barrier marsh component of the Caminada Headland is bounded to the north by the BP Canal and to the south by the gulf shoreline. The marsh is relatively constant in elevation with the exception of areas altered by oil and gas canals and some open water areas characterized as tidal bayous, creeks and ponds. The contractor would be required to submit a construction access plan which should contain provisions for restoring any damaged habitats.

9.1.6 Caminada Headland Renourishment

The Coastal Engineering Manual (CEM) (USACE, 2006) describes feeder beaches as finite-length berms placed along a beach, usually at the updrift end of a littoral cell that has strong unidirectional shore-parallel transport. They can also be placed at a nodal "hot spot," where shore-parallel transport divides, thus moving sediment in both directions away from the node. This concept involves placing a large volume of sediment in a limited area and relying on littoral processes to move it down the beach, thus gradually renourishing the beach at a distance from the placement site. The CEM describes feeder beaches in the same terms as regular or

normal beach restoration projects, with the sediment placed on the beach face, but not necessarily "...the same degree of alongshore uniformity as that provided by placing fill in a prescribed manner throughout the project area." The feeder beach concept has been expanded to include subsurface placement of sediment to create a "feeder bar," which relies on coastal processes to move the sediment onto the beach face naturally. A sub-tidally placed feeder beach that nourishes the beach profile without need for heavy grading machinery and/or disturbance to environmentally sensitive habitats can be more desirable and is typically less expensive than one that is conventionally constructed. In addition, as wave action carries fine sediment onto the beach face and deposits it, an opportunity is afforded for aeolian transport to move it up the beach and onto the dune, nourishing the system.

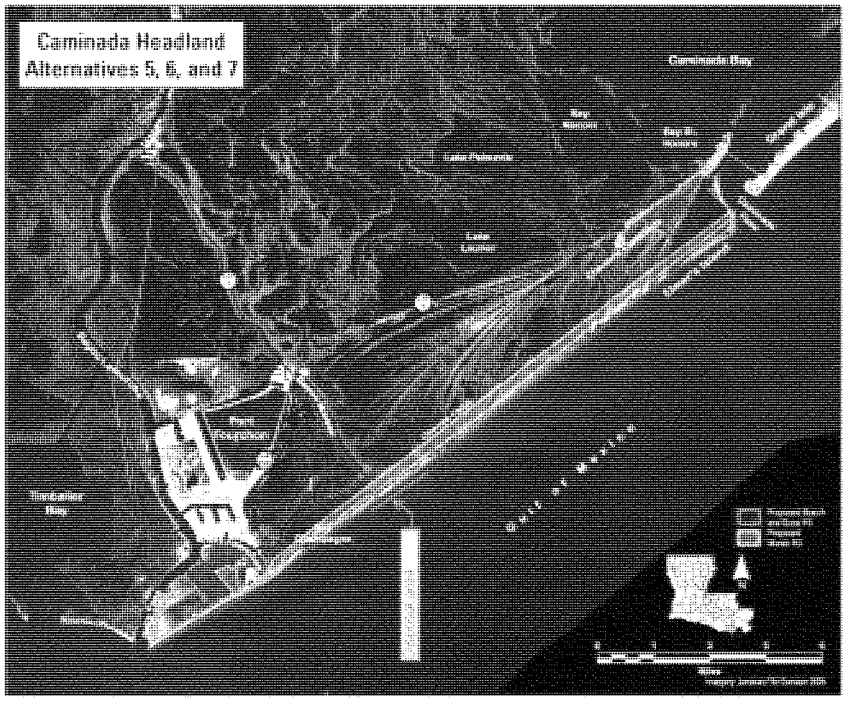


Figure 3: Proposed Action and Nourishment Nodal Point

After review of the sediment budget prepared for the Caminada Headland, the loss of sediment from the headland, which is derived from the total gulf shoreline erosion loss minus the total overwash accumulation, is estimated to be 379,000 cubic yards per year. By designing a feeder berm which utilized the operations and maintenance material removed during the maintenance dredging of the bar channel of Bayou Lafourche, Louisiana (Belle Pass) navigation

project, beneficially at the nodal point (**Figure 3**), this project would be able to sustainably maintain the Caminada Headland over the period of analysis. Dredging of the pass yields on average approximately 650,000 gross cubic yards of material every 1.5 to 2 years. This material would be placed in the littoral drift south of Bayou Moreau where the sediment budget indicates that the long shore transport of material splits going east and west. The material would be placed unconfined between 100 and 300 feet from the mean high water (MHW) mark, allowing the long shore transport and wave action to move and place the sediment along the headland. The material would be pumped offshore of the nodal point directly impacting approximately 67 acres. The Caminada Headland is a high energy wave environment that is very dynamic. The material would be stacked no higher than + 6 feet MLG, but would be quickly reworked by the wind and waves. The pumping of the material would take approximately 54 days, with placement and removal of the pipeline taking a total of approximately 98 days. The pipe would be placed offshore. The material would be dredged from a federal navigation channel which previously received NEPA clearance for the maintenance dredging of the Bayou Lafourche channel. Approximately 124.2 acres would be directly impacted by the dredging. Over each 10 year period, an estimated 3.9 million cubic yards of material from six dredging cycles (650,000 cubic yards per cycle) would be returned to the headland. Unless the shoreline is in danger of breaching, timing of the renourishment would be dependent upon the maintenance dredging requirements of the Bayou Lafourche, Louisiana navigation project. Historically, maintenance dredging has begun as early as March and ended as late as November. The Gradation Curves which reflect the percent composition of sand, silt, and clay of the material that is removed during maintenance dredging are attached in **Appendix A.**

The purpose of the O&M is to sustain the constructed footprint and protect the headland north of the project footprint. The O&M is driven by the need to ensure continuity of the shoreface, and is not determined by the dredging cycle. The beach and dunes protect the more fragile marsh habitats from the direct wave action of the marine environment. Once the shoreline has been breached, erosion rates increase. Because a major objective of this study is to protect the interior marsh and chenier habitats of the headland, continuity of the shoreface to protect these fragile habitats is essential. Research on Louisiana barrier islands has determined that barrier islands are susceptible to breaching when the island width nears 300 feet. The construction design for the Caminada Headland results in a dune crest of 290 feet and a beach and berm that is 160 feet wide from the water (0 NAVD 88) to the base of the dunes. The long term erosion rate of the shoreline is 45 feet per year. O&M should be performed in conjunction with the maintenance dredging to ensure that the sediment budget remains balanced. However, the beach should not be allowed to erode to within one year of estimated erosion of the dunes. Consequently, when the distance between the dunes and the water decreases to 50 feet, O&M would be required. Material would be placed at the nodal zone for headland-wide erosion. Should the shoreline breach or a particular area of the shoreline be in danger of breaching, sediment would be placed near the breach to supplement the existing sediment. Additionally, should particular sections of headland lose elevation, the material should be placed offshore that location. The target would be to maintain dunes to the existing conditions elevation of +4.5 NAVD 88 and the marsh to an elevation between +1.0 to +2.0 NAVD 88. O&M determinations would be made through use of LIDAR, surveys, aerial photography, or site inspections. Site

inspections would conducted by an interagency team containing at minimum USACE and CPRA team members.

If maintenance dredging of the Bayou Lafourche channel is not scheduled when the interagency team determines that renourishment is required, the non-Federal sponsor would provide another source of materials. Any changes to the approved OMRR&R plan would receive environmental clearances, including consultation with the appropriate agencies for compliance with the Endangered Species Act (ESA.) Additionally, because the Belle Pass jetties provide the important function of acting as a terminal groin and trapping sediment, prior to any navigation dredging event, the stability of the jetties would be inspected. If USACE, New Orleans District Operations Division determines that stabilization of the jetties is necessary, sufficient material would be placed to support the jetties.

9.2 Shell Island

The Shell Island reach (formerly Lanaux Island) is part of the 24.8-mile long (40-km long) Plaquemines barrier system and is characterized as rapidly retreating remnant barrier islands and spits which enclose shallow bays such as Shell Island Bay and Bastian Bay (**figure 3**). The Shell Island reach extends approximately 5.24 miles (8.43 km) between Grand Bayou Pass on the west to Fontanelle Pass and the Empire jetties on the east. The approximately 1.41-mile long (2.27 km) Shell Island (west) extends from Grand Bayou Pass to Coupe Bob, and is composed primarily of reworked oyster shells that formed into ridges and swales produced by waves refracting into the entrance to Grand Bayou Pass. Shell Island (east) is approximately 2.54 miles long (4.09 km) and extends from Coupe Bob to Fontanelle Pass. These rapidly retreating barrier islands are becoming increasingly narrower and separated from the remnants of Plaquemines interior marshes.

9.2.1 Shell Island Restoration Purpose

The objectives of this project are to reestablish a barrier(s) between a threatened estuarine ecosystem and the Gulf of Mexico, increase the sustainability of the barrier island shoreline system, restore the geomorphic function of the barrier shoreline in the vicinity of Shell Island, restore shoreline, dune, and back-barrier marsh to increase habitat utilization by essential fish and wildlife species both on the barrier island and in the consequently developed quiescent bays.

The goals and objectives for restoring the Shell Island Reach include:

- Achieve 317 acres of beach/dune acreage on Shell Island.
- Achieve 466 acres of marsh on Shell Island.

9.2.2 Shell Island Needs

Shoreline recession and erosion have resulted in the disintegration of Shell Island. The few remaining islands and shoal remnants provide limited protection to the back barrier environment from waves and flooding. The construction of the Empire Jetties restricted the east

to west long-shore transport and increased the loss rates of Shell Island. Hurricane Bob in 1979 created a new inlet (Coupe Bob) that accelerated retreat and sediment loss.

The average wave height is 2.7 feet. The rate of relative sea level rise is treated as a constant over the 50-year project life, equal to 0.0430 feet/year. Hurricane Bob occurred in 1979. The formation of Coupe Bob caused a quadrupling of the retreat rates of Shell Island and is the major reason for the disintegration of the island. The Empire Jetties were constructed in 1950. The Empire Jetties increased shoreline recession approximately 10 feet/year along the easternmost 5,000 to 8,000 feet of the island

9.2.3 Shell Island TSP Initial Construction

Under the selected alternative 5, the Shell Island component would be restored as one island. The island would include shoreface, dune, and marsh platform features. This alternative would restore Shell Island to a form similar to its pre-Hurricane Bob (1979) condition. The proposed island follows the shortest and shallowest route across Coupe Bob. The landward edge of the dune of alternative 5 would be located seaward of the existing shoreline. The west end of the alternative 5 single island would be terminated approximately 0.5 miles before Grand Bayou. It is anticipated that the closure of Coupe Bob would return the tidal prism to its pre-1979 path—flowing through Grand Bayou, with Grand Bayou increasing in size in response to the altered tidal flow pattern. The west end of alternative 5 is close to the western limit of Shell Island that was observed in 1973, prior to the opening of Coupe Bob. The proposed island follows the shortest and shallowest route across Coupe Bob. The east end of the island would then follow the remnants of Shell Island East, but has a concave shape towards land. This would be required to maintain a smooth shoreline. The eastern end of the island would be located near the Empire Waterway. The constructed dune would have a uniform width of 189 feet along the length of the restored barrier island. Louisiana barrier islands have typical widths in the region of 1,000 feet to 1,500 feet wide from the gulf shoreline to the bayward limit of the marsh. A uniform marsh width of 735 feet was chosen to construct an island that is approximately 1,240 feet wide following equilibration of the shoreline fill. The fill source for dike construction was located within the marsh fill footprint where the existing bathymetry is relatively shallow (less than -2.0 feet). However, in deeper water (bathymetry below -3.0 feet), it is not feasible to construct the marsh section with only marsh sediments, as the marsh would settle too rapidly and nonuniformly to perform its intended purpose effectively. Instead it is recommended to construct a sand base across Coupe Bob, at -3.0 feet, using shoreline fill material. The marsh can then be constructed on top of this base, which would reduce settlement of the marsh material. A second option is to install a geotextile tube for containment of the marsh fill where the -3 feet NAVD sand base is constructed. The geotextile tube could be filled with sand from the sand base. The one island alternative would restore a total of 783 acres. This would include 317 acres of beach/dune and 466 acres of marsh on Shell Island. It is estimated that 5.6 million cubic yards of shoreline fill would be required to construct 317 acres of shoreline/dune area (area above +2 feet, NAVD) and 2.1 million cubic yards of marsh fill would be required to construct 466 acres of marsh. It is estimated that duration for construction would be 635 days. It is estimated that the duration for the plantings would be 420 days over a period of 3 years. **Figure 4** shows alternative 5 for the Shell Island feature.

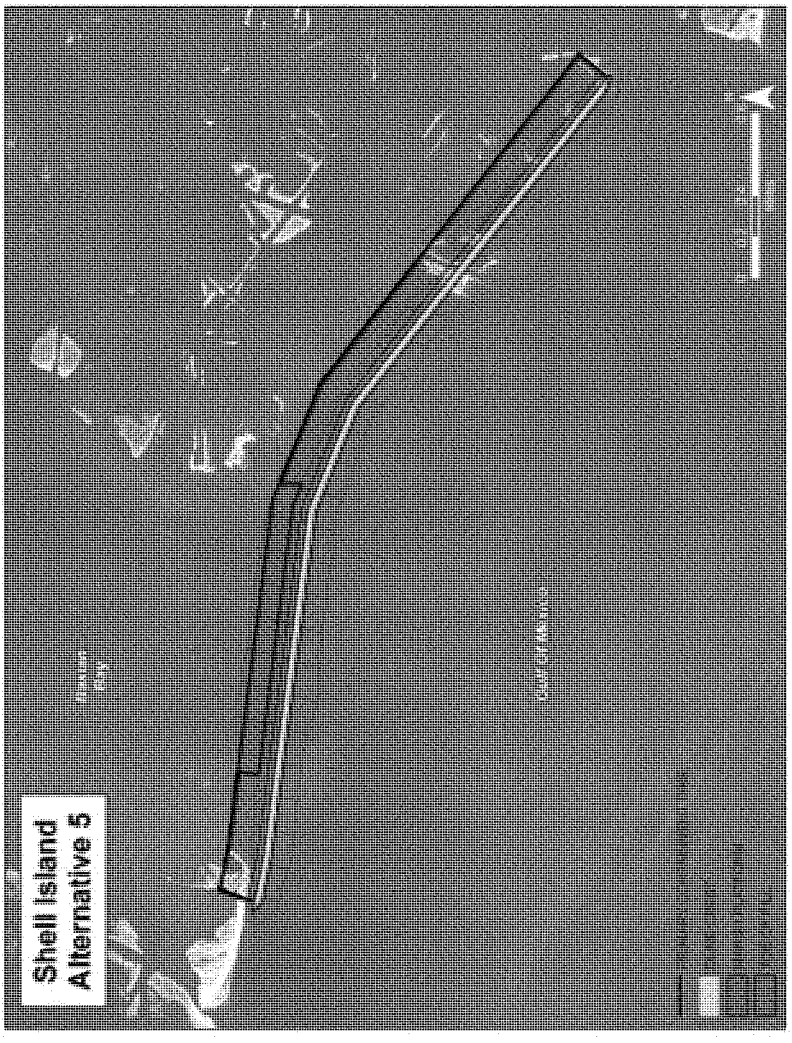


Figure 4: Shell Island Alternative 5

Coupe Bob would be closed by stockpiling extra material on each side of the final closure section of the inlet. Sheet pile 100 to 200 feet in length would be placed on each side of the final

opening to allow sand material to be piled up. When the tide range is the lowest the material would be pushed into the breach.

The contractor would construct a containment dike for marsh creation using material from within the existing footprint. In deeper water it is recommended to construct a sand base to elevation -3.0 with marsh fill on top to reduce settlement. In these deeper areas a geotextile tube would be used for containment of the marsh fill.

Sand fencing and vegetative plantings would be similar to those described for the Caminada Headland alternative.

The borrow source for the dune/beach is a large sand deposit near Nairn in the Mississippi River between mile markers 32 and 34, approximately 11 miles north of the project area. The borrow site is located in a river meander where greater sediment thickness is anticipated due to the presence of relict (vertically stacked) sand bars. USACE boring data indicates sand thickness of at least 70 feet. Based on samples obtained from vibracores, the sand grain size is comparable to the sand at the project site. The dredged material would be pumped from the Mississippi River via pipeline. The 11 pipeline corridor would cross the Mississippi River levee and two highways, traversing property owned by Plaquemines Parish. The pipeline would then be submerged, first crossing, and then following, the western right of way of the Empire Waterway, a Federal waterway. The Empire Waterway terminates at the eastern end of Shell Island. Five booster pumps would be required to move the material from the river to the project area. The borrow source for the marsh restoration is the Empire deposit, approximately 1.5 miles from the Empire Jetties (figure 11). Water depths in the borrow area are from 16 feet to 20 feet. The sedimentary characteristics indicate a silt content of about 40 percent, a clay content of about 22 percent and sand content of about 38 percent. The material would be pumped via cutterhead dredge and pipeline from the borrow source to the project area, requiring one booster pump. **Figure 5** shows the borrow sources for Shell Island.

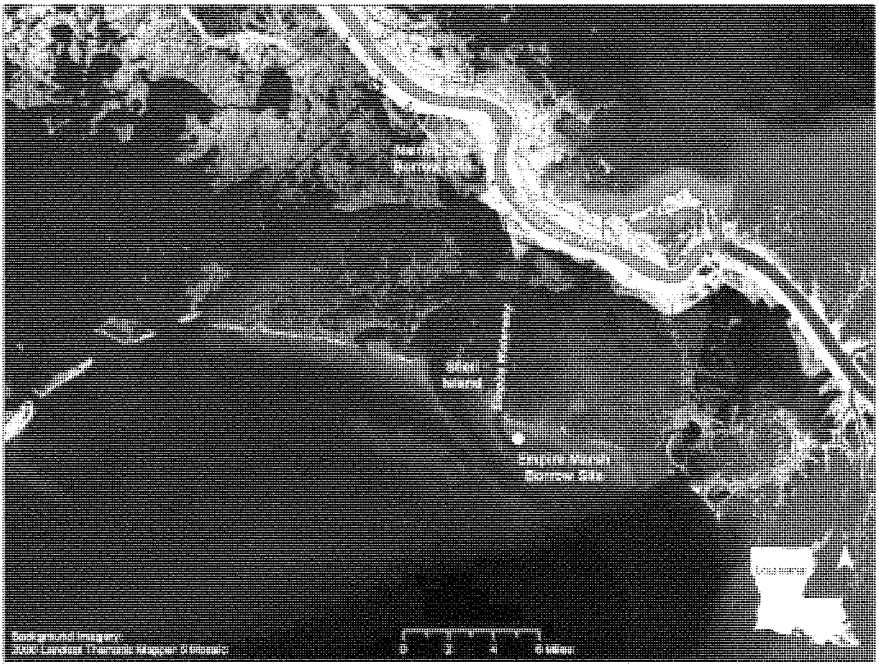


Figure 5: Shell Island Borrow Sites

9.2.4 Shell Island Construction Methods:

Project construction would require the hydraulic placement of both beach and marsh fill within the project area. The previous section discussed possible marsh and beach fill sediment sources. This section discusses transport of the material to the project site and project specific construction items. Construction of the beach and marsh fill would require the use of heavy machinery to manage the pipeline and construct containment dikes. Shell Island West provides a sufficient base for equipment deployment with placed fill used to supplement existing material for containment. However, the contractor would have to construct a beachhead on Shell Island East as the island remnants immediately adjacent to the Empire Waterway are not large enough to support equipment. To start a 2002 beach restoration project at Holly Beach, for example, the contractor placed the end of the dredge pipe on a pontoon and pumped a beachhead without an initial need for heavy equipment (Figure 54). A landing craft, or a barge and crane, could be used to deploy equipment, or the contractor may elect to construct a dock.

The contractor would be required to construct dikes to control the placement of marsh fill. The bayward side of the beach fill would act as a dike to control fill on the south (Gulfward) side of the marsh. Dike construction on the bayward side of the marsh would require the use of a barge mounted bucket or similar equipment. The material used to construct the dikes would be taken from within the footprint of the marsh fill. The excavated ditch would also act as a temporary access canal for the barge. For Alternatives 3 to 8, the contractor may elect to construct a geotextile tube in the 9,000-foot long section of Coupe Bob, instead of transporting silt/clay for dike construction. The geotextile tube could be filled using material from the sand base but within the marsh footprint. The contractor could also choose to construct the dike using sand fill but this option may be more expensive. The method of marsh fill containment should be left to the discretion of the contractor. Excavation for dike construction would not be permitted within 50 feet of any pipelines. The location of secondary dikes or water control structures would be at the discretion of the contractor.

Attempting to close Coupe Bob by the placement of sand in the inlet would increase tidal velocities in the constricted channel. These higher velocities would increase erosion losses at the fill ends bordering the channel. Dredging Grand Bayou and the tidal diversion channel prior to attempting to close Coupe Bob would create a more hydraulically efficient path for the tidal prism, which would assist in the closure of Coupe Bob. The contractor would likely wait for the first or last quarter moon when the tide range is lowest to attempt final closure of the inlet. Possible methods for closure of Coupe Bob include, but are not limited to:

1. Stockpiling material at the sides of the inlet and then bulldozing it into the gap.
2. Bringing a second dredge to the site to increase production rates. This dredge could excavate sand pockets shown by the McLelland cores or dredge sand fill that has been stockpiled or placed along the rest of the island.
3. Sink barges in the gap that can be refloated and removed at a later date, once the beach fill is in place behind or in front of the barge.
4. Drive temporary sheet piling over a short section of the gap. A review of the pipeline databases suggests that there are no pipelines in the vicinity of Coupe Bob that could be endangered by pile driving.

9.2.5 Shell Island Construction Sequence

The construction sequence would be at the discretion of the contractor. However, this section presents a construction scenario to evaluate the feasibility of the project. The construction sequence assumes that the contractor constructs all, or at least a portion, of the beach section prior to constructing the marsh, as the beach acts as the southern containment dike for the marsh fill. Assuming that the contractor uses sand mined from the Mississippi River, the pipeline or scows could be brought to the east end of Shell Island for any of the alternatives. The offloader for the scows could be located in the deep section of the Empire Waterway. For the two-island option, the contractor would likely build Shell Island East first and then submerge the pipeline to cross Coupe Bob, in order to build Shell Island West. The possibility of placing the pipeline across Shell Island Bay should be investigated as this would shorten the pipeline distance to Shell Island West. If an offshore borrow source was used (Sandy Point or Ship Shoal), the

submerged line could be brought ashore at any location. However, the submerged line would have to cross oil pipelines and a magnetometer survey and/or jet probes should confirm whether these lines are buried and determine their depth. Marsh fill containment dikes within Shell Bay would be constructed concurrently with the beach fill. Once the eastern marsh fill containment system is complete (beach fill and back bay containment dikes), overburden from the Empire borrow area can be dredged and pumped into the marsh containment area.

9.2.6 Shell Island Construction Timeline

This construction timeline is based on the assumption that borrow area P1 is used as the beach fill source and that the Empire borrow area is used as the marsh fill source. Previous CPE construction timelines for Louisiana barrier island restoration projects have been based on production rates of 20,000 cubic yards/day for beach fill and 30,000 cubic yards/day for marsh fill.

At Holly Beach, beach fill production rates in excess of 30,000 cubic yards/day were recorded for the dustpan dredge *Beach Builder*, but the average production rate, including all downtime, was 11,970 cubic yards/day. This project experienced greater downtime than would typically be expected for a beach construction project because the dredge had to be removed from the project site twice due to the passage of Hurricanes Lili and Isidore, the submerged pipeline had to be fixed on numerous occasions, and the dustpan had to be cleared of clay frequently (at least twice daily). The maximum pumping distance at Holly Beach was approximately 8 miles and one booster was utilized in the pipeline.

Similar production rates may be expected for the Shell Island project compared to the Holly Beach project. The increased pumping distance to Shell Island would be offset by the unusual delays experienced at Holly Beach. Furthermore, the borrow source and submerged line are within the Mississippi River and a sheltered bay, so the project should not be impacted from as many weather delays as compared to dredging in the Gulf of Mexico.

Construction of the sand fencing can be required concurrently with construction of the beach. The Chaland Headland construction specifications require that sand fencing be constructed within one week of acceptance of the beach section. At Holly Beach the sand fencing was constructed following removal of the shore pipe. One four-person crew installed approximately 450 feet of sand fencing per day.

The marsh fill production rate is expected to be similar to that for the Chaland Headland Barrier Island Restoration Project (BA-38-2). Production rates in the order of 48,000 cubic yards/day were observed at Chaland Headland (CPE, 2007, in print). The marsh component would require 51, 44, and 58 days of pumping to construct the marsh for Alternative 1, 2 and 3 through 8 respectively. Marsh construction can occur concurrently with beach fill construction but it was assumed that half of the marsh would be constructed following completion of the beach fill.

A mobilization time of 2 months is expected to allow the contractor to gather and layout sufficient pipe to transport material from the Mississippi River to Shell Island. Demobilization

would likely require 1 month. Therefore, Alternative 1 would require a total of 632 days to construct, Alternative 2 would require 672 days, Alternatives 3 through 6 would require 834 days, Alternative 7 would require 924 days, and Alternative 8 would require 980 days.

9.2.7 Shell Island Renourishment

Shell Island would be re-nourished 20 years and 40 years after initial construction to the original template of 317 beach/dune acres. The marsh fill for alternative 5 would also be re-nourished to its original construction template at this time interval. Approximately 1.5 million cubic yards of beach fill would be required for re-nourishment cycles in years 20 and 40. In year 20, approximately 907,200 cubic yards of marsh fill would be required and in year 40, 604,700 cubic yards would be required for re-nourishment.

10.0 EXISTING ENVIRONMENT

The Caminada Headland has been said to be one of the most rapidly eroding shorelines in the United States (McBride et al. 1992). The total net gulf shoreline erosion loss is approximately 926,000 cubic yards per year (cy/yr), with an overwash rate of 547,000 cy/yr. The overwash is captured in the back barrier marsh. Consequently, approximately 60% of the sand is retained in the marshes behind the beach and dunes. Of the remaining 379,000 cy, approximately 300,000 cy/yr is lost to Belle Pass, while the remaining is lost to the east towards Grand Isle. **Figure 6** shows the sediment budget for the Caminada Headland.

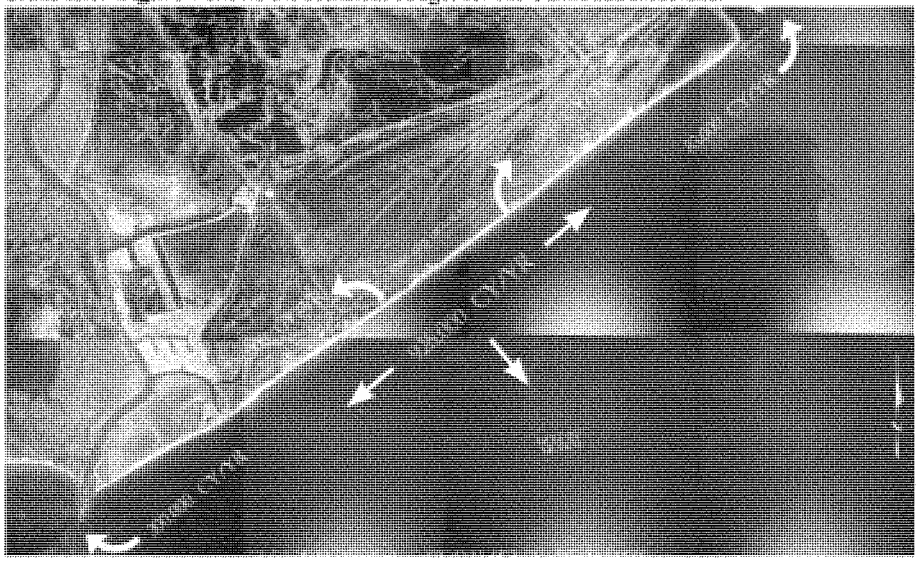


Figure 6: Sediment Budget

10.1 Oil Spill-related Impacts to Environmental Baseline:

The impacts of the Deepwater Horizon oil spill on coastal Louisiana are uncertain at this time (December 2010). The impacts of the oil spill as well as the various emergency actions taken to address oil spill impacts (e.g., use of oil dispersants, creation of sand berms, use of Hesco baskets, rip-rap, sheet piling and other actions) could potentially impact USACE water resources projects and studies within the Louisiana coastal area, including the BBBS project. Potential impacts could include factors such as changes to existing, future-without, and future-with-project conditions, as well as increased project costs and implementation delays. The USACE would continue to monitor and closely coordinate with other Federal and state resource agencies and local sponsors in determining how to best address any potential problems associated with the oil spill that may adversely impact project implementation. Supplemental planning and environmental documentation may be required as information becomes available. If at any time petroleum or crude oil is discovered on project lands, all efforts would be taken to seek clean up by the responsible parties, pursuant to the Oil Pollution Act of 1990 (33 U.S.C. 2701 et seq.).

The Deepwater Horizon was an ultra-deepwater offshore rig that was conducting exploratory drilling off the Coast of Louisiana. On April 20, 2010, the drill breached a pocket of high pressure methane gas which ignited and created an explosion on the platform. The explosion and ensuing fire caused eleven deaths and eventually capsized the rig, creating a massive oil spill in the Gulf of Mexico. The sunken rig is located approximately 125 miles southeast of Timbalier Island. Since the spill, oil has been found on the gulfward shorelines of the Shell Island, Grand Isle, Grand Terre Island, Beauregard Island, the Caminada Headland, and each island in the Isle Dernieres and Timbalier Island reaches. The quantity of oil washed on to the shorelines can be viewed using NOAA's Shoreline Cleanup Assessment Technique (SCAT) data on their website (NOAA, 2010).

Oil has also been found on the Caminada Headland and all the Barataria Barrier Islands, all of which support critical habitat in the project area. Potential piping plover impacts associated with the oil spill primarily consist of a reduction in available food supply. Piping plovers primarily feed on benthic organisms found in intertidal beaches, mudflats, sand flats, algal flats, and washover passes. The effects of oil on the health of benthic communities can be both acute and chronic in nature. According to the USFWS, oil can be directly toxic to these organisms or impact them through physical smothering, altering metabolic and feeding rates, and altering shell formation. Intertidal benthic communities may be particularly vulnerable when oil becomes highly concentrated in narrow bands along the shoreline (USFWS, 2004). Barnacles and other sessile species are vulnerable to smothering by heavy oils while the physiological effects of the hydrocarbons can considerably reduce the mobility of the more mobile species (University of Delaware, 2010). Additionally, sediments can become reservoirs for the spilled petroleum. Some benthic invertebrates can survive the initial exposure, but may accumulate high levels of contaminants in their bodies that can be passed on to predators (USFWS, 2004).

The magnitude of the impacts is also a function of the characteristics of oil spilled. For example, a study conducted on the Amoco Cadiz spill in 1978 revealed that "light oil" resulted in

considerable detrimental impacts to the benthic communities. However, a separate study revealed that the benthic organisms were contaminated, but were not adversely impacted, from a spill of heavy crude (University of Delaware, 2010). In 2003, Donlan et al. assessed the impacts of the North Cape oil spill on communities of piping plover in Rhode Island. The study first examined the abundance of prey species on Moonstone Beach (the oiled island) and compared it to that of an adjacent, un-oiled beach (Goosewing). Although the abundance of benthic organisms was not significantly different between the two beaches, the species composition was considerably dissimilar. For example, only two Amphilporeia were found in the sampling station on Moonstone, compared to 456 at Goosewing. This reinforced the common belief that amphipods are the first group of organisms to disappear and one of the last to recolonize once exposed to oil. Based on this information, the authors concluded that the piping plovers' food supply may have been reduced because of the oil spill. The authors also noted a decline in the number of fledgings produced per nesting pair between 1995 and 1996 (the year of the spill). This reduction was attributed to the lack of available prey species in the intertidal zone, which caused plovers to travel longer distances and expend more energy when feeding (Donlan et al., 2003). Between 1990 and 1995, Jewett et al. assessed the impacts of the Exxon Valdez oil spill on the benthic communities in Prince Williams Sound, Alaska. The metrics of the study included concentrations of hydrocarbons and benthic community composition, diversity, biomass, and abundance. These metrics were compared between a number of reference sites and oiled sites.

The comparison was conducted in 1990 (approximately 16 months after the spill), 1991, 1993, and 1995. According to the authors, the "total abundance and biomass of epifauna were generally higher at oiled sites, primarily because of higher densities of epifaunal bivalves. Otherwise, there were few consistent community-wide responses to oiling in diversity, richness, total abundance, total biomass, or the abundances of major taxonomic groups (e.g. polychaetes or bivalves)." The lack of a stronger community-wide response was attributed to the varying sensitivities of benthic organisms. For example, oil-sensitive amphipods such as Isaeidaes and Phoxocephalidaes were found in lower concentrations at the oiled sites. These impacts were evident throughout the duration of the study (i.e. 6 years after the spill). However, stress-tolerant and opportunistic organisms such as polychaetes were found in higher concentrations at the oiled sites due to organic enrichment. The study also revealed that hydrocarbon concentrations in the sediment were high (up to 15,300 ng/g) in eel grass beds immediately adjacent to the oiled shorelines, but sharply declined after 1990 (Jewett et all, 1999). Although the benthic organisms and habitat types within Prince Williams Sound vary from that of the Project Area (eelgrass beds versus sand beds and mud flats), the study does provide an indication of the resiliency and recovery rates of benthic communities as a whole. Furthermore, the results of the study indicate that the species composition of the benthic communities is expected to shift as a result of the Deepwater Horizon oil spill. For example, amphipods, which are favored by the piping plover, are expected to decrease in number while other less-favorable species may increase. As previously stated in the prior BA the construction of the beach and dune restoration component will likely impact benthic communities by smothering them during fill placement. In the short term, this could further stress the oil-impacted benthic organisms that are currently on the island. However, sediment used for fill placement would be tested to ensure that it is free of oil before it is placed in the project area. Placement of clean sediment in the project area could potentially improve the quality of the benthic habitat by diluting concentrations of oil in the project area's

intertidal zone. Typically feeder berms will slowly allow sediment to gradually move its way on to the beach. This gradual movement could, in turn, speed up the recovery time of the oil-impacted benthic communities.

In response to the Deepwater Horizon spill the barrier berm project was initiated in an attempt to protect Louisiana's coastal marshes from being severely impacted by oil. In the vicinity of the Shell Island component; berm number W8 has currently received approximately 1.3 million cubic yards of sandy fill material. This material is placed in a liniar fashion and is stacked with a slope of approximately 25:1. Impacts to the existing conditions are not known at this time. As this sandy berm is reworked by tidal forces impacts to water depth or sediment composition could result in the project area. CEMVN continues to monitor the impacts from the sand berm and would incorporate new environmental data into the project design when this project enters the PED phase.

11.0 DESCRIPTION OF SPECIES

There are 25 animal and 3 plant species, under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS), presently classified as threatened or endangered within the state of Louisiana. The USFWS and NMFS share jurisdictional responsibility for sea turtles and the gulf sturgeon.

Table 1. Threatened (T) and Endangered (E) Species potentially in LaFourche Parish

Common Name	Scientific name	Federal Status	State Status
Bald eagle	*Haliaeetus leucocephalus*	P	P
Brown Pelican	*Pelecanus occidentalis*	P	P
Green sea turtle	*Chelonia mydas*	T	T
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	E
Leatherback sea turtle	*Dermochelys coriacea*	E	E
Loggerhead sea turtle	*Caretta caretta*	T	T
Piping plover	*Charadrius melodus*	T; Critical Habitat	T

West Indian manatee	*Trichechus manatus*	E	E

Source: United States Fish and Wildlife Service (USFWS; April 2003).
(P = protected; T = Threatened; E = Endangered)

11.1 West Indian Manatee (*Trichechus manatus*)

11.1.1 Description of Species

The West Indian manatee is a large gray or brown aquatic mammal. Adults average approximately 10 feet in length and weigh up to 2,200 pounds. They have no hind limbs, and their forelimbs are modified as flippers. Manatee tails are flattened horizontally and rounded. Their body is covered with sparse hairs and their muzzles with stiff whiskers (USFWS 2001). The nostrils, located on the upper snout, open and close by means of muscular valves as the animal surfaces and dives (Husar 1977, Hartman 1979). Manatees will consume any aquatic vegetation (i.e., submerged, floating, and emergent) available to them and sometimes even shoreline vegetation. Although primarily herbivorous, they will occasionally feed on fish. Manatees may spend about 5 hours a day feeding, and may consume 4 to 9 percent of their body weight per day.

Observations of mating herds indicate that females mate with a number of males during their 2- to 4-week estrus period, and then they go through a pregnancy estimated to last 12 to 14 months (O'Shea *et al.* 1992). Births occur during all months of the year with a slight drop during winter months. Manatee cows usually bear a single calf, but 1.5 percent of births are twins. Calves reach sexual maturity at 3 to 6 years of age. Mature females may give birth every 2 to 5 years (USFWS 2001).

11.1.2 Species Habitat and Distribution

Manatees inhabit both salt and freshwater of sufficient depth (5 feet to usually less than 20 feet) throughout their range. Shallow grassbeds with ready access to deep channels are preferred feeding areas in coastal and riverine habitats (USFWS 2001). They may also be encountered in canals, rivers, estuarine habitats, saltwater bays, and have been observed as much as 3.7 miles off the Florida Gulf Coast. Between October and April, Florida manatees concentrate in areas of warmer water. Severe cold fronts have been known to kill manatees when the animals did not have access to warm water refuges. During warmer months they appear to choose areas based on an adequate food supply, water depth, and proximity to fresh water. Manatees may not need fresh water, but they are frequently observed drinking water from hoses, sewage outfalls, and culverts.

During winter months, the United States' manatee population confines itself to the coastal waters of the southern half of peninsular Florida and to springs and warm water outfalls as far north as southeast Georgia. Power plant and paper mill outfalls created most of the

artificial warm water refuges utilized by manatees. During summer months, they migrate as far north as coastal Virginia on the east coast and the Louisiana coast in the Gulf of Mexico.

During summer months, manatees disperse from winter aggregation areas, and are commonly found almost anywhere in Florida where water depths and access channels are greater than 3.3 to 6.6 feet (O'Shea 1988). In the warmer months, manatees usually occur alone or in pairs, although interacting groups of 5 to 10 animals are not unusual (USFWS 2001). A few individuals have been known to stray as far north as the northern Georgia coast and as far west as the coastal waters of Louisiana.

11.1.3 Status and Cause of Decline

The West Indian manatee was listed as endangered throughout its range for both the Florida and Antillean subspecies on June 2, 1970 and received Federal protection with the passage of the ESA in 1973. Critical habitat was designated in 1976, 1994, 1998, 2002, and 2003 for the Florida subspecies.

The West Indian manatee is also protected under the Marine Mammal Protection Act (MMPA) of 1972. The MMPA establishes a national policy for the maintenance of health and stability of marine ecosystems and for obtaining and maintaining optimum sustainable populations of marine mammals. It includes a moratorium on the taking of marine mammals. The recovery planning under the ESA includes conservation planning under the MMPA (USFWS 2001).

In the early 1980s, scientists tried to develop procedures for estimating the overall manatee population in the southeastern United States. The best estimate throughout the State of Florida was 1,200 manatees (USFWS 2001). In the early 1990s, the State of Florida initiated a statewide aerial survey in potential winter habitats during periods of severe cold weather (Ackerman 1995), and the highest count of 3,276 manatees was recorded in January 2001. Manatees were reported in Lake Pontchartrain prior to the landfall of Hurricane Katrina, however, there were no reports of manatee mortality following the hurricane.

The most significant problem faced by manatees in Florida is death or injury from boat strikes (USFWS 2001). Minimum flows and levels for warm water refuges need to be established to ensure their long-term availability for manatees. Their survival will depend on maintaining the ecosystems and habitat sufficient to support a viable manatee population (USFWS 2001). The focus of recovery is on implementing, monitoring, and addressing the effectiveness of conservation measures to reduce or remove threats that will lead to a healthy and self-sustaining population (USFWS 2001).

11.2 Piping Plover (*Charadrius melodus*)

11.2.1 Description of Species

The piping plover, *(Charadrius melodus)*, is a small shorebird approximately 7 inches in length with a wingspan of approximately 15 inches and weighs from 1.5 to 2 ounces. It is sand-

colored on the back with white undersides. The piping plover is distinguished from similar species by its bright orange legs. During the breeding season, the plover has a single black band across its breast and forehead, which are absent during the winter.

The piping plover is named for its melodic mating call. It is a small, pale-colored North American shorebird. The bird's light sand-colored plumage blends in with sandy beaches and shorelines. There are three populations of piping plovers in the United States. The most endangered is the Great Lakes breeding population, which encompasses only 32 breeding pairs. The Northern Great Plains and Atlantic Coast populations are classified as threatened and include 1398 and 1372 breeding pairs respectively. All piping plovers winter along the southeast and Gulf coasts and are classified as threatened in their wintering habitat (USFWS, 2000)

11.2.2 Species Habitat and Distribution

The piping plover is a shorebird that inhabits open beaches, alkali flats, and sandflats of North America. It breeds primarily along the Atlantic coast from North Carolina to southern Canada, along rivers and wetlands of the northern Great Plains from Nebraska to the southern prairie provinces, and along portions of the western Great Lakes. In winter, most individuals are found on coastal beaches and sand flats from the Carolinas to Yucatan; some scatter through the Bahamas and West Indies. (Haig, 1992)

This plover is divided into two subspecies based on geographic distribution and presence or absence of complete neck bands, although there is little support for this designation (Haig and Oring 1988a). Numerous breeding studies have been conducted across the species range, yet habitat requirements and limiting factors remain poorly known. Conservation efforts are well organized in breeding areas across North America, whereas little has been attempted in winter areas.

Ideal wintering habitat for the piping plover on the Gulf of Mexico coast would contain large sand flats or sand-mud flats adjacent to a tidal pass or tidal inlet (Haig 1985, Nicholls 1989). A thin layer of mud covering the sand seems to attract plovers, due to possible food or refuge association (Nicholls 1989). Nicholls observed that barrier beaches with over wash areas or sections of old marshes also attract plovers. A gulf-facing beach having a very low gradient, thus an increased intertidal zone, offers an almost equally attractive area (Haig 1985). Also piping plovers will inhabit spoil islands on the Gulf Intercoastal Waterway on both Atlantic and Gulf Coasts. Birds are frequently associated with bays, lagoons and inlets. Winter 2001 census observations were in the following habitat type: mudflats (36.3%), sandy beaches (33.2%), sand/salt flats (23.1%) algal mats (2.8%), oyster reefs (1.0%) and gravel shores (0.1%; Haig 2004). Foraging habitat in winter is fairly consistent among numerous Gulf and Atlantic coast sites. On Dauphin Island, AL: protected mudflats or sandflats exposed at low tide; at Texas sites: primarily bayshore sand and algal flats. Comparison among 36 Atlantic winter sites (222 birds observed once each) and 75 Gulf sites (1,508 birds observed once each) indicates foraging activity most often associated with mudflats (25.6% of observations), sandflats (25.1%), and sandy mudflats (31.8%; Haige, 2004).

The historical breeding range in North America of the piping plover included the Atlantic coastal beaches from Newfoundland to South Carolina; beaches of the Great Lakes; and the northern Great Plains region from Alberta to Ontario and south to Nebraska (USFWS, 1988). These populations were reported to winter along the Gulf of Mexico, the Atlantic coast from North Carolina to Florida, eastern Mexico, and in the Caribbean Islands (Haig and Oring, 1985). Approximately 35 percent of the total breeding piping plover population winters along the gulf coast from Florida to Texas and represents 56 percent of the Great Lakes/Great Plains population (Natureserve 2002, 2003). See **Figure** 7 for a view of species range.

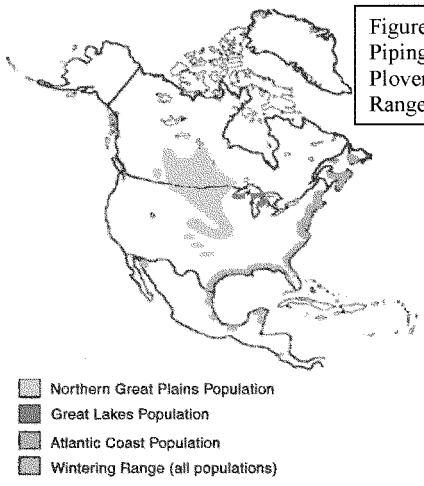


Figure 7: Piping Plover Range

All populations could potentially occur within the proposed action areas since it falls within the wintering range of the species. They arrive from their northern breeding grounds as early as late July and may be present for 8 to 10 months of the year. Inland breeders appear to migrate nonstop to the Gulf of Mexico or Atlantic Coast. Great Lakes and Northern Plains birds are rare at seemingly appropriate inland stopover places: Great Salt Plains National Wildlife Refuge, OK, and Cheyenne Bottoms National Wildlife Refuge, KS (Haig, 1986). Existing stopover records suggest that migration routes are predominantly south/southeast in the fall. In fall, birds depart Massachusetts breeding sites by late August (Haig, 2004). Manitoba and North Dakota nests hatch in late July or early August and stay into September. Generally, females go first, then unpaired males, males with fledglings, followed by unaccompanied juveniles. Peak return to Texas beaches is in August and September, although small numbers may arrive as late as November. Adults may arrive before juveniles as early captures in Texas were of adult birds (sex unknown) and juveniles were not recorded until early November; however, since sample size was small further research is needed.

11.2.3 Status and Cause of Decline

The USFWS determined the piping plover to be endangered and threatened on December 11, 1985. Endangered status was determined for the plover in the watershed of the Great Lakes (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario). It was determined to be threatened in the remainder of its range: northern Great Plains (Iowa, northwestern Minnesota, Montana, Nebraska, North Dakota, South Dakota, Alberta, Manitoba, and Saskatchewan); Atlantic coast (Quebec, Newfoundland, Maritime Provinces, and states from Maine to Florida); Gulf coast (Florida to Mexico); Bahamas; and West Indies.

In July of 2001, the USFWS designated specific areas in the United States as critical habitat for wintering piping plovers (Federal Register / Vol. 66, No. 132, 10 July 2001). Piping plover critical habitat is defined by the USFWS as "those elements essential for the primary biological needs of foraging, sheltering, roosting, and the physical features necessary for maintaining the natural processes that support those habitat components." The USFWS also indicated that constituent elements are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide. Important primary constituent elements of intertidal flats include sand and/or mud flats with no or very sparsely emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting plovers. The USFWS designated a total of 1,798 miles (165,211 acres) of shoreline along the Gulf of Mexico and Atlantic coasts as critical wintering habitat. Critical habitat in Louisiana encompasses 24,950 acres along 342.5 miles of shoreline, which is most of the coast of Louisiana including the island of Grand Isle. The critical habitat designation within Louisiana include:

- **Unit LA-1**: Texas/Louisiana border to Cheniere au Tigre. 2,650 ha (6,548 ac) in Cameron andVermilion Parishes
- **Unit LA-2**: Atchafalaya River Delta. 921 ha (2,276 ac) in St. Mary Parish, LA
- **Unit LA-3**: Point Au Fer Island. 195 ha (482 ac) in Terrebonne Parish.
- **Unit LA-4**: Isles Dernieres. 795 ha (1,964 ac) in Terrebonne Parish
- **Unit LA-5**: Timbalier Island to East Grand Terre Island. 2,321 ha (5,735 ac) in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes.
- **Unit LA-6**: Mississippi River Delta. 105 ha (259 ac) in Plaquemines Parish, LA.
- **Unit LA-7**: Breton Islands and Chandeleur Island Chain. 3,116 ha (7,700 ac) in Plaquemines and St. Bernard Parishes, LA

Unit LA-5 of the piping plover critical habitat falls within the proposed project area. The final ruling on Critical Habitat for the piping plover was established by USFWS as part of the July 10, 2001 (Federal Register Volume 66, No. 132) which designated a total of 1,798 miles (165,211 acres) of shoreline along the Gulf of Mexico and Atlantic coasts as critical wintering habitat. Critical habitat in Louisiana encompasses 24,950 acres along 342.5 miles of shoreline, which is most of the coast of Louisiana including the island of Grand Isle. Piping plover critical habitat is defined by the USFWS as "those elements essential for the primary biological needs of foraging, sheltering, roosting, and the physical features necessary for maintaining the natural processes that support those habitat components. These primary elements are found only in coastal areas with intertidal beaches or flats that are associated with dunes systems and flats above annual high tide." Plovers move among sites as environmental conditions change, and studies have indicated that they generally remain within a 2-mile area. Major threats to this species include the loss and degradation of habitat due to development, disturbance by humans and pets, and predation (USFWS Letter July 10, 2009).

Unit LA-5: Timbalier Island to East Grand Terre Island. 2,321 ha (5,735 ac) in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes. This unit includes: all of Timbalier Island

where primary constituent elements occur to the MLLW, all of Belle Pass West [the "peninsula" extending north/northwest approximately 4.8 km (3.0 mi) from the west side of Belle Pass] where primary constituent elements occur to MLLW; the Gulf shoreline extending approximately 11 km (6.8 mi) east from the east side of Belle Pass bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; all of Elmers Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmers Island to approximately 0.9 km (0.56 mi) west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; the Gulf shoreline of Grand Isle from the Gulf side of the hurricane protection levee to MLLW; and all of East Grand Terre Island where primary constituent elements occur to the MLLW. Critical habitat within the project area for the piping plover is found only along the Caminada Headland portion of the proposed project area, from West Belle Pass to Elmer's Island peninsula. The Shell Island area does not contain designated critical habitat for the piping plover. See **Figure 8** for image of Unit LA-5.

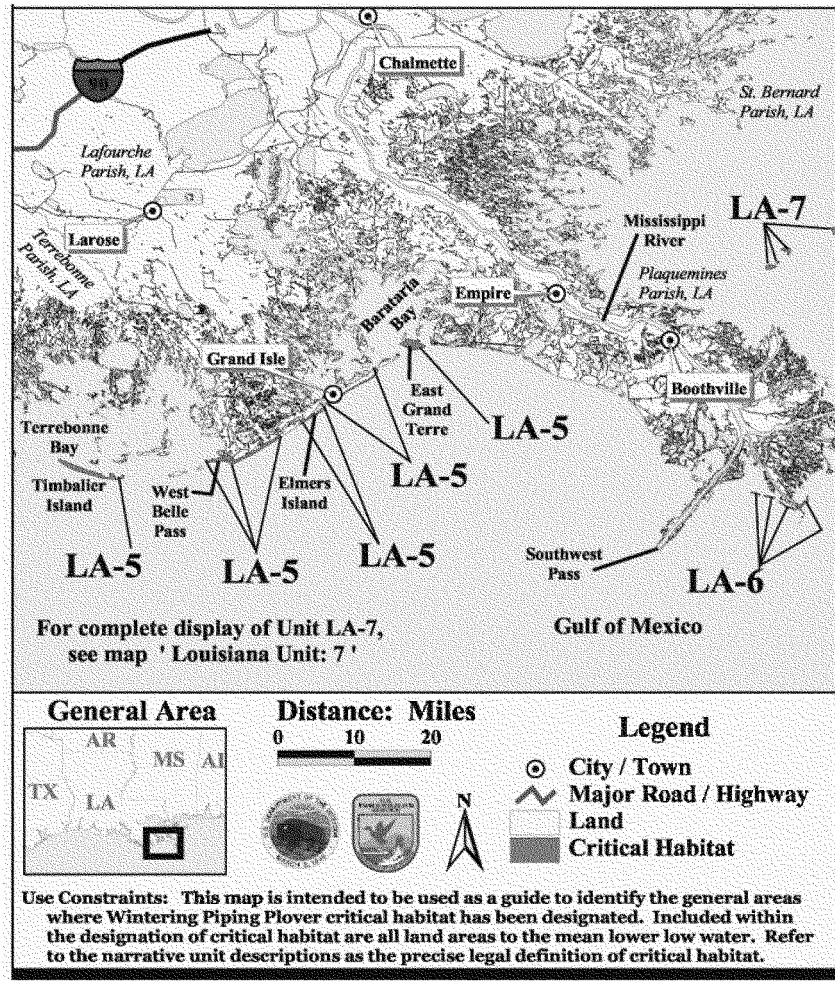


Figure 8: Piping Plover Critical Habitat Unit LA-5 & 6

Hunting in the early 1900s resulted in a drastic reduction of the piping plover population. Ongoing destruction of historical nesting sites further reduced plover populations (USFWS 1988). The primary causes for decline of this species are listed as habitat loss/degradation and human disturbance. Loss of breeding habitat has resulted from recreation and commercial development of sandy beaches on the Great Lakes, Atlantic Coast, and Gulf of Mexico. Where

breeding does occur on coastal beaches, inland lakes, and river sites, reproductive success has been reduced by disturbance from humans and pets. Additional habitat has been lost due to construction and operation of reservoirs and river channelization.

Dune stabilization projects that result in steep beach slopes, narrower beach widths, or increased vegetation to the water's edge, reduce piping plover habitat (Haig 1985). In at least one instance, stabilization of the backside of the dune on Padre Island, Texas, resulted in the destruction of essential sand flat habitat (USFWS ESIS). Additionally, increased urbanization has led to an increase in predation on the piping plover population (USFWS 1988). Recreational activities in localized areas along the gulf coast have been correlated with a decrease in piping plover use of those areas (Nicholls 1989).

Habitat loss is a problem on both breeding and wintering grounds. It occurs when nesting beaches or basins become unsuitable or unavailable to piping plovers through natural causes such as drought, vegetation encroachment, tides and floods, as well as through activities such as beach visitation, housing developments, cattle ranching and water management. Natural factors will undoubtedly continue to be an unpredictable challenge for piping plover recovery in the future, and habitat loss due to human activity will increase with demands for more resources, recreation and living space, as the human population continues to grow (National Recovery Plan).

The barrier islands in Louisiana are the remains of an abandoned Mississippi River Delta; and their degradation is the result of the natural deltaic processes compounded by storm and anthropogenic impacts. Barrier islands act as a buffer to reduce the effects of ocean waves and currents on associated estuaries and wetlands. Louisiana's barrier islands are eroding at a rate of up to 65 feet per year: according to recent USGS estimates, several will disappear by the end of the century (LACPR 2008). With the rapid loss of this habitat occurring along the Louisiana coast restoration efforts are of the highest priority given the large population of piping plovers that winter along the Louisiana coast. With large tracks of critical habitat disappearing piping plovers will be forced to nest in other regions. If barrier islands become unavailable they will be forced to move to mainland beaches where there is increased likelihood for human disturbance and predation. If nothing is done to restore this habitat the piping plover will face difficulty returning to a stable population size.

11.3 Gulf Strugeon (*Acipenser oxyrhynchus desotoi*)

11.3.1 Description of Species

Gulf sturgeon are anadromous fish (migrating seasonally between fresh and saltwater) that range primarily from the Suwannee River in Florida to the Mississippi River in Louisiana (Morrow et al, 1996). Gulf sturgeon are light brown to dark brown in color with a pale underside (USFWS & Gulf States Marine Fisheries Commission, 1995). They have elongate, fusiform bodies covered by naked skin imbedded with bony plates or scutes. The average adult Gulf sturgeon ranges in size from 120-225 cm in length with an average weight between 35-320 lbs. The largest recorded Gulf sturgeon was caught at Cow Horn Reef near the mouth of the

Mississippi River in September 1936. Its reported mass was 228.2 kg with a length of 274 cm (Reynolds, 1993). Size is dependent on the individual's gender, age, and spawning condition (USFWS, 1980; Huff, 1975). Females live longer than males and continue to grow with age, consequently they are larger and weigh more than males (Huff, 1975). Females reach sexual maturity between 8 and 17 years of age while males reach sexual maturity between the ages of 7 to 21 (Huff, 1975). Gulf sturgeon are long lived, having the possibility of reaching at least 42 years old (Huff, 1975).

Gulf sturgeon generally consume soft-bodied foods, avoiding armored or spiny organisms. Organisms that are encrusted or have hardened tubes, such as polychaetes and corophiid amphipods, are not preferred food types (Mason et al., 1993). The diet of juvenile sturgeon 1 to 2 kg includes brackish-water amphipods, chironomid larvae, certapogonid larvae, aquatic insects, and small bivalves. Prey consumed by juvenile sturgeon in the rivers that are also eaten by adults in the estuaries include arthropods, annelids, and mollusks. Macroinvertebrates, such as dipteran larvae, amphipods, isopods, small grass shrimps, and annelids are key prey species of 1-10 kg Gulf sturgeon feeding in the mouth of the river. Subadults 10-19 kg, have diets that include mud or ghost shrimp. Adult Gulf sturgeon in the estuaries and coastal areas mainly consume amphipods, polychaetes, lancelets, gastropods, isopods, brachiopods and shrimp (Mason et al., 1993; and Carr et al., 1996). Bony fish are seldom consumed. Detritus, both inorganic and organic, is consumed incidentally by Gulf sturgeon of all sizes as they feed on various prey (Mason et al., 1993). Non-spawning sturgeon appear to feed longer in the estuaries and bays prior to moving into the rivers than spawning adults (Fox et al., 2000).

11.3.2 Species Habitat and Distribution

Gulf sturgeon live in the estuaries and coastal shelf regions of the Gulf of Mexico during the cooler months of the year (October to March). In March and early April, adult sturgeon start their migration into the freshwater rivers in search of spawning habitat. Non-ripe adults, juveniles and subadults also participate in this yearly migration, but usually lag behind the spawning adults, moving into the rivers anywhere from days to months later. Sexually mature, ripe males and females enter the rivers when the surface water temperatures reach 62-70° F (Carr, Tatman, & Chapman, 1996). Fox et al. (2002), in their studies of Gulf sturgeon in the Choctawhatchee Bay, found that male sturgeon enter the river earlier than female sturgeon and move greater distances upstream. Males were also found to remain at the spawning grounds longer than females. Ripe specimens of both sexes entered the Choctawhatchee River earlier and moved significantly further upstream than non-ripe fish. After spawning, both males and females return to the lower river reaches and join their non-spawning counterparts in summer holding areas where they reside until the fall migration. After hatching, age-0 fish remain in riverine habitats through January, moving into the estuaries in February as age-1 fish (Sulak et al., 1998).

Fall migration after spawning and river temperatures drive the return of sturgeon to the Gulf of Mexico. When river temperatures approximate the fall temperatures of the Gulf of Mexico (usually in late October or early November), and surface temperatures drop between 62-

72° F, sturgeon leave the rivers (Chapman, 2001; Foster & Clugston, 1997) for their winter marine habitats. Sulak et al. (1999) reported that adult Gulf sturgeon in the Suwannee River spend up to several weeks of pre-migratory staging (late November to early December) in the lower river and adjacent estuary. While it has been suggested that this kind of holding pattern prior to the sturgeon's movement between fresh and saline environments may be necessary due to osmoregulatory functions (Murphy & Skaines, 1994), some rivers, like the Pearl River, report sturgeon moving through the river/bay interface rapidly, requiring little if any time for acclimatization (Howard Rogillio, LDWF personal communication). Altinok et al. (1998) determined that, by age one, Gulf sturgeon have developed an active mechanism for osmoregulation and ion balance in euryhaline environments.

Based on distribution information from the NOAA Fisheries (2007), the present range of the Gulf sturgeon extends from Lake Pontchartrain and the Pearl River system in eastern Louisiana and western Mississippi east to the Suwannee River is Florida. The project area is not within the current known range of the Gulf sturgeon. The majority of these sturgeon have their origins in the Pearl River system, where the largest population occurs. However, Gulf sturgeon have historically inhabited many of the larger tributaries east of the Mississippi River, including some upstream of the Ross Barnett Dam (Morrow et al., 1996). As a result of the channelization of the Mississippi River through its extensive lock and levee system, any spawning habitat that may have existed in the Mississippi River for Gulf sturgeon has since been severely degraded. There is no evidence indicating a reproducing population in this river and no verified captures of Gulf sturgeon have occurred in the Mississippi River. The movements of foraging sturgeon along the coast may occasionally place them in the vicinity of the mouth of the Mississippi. At present there is no critical habitat identified in this area for Gulf sturgeon. Their distribution is limited to the Gulf of Mexico by the emergence of peninsular Florida, which led to the development of the separate species. This speciation is maintained by the thermal barrier of the Gulf Stream around south Florida (Huff, 1975). Similarly, the Mississippi River also appears to limit their movements in the Gulf of Mexico to east of the Mississippi River.

11.3.3 Status and Cause of Decline

Historically, Gulf sturgeon have supported both commercial and recreational fisheries throughout most of their range from the Mississippi River east to Tampa Bay (U.S. Commission of Fish and Fisheries, 1902, cited in Wooley and Crateau, 1985). Large-scale exploitation of Gulf sturgeon began around 1860, when it was discovered that smoked sturgeon could be substituted for smoked halibut and that Gulf sturgeon eggs could be made into high-quality caviar (Smith, 1990). Sturgeon have been harvested with gillnets, pound nets, otter trawls, harpoons, trammel nets, weirs, stake row nets, and seines (Huff, 1975; Smith, 1985; Van Den Avyle, 1984; Smith & Clugston, 1997). Gulf sturgeon populations have declined due to fisheries over-exploitation (Barkuloo, 1988), spawning habitat loss via dam construction, and deterioration of water quality in their natal rivers (Morrow et al., 1996). Sturgeon are particularly vulnerable to gill net fisheries and are also found in the bycatch of shrimp trawls. Turtle excluder devices (TEDs) are thought to reduce sturgeon bycatch, though, to date no studies have been conducted to specifically evaluate this possibility. Even though sturgeon fishing regulations are in place, poaching of Gulf sturgeon still occurs (Collins et al., 2000).

Restrictions applied to the sturgeon fisheries have not resulted in the restoration of population size. This may be due to the reduction of suitable spawning habitat. Poss (1998) notes that dredging operations reduce the deeper holes and hard substrate sturgeon require for spawning. Dams and low water sills prevent the movement of spawning adults to traditional spawning grounds. Low dissolved oxygen levels from eutrophication also contribute to spawning habitat degradation. Adults and subadults are not greatly affected by changes in salinity, dissolved oxygen, or high temperatures, however, eggs and larval stages of the sturgeon have low tolerance ranges for these criteria (Collins et al., 2000).

The Gulf sturgeon was Federally listed as threatened throughout its range on September 30, 1991 and is also listed as a threatened species in Louisiana. The present range of the species extends from east of the Mississippi River in Louisiana east to the Suwannee River in Florida (USFWS and NMFS 2003).

On December 18, 1998 a lawsuit was filed against the USFWS and the NMFS by the Sierra Club for failing to designate critical habitat for the Gulf sturgeon. In response to this litigation the USFWS and NMFS were directed to designate critical habitat for the Gulf sturgeon. On March 19, 2003 a final rule was published in the Federal Register (Volume 68, No. 53) designating critical habitat for the Gulf sturgeon in Louisiana, Mississippi, Alabama, and Florida. Portions of the Pearl and Bogue Chitto Rivers, Lake Pontchartrain east of the Lake Pontchartrain Causeway, all of Little Lake, The Rigolets, Lake St. Catherine, and Lake Borgne within Louisiana were included in that designation.

Because the Gulf Sturgeon is anadromous, it uses coastal rivers as spawning habitats, then moves to estuarine habitats around barrier islands to forage. Recent evidence shows that these barrier island habitats are particularly important to the Gulf sturgeon because it feeds exclusively on food items found along the sand substrate at barrier island passes. The unconsolidated, fine- to medium-grain sands found in these habitats support known prey items for the Gulf sturgeon such as lancelets, small crustaceans, and amphipods. According to recent telemetry data collected from estuarine habitats in Louisiana and Mississippi, foraging adult Gulf sturgeon overwinter in the area between barrier islands and the main shoreline, with no evidence of offshore feeding migrations to marine habitats in the Gulf of Mexico. These shallow and productive habitats created and protected by barrier islands are essential for the Gulf sturgeon to complete its life cycle. Any further negative impacts or degradation caused by shoreline change could bring this species closer to extinction because of its already significantly reduced numbers and the extensive degradation of its freshwater spawning habitats. If the Gulf sturgeon is to remain a part of Louisiana's fish community, then barrier islands need to be maintained (O'Connell et al. 2005).

11.4 Green Sea Turtle (*Chelonia mydas*)

11.4.1 Description of Species

The green sea turtle is one of the largest marine turtles with adult weights averaging between 250 to 450 pounds (Dundee 1989). This species can live upwards of 50 years and

usually reaches sexual maturity between ages 20-50 years. During the yearling stages, the species lives in and around offshore areas and its diet is primarily carnivorous (NOAA-1). During their first year of life, green sea turtles are primarily carnivorous, feeding mainly on invertebrates. Green turtles are the only sea turtles that eat large amounts of plants, feeding in shallow water areas with abundant seagrasses or algae (Fritts et al. 1983; Spotila 2004). Green sea turtles also feed on invertebrates and carrion (Dundee and Rossman 1989).

11.4.2 Species Habitat and Distribution

Although green sea turtles are found worldwide in oceans and gulfs with water temperatures greater than 68°F (20°C), their distribution can be correlated to grassbed distribution, location of nesting beaches, and associated ocean currents (Hirth 1971; Perrine 2003; Spotila 2004). Long migrations are often made between feeding and nesting grounds (Carr and Hirth 1962). Within Louisiana waters, these turtles probably occur all along the coast and may nest on the Chandeleur Islands (Dundee and Rossman 1989). Population decline has been attributed to heavy fishing pressure and human nest predation (Dundee and Rossman 1989; Perrine 2003; Spotila 2004). Historically, green sea turtles were fished off the Louisiana coast, especially the Chandeleur Islands (Rebel 1974; http://www.wlf.state.la.us/apps/netgear/index.asp?cn=lawlf&pid=703). Exploitation and incidental drowning in shrimp trawls has contributed to the decline of this species and its eventual listing (King 1981).

The turtles migrate from nesting areas to feeding grounds, which are sometimes several thousand miles away. Most turtles migrate along the coasts, but some populations are known to migrate across the ocean from nesting area to feeding grounds. The major nesting beaches are always found in places where the seawater temperature is greater than 77°F (25°C). As a species that migrates long distances, these turtles face special problems associated with differing attitudes toward conservation in different countries. Green turtles are the only sea turtles known to come ashore for purposes other than nesting. Both immature and adult green sea turtles are known to bask (Perrine 2003).

In the southeastern United States, green sea turtles are found around the U.S. Virgin Islands, Puerto Rico, and the continental U.S. from Texas to Massachusetts. Important feeding grounds in Florida include Indian River Lagoon, the Florida Keys, Florida Bay, Homosassa, Crystal River and Cedar Key. The primary nesting sites in U.S. Atlantic water are along the east coast of Florida, with additional sites in the U.S. Virgin Islands and Puerto Rico.

Green sea turtles are also found throughout the North Pacific, ranging as far north as Eliza Harbor, Admiralty Island, Alaska, and Ucluelet, British Columbia. In the eastern North Pacific, green sea turtles have been sighted from Baja California to southern Alaska. In the central Pacific, green sea turtles can be found at most tropical islands. In U.S. Hawaiian waters, green sea turtles are found around most of the islands in the Hawaiian Archipelago. The primary nesting site is at French Frigate Shoals (http://www.nmfs.noaa.gov/prot_res/species/turtles/green.html).

In the western Atlantic, several major nesting assemblages have been identified and studied (Peters, 1954; Carr and Ogren, 1960; Parsons, 1962; Pritchard, 1969; Carr *et al.*, 1978). In the continental United States, green turtle nesting occurs on the Atlantic coast of Florida (Ehrhart, 1979). Occasional nesting has been documented along the Gulf coast of Florida, at Southwest Florida beaches, as well as the beaches on the Florida Panhandle (Meylan *et al., 1995*). Most documented green turtle nesting activity occurs on Florida index beaches, which were established to standardize data collection methods and effort on key nesting beaches. The pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the six years of regular monitoring since establishment of the index beaches in 1989, perhaps due to increased protective legislation throughout the Caribbean (Meylan *et al.*, 1995).

While nesting activity is obviously important in identifying population trends and distribution, the majority portion of a green turtle's life is spent on the foraging grounds. Green turtles are herbivores, and appear to prefer marine grasses and algae in shallow bays, lagoons and reefs (Rebel, 1974). Some of the principal feeding pastures in the Gulf of Mexico include inshore south Texas waters, the upper west coast of Florida and the northwestern coast of the Yucatan Peninsula. Additional important foraging areas in the western Atlantic include the Indian River Lagoon System in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito coast of Nicaragua, the Caribbean coast of Panama, and scattered areas along Colombia and Brazil (Hirth, 1971). The preferred food sources in these areas are *Cymodocea, Thalassia, Zostera, Sagittaria, and Vallisneria* (Babcock, 1937; Underwood, 1951; Carr, 1952; 1954).

11.4.3 Status and Cause of Decline

The green sea turtle was listed as threatened in U.S. waters, except for the Florida breeding population which is listed as endangered, on July 28, 1978. Due to the inability to distinguish between these populations away from the nesting beach, green turtles are considered endangered wherever they occur in U.S. waters. In 1998, critical habitat for this species was designated in and around the Culebra Islands, which are situated off the eastern coast of Puerto Rico (NMFS 1998).

Green turtles were traditionally highly prized for their flesh, fat, eggs, and shell. Fisheries in the United States and throughout the Caribbean are largely to blame for the decline of the species. Green turtles were once abundant enough in the shallow bays and lagoons of the Gulf to support a commercial fishery, which landed over one million pounds of green turtles in 1890 (Doughty, 1984). Doughty (1984) reported the decline in the turtle fishery throughout the Gulf of Mexico by 1902. Currently, green turtles are uncommon in offshore waters of the northern Gulf, but abundant in some inshore embayments. Shaver (1994) live-captured a number of green turtles in channels entering into Laguna Madre, in south Texas. She noted the abundance of green turtle strandings in Laguna Madre inshore waters and opined that the turtles may establish residency in the inshore foraging habitats as juveniles. Algae along the jetties at entrances to the inshore waters of south Texas was thought to be important to green turtles associated with a radio-telemetry project (Renaud *et al.*, 1995). Transmitter-equipped turtles remained near jetties for most of the tracking period. This project was restricted to late summer

months, and therefore may reflect seasonal influences. Coyne (1994) observed increased movements of green turtles during warm water months.

In the Southeast United States, major nest protection efforts and beach habitat protection are underway for most of the significant nesting areas, and significant progress has been made in reducing mortality from commercial fisheries in U.S. waters with the enforcement of TED regulations. Many coastal counties and communities in Florida have developed lighting ordinances to reduce hatchling disorientations. Important U.S. nesting beaches have been and continue to be acquired for long-term protection. The FWS and NMFS have been funding research on the fibropapilloma disease for several years to expand our knowledge of the disease with the goal of developing an approach for remedying the problem. Due to the long range migratory movements of sea turtles between nesting beaches and foraging areas, long-term international cooperation is absolutely essential for recovery and stability of nesting populations (USFWS North Florida Fact Sheet).

One of the greatest impacts to this species has been the harvest of eggs, juveniles and adults on both nesting and feeding grounds. Additional threats, specifically in the U.S., include the erosion of the coastline and the barrier islands, which results in the loss of suitable habitat for this species (LDWF-2). Fishing and dredging operations, specifically hopper-type dredges, have also adversely impacted this species throughout the years. Also, commercial harvest, habitat degradation, coastal development, disease, and predation have all contributed to the decline of the species.

11.5 Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)

11.5.1 Description of Species

The Kemp's ridley sea turtle is the smallest of the sea turtles with adults reaching an approximate length of 2 to 2 ½ feet and weighing around 110 pounds (Dundee 1989). This species has a single claw located on its front flippers and usually has one to two claws located on its rear flippers (NOAA-3). The species' is carnivorous and usually feeds upon crabs, clams, and snails that inhabit the shallow coastal waters (Dundee 1989).

11.5.2 Species Habitat and Distribution

The Kemp's ridley has the most limited distribution of any sea turtles except the Australian flatback (Perrine 2003). For the most part, breeding is confined to a limited stretch of beach on the Gulf coast of Mexico. The known range of this species includes the Gulf of Mexico and the Atlantic Ocean. The current range for Kemp's ridley in the United States includes marine habitat of the following coastal states: Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas.

During the months of May to October, this species can be found in and around the shore line of Louisiana with adults occupying areas around the mouth of Mississippi during the spring and summertime. As winter approaches, adults and juveniles generally head to warmer waters

offshore. The Kemp's Ridley sea turtle's habitat is comprised of warm bays, coastal waters, sea grass beds, and sandy beaches utilized for nesting (LDWF-4). This species has been observed within the Sabine and Calcasieu Lakes as well as in Lake Borgne and areas around St. Bernard Parish (Dundee 1989). Similar to other sea turtles, threats to this species include the harvest of eggs and nesting adults, incidental trapping in fishing nets, and loss of suitable habitat. It has been suggested that sea turtles may burrow into the estuarine mud along the Gulf coast during the winter, essentially when water temperatures are too low for normal activity, but no dormant sea turtles have been reported in coastal Louisiana.

Inshore areas of the Gulf of Mexico appear to be important habitat for Kemp's ridleys, as they tend to concentrate around the mouths of major rivers (Frazier 1980). Members of this genus are characteristically found in waters of low salinity and high turbidity and organic content, where shrimp are abundant (Zwinenberg 1977; Hughes 1972 as cited in Frazier 1980;). Kemp's ridleys have been collected in Louisiana from Lake Borgne, Barataria and Terrebonne Bays, and near Calcasieu Pass (Dundee and Rossman 1989). Occurrence of these sea turtles in bays and estuaries along the Louisiana coast would not be unexpected, as many of their primary food items occur there. Stomach analyses of specimens collected in shrimp trawls off Louisiana revealed crabs, gastropods, and clams (Dobie et al. 1961). Although Kemp's ridleys are considered primarily carnivorous benthic feeders (Ernst and Barbour 1972), jellyfish as well as by-catch from shrimp trawlers have been reported as part of their diet (Landry 1986).

Research being conducted by Texas A&M University at Galveston has resulted in the intentional live-capture of 516 sea turtles from 1991-1997. Green turtles comprise over 95% of all sea turtle captures recorded by Texas A&M researchers from South Padre/Laguna Madre studies. Conversely, the Kemp's ridley dominates (92.2%) captures from more turbid, blue-crab laden waters of the upper Texas and Louisiana coasts. Capture statistics readily justify Sabine and Calcasieu Passes being considered "index habitat" for the Kemp's ridley (Landrey *et al.*, 1997).

Seasonal abundance of sea turtles utilizing nearshore waters of the northwest Gulf of Mexico varies with species and location. Kemp's ridleys are transient users of the coastal zone who venture toward tidal passes and into bays during May-August when food sources and other environmental factors are favorable. The May-August period has yielded over 80% of the sea turtle captures (N=516) recorded by Texas A&M researchers, over 75% of which were Kemp's ridleys (Landry *et al.*, 1997).

11.5.3 Status and Cause of Decline

The Kemp's ridley sea turtle was listed as endangered throughout its range on December 2, 1970. Commercial harvest, habitat degradation, coastal development, disease, and predation have all contributed to the decline of the species.

Of the seven extant species of sea turtles of the world, the Kemp's ridley has declined to the lowest population level. Kemp's ridleys nest in daytime aggregations known as arribadas, primarily at Rancho Nuevo, a stretch of beach in Mexico. Most of the population of adult

females nest in this single locality (Pritchard, 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand, 1963). By the early 1970s, the world population estimate of mature female Kemp's ridleys had been reduced to 2,500-5,000 individuals. The population declined further through the mid-1980s. Recent observations of increased nesting, suggest that the decline in the ridley population has stopped, and there is cautious optimism that the population is now increasing.

The recent nesting increase can be attributed to full protection of nesting females and their nests in Mexico, and the requirement to use turtle excluder devices in shrimp trawls both in the United States and Mexico. In 1966, conservation efforts for the Kemp's ridley were initiated on the beach near Rancho Nuevo in Tamaulipas, Mexico. This locale is the only place in the world where large nesting aggregations of this sea turtle were and are known to occur. From 1966 to 1987, conservation efforts focused on the area of Rancho Nuevo with one turtle protection camp. In 1978, the U.S. joined with Mexico at Rancho Nuevo in a bi-national effort to prevent the extinction of the Kemp's ridley. In 1988, this bi-national program expanded to the south and another camp was added. In 1989, a third camp was established when the program was expanded to the north of Rancho Nuevo. By 1997, a total of seven camps had been established along the Tamaulipas and Veracruz coasts to allow for increased nest protection efforts (USFWS North Florida Fact Sheet).

The Mexico government also prohibits harvesting and is working to increase the population through more intensive law enforcement, by fencing nest areas to diminish natural predation, and by relocating all nests into corrals to prevent poaching and predation. While relocation of nests into corrals is currently a necessary management measure, this relocation and concentration of eggs into a "safe" area is of concern since it makes the eggs more susceptible to reduced viability due to movement-induced mortality, disease vectors, catastrophic events like hurricanes, and marine predators once the predators learn where to concentrate their efforts (USFWS North Florida Fact Sheet).

In recent years, unprecedented numbers of Kemp's ridley carcasses have been reported from Texas and Louisiana beaches during periods of high levels of shrimping effort. NMFS established a team of population biologists, sea turtle scientists, and managers, known as the Expert Working Group (EWG) to conduct a status assessment of sea turtle populations. Analyses conducted by the group have indicated that the Kemp's ridley population is in the early stages of recovery; however, strandings in some years have increased at rates higher than the rate of increase in the Kemp's population (Expert Working Group, June 1996). While many of the stranded turtles observed in recent years in Texas and Louisiana are believed to have been incidentally taken in the shrimp fishery, other sources of mortality exist in these waters. These stranding events illustrate the vulnerability of Kemp's ridley and loggerhead turtles to the impacts of human activities in nearshore Gulf of Mexico waters.

The EWG developed a population model to evaluate trends in the Kemp's ridley population through the application of empirical data and life history parameter estimates chosen by the EWG. Model results identified three trends in benthic immature Kemp's ridleys. Benthic

immatures are those turtles that are not yet reproductively mature but have recruited to feed in the nearshore benthic environment, where they are available to nearshore mortality sources that often result in strandings. Benthic immature ridleys are estimated to be 2-9 years of age and 20-60 cm in length. Increased production of hatchlings from the nesting beach beginning in 1966 resulted in an increase in benthic ridleys that leveled off in the late 1970s. A second period of increase followed by leveling occurred between 1978 and 1989 as hatchling production was further enhanced by the cooperative program between the USFWS and Mexico's Instituto Nacional de Pesca (INP) to increase the nest protection and relocation program in 1978. A third period of steady increase, which has not leveled off to date, has occurred since 1990 and appears to be due to the greatly increased hatchling production and an apparent increase in survival rates of immature turtles beginning in 1990 due, in part, to the introduction of TEDs. Adult ridley numbers have now grown from a low of approximately 1,050 adults producing 702 nests in 1985, to greater than 3,000 adults producing 1940 nests in 1995 and about 3,425 nests in 1998.

The EWG was unable to estimate the total population size and current mortality rates for the Kemp's ridley population. However, they listed a number of preliminary conclusions. They indicated that the Kemp's ridley population appears to be in the early stage of exponential expansion. Over the period 1987 to 1995, the rate of increase in the annual number of nests accelerated in a trend that would continue with enhanced hatchling production and the use of TEDs. Nesting data indicated that the number of adults declined from a population that produced 6,000 nests in 1966 to a population that produced 924 nests in 1978 and a low of 702 nests in 1985. This trajectory of adult abundance tracks trends in nest abundance from an estimate of 9,600 in 1966 to 1,050 in 1985. The EWG estimated that in 1995 there were 3,000 adult ridleys. The increased recruitment of new adults is illustrated in the proportion of neophyte, or first time nesters, which has increased from 6% to 28% from 1981 to 1989 and from 23% to 41% from 1990 to 1994. The EWG's population model projected that Kemp's ridleys could reach the intermediate recovery goal identified in the Recovery Plan, of 10,000 nesters by the year 2020 if the assumptions of age to sexual maturity and age specific survivorship rates plugged into their model are correct. They determined that the data they reviewed suggested that adult Kemp's ridley turtles were restricted somewhat to the Gulf of Mexico in shallow near shore waters, and benthic immature turtles of 20-60 cm straight line carapace length are found in nearshore coastal waters including estuaries of the Gulf of Mexico and the Atlantic.

The EWG identified an average Kemp's ridley population growth rate of 13% per year between 1991 and 1995. Total nest numbers have continued to increase. However, the 1996 and 1997 nest numbers reflected a slower rate of growth, while the increase in the 1998 nesting level has been much higher. The population growth rate does not appear as steady as originally forecasted by the EWG, but annual fluctuations, due in part to irregular internesting periods, are normal for other sea turtle populations.

The area surveyed for ridley nests in Mexico was expanded in 1990 due to destruction of the primary nesting beach by Hurricane Gilbert. The EWG assumed that the increased nesting observed particularly since 1990 was a true increase, rather than the result of expanded beach coverage. Because systematic surveys of the adjacent beaches were not conducted prior to 1990, there is no way to determine what proportion of the nesting increase documented since that time

is due to the increased survey effort rather than an expanding ridley nesting range. As noted by the EWG, trends in Kemp's ridley nesting even on the Rancho Nuevo beaches alone suggest that recovery of this population has begun but continued caution is necessary to ensure recovery and to meet the goals identified in the Kemp's ridley Recovery Plan.

11.6 Loggerhead Sea Turtle (*Caretta caretta*)

11.6.1 Description of Species

The loggerhead sea turtle is also one the larger marine turtles with average adult lengths ranging from 3 to 7 feet and weighing approximately 300 to 1,100 pounds (Dundee 1989). This species usually reaches sexual maturity around age 35 and mating in the southeastern U.S. can occur between late March and early June.

11.6.2 Species Habitat and Distribution

The habitat for loggerheads consists of three different zones throughout their lifetime: terrestrial zone, oceanic zone, and near shore or neritic zone (NOAA-5). The lifecycle of the loggerhead, from hatchling to adult, begins when hatchlings leave the ocean beach nesting site and migrate towards waters consisting of seaweed and sea grass cover. The juveniles head into the neritic zone during the ages of 7 to 12 and remain there maturing into adulthood. Coastal Areas not only provide an excellent food source for adults inhabiting the area, but they also allow for easy access to migratory routes (NOAA-5).

Loggerheads are circumglobal, inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. In the Atlantic, the loggerhead turtle's range extends from Newfoundland to as far south as Argentina. During the summer, nesting occurs in the lower latitudes. The primary Atlantic nesting sites are along the east coast of Florida, with additional sites in Georgia, and the Carolinas; some nesting also occurs on the Gulf Coast of Florida. In the eastern Pacific, loggerheads are reported as far north as Alaska, and as far south as Chile. Occasional sightings are also reported from the coast of Washington, but most records are of juveniles off the coast of California. Southern Japan is the only known breeding area in the north Pacific (http://www.nmfs.noaa.gov/prot_res/species/turtles/loggerhead.html). Loggerheads probably range all along the Louisiana coast; however, Dundee and Rossman (1989) reported specimens only from Chandeleur Sound, Barataria Bay, and Cameron Parish. The population decline of loggerheads can be attributed to egg and nestling predation by mammals and birds (Dundee and Rossman 1989).

Nesting on the Gulf Coast occurs between the months of April and August, with 90 percent of the nesting effort occurring on the south-central Gulf Coast of Florida (Hildebrand 1981). Although loggerheads have been documented as nesting on the Chandeleurs in 1962 and Grand Isle in the 1930s, it is doubtful whether this species currently successfully nests on the Louisiana coast (Hildebrand 1981, Dundee and Rossman 1989). The loggerhead's diet includes marine invertebrates such as mollusks, shrimp, crabs, sponges, jellyfish, squid, sea urchins, and basket stars (Caldwell et al. 1955, Hendrickson 1980, Nelson 1986). Landry (1986) suggested

that these turtles may also feed on discarded by-catch from shrimp trawling. Adult loggerheads feed in waters less than 50 meters deep, while the primary foraging areas for juveniles appears to be in estuaries and bays (Nelson 1986, Rabalais and Rabalais 1980).

11.6.3 Status and Cause of Decline

The Loggerhead sea turtle was listed as endangered throughout its range on July 28, 1978. Commercial harvest, habitat degradation, coastal development, disease, and predation have all contributed to the decline of the species.

The loggerhead sea turtle has continued to decline in Louisiana (USFWS 1990). Perrine (2003) and Spotila (2004) provide recent summaries of loggerhead sea turtle biology, behavior and conservation. Loggerheads are capable of living in a variety of environments, such as in brackish waters of coastal lagoons and river mouths. During the winter, they may remain dormant, buried in the mud at the bottom of sounds, bays, and estuaries. The major nesting beaches are located in the southeastern United States, primarily along the Atlantic coast of Florida, North Carolina, South Carolina, and Georgia. Only minor and solitary nesting has been recorded along the coasts of the Gulf of Mexico.

The loggerhead is the most abundant species of sea turtle occurring in U.S. waters. The nearshore waters of the Gulf of Mexico are believed to provide important developmental habitat for juvenile loggerheads. Studies conducted on loggerheads stranded on the lower Texas coast (south of Matagorda Island) have indicated that stranded individuals were feeding in nearshore waters shortly before their death (Plotkin *et al.*, 1993).

In the Southeast United States, major nest protection efforts and beach habitat protection are underway for most of the significant nesting areas, and significant progress has been made in reducing mortality from commercial fisheries in U.S. waters with the enforcement of TED regulations. Many coastal counties and communities in Florida, Georgia, and South Carolina have developed lighting ordinances to reduce hatchling disorientations. Important U.S. nesting beaches have been and continue to be acquired for long-term protection. The migratory nature of loggerheads severely compromises these efforts once they move outside U.S. waters, however, since legal and illegal fisheries activities in some countries are causing high mortality on loggerhead sea turtle nesting populations of the western north Atlantic region. Due to the long range migratory movements of sea turtles between nesting beaches and foraging areas, long-term international cooperation is absolutely essential for recovery and stability of nesting populations (USFWS North Florida Fact Sheet).

11.7 Hawksbill Sea Turtle (*Eretmochelys imbricata*)

11.7.1 Description of Species

One of the smaller sea turtles that can reach a maximum length of about three feet and weigh up to 280 pounds (Dundee 1989). It has overlapping scutes (plates) that are thicker than those of other sea turtles. This protects them from being battered against sharp coral and rocks during

storm events. Adults range in size from 30 to 36 inches (0.8- 1.0 meters) carapace length, and weigh 100 to 200 pounds (45-90 kilograms). Its carapace (upper shell) is an attractive dark brown with faint yellow streaks and blotches and a yellow plastron (under shell). The name "hawksbill" refers to the turtle's prominent hooked beak. Another distinguishing feature for this species is that there are two pairs of pre-frontal scales located on the top of its head and each flipper usually has two claws (NOAA-2). The hawksbill turtle is considered to be omnivorous and its diet includes underwater vegetation, jellyfish, and other marine animals (LDWF-3).

In 1998, critical habitat for this species was designated in and around the Mona and Monito Islands, which are situated off the western coast of Puerto Rico (NMFS 1998). Threats to this species have been the loss of suitable habitat, specifically coral reef degradation, commercial exploitation, and human led harvest of adults and eggs on nesting beaches. The potential for this federally listed species to occur within the project vicinity is considered to be low.

11.7.2 Species Habitat and Distribution

This species typically utilizes different habitats depending on the life cycle stage. For the post-hatchling stage, the hawksbill inhabits the pelagic environment, usually taking refuge in algal mats and other free floating matter. As it enters the juvenile stage, the hawksbill migrates to the coastal area and begins to feed upon subsurface organisms (NOAA-2). As the species enters the adult stage the foraging and nesting areas usually consist of estuaries, warm bays, sea grass beds, and islands (LDWF-3). Various forms of sea sponges are a primary component of the juvenile and adult species' diet. In the Gulf region, this species has been sighted along the Florida coast, specifically in the reef, as well as along the Texas coastline

The hawksbill turtle is relatively uncommon in the waters of the continental United States, preferring coral reefs, such as those found in the Caribbean and Central America. Hawksbills generally inhabit coastal reefs, bays, rocky areas, passes, estuaries, and lagoons, where they are found at depths of less than 70 feet. Nesting areas in the western North Atlantic include Puerto Rico and the Virgin Islands. Nesting occurs on undisturbed, deep-sand beaches, from high-energy ocean beaches to tiny pocket beaches several meters wide bounded by crevices of cliff walls; these beaches are typically low-energy, with woody vegetation near the waterline. In the continental United States, nesting sites are restricted to Florida where nesting is sporadic at best (NOAA Fisheries/USFWS, 1993). There are accounts of hawksbills on the reefs of south Florida, and a surprising number of small hawksbills are encountered in Texas. Most of the Texas records are probably in the 1-2 year class range. Many of the individuals captured or stranded are unhealthy or injured (Hildebrand, 1983). The lack of sponge-covered reefs and the cold winters in the northern Gulf of Mexico probably prevent hawksbills from establishing a strong presence in this area. However, a hawksbill was reported near Calcasieu Lake in 1986 (Fuller *et al.*, 1987). Due to the lack of suitable foraging and nesting habitats, there is a low probability of this species occurring within the project area.

11.7.3 Status and Cause of Decline

The hawksbill sea turtle was listed endangered throughout its range on June 2, 1970. Commercial harvest, habitat degradation, coastal development, disease, and predation have all contributed to the decline of the species.

Since hawksbills migrate long distances and co-mingle extensively on foraging areas, and since there are 36 geopolitical units in the Caribbean, implementing effective conservation measures in the Caribbean is complex and will require long-term cooperation between Caribbean nations for recovery efforts to succeed. The most important hawksbill nesting beaches in the Caribbean occur along the Yucatán Peninsula of Mexico. Several Yucatán beaches account for 25 to 30 percent of all hawksbill nesting in the Caribbean. Since 1985, the Fish and Wildlife Service has provided annual funding for surveying and protecting nests at three key beaches along the Yucatán Peninsula. Continued efforts are needed to protect nesting beaches; minimize the threat from illegal exploitation through intensified law enforcement efforts to curb the incidence of poaching and harassment; maintain the ban on international trade in hawksbill products; and ensure long-term protection of important foraging habitats by designating them as marine sanctuaries or as State, territorial, or Commonwealth aquatic preserves or sanctuaries. (USFWS Fact Sheet)

11.8 Leatherback Sea Turtle (*Dermochylys coriacea*)

11.8.1 Description of Species

The leatherback sea turtle is the largest living sea turtle and reptile with adults ranging in length from 4 ½ to 5 ½ feet and weighing between 650 to 2,000 pounds (Dundee 1989). The leatherback is unique in that is lacks a hard, bony shell and instead has a leathery thick connective tissue that sits upon dermal bones (NOAA-4). This species also lacks chewing plates, which a wide variety of sea turtles use to crush hard-shelled prey. Leatherback turtles are omnivorous but feed primarily on jellyfish and other cnidarians, and have been associated with large schools of cabbage head jellyfish *(Stomolophus meleagris)*. Fritts et al. (1983) reported that these turtles also ingest plastic, apparently mistaking it for food. The leatherback instead has hard cusps in addition to a sharp edged jaw, which it uses to eat soft-bodied prey such as jellyfish. The esophagus of the leatherback contains numerous backwards pointing spines that trap jellylike prey and prevent it from escaping (NOAA-4).

11.8.2 Species Habitat and Distribution

Leatherbacks are widely distributed throughout the oceans of the world, and are found throughout waters of the Atlantic, Pacific, Caribbean, and the Gulf of Mexico (Ernst and Barbour, 1972). Leatherbacks are predominantly distributed pelagically, feeding primarily on jellyfish such as *Stomolophus, Chryaora*, and *Aurelia* (Rebel, 1974). The leatherback migrates to barrier islands and coastal beaches to nest (LDWF-5). Nesting occurs from February through July at sites located from Georgia to the U.S. Virgin Islands. Nesting leatherbacks occur along beaches in Florida, Nicaragua, and islands in the West Indies; however, no nesting has been

reported in Louisiana (Gunter 1981, Dundee and Rossman 1989). In Louisiana, leatherbacks are believed to occur offshore in deep waters; however, they have been collected from or sighted in Cameron Parish, Atchafalaya Bay, Timbalier Bay, and Chandeleur Sound (Dundee and Rossman 1989). Leatherbacks are believed to come into shallow waters if there is an abundance of jellyfish nearshore. Leary (1957) reported a large group of up to 100 leatherbacks just offshore of Port Aransas, Texas associated with a dense aggregation of *Stomolophus*.

11.8.3 Status and Cause of Decline

The Leatherback sea turtle was listed as endangered throughout its range on June 2, 1970. Commercial harvest, habitat degradation, coastal development, disease, and predation have all contributed to the decline of the species.

The status of the leatherback population is the most difficult to assess since major nesting beaches occur over broad areas within tropical waters outside the United States. The primary leatherback nesting beaches occur in French Guiana and Suriname in the western Atlantic and in Mexico in the eastern Pacific. Although increased observer effort on some nesting beaches has resulted in increased reports of leatherback nesting, declines in nest abundance have been reported from the beaches of greatest nesting densities. At Mexiquillo, Michoacan, Mexico, Sarti *et al.* (1996) reported an average annual decline in leatherback nesting of about 23 percent between 1984 and 1996. The total number of females nesting on the Pacific coast of Mexico during the 1995-1996 season was estimated at fewer than 1,000. The major western Atlantic nesting area for leatherbacks is located in the Suriname-French Guiana trans-boundary region. Chevalier and Girondot (1998) report that combined nesting in the two countries has been declining since 1992. Some nesting occurs on Florida's east coast, although nests are likely under reported because surveys are not conducted during the entire period that leatherbacks may nest. In the eastern Caribbean, nesting occurs primarily in the Dominican Republic, the Virgin Islands, and on islands near Puerto Rico. Sandy Point, on the western edge of St. Croix, Virgin Islands, has been designated by the U.S. Fish and Wildlife Service (USFWS) as critical habitat for nesting leatherback turtles, and NMFS has designated the adjacent waters surrounding St. Croix, up to and inclusive of the 100 fathom curve, as critical habitat for leatherbacks. Anecdotal information suggests nesting has declined at Caribbean beaches over the last several decades (NMFS and USFWS, 1995).

It is imperative that hatchling production be maximized for the remaining leatherback nesting that occurs along the extensive Pacific coasts of Mexico, Costa Rica, and other Central American countries. Due to the long range migratory movements of sea turtles between nesting beaches and foraging areas, long-term international cooperation is absolutely essential for recovery and stability of nesting populations. Since the 1998-99 nesting season, the Fish and Wildlife Service has provided funding annually to assist recovery efforts for the leatherback in Mexico and Costa Rica, including support for nesting surveys and nest protection. In the Southeast United States and U.S. Caribbean, major nest protection efforts and beach habitat protection are underway for most of the significant nesting areas. In addition, research is underway to develop technologies to minimize leatherback mortality associated with the longline fishery. Many coastal counties and communities have developed lighting ordinances to reduce

hatchling disorientations. Important U.S. nesting beaches have been and continue to be acquired for long-term protection. (USFWS north Florida fact sheet for the leatherback)

Threats to this species include predation of juveniles by humans and other mammals, commercial exploitation of its oil for cosmetics, incidental capture in fishing nets, and the loss of nesting grounds with the erosion of the barrier islands and coastline (Dundee 1989 & NOAA-4).

12.0 SENSITIVE SPECIES AND SPECIES OF CONCERN

12.1 Bald Eagle (*Haliaeetus leucocephalus*)

12.1.1 Status

The successful recovery of bald eagle populations within the continental United States resulted in the delisting of the species from the Endangered Species List by the FWS on August 9, 2007. The bald eagle may nest in some of the remaining large cypress trees within the project area. Though delisted, bald eagles and other raptors are still protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Following the National Bald Eagle Management (NBEM) Guidelines to minimize potential adverse impacts to bald eagles, a "no-work" distance would be established within 660 feet of any bald eagle nests occurring in the project area, during the breeding season, from October 1 thru May 15. In addition, the Division of Migratory Birds for the Southeast Region of the FWS would be contacted prior to start of project activities to update the status of known bald eagle nests and to ascertain if any new nest are discovered within or adjacent to the proposed disposal site.

12.2 Brown Pelican (*Pelecanus occidentalis*)

12.2.1 Status

The successful recovery of the brown pelican population within the continental United States resulted in the delisting of the species from the Endangered Species List by the FWS on November 17, 2009. Though delisted, brown pelicans are still protected by the Migratory Bird Treaty Act. The brown pelican is a year-round resident of Louisiana that typically forages on fishes throughout the study area. This colonial nester has established colonies on Raccoon Point on Isles Dernieres, Queen Bess Island, Plover Island (Baptiste Collette), Wine Island, and islands in the Chandeleur chain. In winter, spring, and summer, nests are built in mangrove trees or other shrubby vegetation, although occasional ground nesting may occur. Small coastal islands and sand bars are typically used as loafing areas and nocturnal roosting areas. The restoration within the project area will prevent them from converting to open water habitats and will allow for the continued use of the project area by the brown pelican. Without coastal restoration efforts the loss of key foraging habitat could hinder the recovery of the brown pelican, which was once extirpated from the state of Louisiana.

12.3 Colonial Nesting Birds

12.3.1 Status

Colonial nesting birds may nest in the area. Colonial nesting marine birds and wading birds (waterbirds) share the characteristic of typically nesting in colonies. They represent several orders of waterbirds, (i.e. cormorants, herons, egrets, ibises, gulls, terns, and skimmers) and are important and conspicuous components of coastal ecosystems. With their tendency to nest in colonies disturbance and habitat modifications can affect large numbers of them at one time.

Colonial nesting wading birds (including, but not limited to herons, egrets, and ibis) and seabirds/waterbirds (including, but not limited to terns, gulls, black skimmers, and brown pelicans) should be avoided to reduce the risk of injuring birds. The nesting activity period generally extends from February 15 through September 15. No colonial nesting bird colonies are known to exist in areas that would be directly affected by the proposed action. The lack of suitable colonial nesting habitat within the directly affected area strongly suggests that no nesting colonies would be affected. Many populations of the Least Tern *(Sterna antillarum)* are considered threatened or endangered by human developments or disturbance. The California population (*Sterna antillarum browni*) is federally listed as endangered. The interior United States population (*Sterna antillarum athalassos*) is federally listed as endangered throughout its range except within 80 km (50 miles) of the coast. In sharp contrast to these populations, least tern populations on the Mississippi Gulf Coast seem to be thriving for now. Least terns nest near seacoasts, beaches, bays, estuaries, lagoons, lakes, and rivers and rest and loaf on sandy beaches, mudflats, and salt-ponds. Nests usually in shallow depression on level ground on sandy or gravelly beaches and banks of rivers or lakes, typically in areas with sparse or no vegetation (usually less than 20% vegetation cover, often 10% or less); also on dredge spoils; on mainland or on barrier island beaches; and on flat gravel-covered rooftops of buildings (especially in the southeastern U.S.) or other similarly barren artificial sites (AOU 1983). Good nesting areas tend to be well beyond the high tide mark, have shell particles/stones/debris for egg camouflage, is out of the way of off-road vehicles and public recreation areas, not subject to unusual predation pressure, and adjacent to plentiful sources of small fishes. Colonies on small islands usually experience less mammalian predation (natureserve, 2009). Habitat destruction and modification has been shown to hinder least tern population recovery. If coastal Louisiana continues to experience the rapid rates of shoreline loss, and sandy non-vegetated habitats such as barrier islands become less common, the population status for the Gulf of Mexico least tern may change.

13.0 ANTICIPATE EFFECTS OF THE PROPOSED ACTION

Barrier system restoration, including interior marsh restoration features, would likely alter the tidal prism, thereby reducing formation of any additional tidal passes as well as "healing" (closing or narrowing) existing tidal passes and overwash areas. This would have an undetermined impact on retarding saltwater intrusion into more northern portions of the Barataria Basin. Restoration of the Caminada Headland and Shell Island would provide an undetermined level of natural storm buffering, reduction of storm surge heights, and would provide protection for the interior wetlands, bays, and estuaries. Additional indirect impacts would include:

- Restore and maintain critical habitat for piping plover along the shoreline over the period of analysis (discussed later in section 10);
- Restore the beach ecotone (i.e., the transition zone between the land and sea);
- Restore important estuarine and marine transitional EFH; and
- Restore essential spawning, nursery, nesting, and feeding habitat for many different fish and wildlife species that presently must compete for these scarce barrier shoreline, headland, and island resources.

13.1 Caminada Headland:

The use of a feeder beach as a shore protection measure provides considerable environmental benefit. Subtropical sandy beaches support a broad range of organisms, from microscopic infauna to reptiles, birds, and mammals, and the varied plants that stabilize the berm and dune and shelter its inhabitants. Of particular importance throughout the Gulf of Mexico is the berm nesting activity of sea turtles (for which there is an extensive body of literature, see Trindell, et al., 1998), the berm and dune nesting activities of several species of shorebirds, and the foraging activities of both shorebirds and transient migratory neotropical birds. The ecology of this assemblage of organisms is quite complex, but the lack of cover has led to adaptations for burrowing and crepuscular and nocturnal activity patterns, thus there is little daylight evidence of the diversity of the assemblage. The burrowing creatures range from polychaete worms, snails and bivalve mollusks, a broad range of arthropods, including insects, to mammals like beach mice. The major predators on many of the burrowing creatures are shore birds and wading birds, some of which also nest in the beach/dune system. The nearshore and surf zones are prime foraging areas for pelicans, skimmers, terns, and gulls, with the latter three also congregating on the beach face in large flocks. Many of the plants and animals are quite resilient, and able to recover from routine tidal inundation and sediment overwash. However, storm surges can devastate some populations: a 1979 hurricane overwash wiped out an endangered beach mouse population on Perdido Key, Florida prior to their restoration project (Dean, 2002) and there are numerous accounts of similar events destroying the majority of sea turtle nests on Gulf of Mexico beaches. It follows that a restored and periodically renourished beach berm and dune system affords more protection than one that continues to erode. (Poff Memorandum, 2010)

The qualitative benefits of feeder beaches are well documented in the literature; several pertinent sources are provided below. Dean and Browder (2000) found that along Perdido Key, Florida a 2 meter thick shore-parallel bar or berm, placed at a depth of -6 m, essentially remained in place, even when impacted by passage of several hurricanes. Pendleton, et al., (2003) observed that the adjacent Perdido Key beach, nourished concurrently (1989-1990) with the berm construction, retained 56% of the restored sand after eight years, which translated into 53 m of additional beach width. Work and Otay (1996) studied the role of the berm in stabilizing that restored beach. They reported that the sand loss from the unprotected beach was 50 m3/m/year, but only 15 m3/m/year from the area protected by the shore-parallel berm. (Poff Memorandum, 2010)

Since the mid-1980's, the City of Naples, Florida has been dredging an inlet, Doctors Pass, at an approximate interval of every five years, and placing the sediment in the nearshore downdrift of the inlet. The dredge material has been pumped parallel to shore in depths of less than -2 m, to above MHW, and subsequently transported onto the beach face within a few months by coastal processes. The dredged volumes were on the order of 50,000 CY and the material made such a noticeable difference in the beach profile that the design template was adjusted (reduced) during the City's most recent beach renourishment in 2006 to account for the beneficial effects of the maintenance dredge sediment (Poff Memorandum, 2010).

Palm Beach County and the State of Florida are planning a feeder beach at the Town of Palm Beach, to combat erosion resulting from an inlet-related sediment deficit (Bureau of Beaches and Coastal Systems, 2008). Other beach renourishment projects have incidentally served as feeder beaches for adjacent shorelines, both up- and downdrift. The Delray Beach, Florida beach, which has been successfully renourished multiple times, has contributed significantly to neighboring beaches to the north and south (Beachler, 1993). A Danish study comparing beach and shoreface nourishment concluded that the shoreface nourishment (i.e. subtidal feeder bar) provided more long-term benefit that the initial beach nourishment, and was more cost-effective (Laustrup, et al., 1996). A similar study from the Netherlands (Hoekstra, et al., 1996) concluded that the success of the shoreface feeder berm was a combination of it performing as a feeder and also as a submerged breakwater, reducing wave impact on the shoreline. Coastal Engineering Consultants Inc. (CECI) team has personal experience with feeder beaches that have also been successfully incorporated into beach renourishment projects including Captiva Island, Florida; St. Petersburg, Florida; Jones Beach Barrier Island, New York; and Corpus Christi Bay, Texas. The volumes of sediment involve in these projects ranged from 50,000 to over 700,000 CY (Poff Memorandum, 2010).

13.2 Shell Island:

For the rare species found in Louisiana, the loss of barrier island habitat has contributed to the decline of listed species; because these islands provide protected, isolated habitats that cannot be found elsewhere along the coast. The link between species at risk and barrier islands is reflected in the fact that of the 8 currently federally threatened and endangered species, and two recently delisted federally threatened and endangered species that occur in coastal Louisiana, eight have direct ties to barrier island habitats (**Table 2**).

Table 2: Federally threatened and endangered species found in coastal Louisiana that are dependent on or use barrier island habitats

Common Name (Scientific Name)	Federal Status	Dependence on Barrier Islands
Gulf Sturgeon (Acipenser *oxyrinchus* desotoi)	Threatened	Feeds in shallow water habitats associated with barrier islands, particularly passes

Brown Pelican (*Pelecanus occidentalis*)	Now de-listed	Uses barrier islands for nesting and nearby aquatic habitats for feeding
Piping Plover (*Charadrius melodus*)	Threatened	Uses barrier islands as wintering habitats because of reduced predation pressure
Hawksbill sea turtle (*Eretomchelys imbricata*)	Endangered	Needs warm, shallow aquatic habitats for feeding
Kemp's Ridley sea turtle (*lepidochelys kempi*)	Endangered	Needs warm, shallow aquatic habitats for feeding
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	Needs warm, shallow aquatic habitats for feeding
Green sea turtle (*Chelonia mydas*)	Threatened	Needs warm, shallow aquatic habitats for feeding
Loggerhead sea turtle (*Caretta caretta*)	Threatened	Nests on barrier islands; needs warm, shallow aquatic habitats for feeding
Bald Eagle (*Haliaeetus leucocephalus*)	Now de-listed	Not dependent on barrier islands but will use forested terrestrial habitats on islands for nesting
West Indian Manatee (*Trichechus manatus*)	Endangered	Not dependent on barrier islands but will use warm, shallow aquatic habitats for feeding.

If barrier islands are lost because of anthropogenic alteration or lack of sufficient sand input over the next century, these are the eight species that will be most negatively affected because they rely on barrier islands for nesting, breeding, and feeding. (O'Connell et al., 2005).

Shell Island Alternative 5 would restore the Shell Island to a pre-Coupe Bob condition and would provide a more robust barrier island separating Bastian Bay from the Gulf of Mexico's influences. This would increase the availability of the unique habitat available on barrier islands to threatened and endangered species in the region. Since a majority of shell islands historic surface area has been lost to natural and anthropogenic processes, increasing the proposed actions restoration efforts in the region would provide more sub-aerial land in areas where it no longer exists. **Table 3** shows the projected habitat acreages for the TSP.

Alternative	Caminada Dune Acres	Caminada Marsh Acres	Shell Island Dune Acres	Shell Island Marsh Acres	Total Acres
C5/S5	880	1186	317	466	2849

Table 3: Habitat Acreage

13.3 West Indian Manatee (*Trichechus manatus*)

Sightings of the West Indian manatee in Louisiana have primarily occurred in Lakes Pontchartrain and Maurepas, and associated coastal waters and streams (i.e., Amite, Blind, Tchefuncte, and Tickfaw Rivers) and a few rare sightings along the Gulf coast during the summer months (i.e., June through September); however, there is no known resident population in the State. To avoid potential impacts to manatees during restoration activities the following standard protective measures would be implemented;

- All contract personnel associated with the project should be informed of the potential presence of manatees and the need to avoid collisions with manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973.

- All construction personnel are responsible for observing water-related activities for the presence of manatee(s).

- Temporary signs should be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area), and at least one sign should be placed where it is visible to the vessel operator.

- Siltation barriers, if used, should be made of material in which manatees could not become entangled, and should be properly secured and monitored.

- If a manatee is sighted within 100 yards of the active work zone, special operating conditions should be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels shall operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, should be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions are no longer necessary, but careful observations would be resumed.

- Any manatee sighting should be immediately reported to the U.S. Fish and Wildlife Service (337/291-3100) and the Louisiana Department of Wildlife and Fisheries, Natural Heritage Program (225/765-2821).

Also, to prevent entrapment of manatee inside of dredged material receiving areas that have dikes or other retention features that enclose an area of open water, the area would be inspected for the presence of manatee: 1) before complete closure of the confining features, and 2) again before material is discharged in to the receiving area. Any manatee that is sighted should be allowed to leave the area before work resumes.

Adherence to the before mentioned protection measures will help ensure that any manatee that wanders into the project area would not be adversely affected. The disturbance to the manatee would only be temporary during project construction, and would result in temporary

displacement. The manatees would likely move to another area for foraging or resting purposes, and there would be other available areas to which the animals may relocate. Since Louisiana has no resident population of West Indian manatee and the protection measures will be adhered to, it is expected that the proposed BBBS project is not likely to adversely affect (NLAA) the species.

13.4 Piping Plover (*Charadrius melodus*)

In order to quantify the impacts that the feeder beach and shell island alternative 5 would have on the piping plover and its critical habitat, additional modeling was necessary. CECI performed an SBEACH and GENESIS modeling analysis to assess the proposed shoreline impacts. The modeling process, results, and analysis are as follows.

For the current model run CECI performed an SBEACH model. The SBEACH model is a widely accepted cross-shore sediment transport model utilized for predicting storm-induced beach and dune erosion. CECI developed the SBEACH input profile from the design template for the TSP at Transect D located within the nodal zone (**Figure 5 in Appendix A**). The assumed construction start date was 2012. The equilibrium and advanced fill was removed and two years of background erosion were applied to yield the projected profile at 2014 equivalent to the first renourishment event designated as the Initial Profile. The feeder beach template at 2014 was then derived as follows.

Step 1. CECI conducted a compatibility analysis of the Belle Pass dredge material with the native beach. In this case it will be Ship Shoal sand since the renourishment occurs after the Headland is restored full length using the Ship Shoal borrow area. Input data were the Belle Pass sediment data provided to CECI by the USACE via email of July 14, 2010 and native beach and Ship Shoal grain size data which were presented in CECI's Caminada Headland Engineering Appendix (CEC and SJB, 2008); none of which are presented herein for brevity. Rather, we reference Annex C-2 of the Engineering Appendix within the EIS for the native beach and Ship Shoal

– South Pelto Blocks 12 and 13 sediment data. The average mean grain size of the dredge material was computed to be 0.06 mm. The post-restoration average mean grain size of the Headland is predicted to be approximately 0.18 mm based on the native beach and Ship sediment data. Thus the dredge material contains a significant greater percentage of fines requiring additional analyses to determine the effective volume that will be yielded from the renourishment strategy and contribute to the littoral system as a feeder beach.

Step 2. CECI determined the overfill ratio proposed by Dean (1986) to identify the "fine" percentage of the Belle Pass dredge material which will be lost in profile equilibration / cross-shore losses and will not contribute to the littoral system. The analysis yielded an overfill ratio of 4.6.

Step 3. CECI determined the total dredge volume by multiplying the established volume of 500,000 CY by the average ratio of the gross volume to pay volume, computed to be

1.2, equal to 620,000 CY. The gross and pay volumes were extracted from the historical dredge records provided to CECI via email on July 19, 2010 by CEMVN.

Step 4. CECI subtracted the volume of "fine" sediment lost in profile equilibration / cross-shore losses from the total dredge volume to yield the effective volume of 135,000 CY that will contribute to the littoral system as a feeder beach. This "stable" volume will have an approximate mean grain size of 0.18 mm by virtue of the process completed above.

Step 5. CECI established the feeder beach design template parameters. The berm elevation was chosen as MHW, equal to +1.5 NAVD88. The seaward slope was set equal to 1:20 consistent with the TSP design template. The length of shoreline was set equal to 6,800 feet based on the Caminada Headland Renourishment Location Map provided to CEC by the USACE via email on July 20, 2010. Based on the effective volume, the average berm width was computed to be 125 feet.

The SBEACH results for the Without Feeder Beach (WOFB) and With Feeder Beach (WFB) model runs are depicted in **Table 4, 5** and **Figure 9**. The positive benefit of the feeder beach is observed in the upland portion of the beach profile as the feeder beach attenuates the wave run-up and reduces erosion of the Headland. To quantify these benefits, volume change above MHW and shoreline change measured at +4 feet NAVD88 for the WOFB and WFB were computed.

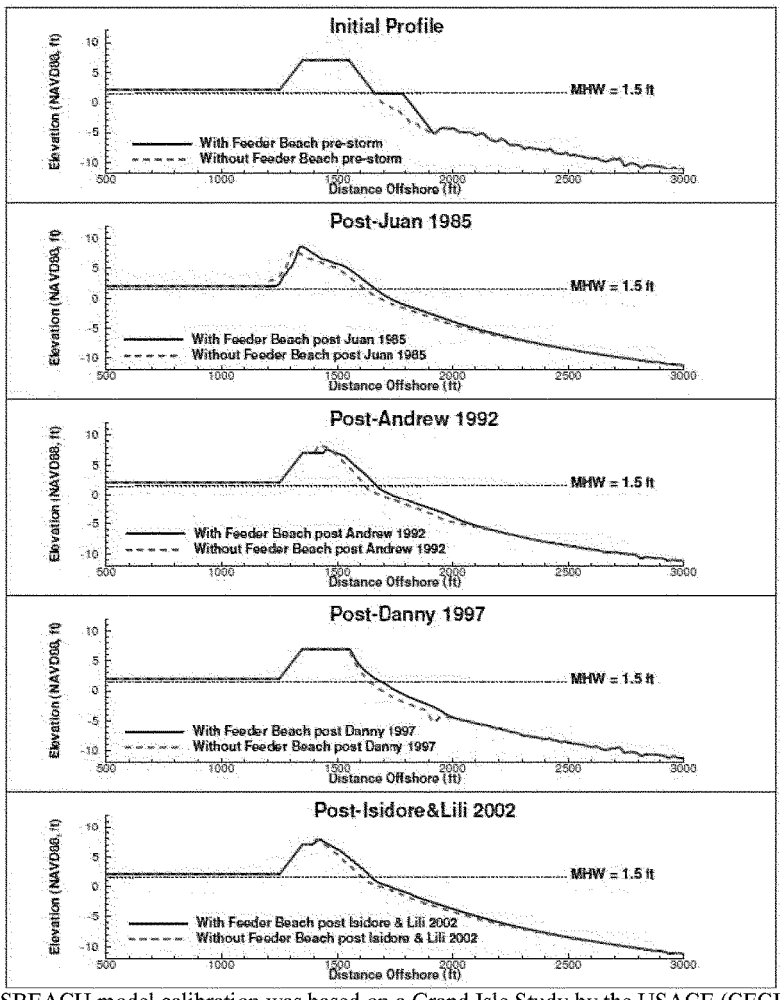
Hurricane Event	Volume of Change above MHW, cy		% Decrease
	WOFB	WFB	
Juan 1985	-11.3	-3.6	68%
Andrew 1992	-8.4	-1.6	81%
Danny 1997	-4.1	-1.4	90%
Isidore & Lily 2002	-15.6	-7.2	54%

Table 4. Volume Results for WOFB and WFB

Hurricane Event	Shoreline Change at +4 NAVD88, ft		% Decrease
	WOFB	WFB	
Juan 1985	-76	-31	59%

Andrew 1992	-43	-8	81%
Danny 1997	-24	-9	63%
Isidore & Lily 2002	-70	-36	49%

Table 5. Shoreline Change Results for WOFB and WFB



* This SBEACH model calibration was based on a Grand Isle Study by the USACE (CECI and SJB, 2008), it is recommended in PED that the modeling program and determination of the effective volume be refined through additional model calibration and verification and an equilibrium profile analysis, respectively, to improve quantifying the benefits from the feeder beach.

Figure 9: Storm Induced Erosion Computed by SBEACH for Several Hurricane Events.

The percent reduction in volume losses from the design storms attributed to the feeder beach ranged from 54 percent to 90 percent and the percent reduction in berm/dune erosion ranged from 49 percent to 81 percent. While the storm damage to the Headland remains significant from storms of these magnitudes, the feeder beach does provide a quantifiable benefit for storm damage reduction. It is noted that these model results should be interpreted carefully for several reasons. First, the material will be placed as unconfined disposal thus the profile shape may vary significantly from the assumed berm configuration. Further, lateral diffusion will occur relatively quickly reducing the "density" of the feeder beach along the placement area. Lastly, the storm damage reduction benefit will be localized to the nodal zone and adjacent beaches as the fill diffuses, which is a relatively minor percentage of the entire Caminada Headland shoreline.

Another alternative for evaluating the benefits from a feeder beach is to examine the nourishment that would occur on the Headland as longshore transport processes spread the sand to the east and west as the feeder beach diffuses over time. CECI selected the GENESIS Model (Hanson 1987, 1989; Hanson and Kraus 1989) which is a widely accepted longshore sediment transport model utilized for predicting long-term platform evolution of a beach in response to imposed wave conditions as well as simulating beach fill diffusion and response to coastal structures. The model's use is considered standard practice both in the United States and internationally as evidenced by the many documented applications in professional journals and conference proceedings. The model description utilized in the previous modeling program, documented in CECI's Caminada Headland Engineering Appendix (CECI and SJB, 2008), was adopted for the current model runs. For brevity the model description and setup are not repeated here; please reference Annex C-3 of the Engineering Appendix within the EIS for these items.

For the current model run CECI performed the GENESIS model. The initial GENESIS shoreline was developed from the design template for the TSP. The assumed construction start date was 2012. The equilibrium and advanced fill was removed and two years of background erosion were applied to yield the shoreline position at 2014 equivalent to the first renourishment event. The feeder beach template at 2014 was derived as described in the previous section. The shoreline was advanced 125 feet seaward along the 6,800 foot long renourishment location described in the previous section. Two 2-year long GENESIS simulations were performed, without and with the feeder beach. Wave data used in the model were obtained from hindcasts at WIS Station 130 (Hubertz, 1992). The data were analyzed to identify 172 different wave height, period, and direction combinations that represented wave conditions along the project area.

A pinned boundary condition was imposed on the east end of the shoreline near Caminada Pass due to time constraints. This boundary condition does not allow shoreline change at the boundary. On the west end, a gated groin boundary condition was imposed to represent the Belle Pass jetty. The following parameters were used in the GENESIS simulations:

Configuration:

- Start date = January 1, 1995
- End date = December 31, 1996
- Time step = 1 hour
- Recording time step = 240 hours

Sand, beach, and transport:

- Effective grain size = 0.176 mm

- Average berm height = 1.4 m (4.5 ft)
- Closure depth = 3.65 m (12 ft)
- Longshore sand transport coefficients K1=0.075, K2=0.05

Boundary conditions:

- Wave model – external
- Number of wave components = 1
- Ratio of shoreline cells to wave model cells = 5
- Height amplification factor = 1
- Angle amplification factor = 1
- Angle offset = 0
- Lateral BC – pinned (east), gated groin (west)

Figure 10 presents a comparison of initial and final shoreline profiles for the WOFB and WFB model runs, respectively. The results indicate that at the end of the 2-year period the feeder beach diffuses to the east and west of its initial placement by approximately 2,000 feet.

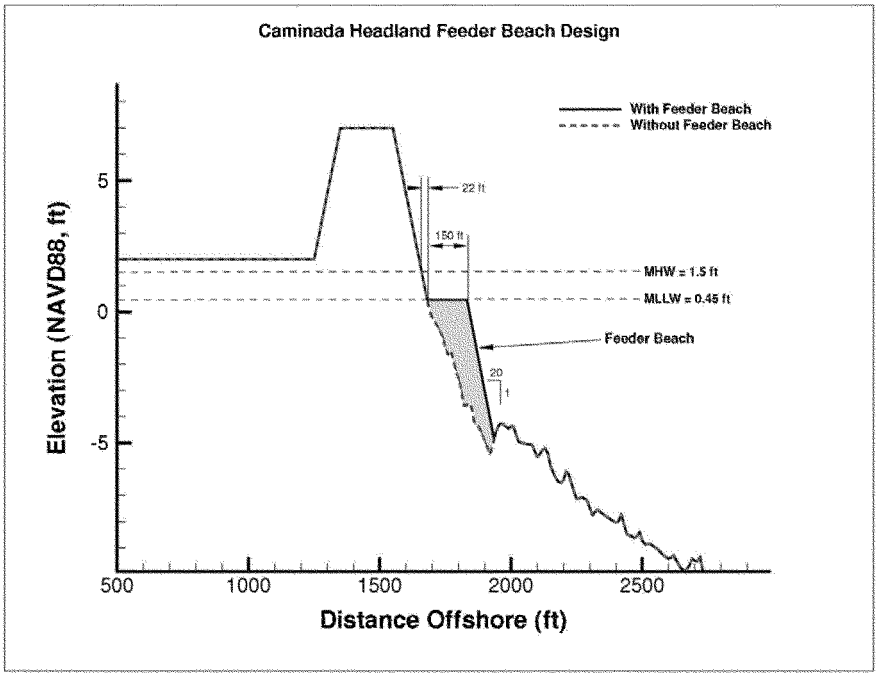


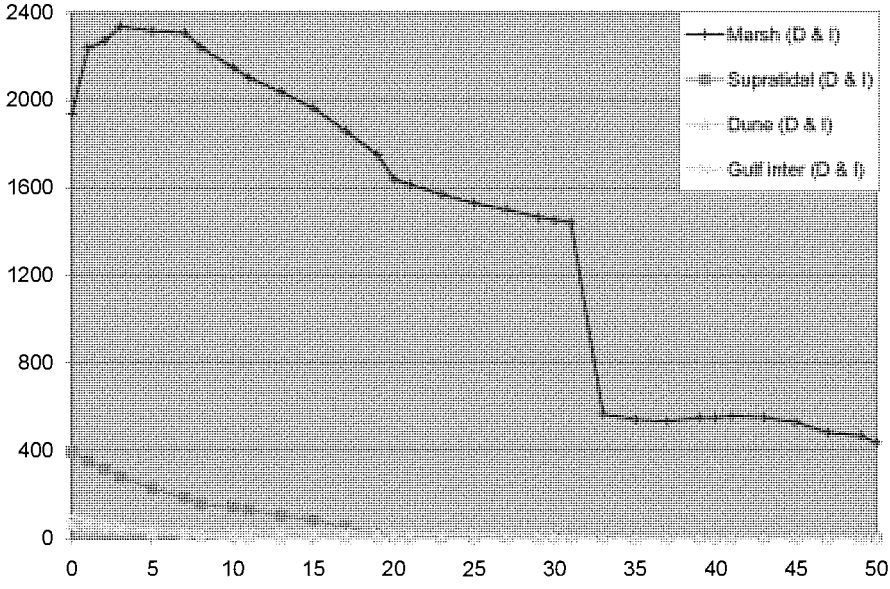
Figure 10: Initial vs. Final GENESIS Shoreline Comparison for WFB and WOFB.

It is understood that habitat management to increase piping plover populations can be accomplished in two ways. First, areas in which overwash and succession could be allowed to proceed naturally can be identified and protected. Second, where property protection precludes allowing natural processes to occur, piping plover habitat can be artificially created. It has long been known that piping plovers will utilize sand or gravel that has been worked by humans

(Cohen et al 2007). The creation of a feeder berm along the Caminada Headland, at the location where longshore transport splits going east and west, will gradual replacement some of the material that is being rapidly lost from the shoreline and thereby slowing shoreline retreat. With modeling projections showing that extensive tracts of land, 75 percent of the land between the Caminada Headland and the Larose to Golden Meadow Hurricane Risk Reduction levees, would be lost by 2060 without the implementation of the BBBS project. Replenishing some of the sediment lost and slowing the rate of habitat degradation would afford greater protection for the piping plover and their critical habitat than allowing shoreline erosion and breaching to continue unfettered.

Modeling for the Caminada Headland shows the expected evolution of acres over time for the future with and without the feeder beach. **Appendix B** models the expected habitat trends for the FWOP and the FWP conditions.

Figure 11: Evolution of Acres over Time for FWOP (Direct & Indirect Boundaries) Caminada Headland (BBBS)



At 31 years following the start of the period of analysis you see a large decrease in marsh availability for the FWP and FWOP conditions. This is because a large quantity of the existing marsh finally succumbs to the projected sea level rise and subsidence at this time. If subtidal acreages were graphed you would see an inverse relationship between marsh and subtidal acreages. Fluctuations in these values will result in higher/lower marsh loss rates.

As **Figure 11** illustrates, without the use of the feeder bar the Caminada Headland would continue to degrade over the period of analysis. With renourishment quantities matching the levels that are being lost the proposed feeder beach will not only increase the area of intertidal habitat which is essential for piping plover foraging, but will restore and maintain supratidal, dune, and marsh habitat within the project area. Much of the existing system is sediment-starved, and the proposed action would introduce sediment into that system that would be reworked and redistributed through natural processes, thus maintaining and/or enhancing the features of critical habitat. The restoration and maintenance of intertidal habitat is important for the restoration of the piping plover population to healthy levels. "Piping plover habitat is constantly changing in quality and quantity owing to factors such as climate, weather conditions, land use, vegetation encroachment, floods and high tides. Given this constant fluctuation, it is important that all piping plover habitat be protected (Goossen et al. 2002)". Caminada Headlands are currently undergoing extensive shoreline retreat and when these losses are combined with the cumulative loss of large tracks of Barrier Island habitat throughout the state, it becomes clear that preventing additional piping plover critical habitat from disappearing is very important for the conservation of the species.

In the July 10, 2001, Federal Register, the USFWS described the primary constituent elements essential for the conservation of the piping plover. Below are the primary constituent elements used to designate critical habitat for the species (USFWS 2001).

> Based upon the behavioral characteristics of wintering piping plovers, we have determined that the primary constituent elements essential for the conservation of wintering piping plovers are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. The primary constituent elements are found in geologically dynamic coastal areas that support intertidal beaches and flats (between annual low tide and annual high tide) and associated dune systems and flats above annual high tide.
>
> Important components (primary constituent elements) of intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. In some cases, these flats may be covered or partially covered by a mat of bluegreen algae. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting piping plovers. Such sites may have debris, detritus (decaying organic matter), or microtopographic relief (less than 50 cm above substrate surface) offering refuge from high winds and cold weather. Important components of the beach/dune ecosystem include surf-cast algae for feeding of prey, sparsely vegetated backbeach (beach area above mean high tide seaward of the dune line, or in cases where no dunes exist, seaward of a delineating feature such as a vegetation line, structure, or road) for roosting and refuge during storms, spits (a small point of land, especially sand, running into water) for feeding and roosting, salterns (bare sand flats in the center of mangrove ecosystems that are found above mean high water and are only irregularly flushed with sea water (Myers and Ewel 1990)) (biologists have documented use of

salterns by piping plovers in southwest Florida) and washover areas for feeding and roosting. Washover areas are broad, unvegetated zones with little or no topographic relief, that are formed and maintained by the action of hurricanes, storm surge, or other extreme wave action. Several of these components (sparse vegetation, little or no topographic relief) are mimicked in artificial habitat types used less commonly by piping plovers, but that are considered critical habitat (e.g., dredge spoil sites).

These habitat components are a result of the dynamic geological processes that dominate coastal landforms throughout the wintering range of piping plovers. These geologically dynamic coastal regions are controlled by processes of erosion, accretion, succession, and sea level change. The integrity of the habitat components depends upon daily tidal events and regular sediment transport processes, as well as episodic, high magnitude storm events; these processes are associated with the formation and movement of barrier islands, inlets, and other coastal landforms. By their nature, these features are in a constant state of change; they may disappear, only to be replaced nearby as coastal processes act on these habitats. Given that piping plovers evolved in this dynamic system, and that they are dependent upon these ever-changing features for their continued survival and eventual recovery, our critical habitat boundaries incorporate sites that experience these natural processes and include sites that may lose and later develop appropriate habitat components.
In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape. The annual, daily, and even hourly availability of the habitat patches is dependent on local weather and tidal conditions. For example, a single piping plover may leave a site if it becomes inundated by a high tide or storm event, or if high winds or cold temperatures make the site unsuitable for foraging or roosting. This bird will move to other patches within the landscape mosaic that might provide refuge from inclement weather conditions, or that simply provide a roosting site until conditions become favorable to resume foraging.

Activities that may destroy or adversely modify critical habitat as it is defined directly above are those that modify primary constituent elements to the extent that the quality of the piping plover critical habitat is reduced. The following seven items are activities that may destroy or modify critical habitat for the piping plover (USFWS 2001).

#1: Significantly and detrimentally altering the hydrology of tidal flats.

Response: The implementation of the TSP will not alter the hydrology of tidal flats, but will increase the acreage of sandy intertidal habitat, which is a preferred foraging habitat.

#2: Significantly and detrimentally altering inputs of sediment and nutrients necessary for the maintenance of geomorphic and biologic processes that insure appropriately configured and productive systems.

Response: The implementation of the TSP will add fine sediments from offshore borrow sites and sandy sediments from Bayou Lafourche into a sediment starved system in order to help maintain the geomorphic and biological processes of the project area.

#3: Introducing significant amounts of emergent vegetation (either through actions such as marsh restoration on naturally unvegetated sites, or through changes in hydrology such as severe rutting or changes in storm or wastewater discharges).

Response: The implementation of the TSP will introduce significant amounts of emergent vegetation to the study area through marsh restoration. However, the areas where the marsh restoration will take place are not available to piping plover, as they are too deep to provide foraging areas. Sandy intertidal areas along the Gulf of Mexico shoreline will either remain untouched or would be nourished with sandy sediment from bayou lafourche. Additionally, the implementation of the TSP will protect the integrity of the Caminada Headland and Shell Island, better maintaining it for the 50-year study period.

#4: Significantly and detrimentally altering the topography of a site (such alteration may affect the hydrology of an area or may render an area unsuitable for roosting).

Response: The implementation of the TSP will not alter the topography of the study area such that it would become unsuitable for roosting or foraging.

#5: Reducing the value of a site by significantly disturbing plovers from activities such as foraging and roosting (including levels of human presence significantly greater than those currently experienced).

Response: While the construction of the TSP will temporarily displace wildlife from the areas of activity, this impact will be temporary, and no long-term increase in human activity or other conditions that would preclude the use by piping plover are expected. The use of recommended primary activity exclusion zones and timing restrictions would be utilized, to the maximum extent practicable, to avoid project construction impacts to piping plover and their critical habitat within the study area.

#6: Significantly and detrimentally altering water quality, that may lead to decreased diversity or productivity of prey organisms or may have direct detrimental effects on piping plovers (as in the case of an oil spill).

Response: The implementation of the TSP is not expected to alter water quality.

#7: Impeding natural processes that create and maintain washover passes and sparsely vegetated intertidal feeding habitats.

Response: The implementation of the TSP will increase the amount of this habitat available by restoring beach and intertidal habitat, which is expected to be sparsely vegetated. Breaches in

the Caminada Headland will be renourished on a site specific basis. The natural processes that create and maintain washover passes will be maintained but shoreline stabilization will reduce the rate in which these overwash gaps occur.

The latest 5-Year Review published by the USFWS (2009) indicated that all three piping plover recovery plans stated that shoreline development throughout the wintering range poses a threat to all populations of piping plovers. The recovery plans further stated that beach maintenance and nourishment can eliminate wintering areas and alter sedimentation patterns leading to the loss of nearby habitat. The piping plover recovery plan by Goosen, et al., recognizes the need to ensure habitat availability; since piping plover habitat is constantly changing in quality and quantity owing to factors such as climate, weather conditions, land use, vegetation encroachment, floods and high tides, it is important that all piping plover habitat be protected. By choosing to restore the Caminada Headland and Shell Island the CEMVN understands that there would be the potential for temporary project-induced impacts that may result during construction activities, but our modeling projects indicate that the initial construction and supplemental nourishment impacts will be significantly less than the detrimental impacts of allowing the unique habitat features within the project area to continue to degrade. The MVN has determined that approximately 485 acres (29 acres of dune, 356 acres of supratidal, and 100 acres of gulf intertidal) of critical habitat on the Caminada Headland within designated Unit LA -5 could be temporarily affected by the TSP. Temporary project induced impacts to designated critical habitat would include construction activities within roosting and foraging habitat and smothering of the benthic community within foraging habitat. The temporary project-induced impacts of implementing alternative C5/S5 would be offset by restoration of a total of 2,849 acres including 1,197 acres of dune and supratidal habitat and 1,652 acres of bayside intertidal marsh habitat on the Caminada Headlands and Shell Island.

Nourishment will follow the same operational protocol as the restoration/nourishment events that have been conducted in the project area, on the Eastern and Western Jetties of Bayou Lafourche (Belle Pass). The beneficial placement of dredge material in the beach nourishment sites has occurred 5 times starting in December of 2002, then on December 2004, April-May 2006, March-April 2007, and lastly October 2008. On August 11th, 2009 a site visit conducted by Thomas Parker and Ed Creef with the US Army Corps of Engineers New Orleans District (CEMVN) documented three piping plovers utilizing the recently placed beach nourishment material (see **Figure 12).**

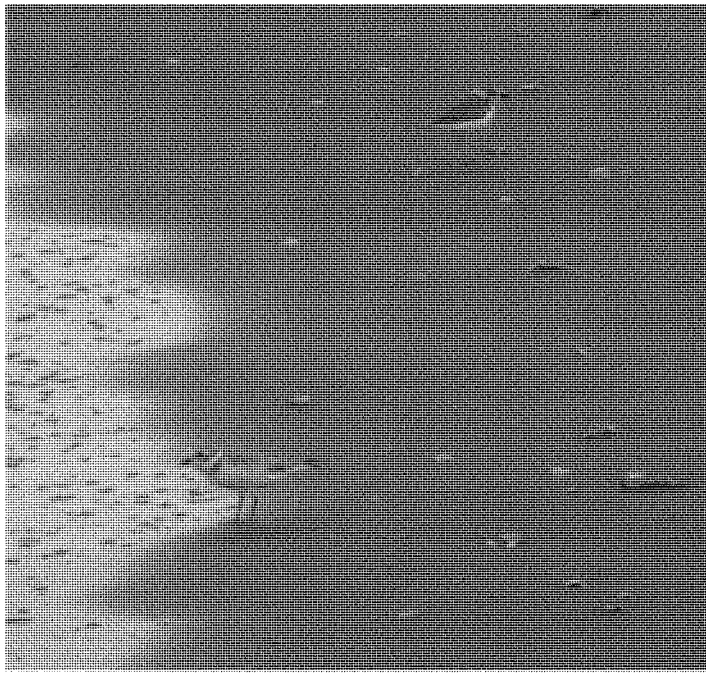


Figure 12: Piping Plover and Semipalmated Plover photographed on Western Beach, Bayou Lafourche at Belle Pass, Port Fourchon, LA. Date: August 11, 2009

Since **Figure 12** was taken the project area was impacted by the Deepwater Horizon incident. With a majority of the critical habitat for the piping plover within the project area being contaminated with oil, compositional changes and possibly an overall reduction in abundance of the benthic community are expected. In an effort to document more current environmental conditions CEMVN personnel along with members of the USFWS Lafayette office performed a site visit on August 23, 2010. During this visit heavy oil clean up activity had severely impacted the beach along the Caminada Headland. The team documented oiled sediments along the intertidal zone along the Gulf. In spite of the heavy traffic and oil contamination, the team documented 16 piping plovers utilizing the Caminada Headland and its associated over wash areas. **Figure 13** shows one of sixteen piping plover identified on the Caminada Headland. The piping plover is standing to the right of a sanderling (*Calidris alba*).

Figure 13: Piping plover on Caminada Headland on August 23, 2010

Oil contamination within the area also increases the potential for some of the borrow material, utilized during the construction of the feeder bar, to be contaminated with hydrocarbons. If the borrow material does contain some oiled sand by the time of project implementation, there is a high likelihood that the oil would be highly weathered and the proposed dredging and pumping of these sediments would further weather and break-up/disperse the oil for microbial action to take effect on the oil particles. If it is determined that there is a high probability of contamination of the borrow material, then testing of the borrow material will be conducted. The fine grained sediment that will be placed in the subtidal feeder bar would move onto the beach face in a gradual manner; consequently the feeder berm is not expected to cause extensive stacking of sediment on the beach which could smother the benthos and contribute additional stress to the remaining benthic community within the piping plover's critical habitat.

As stated earlier, it is estimated that construction of the Shell Island and the Caminada Headland components will both begin construction in January of 2012, which is concurrent with the construction timeline of the Terrebonne Basin Barrier Shoreline (TBBS) Project. Construction is estimated to last for approximately two years pending local weather conditions.

Since piping plovers rely on these barrier landscapes for 8 to 10 months out of the year while overwintering in Louisiana; the use of recommended primary activity exclusion zones and timing restrictions would be utilized, to the maximum extent practicable, to avoid further impacts to piping plover and their critical habitat within the study area. Piping plovers are known to regularly use the beach habitat along the Caminada Headland; however, there are no records of piping plovers using the remnant Shell Island. Potential project-induced direct impacts would consist of temporary displacement to nearby suitable habitats and temporary loss of benthic prey species smothered within the project footprint during construction activities. However, there are suitable habitats nearby into which piping plovers can disperse, including Belle Pass West, the easternmost sand spit of Elmer's Island, Grand Isle, and East Grand Terre Island. Impact from the proposed action would be temporary and would help to stabilize the rapidly retreating and eroding Caminada Headland. MVN therefore concludes that the proposed action is likely to adversely affect the species, and requests that FWS prepare a biological opinion for this project as required by the ESA.

13.5 Gulf Strugeon (*Acipenser oxyrhynchus desotoi*)

Impacts to the Gulf sturgeon are unlikely. The current range of Gulf sturgeon is not believed to be west of the mouth of the Mississippi River. If a Gulf sturgeon was to wander into the area potential direct impacts to the species could result during the initial construction of the project. Gulf sturgeon are succeptible to entrainment by hopper dredges. MVN will comply with all operational requirements detailed in the *Regional Biological Opinion for Hopper Dredging in the Gulf of Mexico* (GRBO) which includes screen inspectors. If a Gulf sturgeon is entrained during the operation all appropriate coordination would be initiated. Given the unlikelihood of this event, MVN believes that the proposed action would not adversely affect the species (NLAA).

13.6 Green Sea Turtle (*Chelonia mydas*)

Impacts to green sea turtle population would be kept to minimum by MVN's conformity to the requirements of the GRBO. Direct impacts to the green sea turtle could result from entrainment and mortality during initial construction activities with a hopper dredge. The following operational protocols will be adhered to during the construction activities to minimize impacts to this protected species.

1. A hopper dredge inspection will be performed using the "COE Sea Turtle Inspection Checklist for Hopper Dredges for COE Projects or COE/Army Permitted Project" (attachment 1). The District POC will be responsible for ensuring that the hopper dredge inspection has been performed and that all recommendations have been implemented or addressed prior to giving the project approval to proceed.

2. Silent Inspector (SI) will be activated and operational in accordance with CECW-CO memorandum, 17 April 2006, subject: Implementation of Automated Dredging Quality Assurance Monitoring.

3. Sea turtle deflecting dragheads, NMFS-approved protected species observers, and 100% inflow screening is required and 100% overflow screening is recommended during all dredging operations. If conditions prevent 100% inflow screening, inflow screening may be reduced gradually, as further detailed in the GRBO, but 100% overflow screening is then required. Variations from these provisions may be granted by the MSC, but any approved variation must be justified from a technical perspective. All corrective actions proposed during the hopper dredge inspection will be made prior to initiation of dredging.

4. Based on project conditions, pre-trawling condition and abundance surveys may be performed prior to initiation of dredging in accordance with the GRBO. The need for relocation trawling during the project may include assessments of pre-trawling surveys and conditions as found in paragraph 4 below, and/or historical records for the project.

5. A risk assessment will be performed by the COE District after each of up to three incidental takes of sea turtles on a particular project. Dredging may continue while the risk assessment is being performed. The risk assessments will include a review of the circumstances which contributed to the take, a review of the SI data, and a physical inspection of the dredge and its operating procedures. A risk management plan will be developed by the COE District after each of up to three incidental takes of sea turtles on a particular project. This plan will address what occurred and suggested changes to the hopper dredge operations. This plan will be provided to the contractor (or the dredge Captain for COE-owned hopper dredges) for implementation in order to minimize the likelihood of additional sea turtle takes and to ensure compliance with the terms and conditions of the GRBO. E-mail notification of recommendations and documentation will be sufficient. Additionally, the District findings will be provided to the EAG for information.

6. At the first take of a Gulf sturgeon on a particular project, a risk assessment will be performed and a risk management plan prepared. Dredging may continue while the risk assessment is being performed. Recommendations will be implemented. The EAG will be engaged in dialogue and remain engaged until such time as the project is completed or the District Commander, in consultation with the EAG, makes a decision to stop work on that project.

7. Should a total take of four sea turtles on a particular project, or if 75% of any specific Operational Limit is reached, a risk assessment will be performed and a risk management plan prepared. Results will be implemented. While the risk assessment is being performed dredging may continue. The EAG will be engaged in dialogue and remain engaged until such time as the project is completed or the District Commander, in consultation with the EAG, makes a decision to stop work on that project.

Indirect impacts to the green sea turtle include the potential temporary removal of food sources by dredging operations which may cause the green sea turtle to forage elsewhere along the Gulf coast until the area is re-colonized by prey species. Since coastal erosion and habitat loss is one of the limiting factors for the successful recovery of sea turtle populations in the

Louisiana coastal zone, the BBBS restoration is expected to benefit the species of sea turtles which inhabit the project area. The restoration of barrier habitat should result in some benefit to sea turtle species in the area. Since the BBBS project will comply with all operations protocols as detailed in the GRBO, CEMVN concludes that the BBBS project is NLAA the species.

13.7 Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)

Impacts to Kemp's Ridley sea turtle population would be similar to those detailed in the green sea turtle section. Since coastal erosion and habitat loss is one of the limiting factors for the successful recovery of sea turtle populations in the Louisiana coastal zone, the BBBS restoration is expected to benefit the species of sea turtles which inhabit the project area. The restoration of barrier habitat should result in some benefit to sea turtle species in the area. Since the BBBS project will comply with all operations protocols as detailed in the GRBO, CEMVN concludes that the BBBS project is NLAA the species.

13.8 Loggerhead Sea Turtle (*Caretta caretta*)

Impacts to the loggerhead sea turtle population would be similar to those detailed in the green sea turtle section. Since coastal erosion and habitat loss is one of the limiting factors for the successful recovery of sea turtle populations in the Louisiana coastal zone, the BBBS restoration is expected to benefit the species of sea turtles which inhabit the project area. The restoration of barrier habitat should result in some benefit to sea turtle species in the area. Since the BBBS project will comply with all operations protocols as detailed in the GRBO, CEMVN concludes that the BBBS project is NLAA the species.

13.9 Hawksbill Sea Turtle (*Eretmochelys imbricata*)

The likelihood of encountering a hawksbill sea turtle in waters of the United States is low. Hawksbill sea turtles typically nest on beaches in the Caribbean and Central America. Given the habitat preferences and infrequency of sightings, the CEMVN concludes that the BBBS project would have no effect on the species.

13.10 Leatherback Sea Turtle (*Dermochylys coriacea*)

The likelihood of encountering a leatherback sea turtle in waters of the United States is low. Leatherback sea turtles typically are found in deep ocean waters and typically nest on beaches along Central America and Costa Rica. Given the habitat preferences and the infrequency of sightings, the CEMVN concludes that the BBBS project is would have no effect the species.

13.11 Bald Eagle (*Haliaeetus leucocephalus*)

Bald eagles are not known to inhabit the project area. If a bald eagle or an active nest is discovered, bald eagle avoidance measures and minimum work distances will be adhered to.

Given the rarity of bald eagles in the project area, MVN concludes that the proposed action would have no effect on the species.

13.12 Brown Pelican (*Pelecanus occidentalis*)

Brown Pelicans are not believed to have nested on shell island. Following restoration the creation of suitable nesting habitat will be available for a population to be established. The nesting of birds will be deterred from nesting within the project area before, and during construction. With the potential benefits from the BBBS project CEMVN determines that the proposed action would have no effect on the species.

13.13 Colonial Nesting Birds

The Corps has standard procedures in place to investigate construction sites for the presence of colonial nesting birds prior to project construction. With these procedures in place, the proposed BBBS project is NLAA the species that fall under this category.

14.0 CONCLUSION AND DETERMINATION

CEMVN understands that though the proposed Shoreline restoration and subsequent beach renourishment on the Caminada Headland and the Shell Island components of the BBBS project will likely benefit the piping plover and its critical habitat, the temporary impacts to plover habitat and it's critical habitat, will temporarily adversely impact the species. Because of impacts from the Deepwater Horizon and because this project will be occurring concurrently with other restoration projects in the project area our determination for this project is a *"likely to adversely Affect"* determination for the piping plover. We request that you review this assessment and request that the USFWS and the NMFS concur or provide us with your Biological Opinion regarding this project.

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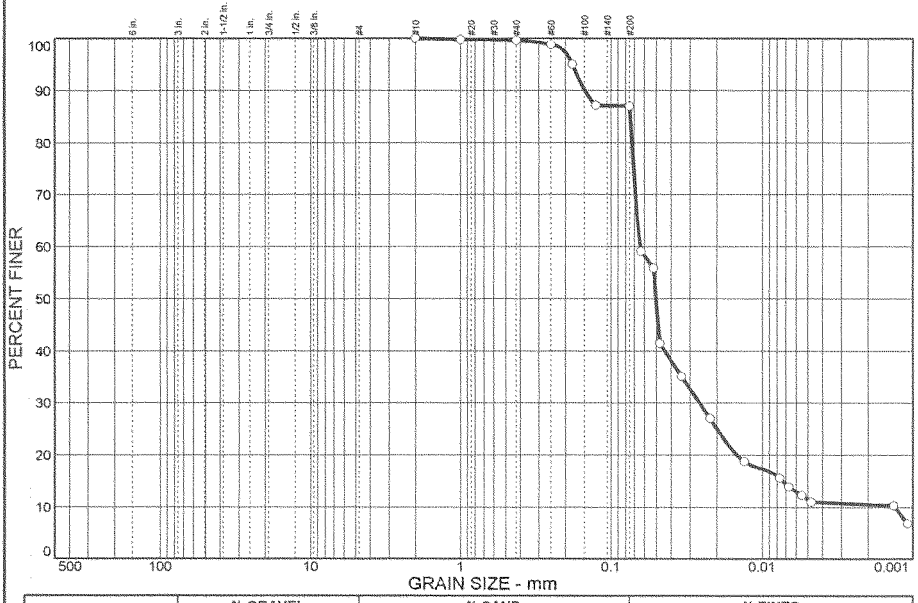
16.0 APPENDIX A

16.0 APPENDIX A

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.4	12.6	75.5	11.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#18	99.8		
#40	99.6		
#60	98.9		
#80	95.1		
#120	87.1		
#200	87.0		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0743 D_{60}= 0.0639 D_{50}= 0.0503
D_{30}= 0.0260 D_{15}= 0.0073 D_{10}= 0.0013
C_u= 48.32 C_c= 7.99

Classification

USCS= ML AASHTO=

Remarks

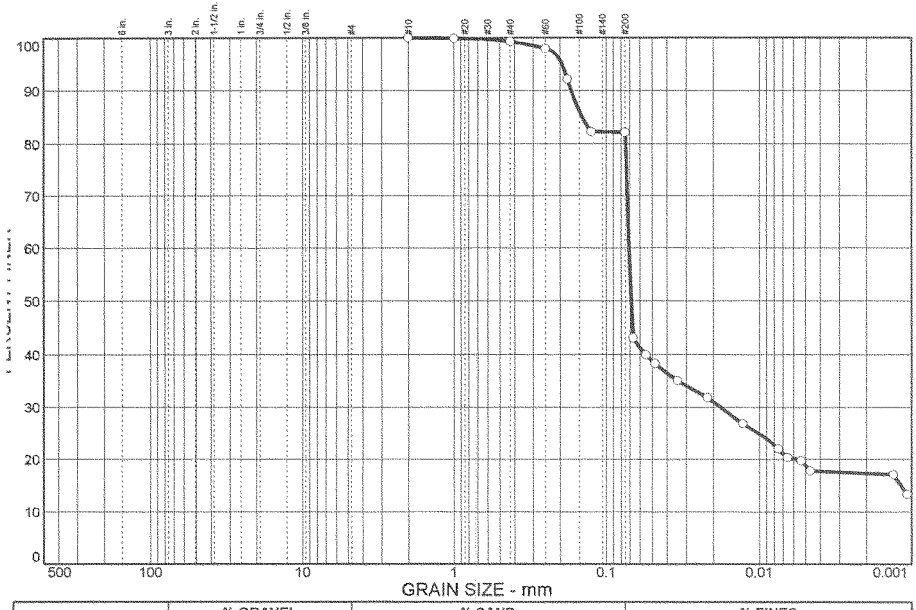
Yi, Hon-Kyu

Sample No.: 1 **Source of Sample:** **Date:** 15 Nov 2006

Location: Port Fourchon Navigation Channel, CUTTERHEAD DREDGE, Lafourche Parish **Elev./Depth:**

US Army Corps of Engineers New Orleans District	**Client:** U.S. Army Corps of Engineers, New Orleans District. **Project:** Port Fourchon Navigation Channel, CUTTERHEAD DREDGE, Lafourche Parish, LOUISIANA. **Project No:** W912P8-06-C-0125 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.7	17.2	63.3	18.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#18	99.9		
#40	99.3		
#60	98.0		
#80	92.2		
#120	82.2		
#200	82.1		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.143 D_{60}= 0.0708 D_{50}= 0.0686
D_{30}= 0.0179 D_{15}= 0.0012 D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

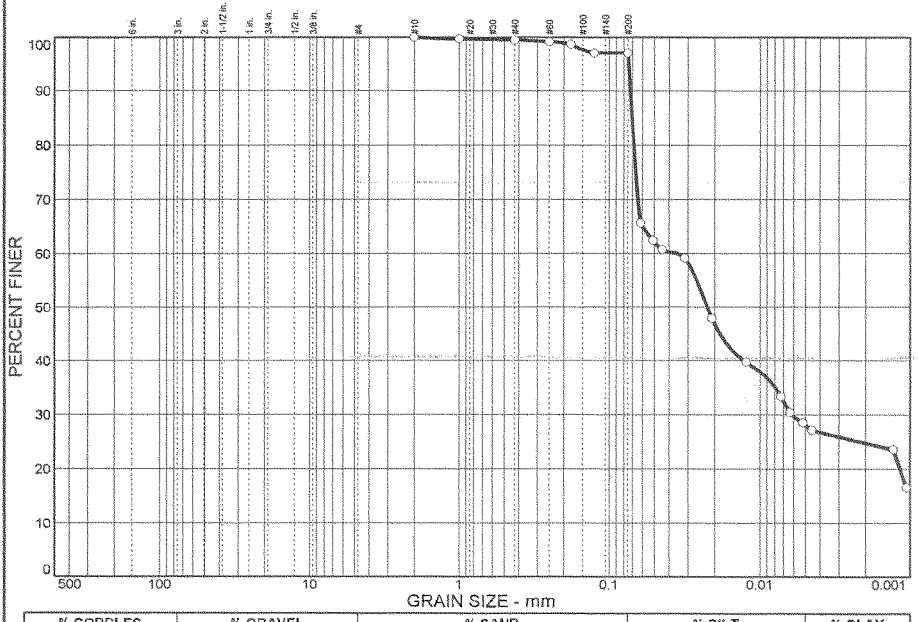
Yi, Hon-Kyu

Sample No.: 2 **Source of Sample:** **Date:** 15 Nov 2006
Location: WEST TOE STATION, Port Fourchon Navigation Channel. **Elev./Depth:**

US Army Corps of Engineers
New Orleans District

Client: U.S. Army Corps of Engineers, New Orleans District.
Project: Port Fourchon Navigation Channel, CUTTERHEAD DREDGE, Lafourche Parish, LOUISIANA.
Project No: W912P8-06-C-0125 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	2.9	69.0	28.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#18	99.7		
#40	99.5		
#60	99.2		
#80	98.7		
#120	97.1		
#200	97.1		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0705 D_{60}= 0.0353 D_{50}= 0.0223
D_{30}= 0.0062 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

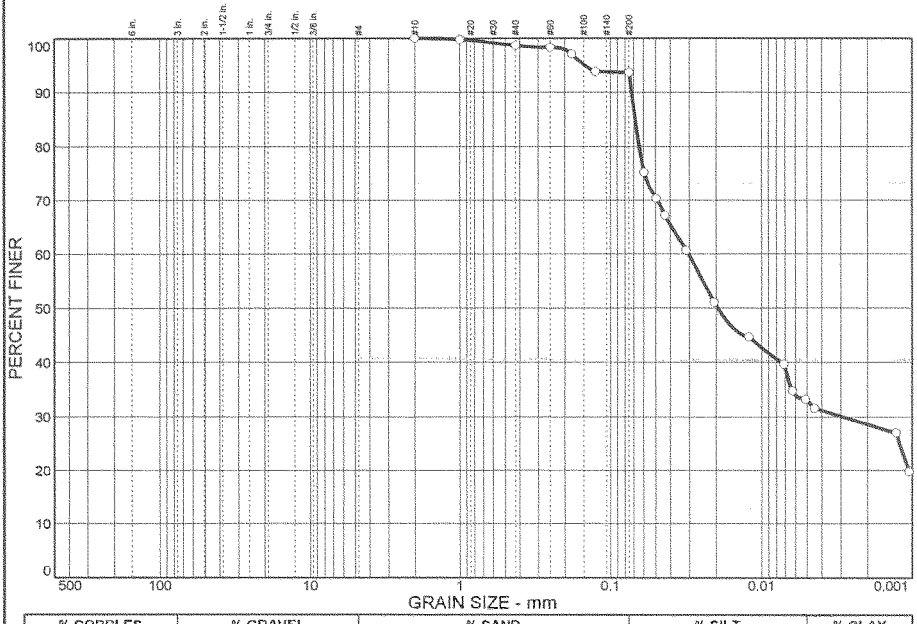
Remarks

Yi, Hon-Kyu

Sample No.: BD-3 **Source of Sample:** **Date:** 17 Nov 2006
Location: WEST TOE STATION, Port Fourchon Navigation Channel, 280+00(EAST TOE) **Elev./Depth:**

US Army Corps of Engineers New Orleans District	**Client:** U.S. Army Corps of Engineers, New Orleans District. **Project:** Port Fourchon Navigation Channel, CUTTERHEAD DREDGE, Lafourche Parish, LOUISIANA. **Project No:** W912P8-06-C-0125 **Plate**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	6.4	60.6	33.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#18	99.8		
#40	98.7		
#60	98.3		
#80	97.1		
#120	93.8		
#200	93.6		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.0683 D_{60}= 0.0304 D_{50}= 0.0194
D_{30}= 0.0029 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Yi, Hon-Kyu

Sample No.: BD-4 **Source of Sample:** **Date:** 17 Nov 2006
Location: WEST TOE STATION, Port Fourchon Navigation Channel, 310+00(WEST TOE) **Elev./Depth:**

US Army Corps of Engineers
New Orleans District

Client: U.S. Army Corps of Engineers, New Orleans District.
Project: Port Fourchon Navigation Channel, CUTTERHEAD DREDGE, Lafourche Parish, LOUISIANA.
Project No: W912P8-06-C-0125 **Plate**

Direct Boundary FWOP	TY1	TY2	TY3	TY5	TY7	TY9
OPEN WATER	414	416	419	410	397	378
MARSH	868	844	821	763	701	637
SUPRATIDAL	316	281	247	195	155	125
DUNE	25	21	17	11	6	2
GULF INTERTIDAL	78	65	53	35	23	17
GULF SUBTIDAL	587	660	730	873	1005	1128
TOTAL	2286	2286	2286	2286	2286	2286

Indirect Boundary FWOP	TY1	TY2	TY3	TY5	TY7	TY9
DUNE	28	24	20	14	9	5
SUPRATIDAL	35	33	32	31	30	29
GULF INTERTIDAL	125	115	105	84	63	44

Total (Dir & Ind) FWOP	TY1	TY2	TY3	TY5	TY7	TY9
DUNE	53	45	37	25	15	7
SUPRATIDAL	351	314	279	226	185	154
GULF INTERTIDAL	203	180	158	119	86	61

NOTES

1. Open Water and Marsh Habitat Zones were not computed for the Indirect Boundary.
2. Gulf Subtidal Habitat Zone was not computed for the Indirect Boundary.

TY10	TY11	TY13	TY15	TY17	TY19	TY20	TY21	TY23
366	349	263	157	79	31	22	20	19
580	507	329	219	137	67	43	39	36
113	102	82	63	42	16	0	0	0
0	0	0	0	0	0	0	0	0
15	14	12	10	8	4	0	0	0
1214	1315	1601	1838	2021	2169	2222	2228	2232
2286	2286	2286	2286	2286	2286	2286	2286	2286

TY10	TY11	TY13	TY15	TY17	TY19	TY20	TY21	TY23
0	0	0	0	0	0	0	0	0
28	26	21	16	8	5	3	3	3
36	28	16	8	3	2	3	4	8

TY10	TY11	TY13	TY15	TY17	TY19	TY20	TY21	TY23
0	0	0	0	0	0	0	0	0
141	128	103	79	50	21	3	3	3
51	42	28	18	11	6	3	4	8

TY25	TY27	TY29	TY30	TY31	TY33	TY35	TY37	TY39
18	17	16	16	15	14	13	12	11
34	33	32	31	30	29	28	26	25
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
2235	2237	2239	2240	2242	2244	2246	2249	2251
2286	2286	2286	2286	2286	2286	2286	2286	2286

TY25	TY27	TY29	TY30	TY31	TY33	TY35	TY37	TY39
0	0	0	0	0	0	0	0	0
3	3	3	3	2	2	2	1	1
13	19	26	28	31	35	37	37	34

TY25	TY27	TY29	TY30	TY31	TY33	TY35	TY37	TY39
0	0	0	0	0	0	0	0	0
3	3	3	3	2	2	2	1	1
13	19	26	28	31	35	37	37	34

TY40	TY41	TY43	TY45	TY47	TY49	TY50
11	10	9	8	7	6	5
24	24	23	23	22	22	22
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
2252	2253	2255	2256	2258	2259	2260
2286	2286	2286	2286	2286	2286	2286

TY40	TY41	TY43	TY45	TY47	TY49	TY50
0	0	0	0	0	0	0
0	0	0	0	0	0	0
32	30	24	18	14	13	14

TY40	TY41	TY43	TY45	TY47	TY49	TY50
0	0	0	0	0	0	0
0	0	0	0	0	0	0
32	30	24	18	14	13	14

Direct Boundary FWP With Feeder Beach	TY1	TY2	TY3	TY5	TY7	TY9
OPEN WATER	0	0	0	0	0	0
MARSH	1186	1186	1186	1071	1022	957
SUPRATIDAL	266	179	135	187	184	180
DUNE	554	554	541	496	449	381
GULF INTERTIDAL	58	58	80	96	118	139
GULF SUBTIDAL	223	309	344	435	513	628
TOTAL	2286	2286	2286	2286	2286	2286

Indirect Boundary FWP With Feeder Beach	TY1	TY2	TY3	TY5	TY7	TY9
DUNE	28	29	31	38	51	73
SUPRATIDAL	35	44	54	73	81	90
GULF INTERTIDAL	125	156	223	318	358	398

Total (Dir & Ind) FWP With Feeder Beach	TY1	TY2	TY3	TY5	TY7	TY9
DUNE	582	583	572	534	500	454
SUPRATIDAL	301	224	189	260	265	270
GULF INTERTIDAL	182	214	302	413	475	537

NOTES
1. Open Water and Marsh Habitat Zones were not computed for the Indirect Boundary.
2. Gulf Subtidal Habitat Zone was not computed for the Indirect Boundary.

Target Years	1	2	3	5	7	8

TY10	TY11	TY13	TY15	TY17	TY19	TY20	TY21	TY23
0	0	0	0	0	0	0	0	0
924	900	827	754	653	551	517	501	472
175	206	277	315	289	252	235	216	193
350	329	276	230	208	181	150	132	75
140	160	160	159	159	160	158	139	141
697	691	745	828	977	1142	1225	1296	1404
2286	2286	2286	2286	2286	2286	2286	2286	2286

TY10	TY11	TY13	TY15	TY17	TY19	TY20	TY21	TY23
81	87	90	86	70	48	38	27	11
94	115	175	209	243	271	268	265	289
403	423	441	426	428	419	411	420	405

TY10	TY11	TY13	TY15	TY17	TY19	TY20	TY21	TY23
431	416	366	316	278	229	188	159	86
270	321	452	524	532	524	503	482	483
543	583	600	585	587	578	569	559	546

10 11 13 15 17 19 20 21 23

TY25	TY27	TY29	TY30	TY31	TY33	TY35	TY37	TY39
0	0	0	0	0	0	0	0	0
450	437	417	413	409	399	379	362	337
169	146	120	112	102	88	74	66	47
34	22	17	12	8	2	0	0	0
143	144	144	145	126	126	126	126	123
1490	1536	1587	1603	1641	1670	1707	1732	1779
2286	2286	2286	2286	2286	2286	2286	2286	2286

TY25	TY27	TY29	TY30	TY31	TY33	TY35	TY37	TY39
3	2	2	1	1	0	0	0	0
313	328	337	326	319	340	360	373	346
388	372	356	348	360	349	337	325	310

TY25	TY27	TY29	TY30	TY31	TY33	TY35	TY37	TY39
36	25	18	13	9	2	0	0	0
483	474	458	437	421	427	434	439	393
531	516	500	493	486	475	463	450	432

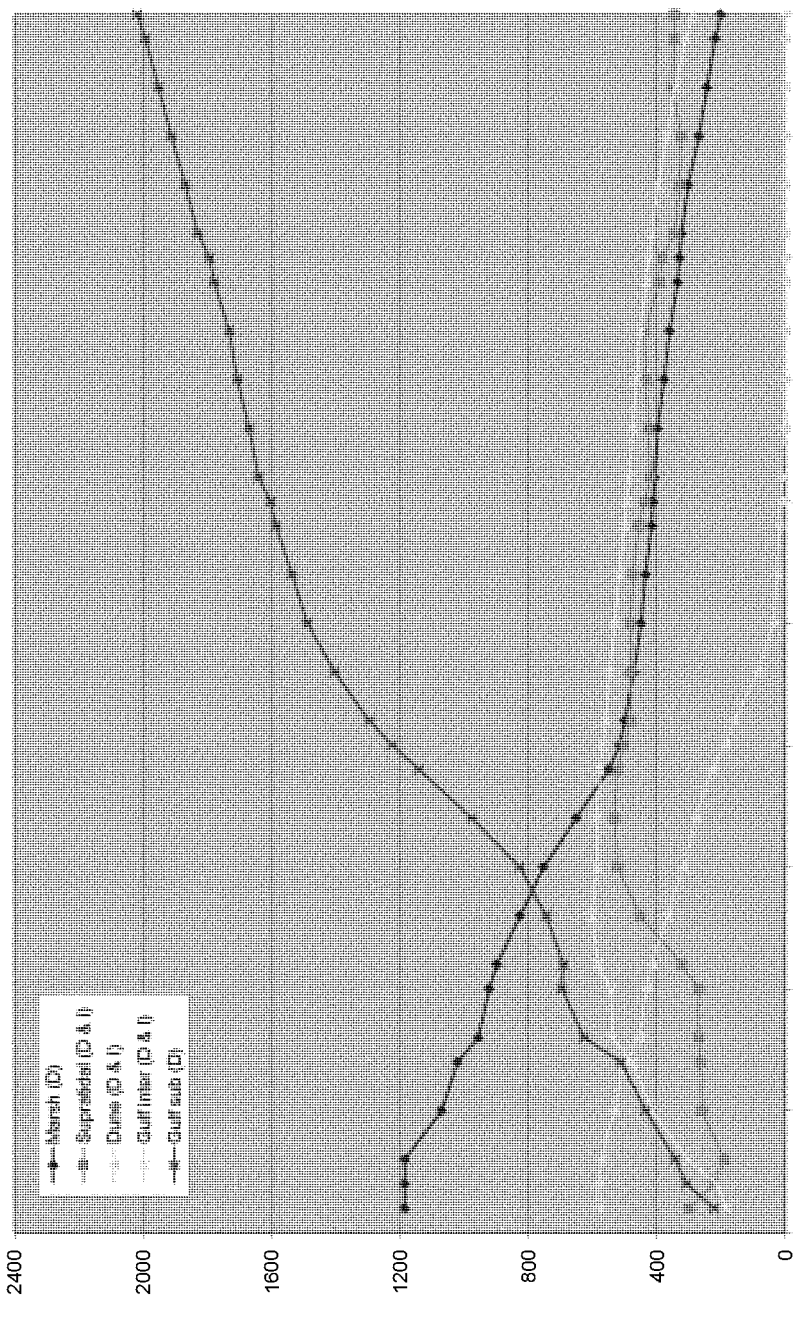
25 27 29 30 31 33 35 37 39

TY40	TY41	TY43	TY45	TY47	TY49	TY50
0	0	0	0	0	0	0
331	325	304	271	244	219	201
40	31	17	11	6	1	0
0	0	0	0	0	0	0
121	100	96	92	83	72	66
1794	1830	1869	1912	1953	1994	2019
2286	2286	2286	2286	2286	2286	2286

TY40	TY41	TY43	TY45	TY47	TY49	TY50
0	0	0	0	0	0	0
345	314	314	314	345	345	345
304	315	298	277	258	238	223

TY40	TY41	TY43	TY45	TY47	TY49	TY50
0	0	0	0	0	0	0
385	345	330	325	351	346	345
426	415	394	369	341	310	288

40 41 43 45 47 49 50


Evolution of Acres over Time for FWP With Feeder Beach (Direct & Indirect Boundaries)
Caminada Headland (BBBS)
CEC File No. 10.099
November 16, 2010
Marsh (D)
Supratidal (D & I)
Dune (D & I)
Gulf Inter (D & I)
Gulf sub (D)
2400
2000
1600
1200
800
400
0
0
5
10
15
20
25
30
35
40
45
50

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF

JUN 0 1 2011

Regional Planning and
Environmental Division South
New Orleans Environmental Branch

Carrie Thompson
US Fish and Wildlife Service
646 Cajundome Blvd., Suite 400
Lafayette, LA 70506
Fax: (337) 291-3139

Dear Mrs. Thompson:

The U.S. Army Corps of Engineers, New Orleans District (CEMVN), is formally submitting information regarding modifications to the proposed action of the Louisiana Coastal Area (LCA) Barataria Basin Barrier Shoreline (BBBS) project, that will require modification to the preliminary Biological Opinion (BO) provided by your office on March 28, 2011 during Formal Consultation as per the requirements of Section 7(a)(2) of the Endangered Species Act of 1973, as amended. We are providing additional information detailing changes made to the operation and maintenance expected on the Caminada Headland. Please review the below information which details changes that have occurred to the scope of the tentatively selected plan (TSP) for the BBBS project, and evaluate any additional effects these changes, not considered in your BO, will have on threatened and endangered species and provide us a revised BO.

Changes were made to the frequency and quantity of renourishment to the Caminada Headland. Originally the proposed action planned to use 500,000 cy of the 650,000 cy of material removed every 1.5 to 2 years during maintenance dredging of Bayou Lafourche. To increase the sustainability of the proposed action; all material removed from maintenance dredging of bayou Lafourche will be placed in the littoral drift south of Bayou Moreau where the long shore transport of material splits going east and west. The additional material will increase the quantity of material placed in the feeder berm from 2 mcy every ten year period to 3.9 mcy every 10 year period. The renourishment frequrency would also increase; resulting in material being placed along the feeder bar 6 times over a 10 year period rather than 4 times over a 10 year period. The increase in renourishment will help to stabilize the Caminada Headland which currently loses 379,000 cy of material every year or 18.95 mcy over 50 years. By increasing the total quantity of material placed over the 50 year period of analysis, we would increase the sustainability of the Caminada Headland. The increase in renourishment to 3.9 every ten years will allow the quantity of sediment placed within the feeder bar to be greater than the projected sediment loss of 3.79 mcy every 10 years as projected by the sediment budget. The location, method, size of renourishment remain as previously discussed. The only change involves a decrease in time between renourishment events

and an increase in quantity placed during renourishment events. The current plan will use all or almost all of the material that is dredged from the bayou Lafourche channel. Placement will be every 1.5 to 2 years, depending upon the dredging schedule. These estimates are based on the long term dredging averages provided by Operations Division. With this additional material we should be able to maintain the construction footprint (2,066 acres) on the Caminada Headland.

If any questions or issues arise, please contact Mr. Thomas Parker of my staff at (504) 862-2526 or by email at thomas.w.parker@usace.army.mil.

Sincerely,

Joan M. Exnicios
Chief, New Orleans Environmental Branch

Enclosure

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

September 2, 2011

Ms. Joan M. Exnicios
Chief, Environmental Branch
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Ms. Exnicios:

This letter acknowledges that on August 26, 2011, the U.S. Fish and Wildlife Service (Service) received your August 19, 2011, letter and June 3, 2011, revised biological assessment (BA) regarding the possible effects of the U.S. Army Corps of Engineers' (Corps) proposed Louisiana Coastal Area (LCA) – Barataria Basin Barrier Shoreline Restoration (BBBS) project in Lafourche and Plaquemines Parishes, Louisiana, on the endangered West Indian manatee (*Trichechus manatus*), the threatened piping plover (*Charadrius melodus*) and its designated critical habitat, and five listed species of sea turtles. Those documents were provided in response to the Service's comments on the Draft Environmental Impact Statement and they provide additional information regarding the endangered pallid sturgeon (*Scaphirhynchus albus*) and shovelnose sturgeon (*Scaphirhynchus platorynchus*) for inclusion in the ongoing early consultation under section 7 of the Endangered Species Act (Act) of 1973, as amended (16 United States Code [U.S.C.] 1531 *et seq.*).

All information required of the Corps to re-initiate consultation was included in the revised BA dated June 3, 2011. We have assigned log number 43440-2011-R-2621 to this consultation. Please refer to that number in future correspondence on this consultation. Section 7 allows the Service up to 90 calendar days to conclude early consultation with your agency and an additional 45 calendar days to prepare our preliminary biological opinion. Therefore, we expect to provide you with our preliminary biological opinion no later than January 8, 2012. Prior to issuance of a final Environmental Impact Statement, the Corps should request confirmation of the preliminary biological opinion. The Service then has 45 days to provide a written response to the Corps to finalize the biological opinion.

As a reminder, the Act requires that after initiation of early consultation, the Federal action agency may not make any irreversible or irretrievable commitment of resources that limits future options. This practice ensures agency actions do not preclude the formulation or implementation of reasonable and prudent alternatives that avoid jeopardizing the continued existence of endangered or threatened species or destroying or modifying their critical habitats.

TAKE PRIDE IN AMERICA

If you have any questions or concerns about this consultation or the early consultation process in general, please contact Ms. Brigette Firmin (337/291-3108) of this office.

Sincerely,

David A. Walther
Acting Supervisor
Louisiana Field Office

cc: NMFS, St. Petersburg, FL (Attn: Eric Hawk)
LDWF, Natural Heritage Program, Baton Rouge, LA (Attn: Michael Seymour)

Louisiana Coastal Area
Barataria Basin Barrier Shoreline Restoration Project
Jefferson, Lafourche, and Plaquemines Parishes, Louisiana

43440-2011-R-2621
Preliminary Biological Opinion
September 30, 2011

Prepared by:
U.S. Fish and Wildlife Service
646 Cajundome Boulevard, Suite 400
Lafayette, LA

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Figure 6. Breeding population distribution in wintering/migration range C-6

Acronyms

Act	Endangered Species Act
ATV	All-terrain vehicle
BA	Biological Assessment
BBBSR	Barataria Basin Barrier Shoreline Restoration
BO	Biological Opinion
CCSP	Climate Change Science Program
CEM	Coastal Engineering Manual
Corps	U.S. Army Corps of Engineers
CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Act
cm	centimeters
CY	Cubic yards
LDNR	Louisiana Department of Natural Resources
DPS	Distinct Population Segment
EPA	Environmental Protection Agency
FDEP	Florida Department of Environmental Protection
FR	Federal Register
IPPC	International Piping Plover Census
km	kilometers
LCA	Louisiana Coastal Area
LDWF	Louisiana Department of Wildlife and Fisheries
m	meters
MBTA	Migratory Bird Treaty Act
MHW	Mean High Water
MLW	Mean Low Water
MLLW	Mean Low Low Water
NAVD	North American Vertical Datum 1988
NMFS	National Marine Fisheries Service
NPS	National Park Service
NRA	Natural Resource Advisor
NRDAR	Natural Resource Damage Assessment and Restoration
O&M	Operations and maintenance
ORV	Off-road vehicle
PCB	Polychlorinated Biphenol
PCE	Primary Constituent Element
SCAT	Shoreline Cleanup Assessment Team
Service	U.S. Fish and Wildlife Service
TSP	Tentatively Selected Plan
TY	Target Year
U.S.	United States
USC	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

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September 30, 2011

Colonel Edward R. Fleming
District Commander
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Fleming:

This document transmits the U.S. Fish and Wildlife Service's (Service) preliminary biological opinion based on our review of the U.S. Army Corps of Engineers' (Corps) proposed Louisiana Coastal Area (LCA) – Barataria Basin Barrier Shoreline Restoration (BBBSR) project that would be located in Jefferson, Lafourche, and Plaquemines Parishes, Louisiana, and its effects on the threatened piping plover (*Charadrius melodus*) and its designated critical habitat, in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 United States Code [U.S.C.] 1531 *et seq.*). Your August 19, 2011, request for early (preliminary) consultation and attached revised biological assessment (BA) dated June 3, 2011, were received via mail on August 26, 2011.

This preliminary biological opinion is based on updated information provided in the Corps' revised June 3, 2011, BA; the Corps' August 9, 2010, supplemental BA; the Corps' April 24, 2009, BA; meetings; telephone conversations; electronic mails; field investigations; and other sources of information. This preliminary biological opinion replaces the March 28, 2011, preliminary biological opinion for this project. A complete administrative record of this consultation (Service Log No. 43440-2011-R-2621) is on file at the Service's Louisiana Ecological Services Office.

The Service concurs with the Corps' determination that the proposed project is not likely to adversely affect the endangered West Indian manatee (*Trichechus manatus*) because: (1) the project area does not contain suitable foraging habitat for that species; and (2) the Corps would implement, as part of the project construction plan, standard conditions for in-water work in the presence of manatees (Appendix A). The Service also concurs with the Corps' determination that the proposed project is not likely to adversely affect the endangered pallid sturgeon (*Scaphirhynchus albus*) and shovelnose sturgeon[1] (*Scaphirhynchus platorynchus*) because: (1) the species rarely occur within the lower portion of the Mississippi River near the Nairn Dune borrow site; and (2) the Corps would implement, as part of the project construction plan, protective measures for sturgeon during dredging operations within the river (Appendix B). Federally listed sea turtles (i.e., Kemp's ridley, hawksbill, loggerhead, leatherback, and green sea turtles) are not currently known to nest in Louisiana. It is our understanding that the Corps has conducted a separate consultation with the National Marine Fisheries Service (NMFS) regarding project-related effects to sea turtles offshore. The NMFS is also responsible for Section 7 consultation with the Corps for the threatened Gulf sturgeon (*Acipenser oxyrhynchus desotoi*) in estuarine and marine waters. Accordingly, none of the species mentioned in this paragraph will be discussed further in this biological opinion (Table 1).

[1] For law enforcement purposes shovelnose sturgeon are classified as "Threatened due to Similarity of Appearance" wherever they coexist with the endangered pallid sturgeon. They are biologically neither endangered nor threatened but this designation extends the ESA take prohibitions to shovelnose sturgeon, shovelnose-pallid sturgeon hybrids, and their roe when associated with a commercial fishing activity.

Table 1. Species and critical habitat evaluated for effects from the proposed action but not discussed further in this biological opinion.

Species or Critical Habitat	Present in Action Area	Present in Action Area but "Not Likely to Adversely Affect"
West Indian manatee	Possible	Yes
Pallid sturgeon	Possible	Yes
Shovelnose sturgeon*	Possible	Yes

* For law enforcement purposes shovelnose sturgeon are classified as "Threatened due to Similarity of Appearance" wherever they coexist with the endangered pallid sturgeon. They are biologically neither endangered nor threatened but this designation extends the ESA take prohibitions to shovelnose sturgeon, shovelnose-pallid sturgeon hybrids, and their roe when associated with a commercial fishing activity.

Consultation History

On September 26, 2003, the Service provided the Corps with a detailed list of and habitat descriptions for federally threatened and endangered species, their critical habitat, and migratory birds that may be found in or near the study area for the draft LCA Comprehensive Study. On May 2, 2005, the Service provided a project-specific list of federally threatened and endangered species to the Corps in response to their request for our comments and participation as a cooperating agency in the preparation of their Draft Environmental Impact Statement for the BBBSR project.

On May 18, 2006, the Service and the Corps conducted a site visit to discuss potential project-related effects to the piping plover and its critical habitat. On July 11, 2006, the Service provided the Corps with additional specific biological information for the piping plover for preparation of their draft BA.

On May 11, 2009, the Service concurred with the Corps' determination that the originally proposed project as described in their April 24, 2009, BA, was not likely to adversely affect the piping plover or its designated critical habitat.

Proposed project modifications were presented to the Service via meetings, telephone calls, and ongoing coordination between the Service and the Corps in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). On August 5, 2010, the Service provided a supplemental letter to our April 30, 2009, draft Fish and Wildlife Coordination Act Report regarding the Corps' proposed changes in the Tentatively Selected Plan (TSP) for the BBBSR project. That letter recommended that the Corps re-initiate section 7 consultation due to the changes in the project scope and location.

On August 11, 2010, the Corps provided the Service with their August 9, 2010, supplemental BA regarding the proposed changes in the scope and location of the BBBSR project, as well as detailed information regarding a change in the environmental baseline due to the impacts to the project area as a result of the Deepwater Horizon Mississippi Canyon Well #252 oil spill. Due to the nature of the project changes and the change in the project-area environmental baseline, the Corps requested to initiate formal consultation. On August 19, 2010, the Service provided confirmation to the Corps that all information had been received and that a biological opinion would be issued no later than December 24, 2010.

On August 23, 2010, the Service and the Corps conducted a site visit to discuss the changes in the proposed project and its potential effects to existing piping plover habitat, as well as the effects to

existing habitat related to the Deepwater Horizon oil spill. On September 16, 2010, the Corps provided the Service with additional clarification of the proposed project changes specifically regarding the proposed location and placement of the feeder beach berm.

On October 7, 2010, the Corps informed the Service that the project plan had changed and that the Corps would be rescinding its request for formal consultation. On December 6, 2010, the Corps rescinded its request for formal consultation and instead requested early consultation; that request also contained a revised version of their August 9, 2010, supplemental BA. On January 6, 2011, the Service provided confirmation to the Corps that all information had been received and that a preliminary biological opinion would be issued no later than April 24, 2011. On March 28, 2011, the Service issued a preliminary biological opinion to the Corps.

On July 11, 2011, the Corps submitted a revised BA dated June 3, 2011, which included changes to the proposed action and a request to re-initiate early consultation due to changes in the frequency and quantity of nourishment for the Caminada Headland portion of the proposed project. On August 3, 2011, the Service provided confirmation to the Corps that all information had been received and that an updated preliminary biological opinion would be issued no later than November 23, 2011.

On July 27, 2011, the Service provided comments on the Corps' Draft Environmental Impact Statement (EIS) requesting that additional information regarding potential project-related effects to the endangered pallid sturgeon and shovelnose sturgeon be included in the Final EIS. Based on that information, the Corps re-submitted their June 3, 2011, BA with the additional information regarding those species with a request to include them in this consultation. On September 2, 2011, the Service provided confirmation to the Corps that all additional information for those species had been received and that an updated preliminary biological opinion would be issued no later than January 8, 2012.

PRELIMINARY BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Corps' 2004 LCA Report developed 3 hydrogeomorphic objectives: (1) maintaining salinity gradients; (2) increasing sediment input from sources outside the estuarine basins; and (3) maintaining or establishing natural landscape features and hydrologic processes that are critical to sustainable ecosystem structure and function. Accordingly, the goals of the proposed BBBSR project are: (1) to restore the geomorphic function and unique fish and wildlife habitats of the Caminada headland barrier system and Shell Island reach; and (2) to reverse the current trend of degradation in the Caminada headland and Shell Island reaches of the Barataria Basin (Figure 1) for a 50-year period (Corps 2009a). The Tentatively Selected Plan (TSP) consists of Caminada Headland Alternative 5 – Preferred Dune with Expanded Marsh and Subtidal Feeder Bar, and Shell Island Alternative 5 – One Island with Two Renourishments. The TSP would implement restoration of geomorphic form and function by separating the Gulf of Mexico from the interior estuaries and helping to regulate salinity gradients important to the range of estuarine and freshwater wetland species for the period of analysis. The geomorphic structures prevent open Gulf of Mexico wave energy from impacting the interior estuary and provide hydrodynamic stability to the system. Loss of those functions would have impacts beyond the project footprint within the Barataria Basin. The Corps anticipates beginning construction of the TSP in early 2012. For details on specific project features (i.e., dredging, sand fencing, planting) common to each alternative component, please refer to the **Restoration features common to the entire project** section of the project description on page 7. Each alternative component is described in detail below.

Caminada Headland Alternative 5: Restored Dune with Created Marsh and Subtidal Feeder Bar

The initial construction on the Caminada Headland will create 1,186 acres of saline marsh and 880 acres of dune/beach complex, for a total of 2,066 acres at target year (TY) 1. The newly created acres will cover much of the existing habitat acreages in the direct project footprint. Borrow material for construction would be used from the South Pelto Block of Ship Shoal located approximately 40 miles offshore, southwest of Belle Pass. The duration for dredging material for the Caminada portion of the project would be approximately 2.5 years. Onshore construction activities would occur concurrently with dredging operations but may extend for another 6 months after dredging is completed. Planting of native vegetation would require approximately 750 days over a 3-year period once all construction is completed.

Dune/Beach Complex

The dune height would be constructed to +7 feet (2.13 meters [m]) North American Vertical Datum 1988 (NAVD) which is higher than the existing (degraded) dune elevation of +3.4 feet (1.04 m) NAVD. The proposed dune width would be 290 feet (88.29 m). The majority of the dune would be located landward over existing higher elevations to maximize project acreage and longevity. The landward and seaward slopes are set at a 20-foot horizontal to 1-foot vertical slope (20H:1V). The beach fill design has a 65-foot-wide (19.81 m) seaward berm at an elevation of +4.5 feet (1.37 m) NAVD. Approximately 13 miles of dune and beach will be created. Fill quantity for the beach/dune complex is 5.1 million cubic yards (CY). Vegetative plantings will include a variety of native dune grass species. Sand fencing will be installed to promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings.

The dune/beach complex feature of the Caminada headland would include repair and/or maintenance of sand fencing. The maintenance estimate for sand fencing includes complete replacement in TY5 with 20 percent replacement every 5 years for the 50-year period of analysis. In addition to this task, the non-Federal sponsor would monitor the project area and enforce the restrictions of the easements through yearly inspections of the project area. Sufficient land rights will be obtained to perform operations and maintenance (O&M) over 50 years.

Marsh Creation

The expanded marsh feature includes restoration and creation of a marsh platform located between the Chevron Canal to the north and the beach/dune component to the south (Figure 2). Approximately 5.36 million CY would be used to construct a marsh elevation of +2.0 feet (0.61 m) NAVD that would create a functioning intertidal marsh with no renourishment planned for the 50-year project life. The native marsh elevation for the back-barrier marsh is 0.94 feet (0.29 m) NAVD. The marsh platform would be planted with various native marsh grasses, and would provide substrate for over-wash splays and northward dune/beach migration.

Subtidal Feeder Bar

The Corps' Coastal Engineering Manual (CEM) (Corps 2006) describes feeder beaches as finite-length berms placed along a beach, usually at the up-drift end of a littoral cell that has strong unidirectional shore-parallel transport. They can also be placed at a nodal "hot spot" where shore-parallel transport divides, thus moving sediment in both directions away from the node. This concept involves placing a

large volume of sediment in a limited area and relying on littoral processes to move it down the beach, thus gradually nourishing the beach at a distance from the placement site. The CEM describes feeder beaches in the same terms as normal beach restoration projects, with the sediment placed on the beach face, but not necessarily "...the same degree of along-shore uniformity as that provided by placing fill in a prescribed manner throughout the project area" (Corps 2006). The feeder beach concept has been expanded to include subsurface placement of sediment to create a "feeder bar," which relies on coastal processes to move the sediment onto the beach face naturally. A sub-tidally placed feeder bar that nourishes the beach profile without need for heavy grading machinery and/or disturbance to environmentally sensitive habitats can be more desirable and is typically less expensive than a conventional feeder beach. In addition, as wave action carries fine sediment onto the beach face and deposits it, an opportunity is afforded for Aeolian transport to move fine sands up the beach and onto the dune, thus, nourishing the system. The fine grained sediment that will be placed in the subtidal feeder bar would move onto the beach face in a gradual manner; consequently the feeder bar is not expected to cause extensive stacking of sediment on the beach which could smother the benthic fauna and contribute additional stress to the remaining benthic community within piping plover critical habitat.

Modeling was used to compare initial and final shorelines with and without the feeder bar. The results indicate that, by the end of the 2-year period between material placement events, the feeder bar diffuses to the east and west of its initial placement by approximately 2,000 feet (609.6 m). The percent reduction in volume losses from the modeled design storms that were attributed to the feeder bar ranged from 54 percent to 90 percent and the percent reduction in beach/dune erosion ranged from 49 percent to 81 percent. While the storm damage to the headland remains significant from storms of these magnitudes, the feeder bar does provide a quantifiable benefit for storm damage reduction. It is noted that these model results should be interpreted carefully for several reasons. First, the material will be placed as unconfined disposal thus the profile shape may vary significantly from the assumed bar configuration. Second, lateral diffusion will occur relatively quickly reducing the "density" of the feeder bar along the placement area. Third, the storm damage reduction benefit will be localized to the nodal zone and adjacent beaches as the feeder bar diffuses, which is approximately 13 percent of the entire Caminada Headland shoreline.

Based on the sediment budget prepared for the Caminada headland, the loss of sediment from the headland is estimated to be 379,000 CY per year. Thus, maintenance of the headland would include the beneficial placement of dredged material from O&M dredging of the bar channel of Bayou Lafourche, Louisiana (i.e., Belle Pass) in a feeder bar disposal area (Corps 2011). Dredging of Belle Pass yields an average of 650,000 CY of material, which would be used to nourish the offshore feeder bar every 1.5 to 2 years. Historically this material has been placed immediately east and west of the jetties at beach nourishment disposal sites. As part of the adaptive management plan, shoreline imagery will be evaluated to determine the renourishment approach. Based on shoreline conditions one of two basic approaches will be used:

1. When monitoring data indicate that the shoreline is relatively intact (i.e., no breaches), the 650,000 cy of dredged material from Belle Pass will be placed at the feeder bar disposal area located in the littoral drift south of Bayou Moreau (Figure 2) where the sediment budget indicates that the long-shore transport of material splits going east and west (Figure 4). Placement of material at this location sustains the project by building out the shoreline at the nodal point, which is an area of more rapid shoreline erosion, and by feeding material along the entire reach through existing long-shore transport patterns. Material would be placed unconfined for a length of 13,000 feet (3,962.4 m) located between 100 and 300 feet (30.48 and 91.44 m, respectively)

from the mean high water (MHW) mark to allow long-shore transport and wave action to move and place the sediment along the headland. There would be no direct placement of sediment onto the beach during the dredged material placement events. All dredged material for the feeder bar would be placed seaward of mean low low water (MLLW) (horizontal) and at, or below, MLLW (vertical) located offshore of the nodal point. The material would be stacked no higher than + 6 feet (1.83 m) mean low grade, but would be quickly reworked by the wind and waves (due to the high energy environment of that area). The pumping of the material would take approximately 54 days, with placement and removal of the pipeline taking a total of approximately 98 days. The pipe would be placed offshore. The material would be dredged from the Bayou Lafourche channel (a federal navigation channel) which previously received clearance under the National Environmental Policy Act for maintenance dredging. Over each 10 year period, an estimated 3.9 million CY of material would be returned to the headland.

2. When monitoring data indicate that the shoreline has been breached or severely damaged by over-wash and/or other erosion, dredged material would be beneficially placed to repair breaches and/or other highly eroded areas. The material would be placed in a manner which restores the shoreline to conditions similar to what existed prior to breaching. Each breach or over-wash restoration action would be coordinated with the Service on a case by case basis. If the volume of material available is greater than the quantity required to repair breaches and erosional hot spots, then the remaining material will be placed in the feeder bar disposal area at the nodal point of the shoreline.

Timing of the renourishment will be dependent upon the maintenance dredging requirements of the Bayou Lafourche, Louisiana project. If maintenance dredging of Bayou Lafourche is not scheduled when the Corps determines that renourishment is required, the non-federal sponsor would provide another source of material. Any changes to the Corps O&M plan would receive environmental clearances, including section 7 consultation under the Act with the appropriate agencies.

Shell Island Alternative 5: One Island with Two Renourishments

Shell Island Alternative 5 would restore the Shell Island reach as a 783-acre island (Figure 3), including a beach berm, dune ridge, and saline marsh platform. The east end of the new island would be located near the Empire waterway, and the west end would be terminated approximately 0.5-mile before Grand Bayou. The alternative would attempt to restore existing island remnants to a pre-Hurricane Bob (1979) condition, and the shortest and shallowest route across Coupe Bob would be utilized. The Corps anticipates that the closure of Coupe Bob would return the tidal prism to its pre-1979 path which flowed through Grand Bayou; thus, Grand Bayou would increase in size in response to the altered tidal flow pattern. The borrow source for the dune/beach complex would be a large sand deposit in the Mississippi River near Nairn between mile markers 32 and 34, which is located approximately 11 miles north of the Shell Island reach. The sand, which is comparable in grain size to sand found at the project site, would be pumped to the project area via pipeline. The borrow source for marsh creation would be the Empire deposit located 1.5 miles from the Empire jetties; that site contains material more suitable for marsh construction.

The duration for construction activities for the Shell Island reach is approximately 2.17 years. Onshore construction activities would occur concurrently with dredging operations but may extend for another 6 months after dredging is completed. Planting of native vegetation would require approximately 360 days over a 3-year period once all construction is completed. Periodic renourishment would be implemented at TY 20 and TY 40. The Corps estimates that approximately 1.5 million CY of beach

fill would be needed for each renourishment cycle in TY 20 and TY 40, approximately 907,200 CY of marsh fill would be needed for renourishment in TY20, and 604,700 CY of marsh fill would be needed in TY 40.

Dune/Beach Complex

The landward edge of the dune would be located seaward of the existing shoreline. The dune height would be constructed to +6 feet (1.83 m) NAVD and dune width would be 189 feet (57.6 m). The landward and seaward slopes are set at a 45-foot horizontal to 1-foot vertical slope (45H:1V). The beach fill design has not yet been selected, and would vary as a non-uniform 300-foot-wide (91.44 m) seaward berm at an elevation of greater than +2 feet (0.61 m) and less than +4.5 feet (1.37 m) NAVD. Approximately 317 acres of shoreline/dune (area above +2 feet NAVD) would be created. The anticipated fill quantity for the beach/dune complex is 5.6 million CY. Vegetative plantings will include a variety of native dune grass species. Sand fencing will be installed to promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings.

Marsh Creation

The marsh feature includes creation of a marsh platform located north of the beach/dune component. However, in deeper water (bathymetry below -3 feet NAVD, as found across Coupe Bob) marsh fill cannot be used because as the material de-waters there would be rapid and non-uniform settling, which would preclude marsh creation. Therefore, at depths of -3 feet and deeper (i.e., across Coupe Bob), a sand base would be constructed and a sand-filled geotextile tube would be used as containment prior to placement of marsh fill material. For areas in shallow water (bathymetry up to -2 or -3 feet NAVD) there is no need for a sand base, and containment dikes would be constructed with waterbottom material within the marsh fill footprint. A uniform marsh width of 735 feet (224 m) would be constructed to result in an island width of approximately 1,240 feet (377.95 m) following equilibration of the shoreline. Approximately 2.1 million CY would be used to construct 466 acres of marsh to an elevation of +2.0 feet (0.61 m) NAVD, which would result in a functioning intertidal marsh. The marsh platform would be planted with various native marsh grasses, and would provide substrate for over-wash splays and northward dune/beach migration.

Restoration features common to the entire project

Dredging of all offshore borrow areas would be conducted using a hydraulic cutter-head dredge, for which the Corps has already conducted section 7 consultation with the NMFS. For the proposed dredging site within the Mississippi River, the Corps would implement protective measures for sturgeon (Appendix B). The dredged material would be transported to an island or headland using a booster pump(s), if needed, and submerged sediment pipeline. Borrow locations are located sufficient distance from the restoration sites that they will not impact littoral drift or project longevity. The following construction actions would be implemented for all of the above-listed alternative features:

a) For the dune areas, the dredged material would be deposited on the beach and re-worked by bulldozers and front-end loaders.
b) For the marsh creation areas, temporary containment dikes would be constructed to contain the marsh fill material during construction. The material for dike construction will be dredged from within the footprint of the marsh creation area so that the excavated area is filled during construction. The dike volume is included within the marsh fill volume. (A second option for

the Shell Island reach only is to contain marsh fill using a sand-filled geotextile tube along the perimeter of the constructed sand base in areas where water depths are deeper than -3 feet NAVD.)

c) All dredging and discharge operations will be completed in a manner that will minimize turbidity of the water at the dredge and discharge sites.
d) Sand fencing will be installed to promote capture of Aeolian sand. One shore-parallel fence will be installed approximately 50 feet (15.24 m) north of the southern toe of the dune to continue the capture of transported sand until the surface is vegetated. The sand fence will extend along the total length of the constructed dune. Sand fences will be installed in sequences/phases. The installation would start from the southern side of the dune so as to build dune towards the Gulf and proceed north. Additional rows of sand fencing may be added once the sand is stacked almost to the top of the fence.
e) Vegetative plantings along the created dune and marsh project features will include a variety of native dune and marsh grass species. The recommended planting density is no greater than 8-foot centers.

Project effects would occur along the entire length of the Caminada headland and the Shell Island reach due to the dynamic nature of coastal processes and the long-shore transport of sediments within the Barataria Basin barrier system. The Shell Island reach is not designated as critical habitat for the piping plover; however, it does consist of suitable habitat for the species. Portions of the Caminada headland are included in critical habitat Unit LA-5 (described in detail in the **Species/critical habitat description** and **Status of the species within the action area** sections of this document). The Service has described the action area to include all of the Caminada headland and Shell Island reach, and their associated sand and mud flats, for reasons that will be explained and discussed in detail in the **EFFECTS OF THE ACTION** section of this consultation.

STATUS OF THE SPECIES/CRITICAL HABITAT

Species/critical habitat description

The piping plover is a small (7 inches [17.78 centimeters (cm)] long), pale, sand-colored shorebird with a wingspan of 15 inches (38.1 cm) (Palmer 1967). On January 10, 1986, the piping plover was listed as endangered in the Great Lakes watershed and threatened elsewhere within its range, including migratory routes outside of the Great Lakes watershed and wintering grounds (Service 1985). Piping plovers were listed principally because of habitat destruction and degradation, predation, and human disturbance. Protection of the species under the Act reflects the species' precarious status range-wide. Three separate breeding populations have been identified, each with its own recovery criteria: the northern Great Plains (threatened), the Great Lakes (endangered), and the Atlantic Coast (threatened). The piping plover winters in coastal areas of the United States (U.S.) from North Carolina to Texas, and along the coast of eastern Mexico and on Caribbean islands from Barbados to Cuba and the Bahamas (Haig and Elliott-Smith 2004). Piping plover subspecies are phenotypically indistinguishable, and most studies in the nonbreeding range report results without regard to breeding origin. Although a recent analysis shows strong patterns in the wintering distribution of piping plovers from different breeding populations, partitioning is not complete and major information gaps persist. Therefore, information summarized here pertains to the species as a whole (i.e., all three breeding populations), except where a particular breeding population is specified (Figure 6).

The Service has designated critical habitat for the piping plover on three occasions. Two of these designations protected different breeding populations. Critical habitat for the Great Lakes breeding

population was designated May 7, 2001 (66 Federal Register (FR) 22938; Service 2001a), and critical habitat for the northern Great Plains breeding population was designated September 11, 2002 (67 FR 57637; Service 2002). The Service designated critical habitat for wintering piping plovers on July 10, 2001 (66 FR 36038; Service 2001b). Wintering piping plovers may include individuals from the Great Lakes and northern Great Plains breeding populations as well as birds that nest along the Atlantic coast.

Designated wintering piping plover critical habitat originally included 142 areas (the rule states 137 units; this is in error) encompassing about 1,793 miles of mapped shoreline and 165,211 acres of mapped areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. Since the designation of wintering critical habitat, 19 units (TX-3,4,7-10, 14-19, 22, 23, 27,28, and 31-33) in Texas have been vacated and remanded back to the Service for reconsideration by Court order (Texas General Land Office v. U.S. Department of Interior, Case No. V-06-CV-00032). On May 19, 2009, the Service published a final rule designating 18 revised critical habitat units in Texas, totaling approximately 139,029 acres (74 FR 23476). The Courts also vacated and remanded back to the Service for reconsideration, four units in North Carolina (Cape Hatteras Access Preservation Alliance v. U.S. Department of Interior, 344 F. Supp. 2d 108 (D.D.C. 2004)). The four critical habitat units vacated were NC-1, 2, 4, and 5, and all occurred within Cape Hatteras National Seashore (CAHA). A revised designation for these four units was published on October 21, 2008 (73 FR 62816).

The primary constituent elements (PCEs) for piping plover wintering habitat are those biological and physical features that are essential to the conservation of the species. The PCEs are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. These areas typically include coastal areas that support intertidal beaches and flats and associated dune systems and flats above annual high tide (Service 2001a). PCEs of wintering piping plover critical habitat include sand or mud flats (or both) with no or sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting piping plovers (Service 2001a). Important components of the beach/dune ecosystem include surf-cast algae, sparsely vegetated back beach and salterns, spits, and washover areas. Washover areas are broad, unvegetated zones, with little or no topographic relief, that are formed and maintained by the action of hurricanes, storm surge, or other extreme wave action. The units designated as critical habitat are those areas that have consistent use by piping plovers and that best meet the biological needs of the species. The amount of wintering habitat included in the designation appears sufficient to support future recovered populations, and the existence of this habitat is essential to the conservation of the species. Additional information on each specific unit included in the designation can be found at 66 FR 36038 (Service 2001a).

Activities that affect PCEs include those that directly or indirectly alter, modify, or destroy the processes that are associated with the formation and movement of barrier islands, inlets, and other coastal landforms. Those processes include erosion, accretion, succession, and sea-level change. The integrity of the habitat components also depends upon daily tidal events and regular sediment transport processes, as well as episodic, high-magnitude storm events (Service 2001b).

Life History

Piping plovers live an average of five years, although studies have documented birds as old as 11 (Wilcox 1959) and 15 years. Breeding activity begins in mid-March when birds begin returning to

their nesting areas (Coutu et al. 1990; Cross 1990; Goldin et al. 1990; MacIvor 1990; Hake 1993). Plovers are known to begin breeding as early as one year of age (MacIvor 1990; Haig 1992); however, the percentage of birds that breed in their first adult year is unknown. Piping plovers generally fledge only a single brood per season, but may re-nest several times if previous nests are lost.

The most consistent finding in the various population viability analyses conducted for piping plovers indicates that even small declines in adult and juvenile survival rates will cause very substantial increases in extinction risk (Ryan et al. 1993; Melvin and Gibbs 1996; Plissner and Haig 2000; Wemmer et al. 2001; Larson et al. 2002; Amirault et al. 2005; Calvert et al. 2006; Brault 2007). A banding study conducted between 1998 and 2004 in Atlantic Canada found lower return rates of juvenile (first year) birds to the breeding grounds than was documented for Massachusetts (Melvin and Gibbs 1994; Service 1996), Maryland (Loegering 1992), and Virginia (Cross 1996) breeding populations in the mid-1980s and very early 1990s. This is consistent with failure of the Atlantic Canada population to increase in abundance despite very high productivity (relative to other breeding populations) and extremely low rates of dispersal to the U.S. over the last 15 plus years (Amirault et al. 2005). Simply stated, this suggests that maximizing productivity does not ensure population increases.

Efforts to partition survival within the annual cycle are beginning to receive more attention, but current information remains limited. Drake et al. (2001) observed no mortality among 49 radio-marked piping plovers (total of 2,704 transmitter days) in Texas in 2007-2008. Cohen et al. (2008a) documented no mortality of 7 radio-tracked wintering piping plovers at Oregon Inlet from December 2005 to March 2006. They speculate their high survival rate was attributed to plover food availability much of the day as well as the low occurrence of days below freezing and infrequent wet weather. Analysis of South Carolina resighting data for 87 banded piping plovers (78 percent Great Lakes breeders) in 2006-2007 and 2007-2008 found 100 percent survival from December to April[2] (J. Cohen, Virginia Polytechnic Institute and State University, pers. comm. 2009). Noel et al. (2007) inferred two winter (November to February) mortalities[3] among 21 banded (but not radio-tagged) overwintering piping plovers in 2003-2004 and 9 mortalities among 19 overwintering birds during the winter of 2004-2005 at Little St. Simons Island, Georgia. LeDee (2008) found higher apparent survival[4] rates during breeding and southward migration than during winter and northward migration for 150 adult (i.e., after-hatch year) Great Lakes piping plovers.

Mark-recapture analysis of resightings of uniquely banded piping plovers from seven breeding areas by Roche et al. (2010) found that apparent adult survival declined in four populations and increased in none over the life of the studies[5]. Some evidence of correlation in year-to-year fluctuations in annual survival of Great Lakes and eastern Canada populations, both of which winter primarily along the southeastern U.S. Atlantic Coast, suggests that shared over-wintering and/or migration habitats may influence annual variation in survival. Further concurrent mark-resighting analysis of color-banded individuals across piping plover breeding populations has the potential to shed light on threats that affect survival in the migration and wintering range. However, very little to no information exists specifically for birds wintering along the northern Gulf of Mexico. An ongoing Natural Resource Damage Assessment and Restoration (NRDAR) study of piping plovers that are potentially affected by

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[2] Of those birds, one unique and one non-uniquely banded piping plover were seen in the first winter and were resighted multiple times in the second fall at the same location but were not seen during the second winter; whether these two birds died in the fall or shifted their wintering location is unknown (Maddock et al. 2009).

[3] Noel et al. (2007) inferred mortality if a uniquely banded piping plover with multiple November to February sightings on the survey site disappeared during that time and was never observed again in either it's nonbreeding or breeding range. Note that most of these birds were from the Great Lakes breeding population, where detectability during the breeding season is very high.

[4] "Apparent survival" does not account for permanent emigration. If marked individuals leave a survey site, apparent survival rates will be lower than true survival. If a survey area is sufficiently large, such that emigration out of the site is unlikely, apparent survival will approach true survival.

[5] Data were analyzed for 3 to 11 years per breeding area, all between 1998 and 2008.

the 2010 Deepwater Horizon oil spill may provide such information once the data gathered are eligible for release to the public.

Migration

Plovers depart their breeding grounds for their wintering grounds from July through late August, but southward migration extends through November. Piping plovers spend up to 10 months of their life cycle on their migration and winter grounds, generally July 15 through as late as May 15. Piping plovers migrate through and winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean. Both spring and fall migration routes of Atlantic Coast breeders are believed to occur primarily within a narrow zone along the Atlantic Coast (Service 1996). The pattern of both fall and spring counts at many Atlantic Coast sites demonstrates that many piping plovers make intermediate stopovers lasting from a few days up to one month during their migrations (Noel et al. 2005; Stucker and Cuthbert 2006). Some mid-continent breeders travel up or down the Atlantic Coast before or after their overland movements (Stucker and Cuthbert 2006). Use of inland stopovers during migration is also documented (Pompei and Cuthbert 2004). The source breeding population of a given wintering individual cannot be determined in the field unless it has been banded or otherwise marked. Information from observation of color-banded piping plovers indicates that the winter ranges of the breeding populations overlap to a significant degree. See the **Status and Distribution** section for additional information pertaining to population distribution on the wintering grounds. While piping plover migration patterns and needs remain poorly understood and occupancy of a particular habitat may involve shorter periods relative to wintering, information about the energetics of avian migration indicates that this might be a particularly critical time in the species' life cycle.

Foraging (nonbreeding portion of annual cycle)

Behavioral observation of piping plovers on the wintering grounds suggests that they spend the majority of their time foraging (Nicholls and Baldassarre 1990a; Drake 1999a, 1999b). Feeding activities may occur during all hours of the day and night (Staine and Burger 1994; Zonick 1997), and at all stages in the tidal cycle (Goldin 1993; Hoopes 1993). Wintering plovers primarily feed on invertebrates such as polychaete marine worms, various crustaceans, fly larvae, beetles, and occasionally bivalve mollusks (Bent 1929; Nicholls 1989; Zonick and Ryan 1995). They peck these invertebrates on top of the soil or just beneath the surface. Plovers forage on moist substrate features such as intertidal portions of ocean beaches, washover areas, mudflats, sand flats, algal flats, shoals, wrack lines, sparse vegetation, shorelines of coastal ponds, lagoons, ephemeral pools and adjacent to salt marshes (Gibbs 1986; Zivojnovich 1987; Nichols 1989; Nicholls and Baldassarre 1990a; Nicholls and Baldassarre 1990b; Coutu et al. 1990; Hoopes et al. 1992; Loegering 1992; Goldin 1993; Elias-Gerken 1994; Wilkinson and Spinks 1994; Zonick 1997; Service 2001a). Studies from the coastal breeding range have shown that the relative importance of various feeding habitat types may vary by site (Gibbs 1986; Coutu et al. 1990; McConnaughey et al. 1990; Loegering 1992; Goldin 1993; Hoopes 1993). Cohen et al. (2006) documented more abundant prey items and biomass on sound island and sound beaches than the ocean beach. On the wintering grounds, Ecological Associates, Inc. (2009) observed that during piping plover surveys at St. Lucie Inlet, Martin County, Florida, intertidal mudflats and/or shallow subtidal grass flats appear to have greater value as foraging habitat than the unvegetated intertidal areas of a flood shoal.

Roosting

Several studies identified wrack (organic material including seaweed, seashells, driftwood, and other materials deposited on beaches by tidal action) as an important component of roosting habitat for nonbreeding piping plovers. Lott et al. (2009) found greater than 90 percent of roosting piping plovers in southwest Florida in old wrack with the remainder roosting on dry sand. In South Carolina, 45 percent of roosting piping plovers were in old wrack, and 18 percent were in fresh wrack. The remainder of roosting birds used intertidal habitat (22 percent), backshore (defined as zone of dry sand, shell, cobble and beach debris from mean high water line up to the toe of the dune)(8 percent), washover and ephemeral pools 2 percent and 1 percent respectively (Maddock et al. 2009). Thirty percent of roosting piping plovers in northwest Florida were observed in wrack substrates with 49 percent on dry sand and 20 percent using intertidal habitat (Smith 2007). In Texas, sea grass debris (bay-shore wrack) was an important feature of piping plover roost sites (Drake 1999b). Mean abundance of two other plover species in California, including the listed western snowy plover (*Charadrius alexandrinus nivosus*), was positively correlated with abundance of wrack during the nonbreeding season (Dugan et al. 2003).

Natural protection

Cryptic coloration is a primary defense mechanism for this species. Nests, adults, and chicks all blend in with their typical beach surroundings. Piping plovers on wintering and migration grounds respond to intruders (pedestrian, avian and mammalian) usually by squatting, running, and flushing (flying).

Wintering habitat

Wintering piping plovers prefer coastal habitat that include sand spits, islets (small islands), tidal flats, shoals (usually flood tidal deltas), and sandbars that are often associated with inlets (Harrington 2008). Sandy mud flats, ephemeral pools, and over-wash areas are also considered primary foraging habitats. These substrate types have a richer infauna than the foreshore of high energy beaches and often attract large numbers of shorebirds (Cohen et al. 2006). Wintering plovers are dependent on a mosaic of habitat patches and move among these patches depending on local weather and tidal conditions (Nicholls and Baldassarre 1990a).

Recent study results in North Carolina, South Carolina, and Florida complement information from earlier investigations in Texas and Alabama (summarized in the 1996 Atlantic Coast and 2003 Great Lakes Recovery Plans) regarding habitat use patterns of piping plovers in their coastal migration and wintering range. Maddock et al. (2009) observed shifts to roosting habitats and behaviors during high-tide periods in South Carolina. In South Carolina, exposed intertidal areas were the dominant foraging substrate (accounting for 94 percent of observed foraging piping plovers; Maddock et al. 2009). As observed in Texas studies, Lott et al. (2009) identified bay beaches (bay shorelines as opposed to ocean-facing beaches) as the most common landform used by foraging piping plovers in southwest Florida. In northwest Florida, however, Smith (2007) reported landform use by foraging piping plovers about equally divided between Gulf of Mexico (ocean-facing) and bay beaches. Exposed intertidal areas were the dominant foraging substrate in South Carolina (accounting for 94 percent of observed foraging piping plovers; Maddock et al. 2009) and in northwest Florida (96 percent of foraging observations; Smith 2007). In southwest Florida, Lott et al. (2009) found approximately 75 percent of foraging piping plovers on intertidal substrates.

Atlantic Coast and Florida studies highlighted the importance of inlets for non-breeding piping plovers. Almost 90 percent of observations of roosting piping plovers at ten coastal sites in southwest Florida were on inlet shorelines (Lott et al. 2009). Piping plovers were among seven shorebird species found

more often than expected ($p = 0.0004$; Wilcoxon Scores test) at inlet locations versus non-inlet locations in an evaluation of 361 International Shorebird Survey sites from North Carolina to Florida (Harrington 2008).

Recent geographic analysis of piping plover distribution on the upper Texas coast noted major concentration areas at the mouths of rivers and washover passes (low, sparsely vegetated barrier island habitats created and maintained by temporary, storm-driven water channels) into major bay systems (Arvin 2008). Earlier studies in Texas have drawn attention to washover passes, which are commonly used by piping plovers during periods of high bay-shore tides and during the spring migration period (Zonick 1997; Zonick 2000). Cobb (*in* Elliott-Smith et al. 2009) reported piping plover concentrations on exposed sea grass beds and oyster reefs during seasonal low water periods in 2006.

The effects of dredge-material deposition merit further study. Drake et al. (2001) concluded that conversion of southern Texas mainland bay-shore tidal flats to dredged material impoundments results in a net loss of habitat for wintering piping plovers, because impoundments eventually convert to upland habitat not used by piping plovers. Zonick et al. (1998) reported that dredged material placement areas along the Intracoastal Waterway in Texas were rarely used by piping plovers, and noted concern that dredge islands block wind-driven water flows, which are critical to maintaining important shorebird habitats. By contrast, most of the sound islands used by foraging piping plovers at Oregon Inlet, North Caroline, were created by the Corps by deposition of dredged material in the subtidal bay bottom, with the most recent deposition ranging from 28 to less than 10 years prior to the study (Cohen et al. 2008a).

Mean home range size (95 percent of locations) for 49 radio-marked piping plovers in southern Texas in 1997-98 was 12.6 square-kilometers (km^2) (3,113 acres), mean core area (50 percent of locations) was 2.9 km^2 (717 acres), and mean linear distance moved between successive locations (1.97 ± 0.04 days apart), averaged across seasons, was 3.3 km (2.1 miles) (Drake 1999b; Drake et al. 2001). Seven radio-tagged piping plovers used a 20.1 km^2 (4,967 acres) area (100 percent minimum convex polygon) at Oregon Inlet in 2005-2006, and piping plover activity was concentrated in 12 areas totaling 2.2 km^2 (544 acres) (Cohen et al. 2008a). Noel and Chandler (2008) observed high fidelity of banded piping plovers to 1 km to 4.5 km (0.62 to 2.8 miles) sections of beach on Little St. Simons Island, Georgia.

Population dynamics

The 2006 Piping Plover Breeding Census, the last comprehensive survey throughout the breeding grounds, documented 3,497 breeding pairs with a total of 8,065 birds throughout Canada and U.S (Elliott-Smith et al. 2009).

Northern Great Plains Population

The Northern Great Plains plover breeds from Alberta to Manitoba, Canada, and south to Nebraska; although some nesting has recently occurred in Oklahoma. Currently the most westerly breeding piping plovers in the United States occur in Montana and Colorado. The decline of piping plovers on rivers in the Northern Great Plains has been largely attributed to the loss of sandbar island habitat and forage base due to dam construction and operation. Nesting occurs on sand flats or bare shorelines of rivers and lakes, including sandbar islands in the upper Missouri River system, and patches of sand, gravel, or pebbly-mud on the alkali lakes of the northern Great Plains. Plovers do nest on shorelines of reservoirs created by the dams, but reproductive success is often low and reservoir habitat is not

available in many years due to high water levels or vegetation. Dams operated with steady constant flows allow vegetation to grow on potential nesting islands, making these sites unsuitable for nesting. Population declines in alkali wetlands are attributed to wetland drainage, contaminants, and predation.

The International Piping Plover Census (IPPC), conducted every five years, also estimates the number of piping plover pairs in the Northern Great Plains. As illustrated in Table 2 (next page), none of the IPPC estimates of the number of pairs in the U.S. suggests that the Northern Great Plains population has yet satisfied the recovery criterion of 2,300 pairs (Plissner and Haig 1997; Ferland and Haig 2002; Elliot-Smith et al. 2009). The IPPC count in prairie Canada reported 1,703 adult birds in 2006, which is also short of the goal of 2,500 adult piping plover as stated in the Service's Recovery Plan (Service 1988).

Table 2. The number of adult piping plovers and breeding pairs reported in the U.S. Northern Great Plains by the IPPC efforts (Plissner and Haig 1997; Ferland and Haig 2002; Elliot-Smith et al. 2009).

Year	Adults	Pairs Reported by the Census
1991	2,023	891
1996	1,599	586
2001	1,981	899
2006	2,959	1,212

The IPPC indicates that the U.S. population decreased between 1991 and 1996, then increased in 2001 and 2006. The Canadian population showed the reverse trend for the first three censuses, increasing slightly as the U.S. population decreased, and then decreasing in 2001. Combined, the IPPC numbers suggest that the population declined from 1991 through 2001, then increased almost 58 percent between 2001 and 2006 (Elliott-Smith et al. 2009).

The increase in 2006 is likely due in large part to a multi-year drought across much of the region starting in 2001 that exposed thousands of acres of nesting habitat. The Corps ran low flows on the riverine stretches of the Missouri River for most of the years between censuses, allowing more habitat to be exposed and resulting in relatively high fledging ratios (Corps 2009b). The Corps also began to construct habitat using mechanical means (dredging sand from the riverbed) on the Missouri River in 2004, providing some new nesting and foraging habitat. The drought also caused reservoir levels to drop on many reservoirs throughout the Northern Great Plains (e.g., Missouri River Reservoirs in North and South Dakota, and Lake McConaughey in Nebraska), providing previously unavailable shoreline habitat. The population increase may also be partially due to more intensive management activities on the alkali lakes, with increased management actions to improve habitat and reduce predation pressures.

While the IPPC provides an index to the piping plover population, the design does not always provide sufficient information to understand the population's dynamics. The five-year time interval between IPPC efforts may be too long to allow managers to get a clear picture of what the short-term population trends are and to respond accordingly if needed. As noted above, the first three IPPCs (1991, 1996, and 2001) showed a declining population, while the fourth (2006) indicated a dramatic population rebound of almost 58 percent for the combined U.S. and Canada Northern Great Plains population between 2001 and 2006. With only four data points over 15 years, it is impossible to determine if and

to what extent the apparent upswing reflects a real population trend versus error(s) in the 2006 census count and/or a previous IPPC. The 2006 IPPC included a detectability component, in which a number of pre-selected sites were visited twice by the same observer(s) during the two-week window to get an estimate of error rate. This study found an approximately 76 percent detectability rate through the entire breeding area, with a range of between 39 percent to 78 percent detectability among habitat types in the Northern Great Plains.

Such a reported large increase in population may indeed indicate a positive population trend, but with the limited data available, it is impossible to determine how much. Furthermore, with the next IPPC not scheduled until 2011, there is limited feedback in many areas on whether this increase is being maintained or if the population is declining in the interim. Additionally, the results from the IPPC have been slow to be released, adding to the time lag between data collection and possible management response.

Great Lakes Population

The Great Lakes plovers once nested on Great Lakes beaches in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario. Great Lakes piping plovers nest on wide, flat, open, sandy or cobble shoreline with very little grass or other vegetation. Reproduction is adversely affected by human disturbance of nesting areas and predation by foxes, gulls, crows and other avian species. Shoreline development, such as the construction of marinas, breakwaters, and other navigation structures, has adversely affected nesting and brood rearing.

The Recovery Plan (Service 2003) sets a population goal of at least 150 pairs (300 individuals), for at least 5 consecutive years, with at least 100 breeding pairs (200 individuals) in Michigan and 50 breeding pairs (100 individuals) distributed among sites in other Great Lakes states.

The Great Lakes piping plover population, which has been traditionally represented as the number of breeding pairs, has increased since the completion of the recovery plan in 2003 (Cuthbert and Roche 2007; 2006; Westbrock et al. 2005; Stucker and Cuthbert 2004; Stucker et al. 2003). The Great Lakes piping plover recovery plan documents the 2002 population at 51 breeding pairs (Service 2003). The census conducted in 2008 found 63 breeding pairs, an increase of approximately 23 percent. Of these, 53 pairs were found nesting in Michigan, while 10 were found outside the state, including six pairs in Wisconsin and four in Ontario, Canada. The 53 nesting pairs in Michigan represent approximately 50 percent of the recovery criterion. The 10 breeding pairs outside Michigan in the Great Lakes basin, represents 20 percent of the goal, albeit the number of breeding pairs outside Michigan has continued to increase over the past five years. The single breeding pair discovered in 2007 in the Great Lakes region of Canada represented the first confirmed piping plover nest there in over 30 years, and in 2008 the number of nesting pairs further increased to four. Breeding pairs increased to 71 in 2009, but fell to 61 pairs in 2010. The decline from 2009 to 2010 is of particular concern because productivity of the Great Lakes population in 2008 and 2009 was very close to rates associated with earlier population growth.

In addition, the number of non-nesting individuals has increased annually since 2003. Between 2003-2008 an annual average of approximately 26 non-nesting piping plovers were observed, based on limited data from 2003, 2006, 2007, and 2008. Although there was some fluctuation in the total population from 2002 to 2008 the overall increase from 51 to 63 pairs combined with the increased observance of non-breeding individuals indicates the population is increasing.

Atlantic Coast Population

The Atlantic Coast piping plover breeds on coastal beaches from Newfoundland and southeastern Quebec to North Carolina. Historical population trends for the Atlantic Coast piping plover have been reconstructed from scattered, largely qualitative records. Nineteenth-century naturalists, such as Audubon and Wilson, described the piping plover as a common summer resident on Atlantic Coast beaches (Haig and Oring 1987). However, by the beginning of the 20th Century, egg collecting and uncontrolled hunting, primarily for the millinery trade, had greatly reduced the population, and in some areas along the Atlantic Coast, the piping plover was close to extirpation. Following passage of the Migratory Bird Treaty Act (40 Stat. 775; 16 U.S.C. 703-712) in 1918, and changes in the fashion industry that no longer exploited wild birds for feathers, piping plover numbers recovered to some extent (Haig and Oring 1985).

Available data suggest that the most recent population decline began in the late 1940s or early 1950s (Haig and Oring 1985). Reports of local or statewide declines between 1950 and 1985 are numerous, and many are summarized by Cairns and McLaren (1980) and Haig and Oring (1985). While Wilcox (1939) estimated more than 500 pairs of piping plovers on Long Island, New York, the 1989 population estimate was 191 pairs (Service 1996). There was little focus on gathering quantitative data on piping plovers in Massachusetts through the late 1960s because the species was commonly observed and presumed to be secure. However, numbers of piping plover breeding pairs declined 50 to 100 percent at seven Massachusetts sites between the early 1970s and 1984 (Griffin and Melvin 1984). Piping plover surveys in the early years of the recovery effort found that counts of these cryptically colored birds sometimes went up with increased census effort, suggesting that some historic counts of piping plovers by one or a few observers may have underestimated the piping plover population. Thus, the magnitude of the species decline may have been more severe than available numbers imply.

Annual estimates of breeding pairs of Atlantic Coast piping plovers are based on multiple surveys at most occupied sites. Sites that cannot be monitored repeatedly in May and June (primarily sites with few pairs or inconsistent occupancy) are surveyed at least once during a standard nine-day count period (Hecht and Melvin 2009).

Since its 1986 listing under the ESA, the Atlantic Coast population estimate (Service 2011) has increased 234 percent, from approximately 790 pairs to an estimated 1,849 pairs in 2009, and the U.S. portion of the population has almost tripled, from approximately 550 pairs to an estimated 1,597 pairs. Even discounting apparent increases in New York, New Jersey, and North Carolina between 1986 and 1989, which likely were due in part to increased census effort (Service 1996), the population nearly doubled between 1989 and 2008. The largest population increase between 1989 and 2009 has occurred in New England (266 percent), followed by New York-New Jersey (70 percent). In the Southern (DE-MD-VA-NC) Recovery Unit, net growth between 1989 and 2009 was 52 percent, but almost all of this increase occurred in two years, 2003 to 2005. The eastern Canada population fluctuated from year to year, with increases often quickly eroded in subsequent years; net growth between 1989 and 2009 was 8 percent.

The overall population growth pattern was tempered by periodic rapid declines in the Southern and Eastern Canada Recovery Units. The eastern Canada population decreased 21 percent in just three years (2002 to 2005), and the population in the southern half of the Southern Recovery Unit declined 68 percent in seven years (1995 to 2001). The recent 64 percent decline in the Maine population, from

66 pairs in 2002 to 24 pairs in 2008, following only a few years of decreased productivity, provides another example of the continuing risk of rapid and precipitous reversals in population growth.

Status and distribution

Nonbreeding (migrating and wintering) Range

Piping plovers spend up to 10 months of their life cycle on their migration and winter grounds, generally July 15 through as late as May 15. Piping plover migration routes and habitats overlap breeding and wintering habitats, and, unless banded, migrants passing through a site usually are indistinguishable from breeding or wintering piping plovers. Migration stopovers by banded piping plovers from the Great Lakes have been documented in New Jersey, Maryland, Virginia, and North Carolina (Stucker and Cuthbert 2006). Migrating breeders from eastern Canada have been observed in Massachusetts, New Jersey, New York, and North Carolina (Amirault et al. 2005). As many as 85 staging piping plovers have been tallied at various sites in the Atlantic breeding range (Perkins 2008 pers. communication), but the composition (e.g., adults that nested nearby and their fledged young of the year versus migrants moving to or from sites farther north), stopover duration, and local movements are unknown. Review of published records of piping plover sightings throughout North America by Pompei and Cuthbert (2004) found more than 3,400 fall and spring stopover records at 1,196 sites. Published reports indicated that piping plovers do not concentrate in large numbers at inland sites and that they seem to stop opportunistically. In most cases, reports of birds at inland sites were single individuals. In general, distance between stopover locations and duration of stopovers throughout the coastal migration range remains poorly understood.

Piping plovers migrate through and winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean. Four range-wide, mid-winter (late January to early February) population surveys, conducted at five-year intervals starting in 1991, are summarized in Table 3. Total numbers have fluctuated over time, with some areas experiencing increases and others decreases. In 2001, 2,389 piping plovers were located during a winter census, accounting for only 40 percent of the known breeding birds recorded during a breeding census (Ferland and Haig 2002). About 89 percent of birds that are known to winter in the U.S. do so along the Gulf Coast (Texas to Florida), while 8 percent winter along the Atlantic Coast (North Carolina to Florida).

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Table 3. Results of the 1991, 1996, 2001, and 2006 International Piping Plover Winter Censuses (Haig et al. 2005, Elliott-Smith et al. 2009).

Location	1991	1996	2001	2006
Virginia	not surveyed (NS)	NS	NS	1
North Carolina	20	50	87	84
South Carolina	51	78	78	100
Georgia	37	124	111	212
Florida	551	375	416	454
-Atlantic	*70*	*31*	*111*	*133*
-Gulf	*481*	*344*	*305*	*321*
Alabama	12	31	30	29
Mississippi	59	27	18	78
Louisiana	750	398	511	226
Texas	1,904	1,333	1,042	2,090
Puerto Rico	0	0	6	NS
U.S. Total	3,384	2,416	2,299	3,355
Mexico	27	16	NS	76
Bahamas	29	17	35	417
Cuba	11	66	55	89
Other Caribbean Islands	0	0	0	28
GRAND TOTAL	3,451	2,515	2,389	3,884
Percent of Total International Piping Plover Breeding Census	62.9%	42.4%	40.2%	48.2%

Regional and local fluctuations may reflect the quantity and quality of suitable foraging and roosting habitat, which vary over time in response to natural coastal formation processes as well as anthropogenic habitat changes (e.g., inlet relocation, dredging of shoals and spits). See, for example, discussions of survey number changes in Mississippi, Louisiana, and Texas by Winstead, Baka, and Cobb, respectively, *in* Elliott-Smith et al. (2009). Fluctuations may also represent localized weather conditions (especially wind) during surveys, or unequal survey coverage. For example, airboats facilitated first-time surveys of several central Texas sites in 2006 (Cobb *in* Elliott-Smith et al. 2009). Similarly, the increase in the 2006 numbers in the Bahamas is attributed to greatly increased census efforts; the extent of additional habitat not surveyed remains undetermined (Maddock and Wardle *in* Elliott-Smith et al. 2009). Changes in wintering numbers may also be influenced by growth or decline in the particular breeding populations that concentrate their wintering distribution in a given area. Major opportunities to locate previously unidentified wintering sites are concentrated in the Caribbean and Mexico (see pertinent sections in Elliott-Smith et al. 2009). Further surveys and assessment of seasonally emergent habitats (e.g., sea grass beds, mudflats, oyster reefs) within bays lying between the mainland and barrier islands in Texas are also needed.

Mid-winter surveys may substantially underestimate the abundance of nonbreeding piping plovers using a site or region during other months. In late September 2007, 104 piping plovers were counted at the south end of Ocracoke Island, North Carolina (NPS 2007), where none were seen during the 2006 International Piping Plover Winter Census (Elliott-Smith et al. 2009). Noel et al. (2007) observed up to 100 piping plovers during peak migration at Little St. Simons Island, Georgia, where approximately 40 piping plovers wintered in 2003 to 2005. Differences among fall, winter, and spring counts in South Carolina were less pronounced, but inter-year fluctuations (e.g., 108 piping plovers in spring

2007 versus 174 piping plovers in spring 2008) at 28 sites were striking (Maddock et al. 2009). Even as far south as the Florida Panhandle, monthly counts at Phipps Preserve in Franklin County ranged from a mid-winter low of four piping plovers in December 2006 to peak counts of 47 in October 2006 and March 2007 (Smith 2007). Pinkston (2004) observed much heavier use of Texas Gulf Coast (ocean-facing) beaches between early September and mid-October (approximately 16 birds per mile) than during December to March (approximately two birds per mile).

Local movements of nonbreeding piping plovers may also affect abundance estimates. At Deveaux Bank, one of South Carolina's most important piping plover sites, five counts at approximately 10-day intervals between August 27 and October 7, 2006, oscillated from 28 to 14 to 29 to 18 to 26 (Maddock et al. 2009). Noel and Chandler (2008) detected banded Great Lakes piping plovers known to be wintering on their Georgia study site in 73.8 ± 8.1 percent of surveys over three years.

Abundance estimates for nonbreeding piping plovers may also be affected by the number of surveyor visits to the site. Preliminary analysis of detection rates by Maddock et al. (2009) found 87 percent detection during the mid-winter period on core sites surveyed three times a month during fall and spring and one time per month during winter, compared with 42 percent detection on sites surveyed three times per year (Cohen 2009 pers. communication).

Gratto-Trevor et al. (2009; Figure 7) found strong patterns (but no exclusive partitioning) in winter distribution of uniquely banded piping plovers from four breeding populations. All eastern Canada and 94 percent of Great Lakes birds wintered from North Carolina to southwest Florida. However, eastern Canada birds were more heavily concentrated in North Carolina, and a larger proportion of Great Lakes piping plovers were found in South Carolina and Georgia. Northern Great Plains populations were primarily seen farther west and south, especially on the Texas Gulf Coast. Although the great majority of Prairie Canada individuals were observed in Texas, particularly southern Texas, individuals from the U.S. Great Plains were more widely distributed on the Gulf Coast from Florida to Texas.

The findings of Gratto-Trevor et al. (2009) provide evidence of differences in the wintering distribution of piping plovers from these four breeding areas. However, the distribution of birds by breeding origin during migration remains largely unknown. Other major information gaps include the wintering locations of the U.S. Atlantic Coast breeding population (banding of U.S. Atlantic Coast piping plovers has been extremely limited) and the breeding origin of piping plovers wintering on the Caribbean islands and in much of Mexico. Banded piping plovers from the Great Lakes, Northern Great Plains, and eastern Canada breeding populations showed similar patterns of seasonal abundance at Little St. Simons Island, Georgia (Noel et al. 2007). However, the number of banded plovers originating from the latter two populations was relatively small at this study area.

This species exhibits a high degree of intra- and inter-annual wintering site fidelity (Nicholls and Baldassarre 1990a; Drake et al. 2001; Noel et al. 2005; Stucker and Cuthbert 2006). Gratto-Trevor et al. (2009) reported that six of 259 banded piping plovers observed more than once per winter moved across boundaries of the seven U.S. regions. Of 216 birds observed in different years, only eight changed regions between years, and several of these shifts were associated with late summer or early spring migration periods (Gratto-Trevor et al. 2009; Figure 7).
Local movements are more common. In South Carolina, Maddock et al. (2009) documented many cross-inlet movements by wintering banded piping plovers as well as occasional movements of up to 18 km (11 miles) by approximately 10 percent of the banded population; larger movements within South Carolina were seen during fall and spring migration. Similarly, eight banded piping plovers that

were observed in two locations during 2006-2007 surveys in Louisiana and Texas were all in close proximity to their original location, such as on the bay and ocean side of the same island or on adjoining islands (Maddock 2008).

The 2004 and 2005 hurricane seasons affected a substantial amount of habitat along the Gulf Coast. Habitats such as those along Gulf Islands National Seashore have benefited from increased washover events, which created optimal habitat conditions for piping plovers. Conversely, hard shoreline structures put into place following storms throughout the species range to prevent such shoreline migration prevent habitat creation. Four hurricanes between 2002 and 2005 are often cited in reference to rapid erosion of the Chandeleur Islands, a chain of low-lying islands in Louisiana where the 1991 IPPC tallied more than 350 piping plovers. Those same storms, however, created habitats such as over-wash fans and sand spits on barrier islands and headlands in other portions of Louisiana. (See the Storm events section below for more details on their effects to habitat.)

The Service is aware of the following site-specific conditions that benefit several habitats piping plover use while wintering and migrating, including critical habitat units. In Texas, one critical habitat unit was afforded greater protection due to the acquisition of adjacent upland properties by the local Audubon chapter. In another unit in Texas, vehicles were removed from a portion of the beach decreasing the likelihood of automobile disturbance to plovers. Exotic plant removal that threatens to invade suitable piping plover habitat is occurring in a critical habitat unit in South Florida. The Service and other government agencies remain in a contractual agreement with the U.S. Department of Agriculture (USDA) for predator control within limited coastal areas in the Florida panhandle, including portions of some critical habitat units. Continued removal of potential terrestrial predators is likely to enhance survivorship of wintering and migrating piping plovers. In North Carolina, one critical habitat unit was afforded greater protection when the local Audubon chapter agreed to manage the area specifically for piping plovers and other shorebirds following the relocation of the nearby inlet channel.

Recovery criteria

Northern Great Plains Population (Service 1988, 1994)

1. Increase the number of birds in the U.S. northern Great Plains states to 2,300 pairs (Service 1994).
2. Increase the number of birds in the prairie region of Canada to 2,500 adult piping plovers (Service 1988).
3. Secure long term protection of essential breeding and wintering habitat (Service 1994).

Great Lakes Population (Service 2003)

1. At least 150 pairs (300 individuals), for at least 5 consecutive years, with at least 100 breeding pairs (200 individuals) in Michigan and 50 breeding pairs (100 individuals) distributed among sites in other Great Lakes states.
2. Five-year average fecundity within the range of 1.5-2.0 fledglings per pair, per year, across the breeding distribution, and ten-year population projections indicate the population is stable or continuing to grow above the recovery goal.
3. Protection and long-term maintenance of essential breeding and wintering habitat is ensured, sufficient in quantity, quality, and distribution to support the recovery goal of 150 pairs (300 individuals).
4. Genetic diversity within the population is deemed adequate for population persistence and can be maintained over the long-term.

5. Agreements and funding mechanisms are in place for long-term protection and management activities in essential breeding and wintering habitat.

Atlantic Coast Population (Service 1996)

1. Increase and maintain for 5 years a total of 2,000 breeding pairs, distributed among 4 recovery units.

Recovery Unit	Minimum Subpopulation
Atlantic (eastern) Canada	400 pairs
New England	625 pairs
New York-New Jersey	575 pairs
Southern (DE-MD-VA-NC)	400 pairs

2. Verify the adequacy of a 2,000 pair population of piping plovers to maintain heterozygosity and allelic diversity over the long term.
3. Achieve a 5-year average productivity of 1.5 fledged chicks per pair in each of the 4 recovery units described in criterion 1, based on data from sites that collectively support at least 90 percent of the recover unit's population.
4. Institute long-term agreements to assure protection and management sufficient to maintain the population targets and average productivity in each recovery unit.
5. Ensure long-term maintenance of wintering habitat, sufficient in quantity, quality, and distribution to maintain survival rates for a 2,000-pair population.

Threats to piping plovers/critical habitat

In the following sections, we provide an analysis of threats to piping plovers in their migration and wintering range. We update information obtained since the 1985 listing rule, the 1991 and 2009 status reviews, and the three breeding population recovery plans. Both previously identified and new threats are discussed. With minor exceptions, this analysis is focused on threats to piping plovers within the continental U.S. portion of their migration and wintering range. Threats in the Caribbean and Mexico remain largely unknown.

Present or threatened destruction, modification, or curtailment of its habitat or range

The status of piping plovers on winter and migration grounds is difficult to assess, but threats to piping plover habitat used during winter and migration (identified by the Service during its designation of critical habitat) continue to affect the species. Unregulated motorized and pedestrian recreational use, inlet and shoreline stabilization projects, beach maintenance and nourishment, and pollution affect most winter and migration areas. Conservation efforts at some locations have likely resulted in the enhancement of wintering habitat.

The 1985 final listing rule stated that the number of piping plovers on the Gulf of Mexico coastal wintering grounds might be declining as indicated by preliminary analysis of Christmas Bird Count data. Independent counts of piping plovers on the Alabama coast indicated a decline in numbers between the 1950s and early 1980s. At the time of listing, the Texas Parks and Wildlife Department stated that 30 percent of wintering habitat in Texas had been lost over the previous 20 years. The final rule also stated that in addition to extensive breeding area problems, the loss and modification of wintering habitat was a significant threat to the piping plover.

The three recovery plans state that shoreline development throughout the wintering range poses a threat to all populations of piping plovers. The plans further state that beach maintenance and nourishment, inlet dredging, and artificial structures, such as jetties and groins, could eliminate wintering areas and alter sedimentation patterns leading to the loss of nearby habitat. Priority 1 actions in the 1996 Atlantic Coast and 2003 Great Lakes Recovery Plans identify tasks to protect natural processes that maintain coastal ecosystems and quality wintering piping plover habitat and to protect wintering habitat from shoreline stabilization and navigation projects. The 1988 Northern Great Plains Recovery Plan states that, as winter habitat is identified, current and potential threats to each site should be determined.

Important components of ecologically sound barrier beach management include perpetuation of natural dynamic coastal formation processes. Structural development along the shoreline or manipulation of natural inlets upsets the dynamic processes and results in habitat loss or degradation (Melvin et al. 1991). Throughout the range of migrating and wintering piping plovers, inlet and shoreline stabilization, inlet dredging, beach maintenance and nourishment activities, and seawall installations continue to constrain natural coastal processes. Dredging of inlets can affect spit formation adjacent to inlets and directly remove or affect ebb and flood tidal shoal formation. Jetties, which stabilize an island, cause island widening and subsequent growth of vegetation on inlet shores. Seawalls restrict natural island movement and exacerbate erosion. As discussed in more detail below, all these efforts result in loss of piping plover habitat. Construction of these projects during months when piping plovers are present also causes disturbance that disrupts the birds' foraging efficiency and hinders their ability to build fat reserves over the winter and in preparation for migration, as well as their recuperation from migratory flights. Additional investigation is needed to determine the extent to which these factors cumulatively affect piping plover survival and how they may impede conservation efforts for the species.

Any assessment of threats to piping plovers from loss and degradation of habitat must recognize that up to 24 shorebird species migrate or winter along the Atlantic Coast and almost 40 species of shorebirds are present during migration and wintering periods in the Gulf of Mexico region (Helmers 1992). Continual degradation and loss of habitats used by wintering and migrating shorebirds may cause an increase in intra-specific and inter-specific competition for remaining food supplies and roosting habitats. In Florida, for example, approximately 825 miles of coastline and parallel bayside flats (unspecified amount) were present prior to the advent of high human densities and beach stabilization projects. We estimate that only about 35 percent of the Florida coastline continues to support natural coastal formation processes, thereby concentrating foraging and roosting opportunities for all shorebird species and forcing some individuals into suboptimal habitats. Thus, intra- and inter-specific competition most likely exacerbates threats from habitat loss and degradation.

Sand placement projects

In the wake of episodic storm events, managers of lands under public, private, and county ownership often protect coastal structures using emergency storm berms; this is frequently followed by beach nourishment or renourishment activities (nourishment projects are considered "soft" stabilization versus "hard" stabilization such as seawalls). Berm placement and beach nourishment deposit substantial amounts of sand along Gulf of Mexico and Atlantic beaches to protect local property in anticipation of preventing erosion and what otherwise will be considered natural processes of over-wash and island migration (Schmitt and Haines 2003). On unpopulated islands, the addition of sand and creation of marsh are sometimes used to counteract the loss of roosting and nesting habitat for shorebirds and wading birds as a result of erosional storm events.

Past and ongoing stabilization projects may fundamentally alter the naturally dynamic coastal processes that create and maintain beach strand and bayside habitats, including those habitat components that piping plovers rely upon. Although impacts may vary depending on a range of factors, stabilization projects may directly degrade or destroy piping plover roosting and foraging habitat in several ways. Front beach habitat may be used to construct an artificial berm that is densely planted in grass, which can directly reduce the availability of roosting habitat. Over time, if the beach narrows due to erosion, additional roosting habitat between the berm and the water can be lost. Berms can also prevent or reduce the natural over-wash that creates roosting habitats by converting vegetated areas to open sand areas. The vegetation growth caused by impeding natural over-wash can also reduce the maintenance and creation of bayside intertidal feeding habitats. In addition, stabilization projects may indirectly encourage further development of coastal areas and increase the threat of disturbance.

At least 668 of 2,340 coastal shoreline miles (29 percent of beaches throughout the piping plover winter and migration range in the U.S.) are bermed, nourished, or renourished, generally for recreational purposes and to protect commercial and private infrastructure (Table 4, next page). However, only approximately 54 miles or 2.31 percent of these impacts have occurred within critical habitat.

Table 4. Summary of the extent of nourished beaches in piping plover wintering and migrating habitat within the conterminous United States. Data extracted from Service unpublished data (project files, gray literature, and field observations) as of 2009.

State	Sandy beach shoreline miles available	Sandy beach shoreline miles nourished to date (within CH[g] units)	Percent of sandy beach shoreline affected (within CH[g] units)
North Carolina	301[a]	117[e] (unknown)	39 (unknown)
South Carolina	187[a]	56 (0.6)	30 (0.32))
Georgia	100[a]	8 (0.4)	8 (0.40)
Florida	825[b]	404 (6)[f]	49 (0.72)
Alabama	53[a]	12 (2)	23 (3.77)
Mississippi	110[c]	≥6 (0)	5 (0)
Louisiana	397[a]	Unquantified (generally restoration-oriented)	Unknown
Texas	367[d]	65 (45)	18 (12.26)
Overall Total	2,340 (does not include Louisiana)	≥668 does not include Louisiana (54 in CH)	29% (≥2.31% in CH)

(a) Data from www.50states.com; (b) Clark 1993; (c) N. Winstead, Mississippi Museum of Natural Science, in lit. 2008; (d) www.Surfrider.org; (e) H. Hall, Service, pers. comm. 2009; (f) Partial data from Lott et al. (2007 in review); (g) CH = critical habitat.

In Louisiana, the sustainability of the coastal ecosystem is threatened by the inability of the barrier islands to maintain geomorphologic functionality (Corps 2011). Consequently, most of the planned sediment placement projects are conducted as environmental restoration projects by various Federal and State agencies because without the sediment many areas would erode below sea level since the Louisiana coastal systems are starved for sediment sources. Agencies conducting coastal restoration

projects aim to design projects that mimic the natural existing elevations of coastal habitats (e.g., beach, dune, and marsh) in order to allow their projects to work within and be sustained by the natural ecosystem processes that maintain those coastal habitats. Due to the low elevation of barrier islands and coastal headlands, placement of additional sediment in those areas generally does not reach an elevation that would prevent the formation of washover areas or impede natural coastal processes, especially during storm events. Such careful design of these restoration projects allows daily tidal processes or storm events to re-work the sediments to reform the Gulf/beach interface and create washover areas, sand flats, and mud flats on the bay-side of the islands, as well as sand spits on the ends of the islands; thus, the added sediment aids in sustaining the barrier island system.

Sediment placement also temporarily affects the benthic fauna found in intertidal systems by covering them with a layer of sediment. Some benthic species can burrow through a thin layer (varies from 15 to 35 inches for different species) of additional sediment since they are adapted to the turbulent environment of the intertidal zone; however, thicker layers (i.e., greater than 40 inches) of sediment are likely to smother the benthic fauna (Greene 2002). Various studies of such effects indicate that the recovery of benthic fauna after beach renourishment or sediment placement can take anywhere from 6 months to 2 years (Rakocinski et al. 1996; Peterson et al. 2000; Peterson et al. 2006). Such delayed recovery of benthic prey species temporarily affects the quality of piping plover foraging habitat.

Inlet stabilization/relocation

Many navigable mainland or barrier island tidal inlets along the Atlantic and Gulf of Mexico coasts are stabilized with jetties, groins, or by seawalls and/or adjacent industrial or residential development. Jetties are structures built perpendicular to the shoreline that extend through the entire nearshore zone and past the breaker zone to prevent or decrease sand deposition in the channel (Hayes and Michel 2008). Inlet stabilization with rock jetties and associated channel dredging for navigation alter the dynamics of long-shore sediment transport and affect the location and movement rate of barrier islands (Camfield and Holmes 1995), typically causing down-drift erosion. Sediment is then dredged and added back to the islands which are subsequently widened. Once the island becomes stabilized, vegetation encroaches on the bayside habitat, thereby diminishing and eventually destroying its value to piping plovers. Accelerated erosion may compound future habitat loss, depending on the degree of sea-level rise. Unstabilized inlets naturally migrate, re-forming important habitat components, whereas jetties often trap sand and cause significant erosion of the down-drift shoreline. These combined actions affect the availability of piping plover habitat (Cohen et al. 2008b).

Using Google Earth© (accessed April 2009), Service biologists visually estimated the number of navigable mainland or barrier island tidal inlets throughout the wintering range of the piping plover in the conterminous U.S. that have some form of hardened structure. This includes seawalls or adjacent development, which lock the inlets in place (Table 5).

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Table 5. Visually estimated numbers of navigable mainland and barrier island inlets and hardened inlets by state.

State	Number of navigable mainland and barrier island inlets	Number of hardened inlets	Percent of inlets affected
North Carolina	20	2.5*	12.5%
South Carolina	34	3.5*	10.3%
Georgia	26	2	7.7%
Florida	82	41	50%
Alabama	14	6	42.9%
Mississippi	16	7	43.8%
Louisiana	40	9	22.5%
Texas	17	10	58.8%
Overall Total	249	81	32.5%

*An inlet at the state line is considered to be half an inlet counted in each state.

Tidal inlet relocation can cause loss and/or degradation of piping plover habitat; although less permanent than construction of hard structures, effects can persist for years. For example, a project on Kiawah Island, South Carolina, degraded one of the most important piping plover habitats in the State by reducing the size and physical characteristics of an active foraging site, changing the composition of the benthic community, decreasing the tidal lag in an adjacent tidal lagoon, and decreasing the exposure time of the associated sand flats (Service and Town of Kiawah Island 2006). In 2006, pre-project piping plover numbers in the project area recorded during four surveys conducted at low tide averaged 13.5 piping plovers. This contrasts with a post-project average of 7.1 plovers during eight surveys (four in 2007 and four in 2008) conducted during the same months (Service and Town of Kiawah Island 2006), indicating that habitat quality was reduced. Service biologists are aware of at least seven inlet relocation projects (two in North Carolina, three in South Carolina, two in Florida), but this number likely under-represents the extent of this activity.

Sand mining/dredging

Sand mining, the practice of extracting (dredging) sand from sand bars, shoals, and inlets in the nearshore zone, is a less expensive source of sand than obtaining sand from offshore shoals for beach nourishment. Sand bars and shoals are sand sources that move onshore over time and act as natural breakwaters. Inlet dredging reduces the formation of exposed ebb and flood tidal shoals considered to be primary or optimal piping plover roosting and foraging habitat. Removing these sand sources can alter depth contours and change wave refraction as well as cause localized erosion (Hayes and Michel 2008). Exposed shoals and sandbars are also valuable to piping plovers, as they tend to receive less human recreational use (because they are only accessible by boat) and therefore provide relatively less disturbed habitats for birds. We do not have a good estimate of the amount of sand mining that occurs across the piping plover wintering range, nor do we have a good estimate of the number of inlet dredging projects that occur. This number is likely greater than the number of total jettied inlets shown in Table 5, since most jettied inlets need maintenance dredging, but non-hardened inlets are often dredged as well.

Groins

Groins (structures made of concrete, rip rap, wood, or metal built perpendicular to the beach in order to trap sand) are typically found on developed beaches with severe erosion. Although groins can be individual structures, they are often clustered along the shoreline. Groins can act as barriers to long-shore sand transport and cause down-drift erosion (Hayes and Michel 2008), which prevents piping plover habitat creation by limiting sediment deposition and accretion. These structures are found throughout the southeastern Atlantic Coast, and although most were in place prior to the piping plover's 1986 listing under the Act, installation of new groins continues to occur.

Seawalls and revetments

Seawalls and revetments are vertical hard structures built parallel to the beach in front of buildings, roads, and other facilities to protect them from erosion. However, these structures often accelerate erosion by causing scouring in front of and down-drift from the structure (Hayes and Michel 2008), which can eliminate intertidal foraging habitat and adjacent roosting habitat. Physical characteristics that determine microhabitats and biological communities can be altered after installation of a seawall or revetment, thereby depleting or changing composition of benthic communities that serve as the prey base for piping plovers. At four California study sites, each comprised of an unarmored segment and a segment seaward of a seawall, Dugan and Hubbard (2006) found that armored segments had narrower intertidal zones, smaller standing crops of macrophyte wrack, and lower shorebird abundance and species richness. Geotubes (long cylindrical bags made of high-strength permeable fabric and filled with sand) are softer alternatives, but act as barriers by preventing over-wash. We did not find any sources that summarize the linear extent of seawall, revetment, and geotube installation projects that have occurred across the piping plover's wintering and migration habitat.

Exotic/invasive vegetation

A recently identified threat to piping plover habitat, not described in the listing rule or recovery plans, is the spread of coastal invasive plants into suitable piping plover habitat. Like most invasive species, coastal exotic plants reproduce and spread quickly and exhibit dense growth habits, often outcompeting native plant species. If left uncontrolled, invasive plants cause a habitat shift from open or sparsely vegetated sand to dense vegetation, resulting in the loss or degradation of piping plover roosting habitat, which is especially important during high tides and migration periods.

Beach vitex (*Vitex rotundifolia*) is a woody vine introduced into the southeastern U.S. as a dune stabilization and ornamental plant (Westbrooks and Madsen 2006). It currently occupies a very small percentage of its potential range in the U.S.; however, it is expected to grow well in coastal communities throughout the southeastern U.S. from Virginia to Florida, and west to Texas (Westbrooks and Madsen 2006). In 2003, the plant was documented in New Hanover, Pender, and Onslow counties in North Carolina, and at 125 sites in Horry, Georgetown, and Charleston counties in South Carolina. One Chesapeake Bay site in Virginia was eradicated, and another site on Jekyll Island, Georgia, is about 95 percent controlled (Suiter 2009 pers. communication). Beach vitex has been documented from two locations in northwest Florida, but one site disappeared after erosional storm events. The landowner of the other site has indicated an intention to eradicate the plant, but follow through is unknown (Farley 2009 pers. communication). The task forces formed in North and South Carolina in 2004 and 2005 have made great strides to remove this plant from their coasts. To date, about 200 sites in North Carolina have been treated, with 200 additional sites in need of treatment. Similar efforts are underway in South Carolina.

Unquantified amounts of crowfoot grass (*Dactyloctenium aegyptium*) grow invasively along portions of the Florida coastline. It forms thick bunches or mats that may change the vegetative structure of coastal plant communities and alter shorebird habitat. The Australian pine (*Casuarina equisetifolia*) also changes the vegetative structure of the coastal community in south Florida and islands within the Bahamas. Shorebirds prefer foraging in open areas where they are able to see potential predators, and tall trees provide good perches for avian predators. Australian pines potentially impact shorebirds, including the piping plover, by reducing attractiveness of foraging habitat and/or increasing avian predation.

The propensity of these exotic species to spread, and their tenacity once established, make them a persistent threat, partially countered by increasing landowner awareness and willingness to undertake eradication activities.

Wrack removal and beach cleaning

Wrack on beaches and baysides provides important foraging and roosting habitat for piping plovers (Drake 1999a; Smith 2007; Maddock et al. 2009; Lott et al. 2009) and many other shorebirds on their winter, breeding, and migration grounds. Because shorebird numbers are positively correlated with wrack cover and biomass of their invertebrate prey that feed on wrack (Tarr and Tarr 1987; Hubbard and Dugan 2003; Dugan et al. 2003), beach grooming will lower bird numbers (Defeo et al. 2009).

There is increasing popularity along developed beaches in the Southeast, especially in Florida, for beach communities to carry out "beach cleaning" and "beach raking" actions. Beach cleaning occurs on private beaches, where piping plover use is not well documented, and on some municipal or county beaches that are used by piping plovers. Most wrack removal on state and federal lands is limited to post-storm cleanup and does not occur regularly.

Man-made beach cleaning and raking machines effectively remove seaweed, fish, glass, syringes, plastic, cans, cigarettes, shells, stone, wood, and virtually any unwanted debris (Barber Beach Cleaning Equipment 2009). These efforts remove accumulated wrack, topographic depressions, and sparse vegetation nodes used by roosting and foraging piping plovers. Removal of wrack also eliminates a beach's natural sand-trapping abilities, further destabilizing the beach. In addition, sand adhering to seaweed and trapped in the cracks and crevices of wrack is removed from the beach. Although the amount of sand lost due to single sweeping actions may be small, it adds up considerably over a period of years (Nordstrom et al. 2006; Neal et al. 2007). Beach cleaning or grooming can result in abnormally broad unvegetated zones that are inhospitable to dune formation or plant colonization, thereby enhancing the likelihood of erosion (Defeo et al. 2009).

Currently, the Florida Department of Environmental Protection's Beaches and Coastal Management Systems section has issued 117 permits for beach raking or cleaning to multiple entities. We estimate that 240 of 825 miles (29 percent) of sandy beach shoreline in Florida are cleaned or raked on various schedules (i.e., daily, weekly, monthly) (FDEP 2008). Service biologists estimate that South Carolina mechanically cleans approximately 34 of its 187 shoreline miles (18 percent), and Texas mechanically cleans approximately 20 of its 367 shoreline miles (5.4 percent). In Louisiana, beach raking occasionally occurs on Grand Isle (the state's only inhabited island) along approximately 8 miles of shoreline, roughly 2 percent of the state's 397 sandy shoreline miles. We are not aware of what percentage of mechanical cleaning occurs elsewhere in piping plover critical habitat.

Tilling beaches to reduce soil compaction, as sometimes required by the Service for sea turtle protection after beach nourishment activities, also has similar impacts. Recently, the Service improved sea turtle protection provisions in Florida; these provisions now require tilling, when needed, to be above the primary wrack line, not within it.

Disease

Neither the final listing rule nor the recovery plans state that disease is an issue for the species, and no plan assigns recovery actions to this threat factor. Based on information available to date, West Nile virus and avian influenza are a minor threat to piping plovers (Service 2009a).

Predation

The impact of predation on migrating or wintering piping plovers remains largely undocumented. Except for one incident reported in 2007 by the New York Times involving a cat in Texas, no depredation of piping plovers during winter or migration has been noted, although it would be difficult to document. Avian and mammalian predators are common throughout the species' wintering range. Predatory birds are relatively common during fall and spring migration, and it is possible that raptors occasionally take piping plovers (Drake et al. 2001). It has been noted, however, that the behavioral response of crouching when in the presence of avian predators may minimize avian predation on piping plovers (Morrier and McNeil 1991; Drake 1999a; Drake et al. 2001).

The 1996 Atlantic Coast Recovery Plan summarized evidence that human activities affect types, numbers, and activity patterns of some predators, thereby exacerbating natural predation on breeding piping plovers. Nonbreeding piping plovers may reap some collateral benefits from predator management conducted for the primary benefit of other species. In 1997, the USDA implemented a public lands predator control partnership in northwest Florida that included the Department of Defense, National Park Service (NPS), the State of Florida (state park lands) and Service (National Wildlife Refuges and Ecological Services). The program continues with all partners except Florida – in 2008, lack of funding precluded inclusion of Florida state lands (although Florida Department of Environmental Protection staff conduct occasional predator trapping on state lands, trapping is not implemented consistently).

The NPS and individual state park staff in North Carolina participate in predator control programs (Rabon 2009 pers. communication). The Service issued permit conditions for raccoon eradication to Indian River County staff in Florida as part of a coastal Habitat Conservation Plan (Adams 2009 pers. communication). Destruction of turtle nests by dogs or coyotes in the Indian River area justified the need to amend the permit to include an education program targeting dog owners regarding the appropriate means to reduce impacts to coastal species caused by their pets. The Service partnered with Texas Audubon and the Coastal Bend Bays and Estuaries Program in Texas to implement predator control efforts on colonial waterbird nesting islands (Cobb 2009 pers. communication). Some of these predator control programs may provide very limited protection to piping plovers, should they use these areas for roosting or foraging. Table 6 summarizes predator control actions on a state-by-state basis. The Service is not aware of any current predator control programs targeting protection of coastal species in Georgia, Alabama, Mississippi, or Louisiana.

Regarding predation, the magnitude of this threat to nonbreeding piping plovers remains unknown, but given the pervasive, persistent, and serious impacts of predation on other coastal reliant species, it remains a potential threat. Focused research to confirm impacts as well as to ascertain effectiveness of

predator control programs may be warranted, especially in areas frequented by Great Lakes birds during migration and wintering months. We consider predator control on their wintering and migration grounds to be a low priority at this time.[6]

Table 6. Summary of predator control programs that may benefit piping plovers on winter and migration grounds (as of 2009).

State	Entities with Predator Control Programs
North Carolina	State Parks, Cape Lookout and Cape Hatteras National Seashores.
South Carolina	As needed throughout the state, targets raccoons and coyotes.
Georgia	No programs known.
Florida	Merritt Island NWR, Cape Canaveral AFS, Indian River County, Eglin AFB, Gulf Islands NS, northwest Florida state parks (up until 2008), St. Vincent NWR, Tyndall AFB.
Alabama	Late 1990's Gulf State Park and Orange Beach for beach mice, no current programs known.
Mississippi	No programs known.
Louisiana	No programs known.
Texas	Aransas NWR (hog control for habitat protection), Audubon (mammalian predator control on colonial waterbird islands that have occasional piping plover use).

Disturbance

Disturbance (i.e., human and pet presence that alters bird behavior) disrupts piping plovers as well as other shorebird species. Intense human disturbance in shorebird winter habitat can be functionally equivalent to habitat loss if the disturbance prevents birds from using an area for a significant amount of time (Goss-Custard et al. 1996), which can lead to roost abandonment and local population declines (Burton et al. 1996). Pfister et al. (1992) implicate anthropogenic disturbance as a factor in the long-term decline of migrating shorebirds at staging areas. Disturbance can also cause shorebirds to spend less time roosting or foraging and more time in alert postures or fleeing from the disturbances (Johnson and Baldassarre 1988; Burger 1991; Burger 1994; Elliott and Teas 1996; Lafferty 2001a, 2001b; Thomas et al. 2002), which limits the local abundance of piping plovers (Zonick and Ryan 1995; Zonick 2000). Shorebirds that are repeatedly flushed in response to disturbance expend energy on costly short flights (Nudds and Bryant 2000) and may not feed enough to support migration and/or subsequent breeding efforts (Puttick 1979; Lafferty 2001b).

Elliott and Teas (1996) found a significant difference in actions between piping plovers encountering pedestrians and those not encountering pedestrians. Piping plovers encountering pedestrians spend proportionately more time in non-foraging behavior. This study suggests that interactions with pedestrians on beaches cause birds to shift their activities from calorie acquisition to calorie expenditure. In wintering and migration sites, human disturbance continues to decrease the amount of undisturbed habitat and appears to limit local piping plover abundance (Zonick and Ryan 1995).

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[6] The threat of direct predation should be distinguished from the threat of disturbance to roosting and feeding piping plovers posed by dogs off leash.

Shorebirds are more likely to flush from the presence of dogs than people, and birds react to dogs from farther distances than people (Lafferty 2001a, 2001b; Thomas et al. 2002). Dogs off leash are more likely to flush piping plovers from farther distances than are dogs on leash; nonetheless, dogs both on and off leashes disturb piping plovers (Hoopes 1993). Pedestrians walking with dogs often go through flocks of foraging and roosting shorebirds; some even encourage their dogs to chase birds.

Off-road vehicles can significantly degrade piping plover habitat (Wheeler 1979) or disrupt the birds' normal behavior patterns (Zonick 2000). The 1996 Atlantic Coast Recovery Plan cites tire ruts crushing wrack into the sand, making it unavailable as cover or as foraging substrate (Hoopes 1993; Goldin 1993). The plan also notes that the magnitude of the threat from off-road vehicles is particularly significant, because vehicles extend impacts to remote stretches of beach where human disturbance will otherwise be very slight. Godfrey et al. (1978, 1980 as cited *in* Lamont et al. 1997) postulated that vehicular traffic along the beach may compact the substrate and kill marine invertebrates that are food for the piping plover. Zonick (2000) found that the density of off-road vehicles negatively correlated with abundance of roosting piping plovers on the ocean beach. Cohen et al. (2008a) found that radio-tagged piping plovers using ocean beach habitat at Oregon Inlet in North Carolina were far less likely to use the north side of the inlet where off-road vehicle use is allowed, and recommended controlled management experiments to determine if recreational disturbance drives roost site selection. Ninety-six percent of piping plover detections was on the south side of the inlet even though it was farther away from foraging sites (1.8 km from the sound side foraging site to the north side of the inlet versus 0.4 km from the sound side foraging site to the north side of the inlet (Cohen et al. 2008a).

Based on surveys with land managers and biologists, knowledge of local site conditions, and other information, the Service has estimated the levels of eight types of disturbance at sites in the U.S. with wintering piping plovers. Table 7 summarizes the disturbance analysis results (Service 2009b). Data are not available on human disturbance at wintering sites in the Bahamas, other Caribbean countries, or Mexico. There are few areas used by wintering piping plovers that are devoid of human presence, and just under half have leashed and unleashed dog presence (Smith 2007; Lott et al. 2009, Service unpublished data 2009; Maddock and Bimbi unpublished data).

Table 7. Percent of known piping plover winter and migration habitat locations, by state, where various types of anthropogenic disturbance have been reported.

	Percent by State							
Disturbance Type	AL	FL	GA	LA	MS	NC	SC	TX
Pedestrians	67	92	94	25	100	100	88	54
Dogs on leash	67	69	31	25	73	94	25	25
Dogs off leash	67	81	19	25	73	94	66	46
Bikes	0	19	63	25	0	0	28	19
ATVs[a]	0	35	0	25	0	17	25	30
ORVs[b]	0	21	0	25	0	50	31	38
Boats	33	65	100	100	0	78	63	44
Kite surfing	0	10	0	0	0	33	0	0

(a) ATV = all-terrain vehicle; (b) ORV = off-road vehicle

Although the timing, frequency, and duration of human and dog presence throughout the wintering range are unknown, studies in Alabama and South Carolina suggest that most disturbances to piping plovers occurs during periods of warmer weather, which coincides with piping plover migration

(Johnson and Baldassarre 1988; Lott et al. 2009; Maddock et al. 2009). Smith (2007) documents varying disturbance levels throughout the nonbreeding season at northwest Florida sites.

LeDee et al. (2010) collected survey responses in 2007 from 35 managers (located in seven states) at sites that were designated as critical habitat for wintering piping plovers. Ownership included federal, state, and local governmental agencies and non-governmental organizations managing national wildlife refuges; national, state, county, and municipal parks; state and estuarine research reserves; state preserves; state wildlife management areas; and other types of managed lands. Of 43 reporting sites, 88 percent allowed public beach access year-round and four sites were closed to the public. Sixty-two percent of site managers reported greater than 10,000 visitors from September through March, and 31 percent reported greater than 100,000 visitors. Restrictions on visitor activities on the beach included automobiles (at 81 percent of sites), all-terrain vehicles (89 percent), and dogs during the winter season (50 percent). Half of the survey respondents reported funding as a primary limitation in managing piping plovers and other threatened and endangered species at their sites. Other limitations included "human resource capacity" (24 percent), conflicting management priorities (12 percent), and lack of research (3 percent).

Disturbance can be addressed by implementing recreational management techniques such as vehicle and pet restrictions and symbolic fencing (usually sign posts and string) of roosting and feeding habitats. In implementing conservation measures, managers need to consider a range of site-specific factors, including the extent and quality of roosting and feeding habitats and the types and intensity of recreational use patterns. In addition, educational materials such as informational signs or brochures can provide valuable information so that the public understands the need for conservation measures.

In summary, although there is some variability among states, disturbance from human activities and pets poses a moderate to high and escalating threat to migrating and wintering piping plovers. Systematic review of recreation policy and beach management across the nonbreeding range will assist in better understanding cumulative impacts. Site-specific analysis and implementation of conservation measures should be a high priority at piping plover sites that have moderate or high levels of disturbance. The Service and state wildlife agencies should increase technical assistance to land managers to implement management strategies and monitor their effectiveness.

Military Actions

Twelve coastal military bases are located in the Southeast. To date, five bases have consulted with the Service under section 7 of the Act, on military activities on beaches and baysides that may affect piping plovers or their habitat (Table 8). Camp Lejeune in North Carolina consulted formally with the Service in 2002 on troop activities, dune stabilization efforts, and recreational use of Onslow Beach. The permit conditions require twice-monthly piping plover surveys and use of buffer zones and work restrictions within buffer zones. Naval Station Mayport in Duval County, Florida, consulted with the Service on Marine Corps training activities that included beach exercises and use of amphibious assault vehicles. The area of impact was not considered optimal for piping plovers, and the consultation was concluded informally. Similar informal consultations have occurred with Tyndall Air Force Base (Bay County) and Eglin Air Force Base (Okaloosa and Santa Rosa counties) in northwest Florida. Both consultations dealt with occasional use of motorized equipment on the beaches and associated baysides. Tyndall Air Force Base has minimal on-the-ground use, and activities, when conducted, occur on the Gulf of Mexico beach, which is not considered the optimal area for piping plovers within this region. Eglin Air Force Base conducts bi-monthly surveys for piping plovers, and habitats consistently documented with piping plover use are posted with avoidance requirements to

minimize direct disturbance from troop activities. A 2001 consultation with the Navy for one-time training and retraction operations on Peveto Beach, in Cameron Parish, Louisiana, concluded informally.

Table 8. Military bases that occur within the wintering/migration range of piping plovers and contain piping plover habitat.

State	Coastal Military Bases
North Carolina	Camp Lejeune*
South Carolina	No coastal beach bases
Georgia	Kings Bay Naval Base
Florida	Key West Base, Naval Station Mayport*, Cape Canaveral Air Force Station, Patrick AFB, MacDill AFB, Eglin AFB*, Tyndall AFB*
Alabama	No coastal beach bases
Mississippi	Keesler AFB
Louisiana	No coastal beach bases
Texas	Corpus Christi Naval Air Station

*Bases which conduct activities that may affect piping plovers or their habitat.

Overall, project avoidance and minimization actions currently reduce threats from military activities to wintering and migrating piping plovers to a minimal threat level. However, prior to removal of the piping plover from protection under the Act, Integrated Resource Management Plans or other agreements should clarify if and how a change in legal status would affect plover protections.

Contaminants

Contaminants have the potential to cause direct toxicity to individual birds or negatively affect their invertebrate prey base (Rattner and Ackerson 2008). Depending on the type and degree of contact, contaminants can have lethal and sub-lethal effects on birds, including behavioral impairment, deformities, and impaired reproduction (Rand and Petrocelli 1985; Gilbertson et al. 1991; Hoffman et al. 1996).

The Great Lakes Recovery Plan states that concentration levels of polychlorinated biphenol (PCB) detected in Michigan piping plover eggs have the potential to cause reproductive harm. They further state that analysis of prey available to piping plovers at representative Michigan breeding sites indicated that breeding areas along the upper Great Lakes region are not likely the major source of contaminants to this population.

Petroleum products are the contaminants of primary concern, as opportunities exist for petroleum to pollute intertidal habitats that provide foraging substrate. Impacts to piping plovers from oil spills have been documented throughout their life cycle (Chapman 1984; Service 1996; Burger 1997; Massachusetts Audubon 2003; Amirault-Langlais et al. 2007; Amos 2009 pers. communication). This threat persists due to the high volume of shipping vessels (from which most documented spills have originated) traveling offshore and within connected bays along the Atlantic Coast and the Gulf of Mexico. Additional risks exist for leaks or spills from offshore oil rigs, associated undersea pipelines, and onshore facilities such as petroleum refineries and petrochemical plants. Beach-stranded 55-gallon barrels and smaller containers, which may fall from moving cargo ships or offshore rigs and are not uncommon on the Texas coast, contain primarily oil products (gasoline or diesel), as well as other chemicals such as methanol, paint, organochlorine pesticides, and detergents (Lee 2009 pers.

communication). Federal and state land managers have protective provisions in place to secure and remove the barrels, thus reducing the likelihood of contamination.

Lightly oiled piping plovers have survived and successfully reproduced (Chapman 1984; Amirault-Langlais et al. 2007; Amos pers. comm. 2009). Chapman (1984) noted shifts in habitat use as piping plovers moved out of spill areas. This behavioral change was believed to be related to the demonstrated decline in benthic infauna (prey items) in the intertidal zone and may have decreased the direct impact to the species. To date, no plover mortality has been attributed to oil contamination outside the breeding grounds, but latent effects would be difficult to prove.

Deepwater Horizon Mississippi Canyon Well #252 Oil Spill

The Deepwater Horizon Mississippi Canyon Well #252 oil spill (Deepwater Horizon), which started April 20, 2010, discharged into the Gulf of Mexico through July 15, 2010. According to government estimates, the leak released between 100 and 200 million gallons of oil into the Gulf of Mexico due to the Deepwater Horizon accident. The U.S. Coast Guard (USCG) estimates that more than 50 million gallons of oil have been removed from the Gulf, or roughly a quarter of the spill amount. Additional impacts to natural resources may also be attributed to the 1.84 million gallons of dispersant that were utilized during the spill. The USCG, the states, and responsible parties that form the Unified Area Command (with advice from federal and state natural resource agencies) initiated protective measures and clean-up efforts per prepared contingency plans to deal with petroleum and other hazardous chemical spills for each state's coastline. The contingency plans identify sensitive habitats, including all federally listed species' habitats, which receive a higher priority for response actions. Those plans allow for immediate habitat protective measures for clean-up activities in response to large contaminant spills. While such plans usually ameliorate the threat to piping plovers, they will not likely provide much improvement in this case given the breadth of the impacts associated with the Deepwater Horizon incident.

As of October 6, 2010, approximately 104 miles of Gulf of Mexico shoreline were affected by moderate to heavy oil (approximately 95 miles in Louisiana, 9 miles in Mississippi, and 1 mile in Florida) and approximately 485 miles of shoreline were affected by light to trace amounts of oil (approximately 224 miles in Louisiana, 81 miles in Mississippi, 60 miles in Alabama, and 114 miles in Florida) (October 6, 2010, Unified Area Command Weekly Update, www.RestoreTheGulf.gov). Those numbers reflect a daily snapshot of shoreline experiencing impacts from oil; they do not include cumulative impacts to date, or shoreline that has already been cleaned. The Operational Science Advisory Team (OSAT-2) of the Gulf Coast Incident Management Team published the *Summary Report for Fate and Effects of Remnant Oil Remaining in the Beach Environment* on February 10, 2011. The OSAT-2 report indicates that:

> "Much of the oil residue on and near the shoreline has been cleaned during the Response phase of the oil spill. As the Gulf shoreline is a dynamic environment, oil residue that is uncovered or moved onto beaches (for example, tar residue balls) will continue to be removed as part of the Monitoring and Maintenance phase of the recovery. Three types of located oil residue were identified as particularly challenging, or potentially damaging to the environment if removed. These three types are the following: supratidal buried oil (SBO), small surface residual balls (SSRBs), and surf zone submerged oil mats (SOM). Previous oil spills have demonstrated that removing oil residue from shoreline environments can cause more harm to the ecosystem than leaving the residue in place."

Thus, specific guidelines for the Monitoring and Maintenance phase of recovery are being developed to determine whether certain oiled habitats warrant further cleaning depending upon the anticipated damage to the environment by oil removal activities. In addition, NRDAR studies regarding potential effects to fish and wildlife resources are currently being conducted along the northern Gulf of Mexico coast.

Throughout the 2010-2011 wintering season piping plovers have been observed along the northern Gulf of Mexico coast. Casual observations from local birders and surveys conducted by oil spill responders have reported visibly oiled piping plovers at various locations in Louisiana. However, exact numbers of oiled piping plovers documented from this spill and the potential expanse of effects to those birds are currently being assessed through specific NRDAR studies; those results have yet to be analyzed or released to the public. Impacts to the species and its habitat are expected but the extent of those impacts remains hard to predict. Based on all available data prior to the Deepwater Horizon oil spill, the risk of impacts from contamination to piping plovers and their habitat was recognized, but the safety contingency plans were considered adequate to alleviate most of these concerns. The Deepwater Horizon incident has brought heightened awareness of the intensity and extent to fish and wildlife habitat from large-scale releases. In addition to potential direct habitat degradation from oiling of intertidal habitats and retraction of stranded boom, impacts to piping plovers may occur from ingestion of oiled benthic prey, loss of benthic prey from shoreline/beach cleaning, and the prolonged human disturbance associated with boom deployment and retraction, clean-up activities, wildlife response, and damage assessment crews working along affected shorelines.

Pesticides

In 2000, mortality of large numbers of wading birds and shorebirds, including one piping plover, at Audubon's Rookery Bay Sanctuary on Marco Island, Florida, occurred following the county's aerial application of the organophosphate pesticide Fenthion for mosquito control purposes (Williams 2001). Fenthion, a known toxin to birds, was registered for use as an avicide by Bayer, a chemical manufacturer. Subsequent to a lawsuit being filed against the Environmental Protection Agency (EPA) in 2002, the manufacturer withdrew Fenthion from the market, and EPA declared all uses of the chemical were to end by November 30, 2004 (American Bird Conservancy 2007). All other counties in the U.S. now use less toxic chemicals for mosquito control. It is unknown whether pesticides are a threat for piping plovers wintering in the Bahamas, other Caribbean countries, or Mexico.

Climate Change (sea-level rise)

Over the past 100 years, the globally averaged sea level has risen approximately 10 to 25 centimeters (cm) (Rahmstorf et al. 2007), a rate that is an order of magnitude greater than that seen in the past several thousand years (Douglas et al. 2001 as cited in Hopkinson et al. 2008). The IPCC suggests that by 2080 sea-level rise could convert as much as 33 percent of the world's coastal wetlands to open water (IPCC 2007). Although rapid changes in sea level are predicted, estimated time frames and resulting water levels vary due to the uncertainty about global temperature projections and the rate of ice sheets melting and slipping into the ocean (IPCC 2007; CCSP 2008).

Potential effects of sea-level rise on coastal beaches may vary regionally due to subsidence or uplift as well as the geological character of the coast and nearshore (CCSP 2009; Galbraith et al. 2002). In the last century, for example, sea-level rise along the U.S. Gulf Coast exceeded the global average by 13 to 15 cm, because coastal lands west of Florida are subsiding (EPA 2009). Sediment compaction and oil and gas extraction compound tectonic subsidence (Penland and Ramsey 1990; Morton et al. 2003;

Hopkinson et al. 2008). Low elevations and proximity to the coast make all nonbreeding coastal piping plover foraging and roosting habitats vulnerable to the effects of rising sea level. Furthermore, areas with small astronomical tidal ranges (e.g., portions of the Gulf Coast where intertidal range is less than 1 meter) are the most vulnerable to loss of intertidal wetlands and flats induced by sea-level rise (EPA 2009). Sea-level rise was cited as a contributing factor in the 68 percent decline in tidal flats and algal mats in the Corpus Christi area (i.e., Lamar Peninsula to Encinal Peninsula) in Texas between the 1950s and 2004 (Tremblay et al. 2008). Mapping by Titus and Richman (2001) showed that more than 80 percent of the lowest land along the Atlantic and Gulf coasts was in Louisiana, Florida, Texas, and North Carolina, where 73.5 percent of all wintering piping plovers were tallied during the 2006 IPPC (Elliott-Smith et al. 2009).

Inundation of piping plover habitat by rising seas could lead to permanent loss of habitat if natural coastal dynamics are impeded by numerous structures or roads, especially if those shorelines are also armored with hardened structures. Without development or armoring, low undeveloped islands can migrate toward the mainland, pushed by the over-washing of sand eroding from the seaward side and being re-deposited in the bay (Scavia et al. 2002). Overwash and sand migration are impeded on developed portions of islands. Instead, as sea-level increases, the ocean-facing beach erodes and the resulting sand is deposited offshore. The buildings and the sand dunes then prevent sand from washing back toward the lagoons, and the lagoon side becomes increasingly submerged during extreme high tides (Scavia et al. 2002), diminishing both barrier beach shorebird habitat and protection for mainland developments.

Modeling for three sea-level rise scenarios (reflecting variable projections of global temperature rise) at five important U.S. shorebird staging and wintering sites predicted loss of 20 to 70 percent of current intertidal foraging habitat (Galbraith et al. 2002). These authors estimated probabilistic sea-level changes for specific sites partially based on historical rates of sea-level change (from tide gauges at or near each site); they then superimposed this on projected 50 percent and 5 percent probability of global sea-level changes by 2100 of 34 cm and 77 cm, respectively. The 50 percent and 5 percent probability sea level change projections were based on assumed global temperature increases of 2° C (50 percent probability) and 4.7° C (5 percent probability). The most severe losses were projected at sites where the coastline is unable to move inland due to steep topography or seawalls. The Galbraith et al. (2002) Gulf Coast study site at Bolivar Flats, Texas, is a designated critical habitat unit known to host high numbers of piping plovers during migration and throughout the winter (e.g., 275 individuals were tallied during the 2006 IPPC) (Elliott-Smith et al. 2009). Under the 50 percent likelihood scenario for sea-level rise, Galbraith et al. (2002) projected approximately 38 percent loss of intertidal flats at Bolivar Flats by 2050; however, after initially losing habitat, the area of tidal flat habitat was predicted to slightly increase by the year 2100, because Bolivar Flats lacks armoring, and the coastline at this site can thus migrate inland. Although habitat losses in some areas are likely to be offset by gains in other locations, Galbraith et al. (2002) noted that time lags may exert serious adverse effects on shorebird populations. Furthermore, even if piping plovers are able to move their wintering locations in response to accelerated habitat changes, there could be adverse effects on the birds' survival rates or reproductive fitness.

Table 9 displays the potential for adjacent development and/or hardened shorelines to impede response of habitat to sea-level rise in the eight states supporting wintering piping plovers. Although complete linear shoreline estimates are not readily obtainable, almost all known piping plover wintering sites in the U.S. were surveyed during the 2006 IPPC. To estimate effects at the census sites, as well as additional areas where piping plovers have been found outside of the census period, Service biologists reviewed satellite imagery and spoke with other biologists familiar with the sites. Of 406 sites, 204

(50 percent) have adjacent structures that may prevent the creation of new habitat if existing habitat were to become inundated. These threats will be perpetuated in places where damaged structures are repaired and replaced, and exacerbated where the height and strength of structures are increased. Data do not exist on the amount or types of hardened structures at wintering sites in the Bahamas, other Caribbean countries, or Mexico.

Table 9. Number of sites surveyed during the 2006 winter IPPC with hardened or developed structures adjacent to the shoreline. Those marked with an asterisk (*) are additional sites that were not surveyed in the 2006 IPPC.

State	Number of sites surveyed during the 2006 winter Census	Number of sites with some armoring or development	Percent of sites affected
North Carolina	37 (+2)*	20	51
South Carolina	39	18	46
Georgia	13	2	15
Florida	188	114	61
Alabama	4 (+2)*	3	50
Mississippi	16	7	44
Louisiana	25 (+2)*	9	33
Texas	78	31	40
Overall Total	406	204	50

Sea-level rise poses a significant threat to all piping plover populations during the migration and wintering portion of their life cycle. Ongoing coastal stabilization activities may strongly influence the effects of sea-level rise on piping plover habitat. Improved understanding of how sea-level rise will affect the quality and quantity of habitat for migrating and wintering piping plovers is an urgent need.

Storm events

Although coastal piping plover habitats are storm-created and maintained, the 1996 Atlantic Coast Recovery Plan also notes that storms and severe cold weather may take a toll on piping plovers, and the 2003 Great Lakes Recovery Plan postulates that loss of habitats, such as over-wash passes or wrack, where birds shelter during harsh weather, poses a threat. Storms are a component of the natural processes that form coastal habitats used by migrating and wintering piping plovers, and positive effects of storm-induced over-wash and vegetation removal have been noted in portions of the wintering range. For example, Gulf Islands National Seashore habitats in Florida benefited from increased washover events that created optimal habitat conditions during the 2004 and 2005 hurricane seasons, with biologists reporting piping plover use of these habitats within six months of the storms (Nicholas 2005 pers. communication). Hurricane Katrina (2005) over-washed the mainland beaches of Mississippi, creating many tidal flats where piping plovers were subsequently observed (Winstead 2008). Hurricane Katrina also created a new inlet and improved habitat conditions on some areas of Dauphin Island, Alabama (LeBlanc 2009 pers. communication). Conversely, localized storms, since Katrina, have induced habitat losses on Dauphin Island (LeBlanc 2009 pers. communication).

Noel et al. (2005) suspect that changes in habitat caused by multiple hurricanes along the Georgia coastline altered the spatial distribution of piping plovers and may have contributed to mortality of three Great Lakes piping plovers wintering along the Georgia coastline. Following Hurricane Ike in 2008, Arvin (2009) reported decreased numbers of piping plovers at some heavily eroded Texas

beaches in the center of the storm impact area and increases in plover numbers at sites about 100 miles to the southwest. However, piping plovers were observed later in the season using tidal lagoons and pools that Ike created behind the eroded beaches (Arvin 2009).

The adverse effects on piping plovers attributed to storms are sometimes due to a combination of storms and other environmental changes or human use patterns. For example, four hurricanes between 2002 and 2005 are often cited in reference to rapid erosion of the Chandeleur Islands, a chain of low-lying islands in Louisiana where the 1991 IPPC tallied more than 350 piping plovers. Comparison of imagery taken three years before and several days after Hurricane Katrina found that the Chandeleur Islands lost 82 percent of their surface area (Sallenger et al. 2009), and a review of aerial photography prior to the 2006 IPPC suggested little piping plover habitat remained (Elliott-Smith et al. 2009). However, Sallenger et al. (2009) noted that habitat changes in the Chandeleur Islands stem not only from the effects of these storms but rather from the combined effects of the storms, long-term (i.e., greater than 1,000 years) diminishing sand supply, and sea-level rise relative to the land. Sallenger et al. (2009) went on to explain that although the marsh platform of the Chandeleur Islands continued to erode for 22 months post-Katrina, some sand was released from the marsh sediments which in turn created beaches, spits, and welded swash bars that advanced the shoreline seaward. Thus, although intense erosional forces have affected the Chandeleur Islands, they are still providing high quality shorebird habitat in the form of sand flats, spits, and beaches, until they are eroded below sea level. On January 18 and 19, 2011, piping plover surveys of the Chandeleur Islands were conducted by the piping plover NRDAR study team. Catlin et al. (2011) observed 194 piping plovers utilizing the Chandeleur Islands, and the birds were not distributed uniformly across the islands but were clumped mostly in three locations. Because the survey was conducted within a two-day window, Catlin et al. (2011) believe that higher numbers of piping plovers are likely using the islands during spring and fall migration.

Other storm-induced adverse effects include post-storm acceleration of human activities such as beach nourishment, sand scraping, and berm and seawall construction. Such stabilization activities can result in the loss and degradation of feeding and resting habitats. Storms also can cause widespread deposition of debris along beaches. Removal of debris often requires large machinery, which can cause extensive disturbance and adversely affect habitat elements such as wrack. Another example of indirect adverse effects linked to a storm event is the increased access to Pelican Island (LeBlanc 2009 pers. communication) due to merging with Dauphin Island following a 2007 storm (Gibson et al. 2009).

Recent climate change studies indicate a trend toward increasing hurricane numbers and intensity (Emanuel 2005; Webster et al. 2005). When combined with predicted effects of sea-level rise, there may be increased cumulative impacts from future storms. Storms can create or enhance piping plover habitat while causing localized losses elsewhere in the wintering and migration range. Available information suggests that some birds may have resiliency to storms and move to unaffected areas without harm, while other reports suggest birds may perish from storm events. Significant concerns include disturbance to piping plovers and habitats during cleanup of debris along shorelines and post-storm acceleration of shoreline stabilization activities, which can cause persistent habitat degradation and loss.

Threats Summary

Habitat loss and degradation on winter and migration grounds from shoreline and inlet stabilization efforts, both within and outside of designated critical habitat, remain a serious threat to all piping

plover populations. Modeling strongly suggests that the population is very sensitive to adult and juvenile survival. Therefore, while there is a great deal of effort extended to improve breeding success, and thus improve and maintain a higher population over time, it is also necessary to ensure that the wintering habitat, where birds spend most of their time, is secure. On some of the wintering grounds, the shoreline areas used by wintering piping plovers are being developed, stabilized, or otherwise altered, generally making the habitat unsuitable. Even in areas where habitat conditions are appropriate, human disturbance on beaches may negatively impact piping plovers' energy budget, as they may spend more time being vigilant and less time in foraging and roosting behavior. In many cases, the disturbance is severe enough that piping plovers appear to avoid some areas altogether. In addition, natural events (e.g., climate change, hurricanes, etc.) can pose a potential threat to piping plover habitat on an irregular basis. Threats on the wintering grounds may impact piping plovers' breeding success if they start migration or arrive at the breeding grounds with a poor body condition.

Analysis of the species/critical habitat likely to be affected

The proposed action has the potential to adversely affect wintering piping plovers and their habitat, including designated critical habitat in Unit LA-5, within the action area. The construction activities may lead to temporarily diminished quantity and quality of intertidal foraging and roosting habitats within the project area and action area, resulting in decreased survivorship of migrating and wintering plovers and temporary adverse effects to critical habitat. The length of construction activities (which varies from 2 to 3 years) may delay the recovery of benthic species due to the prolonged disturbance of the benthic fauna. Ultimately, the project goal is to restore the diversity of coastal barrier headland and island habitats, but the temporary effects of construction will require time for natural recovery and would extend beyond one wintering season. The detailed effects of the proposed action on piping plovers and critical habitat will be considered further in the remaining sections of this opinion.

ENVIRONMENTAL BASELINE

Louisiana's loss of wetlands and barrier islands to open water is now a well-documented fact in numerous studies. Since the 1930s Louisiana has lost 1,900 square miles of land (approximately 1.2 million acres). From 1990 to 2000, approximately 24 square miles of coastal land were lost each year. The 2004 Louisiana Coastal Area Ecosystem Restoration Study projected that 513 square miles of land would disappear by 2050, including a gain of 161 square miles from projects constructed under the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) (Corps 2004). In Louisiana, barrier headland and island erosion is attributable to increasing tidal prism, insufficient volumes of sediment supplied by littoral currents, land subsidence, and sea-level rise (Boesch 1982). Although increases in the tidal prism may be primarily responsible for enlargement of tidal passes, the insufficient supply of sand available to rebuild eroded areas has also contributed to increased tidal pass widths and shoreline retreat (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1999). Where insufficient supplies of sand prevail, measures to maximize sand retention, such as sand fencing and vegetative planting, are used to effectively rebuild and maintain such eroded areas.

Louisiana barrier headlands and islands are part of a complex and dynamic coastal system that continually respond to tidal passes, tides, wind, waves, erosion and deposition, long-shore sediment transport and depletion, fluctuations in sea level, and weather events. During storm events, over-wash is common across the barrier islands and headlands, depositing sediments on the bay-side or landward side, clearing vegetation and increasing the amount of open, sand flat habitat ideal for shoreline dependent shorebirds. Winds move sediment across the dry beaches forming low dunes. The natural

communities contain plants and animals that are subject to shoreline erosion and deposition, salt spray, wind, drought conditions, and sandy soils. Vegetative communities include fore dunes, occasional primary dunes, salt marsh, and black mangroves.

The Caminada headland and Shell Island provide important geomorphic, hydrologic and habitat functions in the Barataria basin. The Corps' modeling results have shown that barrier islands decrease wave energy landward of the island during tropical events. When the barrier islands were degraded in the models, the modeled wave heights increased, thus heightening the potential for overtopping levees and inundation of protected areas. Sustaining the geomorphic form of the barrier islands will provide storm surge protection for the interior wetlands and the surrounding coastal communities. Modeling (which excluded the BBBSR project in its future projections) also estimated that by 2060, 75 percent of the land between the Caminada headland and the Larose to Golden Meadow Hurricane Risk Reduction levees would be lost. In addition, the barrier islands in Plaquemines Parish, including Shell Island, will have disappeared as well as the marshes between the islands and the Mississippi River levees. Salinity modeling reflecting a without-project condition demonstrates the function of the barrier islands in separating the marine from the estuarine environments. On the eastern side of the basin, in areas where the barrier islands are severely eroded (e.g., the Shell Island reach), the salinity fields grow proportionally larger.

The Caminada barrier headland is the predominant feature of the Bayou Lafourche barrier system that includes flanking islands and the retreating headland of the Bayou Lafourche distributary of the Mississippi River (Figure 2) along the southwestern portion of the Barataria Basin. The southwest to northwest-oriented Caminada headland extends approximately 13.18 miles (21.21 km) between Belle Pass to the west and Caminada Pass to the east. Historic maps show that the west end of the Caminada headland is retreating more rapidly than the east end of the headland (Williams et al. 1992). It is one of the most rapidly eroding shorelines in the United States (McBride et al. 1992; Connor et al. 2004). The headland has historically suffered loss of wildlife habitat value and diminished function due to storm overtopping and breaching, saltwater intrusion, wind and wave induced erosion, sea level rise, subsidence, and man-made structures. The observed average shoreline erosion rate at the Caminada Headland is approximately 45 feet per year, and increased stress on the fish and wildlife in the area is expected as habitats continue to be lost.

The Caminada headland consists of narrow and low-lying sand dunes and beaches, barrier marshes, chenier ridges interspersed with mangrove thickets, coastal dune shrub thickets, lagoons, and small bayous. The Corps estimates the average dune elevation to be 3.4 feet NAVD and the back-barrier marsh is approximately 0.94 feet NAVD. Port Fourchon and a Chevron oil and gas facility are located at the western end of the headland and north of the action area. Several marsh restoration projects have occurred on the landward side of the dune along portions of the headland, and multiple sand fencing projects have occurred on the remnant dunes along much of the headland. An existing shoreline protection project consisting of cement-filled geotextile tubing and submarine cement mats extends from the east jetty of Belle Pass to Bay Champagne. That project was constructed in the early-1980s, prior to the piping plover's listing as a threatened species, and the Port Commission along with the local parish government plan to restore it as a result of damage from the 2005 and 2008 hurricane seasons. The Corps also conducts maintenance dredging every 2 years (if needed) within Belle Pass, and deposits material every other cycle along the Caminada headland adjacent to the east jetty. That material is placed unconfined, no closer than 100 feet from the top-of-bank (i.e., in the surf zone), and to an elevation of +6 feet Mean Low Gulf (MLG) (approximately +5 feet NAVD). The linear distance of shoreline nourished varies for each event, and the material is allowed to be naturally re-worked by

wind and wave action. Once the BBBSR project is implemented that material would no longer be placed adjacent to the east jetty but would be used for the sub-tidal feeder bar.

Although much of the headland is privately owned, the beaches are easily accessible by vehicle, foot, or boat, and are generally open to the public for recreation, birding, and fishing. The eastern end of the Caminada headland consists of Elmer's Island which is partially owned by the State, actively managed by LDWF, and is separated from Grand Isle (the State's only inhabited island) by Caminada Pass. That beach is also accessible by vehicle, foot, or boat and open to the general public for recreation, birding, and fishing. As a result of the Deepwater Horizon oil spill and since May 2010, the State and private landowners along the Caminada headland restrict public access when legacy cleanup and O&M activities are necessary.

The Shell Island reach is part of the Plaquemines barrier system along the southeastern portion of the Barataria Basin. Prior to Hurricane Bob in 1979, Shell Island (formerly Lanaux Island) was a continuous barrier island that helped to protect the interior coastal wetlands of the eastern Barataria Basin. The Corps estimates a shoreline recession rate of approximately 10 feet per year along the easternmost 5,000 to 8,000 feet of Shell Island, and indicates that rate is most likely due to installation of the Empire jetties (built in 1950) at the mouth of Fontanelle Pass. Shell Island is now characterized as an undeveloped, rapidly retreating, remnant barrier island (and associated spits and shoals) which partially encloses shallow bays such as Shell Island Bay and Bastian Bay (Figure 3). The Shell Island reach extends approximately 5.24 miles (8.43 km) between Grand Bayou Pass to the west and the Empire jetties to the east. The remnant island along the western edge of the Shell Island reach is approximately 1.41 (2.27 km) miles long and extends from Grand Bayou Pass to Coupe Bob; it is composed primarily of reworked oyster shells that formed into ridges and swales produced by waves refracting into the entrance to Grand Bayou Pass. The remnant island along the eastern edge of the Shell Island reach is approximately 2.54 miles long (4.09 km) and extends from Coupe Bob to Fontanelle Pass; it consists of marsh with a narrow strip of beach along its Gulf-ward side. These rapidly retreating barrier islands are becoming increasingly narrower and are completely separated from the remnants of Plaquemines Parish interior marshes.

Any exposed land (i.e., land above mean high tide) within the Shell Island reach is likely to be privately owned; however, much of the reach has been severely eroded and claimed as State water bottoms. Access to the area is by boat only; thus, human disturbance in the area generally consists of nearby recreational and commercial fishing, occasional oil and gas activity, and annual aerial surveys of nesting shorebird colonies conducted by LDWF. Since the Deepwater Horizon oil spill in April 2010, human activity in the area has increased due to cleanup and O&M activities, as well as construction of 8,439 linear feet (to an elevation of +6 NAVD) of a protective sand berm (as part of the emergency response) along the eastern end of the reach.

The Corps anticipates that the TSP would prevent the fragmentation of the Caminada headland and greatly ameliorate impacts on several important socio-economic sectors such as: Port Fourchon, the largest base for offshore oil and gas operations in coastal Louisiana and the largest coastal fishing port; major oil and gas infrastructure, such as regional transportation and storage facilities, the LOOP, and the Mars pipeline; and the regional hurricane evacuation route serving residents of southern Lafourche Parish, the community of Grand Isle, and approximately 6,000 workers stationed at offshore facilities in the central Gulf of Mexico. By decreasing the rate of erosion and preventing the splintering of the headland, the investment in infrastructure located at Port Fourchon will be less vulnerable to storm surges. Oil and gas pipelines and Louisiana Highway 1 maintenance requirements will lessen compared to the future-without-project conditions. Closure of the Shell Island reach would also aid in

protection of interior marshes within the eastern Barataria Basin and restoration of the tidal prism through Grand Bayou, Bastian Bay, and Shell Island Bay.

Status of the species within the action area

Assessing the number of piping plovers within the action area during winter is difficult for two main reasons: (1) the number of birds utilizing both the Caminada headland and Shell Island reach varies from year to year and throughout each wintering season; and (2) suitable habitat within the Shell Island reach is difficult to assess due to its remote location and generally poor winter weather conditions. Because winter generally produces inclement weather conditions, daily surveys over any length of time during the wintering season are also difficult to coordinate. Consequently, surveys for non-breeding (e.g., over-wintering and migrating) plovers within the Shell Island reach of the action area have been sporadic.

Because the 2005 hurricane season severely damaged much of the piping plover critical habitat across the state, the Service provided funding to the LDWF to conduct post-hurricane impact assessments of piping plovers and their habitat across the Louisiana coast for a three-year period. The LDWF conducted annual, one-day-count piping plover surveys between January 1 and February 18 from 2007 through 2010 (they were able to add a fourth year with the funding provided). Due to lack of manpower and inclement weather (e.g., dangerous boating conditions) LDWF was unable to survey the Shell Island reach in 2007, 2008, and 2009. For surveys that have been successful, results indicate that piping plovers utilize any non-vegetated or sparsely vegetated portions of the subject barrier headlands and islands. Such habitat consists of sand beaches, spits, and flats, mud flats, shell beaches, and oyster reefs associated with both the Gulf- and bay-sides of headlands and islands, as well as washover areas created by storm events. We have also gained access to preliminary survey data related to the Deepwater Horizon oil spill[7]. Survey results from the past 20 years are depicted in Table 10.

Table 10. Piping plover survey results within the action area and nearby beaches and headlands.

	Fourchon Beach and/or Bay Champagne[a]	Elmer's Island[a]	Shell Island[a]	West Belle Pass[b]	Chaland Beach[c]
1991 IPPC[d] Winter Survey	42	1	NS	NS[g]	NS
1996 IPPC Winter Survey	0	0	NS	15	NS
2001 IPPC Winter Survey	0	19	NS	18	NS
2006 IPPC Winter Survey	21	15	NS	1	NS
2006-07 CWS[e] Winter Survey	38	5	NS	0	NS
2007 LDWF[f] Winter Survey	0	14	NS	0	NS
2008 LDWF Winter Survey	41	17	NS	13	NS
2009 LDWF Winter Survey	13	23	NS	25	NS
2010 LDWF Winter Survey	13	38	6	46	6
2010 MC252 Fall Surveys	11	25	1	30	7
2011 MC252 Winter Surveys	20	51	NS	42	NS

(a) Beaches within the action area; (b) West Belle Pass is the small remnant strip of headland on the west side of Belle Pass (just west of the Caminada headland); (c) Chaland Beach is the headland west of Shell Island and Grand Bayou; (d) IPPC = International Piping Plover Census; (e) CWS = Canadian Wildlife Service, Maddock 2008; (f) LDWF = Louisiana Department of Wildlife and Fisheries-Natural Heritage Program; (g) NS = Not Surveyed.

[7] The data depicted in Table 10 for the Deepwater Horizon oil spill were collected from three sources: (1) deployed Service biologists, (2) contracted Natural Resource Advisors (NRAs), or (3) the NRDAR study team. The NRDAR study team followed specific survey protocols and surveys were conducted on a regular basis, as weather permitted. Surveys conducted by the Service or NRAs were done on an irregular basis, although daily surveys were attempted for some areas, and no specific survey methodology was used. Therefore, the survey methodologies used in collecting the oil spill data are not the same as the survey methodology used in the IPPC or LDWF winter surveys. Any data comparisons should carefully note differences in survey methodologies before any conclusions can be drawn from such comparisons.

The Final Determinations of Critical Habitat for Wintering Piping Plovers (Service 2001b) describes critical habitat within the project action area as:

> ". . . the Gulf shoreline extending approximately 11 km (6.8 miles) east from the east side of Belle Pass bounded on the seaward side by MLLW [mean low low water] and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; all of Elmer's Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmer's Island to approximately 0.9-km (0.56-mile) west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur . . ."

At the time of designation approximately 24,964 acres of wintering habitat were designated in Louisiana, and Unit LA-5 consisted of approximately 5,735 acres of that total. Large portions of the Caminada headland are included in that acreage for Unit LA-5. Approximately 1,558 acres of the Caminada barrier headland consisted of sparsely or non-vegetated habitat suitable for piping plovers (based upon 1998 aerial photography), of which approximately 370 acres existed on Elmer's Island and the remaining 1,188 acres existed on Fourchon Beach/Bay Champagne. The Shell Island reach is not included in designated piping plover critical habitat; however, it does provide some amount of suitable habitat for piping plovers. The current acreage of the exposed land along the Shell Island reach has not been estimated; however, 8,439 linear feet (elevation of +6 NAVD) of a protective sand berm has been constructed along the eastern remnant island of the reach as a result of the Deepwater Horizon oil spill. Until that sand berm is eroded below sea level, it will provide suitable habitat for piping plovers.

Based on 2008 aerial photography, the Corps estimates that approximately 485 acres (29 acres dune, 356 acres supratidal, and 100 acres Gulf intertidal) of critical habitat currently exist within the proposed project footprint on the Caminada headland. According to conversations with the Service's coastal restoration biologist working directly with the Corps on this project, the dune, supratidal, and intertidal habitat designations were defined by the Corps during habitat assessments as follows: (1) dune habitat includes any elevations within the project footprint at or above 5 feet NAVD; (2) supratidal habitat includes any elevations within the project footprint at or between 2 and 4.9 feet NAVD; and (3) Gulf intertidal habitat includes any elevations within the project footprint between zero and 2 feet NAVD. Based on evaluations of digital orthophoto quarter quadrangle (DOQQ) imagery dating from 2005 to 2010, light detection and ranging (LIDAR) imagery, and January 2009 and August 2010 site visits, the Service determined that the Corps' habitat acreages need to be defined in terms of suitable piping plover habitat instead of in terms of habitat designations for wetland value assessments. In order to interpret the Corps' habitat designations in terms of suitable habitat for piping plovers, the Service describes the Corps' habitat designations more specifically as follows:

1. The existing dune habitat within the project footprint consists of clumps of remnant dune generally dispersed throughout the high marsh/high beach interface. Those 29 acres of dune should not be considered as suitable piping plover habitat because those areas are densely vegetated and do not exhibit features of suitable piping plover habitat as described above.

2. The supratidal habitat classification includes both the high marsh on the landward side and the high beach along the Gulf side of the remnant dune within the project footprint (i.e., 356 acres). The high marsh consists of densely vegetated areas that are not suitable for the piping plover and are specifically excluded from designated critical habitat as described above. The high

beach consists of bare or sparsely vegetated sand flats above the high tide mark. Because the supratidal habitat area is roughly divided along the centerline of the remnant dune, we believe that no more than half (i.e., 178 acres) of the supratidal habitat classification acreage actually consists of high beach that is suitable roosting habitat for the piping plover.

3. The 100 acres of Gulf intertidal habitat does consist of suitable foraging habitat for the piping plover and is included within the critical habitat designation. That acreage is inclusive of tidal fluctuations throughout the year.

Based on the above information, the Service estimates that approximately 278 acres (178 acres of high beach and 100 acres of Gulf intertidal habitat) of designated critical habitat would be affected by the Caminada Headland-portion of the proposed project. That acreage is approximately 1.1 percent and 4.8 percent of the total acreage of wintering habitat in Louisiana and Unit LA-5, respectively.

Factors affecting species environment within the action area

As mentioned previously, the Caminada headland is the southernmost edge of the mainland and is easily accessed by the public via foot, vehicle, or boat. Only a portion of Elmer's Island (the eastern edge of the headland) is actively managed by LDWF. Port Fourchon and a Chevron facility are located adjacent to the action area on the northwestern portion of the headland. The entire headland receives regular visitors for fishing and bird watching year round and has persistent boat and helicopter traffic to and from the port and nearby support facilities for offshore oil and gas structures. In contrast, the Shell Island reach remains undeveloped and is isolated from the mainland. Any exposed land is afforded protection from major disturbance activities solely due to its remoteness since it is only accessible by boat. Other than infrequent bird surveys (usually conducted from helicopter or fixed-wing aircraft) and nearby boat traffic from fishing and offshore oil and gas activities, the remnant islands within the Shell Island reach do not receive regular visitors.

Mammalian predators (e.g., raccoons, coyotes) occur throughout the Caminada headland, but have limited access to the Shell Island reach. Mammalian predators may swim back and forth to the remnant islands of the Shell Island reach from the nearest mainland, but the islands do not provide enough shelter or forage to sustain a constant predator population. Somewhat regular storm events (e.g., flooding) also tend to discourage mammals from persisting on the remnant islands. Avian predators may also be present within both portions of the action area throughout the year but likely peak during fall and spring migration periods.

A nearby coastal restoration project would also occur in proximity to the action area. In the fall and winter of 2011, the NMFS plans to construct the West Belle Pass Headland Restoration Project under the authority of the CWPPRA program. Piping plovers that normally utilize that area may be temporarily dislocated to the Caminada headland during that project's construction period.

The Deepwater Horizon spill, which started April 20, 2010, discharged into the Gulf of Mexico through July 15, 2010. In May and early June 2010, the presence of oil was confirmed on the Caminada headland and Shell Island reach; those areas were oiled repeatedly throughout the summer months until the damaged oil well was sealed. Shoreline Cleanup Assessment Team (SCAT) reports throughout the duration of the spill documented various degrees of oiling along each of those areas (Table 11). At the time this document is being written, oil spill response efforts are ongoing in the form of continued SCAT surveys, Stage III cleanup efforts, Stage IV maintenance and monitoring efforts, and early stages of developing legacy cleanup procedures.

Table 11. Results of the SCAT reports for the Deepwater Horizon oil spill and cleanup activities along the Caminada headland and Shell Island reach.

Location	Extent of Oil	Cleanup Actions Proposed or Implemented
Elmer's Island	Tar balls; small pools of oil; 11 major tar mats; mousse	Mechanical cleanup with heavy machinery; removal of oiled wrack; beach tilling
Fourchon Beach	Tar balls; tar mats; surface oil residue; partially buried oiled seaweed; oil onshore	Mechanical cleanup with heavy machinery; removal of oiled wrack; beach tilling
West Bay Champagne	10 to 12 discreet patches of oil; tar patties	Mechanical cleanup with heavy machinery; removal of oiled wrack; beach tilling
Shell Island reach (Lanaux Island)	Tar balls; mousse on sand beaches and in marsh areas	Manual cleanup with shovels; removal of oiled wrack

At this time, it is unknown if there are any current or lasting effects to piping plovers migrating or wintering within the action area (i.e., the number of oiled piping plovers observed during NRDAR studies has not yet been released) or to the inter-tidal invertebrate food source used by piping plovers from either oil or oil dispersants and resulting cleanup activities within the action area. A greater impact to the piping plover and its habitat might be the prolonged human disturbance associated with ongoing cleanup activities, wildlife response, and damage assessment crews highly visible on the shorelines, as well as ongoing SCAT surveys and legacy cleanup activities.

EFFECTS OF THE ACTION

The proposed action includes marsh creation and dune and beach restoration along 13.18 miles of headland and 5.24 miles of mixed open water and remnant barrier islands, as well as placement of a 13,000-foot-long subtidal feeder bar offshore of the Caminada headland. The proposed project intends to lengthen and widen the Gulf shorelines of the Caminada headland and Shell Island reach in order to add much-needed sediment to the barrier coastal system of the Barataria Basin, prolong the existence of those land features, and restore barrier headland and island habitat, function, and morphology. Much of the proposed project would occur in habitat that is used regularly by piping plovers and designated as critical habitat for the species. Construction of the fully proposed TSP will overlap with multiple piping plover wintering seasons for both portions of the project. Short-term and temporary construction impacts to piping plovers will occur when the birds are roosting and feeding in the area.

The deposition of sand and marsh material will temporarily deplete the intertidal food base along the Gulf beach and bay-side flats, respectively, and temporarily disturb foraging and roosting birds during project construction on the headland and Shell Island. The shaping and grading of the restored beach and dune would cause disturbance and also remove wrack that has accumulated on the Gulf-side of the headland and remnant islands of the Shell Island reach. This would affect feeding and roosting habitat for piping plovers, since they often use wrack for cover and foraging. The construction of the marsh creation area will cover any existing bay-side flats used by foraging plovers and will render that area unusable until natural processes re-work the sediments and washover areas are again created by tidal and storm events and benthic prey species re-colonize those areas. Similar effects will occur again during renourishment periods (see project plan descriptions on pages 3 through 8 for target years) and benthic effects would extend for up to 2 years beyond the renourishment period until the benthic fauna recovers. The temporary increase in human presence and construction activity on the headland and remnant islands may also disturb piping plovers from utilizing adjacent areas outside of the project footprints, such as nearby sand spits and washover areas. Construction of the subtidal feeder bar

would occur completely offshore of the Caminada headland. Placement of O&M dredged material from the West Belle Pass channel every 1.5 to 2 years would be used to maintain the subtidal feeder bar. According to the Corps, the fine sediment placed in the subtidal feeder bar is not expected to cause extensive stacking of sediment on the beach which could smother benthic fauna. Thus, the subtidal feeder bar would not contribute additional stress to the remaining benthic community within piping plover critical habitat. Overall, the entire project would ultimately benefit piping plover habitat by creating new beach habitat and adding sediment to the Barataria Basin barrier system to be re-worked by natural forces.

The geomorphic characteristics of barrier headlands and islands, dunes, over-wash fans, and inlets are critical to a variety of natural resources and influence a barrier system's ability to respond to wave action, including storm over-wash and sediment transport. The protection or persistence of these important natural processes and wildlife resources are part of the goal of this restoration project. The newly created beach, dune, and marsh will not impede over-wash but may temporarily consist of less optimal roosting and foraging habitat until natural wrack is restored, the benthic prey base is able to recover from the construction activities, and washover areas are again created by natural tidal and weather events. The newly added sediment will be reworked by natural wind and wave processes which will, given time, create sand spits and flats on the ends and bay-sides of the islands, or as sediment is lost from one island, it will be carried by long-shore transport to another island. Thus, piping plover foraging, roosting, and critical habitat will continue to be lost and created through the natural processes associated with daily tidal events and future storm events.

Factors to be considered

Proximity of the action

Lack of regular surveys, fluctuation of use by piping plovers from year to year, and differences in numbers of birds migrating through versus those over-wintering, make it difficult to estimate the number of birds actually using any particular area (headland or island, Gulf- or bay-side) within the action area. Based on survey data depicted in Table 10 (page 41), numbers of piping plovers over-wintering within the action area can range anywhere from one to 51 birds scattered along the Caminada headland (i.e., Fourchon Beach, Bay Champagne, Elmer's Island) and from one to six birds scattered along the remnants of Shell Island; those estimates do not include migrating piping plovers. We expect direct short-term effects in the form of: (1) disturbance due to human presence and equipment noise during onshore pipeline construction activities, sediment placement, dune/beach construction, marsh creation, and vegetative planting; and (2) a temporary loss of food base within the intertidal zone on both the Gulf- and bay-sides of the project footprint on the Caminada headland and Shell Island reach for up to 2 years following completion of sediment placement until the benthic community re-colonizes the project areas. Within the Caminada headland portion of the project, 278 acres is included within critical habitat Unit LA-5. No designated critical habitat occurs within the Shell Island reach. West Belle Pass and East Timbalier Island located west of the Caminada headland and Chaland Beach located west of the Shell Island reach would not be included within any portions of the action area; all of those areas outside of the action area would provide available habitat during project construction. However, a CWPPRA restoration project has been planned for the West Belle Pass headland. Construction funding was allocated in late 2009, and construction is proposed to begin in the fall or winter of 2011. If it remains on schedule through its construction, the restoration of the West Belle Pass headland should be completed and fully available to piping plovers prior to the initiation of the BBBSR project

Distribution

The Corps proposes project construction activities on the Gulf- and protected-sides of the 13.18-mile-long Caminada headland within Lafourche and Jefferson Parishes and the 5.24-mile-long Shell Island reach in Plaquemines Parish. We expect direct effects to wintering piping plovers along existing sand beaches, spits, and flats, mud flats, shell beaches, oyster reefs, and washover areas associated with the Gulf shoreline of the headland and the entire Shell Island reach as a result of human activity and ground disturbance in those areas. Similar temporary disturbance would occur again during a renourishment cycle on the Gulf-side of Shell Island only. Renourishment for the Caminada headland would occur as a result of the replenished sub-tidal feeder bar located just offshore of the headland at its nodal point near the mouth of Bayou Moreau (Figure 2), which would not require any onshore activities during each replenishment of the feeder bar.

Timing

Construction of the TSP will overlap with multiple piping plover wintering/migrating seasons (mid-July to late April) and with construction of several other barrier headland and island restoration projects along the Louisiana coast.

Nature of the adverse effect

The effects to piping plovers may be direct, indirect, and short-term. Activities that impact or alter the use of optimal habitat or increase disturbance to the species may directly decrease the survival and recovery potential of the piping plover by limiting the ability of birds to rest and replenish their fat reserves for spring migration. We expect direct, short-term impacts from human disturbance during project construction to both the bird and its habitat. We anticipate a temporary (i.e., up to 2 years post-construction) decrease in benthic prey species within all existing piping plover foraging habitat within the project footprint as a result of sand and marsh material placement and loss of natural wrack. Following one or two growing seasons, the dune portion of the project may become densely vegetated and would no longer be suitable roosting habitat for piping plovers until a storm event creates over-wash fans. Until the benthic community recovers and new over-wash fans are created, a temporary decrease in prey items and roosting habitat may result in a decrease in the survival of birds on migrating or wintering grounds due to lack of optimal habitat. That situation can contribute to decreased survival rates and may indirectly result in decreased productivity on the breeding grounds. Such effects may temporarily result in increased vulnerability to any of the three piping plover breeding populations.

The effects to 278 acres of critical habitat in Unit LA-5 result from activities that impact or alter the PCEs (disturbance to the species) which may decrease the survival and recovery potential of the piping plover. Such effects consist of temporary reductions in the value of the unit from disturbance to foraging and roosting piping plovers due to human activity during construction, temporary removal of wrack, and a temporary decrease in benthic prey species due to sand placement along the Gulf shoreline. In addition, existing over-wash areas would be covered by placement of new material until natural coastal processes (e.g., daily tidal events, storm events, etc.) are allowed to re-work the additional sediment to create new over-wash areas on Caminada and new sand and mud flats on Shell Island. That acreage (i.e., 278 acres) is approximately 1.1 percent and 4.8 percent of the total acreage of wintering habitat in Louisiana and Unit LA-5, respectively.

Duration

For the TSP initial construction would be completed in approximately 2 to 3 years, with additional time (see project details on pages 3 through 8 for exact timelines) for vegetative planting following dewatering and settlement of the newly placed material. The activities associated with construction of the marsh creation are a one-time occurrence for each portion of the project. Construction of the dune and beach would initially occur at TY1 for the headland and the island; however, two renourishment events (TY20 and TY40) would occur for Shell Island. Each activity may vary in duration depending on the amount of work needed, weather conditions, and equipment mobilization and maintenance. The Corps anticipates beginning construction on the TSP in April 2013. We do not expect long-term, permanent alteration of the natural coastal processes, and the two renourishment events would result in a pulse effect that would temporarily disturb the Gulf-side of the restored Shell Island while the bay-side of the island would remain untouched after initial construction. The initial addition of sand material on 278 acres of critical habitat Unit LA-5 is expected to decrease the quality of foraging habitat from 6 months up to 2 years until the intertidal benthic fauna recovers to normal population levels and natural wrack returns to the shoreline. The sub-tidal feeder bar along the Caminada headland would be reworked by natural processes and would not be placed directly within piping plover foraging habitat.

Disturbance frequency, intensity, and severity

We anticipate that construction activities would have short-term and temporary effects on piping plover populations. We expect short-term disturbance from construction activities and short-term effects due to sand and marsh material placement. Direct effects to 278 acres of critical habitat Unit LA-5 would include temporary removal of wrack, temporary smothering of intertidal benthic prey species at TY1 on the Gulf shoreline of the Caminada headland, and the creation of a dune that may eventually become densely vegetated until new over-wash fans are created. We anticipate that: (1) piping plovers located within the construction area would move outside of the construction zone due to disturbance; (2) natural wrack would be deposited on the Caminada headland and Shell Island reach beaches following normal tidal events; (3) the intertidal benthic fauna would recover within 6 months to 2 years of each initial disturbance event and the two renourishment events on Shell Island; and (4) the density of dune vegetation will ebb and flow as tidal and storm events naturally affect dune vegetation growth. We do not anticipate any permanent adverse changes to barrier headland and island morphology because initial construction elevations and follow-up renourishment elevations would not prevent island washover during storm events and the created marsh platforms would allow for natural headland and island retreat or "rollover." There would not be any increased or continual disturbance within critical habitat Unit LA-5 as a result of the BBBSR project. Over the long-term the additional sediment would allow for creation of piping plover habitat on the Caminada headland and Shell Island as natural processes re-work the sediment to create over-wash areas, sand flats, mud flats, and sand spits.

Analysis for the effects of the action

Direct effects

Direct effects are those direct or immediate effects of a project on the species and/or its habitat. Implementation of the proposed action is not likely to directly kill and piping plovers since the birds are highly mobile and can quickly move out of harm's way. The construction window will extend through several piping plover migration and wintering seasons for the proposed TSP. Heavy

machinery and equipment (e.g., ORVs and bulldozers operating on project area beaches and bay-side sand and mud flats, the placement of the dredge pipeline along the beach, and sand and marsh material disposal) may directly affect migrating and wintering piping plovers in the project area by disturbance and disruption of normal activities such as roosting and feeding, and possibly forcing birds to expend valuable energy reserves to seek available habitat elsewhere.

Direct effects to critical habitat Unit LA-5 consist of sand and marsh material placement over 278 acres of existing habitat on the Gulf shoreline of the Caminada headland at TY1 which would result in temporary loss of wrack, temporary loss of washover areas, and burial and suffocation of intertidal benthic prey species. The natural wrack would be restored following normal tidal events. Washover areas would eventually be re-created during storm events. Burial and suffocation of invertebrate intertidal prey species will occur during initial sand and marsh material placement throughout the entire project area and during follow-up renourishment events on Shell Island only (which does not contain any critical habitat). Impacts will affect the project footprint on both the Caminada headland and the remnant islands of the Shell Island reach, as well as some down-drift areas. Timeframes projected for benthic recruitment and re-establishment following sand and marsh material placement are from 6 months up to 2 years. Due to the duration of project construction and depending on actual recovery rates, impacts on the Shell Island portion will occur even if renourishment events occur outside the plover migration and wintering seasons.

Indirect effects

Indirect effects are those that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. The short-term increase in human disturbance to normal piping plover foraging and roosting behavior, as well as to suitable foraging and roosting habitat, during construction and immediately post-construction is likely to result in indirect effects via increased energy expenditure and a potential lack of adequate food supplies which can then lead to temporarily reduced fitness, fecundity, and over-wintering survival. However, such effects would be temporary for those birds wintering in or migrating through the action area over the course of several wintering seasons.

Reducing the potential for the formation of optimal habitats (such as over-wash or ephemeral pool formations), long-term increased human disturbance, and construction of new infrastructure are possible indirect effects to designated critical habitat. The piping plover's rapid response (within 6 months) to habitats formed by over-wash areas demonstrates the importance of over-wash created sand and mud flats for wintering and migrating piping plovers. Implementation of the proposed project will temporarily cover existing over-wash habitat within the entire action area. Given time, the intertidal zone along the Caminada headland and Shell Island reach will re-establish and with daily tidal processes and occasional storm events natural over-wash and ephemeral pool habitat would again be created throughout the action area.

The project life and expected future re-nourishment activities do not increase the likelihood of long-term increased human disturbance on Elmer's Island or Shell Island, or that the LDWF or other local entities would initiate construction of new infrastructure on those islands. The LDWF is committed to managing and maintaining Elmer's Island as a public recreation area for enjoying wildlife and fishing, as well as improving shorebird nesting, roosting, and foraging habitats with minimal human disturbance. Similarly, Shell Island's remote location and limited access from the mainland discourages regular use of the island. Because the remaining portions of the Caminada headland (i.e., Fourchon Beach/Bay Champagne) are privately owned, it is unknown whether the increased likelihood

of long-term increased human disturbance within those areas would occur due to construction of new infrastructure or upgrading of existing facilities, such as camps or oil and gas infrastructure.

Beneficial effects

Beneficial effects are wholly positive without any adverse effects. We expect the prolonged existence and restoration/creation of foraging and roosting habitat for piping plovers along the Shell Island reach and within critical habitat Unit LA-5 along the Caminada headland as an overall result of the proposed BBBSR project. The Corps has estimated that without the project there would be little or no piping plover critical habitat remaining on the Caminada headland and the remnants of Shell Island would erode below sea level within the 50-year period of analysis. With the project, 880 acres of dune and beach complex would be created along the Caminada headland, and 317 acres of dune and beach complex would be restored along the Shell Island reach (Corps 2011). Much of the existing system is sediment-starved, and the proposed action would introduce sediment into that system that would be reworked and redistributed through natural processes, thus maintaining and/or enhancing the features of critical habitat. The additional sediment (within the sediment-starved Barataria Basin barrier system) would be re-worked by wind and wave action and storm events to allow for natural shoreline nourishment and repair along the Caminada headland and natural island "rollover" on Shell Island, all of which should result in the natural reformation of optimal piping plover habitat in the form of over-wash areas, sand flats, mud flats, and sand spits. The restoration and maintenance of intertidal habitat is important for the restoration of the piping plover population to healthy levels.

Species response to the proposed action

This biological opinion addresses the direct and indirect effects that are anticipated to wintering and migrating piping plovers and designated critical habitat as a result of restoring beach, dune, and marsh on the Caminada headland and the remnants of Shell Island, as well as the temporary disruption of existing plover foraging and roosting habitat for the long-term benefit of maintaining existing barrier headland and island habitat. Although survey data from Table 10 (page 41) indicate that anywhere from 1 to 51 piping plovers could be using any portion of the action area in any given year, it is difficult for the Service to estimate the number of birds migrating through or wintering within the proposed action area because piping plover numbers fluctuate from year to year. Therefore, the Service anticipates that all migrating and wintering piping plovers utilizing the remnants of Shell Island and the Gulf shoreline of the Caminada headland (i.e., a total of 18.42 miles [29.64 km] of shoreline), and up to 278 acres of existing critical habitat will be impacted by: (1) disturbance due to human activity and equipment noise during construction within the action area; and (2) temporary habitat loss within the project footprint along each barrier shoreline for the duration of construction activities (2 to 3 years for each project feature) and up to 2 years post construction for the recovery of intertidal benthic prey species.

The nearest suitable habitats to the Caminada headland into which piping plovers can disperse are located on East Timbalier Island (located between Timbalier Island and the West Belle Pass headland), the West Belle Pass headland (located immediately west of Belle Pass), and Grand Isle (located immediately east of Elmer's Island and Caminada Pass). The next closest suitable habitat areas to the Caminada headland consist of the Isles Dernieres (critical habitat Unit LA-4) to the west and the Grand Terre Islands (critical habitat Unit LA-5) to the east; both of which are greater than 10 miles away from that portion of the action area. The nearest suitable habitat areas to the Shell Island reach are Chaland Beach (located immediately west of Grand Bayou) and Pelican and Scofield Islands (located immediately east of the Empire jetties). The next closest suitable habitat areas to the Shell Island reach

are the Grand Terre Islands to the west, and the mud lumps at mouth of the South Pass of the Mississippi River to the east; both of which are greater than 10 miles away from that portion of the action area. However, all of those areas have been impacted by the Deepwater Horizon oil spill, and foraging and roosting habitat in those areas are recovering from ongoing oil spill cleanup activities and NRDAR surveys and data collection. The duration of disturbance from the oil spill is ongoing for an unknown period of time. In addition, several other coastal restoration projects on the Isles Dernieres, West Belle Pass headland, Scofield Island, and Pelican Island will be constructed before, during, or within 2 years of the construction time frame for the BBBSR project.

The closest non-oiled habitat would be the Atchafalaya River Delta which is located greater than 70 miles west of the action area along the Caminada headland; there is no non-oiled habitat located east of either portion of the BBBSR project. Critical habitat Unit LA-2 consists of the deltaic splay and the dredge disposal islands occurring east and southeast of the main navigation channel of the Atchafalaya River. At this time, there have been no reported impacts to those areas as a result of the Deepwater Horizon oil spill. Table 12 depicts the results of sporadic winter surveys of the Atchafalaya River Delta over the last 19 years.

Table 12. Piping plover numbers from winter surveys within the Atchafalaya River Delta.

Location	1991 IPPC[a] Survey	1996 IPPC Survey	2001 IPPC Survey	2006 IPPC Survey	2006-07 CWS[b] Survey	2007 LDWF[c] Survey	2008 LDWF Survey	2009 LDWF Survey	2010 LDWF Survey
Atchafalaya River Delta	27	0	21	6	NS[d]	NS	27	0	NS

(a) IPPC = International Piping Plover Census; (b) CWS = Canadian Wildlife Service, Maddock 2008; (c) LDWF = Louisiana Department of Wildlife and Fisheries-Natural Heritage Program; (d) NS = Not Surveyed.

Critical habitat within the action area is experiencing ongoing disturbance by oil spill cleanup activities, and such disturbance will continue for an unknown period of time. The proposed action would involve anywhere from 2 to 3 years of disturbance activities for the construction period, plus an additional 2 years of recovery for the intertidal benthic community following TY1. The project would not, however, result in permanent changes to the natural processes that maintain the PCEs of critical habitat. Daily tidal processes and occasional storm events would re-work the additional sediment to recreate over-wash areas, sand and mud flats, and sand spits. Without the additional sediment from the project, critical habitat on the headland would eventually erode below sea level.

Although restoration of the Caminada headland and Shell Island reach would follow on the heels of the Deepwater Horizon oil spill and would result in temporary disturbance within the action area, in time the proposed action would ultimately benefit the piping plover and its critical habitat by restoring diverse barrier headland and island habitats used by the piping plover. The proposed action would also allow for the continued existence and creation of habitat within critical habitat Unit LA-5 throughout the project life.

CUMULATIVE EFFECTS

The proposed project would occur on privately owned and State-owned lands and/or State-owned water bottoms. Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

It is unknown how much influence the proposed project would contribute to increased human disturbance along the privately owned portions of the Caminada headland. However, the remoteness of Shell Island and the LDWF's management of Elmer's Island help to control human disturbance levels within those portions of the action area. Overall recreational use of the Caminada headland (including Elmer's Island) is generally in the form of bird watching and fishing, and because of its remoteness, there is little human disturbance on Shell Island. Any future proposed actions that are within endangered or threatened species habitat will require section 7 or 10 permitting from the Service to be covered under the Act.

Impacts to the action area from the Deepwater Horizon oil spill includes Stage III cleanup actions for weathered oil, tar balls, tar mats, tar patties, oil mousse, oiled wrack, Stage IV monitoring and maintenance activities, ongoing NRDAR surveys and studies, dispersants in the water, and increased human disturbance from those cleanup and monitoring activities. Although the final breadth of the oil spill impacts to the Louisiana Gulf shoreline and shoreline-dependent species remains unknown, section 7 consultation will be completed with the lead Federal agency, the U.S. Coast Guard, at the conclusion of the emergency event.

PRELIMINARY CONCLUSION

The survival and recovery of all breeding populations of piping plovers are fundamentally dependent on the continued availability of sufficient habitat in their coastal migration and wintering range, where the species spends more than two-thirds of its annual cycle. All piping plover populations are inherently vulnerable to even small declines in their most sensitive vital rates (i.e., survival of adults and fledged juveniles). Mark-recapture analysis of resightings of uniquely banded piping plovers from seven breeding areas by Roche et al. (2010) found that apparent adult survival declined in four populations and increased in none over the life of the studies. Some evidence of correlation in year-to-year fluctuations in annual survival of Great Lakes and eastern Canada populations, both of which winter primarily along the southeastern U.S. Atlantic Coast, suggests that shared over-wintering and/or migration habitats may influence annual variation in survival. Further concurrent mark-resighting analysis of color-banded individuals across piping plover breeding populations has the potential to shed light on threats that affect survival in the migration and wintering range. Progress towards recovery (which is attained primarily through intensive protections to increase productivity on the breeding grounds) would be quickly slowed or reversed by even small sustained decreases in survival rates during migration and wintering.

Implementation of the proposed action is not likely to kill any piping plovers since they are highly mobile and can move out of harm's way. The increased disturbance to normal piping plover foraging/roosting behaviors and suitable habitat would likely result in increased energy expenditure and a potential lack of food supply, which may indirectly affect fitness, fecundity, and over-wintering survival. Such effects to migrating and wintering piping plovers would be sporadic and temporary over the course of the 2-year construction window. After reviewing the current status of the piping plover wintering population of the northern Great Plains, the Great Lakes, and the Atlantic Coast; the environmental baseline for the action area; the effects of the proposed BBBSR project; and cumulative effects, it is the Service's preliminary biological opinion that implementation of the BBBSR project, as proposed, is not likely to jeopardize the continued existence of the piping plover. As noted previously, the overall status of the listed species is stable, if not increasing.

Critical Habitat

Critical habitat for this species has been designated within the project area and the action area. The project has been designed to mimic natural barrier headland habitat and, in the long-term, would aid natural processes in creating and maintaining the PCEs of critical habitat on the headland by providing sediment within the sediment-starved barrier headland system. The amount of critical habitat in Unit LA-5 directly affected from the project is approximately 278 acres of sparsely and non-vegetated barrier headland shoreline habitat. The project area would be temporarily disturbed during construction activities which would impede piping plovers attempting to roost and forage in the area during the migration and wintering months that coincide with construction. Temporary disturbance to 278 acres of Unit LA-5 equates to 1.1 percent of designated critical habitat in Louisiana and 0.16 percent of all designated critical habitat throughout the Southeast (i.e., North Carolina to Texas). Because the effects to critical habitat would be temporary in nature and the overall project would be beneficial in the long-term, it is the Service's preliminary biological opinion that implementation of the BBBSR project is not likely to destroy or adversely modify designated critical habitat in Unit LA-5.

INCIDENTAL TAKE STATEMENT

Because the proposed action is likely to result in the taking of a listed species incidental to that action, the Service has included an incidental take statement pursuant to section 7(b)(4) of the Act. However, because this is an early consultation on the prospective action, this incidental take statement does not eliminate the Corps' liability under the taking prohibitions of section 9 of the Act. Instead, this statement provides the Corps with foreknowledge of the terms and conditions that will be required if this prospective action is implemented. These reasonable and prudent measures and implementing terms and conditions become effective only after the Service confirms the preliminary biological opinion as a final biological opinion on the prospective action.

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Corps so that they become binding conditions of any contract, grant, or permit issued to the Corps' contractor, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require its contractor to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the contract, grant, or permit document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps and/or its contractor must report the progress of the action and its impact on

the species to the Service as specified in the incidental take statement [50 Code of Federal Regulations (CFR) §402.14(I) (3)].

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service expects incidental take of piping plover will be difficult to detect for the following reasons:

1. Wintering bird survey data indicate that anywhere from one to 51 piping plovers could be within the action area at any point in time. The number of birds within the action area for the duration of project construction and intertidal benthic recovery is difficult to detect because wintering piping plover numbers within the action area vary from year to year, and migrating piping plover numbers vary between both fall and spring migrations and year to year.
2. Harassment to the level of harm may only be apparent on the breeding grounds the following year as a result of reduced fitness or fecundity, or as lack of over-wintering survival.
3. Over-wintering survival would be difficult to detect because it is difficult to detect birds that do not survive migration back to the breeding grounds.

However, the following level of take of this species can be expected by disturbance to affected shoreline miles because disturbance to suitable habitat within the action area would affect the ability of piping plovers to find foraging and roosting habitat throughout the migrating and wintering periods for the duration of project construction and intertidal benthic recovery. The Service anticipates that directly and indirectly all piping plovers using the affected 18.42 miles (of which 278 acres is designated critical habitat) of Gulf shoreline along both the Caminada headland and Shell Island reaches could be taken in the form of harm and harassment as a result of the proposed action.

The level (i.e., all piping plovers using the 18.42 miles of Gulf shoreline) of take of this species can be anticipated by the proposed activities because:

1. Piping plovers are known to winter in and migrate through the action area.
2. The placement of sand is expected to temporarily affect (e.g., in the form of increased human disturbance during construction, temporary loss of benthic prey, and temporary loss of wrack) 18.42 miles of Gulf shoreline over multiple migrating and wintering seasons until construction is complete and until the benthic fauna recover.
3. Temporarily increased levels of human disturbance are expected for the duration of construction activities which would make the 18.42 miles of Gulf shoreline less desirable habitat for piping plovers and may cause increased energy expenditure as birds move away from construction activities.
4. A temporary reduction of food base will occur due to sand placement which would affect the piping plover's ability to forage and store enough fat reserves for migration back to the breeding grounds for multiple wintering seasons. Such an effect could result in reduced fitness or fecundity.

The Service has reviewed the biological information and other information relevant to this action. The take is expected in the form of harm and harassment because of: (1) temporarily decreased fitness and survivorship of wintering piping plovers; (2) temporarily decreased fitness and survivorship of piping plovers attempting to migrate to breeding grounds, due to temporary loss of and disturbance to foraging and roosting habitat; and (3) an indirect temporary reduction of fecundity on the breeding grounds due to the temporary decrease in fitness and survivorship of wintering piping plovers.

Incidental take covers take of the species within the action area. If the Corps expands the action outside of the action area then consultation must be reinitiated.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the piping plover species or destruction or adverse modification of its critical habitat. Incidental take of piping plovers utilizing the affected 18.42 miles of barrier headland and island habitat is anticipated to occur during project construction, up to 2 years following construction until the intertidal benthic community recovers, and sporadically for up to 3 years following construction for vegetative plantings.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize take on non-breeding piping plovers during implementation of the proposed BBBSR project within the action area.

1. The Corps should carefully mark and stake the boundaries of the project footprint on both the Caminada headland and Shell Island and ensure that those markers are maintained for the duration of project construction activities. Should the project extend outside of those boundary markers, then the level (i.e., all piping plovers using the 18.42 miles of Gulf shoreline) of incidental take for this project would be exceeded and the Corps should reinitiate section 7 consultation with the Service as soon as possible.
2. A baseline piping plover survey should be conducted within the migrating and wintering season immediately prior to initial construction in order to determine the piping plover's preferred habitat use within the action area. Such information could then be used as an aid to determine whether specific project actions require slight modifications in order to minimize the effects of the take for future migrating and wintering seasons. For example, initial bird surveys may aid in locating and marking appropriate ingress and egress routes for ORVs and other work-related equipment, as well as equipment staging areas, in order to reduce disturbance to foraging and roosting birds to the maximum extent practicable.
3. A simple diversity and abundance survey of the intertidal benthic prey species community should be conducted within the migrating and wintering season immediately prior to initial construction (preferably at the same time as the plover distribution surveys) in order to establish a baseline of benthic prey species diversity and abundance. Again, such information could then be used as an aid to determine whether specific project actions require slight modifications in order to minimize the effects of the take for future migrating and wintering seasons. For example, initial surveys could locate areas of abundant benthic prey where birds may tend to congregate for foraging, and those areas could be flagged for avoidance by regular personnel traffic to reduce disturbance to foraging plovers.
4. Piping plover monitoring surveys should be conducted during the migrating and wintering seasons throughout initial project construction and three consecutive years following completion of initial construction in order to determine whether ingress and egress routes are working or whether they need to be adjusted.
5. To determine length of time needed for recovery of suitable foraging habitat for migrating and wintering plovers, monitoring surveys of the intertidal benthic prey species community should be conducted each year following completion of initial construction for three consecutive years. Such information could then be used as an aid to determine whether specific project actions

require slight modifications in order to minimize the effects of the take for future project renourishment and/or maintenance events.

6. At least six months prior to mobilization, the Service should be notified in writing when renourishment events (i.e., renourishment of the subtidal feeder bar and of Shell Island) will occur within the action area so that the Corps and the Service can coordinate and exchange updated information to ensure that reinitiation of consultation is not necessary.
7. A comprehensive report describing the actions taken to implement the RPMs and terms and conditions associated with this incidental take statement shall be submitted to the Service by June 30 of the year following completion of all required surveys.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps shall execute the following terms and conditions, which implement the RPMs described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

Marking Project Boundaries

1. The Corps should carefully survey and mark the boundaries of the project footprint on the Caminada headland and Shell Island.
2. Boundary markers should be semi-permanent such that they should be maintained throughout construction activities and should persist until all construction-related activities are completed.
3. The Service's Louisiana Ecological Services Office (337/291-3108) should be notified immediately if any work or project-related actions exceed the boundary markers so that reinitiation of section 7 consultation can proceed as quickly and efficiently as possible to avoid delay in the project schedule.

Monitoring Requirements

1. Requirements for piping plover surveys
   a) A survey schedule (with dates) is listed in Appendix D and the recommendation is for at least 3 survey dates per month; this schedule should be followed as closely as possible. The Service recognizes that given the remoteness of the project area and the potential for inclement weather conditions during the piping plover wintering season, three survey dates per month may be difficult to achieve in Louisiana. If conditions require a deviation from the recommended survey schedule, such information should be carefully documented, including an explanation why any deviation from the recommended schedule was deemed necessary.
   b) Piping plover identification, especially when in non-breeding plumage, can be difficult. Qualified professionals with shorebird/habitat survey experience must conduct the required survey work. Piping plover monitors must be capable of detecting and recording locations of roosting and foraging plovers, and documenting observations in legible, complete field notes. Aptitude for monitoring includes keen powers of observation, familiarity with avian biology and behavior, experience observing birds or other wildlife for sustained periods, tolerance for adverse weather, experience in data collection and management, and patience.
   c) Binoculars, a global positioning system (GPS) unit, a 10-60x spotting scope with a tripod, and the Service datasheet (Appendix D) must be used to conduct the surveys.
   d) Negative (i.e., no plovers seen) and positive survey data shall be recorded and reported.
   e) Piping plover locations shall be recorded with a GPS unit set to record in decimal degrees in universal transverse mercator (UTM) North American Datum 1983 (NAD83).

f) Habitat, landscape, and substrate features used by piping plovers when seen shall be recorded. Such features are outlined on the Service data sheet in Appendix D.
g) Behavior of piping plovers (e.g., foraging, roosting, preening, bathing, flying, aggression, walking) shall be documented on the Service data sheet in Appendix D.
h) Color-bands seen on piping plovers shall also be carefully documented, and should also be reported according to the information found at the following websites. Information regarding color-band observations can be found at: http://www.fishwild.vt.edu/piping_plover/Protocols_final_draft.pdf, http://www.waterbirds.umn.edu/Piping_Plovers/piping2.htm, and http://www.fws.gov/northeast/pipingplover/pdf/BahamasBandReporting2010.pdf.

2. Requirements for surveying benthic prey species
   a) A qualified professional with sediment/macroinvertebrate sampling experience must conduct the benthic prey species surveys.
   b) A baseline macroinvertebrate survey will be conducted at the same time of the initial piping plover survey during the migrating/wintering season immediately prior to construction. Additional surveys will be conducted during the migrating/wintering season each year post-construction for three consecutive years to determine benthic prey species recovery. Such surveys should be conducted at the same time as the plover surveys.
   c) Sampling will be conducted using a basic before and after control and impact design method. Sampling will be coordinated with piping plover foraging observations based on low tide surveys.
   d) In addition to recording benthic species abundance and diversity, a qualitative measure of sediment characteristics (sand, shell, mud) should also be recorded.
   e) A detailed sampling methodology should be developed in coordination with the Service prior to initiating surveys.

Reporting Requirements

1. Incorporate all data collected into an appropriate database, preferably one for piping plovers and one for benthic prey species.
2. Annual update reports should be provided to the Service by June 30 of each calendar year once construction begins. Annual update reports should include data sheets, maps, a copy of the database, and the progress and initial findings of piping plover and benthic community surveys, as well as any problematic issues that may hinder future survey efforts.
3. If the Corps foresees any problematic issues that would require a change in the recommended survey schedule due to work conditions or project delays, the Corps should immediately notify the Service so that we can resolve/correct any such issues.
4. A final comprehensive report should be provided to the Service by June 30 following the third year of surveys. That final report should include an analysis of all data results from the piping plover and benthic community surveys.
5. At least six months prior to mobilization, the Corps should notify the Service in writing prior to each proposed renourishment event. That notification should include whether there are any changes in the proposed amount of renourishment per island or changes in anticipated project footprints.

Upon locating a dead or injured piping plover that may have been harmed or destroyed as a direct or indirect result of the proposed project, the Corps and/or contractor shall be responsible for notifying the Service's Lafayette, Louisiana, Field Office (337/291-3100) and the LDWF's Natural Heritage Program (225/765-2821). Care shall be taken in handling an injured piping plover to ensure effective

treatment or disposition and in handling dead specimens to preserve biological materials in the best possible state for later analysis.

COORDINATION OF INCIDENTAL TAKE STATEMENT WITH OTHER LAWS, REGULATIONS, AND POLICIES

Migratory Bird Treaty Act (MBTA)

The MBTA implements various treaties and conventions between the U.S., Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the provisions of the MBTA it is unlawful "by any means or manner to pursue, hunt, take, capture or kill any migratory bird except as permitted by regulations issued by the Fish and Wildlife Service. The term "take" is not defined in the MBTA, but the Service has defined it by regulation to mean to pursue, hunt, shoot, wound, kill, trap, capture or collect any migratory bird, or any part, nest or egg or any migratory bird covered by the conventions or to attempt those activities.

In order to comply with the MBTA and potential for this project to impact nesting shorebirds, the Corps should follow the Service and LDWF's guidelines (Appendix E) to protect against impacts to nesting shorebirds during implementation of this project.

The Fish and Wildlife Service will not refer the incidental take of piping plovers for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712), if such take is in compliance with the terms and conditions specified here.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. The Corps should consider retro-fitting all sand fencing poles with pointy tops or caps to reduce avian predation.

2. We encourage the Corps to take a proactive approach in coordinating with the Service regarding programmatic-level section 7 consultations for implementation of landscape-scale coastal protection and restoration programs in Louisiana. Programmatic-level planning and consultation may further reduce and minimize cumulative effects to listed species (e.g., piping plover, pallid sturgeon, West Indian manatee, sea turtles) resulting from implementation of multiple types of coastal protection and restoration projects, including, but not limited to those projects associated with the LCA Study, CWPPRA, and hurricane protection actions.

3. We encourage the Corps to continue to coordinate with the Service during the pre-planning phases of future coastal protection and restoration projects (including any sand placement projects) within piping plover designated critical habitat.

4. We encourage the Corps to participate in and/or fund a benthic study (or studies) along coastal Louisiana, west of the Mississippi River. Information is needed regarding the effects of sand

placement and dredging projects on benthic prey species and their potential recovery time following such actions. That information would benefit our knowledge regarding piping plover foraging biology and aid in future section 7 consultation during project planning for future coastal restoration actions.

In order for the Service to be kept informed of actions that minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes early consultation on the proposed action. The Corps may ask the Service to confirm this preliminary biological opinion as a final biological opinion on the proposed action once the forthcoming draft Environmental Impact Statement has been reviewed by the public and the proposed project features have been confirmed and finalized. The request must be in writing. If the Service reviews the proposed action and finds that there are no significant changes in the action as planned or in the information used during the early consultation, we will confirm the preliminary biological opinion as the final biological opinion.

As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take (i.e., the 18.42 miles of Gulf shoreline described herein) is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take shall cease pending reinitiation.

If the Service does not confirm this preliminary biological opinion as a final biological opinion on the proposed action, the Corps is required to initiate formal consultation with the Service. If you have any questions about this preliminary biological opinion, please contact Ms. Brigette Firmin of this office at 337/291-3108.

Sincerely,

David A. Walther
Acting Supervisor
Louisiana Ecological Services Office

cc: FWS, Atlanta, GA (Attn: Ken Graham)
FWS, Panama City, FL (Attn: Patty Kelly)
LDWF, Baton Rouge, LA
LDWF, Natural Heritage Program, Baton Rouge, LA

LITERATURE CITED

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APPENDIX A

Standard Conditions for In-water Work in the Presence of Manatees

Guidelines for Activities in Proximity to Manatees and Their Habitat

A. All personnel associated with the project should be informed of the potential presence of manatees, manatee speed zones, and the need to avoid collisions with and injury to manatees. Such personnel instruction should also include a discussion of the civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973.

B. All contract and/or construction personnel are responsible for observing water-related activities for the presence of manatee(s).

C. Temporary signs should be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area), and at least one sign should be placed where it is visible to the vessel operator.

D. Siltation barriers, if used, should be made of material in which manatees could not become entangled, and should be properly secured and regularly monitored. Barriers should not impede manatee movement.

E. If a manatee is sighted within 100 yards of the active work zone, special operating conditions should be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels should operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, should be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions are no longer necessary, but careful observations would be resumed.

F. Any manatee sighting should be immediately reported to the U.S. Fish and Wildlife Service's (Service) Lafayette, Louisiana, Field Office (337/291-3100) and the Louisiana Department of Wildlife and Fisheries (LDWF), Natural Heritage Program (225/765-2821).

APPENDIX B

Protective Measures for Dredging Operations in the Presence of Sturgeon

Guidelines for Dredging Operations in the Proximity to Sturgeon

A. All dredged material disposed of in the river should be discharged at the surface, with the use of a baffle plate.

B. The cutterhead should remain completely buried in the bottom material during dredging operations.

C. If pumping water through the cutterhead is necessary to dislodge material, or to clean the pumps or cutterhead, etc., the pumping rate should be reduced to the lowest rate possible until the cutterhead is at mid-depth, where the pumping rate can then be increased. During dredging, the pumping rates should be reduced to the slowest speed feasible while the cutterhead is descending to the channel bottom.

APPENDIX C

FIGURES

Figure 1. The proposed action would be located along the barrier shoreline of the Barataria Basin in Lafourche and Plaquemines Parishes, Louisiana (http://www.lca.gov/Projects/4/Default.aspx).

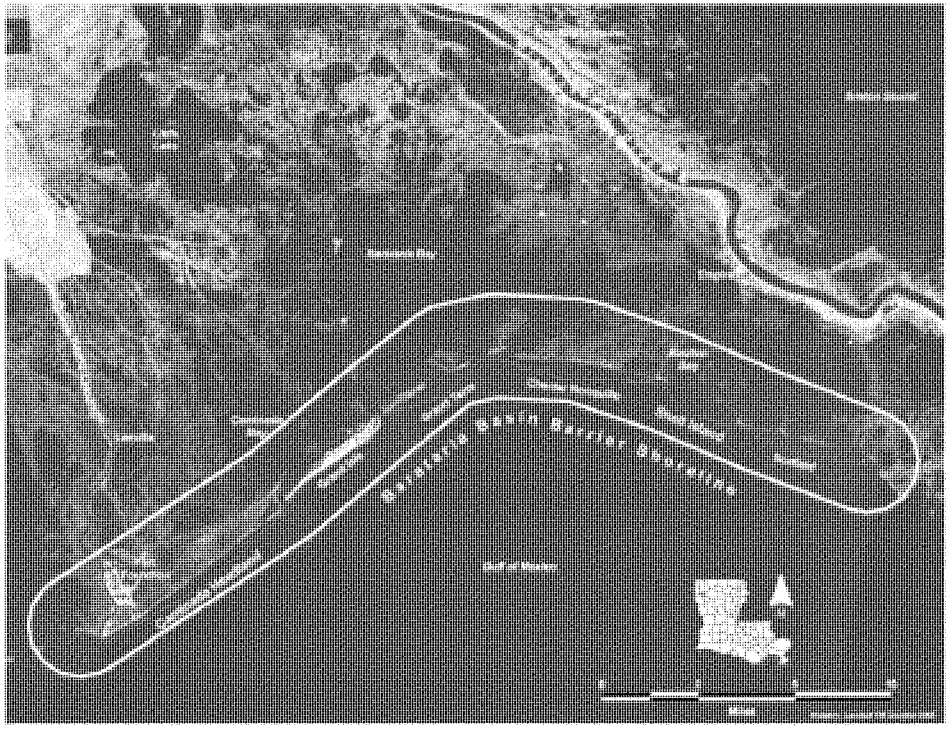


Figure 2. Caminada Headland Alternative 5 – Preferred Dune with Expanded Marsh and Subtidal Feeder Bar (Corps 2011).

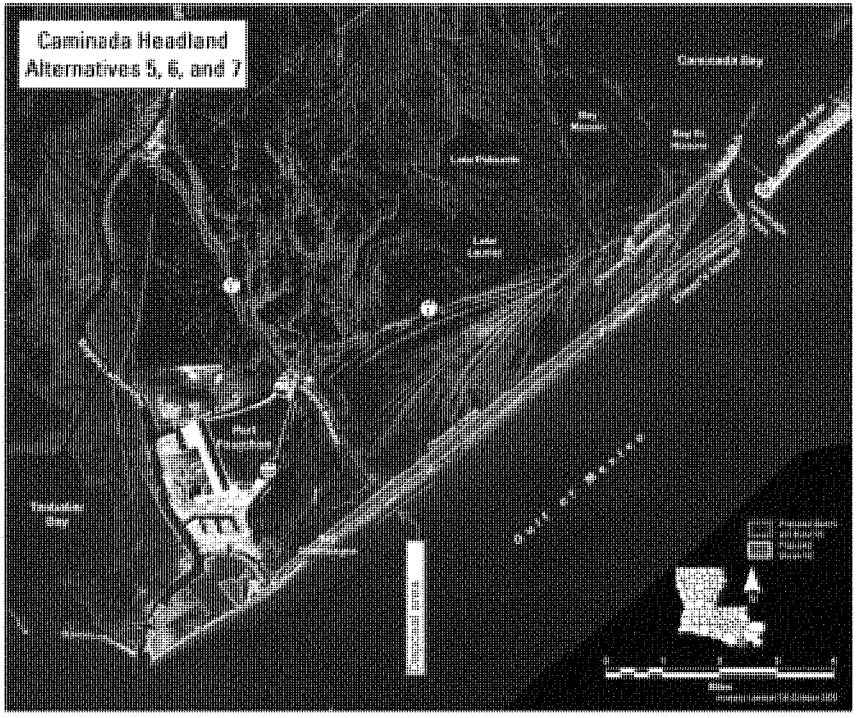


Figure 3. Shell Island Alternative 5 – One Island with Two Renourishments (Corps 2011).

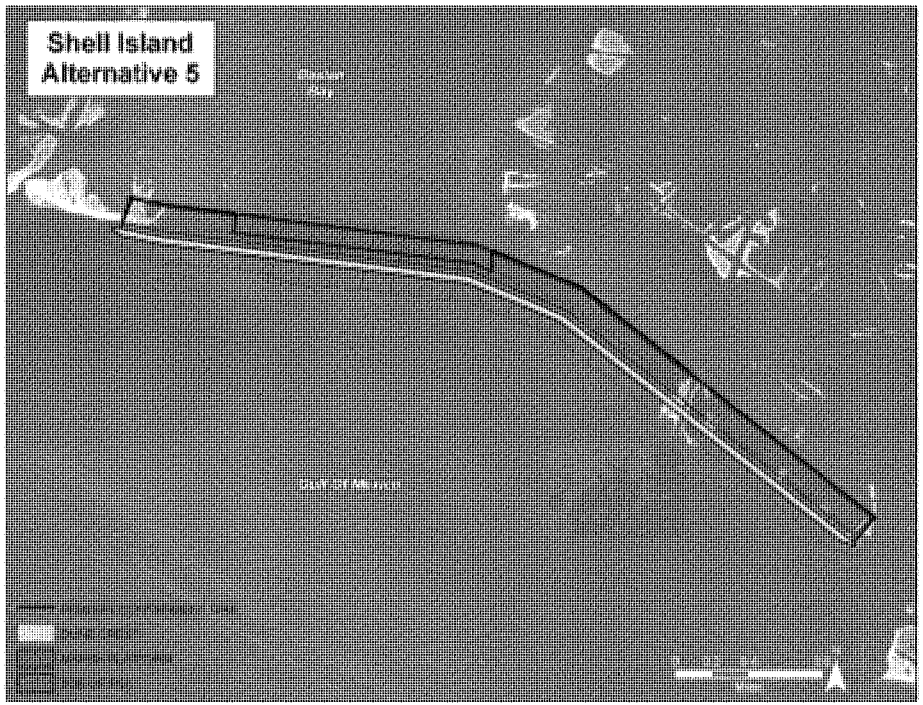


Figure 4. The estimated sediment budget for the Caminada Headland barrier shoreline system (Corps 2010).

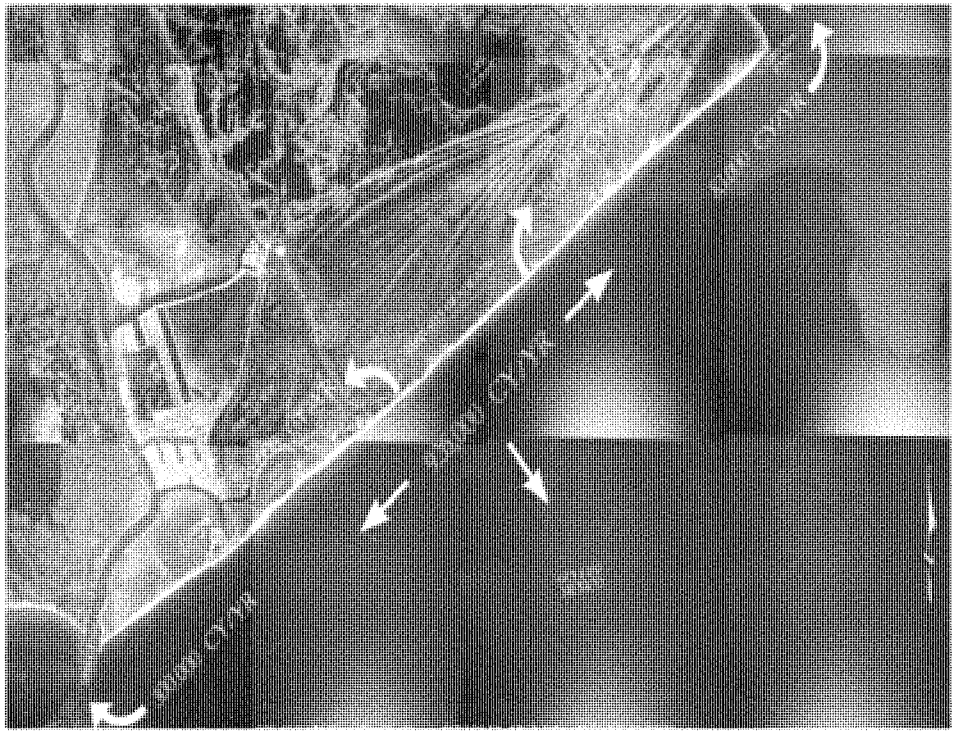


Figure 5. Distribution and range of piping plovers (base map from Haig and Elliott-Smith 2004). Conceptual presentation of subspecies and distinct population segments (DPS) ranges are not intended to convey precise boundaries.

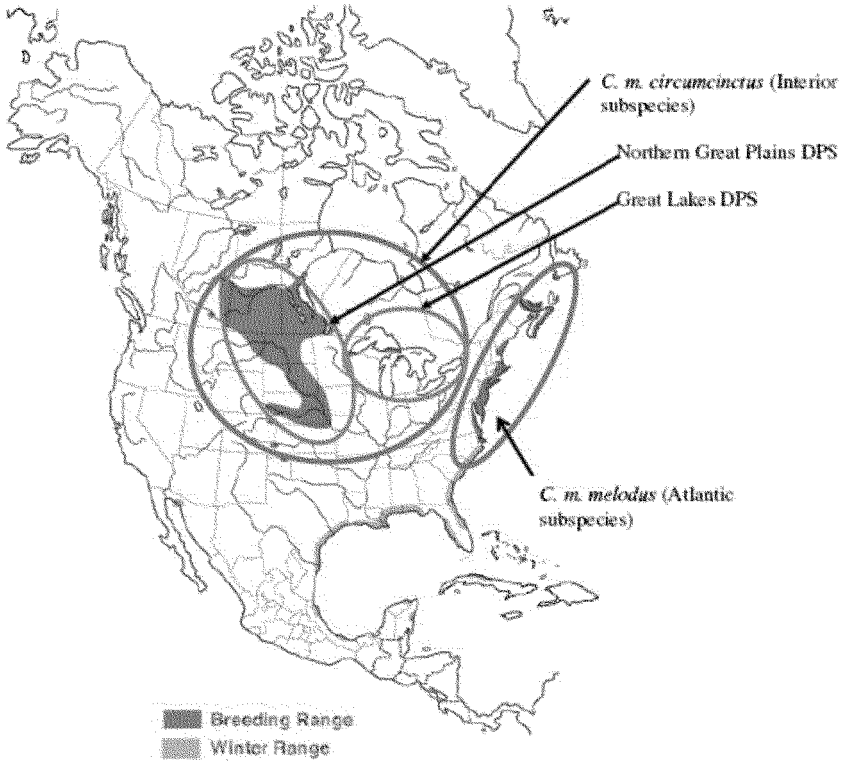
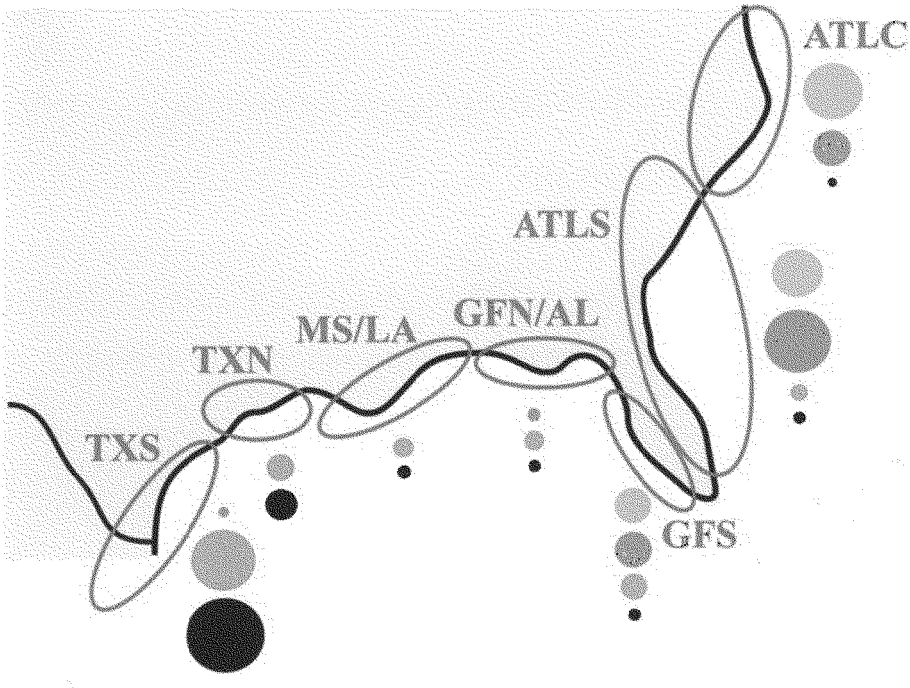


Figure 6. Breeding population distribution* in the wintering/migration range (from Gratto-Trevor et al. 2009, reproduced by permission).



*Regions: ATLC=Atlantic (eastern) Canada; ATLS=Atlantic U.S.; GFS=Gulf Coast of southern Florida; GFN=Gulf Coast of north Florida; AL=Alabama; MS/LA=Mississippi and Louisiana; TXN=northern Texas; and TXS=southern Texas. For each breeding population, circles represent the percentage of individuals reported wintering along the eastern coast of the U.S. from the central Atlantic to southern Texas/Mexico up to December 2008. Each individual was counted only once. Grey circles represent Eastern Canada birds, orange circles for U.S. Great Lakes, green circles for the U.S. Great Plains, and black circles for Prairie Canada. The relative size of the circle represents the percentage from a specific breeding area seen in that winter region. Total number of individuals observed on the wintering grounds was 46 for Eastern Canada, 150 for the U.S. Great Lakes, 169 for the U.S. Great Plains, and 356 for Prairie Canada.

APPENDIX D

Non-breeding Piping Plover Survey Guidelines

U.S. Fish and Wildlife Service
Ecological Services Office
Lafayette, Louisiana

Louisiana Piping Plover Non-Breeding Season Survey Guidelines

The purpose of these guidelines is to assess and/or monitor piping plover use of coastal restoration features related to the Barataria Basin Barrier Shoreline Restoration Project. Survey locations should include the coastal restoration features plus adjacent suitable shorebird habitat (i.e., intertidal beaches, mud flats, sand flats, algal flats, wash-over passes, and associated dunes and flats above annual high tide). Monitoring should be conducted July 15 through May 15 to follow the International Shorebird Survey (ISS) census dates listed below. The ISS schedule usually results in three surveys per month. If this is not feasible, try to do at least two surveys per month on the ISS census dates. Surveys should be conducted on ISS dates plus or minus two days. For example, a survey scheduled for the 15th could be conducted on any day between the 13th through the 17th of that month.

Spring Migration	Fall Migration	Winter
February 25	July 15	October 15
March 5	July 25	October 25
March 25	August 5	November 5
April 5	August 15	November 15
April 15	August 25	November 25
April 25	September 5	December 5
May 5	September 15	December 15
May 15	September 25	December 25
	October 5	January 5
		January 15
		January 25
		February 5
		February 15

To the extent possible, surveys should be conducted when birds are foraging. The best time is at low tide, but surveys can also be conducted on a falling or rising tide provided that the foraging areas are not completely covered. During high tide, birds will be roosting. Although piping plovers often roost near foraging areas, the birds will be more difficult to locate. Avoid conducting surveys during poor weather conditions (e.g., high winds, rain).

Methods

In most cases surveys will be conducted by foot. All terrain vehicles (ATVs) may be used to expedite the transport of observers over long stretches of liner routes ("leapfrogging" teams down a beach in 0.5 to 1 mile increments), but all bird counting will be conducted while walking. **[Driving on vegetated areas shall not be permitted. Any ATV use should be coordinated with the Louisiana Department of Wildlife and Fisheries' Isles Dernieres Wildlife Refuge management staff.]** Birds on exposed mudflats that may be inaccessible by foot should be counted from boats. Each survey crew should use their best professional judgment on the most efficient way to conduct the survey and should document in detail if any deviations to these guidelines are deemed necessary.

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Observers should work in teams of two to four people, depending on the width of the beach and beach/tidal interface. Wide coastal beaches will require a greater number of observers in order to assure that birds are not missed on the back (aft) side of the dune. Observers working on beaches that contain moderate to high dunes should climb them every 0.5 to 1 mile and look for wash-over flats and pools that may not be visible from the beach. Coastal islands will be surveyed on both the Gulf and bay sides (this may require multiple teams of observers in order to finish the surveys in a timely manner).

Piping plover locations will be recorded with global positioning system (GPS) units. GPS locations will be recorded in universal transverse mercator (UTM) map datum NAD 83 CONUS. Each survey team should carry aerial photography of the survey route so that new breaks (cuts) in the beach or island can be noted on the survey maps. Habitat data will also be collected and will include foraging substrate, portion of the beach used and side of the island on which the birds are found (see attached data sheet). These habitat criteria have been adapted from the 2006 International Winter Piping Plover Census organized by the U.S. Geological Survey. Behavioral data (e.g., foraging, roosting, preening, bathing, flying, aggression, walking) of piping plovers when seen should also be documented.

Negative data is as important as positive data. Indicate when surveys have been done and no birds were observed. Although piping plovers are the target species, any additional observations of other species would help the U.S. Fish and Wildlife Service to identify shorebird concentration areas and management needs.

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Ecological Services Office
Lafayette, Louisiana

Louisiana Piping Plover Survey Form

(Note: Most criteria adopted from the 2006 Wintering Piping Plover Census Form)

A. Total # Piping Plovers Observed: _____

B. Location Description (Name): _____
   1. Parish: _____
   2. UTM location NAD 83 CONUS (center):
      Northing_____ Easting_____
   3. Land Ownership:
      ___Federal ___State ___Municipal ___Private ___County ___Tribal

C. Date of survey:_____ Time survey conducted: _____to _____

D. Weather Conditions:
   1. Tide stage(s): ___Low ___Mid ___High (___Rising / ___Falling)
   2. General weather: ___Sunny ___Partly cloudy ___Overcast ___Rain ___Fog
      ___Other (describe):_____
   3. Approximate temperature: _____Celsius / Fahrenheit (circle one)
   4. Wind speed: _____miles/hr Wind direction:_____

E. Description of Habitat Surveyed (check as many as apply). The Code designation will be used in Section F table below:

- **Body of Water Type**:
  ____I. Ocean ____II. Protected bay, harbor, cove, lagoon ____III. Gulf of Mexico
  ____IV. Ocean Inlet ____V. Other (describe)_____

- **Shoreline Type**:
  ____A. Mainland ____B. Barrier Island ____C. Spoil Island ____D. Bar
  ____E. Other Island ____F. Washover area ____G. Other (describe)_____

- **Specific Description**:
  ____1. Sand beach ____2. Sand spit ____3. Sand flat ____4. Sand bar
  ____5. Salt flat ____6. Gravel shore ____7. Oyster reef ____8. Mudflat
  ____9. Vegetation (algal) mat ____10. Vegetated shoreline
  ____11. Other (describe)_____

- **Location Description** (criteria for islands only):
  ____ i. Gulf-side of island ____ii. Bay-side of island
  ____a. Tidal interface ____b. Fore dune ____c. Top of dune ____d. Aft dune

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F. Numbers, behaviors, habitat types, and GPS location(s) of piping plovers observed (mark on map if possible).

Number of Plovers Observed	**Behavior Displayed** *(e.g., foraging, roosting, preening, walking, flying, aggression, etc.)*	**Habitat Type where Plovers were found** *(use designations from Section E above, e.g., IIC8ii, IIIB9ia)*	**UTM location NAD 83 CONUS**	
			Northing	*Easting*

G. Mode(s) of transportation:
____Foot ____Car/Truck ____ATV ____Boat ____Airboat ____Other_____

H. Habitat (shoreline) covered: _____miles (please calculate using aerial photograph's scale)

I. Observers: _____
_____
_____

J. Additional comments or notes:_____
_____
_____
_____

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K. Additional species encountered (for flying flocks lump as peeps and estimate number). Species of special interest are listed below; please add any additional species.

OTHER SPECIES	TOTAL#	OTHER SPECIES	TOTAL#
Reddish Egret			
Marbled Godwit			
Red Knot			
Western Sandpiper			
Stilt Sandpiper			
Short-billed Dowitcher			
Snowy Plover			
Wilson's Plover			
Long-billed Curlew			
American Oystercatcher			

APPENDIX E

Louisiana Guidelines for Minimizing Disturbance to Colonial Nesting Birds

U.S. Fish and Wildlife Service
Ecological Services Office
Lafayette, Louisiana

Louisiana Guidelines for Minimizing Disturbance to Colonial Nesting Birds

Nesting colonies may be present that are not currently listed in the database maintained by the Louisiana Department of Wildlife and Fisheries (LDWF). That database is updated primarily by monitoring the colony sites that were previously surveyed during the 1980s. Until a new, comprehensive coast-wide survey is conducted to determine the location of newly-established nesting colonies, we recommend that a qualified biologist inspect the proposed work site for the presence of undocumented nesting colonies during the nesting season. In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

To minimize disturbance to colonial nesting birds, the following restrictions on activity should be observed:

1. For colonies containing nesting brown pelicans, all activity occurring within 2,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 15 through March 31). Nesting periods vary considerably among Louisiana's brown pelican colonies, however, so it is possible that this activity window could be altered based upon the dynamics of the individual colony. The Louisiana Department of Wildlife and Fisheries' Fur and Refuge Division should be contacted to obtain the most current information about the nesting chronology of individual brown pelican colonies. Brown pelicans are known to nest on barrier islands and other coastal islands in St. Bernard, Plaquemines, Jefferson, Lafourche, and Terrebonne Parishes, and on Rabbit Island in lower Calcasieu Lake, in Cameron Parish.

2. For colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary within this window depending on species present).

3. For colonies containing nesting gulls, terns, and/or black skimmers, all activity occurring within 650 feet of a rookery should be restricted to the non-nesting period (i.e., September 16 through April 1, exact dates may vary within this window depending on species present).

Below is a table explaining the nesting chronology of species that are known to nest in Louisiana. The table is an excerpt from page 31 of:

Martin, R.P., and G.D. Lester. 1990. The Atlas and Census of Wading Bird and Seabird Nesting Colonies of Louisiana: 1990. Louisiana Department of Wildlife and Fisheries – Louisiana Natural Heritage Program. Special Publication No. 3 for the U.S. Department of Interior – Fish and Wildlife Service. Contract No. 14-16-0004-89-963.

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Table 8. Nesting chronology for colonial-nesting waterbirds in Louisiana with suggested activity windows.[a]

Species	Incubation Season	Incubation Period (days)	Days to Fledging	Activity[b] Window
Brown Pelican	1 Nov to 15 Jun	28-30	74-76	1 Aug to 31 Oct
Olivaceous Cormorant	15 Mar to 15 Apr	23-26	35-42	1 Jul to 1 Mar
American Anhinga	15 Mar to 15 Apr	25-28	?	1 Jul to 1 Mar
Great Blue Heron	1 Mar to 30 Apr	25-29	58-62	1 Aug to 15 Feb
Great Egret	1 Mar to 31 May	23-24	40-44	1 Aug to 15 Feb
Snowy Egret	16 Mar to 15 Jun	17-19	20-25	1 Aug to 1 Mar
Little Blue Heron	16 Mar to 15 Jun	22-24	28-32	1 Aug to 1 Mar
Tricolored Heron	16 Mar to 15 Jun	20-22	?	1 Aug to 1 Mar
Reddish Egret	16 Mar to 15 Jun	23-26	?	1 Aug to 1 Mar
Cattle Egret	16 Apr to 30 Jun	21-24	35-40	1 Sep to 1 Apr
Green-backed Heron	1 Apr to 30 Jun	19-21	16-17	1 Sep to 15 Mar
Black-crowned Night-Heron	16 Mar to 15 Jun	24-26	40-42	1 Sep to 1 Mar
Yellow-crowned Night-Heron	1 Apr to 15 Jun	?	?	1 Sep to 15 Mar
White Ibis	16 Apr to 30 Jun	21-23	35-42	1 Sep to 1 Apr
Glossy/White-faced Ibis	16 Apr to 30 Jun	21-23	42-49	1 Sep to 1 Apr
Roseate Spoonbill	16 Apr to 15 Jun	23-24	49-56	1 Aug to 1 Apr
Laughing Gull	16 Apr to 15 Jun	23-25	35-45	1 Aug to 1 Apr
Gull-billed Tern	16 May to 15 Jul	22-23	28-35	16 Sep to 1 May
Caspian Tern	1 May to 15 Jul	26-28	36-48	16 Sep to 15 Apr
Royal Tern	1 May to 15 Jul	28-31	36-48	16 Sep to 15 Apr
Sandwich Tern	1 May to 15 Jul	23-25	22-33	16 Sep to 15 Apr
Common Tern	1 May to 15 Jul	21-25	23-27	16 Sep to 15 Apr
Forster's Tern	1 Apr to 31 May	25-29	23-27	1 Aug to 15 Mar
Least Tern	1 May to 15 Jul	20-25	19-23	16 Sep to 15 Apr
Sooty Tern	16 May to 15 Jul	22-23	30-35	16 Sep to 15 Apr
Black Skimmer	16 May to 15 Jul	22-23	30-35	16 Sep to 1 May

[a] Data are compiled from Bent (1921), Bent (1926), Palmer (1962), Harrison (1975), Portnoy (1977) and Terres (1980).

[b] Suggested project initiation and completion dates to minimize disturbance to nesting birds.

The U.S. Fish and Wildlife Service (Service) realizes that the proposed barrier headland and island restoration work most likely would be constructed during one or more colonial waterbird nesting seasons because construction would extend over 2 or more years. In order to minimize disturbance to nesting gulls, terns, and/or black skimmers, the Service would like to coordinate with the Corps to develop a migratory bird abatement plan. Please contact Ms. Patti Holland (337/291-3121) of the Louisiana Ecological Services Office for further information and coordination associated with the development of a migratory bird abatement plan.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF

December 13, 2011

Regional Planning and
Environmental Division South
New Orleans Environmental Branch

David Walther
US Fish and Wildlife Service
646 Cajundome Blvd., Suite 400
Lafayette, LA 70506
Fax: (337) 291-3139

Dear Mr. Walther:

The U.S. Army Corps of Engineers, New Orleans District (CEMVN), is formally requesting that the preliminary draft biological opinion provided on September 30, 2011 by your office be adopted as the final biological opinion. The draft Environmental Impact Statement (EIS) for the Louisiana Coastal Area (LCA) Barataria Basin Barrier Shoreline (BBBS) project has completed the draft public comment period, Agency Technical Review (ATR), and Independent External Peer Review (IEPR). CEMVN received no comments that required the proposed action, as described within our June 3, 2011 biological assessment, to change. Consequently, since no significant changes to the proposed action have occurred, we request that your office confirm your preliminary biological opinion as the final biological opinion and conclude formal consultation for the LCA BBBS project.

If you have any questions or issues regarding this project, please contact Mr. Thomas Parker of my staff at (504) 862-2526 or by email at thomas.w.parker@usace.army.mil.

Sincerely,

Joan M. Exnicios
Chief, New Orleans Environmental Branch

Enclosure

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

December 21, 2011

Ms. Joan M. Exnicios
Chief, Environmental Branch
U.S. Army Corps of Engineers
P.O. Box 60267
New Orleans, Louisiana 70160-0267

Dear Ms. Exnicios:

Please reference your December 13, 2011, letter requesting the finalization of the U.S. Fish and Wildlife Service's (Service) September 30, 2011, preliminary biological opinion for the Louisiana Coastal Area (LCA) Barataria Basin Barrier Shoreline Restoration (BBBSR) project that would be located in Jefferson, Lafourche, and Plaquemines Parishes, Louisiana. The preliminary biological opinion regards the possible effects of the U.S. Army Corps of Engineers' (Corps) LCA – BBBSR project on the endangered West Indian manatee (*Trichechus manatus*), the threatened piping plover (*Charadrius melodus*) and its designated critical habitat, and the endangered pallid sturgeon (*Scaphirhynchus albus*). The Service has reviewed the information provided and offers the following comments in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 United States Code [U.S.C.] 1531 *et seq.*).

According to your letter, the public comment period for the draft Environmental Impact Statement (EIS) regarding the LCA – BBBSR project is complete. The Corps received no comments that would require changes in the proposed action, and requests that the Service confirm the preliminary biological opinion as the final biological opinion for the LCA – BBBSR project. Because the Corps does not anticipate conducting any significant changes in the proposed action that would require re-initiation of formal consultation and no significant change has occurred regarding the information used during the preliminary biological opinion, the Service confirms that the September 30, 2011, preliminary biological opinion is now a final biological opinion for the proposed action. We have enclosed a copy of that finalized biological opinion for your convenience.

No further ESA consultation with the Service is required for the proposed action. As provided in 50 Cod of Federal Regulations (CFR) §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take (i.e., the 18.42 miles of Gulf shoreline described in the September 30, 2011, biological opinion) is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in the opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by

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the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take shall cease pending reinitiation.

We appreciate the Corps' continued excellent cooperation in the conservation of endangered and threatened species, and their critical habitats. If you or your staff has any questions regarding this letter or the requirements for reinitiation of consultation, please contact Ms. Brigette Firmin (337/291-3108) of this office.

Sincerely,

David A. Walther
Acting Supervisor
Louisiana Ecological Services Office

Enclosure

Louisiana Coastal Area
Barataria Basin Barrier Shoreline Restoration Project
Jefferson, Lafourche, and Plaquemines Parishes, Louisiana

04EL1000-2012-F-0594
Biological Opinion
December 21, 2011

Prepared by:
U.S. Fish and Wildlife Service
646 Cajundome Boulevard, Suite 400
Lafayette, LA

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Acronyms

Act	Endangered Species Act
ATV	All-terrain vehicle
BA	Biological Assessment
BBBSR	Barataria Basin Barrier Shoreline Restoration
BO	Biological Opinion
CCSP	Climate Change Science Program
CEM	Coastal Engineering Manual
Corps	U.S. Army Corps of Engineers
CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Act
cm	centimeters
CY	Cubic yards
LDNR	Louisiana Department of Natural Resources
DPS	Distinct Population Segment
EPA	Environmental Protection Agency
FDEP	Florida Department of Environmental Protection
FR	Federal Register
IPPC	International Piping Plover Census
km	kilometers
LCA	Louisiana Coastal Area
LDWF	Louisiana Department of Wildlife and Fisheries
m	meters
MBTA	Migratory Bird Treaty Act
MHW	Mean High Water
MLW	Mean Low Water
MLLW	Mean Low Low Water
NAVD	North American Vertical Datum 1988
NMFS	National Marine Fisheries Service
NPS	National Park Service
NRA	Natural Resource Advisor
NRDAR	Natural Resource Damage Assessment and Restoration
O&M	Operations and maintenance
ORV	Off-road vehicle
PCB	Polychlorinated Biphenol
PCE	Primary Constituent Element
SCAT	Shoreline Cleanup Assessment Team
Service	U.S. Fish and Wildlife Service
TSP	Tentatively Selected Plan
TY	Target Year
U.S.	United States
USC	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

United States Department of the Interior
FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

December 21, 2011

Colonel Edward R. Fleming
District Commander
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Fleming:

This document transmits the U.S. Fish and Wildlife Service's (Service) final biological opinion based on our review of the U.S. Army Corps of Engineers' (Corps) proposed Louisiana Coastal Area (LCA) – Barataria Basin Barrier Shoreline Restoration (BBBSR) project that would be located in Jefferson, Lafourche, and Plaquemines Parishes, Louisiana, and its effects on the threatened piping plover (*Charadrius melodus*) and its designated critical habitat, in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 United States Code [U.S.C.] 1531 *et seq.*). Your August 19, 2011, request for early (preliminary) consultation and attached revised biological assessment (BA) dated June 3, 2011, were received via mail on August 26, 2011.

This biological opinion is based on updated information provided in the Corps' revised June 3, 2011, BA; the Corps' August 9, 2010, supplemental BA; the Corps' April 24, 2009, BA; meetings; telephone conversations; electronic mails; field investigations; and other sources of information. This final biological opinion replaces the September 30, 2011, preliminary biological opinion for this project. A complete administrative record of this consultation (Service Log No. 04EL1000-2012-F-0594) is on file at the Service's Louisiana Ecological Services Office.

The Service concurs with the Corps' determination that the proposed project is not likely to adversely affect the endangered West Indian manatee (*Trichechus manatus*) because: (1) the project area does not contain suitable foraging habitat for that species; and (2) the Corps would implement, as part of the project construction plan, standard conditions for in-water work in the presence of manatees (Appendix A). The Service also concurs with the Corps' determination that the proposed project is not likely to adversely affect the endangered pallid sturgeon (*Scaphirhynchus albus*) and shovelnose sturgeon[1] (*Scaphirhynchus platorynchus*) because: (1) the species rarely occur within the lower portion of the Mississippi River near the Nairn Dune borrow site; and (2) the Corps would implement, as part of the project construction plan, protective measures for sturgeon during dredging operations within the river (Appendix B). Federally listed sea turtles (i.e., Kemp's ridley, hawksbill, loggerhead, leatherback, and green sea turtles) are not currently known to nest in Louisiana. It is our understanding that the Corps has conducted a separate consultation with the National Marine Fisheries Service (NMFS) regarding project-related effects to sea turtles offshore. The NMFS is also responsible for Section 7 consultation with the Corps for the threatened Gulf sturgeon (*Acipenser oxyrhynchus desotoi*) in estuarine and marine waters. Accordingly, none of the species mentioned in this paragraph will be discussed further in this biological opinion (Table 1).

[1] For law enforcement purposes shovelnose sturgeon are classified as "Threatened due to Similarity of Appearance" wherever they coexist with the endangered pallid sturgeon. They are biologically neither endangered nor threatened but this designation extends the ESA take prohibitions to shovelnose sturgeon, shovelnose-pallid sturgeon hybrids, and their roe when associated with a commercial fishing activity.

Table 1. Species and critical habitat evaluated for effects from the proposed action but not discussed further in this biological opinion.

Species or Critical Habitat	Present in Action Area	Present in Action Area but "Not Likely to Adversely Affect"
West Indian manatee	Possible	Yes
Pallid sturgeon	Possible	Yes
Shovelnose sturgeon*	Possible	Yes

* For law enforcement purposes shovelnose sturgeon are classified as "Threatened due to Similarity of Appearance" wherever they coexist with the endangered pallid sturgeon. They are biologically neither endangered nor threatened but this designation extends the ESA take prohibitions to shovelnose sturgeon, shovelnose-pallid sturgeon hybrids, and their roe when associated with a commercial fishing activity.

Consultation History

On September 26, 2003, the Service provided the Corps with a detailed list of and habitat descriptions for federally threatened and endangered species, their critical habitat, and migratory birds that may be found in or near the study area for the draft LCA Comprehensive Study. On May 2, 2005, the Service provided a project-specific list of federally threatened and endangered species to the Corps in response to their request for our comments and participation as a cooperating agency in the preparation of their Draft Environmental Impact Statement for the BBBSR project.

On May 18, 2006, the Service and the Corps conducted a site visit to discuss potential project-related effects to the piping plover and its critical habitat. On July 11, 2006, the Service provided the Corps with additional specific biological information for the piping plover for preparation of their draft BA.

On May 11, 2009, the Service concurred with the Corps' determination that the originally proposed project as described in their April 24, 2009, BA, was not likely to adversely affect the piping plover or its designated critical habitat.

Proposed project modifications were presented to the Service via meetings, telephone calls, and ongoing coordination between the Service and the Corps in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). On August 5, 2010, the Service provided a supplemental letter to our April 30, 2009, draft Fish and Wildlife Coordination Act Report regarding the Corps' proposed changes in the Tentatively Selected Plan (TSP) for the BBBSR project. That letter recommended that the Corps re-initiate section 7 consultation due to the changes in the project scope and location.

On August 11, 2010, the Corps provided the Service with their August 9, 2010, supplemental BA regarding the proposed changes in the scope and location of the BBBSR project, as well as detailed information regarding a change in the environmental baseline due to the impacts to the project area as a result of the Deepwater Horizon Mississippi Canyon Well #252 oil spill. Due to the nature of the project changes and the change in the project-area environmental baseline, the Corps requested to initiate formal consultation. On August 19, 2010, the Service provided confirmation to the Corps that all information had been received and that a biological opinion would be issued no later than December 24, 2010.

On August 23, 2010, the Service and the Corps conducted a site visit to discuss the changes in the proposed project and its potential effects to existing piping plover habitat, as well as the effects to

existing habitat related to the Deepwater Horizon oil spill. On September 16, 2010, the Corps provided the Service with additional clarification of the proposed project changes specifically regarding the proposed location and placement of the feeder beach berm.

On October 7, 2010, the Corps informed the Service that the project plan had changed and that the Corps would be rescinding its request for formal consultation. On December 6, 2010, the Corps rescinded its request for formal consultation and instead requested early consultation; that request also contained a revised version of their August 9, 2010, supplemental BA. On January 6, 2011, the Service provided confirmation to the Corps that all information had been received and that a preliminary biological opinion would be issued no later than April 24, 2011. On March 28, 2011, the Service issued a preliminary biological opinion (Service Log No. 43440-2010-R-2889) to the Corps.

On July 11, 2011, the Corps submitted a revised BA dated June 3, 2011, which included changes to the proposed action and a request to re-initiate early consultation due to changes in the frequency and quantity of nourishment for the Caminada Headland portion of the proposed project. On August 3, 2011, the Service provided confirmation to the Corps that all information had been received and that an updated preliminary biological opinion would be issued no later than November 23, 2011.

On July 27, 2011, the Service provided comments on the Corps' Draft Environmental Impact Statement (EIS) requesting that additional information regarding potential project-related effects to the endangered pallid sturgeon and shovelnose sturgeon be included in the Final EIS. Based on that information, the Corps re-submitted their June 3, 2011, BA with the additional information regarding those species with a request to include them in this consultation. On September 2, 2011, the Service provided confirmation to the Corps that all additional information for those species had been received and that an updated preliminary biological opinion would be issued no later than January 8, 2012. On September 30, 2011, the Service issued a preliminary biological opinion (Service Log No. 43440-2011-R-2621) to the Corps.

On December 14, 2011, the Service received the Corps' December 13, 2011, request to finalize the September 30, 2011, preliminary biological opinion. No public comments were received on the draft EIS that resulted in changes to the project or to the information used to develop this biological opinion. On December 21, 2011, the Service confirmed that this document transmits the final biological opinion for the proposed action.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Corps' 2004 LCA Report developed 3 hydrogeomorphic objectives: (1) maintaining salinity gradients; (2) increasing sediment input from sources outside the estuarine basins; and (3) maintaining or establishing natural landscape features and hydrologic processes that are critical to sustainable ecosystem structure and function. Accordingly, the goals of the proposed BBBSR project are: (1) to restore the geomorphic function and unique fish and wildlife habitats of the Caminada headland barrier system and Shell Island reach; and (2) to reverse the current trend of degradation in the Caminada headland and Shell Island reaches of the Barataria Basin (Figure 1) for a 50-year period (Corps 2009a). The Tentatively Selected Plan (TSP) consists of Caminada Headland Alternative 5 – Preferred Dune with Expanded Marsh and Subtidal Feeder Bar, and Shell Island Alternative 5 – One Island with Two Renourishments. The TSP would implement restoration of geomorphic form and function by separating the Gulf of Mexico from the interior estuaries and helping to regulate salinity gradients

important to the range of estuarine and freshwater wetland species for the period of analysis. The geomorphic structures prevent open Gulf of Mexico wave energy from impacting the interior estuary and provide hydrodynamic stability to the system. Loss of those functions would have impacts beyond the project footprint within the Barataria Basin. The Corps anticipates beginning construction of the TSP in early 2012. For details on specific project features (i.e., dredging, sand fencing, planting) common to each alternative component, please refer to the **Restoration features common to the entire project** section of the project description on page 7. Each alternative component is described in detail below.

Caminada Headland Alternative 5: Restored Dune with Created Marsh and Subtidal Feeder Bar

The initial construction on the Caminada Headland will create 1,186 acres of saline marsh and 880 acres of dune/beach complex, for a total of 2,066 acres at target year (TY) 1. The newly created acres will cover much of the existing habitat acreages in the direct project footprint. Borrow material for construction would be used from the South Pelto Block of Ship Shoal located approximately 40 miles offshore, southwest of Belle Pass. The duration for dredging material for the Caminada portion of the project would be approximately 2.5 years. Onshore construction activities would occur concurrently with dredging operations but may extend for another 6 months after dredging is completed. Planting of native vegetation would require approximately 750 days over a 3-year period once all construction is completed.

Dune/Beach Complex

The dune height would be constructed to +7 feet (2.13 meters [m]) North American Vertical Datum 1988 (NAVD) which is higher than the existing (degraded) dune elevation of +3.4 feet (1.04 m) NAVD. The proposed dune width would be 290 feet (88.29 m). The majority of the dune would be located landward over existing higher elevations to maximize project acreage and longevity. The landward and seaward slopes are set at a 20-foot horizontal to 1-foot vertical slope (20H:1V). The beach fill design has a 65-foot-wide (19.81 m) seaward berm at an elevation of +4.5 feet (1.37 m) NAVD. Approximately 13 miles of dune and beach will be created. Fill quantity for the beach/dune complex is 5.1 million cubic yards (CY). Vegetative plantings will include a variety of native dune grass species. Sand fencing will be installed to promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings.

The dune/beach complex feature of the Caminada headland would include repair and/or maintenance of sand fencing. The maintenance estimate for sand fencing includes complete replacement in TY5 with 20 percent replacement every 5 years for the 50-year period of analysis. In addition to this task, the non-Federal sponsor would monitor the project area and enforce the restrictions of the easements through yearly inspections of the project area. Sufficient land rights will be obtained to perform operations and maintenance (O&M) over 50 years.

Marsh Creation

The expanded marsh feature includes restoration and creation of a marsh platform located between the Chevron Canal to the north and the beach/dune component to the south (Figure 2). Approximately 5.36 million CY would be used to construct a marsh elevation of +2.0 feet (0.61 m) NAVD that would create a functioning intertidal marsh with no renourishment planned for the 50-year project life. The native marsh elevation for the back-barrier marsh is 0.94 feet (0.29 m) NAVD. The marsh platform

would be planted with various native marsh grasses, and would provide substrate for over-wash splays and northward dune/beach migration.

Subtidal Feeder Bar

The Corps' Coastal Engineering Manual (CEM) (Corps 2006) describes feeder beaches as finite-length berms placed along a beach, usually at the up-drift end of a littoral cell that has strong unidirectional shore-parallel transport. They can also be placed at a nodal "hot spot" where shore-parallel transport divides, thus moving sediment in both directions away from the node. This concept involves placing a large volume of sediment in a limited area and relying on littoral processes to move it down the beach, thus gradually nourishing the beach at a distance from the placement site. The CEM describes feeder beaches in the same terms as normal beach restoration projects, with the sediment placed on the beach face, but not necessarily "...the same degree of along-shore uniformity as that provided by placing fill in a prescribed manner throughout the project area" (Corps 2006). The feeder beach concept has been expanded to include subsurface placement of sediment to create a "feeder bar," which relies on coastal processes to move the sediment onto the beach face naturally. A sub-tidally placed feeder bar that nourishes the beach profile without need for heavy grading machinery and/or disturbance to environmentally sensitive habitats can be more desirable and is typically less expensive than a conventional feeder beach. In addition, as wave action carries fine sediment onto the beach face and deposits it, an opportunity is afforded for Aeolian transport to move fine sands up the beach and onto the dune, thus, nourishing the system. The fine grained sediment that will be placed in the subtidal feeder bar would move onto the beach face in a gradual manner; consequently the feeder bar is not expected to cause extensive stacking of sediment on the beach which could smother the benthic fauna and contribute additional stress to the remaining benthic community within piping plover critical habitat.

Modeling was used to compare initial and final shorelines with and without the feeder bar. The results indicate that, by the end of the 2-year period between material placement events, the feeder bar diffuses to the east and west of its initial placement by approximately 2,000 feet (609.6 m). The percent reduction in volume losses from the modeled design storms that were attributed to the feeder bar ranged from 54 percent to 90 percent and the percent reduction in beach/dune erosion ranged from 49 percent to 81 percent. While the storm damage to the headland remains significant from storms of these magnitudes, the feeder bar does provide a quantifiable benefit for storm damage reduction. It is noted that these model results should be interpreted carefully for several reasons. First, the material will be placed as unconfined disposal thus the profile shape may vary significantly from the assumed bar configuration. Second, lateral diffusion will occur relatively quickly reducing the "density" of the feeder bar along the placement area. Third, the storm damage reduction benefit will be localized to the nodal zone and adjacent beaches as the feeder bar diffuses, which is approximately 13 percent of the entire Caminada Headland shoreline.

Based on the sediment budget prepared for the Caminada headland, the loss of sediment from the headland is estimated to be 379,000 CY per year. Thus, maintenance of the headland would include the beneficial placement of dredged material from O&M dredging of the bar channel of Bayou Lafourche, Louisiana (i.e., Belle Pass) in a feeder bar disposal area (Corps 2011). Dredging of Belle Pass yields an average of 650,000 CY of material, which would be used to nourish the offshore feeder bar every 1.5 to 2 years. Historically this material has been placed immediately east and west of the jetties at beach nourishment disposal sites. As part of the adaptive management plan, shoreline imagery will be evaluated to determine the renourishment approach. Based on shoreline conditions one of two basic approaches will be used:

1. When monitoring data indicate that the shoreline is relatively intact (i.e., no breaches), the 650,000 cy of dredged material from Belle Pass will be placed at the feeder bar disposal area located in the littoral drift south of Bayou Moreau (Figure 2) where the sediment budget indicates that the long-shore transport of material splits going east and west (Figure 4). Placement of material at this location sustains the project by building out the shoreline at the nodal point, which is an area of more rapid shoreline erosion, and by feeding material along the entire reach through existing long-shore transport patterns. Material would be placed unconfined for a length of 13,000 feet (3,962.4 m) located between 100 and 300 feet (30.48 and 91.44 m, respectively) from the mean high water (MHW) mark to allow long-shore transport and wave action to move and place the sediment along the headland. There would be no direct placement of sediment onto the beach during the dredged material placement events. All dredged material for the feeder bar would be placed seaward of mean low low water (MLLW) (horizontal) and at, or below, MLLW (vertical) located offshore of the nodal point. The material would be stacked no higher than + 6 feet (1.83 m) mean low grade, but would be quickly reworked by the wind and waves (due to the high energy environment of that area). The pumping of the material would take approximately 54 days, with placement and removal of the pipeline taking a total of approximately 98 days. The pipe would be placed offshore. The material would be dredged from the Bayou Lafourche channel (a federal navigation channel) which previously received clearance under the National Environmental Policy Act for maintenance dredging. Over each 10 year period, an estimated 3.9 million CY of material would be returned to the headland.

2. When monitoring data indicate that the shoreline has been breached or severely damaged by over-wash and/or other erosion, dredged material would be beneficially placed to repair breaches and/or other highly eroded areas. The material would be placed in a manner which restores the shoreline to conditions similar to what existed prior to breaching. Each breach or over-wash restoration action would be coordinated with the Service on a case by case basis. If the volume of material available is greater than the quantity required to repair breaches and erosional hot spots, then the remaining material will be placed in the feeder bar disposal area at the nodal point of the shoreline.

Timing of the renourishment will be dependent upon the maintenance dredging requirements of the Bayou Lafourche, Louisiana project. If maintenance dredging of Bayou Lafourche is not scheduled when the Corps determines that renourishment is required, the non-federal sponsor would provide another source of material. Any changes to the Corps O&M plan would receive environmental clearances, including section 7 consultation under the Act with the appropriate agencies.

Shell Island Alternative 5: One Island with Two Renourishments

Shell Island Alternative 5 would restore the Shell Island reach as a 783-acre island (Figure 3), including a beach berm, dune ridge, and saline marsh platform. The east end of the new island would be located near the Empire waterway, and the west end would be terminated approximately 0.5-mile before Grand Bayou. The alternative would attempt to restore existing island remnants to a pre-Hurricane Bob (1979) condition, and the shortest and shallowest route across Coupe Bob would be utilized. The Corps anticipates that the closure of Coupe Bob would return the tidal prism to its pre-1979 path which flowed through Grand Bayou; thus, Grand Bayou would increase in size in response to the altered tidal flow pattern. The borrow source for the dune/beach complex would be a large sand deposit in the Mississippi River near Nairn between mile markers 32 and 34, which is located approximately 11 miles north of the Shell Island reach. The sand, which is comparable in grain size to

sand found at the project site, would be pumped to the project area via pipeline. The borrow source for marsh creation would be the Empire deposit located 1.5 miles from the Empire jetties; that site contains material more suitable for marsh construction.

The duration for construction activities for the Shell Island reach is approximately 2.17 years. Onshore construction activities would occur concurrently with dredging operations but may extend for another 6 months after dredging is completed. Planting of native vegetation would require approximately 360 days over a 3-year period once all construction is completed. Periodic renourishment would be implemented at TY 20 and TY 40. The Corps estimates that approximately 1.5 million CY of beach fill would be needed for each renourishment cycle in TY 20 and TY 40, approximately 907,200 CY of marsh fill would be needed for renourishment in TY20, and 604,700 CY of marsh fill would be needed in TY 40.

Dune/Beach Complex

The landward edge of the dune would be located seaward of the existing shoreline. The dune height would be constructed to +6 feet (1.83 m) NAVD and dune width would be 189 feet (57.6 m). The landward and seaward slopes are set at a 45-foot horizontal to 1-foot vertical slope (45H:1V). The beach fill design has not yet been selected, and would vary as a non-uniform 300-foot-wide (91.44 m) seaward berm at an elevation of greater than +2 feet (0.61 m) and less than +4.5 feet (1.37 m) NAVD. Approximately 317 acres of shoreline/dune (area above +2 feet NAVD) would be created. The anticipated fill quantity for the beach/dune complex is 5.6 million CY. Vegetative plantings will include a variety of native dune grass species. Sand fencing will be installed to promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings.

Marsh Creation

The marsh feature includes creation of a marsh platform located north of the beach/dune component. However, in deeper water (bathymetry below -3 feet NAVD, as found across Coupe Bob) marsh fill cannot be used because as the material de-waters there would be rapid and non-uniform settling, which would preclude marsh creation. Therefore, at depths of -3 feet and deeper (i.e., across Coupe Bob), a sand base would be constructed and a sand-filled geotextile tube would be used as containment prior to placement of marsh fill material. For areas in shallow water (bathymetry up to -2 or -3 feet NAVD) there is no need for a sand base, and containment dikes would be constructed with waterbottom material within the marsh fill footprint. A uniform marsh width of 735 feet (224 m) would be constructed to result in an island width of approximately 1,240 feet (377.95 m) following equilibration of the shoreline. Approximately 2.1 million CY would be used to construct 466 acres of marsh to an elevation of +2.0 feet (0.61 m) NAVD, which would result in a functioning intertidal marsh. The marsh platform would be planted with various native marsh grasses, and would provide substrate for over-wash splays and northward dune/beach migration.

Restoration features common to the entire project

Dredging of all offshore borrow areas would be conducted using a hydraulic cutter-head dredge, for which the Corps has already conducted section 7 consultation with the NMFS. For the proposed dredging site within the Mississippi River, the Corps would implement protective measures for sturgeon (Appendix B). The dredged material would be transported to an island or headland using a booster pump(s), if needed, and submerged sediment pipeline. Borrow locations are located sufficient

distance from the restoration sites that they will not impact littoral drift or project longevity. The following construction actions would be implemented for all of the above-listed alternative features:

a) For the dune areas, the dredged material would be deposited on the beach and re-worked by bulldozers and front-end loaders.
b) For the marsh creation areas, temporary containment dikes would be constructed to contain the marsh fill material during construction. The material for dike construction will be dredged from within the footprint of the marsh creation area so that the excavated area is filled during construction. The dike volume is included within the marsh fill volume. (A second option for the Shell Island reach only is to contain marsh fill using a sand-filled geotextile tube along the perimeter of the constructed sand base in areas where water depths are deeper than -3 feet NAVD.)
c) All dredging and discharge operations will be completed in a manner that will minimize turbidity of the water at the dredge and discharge sites.
d) Sand fencing will be installed to promote capture of Aeolian sand. One shore-parallel fence will be installed approximately 50 feet (15.24 m) north of the southern toe of the dune to continue the capture of transported sand until the surface is vegetated. The sand fence will extend along the total length of the constructed dune. Sand fences will be installed in sequences/phases. The installation would start from the southern side of the dune so as to build dune towards the Gulf and proceed north. Additional rows of sand fencing may be added once the sand is stacked almost to the top of the fence.
e) Vegetative plantings along the created dune and marsh project features will include a variety of native dune and marsh grass species. The recommended planting density is no greater than 8-foot centers.

Project effects would occur along the entire length of the Caminada headland and the Shell Island reach due to the dynamic nature of coastal processes and the long-shore transport of sediments within the Barataria Basin barrier system. The Shell Island reach is not designated as critical habitat for the piping plover; however, it does consist of suitable habitat for the species. Portions of the Caminada headland are included in critical habitat Unit LA-5 (described in detail in the **Species/critical habitat description** and **Status of the species within the action area** sections of this document). The Service has described the action area to include all of the Caminada headland and Shell Island reach, and their associated sand and mud flats, for reasons that will be explained and discussed in detail in the **EFFECTS OF THE ACTION** section of this consultation.

STATUS OF THE SPECIES/CRITICAL HABITAT

Species/critical habitat description

The piping plover is a small (7 inches [17.78 centimeters (cm)] long), pale, sand-colored shorebird with a wingspan of 15 inches (38.1 cm) (Palmer 1967). On January 10, 1986, the piping plover was listed as endangered in the Great Lakes watershed and threatened elsewhere within its range, including migratory routes outside of the Great Lakes watershed and wintering grounds (Service 1985). Piping plovers were listed principally because of habitat destruction and degradation, predation, and human disturbance. Protection of the species under the Act reflects the species' precarious status range-wide. Three separate breeding populations have been identified, each with its own recovery criteria: the northern Great Plains (threatened), the Great Lakes (endangered), and the Atlantic Coast (threatened). The piping plover winters in coastal areas of the United States (U.S.) from North Carolina to Texas, and along the coast of eastern Mexico and on Caribbean islands from Barbados to Cuba and the

Bahamas (Haig and Elliott-Smith 2004). Piping plover subspecies are phenotypically indistinguishable, and most studies in the nonbreeding range report results without regard to breeding origin. Although a recent analysis shows strong patterns in the wintering distribution of piping plovers from different breeding populations, partitioning is not complete and major information gaps persist. Therefore, information summarized here pertains to the species as a whole (i.e., all three breeding populations), except where a particular breeding population is specified (Figure 6).

The Service has designated critical habitat for the piping plover on three occasions. Two of these designations protected different breeding populations. Critical habitat for the Great Lakes breeding population was designated May 7, 2001 (66 Federal Register (FR) 22938; Service 2001a), and critical habitat for the northern Great Plains breeding population was designated September 11, 2002 (67 FR 57637; Service 2002). The Service designated critical habitat for wintering piping plovers on July 10, 2001 (66 FR 36038; Service 2001b). Wintering piping plovers may include individuals from the Great Lakes and northern Great Plains breeding populations as well as birds that nest along the Atlantic coast.

Designated wintering piping plover critical habitat originally included 142 areas (the rule states 137 units; this is in error) encompassing about 1,793 miles of mapped shoreline and 165,211 acres of mapped areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. Since the designation of wintering critical habitat, 19 units (TX-3,4,7-10, 14-19, 22, 23, 27,28, and 31-33) in Texas have been vacated and remanded back to the Service for reconsideration by Court order (Texas General Land Office v. U.S. Department of Interior, Case No. V-06-CV-00032). On May 19, 2009, the Service published a final rule designating 18 revised critical habitat units in Texas, totaling approximately 139,029 acres (74 FR 23476). The Courts also vacated and remanded back to the Service for reconsideration, four units in North Carolina (Cape Hatteras Access Preservation Alliance v. U.S. Department of Interior, 344 F. Supp. 2d 108 (D.D.C. 2004)). The four critical habitat units vacated were NC-1, 2, 4, and 5, and all occurred within Cape Hatteras National Seashore (CAHA). A revised designation for these four units was published on October 21, 2008 (73 FR 62816).

The primary constituent elements (PCEs) for piping plover wintering habitat are those biological and physical features that are essential to the conservation of the species. The PCEs are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. These areas typically include coastal areas that support intertidal beaches and flats and associated dune systems and flats above annual high tide (Service 2001a). PCEs of wintering piping plover critical habitat include sand or mud flats (or both) with no or sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting piping plovers (Service 2001a). Important components of the beach/dune ecosystem include surf-cast algae, sparsely vegetated back beach and salterns, spits, and washover areas. Washover areas are broad, unvegetated zones, with little or no topographic relief, that are formed and maintained by the action of hurricanes, storm surge, or other extreme wave action. The units designated as critical habitat are those areas that have consistent use by piping plovers and that best meet the biological needs of the species. The amount of wintering habitat included in the designation appears sufficient to support future recovered populations, and the existence of this habitat is essential to the conservation of the species. Additional information on each specific unit included in the designation can be found at 66 FR 36038 (Service 2001a).

Activities that affect PCEs include those that directly or indirectly alter, modify, or destroy the processes that are associated with the formation and movement of barrier islands, inlets, and other coastal landforms. Those processes include erosion, accretion, succession, and sea-level change. The integrity of the habitat components also depends upon daily tidal events and regular sediment transport processes, as well as episodic, high-magnitude storm events (Service 2001b).

Life History

Piping plovers live an average of five years, although studies have documented birds as old as 11 (Wilcox 1959) and 15 years. Breeding activity begins in mid-March when birds begin returning to their nesting areas (Coutu et al. 1990; Cross 1990; Goldin et al. 1990; MacIvor 1990; Hake 1993). Plovers are known to begin breeding as early as one year of age (MacIvor 1990; Haig 1992); however, the percentage of birds that breed in their first adult year is unknown. Piping plovers generally fledge only a single brood per season, but may re-nest several times if previous nests are lost.

The most consistent finding in the various population viability analyses conducted for piping plovers indicates that even small declines in adult and juvenile survival rates will cause very substantial increases in extinction risk (Ryan et al. 1993; Melvin and Gibbs 1996; Plissner and Haig 2000; Wemmer et al. 2001; Larson et al. 2002; Amirault et al. 2005; Calvert et al. 2006; Brault 2007). A banding study conducted between 1998 and 2004 in Atlantic Canada found lower return rates of juvenile (first year) birds to the breeding grounds than was documented for Massachusetts (Melvin and Gibbs 1994; Service 1996), Maryland (Loegering 1992), and Virginia (Cross 1996) breeding populations in the mid-1980s and very early 1990s. This is consistent with failure of the Atlantic Canada population to increase in abundance despite very high productivity (relative to other breeding populations) and extremely low rates of dispersal to the U.S. over the last 15 plus years (Amirault et al. 2005). Simply stated, this suggests that maximizing productivity does not ensure population increases.

Efforts to partition survival within the annual cycle are beginning to receive more attention, but current information remains limited. Drake et al. (2001) observed no mortality among 49 radio-marked piping plovers (total of 2,704 transmitter days) in Texas in 2007-2008. Cohen et al. (2008a) documented no mortality of 7 radio-tracked wintering piping plovers at Oregon Inlet from December 2005 to March 2006. They speculate their high survival rate was attributed to plover food availability much of the day as well as the low occurrence of days below freezing and infrequent wet weather. Analysis of South Carolina resighting data for 87 banded piping plovers (78 percent Great Lakes breeders) in 2006-2007 and 2007-2008 found 100 percent survival from December to April[2] (J. Cohen, Virginia Polytechnic Institute and State University, pers. comm. 2009). Noel et al. (2007) inferred two winter (November to February) mortalities[3] among 21 banded (but not radio-tagged) overwintering piping plovers in 2003-2004 and 9 mortalities among 19 overwintering birds during the winter of 2004-2005 at Little St. Simons Island, Georgia. LeDee (2008) found higher apparent survival[4] rates during breeding and southward migration than during winter and northward migration for 150 adult (i.e., after-hatch year) Great Lakes piping plovers.

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[2] Of those birds, one unique and one non-uniquely banded piping plover were seen in the first winter and were resighted multiple times in the second fall at the same location but were not seen during the second winter; whether these two birds died in the fall or shifted their wintering location is unknown (Maddock et al. 2009).

[3] Noel et al. (2007) inferred mortality if a uniquely banded piping plover with multiple November to February sightings on the survey site disappeared during that time and was never observed again in either it's nonbreeding or breeding range. Note that most of these birds were from the Great Lakes breeding population, where detectability during the breeding season is very high.

[4] "Apparent survival" does not account for permanent emigration. If marked individuals leave a survey site, apparent survival rates will be lower than true survival. If a survey area is sufficiently large, such that emigration out of the site is unlikely, apparent survival will approach true survival.

Mark-recapture analysis of resightings of uniquely banded piping plovers from seven breeding areas by Roche et al. (2010) found that apparent adult survival declined in four populations and increased in none over the life of the studies[5]. Some evidence of correlation in year-to-year fluctuations in annual survival of Great Lakes and eastern Canada populations, both of which winter primarily along the southeastern U.S. Atlantic Coast, suggests that shared over-wintering and/or migration habitats may influence annual variation in survival. Further concurrent mark-resighting analysis of color-banded individuals across piping plover breeding populations has the potential to shed light on threats that affect survival in the migration and wintering range. However, very little to no information exists specifically for birds wintering along the northern Gulf of Mexico. An ongoing Natural Resource Damage Assessment and Restoration (NRDAR) study of piping plovers that are potentially affected by the 2010 Deepwater Horizon oil spill may provide such information once the data gathered are eligible for release to the public.

Migration

Plovers depart their breeding grounds for their wintering grounds from July through late August, but southward migration extends through November. Piping plovers spend up to 10 months of their life cycle on their migration and winter grounds, generally July 15 through as late as May 15. Piping plovers migrate through and winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean. Both spring and fall migration routes of Atlantic Coast breeders are believed to occur primarily within a narrow zone along the Atlantic Coast (Service 1996). The pattern of both fall and spring counts at many Atlantic Coast sites demonstrates that many piping plovers make intermediate stopovers lasting from a few days up to one month during their migrations (Noel et al. 2005; Stucker and Cuthbert 2006). Some mid-continent breeders travel up or down the Atlantic Coast before or after their overland movements (Stucker and Cuthbert 2006). Use of inland stopovers during migration is also documented (Pompei and Cuthbert 2004). The source breeding population of a given wintering individual cannot be determined in the field unless it has been banded or otherwise marked. Information from observation of color-banded piping plovers indicates that the winter ranges of the breeding populations overlap to a significant degree. See the **Status and Distribution** section for additional information pertaining to population distribution on the wintering grounds. While piping plover migration patterns and needs remain poorly understood and occupancy of a particular habitat may involve shorter periods relative to wintering, information about the energetics of avian migration indicates that this might be a particularly critical time in the species' life cycle.

Foraging (nonbreeding portion of annual cycle)

Behavioral observation of piping plovers on the wintering grounds suggests that they spend the majority of their time foraging (Nicholls and Baldassarre 1990a; Drake 1999a, 1999b). Feeding activities may occur during all hours of the day and night (Staine and Burger 1994; Zonick 1997), and at all stages in the tidal cycle (Goldin 1993; Hoopes 1993). Wintering plovers primarily feed on invertebrates such as polychaete marine worms, various crustaceans, fly larvae, beetles, and occasionally bivalve mollusks (Bent 1929; Nicholls 1989; Zonick and Ryan 1995). They peck these invertebrates on top of the soil or just beneath the surface. Plovers forage on moist substrate features such as intertidal portions of ocean beaches, washover areas, mudflats, sand flats, algal flats, shoals, wrack lines, sparse vegetation, shorelines of coastal ponds, lagoons, ephemeral pools and adjacent to

[5] Data were analyzed for 3 to 11 years per breeding area, all between 1998 and 2008.

salt marshes (Gibbs 1986; Zivojnovich 1987; Nichols 1989; Nicholls and Baldassarre 1990a; Nicholls and Baldassarre 1990b; Coutu et al. 1990; Hoopes et al. 1992; Loegering 1992; Goldin 1993; Elias-Gerken 1994; Wilkinson and Spinks 1994; Zonick 1997; Service 2001a). Studies from the coastal breeding range have shown that the relative importance of various feeding habitat types may vary by site (Gibbs 1986; Coutu et al. 1990; McConnaughey et al. 1990; Loegering 1992; Goldin 1993; Hoopes 1993). Cohen et al. (2006) documented more abundant prey items and biomass on sound island and sound beaches than the ocean beach. On the wintering grounds, Ecological Associates, Inc. (2009) observed that during piping plover surveys at St. Lucie Inlet, Martin County, Florida, intertidal mudflats and/or shallow subtidal grass flats appear to have greater value as foraging habitat than the unvegetated intertidal areas of a flood shoal.

Roosting

Several studies identified wrack (organic material including seaweed, seashells, driftwood, and other materials deposited on beaches by tidal action) as an important component of roosting habitat for nonbreeding piping plovers. Lott et al. (2009) found greater than 90 percent of roosting piping plovers in southwest Florida in old wrack with the remainder roosting on dry sand. In South Carolina, 45 percent of roosting piping plovers were in old wrack, and 18 percent were in fresh wrack. The remainder of roosting birds used intertidal habitat (22 percent), backshore (defined as zone of dry sand, shell, cobble and beach debris from mean high water line up to the toe of the dune)(8 percent), washover and ephemeral pools 2 percent and 1 percent respectively (Maddock et al. 2009). Thirty percent of roosting piping plovers in northwest Florida were observed in wrack substrates with 49 percent on dry sand and 20 percent using intertidal habitat (Smith 2007). In Texas, sea grass debris (bay-shore wrack) was an important feature of piping plover roost sites (Drake 1999b). Mean abundance of two other plover species in California, including the listed western snowy plover (*Charadrius alexandrinus nivosus*), was positively correlated with abundance of wrack during the nonbreeding season (Dugan et al. 2003).

Natural protection

Cryptic coloration is a primary defense mechanism for this species. Nests, adults, and chicks all blend in with their typical beach surroundings. Piping plovers on wintering and migration grounds respond to intruders (pedestrian, avian and mammalian) usually by squatting, running, and flushing (flying).

Wintering habitat

Wintering piping plovers prefer coastal habitat that include sand spits, islets (small islands), tidal flats, shoals (usually flood tidal deltas), and sandbars that are often associated with inlets (Harrington 2008). Sandy mud flats, ephemeral pools, and over-wash areas are also considered primary foraging habitats. These substrate types have a richer infauna than the foreshore of high energy beaches and often attract large numbers of shorebirds (Cohen et al. 2006). Wintering plovers are dependent on a mosaic of habitat patches and move among these patches depending on local weather and tidal conditions (Nicholls and Baldassarre 1990a).

Recent study results in North Carolina, South Carolina, and Florida complement information from earlier investigations in Texas and Alabama (summarized in the 1996 Atlantic Coast and 2003 Great Lakes Recovery Plans) regarding habitat use patterns of piping plovers in their coastal migration and wintering range. Maddock et al. (2009) observed shifts to roosting habitats and behaviors during high-tide periods in South Carolina. In South Carolina, exposed intertidal areas were the dominant foraging

substrate (accounting for 94 percent of observed foraging piping plovers; Maddock et al. 2009). As observed in Texas studies, Lott et al. (2009) identified bay beaches (bay shorelines as opposed to ocean-facing beaches) as the most common landform used by foraging piping plovers in southwest Florida. In northwest Florida, however, Smith (2007) reported landform use by foraging piping plovers about equally divided between Gulf of Mexico (ocean-facing) and bay beaches. Exposed intertidal areas were the dominant foraging substrate in South Carolina (accounting for 94 percent of observed foraging piping plovers; Maddock et al. 2009) and in northwest Florida (96 percent of foraging observations; Smith 2007). In southwest Florida, Lott et al. (2009) found approximately 75 percent of foraging piping plovers on intertidal substrates.

Atlantic Coast and Florida studies highlighted the importance of inlets for non-breeding piping plovers. Almost 90 percent of observations of roosting piping plovers at ten coastal sites in southwest Florida were on inlet shorelines (Lott et al. 2009). Piping plovers were among seven shorebird species found more often than expected ($p = 0.0004$; Wilcoxon Scores test) at inlet locations versus non-inlet locations in an evaluation of 361 International Shorebird Survey sites from North Carolina to Florida (Harrington 2008).

Recent geographic analysis of piping plover distribution on the upper Texas coast noted major concentration areas at the mouths of rivers and washover passes (low, sparsely vegetated barrier island habitats created and maintained by temporary, storm-driven water channels) into major bay systems (Arvin 2008). Earlier studies in Texas have drawn attention to washover passes, which are commonly used by piping plovers during periods of high bay-shore tides and during the spring migration period (Zonick 1997; Zonick 2000). Cobb (*in* Elliott-Smith et al. 2009) reported piping plover concentrations on exposed sea grass beds and oyster reefs during seasonal low water periods in 2006.

The effects of dredge-material deposition merit further study. Drake et al. (2001) concluded that conversion of southern Texas mainland bay-shore tidal flats to dredged material impoundments results in a net loss of habitat for wintering piping plovers, because impoundments eventually convert to upland habitat not used by piping plovers. Zonick et al. (1998) reported that dredged material placement areas along the Intracoastal Waterway in Texas were rarely used by piping plovers, and noted concern that dredge islands block wind-driven water flows, which are critical to maintaining important shorebird habitats. By contrast, most of the sound islands used by foraging piping plovers at Oregon Inlet, North Caroline, were created by the Corps by deposition of dredged material in the subtidal bay bottom, with the most recent deposition ranging from 28 to less than 10 years prior to the study (Cohen et al. 2008a).

Mean home range size (95 percent of locations) for 49 radio-marked piping plovers in southern Texas in 1997-98 was 12.6 square-kilometers (km^2) (3,113 acres), mean core area (50 percent of locations) was 2.9 km^2 (717 acres), and mean linear distance moved between successive locations (1.97 ± 0.04 days apart), averaged across seasons, was 3.3 km (2.1 miles) (Drake 1999b; Drake et al. 2001). Seven radio-tagged piping plovers used a 20.1 km^2 (4,967 acres) area (100 percent minimum convex polygon) at Oregon Inlet in 2005-2006, and piping plover activity was concentrated in 12 areas totaling 2.2 km^2 (544 acres) (Cohen et al. 2008a). Noel and Chandler (2008) observed high fidelity of banded piping plovers to 1 km to 4.5 km (0.62 to 2.8 miles) sections of beach on Little St. Simons Island, Georgia.

Population dynamics

The 2006 Piping Plover Breeding Census, the last comprehensive survey throughout the breeding grounds, documented 3,497 breeding pairs with a total of 8,065 birds throughout Canada and U.S (Elliott-Smith et al. 2009).

Northern Great Plains Population

The Northern Great Plains plover breeds from Alberta to Manitoba, Canada, and south to Nebraska; although some nesting has recently occurred in Oklahoma. Currently the most westerly breeding piping plovers in the United States occur in Montana and Colorado. The decline of piping plovers on rivers in the Northern Great Plains has been largely attributed to the loss of sandbar island habitat and forage base due to dam construction and operation. Nesting occurs on sand flats or bare shorelines of rivers and lakes, including sandbar islands in the upper Missouri River system, and patches of sand, gravel, or pebbly-mud on the alkali lakes of the northern Great Plains. Plovers do nest on shorelines of reservoirs created by the dams, but reproductive success is often low and reservoir habitat is not available in many years due to high water levels or vegetation. Dams operated with steady constant flows allow vegetation to grow on potential nesting islands, making these sites unsuitable for nesting. Population declines in alkali wetlands are attributed to wetland drainage, contaminants, and predation.

The International Piping Plover Census (IPPC), conducted every five years, also estimates the number of piping plover pairs in the Northern Great Plains. As illustrated in Table 2 (next page), none of the IPPC estimates of the number of pairs in the U.S. suggests that the Northern Great Plains population has yet satisfied the recovery criterion of 2,300 pairs (Plissner and Haig 1997; Ferland and Haig 2002; Elliot-Smith et al. 2009). The IPPC count in prairie Canada reported 1,703 adult birds in 2006, which is also short of the goal of 2,500 adult piping plover as stated in the Service's Recovery Plan (Service 1988).

Table 2. The number of adult piping plovers and breeding pairs reported in the U.S. Northern Great Plains by the IPPC efforts (Plissner and Haig 1997; Ferland and Haig 2002; Elliot-Smith et al. 2009).

Year	Adults	Pairs Reported by the Census
1991	2,023	891
1996	1,599	586
2001	1,981	899
2006	2,959	1,212

The IPPC indicates that the U.S. population decreased between 1991 and 1996, then increased in 2001 and 2006. The Canadian population showed the reverse trend for the first three censuses, increasing slightly as the U.S. population decreased, and then decreasing in 2001. Combined, the IPPC numbers suggest that the population declined from 1991 through 2001, then increased almost 58 percent between 2001 and 2006 (Elliott-Smith et al. 2009).

The increase in 2006 is likely due in large part to a multi-year drought across much of the region starting in 2001 that exposed thousands of acres of nesting habitat. The Corps ran low flows on the riverine stretches of the Missouri River for most of the years between censuses, allowing more habitat

to be exposed and resulting in relatively high fledging ratios (Corps 2009b). The Corps also began to construct habitat using mechanical means (dredging sand from the riverbed) on the Missouri River in 2004, providing some new nesting and foraging habitat. The drought also caused reservoir levels to drop on many reservoirs throughout the Northern Great Plains (e.g., Missouri River Reservoirs in North and South Dakota, and Lake McConaughey in Nebraska), providing previously unavailable shoreline habitat. The population increase may also be partially due to more intensive management activities on the alkali lakes, with increased management actions to improve habitat and reduce predation pressures.

While the IPPC provides an index to the piping plover population, the design does not always provide sufficient information to understand the population's dynamics. The five-year time interval between IPPC efforts may be too long to allow managers to get a clear picture of what the short-term population trends are and to respond accordingly if needed. As noted above, the first three IPPCs (1991, 1996, and 2001) showed a declining population, while the fourth (2006) indicated a dramatic population rebound of almost 58 percent for the combined U.S. and Canada Northern Great Plains population between 2001 and 2006. With only four data points over 15 years, it is impossible to determine if and to what extent the apparent upswing reflects a real population trend versus error(s) in the 2006 census count and/or a previous IPPC. The 2006 IPPC included a detectability component, in which a number of pre-selected sites were visited twice by the same observer(s) during the two-week window to get an estimate of error rate. This study found an approximately 76 percent detectability rate through the entire breeding area, with a range of between 39 percent to 78 percent detectability among habitat types in the Northern Great Plains.

Such a reported large increase in population may indeed indicate a positive population trend, but with the limited data available, it is impossible to determine how much. Furthermore, with the next IPPC not scheduled until 2011, there is limited feedback in many areas on whether this increase is being maintained or if the population is declining in the interim. Additionally, the results from the IPPC have been slow to be released, adding to the time lag between data collection and possible management response.

Great Lakes Population

The Great Lakes plovers once nested on Great Lakes beaches in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario. Great Lakes piping plovers nest on wide, flat, open, sandy or cobble shoreline with very little grass or other vegetation. Reproduction is adversely affected by human disturbance of nesting areas and predation by foxes, gulls, crows and other avian species. Shoreline development, such as the construction of marinas, breakwaters, and other navigation structures, has adversely affected nesting and brood rearing.

The Recovery Plan (Service 2003) sets a population goal of at least 150 pairs (300 individuals), for at least 5 consecutive years, with at least 100 breeding pairs (200 individuals) in Michigan and 50 breeding pairs (100 individuals) distributed among sites in other Great Lakes states.

The Great Lakes piping plover population, which has been traditionally represented as the number of breeding pairs, has increased since the completion of the recovery plan in 2003 (Cuthbert and Roche 2007; 2006; Westbrock et al. 2005; Stucker and Cuthbert 2004; Stucker et al. 2003). The Great Lakes piping plover recovery plan documents the 2002 population at 51 breeding pairs (Service 2003). The census conducted in 2008 found 63 breeding pairs, an increase of approximately 23 percent. Of these, 53 pairs were found nesting in Michigan, while 10 were found outside the state, including six pairs in

Wisconsin and four in Ontario, Canada. The 53 nesting pairs in Michigan represent approximately 50 percent of the recovery criterion. The 10 breeding pairs outside Michigan in the Great Lakes basin, represents 20 percent of the goal, albeit the number of breeding pairs outside Michigan has continued to increase over the past five years. The single breeding pair discovered in 2007 in the Great Lakes region of Canada represented the first confirmed piping plover nest there in over 30 years, and in 2008 the number of nesting pairs further increased to four. Breeding pairs increased to 71 in 2009, but fell to 61 pairs in 2010. The decline from 2009 to 2010 is of particular concern because productivity of the Great Lakes population in 2008 and 2009 was very close to rates associated with earlier population growth.

In addition, the number of non-nesting individuals has increased annually since 2003. Between 2003-2008 an annual average of approximately 26 non-nesting piping plovers were observed, based on limited data from 2003, 2006, 2007, and 2008. Although there was some fluctuation in the total population from 2002 to 2008 the overall increase from 51 to 63 pairs combined with the increased observance of non-breeding individuals indicates the population is increasing.

Atlantic Coast Population

The Atlantic Coast piping plover breeds on coastal beaches from Newfoundland and southeastern Quebec to North Carolina. Historical population trends for the Atlantic Coast piping plover have been reconstructed from scattered, largely qualitative records. Nineteenth-century naturalists, such as Audubon and Wilson, described the piping plover as a common summer resident on Atlantic Coast beaches (Haig and Oring 1987). However, by the beginning of the 20th Century, egg collecting and uncontrolled hunting, primarily for the millinery trade, had greatly reduced the population, and in some areas along the Atlantic Coast, the piping plover was close to extirpation. Following passage of the Migratory Bird Treaty Act (40 Stat. 775; 16 U.S.C. 703-712) in 1918, and changes in the fashion industry that no longer exploited wild birds for feathers, piping plover numbers recovered to some extent (Haig and Oring 1985).

Available data suggest that the most recent population decline began in the late 1940s or early 1950s (Haig and Oring 1985). Reports of local or statewide declines between 1950 and 1985 are numerous, and many are summarized by Cairns and McLaren (1980) and Haig and Oring (1985). While Wilcox (1939) estimated more than 500 pairs of piping plovers on Long Island, New York, the 1989 population estimate was 191 pairs (Service 1996). There was little focus on gathering quantitative data on piping plovers in Massachusetts through the late 1960s because the species was commonly observed and presumed to be secure. However, numbers of piping plover breeding pairs declined 50 to 100 percent at seven Massachusetts sites between the early 1970s and 1984 (Griffin and Melvin 1984). Piping plover surveys in the early years of the recovery effort found that counts of these cryptically colored birds sometimes went up with increased census effort, suggesting that some historic counts of piping plovers by one or a few observers may have underestimated the piping plover population. Thus, the magnitude of the species decline may have been more severe than available numbers imply.

Annual estimates of breeding pairs of Atlantic Coast piping plovers are based on multiple surveys at most occupied sites. Sites that cannot be monitored repeatedly in May and June (primarily sites with few pairs or inconsistent occupancy) are surveyed at least once during a standard nine-day count period (Hecht and Melvin 2009).

Since its 1986 listing under the ESA, the Atlantic Coast population estimate (Service 2011) has increased 234 percent, from approximately 790 pairs to an estimated 1,849 pairs in 2009, and the U.S.

portion of the population has almost tripled, from approximately 550 pairs to an estimated 1,597 pairs. Even discounting apparent increases in New York, New Jersey, and North Carolina between 1986 and 1989, which likely were due in part to increased census effort (Service 1996), the population nearly doubled between 1989 and 2008. The largest population increase between 1989 and 2009 has occurred in New England (266 percent), followed by New York-New Jersey (70 percent). In the Southern (DE-MD-VA-NC) Recovery Unit, net growth between 1989 and 2009 was 52 percent, but almost all of this increase occurred in two years, 2003 to 2005. The eastern Canada population fluctuated from year to year, with increases often quickly eroded in subsequent years; net growth between 1989 and 2009 was 8 percent.

The overall population growth pattern was tempered by periodic rapid declines in the Southern and Eastern Canada Recovery Units. The eastern Canada population decreased 21 percent in just three years (2002 to 2005), and the population in the southern half of the Southern Recovery Unit declined 68 percent in seven years (1995 to 2001). The recent 64 percent decline in the Maine population, from 66 pairs in 2002 to 24 pairs in 2008, following only a few years of decreased productivity, provides another example of the continuing risk of rapid and precipitous reversals in population growth.

Status and distribution

Nonbreeding (migrating and wintering) Range

Piping plovers spend up to 10 months of their life cycle on their migration and winter grounds, generally July 15 through as late as May 15. Piping plover migration routes and habitats overlap breeding and wintering habitats, and, unless banded, migrants passing through a site usually are indistinguishable from breeding or wintering piping plovers. Migration stopovers by banded piping plovers from the Great Lakes have been documented in New Jersey, Maryland, Virginia, and North Carolina (Stucker and Cuthbert 2006). Migrating breeders from eastern Canada have been observed in Massachusetts, New Jersey, New York, and North Carolina (Amirault et al. 2005). As many as 85 staging piping plovers have been tallied at various sites in the Atlantic breeding range (Perkins 2008 pers. communication), but the composition (e.g., adults that nested nearby and their fledged young of the year versus migrants moving to or from sites farther north), stopover duration, and local movements are unknown. Review of published records of piping plover sightings throughout North America by Pompei and Cuthbert (2004) found more than 3,400 fall and spring stopover records at 1,196 sites. Published reports indicated that piping plovers do not concentrate in large numbers at inland sites and that they seem to stop opportunistically. In most cases, reports of birds at inland sites were single individuals. In general, distance between stopover locations and duration of stopovers throughout the coastal migration range remains poorly understood.

Piping plovers migrate through and winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean. Four range-wide, mid-winter (late January to early February) population surveys, conducted at five-year intervals starting in 1991, are summarized in Table 3. Total numbers have fluctuated over time, with some areas experiencing increases and others decreases. In 2001, 2,389 piping plovers were located during a winter census, accounting for only 40 percent of the known breeding birds recorded during a breeding census (Ferland and Haig 2002). About 89 percent of birds that are known to winter in the U.S. do so along the Gulf Coast (Texas to Florida), while 8 percent winter along the Atlantic Coast (North Carolina to Florida).

Table 3. Results of the 1991, 1996, 2001, and 2006 International Piping Plover Winter Censuses (Haig et al. 2005, Elliott-Smith et al. 2009).

Location	1991	1996	2001	2006
Virginia	not surveyed (NS)	NS	NS	1
North Carolina	20	50	87	84
South Carolina	51	78	78	100
Georgia	37	124	111	212
Florida	551	375	416	454
-Atlantic	*70*	*31*	*111*	*133*
-Gulf	*481*	*344*	*305*	*321*
Alabama	12	31	30	29
Mississippi	59	27	18	78
Louisiana	750	398	511	226
Texas	1,904	1,333	1,042	2,090
Puerto Rico	0	0	6	NS
U.S. Total	3,384	2,416	2,299	3,355
Mexico	27	16	NS	76
Bahamas	29	17	35	417
Cuba	11	66	55	89
Other Caribbean Islands	0	0	0	28
GRAND TOTAL	3,451	2,515	2,389	3,884
Percent of Total International Piping Plover Breeding Census	62.9%	42.4%	40.2%	48.2%

Regional and local fluctuations may reflect the quantity and quality of suitable foraging and roosting habitat, which vary over time in response to natural coastal formation processes as well as anthropogenic habitat changes (e.g., inlet relocation, dredging of shoals and spits). See, for example, discussions of survey number changes in Mississippi, Louisiana, and Texas by Winstead, Baka, and Cobb, respectively, *in* Elliott-Smith et al. (2009). Fluctuations may also represent localized weather conditions (especially wind) during surveys, or unequal survey coverage. For example, airboats facilitated first-time surveys of several central Texas sites in 2006 (Cobb *in* Elliott-Smith et al. 2009). Similarly, the increase in the 2006 numbers in the Bahamas is attributed to greatly increased census efforts; the extent of additional habitat not surveyed remains undetermined (Maddock and Wardle *in* Elliott-Smith et al. 2009). Changes in wintering numbers may also be influenced by growth or decline in the particular breeding populations that concentrate their wintering distribution in a given area. Major opportunities to locate previously unidentified wintering sites are concentrated in the Caribbean and Mexico (see pertinent sections in Elliott-Smith et al. 2009). Further surveys and assessment of seasonally emergent habitats (e.g., sea grass beds, mudflats, oyster reefs) within bays lying between the mainland and barrier islands in Texas are also needed.

Mid-winter surveys may substantially underestimate the abundance of nonbreeding piping plovers using a site or region during other months. In late September 2007, 104 piping plovers were counted at the south end of Ocracoke Island, North Carolina (NPS 2007), where none were seen during the 2006 International Piping Plover Winter Census (Elliott-Smith et al. 2009). Noel et al. (2007) observed up to 100 piping plovers during peak migration at Little St. Simons Island, Georgia, where approximately 40 piping plovers wintered in 2003 to 2005. Differences among fall, winter, and spring counts in South Carolina were less pronounced, but inter-year fluctuations (e.g., 108 piping plovers in spring 2007 versus 174 piping plovers in spring 2008) at 28 sites were striking (Maddock et al. 2009). Even

as far south as the Florida Panhandle, monthly counts at Phipps Preserve in Franklin County ranged from a mid-winter low of four piping plovers in December 2006 to peak counts of 47 in October 2006 and March 2007 (Smith 2007). Pinkston (2004) observed much heavier use of Texas Gulf Coast (ocean-facing) beaches between early September and mid-October (approximately 16 birds per mile) than during December to March (approximately two birds per mile).

Local movements of nonbreeding piping plovers may also affect abundance estimates. At Deveaux Bank, one of South Carolina's most important piping plover sites, five counts at approximately 10-day intervals between August 27 and October 7, 2006, oscillated from 28 to 14 to 29 to 18 to 26 (Maddock et al. 2009). Noel and Chandler (2008) detected banded Great Lakes piping plovers known to be wintering on their Georgia study site in 73.8 ± 8.1 percent of surveys over three years.

Abundance estimates for nonbreeding piping plovers may also be affected by the number of surveyor visits to the site. Preliminary analysis of detection rates by Maddock et al. (2009) found 87 percent detection during the mid-winter period on core sites surveyed three times a month during fall and spring and one time per month during winter, compared with 42 percent detection on sites surveyed three times per year (Cohen 2009 pers. communication).

Gratto-Trevor et al. (2009; Figure 7) found strong patterns (but no exclusive partitioning) in winter distribution of uniquely banded piping plovers from four breeding populations. All eastern Canada and 94 percent of Great Lakes birds wintered from North Carolina to southwest Florida. However, eastern Canada birds were more heavily concentrated in North Carolina, and a larger proportion of Great Lakes piping plovers were found in South Carolina and Georgia. Northern Great Plains populations were primarily seen farther west and south, especially on the Texas Gulf Coast. Although the great majority of Prairie Canada individuals were observed in Texas, particularly southern Texas, individuals from the U.S. Great Plains were more widely distributed on the Gulf Coast from Florida to Texas.

The findings of Gratto-Trevor et al. (2009) provide evidence of differences in the wintering distribution of piping plovers from these four breeding areas. However, the distribution of birds by breeding origin during migration remains largely unknown. Other major information gaps include the wintering locations of the U.S. Atlantic Coast breeding population (banding of U.S. Atlantic Coast piping plovers has been extremely limited) and the breeding origin of piping plovers wintering on the Caribbean islands and in much of Mexico. Banded piping plovers from the Great Lakes, Northern Great Plains, and eastern Canada breeding populations showed similar patterns of seasonal abundance at Little St. Simons Island, Georgia (Noel et al. 2007). However, the number of banded plovers originating from the latter two populations was relatively small at this study area.

This species exhibits a high degree of intra- and inter-annual wintering site fidelity (Nicholls and Baldassarre 1990a; Drake et al. 2001; Noel et al. 2005; Stucker and Cuthbert 2006). Gratto-Trevor et al. (2009) reported that six of 259 banded piping plovers observed more than once per winter moved across boundaries of the seven U.S. regions. Of 216 birds observed in different years, only eight changed regions between years, and several of these shifts were associated with late summer or early spring migration periods (Gratto-Trevor et al. 2009; Figure 7).
Local movements are more common. In South Carolina, Maddock et al. (2009) documented many cross-inlet movements by wintering banded piping plovers as well as occasional movements of up to 18 km (11 miles) by approximately 10 percent of the banded population; larger movements within South Carolina were seen during fall and spring migration. Similarly, eight banded piping plovers that were observed in two locations during 2006-2007 surveys in Louisiana and Texas were all in close

proximity to their original location, such as on the bay and ocean side of the same island or on adjoining islands (Maddock 2008).

The 2004 and 2005 hurricane seasons affected a substantial amount of habitat along the Gulf Coast. Habitats such as those along Gulf Islands National Seashore have benefited from increased washover events, which created optimal habitat conditions for piping plovers. Conversely, hard shoreline structures put into place following storms throughout the species range to prevent such shoreline migration prevent habitat creation. Four hurricanes between 2002 and 2005 are often cited in reference to rapid erosion of the Chandeleur Islands, a chain of low-lying islands in Louisiana where the 1991 IPPC tallied more than 350 piping plovers. Those same storms, however, created habitats such as over-wash fans and sand spits on barrier islands and headlands in other portions of Louisiana. (See the Storm events section below for more details on their effects to habitat.)

The Service is aware of the following site-specific conditions that benefit several habitats piping plover use while wintering and migrating, including critical habitat units. In Texas, one critical habitat unit was afforded greater protection due to the acquisition of adjacent upland properties by the local Audubon chapter. In another unit in Texas, vehicles were removed from a portion of the beach decreasing the likelihood of automobile disturbance to plovers. Exotic plant removal that threatens to invade suitable piping plover habitat is occurring in a critical habitat unit in South Florida. The Service and other government agencies remain in a contractual agreement with the U.S. Department of Agriculture (USDA) for predator control within limited coastal areas in the Florida panhandle, including portions of some critical habitat units. Continued removal of potential terrestrial predators is likely to enhance survivorship of wintering and migrating piping plovers. In North Carolina, one critical habitat unit was afforded greater protection when the local Audubon chapter agreed to manage the area specifically for piping plovers and other shorebirds following the relocation of the nearby inlet channel.

Recovery criteria

Northern Great Plains Population (Service 1988, 1994)

1. Increase the number of birds in the U.S. northern Great Plains states to 2,300 pairs (Service 1994).
2. Increase the number of birds in the prairie region of Canada to 2,500 adult piping plovers (Service 1988).
3. Secure long term protection of essential breeding and wintering habitat (Service 1994).

Great Lakes Population (Service 2003)

1. At least 150 pairs (300 individuals), for at least 5 consecutive years, with at least 100 breeding pairs (200 individuals) in Michigan and 50 breeding pairs (100 individuals) distributed among sites in other Great Lakes states.
2. Five-year average fecundity within the range of 1.5-2.0 fledglings per pair, per year, across the breeding distribution, and ten-year population projections indicate the population is stable or continuing to grow above the recovery goal.
3. Protection and long-term maintenance of essential breeding and wintering habitat is ensured, sufficient in quantity, quality, and distribution to support the recovery goal of 150 pairs (300 individuals).
4. Genetic diversity within the population is deemed adequate for population persistence and can be maintained over the long-term.

5. Agreements and funding mechanisms are in place for long-term protection and management activities in essential breeding and wintering habitat.

Atlantic Coast Population (Service 1996)

1. Increase and maintain for 5 years a total of 2,000 breeding pairs, distributed among 4 recovery units.

Recovery Unit	Minimum Subpopulation
Atlantic (eastern) Canada	400 pairs
New England	625 pairs
New York-New Jersey	575 pairs
Southern (DE-MD-VA-NC)	400 pairs

2. Verify the adequacy of a 2,000 pair population of piping plovers to maintain heterozygosity and allelic diversity over the long term.
3. Achieve a 5-year average productivity of 1.5 fledged chicks per pair in each of the 4 recovery units described in criterion 1, based on data from sites that collectively support at least 90 percent of the recover unit's population.
4. Institute long-term agreements to assure protection and management sufficient to maintain the population targets and average productivity in each recovery unit.
5. Ensure long-term maintenance of wintering habitat, sufficient in quantity, quality, and distribution to maintain survival rates for a 2,000-pair population.

Threats to piping plovers/critical habitat

In the following sections, we provide an analysis of threats to piping plovers in their migration and wintering range. We update information obtained since the 1985 listing rule, the 1991 and 2009 status reviews, and the three breeding population recovery plans. Both previously identified and new threats are discussed. With minor exceptions, this analysis is focused on threats to piping plovers within the continental U.S. portion of their migration and wintering range. Threats in the Caribbean and Mexico remain largely unknown.

Present or threatened destruction, modification, or curtailment of its habitat or range

The status of piping plovers on winter and migration grounds is difficult to assess, but threats to piping plover habitat used during winter and migration (identified by the Service during its designation of critical habitat) continue to affect the species. Unregulated motorized and pedestrian recreational use, inlet and shoreline stabilization projects, beach maintenance and nourishment, and pollution affect most winter and migration areas. Conservation efforts at some locations have likely resulted in the enhancement of wintering habitat.

The 1985 final listing rule stated that the number of piping plovers on the Gulf of Mexico coastal wintering grounds might be declining as indicated by preliminary analysis of Christmas Bird Count data. Independent counts of piping plovers on the Alabama coast indicated a decline in numbers between the 1950s and early 1980s. At the time of listing, the Texas Parks and Wildlife Department stated that 30 percent of wintering habitat in Texas had been lost over the previous 20 years. The final rule also stated that in addition to extensive breeding area problems, the loss and modification of wintering habitat was a significant threat to the piping plover.

The three recovery plans state that shoreline development throughout the wintering range poses a threat to all populations of piping plovers. The plans further state that beach maintenance and nourishment, inlet dredging, and artificial structures, such as jetties and groins, could eliminate wintering areas and alter sedimentation patterns leading to the loss of nearby habitat. Priority 1 actions in the 1996 Atlantic Coast and 2003 Great Lakes Recovery Plans identify tasks to protect natural processes that maintain coastal ecosystems and quality wintering piping plover habitat and to protect wintering habitat from shoreline stabilization and navigation projects. The 1988 Northern Great Plains Recovery Plan states that, as winter habitat is identified, current and potential threats to each site should be determined.

Important components of ecologically sound barrier beach management include perpetuation of natural dynamic coastal formation processes. Structural development along the shoreline or manipulation of natural inlets upsets the dynamic processes and results in habitat loss or degradation (Melvin et al. 1991). Throughout the range of migrating and wintering piping plovers, inlet and shoreline stabilization, inlet dredging, beach maintenance and nourishment activities, and seawall installations continue to constrain natural coastal processes. Dredging of inlets can affect spit formation adjacent to inlets and directly remove or affect ebb and flood tidal shoal formation. Jetties, which stabilize an island, cause island widening and subsequent growth of vegetation on inlet shores. Seawalls restrict natural island movement and exacerbate erosion. As discussed in more detail below, all these efforts result in loss of piping plover habitat. Construction of these projects during months when piping plovers are present also causes disturbance that disrupts the birds' foraging efficiency and hinders their ability to build fat reserves over the winter and in preparation for migration, as well as their recuperation from migratory flights. Additional investigation is needed to determine the extent to which these factors cumulatively affect piping plover survival and how they may impede conservation efforts for the species.

Any assessment of threats to piping plovers from loss and degradation of habitat must recognize that up to 24 shorebird species migrate or winter along the Atlantic Coast and almost 40 species of shorebirds are present during migration and wintering periods in the Gulf of Mexico region (Helmers 1992). Continual degradation and loss of habitats used by wintering and migrating shorebirds may cause an increase in intra-specific and inter-specific competition for remaining food supplies and roosting habitats. In Florida, for example, approximately 825 miles of coastline and parallel bayside flats (unspecified amount) were present prior to the advent of high human densities and beach stabilization projects. We estimate that only about 35 percent of the Florida coastline continues to support natural coastal formation processes, thereby concentrating foraging and roosting opportunities for all shorebird species and forcing some individuals into suboptimal habitats. Thus, intra- and inter-specific competition most likely exacerbates threats from habitat loss and degradation.

Sand placement projects

In the wake of episodic storm events, managers of lands under public, private, and county ownership often protect coastal structures using emergency storm berms; this is frequently followed by beach nourishment or renourishment activities (nourishment projects are considered "soft" stabilization versus "hard" stabilization such as seawalls). Berm placement and beach nourishment deposit substantial amounts of sand along Gulf of Mexico and Atlantic beaches to protect local property in anticipation of preventing erosion and what otherwise will be considered natural processes of over-wash and island migration (Schmitt and Haines 2003). On unpopulated islands, the addition of sand and creation of marsh are sometimes used to counteract the loss of roosting and nesting habitat for shorebirds and wading birds as a result of erosional storm events.

Past and ongoing stabilization projects may fundamentally alter the naturally dynamic coastal processes that create and maintain beach strand and bayside habitats, including those habitat components that piping plovers rely upon. Although impacts may vary depending on a range of factors, stabilization projects may directly degrade or destroy piping plover roosting and foraging habitat in several ways. Front beach habitat may be used to construct an artificial berm that is densely planted in grass, which can directly reduce the availability of roosting habitat. Over time, if the beach narrows due to erosion, additional roosting habitat between the berm and the water can be lost. Berms can also prevent or reduce the natural over-wash that creates roosting habitats by converting vegetated areas to open sand areas. The vegetation growth caused by impeding natural over-wash can also reduce the maintenance and creation of bayside intertidal feeding habitats. In addition, stabilization projects may indirectly encourage further development of coastal areas and increase the threat of disturbance.

At least 668 of 2,340 coastal shoreline miles (29 percent of beaches throughout the piping plover winter and migration range in the U.S.) are bermed, nourished, or renourished, generally for recreational purposes and to protect commercial and private infrastructure (Table 4, next page). However, only approximately 54 miles or 2.31 percent of these impacts have occurred within critical habitat.

Table 4. Summary of the extent of nourished beaches in piping plover wintering and migrating habitat within the conterminous United States. Data extracted from Service unpublished data (project files, gray literature, and field observations) as of 2009.

State	Sandy beach shoreline miles available	Sandy beach shoreline miles nourished to date (within CH[g] units)	Percent of sandy beach shoreline affected (within CH[g] units)
North Carolina	301[a]	117[e] (unknown)	39 (unknown)
South Carolina	187[a]	56 (0.6)	30 (0.32))
Georgia	100[a]	8 (0.4)	8 (0.40)
Florida	825[b]	404 (6)[f]	49 (0.72)
Alabama	53[a]	12 (2)	23 (3.77)
Mississippi	110[c]	≥6 (0)	5 (0)
Louisiana	397[a]	Unquantified (generally restoration-oriented)	Unknown
Texas	367[d]	65 (45)	18 (12.26)
Overall Total	2,340 (does not include Louisiana)	≥668 does not include Louisiana (54 in CH)	29% (≥2.31% in CH)

(a) Data from www.50states.com; (b) Clark 1993; (c) N. Winstead, Mississippi Museum of Natural Science, in lit. 2008; (d) www.Surfrider.org; (e) H. Hall, Service, pers. comm. 2009; (f) Partial data from Lott et al. (2007 in review); (g) CH = critical habitat.

In Louisiana, the sustainability of the coastal ecosystem is threatened by the inability of the barrier islands to maintain geomorphologic functionality (Corps 2011). Consequently, most of the planned sediment placement projects are conducted as environmental restoration projects by various Federal and State agencies because without the sediment many areas would erode below sea level since the Louisiana coastal systems are starved for sediment sources. Agencies conducting coastal restoration

projects aim to design projects that mimic the natural existing elevations of coastal habitats (e.g., beach, dune, and marsh) in order to allow their projects to work within and be sustained by the natural ecosystem processes that maintain those coastal habitats. Due to the low elevation of barrier islands and coastal headlands, placement of additional sediment in those areas generally does not reach an elevation that would prevent the formation of washover areas or impede natural coastal processes, especially during storm events. Such careful design of these restoration projects allows daily tidal processes or storm events to re-work the sediments to reform the Gulf/beach interface and create washover areas, sand flats, and mud flats on the bay-side of the islands, as well as sand spits on the ends of the islands; thus, the added sediment aids in sustaining the barrier island system.

Sediment placement also temporarily affects the benthic fauna found in intertidal systems by covering them with a layer of sediment. Some benthic species can burrow through a thin layer (varies from 15 to 35 inches for different species) of additional sediment since they are adapted to the turbulent environment of the intertidal zone; however, thicker layers (i.e., greater than 40 inches) of sediment are likely to smother the benthic fauna (Greene 2002). Various studies of such effects indicate that the recovery of benthic fauna after beach renourishment or sediment placement can take anywhere from 6 months to 2 years (Rakocinski et al. 1996; Peterson et al. 2000; Peterson et al. 2006). Such delayed recovery of benthic prey species temporarily affects the quality of piping plover foraging habitat.

Inlet stabilization/relocation

Many navigable mainland or barrier island tidal inlets along the Atlantic and Gulf of Mexico coasts are stabilized with jetties, groins, or by seawalls and/or adjacent industrial or residential development. Jetties are structures built perpendicular to the shoreline that extend through the entire nearshore zone and past the breaker zone to prevent or decrease sand deposition in the channel (Hayes and Michel 2008). Inlet stabilization with rock jetties and associated channel dredging for navigation alter the dynamics of long-shore sediment transport and affect the location and movement rate of barrier islands (Camfield and Holmes 1995), typically causing down-drift erosion. Sediment is then dredged and added back to the islands which are subsequently widened. Once the island becomes stabilized, vegetation encroaches on the bayside habitat, thereby diminishing and eventually destroying its value to piping plovers. Accelerated erosion may compound future habitat loss, depending on the degree of sea-level rise. Unstabilized inlets naturally migrate, re-forming important habitat components, whereas jetties often trap sand and cause significant erosion of the down-drift shoreline. These combined actions affect the availability of piping plover habitat (Cohen et al. 2008b).

Using Google Earth© (accessed April 2009), Service biologists visually estimated the number of navigable mainland or barrier island tidal inlets throughout the wintering range of the piping plover in the conterminous U.S. that have some form of hardened structure. This includes seawalls or adjacent development, which lock the inlets in place (Table 5).

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Table 5. Visually estimated numbers of navigable mainland and barrier island inlets and hardened inlets by state.

State	Number of navigable mainland and barrier island inlets	Number of hardened inlets	Percent of inlets affected
North Carolina	20	2.5*	12.5%
South Carolina	34	3.5*	10.3%
Georgia	26	2	7.7%
Florida	82	41	50%
Alabama	14	6	42.9%
Mississippi	16	7	43.8%
Louisiana	40	9	22.5%
Texas	17	10	58.8%
Overall Total	249	81	32.5%

*An inlet at the state line is considered to be half an inlet counted in each state.

Tidal inlet relocation can cause loss and/or degradation of piping plover habitat; although less permanent than construction of hard structures, effects can persist for years. For example, a project on Kiawah Island, South Carolina, degraded one of the most important piping plover habitats in the State by reducing the size and physical characteristics of an active foraging site, changing the composition of the benthic community, decreasing the tidal lag in an adjacent tidal lagoon, and decreasing the exposure time of the associated sand flats (Service and Town of Kiawah Island 2006). In 2006, pre-project piping plover numbers in the project area recorded during four surveys conducted at low tide averaged 13.5 piping plovers. This contrasts with a post-project average of 7.1 plovers during eight surveys (four in 2007 and four in 2008) conducted during the same months (Service and Town of Kiawah Island 2006), indicating that habitat quality was reduced. Service biologists are aware of at least seven inlet relocation projects (two in North Carolina, three in South Carolina, two in Florida), but this number likely under-represents the extent of this activity.

Sand mining/dredging

Sand mining, the practice of extracting (dredging) sand from sand bars, shoals, and inlets in the nearshore zone, is a less expensive source of sand than obtaining sand from offshore shoals for beach nourishment. Sand bars and shoals are sand sources that move onshore over time and act as natural breakwaters. Inlet dredging reduces the formation of exposed ebb and flood tidal shoals considered to be primary or optimal piping plover roosting and foraging habitat. Removing these sand sources can alter depth contours and change wave refraction as well as cause localized erosion (Hayes and Michel 2008). Exposed shoals and sandbars are also valuable to piping plovers, as they tend to receive less human recreational use (because they are only accessible by boat) and therefore provide relatively less disturbed habitats for birds. We do not have a good estimate of the amount of sand mining that occurs across the piping plover wintering range, nor do we have a good estimate of the number of inlet dredging projects that occur. This number is likely greater than the number of total jettied inlets shown in Table 5, since most jettied inlets need maintenance dredging, but non-hardened inlets are often dredged as well.

Groins

Groins (structures made of concrete, rip rap, wood, or metal built perpendicular to the beach in order to trap sand) are typically found on developed beaches with severe erosion. Although groins can be individual structures, they are often clustered along the shoreline. Groins can act as barriers to long-shore sand transport and cause down-drift erosion (Hayes and Michel 2008), which prevents piping plover habitat creation by limiting sediment deposition and accretion. These structures are found throughout the southeastern Atlantic Coast, and although most were in place prior to the piping plover's 1986 listing under the Act, installation of new groins continues to occur.

Seawalls and revetments

Seawalls and revetments are vertical hard structures built parallel to the beach in front of buildings, roads, and other facilities to protect them from erosion. However, these structures often accelerate erosion by causing scouring in front of and down-drift from the structure (Hayes and Michel 2008), which can eliminate intertidal foraging habitat and adjacent roosting habitat. Physical characteristics that determine microhabitats and biological communities can be altered after installation of a seawall or revetment, thereby depleting or changing composition of benthic communities that serve as the prey base for piping plovers. At four California study sites, each comprised of an unarmored segment and a segment seaward of a seawall, Dugan and Hubbard (2006) found that armored segments had narrower intertidal zones, smaller standing crops of macrophyte wrack, and lower shorebird abundance and species richness. Geotubes (long cylindrical bags made of high-strength permeable fabric and filled with sand) are softer alternatives, but act as barriers by preventing over-wash. We did not find any sources that summarize the linear extent of seawall, revetment, and geotube installation projects that have occurred across the piping plover's wintering and migration habitat.

Exotic/invasive vegetation

A recently identified threat to piping plover habitat, not described in the listing rule or recovery plans, is the spread of coastal invasive plants into suitable piping plover habitat. Like most invasive species, coastal exotic plants reproduce and spread quickly and exhibit dense growth habits, often outcompeting native plant species. If left uncontrolled, invasive plants cause a habitat shift from open or sparsely vegetated sand to dense vegetation, resulting in the loss or degradation of piping plover roosting habitat, which is especially important during high tides and migration periods.

Beach vitex (*Vitex rotundifolia*) is a woody vine introduced into the southeastern U.S. as a dune stabilization and ornamental plant (Westbrooks and Madsen 2006). It currently occupies a very small percentage of its potential range in the U.S.; however, it is expected to grow well in coastal communities throughout the southeastern U.S. from Virginia to Florida, and west to Texas (Westbrooks and Madsen 2006). In 2003, the plant was documented in New Hanover, Pender, and Onslow counties in North Carolina, and at 125 sites in Horry, Georgetown, and Charleston counties in South Carolina. One Chesapeake Bay site in Virginia was eradicated, and another site on Jekyll Island, Georgia, is about 95 percent controlled (Suiter 2009 pers. communication). Beach vitex has been documented from two locations in northwest Florida, but one site disappeared after erosional storm events. The landowner of the other site has indicated an intention to eradicate the plant, but follow through is unknown (Farley 2009 pers. communication). The task forces formed in North and South Carolina in 2004 and 2005 have made great strides to remove this plant from their coasts. To date, about 200 sites in North Carolina have been treated, with 200 additional sites in need of treatment. Similar efforts are underway in South Carolina.

Unquantified amounts of crowfoot grass (*Dactyloctenium aegyptium*) grow invasively along portions of the Florida coastline. It forms thick bunches or mats that may change the vegetative structure of coastal plant communities and alter shorebird habitat. The Australian pine (*Casuarina equisetifolia*) also changes the vegetative structure of the coastal community in south Florida and islands within the Bahamas. Shorebirds prefer foraging in open areas where they are able to see potential predators, and tall trees provide good perches for avian predators. Australian pines potentially impact shorebirds, including the piping plover, by reducing attractiveness of foraging habitat and/or increasing avian predation.

The propensity of these exotic species to spread, and their tenacity once established, make them a persistent threat, partially countered by increasing landowner awareness and willingness to undertake eradication activities.

Wrack removal and beach cleaning

Wrack on beaches and baysides provides important foraging and roosting habitat for piping plovers (Drake 1999a; Smith 2007; Maddock et al. 2009; Lott et al. 2009) and many other shorebirds on their winter, breeding, and migration grounds. Because shorebird numbers are positively correlated with wrack cover and biomass of their invertebrate prey that feed on wrack (Tarr and Tarr 1987; Hubbard and Dugan 2003; Dugan et al. 2003), beach grooming will lower bird numbers (Defeo et al. 2009).

There is increasing popularity along developed beaches in the Southeast, especially in Florida, for beach communities to carry out "beach cleaning" and "beach raking" actions. Beach cleaning occurs on private beaches, where piping plover use is not well documented, and on some municipal or county beaches that are used by piping plovers. Most wrack removal on state and federal lands is limited to post-storm cleanup and does not occur regularly.

Man-made beach cleaning and raking machines effectively remove seaweed, fish, glass, syringes, plastic, cans, cigarettes, shells, stone, wood, and virtually any unwanted debris (Barber Beach Cleaning Equipment 2009). These efforts remove accumulated wrack, topographic depressions, and sparse vegetation nodes used by roosting and foraging piping plovers. Removal of wrack also eliminates a beach's natural sand-trapping abilities, further destabilizing the beach. In addition, sand adhering to seaweed and trapped in the cracks and crevices of wrack is removed from the beach. Although the amount of sand lost due to single sweeping actions may be small, it adds up considerably over a period of years (Nordstrom et al. 2006; Neal et al. 2007). Beach cleaning or grooming can result in abnormally broad unvegetated zones that are inhospitable to dune formation or plant colonization, thereby enhancing the likelihood of erosion (Defeo et al. 2009).

Currently, the Florida Department of Environmental Protection's Beaches and Coastal Management Systems section has issued 117 permits for beach raking or cleaning to multiple entities. We estimate that 240 of 825 miles (29 percent) of sandy beach shoreline in Florida are cleaned or raked on various schedules (i.e., daily, weekly, monthly) (FDEP 2008). Service biologists estimate that South Carolina mechanically cleans approximately 34 of its 187 shoreline miles (18 percent), and Texas mechanically cleans approximately 20 of its 367 shoreline miles (5.4 percent). In Louisiana, beach raking occasionally occurs on Grand Isle (the state's only inhabited island) along approximately 8 miles of shoreline, roughly 2 percent of the state's 397 sandy shoreline miles. We are not aware of what percentage of mechanical cleaning occurs elsewhere in piping plover critical habitat.

Tilling beaches to reduce soil compaction, as sometimes required by the Service for sea turtle protection after beach nourishment activities, also has similar impacts. Recently, the Service improved sea turtle protection provisions in Florida; these provisions now require tilling, when needed, to be above the primary wrack line, not within it.

Disease

Neither the final listing rule nor the recovery plans state that disease is an issue for the species, and no plan assigns recovery actions to this threat factor. Based on information available to date, West Nile virus and avian influenza are a minor threat to piping plovers (Service 2009a).

Predation

The impact of predation on migrating or wintering piping plovers remains largely undocumented. Except for one incident reported in 2007 by the New York Times involving a cat in Texas, no depredation of piping plovers during winter or migration has been noted, although it would be difficult to document. Avian and mammalian predators are common throughout the species' wintering range. Predatory birds are relatively common during fall and spring migration, and it is possible that raptors occasionally take piping plovers (Drake et al. 2001). It has been noted, however, that the behavioral response of crouching when in the presence of avian predators may minimize avian predation on piping plovers (Morrier and McNeil 1991; Drake 1999a; Drake et al. 2001).

The 1996 Atlantic Coast Recovery Plan summarized evidence that human activities affect types, numbers, and activity patterns of some predators, thereby exacerbating natural predation on breeding piping plovers. Nonbreeding piping plovers may reap some collateral benefits from predator management conducted for the primary benefit of other species. In 1997, the USDA implemented a public lands predator control partnership in northwest Florida that included the Department of Defense, National Park Service (NPS), the State of Florida (state park lands) and Service (National Wildlife Refuges and Ecological Services). The program continues with all partners except Florida – in 2008, lack of funding precluded inclusion of Florida state lands (although Florida Department of Environmental Protection staff conduct occasional predator trapping on state lands, trapping is not implemented consistently).

The NPS and individual state park staff in North Carolina participate in predator control programs (Rabon 2009 pers. communication). The Service issued permit conditions for raccoon eradication to Indian River County staff in Florida as part of a coastal Habitat Conservation Plan (Adams 2009 pers. communication). Destruction of turtle nests by dogs or coyotes in the Indian River area justified the need to amend the permit to include an education program targeting dog owners regarding the appropriate means to reduce impacts to coastal species caused by their pets. The Service partnered with Texas Audubon and the Coastal Bend Bays and Estuaries Program in Texas to implement predator control efforts on colonial waterbird nesting islands (Cobb 2009 pers. communication). Some of these predator control programs may provide very limited protection to piping plovers, should they use these areas for roosting or foraging. Table 6 summarizes predator control actions on a state-by-state basis. The Service is not aware of any current predator control programs targeting protection of coastal species in Georgia, Alabama, Mississippi, or Louisiana.

Regarding predation, the magnitude of this threat to nonbreeding piping plovers remains unknown, but given the pervasive, persistent, and serious impacts of predation on other coastal reliant species, it remains a potential threat. Focused research to confirm impacts as well as to ascertain effectiveness of

predator control programs may be warranted, especially in areas frequented by Great Lakes birds during migration and wintering months. We consider predator control on their wintering and migration grounds to be a low priority at this time.[6]

Table 6. Summary of predator control programs that may benefit piping plovers on winter and migration grounds (as of 2009).

State	Entities with Predator Control Programs
North Carolina	State Parks, Cape Lookout and Cape Hatteras National Seashores.
South Carolina	As needed throughout the state, targets raccoons and coyotes.
Georgia	No programs known.
Florida	Merritt Island NWR, Cape Canaveral AFS, Indian River County, Eglin AFB, Gulf Islands NS, northwest Florida state parks (up until 2008), St. Vincent NWR, Tyndall AFB.
Alabama	Late 1990's Gulf State Park and Orange Beach for beach mice, no current programs known.
Mississippi	No programs known.
Louisiana	No programs known.
Texas	Aransas NWR (hog control for habitat protection), Audubon (mammalian predator control on colonial waterbird islands that have occasional piping plover use).

Disturbance

Disturbance (i.e., human and pet presence that alters bird behavior) disrupts piping plovers as well as other shorebird species. Intense human disturbance in shorebird winter habitat can be functionally equivalent to habitat loss if the disturbance prevents birds from using an area for a significant amount of time (Goss-Custard et al. 1996), which can lead to roost abandonment and local population declines (Burton et al. 1996). Pfister et al. (1992) implicate anthropogenic disturbance as a factor in the long-term decline of migrating shorebirds at staging areas. Disturbance can also cause shorebirds to spend less time roosting or foraging and more time in alert postures or fleeing from the disturbances (Johnson and Baldassarre 1988; Burger 1991; Burger 1994; Elliott and Teas 1996; Lafferty 2001a, 2001b; Thomas et al. 2002), which limits the local abundance of piping plovers (Zonick and Ryan 1995; Zonick 2000). Shorebirds that are repeatedly flushed in response to disturbance expend energy on costly short flights (Nudds and Bryant 2000) and may not feed enough to support migration and/or subsequent breeding efforts (Puttick 1979; Lafferty 2001b).

Elliott and Teas (1996) found a significant difference in actions between piping plovers encountering pedestrians and those not encountering pedestrians. Piping plovers encountering pedestrians spend proportionately more time in non-foraging behavior. This study suggests that interactions with pedestrians on beaches cause birds to shift their activities from calorie acquisition to calorie expenditure. In wintering and migration sites, human disturbance continues to decrease the amount of undisturbed habitat and appears to limit local piping plover abundance (Zonick and Ryan 1995).

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[6] The threat of direct predation should be distinguished from the threat of disturbance to roosting and feeding piping plovers posed by dogs off leash.

Shorebirds are more likely to flush from the presence of dogs than people, and birds react to dogs from farther distances than people (Lafferty 2001a, 2001b; Thomas et al. 2002). Dogs off leash are more likely to flush piping plovers from farther distances than are dogs on leash; nonetheless, dogs both on and off leashes disturb piping plovers (Hoopes 1993). Pedestrians walking with dogs often go through flocks of foraging and roosting shorebirds; some even encourage their dogs to chase birds.

Off-road vehicles can significantly degrade piping plover habitat (Wheeler 1979) or disrupt the birds' normal behavior patterns (Zonick 2000). The 1996 Atlantic Coast Recovery Plan cites tire ruts crushing wrack into the sand, making it unavailable as cover or as foraging substrate (Hoopes 1993; Goldin 1993). The plan also notes that the magnitude of the threat from off-road vehicles is particularly significant, because vehicles extend impacts to remote stretches of beach where human disturbance will otherwise be very slight. Godfrey et al. (1978, 1980 as cited *in* Lamont et al. 1997) postulated that vehicular traffic along the beach may compact the substrate and kill marine invertebrates that are food for the piping plover. Zonick (2000) found that the density of off-road vehicles negatively correlated with abundance of roosting piping plovers on the ocean beach. Cohen et al. (2008a) found that radio-tagged piping plovers using ocean beach habitat at Oregon Inlet in North Carolina were far less likely to use the north side of the inlet where off-road vehicle use is allowed, and recommended controlled management experiments to determine if recreational disturbance drives roost site selection. Ninety-six percent of piping plover detections was on the south side of the inlet even though it was farther away from foraging sites (1.8 km from the sound side foraging site to the north side of the inlet versus 0.4 km from the sound side foraging site to the north side of the inlet (Cohen et al. 2008a).

Based on surveys with land managers and biologists, knowledge of local site conditions, and other information, the Service has estimated the levels of eight types of disturbance at sites in the U.S. with wintering piping plovers. Table 7 summarizes the disturbance analysis results (Service 2009b). Data are not available on human disturbance at wintering sites in the Bahamas, other Caribbean countries, or Mexico. There are few areas used by wintering piping plovers that are devoid of human presence, and just under half have leashed and unleashed dog presence (Smith 2007; Lott et al. 2009, Service unpublished data 2009; Maddock and Bimbi unpublished data).

Table 7. Percent of known piping plover winter and migration habitat locations, by state, where various types of anthropogenic disturbance have been reported.

	Percent by State							
Disturbance Type	AL	FL	GA	LA	MS	NC	SC	TX
Pedestrians	67	92	94	25	100	100	88	54
Dogs on leash	67	69	31	25	73	94	25	25
Dogs off leash	67	81	19	25	73	94	66	46
Bikes	0	19	63	25	0	0	28	19
ATVs[a]	0	35	0	25	0	17	25	30
ORVs[b]	0	21	0	25	0	50	31	38
Boats	33	65	100	100	0	78	63	44
Kite surfing	0	10	0	0	0	33	0	0

(a) ATV = all-terrain vehicle; (b) ORV = off-road vehicle

Although the timing, frequency, and duration of human and dog presence throughout the wintering range are unknown, studies in Alabama and South Carolina suggest that most disturbances to piping plovers occurs during periods of warmer weather, which coincides with piping plover migration

(Johnson and Baldassarre 1988; Lott et al. 2009; Maddock et al. 2009). Smith (2007) documents varying disturbance levels throughout the nonbreeding season at northwest Florida sites.

LeDee et al. (2010) collected survey responses in 2007 from 35 managers (located in seven states) at sites that were designated as critical habitat for wintering piping plovers. Ownership included federal, state, and local governmental agencies and non-governmental organizations managing national wildlife refuges; national, state, county, and municipal parks; state and estuarine research reserves; state preserves; state wildlife management areas; and other types of managed lands. Of 43 reporting sites, 88 percent allowed public beach access year-round and four sites were closed to the public. Sixty-two percent of site managers reported greater than 10,000 visitors from September through March, and 31 percent reported greater than 100,000 visitors. Restrictions on visitor activities on the beach included automobiles (at 81 percent of sites), all-terrain vehicles (89 percent), and dogs during the winter season (50 percent). Half of the survey respondents reported funding as a primary limitation in managing piping plovers and other threatened and endangered species at their sites. Other limitations included "human resource capacity" (24 percent), conflicting management priorities (12 percent), and lack of research (3 percent).

Disturbance can be addressed by implementing recreational management techniques such as vehicle and pet restrictions and symbolic fencing (usually sign posts and string) of roosting and feeding habitats. In implementing conservation measures, managers need to consider a range of site-specific factors, including the extent and quality of roosting and feeding habitats and the types and intensity of recreational use patterns. In addition, educational materials such as informational signs or brochures can provide valuable information so that the public understands the need for conservation measures.

In summary, although there is some variability among states, disturbance from human activities and pets poses a moderate to high and escalating threat to migrating and wintering piping plovers. Systematic review of recreation policy and beach management across the nonbreeding range will assist in better understanding cumulative impacts. Site-specific analysis and implementation of conservation measures should be a high priority at piping plover sites that have moderate or high levels of disturbance. The Service and state wildlife agencies should increase technical assistance to land managers to implement management strategies and monitor their effectiveness.

Military Actions

Twelve coastal military bases are located in the Southeast. To date, five bases have consulted with the Service under section 7 of the Act, on military activities on beaches and baysides that may affect piping plovers or their habitat (Table 8). Camp Lejeune in North Carolina consulted formally with the Service in 2002 on troop activities, dune stabilization efforts, and recreational use of Onslow Beach. The permit conditions require twice-monthly piping plover surveys and use of buffer zones and work restrictions within buffer zones. Naval Station Mayport in Duval County, Florida, consulted with the Service on Marine Corps training activities that included beach exercises and use of amphibious assault vehicles. The area of impact was not considered optimal for piping plovers, and the consultation was concluded informally. Similar informal consultations have occurred with Tyndall Air Force Base (Bay County) and Eglin Air Force Base (Okaloosa and Santa Rosa counties) in northwest Florida. Both consultations dealt with occasional use of motorized equipment on the beaches and associated baysides. Tyndall Air Force Base has minimal on-the-ground use, and activities, when conducted, occur on the Gulf of Mexico beach, which is not considered the optimal area for piping plovers within this region. Eglin Air Force Base conducts bi-monthly surveys for piping plovers, and habitats consistently documented with piping plover use are posted with avoidance requirements to

minimize direct disturbance from troop activities. A 2001 consultation with the Navy for one-time training and retraction operations on Peveto Beach, in Cameron Parish, Louisiana, concluded informally.

Table 8. Military bases that occur within the wintering/migration range of piping plovers and contain piping plover habitat.

State	Coastal Military Bases
North Carolina	Camp Lejeune*
South Carolina	No coastal beach bases
Georgia	Kings Bay Naval Base
Florida	Key West Base, Naval Station Mayport*, Cape Canaveral Air Force Station, Patrick AFB, MacDill AFB, Eglin AFB*, Tyndall AFB*
Alabama	No coastal beach bases
Mississippi	Keesler AFB
Louisiana	No coastal beach bases
Texas	Corpus Christi Naval Air Station

*Bases which conduct activities that may affect piping plovers or their habitat.

Overall, project avoidance and minimization actions currently reduce threats from military activities to wintering and migrating piping plovers to a minimal threat level. However, prior to removal of the piping plover from protection under the Act, Integrated Resource Management Plans or other agreements should clarify if and how a change in legal status would affect plover protections.

Contaminants

Contaminants have the potential to cause direct toxicity to individual birds or negatively affect their invertebrate prey base (Rattner and Ackerson 2008). Depending on the type and degree of contact, contaminants can have lethal and sub-lethal effects on birds, including behavioral impairment, deformities, and impaired reproduction (Rand and Petrocelli 1985; Gilbertson et al. 1991; Hoffman et al. 1996).

The Great Lakes Recovery Plan states that concentration levels of polychlorinated biphenol (PCB) detected in Michigan piping plover eggs have the potential to cause reproductive harm. They further state that analysis of prey available to piping plovers at representative Michigan breeding sites indicated that breeding areas along the upper Great Lakes region are not likely the major source of contaminants to this population.

Petroleum products are the contaminants of primary concern, as opportunities exist for petroleum to pollute intertidal habitats that provide foraging substrate. Impacts to piping plovers from oil spills have been documented throughout their life cycle (Chapman 1984; Service 1996; Burger 1997; Massachusetts Audubon 2003; Amirault-Langlais et al. 2007; Amos 2009 pers. communication). This threat persists due to the high volume of shipping vessels (from which most documented spills have originated) traveling offshore and within connected bays along the Atlantic Coast and the Gulf of Mexico. Additional risks exist for leaks or spills from offshore oil rigs, associated undersea pipelines, and onshore facilities such as petroleum refineries and petrochemical plants. Beach-stranded 55-gallon barrels and smaller containers, which may fall from moving cargo ships or offshore rigs and are not uncommon on the Texas coast, contain primarily oil products (gasoline or diesel), as well as other chemicals such as methanol, paint, organochlorine pesticides, and detergents (Lee 2009 pers.

communication). Federal and state land managers have protective provisions in place to secure and remove the barrels, thus reducing the likelihood of contamination.

Lightly oiled piping plovers have survived and successfully reproduced (Chapman 1984; Amirault-Langlais et al. 2007; Amos pers. comm. 2009). Chapman (1984) noted shifts in habitat use as piping plovers moved out of spill areas. This behavioral change was believed to be related to the demonstrated decline in benthic infauna (prey items) in the intertidal zone and may have decreased the direct impact to the species. To date, no plover mortality has been attributed to oil contamination outside the breeding grounds, but latent effects would be difficult to prove.

Deepwater Horizon Mississippi Canyon Well #252 Oil Spill

The Deepwater Horizon Mississippi Canyon Well #252 oil spill (Deepwater Horizon), which started April 20, 2010, discharged into the Gulf of Mexico through July 15, 2010. According to government estimates, the leak released between 100 and 200 million gallons of oil into the Gulf of Mexico due to the Deepwater Horizon accident. The U.S. Coast Guard (USCG) estimates that more than 50 million gallons of oil have been removed from the Gulf, or roughly a quarter of the spill amount. Additional impacts to natural resources may also be attributed to the 1.84 million gallons of dispersant that were utilized during the spill. The USCG, the states, and responsible parties that form the Unified Area Command (with advice from federal and state natural resource agencies) initiated protective measures and clean-up efforts per prepared contingency plans to deal with petroleum and other hazardous chemical spills for each state's coastline. The contingency plans identify sensitive habitats, including all federally listed species' habitats, which receive a higher priority for response actions. Those plans allow for immediate habitat protective measures for clean-up activities in response to large contaminant spills. While such plans usually ameliorate the threat to piping plovers, they will not likely provide much improvement in this case given the breadth of the impacts associated with the Deepwater Horizon incident.

As of October 6, 2010, approximately 104 miles of Gulf of Mexico shoreline were affected by moderate to heavy oil (approximately 95 miles in Louisiana, 9 miles in Mississippi, and 1 mile in Florida) and approximately 485 miles of shoreline were affected by light to trace amounts of oil (approximately 224 miles in Louisiana, 81 miles in Mississippi, 60 miles in Alabama, and 114 miles in Florida) (October 6, 2010, Unified Area Command Weekly Update, www.RestoreTheGulf.gov). Those numbers reflect a daily snapshot of shoreline experiencing impacts from oil; they do not include cumulative impacts to date, or shoreline that has already been cleaned. The Operational Science Advisory Team (OSAT-2) of the Gulf Coast Incident Management Team published the *Summary Report for Fate and Effects of Remnant Oil Remaining in the Beach Environment* on February 10, 2011. The OSAT-2 report indicates that:

> "Much of the oil residue on and near the shoreline has been cleaned during the Response phase of the oil spill. As the Gulf shoreline is a dynamic environment, oil residue that is uncovered or moved onto beaches (for example, tar residue balls) will continue to be removed as part of the Monitoring and Maintenance phase of the recovery. Three types of located oil residue were identified as particularly challenging, or potentially damaging to the environment if removed. These three types are the following: supratidal buried oil (SBO), small surface residual balls (SSRBs), and surf zone submerged oil mats (SOM). Previous oil spills have demonstrated that removing oil residue from shoreline environments can cause more harm to the ecosystem than leaving the residue in place."

Thus, specific guidelines for the Monitoring and Maintenance phase of recovery are being developed to determine whether certain oiled habitats warrant further cleaning depending upon the anticipated damage to the environment by oil removal activities. In addition, NRDAR studies regarding potential effects to fish and wildlife resources are currently being conducted along the northern Gulf of Mexico coast.

Throughout the 2010-2011 wintering season piping plovers have been observed along the northern Gulf of Mexico coast. Casual observations from local birders and surveys conducted by oil spill responders have reported visibly oiled piping plovers at various locations in Louisiana. However, exact numbers of oiled piping plovers documented from this spill and the potential expanse of effects to those birds are currently being assessed through specific NRDAR studies; those results have yet to be analyzed or released to the public. Impacts to the species and its habitat are expected but the extent of those impacts remains hard to predict. Based on all available data prior to the Deepwater Horizon oil spill, the risk of impacts from contamination to piping plovers and their habitat was recognized, but the safety contingency plans were considered adequate to alleviate most of these concerns. The Deepwater Horizon incident has brought heightened awareness of the intensity and extent to fish and wildlife habitat from large-scale releases. In addition to potential direct habitat degradation from oiling of intertidal habitats and retraction of stranded boom, impacts to piping plovers may occur from ingestion of oiled benthic prey, loss of benthic prey from shoreline/beach cleaning, and the prolonged human disturbance associated with boom deployment and retraction, clean-up activities, wildlife response, and damage assessment crews working along affected shorelines.

Pesticides

In 2000, mortality of large numbers of wading birds and shorebirds, including one piping plover, at Audubon's Rookery Bay Sanctuary on Marco Island, Florida, occurred following the county's aerial application of the organophosphate pesticide Fenthion for mosquito control purposes (Williams 2001). Fenthion, a known toxin to birds, was registered for use as an avicide by Bayer, a chemical manufacturer. Subsequent to a lawsuit being filed against the Environmental Protection Agency (EPA) in 2002, the manufacturer withdrew Fenthion from the market, and EPA declared all uses of the chemical were to end by November 30, 2004 (American Bird Conservancy 2007). All other counties in the U.S. now use less toxic chemicals for mosquito control. It is unknown whether pesticides are a threat for piping plovers wintering in the Bahamas, other Caribbean countries, or Mexico.

Climate Change (sea-level rise)

Over the past 100 years, the globally averaged sea level has risen approximately 10 to 25 centimeters (cm) (Rahmstorf et al. 2007), a rate that is an order of magnitude greater than that seen in the past several thousand years (Douglas et al. 2001 as cited in Hopkinson et al. 2008). The IPCC suggests that by 2080 sea-level rise could convert as much as 33 percent of the world's coastal wetlands to open water (IPCC 2007). Although rapid changes in sea level are predicted, estimated time frames and resulting water levels vary due to the uncertainty about global temperature projections and the rate of ice sheets melting and slipping into the ocean (IPCC 2007; CCSP 2008).

Potential effects of sea-level rise on coastal beaches may vary regionally due to subsidence or uplift as well as the geological character of the coast and nearshore (CCSP 2009; Galbraith et al. 2002). In the last century, for example, sea-level rise along the U.S. Gulf Coast exceeded the global average by 13 to 15 cm, because coastal lands west of Florida are subsiding (EPA 2009). Sediment compaction and oil and gas extraction compound tectonic subsidence (Penland and Ramsey 1990; Morton et al. 2003;

Hopkinson et al. 2008). Low elevations and proximity to the coast make all nonbreeding coastal piping plover foraging and roosting habitats vulnerable to the effects of rising sea level. Furthermore, areas with small astronomical tidal ranges (e.g., portions of the Gulf Coast where intertidal range is less than 1 meter) are the most vulnerable to loss of intertidal wetlands and flats induced by sea-level rise (EPA 2009). Sea-level rise was cited as a contributing factor in the 68 percent decline in tidal flats and algal mats in the Corpus Christi area (i.e., Lamar Peninsula to Encinal Peninsula) in Texas between the 1950s and 2004 (Tremblay et al. 2008). Mapping by Titus and Richman (2001) showed that more than 80 percent of the lowest land along the Atlantic and Gulf coasts was in Louisiana, Florida, Texas, and North Carolina, where 73.5 percent of all wintering piping plovers were tallied during the 2006 IPPC (Elliott-Smith et al. 2009).

Inundation of piping plover habitat by rising seas could lead to permanent loss of habitat if natural coastal dynamics are impeded by numerous structures or roads, especially if those shorelines are also armored with hardened structures. Without development or armoring, low undeveloped islands can migrate toward the mainland, pushed by the over-washing of sand eroding from the seaward side and being re-deposited in the bay (Scavia et al. 2002). Overwash and sand migration are impeded on developed portions of islands. Instead, as sea-level increases, the ocean-facing beach erodes and the resulting sand is deposited offshore. The buildings and the sand dunes then prevent sand from washing back toward the lagoons, and the lagoon side becomes increasingly submerged during extreme high tides (Scavia et al. 2002), diminishing both barrier beach shorebird habitat and protection for mainland developments.

Modeling for three sea-level rise scenarios (reflecting variable projections of global temperature rise) at five important U.S. shorebird staging and wintering sites predicted loss of 20 to 70 percent of current intertidal foraging habitat (Galbraith et al. 2002). These authors estimated probabilistic sea-level changes for specific sites partially based on historical rates of sea-level change (from tide gauges at or near each site); they then superimposed this on projected 50 percent and 5 percent probability of global sea-level changes by 2100 of 34 cm and 77 cm, respectively. The 50 percent and 5 percent probability sea level change projections were based on assumed global temperature increases of 2° C (50 percent probability) and 4.7° C (5 percent probability). The most severe losses were projected at sites where the coastline is unable to move inland due to steep topography or seawalls. The Galbraith et al. (2002) Gulf Coast study site at Bolivar Flats, Texas, is a designated critical habitat unit known to host high numbers of piping plovers during migration and throughout the winter (e.g., 275 individuals were tallied during the 2006 IPPC) (Elliott-Smith et al. 2009). Under the 50 percent likelihood scenario for sea-level rise, Galbraith et al. (2002) projected approximately 38 percent loss of intertidal flats at Bolivar Flats by 2050; however, after initially losing habitat, the area of tidal flat habitat was predicted to slightly increase by the year 2100, because Bolivar Flats lacks armoring, and the coastline at this site can thus migrate inland. Although habitat losses in some areas are likely to be offset by gains in other locations, Galbraith et al. (2002) noted that time lags may exert serious adverse effects on shorebird populations. Furthermore, even if piping plovers are able to move their wintering locations in response to accelerated habitat changes, there could be adverse effects on the birds' survival rates or reproductive fitness.

Table 9 displays the potential for adjacent development and/or hardened shorelines to impede response of habitat to sea-level rise in the eight states supporting wintering piping plovers. Although complete linear shoreline estimates are not readily obtainable, almost all known piping plover wintering sites in the U.S. were surveyed during the 2006 IPPC. To estimate effects at the census sites, as well as additional areas where piping plovers have been found outside of the census period, Service biologists reviewed satellite imagery and spoke with other biologists familiar with the sites. Of 406 sites, 204

(50 percent) have adjacent structures that may prevent the creation of new habitat if existing habitat were to become inundated. These threats will be perpetuated in places where damaged structures are repaired and replaced, and exacerbated where the height and strength of structures are increased. Data do not exist on the amount or types of hardened structures at wintering sites in the Bahamas, other Caribbean countries, or Mexico.

Table 9. Number of sites surveyed during the 2006 winter IPPC with hardened or developed structures adjacent to the shoreline. Those marked with an asterisk (*) are additional sites that were not surveyed in the 2006 IPPC.

State	Number of sites surveyed during the 2006 winter Census	Number of sites with some armoring or development	Percent of sites affected
North Carolina	37 (+2)*	20	51
South Carolina	39	18	46
Georgia	13	2	15
Florida	188	114	61
Alabama	4 (+2)*	3	50
Mississippi	16	7	44
Louisiana	25 (+2)*	9	33
Texas	78	31	40
Overall Total	406	204	50

Sea-level rise poses a significant threat to all piping plover populations during the migration and wintering portion of their life cycle. Ongoing coastal stabilization activities may strongly influence the effects of sea-level rise on piping plover habitat. Improved understanding of how sea-level rise will affect the quality and quantity of habitat for migrating and wintering piping plovers is an urgent need.

Storm events

Although coastal piping plover habitats are storm-created and maintained, the 1996 Atlantic Coast Recovery Plan also notes that storms and severe cold weather may take a toll on piping plovers, and the 2003 Great Lakes Recovery Plan postulates that loss of habitats, such as over-wash passes or wrack, where birds shelter during harsh weather, poses a threat. Storms are a component of the natural processes that form coastal habitats used by migrating and wintering piping plovers, and positive effects of storm-induced over-wash and vegetation removal have been noted in portions of the wintering range. For example, Gulf Islands National Seashore habitats in Florida benefited from increased washover events that created optimal habitat conditions during the 2004 and 2005 hurricane seasons, with biologists reporting piping plover use of these habitats within six months of the storms (Nicholas 2005 pers. communication). Hurricane Katrina (2005) over-washed the mainland beaches of Mississippi, creating many tidal flats where piping plovers were subsequently observed (Winstead 2008). Hurricane Katrina also created a new inlet and improved habitat conditions on some areas of Dauphin Island, Alabama (LeBlanc 2009 pers. communication). Conversely, localized storms, since Katrina, have induced habitat losses on Dauphin Island (LeBlanc 2009 pers. communication).

Noel et al. (2005) suspect that changes in habitat caused by multiple hurricanes along the Georgia coastline altered the spatial distribution of piping plovers and may have contributed to mortality of three Great Lakes piping plovers wintering along the Georgia coastline. Following Hurricane Ike in 2008, Arvin (2009) reported decreased numbers of piping plovers at some heavily eroded Texas

beaches in the center of the storm impact area and increases in plover numbers at sites about 100 miles to the southwest. However, piping plovers were observed later in the season using tidal lagoons and pools that Ike created behind the eroded beaches (Arvin 2009).

The adverse effects on piping plovers attributed to storms are sometimes due to a combination of storms and other environmental changes or human use patterns. For example, four hurricanes between 2002 and 2005 are often cited in reference to rapid erosion of the Chandeleur Islands, a chain of low-lying islands in Louisiana where the 1991 IPPC tallied more than 350 piping plovers. Comparison of imagery taken three years before and several days after Hurricane Katrina found that the Chandeleur Islands lost 82 percent of their surface area (Sallenger et al. 2009), and a review of aerial photography prior to the 2006 IPPC suggested little piping plover habitat remained (Elliott-Smith et al. 2009). However, Sallenger et al. (2009) noted that habitat changes in the Chandeleur Islands stem not only from the effects of these storms but rather from the combined effects of the storms, long-term (i.e., greater than 1,000 years) diminishing sand supply, and sea-level rise relative to the land. Sallenger et al. (2009) went on to explain that although the marsh platform of the Chandeleur Islands continued to erode for 22 months post-Katrina, some sand was released from the marsh sediments which in turn created beaches, spits, and welded swash bars that advanced the shoreline seaward. Thus, although intense erosional forces have affected the Chandeleur Islands, they are still providing high quality shorebird habitat in the form of sand flats, spits, and beaches, until they are eroded below sea level. On January 18 and 19, 2011, piping plover surveys of the Chandeleur Islands were conducted by the piping plover NRDAR study team. Catlin et al. (2011) observed 194 piping plovers utilizing the Chandeleur Islands, and the birds were not distributed uniformly across the islands but were clumped mostly in three locations. Because the survey was conducted within a two-day window, Catlin et al. (2011) believe that higher numbers of piping plovers are likely using the islands during spring and fall migration.

Other storm-induced adverse effects include post-storm acceleration of human activities such as beach nourishment, sand scraping, and berm and seawall construction. Such stabilization activities can result in the loss and degradation of feeding and resting habitats. Storms also can cause widespread deposition of debris along beaches. Removal of debris often requires large machinery, which can cause extensive disturbance and adversely affect habitat elements such as wrack. Another example of indirect adverse effects linked to a storm event is the increased access to Pelican Island (LeBlanc 2009 pers. communication) due to merging with Dauphin Island following a 2007 storm (Gibson et al. 2009).

Recent climate change studies indicate a trend toward increasing hurricane numbers and intensity (Emanuel 2005; Webster et al. 2005). When combined with predicted effects of sea-level rise, there may be increased cumulative impacts from future storms. Storms can create or enhance piping plover habitat while causing localized losses elsewhere in the wintering and migration range. Available information suggests that some birds may have resiliency to storms and move to unaffected areas without harm, while other reports suggest birds may perish from storm events. Significant concerns include disturbance to piping plovers and habitats during cleanup of debris along shorelines and post-storm acceleration of shoreline stabilization activities, which can cause persistent habitat degradation and loss.

Threats Summary

Habitat loss and degradation on winter and migration grounds from shoreline and inlet stabilization efforts, both within and outside of designated critical habitat, remain a serious threat to all piping

plover populations. Modeling strongly suggests that the population is very sensitive to adult and juvenile survival. Therefore, while there is a great deal of effort extended to improve breeding success, and thus improve and maintain a higher population over time, it is also necessary to ensure that the wintering habitat, where birds spend most of their time, is secure. On some of the wintering grounds, the shoreline areas used by wintering piping plovers are being developed, stabilized, or otherwise altered, generally making the habitat unsuitable. Even in areas where habitat conditions are appropriate, human disturbance on beaches may negatively impact piping plovers' energy budget, as they may spend more time being vigilant and less time in foraging and roosting behavior. In many cases, the disturbance is severe enough that piping plovers appear to avoid some areas altogether. In addition, natural events (e.g., climate change, hurricanes, etc.) can pose a potential threat to piping plover habitat on an irregular basis. Threats on the wintering grounds may impact piping plovers' breeding success if they start migration or arrive at the breeding grounds with a poor body condition.

Analysis of the species/critical habitat likely to be affected

The proposed action has the potential to adversely affect wintering piping plovers and their habitat, including designated critical habitat in Unit LA-5, within the action area. The construction activities may lead to temporarily diminished quantity and quality of intertidal foraging and roosting habitats within the project area and action area, resulting in decreased survivorship of migrating and wintering plovers and temporary adverse effects to critical habitat. The length of construction activities (which varies from 2 to 3 years) may delay the recovery of benthic species due to the prolonged disturbance of the benthic fauna. Ultimately, the project goal is to restore the diversity of coastal barrier headland and island habitats, but the temporary effects of construction will require time for natural recovery and would extend beyond one wintering season. The detailed effects of the proposed action on piping plovers and critical habitat will be considered further in the remaining sections of this opinion.

ENVIRONMENTAL BASELINE

Louisiana's loss of wetlands and barrier islands to open water is now a well-documented fact in numerous studies. Since the 1930s Louisiana has lost 1,900 square miles of land (approximately 1.2 million acres). From 1990 to 2000, approximately 24 square miles of coastal land were lost each year. The 2004 Louisiana Coastal Area Ecosystem Restoration Study projected that 513 square miles of land would disappear by 2050, including a gain of 161 square miles from projects constructed under the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) (Corps 2004). In Louisiana, barrier headland and island erosion is attributable to increasing tidal prism, insufficient volumes of sediment supplied by littoral currents, land subsidence, and sea-level rise (Boesch 1982). Although increases in the tidal prism may be primarily responsible for enlargement of tidal passes, the insufficient supply of sand available to rebuild eroded areas has also contributed to increased tidal pass widths and shoreline retreat (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1999). Where insufficient supplies of sand prevail, measures to maximize sand retention, such as sand fencing and vegetative planting, are used to effectively rebuild and maintain such eroded areas.

Louisiana barrier headlands and islands are part of a complex and dynamic coastal system that continually respond to tidal passes, tides, wind, waves, erosion and deposition, long-shore sediment transport and depletion, fluctuations in sea level, and weather events. During storm events, over-wash is common across the barrier islands and headlands, depositing sediments on the bay-side or landward side, clearing vegetation and increasing the amount of open, sand flat habitat ideal for shoreline dependent shorebirds. Winds move sediment across the dry beaches forming low dunes. The natural

communities contain plants and animals that are subject to shoreline erosion and deposition, salt spray, wind, drought conditions, and sandy soils. Vegetative communities include fore dunes, occasional primary dunes, salt marsh, and black mangroves.

The Caminada headland and Shell Island provide important geomorphic, hydrologic and habitat functions in the Barataria basin. The Corps' modeling results have shown that barrier islands decrease wave energy landward of the island during tropical events. When the barrier islands were degraded in the models, the modeled wave heights increased, thus heightening the potential for overtopping levees and inundation of protected areas. Sustaining the geomorphic form of the barrier islands will provide storm surge protection for the interior wetlands and the surrounding coastal communities. Modeling (which excluded the BBBSR project in its future projections) also estimated that by 2060, 75 percent of the land between the Caminada headland and the Larose to Golden Meadow Hurricane Risk Reduction levees would be lost. In addition, the barrier islands in Plaquemines Parish, including Shell Island, will have disappeared as well as the marshes between the islands and the Mississippi River levees. Salinity modeling reflecting a without-project condition demonstrates the function of the barrier islands in separating the marine from the estuarine environments. On the eastern side of the basin, in areas where the barrier islands are severely eroded (e.g., the Shell Island reach), the salinity fields grow proportionally larger.

The Caminada barrier headland is the predominant feature of the Bayou Lafourche barrier system that includes flanking islands and the retreating headland of the Bayou Lafourche distributary of the Mississippi River (Figure 2) along the southwestern portion of the Barataria Basin. The southwest to northwest-oriented Caminada headland extends approximately 13.18 miles (21.21 km) between Belle Pass to the west and Caminada Pass to the east. Historic maps show that the west end of the Caminada headland is retreating more rapidly than the east end of the headland (Williams et al. 1992). It is one of the most rapidly eroding shorelines in the United States (McBride et al. 1992; Connor et al. 2004). The headland has historically suffered loss of wildlife habitat value and diminished function due to storm overtopping and breaching, saltwater intrusion, wind and wave induced erosion, sea level rise, subsidence, and man-made structures. The observed average shoreline erosion rate at the Caminada Headland is approximately 45 feet per year, and increased stress on the fish and wildlife in the area is expected as habitats continue to be lost.

The Caminada headland consists of narrow and low-lying sand dunes and beaches, barrier marshes, chenier ridges interspersed with mangrove thickets, coastal dune shrub thickets, lagoons, and small bayous. The Corps estimates the average dune elevation to be 3.4 feet NAVD and the back-barrier marsh is approximately 0.94 feet NAVD. Port Fourchon and a Chevron oil and gas facility are located at the western end of the headland and north of the action area. Several marsh restoration projects have occurred on the landward side of the dune along portions of the headland, and multiple sand fencing projects have occurred on the remnant dunes along much of the headland. An existing shoreline protection project consisting of cement-filled geotextile tubing and submarine cement mats extends from the east jetty of Belle Pass to Bay Champagne. That project was constructed in the early-1980s, prior to the piping plover's listing as a threatened species, and the Port Commission along with the local parish government plan to restore it as a result of damage from the 2005 and 2008 hurricane seasons. The Corps also conducts maintenance dredging every 2 years (if needed) within Belle Pass, and deposits material every other cycle along the Caminada headland adjacent to the east jetty. That material is placed unconfined, no closer than 100 feet from the top-of-bank (i.e., in the surf zone), and to an elevation of +6 feet Mean Low Gulf (MLG) (approximately +5 feet NAVD). The linear distance of shoreline nourished varies for each event, and the material is allowed to be naturally re-worked by

wind and wave action. Once the BBBSR project is implemented that material would no longer be placed adjacent to the east jetty but would be used for the sub-tidal feeder bar.

Although much of the headland is privately owned, the beaches are easily accessible by vehicle, foot, or boat, and are generally open to the public for recreation, birding, and fishing. The eastern end of the Caminada headland consists of Elmer's Island which is partially owned by the State, actively managed by LDWF, and is separated from Grand Isle (the State's only inhabited island) by Caminada Pass. That beach is also accessible by vehicle, foot, or boat and open to the general public for recreation, birding, and fishing. As a result of the Deepwater Horizon oil spill and since May 2010, the State and private landowners along the Caminada headland restrict public access when legacy cleanup and O&M activities are necessary.

The Shell Island reach is part of the Plaquemines barrier system along the southeastern portion of the Barataria Basin. Prior to Hurricane Bob in 1979, Shell Island (formerly Lanaux Island) was a continuous barrier island that helped to protect the interior coastal wetlands of the eastern Barataria Basin. The Corps estimates a shoreline recession rate of approximately 10 feet per year along the easternmost 5,000 to 8,000 feet of Shell Island, and indicates that rate is most likely due to installation of the Empire jetties (built in 1950) at the mouth of Fontanelle Pass. Shell Island is now characterized as an undeveloped, rapidly retreating, remnant barrier island (and associated spits and shoals) which partially encloses shallow bays such as Shell Island Bay and Bastian Bay (Figure 3). The Shell Island reach extends approximately 5.24 miles (8.43 km) between Grand Bayou Pass to the west and the Empire jetties to the east. The remnant island along the western edge of the Shell Island reach is approximately 1.41 (2.27 km) miles long and extends from Grand Bayou Pass to Coupe Bob; it is composed primarily of reworked oyster shells that formed into ridges and swales produced by waves refracting into the entrance to Grand Bayou Pass. The remnant island along the eastern edge of the Shell Island reach is approximately 2.54 miles long (4.09 km) and extends from Coupe Bob to Fontanelle Pass; it consists of marsh with a narrow strip of beach along its Gulf-ward side. These rapidly retreating barrier islands are becoming increasingly narrower and are completely separated from the remnants of Plaquemines Parish interior marshes.

Any exposed land (i.e., land above mean high tide) within the Shell Island reach is likely to be privately owned; however, much of the reach has been severely eroded and claimed as State water bottoms. Access to the area is by boat only; thus, human disturbance in the area generally consists of nearby recreational and commercial fishing, occasional oil and gas activity, and annual aerial surveys of nesting shorebird colonies conducted by LDWF. Since the Deepwater Horizon oil spill in April 2010, human activity in the area has increased due to cleanup and O&M activities, as well as construction of 8,439 linear feet (to an elevation of +6 NAVD) of a protective sand berm (as part of the emergency response) along the eastern end of the reach.

The Corps anticipates that the TSP would prevent the fragmentation of the Caminada headland and greatly ameliorate impacts on several important socio-economic sectors such as: Port Fourchon, the largest base for offshore oil and gas operations in coastal Louisiana and the largest coastal fishing port; major oil and gas infrastructure, such as regional transportation and storage facilities, the LOOP, and the Mars pipeline; and the regional hurricane evacuation route serving residents of southern Lafourche Parish, the community of Grand Isle, and approximately 6,000 workers stationed at offshore facilities in the central Gulf of Mexico. By decreasing the rate of erosion and preventing the splintering of the headland, the investment in infrastructure located at Port Fourchon will be less vulnerable to storm surges. Oil and gas pipelines and Louisiana Highway 1 maintenance requirements will lessen compared to the future-without-project conditions. Closure of the Shell Island reach would also aid in

protection of interior marshes within the eastern Barataria Basin and restoration of the tidal prism through Grand Bayou, Bastian Bay, and Shell Island Bay.

Status of the species within the action area

Assessing the number of piping plovers within the action area during winter is difficult for two main reasons: (1) the number of birds utilizing both the Caminada headland and Shell Island reach varies from year to year and throughout each wintering season; and (2) suitable habitat within the Shell Island reach is difficult to assess due to its remote location and generally poor winter weather conditions. Because winter generally produces inclement weather conditions, daily surveys over any length of time during the wintering season are also difficult to coordinate. Consequently, surveys for non-breeding (e.g., over-wintering and migrating) plovers within the Shell Island reach of the action area have been sporadic.

Because the 2005 hurricane season severely damaged much of the piping plover critical habitat across the state, the Service provided funding to the LDWF to conduct post-hurricane impact assessments of piping plovers and their habitat across the Louisiana coast for a three-year period. The LDWF conducted annual, one-day-count piping plover surveys between January 1 and February 18 from 2007 through 2010 (they were able to add a fourth year with the funding provided). Due to lack of manpower and inclement weather (e.g., dangerous boating conditions) LDWF was unable to survey the Shell Island reach in 2007, 2008, and 2009. For surveys that have been successful, results indicate that piping plovers utilize any non-vegetated or sparsely vegetated portions of the subject barrier headlands and islands. Such habitat consists of sand beaches, spits, and flats, mud flats, shell beaches, and oyster reefs associated with both the Gulf- and bay-sides of headlands and islands, as well as washover areas created by storm events. We have also gained access to preliminary survey data related to the Deepwater Horizon oil spill[7]. Survey results from the past 20 years are depicted in Table 10.

Table 10. Piping plover survey results within the action area and nearby beaches and headlands.

	Fourchon Beach and/or Bay Champagne[a]	Elmer's Island[a]	Shell Island[a]	West Belle Pass[b]	Chaland Beach[c]
1991 IPPC[d] Winter Survey	42	1	NS	NS[g]	NS
1996 IPPC Winter Survey	0	0	NS	15	NS
2001 IPPC Winter Survey	0	19	NS	18	NS
2006 IPPC Winter Survey	21	15	NS	1	NS
2006-07 CWS[e] Winter Survey	38	5	NS	0	NS
2007 LDWF[f] Winter Survey	0	14	NS	0	NS
2008 LDWF Winter Survey	41	17	NS	13	NS
2009 LDWF Winter Survey	13	23	NS	25	NS
2010 LDWF Winter Survey	13	38	6	46	6
2010 MC252 Fall Surveys	11	25	1	30	7
2011 MC252 Winter Surveys	20	51	NS	42	NS

(a) Beaches within the action area; (b) West Belle Pass is the small remnant strip of headland on the west side of Belle Pass (just west of the Caminada headland); (c) Chaland Beach is the headland west of Shell Island and Grand Bayou; (d) IPPC = International Piping Plover Census; (e) CWS = Canadian Wildlife Service, Maddock 2008; (f) LDWF = Louisiana Department of Wildlife and Fisheries-Natural Heritage Program; (g) NS = Not Surveyed.

[7] The data depicted in Table 10 for the Deepwater Horizon oil spill were collected from three sources: (1) deployed Service biologists, (2) contracted Natural Resource Advisors (NRAs), or (3) the NRDAR study team. The NRDAR study team followed specific survey protocols and surveys were conducted on a regular basis, as weather permitted. Surveys conducted by the Service or NRAs were done on an irregular basis, although daily surveys were attempted for some areas, and no specific survey methodology was used. Therefore, the survey methodologies used in collecting the oil spill data are not the same as the survey methodology used in the IPPC or LDWF winter surveys. Any data comparisons should carefully note differences in survey methodologies before any conclusions can be drawn from such comparisons.

The Final Determinations of Critical Habitat for Wintering Piping Plovers (Service 2001b) describes critical habitat within the project action area as:

> ". . . the Gulf shoreline extending approximately 11 km (6.8 miles) east from the east side of Belle Pass bounded on the seaward side by MLLW [mean low low water] and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; all of Elmer's Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmer's Island to approximately 0.9-km (0.56-mile) west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur . . ."

At the time of designation approximately 24,964 acres of wintering habitat were designated in Louisiana, and Unit LA-5 consisted of approximately 5,735 acres of that total. Large portions of the Caminada headland are included in that acreage for Unit LA-5. Approximately 1,558 acres of the Caminada barrier headland consisted of sparsely or non-vegetated habitat suitable for piping plovers (based upon 1998 aerial photography), of which approximately 370 acres existed on Elmer's Island and the remaining 1,188 acres existed on Fourchon Beach/Bay Champagne. The Shell Island reach is not included in designated piping plover critical habitat; however, it does provide some amount of suitable habitat for piping plovers. The current acreage of the exposed land along the Shell Island reach has not been estimated; however, 8,439 linear feet (elevation of +6 NAVD) of a protective sand berm has been constructed along the eastern remnant island of the reach as a result of the Deepwater Horizon oil spill. Until that sand berm is eroded below sea level, it will provide suitable habitat for piping plovers.

Based on 2008 aerial photography, the Corps estimates that approximately 485 acres (29 acres dune, 356 acres supratidal, and 100 acres Gulf intertidal) of critical habitat currently exist within the proposed project footprint on the Caminada headland. According to conversations with the Service's coastal restoration biologist working directly with the Corps on this project, the dune, supratidal, and intertidal habitat designations were defined by the Corps during habitat assessments as follows: (1) dune habitat includes any elevations within the project footprint at or above 5 feet NAVD; (2) supratidal habitat includes any elevations within the project footprint at or between 2 and 4.9 feet NAVD; and (3) Gulf intertidal habitat includes any elevations within the project footprint between zero and 2 feet NAVD. Based on evaluations of digital orthophoto quarter quadrangle (DOQQ) imagery dating from 2005 to 2010, light detection and ranging (LIDAR) imagery, and January 2009 and August 2010 site visits, the Service determined that the Corps' habitat acreages need to be defined in terms of suitable piping plover habitat instead of in terms of habitat designations for wetland value assessments. In order to interpret the Corps' habitat designations in terms of suitable habitat for piping plovers, the Service describes the Corps' habitat designations more specifically as follows:

1. The existing dune habitat within the project footprint consists of clumps of remnant dune generally dispersed throughout the high marsh/high beach interface. Those 29 acres of dune should not be considered as suitable piping plover habitat because those areas are densely vegetated and do not exhibit features of suitable piping plover habitat as described above.

2. The supratidal habitat classification includes both the high marsh on the landward side and the high beach along the Gulf side of the remnant dune within the project footprint (i.e., 356 acres). The high marsh consists of densely vegetated areas that are not suitable for the piping plover and are specifically excluded from designated critical habitat as described above. The high

beach consists of bare or sparsely vegetated sand flats above the high tide mark. Because the supratidal habitat area is roughly divided along the centerline of the remnant dune, we believe that no more than half (i.e., 178 acres) of the supratidal habitat classification acreage actually consists of high beach that is suitable roosting habitat for the piping plover.

3. The 100 acres of Gulf intertidal habitat does consist of suitable foraging habitat for the piping plover and is included within the critical habitat designation. That acreage is inclusive of tidal fluctuations throughout the year.

Based on the above information, the Service estimates that approximately 278 acres (178 acres of high beach and 100 acres of Gulf intertidal habitat) of designated critical habitat would be affected by the Caminada Headland-portion of the proposed project. That acreage is approximately 1.1 percent and 4.8 percent of the total acreage of wintering habitat in Louisiana and Unit LA-5, respectively.

Factors affecting species environment within the action area

As mentioned previously, the Caminada headland is the southernmost edge of the mainland and is easily accessed by the public via foot, vehicle, or boat. Only a portion of Elmer's Island (the eastern edge of the headland) is actively managed by LDWF. Port Fourchon and a Chevron facility are located adjacent to the action area on the northwestern portion of the headland. The entire headland receives regular visitors for fishing and bird watching year round and has persistent boat and helicopter traffic to and from the port and nearby support facilities for offshore oil and gas structures. In contrast, the Shell Island reach remains undeveloped and is isolated from the mainland. Any exposed land is afforded protection from major disturbance activities solely due to its remoteness since it is only accessible by boat. Other than infrequent bird surveys (usually conducted from helicopter or fixed-wing aircraft) and nearby boat traffic from fishing and offshore oil and gas activities, the remnant islands within the Shell Island reach do not receive regular visitors.

Mammalian predators (e.g., raccoons, coyotes) occur throughout the Caminada headland, but have limited access to the Shell Island reach. Mammalian predators may swim back and forth to the remnant islands of the Shell Island reach from the nearest mainland, but the islands do not provide enough shelter or forage to sustain a constant predator population. Somewhat regular storm events (e.g., flooding) also tend to discourage mammals from persisting on the remnant islands. Avian predators may also be present within both portions of the action area throughout the year but likely peak during fall and spring migration periods.

A nearby coastal restoration project would also occur in proximity to the action area. In the fall and winter of 2011, the NMFS plans to construct the West Belle Pass Headland Restoration Project under the authority of the CWPPRA program. Piping plovers that normally utilize that area may be temporarily dislocated to the Caminada headland during that project's construction period.

The Deepwater Horizon spill, which started April 20, 2010, discharged into the Gulf of Mexico through July 15, 2010. In May and early June 2010, the presence of oil was confirmed on the Caminada headland and Shell Island reach; those areas were oiled repeatedly throughout the summer months until the damaged oil well was sealed. Shoreline Cleanup Assessment Team (SCAT) reports throughout the duration of the spill documented various degrees of oiling along each of those areas (Table 11). At the time this document is being written, oil spill response efforts are ongoing in the form of continued SCAT surveys, Stage III cleanup efforts, Stage IV maintenance and monitoring efforts, and early stages of developing legacy cleanup procedures.

Table 11. Results of the SCAT reports for the Deepwater Horizon oil spill and cleanup activities along the Caminada headland and Shell Island reach.

Location	Extent of Oil	Cleanup Actions Proposed or Implemented
Elmer's Island	Tar balls; small pools of oil; 11 major tar mats; mousse	Mechanical cleanup with heavy machinery; removal of oiled wrack; beach tilling
Fourchon Beach	Tar balls; tar mats; surface oil residue; partially buried oiled seaweed; oil onshore	Mechanical cleanup with heavy machinery; removal of oiled wrack; beach tilling
West Bay Champagne	10 to 12 discreet patches of oil; tar patties	Mechanical cleanup with heavy machinery; removal of oiled wrack; beach tilling
Shell Island reach (Lanaux Island)	Tar balls; mousse on sand beaches and in marsh areas	Manual cleanup with shovels; removal of oiled wrack

At this time, it is unknown if there are any current or lasting effects to piping plovers migrating or wintering within the action area (i.e., the number of oiled piping plovers observed during NRDAR studies has not yet been released) or to the inter-tidal invertebrate food source used by piping plovers from either oil or oil dispersants and resulting cleanup activities within the action area. A greater impact to the piping plover and its habitat might be the prolonged human disturbance associated with ongoing cleanup activities, wildlife response, and damage assessment crews highly visible on the shorelines, as well as ongoing SCAT surveys and legacy cleanup activities.

EFFECTS OF THE ACTION

The proposed action includes marsh creation and dune and beach restoration along 13.18 miles of headland and 5.24 miles of mixed open water and remnant barrier islands, as well as placement of a 13,000-foot-long subtidal feeder bar offshore of the Caminada headland. The proposed project intends to lengthen and widen the Gulf shorelines of the Caminada headland and Shell Island reach in order to add much-needed sediment to the barrier coastal system of the Barataria Basin, prolong the existence of those land features, and restore barrier headland and island habitat, function, and morphology. Much of the proposed project would occur in habitat that is used regularly by piping plovers and designated as critical habitat for the species. Construction of the fully proposed TSP will overlap with multiple piping plover wintering seasons for both portions of the project. Short-term and temporary construction impacts to piping plovers will occur when the birds are roosting and feeding in the area.

The deposition of sand and marsh material will temporarily deplete the intertidal food base along the Gulf beach and bay-side flats, respectively, and temporarily disturb foraging and roosting birds during project construction on the headland and Shell Island. The shaping and grading of the restored beach and dune would cause disturbance and also remove wrack that has accumulated on the Gulf-side of the headland and remnant islands of the Shell Island reach. This would affect feeding and roosting habitat for piping plovers, since they often use wrack for cover and foraging. The construction of the marsh creation area will cover any existing bay-side flats used by foraging plovers and will render that area unusable until natural processes re-work the sediments and washover areas are again created by tidal and storm events and benthic prey species re-colonize those areas. Similar effects will occur again during renourishment periods (see project plan descriptions on pages 3 through 8 for target years) and benthic effects would extend for up to 2 years beyond the renourishment period until the benthic fauna recovers. The temporary increase in human presence and construction activity on the headland and remnant islands may also disturb piping plovers from utilizing adjacent areas outside of the project footprints, such as nearby sand spits and washover areas. Construction of the subtidal feeder bar

would occur completely offshore of the Caminada headland. Placement of O&M dredged material from the West Belle Pass channel every 1.5 to 2 years would be used to maintain the subtidal feeder bar. According to the Corps, the fine sediment placed in the subtidal feeder bar is not expected to cause extensive stacking of sediment on the beach which could smother benthic fauna. Thus, the subtidal feeder bar would not contribute additional stress to the remaining benthic community within piping plover critical habitat. Overall, the entire project would ultimately benefit piping plover habitat by creating new beach habitat and adding sediment to the Barataria Basin barrier system to be re-worked by natural forces.

The geomorphic characteristics of barrier headlands and islands, dunes, over-wash fans, and inlets are critical to a variety of natural resources and influence a barrier system's ability to respond to wave action, including storm over-wash and sediment transport. The protection or persistence of these important natural processes and wildlife resources are part of the goal of this restoration project. The newly created beach, dune, and marsh will not impede over-wash but may temporarily consist of less optimal roosting and foraging habitat until natural wrack is restored, the benthic prey base is able to recover from the construction activities, and washover areas are again created by natural tidal and weather events. The newly added sediment will be reworked by natural wind and wave processes which will, given time, create sand spits and flats on the ends and bay-sides of the islands, or as sediment is lost from one island, it will be carried by long-shore transport to another island. Thus, piping plover foraging, roosting, and critical habitat will continue to be lost and created through the natural processes associated with daily tidal events and future storm events.

Factors to be considered

Proximity of the action

Lack of regular surveys, fluctuation of use by piping plovers from year to year, and differences in numbers of birds migrating through versus those over-wintering, make it difficult to estimate the number of birds actually using any particular area (headland or island, Gulf- or bay-side) within the action area. Based on survey data depicted in Table 10 (page 41), numbers of piping plovers over-wintering within the action area can range anywhere from one to 51 birds scattered along the Caminada headland (i.e., Fourchon Beach, Bay Champagne, Elmer's Island) and from one to six birds scattered along the remnants of Shell Island; those estimates do not include migrating piping plovers. We expect direct short-term effects in the form of: (1) disturbance due to human presence and equipment noise during onshore pipeline construction activities, sediment placement, dune/beach construction, marsh creation, and vegetative planting; and (2) a temporary loss of food base within the intertidal zone on both the Gulf- and bay-sides of the project footprint on the Caminada headland and Shell Island reach for up to 2 years following completion of sediment placement until the benthic community re-colonizes the project areas. Within the Caminada headland portion of the project, 278 acres is included within critical habitat Unit LA-5. No designated critical habitat occurs within the Shell Island reach. West Belle Pass and East Timbalier Island located west of the Caminada headland and Chaland Beach located west of the Shell Island reach would not be included within any portions of the action area; all of those areas outside of the action area would provide available habitat during project construction. However, a CWPPRA restoration project has been planned for the West Belle Pass headland. Construction funding was allocated in late 2009, and construction is proposed to begin in the fall or winter of 2011. If it remains on schedule through its construction, the restoration of the West Belle Pass headland should be completed and fully available to piping plovers prior to the initiation of the BBBSR project

Distribution

The Corps proposes project construction activities on the Gulf- and protected-sides of the 13.18-mile-long Caminada headland within Lafourche and Jefferson Parishes and the 5.24-mile-long Shell Island reach in Plaquemines Parish. We expect direct effects to wintering piping plovers along existing sand beaches, spits, and flats, mud flats, shell beaches, oyster reefs, and washover areas associated with the Gulf shoreline of the headland and the entire Shell Island reach as a result of human activity and ground disturbance in those areas. Similar temporary disturbance would occur again during a renourishment cycle on the Gulf-side of Shell Island only. Renourishment for the Caminada headland would occur as a result of the replenished sub-tidal feeder bar located just offshore of the headland at its nodal point near the mouth of Bayou Moreau (Figure 2), which would not require any onshore activities during each replenishment of the feeder bar.

Timing

Construction of the TSP will overlap with multiple piping plover wintering/migrating seasons (mid-July to late April) and with construction of several other barrier headland and island restoration projects along the Louisiana coast.

Nature of the adverse effect

The effects to piping plovers may be direct, indirect, and short-term. Activities that impact or alter the use of optimal habitat or increase disturbance to the species may directly decrease the survival and recovery potential of the piping plover by limiting the ability of birds to rest and replenish their fat reserves for spring migration. We expect direct, short-term impacts from human disturbance during project construction to both the bird and its habitat. We anticipate a temporary (i.e., up to 2 years post-construction) decrease in benthic prey species within all existing piping plover foraging habitat within the project footprint as a result of sand and marsh material placement and loss of natural wrack. Following one or two growing seasons, the dune portion of the project may become densely vegetated and would no longer be suitable roosting habitat for piping plovers until a storm event creates over-wash fans. Until the benthic community recovers and new over-wash fans are created, a temporary decrease in prey items and roosting habitat may result in a decrease in the survival of birds on migrating or wintering grounds due to lack of optimal habitat. That situation can contribute to decreased survival rates and may indirectly result in decreased productivity on the breeding grounds. Such effects may temporarily result in increased vulnerability to any of the three piping plover breeding populations.

The effects to 278 acres of critical habitat in Unit LA-5 result from activities that impact or alter the PCEs (disturbance to the species) which may decrease the survival and recovery potential of the piping plover. Such effects consist of temporary reductions in the value of the unit from disturbance to foraging and roosting piping plovers due to human activity during construction, temporary removal of wrack, and a temporary decrease in benthic prey species due to sand placement along the Gulf shoreline. In addition, existing over-wash areas would be covered by placement of new material until natural coastal processes (e.g., daily tidal events, storm events, etc.) are allowed to re-work the additional sediment to create new over-wash areas on Caminada and new sand and mud flats on Shell Island. That acreage (i.e., 278 acres) is approximately 1.1 percent and 4.8 percent of the total acreage of wintering habitat in Louisiana and Unit LA-5, respectively.

Duration

For the TSP initial construction would be completed in approximately 2 to 3 years, with additional time (see project details on pages 3 through 8 for exact timelines) for vegetative planting following dewatering and settlement of the newly placed material. The activities associated with construction of the marsh creation are a one-time occurrence for each portion of the project. Construction of the dune and beach would initially occur at TY1 for the headland and the island; however, two renourishment events (TY20 and TY40) would occur for Shell Island. Each activity may vary in duration depending on the amount of work needed, weather conditions, and equipment mobilization and maintenance. The Corps anticipates beginning construction on the TSP in April 2013. We do not expect long-term, permanent alteration of the natural coastal processes, and the two renourishment events would result in a pulse effect that would temporarily disturb the Gulf-side of the restored Shell Island while the bay-side of the island would remain untouched after initial construction. The initial addition of sand material on 278 acres of critical habitat Unit LA-5 is expected to decrease the quality of foraging habitat from 6 months up to 2 years until the intertidal benthic fauna recovers to normal population levels and natural wrack returns to the shoreline. The sub-tidal feeder bar along the Caminada headland would be reworked by natural processes and would not be placed directly within piping plover foraging habitat.

Disturbance frequency, intensity, and severity

We anticipate that construction activities would have short-term and temporary effects on piping plover populations. We expect short-term disturbance from construction activities and short-term effects due to sand and marsh material placement. Direct effects to 278 acres of critical habitat Unit LA-5 would include temporary removal of wrack, temporary smothering of intertidal benthic prey species at TY1 on the Gulf shoreline of the Caminada headland, and the creation of a dune that may eventually become densely vegetated until new over-wash fans are created. We anticipate that: (1) piping plovers located within the construction area would move outside of the construction zone due to disturbance; (2) natural wrack would be deposited on the Caminada headland and Shell Island reach beaches following normal tidal events; (3) the intertidal benthic fauna would recover within 6 months to 2 years of each initial disturbance event and the two renourishment events on Shell Island; and (4) the density of dune vegetation will ebb and flow as tidal and storm events naturally affect dune vegetation growth. We do not anticipate any permanent adverse changes to barrier headland and island morphology because initial construction elevations and follow-up renourishment elevations would not prevent island washover during storm events and the created marsh platforms would allow for natural headland and island retreat or "rollover." There would not be any increased or continual disturbance within critical habitat Unit LA-5 as a result of the BBBSR project. Over the long-term the additional sediment would allow for creation of piping plover habitat on the Caminada headland and Shell Island as natural processes re-work the sediment to create over-wash areas, sand flats, mud flats, and sand spits.

Analysis for the effects of the action

Direct effects

Direct effects are those direct or immediate effects of a project on the species and/or its habitat. Implementation of the proposed action is not likely to directly kill and piping plovers since the birds are highly mobile and can quickly move out of harm's way. The construction window will extend through several piping plover migration and wintering seasons for the proposed TSP. Heavy

machinery and equipment (e.g., ORVs and bulldozers operating on project area beaches and bay-side sand and mud flats, the placement of the dredge pipeline along the beach, and sand and marsh material disposal) may directly affect migrating and wintering piping plovers in the project area by disturbance and disruption of normal activities such as roosting and feeding, and possibly forcing birds to expend valuable energy reserves to seek available habitat elsewhere.

Direct effects to critical habitat Unit LA-5 consist of sand and marsh material placement over 278 acres of existing habitat on the Gulf shoreline of the Caminada headland at TY1 which would result in temporary loss of wrack, temporary loss of washover areas, and burial and suffocation of intertidal benthic prey species. The natural wrack would be restored following normal tidal events. Washover areas would eventually be re-created during storm events. Burial and suffocation of invertebrate intertidal prey species will occur during initial sand and marsh material placement throughout the entire project area and during follow-up renourishment events on Shell Island only (which does not contain any critical habitat). Impacts will affect the project footprint on both the Caminada headland and the remnant islands of the Shell Island reach, as well as some down-drift areas. Timeframes projected for benthic recruitment and re-establishment following sand and marsh material placement are from 6 months up to 2 years. Due to the duration of project construction and depending on actual recovery rates, impacts on the Shell Island portion will occur even if renourishment events occur outside the plover migration and wintering seasons.

Indirect effects

Indirect effects are those that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. The short-term increase in human disturbance to normal piping plover foraging and roosting behavior, as well as to suitable foraging and roosting habitat, during construction and immediately post-construction is likely to result in indirect effects via increased energy expenditure and a potential lack of adequate food supplies which can then lead to temporarily reduced fitness, fecundity, and over-wintering survival. However, such effects would be temporary for those birds wintering in or migrating through the action area over the course of several wintering seasons.

Reducing the potential for the formation of optimal habitats (such as over-wash or ephemeral pool formations), long-term increased human disturbance, and construction of new infrastructure are possible indirect effects to designated critical habitat. The piping plover's rapid response (within 6 months) to habitats formed by over-wash areas demonstrates the importance of over-wash created sand and mud flats for wintering and migrating piping plovers. Implementation of the proposed project will temporarily cover existing over-wash habitat within the entire action area. Given time, the intertidal zone along the Caminada headland and Shell Island reach will re-establish and with daily tidal processes and occasional storm events natural over-wash and ephemeral pool habitat would again be created throughout the action area.

The project life and expected future re-nourishment activities do not increase the likelihood of long-term increased human disturbance on Elmer's Island or Shell Island, or that the LDWF or other local entities would initiate construction of new infrastructure on those islands. The LDWF is committed to managing and maintaining Elmer's Island as a public recreation area for enjoying wildlife and fishing, as well as improving shorebird nesting, roosting, and foraging habitats with minimal human disturbance. Similarly, Shell Island's remote location and limited access from the mainland discourages regular use of the island. Because the remaining portions of the Caminada headland (i.e., Fourchon Beach/Bay Champagne) are privately owned, it is unknown whether the increased likelihood

of long-term increased human disturbance within those areas would occur due to construction of new infrastructure or upgrading of existing facilities, such as camps or oil and gas infrastructure.

Beneficial effects

Beneficial effects are wholly positive without any adverse effects. We expect the prolonged existence and restoration/creation of foraging and roosting habitat for piping plovers along the Shell Island reach and within critical habitat Unit LA-5 along the Caminada headland as an overall result of the proposed BBBSR project. The Corps has estimated that without the project there would be little or no piping plover critical habitat remaining on the Caminada headland and the remnants of Shell Island would erode below sea level within the 50-year period of analysis. With the project, 880 acres of dune and beach complex would be created along the Caminada headland, and 317 acres of dune and beach complex would be restored along the Shell Island reach (Corps 2011). Much of the existing system is sediment-starved, and the proposed action would introduce sediment into that system that would be reworked and redistributed through natural processes, thus maintaining and/or enhancing the features of critical habitat. The additional sediment (within the sediment-starved Barataria Basin barrier system) would be re-worked by wind and wave action and storm events to allow for natural shoreline nourishment and repair along the Caminada headland and natural island "rollover" on Shell Island, all of which should result in the natural reformation of optimal piping plover habitat in the form of over-wash areas, sand flats, mud flats, and sand spits. The restoration and maintenance of intertidal habitat is important for the restoration of the piping plover population to healthy levels.

Species response to the proposed action

This biological opinion addresses the direct and indirect effects that are anticipated to wintering and migrating piping plovers and designated critical habitat as a result of restoring beach, dune, and marsh on the Caminada headland and the remnants of Shell Island, as well as the temporary disruption of existing plover foraging and roosting habitat for the long-term benefit of maintaining existing barrier headland and island habitat. Although survey data from Table 10 (page 41) indicate that anywhere from 1 to 51 piping plovers could be using any portion of the action area in any given year, it is difficult for the Service to estimate the number of birds migrating through or wintering within the proposed action area because piping plover numbers fluctuate from year to year. Therefore, the Service anticipates that all migrating and wintering piping plovers utilizing the remnants of Shell Island and the Gulf shoreline of the Caminada headland (i.e., a total of 18.42 miles [29.64 km] of shoreline), and up to 278 acres of existing critical habitat will be impacted by: (1) disturbance due to human activity and equipment noise during construction within the action area; and (2) temporary habitat loss within the project footprint along each barrier shoreline for the duration of construction activities (2 to 3 years for each project feature) and up to 2 years post construction for the recovery of intertidal benthic prey species.

The nearest suitable habitats to the Caminada headland into which piping plovers can disperse are located on East Timbalier Island (located between Timbalier Island and the West Belle Pass headland), the West Belle Pass headland (located immediately west of Belle Pass), and Grand Isle (located immediately east of Elmer's Island and Caminada Pass). The next closest suitable habitat areas to the Caminada headland consist of the Isles Dernieres (critical habitat Unit LA-4) to the west and the Grand Terre Islands (critical habitat Unit LA-5) to the east; both of which are greater than 10 miles away from that portion of the action area. The nearest suitable habitat areas to the Shell Island reach are Chaland Beach (located immediately west of Grand Bayou) and Pelican and Scofield Islands (located immediately east of the Empire jetties). The next closest suitable habitat areas to the Shell Island reach

are the Grand Terre Islands to the west, and the mud lumps at mouth of the South Pass of the Mississippi River to the east; both of which are greater than 10 miles away from that portion of the action area. However, all of those areas have been impacted by the Deepwater Horizon oil spill, and foraging and roosting habitat in those areas are recovering from ongoing oil spill cleanup activities and NRDAR surveys and data collection. The duration of disturbance from the oil spill is ongoing for an unknown period of time. In addition, several other coastal restoration projects on the Isles Dernieres, West Belle Pass headland, Scofield Island, and Pelican Island will be constructed before, during, or within 2 years of the construction time frame for the BBBSR project.

The closest non-oiled habitat would be the Atchafalaya River Delta which is located greater than 70 miles west of the action area along the Caminada headland; there is no non-oiled habitat located east of either portion of the BBBSR project. Critical habitat Unit LA-2 consists of the deltaic splay and the dredge disposal islands occurring east and southeast of the main navigation channel of the Atchafalaya River. At this time, there have been no reported impacts to those areas as a result of the Deepwater Horizon oil spill. Table 12 depicts the results of sporadic winter surveys of the Atchafalaya River Delta over the last 19 years.

Table 12. Piping plover numbers from winter surveys within the Atchafalaya River Delta.

Location	1991 IPPC[a] Survey	1996 IPPC Survey	2001 IPPC Survey	2006 IPPC Survey	2006-07 CWS[b] Survey	2007 LDWF[c] Survey	2008 LDWF Survey	2009 LDWF Survey	2010 LDWF Survey
Atchafalaya River Delta	27	0	21	6	NS[d]	NS	27	0	NS

(a) IPPC = International Piping Plover Census; (b) CWS = Canadian Wildlife Service, Maddock 2008; (c) LDWF = Louisiana Department of Wildlife and Fisheries-Natural Heritage Program; (d) NS = Not Surveyed.

Critical habitat within the action area is experiencing ongoing disturbance by oil spill cleanup activities, and such disturbance will continue for an unknown period of time. The proposed action would involve anywhere from 2 to 3 years of disturbance activities for the construction period, plus an additional 2 years of recovery for the intertidal benthic community following TY1. The project would not, however, result in permanent changes to the natural processes that maintain the PCEs of critical habitat. Daily tidal processes and occasional storm events would re-work the additional sediment to recreate over-wash areas, sand and mud flats, and sand spits. Without the additional sediment from the project, critical habitat on the headland would eventually erode below sea level.

Although restoration of the Caminada headland and Shell Island reach would follow on the heels of the Deepwater Horizon oil spill and would result in temporary disturbance within the action area, in time the proposed action would ultimately benefit the piping plover and its critical habitat by restoring diverse barrier headland and island habitats used by the piping plover. The proposed action would also allow for the continued existence and creation of habitat within critical habitat Unit LA-5 throughout the project life.

CUMULATIVE EFFECTS

The proposed project would occur on privately owned and State-owned lands and/or State-owned water bottoms. Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

It is unknown how much influence the proposed project would contribute to increased human disturbance along the privately owned portions of the Caminada headland. However, the remoteness of Shell Island and the LDWF's management of Elmer's Island help to control human disturbance levels within those portions of the action area. Overall recreational use of the Caminada headland (including Elmer's Island) is generally in the form of bird watching and fishing, and because of its remoteness, there is little human disturbance on Shell Island. Any future proposed actions that are within endangered or threatened species habitat will require section 7 or 10 permitting from the Service to be covered under the Act.

Impacts to the action area from the Deepwater Horizon oil spill includes Stage III cleanup actions for weathered oil, tar balls, tar mats, tar patties, oil mousse, oiled wrack, Stage IV monitoring and maintenance activities, ongoing NRDAR surveys and studies, dispersants in the water, and increased human disturbance from those cleanup and monitoring activities. Although the final breadth of the oil spill impacts to the Louisiana Gulf shoreline and shoreline-dependent species remains unknown, section 7 consultation will be completed with the lead Federal agency, the U.S. Coast Guard, at the conclusion of the emergency event.

CONCLUSION

The survival and recovery of all breeding populations of piping plovers are fundamentally dependent on the continued availability of sufficient habitat in their coastal migration and wintering range, where the species spends more than two-thirds of its annual cycle. All piping plover populations are inherently vulnerable to even small declines in their most sensitive vital rates (i.e., survival of adults and fledged juveniles). Mark-recapture analysis of resightings of uniquely banded piping plovers from seven breeding areas by Roche et al. (2010) found that apparent adult survival declined in four populations and increased in none over the life of the studies. Some evidence of correlation in year-to-year fluctuations in annual survival of Great Lakes and eastern Canada populations, both of which winter primarily along the southeastern U.S. Atlantic Coast, suggests that shared over-wintering and/or migration habitats may influence annual variation in survival. Further concurrent mark-resighting analysis of color-banded individuals across piping plover breeding populations has the potential to shed light on threats that affect survival in the migration and wintering range. Progress towards recovery (which is attained primarily through intensive protections to increase productivity on the breeding grounds) would be quickly slowed or reversed by even small sustained decreases in survival rates during migration and wintering.

Implementation of the proposed action is not likely to kill any piping plovers since they are highly mobile and can move out of harm's way. The increased disturbance to normal piping plover foraging/roosting behaviors and suitable habitat would likely result in increased energy expenditure and a potential lack of food supply, which may indirectly affect fitness, fecundity, and over-wintering survival. Such effects to migrating and wintering piping plovers would be sporadic and temporary over the course of the 2-year construction window. After reviewing the current status of the piping plover wintering population of the northern Great Plains, the Great Lakes, and the Atlantic Coast; the environmental baseline for the action area; the effects of the proposed BBBSR project; and cumulative effects, it is the Service's biological opinion that implementation of the BBBSR project, as proposed, is not likely to jeopardize the continued existence of the piping plover. As noted previously, the overall status of the listed species is stable, if not increasing.

Critical Habitat

Critical habitat for this species has been designated within the project area and the action area. The project has been designed to mimic natural barrier headland habitat and, in the long-term, would aid natural processes in creating and maintaining the PCEs of critical habitat on the headland by providing sediment within the sediment-starved barrier headland system. The amount of critical habitat in Unit LA-5 directly affected from the project is approximately 278 acres of sparsely and non-vegetated barrier headland shoreline habitat. The project area would be temporarily disturbed during construction activities which would impede piping plovers attempting to roost and forage in the area during the migration and wintering months that coincide with construction. Temporary disturbance to 278 acres of Unit LA-5 equates to 1.1 percent of designated critical habitat in Louisiana and 0.16 percent of all designated critical habitat throughout the Southeast (i.e., North Carolina to Texas). Because the effects to critical habitat would be temporary in nature and the overall project would be beneficial in the long-term, it is the Service's biological opinion that implementation of the BBBSR project is not likely to destroy or adversely modify designated critical habitat in Unit LA-5.

INCIDENTAL TAKE STATEMENT

Because the proposed action is likely to result in the taking of a listed species incidental to that action, the Service has included an incidental take statement pursuant to section 7(b)(4) of the Act. Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Corps so that they become binding conditions of any contract, grant, or permit issued to the Corps' contractor, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require its contractor to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the contract, grant, or permit document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps and/or its contractor must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 Code of Federal Regulations (CFR) §402.14(I) (3)].

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service expects incidental take of piping plover will be difficult to detect for the following reasons:

1. Wintering bird survey data indicate that anywhere from one to 51 piping plovers could be within the action area at any point in time. The number of birds within the action area for the duration of project construction and intertidal benthic recovery is difficult to detect because wintering piping plover numbers within the action area vary from year to year, and migrating piping plover numbers vary between both fall and spring migrations and year to year.
2. Harassment to the level of harm may only be apparent on the breeding grounds the following year as a result of reduced fitness or fecundity, or as lack of over-wintering survival.
3. Over-wintering survival would be difficult to detect because it is difficult to detect birds that do not survive migration back to the breeding grounds.

However, the following level of take of this species can be expected by disturbance to affected shoreline miles because disturbance to suitable habitat within the action area would affect the ability of piping plovers to find foraging and roosting habitat throughout the migrating and wintering periods for the duration of project construction and intertidal benthic recovery. The Service anticipates that directly and indirectly all piping plovers using the affected 18.42 miles (of which 278 acres is designated critical habitat) of Gulf shoreline along both the Caminada headland and Shell Island reaches could be taken in the form of harm and harassment as a result of the proposed action.

The level (i.e., all piping plovers using the 18.42 miles of Gulf shoreline) of take of this species can be anticipated by the proposed activities because:

1. Piping plovers are known to winter in and migrate through the action area.
2. The placement of sand is expected to temporarily affect (e.g., in the form of increased human disturbance during construction, temporary loss of benthic prey, and temporary loss of wrack) 18.42 miles of Gulf shoreline over multiple migrating and wintering seasons until construction is complete and until the benthic fauna recover.
3. Temporarily increased levels of human disturbance are expected for the duration of construction activities which would make the 18.42 miles of Gulf shoreline less desirable habitat for piping plovers and may cause increased energy expenditure as birds move away from construction activities.
4. A temporary reduction of food base will occur due to sand placement which would affect the piping plover's ability to forage and store enough fat reserves for migration back to the breeding grounds for multiple wintering seasons. Such an effect could result in reduced fitness or fecundity.

The Service has reviewed the biological information and other information relevant to this action. The take is expected in the form of harm and harassment because of: (1) temporarily decreased fitness and survivorship of wintering piping plovers; (2) temporarily decreased fitness and survivorship of piping plovers attempting to migrate to breeding grounds, due to temporary loss of and disturbance to foraging and roosting habitat; and (3) an indirect temporary reduction of fecundity on the breeding grounds due to the temporary decrease in fitness and survivorship of wintering piping plovers. Incidental take covers take of the species within the action area. If the Corps expands the action outside of the action area then consultation must be reinitiated.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the piping plover species or destruction or adverse modification of its

critical habitat. Incidental take of piping plovers utilizing the affected 18.42 miles of barrier headland and island habitat is anticipated to occur during project construction, up to 2 years following construction until the intertidal benthic community recovers, and sporadically for up to 3 years following construction for vegetative plantings.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize take on non-breeding piping plovers during implementation of the proposed BBBSR project within the action area.

1. The Corps should carefully mark and stake the boundaries of the project footprint on both the Caminada headland and Shell Island and ensure that those markers are maintained for the duration of project construction activities. Should the project extend outside of those boundary markers, then the level (i.e., all piping plovers using the 18.42 miles of Gulf shoreline) of incidental take for this project would be exceeded and the Corps should reinitiate section 7 consultation with the Service as soon as possible.
2. A baseline piping plover survey should be conducted within the migrating and wintering season immediately prior to initial construction in order to determine the piping plover's preferred habitat use within the action area. Such information could then be used as an aid to determine whether specific project actions require slight modifications in order to minimize the effects of the take for future migrating and wintering seasons. For example, initial bird surveys may aid in locating and marking appropriate ingress and egress routes for ORVs and other work-related equipment, as well as equipment staging areas, in order to reduce disturbance to foraging and roosting birds to the maximum extent practicable.
3. A simple diversity and abundance survey of the intertidal benthic prey species community should be conducted within the migrating and wintering season immediately prior to initial construction (preferably at the same time as the plover distribution surveys) in order to establish a baseline of benthic prey species diversity and abundance. Again, such information could then be used as an aid to determine whether specific project actions require slight modifications in order to minimize the effects of the take for future migrating and wintering seasons. For example, initial surveys could locate areas of abundant benthic prey where birds may tend to congregate for foraging, and those areas could be flagged for avoidance by regular personnel traffic to reduce disturbance to foraging plovers.
4. Piping plover monitoring surveys should be conducted during the migrating and wintering seasons throughout initial project construction and three consecutive years following completion of initial construction in order to determine whether ingress and egress routes are working or whether they need to be adjusted.
5. To determine length of time needed for recovery of suitable foraging habitat for migrating and wintering plovers, monitoring surveys of the intertidal benthic prey species community should be conducted each year following completion of initial construction for three consecutive years. Such information could then be used as an aid to determine whether specific project actions require slight modifications in order to minimize the effects of the take for future project renourishment and/or maintenance events.
6. At least six months prior to mobilization, the Service should be notified in writing when renourishment events (i.e., renourishment of the subtidal feeder bar and of Shell Island) will occur within the action area so that the Corps and the Service can coordinate and exchange updated information to ensure that reinitiation of consultation is not necessary.

7. A comprehensive report describing the actions taken to implement the RPMs and terms and conditions associated with this incidental take statement shall be submitted to the Service by June 30 of the year following completion of all required surveys.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps shall execute the following terms and conditions, which implement the RPMs described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

Marking Project Boundaries

1. The Corps should carefully survey and mark the boundaries of the project footprint on the Caminada headland and Shell Island.
2. Boundary markers should be semi-permanent such that they should be maintained throughout construction activities and should persist until all construction-related activities are completed.
3. The Service's Louisiana Ecological Services Office (337/291-3108) should be notified immediately if any work or project-related actions exceed the boundary markers so that reinitiation of section 7 consultation can proceed as quickly and efficiently as possible to avoid delay in the project schedule.

Monitoring Requirements

1. Requirements for piping plover surveys
   a) A survey schedule (with dates) is listed in Appendix D and the recommendation is for at least 3 survey dates per month; this schedule should be followed as closely as possible. The Service recognizes that given the remoteness of the project area and the potential for inclement weather conditions during the piping plover wintering season, three survey dates per month may be difficult to achieve in Louisiana. If conditions require a deviation from the recommended survey schedule, such information should be carefully documented, including an explanation why any deviation from the recommended schedule was deemed necessary.
   b) Piping plover identification, especially when in non-breeding plumage, can be difficult. Qualified professionals with shorebird/habitat survey experience must conduct the required survey work. Piping plover monitors must be capable of detecting and recording locations of roosting and foraging plovers, and documenting observations in legible, complete field notes. Aptitude for monitoring includes keen powers of observation, familiarity with avian biology and behavior, experience observing birds or other wildlife for sustained periods, tolerance for adverse weather, experience in data collection and management, and patience.
   c) Binoculars, a global positioning system (GPS) unit, a 10-60x spotting scope with a tripod, and the Service datasheet (Appendix D) must be used to conduct the surveys.
   d) Negative (i.e., no plovers seen) and positive survey data shall be recorded and reported.
   e) Piping plover locations shall be recorded with a GPS unit set to record in decimal degrees in universal transverse mercator (UTM) North American Datum 1983 (NAD83).
   f) Habitat, landscape, and substrate features used by piping plovers when seen shall be recorded. Such features are outlined on the Service data sheet in Appendix D.
   g) Behavior of piping plovers (e.g., foraging, roosting, preening, bathing, flying, aggression, walking) shall be documented on the Service data sheet in Appendix D.
   h) Color-bands seen on piping plovers shall also be carefully documented, and should also be reported according to the information found at the following websites. Information regarding

color-band observations can be found at:
http://www.fishwild.vt.edu/piping_plover/Protocols_final_draft.pdf,
http://www.waterbirds.umn.edu/Piping_Plovers/piping2.htm, and
http://www.fws.gov/northeast/pipingplover/pdf/BahamasBandReporting2010.pdf.

2. Requirements for surveying benthic prey species
   a) A qualified professional with sediment/macroinvertebrate sampling experience must conduct the benthic prey species surveys.
   b) A baseline macroinvertebrate survey will be conducted at the same time of the initial piping plover survey during the migrating/wintering season immediately prior to construction. Additional surveys will be conducted during the migrating/wintering season each year post-construction for three consecutive years to determine benthic prey species recovery. Such surveys should be conducted at the same time as the plover surveys.
   c) Sampling will be conducted using a basic before and after control and impact design method. Sampling will be coordinated with piping plover foraging observations based on low tide surveys.
   d) In addition to recording benthic species abundance and diversity, a qualitative measure of sediment characteristics (sand, shell, mud) should also be recorded.
   e) A detailed sampling methodology should be developed in coordination with the Service prior to initiating surveys.

Reporting Requirements

1. Incorporate all data collected into an appropriate database, preferably one for piping plovers and one for benthic prey species.
2. Annual update reports should be provided to the Service by June 30 of each calendar year once construction begins. Annual update reports should include data sheets, maps, a copy of the database, and the progress and initial findings of piping plover and benthic community surveys, as well as any problematic issues that may hinder future survey efforts.
3. If the Corps foresees any problematic issues that would require a change in the recommended survey schedule due to work conditions or project delays, the Corps should immediately notify the Service so that we can resolve/correct any such issues.
4. A final comprehensive report should be provided to the Service by June 30 following the third year of surveys. That final report should include an analysis of all data results from the piping plover and benthic community surveys.
5. At least six months prior to mobilization, the Corps should notify the Service in writing prior to each proposed renourishment event. That notification should include whether there are any changes in the proposed amount of renourishment per island or changes in anticipated project footprints.

Upon locating a dead or injured piping plover that may have been harmed or destroyed as a direct or indirect result of the proposed project, the Corps and/or contractor shall be responsible for notifying the Service's Lafayette, Louisiana, Field Office (337/291-3100) and the LDWF's Natural Heritage Program (225/765-2821). Care shall be taken in handling an injured piping plover to ensure effective treatment or disposition and in handling dead specimens to preserve biological materials in the best possible state for later analysis.

COORDINATION OF INCIDENTAL TAKE STATEMENT WITH OTHER LAWS, REGULATIONS, AND POLICIES

Migratory Bird Treaty Act (MBTA)

The MBTA implements various treaties and conventions between the U.S., Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the provisions of the MBTA it is unlawful "by any means or manner to pursue, hunt, take, capture or kill any migratory bird except as permitted by regulations issued by the Fish and Wildlife Service. The term "take" is not defined in the MBTA, but the Service has defined it by regulation to mean to pursue, hunt, shoot, wound, kill, trap, capture or collect any migratory bird, or any part, nest or egg or any migratory bird covered by the conventions or to attempt those activities.

In order to comply with the MBTA and potential for this project to impact nesting shorebirds, the Corps should follow the Service and LDWF's guidelines (Appendix E) to protect against impacts to nesting shorebirds during implementation of this project.

The Fish and Wildlife Service will not refer the incidental take of piping plovers for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712), if such take is in compliance with the terms and conditions specified here.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. The Corps should consider retro-fitting all sand fencing poles with pointy tops or caps to reduce avian predation.

2. We encourage the Corps to take a proactive approach in coordinating with the Service regarding programmatic-level section 7 consultations for implementation of landscape-scale coastal protection and restoration programs in Louisiana. Programmatic-level planning and consultation may further reduce and minimize cumulative effects to listed species (e.g., piping plover, pallid sturgeon, West Indian manatee, sea turtles) resulting from implementation of multiple types of coastal protection and restoration projects, including, but not limited to those projects associated with the LCA Study, CWPPRA, and hurricane protection actions.

3. We encourage the Corps to continue to coordinate with the Service during the pre-planning phases of future coastal protection and restoration projects (including any sand placement projects) within piping plover designated critical habitat.

4. We encourage the Corps to participate in and/or fund a benthic study (or studies) along coastal Louisiana, west of the Mississippi River. Information is needed regarding the effects of sand placement and dredging projects on benthic prey species and their potential recovery time following such actions. That information would benefit our knowledge regarding piping plover

foraging biology and aid in future section 7 consultation during project planning for future coastal restoration actions.

In order for the Service to be kept informed of actions that minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes consultation on the proposed action. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take (i.e., the 18.42 miles of Gulf shoreline described herein) is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take shall cease pending reinitiation.

The above findings and recommendations constitute the report of the Department of the Interior. If you have any questions about this final biological opinion, please contact Ms. Brigette Firmin of this office at 337/291-3108.

Sincerely,

David A. Walther
Acting Supervisor
Louisiana Ecological Services Office

cc: FWS, Atlanta, GA (Attn: Ken Graham)
FWS, Panama City, FL (Attn: Patty Kelly)
LDWF, Baton Rouge, LA
LDWF, Natural Heritage Program, Baton Rouge, LA

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APPENDIX A

Standard Conditions for In-water Work in the Presence of Manatees

Guidelines for Activities in Proximity to Manatees and Their Habitat

A. All personnel associated with the project should be informed of the potential presence of manatees, manatee speed zones, and the need to avoid collisions with and injury to manatees. Such personnel instruction should also include a discussion of the civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973.

B. All contract and/or construction personnel are responsible for observing water-related activities for the presence of manatee(s).

C. Temporary signs should be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area), and at least one sign should be placed where it is visible to the vessel operator.

D. Siltation barriers, if used, should be made of material in which manatees could not become entangled, and should be properly secured and regularly monitored. Barriers should not impede manatee movement.

E. If a manatee is sighted within 100 yards of the active work zone, special operating conditions should be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels should operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, should be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions are no longer necessary, but careful observations would be resumed.

F. Any manatee sighting should be immediately reported to the U.S. Fish and Wildlife Service's (Service) Lafayette, Louisiana, Field Office (337/291-3100) and the Louisiana Department of Wildlife and Fisheries (LDWF), Natural Heritage Program (225/765-2821).

APPENDIX B

Protective Measures for Dredging Operations in the Presence of Sturgeon

Guidelines for Dredging Operations in the Proximity to Sturgeon

A. All dredged material disposed of in the river should be discharged at the surface, with the use of a baffle plate.

B. The cutterhead should remain completely buried in the bottom material during dredging operations.

C. If pumping water through the cutterhead is necessary to dislodge material, or to clean the pumps or cutterhead, etc., the pumping rate should be reduced to the lowest rate possible until the cutterhead is at mid-depth, where the pumping rate can then be increased. During dredging, the pumping rates should be reduced to the slowest speed feasible while the cutterhead is descending to the channel bottom.

APPENDIX C

FIGURES

Figure 1. The proposed action would be located along the barrier shoreline of the Barataria Basin in Lafourche and Plaquemines Parishes, Louisiana (http://www.lca.gov/Projects/4/Default.aspx).

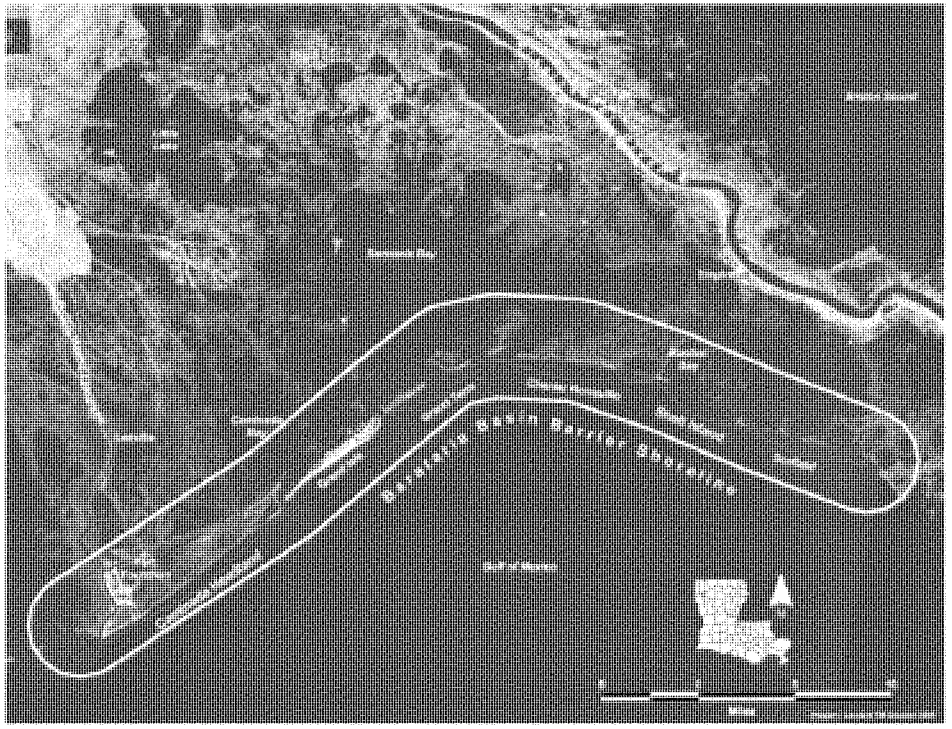


Figure 2. Caminada Headland Alternative 5 – Preferred Dune with Expanded Marsh and Subtidal Feeder Bar (Corps 2011).

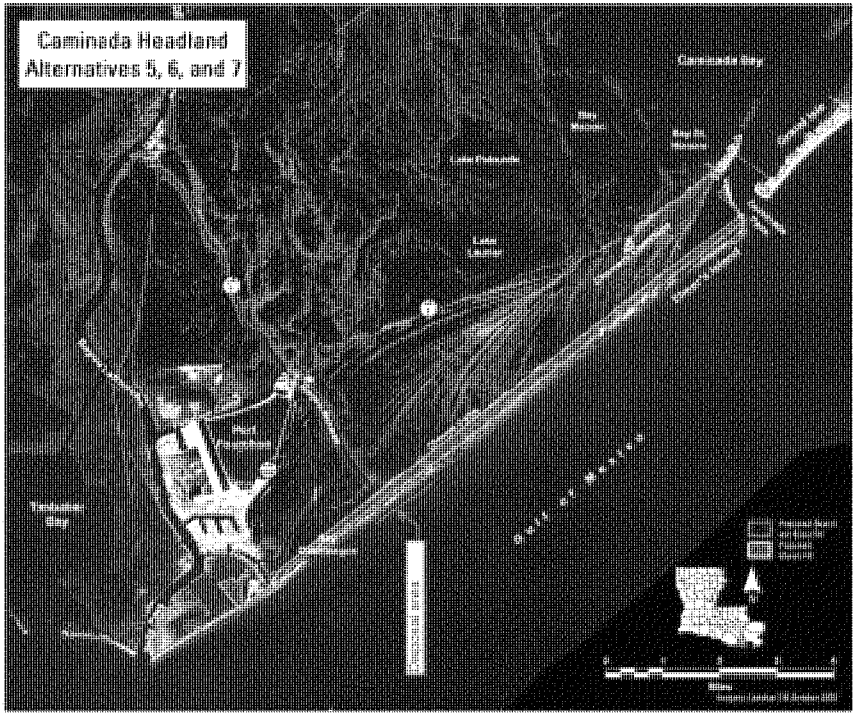


Figure 3. Shell Island Alternative 5 – One Island with Two Renourishments (Corps 2011).

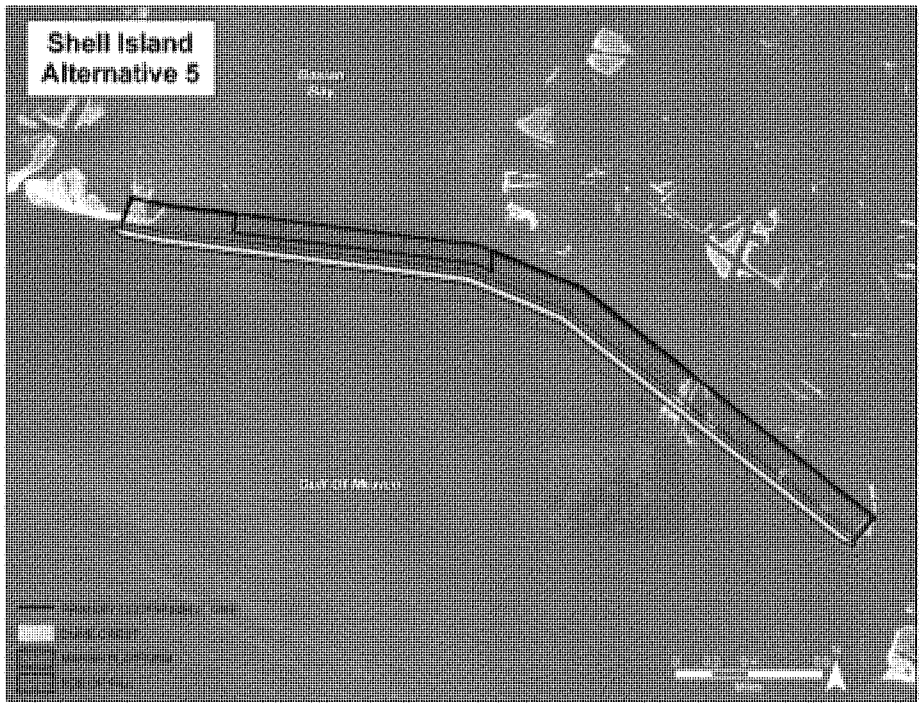


Figure 4. The estimated sediment budget for the Caminada Headland barrier shoreline system (Corps 2010).

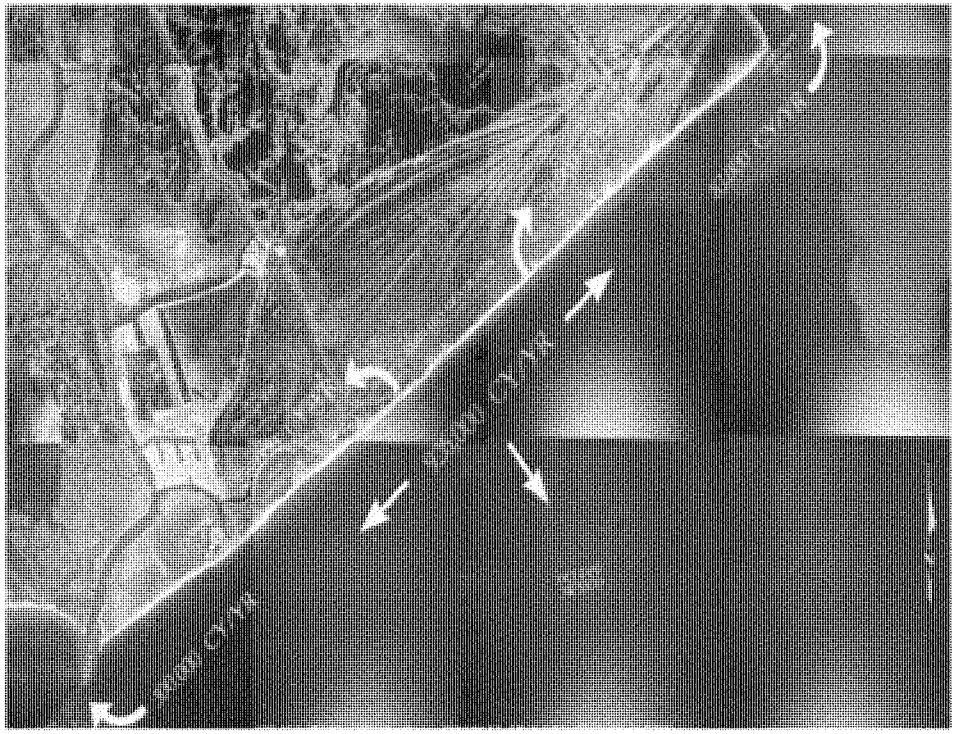


Figure 5. Distribution and range of piping plovers (base map from Haig and Elliott-Smith 2004). Conceptual presentation of subspecies and distinct population segments (DPS) ranges are not intended to convey precise boundaries.

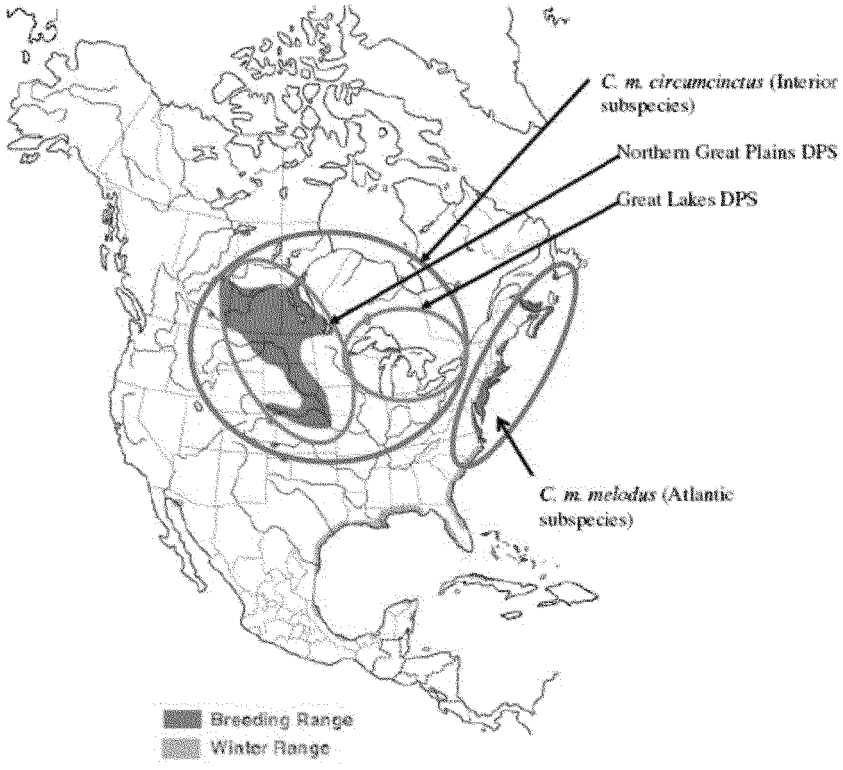
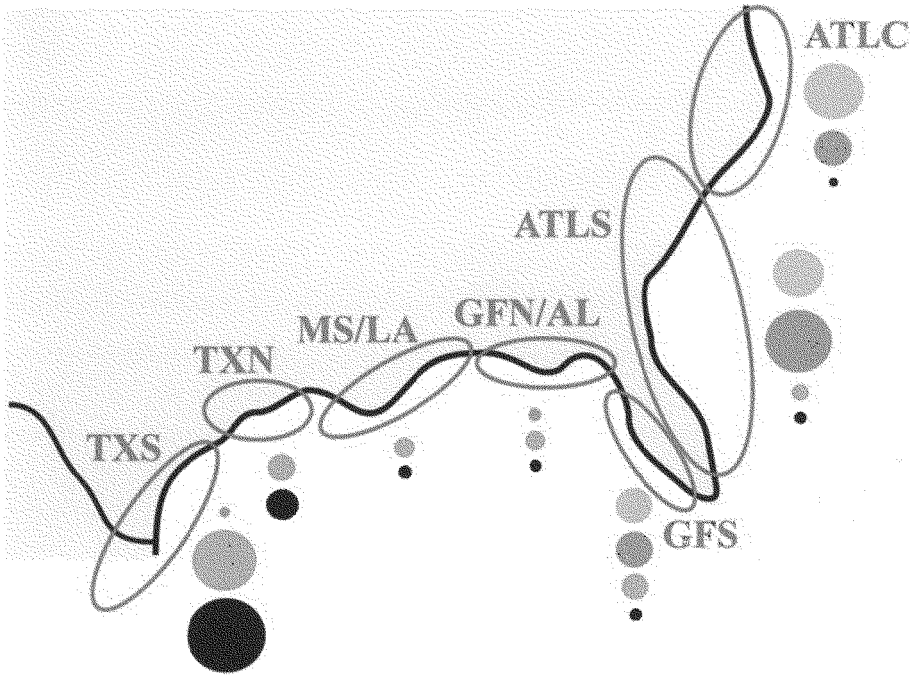


Figure 6. Breeding population distribution* in the wintering/migration range (from Gratto-Trevor et al. 2009, reproduced by permission).



*Regions: ATLC=Atlantic (eastern) Canada; ATLS=Atlantic U.S.; GFS=Gulf Coast of southern Florida; GFN=Gulf Coast of north Florida; AL=Alabama; MS/LA=Mississippi and Louisiana; TXN=northern Texas; and TXS=southern Texas. For each breeding population, circles represent the percentage of individuals reported wintering along the eastern coast of the U.S. from the central Atlantic to southern Texas/Mexico up to December 2008. Each individual was counted only once. Grey circles represent Eastern Canada birds, orange circles for U.S. Great Lakes, green circles for the U.S. Great Plains, and black circles for Prairie Canada. The relative size of the circle represents the percentage from a specific breeding area seen in that winter region. Total number of individuals observed on the wintering grounds was 46 for Eastern Canada, 150 for the U.S. Great Lakes, 169 for the U.S. Great Plains, and 356 for Prairie Canada.

APPENDIX D

Non-breeding Piping Plover Survey Guidelines

U.S. Fish and Wildlife Service
Ecological Services Office
Lafayette, Louisiana

Louisiana Piping Plover Non-Breeding Season Survey Guidelines

The purpose of these guidelines is to assess and/or monitor piping plover use of coastal restoration features related to the Barataria Basin Barrier Shoreline Restoration Project. Survey locations should include the coastal restoration features plus adjacent suitable shorebird habitat (i.e., intertidal beaches, mud flats, sand flats, algal flats, wash-over passes, and associated dunes and flats above annual high tide). Monitoring should be conducted July 15 through May 15 to follow the International Shorebird Survey (ISS) census dates listed below. The ISS schedule usually results in three surveys per month. If this is not feasible, try to do at least two surveys per month on the ISS census dates. Surveys should be conducted on ISS dates plus or minus two days. For example, a survey scheduled for the 15th could be conducted on any day between the 13th through the 17th of that month.

Spring Migration	Fall Migration	Winter
February 25	July 15	October 15
March 5	July 25	October 25
March 25	August 5	November 5
April 5	August 15	November 15
April 15	August 25	November 25
April 25	September 5	December 5
May 5	September 15	December 15
May 15	September 25	December 25
	October 5	January 5
		January 15
		January 25
		February 5
		February 15

To the extent possible, surveys should be conducted when birds are foraging. The best time is at low tide, but surveys can also be conducted on a falling or rising tide provided that the foraging areas are not completely covered. During high tide, birds will be roosting. Although piping plovers often roost near foraging areas, the birds will be more difficult to locate. Avoid conducting surveys during poor weather conditions (e.g., high winds, rain).

Methods

In most cases surveys will be conducted by foot. All terrain vehicles (ATVs) may be used to expedite the transport of observers over long stretches of liner routes ("leapfrogging" teams down a beach in 0.5 to 1 mile increments), but all bird counting will be conducted while walking. **[Driving on vegetated areas shall not be permitted. Any ATV use should be coordinated with the Louisiana Department of Wildlife and Fisheries' Isles Dernieres Wildlife Refuge management staff.]** Birds on exposed mudflats that may be inaccessible by foot should be counted from boats. Each survey crew should use their best professional judgment on the most efficient way to conduct the survey and should document in detail if any deviations to these guidelines are deemed necessary.

Observers should work in teams of two to four people, depending on the width of the beach and beach/tidal interface. Wide coastal beaches will require a greater number of observers in order to assure that birds are not missed on the back (aft) side of the dune. Observers working on beaches that contain moderate to high dunes should climb them every 0.5 to 1 mile and look for wash-over flats and pools that may not be visible from the beach. Coastal islands will be surveyed on both the Gulf and bay sides (this may require multiple teams of observers in order to finish the surveys in a timely manner).

Piping plover locations will be recorded with global positioning system (GPS) units. GPS locations will be recorded in universal transverse mercator (UTM) map datum NAD 83 CONUS. Each survey team should carry aerial photography of the survey route so that new breaks (cuts) in the beach or island can be noted on the survey maps. Habitat data will also be collected and will include foraging substrate, portion of the beach used and side of the island on which the birds are found (see attached data sheet). These habitat criteria have been adapted from the 2006 International Winter Piping Plover Census organized by the U.S. Geological Survey. Behavioral data (e.g., foraging, roosting, preening, bathing, flying, aggression, walking) of piping plovers when seen should also be documented.

Negative data is as important as positive data. Indicate when surveys have been done and no birds were observed. Although piping plovers are the target species, any additional observations of other species would help the U.S. Fish and Wildlife Service to identify shorebird concentration areas and management needs.

U.S. Fish and Wildlife Service
Ecological Services Office
Lafayette, Louisiana

Louisiana Piping Plover Survey Form

(Note: Most criteria adopted from the 2006 Wintering Piping Plover Census Form)

A. Total # Piping Plovers Observed: _____

B. Location Description (Name): _____
   1. Parish: _____
   2. UTM location NAD 83 CONUS (center):
      Northing_____ Easting_____
   3. Land Ownership:
      ___Federal ___State ___Municipal ___Private ___County ___Tribal

C. Date of survey:_____ Time survey conducted: _____to _____

D. Weather Conditions:
   1. Tide stage(s): ___Low ___Mid ___High (___Rising / ___Falling)
   2. General weather: ___Sunny ___Partly cloudy ___Overcast ___Rain ___Fog
      ___Other (describe):_____
   3. Approximate temperature: _____Celsius / Fahrenheit (circle one)
   4. Wind speed: _____miles/hr Wind direction:_____

E. Description of Habitat Surveyed (check as many as apply). The Code designation will be used in Section F table below:

- **Body of Water Type**:
  ____I. Ocean ____II. Protected bay, harbor, cove, lagoon ____III. Gulf of Mexico
  ____IV. Ocean Inlet ____V. Other (describe)_____

- **Shoreline Type**:
  ____A. Mainland ____B. Barrier Island ____C. Spoil Island ____D. Bar
  ____E. Other Island ____F. Washover area ____G. Other (describe)_____

- **Specific Description**:
  ____1. Sand beach ____2. Sand spit ____3. Sand flat ____4. Sand bar
  ____5. Salt flat ____6. Gravel shore ____7. Oyster reef ____8. Mudflat
  ____9. Vegetation (algal) mat ____10. Vegetated shoreline
  ____11. Other (describe)_____

- **Location Description** (criteria for islands only):
  ____ i. Gulf-side of island ____ii. Bay-side of island
  ____a. Tidal interface ____b. Fore dune ____c. Top of dune ____d. Aft dune

U.S. Fish and Wildlife Service
Ecological Services Office
Lafayette, Louisiana

F. Numbers, behaviors, habitat types, and GPS location(s) of piping plovers observed (mark on map if possible).

Number of Plovers Observed	**Behavior Displayed** *(e.g., foraging, roosting, preening, walking, flying, aggression, etc.)*	**Habitat Type where Plovers were found** *(use designations from Section E above, e.g., IIC8ii, IIIB9ia)*	**UTM location NAD 83 CONUS**	
			Northing	*Easting*

G. Mode(s) of transportation:
____Foot ____Car/Truck ____ATV ____Boat ____Airboat ____Other_____

H. Habitat (shoreline) covered: _____miles (please calculate using aerial photograph's scale)

I. Observers: _____
_____
_____

J. Additional comments or notes:_____
_____
_____
_____

U.S. Fish and Wildlife Service
Ecological Services Office
Lafayette, Louisiana

K. Additional species encountered (for flying flocks lump as peeps and estimate number). Species of special interest are listed below; please add any additional species.

OTHER SPECIES	TOTAL#	OTHER SPECIES	TOTAL#
Reddish Egret			
Marbled Godwit			
Red Knot			
Western Sandpiper			
Stilt Sandpiper			
Short-billed Dowitcher			
Snowy Plover			
Wilson's Plover			
Long-billed Curlew			
American Oystercatcher			

APPENDIX E

Louisiana Guidelines for Minimizing Disturbance to Colonial Nesting Birds

U.S. Fish and Wildlife Service
Ecological Services Office
Lafayette, Louisiana

Louisiana Guidelines for Minimizing Disturbance to Colonial Nesting Birds

Nesting colonies may be present that are not currently listed in the database maintained by the Louisiana Department of Wildlife and Fisheries (LDWF). That database is updated primarily by monitoring the colony sites that were previously surveyed during the 1980s. Until a new, comprehensive coast-wide survey is conducted to determine the location of newly-established nesting colonies, we recommend that a qualified biologist inspect the proposed work site for the presence of undocumented nesting colonies during the nesting season. In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

To minimize disturbance to colonial nesting birds, the following restrictions on activity should be observed:

1. For colonies containing nesting brown pelicans, all activity occurring within 2,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 15 through March 31). Nesting periods vary considerably among Louisiana's brown pelican colonies, however, so it is possible that this activity window could be altered based upon the dynamics of the individual colony. The Louisiana Department of Wildlife and Fisheries' Fur and Refuge Division should be contacted to obtain the most current information about the nesting chronology of individual brown pelican colonies. Brown pelicans are known to nest on barrier islands and other coastal islands in St. Bernard, Plaquemines, Jefferson, Lafourche, and Terrebonne Parishes, and on Rabbit Island in lower Calcasieu Lake, in Cameron Parish.

2. For colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, and roseate spoonbills), anhingas, and/or cormorants, all activity occurring within 1,000 feet of a rookery should be restricted to the non-nesting period (i.e., September 1 through February 15, exact dates may vary within this window depending on species present).

3. For colonies containing nesting gulls, terns, and/or black skimmers, all activity occurring within 650 feet of a rookery should be restricted to the non-nesting period (i.e., September 16 through April 1, exact dates may vary within this window depending on species present).

Below is a table explaining the nesting chronology of species that are known to nest in Louisiana. The table is an excerpt from page 31 of:

Martin, R.P., and G.D. Lester. 1990. The Atlas and Census of Wading Bird and Seabird Nesting Colonies of Louisiana: 1990. Louisiana Department of Wildlife and Fisheries – Louisiana Natural Heritage Program. Special Publication No. 3 for the U.S. Department of Interior – Fish and Wildlife Service. Contract No. 14-16-0004-89-963.

U.S. Fish and Wildlife Service
Ecological Services Office
Lafayette, Louisiana

Table 8. Nesting chronology for colonial-nesting waterbirds in Louisiana with suggested activity windows.[a]

Species	Incubation Season	Incubation Period (days)	Days to Fledging	Activity[b] Window
Brown Pelican	1 Nov to 15 Jun	28-30	74-76	1 Aug to 31 Oct
Olivaceous Cormorant	15 Mar to 15 Apr	23-26	35-42	1 Jul to 1 Mar
American Anhinga	15 Mar to 15 Apr	25-28	?	1 Jul to 1 Mar
Great Blue Heron	1 Mar to 30 Apr	25-29	58-62	1 Aug to 15 Feb
Great Egret	1 Mar to 31 May	23-24	40-44	1 Aug to 15 Feb
Snowy Egret	16 Mar to 15 Jun	17-19	20-25	1 Aug to 1 Mar
Little Blue Heron	16 Mar to 15 Jun	22-24	28-32	1 Aug to 1 Mar
Tricolored Heron	16 Mar to 15 Jun	20-22	?	1 Aug to 1 Mar
Reddish Egret	16 Mar to 15 Jun	23-26	?	1 Aug to 1 Mar
Cattle Egret	16 Apr to 30 Jun	21-24	35-40	1 Sep to 1 Apr
Green-backed Heron	1 Apr to 30 Jun	19-21	16-17	1 Sep to 15 Mar
Black-crowned Night-Heron	16 Mar to 15 Jun	24-26	40-42	1 Sep to 1 Mar
Yellow-crowned Night-Heron	1 Apr to 15 Jun	?	?	1 Sep to 15 Mar
White Ibis	16 Apr to 30 Jun	21-23	35-42	1 Sep to 1 Apr
Glossy/White-faced Ibis	16 Apr to 30 Jun	21-23	42-49	1 Sep to 1 Apr
Roseate Spoonbill	16 Apr to 15 Jun	23-24	49-56	1 Aug to 1 Apr
Laughing Gull	16 Apr to 15 Jun	23-25	35-45	1 Aug to 1 Apr
Gull-billed Tern	16 May to 15 Jul	22-23	28-35	16 Sep to 1 May
Caspian Tern	1 May to 15 Jul	26-28	36-48	16 Sep to 15 Apr
Royal Tern	1 May to 15 Jul	28-31	36-48	16 Sep to 15 Apr
Sandwich Tern	1 May to 15 Jul	23-25	22-33	16 Sep to 15 Apr
Common Tern	1 May to 15 Jul	21-25	23-27	16 Sep to 15 Apr
Forster's Tern	1 Apr to 31 May	25-29	23-27	1 Aug to 15 Mar
Least Tern	1 May to 15 Jul	20-25	19-23	16 Sep to 15 Apr
Sooty Tern	16 May to 15 Jul	22-23	30-35	16 Sep to 15 Apr
Black Skimmer	16 May to 15 Jul	22-23	30-35	16 Sep to 1 May

[a] Data are compiled from Bent (1921), Bent (1926), Palmer (1962), Harrison (1975), Portnoy (1977) and Terres (1980).

[b] Suggested project initiation and completion dates to minimize disturbance to nesting birds.

The U.S. Fish and Wildlife Service (Service) realizes that the proposed barrier headland and island restoration work most likely would be constructed during one or more colonial waterbird nesting seasons because construction would extend over 2 or more years. In order to minimize disturbance to nesting gulls, terns, and/or black skimmers, the Service would like to coordinate with the Corps to develop a migratory bird abatement plan. Please contact Ms. Patti Holland (337/291-3121) of the Louisiana Ecological Services Office for further information and coordination associated with the development of a migratory bird abatement plan.

LOUISIANA COASTAL AREA
BARATARIA BASIN BARRIER SHORELINE RESTORATION
FINAL CONSTRUCTION REPORT
AND
FINAL ENVIRONMENTAL IMPACT STATEMENT

APPENDIX D
ANNEX F

U.S. Fish and Wildlife Service Draft and Final Coordination Act Report

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

December 22, 2011

Colonel Edward R Fleming
District Engineer
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Fleming:

Please reference the "Near-Term Ecosystem Restoration Plan (NTP) for Louisiana Coastal Area (LCA), Louisiana Ecosystem Restoration: Barataria Basin Barrier Shoreline Restoration, Feasibility Study". This study was originally authorized by resolutions adopted by the U.S. House of Representatives and Senate Committees on Public Works, on October 19, 1967, and April 19, 1967, respectively. Those resolutions sought to improve existing hurricane protection features and the ". . . prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and related water resource purposes." The Barataria Basin Barrier Shoreline Restoration Project was identified as a critical near-term restoration project in the NTP of the 2004 LCA Report. This project was recommended for authorization by the Chief of Engineers on January 31, 2005, and was authorized in Title VII of the Water Resources Development Act of 2007.

This final report contains a description of existing fish and wildlife resources in the project area, discusses future with-project (FWP) and future without-project (FWOP) habitat conditions, identifies fish and wildlife-related impacts, and provides recommendations to improve the proposed barrier shoreline restoration measures. This final report constitutes the report of the Secretary of the Interior as required by Section 2(b) of the FWCA. The draft FWCA Report was provided to the Louisiana Department of Wildlife and Fisheries and the National Marine Fisheries Service; their comments are incorporated into this final report. This report is submitted in fulfillment of the requirements of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and constitutes the report of the Secretary of the Interior as required by Section 2(b) of that Act.

TAKE PRIDE IN AMERICA

We appreciate the cooperation of your staff on this study. Should your staff have any questions regarding the enclosed report, please have them contact Ms. Catherine Breaux (504/862-2689) of this office.

Sincerely,

David A. Walther
Acting Supervisor
Louisiana Ecological Services Office

Enclosures

cc: Environmental Protection Agency, Dallas, TX
National Marine Fisheries Service, Baton Rouge, LA
LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
LA Dept. of Natural Resources (CMD), Baton Rouge, LA
CPRA, Baton Rouge, La
Natural Resources Conservation Service, Alexandria, LA

FINAL
FISH AND WILDLIFE COORDINATION ACT REPORT

ON

NEAR-TERM ECOSYSTEM RESTORATION PLAN FOR LOUISIANA COASTAL AREA, LOUISIANA ECOSYSTEM RESTORATION: BARATARIA BASIN BARRIER SHORELINE RESTORATION, FEASIBILITY STUDY

Submitted To
New Orleans District
U.S. Army Corps of Engineers
and
Coastal Protection and Restoration Authority

Prepared by
Catherine Breaux
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
Ecological Services
Lafayette, Louisiana

December 2011

EXECUTIVE SUMMARY

The Barataria Basin Barrier Shoreline Restoration Integrated Feasibility Report and Environmental Impact Statement (EIS) was prepared by the U.S. Army Corps of Engineers-Mississippi Valley Division, New Orleans District (Corps), with input provided by the local sponsor, the Coastal Protection And Restoration Authority (CPRA), and other Federal and State coastal resource agencies. The Near-term Ecosystem Restoration Plan (NTP) for the Louisiana Coastal Area (LCA), Louisiana, Ecosystem Restoration Feasibility Study was originally authorized by Resolutions adopted by the U.S. House of Representatives and Senate Committees on Public Works, on October 19, 1967, and April 19, 1967, respectively. Those resolutions sought to improve existing hurricane protection features and the ". . . prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and related water resource purposes." The Barataria Basin Barrier Shoreline Restoration Project was identified as a critical near-term restoration project in the NTP (USACE 2004). This project was recommended for authorization by the Chief of Engineers on January 31, 2005, was transmitted by the Assistant Secretary of the Army for Civil Works to Congress on November 18, 2005, and authorized in Title VII of the Water Resources Development Act of 2007.

The Barataria Basin Barrier Shoreline Restoration Project would reconstruct coastal landforms of the barrier shoreline in the Barataria Basin. Restored barrier shoreline and marsh features would 1) contribute to geomorphic stability and processes of the basin shorelines, 2) help re-establish pre-existing water quality trends and hydrologic processes, and 3) sustain and improve ecosystem processes and habitats for migratory and resident species. The Barataria Basin Barrier Shoreline is divided into five reaches (Caminada Headland, Grand Terre, Chenier Ronquille, Shell Island, and Scofield). Initial study efforts considered shoreline restoration for all five reaches in the Barataria Basin Barrier Shoreline. The NTP LCA Report identified restoration of Caminada Headland and Shell Island Reaches as a critical near-term project for the Barataria Basin Barrier Shoreline.

The 13-miles long Caminada Headland Reach, located in Lafourche and Jefferson Parishes, extends from the Belle Pass jetties at the mouth of Bayou Lafourche on the western end of the headland to Caminada Pass on the eastern end of the headland. The Shell Island Reach lays approximately 49 miles south-southeast of New Orleans, Louisiana in Plaquemines parish. The remnants of Shell Island are located between Fontanelle Pass (Empire Jetties) and Grand Bayou Pass.

This final report contains a description of existing fish and wildlife resources in the project area, discusses future with-project (FWP) and future without-project (FWOP) habitat conditions, identifies fish and wildlife-related impacts, and provides recommendations to improve the proposed barrier shoreline restoration measures. This report is submitted in fulfillment of the requirements of the Fish and Wildlife Coordination Act (FWCA, 48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and constitutes the report of the Secretary of the Interior as required by Section 2(b) of that Act. The draft FWCA Report was provided to the Louisiana Department of

Wildlife and Fisheries (LDWF) and the National Marine Fisheries Service (NMFS); their comments are incorporated into this final report.

Four alternatives (Alternatives 1, 2, 3, and 5) for Shell Island and four alternatives (Alternatives 5, 6, 7, and 9) for Caminada Headlands were evaluated for this study. Those alternatives included restoring and sustaining (for the 50-year project life) barrier shoreline, dune, and interior or back-barrier marsh habitats as well as the geomorphic function of the barrier shorelines. Alternatives were screened on the basis of cost-effectiveness, incremental cost analysis, and their ability to meet the critical goal of preserving habitat in the area. The Tentatively Selected Plan (TSP) was revised and redefined since the draft EIS to included Shell Island's Alternative 5 (Single Island with Renourishment) and Caminada's Headland Alternative 5 (preferred dune with expanded marsh and renourishment).

Because the NER plan cannot be constructed within the maximum project cost as authorized by WRDA 2007, a subset of the NER, Caminada Headland Alternative 5, was selected as the recommended component of construction. The recommended component of construction represents an implementable and separable element of the NER plan, is cost effective and incrementally justified, and within the cost and scope of the current authorization.

The WVA analyses indicate that the Tentatively Selected Plan for Shell Island and Caminada would result in the direct and indirect net gains in the quality and quantity of barrier island/headland and back-barrier marsh habitats of 731 AAHUs and 694 acres and 988 AAHUs and 990 acres, respectively, for a total net gain of 1719 AAHUs and a total net gain of 1684 acres compared to the future without-project conditions.

Direct and indirect project-related benefits will occur through the creation of island/headland and back-barrier marsh habitats. The newly created barrier shoreline and back-barrier marsh will provide more sediment to the system, combat subsidence, make the area less susceptible to breaching and erosion, increase available nutrients, reduce wave fetch from previously breached headland/island and broken marsh, and create marsh at a higher elevation than existing marshes thus allowing for more vertical accumulation of vegetation. In addition to the direct island/headland and marsh creation benefits of the TSP, indirect benefits will also accrue. By implementing the TSP, the project goals of contributing to geomorphic stability and process of the basin shorelines, helping to re-establish pre-existing water quality trends and hydrologic processes, and sustaining and improving ecosystem processes and habitats for migratory and native species for the 50 year project life will be achieved. In addition, there will be an increase in sediments and nutrients to the barrier shoreline system.

The Service is pleased to see the increase of sediment and the addition of renourishment to the Caminada Headland and the single island alternative plus renourishment for Shell Island and agree that those additional features would result in greater overall benefits. The Service feels the new TSP represents a significant gain in habitat for fish and wildlife resources over the project life. In fact with the changes to the TSP two of our previous FWCA report recommendations have been resolved. The Service believes that the impact analysis and recommendations (presented below) provided in our April 2009, August 5, 2010, and June 3, 2011 FWCA Report

and Supplemental Reports continue to remain valid with the addition of the first recommendation and the removal of the two recommendations mentioned above.

1. The Service, NMFS, and LDWF should be provided an opportunity to review and submit recommendations on future detailed planning reports and the draft plans and specifications on the Barataria Basin Barrier Shoreline Restoration Project addressed in this report.

2. Coordination should continue with the Service and NMFS on detailed contract specifications to avoid and minimize potential impacts to piping plover and their critical habitat, manatees, pallid sturgeon, and sea turtles.

3. Avoid adverse impacts to nesting seabird colonies through careful design project features and timing of construction. For colonies containing nesting gulls, terns, and/or black skimmers, all activity occurring within 650 feet of a rookery should be restricted to the non-nesting period (i.e., September 16 through April 1, exact dates may vary within this window depending on species present). Prior to any such work, surveys should be conducted by qualified personnel during the colonial seabird nesting season to determine the presence and location of any such colonies. In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

4. If the proposed project has not been constructed within 1 year or if changes are made to the proposed project, the Corps should re-initiate Endangered Species Act consultation with the Service.

5. The newly created barrier headland/island and back-barrier marsh, as well as the surrounding habitats that may be indirectly benefited by long-shore transport and sediment overwash, should be monitored over the project life for effectiveness and the results should be provided to all resource agencies. Development of those monitoring plans should be coordinated with all natural resource agencies.

6. All containment features should be breached or degraded, if necessary to restore tidal connectivity, once the marsh creation/nourishment areas have at least 80% coverage of emergent vegetation.

8. Identification of additional borrow sites should be coordinated with the Service and other natural resource agencies.

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INTRODUCTION

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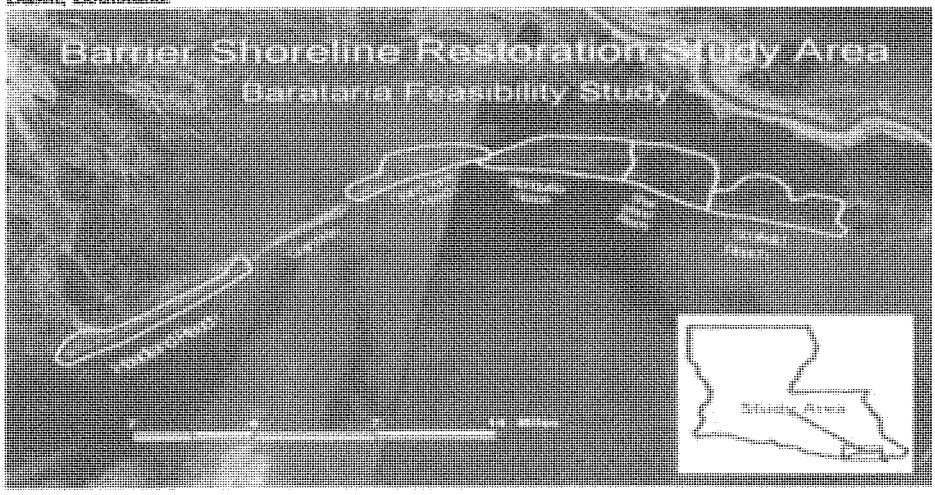
This final report contains a description of existing fish and wildlife resources in the project area, discusses future with-project (FWP) and future without-project (FWOP) habitat conditions, identifies fish and wildlife-related impacts, and provides recommendations to improve the proposed barrier shoreline restoration measures. This report is submitted in partial fulfillment of the requirements of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and constitutes the report of the Secretary of the Interior as required by Section 2(b) of that Act. The draft FWCA Report was provided to the Louisiana Department of Wildlife and Fisheries (LDWF) and the National Marine Fisheries Service (NMFS); their comments are incorporated into this final report.

Figure 1. The five reaches of the Barrier Shoreline Restoration Feasibility Study, Barataria Basin, Louisiana.



DESCRIPTION OF STUDY AREA

The study area lies within the Barataria Basin, which comprises the area between the Mississippi River and Bayou Lafourche. Both Caminada Headland and Shell Island are located in the southern end of the Barataria Basin in southeastern Louisiana.

The study area is composed of a series of headlands and flanking barrier islands formed by the reworking of abandoned Mississippi River delta complexes. The main distributary location of the Mississippi River switches to a more hydraulically efficient route about every 1,000 years, building a new delta complex. The abandoned delta subsides and the seaward margins are reworked by coastal processes, forming a sandy barrier shoreline (headland) and eventually detached barrier islands. The Caminada Headland Reach was formed following abandonment of the Lafourche Delta, which was active from approximately 1,000 years ago to 300 years ago. Major abandoned distributaries in this reach are Bayous Lafourche and Moreau. The Shell Island Reach was associated with distributaries in the Plaquemine Delta which was active from approximately 905 years ago to 350 years ago.

The 13-miles long Caminada Headland Reach (Figure 2), located in Lafourche and Jefferson Parishes, extends from the Belle Pass jetties at the mouth of Bayou Lafourche on the western end of the headland to Caminada Pass on the eastern end of the headland. The Caminada Headland is bounded by the Gulf of Mexico (Gulf) to the south and extends approximately 2250 feet north of the Gulf. The Headland maintains the integrity of the Gulf shoreline and protects the interior coast from further deterioration. This reach is the longest uninterrupted stretch of beach in the

Barataria basin and consists of sand dune, beach berm, barrier marshes, and chenier ridges interspersed with mangrove thickets, coastal dune shrub thickets, lagoons and small bayous. Ritchie et al. (1995) characterize the Caminada Headland as comprised of very well sorted sand. A representative profile of the Headland, beginning at the beach and proceeding landward, would characterized by an active beach, overwash, dunes, barrier flats (scrub/shrub and salt flats), back-barrier saline, intertidal flats, and open water. On Caminada the elevations range from an average of +3.5 feet North American Vertical Datum of 1988 (NAVD) to the average back-barrier marsh elevation of 0.94 feet, NAVD while the Mean High Water is 1.53 feet NAVD and Mean Low Water is 0.48 feet NAVD. The rate of relative sea level rise for Caminada is 0.025 feet/year (Coastal Engineering Consultants, Inc. [CEC] and SJB Group, 2005 and 2008). Most of the land in the Caminada Headland is privately owned.

In 1935, the Belle Pass Jetties were constructed of rip-rap and have been modified over time with some of the rip-rap placed in the nearshore zone just east of the Bell Pass Jetty on the Caminada Headland. The jetties have an impact on the longshore transport along the headland to the west, trapping sand, and causing a significant down drift impact on the Timbalier Islands to the west. Following Hurricane Juan, in 1986 a section of the Caminada Headland seaward of Port Fourchon was armored with a cement-filled bag revetment locally referred to as the Boudin bags. Beach was added in front of the Boudin bags, as well as, dredged material was backfilled landward of the revetment. The revetment is an interruption of the natural coastal processes including cross shore sediment transport by both washover/backwash events as well as Aeolian processes. In 1992, Hurricane Andrew struck the Louisiana coastline causing considerable damage to the revetment, displacing the bags as much as 130 feet landward (Ritchie et al, 1995). In an attempt to prevent erosion along the headland fronting the oil and gas facilities, private oil companies constructed thirteen breakwaters by sinking barges in the nearshore zone. Subsequently, the barges were filled with rip-rap.

The Shell Island Reach (Figure 3) lies approximately 49 miles south-southeast of New Orleans, Louisiana in Plaquemines parish. The remnants of Shell Island are located between Fontanelle Pass (Empire Jetties) and Grand Bayou Pass. Shell Island used to enclose both Bastian Bay and Shell Island Bay but shoreline recession and erosion has since disintegrated the island into several smaller islands and shoals. The few remaining islands and shoal remnants provide limited protection to the back barrier environment from waves and flooding. The construction of the Empire Jetties, in 1950, restricted the east to west longshore transport and increased the loss rates of Shell Island by approximately 10 feet/year along the easternmost 5,000 to 8,000 feet of the island (Thomson et al, 2005 and 2008). Hurricane Bob in 1979 created a new inlet (Coupe Bob) that accelerated retreat and sediment loss. In fact it is believed that the creation of Coupe Bob caused a quadrupling of the retreat rates of Shell Island and is the major reason for the disintegration of the island (Thomson et al, 2005 and 2008).

Shell Island consists primarily of open water with little beach or saline marsh habitat with few shrubs and mangroves. Ritchie et al. (1995) characterized the Shell Island area as a recently breached recurved spit composed of beach sand along the Gulf shoreline and reworked oyster

shells with thin layers of sand strata behind the narrow flat eroding beaches. The shell deposits are formed into well-defined ridges and swales. Although the vegetation and surface forms resemble dune ridges, there is no Aeolian (wind-driven) sand. Shell Island elevations range from an average of 4 feet, NAVD at the dune/supratidal height to an average of 1.5 feet, NAVD in the marsh with the change in offshore slope determined to be at -5 feet, NAVD, and the depth to closure calculated at -15.5 feet, NAVD. The rate of relative sea level rise in the Shell Island reach was determined to be 0.055 feet/year (Thomson et al, 2005).

In 2008, Hurricanes Gustav and Ike affected the Louisiana coastline. Erosion, overwash, and washouts occurred across the Caminada Headland project area. Similar conditions existed after Hurricanes Katrina and Rita in 2005, however, by 2007 natural rebuilding processes had closed smaller washouts while larger washouts were reduced in size. In addition, rebuilding of beaches had occurred along the entire project area. The Service is unaware of any factors that would significantly change the natural rebuilding process, therefore natural restoration of the beach and closure of washouts is expected to occur. Regardless of the rate of natural rebuilding the configuration of any implemented plan would likely remain unchanged; therefore, benefits of any restoration would remain unchanged except if natural rebuilding occurred slower than previous events, then benefits may represent a conservative estimate.

Figure 2. Caminada Headland Reach.

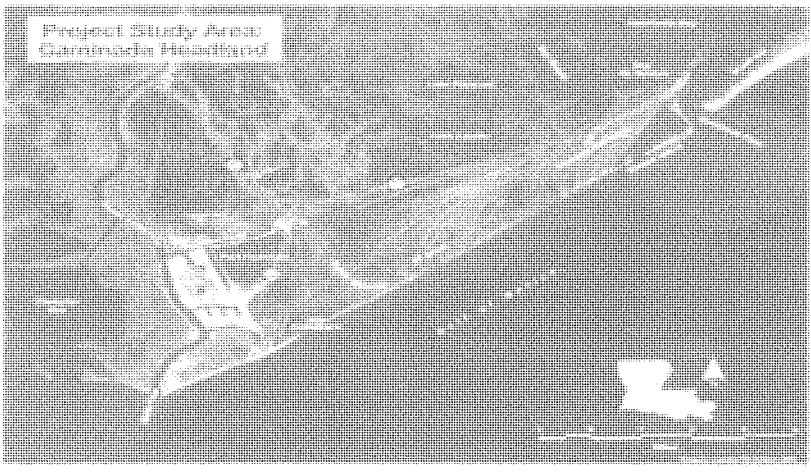
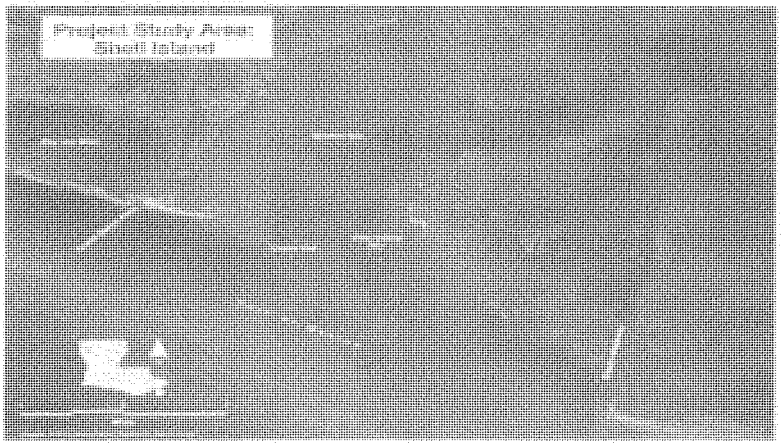


Figure 3. Shell Island Reach.



FISH AND WILDLIFE RESOURCES

Description of Habitats

The Barataria Basin is a broad, low-lying region that is bounded by the Mississippi River on the east and Bayou Lafourche on the west. The southern half of the basin consists of tidally influenced marshes connected to a large bay system bordered by a series of barrier headlands, islands and shorelines which separates the basin from the Gulf of Mexico to the south.

The proposed barrier shoreline restoration sites are within the estuarine portion of the Barataria Basin, and associated marsh or shallow open water at the southern extreme of the basin. At the Caminada Headlands there are approximately 1,360 existing acres of headland and marsh habitats. At Shell Island there currently exist approximately 145 acres of barrier shoreline and backbarrier marsh habitats. The primary factors controlling plant species distribution at those sites are salinity and elevation. The habitat types in the study area primarily consist of beach, overwash, dune, barrier flats (scrub/shrub and salt flats), mainland and back-barrier saline marsh, intertidal flats, and open water.

Beach and Overwash

Active beach and overwash areas occur on the gulfside of barrier shorelines from the intertidal zone to the toe of the dune. This area contains wave-washed, sandy sediments and is usually too unstable for vegetation establishment. Plants adapted to harsh backshore conditions (i.e., high salinity, high winds, and rapid sand burial) may become established in front of the dunes. Pioneer beach vegetation may include sea purslane, marsh hay cordgrass, sea rocket, and seaside

heliotrope. Overwash areas may become colonized by grasses (i.e., coastal dropseed, salt grass, and *Paspalum* spp.) as well as morning glory and sea purslane.

Dune

Dunes were formed from sand deposited by storm surges and/or transported by wind and trapped by dune grasses. Dune height and orientation are a function of prevailing wind direction and speed and sand size. Sea oats can tolerate salt spray and sand burial, and contribute to the dune building process by stabilizing windblown sand. Other plants include marsh hay cordgrass, bitter panicum, and beach croton.

Barrier Flats and Shrub/scrub

Plants requiring elevation and protection from coastal processes may be found behind the dunes. Saltwort, creeping glasswort, and Bigelow glasswort are found in pockets of high salinity, often in areas that are only intermittently flooded due to their higher elevation. In areas subjected to frequent drying, seaside goldenrod and groundsel bush are occasionally found, as well as the salt-tolerant shrubs including sea myrtle, sea ox-eye and marsh elder. Shrubs are occasionally covered with the parasitic vines, including common dodder and pretty dodder. These plants may also be found in the high marsh zone.

Saline Marsh

Saline marshes in the project area occur behind the barrier headlands and on the bayside of the barrier islands. Those intertidal marshes usually exhibit fairly firm mineral soils and experience moderate to high daily tidal energy. The saline marsh community typically has the lowest plant species diversity of any marsh type. Although many plants can tolerate a periodically flooded substrate, few can tolerate the combined stresses of flooding and high salinity. The dominant species in the salt marshes of the project area is saltmarsh cordgrass, a perennial grass that grows from extensive rhizomes. Saltmarsh cordgrass also dominates the high marsh areas subject to intermittent flooding, although the highly salt-tolerant salt grass, black needle rush, and glassworts are also frequently present. Black mangrove occurs as a shrub along the flooded marsh edges of the barrier islands and on the banks of tidal streams, ponds, and bays. Mangroves are extremely important in stabilizing the shoreline and reducing erosion in these areas. The Louisiana Natural Heritage Program (Smith 1988) classifies the mangrove zones separately from salt marsh as intertidal saltwater swamps. Mangroves are at their northern natural limit here and are periodically killed back by winter freezes. The mangrove population of coastal Louisiana was damaged by severe freezes in 1983 and 1984. The recent mild winters have allowed strong regrowth, but most plants are only three to six feet tall.

Intertidal Flats

Intertidal mud flats are typically ephemeral areas of unconsolidated organic and mud deposits that occur in areas of low wave and tidal energy. Although those areas are considered "non-vegetated," mats of algae may form on them. Benthic microalgae are also found in the top few centimeters of sediment. Where significant wave action occurs along the bayside margin of the barrier, fine sand may be reworked into small beaches and sandy intertidal flats. Waves keep silts and clays suspended until they eventually settle in deeper water or protected intertidal mud flats. Sand flats are the preferred habitats of various invertebrates, crustaceans, and mollusks.

Open Water

The major water bodies in the study area are the Gulf of Mexico, Bayou Lafourche, Caminada Bay, Caminada Pass, Bay Champagne, Bayou Moreau, Bayou Thunder Von Tranc, Bastian Bay, Shell Island Bay, Grand Bayou Pass, and Bayou Fontanelle. These areas are crossed with numerous oil & gas access canals. In the majority of the study area, the levels of turbidity and energy are too high for the growth of submerged aquatic vegetation.

Borrow Sources

It is expected that two borrow sources will be used for this project: a high-quality sand source for the beach-dune portion of the project and an offshore mixed-sediment deposit to be used for the marsh construction. It was assumed that the Mississippi River is the source of high-quality sand that would be used for the Shell Island portion of the project. The Empire borrow area is assumed to be used for the marsh construction at Shell Island. However, the Empire borrow area is expected to be used for the Pelican Island Restoration Project which would result in an insufficient amount of borrow for this project. Further investigations are needed to identify additional borrow sources.

For Shell Island several other borrow areas were purposed to provide sediments for marsh restoration, primarily including Empire, Quatre Bayou deep (will be partially used for the restoration of Chaland Headland), Quatre Bayou D2, and Sandy Point (farthest away). Other sources were identified and further investigation is recommended to find the closest mixed sediment source for marsh restoration. Ship Shoal was also identified as another potential source of high quality sands for beach-dune creation, however, the distance to Shell Island makes this sand source prohibitively expensive.

For construction at the Caminada Headland portion of the project, material for the dune and beach construction would be taken from the South Pelto Block of Ship Shoal. Ship Shoal is a large offshore submerged sandy shoal in the Gulf located approximately 50 miles southwest of Belle Pass. A suitability analysis was conducted comparing Caminada sediments to South Pelto Block sediments. The sediments from South Pelto Block were concluded to be suitable for beach and dune restoration. It is recommended that an overfill ratio of 1.08 be used in design volume

analysis.

CPRA is currently performing a nearshore borrow area investigation in addition to the Ship Shoal investigation for the purpose of creating the back-barrier marsh fill platform. It is recommended that this include an evaluation of the potential borrow materials for compatibility with the native marsh.

The amount of waterbottoms expected to be excavated for beach/dune and marsh creation for each island is only an estimate for the initial construction. The preference of the State would be to use the same borrow sites for each renourishment cycle, but it is unknown if those sites will be replenished with the same type of material in time for each renourishment. Therefore, if additional borrow sites for renourishment are needed, then those borrow sources will need to be addressed in supplemental environmental documents.

Fishery Resources and Essential Fish Habitat

Barataria Bay Barrier Shoreline's transitional habitats provide unique nursery, foraging, predator refugia, and spawning habitat for numerous economically important marine and estuarine species that exhibit a preference for or are dependent on these habitats as transients during portions of their life history (Saucier and Baltz 1993). Surf zone, intra-island ponds and tidal creeks, and back-bay sand flats, including those along barrier islands and headlands support distinct fish and crustacean assemblages in comparison to mainland or inland saline marshes (Williams 1998). Common surf zone species include Gulf menhaden (*Brevoortia patronus*), spot (*Leistomus xanthurus*), striped mullet (*Mugil cephalus*), southern kingfish (*Menticirrhus americanus*), anchovies (Anchoa spp.), scaled sardine (*Harengula jaguana*), Florida pompano (*Trachinotus carolinus*), Atlantic bumper (*Chloroscombrus chrysurus*), Spotfin mojarra (*Euchinostomus argenteus*), and rough silverside (*Membras martinica*). The surf zone is used temporarily by larval and juvenile life stages of some of these species awaiting transport to back-barrier, bay, or mainland habitats. Barrier island flats typically are used by white mullet (*Mugil curema*), longnose killifish, darter gobies, and inland silversides (*Minidia beryllina*). Marsh edge and interior creeks are used by brown shrimp (*Farfantepenaeus aztecus*), white shrimp (*Litopeneaus setiferus*), Atlantic croaker (*Micropogonias undulatus*), spotted seatrout (*Cynoscion nebulosus*), sheepshead minnow (*Cyprinodon variegatus*), killifish, and sand seatrout (*Cynoscion arenarius*), some of which are constituents of assemblages that use the other island aquatic habitats (Foreman 1968; Zimmerman 1988). Fox and Mock (1968) reported bay anchovy (*Anchoa mitchilli*), hardhead catfish (*Aropsis felis*), Gulf menhaden, Atlantic croaker, and inland silverside accounted for over 90% of the total specimens collected from a vegetated bayside edge near the study area. Additionally, young of the year red drum and mangrove snapper (*Lutjanus griseus*) have a high affinity for quiescent intra-island creeks and ponds in the post larval early juvenile stages (Thompson 1988).

Economically important fish species, spotted seatrout, red drum (*Sciaenops ocellatus*), black drum (*Pogonias cromis*), spotted seatrout, Gulf menhaden, striped mullet, and southern flounder (*Paralichthys lethostigma*), use barrier island habitats (e.g., shorelines and passes) for foraging

areas, nursery habitat, and staging areas during spawning or associated migratory aggregations (Saucier and Baltz 1993). Additionally, young of the year red drum and mangrove snapper (Lutjanus griseus) have a high affinity for quiescent intra-island creeks and ponds in the post larval early juvenile stages (Thompson 1988). Commercially and recreationally important species of shellfish include blue crab, white shrimp, brown shrimp, American oyster, and Gulf stone crab.

Other finfishes and crustaceans expected to occur in the study area include gafftopsail catfish, Spanish mackerel, bull shark, ladyfish, Atlantic needlefish, Gulf killifish, fat sleeper, gobies, speckled wormeel, least puffer, Gulf pipefish, Atlantic spadefish, alligator gar, pink shrimp, seabob, roughneck shrimp, grass shrimp, mysid shrimp, and mud crab. Other invertebrates found in the study area include *Rangia* clam, jellyfish, and ctenophores.

Temperature and salinity govern the general patterns of estuarine use by fishes and macroinvertebrates (Day et al. 1989; Baltz and Jones 2003). Freshwater species are not expected to occur in the study area. However, freshwater species would typically occur in the proposed Mississippi River borrow site near Naim, Louisiana. Freshwater species include largemouth bass and channel catfish.

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; P.L. 104-297) set forth a new mandate for NOAA's National Marine Fisheries Service (NMFS), regional fishery management councils (FMC), and other federal agencies to identify and protect important marine and anadromous fish habitat. The Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Act support one of the nation's overall marine resource management goals- maintaining sustainable fisheries. Essential to achieving this goal is the maintenance of suitable marine fishery habitat quality and quantity. Detailed information on Federally managed fisheries and their EFH is provided in the 1999 generic amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the Gulf of Mexico FMC. The generic FMP subsequently was updated and revised in 2005 and became effective in January 2006 (70 FR 76216). NMFS administers EFH regulations. Categories of EFH in the project vicinity include estuarine and marine areas. Estuarine categories include estuarine emergent wetlands, mangrove wetlands, submerged aquatic vegetation, and estuarine water column, mud, sand and shell water bottoms. Marine areas include water column, non-vegetated bottoms, and continental shelf features. EFH has been designated in project fill areas for brown shrimp, white shrimp, red drum, bluefish, and Spanish mackerel. EFH has been designated in the potential offshore borrow sites for the following species in addition those listed for the fill areas: red snapper, gray triggerfish, king mackerel, cobia, little tunny, bonnethead shark, blacknose shark, and stone crab. Coastal wetlands also provide nursery and foraging habitat that supports economically important marine fishery species such as spotted seatrout, sand seatrout, southern flounder, Atlantic croaker, spot, Gulf menhaden, striped mullet, white mullet, silversides, killifish, kingfish, pompano, scaled sardines, anchovies, and blue crab. Some of these species serve as prey for other fish species managed under the Magnuson-Stevens Act by the GMFMC (e.g., mackerels, snappers, and groupers) and highly migratory species managed by

NMFS (e.g., billfishes and sharks). These wetlands also produce nutrients and detritus, important components of the aquatic food web, which contribute to the overall productivity of the Barataria Bay estuary and nearshore Gulf of Mexico.

Salinity conditions are primarily saline and the project areas usually do not contain submerged aquatic vegetation. Much of the open water has become established at the expense of the barrier shoreline and emergent marsh.

Wildlife Resources

Because of their permeable skin and the need for osmoregulation, amphibians are typically restricted to the less-saline areas that are located primarily in the upper portions of the Basin. Amphibians found in the lower basin where suitable freshwater pools may form include the green tree frog, squirrel treefrog, Gulf coast toad, and eastern narrow-mouthed toad (Dundee and Rossman 1989). Mabie (1976) indicates that the only species typically found in the Gulf salt marsh environment is the Gulf coast toad and little information is available on their distribution on the barrier islands. Dundee and Rossman (1989) report that the eastern narrow-mouthed toad has been found on sea beaches in southeastern Louisiana, as well as under boards in a salt marsh in Cameron Parish.

In saline marshes, reptiles are limited primarily to the salt marsh snake and the diamond-backed terrapin. Sea turtles may seasonally utilize the bays and saline marshes adjacent to and including the Gulf and barrier island beaches.

Many mammals, because of their life history requirements, would not likely be found in the Caminada Headland or Shell Island study area. The swamp rabbit can be found in the Caminada Headland portion of the study area, the river otter is typically found in greatest densities in the brackish marshes, and muskrat can be found in brackish and saline marshes of the basin (LCWCRTF and WCRA 1999; Condrey et al. 1995). However, raccoons and coyotes are the most likely mammals to occur on the barrier islands. The Coast 2050 Report (LCWCRTF and WCRA 1999) indicates an overall decline in furbearers that were historically present in the study area over the past 10 to 20 years. The bottlenose dolphin is the primary marine mammal that would likely be found in the study area, and then only in estuarine/marine open water portions of the area. However, the West Indian manatee has been documented occasionally in nearby Bayou Lafourche and other surrounding areas like Lake Pontchartrain. In addition, various species of whales have been documented in the offshore waters of the study area.

Birds are the most diverse group of terrestrial vertebrate species that can be found in the study area and include both resident and migrant species among the following groups: waterfowl, seabirds, wading birds, shorebirds, raptors, and songbirds. Avian use of existing wetlands within the study area varies, depending upon existing seasonal and environmental conditions.

The outer coast and barrier habitats are especially critical to migrating birds, such as songbirds, shorebirds, and waterfowl as they provide a place to land, recover, and feed. Trans-gulf migrants use the Barataria Basin barrier shoreline and surrounding areas as a staging area and as a final departure area for their fall migration as well as first landfall during spring migration. The Barataria Basin is at the terminus of the Mississippi Flyway, which is the largest waterfowl migration route in North America. The 1986 *North American Waterfowl Management Plan* (Secretary, U.S. Department of the Interior and Canada Minister of the Environment 1986) identified the preservation and maintenance of critical over-wintering habitats as a key factor in preventing the further decline in the continental waterfowl population. The 2004 North American Waterfowl Plan outlined in *Strategic Guidance* (Secretary, U.S. Department of the Interior and Canada Minister of the Environment, Mexico Secretary of the Environment and Natural Resources 2004) renews the commitment to the 1986 Plan as well as providing goals, priorities, and strategies for the next 15 years.

The Coast 2050 Report (LCWCRTF and WCRA 1999) characterizes dabbling and diving duck population trends since 1985 as steady in the open water and salt marsh habitat of the Caminada Headland but decreasing in the Shell Island area, but are not historically present on the barrier shorelines.

Shorebirds such as the piping plover, semipalmated sandpiper, western sandpiper, curlew, ruddy turnstone, American avocet, oystercatcher, greater yellowlegs, common snipe, and killdeer are found within the study area. Shorebirds inhabit saline marsh, and shallow water/mud flat habitats of the barrier shorelines and surrounding estuary. Roosting habitats include beaches, sandbars, spits, or flats above high tide and shallowly flooded areas or islands free of vegetation (Helmers 1992). Many shorebird species are regular to accidental migrants, although some are common residents throughout the study area. In the Caminada headland portion of the study area shorebirds have been steady for the past 10 to 20 years, while they have seen a decrease in the Shell Island area mostly because of land loss of the island and surrounding areas (LCWCRTF and WCRA 1999).

Seabirds including pelicans, gulls, terns, and skimmers are also found within the Barataria Basin and its barrier shorelines. Gulls, terns, and skimmers are colonial nesters on sites near or within the study area (Michot et al. 2003; Martin and Lester 1990; Visser and Peterson 1994). In fact coastal Louisiana has the Nation's largest concentrations of colonial nesting wading birds and seabirds. One hundred ninety-seven colonies of wading birds and seabirds (representing 215,249 pairs of nesting birds), were observed in coastal Louisiana during a 2001 survey (Michot et al. 2003). Queen Bess Island is an active brown pelican nesting site north of the study area. Condrey et al. (1995) reported that most seabird species nest on islands because of their remoteness and lack of predators. Non-island breeding sites are more frequently abandoned by the seabird species that use them, in contrast to the barrier island sites, which tend to be used for 10 years or more. The Coast 2050 Report (LCWCRTF and WCRA 1999) indicates that since 1985 seabirds have been declining on the barrier shorelines of the study area, however, they have been steady in the Caminada salt marsh and open water areas as well as the open water areas of

Shell Island. There has been an overall increasing trend of pelican in most of the basin as well as the study area since 1985.

Condrey et al. (1995) indicate that most colonies of wading birds (herons and egrets) are found in the swamp, although most species of wading birds will also nest on barrier islands and in almost any marsh, fresh to saline, where shrubs and mangroves are available. The Coast 2050 Report (LCWCRTF and WCRA 1999) characterizes wading bird population trends since 1985 as steady in the salt marsh and barrier beaches of the Caminada Headland and decreasing at and around Shell Island.

Raptors are not typically or have not been historically present on the barrier shorelines and surrounding open water and salt marsh of the study area (LCWCRTF and WCRA 1999). The Coast 2050 Report (LCWCRTF and WCRA 1999) indicates that rails, coots, and gallinules have not been historically present on the barrier shorelines of the study area but are have been steady since 1985 in the salt marsh habitat of the surrounding Caminada area.

Because of their life history requirements, few other bird species are expected to inhabit the surrounding marshes and open water areas of the study area except to use them as temporary staging areas before and after trans-gulf migrations. The seaside sparrow is associated with the pounding surf and the densely matted grasses and sedges along the shorelines of Louisiana beaches with their nest placed often only a foot or so high in a mangrove bush (Lowery 1974). For the most part where these species of birds exist in the study area they have been steady in the surrounding marsh and open water areas of the Caminada Headland and either have been steady or declining in and around Shell Island (LCWCRTF and WCRA 1999).

Invasive Species

Both nutria and feral hogs are the primary invasive mammalian species that could occur throughout the Barataria Basin. However, they both are typically found in the freshwater swamps and marshes of the basin (Condrey et al. 1995), which is located outside of the study area.

The monk parakeet, Eurasian collarded-dove, English sparrow, and cattle egret are all potential invasive avian species in the basin but again are not likely to occur in the study area.

Although Chinese tallow and other potentially invasive species have been sighted on rare occasions, no problems caused by encroachment of invasive plant species have been reported on Louisiana's barrier islands. This is likely due to the extreme environmental conditions, such as higher salinities, shifting substrates, and frequent storm disturbance that may severely limit suitability of the habitat for colonization.

Threatened and Endangered Species

Federally listed threatened (T) and endangered (E) species and/or their designated critical habitat occurring in the study area include the piping plover (T) and its designated critical habitat, pallid sturgeon (E), and West Indian manatee (E). Several species of threatened/endangered sea turtles are also known to forage in the coastal waters of the study area. Those species include the loggerhead sea turtle (T), Kemp's ridley Sea turtle (E), green sea turtle (T), leatherback sea turtle (E), and hawksbill sea turtle (E). Additionally the brown pelican, protected under the MBTA, and the bald eagle, protected under the Bald and Golden Eagle Protection Act (BGEPA), may exist in the project area or the near Mississippi River borrow area for Shell Island.

The piping plover (*Charadrius melodus*), as well as its designated critical habitat, occur along the Louisiana coast. Piping plovers winter in Louisiana, and may be present for 8 to 10 months, arriving from the breeding grounds as early as late July and remaining until late March or April. Piping plovers feed extensively on intertidal beaches, mudflats, sand flats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting. Roosting areas may have debris, detritus, or micro-topographic relief offering refuge to plovers from high winds and cold weather. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape, as the suitability of a particular site for foraging or roosting is dependent on local weather and tidal conditions. Plovers move among sites as environmental conditions change.

On July 10, 2001, the U.S. Fish and Wildlife Service designated critical habitat for wintering piping plovers (66 FR, No. 132). Their designated critical habitat identifies specific areas that are essential to the conservation of the species. The primary constituent elements for piping plover wintering habitat are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support those habitat components. Constituent elements are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide. Important components (or primary constituent elements) of intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting plovers. Major threats to this species include the loss and degradation of habitat due to development, disturbance by humans and pets, and predation.

The study area encompasses Critical Habitat Unit LA-5 which includes portions of the Louisiana shoreline from Timbalier Island to East Grand Terre Island. At the time of designation, that Unit consisted of approximately 5,735 acres. Specifically, piping plover critical habitat within Unit 5 includes ". . . all of Timbalier Island where primary constituent elements occur to the MLLW [mean low low water], all of Belle Pass West . . . where primary constituent elements occur to the MLLW; the Gulf shoreline extending approximately [6.8 miles] east from the east side of Belle Pass bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; all of Elmers Island peninsula where primary constituent elements occur to MLLW

and the Gulf shoreline from Elmers Island to approximately [0.56 mile] west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat . . . begins and where the constituent elements no longer occur; the Gulf shoreline of Grand Isle from the Gulf side of the hurricane protection levee to MLLW; and all of East Grand Terre Island where primary constituent elements occur to the MLLW" (66 FR, No. 132, Page 36127).

The pallid sturgeon (*Scaphirhynchus albus*) is an endangered fish found in Louisiana, in both the Mississippi and Atchafalaya Rivers (with known concentrations in the vicinity of the Old River Control Structure Complex); it is possibly found in the Red River as well. The pallid sturgeon may exist at the potential Mississippi River borrow site for Shell Island. The pallid sturgeon is adapted to large, free-flowing, turbid rivers with a diverse assemblage of physical characteristics that are in a constant state of change. Detailed habitat requirements of this fish are not known, but it is believed to spawn in Louisiana. Habitat loss through river channelization and dams has adversely affected this species throughout its range. Measures that would reduce the likelihood of adversely affecting the pallid sturgeon include keeping the cutterhead shall completely buried in the bottom material during dredging operations. Also, during dredging, the pumping rates shall be reduced to the slowest speed feasible while the cutterhead is descending to the channel bottom. If pumping water through the cutterhead is necessary to dislodge material, or to clean the pumps or cutterhead, etc., the pumping rate shall be reduced to the lowest rate possible until the cutterhead is at mid-depth, where the pumping rate can then be increased. Should the proposed project directly or indirectly affect the pallid sturgeon or its habitat, further consultation with this office will be necessary.

West Indian manatees (*Trichechus manatus*) have been occasionally observed along the Louisiana Gulf coast during the summer months. The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals.

Endangered and threatened sea turtles forage in the nearshore waters, bays and sounds of Louisiana. NOAA Fisheries is responsible for aquatic marine threatened or endangered species. Eric Hawk (727/570-5312) in St. Petersburg, Florida, should be contacted for information concerning those marine species.

Species of Special Interest

Although the brown pelican has been removed from the List of Endangered and Threatened Species, brown pelicans (*Pelecanus occidentalis*) and their nests continue to be protected under the MBTA. Brown pelicans nest on nearby Queen Bess Island, however no known nesting sites occur within the study area. However, brown pelicans may forage in the shallow estuarine waters and use sand pits and offshore sand bars as resting and roosting areas. Major threats to this species include chemical pollutants, colony site erosion, disease, and human disturbance. To minimize disturbance to nesting colonies of brown pelicans, all activity occurring within 2,000

feet of a rookery should be restricted to the non-nesting period (i.e., September 15 through March 31).

The proposed project area may provide nesting habitat for the bald eagle (*Haliaeetus leucocephalus*), which was officially removed from the List of Endangered and Threatened Species as of August 8, 2007. However, the bald eagle remains protected under the MBTA and BGEPA. Comprehensive bald eagle survey data have not been collected by the Louisiana Department of Wildlife and Fisheries (LDWF) since 2008, and new active, inactive, or alternate nests may have been constructed within the proposed project area since that time. Although no nests are known to occur within the study area, unknown nest sites may potentially exist near the Nairn borrow source for Shell Island which is along the Mississippi River.

Bald eagles typically nest in large trees located near coastlines, rivers, or lakes that support adequate foraging from October through mid-May. In southeastern Louisiana parishes, eagles typically nest in mature trees (e.g., baldcypress, sycamore, willow, etc.) near fresh to intermediate marshes or open water. Bald eagles may also nest in mature pine trees near large lakes in central and northern Louisiana. Major threats to this species include habitat alteration, human disturbance, and environmental contaminants. Furthermore, bald eagles are vulnerable to disturbance during courtship, nest building, egg laying, incubation, and brooding. Disturbance during these periods may lead to nest abandonment, cracked and chilled eggs, and exposure of small young to the elements. Human activity near a nest late in the nesting cycle may also cause flightless birds to jump from the nest tree, thus reducing their chance of survival.

Please be aware that the Service has developed National Bald Eagle Management (NBEM) Guidelines to provide landowners, land managers, and others with information and recommendations to minimize potential project impacts to bald eagles, particularly where such impacts may constitute "disturbance," which is prohibited by the BGEPA. A copy of the NBEM Guidelines is available at:
http://www.fws.gov/southeast/es/baldeagle/NationalBaldEagleManagementGuidelines.pdf. Those Guidelines recommend: (1) maintaining a specified distance between the activity and the nest (buffer area); (2) maintaining natural areas (preferably forested) between the activity and nest trees (landscape buffers); and (3) avoiding certain activities during the breeding season. During any project construction, on-site personnel should be informed of the possible presence of nesting bald eagles in the vicinity of the project boundary, and should identify, avoid, and immediately report any such nests to this office. If a bald eagle nest occurs or is discovered within 1,500 feet of the proposed project area, then an evaluation must be performed to determine whether the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at: http://www.fws.gov/southeast/es/baldeagle. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary.

On September 11, 2009, the Service published two federal regulations establishing the authority to issue permits for non-purposeful bald eagle take (typically disturbance) and eagle nest take

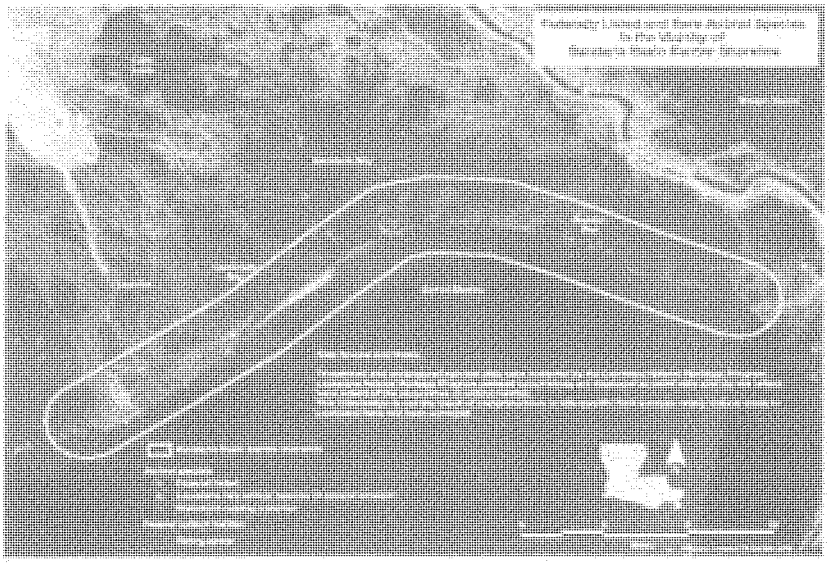
when recommendations of the NBEM Guidelines cannot be achieved. Permits may be issued for nest take only under the following circumstances where: 1) necessary to alleviate a safety emergency to people or eagles, 2) necessary to ensure public health and safety, 3) the nest prevents the use of a pre-existing human-engineered structure, or 4) the activity or mitigation for the activity will provide a net benefit to eagles. Except in emergencies, only inactive nests may be permitted to be taken. The Division of Migratory Birds for the Southeast Region of the Service (phone: 404/679-7051, e-mail: SEmigratorybirds@fws.gov) has the lead role in conducting consultations and issuance of permits. Should you need further assistance interpreting the guidelines, avoidance measures, or performing an on-line project evaluation, please contact this office.

The Corps is responsible for determining whether the selected alternative is likely (or not likely) to adversely affect any listed species and/or critical habitat, and for requesting the Service's concurrence with that determination. The Corps determined, and the Service concurs, that the selected alternative is not likely to adversely affect the West Indian manatee or the pallid and shovelnose sturgeon. The Service and the Corps are currently in formal consultation for potential impacts to piping plover and their critical habitat.

The Service has been and currently is a cooperating agency for the LCA Comprehensive Study, the LCA Near-Term Plan Study, and the LCA Barrier Shoreline study. The Service provided a September 26, 2003, letter to the Corps detailing federally listed threatened and endangered species, their critical habitat, and migratory birds that may be found in or near the study area for the draft LCA Comprehensive Study. That letter and the draft Biological Assessment (BA) are applicable to the LCA Near-Term Plan, of which this study is a subset. On May 2, 2005 the Service provided a project-specific list of federally listed threatened and endangered species. On May 11, 2009, the Service concurred with the Corps' determination that the originally proposed project as described in their April 24, 2009, BA, was not likely to adversely affect the piping plover or its designated critical habitat. As a result of a revised TSP, the Service requested the Corps to reinitiate section 7 consultation in our August 5, 2010 supplemental Fish and Wildlife Coordination Act Letter. On August 9, 2010 the Corps initiated formal consultation for impacts to the piping plover and their critical habitat. On December 6, 2010 the Corps rescinded their request for formal consultation and instead requested early consultation. On March 28, 2011, the Service issued a preliminary biological opinion to the Corps. The Corps submitted a revised BA dated June 3, 2011, which included changes to the proposed action and a request to re-initiate early consultation due to the changes in the frequency and quantity of nourishment for the Caminada Headland portion of the proposed project. Based on the Services' July 27, 2011, comment letter on the Draft EIS, the Corps re-submitted their June 3, 2011, BA with additional information regarding the endangered pallid sturgeon and shovelnose sturgeon with a request to include them in that consultation. On September 2, 2011, the Service provided confirmation to the Corps that all additional information for those species had been received. The Service finalized its Biological Opinion on December 12, 2011 and has transmitted that opinion to the Corps.

The following figure displays federally listed rare animal species, designated critical habitat, and important bird areas in the study area (source: Louisiana Natural Heritage Program).

Figure 4 Federally listed rare animal species, designated critical habitat, and important bird areas in the study area (source: Louisiana Natural Heritage Program, LDWF).



Refuges and Wildlife Management Areas

The Service administers 10 National Wildlife Refuges (NWR) encompassing more than 301,700 acres in Coastal Louisiana. However, there are no NWR in the study area. The Louisiana Department of Wildlife and Fisheries operates 17 refuges, preserves, and wildlife management areas (WMA) in coastal Louisiana, comprising more than 572,000 acres. The Wisner State WMA has 21,621 acres that are located just north of the Caminada Headland study area.

EVALUATION METHODOLOGY

Evaluation of project-related impacts on fish and wildlife resources was aided by use of the Wetland Value Assessment (WVA) methodology developed for the evaluation of proposed Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) projects (LCWCRTF 2006). The WVA methodology is similar to the Service's Habitat Evaluation Procedures (HEP), in that habitat quality and quantity are measured for baseline conditions and predicted for future without-project (FWOP) and future with-project (FWP) conditions. Separate habitat assessment models were used, including the Barrier Island, the Barrier Headland, and the Saline Marsh Community Models. Instead of the species-based approach of HEP, each model utilizes an

assemblage of variables considered important to the suitability of a given habitat type for supporting a diversity of fish and wildlife species. As with HEP, these models allow a numeric comparison of each future condition and provide a combined quantitative and qualitative estimate of project-related impacts to fish and wildlife resources.

The WVA models operate under the assumption that optimal conditions for fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated and expressed through the use of a mathematical model developed specifically for each habitat type. Each model consists of: 1) a list of variables that are considered important in characterizing fish and wildlife habitat; 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Indices) and different variable values; and 3) a mathematical formula that combines the Suitability Indices for each variable into a single value for wetland habitat quality, termed the Habitat Suitability Index (HSI).

The WVA methodology was first developed in 1991 by the CWPPRA Environmental Work Group (LCWCRTF 2006). Initially, emergent marsh habitat models were developed for fresh, intermediate, brackish and saline marsh types. Subsequently, models were also developed for swamps, barrier islands, barrier headlands, and coastal forested ridges. The habitat variable-habitat suitability relationships within the WVA models have not been verified by field experiments or validated through a rigorous scientific process. However, the variables were originally derived from HEP suitability indices taken from species models for species found in that habitat type. It should also be noted that some aspects of the WVA have been defined by policy and/or functional considerations of CWPPRA. However, habitat variable-habitat suitability relationships are, in most cases, supported by scientific literature and research findings. In other cases, best professional judgment by a team of fisheries biologists, wildlife biologists, ecologists, and university scientists may have been used to determine certain habitat variable-habitat suitability relationships. In addition, the WVA models have undergone a refinement process and habitat variable-habitat suitability relationships, HSIs, and other model aspects are periodically modified as more information becomes available regarding coastal fish and wildlife habitat suitability, coastal processes, and the efficacy of restoration projects being evaluated.

The WVA models assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. This standardized, multi-species, habitat-based methodology facilitates the assessment of project-induced impacts on fish and wildlife resources. The barrier island WVA model consists of seven variables: 1) percent of the total subaerial area that is classified as dune habitat; 2) percent of the total subaerial area that is classified as supratidal habitat; 3) percent of the total subaerial area that is classified as intertidal; 4) percent vegetative cover of dune, supratidal, and intertidal habitats; 5) percent vegetative cover by woody species; 6) degree of marsh edge and interspersion; and 7) beach/surf zone features. The barrier headland WVA model consists of five

variables: 1) percent of the total project area that is classified as dune habitat; 2) percent of the total project area that is classified as supratidal habitat; 3) percent vegetative cover of dune and supratidal habitats; 4) percent vegetative cover by woody species; and 5) beach/surf zone features. The saline marsh WVA model saline marsh consists of six variables: 1) percent of wetland covered by emergent vegetation; 2) percent open water dominated by submerged aquatic vegetation; 3) degree of marsh edge and interspersion; 4) percent of open water less than or equal to 1.5 feet deep; 5) salinity; and 6) aquatic organism access.

Using the WVA methodology, impact assessments were conducted by the Habitat Evaluation Team (HET), which included representatives of the Corps, the Service, CPRA, National Marine Fisheries Service, and National Resource Conservation Service. To assess impacts the HET used Storm-induced BEAch CHange (SBEACH) model and GENESIS model output, surveys, shoreline erosion and marsh loss data, knowledge of the area, experience with similar projects, the use of the previous LCA Barrier Island study (Jan 2003), field inspections conducted on July 2005 and May 2006, 1998 and October 2005 Digital Ortho-quarter Quadrangle aerial photographs (DOQQ), post hurricane's Katrina and Rita (CWPPRA) flight videos and photos, and May 2006 helicopter flight photos and video. Habitat acreage data were obtained from the U.S. Geological Survey (USGS). Interior marsh loss rates were obtained from the U.S. Army Corps of Engineers, New Orleans District and USGS.

These elements were used in conjunction with the above-discussed mathematical models to compute an HSI value for each target year (TY). Target years were established when significant changes in habitat quality or quantity were expected during the 50-year project life, under FWP and FWOP conditions.

The product of an HSI and the acreage of available habitat for a given target year is known as the Habitat Unit (HU). The HU is the basic unit for measuring project effects on fish and wildlife habitat. Future HUs change according to changes in habitat quality and/or quantity. Results are annualized over the project life to determine the Average Annual Habitat Units (AAHUs) available for each habitat type.

The change in AAHUs for each FWP scenario, compared to FWOP project conditions, provides a measure of anticipated impacts. A net gain in AAHUs indicates that the project is beneficial to the habitat being evaluated; a net loss of AAHUs indicates that the project is damaging to that habitat type.

In the final array four alternatives were evaluated for Shell Island: Alternative 1 – two islands with no renourishment and advanced fill for 9 years, Alternative 2 – two islands with renourishment every 10 years and advanced fill for 10 years, Alternative 3 –one island with no renourishment and advanced fill for 10 years, and Alternative 5 –one island with renourishment every 20 years and advanced fill for 10 years. Four alternatives were also investigated for the Caminada Headlands: Alternative 5 – Preferred Dune with Expanded Marsh, Alternative 6 – Preferred Dune with Expanded Marsh and 1 Renourishment, Alternative 7 – Preferred dune with

Expanded Marsh and 2 Renourishments, and Alternative 9 – Optimized with Expanded Marsh and 4 Renourishments. Shell Island used the Barrier Island model and was evaluated by separating the islands into two components (east and west) for Alternatives 1 and 2 and as a single island for Alternative 3 and 5, for a combined total of 6 WVA evaluations. For Caminada each alternative was evaluated for the headland portion as well as both direct and indirect marsh effects, involving a combined total of 12 WVA evaluations. After initial selection, the TSP was revised to include renourishment on both Caminada and Shell Island to address sustainability for the project life.

The Project Information Sheets, including assumptions used by the HET, for Caminada Headland and Shell Island habitat assessments are presented in Appendix A and B, respectively. The complete WVA analysis can be obtained from the Service's Louisiana Ecological Services Office.

FUTURE WITHOUT-PROJECT FISH AND WILDLIFE RESOURCES

The net land loss in the Barataria Basin from 1978 to 2000 was 213 square miles (136,320 acres). Since hurricanes Katrina and Rita struck the Louisiana coast in 2005 the basin lost an additional 17.6 square miles (11,264 acres) of land (Padgett 2006 pers. comm.). Without actions, another fifth of the basin's wetlands would be lost to open water by 2045 (LCWCRTF 1993). According to USGS (Padgett 2006 pers. comm.) the predicted loss for 2000 to 2050 in the basin is 186 square miles (119,040 acres).

In Louisiana, barrier island erosion is attributable to shoreline erosion, insufficient volumes of sediment supplied by littoral currents, increasing tidal prism, land subsidence, sea-level rise, storms, and human impacts (Boesch 1982). Significant shoreline erosion and interior marsh loss has occurred on Shell Island and Caminada.

Shoreline erosion

The barrier islands of the Barataria basin are constantly changing and eroding and have decreased in area by 47 percent from the 1890s to 1988. The Shell Island and Caminada barrier shorelines have undergone dramatic changes, including rapid shoreline retreat and island erosion and breaches. In fact, the Caminada Headland Reach has experienced some of the highest shoreline erosion in Louisiana and the United States, with some areas retreating at a rate of over 100 feet per year (LCWCRTF and WCRA 1999).

Shoreline recession and erosion have resulted in the disintegration of Shell Island. The few remaining islands and shoal remnants provide limited protection to the back barrier environment from waves and flooding. The construction of the Empire Jetties restricted the east to west longshore transport and increased the loss rates of Shell Island. Hurricane Bob in 1979 created a new inlet (Coupe Bob) that accelerated retreat and sediment loss. In the FWOP, there is no dune or marsh habitat and only 105 acres of subtidal habitat at Shell Island in 50 years (Thomson et al,

2005).

The erosional Caminada Headland has historically suffered loss of wetland habitat and diminished function within the Gulf shoreline. The marsh, beach, and dune habitats within the headland have undergone significant loss due to storm overtopping and breaching, saltwater intrusion, wind and wave induced erosion, sea level rise, subsidence, and man-made structures. The observed long-term (100 years) average shoreline erosion rate at the Caminada Headland, approximately 45 feet per year, would likely continue for the foreseeable future. The beach has eroded and the dune ridge has been breached by overwash from storm surges at several locations, including multiple shoreline breaches during the 2002, 2004 and 2005 hurricane seasons. A coastal Louisiana land loss model presented in the LCA Study (USACE 2004) indicates that with no intervention, the Caminada Headland will experience a projected land loss of 3,750 acres from the Headland and 14,780 acres from the area to the north from 2000 to 2050 (CEC 2006). Only a skeletal framework of natural barrier ridges and spoil banks would remain in 2050. Port Fourchon would be further isolated from the remaining mainland, and could become a detached small barrier island.

Interior marsh losses

Louisiana has the highest subsidence rates of any other land area around the Gulf of Mexico, i.e., 0.8 to 1.07 centimeter (cm)/year (Penland et al. 1987). Louisiana is also experiencing the highest rate of relative sea level (RSL) rise in the Gulf of Mexico, with rates between 1.03 and 1.19 cm/year. Regarding coastal wetland loss and flood damages to coastal communities, RSL, or apparent subsidence, is a more critical unit of measure than either subsidence or sea level rise alone. RSL is defined as the water surface level relative to the wetland surface and takes into account eustatic sea level rise, subsidence, and accretion.

Boesch et al. (1994) concluded that interior wetland loss is a consequence of sinking land and inadequate soil replenishment rather than erosion of its edges, filling, or draining. Interior marsh loss accounts for about two-thirds of coastal land loss (Wayne et al. 1994). Without the replenishment of sediments, these interior marshes will continue to deteriorate from subsidence, sea level rise, and other land-loss causes. Most Barataria Basin coastal marsh accretion rates are within the range of 0.6 to 0.9 cm/yr (Penland et al. 1988). DeLaune et al. (1994) detected that submergence in the study area averaged 1.38 cm/year and accretion averaged 0.98 cm/yr, leaving a net submergence rate of 0.4 cm/yr.

The average elevation of the existing native back-barrier marsh on Shell Island was determined to be approximately +1.1 feet, NAVD (Thomson et al, 2008) and 0.94 feet, NAVD for Caminada (CEC, 2008). The 2005 mean high water and mean low water elevations are +1.63 feet and +0.58 feet, NAVD, respectively for Shell Island and +1.53 feet and +0.48 feet NAVD, respectively for Caminada. These elevations are continuing to increase over time due to eustatic sea level rise, demonstrating that the existing marsh is inundated during the tidal cycle. A critical goal is for the marsh platforms to maintain an elevation between mean high water and mean low water. However, it is expected that in 50 years the mean high water and mean low water

elevations will rise from +1.64 feet to +2.26 feet, NAVD and +0.58 feet to 1.23 feet, NAVD, respectively (Thomson et al, 2008). This is due to an average eustatic sea level rise of 0.013 feet/year. Thus it is clear that even with accretion, if new sediment is not added to these marshes they will experience greater inundation in the future. When the marsh plants become inundated, they become stressed (Mendelssohn and McKee 1987) and eventually die.

The Davis Pond Freshwater Diversion Project will freshen marshes north of the study area. However, that project will not add large amounts of land-building sediments, and marsh deterioration in the study area will continue even under fresher conditions farther north.

As the barrier shorelines and the back-barrier marshes continue to erode and disappear, back bays and marshes will be exposed to increased tidal energy and salinities from the Gulf and tidal passes will enlarge and deepen, thus, reducing the hydrologic benefits of the islands to the basin. In fact, at Shell Island the complete opening of the bays would nearly double open water and fetch within these bays, decreasing their ecological value. North of Bastian Bay, only a few marsh islands and small ridges separate it from the much larger Adams Bay. Coalescence of the three bays would continue and accelerate without this project. Without the project, a large sound would develop between Empire and the Gulf of Mexico. This sound would have a profound impact on the entire region. Ecologic changes would occur and storm surges would increase requiring greater levels of flood and wave erosion protection.

The continued loss of the barrier shoreline habitat and the accompanying trend toward higher salinities typically leads to lower biodiversity and long-term productivity. Marshes will continue to deteriorate and convert to open water, leaving scattered fragments of marsh and sandy shoals. Fish and wildlife habitat quality will likely decrease as the barrier shoreline continues to erode and islands breakup or disappear. Increased stress on the fish and wildlife is expected as various fish and wildlife breading, nesting, nursery, feeding, roosting, or overwintering habitats continue to be lost. Habitat for endangered species would be further degraded and/or reduced. The Coast 2050 report (LCWCRTF and WCRA 1999) estimates that an additional 1,460 acres will be lost in the Caminada area by the year 2050. This number would be greater if it were not for the existing CWPPRA projects.

Fisheries Resources

Within the Barataria estuary, salinity and proximity to the marsh edge strongly determine the distribution of most fishes, the abundance of fishes decline dramatically with distance from marsh edge (Baltz et al. 1993). Intertidal marsh grass stems provide cover for juvenile fishes and adults of smaller species, as well as substrate for epiphytes and epifauna, which small fishes consume. Larger predatory fishes, such as spotted seatrout and red drum, forage along the marsh edge for small fishes, blue crab, and shrimp. Fishes that live in the open water of estuarine bays, such as bay anchovy and Gulf menhaden, gain refuge from sight-feeding predators in the turbid water. Those prey species are typically filter feeders, which eat zooplankton and phytoplankton. Demersal fishes, such as flounders and gobies, live in proximity to the bottom, and are typically

indistinguishable from the substrate. The deterioration of emergent wetlands may temporarily benefit some estuarine-dependant fisheries, but an eventual decline in productivity will result as detrital input and marsh-edge habitat are significantly reduced via conversion to open water (Turner et al., 1982).

It is likely that the wetlands of the basin have deteriorated beyond the most productive stage for estuarine-dependant fisheries, and that they will continue to experience loss (and decreased habitat quality) under FWOP conditions. Along with the disappearance of estuarine marsh nursery areas, the continual disappearance of the barrier shorelines and their surrounding estuarine marshes in the study area will substantially contribute to the on-going decline of fishery resources. The loss of barrier island marsh will eliminate nursery habitat for many species of young-of the year estuarine marine fish and macroinvertebrates that move inland to mainland marshes. In addition, high-energy beach habitat utilized by some species as nursery ground will be lost causing those species to decline. The Coast 2050 report (LCWCRTF and WCRA 1999) estimates that red and black drum, spotted seatrout, Gulf menhaden, southern flounder, white and brown shrimp, and blue crab will continue a decreasing population trend into the future in and around the barrier islands of the study area.

Wildlife Resources

Little, if any, information exists regarding population status and trends of reptiles and amphibians in the study area. According to the Barataria Terrebonne National Estuary Program (BTNEP) (Industrial Economics, Inc., 1996), over-harvesting and the loss of habitat, both within and outside the Barataria-Terrebonne estuary, threatens turtle populations. Over-harvesting and habitat loss threaten the snapping turtle, while coastal erosion and barrier island retreat directly threaten the diamond-backed terrapin.

Of the mammals that may be seen in the study area, including swamp rabbit, muskrat, raccoon, and coyote are the most likely to occur on the barrier shorelines. These species populations are projected to decrease by the year 2050 on the barrier shorelines and surrounding areas as those areas continue to erode and disappear (LCWCRTF and WCRA 1999). The Coast 2050 Plan (LCWCRTF and WCRA 1999) indicates that seabird populations over the study area show decreasing population trends and are projected to continue to decline into 2050. Waterfowl, wading birds, shorebirds, rails, coots, and gallinules are also expected to decrease by the year 2050 (LCWCRTF and WCRA 1999), as habitat continues to decline. Habitat quality for wildlife is expected to decline as the barrier shoreline in the study area continues to deteriorate and convert to open water under FWOP conditions. The above predictions are based almost exclusively on the predicted conversion of dune and marsh to open water and the gradual inundation and resultant deterioration of marshes and chenier ridges adjacent to the study area (LCWCRTF and WCRA 1999).

The barrier shorelines, adjacent marshes, and the chenier ridge habitat just north of the Caminada headland serve as vital resting and foraging habitat for trans-gulf neotropical migrant birds.

Available habitat is very important to trans-gulf migrants, and along the coast, they tend to choose wooded chenier areas and the scrub/shrub habitat of the shorelines and adjacent spoil or bayou banks over more open marshes. This habitat is especially critical when severe weather in spring causes migrating birds to reach land exhausted, or during the fall, when bad weather forces the birds to abort their southward migration at the last moment, before leaving land. Many of the cheniers have been lost in the vicinity of the study area, and as the barrier shorelines and few remaining ridges continue to subside below elevations that can support scrub/shrub habitat and maritime forest, very large numbers of neotropical migratory birds will be negatively affected.

Threatened and Endangered Species

The brown pelican and bald eagle, protected by the Migratory Bird Treaty Act (MBTA) and the BGEPA, respectively, are recovering from very low populations experienced over the last three decades. Increasing populations for those two species are projected to continue in the future primarily from efforts of the ESA and independent of changes to barrier islands and headlands. Similarly, the West Indian manatee and the pallid sturgeon will not likely be affected by the continued deterioration of the Louisiana coastal barrier shorelines, as their habitat needs are not dependent on those land features. However manatee could possibly be present at the project sites. The Service does not expect pallid sturgeon to be at the project site though they may occur at the Mississippi borrow site for Shell Island. In the case of pallid sturgeon entrainment issues associated with dredging operations in the Mississippi River is a potential effect that should be addressed in future planning studies and/or in analyzing current project effects. In the unlikely event that these species are observed in any part of the project area during construction or operation, the Corps should contact Ms. Deborah Fuller of the Service's Lafayette, Louisiana, Office at (337) 291-3124.

The fate of the piping plover may be influenced by the habitat conditions of Louisiana's barrier islands and coastal headlands, which support foraging, roosting, and sheltering needs of the piping plover. Many of Louisiana's barrier islands are used by the piping plover for their wintering habitat, and they may be present for 8 to 10 months annually from late July to late March or April. As barrier islands and headlands degrade, so declines those habitat components that support the piping plover's wintering critical habitat; thus, creating increased competition for the scarce coastal resources. Regardless of the efforts of the ESA, if the piping plover's wintering critical habitat in coastal Louisiana continues to decline unabated the species may continue to be negatively affected. In addition, as barrier shorelines continued to deteriorate and be loss the characteristics of the nearshore waters and bay are expected to change, thus potentially impact sea turtles foraging areas.

DESCRIPTION OF TENATIVELY SELECTED PLAN

Four alternatives (Alternatives 1, 2, 3, and 5) for Shell Island and four alternatives (Alternatives 5, 6, 7, and 9) for Caminada Headlands were evaluated for this study. Those alternatives

included restoring and sustaining (for the 50-year project life) barrier shoreline, dune, and interior or back-barrier marsh habitats as well as the geomorphic function of the barrier shorelines. Alternatives were screened on the basis of cost-effectiveness, incremental cost analysis, and their ability to meet the critical goal of preserving habitat in the area. The Tentatively Selected Plan (TSP) was revised and redefined since the draft EIS to include Shell Island's Alternative 5 (Single Island with Renourishment) and Caminada's Headland Alternative 5 (preferred dune with expanded marsh and renourishment).

Because the NER plan cannot be constructed within the maximum project cost as authorized by WRDA 2007, a subset of the NER, Caminada Headland Alternative 5, was selected as the recommended component of construction. The recommended component of construction represents an implementable and separable element of the NER plan, is cost effective and incrementally justified, and within the cost and scope of the current authorization.

Shell Island Alternative 5 – Single Island with renourishment to its original construction template in years 20 and 40

Under Alternative 5, the Shell Island reach would be restored as one island. The island would include shoreface, dune, and marsh platform features. This alternative would restore Shell Island to a form similar to its pre-Hurricane Bob (1979) condition

The landward edge of the dune of Alternative 5 would be located seaward of the existing shoreline. The west end of the Alternative 5 single island would terminate approximately 0.5 mile before Grand Bayou. It is anticipated that the closure of Coupe Bob would return the tidal prism to its pre-1979 path—flowing through Grand Bayou, with Grand Bayou increasing in size in response to the altered tidal flow pattern. The west end of Alternative 5 is close to the western limit of Shell Island that was observed in 1973, prior to the opening of Coupe Bob. The proposed island follows the shortest and shallowest route across Coupe Bob. The east end of the island would then follow the remnants of Shell Island East, but with a concave shape towards land. This would be required to maintain a smooth shoreline. The eastern end of the island would be located near the Empire Waterway. The constructed dune would have a uniform width of 189 feet along the length of the restored barrier island.

Louisiana barrier islands have typical widths in the region of 1,000 feet to 1,500 feet wide from the gulf shoreline to the bayward limit of the marsh. A uniform marsh width of 735 feet was chosen to construct an island that is approximately 1,240 feet wide following equilibration of the shoreline fill. The fill source for dike construction was located within the marsh fill footprint where the existing bathymetry is relatively shallow (less than -2.0 feet).

However, in deeper water (bathymetry below -3.0 feet), it is not feasible to construct the marsh section with only marsh sediments, as the marsh would settle too rapidly and nonuniformly to perform its intended purpose effectively. Instead it is recommended to construct a sand base across Coupe Bob, at -3.0 feet, using shoreline fill material. The marsh can then be constructed on top of this base, which would reduce settlement of the marsh material. A second option is to install a geotextile tube for containment of the marsh fill where the -3 feet NAVD sand base is constructed. The geotextile tube could be filled with sand from the sand base. This option was used for the development of Alternative 5.

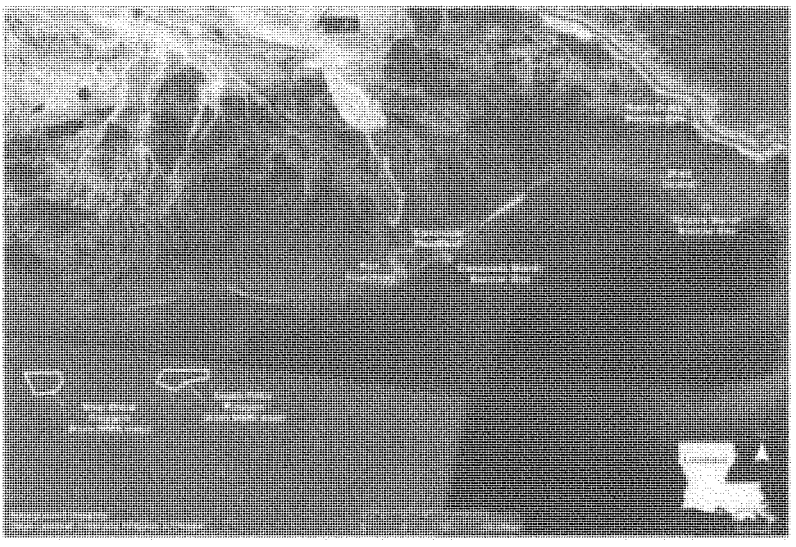
It is estimated that 5.6 million cubic yards of shoreline fill would be required to construct 317

acres of shoreline/dune area (area above +2 feet, NAVD). Approximately 2.1 million cubic yards of marsh fill would be required to construct 466 acres of marsh.

Shell Island would be re-nourished 20 years and 40 years after initial construction to the original template of 317 beach/dune acres. The marsh fill for Alternative 5 would also be re-nourished to its original construction template at these times. In year 20, approximately 907,200 cubic yards of marsh fill would be required and in year 40, 604,700 cubic yards would be required for re-nourishment. The renourishment in year 20 is estimated to be $63.3 million and the renourishment in year 40 is estimated to cost $60.9 million.

The borrow source for the dune/beach would be a large sand deposit in the Mississippi River between mile markers 32 and 34, approximately 11 miles north of the project area. The borrow site is located in a river meander where greater sediment thickness is anticipated due to the presence of relict (vertically stacked) sand bars. Corps sediment boring data indicates sand thickness of at least 70 feet in this area. Based on samples obtained from vibracores, the sand grain size is comparable to that at the project site. The dredged borrow material would be pumped from the Mississippi River via pipeline. The borrow source for the marsh restoration would be the Empire deposit, approximately 1.5 miles from the Empire Jetties. Water depths in the borrow area range from 16 feet to 20 feet. The borrow area covers about 207 acres and total mixed sediment volumes range from 5.5 million to 6.6 million cubic yards for 15 foot and 20 foot cut depths, respectively. The sedimentary characteristics indicate a silt content of about 40 percent, a clay content of about 22 percent and sand content of about 38 percent. The estimated total construction cost is $200,000,000. It is estimated that the duration of construction would be 787 days and the duration for the vegetative plantings would be 360 days over a period of 3 years. Figure 5 displays the project areas and the borrow sources.

Figure 5. Project area and designated borrow sources.



Caminada Alternative 5 – Preferred Dune with Expanded Marsh
Caminada Headland Alternative 5 proposes a dune height of +7 feet NAVD88 with a dune width of 290 feet. Alternative 5 also proposes a landward beach and dune component in order to maximize acreage and longevity. The landward and seaward slopes would be 20 feet horizontal to 1 foot vertical. The marsh fill is proposed on the landward side of the dune at an elevation of +2.0 feet NAVD88. Approximately 880 acres of beach/dune and 1,186 acres of marsh would be created, resulting in a total of 2,066 acres. Fill quantities for the dune and marsh fills would be 5.1 million and 5.36 million cubic yards, respectively. For the dune area, the material would be pumped from the dredge to the beach. The material would then be worked on the beach by bulldozers and front-end loaders. Points of direct access to the project area are Louisiana Highway 3090 and a beach road at Elmer's Island on the eastern end. For the marsh area, the material would be pumped from the offshore borrow site. The dune would serve as the southern dike for the marsh fill. Additional dikes would be constructed around the remaining perimeter. These operations would be completed in a manner that would minimize turbidity of the water at the dredge site and the discharge site.

Approximately 71,500 feet of sand fencing would be installed. The sand fences would be porous barriers that would reduce wind speed along the coast such that sand being transported by the wind accumulates on the downwind side of the fence. The sand fences would promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings. Vegetative plantings would include a variety of native species. The recommended planting density is no greater than 8-foot centers.

The borrow area identified for the beach/dune restoration is Ship Shoal, a large submerged sand body in the Gulf of Mexico located south of central Louisiana. The shoal is about 31 miles long and 7 miles wide with water depths of 9 feet to 30 feet. Preliminary studies have shown it is the remaining seaward shoal from one of the older, abandoned Mississippi River deltas. It is composed of well-graded quartz sand and is suitable for use in restoring the Caminada Headland since its grain size is similar to the sand found on the headland. The borrow area is located in South Pelto, Blocks 12 and 13, which is approximately 40 miles from the project site. The borrow site for the marsh restoration would be located approximately 1.5 miles south of the central portion of the Caminada Headland, and 4.7 miles southwest of Caminada Pass. The estimated total cost of construction, is $220,000,000 (October 2010). The estimated duration of construction is 936 days and the estimated duration of plantings would be 750 days over a 3-year period.

The TSP will include renourishment of the Caminada Headland per the 2004 LCA report which included near-shore recovery of 2 million cubic yards of sand every 10 years. Corps operations and maintenance dredging of the Bayou Lafourche navigation channel (i.e., Belle Pass) yields, on average, approximately 650,000 cubic yards of material every 1.5 to 2 years. All 650,000 cubic yards will be placed in the littoral drift south of Bayou Moreau where the long shore transport of material bifurcates going both east and west. The material will be placed as a subtidal feeder bar, allowing the long shore transport and wave action to move and place the sediment along the headland. Over each 10 year period, an estimated 2 million cubic yards of material will be returned to the headland. This renourishment is part of the non-Federal sponsor's operations and maintenance requirements. The non-Federal sponsor will pay the incremental cost of beneficially using this material over the federal standard which is estimated to be $6.21 million per event.

The renourishment will create a subtidal feeder berm, where material is introduced in the littoral zone and distributed by the longshore current, near the nodal point of the Caminada Headland.

The nodal point is an erosion "hot spot" due to bifurcation of the sediment transport, thus it breaches more frequently than other locations on the Headland. By placing the material at the nodal point, the entire Headland will benefit by reducing such breaching.

EVALUATION OF TENTATIVELY SELECTED PLAN

The WVA analyses indicate that the TSP for Shell Island and Caminada would result in the direct and indirect net gains in the quality and quantity of barrier island/headland and back-barrier marsh habitats of 731 AAHUs and 694 acres and 988 AAHUs and 989 acres, respectively, for a total net gain of 1,719 AAHUs and a total net gain of 1683 acres compared to the future without-project conditions (Table 1).

Table 1. Net wetland acreage and AAHUs established with the Tentatively Selected Plan.

	Portion of the Island Evaluated	Existing Acres	Initial Acres Created	FWOP Acres at TY50	FWP Acres at TY50	Net Acres Gained at TY50	Net AAHUs Gained
Shell Island Alt 5		386	788	105	799	694	730.6
Caminada Alt 5							
	Headland	385	880	0	345	345	373.2
	Direct marsh	876	1186	22	446	424	454.6
	Indirect marsh	926	0	12	232	220	160.6
Caminada Total		2187	2066	34	1023	989	988.4
TSP Shell and Caminada Totals		2573	2854	139	1822	1683	1718.9

PROJECT IMPACTS

Direct and indirect project-related benefits will occur through the creation of island/headland and back-barrier marsh habitats. The newly created barrier shoreline and back-barrier marsh will provide more sediment to the system, combat subsidence, make the area less susceptible to breaching and erosion, increase available nutrients, reduce wave fetch from previously breached headland/island and broken marsh, and create marsh at a higher elevation than existing marshes thus allowing for more vertical accumulation of vegetation. In addition to the direct island/headland and marsh creation benefits of the TSP, indirect benefits will also accrue. By implementing the TSP, the project goals of contributing to geomorphic stability and process of the basin shorelines, helping to re-establish pre-existing water quality trends and hydrologic processes, and sustaining and improving ecosystem processes and habitats for migratory and native species for the 50 year project life will be achieved. In addition, there will be an increase in sediments and nutrients to the barrier shoreline system. Because the indirect area of Caminada is adjacent to the direct marsh creation area there will be benefits to this area as well but they are not considered to be as substantial. Most importantly, it is assumed there will be an increase in sediments to the system based on the proximity of the indirect area to the marsh creation foot print

which will add nutrients and there will likely be less wave fetch from the broken marsh of the direct area.

Shell Island Alternative 5 – Single island with renourishment
The project boundary for Alternative 5 includes approximately 386 acres of existing marsh with no dune or supratidal habitats at TY0. Project construction includes approximately 788 acres of new marsh, dune, supratidal and gulf intertidal habitats at TY1 with an estimated 694 acres of these habitats left at TY50. It should be noted that newly created acres will cover the existing acres.

Shell Island Alternative 5 – Single island with renourishment, will extend across Coupe Bob connecting the two islands making them a single island again. This option better meets the project goals of reducing wave energy transmission into Bastian Bay and re-establishing the historic longshore sediment transport than other alternatives evaluated. By re-establishing the single island as a base, the island is in a better more stable condition. However prior to construction of Shell Island Alternative 5, the single island alternative should be model to determine the effects of change in tidal prism as a result of closing Coup Bob.

Caminada Alternative 5 – Preferred Dune with Expanded Marsh
The project direct boundary for Alternative 5 includes approximately 1,361 acres of existing marsh, dune, supratidal, and gulf intertidal habitats at TY0. Project construction includes approximately 2066 acres of new marsh, dune, supratidal and gulf intertidal habitats for a total of approximately 2,849 acres at TY1 with approximately 989 acres of these habitats left at TY50. It should be noted that the newly created acres will cover most of the existing acres in the direct project footprints.

With regard to the indirect project boundary, the existing upland acreage approximately equal to 77 acres (Tank Farm, Chevron Facility) will be preserved through the project life at TY50. Because the Chevron Facility (77 acres) is considered to be developed and not wetlands; it is taken out of the WVA acres. However, the significant majority of the marsh acreage will disappear over the 50 years through natural subsidence (estimated to be 0.025 feet per year).

Combined Effect of the TSP Project Features
Collectively the TSP will initially create a total of over 2,854 acres (788 for Shell Island and 2,066 for Caminada Headlands) of directly created/restored habitat.

By moving forward with the TSP, the project will be contributing to the maintenance of fish and wildlife habitats by decreasing stress to fish and wildlife as their breading, nesting, nursery, feeding, roosting, or overwintering habitats are restored, thus adding to the biodiversity and productivity of the area. In addition, because the barrier island and shorelines are considered critical to the neotropical migrants, the creation of this habitat is considered an essential restoration need of the Barataria Basin. Habitat used by piping plovers may be increased in time by the implementation of the TSP.

Large-scale landscape change and ecosystem deterioration have occurred in the Barataria Basin. However, more far reaching benefits to fish and wildlife resources may result from the synergistic effect of the TSP and the Davis Pond Freshwater Diversion, the CIAP Long Distance Sediment Pipeline Project, Bayou Dupont Marsh Creation project, other CWPPRA-funded barrier island projects including East/West Grand Terre Island Restoration, Pass Chaland to Grand Bayou Pass, Pelican Island and Pass La Mer to Chaland Pass restoration and other CWPPRA-funded projects including West Bay sediment diversion, Barataria Basin Landbridge Shoreline Protection (phases 1 thru 4), Naomi Outfall Management, Little Lake shoreline protection/dedicated dredging near Round Lake, and Barataria Bay Waterway East/West side shoreline protection and wetland restoration (3 projects). Those projects would help further restore and maintain the functional integrity of the Barataria Basin.

Aside from supporting coastal habitats, the coastal barrier island chains in Louisiana are the first line of defense for protecting wetlands, inland bays, and mainland regions from the direct effects of wind, waves, and storms. The barrier system serve multiple defensive purposes to: reduce coastal flooding during periods of storm surge; prevent direct ocean wave attach, which would accelerate rates of erosion and degradation of marshes and other wetlands; and help maintain gradients between saline and freshwater, thereby helping to preserve the estuarine systems.

Without ecologic restoration large-scale change would occur due to the encroachment of the Gulf into the coastal wetlands. Implementing the TSP will help to protect vulnerable cheniers north of the Caminada Headland as well as the local infrastructure of Chevron, Louisiana Offshore Oil Port (LOOP), and Port Fourchon. Rebuilding Shell Island will help protect interior marsh and bays from the intrusion of the Gulf and down drift shoreline habitats from further deterioration by helping to maintain the salinity gradients, temporarily preventing further disruption to the hydrology of the estuary, and by adding sediment to the barrier island/headland system. Ultimately the Port of Empire will benefit from the added protection resulting from the restoration of Shell Island.

The TSP is a component of a comprehensive strategy to sustain the wetlands and associated fish and wildlife productivity of the Barataria Basin. The establishment of 1683 net acres of barrier island/headland and emergent marsh with renourishment for the project life will help reduce the decline in fish and wildlife habitat quality and detrital production over time.

FISH AND WILDLIFE CONSERVATION MEASURES

The Service, NMFS, and LDWF should be consulted during the preconstruction engineering and detailed design phases so that optimum project benefits to coastal wetlands and associated fish and wildlife resources are achieved, and potential impacts to those resources are minimized. In addition, the newly created barrier headland/island and back-barrier marsh creation should be monitored for effectiveness, and the results should be provided to all resource agencies.

While no active waterbird nesting sites were found during recent surveys, the possibility exists that colonies may become established once construction begins, especially on bare, newly

established spoil areas. Construction should be conducted in a manner that avoids impacts to any established or newly occupied waterbird colonies. The Service recommends that a biologist inspect the proposed work sites for the presence of undocumented nesting colonies during the nesting season (i.e., mid-February through August, depending upon species present). Work should not take place within 650 feet of any waterbird colonies located in the study area during the nesting season; some work during those months may be allowable, depending upon a field assessment of bird nesting status, however, such allowances should be coordinated with the Service and LDWF.

The threatened piping plover, as well as its designated critical habitat, occur within the Caminada headland portion of the proposed project areas. Piping plovers may be present as early as late July and remain until late March or April. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape because the suitability of a particular site for foraging or roosting is dependent on local weather and tidal conditions. Plovers move among sites as environmental conditions change, and studies have indicated that they exhibit strong site fidelity and generally remain within a 2-mile area on their wintering grounds.

The project area on the Caminada headland would be approximately 13 miles in length, and proposed construction would occur in a linear fashion during a two-year period. Based on 2005 aerial photography, approximately 278 acres of designated critical habitat and 193 acres of additional habitat that piping plovers may use would be temporarily impacted during, and immediately post-construction. Such impacts would include displacement of birds to nearby suitable areas, loss of fresh and old natural organic material (i.e., wrack), and disruption of the benthic prey base. Studies indicate that benthic community assemblages generally recover within 2 years post-construction if the newly deposited sediments are similar to pre-construction sediments. Due to the length of the project area, the duration of construction, the time until benthic prey re-colonization, and the tendency of plovers to remain within a 2-mile area on wintering grounds, the proposed project may affect piping plovers because there may be little available foraging habitat within a 2-mile radius of the project area during the later stages of construction and immediately post-construction.

Measures should be implemented to ensure that the proposed activities are conducted to minimize any potential effects to the piping plover and its designated critical habitat during and immediately post-construction. The following are measures that would minimize potential effects:

1. To the maximum extent possible, design the construction schedule to avoid the piping plover wintering season. Because the duration of the project would be approximately two years, project construction would still occur within a portion of one wintering season (possibly two) since plovers may be present in the project area for 8 to 10 months.

2. To improve the quality of newly created roosting habitat and to aid in the re-colonization of newly created foraging habitat, natural organic material (i.e., wrack) should be

stockpiled or removed from the beach prior to construction and then re-distributed across the project area immediately post-construction.

3. Design the construction in such a manner that not the piping plover's entire habitat is not disturbed at one time by constructing in short stretches (e.g., 2,500-foot-long stretches). Short construction stretches would allow for sufficient habitat within a 2-mile area for piping plovers to disperse into while the initial disruption is occurring. Construction disturbance would be temporary in nature and would not permanently exclude piping plovers from utilizing the island or the project area for resting or foraging. However, in the short-term, the proposed project area would provide less than ideal habitat over the next few years until wave and wind actions have redistributed the sand fill and the beach re-stabilizes within the dynamic barrier island/headland environment. Newly created foraging habitat would not be suitable immediately post-construction due to high elevation and lack of a prey base, but may become suitable after natural processes have affected the beach for several years.

4. Conduct pre- and post- construction surveys of piping plover designated critical habitat using methods presented in the Service's December 12, 2011, Final Biological Opinion.

5. Prior to each renourishment the Corps should coordinate with the Service regarding the status of project conditions.

Based on the project description, the above recommendations would help to minimize project-related effects to the piping plover and its designated critical habitat. For more conservation measures for piping plover please see the Final Biological Opinion. The Corps determined, and the Service concurred, that the selected alternative is not likely to adversely affect the West Indian manatee or the pallid and shovelnose sturgeon. For details regarding that Section 7 consultation please see pages 1 and 2 of the Final Biological Opinion.

SERVICE POSITION AND RECOMMENDATIONS

The Service is pleased to see the increase of sediment and the addition of renourishment to the Caminada Headland and the single island alternative plus renourishment for Shell Island and agree the additional feature would result in greater overall benefits to the project. The Service feels the new TSP represents a significant gain in habitat for fish and wildlife resources over the project life. In fact with the changes to the TSP two of our previous recommendations have been resolved and removed from the list below. The Service believes that the impact analysis and recommendations provided in our April 2009, August 5, 2010, and June 3, 2011 FWCA Report and Supplemental Reports continue to remain valid with the addition of the first recommendation and the removal of the two recommendations mentioned above.

1. The Service, NMFS, and LDWF should be provided an opportunity to review and submit recommendations on future detailed planning reports and the draft plans and

specifications on the Barataria Basin Barrier Shoreline Restoration Project addressed in this report.

2. Coordination should continue with the Service and NMFS on detailed contract specifications to avoid and minimize potential impacts to piping plover and their critical habitat, manatees, pallid sturgeon, and sea turtles.

3. Avoid adverse impacts to nesting seabird colonies through careful design project features and timing of construction. For colonies containing nesting gulls, terns, and/or black skimmers, all activity occurring within 650 feet of a rookery should be restricted to the non-nesting period (i.e., September 16 through April 1, exact dates may vary within this window depending on species present). Prior to any such work, surveys should be conducted by qualified personnel during the colonial seabird nesting season to determine the presence and location of any such colonies. In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

7. If the proposed project has not been constructed within 1 year or if changes are made to the proposed project, the Corps should re-initiate Endangered Species Act consultation with the Service.

4. The newly created barrier headland/island and back-barrier marsh, as well as the surrounding habitats that may be indirectly benefited by long-shore transport and sediment overwash, should be monitored over the project life for effectiveness and the results should be provided to all resource agencies. Development of those monitoring plans should be coordinated with all natural resource agencies.

5. All containment features should be breached or degraded, if necessary to restore tidal connectivity, once the marsh creation/nourishment areas have at least 80% coverage of emergent vegetation.

8. Identification of additional borrow sites should be coordinated with the Service and other natural resource agencies.

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APPENDIX A

HABITAT ANALYSIS PROJECT INFORMATION SHEETS FOR CAMINADA HEADLANDS

Project Information Sheet Barrier Island Value Assessment
CAMINADA HEADLAND

3 December 2010

Project Name: Barataria Basin Barrier Shoreline Restoration Caminada Headland Feature

Project Type(s): Barrier headland restoration, marsh restoration/creation, vegetative planting, and sand fencing.

Sponsoring Agency: Louisiana Department of Natural Resources and US Army Corps of Engineers
Preparer of information sheet: Catherine Breaux/Patrick Williams
Information found in this project information sheet was obtained primarily from the Draft Feasibility report appendix (CEC 2005 and 2007).

Project Area: The project area lies within the Barataria Basin, which comprises the area between the Mississippi River and Bayou Lafourche. The 13-miles long Caminada Headland located in Lafourche and Jefferson Parishes extends from the Belle Pass jetties at the mouth of Bayou Lafourche on the western end of the headland to Caminada Pass on the eastern end of the headland. The project area is bounded by the Gulf of Mexico to the south and approximately 2250 feet north of the Gulf to the North. The headland maintains the integrity of the gulf shoreline and protects the interior coast from further deterioration. The Caminada Headland consists of narrow and low-lying sand dune and beach berm, barrier marshes, and chenier ridges interspersed with mangrove thickets, coastal dune shrub thickets, lagoons and small bayous. The average dune elevation is estimated to be +3.5 feet North American Vertical Datum of 1988 (NAVD) and the back-barrier marsh was determined to be 0.94 feet NAVD.

Problem: The erosional Caminada Headland has historically suffered loss of wetland habitat and diminished function within the gulf shoreline. The marsh, beach, and dune habitats within the project area have undergone significant loss due to storm overtopping and breaching, saltwater intrusion, wind and wave induced erosion, sea level rise, subsidence, and man-made structures. The observed long-term (100 years) average shoreline erosion rate at the Caminada Headland, approximately 45 feet per year, would likely continue for the foreseeable future. The beach has eroded and the dune ridge has been breached by overwash from storm surges at several locations, including multiple shoreline breaches during the 2002, 2004 and 2005 hurricane seasons. Increased stress on the fish and wildlife is expected as various fish and wildlife nursery, feeding, nesting and roosting habitats continue to be lost. A coastal Louisiana land loss model presented in the LCA Study (USACE 2004) indicates that with no intervention, the Caminada Headland will experience a projected land loss of 3,750 acres from the Headland and 14,780 acres from the area to the north from 2000 to 2050. Only a skeletal framework of natural barrier ridges and

spoil banks would will remain in 2050. Port Fourchon would be further isolated from the remaining mainland, and could become a detached small barrier island.

Study Purpose
The purpose of the proposed action is to restore the geomorphic function and unique critical and essential fish and wildlife habitats of the Caminada Headland's barrier system. The proposed action would also provide some degree of storm surge protection.

Goals and Objectives
- Project life equal to fifty years (Year 50)
- Sustain and improve shoreline, dune, and interior marsh habitat for essential fish and wildlife species
- Reduce wave energy transmission by providing a natural storm protective buffer for interior marsh and chenier ridge habitats north of Caminada Headland
- Address the severity of erosion along the gulf-front shoreline
- Close the breaches that have occurred due to recent storm and hurricane damage and prevent breaching during the design life
- Vegetate newly created marsh and dune areas
- Provide compatible sediments for marsh, beach and dune restoration
- Avoid impacts to adjacent shorelines from borrow area excavation
- Maintain the Caminada Headland without disrupting the natural hydrologic regime

Project Features
Dune/Beach Component
The proposed alternative designs that were moved forward for WVA analysis would include a continuous beach and dune restoration component. The alternatives evaluated have a landward beach and dune component in order to maximize acreage and longevity. All dune restoration components would also include sand fencing and plantings of native vegetation that is anticipated to promote additional dune elevation growth by capturing Aeolian sands.

Marsh Component
The proposed alternative designs include restoration/creation of a marsh platform contiguous with the Chevron Canal on its northern boundary and the beach and dune fill component along its southern boundary. A constructed marsh elevation of +2.0 feet NAVD would be used to maintain a functioning intertidal marsh between the marsh-renourishment cycles. The native marsh elevation for the back-barrier marsh was determined to be 0.94 feet NAVD. Mean high water is 1.53 feet NAVD and mean low water is 0.48 feet NAVD and increases over time due to an eaustatic sea level rise, demonstrating that the existing marsh is inundated during the tidal cycle. Neighboring CWPPRA projects (Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration BA-35, Chaland Headland Restoration BA-38, and East and West Grand Terre Island Restoration BA-30) were used to estimate settlement and consolidation of fill material. A sea level rise rate of 2.5 feet per century is used for this analysis. Temporary containment dikes would be constructed to contain the marsh fill material during construction. The fill material for dike construction would be dredged from within the footprint of the

marsh so that the excavated area is filled during construction. The dike volume is included within the marsh fill volume. The marsh fill is proposed on the landward side of the beach and dune. The marsh platform would be planted with appropriate vegetation.

Borrow Material
Material for the dune and beach construction would be borrowed from the South Pelto Block of Ship Shoal. Ship Shoal is a large offshore submerged sand body in the Gulf located approximately 50 miles southwest of Belle Pass. A suitability analysis was conducted comparing Caminada sediments to South Pelto Block sediments. The sediments from South Pelto Block were concluded to be suitable for beach and dune restoration. It is recommended that an overfill ratio of 1.08 be used in design volume analysis.

Louisiana Department of Natural Resources (LDNR) is currently performing a nearshore borrow area investigation in addition to the Ship Shoal investigation for the purpose of creating the back-barrier marsh fill platform. It is recommended that this include an evaluation of the potential borrow materials for compatibility with the native marsh.

Operations and Maintenance Phase
The following planting plan was adapted from a DNR plan after recommendations from the agencies including means to achieve optimal environmental benefit based on percent cover values in the Barrier Headland and Wetland Island Value Assessment models, funding considerations, and expected annual industry limitations. Note that this should be viewed as a preliminary/conceptual planting plan only, to be amended as needed and site conditions warrant if the project is constructed. Planting density could be increased (5'-7' centers) if the budget allows. Also if the budget allows, for optimal results, herbaceous and woody species plantings on all habitat types should be phased, with the first phase of herbaceous plantings occurring at TY1 and woody plantings at TY3.

General assumptions include:

- strive to develop a planting plan to attain optimal functionality for less than 5% of the construction cost (without contingency)
- plant 100% of the dune (that includes the crown and slopes)
- plant 100% of the bayside supratidal and gulfside supratidal including the seaward berm and dune downslope, but not the beach
- aerially seed the dune and supratidal (for conservative cost estimating purposes only assumed aerially seeding all of the supratidal acres)
- plant 50% of the marsh acres; half in TY2 and half in TY3

DUNE & SUPRATIDAL PLATFORM:
Species
Seeding of the dune platform (aerial or ground application) could be considered depending on the time of the year construction is completed. Rye grass seed could be considered if construction is completed in the summer or fall to be used as a ground cover during the winter months. Bermuda grass seed has been dispersed on the barrier island dune platforms in the past as well, but with strong objection by some Federal and state wildlife agencies as it is non-native.

Herbaceous dune and supratidal plants will consist of a variety of dune species including bitter panicum (*Panicum amarum* var *amarum* 'Fourchon'), sea oats (*Uniola paniculata* 'Caminada'),

marshhay cordgrass (*Spartina patens* 'Gulf Coast') and gulf cordgrass (*Spartina spartinae*). Plants shall be grown mainly in four-inch containers (sea oats in a slightly larger container.) The aforementioned recommendations are general recommendations. Species recommendations may change due to soil properties and conditions, elevation after final construction, salinity, available soil moisture, and other site conditions. Other plants that could be considered to add diversity (other than the plants mentioned) are seacoast bluestem (*Schizachyrium maritimum*), seashore dropseed (*Sporobolous virginicus*), and salt grass (*Distichlis spicata*).

Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, iva, baccharis, and hercules club.
It has been suggested that more woody vegetation be included on Caminada than Shell Island. Planting of woody species should be delayed until TY3 to allow for stabilization and leaching of salt from deposited material.

Density
Plants on the dune, supratidal, and marsh platforms would be installed in variable density patterns based on site conditions. For quantity and cost estimating purposes, it was assumed that plants would be installed on 8' centers throughout 100% of appropriate dune and supratidal acreage at the certain target years. For estimating purposes, woody vegetation also was assumed to be planted on 8' centers throughout 15% of the dune, swale, and marsh acreage.

MARSH PLATFORM:
Species
Herbaceous marsh plants will consist of mainly smooth cordgrass (*Spartina alterniflora* 'Vermilion'). A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated to add a larger seed bank for black mangroves. Plants shall mainly consist of vegetative plug material or four-inch containers (smooth cordgrass), or tube-tainers (mangroves).

Density
The planting density was assumed to be 8' on center applied to 100% of the marsh acres.

Total Costs:
All prices mentioned includes: cost of plant, delivery, fertilizer, transportation, installation, etc. However, note that recent post-storm cost estimating (since preparation of the Shell Island Vegetation Cost estimates) generally are now including $20,000 mob/demob and $4/plug for the herbaceous marsh plants, and $8 to 10/plant for the woody species. Unit costs are consistent with guidance by NRCS and LDNR as recommended to the CWPPRA program on ppl18. Also note that the total amount of plants project during TY1 for the various alternatives is a substantial amount likely matching or exceeding the current industry annual supply.

Alternative	Alt 5
Estimated Cost	$6,160,015.35

Percentage of construction cost 3.7%

One shore-parallel fence will be installed about 50 feet north of the southern toe of the dune to continue the capture of transported sand until the surface is vegetated. The sand fence will extend along the total length of the constructed dune. Sand fences must be installed in sequence/phases. The installation should start from the southern side of the dune so as to build dune towards the Gulf and proceed north. Additional rows of sand fencing can be added once the existing sand fence is full (i.e. sand is stacked up to the top of the fence).

Monitoring Information/Adaptive Management Recommendations:
Monitoring Information:
Adaptive management involves monitoring the evolution of the project and updating the project design to incorporate the additional data. A field effort is recommended to attempt to ascertain the depth of closure. To improve the understanding of the current sediment transport rates, it is recommended that additional analysis be undertaken including profile measurement to determine average cross section and digitizing the current shoreline and comparing it to the 1988 shoreline to document short-term spit growth and attempt to estimate the rate.

Site Characteristics
The native marsh elevation for the back-barrier marsh was determined to be 0.94 feet NAVD.
The average wave height is 3.7 feet.
Mean High Water is 1.53 feet NAVD and Mean Low Water is 0.48 feet NAVD.
The rate of relative sea level rise is treated as a constant over the 50-year project life, equal to 0.025 feet/year or 1 ft/40 years (USACE 2004).

In 1935 the Belle Pass Jetties were constructed of rip-rap and have been modified over time with some of the rip-rap placed in the nearshore zone just east of the Bell Pass Jetty on the Caminada Headland. The jetties have an impact on the longshore transport along the headland to the west, trapping sand, and causing a significant downdrift impact on the Timbalier Islands to the west.

Following Hurricane Juan, in 1986 a section of the Caminada Headland seaward of Port Fourchon was armored with a cement-filled bag revetment locally referred to as the Boudin bags. Beach was added in front of the Boudin bags, as well as, dredged material was backfilled landward of the revetment. The revetment is an interruption of the natural coastal processes including cross shore sediment transport by both washover/backwash events as well as Aeolian processes. In 1992 Hurricane Andrew struck the Louisiana coastline causing considerable damage to the revetment, displacing the bags as much as 130 feet landward (Ritchie et al, 1995).

In an attempt to prevent erosion along the headland fronting the oil and gas facilities, private oil companies constructed thirteen breakwaters by sinking barges in the nearshore zone. Subsequently, the barges were filled with rip-rap.

General Methodology and Assumptions -*This section summarizes the procedures used to develop planform performance projections.*

Wave and water level data for storms having an impact on the Caminada Headland from 1985 to 2004 were assembled (12 storms). The input storm conditions of the five most severe storms from an erosion standpoint due to their high peak water levels, storm duration, and wave characteristics, including Juan 1985, Andrew 1992, Danny 1997, Isidore 2002, and Lili 2002, were used to be representative of storms that occur every 5 to 7 years.

The recommended design criteria for depth of closure is –12 feet NAVD.

The cumulative sediment budget change, including overwash accumulation, has a total net gulf shoreline erosion loss equal to approximately 926,000 cu yds per year. The total overwash rate is estimated to be approximately 547,000 cu yds per year. Assume the significant majority of the infilling rate of 300,000 cu yds per year in Belle Pass is due to sediment losses off the Headland to the west. 83,000 cu yds per year is reported to arrive at Grand Isle from Caminada.

Cross-shore sediment transport modeling was performed using the Storm-induced BEAch CHange (SBEACH) model. SBEACH is two-dimensional model developed to simulate cross-shore sediment transport primarily due to breaking waves and changing water levels. SBEACH is intended to predict short-term, storm-induced profile equilibration. A fundamental assumption of the SBEACH model is that the profile change is produced solely by cross-shore processes, resulting in a redistribution of sediment across the profile with no net gain or loss of material. Longshore processes are considered to be negligibly small in calculating profile change, and therefore, longshore wave and current sediment transport is not accounted for by SBEACH.

The predicted design rate for sea level rise of 0.013 feet per year is recommended as design criteria for the project.

For the shoreline equilibrium component of the advanced fill, a mass balance was performed by comparing existing profiles to construction profiles. The theory used was that the construction template would reform through coastal processes to gulfward slopes similar to those of existing profiles. It was assumed that the volume of beach and dune erosion would equal the amount of sand transported to the depth of closure.

Assume an average shoreline erosion rate of 45 feet per year. This is based on survey data, aerial photography, and the long-term (1887-1988 time period) erosion rate.

Using the 2005 survey data, aerial photography, historical erosion rate of 45 feet per year, and conceptual sediment budget, the acreages of each habitat component in the land mass within the WVA boundaries were computed.

The landward indirect erosion rate is based on aerial photographs and the historic erosion rate of 45 feet

per year. The indirect boundary is to the extent of where the shoreline would erode (using 45 ft/year) to in 50 years without the proposed project. The FWP conditions will prevent the loss from occurring in the indirect marsh area.

FWOP analyses considered changes that the project area for each alternative will undergo for a no action scenario. The impacts that coastal processes such as erosion, storms, subsidence and sea level rise would have on the existing habitat categories were considered. The 2005 survey was eroded by two years to represent 2007 conditions for TY0.

FWP analyses considered changes from processes such as equilibrium, storm events, overwash, subsidence, sea level rise etc., and resulted in an overall change in the platform area or in the conversion of one WVA habitat type to another. Assuming construction takes one year for all FWP Alternatives (TY1 represents the as-built configurations). TY2 represents initial equilibration of beach fill for FWP. Once re-nourishment took place, the process was repeated to account for equilibrium and other coastal processes again.

FWP TY1 all intertidal habitat is built to +2 ft NAVD elevation. Therefore there is no conversion of supratidal to intertidal habitat after initial construction. Loss to supratidal habitat is on the front side of the headland (loss to gulf subtidal).

Gulf intertidal acres are included in the direct marsh to account for the renourishement benefits since the sediments would be placed in the littoral drift at the nodal point carrying sediment both east and west and allowing the wave action to work it onto the headland. The headland model doesn't use gulf intertidal acres. Adding the gulf intertidal acres to the direct marsh is an approach that was used for West Bell Pass Headland WVA.

No interior loss to the direct and indirect marsh was applied because it is captured with modeling through subsidence, sea level rise, storm events, etc. Including interior loss was considered to be double counting loss. In addition the SLR rate was fairly high and falls between the medium and high SLR scenarios.

As the headland rolled landward, marsh that became supratidal and gulf intertidal acres in the indirect marsh area was counted in the headland model.

Assume 50% functionality for all marsh created and renourished for the first year after the creation cycle and habitats remain fully functional after renourishment cycles.

The indirect areas for all alternatives removed 77 acres that represent the Cheveron facility tank farm, which is considered to be developed land (elevations above +5 feet NAVD) and not wetlands.

Retention dikes are not removed from the saline marsh model post-construction.

Models Applied

The Barrier Headland model is applied to beach and dune components, and the saline marsh WVA is used for the remainder of the project area.

Alternative 5 – Preferred Dune with Expanded Marsh

The dune height is proposed to be +7 feet NAVD which is slightly higher than the existing dune elevation in the area of +3.4 feet NAVD. The proposed dune width is 290 feet. The majority of the dune is sited landward over existing higher elevations, maximizing acreage and longevity. The advanced fill quantities account for initial losses due to shoreline equilibrium.

The landward and seaward slopes are set at a1V:20H. The beach fill template has a 65 ft wide seaward berm at an elevation of +4.5 feet NAVD and a marsh fill template is proposed on the landward side of the dune at an elevation of +2.0 feet NAVD. Approximately 13 miles of dune will be created. Fill quantities for the beach/dune and marsh fills are 5.1 million and 5.36 million cubic yards respectively.

The project direct boundary for Alternative 5 includes approximately 1,361 acres of existing marsh, dune, supratidal, and gulf intertidal habitats at TY0. Project construction includes approximately 705 acres of new marsh, dune, supratidal and gulf intertidal habitats for a total of approximately 2,066 acres at TY1 with approximately 101 acres of these habitats left at TY50. It should be noted that the newly created acres will cover most of the existing acres in the direct project footprints.

Alternative 5 will include renourishement per the 2004 LCA report which included near-shore recovery of 2 million cubic yards of sand every 10 years. Corps operations and maintenance dredging of the Bayou Lafourche, Louisiana (Belle Pass) navigation project yields on average approximately 650,000 cubic yards of material every 1.5 to 2 years. Of this material, 500,000 cubic yards will be placed in the littoral drift south of Bayou Moreau where the long shore transport of material splits going east and west. The material will be placed, allowing the long shore transport and wave action to move and place the sediment along the headland. Over each 10 year period, an estimated 2 million cubic yards of material will be returned to the headland, replacing 53% of the sediment lost from the headland. Dredged material in excess of 500,000 cubic yards will be used beneficially per the requirements of the Bayou Lafourche, Louisiana navigation project.

With regard to the indirect project boundary, the existing upland acreage approximately equal to 77 acres (Tank Farm, Chevron Facility) will be preserved through the project life at TY50. Because the Chevron Facility (77 acres) is considered to be developed and not wetlands it is taken out of the WVA acres. However, the significant majority of the marsh acreage will disappear over the 50 years through natural subsidence (estimated to be 0.025 feet per year).

Headland model

The project boundary for the headland model encompasses the proposed footprint for the beach, dune, and supratidal area. Using the survey data, aerial photography, historical erosion rate of 45

feet per year, and conceptual sediment budget, the acreages of each habitat component in the land mass within the WVA boundaries were computed. Baseline (TY0) Acreages within the project boundary were rolled forward to 2007.

V1 and V2 – Percent subaerial area that is dune and supratidal
See attached spreadsheet.

Variable V3 - Percent vegetative cover of dune and supratidal habitats
Based on site visits (July 2005), examination of pre and post-storm photography, and post-storm flight, the headland portion of the project area is primarily vegetated by goldenrod (*Solidago* sp.), *Salicornia*, *Distichlis spicata*, roseau cane (*Phragmites*), *Spartina alterniflora*, *Spartina patens*, bitter panicum (*Panicum amarum*), three-cornered grass (*Scirpus olneyi*), pennywort, seaside heliotrope (*Heliotropium curassavicum*), sea-oxeye, dodder vine, deerpea, morning glory, sea oats, *Sesbania* sp., croton, black mangrove, *Iva frutescens*, wax myrtle, and what appeared to be toothache tree.

FWOP Caminada Alternative 5

TY0	35%	Transect average from field trip is 50%. Old Caminada Headland WVA baseline was 50%. Review of helicopter flight photos of Caminada Headland after hurricanes Katrina and Rita resulted in 15% vegetation. There was a lot of overwash, loss of veg, and appears to be loss of dune and supratidal habitats in the headland. Based on the May 2006 field trip, photos, and flight which showed some recovery of breaches; the Elmer's Island portion had about 25% veg cover, the western portion (Bell Pass to the breakwaters) was about 25% cover, and the bulk of the middle (breakwaters to Elmer's) was mostly void of veg and had sandy overwash to the intertidal marsh, thus 5% veg cover in the middle portion. For the May 2006 field trip it was estimated to have is an average of 10% veg cover. Adding 2 years of vegetative rebound for 2008 baseline.
TY1	40%	continued growth
TY3	35%	
TY5	33%	
TY7	30%	
TY9	27%	
TY10	25%	No dune acres are left. 40% of baseline supratidal acres are left. Assume much of it may be overwashed.
TY11	24%	
TY13	20%	
TY15	10%	
TY17	5%	
TY19	5%	
TY20	4%	
TY21	4%	

TY23	4%	
TY25	3%	
TY27	3%	
TY29	2%	
TY30	2%	
TY31	1%	no supratidal acres remain.
TY33	0%	
TY35	0%	
TY37	0%	
TY39	0%	
TY40	0%	
TY41	0%	
TY43	0%	
TY45	0%	
TY47	0%	
TY49	0%	
TY50	0%	There are no subaerial acres remaining.

FWP Caminada Alternative 5

TY0	35%	
*TY1	10%	(582 acres of dune + 301 acres of supratidal @ 10% cover)/883 subaerial acres. All intertidal habitat is built to +2 ft NAVD. No supratidal habitat is converted to intertidal habitat in later TYs because of initial equilibrium. Assume 100% of dune acres and berm planted at TY1 (immediately post construction). Estimated coverage of dune and supratidal planted area is 10%.
TY3	40%	(572 acres of dune + 189 acres of supratidal @ 40% cover)/761 subaerial acres.
TY5	60%	(534 acres of dune + 260 acres of supratidal @ 60% cover)/794 subaerial acres.
TY7	65%	(500 acres of dune + 265 acres of supratidal @ 65% cover)/765 subaerial acres.
TY9	68%	(454 acres of dune + 270 acres of supratidal @ 68% cover)/724 subaerial acres.
TY10	70%	(431 acres of dune + 270 acres of supratidal @ 70% cover)/701 subaerial acres. Continued gains.
TY11	70%	(416 acres of dune + 321 acres of supratidal @ 70% cover)/737 subaerial acres.
TY13	70%	(366 acres of dune + 452 acres of supratidal @ 70% cover)/818 subaerial acres.
TY15	70%	(316 acres of dune + 524 acres of supratidal @ 70% cover)/840 subaerial acres.
TY17	70%	(278 acres of dune + 532 acres of supratidal @ 70% cover)/810 subaerial acres.
TY19	70%	(229 acres of dune + 524 acres of supratidal @ 70% cover)/753 subaerial acres.
TY20	75%	(188 acres of dune + 503 acres of supratidal @ 75% cover)/691 subaerial acres.
TY21	75%	(159 acres of dune + 482 acres of supratidal @ 75% cover)/641 subaerial acres.
TY23	75%	(86 acres of dune + 483 acres of supratidal @ 75% cover)/569 subaerial acres.
TY25	75%	(36 acres of dune + 483 acres of supratidal @ 75% cover)/519 subaerial acres.
TY27	80%	(25 acres of dune + 474 acres of supratidal @ 80% cover)/499 subaerial acres.
TY29	80%	(18 acres of dune + 458 acres of supratidal @ 80% cover)/476 subaerial acres.
TY30	80%	(13 acres of dune + 437 acres of supratidal @ 80% cover)/450 subaerial acres.

		Some loss over time.
TY31	80%	(9 acres of dune + 421 acres of supratidal @ 80% cover)/430 subaerial acres
TY33	80%	(2 acres of dune + 427 acres of supratidal @ 80% cover)/429 subaerial acres
TY35	75%	(434 acres of supratidal @ 75% cover)/434 subaerial acres
TY37	75%	(439 acres of supratidal @ 75% cover)/439 subaerial acres
TY39	75%	(393 acres of supratidal @ 75% cover)/393 subaerial acres
TY40	75%	(385 acres of supratidal @ 75% cover)/385 subaerial acres
TY41	75%	(345 acres of supratidal @ 75% cover)/345 subaerial acres
TY43	75%	(330 acres of supratidal @ 75% cover)/330 subaerial acres
TY45	75%	(325 acres of supratidal @ 75% cover)/325 subaerial acres
TY47	70%	(351 acres of supratidal @ 70% cover)/351 subaerial acres
TY49	70%	(346 acres of supratidal @ 70% cover)/346 subaerial acres
TY50	70%	(345 acres of supratidal @ 70% cover)/345 subaerial acres

Variable V4- Percent vegetative cover by woody species

Woody vegetation on Caminada included mangrove and *Iva frutescens*.

FWOP Caminada Alternative 5

TY0	4%	Many woody species seen on the May 2006 field trip appeared to be burned from salt from the storms. There weren't much woody species left. At the time assumed 2% of the entire 13 miles had some woody species. In 2008 assume more has rebound.
TY1	4%	
TY3	4%	
TY5	3%	
TY7	3%	
TY9	3%	
TY10	3%	No dune remains. 141 acres of supratidal, some is expected to be overwashed.
TY11	3%	
TY13	2%	
TY15	2%	
TY17	2%	
TY19	2%	
TY20	1%	No dune and only 3 acres of supratidal.
TY21	1%	
TY23	1%	
TY25	1%	
TY27	1%	
TY29	0%	
TY30	0%	
TY31	0%	No dune or supratidal remain.
TY33	0%	
TY35	0%	

TY37	0%	
TY39	0%	
TY40	0%	
TY41	0%	
TY43	0%	
TY45	0%	
TY47	0%	
TY49	0%	
TY50	0%	

FWP Caminada Alternative 5

TY0	4%	
TY1	0%	Burial of all existing woody vegetation in the headland model boundary
TY3	2%	Black mangrove and other available woody vegetation installed in TY2 or TY3. Assume 2% of 761 total dune and supratidal acres have woody vegetation established through natural recruitment and plantings.
TY5	5%	Assume 5% of 794 total dune and supratidal acres.
TY7	7%	Assume 7% of 765 total dune and supratidal acres.
TY9	8%	Assume 8% of 724 total dune and supratidal acres.
TY10	10%	Assume 10% cover of 701 total dune and supratidal acres.
TY11	10%	Assume 10% cover of 737 total dune and supratidal acres.
TY13	12%	Assume 12% cover of 818 total dune and supratidal acres.
TY15	13%	Assume 13% cover of 840 total dune and supratidal acres.
TY17	14%	Assume 14% cover of 810 total dune and supratidal acres.
TY19	15%	Assume 14% cover of 753 total dune and supratidal acres.
TY20	15%	Assume 15% cover of 691 total dune and supratidal acres.
TY21	15%	Assume 15% cover of 641 total dune and supratidal acres.
TY23	15%	Assume 15% cover of 569 total dune and supratidal acres.
TY25	18%	Assume 18% cover of 519 total dune and supratidal acres.
TY27	18%	Assume 18% cover of 499 total dune and supratidal acres.
TY29	20%	Assume 20% cover of 476 total dune and supratidal acres.
TY30	20%	Assume 20% cover of 450 total dune and supratidal acres.
TY31	20%	Assume 20% cover of 430 total dune and supratidal acres.
TY33	20%	Assume 20% cover of 429 total dune and supratidal acres.
TY35	20%	Assume 20% cover of 434 total supratidal acres.
TY37	20%	Assume 20% cover of 439 total supratidal acres.
TY39	18%	Assume 18% cover of 393 total supratidal acres.
TY40	18%	Assume 18% cover of 385 total supratidal acres.
TY41	16%	Assume 16% cover of 345 total supratidal acres.
TY43	15%	Assume 15% cover of 330 total supratidal acres.
TY45	15%	Assume 15% cover of 325 total supratidal acres.
TY47	15%	Assume 15% cover of 351 total supratidal acres.
TY49	15%	Assume 15% cover of 346 total supratidal acres.

TY50 15% Assume 15% cover of 345 total supratidal acres.

Variable V5 - Beach/Surf Zone Features

FWOP

TY0 – TY39 9% is Class 3 (SI = 0.9) for breakwaters (5,567 ft) and Bell Pass Jetties with rip rap (~500 ft) placed nearshore just east of the Bell Pass Jetty. Boudin bags on beach at same location as 13 sunken barge breakwaters. 91% Class 1 (SI =1.0) the rest of the headland is unconfined natural beach with no shore parallel structures. The weighted SI = (0.09*0.9 + 0.91*1) = 0.99

TY 40-50 100% Class 1. The effect of the breakwaters would cease by TY40 due to their distance offshore.

FWP

TY1-50 8% Class 3 because Jetty and breakwaters will remain for FWP but some created beach/dune may cover the rip rap just east of the Bell Pass Jetty. 92% Class 1 the rest of the headland is unconfined natural beach and containment built for construction would be graded into the template for a more natural slope as-built. The weighted SI = (0.09*0.8 + 0.92*1) = 0.99

Saline Marsh model

The project boundary for the saline marsh model encompasses the area of marsh fill. The WVA boundary for indirect benefits was delineated using the historical Caminada Headland erosion rate of 45 feet per year. The landward extent of this boundary was offset from the target year zero (TY0) shoreline by the maximum distance eroded during the life of the project (45ft/yr X 50 years = 2,250ft). This rate is not expected to increase due to dune disappearance. Review of historic maps has shown that the Headland's natural dune has progressed landward in position but has not disappeared. This boundary is also bordered by the direct boundary in the gulfward direction.

Variable V1 – Percent of wetland area covered by emergent vegetation

See attached spreadsheet for direct and indirect benefit areas.

TY1 100% of the 1186-acre marsh platform is built at marsh elevation (+ 2ft NAVD) at construction. Equilibrium after the first year brings the elevation down from +2 ft. The project area may be a different size from baseline b/c some of the marsh was converted to supratidal in the headland portion of the project. Assume 10% functionality for marsh created for the first year, 30% functionality for the third year, and 100% functionality for the fifth year after the creation cycle. See spreadsheet for FWOP and FWP.

Note: we added the Gulf intertidal acres here to capture benefits from renourishment. The headland model doesn't include Gulf intertidal but because of the renourishment technique of placing material in the littoral drift, that habitat is wear many of the benefits of are seen.

Variable V2 - Percent of open water area covered by aquatic vegetation

No SAV has been observed in the either the direct or indirect project area based on May 2006, July 2005 and April 2001 site visits. Proposed as 0% for FWOP and FWP, all TYs.

Variable V3- Marsh edge and interspersion

Based on the acreage data in V1, 1998 DOQQ, October 2005 DOQQs, and post storm flight and photography, and the May 2006 field trip, photos, and flight.

Direct Benefit Area Caminada Alternative 5

FWOP

TY0 10% class 2
60% class 3
30% class 4 – 30% water.

Assumed additional loss reduced class variables. Below is what was used in 2008
20% class 2
60% class 3
20% class 4 - 32% water. Based primarily on % land/water. Viewed post Katrina and Rita (CWPPRA) video and photos, 1998 DOQQ, 2005 DOQQ, and May 2006 helicopter flight photos and video. Previous study used 50% class 3 and 50% class 4 (Jan 03).

TY1 10% class 2 - 30% water.
60% class 3
30% class 4

TY3 5% class 2
55% class 3
40% class 4

TY5 55% class 3
45% class 4

TY7 50% class 3
50% class 4

TY9 45% class 3
55% class 4

TY10 40% class 3 - 38% water
60% class 4

TY11 40% class 3
60% class 4

TY13 30% class 3
70% class 4

TY15 20% class 3
80% class 4

TY17 10% class 3
90% class 4

TY19 10% class 3
90% class 4

TY20 10% class 3
90% class 4 25% water
TY21 10% class 3
90% class 4
TY23 5% class 3
95% class 4
TY25 5% class 3
95% class 4
TY27 5% class 3
95% class 4
TY29 100% class 4
TY30 100% class 4
TY31 100% class 4
TY33 100% class 4
TY35 100% class 4
TY37 100% class 4
TY39 100% class 4
TY40 100% class 4
TY41 100% class 4
TY43 100% class 4
TY45 100% class 4
TY47 100% class 4
TY49 100% class 4
TY50 90% class 4 - 19% water

Direct Benefit Area Caminada Alternative 5
FWP
TY0 10% class 2
60% class 3
30% class 4
TY1 100% class 1. There is 0% water
TY3 100% class 1. There is 0% water.
TY5 100% class 1. There is 0% water. Renourishment helps maintain higher classes
TY7 100% class 1.
TY9 90% class 1.
10% class 2
TY10 90% class 1.
10% class 2
TY11 90% class 1.
10% class 2
TY13 80% class 1.
20% class 2

TY15	80% class 1.
	20% class 2
TY17	80% class 1.
	20% class 2
TY19	70% class 1.
	30% class 2
TY20	70% class 1.
	30% class 2
TY21	70% class 1.
	30% class 2
TY23	60% class 1.
	40% class 2
TY25	60% class 1.
	40% class 2
TY27	60% class 1.
	40% class 2
TY29	60% class 1.
	40% class 2
TY30	60% class 1.
	40% class 2
TY31	60% class 1.
	40% class 2
TY33	50% class 1.
	50% class 2
TY35	50% class 1.
	50% class 2
TY37	50% class 1.
	50% class 2
TY39	40% class 1.
	60% class 2
TY40	40% class 1.
	60% class 2
TY41	40% class 1.
	60% class 2
TY43	30% class 1.
	70% class 2
TY45	30% class 1.
	70% class 2
TY47	20% class 1.
	80% class 2
TY49	20% class 1.
	80% class 2
TY50	100% class 2.

Indirect Benefit Area Caminada Alternative 5

FWOP

TY0 5% class 2
65% class 3
30% class 4 – 34% water

Assumed additional loss reduced class variables. Below is what was used in 2008
20% class 2
60% class 3
20% class 4 – 38% water. Based primarily on % land/water. Viewed post Katrina and Rita (CWPPRA) video and photos, 1998 DOQQ, 2005 DOQQ, and May 2006 helicopter flight photos and video. Previous study used 50% class 3 and 50% class 4 (Jan 03). July 06 used 60% class2; 20% class 3, 20% class 4 with 41% water.

TY1 5% class 2 – 34% water. (July 06 41% water, same classes)
65% class 3
30% class 4

TY3 70% class 3
30% class 4

TY5 65% class 3
35% class 4

TY7 65% class 3
35% class 4

TY9 60% class 3
40% class 4

TY10 60% class 3 –42% water. (July 06 50% water, 60% class 3; 40% class 4)
40% class 4

TY11 60% class 3
40% class 4

TY13 55% class 3
45% class 4

TY15 55% class 3
45% class 4

TY17 50% class 3
50% class 4

TY19 50% class 3
50% class 4

TY20 45% class 3 – 51% water (July 06 61% water, 20% class 3, 80% class 4)
55% class 4

TY21 45% class 3
55% class 4

TY23 40% class 3

60% class 4
TY25 40% class 3
60% class 4
TY27 30% class 3
70% class 4
TY29 25% class 3
75% class 4
TY30 20% class 3
80% class 4
TY31 10% class 3
90% class 4
TY33 100% class 4
TY35 100% class 5
TY37 100% class 5
TY39 100% class 5
TY40 100% class 5
TY41 100% class 5
TY43 100% class 5
TY45 100% class 5
TY47 100% class 5
TY49 100% class 5
TY50 100% class 5. 99% water

Indirect Benefit Area Caminada Alternative 5
FWP
TY0 5% class 2
65% class 3
30% class 4 – 34% water
TY1 5% class 2
65% class 3
30% class 4
TY3 5% class 2
65% class 3
30% class 4
TY5 70% class 3
30% class 4
TY7 70% class 3
30% class 4
TY9 70% class 3
30% class 4
TY10 60% class 3 – 12% water
40% class 4
TY11 60% class 3

	40% class 4
TY13	60% class 3
	40% class 4
TY15	60% class 3
	40% class 4
TY17	60% class 3
	40% class 4
TY19	55% class 3
	45% class 4
TY20	55% class 3 – 7% water
	45% class 4
TY21	55% class 3
	45% class 4
TY23	55% class 3
	45% class 4
TY25	55% class 3
	45% class 4
TY27	55% class 3
	45% class 4
TY29	55% class 3
	45% class 4
TY30	55% class 3
	45% class 4
TY31	55% class 3
	45% class 4
TY33	50% class 3
	50% class 4
TY35	50% class 3 – 86% water
	50% class 4
TY37	50% class 3
	50% class 4
TY39	50% class 3
	50% class 4
TY40	45% class 3
	55% class 4
TY41	40% class 3
	60% class 4
TY43	40% class 3
	60% class 4
TY45	30% class 3
	70% class 4
TY47	20% class 3
	80% class 4

TY49 10% class 3
90% class 4
TY50 100% class 4 – 80% water

Variable V4 – Percent of open water area < 1.5 feet deep in relation to marsh surface
There were no survey data available going through the direct or indirect benefit areas to help determine shallow open water. Shallow open water was based on review of aerial photography and discussion with locals (pers. com. Forrest Travirca, May 18, 2006) extremely familiar with the area. Depths varied from primarily less than 1.5 feet in most of the project area, 3 feet in some of the ponds (indirect area), 8 to 10 feet in other ponds (out of project area), 5 to 8 feet in the canals, as much as 18 feet in one area (outside of project area), and 25 feet at the cross section of Bayou Moreau and the BP canal.

Direct Benefit Area Caminada Alternative 5
FWOP
TY0 70% Assume that all shallow water is within the fragmented marsh, on the edge of canals, bayous, bays, and ponds. Within the direct and indirect area of this project it was estimated that about 70% of the open water areas was less than 1.5 feet. Previously assumed 75%. We decreased the amount to account for 2 more years subsidence.
TY1 70%
TY3 67%
TY5 65%
TY7 63%
TY9 61%
TY10 60% over time shallow water becomes deeper as material is flushed out of the system through the tidal prism. Though new shallow water is created as marsh is lost we assume slightly more loss of shallow open water converting to greater than 1.5 feet deep.
TY11 57%
TY13 55%
TY15 52%
TY17 50%
TY19 45%
TY20 45%
TY21 40%
TY23 40%
TY25 35%
TY27 35%
TY29 30%
TY30 30%
TY31 25%
TY33 25%
TY35 20%
TY37 15%
TY39 15%
TY40 10%

TY41 10%
TY43 8%
TY45 7%
TY47 7%
TY49 6%
TY50 5%

Direct Marsh Area Caminada Alternative 5
FWP
TY0 70%
TY1 100% Most open water is filled in.
TY3 95% Assume that most of the marsh lost to open water becomes shallow open water.
TY5 95%
TY7 90%
TY9 85%
TY10 85% Over time water remains shallow with renourishment and overwash.
TY11 85%
TY13 85%
TY15 85%
TY17 80%
TY19 80%
TY20 80%
TY21 80%
TY23 80%
TY25 80%
TY27 80%
TY29 80%
TY30 80%
TY31 75%
TY33 75%
TY35 75%
TY37 75%
TY39 75%
TY40 75%
TY41 60%
TY43 60%
TY45 60%
TY47 60%
TY49 55%
TY50 55%

Indirect Benefit Area Caminada Alternative 5
FWOP
TY0 70% Assume that all shallow water is within the fragmented marsh, on the edge of canals,

bayous, bays, and ponds. Within the direct and indirect area of this project it was estimated that about 75% of the open water areas was less than 1.5 feet.

TY1 70%
TY3 70%
TY5 65%
TY7 65%
TY9 60%
TY10 60%
TY11 60%
TY13 55%
TY15 55%
TY17 50%
TY19 50%
TY20 45%
TY21 45%
TY23 40%
TY25 35%
TY27 35%
TY29 30%
TY30 30%
TY31 25%
TY33 25%
TY35 20%
TY37 20%
TY39 15%
TY40 15%
TY41 15%
TY43 10%
TY45 10%
TY47 5%
TY49 5%
TY50 5%

Indirect Benefit Area Caminada Alternative 5

FWP

TY0 70% Assume that all shallow water is within the fragmented marsh, on the edge of canals, bayous, bays, and ponds. Within the direct and indirect area of this project it was estimated that about 70% of the open water areas was less than 1.5 feet.

TY1 75% - 34% water
TY3 75%
TY5 75%
TY7 75%
TY9 80%

TY10 80% - 12% water
TY11 80%
TY13 80%
TY15 80%
TY17 80%
TY19 75%
TY20 75% -7% water
TY21 75%
TY23 75%
TY25 75%
TY27 70%
TY29 70%
TY30 70%
TY31 70%
TY33 65%
TY35 65% -86% water
TY37 65%
TY39 60%
TY40 60%
TY41 60%
TY43 55%
TY45 55%
TY47 50%
TY49 50%
TY50 45% - 80% water

Variable V5 – Average annual Salinity
Based on salinity readings from the May 2006 field trip average salinities were 31 ppt. Storm surges associated with Hurricanes Katrina and Rita in 2005 introduced saline waters to the study area, and low levels of precipitation have resulted in continued high salinities in the area. These readings were assumed to be abnormally high.

The baseline salinities from the LCA Barrier Island Study of 20 ppt were used. Although current salinity readings are higher, assume 20 ppt as the baseline for the model purposes. Salinity remains the same for direct and indirect FWOP and FWP for all TYs.

Variable V6 – Aquatic organism access
Direct and Indirect benefit areas Caminada Alternative 5
FWOP
TY0-TY50 1

Direct benefit area Caminada Alternative 5
FWP

TY0		1
TY1		0.0001 Marsh platform is impounded by retention dikes
TY3	1	Assume retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks are constructed in the intertidal marsh habitat.
TY5-TY50		1

Indirect benefit area Caminada Alternative 5

FWOP and FWP

TY0	1
TY1-TY50	1

Literature cited

Coastal Engineering Consultants, Inc. 2005. Barataria Barrier Shoreline Restoration Feasibility Study, Appendix C, Caminada Headland, LDNR Contract No. 2503-05-47, Lafourche Parish, Louisiana.

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Richie, W., et al. 1995. "Coastal Sand Dunes of Louisiana, The Bayou Lafourche Barrier Shoreline," Coastal Geology Technical Report no. 9. Louisiana Geological Survey and University of Aberdeen, Scotland.

SJB Group, Inc. and Coastal Engineering Consultants, Inc. 2005. "Barataria Barrier Shoreline Restoration Feasibility Study- Appendix C: Caminada Headland."

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APPENDIX B

HABITAT ANALYSIS PROJECT INFORMATION SHEETS FOR SHELL ISLAND

Project Information Sheet Barrier Island Value Assessment
SHELL ISLAND
28 March 2008

Draft

Project Name: Barataria Basin Barrier Shoreline Restoration Shell Island Feature

Project Type(s): Barrier island restoration, marsh creation, vegetative planting

Sponsoring Agency: Louisiana Department of Natural Resources and US Army Corps of Engineers
Preparer of information sheet: Catherine Breaux/Patrick Williams
Information found in this project information sheet was obtained primarily from the Draft Feasibility Report appendix (CPE 2005 and 2007).

Project Area: The Barataria/Plaquemines barrier island complex lays approximately 49 miles south-southeast of New Orleans, Louisiana. Tidal creeks, man-made canals, marshlands, sandy barrier islands, and several bays characterize the barrier island complex. The remnants of Shell Island are located between Fontanelle Pass (Empire Jetties) and Grand Bayou Pass. Shell Island used to enclose both Bastian Bay and Shell Island Bay but has since disintegrated into several smaller islands and shoals. The project area is located in Plaquemines Parish.

The project boundaries were defined based on the outer edges of the landmasses digitized from the 2004 DOQQ's. The west end of Shell Island West was included within the project boundary as it was anticipated that area could be affected by construction of any alternative. Existing Shell Island remnants were included within the boundary to incorporate the without project conditions.

Problem: Shoreline recession and erosion have resulted in the disintegration of Shell Island. The few remaining islands and shoal remnants provide limited protection to the back barrier environment from waves and flooding. The construction of the Empire Jetties restricted the east to west longshore transport and increased the loss rates of Shell Island. Hurricane Bob in 1979 created a new inlet (Coupe Bob) that accelerated retreat and sediment loss.

Goals and Objectives
The objectives of this project are to reestablish a barrier(s) between a threatened estuarine ecosystem and the Gulf of Mexico, increase the sustainability of the barrier island shoreline system, restore the geomorphic function of the barrier shoreline in the vicinity of Shell Island, restore shoreline, dune, and back-barrier marsh to increase habitat utilization by essential fish and wildlife species both on the barrier island and in the consequently developed quiescent bays.

Specific post-construction acreage goals for Alternative 1 are:

1. Achieve 158 acres of dune and supratidal acreage on Shell Island West.
2. Achieve 74 acres of marsh (intertidal acreage) on Shell Island West.
3. Achieve 223 acres of dune and supratidal acreage on Shell Island East.
4. Achieve 191 acres of marsh (intertidal acreage) on Shell Island East.

Project Features
Construction and Design Templates

Dune/Beach
The alternatives include a beach and dune fill to reestablish a sustainable barrier island shoreline system, thus restoring the geomorphic function and increasing the habitat utilization by fish and wildlife species. The construction cross-section was based on templates used for projects previously constructed in Louisiana. The dune design is to +6feet, NAVD with a back- and fore-slopes of 1V:45H. The dune crest width varies by alternative. Other barrier island projects in Louisiana have used a steeper construction slope (1V:30H) on the bayward side because these islands have been relatively intact and the island provides a means of fill retention, allowing steeper slopes to be constructed. Most of Shell Island will be constructed in open water or on scattered island remnants. The +6.0 feet, NAVD dune elevation is above the 20-year return period surge elevation (+5.9 feet, NAVD).

The crest width of the dune is a function of the purpose of the individual alternatives. The dune width for Alternative 1 is based on a cost and target acreage goals that dictate the volume and cross-section width. Alternative 2 through 8 will be based on a design width plus various advanced nourishment width.

The beach profile equilibration process assumes that there is only cross-shore redistribution of sediment and that sand volume is conserved. It is estimated that the mean high water shoreline will retreat approximately 20 feet due to profile equilibration.

Construction of sand fencing and planting of vegetation along the dune will promote additional elevation growth of the dune by holding the blowing sand. A 5-foot wide +9 feet NAVD additional dune element was added to the top of the construction template to simulate this increase in dune elevation. It was assumed that this additional dune feature would take approximately 1 year to form.

A beach nourishment cross-section consist of two primary components: 1) the design section, which is the fill volume required at TY50 to meet applicable project goals, and 2) advanced nourishment, which is the sacrificial portion of the fill that will erode over the 50-year project life. Sufficient advanced nourishment can be added during construction or replaced periodically during renourishment projects. Advanced fill is distributed non-uniformly to account for diffusion losses, longshore losses, and tidal inlet losses, that vary along the project length.

Marsh
The proposed marsh construction elevations were based on developing an intertidal marsh over the life

of the 50-year project, considering the rate of relative sea level rise, and consolidation of placed and subgrade sediments. The average elevation of the existing marsh platform on Shell Island was determined to be approximately +1.1 feet, NAVD. This elevation is comparable to other marsh platforms in the area such as East Grand Terre, Chaland Headland, and Pelican Island. The 2005 mean high water and mean low water elevations are +1.63 feet and +0.58 feet, NAVD respectively, demonstrating that the existing marsh is inundated during the tidal cycle.

The proposed marsh platform has a 50-year project life. The critical goal is to construct a marsh platform that maintains an elevation between mean high water and mean low water through TY50. With an assumed start date of 2009, the mean high water and mean low water elevations will rise from +1.64 feet to +2.26 feet, NAVD and +0.58 feet to 1.23 feet, NAVD, respectively. This is due to an average eustatic sea level rise of 0.013 feet/year. Therefore, the marsh was designed to obtain a marsh elevation above +1.2 feet, NAVD at TY50. The marsh platform will have to be renourished periodically over the life of the project so that it remains within the tidal zone.

Temporary containment dikes are proposed to contain the marsh fill material during construction. The material for dike construction will be dredged from within the footprint of the marsh so that the excavated area is filled during construction. The dike volume is included within the marsh fill volume.

Alternative 1 – two islands with no renourishment
East Island has a target (see goals above) of 223 acres of beach/dune and 191 acres of marsh following construction. Dune width is approximately 281 feet wide and is uniform along the length of the 15,400-foot long dune. Most of the sand fill is being placed in front of the existing island. Fill quantities for the beach/dune and marsh fills are 2.9 million and 1.1 million cubic yards respectively. Marsh width varies from 525 – 1,200 feet wide.

West Island will have 158 acres of dune and 74 acres of marsh following construction. Dune width is approximately 688 feet on the east end compared to 196 feet on the west end. Total length is 5,500 feet. The proposed beach fill extends partially into Coupe Bob. The marsh on west island follows the outline of the LCA plan, which as a triangular shape. Fill quantities for the beach/dune and marsh fills are 1.3 million and 0.7 million cubic yards respectively.

The constructed marsh elevation is +2.5 feet, NAVD. Alternative 1 is expected to create 293 acres of additional marsh behind Shell Island East and West under one construction event (no renourishment). Approximately 40 acres will be enhanced by increasing the existing elevation, so a total of 333 acres will be created or enhanced.

Constructing the marsh elevation at an elevation of +2.5 feet, NAVD will result in a marsh that will become bay intertidal during TY2 (2011) and remain bay intertidal until TY50 (2059). The marsh will be continually submerged (average elevation below mean low water) after TY34 (2043). The long term goal of maintaining the marsh elevation above elevation 0 feet, NAVD at TY50 can only be achieved by increasing the construction elevation above +2.6 feet, NAVD but this increases the time required for the marsh to subside to the mean high water level, and so reduces project benefits in the near term. Total fill

quantities for the beach/dune and marsh fill are 4.1 million cubic yards of sand and 1.9 million cubic yards of sediment respectively.

Alternative 2 – two islands with renourishment
Alternative 2 includes periodic nourishment using the Alternative 1 fill plan as the starting point.

Shell Island West dune crest width has been increased gulfward by 82 feet; to provide 16 additional acres of dune acreage and additional advanced fill to last through the first renourishment project in 10 years. Fill quantities for the beach/dune and marsh fills are 1.4 million and 0.6 million cubic yards respectively.

The width of the Shell Island East dune crest has been reduced 3 feet to 278 feet wide, decreasing the dune acreage by 1 acre. The fill quantities for the beach/dune and marsh fills are 2.9 million and 1.0 million cubic yards respectively.

Since Alternative 2 is being renourished it is possible to use a different marsh construction elevation than was used for Alternative 1 to maximize the time period that the marsh is within the WVA bay intertidal zone, as well as within the mean high water to mean low water range. The recommended construction elevation is +2.0 feet, NAVD. Alternative 2 incorporates a marsh renourishment every 20 years.

Total fill quantities for the beach/dune and marsh fills are 4.3 million and 1.6 million cubic yards respectively.

Alternative 3 –one island with no renourishment
Dune crest is a uniform 189 feet wide along the length of the island. Following equilibration of the beach fill, total island width will be approximately 1,240 feet wide (typical Louisiana barrier islands have widths of 1,000 to 1,500 feet wide).

The landward dune crest of Alternative 3 is located in front of the existing shoreline, as with Alternatives 1 and 2. The closure of Coupe Bob is expected to return the tidal prism to its pre-1979 path of flowing through Grand Bayou and it is expected that Grand Bayou will increase in size. The west end terminus of Alternative 3 is close to the western limit of the 1973 shoreline location of Shell Island in anticipation that Grand Bayou will start to widen.

Coupe Bob – The single island option crosses Coupe Bob with depths approaching –10 feet, NAVD in the main channel. In deeper water it is not feasible to construct the marsh section with only marsh sediments, as the marsh will settle too rapidly and non-uniformly to erform its intended purpose effectively. To construct a marsh at +2 or +3 feet, NAVD would require lift heights that are 12 or 13 feet high, resulting in differential settlements across the island of 2 or 3 feet over 20 years, which can lead to sever plant stress and reduced growth. Therefore, it is recommended a sand platform base would be constructed up to –3 feet, NAVD with marsh on top of this base. In the middle of Coupe Bob where the sand base has been constructed, the contractor would likely have to transport the muds from the

shallow bay areas for construction of a dike to create the marsh platform. A second option is to install a geotextile tube for containment of the marsh fill where the –3 feet, NAVD sand base is constructed. The geotextile tube could be filled with sand from the sand base. This option is shown in the plans. A third option could be to construct the dike with sand fill but this would require a wide crest as the sand dike will be exposed to waves coming from the north across Bastian Bay.

Marsh width is a uniform 735 feet. Alternative 3 will have no renourishment of the marsh fill. The recommended construction elevation is +2.0 feet, NAVD. Alternative 3 will have marsh submerged below MLW by TY18 (2027). The marsh fill should be considered intertidal a the way through TY50 (2059).

Total fill quantities for the beach/dune and marsh fills are 5.6 million and 2.1 million cubic yards respectively.

Alternative 5 – single island with renourishment
Alternative 5 has an identical construction template as Alternative 3. Alternative 5 will initially be constructed with 10 years of advanced nourishment, requiring 5.6 million cubic yards of beach fill, which will create 317 acres of beach/dune area (area above +2 feet, NAVD). The marsh fill will be renourished to its original construction template at 20 and 40 years after construction. The marsh elevation will be below the MLW at TY18 (2027) before returning to its original elevation of +2.0 feet (NAVD) after TY20.

Borrow Areas
It is expected that two borrow sources will be used for this project: a high-quality sand source for the beach-dune portion of the project and an offshore mixed-sediment deposit to be used for the marsh construction. It was assumed that the Mississippi River is the source of high-quality sand that would be used for this project. The Empire borrow area is assumed to be used for the marsh construction. The Empire borrow area was previously evaluated and is expected to be used for the Pelican Island Restoration Project. This will leave the borrow needs for this project short. It is expected that more sediment is out there and further investigations are needed.

Several other borrow areas were suggested for investigations for use of mixed sediments for marsh restoration, primarily including Empire, Quatre Bayou deep (will be partially used for the restoration of Chaland Headland), Quatre Bayou D2, and Sandy Point (farthest away). Others were discussed and further investigation is recommended to find the closest mixed sediment source for marsh restoration. Ship Shoal was also discussed as another source of high quality sands for beach-dune creation. However, the distance to the project site makes this sand source prohibitively expensive.

As-built Conditions

Alternative 1 – two islands with no renourishment

On both Shell Island East and West approximately 336 acres of the TY1 supratidal acres are marsh platform areas that will be above +2.0 feet immediately after construction. Based on settlement curves and elevations of existing marsh, it is projected that all of the marsh platform will settle to intertidal range by TY3.

Shell Island East - As-built, TY1 configuration is anticipated to create 126 acres of dune, 297 acres of supratidal, and 47 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 11 acres of as-built dune area.

Shell Island West - As-built, TY1 configuration is anticipated to create 51 acres of dune, 192 acres of supratidal, and 21 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 8 acres of as-built dune area. All of the beach and marsh fill placed during construction of Shell Island West will have eroded in 23 years (TY25), leaving pre-construction conditions. By TY25 Shell Island West will have receded to the point where there is no supratidal acreage. Once the supratidal acreage is lost, it was assumed that the marsh would be exposed to wave action from the Gulf and that the marsh would recede at the gulf retreat rate.

The shoreline recession rates are 34.9 feet/year for Shell Island West and 12.4 feet/year for Shell Island East. Subtidal acreage decreases following construction because parts of the subtidal acreage are located within the construction footprint.

The volume of sand that could be lost into Coupe Bob every year from the two-island option is approximately 101,000 cubic yards. At this rate it would take Coupe Bob approximately 33 years to reach its accommodation volume of 3.3 million cubic yards. It is unlikely that Coupe Bob will reach its accommodation volume given that the total volume of sand fill placed in Alternative 1 is 4.1 million cubic yards but it does suggest that little natural bypassing of sand should be expected across Coup Bob.

Alternative 2 – two islands with renourishment

The shoreline recession rates are 35.2 feet/year for Shell Island West and 12.3 feet/year for Shell Island East. After TY35, the shoreline recession rate is assumed to decrease from 35.2 feet/year to 11.8 feet/year on Shell Island West and from 12.3 feet/year to 5.4 feet/year on Shell Island East.

Shell Island East - As-built, TY1 configuration is anticipated to create 125 acres of dune, 103 acres of supratidal, and 241 acres of intertidal areas. The constructed marsh elevation is +2.0 feet, NAVD so it is considered bay intertidal upon construction. Dune equilibration losses are reflected at TY2 with the loss of 11 acres of as-built dune area.

Shell Island West - As-built, TY1 configuration is anticipated to create 67 acres of dune, 44 acres of supratidal, and 160 acres of intertidal areas. The constructed marsh elevation is +2.0 feet, NAVD so it is considered bay intertidal upon construction. Dune equilibration losses are

reflected at TY2 with the loss of 7 acres of as-built dune area.

The optimum renourishment interval for the beach is 10 years, with the marsh being renourished every 20 years.

It is estimated that the Coupe Bob ebb shoal will grow by 101,000 cubic yards/year and require 33 years to reach its accommodation volume. As Coupe Bob approaches its accommodation volume, more sand will be bypassed across the inlet. As the net longshore drift is east to west, the sand transported longshore from Shell Island East will no longer be lost to the ebb shoal, but instead be transported across the inlet. The GENESIS model does not account for this change in coastal processes due to infilling of the ebb shoal. It was assumed the longshore losses on Shell Island East were reduced to 10,000 cubic yards/year (from 52,000 cubic yards/year) at TY35 and that longshore losses from Shell Island West were reduced to approximately 18,500 cubic yards/year (from 79,000 cubic yards/year). Coupe Bob is capable of reaching its accommodation volume because of the sand volume added to the project area during the renourishment cycles.

Alternative 3 – 10 years advanced fill and no renourishment

As-built, TY1 configuration is anticipated to create 153 acres of dune, 165 acres of supratidal, and 525 acres of intertidal areas. The constructed marsh elevation is +2.0 feet, NAVD so it is considered bay intertidal upon construction. Dune equilibration losses are reflected at TY2 with the loss of 16 acres of as-built dune area. Alternative 3 has more than 100 additional acres of bay intertidal acreage compared to Alternative 2.

The construction of Alternative 3 will result in increased flow through Grand Bayou and Fontanelle Pass as the tidal prism is redirected due to the closure of Coupe Bob. It is expected that the increased flow through Grand Bayou will start to reopen the pass and it could expand to its pre-1979 size. The western end of Shell Island West would likely be eroded and the sediment transported to the Grand Bayou ebb shoal. It is assumed that the erosion of the west end of Shell Island West will occur within 10 years of construction.

A bayside recession rate of 3.6 feet/year was assumed. No benefit has been included for the construction of the geotextile tube on the bay side, as this is a construction option available to the contractor and may not necessarily be conducted. Ignoring erosion protection provided by the geotextile tube provides a conservative acreage assessment.

A breach analysis was conducted on Alternative 3 to access its breaching potential (for the breach analysis assumptions refer to the General Methodology and Assumptions Section). The recession rate of the total island length due to breaching is 631 feet/year at TY31 and slowly decreases every year to a rate of 397 feet/year by TY50. Breaching occurs at TY30, with the breaching effects beginning at TY31.

Alternative 5 – single island with renourishment

Alternative 5 is again designed to have the same construction template as Alternative 3. As-built, TY1 configuration is anticipated to create 153 acres of dune, 165 acres of supratidal, and 525 acres of intertidal areas. The constructed marsh elevation is +2.0 feet, NAVD so it is considered bay intertidal upon construction. Dune equilibration losses are reflected at TY2 with the loss of 16 acres of as-built dune area. Alternative 5 has a renourishment interval of 20 years. Both the beach and marsh fill will be renourished at TY20 and TY40. Alternative 5 creates the same initial acreages as Alternative 3 but a total of 699 acres remain after 50 years. Since only 10 years of advanced fill will be added at the TY40 renourishment, the design section will be exposed at TY50.

Operations and Maintenance Phase

The following planting plan was adapted from a DNR plan after recommendations from the agencies including means to achieve optimal environmental benefit based on percent cover values in the Barrier Headland and Wetland Island Value Assessment models, funding considerations, and expected annual industry limitations. Note that this should be viewed as a preliminary/conceptual planting plan only, to be amended as needed and site conditions warrant if the project is constructed. Planting density could be increased (5'-7' centers) if the budget allows. Also if the budget allows, for optimal results, herbaceous and woody species plantings on all habitat types should be phased, with the first phase of herbaceous plantings occurring at TY1 and woody plantings at TY3.

General assumptions include:

- strive to develop a planting plan to attain optimal functionality for less than 5% of the construction cost (without contingency)
- plant 100% of the dune (that includes the crown and slopes)
- plant 100% of the bayside supratidal and gulfside supratidal including the seaward berm and dune downslope, but not the beach
- aerially seed the dune and supratidal (for conservative cost estimating purposes only assumed aerially seeding all of the supratidal acres)
- plant 50% of the marsh acres; half in TY2 and half in TY3

DUNE & SUPRATIDAL PLATFORM:

Species

Seeding of the dune platform (aerial or ground application) could be considered depending on the time of the year construction is completed. Rye grass seed could be considered if construction is completed in the summer or fall to be used as a ground cover during the winter months. Bermuda grass seed has been dispersed on the barrier island dune platforms in the past as well, but with strong objection by some Federal and state wildlife agencies as it is non-native.

Herbaceous dune and supratidal plants will consist of a variety of dune species including bitter panicum (*Panicum amarum* var *amarum* 'Fourchon'), sea oats (*Uniola paniculata* 'Caminada'), marshhay cordgrass (*Spartina patens* 'Gulf Coast') and gulf cordgrass (*Spartina spartinae*). Plants shall be grown mainly in four-inch containers (sea oats in a slightly larger container.) The aforementioned recommendations are general recommendations. Species recommendations may change due to soil properties and conditions, elevation after final construction, salinity, available soil

moisture, and other site conditions. Other plants that could be considered to add diversity (other than the plants mentioned) are seacoast bluestem (*Schizachyrium maritimum*), seashore dropseed (*Sporobolous virginicus*), and salt grass (*Distichlis spicata*).

Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, iva, baccharis, and hercules club.
It has been suggested that more woody vegetation be included on Caminada than Shell Island. Planting of woody species should be delayed until TY3 to allow for stabilization and leaching of salt from deposited material.

Density
Plants on the dune, supratidal, and marsh platforms would be installed in variable density patterns based on site conditions. For quantity and cost estimating purposes, it was assumed that plants would be installed on 8' centers throughout 100% of appropriate dune and supratidal acreage at the certain target years. For estimating purposes, woody vegetation also was assumed to be planted on 8' centers throughout 15% of the dune, swale, and marsh acreage.

MARSH PLATFORM:
Species
Herbaceous marsh plants will consist of mainly smooth cordgrass (*Spartina alterniflora* 'Vermilion'). A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated to add a larger seed bank for black mangroves. Plants shall mainly consist of vegetative plug material or four-inch containers (smooth cordgrass), or tube-tainers (mangroves).

Density
The planting density was assumed to be 8' on center applied to 100% of the marsh acres.

Total Costs:
All prices mentioned includes: cost of plant, delivery, fertilizer, transportation, installation, etc. However, note that recent post-storm cost estimating (since preparation of the Shell Island Vegetation Cost estimates) generally are now including $20,000 mob/demob and $4/plug for the herbaceous marsh plants, and $8 to 10/plant for the woody species. Unit costs are consistent with guidance by NRCS and LDNR as recommended to the CWPPRA program on ppl18. Also note that the total amount of plants project during TY1 for the various alternatives is a substantial amount likely matching or exceeding the current industry annual supply.

Alternative	Alt 1	Alt 2	Alt 3	Alt 5
Estimated Cost	$3,189,223	$2,324,779	$2,488,652	$2,490,190
Percentage of construction cost	4.2%	3.0%	2.5%	2.5%

One shore parallel fence will be installed about 50 feet north of the southern toe of the dune to continue the capture of transported sand until the surface is vegetated. The sand fence will extend along the total length of the constructed dune. Sand fences must be installed in sequence/phases. The installation should start from the southern side of the dune so as to build dune towards the Gulf and proceed north. Additional rows of sand fencing can be added once the existing sand fence is full (i.e. sand is stacked up to the top of the fence.)

Monitoring Information/Adaptive Management Recommendations:
Adaptive management involves monitoring the evolution of the project and updating the project design to incorporate the additional data. It is recommended that annual surveys be conducted of the project area. This includes surveys of the beach and marsh, as well as hydrographic surveys of the offshore, back bay and tidal inlet areas. This will allow for the development of an accurate sediment budget by which sediment transport in the area can be tracked. This will be especially important for Alternative 2 where the rate of growth of Coupe Bob ebb shoal could impact the renourishment interval. The surveys will provide a basis for distributing advanced fill along the project length.

Monitoring of the project will also indicate the performance of the island elevation. This will indicate whether future renourishment projects should be constructed at higher or lower elevations. The limited geotechnical data available makes adaptive management more important for this project, especially with regard to the marsh elevation.

Additional studies should be conducted to model water circulation and current velocities in the back bays and inlets to help determine the benefits or disadvantages a single island option.

Site Characteristics
The average wave height is 2.7 feet
The rate of relative sea level rise is treated as a constant over the 50-year project life, equal to 0.0430 feet/year.
Hurricane Bob occurred in 1979. The formation of Coupe Bob caused a quadrupling of the retreat rates of Shell Island and is the major reason for the disintegration of the island.
The Empire Jetties were constructed in 1950. The Empire Jetties increased shoreline recession approximately 10 feet/year along the easternmost 5,000 to 8,000 feet of the island.

General Methodology and Assumptions -*This section summarizes the procedures used to develop planform performance projections.*

Assuming construction takes one year for Alternative 1 and 2 and two years for Alternative 3 through 8 and a 100% vegetation occurs within 3 years following construction, benefits from detritus will begin at TY5 (2014) for Alternatives 1 and 2, and TY6 (2015) for Alternative 3 through 8.

Shoreline recession rates were determined by the following. Shoreline recession rates were determined for the 1956 to 1973 time frame (prior to the formation of Coupe Bob). The Dynamic Morphosedimentary Model was used to differentiate between longshore, cross-shore, and subsidence losses. A longshore transport curve was developed for the 1956 to 1973 timeframe. The GENESIS model was calibrated to match the longshore transport curve. The three alternatives were modeled using GENESIS. This provided shoreline recession rates due to longshore transport. Shoreline recession rates (due to longshore transport) were converted to volumetric losses. Volumetric cross-shore losses due to relative sea level rise were added to the volumetric longshore losses. Volumetric losses were then converted to a shoreline recession.

The erosion rates incorporate storm events for shoreline recession. It averages the shoreline recession rate rather than having distinct changes following a storm event. Also, it does not account for a change in the cross-shore profile due to a storm event.

FWP for alternatives 1 a total average shoreline recession of 12.4 feet/year for Shell Island East and a total shoreline recession of 34.9 feet/year for Shell Island West was used. The Gulfside recession rate for Alternative 2 are 35.2 feet/year for Shell Island West and 12.3 feet/year for Shell Island East. Alternative 3 and 5 total Gulfside recession rate is 7.9 feet/year. The shoreline recession rate is less for alternative 3 and 5 than it was for alternatives 1 and 2 because the longshore losses are lower since there is no loss from either Shell Island East or West into Coupe Bob and sand is only lost into Grand Bayou. The average bayside recession value of 3.6 feet/year was used to estimate future bayside marsh recession. The volume lost due to wave action was assumed to be transported outside of the project boundaries.

The volumetric change estimate was based on the shoreline change data because few of the surveyed profile lines crossed the existing island and therefore the profiles could not provide volume change estimates. Shoreline change between 1956 and 1973 was used as this time period is the latest time period that had an intact shoreline.

Coup Bob could form an ebb shoal containing 3.4 million cubic yards of sediment. The formation of the Coupe Bob ebb shoal appears to be constrained by a lack of available sediment in the current system. The two island without renourishment scenario will likely form a partial offshore bar, while the two island with renourishment alternative is expected to take 33 years to reach its accommodation volume. As Coupe Bob approaches its accommodation volume, more sand will be bypassed across the inlet.

The total acreage in the project boundary changes over the target years as project site conditions change. Genesis modeling and the sediment budget are used to quantify barrier island shoreline changes and thus acreage values. The project boundaries were defined based on the outer edges of the landmasses digitized from the 2004 DOQQ's. The west end of Shell Island West was included within the project boundary as it was anticipated that this area could be affected by construction of any alternative. Existing Shell Island remnants were included within the boundary to incorporate the without project conditions. The areas for the without project

condition that lie outside of the construction template are included in the acreage estimates for all three alternatives. No change in recession or subsidence rates is applied to the areas outside the construction footprint.

The higher and wider constructed beach elevation will limit the amount of island overtopping and thus restrict nourishing of the marshes in the back. The beach section will maintain its elevation due to the natural processes of island building while the marsh will sink.

The beach profile equilibration process assumes that there is only cross-shore redistribution of sediment and that sand volume is conserved. It is estimated that the mean high water shoreline will retreat approximately 20 feet due to profile equilibration.

The dune, supratidal, and gulf intertidal contours are parallel and retreat at the same rate (no change in cross-shore profile) following cross-shore profile equilibration.

Subsidence is uniform and there is no differential settlement due to fill heights differences or variations in the constructed elevation. There is no subsidence of the dune, (sand fill) supratidal, or gulf intertidal areas due to dynamic morphosedimentary principles. The volume to counterbalance subsidence is included in the shoreline recession rate. Subsidence of the (marsh fill) supratidal and bay intertidal areas incorporate regional subsidence, primary and secondary consolidation, dewatering, and detritus to develop total subsidence rates. Marsh elevations were based on the marsh settlement curves presented in section 4.4 of the Draft Feasibility Report appendix (CPE 2005).

The bayside perimeter of the dike recedes at 3.6 feet/year due to wave action. Once the dike recedes past the +2.0 feet, NAVD contour, the marsh perimeter begins to recede at 3.6 feet/year. Dike and marsh material lost due to bayside recession is assumed to remain in suspension and settle outside of the project boundaries.

An estimate of existing (2005) acreages was developed based on the 2004 DOQQ's, 2005 JCLS survey, and the July 18, 2005 site visit. Due to a lack of recent onshore survey data for the project area, the acreages for the current conditions within the project boundary were derived from digitizing the visible shorelines of the 2004 DOQQ's. These shorelines were assumed to be the +0.6 feet, NAVD contour (mean low water).

Changes in island profile are derived from SBEACH. GENESIS was used to generate acreage projections. The dynamic morphosedimentary model was used to calibrate GENESIS. SBEACH was used to develop the design template and predict cross shore performance.

Survey data was used and rolled forward to 2009 (TY0) based on anticipated losses derived from GENISIS modeling, sea level rise and associated northward shifting (i.e., translocation) of the cross section for FWOP conditions. The equilibrium profile was used for the FWP conditions.

Annual and episodic events are incorporated into losses through the application of GENESIS modeling, which assumes that the profile/cross section does not change shape but merely recedes or is translocated northward. Planform areas were calculated by applying GENESIS derived shoreline positions. GENESIS includes 20-year storm effects.

FWP TY1 represents the as-built configuration. FWP TY2 includes post-construction beach equilibration losses (for all alternatives) and conversion of the marsh platform to intertidal elevations for alternative 1.

The intertidal (bayside) losses applied by the design engineer included 3.6 feet/year that was applied to the bayside edge. Due to the substantially contained nature of the marsh platform, interior intertidal marsh losses are not projected by the design engineer. However, we do anticipate some internal loss of intertidal marsh functions, especially during the later portion of the Alternative 1 project life. Although decreases in the elevation of the marsh platform are not anticipated to reduce elevation below 0.0 feet throughout TY50, it is expected that a portion of these areas would be too low to support emergent vegetation. These losses are reflected in V4, Percent Subaerial Vegetated Variable by adjusting the portion of the marsh platform that is vegetated at various TYs.

FWOP TY3 and TY5 were included because the data were available. It may not be necessary to include these TYs. FWP TYs 3 and 5 are included solely for percent vegetation variables.

Over the 50-year project life (2009 to 2059) the relative sea-level rise is increasing and a relative sea-level rise rate of 0.0463 feet/year was calculated for 2059. The rate of relative sea-level rise will be treated as a constant over the 50-year project life, equal to 0.043 feet/year.

NOAA (July 2004) has published updated subsidence rates in south Louisiana that suggest a higher subsidence rate than that developed by the NRC for Grand Isle. An average subsidence rate of 0.0430 feet/year was calculated by averaging the subsidence rate f 65 monuments located between Venice and Port Sulphur, compared to the historic value of 0.292 feet/year. However the Corps has indicated a preference to use 0.0292 feet/year as the subsidence rate to maintain consistency with other project analyses (E-mail correspondence with Beau Tate, 2007). The concern is that the recently measured values may be influenced by their location adjacent to developed areas, which due to development may be causing localized subsidence and thus not representative of subsidence along the barrier island chain.

The following assumptions were for the breach analysis conducted on Alternative 3.

Breaching can be expected to occur after the interior width is less than 300 feet.

The initial width of the beach and marsh following construction will be 585 and 370 feet respectively, yielding an initial island width of 955 feet.

Equilibration of the beach, which is expected to occur during the first year following construction, will decrease the beach width by 20 feet.

The Gulf side of the beach will retreat at a rate of 7.9 feet per year.

The Bay side of the marsh will retreat at a rate of 3.6 feet per year until the marsh subsides below mean low water, which is expected to occur after TY19.

After the marsh subsides below mean low water, the Bay side of the beach will retreat at a rate of 3.4 feet per year.

The following assumptions were for the dynamic morphosedimentary model input:

Shoreline retreat rate is 26 feet/year. 20 feet/year is from cross-shore loss and 6 feet/year is from long-shore loss. The 1956 to 1973 period was used because it was after the construction of the Empire Jetties but prior to the formation of Coupe Bob in 1979.

The process of storm overwash and relative sea level rise combine to effectively compress the island footprint to allow it to keep pace with relative sea level rise. Shell Island retreats an average of 8.4 feet/year to provide sufficient sediment for the rate of rise of the island element to match the relative sea level rise rate.

The rate of relative sea level rise was estimated to be 0.043 feet/year for this section of Louisiana between 2009 and 2059. The relative sea level rise of 0.039 feet/year was used in this model because this model was calibrated using the estimated 1956-1973 time period. A relative sea-level rise rate of 0.039 feet/year was used in the dynamic morhosedimentary model based on rates presented in the Chaland Headland and Pelican Island Barrier Shoreline Restoration Projects (CPE, 2003b).

Alternative 1 – two islands with no renourishment Shell Island East

V1, V2, and V3 – Percent subaerial area that is dune, supratidal and intertidal, respectively
See attached spreadsheet.

Variable V4 - Percent vegetative cover of dune, supratidal, and intertidal habitats
Based on site visits (July 2005), examination of pre and post-storm photography, and post-storm flight, wetland habitat on both islands is primarily vegetated by *Spartina alterniflora*, *S. patens*, black mangrove, sea oxeye, *Iva frutescens*, *Distichilis* spp., roseaucane, and seaside purslane. Shell Island East is characterized primarily by remnant shoals with very little subaerial habitat.

FWOP Shell Island East

TY0 45% There is no dune or supratidal habitat, thus no dune or supratidal vegetation present. Of the bayside intertidal habitat (40 acres), it is estimated that about 30% of the existing subaerial is vegetated and about 70% is barren (overwash flats, beach). This estimate is based mostly on post storm flight, pre and post storm photography (Oct 2005, June 2005, Oct 2004), and July 2005 site inspection.

TY1 45%

TY3 40% The area will continue to deteriorate.

TY5 33% Minor decreases in percent vegetative cover due to continued deterioration and lowering of profile.

TY10 20% Only 7 acres of bayside intertidal and 11 acres of gulfside intertidal habitat still exist. (50% of 7 acres)/18 subarial acres.

TY20 5% 2 acres of bayside intertidal and 8 acres of gulfside intertidal habitat exist. (25% of 2 bayside intertidal acres)/10 acres.

TY50 0% There are no subaerial acres left by target year 50.

FWP Shell Island East

TY0 45%

TY1 5% (115 dune acres + 103 supratidal acres @ 10% cover)/470 subaerial acres.
Assume: 100% of post-equilibration (i.e., TY2) dune acres and associated back slope (i.e., post-equilibration, TY3 supratidal acres) planted at TY1 (immediately post-construction), resulting in planting of a portion of the subaerial project area. This assumes only planting the area of the dune and supratidal that wouldn't be lost to equilibration and only 5% of the planted area would have optimal coverage.

TY2 15% (115 dune acres + 103 supratidal acres @ 20% cover) + (25% cover of 103 acres of marsh platform)/449
Assume: the post-equilibration portion of dune and supratidal acres all planted at TY1. Half of marsh platform is planted and has 25% cover

TY3 37% (110 dune acres + 103 supratidal acres @ 40% cover) +(50% cover 102 acres of marsh platform and 25% cover remaining 102 marsh platform)/443
Assume: 40% cover dune and supratidal areas; 50% cover of TY2 marsh plantings; remaining 50% marsh platform planted at TY3 and has 25% cover.

TY5 63% (102 dune acres + 100 supratidal acres @ 60% cover) + (75% 202 acres marsh platform)/429
Assume: Dune and supratidal acres 60% cover and 75% marsh platform

TY10 56% (80 dune acres + 100 supratidal acres @ 50% cover) + (70% 185 intertidal area vegetated)/390

TY20 51% (36 dune acres + 100 supratidal acres @ 50% cover) + (60% of 171 intertidal area vegetated)/333

TY25 48% (0 dune acres + 42 supratidal acres @ 30% cover) + (60% of 164 intertidal area vegetated)/232

TY35 43% (50% of 150 intertidal area vegetated)/176
Assume: no remaining dune or supratidal acres is expected to exist by TY35.

TY42 50% (50% of 136 intertidal area vegetated)/136

TY50 0% no subaerial acres remain.

Variable V5- Percent of vegetative cover comprised by woody species

Woody vegetation on Shell Island East included black mangrove and *Iva frutescens*. These species were seen predominantly along a canal in the center portion of the project area. There also may have been a few on the far eastern end and far western end of Shell Island East.

FWOP Shell Island East

Assumed that all TY's have only one woody species because there is no dune or supratidal habitat remaining.

TY0 5% Very little of the vegetated subaerial acres is vegetated with woody species.
TY1-2 5%
TY3 4%
TY5 3% Continued subsidence and deterioration reduces favorable conditions.
TY10 1% It is expected that only 20% of Shell Island East is vegetated. Of that very little wood vegetation is expected to remain.
TY20 0% 2 acres of bayside intertidal and 8 acres of gulfside intertidal habitat exist.
TY50 0% There are no subaerial acres left.

FWP Shell Island East

Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, *Iva frutescens*, *Baccharis* spp., and hercules club. A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated in the intertidal habitat to add a larger seed bank for black mangroves.

TY0 5%
TY1-3 0% Burial of majority of existing woody vegetation is expected.
TY5 5% Black mangrove and other available woody vegetation installed in TY2 or TY3.
TY10 10% Based on existing and natural recruitment on the subaerial acres
TY20 10% Based on decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY25 5% 42 acres of supratidal and 164 acres of intertidal acres remaining.
TY35 3% No supratidal acres remaining, therefore assume only one woody species is remaining. 150 acres of bay intertidal acres remaining.
TY42 0% 136 acres of bay intertidal acres remaining.
TY50 0% No remaining supratidal or bay intertidal acres remaining.

Variable V6 - Edge and interspersion

FWOP Shell Island East

TY0 100% Class 4
26% of the project area is subaerial
TY1-20 100% Class 4
At TY20 7% of the project area is subaerial
TY50 100% Class 5

None of the project area is subaerial

FWP Shell Island East

TY0 100% Class 4

TY1 100% Class 3
74% of the project area is subaerial
Expected to be confined carpet marsh. Fish access is prevented until retention dikes degrade to marsh elevations naturally on there own.

TY2 100% Class 3
73% of the project area is subaerial
Confined carpet marsh. Although the marsh elevation is expected to settle to +0.2 or less, it is expected that the retention dikes will prevent tidal access.

TY3 100% Class 1
73% of the project area is subaerial
Retention dikes may start to naturally degrade in some areas providing tidal access.

TY5 100% Class 1
72% of the project area is subaerial

TY10 80% Class 1; 20% Class 2
71% of the project area is subaerial

TY20 25% Class 1; 50% Class 2; 25% Class 3
69% of the project area is subaerial

TY25 70% Class 2; 30% Class 3
61% of the project area is subaerial

TY35 50% Class 3; 50% Class 4
56% of the project area is subaerial

TY42 15% Class 3; 85% Class 4
51% of the project area is subaerial

TY50 100% Class 5
0% of the project area is subaerial

Variable V7 - Beach/Surf Zone Features
FWOP and FWP - 100% Class 1; unconfined natural beach with no shore parallel structures. Containment built for construction would be graded into the template for a more natural slope as-built.

Alternative 1 – two islands with no renourishment Shell Island West
V1, V2, and V3 – Percent subaerial area that is dune, supratidal and intertidal, respectively
See attached spreadsheet.

Variable V4 - Percent vegetative cover of dune, supratidal, and intertidal habitats
Based on site visits (July 2005), examination of pre and post-storm photography, and post-storm flight, wetland habitat on both islands is primarily vegetated by *Spartina alterniflora*, *S. patens*, black mangrove, sea oxeye, black mangrove, *Iva frutescens*, *Distichilis* spp., roseaucane, seaside

purslan, black needlerush, deer pea, croton, and *Solidago*. Shell Island West is characterized by mostly intertidal habitat and some supratidal acres. There are remnant ridges throughout some of the bayside intertidal habitat toward the west side of the island. There is substantial interspersion on Shell Island West. The marsh appeared to be stressed during the field visit, which followed a storm. The spit on the east end of Shell Island West is very low.

FWOP Shell Island West

TY0 60% There are no dune acres, 6 acres of supratidal habitat, and 49 acres of bayside intertidal habitat present. Best estimate based mostly on post storm flight, pre and post storm photography (Oct 2005, June 2005, Oct 2004), and pre storm field inspection (July 2005). About 35% of the existing subaerial area is barren (washover flats, beach) and 65% is vegetated with supratidal or marsh vegetation. (6 supratidal acres + 49 bayside intertidal acres)/92 total acres.

TY1 60%

TY3 58% The area will continue to deteriorate.

TY5 50% Continued deterioration and lowering of profile.

TY10 30% Only15 acres of bayside intertidal and 9 acres of gulfside intertidal habitat still exist. (50% of 15 acres)/25 subaerial acres.

TY20 1% 3 acres of bayside intertidal and 5 acres of gulfside intertidal habitat exist. (25% of 3 acres)/8

TY50 0% There are no subaerial acres left by target year 50.

FWP Shell Island West

TY0 60%

TY1 3% (43 dune acres + 48 supratidal acres @ 10% cover)/264 subaerial acres.
Assume: 100% of post-equilibration (i.e., TY2) dune acres and associated back slope (i.e., post-equilibration, TY3 supratidal acres) planted at TY1 (immediately post-construction), resulting in planting of a portion of the subaerial project area. This assumes only planting the area of the dune and supratidal that wouldn't be lost to equilibration and only 3% of the planted area would have optimal coverage.

TY2 14% (43 dune acres + 48 supratidal acres @ 20% cover) + (25% cover of 72.5 acres of marsh platform)/253
Assume: The post-equilibration portion of dune and supratidal acres all planted at TY1. Half of marsh platform is planted and has 25% cover

TY3 36% (39 dune acres + 48 supratidal acres @ 40% cover) +(50% cover 72.5 acres of marsh platform and 25% cover remaining 72.5 marsh platform)/248
Assume: 40% cover dune and supratidal areas; 50% cover of TY2 marsh plantings; remaining 50% marsh platform planted at TY3 and has 25% cover.

TY5 65% (29 dune acres + 47 supratidal acres @ 60% cover) + (75% of 145 acres marsh platform)/237
Assume: Dune and supratidal acres 60% cover and 75% marsh platform

TY10 61% (0 dune acres + 13 supratidal acres @ 40% cover) + (70% of 139 intertidal area vegetated)/168

TY20 53% (0 dune acres + 0 supratidal acres @ 0% cover) + (60% of 116 intertidal area vegetated)/132
TY25 47% (0 dune acres + 0 supratidal acres @ 0% cover) + (55% of 90 intertidal area vegetated)/105
TY35 21% (0 dune acres + 0 supratidal acres @ 0% cover) + (30% of 37 intertidal area vegetated)/53
TY42 0% no subaerial acres remain.
TY50 0%

Variable V5 - Percent of vegetative cover comprised by woody species
Woody vegetation on Shell Island West included black mangrove, B*accharis* spp., and *Iva frutescens*. These species were seen through out the vegetated areas, especially on the interior ridges.

FWOP Shell Island West
TY0 10% About 10% of the vegetated subaerial acres is vegetated with woody species.
TY1-2 10%
Assume TY3-50 have only one woody species because there is no dune or supratidal habitat remaining.
TY3 9%
TY5 8% Continued subsidence and deterioration reduces favorable conditions.
TY10 4% It is expected that 30% of Shell Island West is vegetated. Of that about 4% of the vegetated area is expected to have wood vegetation remaining.
TY20 0% 3 acres of bayside intertidal and 5 acres of gulfside intertidal habitat exist..
TY50 0% There are no subaerial acres left.

FWP Shell Island West
Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, *Iva frutescens*, B*accharis* spp., and hercules club. A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated in the intertidal habitat to add a larger seed bank for black mangroves.
TY0 10%
TY1-3 1% Burial of majority of existing woody vegetation is expected.
TY5 5% Black mangrove and other available woody vegetation installed in TY2 or TY3.
TY10 10% Based on existing and natural recruitment on the subaerial acres
TY20 5% No supratidal acres remaining, therefore it is assumed that only one woody species is remaining. 116 acres of intertidal acres remaining.
TY25 3% No supratidal acres remaining, therefore it is assumed that only one woody species is remaining. 90 acres of intertidal acres remaining.
TY35 1% No supratidal acres remaining, therefore it is assumed that only one woody species is remaining. 37 acres of intertidal acres remaining.
TY42 0% No supratidal or bay intertidal acres remaining.
TY50 0% No remaining supratidal or bay intertidal acres.

Variable V6 - Edge and interspersion

FWOP Shell Island West

TY0 15% Class 2; 65% Class 3; 20% Class 4
76% of the project area is subaerial

TY1-5 15% Class 2; 65% Class 3; 20% Class 4
For these TYs between 76% (63 acres) and 81% (54 acres) of the project area is subaerial

TY10 40% Class 3; 60% Class 4
75% (25 acres) of the project area is subaerial

TY20 100% Class 4
70% (8 acres) of the project area is subaerial

TY50 100% Class 5

FWP Shell Island West

TY0 15% Class 2; 65% Class 3; 20% Class 4

TY1 100% Class 3
100% of the project area is subaerial
Expected to be confined carpet marsh. Fish access is prevented until retention dikes degrade to marsh elevations naturally on their own.

TY2 100% Class 3
100% of the project area is subaerial
Confined carpet marsh. Although the marsh elevation is expected to settle to +0.2 or less, it is expected that the retention dikes will prevent tidal access.

TY3 100% Class 1
100% of the project area is subaerial
Retention dikes may start to naturally degrade in some areas providing some tidal access.

TY5 100% Class 1
100% of the project area is subaerial

TY10 80% Class 1; 20% Class 2
99% of the project area is subaerial

TY20 10% Class 1; 55% Class 2; 35% Class 3
99% of the project area is subaerial

TY25 10% Class 2; 70% Class 3; 20% Class 4
99% (105 acres) of the project area is subaerial

TY35 100% Class 4
98% (53 acres) of the project area is subaerial

TY42 100% Class 5
0% (0 acres) of the project area is subaerial

TY50 100% Class 5
0% of the project area is subaerial

Variable V7 - Beach/Surf Zone Features

FWOP and FWP - 100% Class 1; unconfined natural beach with no shore parallel structures.

Containment built for construction would be graded into the template for a more natural slope as-built.

Alternative 2 – two islands with renourishment Shell Island East

V1, V2, and V3 – Percent subaerial area that is dune, supratidal and intertidal, respectively
See attached spreadsheet.

Variable V4 - Percent vegetative cover of dune, supratidal, and intertidal habitats
See description above in Alternative 1 Shell Island East.

FWOP Shell Island East – same as Alternative 1 FWOP Shell Island East above.

FWP Shell Island East

TY0 45%

TY1 5% (114 dune acres + 100 supratidal acres @ 10% cover)/469 subaerial acres.
Assume: 100% of post-equilibration (i.e., TY2) dune acres and associated back slope (i.e., post-equilibration, TY3 supratidal acres) planted at TY1 (immediately post-construction), resulting in planting of a portion of the subaerial project area. This assumes only planting the area of the dune and supratidal that wouldn't be lost to equilibration and only 5% of the planted area would have optimal coverage.

TY2 15% (114 dune acres + 100 supratidal acres @ 20% cover) + (25% cover of 102 acres of marsh platform)/448
Assume: the post-equilibration portion of dune and supratidal acres all planted at TY1. Half of marsh platform is planted and has 25% cover

TY3 36% (109 dune acres + 100 supratidal acres @ 40% cover) + (50% cover 102 acres of marsh platform and 25% cover remaining 102 marsh platform)/441
Assume: 40% cover dune and supratidal areas; 50% cover of TY2 marsh plantings; remaining 50% marsh platform planted at TY3 and has 25% cover.

TY5 63% (101 dune acres + 97 supratidal acres @ 60% cover) + (75% of 202 acres marsh platform)/428
Assume: Dune and supratidal acres 60% cover and 75% marsh platform

TY10 58% (79 dune acres + 97 supratidal acres @ 50% cover) + (75% of 184 intertidal area vegetated)/389

TY11 51% (114 dune acres @ 20% cover + 97 supratidal acres @ 55% cover + 80% of 183 intertidal area vegetated)/441
Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will be planted excluding acreage that would be lost.

TY12 59% (114 dune acres @ 40% cover + 97 supratidal acres @ 60% cover + 80% of 182 intertidal area vegetated)/421

TY13 60% (109 dune acres @ 50% cover + 97 supratidal acres @ 60% cover + 75% of

180)/415

TY15	60%	(101 dune acres + 97 supratidal acres @ 60% cover) + (70% of 178 intertidal area vegetated)/404
TY20	46%	(79 dune acres + 97 supratidal acres @ 40% cover) + (60% of 171 intertidal area vegetated)/375
TY21	39%	(114 dune acres @ 20% cover +100 supratidal acres @ 60% cover + 50% of 195 intertidal area vegetated)/459 Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants. In addition, the marsh is also renourished covering some plants but the marsh platform is anticipated to remain somewhat vegetated after renourishment.
TY22	53%	(114 dune acres @ 30% cover + 100 supratidal acres @ 60% cover + 70% of 195 intertidal area vegetated)/439
TY23	63%	(109 dune acres @ 50% cover + 100 supratidal acres @ 60% cover) + (80% of 195 intertidal acres)/433
TY25	65%	(101 dune acres + 97 supratidal acres @ 60% cover) + (80% of 195 intertidal area vegetated)/422
TY30	56%	(79 dune acres + 97 supratidal acres @ 40% cover) + (80% of 185 intertidal area vegetated)/389
TY31	54%	(93 dune acres @ 20% + 97 supratidal acres @ 65% + 183 intertidal acres@ 80%)/420 Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants.
TY32	59%	(93 dune acres @ 30% + 97 supratidal acres @ 65% + 182 intertidal acres @ 80%)/400
TY33	64%	(89 dune acres @ 50% cover + 97 supratidal acres @ 65% cover + 80% of 180 intertidal acres)/394
TY35	64%	(85 dune acres @ 60%+ 97 supratidal acres @ 65% cover + 177 intertidal acres @ 75%)/388
TY40	58%	(75 dune acres + 97 supratidal acres @ 50% cover) + (171 intertidal acres @ 75%)/371
TY41	43%	(75 dune acres @ 20% cover +100 supratidal acres @ 65% cover + 50% of 195 intertidal area vegetated)/417 Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants. In addition, the marsh is also renourished covering some plants but the marsh platform is anticipated to remain somewhat vegetated after renourishment.

TY42	56%	(75 dune acres @ 30% cover + 100 supratidal acres @ 65% cover + 70% of 195 intertidal area vegetated)/400
TY43	65%	(73 dune acres @ 50% + 100 supratidal acres @ 65% cover + 80% of 195 intertidal acres)/397
TY45	67%	(71 dune acres @ 60% + 97 supratidal acres @65% cover + 195 intertidal acres @ 80%)/392
TY50	61%	(64 dune acres + 97 supratidal acres @ 50% cover) + (80% of 185 intertidal area vegetated)/374

Variable V5 - Percent of vegetative cover comprised by woody species

Woody vegetation on Shell Island East included black mangrove and *Iva frutescens*. These species were seen predominantly along a canal in the center portion of the project area. There also may have been a few on the far eastern end and far western end of Shell Island East.

FWOP Shell Island East

See alternative 1 FWOP Shell Island East above.

FWP Shell Island East with renourshment

Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, *Iva frutescens*, B*accharis* spp., and hercules club. A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated in the intertidal habitat to add a larger seed bank for black mangroves.

TY0	5%	
TY1-3	0%	Burial of majority of existing woody vegetation is expected.
TY5	5%	Black mangrove and other available woody vegetation installed in TY2 or TY3.
TY10	10%	Based on existing and natural recruitment on the subaerial acres
TY11	8%	The dune is renourished in TY11 resulting in the covering of some woody species.
TY12	10%	Based on existing and natural recruitment.
TY13	12%	Based on existing and natural recruitment.
TY15	15%	Based on existing and natural recruitment.
TY20	15%	Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY21	11%	The dune and marsh is renourished in TY21 resulting in the covering of some woody species.
TY22	13%	Based on existing and natural recruitment.
TY23	14%	Based on existing and natural recruitment.
TY25	16%	Based on existing and natural recruitment.
TY30	16%	Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY31	11%	The dune is renourished in TY31 resulting in the covering of some woody species.
TY32	13%	Based on existing and natural recruitment.
TY33	14%	Based on existing and natural recruitment.

TY35 16% Based on existing and natural recruitment.
TY40 16% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY41 11% The dune and marsh is renourished in TY41 resulting in the covering of some woody species.
TY42 13% Based on existing and natural recruitment.
TY43 14% Based on existing and natural recruitment.
TY45 16% Based on existing and natural recruitment.
TY50 16% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.

Variable V6 - Edge and interspersion

FWOP Shell Island East

Same as Alt 1

FWP Shell Island East

TY0 100% Class 4

Assume tidal creeks are constructed in the intertidal marsh habitat.

TY1 100% Class 3
74% of the project area is subaerial
Expected to be confined carpet marsh. Fish access is prevented until retention dikes degrade to marsh elevations naturally on their own.

TY2 100% Class 3
73% of the project area is subaerial
Confined carpet marsh. Although the marsh elevation is expected to settle to +0.2 or less, it is expected that the retention dikes will prevent tidal access.

TY3 100% Class 1
72% of the project area is subaerial
Retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks were constructed.

TY5 100% Class 1
72% of the project area is subaerial

TY10 80% Class 1; 20% Class 2
70% of the project area is subaerial

TY11 80% Class 1; 20% Class 2
73% of the project area is subaerial. Although the dune is renourished the marsh isn't in this cycle.

TY12 70% Class 1; 30% Class 2
72% of the project area is subaerial

TY13 60% Class 1; 40% Class 2
72% of the project area is subaerial

TY15 35% Class 1; 65% Class 2
72% of the project area is subaerial

TY20 10% Class 1; 60% Class 2; 30% Class 3
71% of the project area is subaerial.

TY21 100% Class 3
75% of the project area is subaerial. Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh renourishment.

TY22 100% Class 1
74% of the project area is subaerial. It is expected that the retention dikes will have degraded naturally in some areas allowing for tidal access.

TY23 100% Class 1
74% of the project area is subaerial

TY25 100% Class 1
74% of the project area is subaerial

TY30 80% Class 1; 20% Class 2
73% of the project area is subaerial

TY31 80% Class 1; 20% Class 2
74% of the project area is subaerial. The dune is renourished, the marsh is not in this cycle.

TY32 70% Class 1; 30% Class 2
73% of the project area is subaerial

TY33 60% Class 1; 40% Class 2
73% of the project area is subaerial

TY35 35% Class 1; 65% Class 2
73% of the project area is subaerial

TY40 10% Class 1; 60% Class 2; 30% Class 3
73% of the project area is subaerial

TY41 100% Class 3
75% of the project area is subaerial. Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh renourishment.

TY42 100% Class 1
75% of the project area is subaerial. It is expected that the retention dikes will have degraded naturally in some areas allowing for tidal access

TY43 100% Class 1
75% of the project area is subaerial

TY45 100% Class 1
74% of the project area is subaerial

TY50 80% Class 1; 20% Class 2
74% of the project area is subaerial

Variable V7 - Beach/Surf Zone Features

FWOP and FWP - 100% Class 1; unconfined natural beach with no shore parallel structures. Containment built for construction would be graded into the template for a more natural slope as-built.

Alternative 2 – two islands with renourishment Shell Island West

V1, V2, and V3 – Percent subaerial area that is dune, supratidal and intertidal, respectively

See description above in Alternative 1 Shell Island West.

Variable V4 - Percent vegetative cover of dune, supratidal, and intertidal habitats

See description above.

FWOP Shell Island West – same as Alternative 1 FWOP Shell Island West above.

FWP Shell Island West

TY0 60%

TY1 4% (60 dune acres + 43 supratidal acres @ 10% cover)/272 subaerial acres.
Assume: 100% of post-equilibration (i.e., TY2) dune acres and associated back slope (i.e., post-equilibration, TY3 supratidal acres) planted at TY1 (immediately post-construction), resulting in planting of a portion of the subaerial project area. This assumes only planting the area of the dune and supratidal that wouldn't be lost to equilibration and only 4% of the planted area would have optimal coverage.

TY2 15% (60 dune acres + 43 supratidal acres @ 20% cover) + (25% cover of 72 acres of marsh platform)/261
Assume: The post-equilibration portion of dune and supratidal acres all planted at TY1. Half of marsh platform is planted and has 25% cover

TY3 37% (55 dune acres + 43 supratidal acres @ 40% cover) +(50% cover 72 acres of marsh platform and 25% cover remaining 73 marsh platform)/256
Assume: 40% cover dune and supratidal areas; 50% cover of TY2 marsh plantings; remaining 50% marsh platform planted at TY3 and has 25% cover.

TY5 66% (46 dune acres + 42 supratidal acres @ 60% cover) + (75% of 145 acres marsh platform)/245
Assume: Dune and supratidal acres 60% cover and 75% marsh platform

TY10 63% (22 dune acres + 42 supratidal acres @ 50% cover) + (75% of 139 intertidal area vegetated)/215

TY11 55% (60 dune acres @ 20% cover + 42 supratidal acres @ 55% cover + 80% of 139 intertidal area vegetated)/263
Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will be planted excluding acreage that would be lost.

TY12 61% (60 dune acres @ 30% cover + 42 supratidal acres @ 60% cover + 80% of 138 intertidal area vegetated)/252

TY13 66% (55 dune acres @ 50% + 42 supratidal acres @ 60% cover + 80% of 137)/247

TY15	68%	(46 dune acres + 42 supratidal acres @ 60% cover) + (80% of 136 intertidal area vegetated)/236
TY20	63%	(22 dune acres + 42 supratidal acres @ 40% cover) + (80% of 134 intertidal area vegetated)/210
TY21	41%	(60 dune acres @ 20% cover +43 supratidal acres @ 60% cover + 50% of 145 intertidal area vegetated)/272 Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants. In addition, the marsh is also renourished covering some plants but the marsh platform is anticipated to remain somewhat vegetated after renourishment.
TY22	56%	(60 dune acres @ 30% cover + 43 supratidal acres @ 60% cover + 70% of 145 intertidal area vegetated)/261
TY23	66%	(55 dune acres @ 50% + 43 supratidal acres @ 60% cover + 80% of 145 intertidal acres)/256
TY25	69%	(46 dune acres + 42 supratidal acres @ 60% cover) + (80% of 145 intertidal area vegetated)/245
TY30	64%	(22 dune acres + 42 supratidal acres @ 40% cover) + (80% of 139 intertidal area vegetated)/215
TY31	58%	(52 dune acres @ 20% + 42 supratidal acres @ 65% + 139 intertidal acres@ 80%)/255 Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants.
TY32	63%	(52 dune acres @ 30% + 42 supratidal acres @ 65% + 138 intertidal acres @ 80%)/244
TY33	67%	(47 dune acres @ 50% + 42 supratidal acres @ 65% cover) + (80% of 137 intertidal acres)/239
TY35	66%	(44 dune acres @ 60%+ 42 supratidal acres @ 65% cover + 136 intertidal acres @ 75%)/235
TY40	62%	(36 dune acres + 42 supratidal acres @ 50% cover) + (134 intertidal acres @ 75%)/224
TY41	43%	(46 dune acres @ 20% cover + 43 supratidal acres @ 65% cover + 50% of 145 intertidal area vegetated)/255 Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants. In addition, the marsh is also renourished covering some plants but the marsh platform is anticipated to remain somewhat vegetated after renourishment.

TY42 58% (46 dune acres @ 30% cover + 43 supratidal acres @ 65 % cover + 145 intertidal acres @ 70% cover)/247
TY43 68% (45 dune acres @ 50% + 43 supratidal acres @ 65% cover + 80% of 145 intertidal acres)/245
TY45 70% (43 dune acres @ 60% + 42 supratidal acres @ 65% cover + 145 intertidal acres @ 80%)/243
TY50 65% (37 dune acres + 42 supratidal acres @ 50% cover) + (80% of 139 intertidal area vegetated)/230

Variable V5 - Percent of vegetative cover comprised by woody species
Woody vegetation on Shell Island West included black mangrove and *Iva frutescens*. These species were seen through out the vegetated areas, especially on the interior ridges.

FWOP Shell Island West
See Alternative 1 FWOP Shell Island West above.

FWP Shell Island West
Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, *Iva frutescens*, B*accharis* spp., and hercules club. A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated in the intertidal habitat to add a larger seed bank for black mangroves.

TY0 10%
TY1-3 1% Burial of majority of existing woody vegetation is expected with very little existing plants surviving.
TY5 5% Black mangrove and other available woody vegetation installed in TY2 or TY3.
TY10 10% Based on existing and natural recruitment on the subaerial acres
TY11 8% The dune is renourished in TY11 resulting in the covering of some woody species.

TY12 10% Based on existing and natural recruitment.
TY13 12% Based on existing and natural recruitment.
TY15 15% Based on existing and natural recruitment.
TY20 15% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY21 11% The dune and marsh is renourished in TY21 resulting in the covering of some woody species.
TY22 13% Based on existing and natural recruitment.
TY23 14% Based on existing and natural recruitment.
TY25 16% Based on existing and natural recruitment.
TY30 16% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY31 11% The dune is renourished in TY31 resulting in the covering of some woody species.

TY32 13% Based on existing and natural recruitment.

TY33 14% Based on existing and natural recruitment.
TY35 16% Based on existing and natural recruitment.
TY40 16% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY41 11% The dune and marsh is renourished in TY41 resulting in the covering of some woody species.
TY42 13% Based on existing and natural recruitment.
TY43 14% Based on existing and natural recruitment.
TY45 16% Based on existing and natural recruitment.
TY50 16% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.

Variable V6 - Edge and interspersion

FWOP Shell Island West

Same as alt 1

FWP Shell Island West

Assume tidal creeks are constructed in the intertidal marsh habitat.

TY0 15% Class 2; 65% Class 3; 20% Class 4
100% of the project area is subaerial for all remaining TYs (TY1-TY50).

TY1 100% Class 3
Expected to be confined carpet marsh. Fish access is prevented until retention dikes degrade to marsh elevations naturally on there own.

TY2 100% Class 3
Confined carpet marsh. Although the marsh elevation is expected to settle to +0.2 or less, it is expected that the retention dikes will prevent tidal access.

TY3 100% Class 1
Retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks were constructed in the intertidal marsh habitat.

TY5 100% Class 1

TY10 80% Class 1; 20% Class 2

TY11 80% Class 1; 20% Class 2
Although the dune is renourished, the marsh isn't in this cycle.

TY12 70% Class 1; 30% Class 2

TY13 60% Class 1; 40% Class 2

TY15 35% Class 1; 65% Class 2

TY20 10% Class 1; 60% Class 2; 30% Class 3

TY21 100% Class 3
Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh renourishment.

TY22 100% Class 1
It is expected that the retention dikes will have degraded naturally in some areas allowing

for tidal access.

TY23 100% Class 1
TY25 100% Class 1
TY30 80% Class 1; 20% Class 2
TY31 80% Class 1; 20% Class 2
Although the dune is renourished, the marsh is not in this cycle.

TY32 70% Class 1; 30% Class 2
TY33 60% Class 1; 40% Class 2
TY35 35% Class 1; 65% Class 2
TY40 10% Class 1; 60% Class 2; 30% Class 3
TY41 100% Class 3
Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh renourishment.

TY42 100% Class 1
It is expected that the retention dikes will have degraded naturally in some areas allowing for tidal access

TY43 100% Class 1
TY45 100% Class 1
TY50 80% Class 1; 20% Class 2

Variable V7 - Beach/Surf Zone Features
FWOP and FWP - 100% Class 1; unconfined natural beach with no shore parallel structures. Containment built for construction would be graded into the template for a more natural slope as-built.

Alternative 3 – single island 10 Yrs Adv Fill + No Renourishment

V1, V2, and V3 – Percent subaerial area that is dune, supratidal and intertidal, respectively
See attached spreadsheet.

Variable V4 - Percent vegetative cover of dune, supratidal, and intertidal habitats
See description above in Alternative 1.

FWOP Shell Island Total

TY0 50% There is no dune, 6 acres of supratidal habitat, and about 89 acres and 50 acres of bayside and gulfside intertidal habitat, respectively. It is estimated that about 50% of the existing subaerial is vegetated and about 50% is barren (overwash flats, beach). Best estimate is based mostly on post storm flight, pre and post storm photography (Oct 2005, June 2005, Oct 2004), and July 2005 site inspection.
TY1 50%
TY3 48% The area will continue to deteriorate.

TY5 40% Continued deterioration and lowering of profile.
TY10 26% 22 acres of bayside intertidal and 21 acres of gulfside intertidal habitat still remain. (50% of 22 acres)/43 subaerial acres.
TY20 7% 5 acres of bayside intertidal and 13 acres of gulfside intertidal habitat exist. (25% of 5 acres)/18
TY50 0% There are no subaerial acres left by target year 50.

FWP Shell Island Single Island

TY0 50%
TY1 4% (137 dune acres + 159 supratidal acres @ 10% cover)/842 subaerial acres.
Assume: 100% of post-equilibration (i.e., TY2) dune acres and associated back slope (i.e., post-equilibration, TY3 supratidal acres) planted at TY1 (immediately post-construction), resulting in planting of a portion of the subaerial project area. This assumes only planting the area of the dune and supratidal that wouldn't be lost to equilibration and only 4% of the planted area would have optimal coverage.
TY2 14% (137 dune acres + 159 supratidal acres @ 20% cover) + (25% cover of 227.5 acres of marsh platform)/800
Assume: The post-equilibration portion of dune and supratidal acres all planted at TY1. Half of marsh platform is planted and has 25% cover
TY3 36% (133 dune acres + 159 supratidal acres @ 40% cover) +(50% cover 227.5 acres of marsh platform and 25% cover remaining 227.5 marsh platform)/781
Assume: 40% cover dune and supratidal areas; 50% cover of TY2 marsh plantings; remaining 50% marsh platform planted at TY3 and has 25% cover.
TY5 65% (124 dune acres + 154 supratidal acres @ 60% cover) + (75% of 429 acres marsh platform)/749
Assume: Dune and supratidal acres 60% cover and 75% marsh platform
TY10 61% (102 dune acres + 154 supratidal acres @ 50% cover) + (75% of 393 intertidal area vegetated)/691
TY20 62% (58 dune acres + 154 supratidal acres @ 50% cover) + (75% of 371 intertidal area vegetated)/625
TY30 62% (14 dune acres + 154 supratidal acres @ 50% cover) + (75% of 350 intertidal area vegetated)/560
TY33 62% (0 dune acres + 142 supratidal acres @ 50% cover) + (319 intertidal acres @ 75%)/500
TY50 63% (0 dune acres + 45 supratidal acres @ 50% cover) + (75% of 183 intertidal area vegetated)/252

Variable V5 - Percent of vegetative cover comprised by woody species

Woody vegetation on Shell Island East and West included black mangrove and *Iva frutescens*. These species were seen predominantly along a canal in the center portion of the project area of Shell Island East. There also may have been a few on the far eastern end and far western end of Shell Island East. These species were seen through out the vegetated areas, especially on the

interior ridges of Shell Island West.

FWOP Shell Island Total

TY0	8%	About 8% of the vegetated subaerial acres is vegetated with woody species.
TY1-2	8%	

Assume TY3-50 have only one woody species because there is no dune or supratidal habitat remaining.

TY3	7%	
TY5	5%	Continued subsidence and deterioration reduces favorable conditions.
TY10	3%	It is expected that 26% of both Shell Islands will be vegetated. Of that about 3% of the vegetated area is expected to have wood vegetation remaining.
TY20	1%	5 acres of bayside intertidal and 13 acres of gulfside intertidal habitat exist.
TY50	0%	There are no subaerial acres left.

FWP Shell Island Single Island without renourishment

Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, *Iva frutescens*, B*accharis* spp., and hercules club. A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated in the intertidal habitat to add a larger seed bank for black mangroves.

TY0	8%	
TY1-3	1%	Burial of majority of existing woody vegetation is expected with very little existing plants surviving.
TY5	5%	Black mangrove and other available woody vegetation installed in TY2 or TY3.
TY10	10%	Based on existing and natural recruitment on the subaerial acres
TY20	9%	Based on decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY30	9%	14 acres of dune, 154 acres of supratidal and 350 acres of bay intertidal remain.
TY33	9%	0 dune acres, 142 acres of supratidal, and 319 acres of bay intertidal remain.
TY50	5%	45 acres of supratidal and 183 acres of bay intertidal remain.

Variable V6 - Edge and interspersion

FWOP Shell Island Total

TY0 30% Class 3; 70% Class 4
38% of the project area is subaerial

TY1-5 30% Class 3; 70% Class 4
33% to 35% of the project area is subaerial

TY10 25% Class 3; 75% Class 4
19% of the project area is subaerial

TY20 100% Class 4
At TY20 11% (18 acres) of the project area is subaerial

TY50 100% Class 5
None of the project area is subaerial

FWP Shell Island Single Island
Assume tidal creeks are constructed in the intertidal marsh habitat.

TY0 30% Class 3; 70% Class 4
38% of the project area is subaerial

TY1 100% Class 3
85% of the project area is subaerial
Expected to be confined carpet marsh. Fish access is prevented until retention dikes degrade to marsh elevations naturally on their own.

TY2 100% Class 3
84% of the project area is subaerial
Confined carpet marsh. Although the marsh elevation is expected to settle to +0.2 or less, it is expected that the retention dikes will prevent tidal access.

TY3 100% Class 1
84% of the project area is subaerial
Retention dikes may start to naturally degrade in some areas providing tidal access.
Assume tidal creeks are constructed in the intertidal marsh habitat.

TY5 100% Class 1
83% of the project area is subaerial

TY10 80% Class 1; 20% Class 2
83% of the project area is subaerial

TY20 10% Class 1; 60% Class 2; 30% Class 3
82% of the project area is subaerial.

TY30 60% Class 3; 40% Class 4
83% of the project area is subaerial

TY33 60% Class 3; 40% Class 4
83% of the project area is subaerial

TY50 30% Class 3; 70% Class 4
85% of the project area is subaerial

Variable V7 - Beach/Surf Zone Features
FWOP and FWP - 100% Class 1; unconfined natural beach with no shore parallel structures. Containment built for construction would be graded into the template for a more natural slope as-built.

Alternative 5 – single island 10 Yrs Adv Fill + Renourishment at TY20 and TY40
V1, V2, and V3 – Percent subaerial area that is dune, supratidal and intertidal, respectively
See attached spreadsheet.

Variable V4 - Percent vegetative cover of dune, supratidal, and intertidal habitats
See description above in Alternative 1.

FWOP Shell Island Total Same as Alt 3

FWP Shell Island Single Island

TY0	50%	
TY1	4%	(137 dune acres + 159 supratidal acres @ 10% cover)/842 subaerial acres. Assume: 100% of post-equilibration (i.e., TY2) dune acres and associated back slope (i.e., post-equilibration, TY3 supratidal acres) planted at TY1 (immediately post-construction), resulting in planting of a portion of the subaerial project area. This assumes only planting the area of the dune and supratidal that wouldn't be lost to equilibration and only 4% of the planted area would have optimal coverage.
TY2	14%	(137 dune acres + 159 supratidal acres @ 20% cover) + (25% cover of 227.5 acres of marsh platform)/800 Assume: The post-equilibration portion of dune and supratidal acres all planted at TY1. Half of marsh platform is planted and has 25% cover
TY3	36%	(133 dune acres + 159 supratidal acres @ 40% cover) +(50% cover 227.5 acres of marsh platform and 25% cover remaining 227.5 marsh platform)/781 Assume: 40% cover dune and supratidal areas; 50% cover of TY2 marsh plantings; remaining 50% marsh platform planted at TY3 and has 25% cover.
TY5	65%	(124 dune acres + 155 supratidal acres @ 60% cover) + (75% of 429 acres marsh platform)/750 Assume: Dune and supratidal acres 60% cover and 75% marsh platform
TY10	61%	(102 dune acres + 155 supratidal acres @ 50% cover) + (75% of 393 intertidal area vegetated)/691
TY20	61%	(58 dune acres + 155 supratidal acres @ 50% cover) + (75% of 371 intertidal area vegetated)/625
TY21	42%	(137 dune acres @ 20% cover + 159 supratidal acres @ 60% cover + 50% of 410 intertidal area vegetated)/778 Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants. In addition, the marsh is also renourished covering some plants but the marsh platform is anticipated to remain somewhat vegetated after renourishment.
TY22	57%	(137 dune acres @ 30% cover + 161 supratidal acres @ 60% cover + 70% of 410 intertidal area vegetated)/750
TY23	66%	(133 dune acres @ 50% + 159 supratidal acres @ 60% cover + 80% of 410 intertidal acres)/743
TY25	68%	(124 dune acres + 154 supratidal acres @ 60% cover) + (80% of 410 intertidal area vegetated)/730
TY30	64%	(102 dune acres + 154 supratidal acres @ 50% cover) + (80% of 392 intertidal area vegetated)/690
TY40	64%	(58 dune acres + 154 supratidal acres @ 50% cover) + (370 intertidal acres @

80%)/624

TY41	43%	(137 dune acres @ 20% cover + 159 supratidal acres @ 65% cover + 50% of 410 intertidal area vegetated)/778 Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants. In addition, the marsh is also renourished covering some plants but the marsh platform is anticipated to remain somewhat vegetated after renourishment.
TY42	58%	(137 dune acres @ 30% cover + 159 supratidal acres @ 65 % cover + 410 intertidal acres @ 70% cover)/750
TY43	67%	(133 dune acres @ 50% + 159 supratidal acres @ 65% cover + 80% of 410 intertidal acres)/743
TY45	69%	(124 dune acres @ 60% + 154 supratidal acres @ 65% cover + 410 intertidal acres @ 80%)/730
TY50	64%	(102 dune acres + 154 supratidal acres @ 50% cover) + (80% of 392 intertidal area vegetated)/690

Variable V5 - Percent of vegetative cover comprised by woody species

Woody vegetation on Shell Island East and West included black mangrove and *Iva frutescens*. These species were seen predominantly along a canal in the center portion of the project area of Shell Island East. There also may have been a few on the far eastern end and far western end of Shell Island East. These species were seen through out the vegetated areas, especially on the interior ridges of Shell Island West.

FWOP Shell Island Total

Same as Alt 3

FWP Shell Island Single Island with renourishment

Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, *Iva frutescens*, *Baccharis* spp., and hercules club. A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated in the intertidal habitat to add a larger seed bank for black mangroves.

TY0	8%	
TY1-3	1%	Burial of majority of existing woody vegetation is expected with very little existing plants surviving.
TY5	5%	Black mangrove and other available woody vegetation installed in TY2 or TY3.
TY10	10%	Based on existing and natural recruitment on the subaerial acres
TY20	10%	Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY21	7%	The dune and marsh is renourished in TY21 resulting in the covering of some woody species.
TY22	8%	Based on existing and natural recruitment.

TY23 9% Based on existing and natural recruitment.
TY25 11% Based on existing and natural recruitment.
TY30 13% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY40 13% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY41 11% The dune and marsh is renourished in TY41 resulting in the covering of some woody species.
TY42 13% Based on existing and natural recruitment.
TY43 14% Based on existing and natural recruitment.
TY45 16% Based on existing and natural recruitment.
TY50 16% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.

Variable V6 - Edge and interspersion
FWOP Shell Island Total
Same as Alt 3

FWP Shell Island Single Island
Assume tidal creeks are constructed in the intertidal marsh habitat.
TY0 30% Class 3; 70% Class 4
38% of the project area is subaerial
TY1 100% Class 3
85% of the project area is subaerial
Expected to be confined carpet marsh. Fish access is prevented until retention dikes degrade to marsh elevations naturally on their own.
TY2 100% Class 3
84% of the project area is subaerial
Confined carpet marsh. Although the marsh elevation is expected to settle to +0.2 or less, it is expected that the retention dikes will prevent tidal access.
TY3 100% Class 1
84% of the project area is subaerial
Retention dikes may start to naturally degrade in some areas providing tidal access.
Assume tidal creeks are constructed in the intertidal marsh habitat.
TY5 100% Class 1
83% of the project area is subaerial
TY10 80% Class 1; 20% Class 2
83% of the project area is subaerial
TY20 10% Class 1; 60% Class 2; 30% Class 3
82% of the project area is subaerial.
TY21 100% Class 3
Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh renourishment.

TY22 100% Class 3
TY23 100% Class 1
It is expected that the retention dikes will have degraded naturally in some areas allowing for tidal access.
TY25 100% Class 1
TY30 80% Class 1; 20% Class 2
84% of the project area is subaerial
TY40 10% Class 1; 60% Class 2; 30% Class 3
84% of the project area is subaerial
TY41 100% Class 3
Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh renourishment.
TY42 100% Class 3
TY43 100% Class 1
It is expected that the retention dikes will have degraded naturally in some areas allowing for tidal access
TY45 100% Class 1
TY50 80% Class 1; 20% Class 2

Variable V7 - Beach/Surf Zone Features
FWOP and FWP - 100% Class 1; unconfined natural beach with no shore parallel structures. Containment built for construction would be graded into the template for a more natural slope as-built.

Literature cited

Coastal Planning and Engineering. 2007. Barataria Basin Barrier Island Shoreline Restoration, Shell Island Feasibility Report Plaquemines, Louisiana. Draft Feasibility Report.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506
April 30, 2009

Robert J. Barham
Secretary
Louisiana Department of Wildlife and Fisheries
Post Office Box 98000
Baton Rouge, Louisiana 70898-9000

Dear Mr. Barham:

Attached is the Draft Fish and Wildlife Coordination Act Report on the "Near-Term Ecosystem Restoration Plan for Louisiana Coastal Area, Louisiana Ecosystem Restoration: Barataria Basin Barrier Shoreline Restoration, Feasibility Study". This report does not constitute the 2(b) report of the Fish and Wildlife Service (Service). The Service will incorporate your agency's comments into the final report prior to its submission to the U.S. Army Corps of Engineers. Should your staff have any questions regarding this report, please have them contact Catherine Breaux (504/862-2689) of this office.

Your cooperation in this matter is appreciated.

Sincerely,

James H. Boggs
Supervisor
Louisiana Field Office

Attachment

TAKE PRIDE IN AMERICA

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506
April 30, 2009

Mr. Richard Hartman
Branch Chief
Habitat Conservation Division
National Marine Fisheries Service
c/o Louisiana State University
Baton Rouge, Louisiana 70803-7535

Dear Mr. Hartman:

Attached is the Draft Fish and Wildlife Coordination Act Report on the "Near-Term Ecosystem Restoration Plan for Louisiana Coastal Area, Louisiana Ecosystem Restoration: Barataria Basin Barrier Shoreline Restoration, Feasibility Study". This report does not constitute the 2(b) report of the Fish and Wildlife Service (Service). The Service will incorporate your agency's comments into the final report prior to its submission to the U.S. Army Corps of Engineers. Should your staff have any questions regarding this report, please have them contact Catherine Breaux (504/862-2689) of this office.

Your cooperation in this matter is appreciated.

Sincerely,

James F. Boggs
Supervisor
Louisiana Field Office

Attachment

TAKE PRIDE IN AMERICA

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506
April 30, 2009

Colonel Alvin B. Lee
District Engineer
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Lee

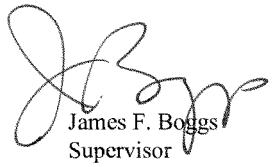
Please reference the "Near-Term Ecosystem Restoration Plan (NTP) for Louisiana Coastal Area (LCA), Louisiana Ecosystem Restoration: Barataria Basin Barrier Shoreline Restoration, Feasibility Study". This study was originally authorized by resolutions adopted by the U.S. House of Representatives and Senate Committees on Public Works, on October 19, 1967, and April 19, 1967, respectively. Those resolutions sought to improve existing hurricane protection features and the ". . . prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and related water resource purposes." The Barataria Basin Barrier Shoreline Restoration Project was identified as a critical near-term restoration project in the NTP of the 2004 LCA Report. This project was recommended for authorization by the Chief of Engineers on January 31, 2005, and was authorized in Title VII of the Water Resources Development Act of 2007.

This draft report contains a description of existing fish and wildlife resources in the project area, discusses future with-project (FWP) and future without-project (FWOP) habitat conditions, identifies fish and wildlife-related impacts, and provides recommendations to improve the proposed barrier shoreline restoration measures. This draft report does not constitute the report of the Secretary of the Interior as required by Section 2(b) of the FWCA. This draft FWCA Report is being provided to the Louisiana Department of Wildlife and Fisheries and the National Marine Fisheries Service; their comments will be incorporated into the final report. When finalized, this report will be submitted in fulfillment of the requirements of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and will constitute the report of the Secretary of the Interior as required by Section 2(b) of that Act.

TAKE PRIDE IN AMERICA

We appreciate the cooperation of your staff on this study. Should your staff have any questions regarding the enclosed report, please have them contact Ms. Catherine Breaux (504/862-2689) of this office.

Sincerely,



James F. Boggs
Supervisor
Louisiana Field Office

Attachment

cc: EPA, Dallas, TX
National Marine Fisheries Service, Baton Rouge, LA
LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
LA Dept. of Natural Resources (CMD/CRD), Baton Rouge, LA

DRAFT
FISH AND WILDLIFE COORDINATION ACT REPORT

ON

NEAR-TERM ECOSYSTEM RESTORATION PLAN FOR LOUISIANA COASTAL AREA, LOUISIANA ECOSYSTEM RESTORATION: BARATARIA BASIN BARRIER SHORELINE RESTORATION, FEASIBILITY STUDY

Submitted To
New Orleans District
U.S. Army Corps of Engineers
and
Louisiana Department of Natural Resources

Prepared by
Catherine Breaux
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
Ecological Services
Lafayette, Louisiana

April 2009

EXECUTIVE SUMMARY

The Barataria Basin Barrier Shoreline Restoration Integrated Feasibility Report and Environmental Impact Statement (EIS) was prepared by the U.S. Army Corps of Engineers-Mississippi Valley Division, New Orleans District (Corps), with input provided by the local sponsor, the Coastal Protection And Restoration Authority (CPRA), and other Federal and State coastal resource agencies. The Near-term Ecosystem Restoration Plan (NTP) for the Louisiana Coastal Area (LCA), Louisiana, Ecosystem Restoration Feasibility Study was originally authorized by Resolutions adopted by the U.S. House of Representatives and Senate Committees on Public Works, on October 19, 1967, and April 19, 1967, respectively. Those resolutions sought to improve existing hurricane protection features and the ". . . prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and related water resource purposes." The Barataria Basin Barrier Shoreline Restoration Project was identified as a critical near-term restoration project in the NTP (USACE 2004). This project was recommended for authorization by the Chief of Engineers on January 31, 2005, was transmitted by the Assistant Secretary of the Army for Civil Works to Congress on November 18, 2005, and authorized in Title VII of the Water Resources Development Act of 2007.

The Barataria Basin Barrier Shoreline Restoration Project would reconstruct coastal landforms of the barrier shoreline in the Barataria Basin. Restored barrier shoreline and marsh features would 1) contribute to geomorphic stability and processes of the basin shorelines, 2) help re-establish pre-existing water quality trends and hydrologic processes, and 3) sustain and improve ecosystem processes and habitats for migratory and resident species. The Barataria Basin Barrier Shoreline is divided into five reaches (Caminada Headland, Grand Terre, Chenier Ronquille, Shell Island, and Scofield). Initial study efforts considered shoreline restoration for all five reaches in the Barataria Basin Barrier Shoreline. The NTP LCA Report identified restoration of Caminada Headland and Shell Island Reaches as a critical near-term project for the Barataria Basin Barrier Shoreline.

The 13-miles long Caminada Headland Reach, located in Lafourche and Jefferson Parishes, extends from the Belle Pass jetties at the mouth of Bayou Lafourche on the western end of the headland to Caminada Pass on the eastern end of the headland. The Shell Island Reach lays approximately 49 miles south-southeast of New Orleans, Louisiana in Plaquemines parish. The remnants of Shell Island are located between Fontanelle Pass (Empire Jetties) and Grand Bayou Pass.

This draft report contains a description of existing fish and wildlife resources in the project area, discusses future with-project (FWP) and future without-project (FWOP) habitat conditions, identifies fish and wildlife-related impacts, and provides recommendations to improve the proposed barrier shoreline restoration measures. When finalized, this report will be submitted in fulfillment of the requirements of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and will constitute the report of the Secretary of the Interior as required by Section 2(b) of that Act. This draft FWCA Report is being provided to the Louisiana Department of Wildlife and Fisheries (LDWF) and the National Marine Fisheries Service

(NMFS); their comments will be incorporated into the final report.

Four alternatives (Alternatives 1, 2, 3, and 5) for Shell Island and four alternatives (Alternatives 5, 6, 7, and 9) for Caminada were evaluated during this study. Those alternatives included restoring and sustaining (for the 50-year project life) barrier shoreline, dune, and interior or back-barrier marsh habitats as well as the geomorphic function of the barrier shorelines. Alternatives were screened on the basis of cost-effectiveness, incremental cost analysis, and their ability to meet the critical goal of preserving habitat in the area. The Tentatively Selected Plan (TSP) includes Shell Island's Alternative 1 (Two Islands with No Renourishment and 9 years of Advanced Fill) and Caminada's Alternative 5 (preferred dune with expanded marsh).

The Wetland Value Assessment (WVA) analyses indicate that the TSP for Shell Island and Caminada would result in the direct and indirect net gains in the quality and quantity of barrier island/headland and back-barrier marsh habitats of 303 AAHUs and 111 acres and 269 AAHUs and 0 acres, respectively, for a total net gain of 572 AAHUs and a total net gain of 111 acres compared to the future without-project conditions.

The TSP will benefit the fish and wildlife resources of the Barataria Basin by creating and nourishing a barrier island and headland and back barrier marsh. The Service will support further planning of the proposed project provided that the following fish and wildlife recommendations are included in the feasibility report and related planning and authorizing documents and are implemented concurrently with project implementation:

The Service, NMFS, and LDWF should be provided an opportunity to review and submit recommendations on future detailed planning reports and the draft plans and specifications on the Barataria Basin Barrier Shoreline Restoration Project addressed in this report.

Coordination should continue with the Service and NMFS on detailed contract specifications to avoid and minimize potential impacts to piping plover and their critical habitat, manatees, pallid sturgeon, and sea turtles.

Avoid adverse impacts to nesting seabird colonies through careful design project features and timing of construction. For colonies containing nesting gulls, terns, and/or black skimmers, all activity occurring within 650 feet of a rookery should be restricted to the non-nesting period (i.e., September 16 through April 1, exact dates may vary within this window depending on species present). Prior to any such work, surveys should be conducted by qualified personnel during the colonial seabird nesting season to determine the presence and location of any such colonies. In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

If the proposed project has not been constructed within 1 year or if changes are made to the proposed project, the Corps should re-initiate Endangered Species Act consultation with the Service.

The newly created barrier headland/island and back-barrier marsh, as well as the surrounding habitats that may be indirectly benefited by long-shore transport and sediment overwash, should be monitored over the project life for effectiveness and the results should be provided to all resource agencies. Development of those monitoring plans should be coordinated with all natural resource agencies.

All containment features should be breached or degraded, if necessary to restore tidal connectivity, once the marsh creation/nourishment areas have at least 80% coverage of emergent vegetation.

7. The Service recommends that Caminada Alternative 5 and Shell Island Alternative 3 be re-analyzed as potential alternatives if: 1) the authorized funding limit is increased for this project, 2) if further planning studies are conducted, or 3) if significant modifications to the project are proposed.

8. During future maintenance events of the Empire Waterway the Corps should determine if the dredged material is suitable for placement on the beach/dune or in a feeder berm to help maintain Shell Island. The results of that determination and the placement of that material should be coordinated with the Service and other natural resource agencies. If suitable that material should be used accordingly.

9. Identification of additional borrow sites should be coordinated with the Service and other natural resource agencies.

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INTRODUCTION

The Barataria Basin Barrier Shoreline Restoration Integrated Feasibility Report and Environmental Impact Statement (EIS) was prepared by the U.S. Army Corps of Engineers-Mississippi Valley, New Orleans District (Corps), with input provided by the local sponsor, the Coastal Protection and Restoration Authority (CPRA), and other Federal and State coastal resource agencies. The Near-term Ecosystem Restoration Plan (NTP) for the Louisiana Coastal Area (LCA), Louisiana, Ecosystem Restoration Feasibility Study was originally authorized by Resolutions adopted by the U.S. House of Representatives and Senate Committees on Public Works, on October 19, 1967, and April 19, 1967, respectively. Those resolutions sought to improve existing hurricane protection features and the ". . . prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and related water resource purposes." The Barataria Basin Barrier Shoreline Restoration Project was identified as a critical near-term restoration project in the NTP (USACE 2004). This project was recommended for authorization by the Chief of Engineers on January 31, 2005, was transmitted by the Assistant Secretary of the Army for Civil Works (ASA (CW)) to Congress on November 18, 2005, and authorized in Title VII of the Water Resources Development Act of 2007.

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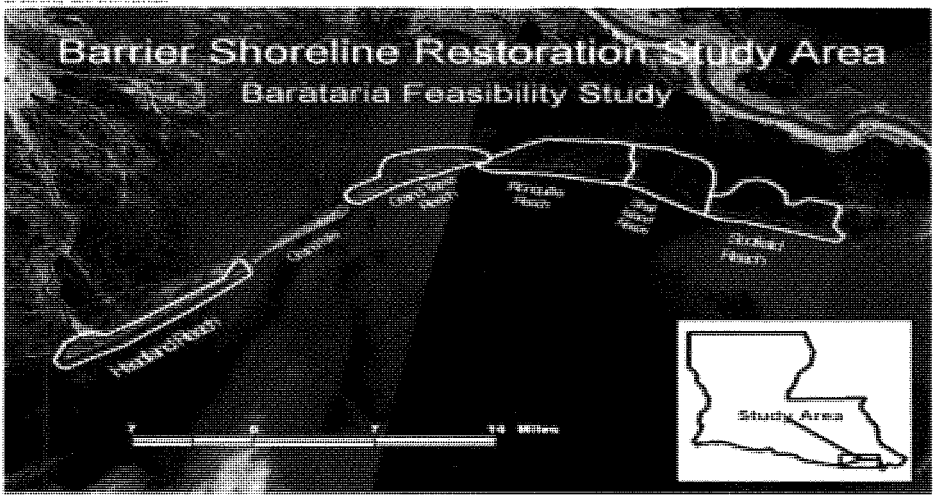
This draft report contains a description of existing fish and wildlife resources in the project area, discusses future with-project (FWP) and future without-project (FWOP) habitat conditions, identifies fish and wildlife-related impacts, and provides recommendations to improve the proposed barrier shoreline restoration measures. When finalized, this report will be submitted in partial fulfillment of the requirements of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and will constitute the report of the Secretary of the Interior as required by Section 2(b) of that Act. This draft FWCA Report is being provided to the Louisiana Department of Wildlife and Fisheries (LDWF) and the National Marine Fisheries Service (NMFS); their comments will be incorporated into the final report.

Figure 1. The five reaches of the Barrier Shoreline Restoration Feasibility Study, Barataria Basin, Louisiana.



DESCRIPTION OF STUDY AREA

The study area lies within the Barataria Basin, which comprises the area between the Mississippi River and Bayou Lafourche. Both Caminada Headland and Shell Island are located in the southern end of the Barataria Basin in southeastern Louisiana.

The study area is composed of a series of headlands and flanking barrier islands formed by the reworking of abandoned Mississippi River delta complexes. The main distributary location of the Mississippi River switches to a more hydraulically efficient route about every 1,000 years, building a new delta complex. The abandoned delta subsides and the seaward margins are reworked by coastal processes, forming a sandy barrier shoreline (headland) and eventually detached barrier islands. The Caminada Headland Reach was formed following abandonment of the Lafourche Delta, which was active from approximately 1,000 years ago to 300 years ago. Major abandoned distributaries in this reach are Bayous Lafourche and Moreau. The Shell Island Reach was associated with distributaries in the Plaquemine Delta which was active from approximately 905 years ago to 350 years ago.

The 13-miles long Caminada Headland Reach (Figure 2), located in Lafourche and Jefferson Parishes, extends from the Belle Pass jetties at the mouth of Bayou Lafourche on the western end of the headland to Caminada Pass on the eastern end. The Caminada Headland is bounded by the Gulf of Mexico (Gulf) to the south and extends approximately 2,250 feet north of the Gulf. The Headland maintains the integrity of the Gulf shoreline and protects the interior coast from further deterioration. This reach is the longest uninterrupted stretch of beach in the Barataria basin and

consists of sand dune, beach berm, barrier marshes, and chenier ridges interspersed with mangrove thickets, coastal dune shrub thickets, lagoons and small bayous. Ritchie et al. (1995) characterize the Caminada Headland as comprised of very well sorted sand. A representative profile of the Headland, beginning at the beach and proceeding landward, would characterized by an active beach, overwash, dunes, barrier flats (scrub/shrub and salt flats), back-barrier saline, intertidal flats, and open water. On Caminada the elevations range from an average of +3.5 feet North American Vertical Datum of 1988 (NAVD) to the average back-barrier marsh elevation of 0.94 feet, NAVD while the Mean High Water is 1.53 feet NAVD and Mean Low Water is 0.48 feet NAVD. The rate of relative sea level rise for Caminada is 0.025 feet/year (Coastal Engineering Consultants, Inc. [CEC] and SJB Group, 2005 and 2008). Most of the land in the Caminada Headland is privately owned.

In 1935, the Belle Pass Jetties were constructed of rip-rap and have been modified over time with some of the rip-rap placed in the nearshore zone just east of the Bell Pass Jetty on the Caminada Headland. The jetties have an impact on the longshore transport along the headland to the west, trapping sand, and causing a significant downdrift impact on the Timbalier Islands to the west. Following Hurricane Juan, in 1986 a section of the Caminada Headland seaward of Port Fourchon was armored with a cement-filled bag revetment locally referred to as the Boudin bags. Beach was added in front of the Boudin bags, as well as, dredged material was backfilled landward of the revetment. The revetment is an interruption of the natural coastal processes including cross shore sediment transport by both washover/backwash events as well as Aeolian processes. In 1992, Hurricane Andrew struck the Louisiana coastline causing considerable damage to the revetment, displacing the bags as much as 130 feet landward (Ritchie et al, 1995). In an attempt to prevent erosion along the headland fronting the oil and gas facilities, private oil companies constructed thirteen breakwaters by sinking barges in the nearshore zone. Subsequently, the barges were filled with rip-rap.

The Shell Island Reach (Figure 3) lies approximately 49 miles south-southeast of New Orleans, Louisiana in Plaquemines parish. The remnants of Shell Island are located between Fontanelle Pass (Empire Jetties) and Grand Bayou Pass. Shell Island used to enclose both Bastian Bay and Shell Island Bay but shoreline recession and erosion has since disintegrated the island into several smaller islands and shoals. The few remaining islands and shoal remnants provide limited protection to the back barrier environment from waves and flooding. The construction of the Empire Jetties, in 1950, restricted the east to west longshore transport and increased the loss rates of Shell Island by approximately 10 feet/year along the easternmost 5,000 to 8,000 feet of the island (Thomson et al, 2005 and 2008). Hurricane Bob in 1979 created a new inlet (Coupe Bob) that accelerated retreat and sediment loss. It is believed, that the creation of Coupe Bob caused a quadrupling of the retreat rates of Shell Island and is the major reason for the disintegration of the island (Thomson et al, 2005 and 2008).

Shell Island consists primarily of open water with little beach or saline marsh habitat with few shrubs and mangroves. Ritchie et al. (1995) characterized the Shell Island area as a recently breached recurved spit composed of beach sand along the Gulf shoreline and reworked oyster

shells with thin layers of sand strata behind the narrow flat eroding beaches. The shell deposits are formed into well-defined ridges and swales. Although the vegetation and surface forms resemble dune ridges, there is no Aeolian (wind-driven) sand. Shell Island elevations range from an average of 4 feet, NAVD at the dune/supratidal height to an average of 1.5 feet, NAVD in the marsh with the change in offshore slope determined to be at -5 feet, NAVD, and the depth to closure calculated at -15.5 feet, NAVD. The rate of relative sea level rise in the Shell Island reach was determined to be 0.055 feet/year (Thomson et al, 2005).

In 2008, Hurricanes Gustav and Ike affected the Louisiana coastline. Erosion, overwash, and washouts occurred across the Caminada Headland project area. Similar conditions existed after Hurricanes Katrina and Rita in 2005, however, by 2007 natural rebuilding processes had closed smaller washouts while larger washouts were reduced in size. In addition, rebuilding of beaches had occurred along the entire project area. The Fish and Wildlife Service (Service) is unaware of any factors that would significantly change the natural rebuilding process, therefore natural restoration of the beach and closure of washouts is expected to occur. Regardless of the rate of natural rebuilding the configuration of any implemented plan would likely remain unchanged; therefore, benefits of any restoration would remain unchanged except if natural rebuilding occurred slower than previous events, then benefits may represent a conservative estimate.

Figure 2. Caminada Headland Reach.

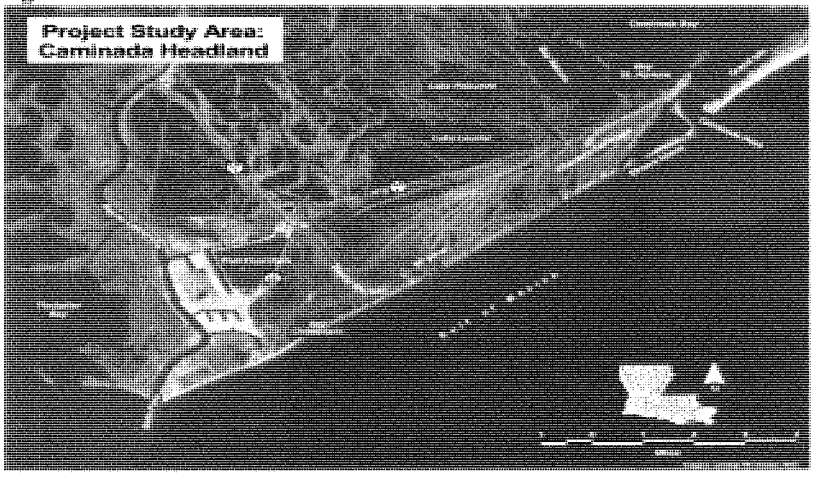
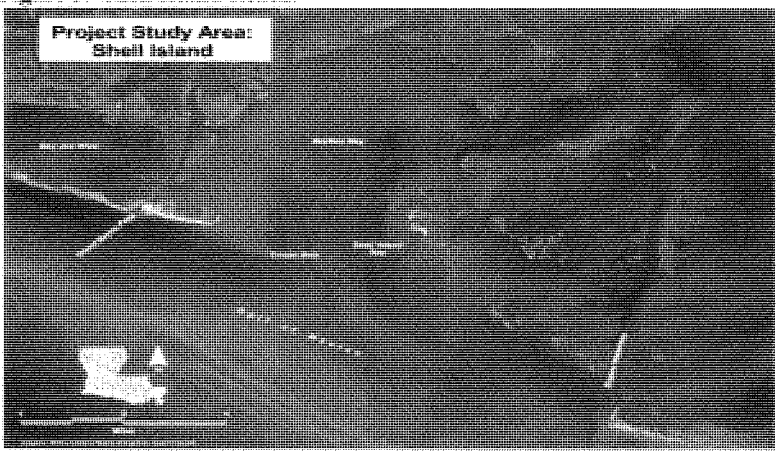


Figure 3. Shell Island Reach.



FISH AND WILDLIFE RESOURCES

Description of Habitats

The Barataria Basin is a broad, low-lying region that is bounded by the Mississippi River on the east and Bayou Lafourche on the west. The southern half of the basin consists of tidally influenced marshes connected to a large bay system bordered by a series of barrier headlands, islands and shorelines which separates the basin from the Gulf of Mexico to the south.

The proposed barrier shoreline restoration sites are within the estuarine portion of the Barataria Basin, and associated marsh or shallow open water at the southern extreme of the basin. At the Caminada Headlands there are approximately 1,360 existing acres of headland and marsh habitats. At Shell Island there currently exist approximately 145 acres of barrier shoreline and backbarrier marsh habitats. The primary factors controlling plant species distribution at those sites are salinity and elevation. The habitat types in the study area primarily consist of beach, overwash, dune, barrier flats (scrub/shrub and salt flats), mainland and back-barrier saline marsh, intertidal flats, and open water.

Beach and Overwash

Active beach and overwash areas occur on the gulfside of barrier shorelines from the intertidal zone to the toe of the dune. This area contains wave-washed, sandy sediments and is usually too unstable for vegetation establishment. Plants adapted to harsh backshore conditions (i.e., high salinity, high winds, and rapid sand burial) may become established in front of the dunes. Pioneer beach vegetation may include sea purslane, marsh hay cordgrass, sea rocket, and seaside heliotrope. Overwash areas may become colonized by grasses (i.e., coastal dropseed, salt grass,

and *Paspalum* spp.) as well as morning glory and sea purslane.

Dune

Dunes were formed from sand deposited by storm surges and/or transported by wind and trapped by dune grasses. Dune height and orientation are a function of prevailing wind direction and speed and sand size. Sea oats can tolerate salt spray and sand burial, and contribute to the dune building process by stabilizing wind blown sand. Other plants include marsh hay cordgrass, bitter panicum, and beach croton.

Barrier Flats and Shrub/scrub

Plants requiring elevation and protection from coastal processes may be found behind the dunes. Saltwort, creeping glasswort, and Bigelow glasswort are found in pockets of high salinity, often in areas that are only intermittently flooded due to their higher elevation. In areas subjected to frequent drying, seaside goldenrod and groundsel bush are occasionally found, as well as the salt-tolerant shrubs including sea myrtle, sea ox-eye and marsh elder. Shrubs are occasionally covered with the parasitic vines, including common dodder and pretty dodder. These plants may also be found in the high marsh zone.

Saline Marsh

Saline marshes in the project area occur behind the barrier headlands and on the bayside of the barrier islands. Those intertidal marshes usually exhibit fairly firm mineral soils and experience moderate to high daily tidal energy. The saline marsh community typically has the lowest plant species diversity of any marsh type. Although many plants can tolerate a periodically flooded substrate, few can tolerate the combined stresses of flooding and high salinity. The dominant species in the salt marshes of the project area is saltmarsh cordgrass, a perennial grass that grows from extensive rhizomes. Saltmarsh cordgrass also dominates the high marsh areas subject to intermittent flooding, although the highly salt-tolerant salt grass, black needle rush, and glassworts are also frequently present. Black mangrove occurs as a shrub along the flooded marsh edges of the barrier islands and on the banks of tidal streams, ponds, and bays. Mangroves are extremely important in stabilizing the shoreline and reducing erosion in these areas. The Louisiana Natural Heritage Program (Smith 1988) classifies the mangrove zones separately from salt marsh as intertidal saltwater swamps. Mangroves are at their northern natural limit here and are periodically killed back by winter freezes. The mangrove population of coastal Louisiana was damaged by severe freezes in 1983 and 1984. The recent mild winters have allowed strong regrowth, but most plants are only three to six feet tall.

Intertidal Flats

Intertidal mud flats are typically ephemeral areas of unconsolidated organic and mud deposits that occur in areas of low wave and tidal energy. Although those areas are considered "non-

vegetated," mats of algae may form on them. Benthic microalgae are also found in the top few centimeters of sediment. Where significant wave action occurs along the bayside margin of the barrier, fine sand may be reworked into small beaches and sandy intertidal flats. Waves keep silts and clays suspended until they eventually settle in deeper water or protected intertidal mud flats. Sand flats are the preferred habitats of various invertebrates, crustaceans, and mollusks.

Open Water

The major water bodies in the study area are the Gulf of Mexico, Bayou Lafourche, Caminada Bay, Caminada Pass, Bay Champagne, Bayou Moreau, Bayou Thunder Von Tranc, Bastian Bay, Shell Island Bay, Grand Bayou Pass, and Bayou Fontanelle. These areas are crossed with numerous oil & gas access canals. In the majority of the study area, the levels of turbidity and energy are too high for the growth of submerged aquatic vegetation.

Borrow Sources

It is expected that two borrow sources will be used for this project: a high-quality sand source for the beach-dune portion of the project and an offshore mixed-sediment deposit to be used for the marsh construction. It was assumed that the Mississippi River is the source of high-quality sand that would be used for the Shell Island portion of the project. The Empire borrow area is assumed to be used for the marsh construction at Shell Island. However, the Empire borrow area is expected to be used for the Pelican Island Restoration Project which would result in an insufficient amount of borrow for this project. Further investigations are needed to identify additional borrow sources.

For Shell Island several other borrow areas were purposed to provide sediments for marsh restoration, primarily including Empire, Quatre Bayou deep (will be partially used for the restoration of Chaland Headland), Quatre Bayou D2, and Sandy Point (farthest away). Other sources were identified and further investigation is recommended to find the closest mixed sediment source for marsh restoration. Ship Shoal was also identified as another potential source of high quality sands for beach-dune creation, however, the distance to Shell Island makes this sand souree prohibitively expensive.

For construction at the Caminada Headland portion of the project, material for the dune and beach construction would be taken from the South Pelto Block of Ship Shoal. Ship Shoal is a large offshore submerged sandy shoal in the Gulf located approximately 50 miles southwest of Belle Pass. A suitability analysis was conducted comparing Caminada sediments to South Pelto Block sediments. The sediments from South Pelto Block were concluded to be suitable for beach and dune restoration. It is recommended that an overfill ratio of 1.08 be used in design volume analysis.

CPRA is currently performing a nearshore borrow area investigation in addition to the Ship Shoal investigation for the purpose of creating the back-barrier marsh fill platform. It is

recommended that this include an evaluation of the potential borrow materials for compatibility with the native marsh.

The amount of waterbottoms expected to be excavated for beach/dune and marsh creation for each island is only an estimate for the initial construction. The preference of the State would be to use the same borrow sites for each renourishment cycle, but it is unknown if those sites will be replenished with the same type of material in time for each renourishment. Therefore, if additional borrow sites for renourishment are needed, then those borrow sources will need to be addressed in supplemental environmental documents.

Fishery Resources and Essential Fish Habitat

Barataria Bay Barrier Shoreline's transitional habitats provide unique nursery, foraging, predator refugia, and spawning habitat for numerous economically important marine and estuarine species that exhibit a preference for or are dependent on these habitats as transients during portions of their life history (Saucier and Baltz 1993). Surf zone, intra-island ponds and tidal creeks, and back-bay sand flats, including those along barrier islands and headlands support distinct fish and crustacean assemblages in comparison to mainland or inland saline marshes (Williams 1998). Common surf zone species include Gulf menhaden (*Brevoortia patronus*), spot (*Leistomus xanthurus*), striped mullet (*Mugil cephalus*), southern kingfish (*Menticirrhus americanus*), anchovies (Anchoa spp.), scaled sardine (*Harengula jaguana*), Florida pompano (*Trachinotus carolinus*), Atlantic bumper (*Chloroscombrus chrysurus*), Spotfin mojarra (*Euchinostomus argenteus*), and rough silverside (*Membras martinica*). The surf zone is used temporarily by larval and juvenile life stages of some of these species awaiting transport to back-barrier, bay, or mainland habitats. Barrier island flats typically are used by white mullet (*Mugil curema*), longnose killifish, darter gobies, and inland silversides (*Minidia beryllina*). Marsh edge and interior creeks are used by brown shrimp (*Farfantepenaeus aztecus*), white shrimp (*Litopeneaus setiferus*), Atlantic croaker (*Micropogonias undulatus*), spotted seatrout (*Cynoscion nebulosus*), sheepshead minnow (*Cyprinodon variegatus*), killifish, and sand seatrout (*Cynoscion arenarius*), some of which are constituents of assemblages that use the other island aquatic habitats (Foreman 1968; Zimmerman 1988). Fox and Mock (1968) reported bay anchovy (*Anchoa mitchilli*), hardhead catfish (*Aropsis felis*), Gulf menhaden, Atlantic croaker, and inland silverside accounted for over 90% of the total specimens collected from a vegetated bayside edge near the study area. Additionally, young of the year red drum and mangrove snapper (*Lutjanus griseus*) have a high affinity for quiescent intra-island creeks and ponds in the post larval early juvenile stages (Thompson 1988).

Economically important fish species, spotted seatrout, red drum (*Sciaenops ocellatus*), black drum (*Pogonias cromis*), spotted seatrout, Gulf menhaden, striped mullet, and southern flounder (*Paralichthys lethostigma*), use barrier island habitats (e.g., shorelines and passes) for foraging areas, nursery habitat, and staging areas during spawning or associated migratory aggregations (Saucier and Baltz 1993). Additionally, young of the year red drum and mangrove snapper (Lutjanus griseus) have a high affinity for quiescent intra-island creeks and ponds in the post

larval early juvenile stages (Thompson 1988). Commercially and recreationally important species of shellfish include blue crab, white shrimp, brown shrimp, American oyster, and Gulf stone crab.

Other finfishes and crustaceans expected to occur in the study area include gafftopsail catfish, Spanish mackerel, bull shark, ladyfish, Atlantic needlefish, Gulf killifish, fat sleeper, gobies, speckled wormeel, least puffer, Gulf pipefish, Atlantic spadefish, alligator gar, pink shrimp, seabob, roughneck shrimp, grass shrimp, mysid shrimp, and mud crab. Other invertebrates found in the study area include *Rangia* clam, jellyfish, and ctenophores.

Temperature and salinity govern the general patterns of estuarine use by fishes and macroinvertebrates (Day et al. 1989; Baltz and Jones 2003). Freshwater species are not expected to occur in the study area. However, freshwater species would typically occur in the proposed Mississippi River borrow site near Nairn, Louisiana. Freshwater species include largemouth bass and channel catfish.

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; P.L. 104-297) set forth a new mandate for NOAA's National Marine Fisheries Service (NMFS), regional fishery management councils (FMC), and other federal agencies to identify and protect important marine and anadromous fish habitat. The Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Act support one of the nation's overall marine resource management goals- maintaining sustainable fisheries. Essential to achieving this goal is the maintenance of suitable marine fishery habitat quality and quantity. Detailed information on Federally managed fisheries and their EFH is provided in the 1999 generic amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the Gulf of Mexico FMC. The generic FMP subsequently was updated and revised in 2005 and became effective in January 2006 (70 FR 76216). NMFS administers EFH regulations. Categories of EFH in the project vicinity include estuarine and marine areas. Estuarine categories include estuarine emergent wetlands, mangrove wetlands, submerged aquatic vegetation, and estuarine water column, mud, sand and shell water bottoms. Marine areas include water column, non-vegetated bottoms, and continental shelf features. EFH has been designated in project fill areas for brown shrimp, white shrimp, red drum, bluefish, and Spanish mackerel. EFH has been designated in the potential offshore borrow sites for the following species in addition those listed for the fill areas: red snapper, gray triggerfish, king mackerel, cobia, little tunny, bonnethead shark, blacknose shark, and stone crab. Coastal wetlands also provide nursery and foraging habitat that supports economically important marine fishery species such as spotted seatrout, sand seatrout, southern flounder, Atlantic croaker, spot, Gulf menhaden, striped mullet, white mullet, silversides, killifish, kingfish, pompano, scaled sardines, anchovies, and blue crab. Some of these species serve as prey for other fish species managed under the Magnuson-Stevens Act by the GMFMC (e.g., mackerels, snappers, and groupers) and highly migratory species managed by NMFS (e.g., billfishes and sharks). These wetlands also produce nutrients and detritus, important components of the aquatic food web, which contribute to the overall productivity of the Barataria Bay estuary and nearshore Gulf of Mexico.

Salinity conditions are primarily saline and the project areas usually do not contain submerged aquatic vegetation. Much of the open water has become established at the expense of the barrier shoreline and emergent marsh.

Wildlife Resources

Because of their permeable skin and the need for osmoregulation, amphibians are typically restricted to the less-saline areas that are located primarily in the upper portions of the Basin. Amphibians found in the lower basin where suitable freshwater pools may form include the green tree frog, squirrel treefrog, Gulf coast toad, and eastern narrow-mouthed toad (Dundee and Rossman 1989). Mabie (1976) indicates that the only species typically found in the Gulf salt marsh environment is the Gulf coast toad and little information is available on their distribution on the barrier islands. Dundee and Rossman (1989) report that the eastern narrow-mouthed toad has been found on sea beaches in southeastern Louisiana, as well as under boards in a salt marsh in Cameron Parish.

In saline marshes, reptiles are limited primarily to the salt marsh snake and the diamond-backed terrapin. Sea turtles may seasonally utilize the bays and saline marshes adjacent to and including the Gulf and barrier island beaches.

Many mammals, because of their life history requirements, would not likely be found in the Caminada Headland or Shell Island study area. The swamp rabbit can be found in the Caminada Headland portion of the study area, the river otter is typically found in greatest densities in the brackish marshes, and muskrat can be found in brackish and saline marshes of the basin (LCWCRTF and WCRA 1999; Condrey et al. 1995). However, raccoons and coyotes are the most likely mammals to occur on the barrier islands. The Coast 2050 Report (LCWCRTF and WCRA 1999) indicates an overall decline in furbearers that were historically present in the study area over the past 10 to 20 years. The bottlenose dolphin is the primary marine mammal that would likely be found in the study area, and then only in estuarine/marine open water portions of the area. However, the West Indian manatee has been documented occasionally in near by Bayou Lafourche and other surrounding areas like Lake Pontchartrain. In addition, various species of whales have been documented in the offshore waters of the study area.

Birds are the most diverse group of terrestrial vertebrate species that can be found in the study area and include both resident and migrant species among the following groups: waterfowl, seabirds, wading birds, shorebirds, raptors, and songbirds. Avian use of existing wetlands within the study area varies, depending upon existing seasonal and environmental conditions.

The outer coast and barrier habitats are especially critical to migrating birds, such as songbirds, shorebirds, and waterfowl as they provide a place to land, recover, and feed. Trans-gulf migrants use the Barataria Basin barrier shoreline and surrounding areas as a staging area and as a final departure area for their fall migration as well as first landfall during spring migration. The

Barataria Basin is at the terminus of the Mississippi Flyway, which is the largest waterfowl migration route in North America. The 1986 *North American Waterfowl Management Plan* (Secretary, U.S. Department of the Interior and Canada Minister of the Environment 1986) identified the preservation and maintenance of critical over-wintering habitats as a key factor in preventing the further decline in the continental waterfowl population. The 2004 North American Waterfowl Plan outlined in *Strategic Guidance* (Secretary, U.S. Department of the Interior and Canada Minister of the Environment, Mexico Secretary of the Environment and Natural Resources 2004) renews the commitment to the 1986 Plan as well as providing goals, priorities, and strategies for the next 15 years.

The Coast 2050 Report (LCWCRTF and WCRA 1999) characterizes dabbling and diving duck population trends since 1985 as steady in the open water and salt marsh habitat of the Caminada Headland but decreasing in the Shell Island area. However, waterfowl are not historically present on the barrier shorelines.

Shorebirds such as the piping plover, semipalmated sandpiper, western sandpiper, curlew, ruddy turnstone, American avocet, oystercatcher, greater yellowlegs, common snipe, and killdeer are found within the study area. Shorebirds inhabit saline marsh, and shallow water/mud flat habitats of the barrier shorelines and surrounding estuary. Roosting habitats include beaches, sandbars, spits, or flats above high tide and shallowly flooded areas or islands free of vegetation (Helmers 1992). Many shorebird species are regular to accidental migrants, although some are common residents throughout the study area. In the Caminada headland portion of the study area shorebirds have been steady for the past 10 to 20 years, while they have seen a decrease in the Shell Island area mostly because of land loss of the island and surrounding areas (LCWCRTF and WCRA 1999).

Seabirds including pelicans, gulls, terns, and skimmers are also found within the Barataria Basin and its barrier shorelines. Gulls, terns, and skimmers are colonial nesters on sites near or within the study area (Michot et al. 2003; Martin and Lester 1990; Visser and Peterson 1994). In fact coastal Louisiana has the Nation's largest concentrations of colonial nesting wading birds and seabirds. One hundred ninety-seven colonies of wading birds and seabirds (representing 215,249 pairs of nesting birds), were observed in coastal Louisiana during a 2001 survey (Michot et al. 2003). Queen Bess Island is an active brown pelican nesting site north of the study area. Condrey et al. (1995) reported that most seabird species nest on islands because of their remoteness and lack of predators. Non-island breeding sites are more frequently abandoned by the seabird species that use them, in contrast to the barrier island sites, which tend to be used for 10 years or more. The Coast 2050 Report (LCWCRTF and WCRA 1999) indicates that since 1985 seabirds have been declining on the barrier shorelines of the study area, however, they have been steady in the Caminada salt marsh and open water areas as well as the open water areas of Shell Island. There has been an overall increasing trend of pelican in most of the basin as well as the study area since 1985.

Condrey et al. (1995) indicate that most colonies of wading birds (herons and egrets) are found in

the swamp, although most species of wading birds will also nest on barrier islands and in almost any marsh, fresh to saline, where shrubs and mangroves are available. The Coast 2050 Report (LCWCRTF and WCRA 1999) characterizes wading bird population trends since 1985 as steady in the salt marsh and barrier beaches of the Caminada Headland and decreasing at and around Shell Island.

Raptors are not typically or have not been historically present on the barrier shorelines and surrounding open water and salt marsh of the study area (LCWCRTF and WCRA 1999). The Coast 2050 Report (LCWCRTF and WCRA 1999) indicates that rails, coots, and gallinules have not been historically present on the barrier shorelines of the study area but are have been steady since 1985 in the salt marsh habitat of the surrounding Caminada area.

Because of their life history requirements, few other bird species are expected to inhabit the surrounding marshes and open water areas of the study area except to use them as temporary staging areas before and after trans-gulf migrations. The seaside sparrow is associated with the pounding surf and the densely matted grasses and sedges along the shorelines of Louisiana beaches with their nest placed often only a foot or so high in a mangrove bush (Lowery 1974). For the most part where these species of birds exist in the study area they have been steady in the surrounding marsh and open water areas of the Caminada Headland and either have been steady or declining in and around Shell Island (LCWCRTF and WCRA 1999).

Invasive Species

Both nutria and feral hogs are the primary invasive mammalian species that could occur throughout the Barataria Basin. However, they both are typically found in the freshwater swamps and marshes of the basin (Condrey et al. 1995), which is located outside of the study area.

The monk parakeet, Eurasian collarded-dove, European starling, English sparrow, and cattle egret are all potential invasive avian species in the basin but again are not likely to occur in the study area.

Although Chinese tallow and other potentially invasive species have been sighted on rare occasions, no problems caused by encroachment of invasive plant species have been reported on Louisiana's barrier islands. This is likely due to the extreme environmental conditions, such as higher salinities, shifting substrates, and frequent storm disturbance that may severely limit suitability of the habitat for colonization.

Threatened and Endangered Species

Federally listed threatened (T) and endangered (E) species and/or their designated critical habitat occurring in the study area include the brown pelican (E), piping plover (T) and its designated critical habitat, pallid sturgeon (E), and West Indian manatee (E). Several species of

threatened/endangered sea turtles are also known to forage in the coastal waters of the study area. Those species include the loggerhead sea turtle (T), Kemp's ridley Sea turtle (E), green sea turtle (T), leatherback sea turtle (E), and hawksbill sea turtle (E). Additionally the bald eagle is protected under the Bald and Golden Eagle Protection Act (BGEPA) and may exist in the Mississippi River borrow area for Shell Island.

Although brown pelicans (*Pelecanus occidentalis*) nest on Queen Bess Island, no known brown pelican nesting sites occur within the study area. However, brown pelicans may forage in the shallow estuarine waters and use sand pits and offshore sand bars as resting and roosting areas. Major threats to this species include chemical pollutants, colony site erosion, disease, and human disturbance.

The piping plover (*Charadrius melodus*), as well as its designated critical habitat, occur along the Louisiana coast. Piping plovers winter in Louisiana, and may be present for 8 to 10 months, arriving from the breeding grounds as early as late July and remaining until late March or April. Piping plovers feed extensively on intertidal beaches, mudflats, sand flats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting. Roosting areas may have debris, detritus, or micro-topographic relief offering refuge to plovers from high winds and cold weather. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape, as the suitability of a particular site for foraging or roosting is dependent on local weather and tidal conditions. Plovers move among sites as environmental conditions change.

On July 10, 2001, the U.S. Fish and Wildlife Service designated critical habitat for wintering piping plovers (66 FR, No. 132). Their designated critical habitat identifies specific areas that are essential to the conservation of the species. The primary constituent elements for piping plover wintering habitat are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support those habitat components. Constituent elements are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide. Important components (or primary constituent elements) of intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting plovers. Major threats to this species include the loss and degradation of habitat due to development, disturbance by humans and pets, and predation.

The study area encompasses Critical Habitat Unit LA-5 which includes portions of the Louisiana shoreline from Timbalier Island to East Grand Terre Island. At the time of designation, that Unit consisted of approximately 5,735 acres. Specifically, piping plover critical habitat within Unit 5 includes ". . . all of Timbalier Island where primary constituent elements occur to the MLLW [mean low low water], all of Belle Pass West . . . where primary constituent elements occur to the MLLW; the Gulf shoreline extending approximately [6.8 miles] east from the east side of

Belle Pass bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; all of Elmers Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmers Island to approximately [0.56 mile] west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat . . . begins and where the constituent elements no longer occur; the Gulf shoreline of Grand Isle from the Gulf side of the hurricane protection levee to MLLW; and all of East Grand Terre Island where primary constituent elements occur to the MLLW" (66 FR, No. 132, Page 36127).

The pallid sturgeon (*Scaphirhynchus albus*) is an endangered fish found in Louisiana, in both the Mississippi and Atchafalaya Rivers (with known concentrations in the vicinity of the Old River Control Structure Complex); it is possibly found in the Red River as well. The pallid sturgeon may exist at the potential Mississippi River borrow site for Shell Island. The pallid sturgeon is adapted to large, free-flowing, turbid rivers with a diverse assemblage of physical characteristics that are in a constant state of change. Detailed habitat requirements of this fish are not known, but it is believed to spawn in Louisiana. Habitat loss through river channelization and dams has adversely affected this species throughout its range. Measures that would reduce the likelihood of adversely affecting the pallid sturgeon include keeping the cutterhead shall completely buried in the bottom material during dredging operations. Also, during dredging, the pumping rates shall be reduced to the slowest speed feasible while the cutterhead is descending to the channel bottom. If pumping water through the cutterhead is necessary to dislodge material, or to clean the pumps or cutterhead, etc., the pumping rate shall be reduced to the lowest rate possible until the cutterhead is at mid-depth, where the pumping rate can then be increased. Should the proposed project directly or indirectly affect the pallid sturgeon or its habitat, further consultation with this office will be necessary.

West Indian manatees (*Trichechus manatus*) have been occasionally observed along the Louisiana Gulf coast during the summer months. The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals.

Endangered and threatened sea turtles forage in the nearshore waters, bays and sounds of Louisiana. NOAA Fisheries is responsible for aquatic marine threatened or endangered species. Eric Hawk (727/570-5312) in St. Petersburg, Florida, should be contacted for information concerning those marine species.

Species of Special Interest

Bald eagles (*Haliaeetus leucocephalus*) nest in Louisiana from October through mid-May. Eagles typically nest in bald cypress trees near fresh to intermediate marshes or open water in the southeastern parishes. Although no nests are known to occur within the study area, unknown nest sites may potentially exist near the Nairn borrow source for Shell Island which is along the

Mississippi River. Major threats to this species include habitat alteration, human disturbance, and environmental contaminants (i.e., organochlorine pesticides and lead).

Although the bald eagle has been removed from the List of Endangered and Threatened Species, it continues to be protected under the MBTA and the BGEPA. The Service developed the National Bald Eagle Management (NBEM) Guidelines to provide landowners, land managers, and others with information and recommendations to minimize potential project impacts to bald eagles, particularly where such impacts may constitute "disturbance," which is prohibited by the BGEPA. A copy of the NBEM Guidelines is available at: http://www.fws.gov/southeast/es/baldeagle/NationalBaldEagleManagementGuidelines.pdf. Those guidelines recommend: (1) maintaining a specified distance between the activity and the nest (buffer area); (2) maintaining natural areas (preferably forested) between the activity and nest trees (landscape buffers); and (3) avoiding certain activities during the breeding season. On-site personnel should be informed of the possible presence of nesting bald eagles within the project boundary, and should identify, avoid, and immediately report any such nests to this office. If a bald eagle nest is discovered within or adjacent to the proposed project area, then an evaluation must be performed to determine whether the project is likely to disturb nesting bald eagles. That evaluation may be conducted on-line at: http://www.fws.gov/southeast/es/baldeagle. Following completion of the evaluation, that website will provide a determination of whether additional consultation is necessary; a copy of that determination should be provided to this office. The Division of Migratory Birds for the Southeast Region of the Service (phone: 404/679-7051, e-mail: SEmigratorybirds@fws.gov) has the lead role in conducting such consultations. Should you need further assistance interpreting the guidelines or performing an on-line project evaluation, please contact this office.

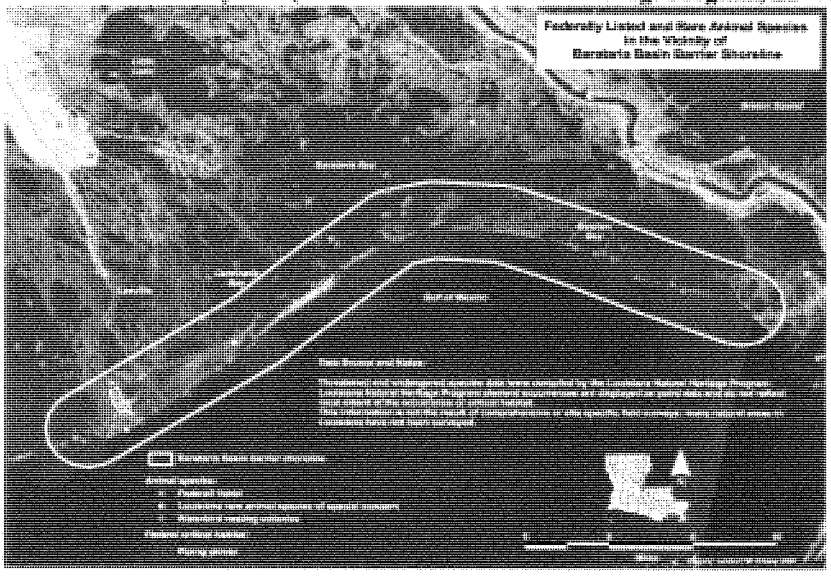
The Corps is responsible for determining whether the selected alternative is likely (or not likely) to adversely affect any listed species and/or critical habitat, and for requesting the Service's concurrence with that determination. If the Corps determines, and the Service concurs, that the selected alternative is likely to adversely affect listed species and/or critical habitat, a request for formal consultation in accordance with Section 7 of the ESA should be submitted to the Service. That request should also include the Corps' rationale supporting their determination.

The Service has been and currently is a cooperating agency for the LCA Comprehensive Study, the LCA Near-Term Plan Study, and the LCA Barrier Shoreline study. The Service provided a September 26, 2003, letter to the Corps detailing Federally listed threatened and endangered species, their critical habitat, and migratory birds that may be found in or near the study area for the draft LCA Comprehensive Study. That letter and the draft Biological Assessment are applicable to the LCA Near-Term Plan, of which this study is a subset. In addition the Service's comment letter on the Notice of Intent to prepare a Draft Environmental Impact Statement for this LCA Barrier Shoreline study identified the need to address potential impacts to threatened and endangered species.

The following figure displays federally listed rare animal species, designated critical habitat, and

important bird areas in the study area (source: Louisiana Natural Heritage Program).

Figure 4 Federally listed rare animal species, designated critical habitat, and important bird areas in the study area (source: Louisiana Natural Heritage Program, LDWF).



Refuges and Wildlife Management Areas

The Service administers 10 National Wildlife Refuges (NWR) encompassing more than 301,700 acres in Coastal Louisiana. However, there are no NWR in the study area. The Louisiana Department of Wildlife and Fisheries operates 17 refuges, preserves, and wildlife management areas (WMA) in coastal Louisiana, comprising more than 572,000 acres. The Wisner State WMA has 21,621 acres that are located just north of the Caminada Headland study area. The Louisiana Office of State Parks operates the Grand Isle State Park, located on Grand Isle, between the Headland and Grand Terre Reaches.

EVALUATION METHODOLOGY

Evaluation of project-related impacts on fish and wildlife resources was aided by use of the Wetland Value Assessment (WVA) methodology developed for the evaluation of proposed Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) projects (LCWCRTF 2006). The WVA methodology is similar to the Service's Habitat Evaluation Procedures (HEP), in that habitat quality and quantity are measured for baseline conditions and predicted for future without-project (FWOP) and future with-project (FWP) conditions. Separate habitat assessment

models were used, including the Barrier Island, the Barrier Headland, and the Saline Marsh Community Models. Instead of the species-based approach of HEP, each model utilizes an assemblage of variables considered important to the suitability of a given habitat type for supporting a diversity of fish and wildlife species. As with HEP, these models allow a numeric comparison of each future condition and provide a combined quantitative and qualitative estimate of project-related impacts to fish and wildlife resources.

The WVA models operate under the assumption that optimal conditions for fish and wildlife habitat within a given coastal wetland type can be characterized, and that existing or predicted conditions can be compared to that optimum to provide an index of habitat quality. Habitat quality is estimated and expressed through the use of a mathematical model developed specifically for each habitat type. Each model consists of: 1) a list of variables that are considered important in characterizing fish and wildlife habitat; 2) a Suitability Index graph for each variable, which defines the assumed relationship between habitat quality (Suitability Indices) and different variable values; and 3) a mathematical formula that combines the Suitability Indices for each variable into a single value for wetland habitat quality, termed the Habitat Suitability Index (HSI).

The WVA methodology was initially developed in 1991 by the CWPPRA Environmental Work Group (LCWCRTF 2006). Initially, emergent marsh habitat models were developed for fresh, intermediate, brackish and saline marsh types. Subsequently, models were also developed for swamps, barrier islands, barrier headlands, and coastal forested ridges. The habitat variable-habitat suitability relationships within the WVA models have not been verified by field experiments or validated through a rigorous scientific process. However, the variables were originally derived from HEP suitability indices taken from species models for species found in that habitat type. It should also be noted that some aspects of the WVA have been defined by policy and/or functional considerations of CWPPRA. However, habitat variable-habitat suitability relationships are, in most cases, supported by scientific literature and research findings. In other cases, best professional judgment by a team of fisheries biologists, wildlife biologists, ecologists, and university scientists may have been used to determine certain habitat variable-habitat suitability relationships. In addition, the WVA models have undergone a refinement process and habitat variable-habitat suitability relationships, HSIs, and other model aspects are periodically modified as more information becomes available regarding coastal fish and wildlife habitat suitability, coastal processes, and the efficacy of restoration projects being evaluated.

The WVA models assess the suitability of each habitat type for providing resting, foraging, breeding, and nursery habitat to a diverse assemblage of fish and wildlife species. This standardized, multi-species, habitat-based methodology facilitates the assessment of project-induced impacts on fish and wildlife resources. The barrier island WVA model consists of seven variables: 1) percent of the total subaerial area that is classified as dune habitat; 2) percent of the total subaerial area that is classified as supratidal habitat; 3) percent of the total subaerial area that is classified as intertidal; 4) percent vegetative cover of dune, supratidal, and intertidal

habitats; 5) percent vegetative cover by woody species; 6) degree of marsh edge and interspersion; and 7) beach/surf zone features. The barrier headland WVA model consists of five variables: 1) percent of the total project area that is classified as dune habitat; 2) percent of the total project area that is classified as supratidal habitat; 3) percent vegetative cover of dune and supratidal habitats; 4) percent vegetative cover by woody species; and 5) beach/surf zone features. The saline marsh WVA model saline marsh consists of six variables: 1) percent of wetland covered by emergent vegetation; 2) percent open water dominated by submerged aquatic vegetation; 3) degree of marsh edge and interspersion; 4) percent of open water less than or equal to 1.5 feet deep; 5) salinity; and 6) aquatic organism access.

Using the WVA methodology, impact assessments were conducted by the Habitat Evaluation Team (HET), which included representatives of the Corps, the Service, CPRA, NMFS, and National Resource Conservation Service. To assess impacts the HET used Storm-induced BEAch CHange (SBEACH) model and GENESIS model output, surveys, shoreline erosion and marsh loss data, knowledge of the area, experience with similar projects, the previous LCA Barrier Island study (Jan 2003), field inspections conducted on July 2005 and May 2006, 1998 and October 2005 Digital Ortho-quarter Quadrangle aerial photographs (DOQQ), post hurricane's Katrina and Rita (CWPPRA) flight videos and photos, and May 2006 helicopter flight photos and video. Habitat acreage data were obtained from the U.S. Geological Survey (USGS). Interior marsh loss rates were obtained from the U.S. Army Corps of Engineers, New Orleans District and USGS.

These elements were used in conjunction with the above-discussed mathematical models to compute an HSI value for each target year (TY). Target years were established when significant changes in habitat quality or quantity were expected during the 50-year project life, under FWP and FWOP conditions.

The product of an HSI and the acreage of available habitat for a given target year is known as the Habitat Unit (HU). The HU is the basic unit for measuring project effects on fish and wildlife habitat. Future HUs change according to changes in habitat quality and/or quantity. Results are annualized over the project life to determine the Average Annual Habitat Units (AAHUs) available for each habitat type.

The change in AAHUs for each FWP scenario, compared to FWOP project conditions, provides a measure of anticipated impacts. A net gain in AAHUs indicates that the project is beneficial to the habitat being evaluated; a net loss of AAHUs indicates that the project is damaging to that habitat type.

Four alternatives were evaluated for Shell Island: Alternative 1 – two islands with no renourishment and advanced fill for 9 years, Alternative 2 – two islands with renourishment every 10 years and advanced fill for 10 years, Alternative 3 –one island with no renourishment and advanced fill for 10 years, and Alternative 5 –one island with renourishment every 20 years and advanced fill for 10 years. Four alternatives were also investigated for the Caminada

Headlands: Alternative 5 – Preferred Dune with Expanded Marsh, Alternative 6 – Preferred Dune with Expanded Marsh and 1 Renourishment, Alternative 7 – Preferred dune with Expanded Marsh and 2 Renourishments, and Alternative 9 – Optimized with Expanded Marsh and 4 Renourishments. Shell Island used the Barrier Island model and was evaluated by separating the islands into two components (east and west) for Alternatives 1 and 2 and as a single island for Alternative 3 and 5, for a combined total of 6 WVA evaluations. For Caminada each alternative was evaluated for the headland portion as well as both direct and indirect marsh effects, involving a combined total of 12 WVA evaluations.

The Project Information Sheet, including assumptions used by the HET, for Caminada Headland and Shell Island are presented in Appendix A and B, respectively. The complete WVA analysis can be obtained from the Service's Lafayette, Louisiana Ecological Services Office.

FUTURE WITHOUT-PROJECT FISH AND WILDLIFE RESOURCES

The net land loss in the Barataria Basin from 1978 to 2000 was 213 square miles (136,320 acres). Since hurricanes Katrina and Rita struck the Louisiana coast in 2005 the basin lost an additional 17.6 square miles (11,264 acres) of land (Padgett 2006 pers. comm.). Without actions, another fifth of the basin's wetlands would be lost to open water by 2045 (LCWCRTF 1993). According to USGS (Padgett 2006 pers. comm.) the predicted loss for 2000 to 2050 in the basin is 186 square miles (119,040 acres).

In Louisiana, barrier island erosion is attributable to shoreline erosion, insufficient volumes of sediment supplied by littoral currents, increasing tidal prism, land subsidence, sea-level rise, storms, and human impacts (Boesch 1982). Significant shoreline erosion and interior marsh loss has occurred on Shell Island and Caminada.

Shoreline erosion

The barrier islands of the Barataria basin are constantly changing and eroding and have decreased in area by 47 percent from the 1890s to 1988. The Shell Island and Caminada barrier shorelines have undergone dramatic changes, including rapid shoreline retreat and island erosion and breaches. In fact, the Caminada Headland Reach has experienced some of the highest shoreline erosion in Louisiana and the United States, with some areas retreating at a rate of over 100 feet per year (LCWCRTF and WCRA 1999).

Shoreline recession and erosion have resulted in the disintegration of Shell Island. The few remaining islands and shoal remnants provide limited protection to the back barrier environment from waves and flooding. The construction of the Empire Jetties restricted the east to west longshore transport and increased the loss rates of Shell Island. Hurricane Bob in 1979 created a new inlet (Coupe Bob) that accelerated retreat and sediment loss. In the FWOP scenario, there is no dune or marsh habitat and only 105 acres of subtidal habitat at Shell Island in 50 years (Thomson et al, 2005).

The erosional Caminada Headland has historically suffered loss of wetland habitat and diminished function within the Gulf shoreline. The marsh, beach, and dune habitats within the headland have undergone significant loss due to storm overtopping and breaching, saltwater intrusion, wind and wave induced erosion, sea level rise, subsidence, and man-made structures. The observed long-term (100 years) average shoreline erosion rate at the Caminada Headland, approximately 45 feet per year, would likely continue for the foreseeable future. The beach has eroded and the dune ridge has been breached by overwash from storm surges at several locations, including multiple shoreline breaches during the 2002, 2004 and 2005 hurricane seasons. A coastal Louisiana land loss model presented in the LCA Study (USACE 2004) indicates that with no intervention, the Caminada Headland will experience a projected land loss of 3,750 acres from the Headland and 14,780 acres from the area to the north from 2000 to 2050 (CEC 2006). Only a skeletal framework of natural barrier ridges and spoil banks would remain in 2050. Port Fourchon would be further isolated from the remaining mainland, and could become a detached small barrier island.

Interior marsh losses

Louisiana has the highest subsidence rates of any other land area around the Gulf of Mexico, i.e., 0.8 to 1.07 centimeter (cm)/year (Penland et al. 1987). Louisiana is also experiencing the highest rate of relative sea level (RSL) rise in the Gulf of Mexico, with rates between 1.03 and 1.19 cm/year. Regarding coastal wetland loss and flood damages to coastal communities, RSL, or apparent subsidence, is a more critical unit of measure than either subsidence or sea level rise alone. RSL is defined as the water surface level relative to the wetland surface and takes into account eustatic sea level rise, subsidence, and accretion.

Boesch et al. (1994) concluded that interior wetland loss is a consequence of sinking land and inadequate soil replenishment rather than erosion of its edges, filling, or draining. Interior marsh loss accounts for about two-thirds of coastal land loss (Wayne et al. 1994). Without the replenishment of sediments, these interior marshes will continue to deteriorate from subsidence, sea level rise, and other land-loss causes. Most Barataria Basin coastal marsh accretion rates are within the range of 0.6 to 0.9 cm/yr (Penland et al. 1988). DeLaune et al. (1994) detected that submergence in the study area averaged 1.38 cm/year and accretion averaged 0.98 cm/yr, leaving a net submergence rate of 0.4 cm/yr.

The average elevation of the existing native back-barrier marsh on Shell Island was determined to be approximately +1.1 feet, NAVD (Thomson et al, 2008) and 0.94 feet, NAVD for Caminada (CEC, 2008). The 2005 mean high water and mean low water elevations are +1.63 feet and +0.58 feet, NAVD, respectively for Shell Island and +1.53 feet and +0.48 feet NAVD, respectively for Caminada. These elevations are continuing to increase over time due to an eaustatic sea level rise, demonstrating that the existing marsh is inundated during the tidal cycle. A critical goal is for the marsh platforms to maintain an elevation between mean high water and mean low water. However, it is expected that in 50 years the mean high water and mean low

water elevations will rise from +1.64 feet to +2.26 feet, NAVD and +0.58 feet to 1.23 feet, NAVD, respectively (Thomson et al, 2008). This is due to an average eustatic sea level rise of 0.013 feet/year. Thus it is clear that even with accretion, if new sediment is not added to these marshes they will experience greater inundation in the future. When the marsh plants become inundated, they become stressed (Mendelssohn and McKee 1987) and eventually die.

The Davis Pond Freshwater Diversion Project will freshen marshes north of the study area. However, that project will not add large amounts of land-building sediments, and marsh deterioration in the study area will continue even under fresher conditions farther north.

As the barrier shorelines and the back-barrier marshes continue to erode and disappear, back bays and marshes will be exposed to increased tidal energy and salinities from the Gulf and tidal passes will enlarge and deepen, thus, reducing the hydrologic benefits of the islands to the basin. In fact, at Shell Island the complete opening of the bays would nearly double open water and fetch within these bays, decreasing their ecological value. North of Bastian Bay, only a few marsh islands and small ridges separate it from the much larger Adams Bay. Coalescence of the three bays would continue and accelerate without this project. Without the project, a large sound would develop between Empire and the Gulf of Mexico. This sound would have a profound impact on the entire region. Ecologic changes would occur and storm surges would increase requiring greater levels of flood and wave erosion protection.

The continued loss of the barrier shoreline habitat and the accompanying trend toward higher salinities typically leads to lower biodiversity and long-term productivity. Marshes will continue to deteriorate and convert to open water, leaving scattered fragments of marsh and sandy shoals. Fish and wildlife habitat quality will likely decrease as the barrier shoreline continues to erode and islands breakup or disappear. Increased stress on the fish and wildlife is expected as various fish and wildlife breading, nesting, nursery, feeding, roosting, or overwintering habitats continue to be lost. Habitat for endangered species would be further degraded and/or reduced. The Coast 2050 report (LCWCRTF and WCRA 1999) estimates that an additional 1,460 acres will be lost in the Caminada area by the year 2050. This number would be greater if it were not for the existing CWPPRA projects.

Fisheries Resources

Within the Barataria estuary, salinity and proximity to the marsh edge strongly determine the distribution of most fishes, the abundance of fishes decline dramatically with distance from marsh edge (Baltz et al. 1993). Intertidal marsh grass stems provide cover for juvenile fishes and adults of smaller species, as well as substrate for epiphytes and epifauna, which small fishes consume. Larger predatory fishes, such as spotted seatrout and red drum, forage along the marsh edge for small fishes, blue crab, and shrimp. Fishes that live in the open water of estuarine bays, such as bay anchovy and Gulf menhaden, gain refuge from sight-feeding predators in the turbid water. Those prey species are typically filter feeders, which eat zooplankton and phytoplankton. Demersal fishes, such as flounders and gobies, live in proximity to the bottom, and are typically

indistinguishable from the substrate. The deterioration of emergent wetlands may temporarily benefit some estuarine-dependant fisheries, but an eventual decline in productivity will result as detrital input and marsh-edge habitat are significantly reduced via conversion to open water (Turner et al., 1982).

It is likely that the wetlands of the basin have deteriorated beyond the most productive stage for estuarine-dependant fisheries, and that they will continue to experience loss (and decreased habitat quality) under FWOP conditions. Along with the disappearance of estuarine marsh nursery areas, the continual disappearance of the barrier shorelines and their surrounding estuarine marshes in the study area will substantially contribute to the on-going decline of fishery resources. The loss of barrier island marsh will eliminate nursery habitat for many species of young-of the year estuarine marine fish and macroinvertebrates that move inland to mainland marshes. In addition, high-energy beach habitat utilized by some species as a nursery ground will be lost causing those species to decline. The Coast 2050 report (LCWCRTF and WCRA 1999) estimates that red and black drum, spotted seatrout, Gulf menhaden, southern flounder, white and brown shrimp, and blue crab will continue a decreasing population trend into the future in and around the barrier islands of the study area.

Wildlife Resources

Little, if any, information exists regarding population status and trends of reptiles and amphibians in the study area. According to the Barataria Terrebonne National Estuary Program (BTNEP) (Industrial Economics, Inc., 1996), over-harvesting and the loss of habitat, both within and outside the Barataria-Terrebonne estuary, threatens turtle populations. Over-harvesting and habitat loss threaten the snapping turtle, while coastal erosion and barrier island retreat directly threaten the diamond-backed terrapin.

Of the mammals that may be seen in the study area, including swamp rabbit, muskrat, raccoon, and coyote are the most likely to occur on the barrier shorelines. These species populations are projected to decrease by the year 2050 on the barrier shorelines and surrounding areas as those areas continue to erode and disappear (LCWCRTF and WCRA 1999). The Coast 2050 Plan (LCWCRTF and WCRA 1999) indicates that seabird populations over the study area show decreasing population trends and are projected to continue to decline into 2050. Waterfowl, wading birds, shorebirds, rails, coots, and gallinules are also expected to decrease by the year 2050 (LCWCRTF and WCRA 1999), as habitat continues to decline. Habitat quality for wildlife is expected to decline as the barrier shoreline in the study area continues to deteriorate and convert to open water under FWOP conditions. The above predictions are based almost exclusively on the predicted conversion of dune and marsh to open water and the gradual inundation and resultant deterioration of marshes and chenier ridges adjacent to the study area (LCWCRTF and WCRA 1999).

The barrier shorelines, adjacent marshes, and the chenier ridge habitat just north of the Caminada headland serve as vital resting and foraging habitat for trans-gulf neotropical migrant birds.

Available habitat is very important to trans-gulf migrants, and along the coast, they tend to choose wooded chenier areas and the scrub/shrub habitat of the shorelines and adjacent spoil or bayou banks over more open marshes. This habitat is especially critical when severe weather in spring causes migrating birds to reach land exhausted, or during the fall, when bad weather forces the birds to abort their southward migration at the last moment, before leaving land. Many of the cheniers have been lost in the vicinity of the study area, and as the barrier shorelines and few remaining ridges continue to subside below elevations that can support scrub/shrub habitat and maritime forest, a large numbers of neotropical migratory birds will be negatively affected.

Threatened and Endangered Species

The brown pelican and bald eagle, protected by the Endangered Species Act (ESA) and the BGEPA, respectively, are recovering from very low populations experienced over the last three decades. Increasing populations for those two species are projected to continue in the future primarily from efforts of the ESA and independent of changes to barrier islands and headlands. Similarly, the West Indian manatee and the pallid sturgeon will not likely be affected by the continued deterioration of the Louisiana coastal barrier shorelines, as their habitat needs are not dependent on those land features. However manatee could possibly be present at the project sites. The Service does not expect pallid sturgeon to be at the project site though they may occur at the Mississippi borrow site for Shell Island. In the case of pallid sturgeon entrainment issues associated with dredging operations in the Mississippi River is a potential effect that should be addressed in future planning studies and/or in analyzing current project effects. In the unlikely event that these species are observed in any part of the project area during construction or operation, the Corps should contact Ms. Deborah Fuller of the Service's Lafayette, Louisiana, Office at (337) 291-3124.

The fate of the piping plover may be influenced by the habitat conditions of Louisiana's barrier islands and coastal headlands, which support foraging, roosting, and sheltering needs of the piping plover. Many of Louisiana's barrier islands are used by the piping plover for their wintering habitat, and they may be present for 8 to 10 months annually from late July to late March or April. As barrier islands and headlands degrade, so declines those habitat components that support the piping plover's wintering critical habitat; thus, creating increased competition for the scarce coastal resources. Regardless of the efforts of the ESA, if the piping plover's wintering critical habitat in coastal Louisiana continues to decline unabated the species may continue to be negatively effected. In addition, as barrier shorelines continued to deteriorate and be loss the characteristics of the nearshore waters and bay are expected to change, thus potentially impact sea turtles foraging areas.

DESCRIPTION OF TENATIVELY SELECTED PLAN

Four alternatives (Alternatives 1, 2, 3, and 5) for Shell Island and four alternatives (Alternatives 5, 6, 7, and 9) for Caminada Headlands were evaluated for this study. Those alternatives included restoring and sustaining (for the 50-year project life) barrier shoreline, dune, and interior

or back-barrier marsh habitats as well as the geomorphic function of the barrier shorelines. Alternatives were screened on the basis of cost-effectiveness, incremental cost analysis, and their ability to meet the critical goal of preserving habitat in the area. The Tentatively Selected Plan (TSP) includes Shell Island's Alternative 1 (Two Islands with No Renourishment and 9 years of Advanced Fill) and Caminada's Headland Alternative 5 (preferred dune with expanded marsh).

Shell Island Alternative 1 – Two Islands with No Renourishment and 9 years of Advanced Fill

Dune/Beach Component
The TSP for the Shell Island Reach includes a beach and dune fill to reestablish a barrier island shoreline system, thus restoring a portion of the geomorphic function and increasing the habitat utilization by fish and wildlife species. The construction cross-section was based on templates used for projects previously constructed in Louisiana.

The beach nourishment cross-section consist of two primary components: 1) the design section, which is the fill volume required to meet applicable project goals, and 2) advanced nourishment, which is the sacrificial portion of the fill that is expected to erode over the first 9 years of the project life. Sufficient advanced nourishment can be added during construction or replaced periodically during renourishment projects. Advanced fill is distributed non-uniformly to account for diffusion losses, longshore losses, and tidal inlet losses, that vary along the project length. It is estimated that the mean high water shoreline will retreat approximately 20 feet due to profile equilibration. Alternative 1 will have no beach/dune renourishment.

The dune design is to +6 feet, North American Vertical Datum of 1988 (NAVD) with a back- and fore-slopes of 1 vertical (V):45 horizontal (H). The dune crest is 200 feet wide, which is based on a design width plus advanced nourishment width. Other barrier island projects in Louisiana have used a steeper construction slope (1V:30H) on the bayward side because these islands have been relatively intact and the island provides a means of fill retention, allowing steeper slopes to be constructed. Most of Shell Island will be constructed in open water or on scattered island remnants. The +6.0 feet, NAVD dune elevation is above the 20-year return period surge elevation (+5.9 feet, NAVD).

Construction of sand fencing and planting of vegetation along the dune will promote additional elevation growth of the dune by capturing and holding wind blown sand. A 5-foot wide, +9 feet NAVD high additional dune element was added to the top of the construction template to simulate this increase in dune elevation. It was assumed that this additional dune feature would take approximately 1 year to form.

Marsh Component
The proposed marsh construction elevations were based on developing an intertidal marsh over the life of the 50-year project, considering the rate of relative sea level rise, and consolidation of placed and subgrade sediments. The average elevation of the existing marsh platform on Shell Island was determined to be approximately +1.1 feet, NAVD. This elevation is comparable to

other marsh platforms in the area such as East Grand Terre, Chaland Headland, and Pelican Island. The 2005 mean high water and mean low water elevations are +1.63 feet and +0.58 feet, NAVD respectively, demonstrating that the existing marsh is inundated during the tidal cycle.

The proposed marsh platform has a 50-year project life. The critical goal is to construct a marsh platform that maintains an elevation between mean high water and mean low water through TY50. With an assumed start date of 2009, the mean high water and mean low water elevations will rise from +1.64 feet to +2.26 feet, NAVD and +0.58 feet to 1.23 feet, NAVD, respectively. This is due to an average eustatic sea level rise of 0.013 feet/year. Therefore, the marsh was designed to obtain a marsh elevation above +1.2 feet, NAVD at TY50. Though Alternative 1 does not have renourishment, the marsh platform would have to be renourished periodically over the life of the project in order for it to remain within the tidal zone. A bayside recession rate of 3.6 feet/year was assumed.

Temporary containment dikes are proposed to contain the marsh fill material during construction. The material for dike construction will be dredged from within the footprint of the marsh so that the excavated area is filled during construction. The dike volume is included within the marsh fill volume.

Caminada Alternative 5 – Preferred Dune with Expanded Marsh

Dune/Beach Component
The proposed alternative designs that were moved forward for WVA analysis would include a continuous beach and dune restoration component. The alternatives evaluated have a landward beach and dune component in order to maximize acreage and longevity. All dune restoration components would also include sand fencing and plantings of native vegetation that is anticipated to promote additional dune elevation growth by capturing Aeolian sands.

Marsh Component
Alternative 5 designs (CEC 2008) include restoration/creation of a marsh platform contiguous with the Cheveron Canal on its northern boundary and the beach and dune fill component along its southern boundary. A constructed marsh elevation of +2.0 feet NAVD would be used to obtain a functioning intertidal marsh for part of the project life. The native marsh elevation for the back-barrier marsh was determined to be 0.94 feet NAVD. Mean high water is 1.53 feet NAVD and mean low water is 0.48 feet NAVD and increases over time due to an eaustatic sea level rise, demonstrating that the existing marsh is inundated during the tidal cycle. Neighboring CWPPRA projects (Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration BA-35, Chaland Headland Restoration BA-38, and East and West Grand Terre Island Restoration BA-30) were used to estimate settlement and consolidation of fill material. A sea level rise rate of 2.5 feet per century is used for this analysis. Temporary containment dikes would be constructed to contain the marsh fill material during construction. The fill material for dike construction would be dredged from within the footprint of the marsh so that the excavated area is filled during construction. The dike volume is included within the marsh fill volume. The marsh fill is

proposed on the landward side of the beach and dune. The marsh platform would be planted with appropriate vegetation.

Shell Island Alternative 3 – Single Island with No Renourishment and 10 years of Advanced Fill
Though not part of the TSP, Shell Island Alternative 3 warrants discussion. Alternative 3 has a similar design to Alternative 1 in regards to dune and back barrier marsh construction. It will extend across Coupe Bob connecting the two islands making them a single island again. This option better meets the project goals of reducing wave energy transmission into Bastian Bay and re-establishing the historic longshore sediment transport than Alternative 1. Though any single island alternative with renourishment would be preferred, Alternative 3 has the lowest cost of the single-island alternatives because there is no renourishment component for either the marsh or the beach. Since Alternative 3 has no renourishment it is expected to continue to degrade until it breaches around TY30. Following breaching, island loss is expected to accelerate. However by re-establishing the single island as a base the island is in a better, more stable condition for other projects or future authorizations to continue building on and replenishing this island. If Alternative 3 is constructed however, modeling the effects of change in tidal prism as a result of closing Coup Bob will need to be conducted.

EVALUATION OF TENTATIVELY SELECTED PLAN

The WVA analyses indicate that the TSP for Shell Island and Caminada would result in the direct and indirect net gains in the quality and quantity of barrier island/headland and back-barrier marsh habitats of 303 AAHUs and 111 acres and 269 AAHUs and 0 acres, respectively, for a total net gain of 572 AAHUs and a total net gain of 111 acres compared to the future without-project conditions (Table 1).

Direct and indirect project-related benefits will occur through the creation of island/headland and back-barrier marsh habitats. The newly created barrier shoreline and back-barrier marsh of the direct area will provide more sediment to the system, combat subsidence, the area will be less susceptible to breaching and increased erosion, there will be new nutrients available to the area, there may be less wave fetch from previously breached headland/island and broken marsh, and created marsh will be at a higher marsh elevation than some of the FWOP marsh thus allowing for more vertical accumulation of vegetation. In addition to the direct island/headland and marsh creation benefits of the TSP, indirect benefits will accrue. Because the indirect area is adjacent to the direct marsh creation area there will be benefits to this area as well but they are not considered to be as substantial as the directly created areas. Most importantly, it is assumed there will be an increase in sediments to the system based on the proximity of the indirect area to the marsh creation foot print which will add nutrients and there will likely be less wave fetch from the broken marsh of the direct area.

Table 1. Net wetland acreage and AAHUs established with the Tentatively Selected Plan.

	Portion of the Island Evaluated	Existing Acres	Initial Acres Created	FWOP at TY50	FWP at TY50	Net Acres Gained at TY50	Net AAHUs Gained
Shell Island Alt 1	East Island	294	623	101	212	111	248
	West Island	92	255	0	0	0	54.9
Shell Alt 1 Total		386	878	101	212	**111**	**302.9**
Caminada Alt 5							
	Headland	385	820	0	0	0	164.2
	Direct marsh	876	1186	0	0	0	52.6
	Indirect marsh	926	0	0	0	0	52.3
Caminada Total		2187	2006	0	0	**0**	**269.1**
TSP Shell and Caminada Totals		2481	2629	101	212	111	572
Shell Island Alt 3 (Service Preferred Alternative)		386	949	105	295	**190**	**522.9**

PROJECT IMPACTS

Shell Island Alternative 1 – Two islands with no renourishment
East Island's dune width is approximately 281 feet wide and is uniform along the length of the 15,400-foot long dune. Most of the sand fill is being placed in front of the existing island. Fill quantities for the beach/dune and marsh fills are 2.9 million and 1.1 million cubic yards respectively. Marsh width varies from 525 – 1,200 feet wide.

West Island's dune width is approximately 688 feet on the east end compared to 196 feet on the west end. Total length is 5,500 feet. The proposed beach fill extends partially into Coupe Bob. The marsh on West Island follows the outline of the LCA plan, which has a triangular shape. Fill

quantities for the beach/dune and marsh fills are 1.3 million and 0.7 million cubic yards respectively.

The constructed marsh elevation is +2.5 feet, NAVD. Alternative 1 is expected to create 293 acres of additional marsh behind Shell Island East and West under one construction event (no renourishment). Approximately 40 acres will be enhanced by increasing the existing elevation, so a total of 333 acres will be created or enhanced.

Constructing the marsh elevation at an elevation of +2.5 feet, NAVD will result in a marsh that will become bay intertidal during TY2 (2011) and remain bay intertidal until TY50 (2059). The marsh will be continually submerged (average elevation below mean low water) after TY34 (2043). The long term goal of maintaining the marsh elevation above elevation 0 feet, NAVD at TY50 can only be achieved by increasing the construction elevation above +2.6 feet, NAVD but this increases the time required for the marsh to subside to the mean high water level, and so reduces project benefits in the near term. Total fill quantities for the beach/dune and marsh fill are 4.1 million cubic yards of sand and 1.9 million cubic yards of sediment, respectively.

Caminada Alternative 5 – Preferred Dune with Expanded Marsh
The dune height is proposed to be +7 feet NAVD which is slightly higher than the existing dune elevation in the area of +3.4 feet NAVD. The proposed dune width is 290 feet. The majority of the dune is sited landward over existing higher elevations, maximizing acreage and longevity. The advanced fill quantities account for initial losses due to shoreline equilibrium.

The landward and seaward slopes are set at a1V:20H. The beach fill template has a 65 feet wide seaward berm at an elevation of +4.5 feet NAVD and a marsh fill template is proposed on the landward side of the dune at an elevation of +2.0 feet NAVD. Approximately 13 miles of dune will be created. Fill quantities for the beach/dune and marsh fills are 6.3 million and 5.4 million cubic yards, respectively.

The project direct boundary for Alternative 5 includes approximately 1,361 acres of existing marsh, dune, supratidal, and gulf intertidal habitats at TY0. Project construction includes approximately 705 acres of new marsh, dune, supratidal and gulf intertidal habitats for a total of approximately 2,065 acres at TY1 with approximately 26 acres of these habitats left at TY50. It should be noted that the newly created acres will cover most of the existing acres in the direct project footprints. There is no renourishment of dune or marsh for alternative 5.

With regard to the indirect project boundary, the existing upland acreage approximately equal to 77 acres (Tank Farm, Chevron Facility) will be preserved through the project life at TY50. Because the Chevron Facility (77 acres) is considered to be developed and not wetlands; it is taken out of the WVA acres. However, the significant majority of the marsh acreage will disappear over the 50 years through natural subsidence (estimated to be 0.025 feet per year).

Combined Effect of the TSP Project Features

Collectively the TSP will initially create a total of over 2,600 acres (878 for Shell Island and 2,006 for Caminada Headlands) of directly created/restored habitat. The TSP will have a positive effect on essential fish and wildlife resources by reestablish a barrier between a threatened estuarine ecosystem and the Gulf of Mexico there by increasing unique critical and essential habitat that will be utilized by those species both on the barrier island and in the consequently developed quiescent bays. The TSP will increase the sustainability of the barrier island shoreline system; help restore the geomorphic function of the barrier shoreline thus restoring the hydrologic benefits of the islands to the basin; create and restore shoreline, dune, and back-barrier marsh, which will be stabilizing with vegetative plantings and sand fencing; reduce wave and tidal energies and salinities from the Gulf by providing a natural storm protective buffer for interior marsh and chenier ridge habitats; address some of the severity of erosion along the Gulf-front shoreline; close the breaches that have occurred due to recent and past storm and hurricane damage; and provide some degree of storm surge protection.

By moving forward with the TSP, the project will be contributing to the maintenance of fish and wildlife habitats by decreasing stress to fish and wildlife as their breading, nesting, nursery, feeding, roosting, or overwintering habitats are restored, thus adding to the biodiversity and productivity of the area. In addition, because the barrier island and shorelines are considered critical to the neotropical migrants, the creation of this habitat is considered an essential restoration need of the Barataria Basin. Habitat used by piping plovers may be increased by the implementation of the TSP.

Large-scale landscape change and ecosystem deterioration have occurred in the Barataria Basin. However, more far reaching benefits to fish and wildlife resources may result from the synergistic effect of the TSP and the Davis Pond Freshwater Diversion, other potential CWPPRA-funded barrier island projects including East/West Grand Terre Island Restoration, Pass Chaland to Grand Bayou Pass, Pelican Island and Pass La Mer to Chaland Pass restoration and other CWPPRA-funded projects including West Bay sediment diversion, Barataria Basin Landbridge Shoreline Protection (phases 1 thru 4), Naomi Outfall Management, Little Lake shoreline protection/dedicated dredging near Round Lake, and Barataria Bay Waterway East/West side shoreline protection and wetland restoration (3 projects). Those projects would help further restore and maintain the functional integrity of the Barataria Basin.

Aside from supporting coastal habitats, the coastal barrier island chains in Louisiana are the first line of defense for protecting wetlands, inland bays, and mainland regions from the direct effects of wind, waves, and storms. The barrier system serve multiple defensive purposes to: reduce coastal flooding during periods of storm surge; prevent direct ocean wave attach, which would accelerate rates of erosion and degradation of marshes and other wetlands; and help maintain gradients between saline and freshwater, thereby helping to preserve the estuarine systems.

Without ecologic restoration large-scale change would occur due to the encroachment of the Gulf into the coastal wetlands. Implementing the TSP will help to protect vulnerable cheniers north of the Caminada Headland as well as the local infrastructure of Chevron, Louisiana Offshore Oil

Port (LOOP), and Port Fourchon. Rebuilding Shell Island will help protect interior marsh and bays from the intrusion of the Gulf and downdrift shoreline habitats from further deterioration by helping to maintain the salinity gradients, temporarily preventing further disruption to the hydrology of the esturary, and by adding sediment to the system. Ultimately the Port of Empire will benefit from the added protection resulting from the restoration of Shell Island.

The TSP is a component of a comprehensive strategy to sustain the wetlands and associated fish and wildlife productivity of the Barataria Basin. The establishment of 111 acres of barrier island/headland and emergent marsh will help reduce the decline in fish and wildlife habitat quality and detrital production over time. Though the TSP will provide for many needed benefits these benefits would be more substantial with renourishment on both islands and as a single island on Shell Island.

Service Preferred Alternatives:

Caminada Headland and Shell Island with renourishment
To better meet the project goals of contributing to geomorphic stability and process of the basin shorelines, helping to re-establish pre-existing water quality trends and hydrologic processes, and sustaining and improving ecosystem processes and habitats for migratory and native species for the 50 year project life on both Caminada Headlands and Shell Island, the alternatives with renourishment would be the optimal choices. Because of the financial restraint of the projects' authorization both Caminada and Shell are limited to the initial build with no renourishment. By laying the foundation the hope is future authorization or other programs can continue the work needed on both these shorelines.

Shell Island Alternative 3 – One island with no renourishment
Though Shell Island Alternative 1 was selected as part of the TSP, the Service feels Alternative 3 would have been a better selection in regards to meeting the over all objectives of this project. AAHUs resulting from implementing this alternative are displayed in Table 1. Alternative 3 builds Shell Island back to its former single island formation rather than Alternative 1's rebuilding two separate islands. By rebuilding a single island the historic foundation will have been re-established, thus allowing a better base for future projects to maintaining that platform and the erosion rate would be reduced by closing Coup Bob. The objectives listed above would be more clearly met. Though, if Alternative 3 is built, modeling will be necessary to address the potential tidal prism effects of closing off Coup Bob since the bays have greatly increased and the marsh is far more degraded than before Coup Bob existed.

In order to restore both barrier shorelines, the Corps and the CPRA were limited to selecting Shell Island Alternative 1 because Alternative 3, in combination with Caminada Alternative 5, would have exceeded the authorization thus requiring a post authorization change. Considering the immediate need for restoration in the area, the Corps and CPRA believe its in the best interest to remain within the current authorization and proceed to building the foundation that future authorizations or other programs can build on to complete the ultimate project goals. Though

Shell Island Alternative 3 brings the project cost above the authorized limit, the incremental cost increase from Alternative 1 to Alternative 3 is relatively small. The Service would optimally prefer to see both Caminada and Shell Island with renourishment components and at a minimum Caminada Alternative 5 and Shell Island Alternative 3 as the TSP.

FISH AND WILDLIFE CONSERVATION MEASURES

The Service, NMFS, and LDWF should be consulted during the preconstruction engineering and detailed design phases so that optimum project benefits to coastal wetlands and associated fish and wildlife resources are achieved, and potential impacts to those resources are minimized. In addition, the newly created barrier headland/island and back-barrier marsh creation should be monitored for effectiveness, and the results should be provided to all resource agencies.

While no active waterbird nesting sites were found during recent surveys, the possibility exists that colonies may become established once construction begins, especially on bare, newly established spoil areas. Construction should be conducted in a manner that avoids impacts to any established or newly occupied waterbird colonies. The Service recommends that a biologist inspect the proposed work sites for the presence of undocumented nesting colonies during the nesting season (i.e., mid-February through August, depending upon species present). Work should not take place within 650 feet of any waterbird colonies located in the study area during the nesting season; some work during those months may be allowable, depending upon a field assessment of bird nesting status, however, such allowances should be coordinated with the Service and LDWF.

The threatened piping plover, as well as its designated critical habitat, occur within the Caminada headland portion of the proposed project areas. Piping plovers may be present as early as late July and remain until late March or April. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape because the suitability of a particular site for foraging or roosting is dependent on local weather and tidal conditions. Plovers move among sites as environmental conditions change, and studies have indicated that they exhibit strong site fidelity and generally remain within a 2-mile area on their wintering grounds.

The project area on the Caminada headland would be approximately 13 miles in length, and proposed construction would occur in a linear fashion during a two-year period. Based on 2005 aerial photography, approximately 762 acres of designated critical habitat and 193 acres of additional habitat that piping plovers may use would be temporarily impacted during and immediately post-construction. Such impacts would include displacement of birds to nearby suitable areas, loss of fresh and old natural organic material (i.e., wrack), and disruption of the benthic prey base. Studies indicate that benthic community assemblages generally recover within 2 years post-construction if the newly deposited sediments are similar to pre-construction sediments. Due to the length of the project area, the duration of construction, the duration of benthic prey re-colonization, and the tendency of plovers to remain within a 2-mile area on wintering grounds, the proposed project may affect piping plovers because there may be little

available foraging habitat within a 2-mile radius of the project area during the later stages of construction and immediately post-construction.

Measures should be implemented to ensure that the proposed activities are conducted to minimize any potential effects to the piping plover and its designated critical habitat during and immediately post-construction. The following are measures that would minimize potential effects:

To the maximum extent possible, design the construction schedule to avoid the piping plover wintering season. Because the duration of the project would be approximately two years, project construction would still occur within a portion of one wintering season (possibly two) since plovers may be present in the project area for 8 to 10 months.

To improve the quality of newly created roosting habitat and to aid in the re-colonization of newly created foraging habitat, natural organic material (i.e., wrack) should be stockpiled or removed from the beach prior to construction and then re-distributed across the project area immediately post-construction.

Design the construction in such a manner that not all of the piping plover's habitat is disturbed at one time by constructing in short stretches (e.g., 2,500-foot-long stretches). Short construction stretches would allow for sufficient habitat within a 2-mile area for piping plovers to disperse into while the initial disruption is occurring. Construction disturbance would be temporary in nature and would not permanently exclude piping plovers from utilizing the island or the project area for resting or foraging. However, in the short-term, the proposed project area would provide less than ideal habitat over the next few years until wave and wind actions have redistributed the sand fill and the beach re-stabilizes within the dynamic barrier island/headland environment. Newly created foraging habitat would not be suitable immediately post-construction due to high elevation and lack of a prey base, but may become suitable after natural processes have affected the beach for several years.

Conduct pre- and post-construction surveys of piping plover designated critical habitat. Post-construction surveys should follow Service guidelines and should occur 2 years and 4 years after project completion to document quality of critical habitat. Comparisons of those surveys should indicate that impacts to designated critical habitat were indeed temporary in nature.

Based on the preliminary project description, the above recommendations would help to minimize project-related effects to the piping plover and its designated critical habitat. Please be aware that the Corps has an affirmative responsibility to consult with the Service regarding the potential effects of their proposed action to both federally listed threatened and endangered species, and their critical habitat. The Corps should provide this office with their determinations of whether the proposed project is/is not likely to adversely affect the piping plover and its designated critical habitat, as well as a basis for those determinations. We look forward to

coordinating with the Corps regarding this matter and reviewing those determinations.

As discussed above, The Service would optimally prefer to see both Caminada and Shell Island with renourishment components and at a minimum Caminada Alternative 5 and Shell Island Alternative 3 as the TSP.

SERVICE POSITION AND RECOMMENDATIONS

The Tentatively Selected Plan will benefit the fish and wildlife resources of the Barataria Basin by creating and nourishing a barrier island and headland and back barrier marsh. The Service will support further planning of the proposed project provided that the following fish and wildlife recommendations are included in the feasibility report and related planning and authorizing documents and are implemented concurrently with project implementation:

The Service, NMFS, and LDWF should be provided an opportunity to review and submit recommendations on future detailed planning reports and the draft plans and specifications on the Barataria Basin Barrier Shoreline Restoration Project addressed in this report.

Coordination should continue with the Service and NMFS on detailed contract specifications to avoid and minimize potential impacts to piping plover and their critical habitat, manatees, pallid sturgeon, and sea turtles.

Avoid adverse impacts to nesting seabird colonies through careful design project features and timing of construction. For colonies containing nesting gulls, terns, and/or black skimmers, all activity occurring within 650 feet of a rookery should be restricted to the non-nesting period (i.e., September 16 through April 1, exact dates may vary within this window depending on species present). Prior to any such work, surveys should be conducted by qualified personnel during the colonial seabird nesting season to determine the presence and location of any such colonies. In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

If the proposed project has not been constructed within 1 year or if changes are made to the proposed project, the Corps should re-initiate Endangered Species Act consultation with the Service.

The newly created barrier headland/island and back-barrier marsh, as well as the surrounding habitats that may be indirectly benefited by long-shore transport and sediment overwash, should be monitored over the project life for effectiveness and the results should be provided to all resource agencies. Development of those monitoring plans should be coordinated with all natural resource agencies.

All containment features should be breached or degraded, if necessary to restore tidal

connectivity, once the marsh creation/nourishment areas have at least 80% coverage of emergent vegetation.

7. The Service recommends that Caminada Alternative 5 and Shell Island Alternative 3 be re-analyzed as potential alternatives if: 1) the authorized funding limit is increased for this project, 2) if further planning studies are conducted, or 3) if significant modifications to the project are proposed.

8. During future maintenance events of the Empire Waterway the Corps should determine if the dredged material is suitable for placement on the beach/dune or in a feeder berm to help maintain Shell Island. The results of that determination and the placement of that material should be coordinated with the Service and other natural resource agencies. If suitable that material should be used accordingly.

9. Identification of additional borrow sites should be coordinated with the Service and other natural resource agencies.

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APPENDIX A

HABITAT ANALYSIS PROJECT INFORMATION SHEETS FOR CAMINADA HEADLANDS

Project Information Sheet Barrier Island Value Assessment
CAMINADA HEADLAND

28 March 2008

Project Name: Barataria Basin Barrier Shoreline Restoration Caminada Headland Feature

Project Type(s): Barrier headland restoration, marsh restoration/creation, vegetative planting, and sand fencing.

Sponsoring Agency: Louisiana Department of Natural Resources and US Army Corps of Engineers
Preparer of information sheet: Catherine Breaux/Patrick Williams
Information found in this project information sheet was obtained primarily from the Draft Feasibility report appendix (CEC 2005 and 2007).

Project Area: The project area lies within the Barataria Basin, which comprises the area between the Mississippi River and Bayou Lafourche. The 13-miles long Caminada Headland located in Lafourche and Jefferson Parishes extends from the Belle Pass jetties at the mouth of Bayou Lafourche on the western end of the headland to Caminada Pass on the eastern end of the headland. The project area is bounded by the Gulf of Mexico to the south and approximately 2250 feet north of the Gulf to the North. The headland maintains the integrity of the gulf shoreline and protects the interior coast from further deterioration. The Caminada Headland consists of narrow and low-lying sand dune and beach berm, barrier marshes, and chenier ridges interspersed with mangrove thickets, coastal dune shrub thickets, lagoons and small bayous. The average dune elevation is estimated to be +3.5 feet North American Vertical Datum of 1988 (NAVD)and the back-barrier marsh was determined to be 0.94 feet NAVD.

Problem: The erosional Caminada Headland has historically suffered loss of wetland habitat and diminished function within the gulf shoreline. The marsh, beach, and dune habitats within the project area have undergone significant loss due to storm overtopping and breaching, saltwater intrusion, wind and wave induced erosion, sea level rise, subsidence, and man-made structures. The observed long-term (100 years) average shoreline erosion rate at the Caminada Headland, approximately 45 feet per year, would likely continue for the foreseeable future. The beach has eroded and the dune ridge has been breached by overwash from storm surges at several locations, including multiple shoreline breaches during the 2002, 2004 and 2005 hurricane seasons. Increased stress on the fish and wildlife is expected as various fish and wildlife nursery, feeding, nesting and roosting habitats continue to be lost. A coastal Louisiana land loss model presented in the LCA Study (USACE 2004) indicates that with no intervention, the Caminada Headland will experience a projected land loss of 3,750 acres from the Headland and 14,780 acres from the area to the north from 2000 to 2050. Only a skeletal framework of natural barrier ridges and spoil banks would will remain in 2050. Port Fourchon would be further isolated from the

remaining mainland, and could become a detached small barrier island.

Study Purpose
The purpose of the proposed action is to restore the geomorphic function and unique critical and essential fish and wildlife habitats of the Caminada Headland's barrier system. The proposed action would also provide some degree of storm surge protection.

Goals and Objectives
Project life equal to fifty years (Year 50)
Sustain and improve shoreline, dune, and interior marsh habitat for essential fish and wildlife species
Reduce wave energy transmission by providing a natural storm protective buffer for interior marsh and chenier ridge habitats north of Caminada Headland
Address the severity of erosion along the gulf-front shoreline
Close the breaches that have occurred due to recent storm and hurricane damage and prevent breaching during the design life
Vegetate newly created marsh and dune areas
Provide compatible sediments for marsh, beach and dune restoration
Avoid impacts to adjacent shorelines from borrow area excavation
Maintain the Caminada Headland without disrupting the natural hydrologic regime

Project Features
Dune/Beach Component
The proposed alternative designs that were moved forward for WVA analysis would include a continuous beach and dune restoration component. The alternatives evaluated have a landward beach and dune component with in order to maximize acreage and longevity. All dune restoration components would also include sand fencing and plantings of native vegetation that is anticipated to promote additional dune elevation growth by capturing Aeolian sands.

Marsh Component
The proposed alternative designs include restoration/creation of a marsh platform contiguous with the Cheveron Canal on its northern boundary and the beach and dune fill component along its southern boundary. A constructed marsh elevation of +2.0 feet NAVD would be used to maintain a functioning intertidal marsh between the marsh-renourishment cycles. The native marsh elevation for the back-barrier marsh was determined to be 0.94 feet NAVD. Mean high water is 1.53 feet NAVD and mean low water is 0.48 feet NAVD and increases over time due to an eaustatic sea level rise, demonstrating that the existing marsh is inundated during the tidal cycle. Neighboring CWPPRA projects (Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration BA-35, Chaland Headland Restoration BA-38, and East and West Grand Terre Island Restoration BA-30) were used to estimate settlement and consolidation of fill material. A sea level rise rate of 2.5 feet per century is used for this analysis. Temporary containment dikes would be constructed to contain the marsh fill material during construction. The fill material for dike construction would be dredged from within the footprint of the marsh so that the excavated

area is filled during construction. The dike volume is included within the marsh fill volume. The marsh fill is proposed on the landward side of the beach and dune. The marsh platform would be planted with appropriate vegetation

	Caminada Headland Alternatives			
	Alt 5 preferred dune w/ expanded marsh	Alt 6 preferred dune w/ exp marsh 1 renourishmt	Alt 7 preferred dune w/ exp marsh 2 renour	Alt 9 Optimized w/ exp marsh 4 renourish
Dune Elevation	+ 7 feet	+ 7 feet	+ 7 feet	+ 7 feet
Dune width	290 feet	290 feet	290 feet	290 feet
Beach width	Advance fill at elev of +4.5 feet	Advance fill at elev of +4.5 feet	Advance fill at elev of +4.5 feet	Advance fill & design fill at elev of +4.5 feet
Beach/dune length	13 miles	13 miles	13 miles	13 miles
Beach/dune quantity fill material	6.3 million cy	6.3 million cy	6.3 million cy	5.1 million cy
Beach/dune renourishment cycle	none	TY25	TY 20 and TY40	Every 10 years
Marsh elevation	+2.0 feet	+2.0 feet	+2.0 feet	+2.0 feet
Marsh quantity fill material	5.4 million cy	5.36 million cy	5.36 million cy	5.4 million cy
Existing marsh, dune, supratidal, & gulf intertidal	1361 acres	1361 acres	1361 acres	1361 acres
New (TY1) marsh, dune, supra, & gulf intertidal	705 acres	705 acres	705 acres	705 acres
Net acres (at TY 50)s	26 acres of marsh	564 acres total 332 acres marsh 169 acres supratidal 23 acres dune 40 acres gulf intertidal	1451 acres total 543 acres marsh 395 acres supratidal 458 acres dune 55 acres gulf intertidal	1451 acres total 898 acres marsh 170 acres supratidal 328 acres dune 55 acres gulf intertidal

Borrow Areas
Material for the dune and beach construction would be borrowed from the South Pelto Block of Ship Shoal. Ship Shoal is a large offshore submerged sand body in the Gulf located approximately 50 miles southwest of Belle Pass. A suitability analysis was conducted comparing Caminada sediments to South Pelto Block sediments. The sediments from South Pelto Block were concluded to be suitable for beach and dune restoration. It is recommended that an overfill ratio of 1.08 be used in design volume analysis.

Louisiana Department of Natural Resources (LDNR) is currently performing a nearshore borrow area investigation in addition to the Ship Shoal investigation for the purpose of creating the back-barrier marsh fill platform. It is recommended that this include an evaluation of the potential borrow materials for compatibility with the native marsh.

Operations and Maintenance Phase
The following planting plan was adapted from a DNR plan after recommendations from the agencies including means to achieve optimal environmental benefit based on percent cover values in the Barrier Headland and Wetland Island Value Assessment models, funding considerations, and expected annual industry limitations. Note that this should be viewed as a preliminary/conceptual planting plan only, to be amended as needed and site conditions warrant if the project is constructed. Planting density could be increased (5'-7' centers) if the budget allows. Also if the budget allows, for optimal results, herbaceous and woody species plantings on all habitat types should be phased, with the first phase of herbaceous plantings occurring at TY1 and woody plantings at TY3.

General assumptions include:
strive to develop a planting plan to attain optimal functionality for less than 5% of the construction cost (without contingency)
plant 100% of the dune (that includes the crown and slopes)
plant 100% of the bayside supratidal and gulfside supratidal including the seaward berm and dune downslope, but not the beach
aerially seed the dune and supratidal (for conservative cost estimating purposes only assumed aerially seeding all of the supratidal acres)
plant 50% of the marsh acres; half in TY2 and half in TY3

DUNE & SUPRATIDAL PLATFORM:

Species
Seeding of the dune platform (aerial or ground application) could be considered depending on the time of the year construction is completed. Rye grass seed could be considered if construction is completed in the summer or fall to be used as a ground cover during the winter months. Bermuda grass seed has been dispersed on the barrier island dune platforms in the past as well, but with strong objection by some Federal and state wildlife agencies as it is non-native.

Herbaceous dune and supratidal plants will consist of a variety of dune species including bitter panicum (*Panicum amarum* var *amarum* 'Fourchon'), sea oats (*Uniola paniculata* 'Caminada'), marshhay cordgrass (*Spartina patens* 'Gulf Coast') and gulf cordgrass (*Spartina spartinae*). Plants shall be grown mainly in four-inch containers (sea oats in a slightly larger container.) The aforementioned recommendations are general recommendations. Species recommendations may change due to soil properties and conditions, elevation after final construction, salinity, available soil moisture, and other site conditions. Other plants that could be considered to add diversity (other than the plants mentioned) are seacoast bluestem (*Schizachyrium maritimum*), seashore dropseed (*Sporobolous virginicus*), and salt grass (*Distichlis spicata*).

Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, iva, baccharis, and hercules club. It has been suggested that more woody vegetation be included on Caminada than Shell Island. Planting of woody species should be delayed until TY3 to allow for stabilization and leaching of salt from deposited material.

Density
Plants on the dune, supratidal, and marsh platforms would be installed in variable density patterns based on site conditions. For quantity and cost estimating purposes, it was assumed that plants would be installed on 8' centers throughout 100% of appropriate dune and supratidal acreage at the certain target years. For estimating purposes, woody vegetation also was assumed to be planted on 8' centers throughout 15% of the dune, swale, and marsh acreage.

MARSH PLATFORM:
Species
Herbaceous marsh plants will consist of mainly smooth cordgrass (*Spartina alterniflora* 'Vermilion'). A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated to add a larger seed bank for black mangroves. Plants shall mainly consist of vegetative plug material or four-inch containers (smooth cordgrass), or tube-tainers (mangroves).

Density
The planting density was assumed to be 8' on center applied to 100% of the marsh acres.

Total Costs:
All prices mentioned includes: cost of plant, delivery, fertilizer, transportation, installation, etc. However, note that recent post-storm cost estimating (since preparation of the Shell Island Vegetation Cost estimates) generally are now including $20,000 mob/demob and $4/plug for the herbaceous marsh plants, and $8 to 10/plant for the woody species. Unit costs are consistent with guidance by NRCS and LDNR as recommended to the CWPPRA program on ppl18. Also note that the total amount of plants project during TY1 for the various alternatives is a substantial amount likely matching or exceeding the current industry annual supply.

Alternative	Alt 5, 6, 7, & 9
Estimated Cost	$6,160,015.35
Percentage of construction cost	3.7%

One shore-parallel fence will be installed about 50 feet north of the southern toe of the dune to continue the capture of transported sand until the surface is vegetated. The sand fence will extend along the total length of the constructed dune. Sand fences must be installed in sequence/phases. The installation should start from the southern side of the dune so as to build dune towards the Gulf and proceed north. Additional rows of sand fencing can be added once the existing sand fence is full (i.e. sand is stacked up to the top of the fence).

Monitoring Information/Adaptive Management Recommendations:
Monitoring Information:
Adaptive management involves monitoring the evolution of the project and updating the project design to incorporate the additional data. A field effort is recommended to attempt to ascertain the depth of closure. To improve the understanding of the current sediment transport rates, it is recommended that additional analysis be undertaken including profile measurement to determine average cross section and digitizing the current shoreline and comparing it to the 1988 shoreline to document short-term spit growth and attempt to estimate the rate.

Site Characteristics
The native marsh elevation for the back-barrier marsh was determined to be 0.94 feet NAVD.
The average wave height is 3.7 feet.
Mean High Water is 1.53 feet NAVD and Mean Low Water is 0.48 feet NAVD.
The rate of relative sea level rise is treated as a constant over the 50-year project life, equal to 0.025 feet/year or 1 ft/40 years (USACE 2004).

In 1935 the Belle Pass Jetties were constructed of rip-rap and have been modified over time with some of the rip-rap placed in the nearshore zone just east of the Bell Pass Jetty on the Caminada Headland. The jetties have an impact on the longshore transport along the headland to the west, trapping sand, and causing a significant downdrift impact on the Timbalier Islands to the west.

Following Hurricane Juan, in 1986 a section of the Caminada Headland seaward of Port Fourchon was armored with a cement-filled bag revetment locally referred to as the Boudin bags. Beach was added in front of the Boudin bags, as well as, dredged material was backfilled landward of the revetment. The revetment is an interruption of the natural coastal processes including cross shore sediment transport by both washover/backwash events as well as Aeolian processes. In 1992 Hurricane Andrew struck the Louisiana coastline causing considerable damage to the revetment, displacing the bags as much as 130 feet landward (Ritchie et al, 1995).

In an attempt to prevent erosion along the headland fronting the oil and gas facilities, private oil companies constructed thirteen breakwaters by sinking barges in the nearshore zone.

Subsequently, the barges were filled with rip-rap.

General Methodology and Assumptions -*This section summarizes the procedures used to develop planform performance projections.*

Wave and water level data for storms having an impact on the Caminada Headland from 1985 to 2004 were assembled (12 storms). The input storm conditions of the five most severe storms from an erosion standpoint due to their high peak water levels, storm duration, and wave characteristics, including Juan 1985, Andrew 1992, Danny 1997, Isidore 2002, and Lili 2002, were used to be representative of storms that occur every 5 to 7 years.

The recommended design criteria for depth of closure is –12 feet NAVD.

The cumulative sediment budget change, including overwash accumulation, has a total net gulf shoreline erosion loss equal to approximately 926,000 cu yds per year. The total overwash rate is estimated to be approximately 547,000 cu yds per year. Assume the significant majority of the infilling rate of 300,000 cu yds per year in Belle Pass is due to sediment losses off the Headland to the west. 83,000 cu yds per year is reported to arrive at Grand Isle from Caminada.

Cross-shore sediment transport modeling was performed using the Storm-induced BEAch CHange (SBEACH) model. SBEACH is two-dimensional model developed to simulate cross-shore sediment transport primarily due to breaking waves and changing water levels. SBEACH is intended to predict short-term, storm-induced profile equilibration. A fundamental assumption of the SBEACH model is that the profile change is produced solely by cross-shore processes, resulting in a redistribution of sediment across the profile with no net gain or loss of material. Longshore processes are considered to be negligibly small in calculating profile change, and therefore, longshore wave and current sediment transport is not accounted for by SBEACH.

The predicted design rate for sea level rise of 0.013 feet per year is recommended as design criteria for the project.

For the shoreline equilibrium component of the advanced fill, a mass balance was performed by comparing existing profiles to construction profiles. The theory used was that the construction template would reform through coastal processes to gulfward slopes similar to those of existing profiles. It was assumed that the volume of beach and dune erosion would equal the amount of sand transported to the depth of closure.

Assume an average shoreline erosion rate of 45 feet per year. This is based on survey data, aerial photography, and the long-term (1887-1988 time period) erosion rate.

Using the 2005 survey data, aerial photography, historical erosion rate of 45 feet per year, and conceptual sediment budget, the acreages of each habitat component in the land mass within the WVA boundaries were computed.

The landward indirect erosion rate is based on aerial photographs and the historic erosion rate of 45 feet per year. The indirect boundary is to the extent of where the shoreline would erode (using 45 ft/year) to in 50 years without the proposed project. The FWP conditions will prevent the loss from occurring in the indirect marsh area.

FWOP analyses considered changes that the project area for each alternative will undergo for a no action scenario. The impacts that coastal processes such as erosion, storms, subsidence and sea level rise would have on the existing habitat categories were considered. The 2005 survey was eroded by two years to represent 2007 conditions for TY0.

FWP analyses considered changes from processes such as equilibrium, storm events, overwash, subsidence, etc., and resulted in an overall change in the platform area or in the conversion of one WVA habitat type to another. Assuming construction takes one year for all FWP Alternatives (TY1 represents the as-built configurations). TY2 represents initial equilibration of beach fill for FWP. Once re-nourishment took place, the process was repeated to account for equilibrium and other coastal processes again.

FWP TY1 all intertidal habitat is built to +2 ft NAVD elevation. Therefore there is no conversion of supratidal to intertidal habitat after initial construction. Loss to supratidal habitat is on the front side of the headland (loss to gulf subtidal).

Assume interior loss rate to be -0.61%/year for all alternatives marsh creation acres. Interior loss rate is based on USGS 1956 to October 25, 2005 data. The USACE interior loss data ranged from -0.04%/year to -0.66%/year and the USACE longterm rate from 1932 to 2001 was -0.27%/year. The USGS data had much more variation and ranged from -0.5%/year to -6.68%/year and several time periods had positive rates as high as 8.61%/year, which may indicate growth or maybe variations from fluctuating water levels. The previous LCA Barrier Shoreline Study, Caminada Headland reach (Jan 2003) used the USACE's 1983-90 land loss rate of -0.2%/year, which was taken from the Chenier subunit from the Wetland Creation Feasibility Study. Either longterm rate (USACE -0.27%/year or USGS -0.61%/year) would be appropriate to use but the USGS longterm rate was chosen as the best representation of loss rates within the project area for the following reasons: the USGS data includes recent storm events (hurricanes Katrina and Rita) where as the USACE data stops in 2001, the USGS longterm (1956-2005) estimate eliminated some of the variation seen in the shorter and more recent USGS time periods, and the USGS rate is a more conservative estimate.

Interior land loss is applied to the Direct and Indirect areas for FWOP and FWP. The acreage numbers for each target year (TY) provided by CEC did not account for interior loss, rather the losses to intertidal habitat shown are from overwash converting marsh acres to supratidal habitat. According to CEC extrapolation of figure C-4-5 to 20 or 25 years, marsh elevations will not decrease out of intertidal zone (2 feet to 0 feet NAVD) within 20 (or 25) years at which time there is a renourishment cycle for Alternatives 6, 7, and 9. Because of this method, there is no

conversion of marsh to open water shown for the project life for alternative 6, 7, and 9 for direct or indirect areas.

The interior loss rates applied for WVA to FWP for direct and indirect areas are as follows. Typical of CWPPRA marsh creation projects, a 50% reduction in the FWOP marsh loss rate is applied to created or nourished marsh. Thus a 50% reduction (-0.31%/year was used) of the background loss rate (-0.61%/year) was applied to the direct marsh areas. The newly created marsh of the direct area will provide more sediment to the system, combat subsidence, the area is less susceptible to breaching and increased erosion, there will be new nutrients available to the area, there may be less wave fetch from open water areas from previously broken marsh, and created marsh will be at a higher marsh elevation than some of the FWOP marsh thus allowing for more vertical accumulation of vegetation.

A 25% reduction (-0.46%/year was used) of the background loss rate (-0.61%/year) was applied to the indirect marsh area. Because the indirect area is adjacent to the direct marsh creation area there will be benefits to this area (reduction in loss rate) as well but they are not considered to be as substantial as the direct marsh area. Most importantly, it is assumed there will be an increase in sediments to the system based on the proximity of the indirect area to the marsh creation foot print which will add nutrients and there will likely be less wave fetch from the broken marsh of the direct area.

The loss rate was applied to both direct and indirect habitat areas as well as the loss provided by CEC to represent overwash events and conversion of marsh to supratidal habitat. Its believed these losses (habitat conversions) represent episodic storm events.

Assume 50% functionality for all marsh created and renourished for the first year after the creation/renourishment cycle.

The indirect areas for all alternatives removed 77 acres that represent the Cheveron facility tank farm, which is considered to be developed land (elevations above +5 feet NAVD) and not wetlands.

Retention dikes are not removed from the saline marsh model post-construction.

Models Applied
The Barrier Headland model is applied to beach and dune components, and the saline marsh WVA is used for the remainder of the project area.

Alternative 5 – Preferred Dune with Expanded Marsh
The dune height is proposed to be +7 feet NAVD which is slightly higher than the existing dune elevation in the area of +3.4 feet NAVD. The proposed dune width is 290 feet. The majority of the dune is sited landward over existing higher elevations, maximizing acreage and longevity. The advanced fill quantities account for initial losses due to shoreline equilibrium.

The landward and seaward slopes are set at a1V:20H. The beach fill template has a 65 ft wide seaward berm at an elevation of +4.5 feet NAVD and a marsh fill template is proposed on the landward side of the dune at an elevation of +2.0 feet NAVD. Approximately 13 miles of dune will be created. Fill quantities for the beach/dune and marsh fills are 6.3 million and 5.4 million cubic yards respectively.

The project direct boundary for Alternative 5 includes approximately 1,361 acres of existing marsh, dune, supratidal, and gulf intertidal habitats at TY0. Project construction includes approximately 705 acres of new marsh, dune, supratidal and gulf intertidal habitats for a total of approximately 2,065 acres at TY1 with approximately 26 acres of these habitats left at TY50. It should be noted that the newly created acres will cover most of the existing acres in the direct project footprints. There is no renourishment of dune or marsh for alternative 5.

With regard to the indirect project boundary, the existing upland acreage approximately equal to 77 acres (Tank Farm, Chevron Facility) will be preserved through the project life at TY50. Because the Chevron Facility (77 acres) is considered to be developed and not wetlands it is taken out of the WVA acres. However, the significant majority of the marsh acreage will disappear over the 50 years through natural subsidence (estimated to be 0.025 feet per year).

Headland model

The project boundary for the headland model encompasses the proposed footprint for the beach, dune, and supratidal area. Using the survey data, aerial photography, historical erosion rate of 45 feet per year, and conceptual sediment budget, the acreages of each habitat component in the land mass within the WVA boundaries were computed. Baseline (TY0) Acreages within the project boundary were rolled forward to 2007.

V1 and V2 – Percent subaerial area that is dune and supratidal

See attached spreadsheet.

Variable V3 - Percent vegetative cover of dune and supratidal habitats

Based on site visits (July 2005), examination of pre and post-storm photography, and post-storm flight, the headland portion of the project area is primarily vegetated by goldenrod (*Solidago* sp.), *Salicornia*, *Distichlis spicata*, roseau cane (*Phragmites*), *Spartina alterniflora*, *Spartina patens*, bitter panicum (*Panicum amarum*), three-cornered grass (*Scirpus olneyi*), pennywort, seaside heliotrope (*Heliotropium curassavicum*), sea-oxeye, dodder vine, deerpea, morning glory, sea oats, *Sesbania* sp., croton, black mangrove, *Iva frutescens*, wax myrtle, and what appeared to be toothache tree.

FWOP Caminada Alternative 5

TY0 35% Transect average from field trip is 50%. Old Caminada Headland WVA baseline

was 50%. Review of helicopter flight photos of Caminada Headland after hurricanes Katrina and Rita resulted in 15% vegetation. There was a lot of overwash, loss of veg, and appears to be loss of dune and supratidal habitats in the headland. Based on the May 2006 field trip, photos, and flight which showed some recovery of breaches; the Elmer's Island portion had about 25% veg cover, the western portion (Bell Pass to the breakwaters) was about 25% cover, and the bulk of the middle (breakwaters to Elmer's) was mostly void of veg and had sandy overwash to the intertidal marsh, thus 5% veg cover in the middle portion. For the May 2006 field trip it was estimated to have is an average of 10% veg cover. Adding 2 years of vegetative rebound for 2008 baseline.

TY1 40% continued growth
TY10 25% No dune acres are left. 32% of baseline supratidal acres are left. Assume much of it may be overwashed.
TY20 0% no supratidal acres remain.
TY50 0% There are no subaerial acres remaining.

FWP Caminada Alternative 5
TY0 35%
*TY1 10% (554 acres of dune + 266 acres of supratidal @ 10% cover)/820 subaerial acres. All intertidal habitat is built to +2 ft NAVD. No supratidal habitat is converted to intertidal habitat in later TYs because of initial equilibrium. Assume 100% of dune acres and berm planted at TY1 (immediately post construction). Estimated coverage of dune and supratidal planted area is 10%.
TY3 40% (538 acres of dune + 133 acres of supratidal @ 40% cover)/671 subaerial acres.
TY5 60% (490 acres of dune + 186 acres of supratidal @ 60% cover)/676 subaerial acres.
TY10 60% (328 acres of dune + 170 acres of supratidal @ 60% cover)/498 subaerial acres. Some loss over time.
TY20 60% (130 acres of dune + 225 acres of supratidal @ 60% cover)/355 subaerial acres.
TY50 0% no dune or supratidal acres remain.

Variable V4- Percent vegetative cover by woody species
Woody vegetation on Caminada included mangrove and *Iva frutescens*.

FWOP Caminada Alternative 5
TY0 4% Many woody species seen on the May 2006 field trip appeared to be burned from salt from the storms. There weren't much woody species left. At the time assumed 2% of the entire 13 miles had some woody species. In 2008 assume more has rebound.
TY1 4%
TY10 2% No dune remains. 113 acres of supratidal, some is expected to be overwashed.
TY20 0% No dune or supratidal remain.
TY50 0%

FWP Caminada Alternative 5
TY0 4%

TY1 0% Burial of all existing woody vegetation in the headland model boundary
TY3 2% Black mangrove and other available woody vegetation installed in TY2 or TY3. Assume 2% of 671 total dune and supratidal acres have woody vegetation established through natural recruitment and plantings.
TY5 5% Assume 5% of 676 total dune and supratidal acres.
TY10 10% Assume 10% cover of 498 total dune and supratidal acres.
TY20 10% Assume 8% cover of 355 total dune and supratidal acres.
TY50 0% there are no dune or supratidal acres remaining.

Variable V5 - Beach/Surf Zone Features
FWOP
TY0 – TY39 9% is Class 3 (SI = 0.9) for breakwaters (5,567 ft) and Bell Pass Jetties with rip rap (~500 ft) placed nearshore just east of the Bell Pass Jetty. Boudin bags on beach at same location as 13 sunken barge breakwaters. 91% Class 1 (SI =1.0) the rest of the headland is unconfined natural beach with no shore parallel structures. The weighted SI = (0.09*0.9 + 0.91*1) = 0.99
TY 40-50 100% Class 1. The effect of the breakwaters would cease by TY40 due to their distance offshore.
FWP
TY1-50 8% Class 3 because Jetty and breakwaters will remain for FWP but some created beach/dune may cover the rip rap just east of the Bell Pass Jetty. 92% Class 1 the rest of the headland is unconfined natural beach and containment built for construction would be graded into the template for a more natural slope as-built. The weighted SI = (0.09*0.8 + 0.92*1) = 0.99

Saline Marsh model
The project boundary for the saline marsh model encompasses the area of marsh fill. The WVA boundary for indirect benefits was delineated using the historical Caminada Headland erosion rate of 45 feet per year. The landward extent of this boundary was offset from the target year zero (TY0) shoreline by the maximum distance eroded during the life of the project (45ft/yr X 50 years = 2,250ft). This rate is not expected to increase due to dune disappearance. Review of historic maps has shown that the Headland's natural dune has progressed landward in position but has not disappeared. This boundary is also bordered by the direct boundary in the gulfward direction.

Variable V1 – Percent of wetland area covered by emergent vegetation
See attached spreadsheet for direct and indirect benefit areas. Not enough material is added initially to not lose marsh below the intertidal elevation zone. FWOP we applied a background loss rate of 0.61%/year in direct and indirect areas. FWP we applied an interior loss rate of 0.31%/year in direct areas and 0.46%/year in indirect areas to all target years to determine the number of acres that convert to open water. The loss rate was applied to both direct and indirect habitat areas as well as the loss provided by CEC to represent overwash events and conversion of marsh to supratidal habitat. Its believed these losses (habitat conversions) represent episodic storm events.

TY1 100% of the 1186-acre marsh platform is built at marsh elevation (+ 2ft NAVD) at construction. Equilibrium after the first year brings the elevation down from +2 ft. The project area may be a different size from baseline b/c some of the marsh was converted to supratidal in the headland portion of the project. Assume 10% functionality for marsh created for the first year, 30% functionality for the third year, and 100% functionality for the fifth year after the creation cycle. See spreadsheet for Alt 5 FWOP and FWP.

Variable V2 - Percent of open water area covered by aquatic vegetation
No SAV has been observed in the either the direct or indirect project area based on May 2006, July 2005 and April 2001 site visits. Proposed as 0% for FWOP and FWP, all TYs.

Variable V3- Marsh edge and interspersion
Based on the acreage data in V1, 1998 DOQQ, October 2005 DOQQs, and post storm flight and photography, and the May 2006 field trip, photos, and flight.

Direct Benefit Area Caminada Alternative 5
FWOP
TY0 20% class 2
60% class 3
20% class 4 - 32% water. Based primarily on % land/water. Viewed post Katrina and Rita (CWPPRA) video and photos, 1998 DOQQ, 2005 DOQQ, and May 2006 helicopter flight photos and video. Previous study used 50% class 3 and 50% class 4 (Jan 03). July 06 study used 40% class 1; 60% class 2 18% water.
TY1 20% class 2 - 33% water.
60% class 3
20% class 4 - July 06 study used 40% class 1; 60% class 2 19% water.
TY10 10% class 2 - 59% water.
45% class 3
45% class 4 - July 06 study used 30% class 1; 70% class 2 21% water.
TY20 100% class 5. 100% water. July 06 study used 100% class 2 23% water.
TY50 100% class 5. No marsh remaining.

Direct Benefit Area Caminada Alternative 5
FWP
TY0 40% class 2
60% class 3
TY1 100% class 1. There is 8% water
TY3 100% class 1. There is 9% water.
TY5 80% class 1. There is 10% water.
20% class 2
TY10 60% class 1. There is 23% water.
25% class 2

15% class 3
TY20 55% class 3. There is 55% water.
45% class 4
TY50 100% class 5. There is 100% water.

Indirect Benefit Area Caminada Alternative 5
FWOP
TY0 20% class 2
60% class 3
20% class 4 – 38% water. Based primarily on % land/water. Viewed post Katrina and Rita (CWPPRA) video and photos, 1998 DOQQ, 2005 DOQQ, and May 2006 helicopter flight photos and video. Previous study used 50% class 3 and 50% class 4 (Jan 03). July 06 used 60% class2; 20% class 3, 20% class 4 with 41% water.
TY1 20% class 2 – 38% water. (July 06 41% water, same classes)
60% class 3
20% class 4
TY10 15% class 2 – 43% water. (July 06 50% water, 60% class 3; 40% class 4)
55% class 3
30% class 4
TY20 10% class 2
45% class 3 – 55% water (July 06 61% water, 20% class 3, 80% class 4)
45% class 4
TY37 100% class 5. No marsh remaining.
TY50 100% class 5. No marsh remaining.

Indirect Benefit Area Caminada Alternative 5
FWP
TY0 20% class 2
60% class 3
20% class 4
TY1 20% class 2 – 38% water (was 41% water)
60% class 3
20% class 4
TY10 15% class 2 – 41% water (was 43% water)
55% class 3
30% class 4
TY20 10% class 2 – 48% water (was 45% water)
45% class 3
45% class 4
TY50 100% class 5 – 100% water (was 53% water)

Variable V4 – Percent of open water area < 1.5 feet deep in relation to marsh surface
There were no survey data available going through the direct or indirect benefit areas to help

determine shallow open water. Shallow open water was based on review of aerial photography and discussion with locals (pers. com. Forrest Travirca, May 18, 2006) extremely familiar with the area. Depths varied from primarily less than 1.5 feet in most of the project area, 3 feet in some of the ponds (indirect area), 8 to 10 feet in other ponds (out of project area), 5 to 8 feet in the canals, as much as 18 feet in one area (outside of project area), and 25 feet at the cross section of Bayou Moreau and the BP canal.

Direct Benefit Area Caminada Alternative 5
FWOP
TY0 75% Assume that all shallow water is within the fragmented marsh, on the edge of canals, bayous, bays, and ponds. Within the direct and indirect area of this project it was estimated that about 75% of the open water areas was less than 1.5 feet.
TY1 75%
TY10 70% over time shallow water becomes deeper as material is flushed out of the system through the tidal prism. Though new shallow water is created as marsh is lost we assume slightly more loss of shallow open water converting to greater than 1.5 feet deep.
TY20 55%
TY50 0% Direct benefit area has no shallow water at TY50 because the area is 100% gulf.

Direct Marsh Area Caminada Alternative 5
FWP
TY0 75%
TY1 100% Most open water is filled in (107 (8%) acres water). 8% water is from interior loss converting marsh to shallow water.
TY3 100% Assume that most of the marsh lost to open water (9% 114 acres) becomes shallow open water.
TY5 95% Same as TY3 (10% 121 water acres).
TY10 85% (23% 261 acres water).
TY20 75% (50% water)
TY50 50% (100% water)

Indirect Benefit Area Caminada Alternative 5
FWOP
TY0 75% Assume that all shallow water is within the fragmented marsh, on the edge of canals, bayous, bays, and ponds. Within the direct and indirect area of this project it was estimated that about 75% of the open water areas was less than 1.5 feet.
TY1 75%
TY10 70%
TY20 55%
TY37 30%
TY50 0% Indirect benefit area has no shallow water at TY50 because the area is 100% gulf.

Indirect Benefit Area Caminada Alternative 5

FWP
TY0 75% Assume that all shallow water is within the fragmented marsh, on the edge of canals, bayous, bays, and ponds. Within the direct and indirect area of this project it was estimated that about 75% of the open water areas was less than 1.5 feet.
TY1 75% - 38% water
TY10 75% - 41% water
TY20 70% - 45% water
TY50 40% - 100% water

Variable V5 – Average annual Salinity
Based on salinity readings from the May 2006 field trip average salinities were 31 ppt. Storm surges associated with Hurricanes Katrina and Rita in 2005 introduced saline waters to the study area, and low levels of precipitation have resulted in continued high salinities in the area. These readings were assumed to be abnormally high.

The baseline salinities from the LCA Barrier Island Study of 20 ppt were used. Although current salinity readings are higher, assume 20 ppt as the baseline for the model purposes. Salinity remains the same for direct and indirect FWOP and FWP for all TYs.

Variable V6 – Aquatic organism access
Direct and Indirect benefit areas Caminada Alternative 5
FWOP
TY0-TY50 1

Direct benefit area Caminada Alternative 5
FWP
TY0 1
TY1 0.0001 Marsh platform is impounded by retention dikes
TY3 1 Assume retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks are constructed in the intertidal marsh habitat.
TY5-TY50 1

Indirect benefit area Caminada Alternative 5
FWOP and FWP
TY0 1
TY1-TY50 1

Alternative 6 – Preferred Dune with Expanded Marsh and 1 Renourishment
The dune height is proposed to be +7 feet NAVD which is slightly higher than the existing dune elevation in the area of +3.4 feet NAVD. The proposed dune width is 290 feet. The majority of the dune is sited landward over existing higher elevations, maximizing acreage and longevity. The advanced fill quantities account for initial losses due to shoreline equilibrium.

The landward and seaward slopes are set at a1V:20H. The beach fill template has a 65 ft wide seaward berm at an elevation of +4.5 feet NAVD and a marsh fill template is proposed on the landward side of the dune at an elevation of +2.0 feet NAVD. Approximately 13 miles of dune will be created. Fill quantities for the beach/dune and marsh fills are 6.3 million and 5.4 million cubic yards respectively.

The project direct boundary for Alternative 6 includes approximately 1,361 acres of existing marsh, dune, supratidal, and gulf intertidal habitats at TY0. Project construction includes approximately 705 acres of new marsh, dune, supratidal and gulf intertidal habitats for a total of approximately 2,065 acres at TY1. The beach, dune, and marsh will be rebuilt at 25 years, preserving approximately 565 acres of these habitats left at TY50. It should be noted that the newly created acres will cover most of the existing acres in the direct project footprints.

With regard to the indirect project boundary, the existing upland acreage approximately equal to 77 acres (Tank Farm, Chevron Facility) will be preserved through the project life at TY50. Because the Chevron Facility (77 acres) is considered to be developed and not wetlands it is taken out of the WVA acres. However, the significant majority of the marsh acreage will disappear over the 50 years through natural subsidence (estimated to be 0.025 feet per year).

Headland model

The project boundary for the headland model encompasses the proposed footprint for the beach, dune, and supratidal area. Using the survey data, aerial photography, historical erosion rate of 45 feet per year, and conceptual sediment budget, the acreages of each habitat component in the land mass within the WVA boundaries were computed. Baseline (TY0) Acreages within the project boundary were rolled forward to 2007.

V1 and V2 – Percent subaerial area that is dune and supratidal
See attached spreadsheet.

Variable 3 - Percent vegetative cover of dune and supratidal habitats
Based on site visits (July 2005), examination of pre and post-storm photography, and post-storm flight, the headland portion of the project area is primarily vegetated by goldenrod (*Solidago* sp.), *Salicornia*, *Distichlis spicata*, roseau cane (*Phragmites*), *Spartina alterniflora*, *Spartina patens*, bitter panicum (*Panicum amarum*), three-cornered grass (*Scirpus olneyi*), pennywort, seaside heliotrope (*Heliotropium curassavicum*), sea-oxeye, dodder vine, deerpea, morning glory, sea oats, *Sesbania* sp., croton, black mangrove, *Iva frutescens*, wax myrtle, and what appeared to be toothache tree.

FWOP Caminada Alternative 6
See Alternative 5 FWOP

FWP Caminada Alternative 6
TY0 35%

*TY1 10% (554 acres of dune + 266 acres of supratidal @ 10% cover)/820 subaerial acres. All intertidal habitat is built to +2 ft NAVD. No supratidal habitat is converted to intertidal habitat in later TYs because of initial equilibrium. Assume 100% of dune acres and berm planted at TY1 (immediately post construction). Estimated coverage of dune and supratidal planted area is 10%.
TY3 40% (538 acres of dune + 133 acres of supratidal @ 40% cover)/671 subaerial acres.
TY5 60% (490 acres of dune + 186 acres of supratidal @ 60% cover)/676 subaerial acres.
TY10 65% (328 acres of dune + 170 acres of supratidal @ 65% cover)/498 subaerial acres.
TY20 70% (130 acres of dune + 225 acres of supratidal @ 70% cover)/355 subaerial acres.
TY25 70% (23 acres of dune + 169 acres of supratidal @ 70% cover)/192 subaerial acres.
*TY26 35% (577 acres of dune @ 20% + 435 acres of supratidal @ 55% cover)/1012 subaerial acres. Dune is renourished covering some plants but supratidal platform is anticipated to remain somewhat vegetated after renourishment.
TY28 53% (561 acres of dune @ 50% + 302 acres of supratidal @ 60% cover)/863 subaerial acres.
TY30 65% (513 acres of dune + 355 acres of supratidal @ 65% cover)/868 subaerial acres.
TY50 65% (23 acres of dune + 169 acres of supratidal @ 65% cover)/192 subaerial acres.

Variable V4- Percent vegetative cover by woody species
Woody vegetation on Caminada included mangrove and *Iva frutescens.*

FWOP Caminada Alternative 6
Same as Alt 5

FWP Caminada Alternative 6
TY0 4%
TY1 0% Burial of all existing woody vegetation in the headland model boundary
TY3 2% Black mangrove and other available woody vegetation installed in TY2 or TY3. Assume 2% of subaerial acres have woody vegetation coverage established through natural recruitment and plantings.
TY5 5% Assume 5% of supratidal acres have woody vegetation coverage established through natural recruitment and plantings.
TY10 10% Assume 10% cover of 498 total dune and supratidal acres.
TY20 10% Assume 5% cover of 355 total dune and supratidal acres.
TY25 10% Assume 5% cover of 192 total dune and supratidal acres.
*TY26 4% Assume 4% cover of 1012 total dune and supratidal acres.
TY28 5% Assume 5% cover of 863 total dune and supratidal acres.
TY30 8% Assume 8% cover of 868 total dune and supratidal acres.
TY50 17% Assume 17% cover of 192 total dune and supratidal acres.

Variable V5 - Beach/Surf Zone Features
FWOP
TY0 – TY39 9% is Class 3 (Sl = 0.9) for breakwaters (5,567 ft) and Bell Pass Jetties with rip

rap (~500 ft) placed nearshore just east of the Bell Pass Jetty. Boudin bags on beach at same location as 13 sunken barge breakwaters. 91% Class 1 (SI =1.0) the rest of the headland is unconfined natural beach with no shore parallel structures. The weighted SI = (0.09*0.9 + 0.91*1) = 0.99

TY 40-50 100% Class 1. The effect of the breakwaters would cease by TY40 due to their distance offshore.

FWP

TY1-50 8% Class 3 because Jetty and breakwaters will remain for FWP but some created beach/dune may cover the rip rap just east of the Bell Pass Jetty. 92% Class 1 the rest of the headland is unconfined natural beach and containment built for construction would be graded into the template for a more natural slope as-built. The weighted SI = (0.09*0.8 + 0.92*1) = 0.99

Saline Marsh model

The project boundary for the saline marsh model encompasses the area of marsh fill. The WVA boundary for indirect benefits was delineated using the historical Caminada Headland erosion rate of 45 feet per year. The landward extent of this boundary was offset from the target year zero (TY0) shoreline by the maximum distance eroded during the life of the project (45ft/yr X 50 years = 2,250ft). This rate is not expected to increase due to dune disappearance. Review of historic maps has shown that the Headland's natural dune has progressed landward in position but has not disappeared. This boundary is also bordered by the direct boundary in the gulfward direction.

Variable V1 – Percent of wetland area covered by emergent vegetation

See attached spreadsheet for direct and indirect benefit areas. Enough material is added initially and with renourishments to not lose marsh below the intertidal elevation zone. FWOP we applied a background loss rate of 0.61%/year in direct and indirect areas. FWP we applied an interior loss rate of 0.31%/year in direct areas and 0.46%/year in indirect areas to all target years to determine the number of acres that convert to open water. The loss rate was applied to both direct and indirect habitat areas as well as the loss provided by CEC to represent overwash events and conversion of marsh to supratidal habitat. Its believed these losses (habitat conversions) represent episodic storm events.

TY1 100% of the 1186-acre marsh platform is built at marsh elevation (+ 2ft NAVD) at construction. Equilibrium after the first year brings the elevation down from +2 ft. The project area may be a different size from baseline b/c some of the marsh was converted to supratidal in the headland portion of the project. Assume 10% functionality for marsh created for the first year, 30% functionality for the third year, and 100% functionality for the fifth year after the creation cycle. See spreadsheet for Alt 5 FWOP and FWP.

Variable V2 - Percent of open water area covered by aquatic vegetation

No SAV has been observed in the either the direct or indirect project area based on May 2006, July 2005 and April 2001 site visits. Proposed as 0% for FWOP and FWP, all TYs.

Variable V3- Marsh edge and interspersion
Based on the acreage data in V1, 1998 DOQQ, October 2005 DOQQs, and post storm flight and photography, and the May 2006 field trip, photos, and flight.

Direct Benefit Area Caminada Alternative 6
FWOP
Same as Alternative 5

Direct Benefit Area Caminada Alternative 6
FWP
TY0 20% class 2
60% class 3
20% class 4
TY1 100% class 1. There is 8% water
TY3 100% class 1. There is 9% water.
TY5 80% class 1. There is 10% water.
20% class 2
TY10 60% class 1. There is 23% water.
25% class 2
15% class 3
TY20 55% class 3. There is 55% water.
45% class 4
TY25 35% class 3. There is 78% water.
65% class 4
*TY26 55% class 1. There is 28% water after renourishment.
30% class 2
15% class 3
TY28 55% class 1. There is 28% water.
30% class 2
15% class 3
TY30 40% class 1. There is 32% water.
30% class 2
30% class 3
TY50 100% class 3. There is 82% water.

Indirect Benefit Area Caminada Alternative 6
FWOP
Same as Alternative 5

Indirect Benefit Area Caminada Alternative 5
FWP
TY0 20% class 2
60% class 3

20% class 4
TY1 20% class 2 – 38% water.
60% class 3
20% class 4
TY10 15% class 2 – 43% water.
55% class 3
30% class 4
TY37 50% class 3– 55% water
50% class 4
TY50 100% class 5 – 100% water

Variable V4 – Percent of open water area < 1.5 feet deep in relation to marsh surface
There were no survey data available going through the direct or indirect benefit areas to help determine shallow open water. Shallow open water was based on review of aerial photography and discussion with local (pers. com. Forrest Travirca, May 18, 2006) extremely familiar with the area. Depths varied from primarily less than 1.5 feet in most of the project area, 3 feet in some of the ponds (indirect area), 8 to 10 feet in other ponds (out of project area), 5 to 8 feet in the canals, as much as 18 feet in one area (outside of project area), and 25 feet at the cross section of Bayou Moreau and the BP canal.

Direct Benefit Area Caminada Alternative 6
FWOP
Same as Alternative 5

Direct Marsh Area Caminada Alternative 6
FWP
TY0 75%
TY1 100% Most open water is filled in (107 acres water). 8% water is from interior loss converting marsh to shallow water.
TY3 100% Assume that most of the marsh lost to open water (9% -114 acres) becomes shallow open water.
TY5 95% Same as TY3 (10% 121 water acres).
TY10 85% (23% 261 acres water).
TY20 75% (55% water)
TY25 70% (78% water)
*TY26 95% after renourishment any deeper open water may have become shallow again.
TY28 95%
TY30 90%
TY50 70%

Indirect Benefit Area Caminada Alternative 6
FWOP
Same as Alternative 5

Indirect Benefit Area Caminada Alternative 6
FWP
TY0 75% Assume that all shallow water is within the fragmented marsh, on the edge of canals, bayous, bays, and ponds. Within the direct and indirect area of this project it was estimated that about 75% of the open water areas was less than 1.5 feet.
TY1 75% - 38% water
TY10 75% - 41% water
TY37 60% - 55% water
TY50 30% - 100% water

Variable V5 – Average annual Salinity
Based on salinity readings from the May 2006 field trip average salinities were 31 ppt. Storm surges associated with Hurricanes Katrina and Rita in 2005 introduced saline waters to the study area, and low levels of precipitation have resulted in continued high salinities in the area. These readings were assumed to be abnormally high.

The baseline salinities from the LCA Barrier Island Study of 20 ppt were used. Although current salinity readings are higher, assume 20 ppt as the baseline for the model purposes. Salinity remains the same for direct and indirect FWOP and FWP for all TYs.

Variable V6 – Aquatic organism access
Direct and Indirect benefit areas Caminada Alternative 6
FWOP
TY0-TY50 1

Direct benefit area Caminada Alternative 6
FWP
TY0 1
TY1 0.0001 Marsh platform is impounded by retention dikes
TY3 1 Assume retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks are constructed in the intertidal marsh habitat.
TY5-TY25 1
TY26 0.0001 Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh creation.
TY28 1 Assume retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks are constructed in the intertidal marsh habitat.
TY30-50 1

Indirect benefit area Caminada Alternative 6
FWOP and FWP
TY0 1
TY1-TY50 1

Alternative 7 – Preferred dune with Expanded Marsh and 2 Renourishments
The dune height is proposed to be +7 feet NAVD which is slightly higher than the existing dune elevation in the area of +3.4 feet NAVD. The proposed dune width is 290 feet. The majority of the dune is sited landward over existing higher elevations, maximizing acreage and longevity. The advanced fill quantities account for initial losses due to shoreline equilibrium.

The landward and seaward slopes are set at a1V:20H. The beach fill template has a 65 ft wide seaward berm at an elevation of +4.5 feet NAVD and a marsh fill template is proposed on the landward side of the dune at an elevation of +2.0 feet NAVD. Approximately 13 miles of dune will be created. Fill quantities for the beach/dune and marsh fills are 6.3 million and 5.4 million cubic yards respectively.

The project direct boundary for Alternative 7 includes approximately 1,361 acres of existing marsh, dune, supratidal, and gulf intertidal habitats at TY0. Project construction includes approximately 705 acres of new marsh, dune, supratidal and gulf intertidal habitats for a total of approximately 2,065 acres at TY1. The beach, dune, and marsh will be rebuilt at year 20 and year 40, preserving approximately 1450 acres of these habitats throughout the project life at TY50. It should be noted that the newly created acres will cover most of the existing acres in the direct project footprints.

With regard to the indirect project boundary, the existing upland acreage approximately equal to 77 acres (Tank Farm, Chevron Facility) will be preserved through the project life at TY50. Because the Chevron Facility (77 acres) is considered to be developed and not wetlands it is taken out of the WVA acres. However, the significant majority of the marsh acreage will disappear over the 50 years through natural subsidence (estimated to be 0.025 feet per year).

Headland model
The project boundary for the headland model encompasses the proposed footprint for the beach, dune, and supratidal area. Using the survey data, aerial photography, historical erosion rate of 45 feet per year, and conceptual sediment budget, the acreages of each habitat component in the land mass within the WVA boundaries were computed. Baseline (TY0) Acreages within the project boundary were rolled forward to 2007.

V1 and V2 – Percent subaerial area that is dune and supratidal
See attached spreadsheet.

Variable V3 - Percent vegetative cover of dune and supratidal habitats
Based on site visits (July 2005), examination of pre and post-storm photography, and post-storm flight, the headland portion of the project area is primarily vegetated by goldenrod (*Solidago* sp.), *Salicornia*, *Distichlis spicata*, roseau cane (*Phragmites*), *Spartina alterniflora*, *Spartina patens*, bitter panicum (*Panicum amarum*), three-cornered grass (*Scirpus olneyi*), pennywort, seaside heliotrope (*Heliotropium curassavicum*), sea-oxeye, dodder vine, deerpea, morning glory, sea

oats, *Sesbania* sp., croton, black mangrove, *Iva frutescens*, wax myrtle, and what appeared to be toothache tree.

FWOP Caminada Alternative 7
Same as Alternative 5

FWP Caminada Alternative 7
TY0 35%
TY1 10% (554 acres of dune + 266 acres of supratidal @ 10% cover)/820 subaerial acres. All intertidal habitat is built to +2 ft NAVD. No supratidal habitat is converted to intertidal habitat in later TYs because of initial equilibrium. Assume 100% of dune acres and berm planted at TY1 (immediately post construction). Estimated coverage of dune and supratidal planted area is 10%.
TY3 40% (538 acres of dune + 133 acres of supratidal @ 40% cover)/671 subaerial acres.
TY5 60% (490 acres of dune + 186 acres of supratidal @ 60% cover)/676 subaerial acres.
TY10 60% (328 acres of dune + 170 acres of supratidal @ 60% cover)/498 subaerial acres. Some loss over time.
TY20 60% (130 acres of dune + 225 acres of supratidal @ 60% cover)/355 subaerial acres. Some loss over time.
*TY21 35% (684 acres of dune @ 20% + 490 acres of supratidal @ 55% cover)/1174 subaerial acres. Dune is renourished covering some plants but supratidal platform is anticipated to remain somewhat vegetated after renourishment.
TY23 53% (669 acres of dune @ 50% + 358 acres of supratidal @ 60% cover)/1027 subaerial acres.
TY25 65% (620 acres of dune + 411 acres of supratidal @ 65% cover)/1031 subaerial acres.
TY30 70% (458 acres of dune + 395 acres of supratidal @ 70% cover)/853 subaerial acres.
TY40 70% (130 acres of dune + 225 acres of supratidal @ 70% cover)/355 subaerial acres.
*TY41 37% (684 acres of dune @ 20% + 490 acres of supratidal @ 60% cover)/1174 subaerial acres. Dune is renourished covering some plants but supratidal platform is anticipated to remain somewhat vegetated after renourishment.
TY43 55% (668 acres of dune @ 50% + 358 acres of supratidal @ 65% cover)/1026 subaerial acres.
TY45 65% (620 acres of dune + 411 acres of supratidal @ 65% cover)/1031 subaerial acres.
TY50 70% (458 acres of dune + 395 acres of supratidal @ 70% cover)/853 subaerial acres.

Variable V4- Percent vegetative cover by woody species
Woody vegetation on Caminada included mangrove and *Iva frutescens*.

FWOP Caminada Alternative 7
Same as Alt 5

FWP Caminada Alternative 7

TY0 4%
TY1 0% Burial of all existing woody vegetation in the headland model boundary
TY3 2% Black mangrove and other available woody vegetation installed in TY2 or TY3. Assume 2% of subaerial acres have woody vegetation coverage established through natural recruitment and plantings.
TY5 3% Assume 3% of subaerial acres have woody vegetation coverage established through natural recruitment and plantings.
TY10 8% Assume 4% cover of 498 total subaerial acres.
TY20 9% Assume 5% cover of 355 total subaerial acres.
*TY21 3% Assume 3% cover of 1174 total subaerial acres.
TY23 6% Assume 6% cover of 1027 total subaerial acres.
TY25 9% Assume 9% cover of 1031 total subaerial acres
TY30 9% Assume 10% cover of 853 total subaerial acres.
TY40 9% Assume 12% cover of 355 total subaerial acres
*TY41 3% Assume 4% cover of 1174 total subaerial acres.
TY43 6% Assume 6% cover of 1026 total subaerial acres.
TY45 9% Assume 9% cover of 1031 total subaerial acres.
TY50 9% Assume 10% cover of 853 total subaerial acres.

Variable V5 - Beach/Surf Zone Features
FWOP
TY0 – TY39 9% is Class 3 (SI = 0.9) for breakwaters (5,567 ft) and Bell Pass Jetties with rip rap (~500 ft) placed nearshore just east of the Bell Pass Jetty. Boudin bags on beach at same location as 13 sunken barge breakwaters. 91% Class I (SI =1.0) the rest of the headland is unconfined natural beach with no shore parallel structures. The weighted SI = (0.09*0.9 + 0.91*1) = 0.99
TY 40-50 100% Class 1. The effect of the breakwaters would cease by TY40 due to their distance offshore.
FWP
TY1-50 8% Class 3 because Jetty and breakwaters will remain for FWP but some created beach/dune may cover the rip rap just east of the Bell Pass Jetty. 92% Class 1 the rest of the headland is unconfined natural beach and containment built for construction would be graded into the template for a more natural slope as-built. The weighted SI = (0.09*0.8 + 0.92*1) = 0.99

Saline Marsh model
The project boundary for the saline marsh model encompasses the area of marsh fill. The WVA boundary for indirect benefits was delineated using the historical Caminada Headland erosion rate of 45 feet per year. The landward extent of this boundary was offset from the target year zero (TY0) shoreline by the maximum distance eroded during the life of the project (45ft/yr X 50 years = 2,250ft). This rate is not expected to increase due to dune disappearance. Review of historic maps has shown that the Headland's natural dune has progressed landward in position but has not disappeared. This boundary is also bordered by the direct boundary in the gulfward direction.

Interior marsh loss is estimated to be 0.025 feet per year.

Variable V1 – Percent of wetland area covered by emergent vegetation
See attached spreadsheet for direct and indirect benefit areas. Enough material is added initially and with renourishments to not lose marsh below the intertidal elevation zone. FWOP we applied a background loss rate of 0.61%/year in direct and indirect areas. FWP we applied an interior loss rate of 0.31%/year in direct areas and 0.46%/year in indirect areas to all target years to determine the number of acres that convert to open water. The loss rate was applied to both direct and indirect habitat areas as well as the loss provided by CEC to represent overwash events and conversion of marsh to supratidal habitat. Its believed these losses (habitat conversions) represent episodic storm events.

TY1 100% of the 1186-acre marsh platform is built at marsh elevation (+ 2ft NAVD) at construction. Equilibrium after the first year brings the elevation down from +2 ft. The project area may be a different size from baseline b/c some of the marsh was converted to supratidal in the headland portion of the project. Assume 10% functionality for marsh created for the first year, 30% functionality for the third year, and 100% functionality for the fifth year after the creation cycle. See spreadsheet for Alt 7 FWOP and FWP.

Variable V2 - Percent of open water area covered by aquatic vegetation
No SAV has been observed in the either the direct or indirect project area based on May 2006, July 2005 and April 2001 site visits. Proposed as 0% for FWOP and FWP, all TYs.

Variable V3- Marsh edge and interspersion
Based on the acreage data in V1, 1998 DOQQ, October 2005 DOQQs, and post storm flight and photography, and the May 2006 field trip, photos, and flight.

Direct Benefit Area Caminada Alternative 7
FWOP
Same as Alternative 5

Direct Benefit Area Caminada Alternative 7
FWP

TY0	20% class 2
	60% class 3
	20% class 4
TY1	100% class 1. There is 8% water
TY3	100% class 1. There is 9% water.
TY5	80% class 1. There is 10% water.
	20% class 2
TY10	60% class 1. There is 23% water.
	25% class 2

15% class 3
TY20 55% class 3. There is 55% water.
45% class 4
*TY21 70% class 2. There is 40% water after renourishment.
30% class 3
TY23 70% class 2. There is 41% water.
30% class 3
TY25 65% class 2. There is 45% water.
35% class 3
TY30 55% class 2. There is 59% water.
45% class 3
TY40 30% class 2. There is 72% water.
70% class 3
*TY41 70% class 2. There is 43% water after renourishment.
30% class 3
TY43 70% class 2. There is 43% water.
30% class 3
TY45 65% class 2. There is 48% water.
35% class 3
TY50 50% class 2. There is 62% water.
50% class 3

Indirect Benefit Area Caminada Alternative 7
FWOP
Same as Alternative 5

Indirect Benefit Area Caminada Alternative 7
FWP
TY0 20% class 2
60% class 3
20% class 4
TY1 20% class 2 – 38% water
60% class 3
20% class 4
TY10 15% class 2 – 41% water
45% class 3
45% class 4
TY35 100% class 5 – 100% water
TY50 100% class 5 – 100% water

Variable V4 – Percent of open water area < 1.5 feet deep in relation to marsh surface
There were no survey data available going through the direct or indirect benefit areas to help determine shallow open water. Shallow open water was based on review of aerial photography

and discussion with local (pers. com. Forrest Travirca, May 18, 2006) extremely familiar with the area. Depths varied from primarily less than 1.5 feet in most of the project area, 3 feet in some of the ponds (indirect area), 8 to 10 feet in other ponds (out of project area), 5 to 8 feet in the canals, as much as 18 feet in one area (outside of project area), and 25 feet at the cross section of Bayou Moreau and the BP canal.

Direct Benefit Area Caminada Alternative 7
FWOP
Same as Alternative 5

Direct Marsh Area Caminada Alternative 7
FWP
TY0 75%
TY1 100% Most open water is filled in (107 acres water). 8% water is from interior loss converting marsh to shallow water.
TY3 100% Assume that most of the marsh lost to open water (9% -114 acres) becomes shallow open water.
TY5 95% Same as TY3 (10% 121 water acres).
TY10 85% (23% 261 acres water).
TY20 75% (55% water)
*TY21 95% after renourishment any deeper open water may have become shallow again.
TY23 95%
TY25 90%
TY30 75% (59% water)
TY40 65% (72% water)
*TY41 95% after renourishment any deeper open water may have become shallow again.
TY43 95%
TY45 90%
TY50 75%

Indirect Benefit Area Caminada Alternative 7
FWOP
Same as Alternative 5

Indirect Benefit Area Caminada Alternative 7
FWP
TY0 75% Assume that all shallow water is within the fragmented marsh, on the edge of canals, bayous, bays, and ponds. Within the direct and indirect area of this project it was estimated that about 75% of the open water areas was less than 1.5 feet.
TY1 75% - 38% water
TY10 75% - 41% water
TY35 50% - 100% water
TY50 15% - 100% water

Variable V5 – Average annual Salinity
Based on salinity readings from the May 2006 field trip average salinities were 31 ppt. Storm surges associated with Hurricanes Katrina and Rita in 2005 introduced saline waters to the study area, and low levels of precipitation have resulted in continued high salinities in the area. These readings were assumed to be abnormally high.

The baseline salinities from the LCA Barrier Island Study of 20 ppt were used. Although current salinity readings are higher, assume 20 ppt as the baseline for the model purposes. Salinity remains the same for direct and indirect FWOP and FWP for all TYs.

Variable V6 – Aquatic organism access
Direct and Indirect benefit areas Caminada Alternative 7
FWOP
TY0-TY50 1

Direct benefit area Caminada Alternative 7
FWP
TY0 1
TY1 0.0001 Marsh platform is impounded by retention dikes
TY3 1 Assume retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks are constructed in the intertidal marsh habitat.
TY5-TY20 1
TY21 0.0001 Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh creation.
TY23 1 Assume retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks are constructed in the intertidal marsh habitat.
TY25-40 1
TY41 0.0001 Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh creation.
TY43 1 Assume retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks are constructed in the intertidal marsh habitat.
TY45-50 1

Indirect benefit area Caminada Alternative 7
FWOP and FWP
TY0 1
TY1-TY50 1

Alternative 9 – Optimized with Expanded Marsh and 4 Renourishments
The dune height is proposed to be +7 feet NAVD which is slightly higher than the existing dune elevation in the area of +3.4 feet NAVD. The proposed dune width is 290 feet. The majority of the dune is sited landward over existing higher elevations, maximizing acreage and longevity.

The advanced fill quantities account for initial losses due to shoreline equilibrium.

The landward and seaward slopes are set at a1V:20H. The beach fill template has a 65 ft wide seaward berm at an elevation of +4.5 feet NAVD and a marsh fill template is proposed on the landward side of the dune at an elevation of +2.0 feet NAVD. Approximately 13 miles of dune will be created. Fill quantities for the beach/dune and marsh fills are 5.1 million and 5.4 million cubic yards respectively.

The project direct boundary for Alternative 9 includes approximately 1,361 acres of existing marsh, dune, supratidal, and gulf intertidal habitats at TY0. Project construction includes approximately 705 acres of new marsh, dune, supratidal and gulf intertidal habitats for a total of approximately 2,065 acres at TY1. The beach and dune will be rebuilt every 10 years and the marsh will be rebuilt every 20 years, preserving approximately 1450 acres of these habitats throughout the project life at TY50. It should be noted that the newly created acres will cover most of the existing acres in the direct project footprints.

With regard to the indirect project boundary, the existing upland acreage approximately equal to 77 acres (Tank Farm, Chevron Facility) will be preserved through the project life at TY50. Because the Chevron Facility (77 acres) is considered to be developed and not wetlands it is taken out of the WVA acres. However, the significant majority of the marsh acreage will disappear over the 50 years through natural subsidence (estimated to be 0.025 feet per year).

Headland model

The project boundary for the headland model encompasses the proposed footprint for the beach, dune, and supratidal area. Using the survey data, aerial photography, historical erosion rate of 45 feet per year, and conceptual sediment budget, the acreages of each habitat component in the land mass within the WVA boundaries were computed. Baseline (TY0) Acreages within the project boundary were rolled forward to 2007.

V1 and V2 – Percent subaerial area that is dune and supratidal
See attached spreadsheet.

Variable V3 - Percent vegetative cover of dune and supratidal habitats
Based on site visits (July 2005), examination of pre and post-storm photography, and post-storm flight, the headland portion of the project area is primarily vegetated by goldenrod (*Solidago* sp.), *Salicornia*, *Distichlis spicata*, roseau cane (*Phragmites*), *Spartina alterniflora*, *Spartina patens*, bitter panicum (*Panicum amarum*), three-cornered grass (*Scirpus olneyi*), pennywort, seaside heliotrope (*Heliotropium curassavicum*), sea-oxeye, dodder vine, deerpea, morning glory, sea oats, *Sesbania* sp., croton, black mangrove, *Iva frutescens*, wax myrtle, and what appeared to be toothache tree.

FWOP Caminada Alternative 9
Same as Alternative 5

FWP Caminada Alternative 9
TY0 35%
TY1 10% (554 acres of dune + 266 acres of supratidal @ 10% cover)/820 subaerial acres. All intertidal habitat is built to +2 ft NAVD. No supratidal habitat is converted to intertidal habitat in later TYs because of initial equilibrium. Assume 100% of dune acres and berm planted at TY1 (immediately post construction). Estimated coverage of dune and supratidal planted area is 10%.
TY3 40% (538 acres of dune + 133 acres of supratidal @ 40% cover)/671 subaerial acres.
TY5 60% (490 acres of dune + 186 acres of supratidal @ 60% cover)/676 subaerial acres.
TY10 55% (328 acres of dune + 170 acres of supratidal @ 55% cover)/498 subaerial acres. Some loss over time.
*TY11 32% (734 acres of dune @ 20% + 374 acres of supratidal @ 55% cover)/1108 subaerial acres. Dune is renourished covering some plants but supratidal platform is anticipated to remain somewhat vegetated after renourishment.
TY13 53% (718 acres of dune @ 50% + 241 acres of supratidal @ 60% cover)/959 subaerial acres.
TY15 65% (545 acres of dune + 294 acres of supratidal @ 65% cover)/839 subaerial acres.
TY20 70% (328 acres of dune + 170 acres of supratidal @ 70% cover)/498 subaerial acres.
*TY21 34% (734 acres of dune @ 20% + 374 acres of supratidal @ 60% cover)/1108 subaerial acres. Dune is renourished covering some plants but supratidal platform is anticipated to remain somewhat vegetated after renourishment.
TY23 53% (718 acres of dune @ 50% + 241 acres of supratidal @ 60% cover)/959 subaerial acres.
TY25 65% (545 acres of dune + 294 acres of supratidal @ 65% cover)/839 subaerial acres.
TY30 70% (328 acres of dune + 170 acres of supratidal @ 70% cover)/498 subaerial acres.
*TY31 34% (734 acres of dune @ 20% + 374 acres of supratidal @ 60% cover)/1108 subaerial acres. Dune is renourished covering some plants but supratidal platform is anticipated to remain somewhat vegetated after renourishment.
TY33 53% (718 acres of dune @ 50% + 241 acres of supratidal @ 60% cover)/959 subaerial acres.
TY35 65% (545 acres of dune + 294 acres of supratidal @ 65% cover)/839 subaerial acres.
TY40 70% (328 acres of dune + 170 acres of supratidal @ 70% cover)/498 subaerial acres.
*TY41 34% (734 acres of dune @ 20% + 374 acres of supratidal @ 60% cover)/1108 subaerial acres. Dune is renourished covering some plants but supratidal platform is anticipated to remain somewhat vegetated after renourishment.
TY43 54% (718 acres of dune @ 50% + 241 acres of supratidal @ 65% cover)/959 subaerial acres.
TY45 65% (545 acres of dune + 294 acres of supratidal @ 65% cover)/839 subaerial acres.
TY50 70% (328 acres of dune + 170 acres of supratidal @ 70% cover)/498 subaerial acres.

Variable V4- Percent vegetative cover by woody species
Woody vegetation on Caminada included mangrove and *Iva frutescens.*

FWOP Caminada Alternative 9
Same as Alt 5

FWP Caminada Alternative 9
TY0 4%
TY1 0% Burial of all existing woody vegetation in the headland model boundary
TY3 2% Black mangrove and other available woody vegetation installed in TY2 or TY3. Assume 2% of subaerial acres have woody vegetation coverage established through natural recruitment and plantings.
TY5 3% Assume 3% of subaerial acres have woody vegetation coverage established through natural recruitment and plantings.
TY10 8% Assume 4% cover of 498 total subaerial acres.
*TY11 3% Assume 3% cover of 1108 total subaerial acres.
TY13 6% Assume 6% cover of 959 total subaerial acres.
TY15 9% Assume 9% cover of 839 total subaerial acres
TY20 10% Assume 10% cover of 498 total subaerial acres.
*TY21 4% Assume 4% cover of 1108 total subaerial acres.
TY23 7% Assume 7% cover of 959 total subaerial acres.
TY25 10% Assume 10% cover of 839 total subaerial acres
TY30 10% Assume 10% cover of 498 total subaerial acres.
*TY31 4% Assume 4% cover of 1108 total subaerial acres.
TY33 7% Assume 7% cover of 959 total subaerial acres.
TY35 10% Assume 10% cover of 839 total subaerial acres
TY40 12% Assume 12% cover of 498 total subaerial acres
*TY41 5% Assume 5% cover of 1108 total subaerial acres.
TY43 7% Assume 7% cover of 959 total subaerial acres.
TY45 10% Assume 10% cover of 839 total subaerial acres.
TY50 12% Assume 12% cover of 498 total subaerial acres.

<u>Variable V5 - Beach/Surf Zone Features</u>
FWOP
TY0 – TY39 9% is Class 3 (SI = 0.9) for breakwaters (5,567 ft) and Bell Pass Jetties with rip rap (~500 ft) placed nearshore just east of the Bell Pass Jetty. Boudin bags on beach at same location as 13 sunken barge breakwaters. 91% Class 1 (SI =1.0) the rest of the headland is unconfined natural beach with no shore parallel structures. The weighted SI = (0.09*0.9 + 0.91*1) = 0.99
TY 40-50 100% Class 1. The effect of the breakwaters would cease by TY40 due to their distance offshore.
FWP
TY1-50 8% Class 3 because Jetty and breakwaters will remain for FWP but some created beach/dune may cover the rip rap just east of the Bell Pass Jetty. 92% Class 1 the rest of the headland is unconfined natural beach and containment built for construction would be graded

into the template for a more natural slope as-built. The weighted SI = (0.09*0.8 + 0.92*1) = 0.99

Saline Marsh model
The saline marsh component includes both direct and indirect benefit areas. The directly affected area is the footprint of the marsh platform, extending from the southern +2 ft NAVD limit north of the supratidal area (i.e., interface with supratidal boundary under the Headland model) to the northern toe of the marsh containment dike. The direct benefit area/boundary for the saline marsh component was established based on survey data and projections of the maximum area of saline marsh and associated shallow open water that would be directly affected by project construction. The total area included in this boundary is 925 acres.

The WVA boundary for indirect benefits was delineated using the historical Caminada Headland erosion rate of 45 feet per year. The landward extent of this boundary was offset from the target year zero (TY0) shoreline by the maximum distance eroded during the life of the project (45ft/yr X 50 years = 2,250ft). This rate is not expected to increase due to dune disappearance. Review of historic maps has shown that the Headland's natural dune has progressed landward in position but has not disappeared. This boundary is also bordered by the direct boundary in the gulfward direction. The total area included in this boundary is 2,184 acres.

Background interior marsh loss is estimated to be 0.61 % per year. A 50% reduction of the background loss rate was applied to the direct marsh areas (0.31% per year was used). A 25% reduction (-0.46%/year was used) of the background loss rate was applied to the Indirect marsh area.

Variable V1 – Percent of wetland area covered by emergent vegetation
See attached spreadsheet for direct and indirect benefit areas. Enough material is added initially and with renourishments to not lose marsh below the intertidal elevation zone. FWOP we applied a background loss rate of 0.61%/year in direct and indirect areas. FWP we applied an interior loss rate of 0.31%/year in direct areas and 0.46%/year in indirect areas to all target years to determine the number of acres that convert to open water. The loss rate was applied to both direct and indirect habitat areas as well as the loss provided by CEC to represent overwash events and conversion of marsh to supratidal habitat. Its believed these losses (habitat conversions) represent episodic storm events.

TY1 100% of the 1186-acre marsh platform is built at marsh elevation (+ 2ft NAVD) at construction. Equilibrium after the first year brings the elevation down from +2 ft. The project area may be a different size from baseline b/c some of the marsh was converted to supratidal in the headland portion of the project. Assume 10% functionality for marsh created for the first year, 30% functionality for the third year, and 100% functionality for the fifth year after the creation cycle. See spreadsheet for Alt 5 FWOP and FWP.

Variable V2 - Percent of open water area covered by aquatic vegetation
No SAV has been observed in the either the direct or indirect project area based on May 2006,

July 2005 and April 2001 site visits. Proposed as 0% for FWOP and FWP, all TYs.

Variable V3- Marsh edge and interspersion
Based on the acreage data in V1, 1998 DOQQ, October 2005 DOQQs, and post storm flight and photography, and the May 2006 field trip, photos, and flight.

Direct Benefit Area Caminada Alternative 9
FWOP
Same as Alternative 5

Direct Marsh Area Caminada Alternative 9
FWP

TY0	20% class 2
	60% class 3
	20% class 4
TY1	100% class 1. There is 8% water
TY3	100% class 1. There is 9% water.
TY5	80% class 1. There is 10% water.
	20% class 2
TY10	60% class 1. There is 23% water.
	25% class 2
	15% class 3
*TY11	75% class 2. There is 33% water after renourishment.
	25% class 3
TY13	75% class 2. There is 34% water.
	25% class 3
TY15	75% class 2. There is 34% water.
	25% class 3
TY20	70% class 2. There is 35% water.
	30% class 3
*TY21	75% class 2. There is 35% water after renourishment.
	25% class 3
TY23	75% class 2. There is 36% water.
	25% class 3
TY25	75% class 2. There is 36% water.
	25% class 3
TY30	70% class 2. There is 37% water.
	30% class 3
*TY31	75% class 2. There is 37% water after renourishment.
	25% class 3
TY33	75% class 2. There is 37% water.
	25% class 3
TY35	75% class 2. There is 38% water.

25% class 3
TY40 70% class 2. There is 39% water.
30% class 3
*TY41 75% class 2. There is 39% water after renourishment.
25% class 3
TY43 75% class 2. There is 39% water.
25% class 3
TY45 75% class 2. There is 40% water.
25% class 3
TY50 70% class 2. There is 41% water.
30% class 3

Indirect Benefit Area Caminada Alternative 9
FWOP
Same as Alternative 5

Indirect Benefit Area Caminada Alternative 9
FWP
TY0 20% class 2
60% class 3
20% class 4
TY1 20% class 2 – 38% water
60% class 3
20% class 4
TY34 100% class 4 – 47% water
TY35 100% class 5 – 100% water
TY40 100% class 5 – 100% water
TY50 100% class 5 – 100% water

Variable V4 – Percent of open water area < 1.5 feet deep in relation to marsh surface
There were no survey data available going through the direct or indirect benefit areas to help determine shallow open water. Shallow open water was based on review of aerial photography and discussion with local (pers. com. Forrest Travirca, May 18, 2006) extremely familiar with the area. Depths varied from primarily less than 1.5 feet in most of the project area, 3 feet in some of the ponds (indirect area), 8 to 10 feet in other ponds (out of project area), 5 to 8 feet in the canals, as much as 18 feet in one area (outside of project area), and 25 feet at the cross section of Bayou Moreau and the BP canal.

Direct Benefit Area Caminada Alternative 9
FWOP
Same as Alternative 5

Direct Marsh Area Caminada Alternative 9

FWP
TY0 75%
TY1 100% Most open water is filled in (107 acres water). 8% water is from interior loss converting marsh to shallow water.
TY3 100% Assume that most of the marsh lost to open water (9% -114 acres) becomes shallow open water.
TY5 95% Same as TY3 (10% 121 water acres).
TY10 85% (23% 261 acres water).
*TY11 95% after renourishment any deeper open water may have become shallow again.
TY13 95%
TY15 90%
TY20 75% (35% water)
*TY21 95% after renourishment any deeper open water may have become shallow again.
TY23 95%
TY25 90%
TY30 75% (37% water)
*TY31 95% after renourishment any deeper open water may have become shallow again.
TY33 95%
TY35 90%
TY40 75% (39% water)
*TY41 95% after renourishment any deeper open water may have become shallow again.
TY43 95%
TY45 90%
TY50 75% (41% water)

Indirect Benefit Area Caminada Alternative 9
FWOP
Same as Alternative 5

Indirect Benefit Area Caminada Alternative 9
FWP
TY0 75% Assume that all shallow water is within the fragmented marsh, on the edge of canals, bayous, bays, and ponds. Within the direct and indirect area of this project it was estimated that about 75% of the open water areas was less than 1.5 feet.
TY1 75% - 38% water
TY34 75% - 47% water
TY35 50% - 100% water
TY40 25% - 100% water
TY50 15% - 100% water

Variable V5 – Average annual Salinity
Based on salinity readings from the May 2006 field trip average salinities were 31 ppt. Storm surges associated with Hurricanes Katrina and Rita in 2005 introduced saline waters to the study

area, and low levels of precipitation have resulted in continued high salinities in the area. These readings were assumed to be abnormally high.

The baseline salinities from the LCA Barrier Island Study of 20 ppt were used. Although current salinity readings are higher, assume 20 ppt as the baseline for the model purposes. Salinity remains the same for direct and indirect FWOP and FWP for all TYs.

Variable V6 – Aquatic organism access
Direct and Indirect benefit areas Caminada Alternative 9
FWOP
TY0-TY50 1

Direct benefit area Caminada Alternative 9
FWP
TY0 1
TY1 0.0001 Marsh platform is impounded by retention dikes
TY3 1 Assume retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks are constructed in the intertidal marsh habitat.
TY5-TY10 1
TY11 0.0001 Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh creation.
TY13 1 Assume retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks are constructed in the intertidal marsh habitat.
TY15-20 1
TY21 0.0001 Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh creation.
TY23 1 Assume retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks are constructed in the intertidal marsh habitat.
TY25-30 1
TY31 0.0001 Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh creation.
TY33 1 Assume retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks are constructed in the intertidal marsh habitat.
TY35-40 1
TY41 0.0001 Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh creation.
TY43 1 Assume retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks are constructed in the intertidal marsh habitat.
TY45-50 1

Indirect benefit area Caminada Alternative 9
FWOP and FWP
TY0 1

TY1-TY50 1

Literature cited

Coastal Engineering Consultants, Inc. 2005. Barataria Barrier Shoreline Restoration Feasibility Study, Appendix C, Caminada Headland, LDNR Contract No. 2503-05-47, Lafourche Parish, Louisiana.

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APPENDIX B

HABITAT ANALYSIS PROJECT INFORMATION SHEETS FOR SHELL ISLAND

Project Information Sheet Barrier Island Value Assessment
SHELL ISLAND
28 March 2008

Draft

Project Name: Barataria Basin Barrier Shoreline Restoration Shell Island Feature

Project Type(s): Barrier island restoration, marsh creation, vegetative planting

Sponsoring Agency: Louisiana Department of Natural Resources and US Army Corps of Engineers
Preparer of information sheet: Catherine Breaux/Patrick Williams
Information found in this project information sheet was obtained primarily from the Draft Feasibility Report appendix (CPE 2005 and 2007).

Project Area: The Barataria/Plaquemines barrier island complex lays approximately 49 miles south-southeast of New Orleans, Louisiana. Tidal creeks, man-made canals, marshlands, sandy barrier islands, and several bays characterize the barrier island complex. The remnants of Shell Island are located between Fontanelle Pass (Empire Jetties) and Grand Bayou Pass. Shell Island used to enclose both Bastian Bay and Shell Island Bay but has since disintegrated into several smaller islands and shoals. The project area is located in Plaquemines Parish.

The project boundaries were defined based on the outer edges of the landmasses digitized from the 2004 DOQQ's. The west end of Shell Island West was included within the project boundary as it was anticipated that area could be affected by construction of any alternative. Existing Shell Island remnants were included within the boundary to incorporate the without project conditions.

Problem: Shoreline recession and erosion have resulted in the disintegration of Shell Island. The few remaining islands and shoal remnants provide limited protection to the back barrier environment from waves and flooding. The construction of the Empire Jetties restricted the east to west longshore transport and increased the loss rates of Shell Island. Hurricane Bob in 1979 created a new inlet (Coupe Bob) that accelerated retreat and sediment loss.

Goals and Objectives
The objectives of this project are to reestablish a barrier(s) between a threatened estuarine ecosystem and the Gulf of Mexico, increase the sustainability of the barrier island shoreline system, restore the geomorphic function of the barrier shoreline in the vicinity of Shell Island, restore shoreline, dune, and back-barrier marsh to increase habitat utilization by essential fish and wildlife species both on the barrier island and in the consequently developed quiescent bays.

Specific post-construction acreage goals for Alternative 1 are:

Achieve 158 acres of dune and supratidal acreage on Shell Island West.
Achieve 74 acres of marsh (intertidal acreage) on Shell Island West.
Achieve 223 acres of dune and supratidal acreage on Shell Island East.
Achieve 191 acres of marsh (intertidal acreage) on Shell Island East.

Project Features
Construction and Design Templates

Dune/Beach
The alternatives include a beach and dune fill to reestablish a sustainable barrier island shoreline system, thus restoring the geomorphic function and increasing the habitat utilization by fish and wildlife species. The construction cross-section was based on templates used for projects previously constructed in Louisiana. The dune design is to +6 feet, NAVD with a back- and fore-slopes of 1V:45H. The dune crest width varies by alternative. Other barrier island projects in Louisiana have used a steeper construction slope (1V:30H) on the bayward side because these islands have been relatively intact and the island provides a means of fill retention, allowing steeper slopes to be constructed. Most of Shell Island will be constructed in open water or on scattered island remnants. The +6.0 feet, NAVD dune elevation is above the 20-year return period surge elevation (+5.9 feet, NAVD).

The crest width of the dune is a function of the purpose of the individual alternatives. The dune width for Alternative 1 is based on a cost and target acreage goals that dictate the volume and cross-section width. Alternative 2 through 8 will be based on a design width plus various advanced nourishment width.

The beach profile equilibration process assumes that there is only cross-shore redistribution of sediment and that sand volume is conserved. It is estimated that the mean high water shoreline will retreat approximately 20 feet due to profile equilibration.

Construction of sand fencing and planting of vegetation along the dune will promote additional elevation growth of the dune by holding the blowing sand. A 5-foot wide +9 feet NAVD additional dune element was added to the top of the construction template to simulate this increase in dune elevation. It was assumed that this additional dune feature would take approximately 1 year to form.

A beach nourishment cross-section consist of two primary components: 1) the design section, which is the fill volume required at TY50 to meet applicable project goals, and 2) advanced nourishment, which is the sacrificial portion of the fill that will erode over the 50-year project life. Sufficient advanced nourishment can be added during construction or replaced periodically during renourishment projects. Advanced fill is distributed non-uniformly to account for diffusion losses, longshore losses, and tidal inlet losses, that vary along the project length.

Marsh
The proposed marsh construction elevations were based on developing an intertidal marsh over the life of the 50-year project, considering the rate of relative sea level rise, and consolidation of placed and subgrade sediments. The average elevation of the existing marsh platform on Shell Island was determined to be approximately +1.1 feet, NAVD. This elevation is comparable to other marsh platforms in the area such as East Grand Terre, Chaland Headland, and Pelican Island. The 2005 mean high water and mean low water elevations are +1.63 feet and +0.58 feet, NAVD respectively, demonstrating that the existing marsh is inundated during the tidal cycle.

The proposed marsh platform has a 50-year project life. The critical goal is to construct a marsh platform that maintains an elevation between mean high water and mean low water through TY50. With an assumed start date of 2009, the mean high water and mean low water elevations will rise from +1.64 feet to +2.26 feet, NAVD and +0.58 feet to 1.23 feet, NAVD, respectively. This is due to an average eustatic sea level rise of 0.013 feet/year. Therefore, the marsh was designed to obtain a marsh elevation above +1.2 feet, NAVD at TY50. The marsh platform will have to be renourished periodically over the life of the project so that it remains within the tidal zone.

Temporary containment dikes are proposed to contain the marsh fill material during construction The material for dike construction will be dredged from within the footprint of the marsh so that the excavated area is filled during construction. The dike volume is included within the marsh fill volume.

Alternative 1 – two islands with no renourishment
East Island has a target (see goals above) of 223 acres of beach/dune and 191 acres of marsh following construction. Dune width is approximately 281 feet wide and is uniform along the length of the 15,400-foot long dune. Most of the sand fill is being placed in front of the existing island. Fill quantities for the beach/dune and marsh fills are 2.9 million and 1.1 million cubic yards respectively. Marsh width varies from 525 – 1,200 feet wide.

West Island will have 158 acres of dune and 74 acres of marsh following construction. Dune width is approximately 688 feet on the east end compared to 196 feet on the west end. Total length is 5,500 feet. The proposed beach fill extends partially into Coupe Bob. The marsh on west island follows the outline of the LCA plan, which as a triangular shape. Fill quantities for the beach/dune and marsh fills are 1.3 million and 0.7 million cubic yards respectively.

The constructed marsh elevation is +2.5 feet, NAVD. Alternative 1 is expected to create 293 acres of additional marsh behind Shell Island East and West under one construction event (no renourishment). Approximately 40 acres will be enhanced by increasing the existing elevation, so a total of 333 acres will be created or enhanced.

Constructing the marsh elevation at an elevation of +2.5 feet, NAVD will result in a marsh that will become bay intertidal during TY2 (2011) and remain bay intertidal until TY50 (2059). The

marsh will be continually submerged (average elevation below mean low water) after TY34 (2043). The long term goal of maintaining the marsh elevation above elevation 0 feet, NAVD at TY50 can only be achieved by increasing the construction elevation above +2.6 feet, NAVD but this increases the time required for the marsh to subside to the mean high water level, and so reduces project benefits in the near term. Total fill quantities for the beach/dune and marsh fill are 4.1 million cubic yards of sand and 1.9 million cubic yards of sediment respectively.

Alternative 2 – two islands with renourishment
Alternative 2 includes periodic nourishment using the Alternative 1 fill plan as the starting point.

Shell Island West dune crest width has been increased gulfward by 82 feet; to provide 16 additional acres of dune acreage and additional advanced fill to last through the first renourishment project in 10 years. Fill quantities for the beach/dune and marsh fills are 1.4 million and 0.6 million cubic yards respectively.

The width of the Shell Island East dune crest has been reduced 3 feet to 278 feet wide, decreasing the dune acreage by 1 acre. The fill quantities for the beach/dune and marsh fills are 2.9 million and 1.0 million cubic yards respectively.

Since Alternative 2 is being renourished it is possible to use a different marsh construction elevation than was used for Alternative 1 to maximize the time period that the marsh is within the WVA bay intertidal zone, as well as within the mean high water to mean low water range. The recommended construction elevation is +2.0 feet, NAVD. Alternative 2 incorporates a marsh renourishment every 20 years.

Total fill quantities for the beach/dune and marsh fills are 4.3 million and 1.6 million cubic yards respectively.

Alternative 3 –one island with no renourishment
Dune crest is a uniform 189 feet wide along the length of the island. Following equilibration of the beach fill, total island width will be approximately 1,240 feet wide (typical Louisiana barrier islands have widths of 1,000 to 1,500 feet wide).

The landward dune crest of Alternative 3 is located in front of the existing shoreline, as with Alternatives 1 and 2. The closure of Coupe Bob is expected to return the tidal prism to its pre-1979 path of flowing through Grand Bayou and it is expected that Grand Bayou will increase in size. The west end terminus of Alternative 3 is close to the western limit of the 1973 shoreline location of Shell Island in anticipation that Grand Bayou will start to widen.

Coupe Bob – The single island option crosses Coupe Bob with depths approaching –10 feet, NAVD in the main channel. In deeper water it is not feasible to construct the marsh section with only marsh sediments, as the marsh will settle too rapidly and non-uniformly to erform its

intended purpose effectively. To construct a marsh at +2 or +3 feet, NAVD would require lift heights that are 12 or 13 feet high, resulting in differential settlements across the island of 2 or 3 feet over 20 years, which can lead to sever plant stress and reduced growth. Therefore, it is recommended a sand platform base would be constructed up to –3 feet, NAVD with marsh on top of this base. In the middle of Coupe Bob where the sand base has been constructed, the contractor would likely have to transport the muds from the shallow bay areas for construction of a dike to create the marsh platform. A second option is to install a geotextile tube for containment of the marsh fill where the –3 feet, NAVD sand base is constructed. The geotextile tube could be filled with sand from the sand base. This option is shown in the plans. A third option could be to construct the dike with sand fill but this would require a wide crest as the sand dike will be exposed to waves coming from the north across Bastian Bay.

Marsh width is a uniform 735 feet. Alternative 3 will have no renourishment of the marsh fill. The recommended construction elevation is +2.0 feet, NAVD. Alternative 3 will have marsh submerged below MLW by TY18 (2027). The marsh fill should be considered intertidal a the way through TY50 (2059).

Total fill quantities for the beach/dune and marsh fills are 5.6 million and 2.1 million cubic yards respectively.

Alternative 5 – single island with renourishment
Alternative 5 has an identical construction template as Alternative 3. Alternative 5 will initially be constructed with 10 years of advanced nourishment, requiring 5.6 million cubic yards of beach fill, which will create 317 acres of beach/dune area (area above +2 feet, NAVD). The marsh fill will be renourished to its original construction template at 20 and 40 years after construction. The marsh elevation will be below the MLW at TY18 (2027) before returning to its original elevation of +2.0 feet (NAVD) after TY20.

Borrow Areas
It is expected that two borrow sources will be used for this project: a high-quality sand source for the beach-dune portion of the project and an offshore mixed-sediment deposit to be used for the marsh construction. It was assumed that the Mississippi River is the source of high-quality sand that would be used for this project. The Empire borrow area is assumed to be used for the marsh construction. The Empire borrow area was previously evaluated and is expected to be used for the Pelican Island Restoration Project. This will leave the borrow needs for this project short. It is expected that more sediment is out there and further investigations are needed.

Several other borrow areas were suggested for investigations for use of mixed sediments for marsh restoration, primarily including Empire, Quatre Bayou deep (will be partially used for the restoration of Chaland Headland), Quatre Bayou D2, and Sandy Point (farthest away). Others were discussed and further investigation is recommended to find the closest mixed sediment source for marsh restoration. Ship Shoal was also discussed as another source of high quality sands for beach-dune creation. However, the distance to the project site makes this sand source

prohibitively expensive.

As-built Conditions
Alternative 1 – two islands with no renourishment

On both Shell Island East and West approximately 336 acres of the TY1 supratidal acres are marsh platform areas that will be above +2.0 feet immediately after construction. Based on settlement curves and elevations of existing marsh, it is projected that all of the marsh platform will settle to intertidal range by TY3.

Shell Island East - As-built, TY1 configuration is anticipated to create 126 acres of dune, 297 acres of supratidal, and 47 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 11 acres of as-built dune area.

Shell Island West - As-built, TY1 configuration is anticipated to create 51 acres of dune, 192 acres of supratidal, and 21 acres of intertidal areas. Dune equilibration losses are reflected at TY2 with the loss of 8 acres of as-built dune area. All of the beach and marsh fill placed during construction of Shell Island West will have eroded in 23 years (TY25), leaving pre-construction conditions. By TY25 Shell Island West will have receded to the point where there is no supratidal acreage. Once the supratidal acreage is lost, it was assumed that the marsh would be exposed to wave action from the Gulf and that the marsh would recede at the gulf retreat rate.

The shoreline recession rates are 34.9 feet/year for Shell Island West and 12.4 feet/year for Shell Island East. Subtidal acreage decreases following construction because parts of the subtidal acreage are located within the construction footprint.

The volume of sand that could be lost into Coupe Bob every year from the two-island option is approximately 101,000 cubic yards. At this rate it would take Coupe Bob approximately 33 years to reach its accommodation volume of 3.3 million cubic yards. It is unlikely that Coupe Bob will reach its accommodation volume given that the total volume of sand fill placed in Alternative 1 is 4.1 million cubic yards but it does suggest that little natural bypassing of sand should be expected across Coup Bob.

Alternative 2 – two islands with renourishment

The shoreline recession rates are 35.2 feet/year for Shell Island West and 12.3 feet/year for Shell Island East. After TY35, the shoreline recession rate is assumed to decrease from 35.2 feet/year to 11.8 feet/year on Shell Island West and from 12.3 feet/year to 5.4 feet/year on Shell Island East.

Shell Island East - As-built, TY1 configuration is anticipated to create 125 acres of dune, 103

acres of supratidal, and 241 acres of intertidal areas. The constructed marsh elevation is +2.0 feet, NAVD so it is considered bay intertidal upon construction. Dune equilibration losses are reflected at TY2 with the loss of 11 acres of as-built dune area.

Shell Island West - As-built, TY1 configuration is anticipated to create 67 acres of dune, 44 acres of supratidal, and 160 acres of intertidal areas. The constructed marsh elevation is +2.0 feet, NAVD so it is considered bay intertidal upon construction. Dune equilibration losses are reflected at TY2 with the loss of 7 acres of as-built dune area.

The optimum renourishment interval for the beach is 10 years, with the marsh being renourished every 20 years.

It is estimated that the Coupe Bob ebb shoal will grow by 101,000 cubic yards/year and require 33 years to reach its accommodation volume. As Coupe Bob approaches its accommodation volume, more sand will be bypassed across the inlet. As the net longshore drift is east to west, the sand transported longshore from Shell Island East will no longer be lost to the ebb shoal, but instead be transported across the inlet. The GENESIS model does not account for this change in coastal processes due to infilling of the ebb shoal. It was assumed the longshore losses on Shell Island East were reduced to 10,000 cubic yards/year (from 52,000 cubic yards/year) at TY35 and that longshore losses from Shell Island West were reduced to approximately 18,500 cubic yards/year (from 79,000 cubic yards/year). Coupe Bob is capable of reaching its accommodation volume because of the sand volume added to the project area during the renourishment cycles.

Alternative 3 – 10 years advanced fill and no renourishment

As-built, TY1 configuration is anticipated to create 153 acres of dune, 165 acres of supratidal, and 525 acres of intertidal areas. The constructed marsh elevation is +2.0 feet, NAVD so it is considered bay intertidal upon construction. Dune equilibration losses are reflected at TY2 with the loss of 16 acres of as-built dune area. Alternative 3 has more than 100 additional acres of bay intertidal acreage compared to Alternative 2.

The construction of Alternative 3 will result in increased flow through Grand Bayou and Fontanelle Pass as the tidal prism is redirected due to the closure of Coupe Bob. It is expected that the increased flow through Grand Bayou will start to reopen the pass and it could expand to its pre-1979 size. The western end of Shell Island West would likely be eroded and the sediment transported to the Grand Bayou ebb shoal. It is assumed that the erosion of the west end of Shell Island West will occur within 10 years of construction.

A bayside recession rate of 3.6 feet/year was assumed. No benefit has been included for the construction of the geotextile tube on the bay side, as this is a construction option available to the contractor and may not necessarily be conducted. Ignoring erosion protection provided by the geotextile tube provides a conservative acreage assessment.

A breach analysis was conducted on Alternative 3 to access its breaching potential (for the breach analysis assumptions refer to the General Methodology and Assumptions Section). The recession rate of the total island length due to breaching is 631 feet/year at TY31 and slowly decreases every year to a rate of 397 feet/year by TY50. Breaching occurs at TY30, with the breaching effects beginning at TY31.

Alternative 5 – single island with renourishment
Alternative 5 is again designed to have the same construction template as Alternative 3. As-built, TY1 configuration is anticipated to create 153 acres of dune, 165 acres of supratidal, and 525 acres of intertidal areas. The constructed marsh elevation is +2.0 feet, NAVD so it is considered bay intertidal upon construction. Dune equilibration losses are reflected at TY2 with the loss of 16 acres of as-built dune area. Alternative 5 has a renourishment interval of 20 years. Both the beach and marsh fill will be renourished at TY20 and TY40. Alternative 5 creates the same initial acreages as Alternative 3 but a total of 699 acres remain after 50 years. Since only 10 years of advanced fill will be added at the TY40 renourishment, the design section will be exposed at TY50.

Operations and Maintenance Phase
The following planting plan was adapted from a DNR plan after recommendations from the agencies including means to achieve optimal environmental benefit based on percent cover values in the Barrier Headland and Wetland Island Value Assessment models, funding considerations, and expected annual industry limitations. Note that this should be viewed as a preliminary/conceptual planting plan only, to be amended as needed and site conditions warrant if the project is constructed. Planting density could be increased (5'-7' centers) if the budget allows. Also if the budget allows, for optimal results, herbaceous and woody species plantings on all habitat types should be phased, with the first phase of herbaceous plantings occurring at TY1 and woody plantings at TY3.

General assumptions include:
strive to develop a planting plan to attain optimal functionality for less than 5% of the construction cost (without contingency)
plant 100% of the dune (that includes the crown and slopes)
plant 100% of the bayside supratidal and gulfside supratidal including the seaward berm and dune downslope, but not the beach
aerially seed the dune and supratidal (for conservative cost estimating purposes only assumed aerially seeding all of the supratidal acres)
plant 50% of the marsh acres; half in TY2 and half in TY3

DUNE & SUPRATIDAL PLATFORM:
Species
Seeding of the dune platform (aerial or ground application) could be considered depending on the time of the year construction is completed. Rye grass seed could be considered if construction is

completed in the summer or fall to be used as a ground cover during the winter months. Bermuda grass seed has been dispersed on the barrier island dune platforms in the past as well, but with strong objection by some Federal and state wildlife agencies as it is non-native.

Herbaceous dune and supratidal plants will consist of a variety of dune species including bitter panicum (*Panicum amarum* var *amarum* 'Fourchon'), sea oats (*Uniola paniculata* 'Caminada'), marshhay cordgrass (*Spartina patens* 'Gulf Coast') and gulf cordgrass (*Spartina spartinae*). Plants shall be grown mainly in four-inch containers (sea oats in a slightly larger container.) The aforementioned recommendations are general recommendations. Species recommendations may change due to soil properties and conditions, elevation after final construction, salinity, available soil moisture, and other site conditions. Other plants that could be considered to add diversity (other than the plants mentioned) are seacoast bluestem (*Schizachyrium maritimum*), seashore dropseed (*Sporobolous virginicus*), and salt grass (*Distichlis spicata*).

Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, iva, baccharis, and hercules club. It has been suggested that more woody vegetation be included on Caminada than Shell Island. Planting of woody species should be delayed until TY3 to allow for stabilization and leaching of salt from deposited material.

Density
Plants on the dune, supratidal, and marsh platforms would be installed in variable density patterns based on site conditions. For quantity and cost estimating purposes, it was assumed that plants would be installed on 8' centers throughout 100% of appropriate dune and supratidal acreage at the certain target years. For estimating purposes, woody vegetation also was assumed to be planted on 8' centers throughout 15% of the dune, swale, and marsh acreage.

MARSH PLATFORM:
Species
Herbaceous marsh plants will consist of mainly smooth cordgrass (*Spartina alterniflora* 'Vermilion'). A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated to add a larger seed bank for black mangroves. Plants shall mainly consist of vegetative plug material or four-inch containers (smooth cordgrass), or tube-tainers (mangroves).

Density
The planting density was assumed to be 8' on center applied to 100% of the marsh acres.

Total Costs:
All prices mentioned includes: cost of plant, delivery, fertilizer, transportation, installation, etc. However, note that recent post-storm cost estimating (since preparation of the Shell Island Vegetation Cost estimates) generally are now including $20,000 mob/demob and $4/plug for the herbaceous marsh plants, and $8 to 10/plant for the woody species. Unit costs are consistent with guidance by NRCS and LDNR as recommended to the CWPPRA program on Project

Priority List (ppl) 18. Also note that the total amount of plants project during TY1 for the various alternatives is a substantial amount likely matching or exceeding the current industry annual supply.

Alternative	Alt 1	Alt 2	Alt 3	Alt 5
Estimated Cost	$3,189,223	$2,324,779	$2,488,652	$2,490,190
Percentage of construction cost	4.2%	3.0%	2.5%	2.5%

One shore parallel fence will be installed about 50 feet north of the southern toe of the dune to continue the capture of transported sand until the surface is vegetated. The sand fence will extend along the total length of the constructed dune. Sand fences must be installed in sequence/phases. The installation should start from the southern side of the dune so as to build dune towards the Gulf and proceed north. Additional rows of sand fencing can be added once the existing sand fence is full (i.e. sand is stacked up to the top of the fence.)

Monitoring Information/Adaptive Management Recommendations:
Adaptive management involves monitoring the evolution of the project and updating the project design to incorporate the additional data. It is recommended that annual surveys be conducted of the project area. This includes surveys of the beach and marsh, as well as hydrographic surveys of the offshore, back bay and tidal inlet areas. This will allow for the development of an accurate sediment budget by which sediment transport in the area can be tracked. This will be especially important for Alternative 2 where the rate of growth of Coupe Bob ebb shoal could impact the renourishment interval. The surveys will provide a basis for distributing advanced fill along the project length.

Monitoring of the project will also indicate the performance of the island elevation. This will indicate whether future renourishment projects should be constructed at higher or lower elevations. The limited geotechnical data available makes adaptive management more important for this project, especially with regard to the marsh elevation.

Additional studies should be conducted to model water circulation and current velocities in the back bays and inlets to help determine the benefits or disadvantages a single island option.

Site Characteristics
The average wave height is 2.7 feet
The rate of relative sea level rise is treated as a constant over the 50-year project life, equal to 0.0430 feet/year.
Hurricane Bob occurred in 1979. The formation of Coupe Bob caused a quadrupling of the

retreat rates of Shell Island and is the major reason for the disintegration of the island.
The Empire Jetties were constructed in 1950. The Empire Jetties increased shoreline recession approximately 10 feet/year along the easternmost 5,000 to 8,000 feet of the island.

General Methodology and Assumptions -*This section summarizes the procedures used to develop planform performance projections.*

Assuming construction takes one year for Alternative 1 and 2 and two years for Alternative 3 through 8 and a 100% vegetation occurs within 3 years following construction, benefits from detritus will begin at TY5 (2014) for Alternatives 1 and 2, and TY6 (2015) for Alternative 3 through 8.

Shoreline recession rates were determined by the following. Shoreline recession rates were determined for the 1956 to 1973 time frame (prior to the formation of Coupe Bob). The Dynamic Morphosedimentary Model was used to differentiate between longshore, cross-shore, and subsidence losses. A longshore transport curve was developed for the 1956 to 1973 timeframe. The GENESIS model was calibrated to match the longshore transport curve. The three alternatives were modeled using GENESIS. This provided shoreline recession rates due to longshore transport. Shoreline recession rates (due to longshore transport) were converted to volumetric losses. Volumetric cross-shore losses due to relative sea level rise were added to the volumetric longshore losses. Volumetric losses were then converted to a shoreline recession.

The erosion rates incorporate storm events for shoreline recession. It averages the shoreline recession rate rather than having distinct changes following a storm event. Also, it does not account for a change in the cross-shore profile due to a storm event.

FWP for alternatives 1 a total average shoreline recession of 12.4 feet/year for Shell Island East and a total shoreline recession of 34.9 feet/year for Shell Island West was used. The Gulfside recession rate for Alternative 2 are 35.2 feet/year for Shell Island West and 12.3 feet/year for Shell Island East. Alternative 3 and 5 total Gulfside recession rate is 7.9 feet/year. The shoreline recession rate is less for alternative 3 and 5 than it was for alternatives 1 and 2 because the longshore losses are lower since there is no loss from either Shell Island East or West into Coupe Bob and sand is only lost into Grand Bayou.
The average bayside recession value of 3.6 feet/year was used to estimate future bayside marsh recession. The volume lost due to wave action was assumed to be transported outside of the project boundaries.

The volumetric change estimate was based on the shoreline change data because few of the surveyed profile lines crossed the existing island and therefore the profiles could not provide volume change estimates. Shoreline change between 1956 and 1973 was used as this time period is the latest time period that had an intact shoreline.

Coup Bob could form an ebb shoal containing 3.4 million cubic yards of sediment. The

formation of the Coupe Bob ebb shoal appears to be constrained by a lack of available sediment in the current system. The two island without renourishment scenario will likely form a partial offshore bar, while the two island with renourishment alternative is expected to take 33 years to reach its accommodation volume. As Coupe Bob approaches its accommodation volume, more sand will be bypassed across the inlet.

The total acreage in the project boundary changes over the target years as project site conditions change. Genesis modeling and the sediment budget are used to quantify barrier island shoreline changes and thus acreage values. The project boundaries were defined based on the outer edges of the landmasses digitized from the 2004 Digital Ortho-quarter Quadrangle maps (DOQQ). The west end of Shell Island West was included within the project boundary as it was anticipated that this area could be affected by construction of any alternative. Existing Shell Island remnants were included within the boundary to incorporate the without project conditions. The areas for the without project condition that lie outside of the construction template are included in the acreage estimates for all three alternatives. No change in recession or subsidence rates is applied to the areas outside the construction footprint.

The higher and wider constructed beach elevation will limit the amount of island overtopping and thus restrict nourishing of the marshes in the back. The beach section will maintain its elevation due to the natural processes of island building while the marsh will sink.

The beach profile equilibration process assumes that there is only cross-shore redistribution of sediment and that sand volume is conserved. It is estimated that the mean high water shoreline will retreat approximately 20 feet due to profile equilibration.

The dune, supratidal, and gulf intertidal contours are parallel and retreat at the same rate (no change in cross-shore profile) following cross-shore profile equilibration.

Subsidence is uniform and there is no differential settlement due to fill heights differences or variations in the constructed elevation. There is no subsidence of the dune, (sand fill) supratidal, or gulf intertidal areas due to dynamic morphosedimentary principles. The volume to counterbalance subsidence is included in the shoreline recession rate. Subsidence of the (marsh fill) supratidal and bay intertidal areas incorporate regional subsidence, primary and secondary consolidation, dewatering, and detritus to develop total subsidence rates. Marsh elevations were based on the marsh settlement curves presented in section 4.4 of the Draft Feasibility Report appendix (CPE 2005).

The bayside perimeter of the dike recedes at 3.6 feet/year due to wave action. Once the dike recedes past the +2.0 feet, NAVD contour, the marsh perimeter begins to recede at 3.6 feet/year. Dike and marsh material lost due to bayside recession is assumed to remain in suspension and settle outside of the project boundaries.

An estimate of existing (2005) acreages was developed based on the 2004 DOQQ's, 2005 JCLS

survey, and the July 18, 2005 site visit. Due to a lack of recent onshore survey data for the project area, the acreages for the current conditions within the project boundary were derived from digitizing the visible shorelines of the 2004 DOQQ's. These shorelines were assumed to be the +0.6 feet, NAVD contour (mean low water).

Changes in island profile are derived from SBEACH. GENESIS was used to generate acreage projections. The dynamic morphosedimentary model was used to calibrate GENESIS. SBEACH was used to develop the design template and predict cross shore performance.

Survey data was used and rolled forward to 2009 (TY0) based on anticipated losses derived from GENISIS modeling, sea level rise and associated northward shifting (i.e., translocation) of the cross section for FWOP conditions. The equilibrium profile was used for the FWP conditions.

Annual and episodic events are incorporated into losses through the application of GENESIS modeling, which assumes that the profile/cross section does not change shape but merely recedes or is translocated northward. Planform areas were calculated by applying GENESIS derived shoreline positions. GENESIS includes 20-year storm effects.

FWP TY1 represents the as-built configuration. FWP TY2 includes post-construction beach equilibration losses (for all alternatives) and conversion of the marsh platform to intertidal elevations for alternative 1.

The intertidal (bayside) losses applied by the design engineer included 3.6 feet/year that was applied to the bayside edge. Due to the substantially contained nature of the marsh platform, interior intertidal marsh losses are not projected by the design engineer. However, we do anticipate some internal loss of intertidal marsh functions, especially during the later portion of the Alternative 1 project life. Although decreases in the elevation of the marsh platform are not anticipated to reduce elevation below 0.0 feet throughout TY50, it is expected that a portion of these areas would be too low to support emergent vegetation. These losses are reflected in V4, Percent Subaerial Vegetated Variable by adjusting the portion of the marsh platform that is vegetated at various TYs.

FWOP TY3 and TY5 were included because the data were available. It may not be necessary to include these TYs. FWP TYs 3 and 5 are included solely for percent vegetation variables.

Over the 50-year project life (2009 to 2059) the relative sea-level rise is increasing and a relative sea-level rise rate of 0.0463 feet/year was calculated for 2059. The rate of relative sea-level rise will be treated as a constant over the 50-year project life, equal to 0.043 feet/year.

NOAA (July 2004) has published updated subsidence rates in south Louisiana that suggest a higher subsidence rate than that developed by the NRC for Grand Isle. An average subsidence rate of 0.0430 feet/year was calculated by averaging the subsidence rate of 65 monuments located between Venice and Port Sulphur, compared to the historic value of 0.292 feet/year. However

the USACE has indicated a preference to use 0.0292 feet/year as the subsidence rate to maintain consistency with other project analyses (E-mail correspondence with Beau Tate, 2007). The concern is that the recently measured values may be influenced by their location adjacent to developed areas, which due to development may be causing localized subsidence and thus not representative of subsidence along the barrier island chain.

The following assumptions were for the breach analysis conducted on Alternative 3.

Breaching can be expected to occur after the interior width is less than 300 feet.

The initial width of the beach and marsh following construction will be 585 and 370 feet respectively, yielding an initial island width of 955 feet.

Equilibration of the beach, which is expected to occur during the first year following construction, will decrease the beach width by 20 feet.

The Gulf side of the beach will retreat at a rate of 7.9 feet per year.

The Bay side of the marsh will retreat at a rate of 3.6 feet per year until the marsh subsides below mean low water, which is expected to occur after TY19.

After the marsh subsides below mean low water, the Bay side of the beach will retreat at a rate of 3.4 feet per year.

The following assumptions were for the dynamic morphosedimentary model input:

Shoreline retreat rate is 26 feet/year. 20 feet/year is from cross-shore loss and 6 feet/year is from long-shore loss. The 1956 to 1973 period was used because it was after the construction of the Empire Jetties but prior to the formation of Coupe Bob in 1979.

The process of storm overwash and relative sea level rise combine to effectively compress the island footprint to allow it to keep pace with relative sea level rise. Shell Island retreats an average of 8.4 feet/year to provide sufficient sediment for the rate of rise of the island element to match the relative sea level rise rate.

The rate of relative sea level rise was estimated to be 0.043 feet/year for this section of Louisiana between 2009 and 2059. The relative sea level rise of 0.039 feet/year was used in this model because this model was calibrated using the estimated 1956-1973 time period. A relative sea-level rise rate of 0.039 feet/year was used in the dynamic morhosedimentary model based on rates presented in the Chaland Headland and Pelican Island Barrier Shoreline Restoration Projects (CPE, 2003b).

Alternative 1 – two islands with no renourishment Shell Island East

V1, V2, and V3 – Percent subaerial area that is dune, supratidal and intertidal, respectively
See attached spreadsheet.

Variable V4 - Percent vegetative cover of dune, supratidal, and intertidal habitats
Based on site visits (July 2005), examination of pre and post-storm photography, and post-storm flight, wetland habitat on both islands is primarily vegetated by *Spartina alterniflora*, *S. patens*, black mangrove, sea oxeye, *Iva frutescens*, *Distichilis* spp., roseaucane, and seaside purslane. Shell Island East is characterized primarily by remnant shoals with very little subaerial habitat.

FWOP Shell Island East

TY0 45% There is no dune or supratidal habitat, thus no dune or supratidal vegetation present. Of the bayside intertidal habitat (40 acres), it is estimated that about 30% of the existing subaerial is vegetated and about 70% is barren (overwash flats, beach). This estimate is based mostly on post storm flight, pre and post storm photography (Oct 2005, June 2005, Oct 2004), and July 2005 site inspection.
TY1 45%
TY3 40% The area will continue to deteriorate.
TY5 33% Minor decreases in percent vegetative cover due to continued deterioration and lowering of profile.
TY10 20% Only 7 acres of bayside intertidal and 11 acres of gulfside intertidal habitat still exist. (50% of 7 acres)/18 subarial acres.
TY20 5% 2 acres of bayside intertidal and 8 acres of gulfside intertidal habitat exist. (25% of 2 bayside intertidal acres)/10 acres.
TY50 0% There are no subaerial acres left by target year 50.

FWP Shell Island East
TY0 45%
TY1 5% (115 dune acres + 103 supratidal acres @ 10% cover)/470 subaerial acres.
Assume: 100% of post-equilibration (i.e., TY2) dune acres and associated back slope (i.e., post-equilibration, TY3 supratidal acres) planted at TY1 (immediately post-construction), resulting in planting of a portion of the subaerial project area. This assumes only planting the area of the dune and supratidal that wouldn't be lost to equilibration and only 5% of the planted area would have optimal coverage.
TY2 15% (115 dune acres + 103 supratidal acres @ 20% cover) + (25% cover of 103 acres of marsh platform)/449
Assume: the post-equilibration portion of dune and supratidal acres all planted at TY1. Half of marsh platform is planted and has 25% cover
TY3 37% (110 dune acres + 103 supratidal acres @ 40% cover) +(50% cover 102 acres of marsh platform and 25% cover remaining 102 marsh platform)/443
Assume: 40% cover dune and supratidal areas; 50% cover of TY2 marsh plantings; remaining

50% marsh platform planted at TY3 and has 25% cover.
TY5 63% (102 dune acres + 100 supratidal acres @ 60% cover) + (75% 202 acres marsh platform)/429
Assume: Dune and supratidal acres 60% cover and 75% marsh platform
TY10 56% (80 dune acres + 100 supratidal acres @ 50% cover) + (70% 185 intertidal area vegetated)/390
TY20 51% (36 dune acres + 100 supratidal acres @ 50% cover) + (60% of 171 intertidal area vegetated)/333
TY25 48% (0 dune acres + 42 supratidal acres @ 30% cover) + (60% of 164 intertidal area vegetated)/232
TY35 43% (50% of 150 intertidal area vegetated)/176
Assume: no remaining dune or supratidal acres is expected to exist by TY35.
TY42 50% (50% of 136 intertidal area vegetated)/136
TY50 0% no subaerial acres remain.

Variable V5- Percent of vegetative cover comprised by woody species
Woody vegetation on Shell Island East included black mangrove and *Iva frutescens*. These species were seen predominantly along a canal in the center portion of the project area. There also may have been a few on the far eastern end and far western end of Shell Island East.

FWOP Shell Island East
Assumed that all TY's have only one woody species because there is no dune or supratidal habitat remaining.
TY0 5% Very little of the vegetated subaerial acres is vegetated with woody species.
TY1-2 5%
TY3 4%
TY5 3% Continued subsidence and deterioration reduces favorable conditions.
TY10 1% It is expected that only 20% of Shell Island East is vegetated. Of that very little wood vegetation is expected to remain.
TY20 0% 2 acres of bayside intertidal and 8 acres of gulfside intertidal habitat exist.
TY50 0% There are no subaerial acres left.

FWP Shell Island East
Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, *Iva frutescens*, B*accharis* spp., and hercules club. A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated in the intertidal habitat to add a larger seed bank for black mangroves.
TY0 5%
TY1-3 0% Burial of majority of existing woody vegetation is expected.
TY5 5% Black mangrove and other available woody vegetation installed in TY2 or TY3.
TY10 10% Based on existing and natural recruitment on the subaerial acres
TY20 10% Based on decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.

TY25 5% 42 acres of supratidal and 164 acres of intertidal acres remaining.
TY35 3% No supratidal acres remaining, therefore assume only one woody species is remaining. 150 acres of bay intertidal acres remaining.
TY42 0% 136 acres of bay intertidal acres remaining.
TY50 0% No remaining supratidal or bay intertidal acres remaining.

Variable V6 - Edge and interspersion
FWOP Shell Island East
TY0 100% Class 4
26% of the project area is subaerial
TY1-20 100% Class 4
At TY20 7% of the project area is subaerial
TY50 100% Class 5
None of the project area is subaerial

FWP Shell Island East
TY0 100% Class 4
TY1 100% Class 3
74% of the project area is subaerial
Expected to be confined carpet marsh. Fish access is prevented until retention dikes degrade to marsh elevations naturally on there own.
TY2 100% Class 3
73% of the project area is subaerial
Confined carpet marsh. Although the marsh elevation is expected to settle to +0.2 or less, it is expected that the retention dikes will prevent tidal access.
TY3 100% Class 1
73% of the project area is subaerial
Retention dikes may start to naturally degrade in some areas providing tidal access.
TY5 100% Class 1
72% of the project area is subaerial
TY10 80% Class 1; 20% Class 2
71% of the project area is subaerial
TY20 25% Class 1; 50% Class 2; 25% Class 3
69% of the project area is subaerial
TY25 70% Class 2; 30% Class 3
61% of the project area is subaerial
TY35 50% Class 3; 50% Class 4
56% of the project area is subaerial
TY42 15% Class 3; 85% Class 4
51% of the project area is subaerial
TY50 100% Class 5
0% of the project area is subaerial

Variable V7 - Beach/Surf Zone Features
FWOP and FWP - 100% Class 1; unconfined natural beach with no shore parallel structures. Containment built for construction would be graded into the template for a more natural slope as-built.

Alternative 1 – two islands with no renourishment Shell Island West
V1, V2, and V3 – Percent subaerial area that is dune, supratidal and intertidal, respectively
See attached spreadsheet.

Variable V4 - Percent vegetative cover of dune, supratidal, and intertidal habitats
Based on site visits (July 2005), examination of pre and post-storm photography, and post-storm flight, wetland habitat on both islands is primarily vegetated by *Spartina alterniflora*, *S. patens*, black mangrove, sea oxeye, black mangrove, *Iva frutescens*, *Distichilis* spp., roseaucane, seaside purslan, black needlerush, deer pea, croton, and *Solidago*. Shell Island West is characterized by mostly intertidal habitat and some supratidal acres. There are remnant ridges throughout some of the bayside intertidal habitat toward the west side of the island. There is substantial interspersion on Shell Island West. The marsh appeared to be stressed during the field visit, which followed a storm. The spit on the east end of Shell Island West is very low.

FWOP Shell Island West
TY0 60% There are no dune acres, 6 acres of supratidal habitat, and 49 acres of bayside intertidal habitat present. Best estimate based mostly on post storm flight, pre and post storm photography (Oct 2005, June 2005, Oct 2004), and pre storm field inspection (July 2005). About 35% of the existing subaerial area is barren (washover flats, beach) and 65% is vegetated with supratidal or marsh vegetation. (6 supratidal acres + 49 bayside intertidal acres)/92 total acres.
TY1 60%
TY3 58% The area will continue to deteriorate.
TY5 50% Continued deterioration and lowering of profile.
TY10 30% Only15 acres of bayside intertidal and 9 acres of gulfside intertidal habitat still exist. (50% of 15 acres)/25 subaerial acres.
TY20 1% 3 acres of bayside intertidal and 5 acres of gulfside intertidal habitat exist. (25% of 3 acres)/8
TY50 0% There are no subaerial acres left by target year 50.

FWP Shell Island West
TY0 60%
TY1 3% (43 dune acres + 48 supratidal acres @ 10% cover)/264 subaerial acres.
Assume: 100% of post-equilibration (i.e., TY2) dune acres and associated back slope (i.e., post-equilibration, TY3 supratidal acres) planted at TY1 (immediately post-construction), resulting in planting of a portion of the subaerial project area. This assumes only planting the area of the dune and supratidal that wouldn't be lost to equilibration and only 3% of the planted area would have optimal coverage.
TY2 14% (43 dune acres + 48 supratidal acres @ 20% cover) + (25% cover of 72.5 acres of

marsh platform)/253

Assume: The post-equilibration portion of dune and supratidal acres all planted at TY1. Half of marsh platform is planted and has 25% cover

TY3 36% (39 dune acres + 48 supratidal acres @ 40% cover) +(50% cover 72.5 acres of marsh platform and 25% cover remaining 72.5 marsh platform)/248

Assume: 40% cover dune and supratidal areas; 50% cover of TY2 marsh plantings; remaining 50% marsh platform planted at TY3 and has 25% cover.

TY5 65% (29 dune acres + 47 supratidal acres @ 60% cover) + (75% of 145 acres marsh platform)/237

Assume: Dune and supratidal acres 60% cover and 75% marsh platform

TY10 61% (0 dune acres + 13 supratidal acres @ 40% cover) + (70% of 139 intertidal area vegetated)/168

TY20 53% (0 dune acres + 0 supratidal acres @ 0% cover) + (60% of 116 intertidal area vegetated)/132

TY25 47% (0 dune acres + 0 supratidal acres @ 0% cover) + (55% of 90 intertidal area vegetated)/105

TY35 21% (0 dune acres + 0 supratidal acres @ 0% cover) + (30% of 37 intertidal area vegetated)/53

TY42 0% no subaerial acres remain.

TY50 0%

Variable V5 - Percent of vegetative cover comprised by woody species

Woody vegetation on Shell Island West included black mangrove, B*accharis* spp., and *Iva frutescens*. These species were seen through out the vegetated areas, especially on the interior ridges.

FWOP Shell Island West

TY0 10% About 10% of the vegetated subaerial acres is vegetated with woody species.

TY1-2 10%

Assume TY3-50 have only one woody species because there is no dune or supratidal habitat remaining.

TY3 9%

TY5 8% Continued subsidence and deterioration reduces favorable conditions.

TY10 4% It is expected that 30% of Shell Island West is vegetated. Of that about 4% of the vegetated area is expected to have wood vegetation remaining.

TY20 0% 3 acres of bayside intertidal and 5 acres of gulfside intertidal habitat exist..

TY50 0% There are no subaerial acres left.

FWP Shell Island West

Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, *Iva frutescens*, B*accharis* spp., and hercules club. A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated in the intertidal habitat to add a larger seed bank for black mangroves.

TY0 10%
TY1-3 1% Burial of majority of existing woody vegetation is expected.
TY5 5% Black mangrove and other available woody vegetation installed in TY2 or TY3.
TY10 10% Based on existing and natural recruitment on the subaerial acres
TY20 5% No supratidal acres remaining, therefore it is assumed that only one woody species is remaining. 116 acres of intertidal acres remaining.
TY25 3% No supratidal acres remaining, therefore it is assumed that only one woody species is remaining. 90 acres of intertidal acres remaining.
TY35 1% No supratidal acres remaining, therefore it is assumed that only one woody species is remaining. 37 acres of intertidal acres remaining.
TY42 0% No supratidal or bay intertidal acres remaining.
TY50 0% No remaining supratidal or bay intertidal acres.

Variable V6 - Edge and interspersion

FWOP Shell Island West

TY0 15% Class 2; 65% Class 3; 20% Class 4
76% of the project area is subaerial
TY1-5 15% Class 2; 65% Class 3; 20% Class 4
For these TYs between 76% (63 acres) and 81% (54 acres) of the project area is subaerial
TY10 40% Class 3; 60% Class 4
75% (25 acres) of the project area is subaerial
TY20 100% Class 4
70% (8 acres) of the project area is subaerial
TY50 100% Class 5

FWP Shell Island West

TY0 15% Class 2; 65% Class 3; 20% Class 4
TY1 100% Class 3
100% of the project area is subaerial
Expected to be confined carpet marsh. Fish access is prevented until retention dikes degrade to marsh elevations naturally on their own.
TY2 100% Class 3
100% of the project area is subaerial
Confined carpet marsh. Although the marsh elevation is expected to settle to +0.2 or less, it is expected that the retention dikes will prevent tidal access.
TY3 100% Class 1
100% of the project area is subaerial
Retention dikes may start to naturally degrade in some areas providing some tidal access.
TY5 100% Class 1
100% of the project area is subaerial
TY10 80% Class 1; 20% Class 2
99% of the project area is subaerial
TY20 10% Class 1; 55% Class 2; 35% Class 3

99% of the project area is subaerial
TY25 10% Class 2; 70% Class 3; 20% Class 4
99% (105 acres) of the project area is subaerial
TY35 100% Class 4
98% (53 acres) of the project area is subaerial
TY42 100% Class 5
0% (0 acres) of the project area is subaerial
TY50 100% Class 5
0% of the project area is subaerial

Variable V7 - Beach/Surf Zone Features
FWOP and FWP - 100% Class 1; unconfined natural beach with no shore parallel structures. Containment built for construction would be graded into the template for a more natural slope as-built.

Alternative 2 – two islands with renourishment Shell Island East

V1, V2, and V3 – Percent subaerial area that is dune, supratidal and intertidal, respectively
See attached spreadsheet.
Variable V4 - Percent vegetative cover of dune, supratidal, and intertidal habitats
See description above in Alternative 1 Shell Island East.

FWOP Shell Island East – same as Alternative 1 FWOP Shell Island East above.
FWP Shell Island East

TY0 45%
TY1 5% (114 dune acres + 100 supratidal acres @ 10% cover)/469 subaerial acres.
Assume: 100% of post-equilibration (i.e., TY2) dune acres and associated back slope (i.e., post-equilibration, TY3 supratidal acres) planted at TY1 (immediately post-construction), resulting in planting of a portion of the subaerial project area. This assumes only planting the area of the dune and supratidal that wouldn't be lost to equilibration and only 5% of the planted area would have optimal coverage.
TY2 15% (114 dune acres + 100 supratidal acres @ 20% cover) + (25% cover of 102 acres of marsh platform)/448
Assume: the post-equilibration portion of dune and supratidal acres all planted at TY1. Half of marsh platform is planted and has 25% cover
TY3 36% (109 dune acres + 100 supratidal acres @ 40% cover) + (50% cover 102 acres of marsh platform and 25% cover remaining 102 marsh platform)/441
Assume: 40% cover dune and supratidal areas; 50% cover of TY2 marsh plantings; remaining 50% marsh platform planted at TY3 and has 25% cover.
TY5 63% (101 dune acres + 97 supratidal acres @ 60% cover) + (75% of 202 acres marsh platform)/428

Assume: Dune and supratidal acres 60% cover and 75% marsh platform
TY10 58% (79 dune acres + 97 supratidal acres @ 50% cover) + (75% of 184 intertidal area vegetated)/389
TY11 51% (114 dune acres @ 20% cover + 97 supratidal acres @ 55% cover + 80% of 183 intertidal area vegetated)/441
Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will be planted excluding acreage that would be lost.
TY12 59% (114 dune acres @ 40% cover + 97 supratidal acres @ 60% cover + 80% of 182 intertidal area vegetated)/421
TY13 60% (109 dune acres @ 50% cover + 97 supratidal acres @ 60% cover + 75% of 180)/415
TY15 60% (101 dune acres + 97 supratidal acres @ 60% cover) + (70% of 178 intertidal area vegetated)/404
TY20 46% (79 dune acres + 97 supratidal acres @ 40% cover) + (60% of 171 intertidal area vegetated)/375
TY21 39% (114 dune acres @ 20% cover +100 supratidal acres @ 60% cover + 50% of 195 intertidal area vegetated)/459
Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants. In addition, the marsh is also renourished covering some plants but the marsh platform is anticipated to remain somewhat vegetated after renourishment.
TY22 53% (114 dune acres @ 30% cover + 100 supratidal acres @ 60% cover + 70% of 195 intertidal area vegetated)/439
TY23 63% (109 dune acres @ 50% cover + 100 supratidal acres @ 60% cover) + (80% of 195 intertidal acres)/433
TY25 65% (101 dune acres + 97 supratidal acres @ 60% cover) + (80% of 195 intertidal area vegetated)/422
TY30 56% (79 dune acres + 97 supratidal acres @ 40% cover) + (80% of 185 intertidal area vegetated)/389
TY31 54% (93 dune acres @ 20% + 97 supratidal acres @ 65% + 183 intertidal acres@ 80%)/420
Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants.
TY32 59% (93 dune acres @ 30% + 97 supratidal acres @ 65% + 182 intertidal acres @ 80%)/400
TY33 64% (89 dune acres @ 50% cover + 97 supratidal acres @ 65% cover + 80% of 180 intertidal acres)/394
TY35 64% (85 dune acres @ 60%+ 97 supratidal acres @ 65% cover + 177 intertidal acres @ 75%)/388

TY40 58% (75 dune acres + 97 supratidal acres @ 50% cover) + (171 intertidal acres @ 75%)/371
TY41 43% (75 dune acres @ 20% cover +100 supratidal acres @ 65% cover + 50% of 195 intertidal area vegetated)/417
Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants. In addition, the marsh is also renourished covering some plants but the marsh platform is anticipated to remain somewhat vegetated after renourishment.
TY42 56% (75 dune acres @ 30% cover + 100 supratidal acres @ 65% cover + 70% of 195 intertidal area vegetated)/400
TY43 65% (73 dune acres @ 50% + 100 supratidal acres @ 65% cover + 80% of 195 intertidal acres)/397
TY45 67% (71 dune acres @ 60% + 97 supratidal acres @65% cover + 195 intertidal acres @ 80%)/392
TY50 61% (64 dune acres + 97 supratidal acres @ 50% cover) + (80% of 185 intertidal area vegetated)/374

Variable V5 - Percent of vegetative cover comprised by woody species
Woody vegetation on Shell Island East included black mangrove and *Iva frutescens*. These species were seen predominantly along a canal in the center portion of the project area. There also may have been a few on the far eastern end and far western end of Shell Island East.

FWOP Shell Island East
See alternative 1 FWOP Shell Island East above.

FWP Shell Island East with renourshment
Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, *Iva frutescens*, B*accharis* spp., and hercules club. A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated in the intertidal habitat to add a larger seed bank for black mangroves.
TY0 5%
TY1-3 0% Burial of majority of existing woody vegetation is expected.
TY5 5% Black mangrove and other available woody vegetation installed in TY2 or TY3.
TY10 10% Based on existing and natural recruitment on the subaerial acres
TY11 8% The dune is renourished in TY11 resulting in the covering of some woody species.
TY12 10% Based on existing and natural recruitment.
TY13 12% Based on existing and natural recruitment.
TY15 15% Based on existing and natural recruitment.
TY20 15% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY21 11% The dune and marsh is renourished in TY21 resulting in the covering of some woody species.

TY22 13% Based on existing and natural recruitment.
TY23 14% Based on existing and natural recruitment.
TY25 16% Based on existing and natural recruitment.
TY30 16% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY31 11% The dune is renourished in TY31 resulting in the covering of some woody species.

TY32 13% Based on existing and natural recruitment.
TY33 14% Based on existing and natural recruitment.
TY35 16% Based on existing and natural recruitment.
TY40 16% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY41 11% The dune and marsh is renourished in TY41 resulting in the covering of some woody species.
TY42 13% Based on existing and natural recruitment.
TY43 14% Based on existing and natural recruitment.
TY45 16% Based on existing and natural recruitment.
TY50 16% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.

Variable V6 - Edge and interspersion
FWOP Shell Island East
Same as Alt 1

FWP Shell Island East
TY0 100% Class 4
Assume tidal creeks are constructed in the intertidal marsh habitat.
TY1 100% Class 3
74% of the project area is subaerial
Expected to be confined carpet marsh. Fish access is prevented until retention dikes degrade to marsh elevations naturally on their own.
TY2 100% Class 3
73% of the project area is subaerial
Confined carpet marsh. Although the marsh elevation is expected to settle to +0.2 or less, it is expected that the retention dikes will prevent tidal access.
TY3 100% Class 1
72% of the project area is subaerial
Retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks were constructed.
TY5 100% Class 1
72% of the project area is subaerial
TY10 80% Class 1; 20% Class 2
70% of the project area is subaerial

TY11 80% Class 1; 20% Class 2

73% of the project area is subaerial. Although the dune is renourished the marsh isn't in this cycle.

TY12 70% Class 1; 30% Class 2

72% of the project area is subaerial

TY13 60% Class 1; 40% Class 2

72% of the project area is subaerial

TY15 35% Class 1; 65% Class 2

72% of the project area is subaerial

TY20 10% Class 1; 60% Class 2; 30% Class 3

71% of the project area is subaerial.

TY21 100% Class 3

75% of the project area is subaerial. Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh renourishment.

TY22 100% Class 1

74% of the project area is subaerial. It is expected that the retention dikes will have degraded naturally in some areas allowing for tidal access.

TY23 100% Class 1

74% of the project area is subaerial

TY25 100% Class 1

74% of the project area is subaerial

TY30 80% Class 1; 20% Class 2

73% of the project area is subaerial

TY31 80% Class 1; 20% Class 2

74% of the project area is subaerial. The dune is renourished, the marsh is not in this cycle.

TY32 70% Class 1; 30% Class 2

73% of the project area is subaerial

TY33 60% Class 1; 40% Class 2

73% of the project area is subaerial

TY35 35% Class 1; 65% Class 2

73% of the project area is subaerial

TY40 10% Class 1; 60% Class 2; 30% Class 3

73% of the project area is subaerial

TY41 100% Class 3

75% of the project area is subaerial. Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh renourishment.

TY42 100% Class 1

75% of the project area is subaerial. It is expected that the retention dikes will have degraded naturally in some areas allowing for tidal access

TY43 100% Class 1

75% of the project area is subaerial
TY45 100% Class 1
74% of the project area is subaerial
TY50 80% Class 1; 20% Class 2
74% of the project area is subaerial

Variable V7 - Beach/Surf Zone Features
FWOP and FWP - 100% Class 1; unconfined natural beach with no shore parallel structures. Containment built for construction would be graded into the template for a more natural slope as-built.

Alternative 2 – two islands with renourishment Shell Island West
V1, V2, and V3 – Percent subaerial area that is dune, supratidal and intertidal, respectively
See description above in Alternative 1 Shell Island West.

V4 - Percent vegetative cover of dune, supratidal, and intertidal habitats
See description above.

FWOP Shell Island West – same as Alternative 1 FWOP Shell Island West above.
FWP Shell Island West

TY0 60%
TY1 4% (60 dune acres + 43 supratidal acres @ 10% cover)/272 subaerial acres.
Assume: 100% of post-equilibration (i.e., TY2) dune acres and associated back slope (i.e., post-equilibration, TY3 supratidal acres) planted at TY1 (immediately post-construction), resulting in planting of a portion of the subaerial project area. This assumes only planting the area of the dune and supratidal that wouldn't be lost to equilibration and only 4% of the planted area would have optimal coverage.
TY2 15% (60 dune acres + 43 supratidal acres @ 20% cover) + (25% cover of 72 acres of marsh platform)/261
Assume: The post-equilibration portion of dune and supratidal acres all planted at TY1. Half of marsh platform is planted and has 25% cover
TY3 37% (55 dune acres + 43 supratidal acres @ 40% cover) +(50% cover 72 acres of marsh platform and 25% cover remaining 73 marsh platform)/256
Assume: 40% cover dune and supratidal areas; 50% cover of TY2 marsh plantings; remaining 50% marsh platform planted at TY3 and has 25% cover.
TY5 66% (46 dune acres + 42 supratidal acres @ 60% cover) + (75% of 145 acres marsh platform)/245
Assume: Dune and supratidal acres 60% cover and 75% marsh platform
TY10 63% (22 dune acres + 42 supratidal acres @ 50% cover) + (75% of 139 intertidal area vegetated)/215
TY11 55% (60 dune acres @ 20% cover + 42 supratidal acres @ 55% cover + 80% of 139

intertidal area vegetated)/263
Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will be planted excluding acreage that would be lost.
TY12 61% (60 dune acres @ 30% cover + 42 supratidal acres @ 60% cover + 80% of 138 intertidal area vegetated)/252
TY13 66% (55 dune acres @ 50% + 42 supratidal acres @ 60% cover + 80% of 137)/247
TY15 68% (46 dune acres + 42 supratidal acres @ 60% cover) + (80% of 136 intertidal area vegetated)/236
TY20 63% (22 dune acres + 42 supratidal acres @ 40% cover) + (80% of 134 intertidal area vegetated)/210
TY21 41% (60 dune acres @ 20% cover +43 supratidal acres @ 60% cover + 50% of 145 intertidal area vegetated)/272
Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants. In addition, the marsh is also renourished covering some plants but the marsh platform is anticipated to remain somewhat vegetated after renourishment.
TY22 56% (60 dune acres @ 30% cover + 43 supratidal acres @ 60% cover + 70% of 145 intertidal area vegetated)/261
TY23 66% (55 dune acres @ 50% + 43 supratidal acres @ 60% cover + 80% of 145 intertidal acres)/256
TY25 69% (46 dune acres + 42 supratidal acres @ 60% cover) + (80% of 145 intertidal area vegetated)/245
TY30 64% (22 dune acres + 42 supratidal acres @ 40% cover) + (80% of 139 intertidal area vegetated)/215
TY31 58% (52 dune acres @ 20% + 42 supratidal acres @ 65% + 139 intertidal acres@ 80%)/255
Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants.
TY32 63% (52 dune acres @ 30% + 42 supratidal acres @ 65% + 138 intertidal acres @ 80%)/244
TY33 67% (47 dune acres @ 50% + 42 supratidal acres @ 65% cover) + (80% of 137 intertidal acres)/239
TY35 66% (44 dune acres @ 60%+ 42 supratidal acres @ 65% cover + 136 intertidal acres @ 75%)/235
TY40 62% (36 dune acres + 42 supratidal acres @ 50% cover) + (134 intertidal acres @ 75%)/224
TY41 43% (46 dune acres @ 20% cover + 43 supratidal acres @ 65% cover + 50% of 145 intertidal area vegetated)/255
Assume: Dune is renourished covering some plants but dune platform is anticipated to remain

somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants. In addition, the marsh is also renourished covering some plants but the marsh platform is anticipated to remain somewhat vegetated after renourishment.
TY42 58% (46 dune acres @ 30% cover + 43 supratidal acres @ 65 % cover + 145 intertidal acres @ 70% cover)/247
TY43 68% (45 dune acres @ 50% + 43 supratidal acres @ 65% cover + 80% of 145 intertidal acres)/245
TY45 70% (43 dune acres @ 60% + 42 supratidal acres @ 65% cover + 145 intertidal acres @ 80%)/243
TY50 65% (37 dune acres + 42 supratidal acres @ 50% cover) + (80% of 139 intertidal area vegetated)/230

Variable V5 - Percent of vegetative cover comprised by woody species
Woody vegetation on Shell Island West included black mangrove and *Iva frutescens*. These species were seen through out the vegetated areas, especially on the interior ridges.

FWOP Shell Island West
See Alternative 1 FWOP Shell Island West above.

FWP Shell Island West
Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, *Iva frutescens*, B*accharis* spp., and hercules club. A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated in the intertidal habitat to add a larger seed bank for black mangroves.
TY0 10%
TY1-3 1% Burial of majority of existing woody vegetation is expected with very little existing plants surviving.
TY5 5% Black mangrove and other available woody vegetation installed in TY2 or TY3.
TY10 10% Based on existing and natural recruitment on the subaerial acres
TY11 8% The dune is renourished in TY11 resulting in the covering of some woody species.

TY12 10% Based on existing and natural recruitment.
TY13 12% Based on existing and natural recruitment.
TY15 15% Based on existing and natural recruitment.
TY20 15% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY21 11% The dune and marsh is renourished in TY21 resulting in the covering of some woody species.
TY22 13% Based on existing and natural recruitment.
TY23 14% Based on existing and natural recruitment.
TY25 16% Based on existing and natural recruitment.
TY30 16% Based on slight decreasing elevation of supratidal and intertidal acreage and

shoreline deterioration.
TY31 11% The dune is renourished in TY31 resulting in the covering of some woody species.

TY32 13% Based on existing and natural recruitment.
TY33 14% Based on existing and natural recruitment.
TY35 16% Based on existing and natural recruitment.
TY40 16% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY41 11% The dune and marsh is renourished in TY41 resulting in the covering of some woody species.
TY42 13% Based on existing and natural recruitment.
TY43 14% Based on existing and natural recruitment.
TY45 16% Based on existing and natural recruitment.
TY50 16% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.

Variable V6 - Edge and interspersion
FWOP Shell Island West
Same as alt 1

FWP Shell Island West
Assume tidal creeks are constructed in the intertidal marsh habitat.
TY0 15% Class 2; 65% Class 3; 20% Class 4
100% of the project area is subaerial for all remaining TYs (TY1-TY50).
TY1 100% Class 3
Expected to be confined carpet marsh. Fish access is prevented until retention dikes degrade to marsh elevations naturally on there own.
TY2 100% Class 3
Confined carpet marsh. Although the marsh elevation is expected to settle to +0.2 or less, it is expected that the retention dikes will prevent tidal access.
TY3 100% Class 1
Retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks were constructed in the intertidal marsh habitat.
TY5 100% Class 1
TY10 80% Class 1; 20% Class 2
TY11 80% Class 1; 20% Class 2
Although the dune is renourished, the marsh isn't in this cycle.
TY12 70% Class 1; 30% Class 2
TY13 60% Class 1; 40% Class 2
TY15 35% Class 1; 65% Class 2
TY20 10% Class 1; 60% Class 2; 30% Class 3
TY21 100% Class 3
Both the dune and marsh are renourished. There will be some retention dikes (probably

not as substantial as the original dikes) used for the marsh renourishment.
TY22 100% Class 1
It is expected that the retention dikes will have degraded naturally in some areas allowing for tidal access.
TY23 100% Class 1
TY25 100% Class 1
TY30 80% Class 1; 20% Class 2
TY31 80% Class 1; 20% Class 2
Although the dune is renourished, the marsh is not in this cycle.
TY32 70% Class 1; 30% Class 2
TY33 60% Class 1; 40% Class 2
TY35 35% Class 1; 65% Class 2
TY40 10% Class 1; 60% Class 2; 30% Class 3
TY41 100% Class 3
Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh renourishment.
TY42 100% Class 1
It is expected that the retention dikes will have degraded naturally in some areas allowing for tidal access
TY43 100% Class 1
TY45 100% Class 1
TY50 80% Class 1; 20% Class 2

Variable V7 - Beach/Surf Zone Features
FWOP and FWP - 100% Class 1; unconfined natural beach with no shore parallel structures. Containment built for construction would be graded into the template for a more natural slope as-built.

Alternative 3 – single island 10 Yrs Adv Fill + No Renourishment

V1, V2, and V3 – Percent subaerial area that is dune, supratidal and intertidal, respectively
See attached spreadsheet.

Variable V4 - Percent vegetative cover of dune, supratidal, and intertidal habitats
See description above in Alternative 1.

FWOP Shell Island Total

TY0 50% There is no dune, 6 acres of supratidal habitat, and about 89 acres and 50 acres of bayside and gulfside intertidal habitat, respectively. It is estimated that about 50% of the existing subaerial is vegetated and about 50% is barren (overwash flats, beach). Best estimate is based mostly on post storm flight, pre and post storm photography (Oct 2005, June 2005, Oct 2004),

and July 2005 site inspection.
TY1 50%
TY3 48% The area will continue to deteriorate.
TY5 40% Continued deterioration and lowering of profile.
TY10 26% 22 acres of bayside intertidal and 21 acres of gulfside intertidal habitat still remain. (50% of 22 acres)/43 subaerial acres.
TY20 7% 5 acres of bayside intertidal and 13 acres of gulfside intertidal habitat exist. (25% of 5 acres)/18
TY50 0% There are no subaerial acres left by target year 50.

FWP Shell Island Single Island

TY0 50%
TY1 4% (137 dune acres + 159 supratidal acres @ 10% cover)/842 subaerial acres.
Assume: 100% of post-equilibration (i.e., TY2) dune acres and associated back slope (i.e., post-equilibration, TY3 supratidal acres) planted at TY1 (immediately post-construction), resulting in planting of a portion of the subaerial project area. This assumes only planting the area of the dune and supratidal that wouldn't be lost to equilibration and only 4% of the planted area would have optimal coverage.
TY2 14% (137 dune acres + 159 supratidal acres @ 20% cover) + (25% cover of 227.5 acres of marsh platform)/800
Assume: The post-equilibration portion of dune and supratidal acres all planted at TY1. Half of marsh platform is planted and has 25% cover
TY3 36% (133 dune acres + 159 supratidal acres @ 40% cover) +(50% cover 227.5 acres of marsh platform and 25% cover remaining 227.5 marsh platform)/781
Assume: 40% cover dune and supratidal areas; 50% cover of TY2 marsh plantings; remaining 50% marsh platform planted at TY3 and has 25% cover.
TY5 65% (124 dune acres + 154 supratidal acres @ 60% cover) + (75% of 429 acres marsh platform)/749
Assume: Dune and supratidal acres 60% cover and 75% marsh platform
TY10 61% (102 dune acres + 154 supratidal acres @ 50% cover) + (75% of 393 intertidal area vegetated)/691
TY20 62% (58 dune acres + 154 supratidal acres @ 50% cover) + (75% of 371 intertidal area vegetated)/625
TY30 62% (14 dune acres + 154 supratidal acres @ 50% cover) + (75% of 350 intertidal area vegetated)/560
TY33 62% (0 dune acres + 142 supratidal acres @ 50% cover) + (319 intertidal acres @ 75%)/500
TY50 63% (0 dune acres + 45 supratidal acres @ 50% cover) + (75% of 183 intertidal area vegetated)/252

Variable V5 - Percent of vegetative cover comprised by woody species

Woody vegetation on Shell Island East and West included black mangrove and *Iva frutescens*. These species were seen predominantly along a canal in the center portion of the project area of Shell Island East. There also may have been a few on the far eastern end and far western end of Shell Island East. These species were seen through out the vegetated areas, especially on the interior ridges of Shell Island West.

FWOP Shell Island Total

TY0 8% About 8% of the vegetated subaerial acres is vegetated with woody species.

TY1-2 8%

Assume TY3-50 have only one woody species because there is no dune or supratidal habitat remaining.

TY3 7%

TY5 5% Continued subsidence and deterioration reduces favorable conditions.

TY10 3% It is expected that 26% of both Shell Islands will be vegetated. Of that about 3% of the vegetated area is expected to have wood vegetation remaining.

TY20 1% 5 acres of bayside intertidal and 13 acres of gulfside intertidal habitat exist.

TY50 0% There are no subaerial acres left.

FWP Shell Island Single Island without renourishment

Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, *Iva frutescens*, B*accharis* spp., and hercules club. A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated in the intertidal habitat to add a larger seed bank for black mangroves.

TY0 8%

TY1-3 1% Burial of majority of existing woody vegetation is expected with very little existing plants surviving.

TY5 5% Black mangrove and other available woody vegetation installed in TY2 or TY3.

TY10 10% Based on existing and natural recruitment on the subaerial acres

TY20 9% Based on decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.

TY30 9% 14 acres of dune, 154 acres of supratidal and 350 acres of bay intertidal remain.

TY33 9% 0 dune acres, 142 acres of supratidal, and 319 acres of bay intertidal remain.

TY50 5% 45 acres of supratidal and 183 acres of bay intertidal remain.

Variable V6 - Edge and interspersion

FWOP Shell Island Total

TY0 30% Class 3; 70% Class 4
38% of the project area is subaerial

TY1-5 30% Class 3; 70% Class 4
33% to 35% of the project area is subaerial

TY10 25% Class 3; 75% Class 4
19% of the project area is subaerial

TY20 100% Class 4
At TY20 11% (18 acres) of the project area is subaerial
TY50 100% Class 5
None of the project area is subaerial

FWP Shell Island Single Island
Assume tidal creeks are constructed in the intertidal marsh habitat.
TY0 30% Class 3; 70% Class 4
38% of the project area is subaerial
TY1 100% Class 3
85% of the project area is subaerial
Expected to be confined carpet marsh. Fish access is prevented until retention dikes degrade to marsh elevations naturally on their own.
TY2 100% Class 3
84% of the project area is subaerial
Confined carpet marsh. Although the marsh elevation is expected to settle to +0.2 or less, it is expected that the retention dikes will prevent tidal access.
TY3 100% Class 1
84% of the project area is subaerial
Retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks are constructed in the intertidal marsh habitat.
TY5 100% Class 1
83% of the project area is subaerial
TY10 80% Class 1; 20% Class 2
83% of the project area is subaerial
TY20 10% Class 1; 60% Class 2; 30% Class 3
82% of the project area is subaerial.
TY30 60% Class 3; 40% Class 4
83% of the project area is subaerial
TY33 60% Class 3; 40% Class 4
83% of the project area is subaerial
TY50 30% Class 3; 70% Class 4
85% of the project area is subaerial

Variable V7 - Beach/Surf Zone Features
FWOP and FWP - 100% Class 1; unconfined natural beach with no shore parallel structures. Containment built for construction would be graded into the template for a more natural slope as-built.

Alternative 5 – single island 10 Yrs Adv Fill + Renourishment at TY20 and TY40
V1, V2, and V3 – Percent subaerial area that is dune, supratidal and intertidal, respectively
See attached spreadsheet.
Variable V4 - Percent vegetative cover of dune, supratidal, and intertidal habitats

See description above in Alternative 1.

FWOP Shell Island Total
Same as Alt 3

FWP Shell Island Single Island

TY0 50%
TY1 4% (137 dune acres + 159 supratidal acres @ 10% cover)/842 subaerial acres.
Assume: 100% of post-equilibration (i.e., TY2) dune acres and associated back slope (i.e., post-equilibration, TY3 supratidal acres) planted at TY1 (immediately post-construction), resulting in planting of a portion of the subaerial project area. This assumes only planting the area of the dune and supratidal that wouldn't be lost to equilibration and only 4% of the planted area would have optimal coverage.
TY2 14% (137 dune acres + 159 supratidal acres @ 20% cover) + (25% cover of 227.5 acres of marsh platform)/800
Assume: The post-equilibration portion of dune and supratidal acres all planted at TY1. Half of marsh platform is planted and has 25% cover
TY3 36% (133 dune acres + 159 supratidal acres @ 40% cover) +(50% cover 227.5 acres of marsh platform and 25% cover remaining 227.5 marsh platform)/781
Assume: 40% cover dune and supratidal areas; 50% cover of TY2 marsh plantings; remaining 50% marsh platform planted at TY3 and has 25% cover.
TY5 65% (124 dune acres + 155 supratidal acres @ 60% cover) + (75% of 429 acres marsh platform)/750
Assume: Dune and supratidal acres 60% cover and 75% marsh platform
TY10 61% (102 dune acres + 155 supratidal acres @ 50% cover) + (75% of 393 intertidal area vegetated)/691
TY20 61% (58 dune acres + 155 supratidal acres @ 50% cover) + (75% of 371 intertidal area vegetated)/625
TY21 42% (137 dune acres @ 20% cover + 159 supratidal acres @ 60% cover + 50% of 410 intertidal area vegetated)/778
Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants. In addition, the marsh is also renourished covering some plants but the marsh platform is anticipated to remain somewhat vegetated after renourishment.
TY22 57% (137 dune acres @ 30% cover + 161 supratidal acres @ 60% cover + 70% of 410 intertidal area vegetated)/750
TY23 66% (133 dune acres @ 50% + 159 supratidal acres @ 60% cover + 80% of 410 intertidal acres)/743
TY25 68% (124 dune acres + 154 supratidal acres @ 60% cover) + (80% of 410 intertidal area vegetated)/730

TY30 64% (102 dune acres + 154 supratidal acres @ 50% cover) + (80% of 392 intertidal area vegetated)/690
TY40 64% (58 dune acres + 154 supratidal acres @ 50% cover) + (370 intertidal acres @ 80%)/624
TY41 43% (137 dune acres @ 20% cover + 159 supratidal acres @ 65% cover + 50% of 410 intertidal area vegetated)/778
Assume: Dune is renourished covering some plants but dune platform is anticipated to remain somewhat vegetated after renourishment. 100% of post-equilibration (i.e., TY2) dune acres are used to estimate the portion of the dune acres that will contain plants. In addition, the marsh is also renourished covering some plants but the marsh platform is anticipated to remain somewhat vegetated after renourishment.
TY42 58% (137 dune acres @ 30% cover + 159 supratidal acres @ 65 % cover + 410 intertidal acres @ 70% cover)/750
TY43 67% (133 dune acres @ 50% + 159 supratidal acres @ 65% cover + 80% of 410 intertidal acres)/743
TY45 69% (124 dune acres @ 60% + 154 supratidal acres @ 65% cover + 410 intertidal acres @ 80%)/730
TY50 64% (102 dune acres + 154 supratidal acres @ 50% cover) + (80% of 392 intertidal area vegetated)/690

Variable V5 - Percent of vegetative cover comprised by woody species
Woody vegetation on Shell Island East and West included black mangrove and *Iva frutescens*. These species were seen predominantly along a canal in the center portion of the project area of Shell Island East. There also may have been a few on the far eastern end and far western end of Shell Island East. These species were seen through out the vegetated areas, especially on the interior ridges of Shell Island West.

FWOP Shell Island Total
Same as Alt 3

FWP Shell Island Single Island with renourishment
Woody species that would be considered for planting on the dune and supratidal swale areas include, but are not limited to matrimony vine, wax myrtle, *Iva frutescens*, B*accharis* spp., and hercules club. A smaller planting of black mangrove (*Avicennia germinans* 'Pelican') may be incorporated in the intertidal habitat to add a larger seed bank for black mangroves.
TY0 8%
TY1-3 1% Burial of majority of existing woody vegetation is expected with very little existing plants surviving.
TY5 5% Black mangrove and other available woody vegetation installed in TY2 or TY3.
TY10 10% Based on existing and natural recruitment on the subaerial acres
TY20 10% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY21 7% The dune and marsh is renourished in TY21 resulting in the covering of some

woody species.
TY22 8% Based on existing and natural recruitment.
TY23 9% Based on existing and natural recruitment.
TY25 11% Based on existing and natural recruitment.
TY30 13% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY40 13% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.
TY41 11% The dune and marsh is renourished in TY41 resulting in the covering of some woody species.
TY42 13% Based on existing and natural recruitment.
TY43 14% Based on existing and natural recruitment.
TY45 16% Based on existing and natural recruitment.
TY50 16% Based on slight decreasing elevation of supratidal and intertidal acreage and shoreline deterioration.

Variable V6 - Edge and interspersion
FWOP Shell Island Total
Same as Alt 3

FWP Shell Island Single Island
Assume tidal creeks are constructed in the intertidal marsh habitat.
TY0 30% Class 3; 70% Class 4
38% of the project area is subaerial
TY1 100% Class 3
85% of the project area is subaerial
Expected to be confined carpet marsh. Fish access is prevented until retention dikes degrade to marsh elevations naturally on their own.
TY2 100% Class 3
84% of the project area is subaerial
Confined carpet marsh. Although the marsh elevation is expected to settle to +0.2 or less, it is expected that the retention dikes will prevent tidal access.
TY3 100% Class 1
84% of the project area is subaerial
Retention dikes may start to naturally degrade in some areas providing tidal access. Assume tidal creeks are constructed in the intertidal marsh habitat.
TY5 100% Class 1
83% of the project area is subaerial
TY10 80% Class 1; 20% Class 2
83% of the project area is subaerial
TY20 10% Class 1; 60% Class 2; 30% Class 3
82% of the project area is subaerial.
TY21 100% Class 3

Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh renourishment.
TY22 100% Class 3
TY23 100% Class 1
It is expected that the retention dikes will have degraded naturally in some areas allowing for tidal access.
TY25 100% Class 1
TY30 80% Class 1; 20% Class 2
84% of the project area is subaerial
TY40 10% Class 1; 60% Class 2; 30% Class 3
84% of the project area is subaerial
TY41 100% Class 3
Both the dune and marsh are renourished. There will be some retention dikes (probably not as substantial as the original dikes) used for the marsh renourishment.
TY42 100% Class 3
TY43 100% Class 1
It is expected that the retention dikes will have degraded naturally in some areas allowing for tidal access
TY45 100% Class 1
TY50 80% Class 1; 20% Class 2

Variable V7 - Beach/Surf Zone Features
FWOP and FWP - 100% Class 1; unconfined natural beach with no shore parallel structures. Containment built for construction would be graded into the template for a more natural slope as-built.

Literature cited

Coastal Planning and Engineering. 2007. Barataria Basin Barrier Island Shoreline Restoration, Shell Island Feasibility Report Plaquemines, Louisiana. Draft Feasibility Report.
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National Oceanic and Atmospheric Administration, 2004. rates of Vertical Displacement at Benchmarks in the Lower Mississippi Valley and the Northern Gulf Coast. NOAA Technical Report NOA/NGS 50.
Tate, Beau, 2007. E-mail correspondence August 8, 2005. LCA Construction Cost. Louisiana Department of Natural Resources.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
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June 3, 2011

Colonel Edward R. Fleming
District Commander
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Fleming:

Please reference the "Near-Term Ecosystem Restoration Plan (NTP) for Louisiana Coastal Area (LCA), Louisiana Ecosystem Restoration: Barataria Basin Barrier Shoreline (BBBS) Restoration, Feasibility Study". This study was originally authorized by resolutions adopted by the U.S. House of Representatives and Senate Committees on Public Works, on October 19, 1967, and April 19, 1967, respectively. Those resolutions sought to improve existing hurricane protection features and the ". . . prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and related water resource purposes." The BBBS Restoration Project was identified as a critical near-term restoration project in the NTP of the 2004 LCA Report. This project was recommended for authorization by the Chief of Engineers on January 31, 2005, and was authorized in Title VII of the Water Resources Development Act of 2007.

The U.S. Army Corps of Engineers (Corps) has recently redefined the Tentatively Selected Plan (TSP) for Caminada to include, for "sustainability," an increase in renourishment from 500,000 cubic yards (cy) of material four times every 10 years (previous TSP) to 650,000 cy of material six times every 10years (current TSP). The selection of the Shell Island alternative 5, which includes a one-island configuration and renourishment to its original construction template in years 20 and 40, remains the same. The U.S. Fish and Wildlife Service (Service) provided recommendations on the previously proposed TSPs to the Corps in an April 30, 2009, Draft Fish and Wildlife Coordination Act (FWCA) Report and on the revised TSP with renourishment on Caminada in an August 5, 2010, and December 6, 2010, supplemental FWCA Reports. This letter supplements those reports and is submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) but does not constitute the report of the Secretary of the Interior as required by Section 2(b) of that Act.

The Service also provided concurrence with the Corps' determination that the previously proposed TSP was not likely to adversely affect the threatened piping plover (*Charadrius melodus*) and its designated critical habitat in a letter dated May 11, 2009. Due to the currently proposed changes to the TSP, the Service also offers the following comments in accordance with provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

TAKE PRIDE IN AMERICA

A description of the study area, a discussion of the significant fish and wildlife resources (including habitats) that occur within that study area, and the benefits analysis are contained in our April 2009 and August and December 2010 supplemental reports. For brevity, that information and discussion is incorporated by reference herein. The renourishment component to the TSP per the 2004 LCA report included near-shore recovery of 2 million cubic yards of sand every 10 years for the Caminada Headland.

Benefit impacts using Wetland Value Assessment (WVA) were previously evaluated on the revised TSP with renourishment for the BBBS project which yielded a total of 1719 Average Annual Habitat Units (AAHUs) and 1684 net acres for both Caminada Headland and Shell Island. Rather than revisit the WVAs, which with the increase in sediment is expected show an increase in AAHUs and net acres from what was previously evaluated, the Corps has chosen not to reevaluate the benefits thus going with a more conservative estimate for the project. The Corps is assuming that the overall rating of alternatives would not change. The Service agrees with this assessment and approach.

The above described changes in the TSP also constitute a change in the scope and location of certain project features for which the Corps previously consulted with the Service. Potential effects to the piping plover and its critical habitat resulting from the proposed changes in the TSP were not considered in our previous analysis of project-related effects; thus, the Corps should reinitiate ESA consultation for the proposed project changes.

The Service is pleased to see the increase of sediment and the addition of renourishment to the Caminada headland and the single island alternative plus renourishment for Shell Island and agree the additional feature would result in greater overall benefits to the project. The Service feels the new TSP represents a significant gain in habitat for fish and wildlife resources over the project life. In fact with the changes to the TSP two of our previous recommendations have been resolved and removed from the below list. The Service believes that the impact analysis and recommendations (presented below) provided in our April 2009 and August 2010, FWCA Reports continue to remain valid with the addition of the first recommendation and the removal of the two recommendations mentioned above.

1. The Corps should reinitiate ESA consultation with the Service for the proposed renourishment, especially in regards to potential impacts to the piping plover and its critical habitat.

2. The Service, NMFS, and LDWF should be provided an opportunity to review and submit recommendations on future detailed planning reports and the draft plans and specifications on the Barataria Basin Barrier Shoreline Restoration Project addressed in this report.

3. Coordination should continue with the Service and NMFS on detailed contract specifications to avoid and minimize potential impacts to piping plover and their critical habitat, manatees, pallid sturgeon, and sea turtles.

4. Avoid adverse impacts to nesting seabird colonies through careful design project features and timing of construction. For colonies containing nesting gulls, terns, and/or black

skimmers, all activity occurring within 650 feet of a rookery should be restricted to the non-nesting period (i.e., September 16 through April 1, exact dates may vary within this window depending on species present). Prior to any such work, surveys should be conducted by qualified personnel during the colonial seabird nesting season to determine the presence and location of any such colonies. In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

5. If the proposed project has not been constructed within 1 year or if changes are made to the proposed project, the Corps should re-initiate Endangered Species Act consultation with the Service.

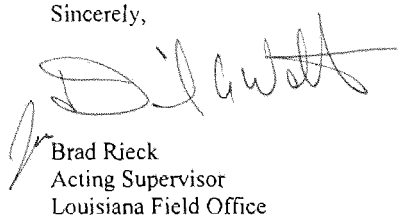
6. The newly created barrier headland/island and back-barrier marsh, as well as the surrounding habitats that may be indirectly benefited by long-shore transport and sediment overwash, should be monitored over the project life for effectiveness and the results should be provided to all resource agencies. Development of those monitoring plans should be coordinated with all natural resource agencies.

7. All containment features should be breached or degraded, if necessary to restore tidal connectivity, once the marsh creation/nourishment areas have at least 80% coverage of emergent vegetation.

8. Identification of additional borrow sites should be coordinated with the Service and other natural resource agencies.

Thank you for the opportunity to review this proposed revision to the LCA, Louisiana Ecosystem Restoration: Barataria Basin Barrier Shoreline Restoration, Feasibility Study. If the project scope or design changes, the Service requests that the Corps reinitiate FWCA coordination to ensure that the above recommendations remains valid. If you or your staff has any questions regarding this matter, please have them contact Catherine Breaux (504/862-2689) of this office.

Sincerely,



Brad Rieck
Acting Supervisor
Louisiana Field Office

cc: LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
LA Dept. of Natural Resources (CMD), Baton Rouge, LA
OCPR, Baton Rouge, LA
National Marine Fisheries Service, Baton Rouge, LA
Environmental Protection Agency, Dallas, TX
Natural Resources Conservation Service, Alexandria, LA

United States Department of the Interior

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December 8, 2010

Colonel Edward R. Fleming
District Commander
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Fleming:

Please reference the "Near-Term Ecosystem Restoration Plan (NTP) for Louisiana Coastal Area (LCA), Louisiana Ecosystem Restoration: Barataria Basin Barrier Shoreline (BBBS) Restoration, Feasibility Study". This study was originally authorized by resolutions adopted by the U.S. House of Representatives and Senate Committees on Public Works, on October 19, 1967, and April 19, 1967, respectively. Those resolutions sought to improve existing hurricane protection features and the ". . . prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and related water resource purposes." The BBBS Restoration Project was identified as a critical near-term restoration project in the NTP of the 2004 LCA Report. This project was recommended for authorization by the Chief of Engineers on January 31, 2005, and was authorized in Title VII of the Water Resources Development Act of 2007.

The U.S. Army Corps of Engineers (Corps) has recently redefined the Tentatively Selected Plan (TSP) to include renourishment (on average every 2 years) of the previously selected Caminada Headland alternative 5 and the selection of the Shell Island alternative 5, which includes a one-island configuration and renourishment to its original construction template in years 20 and 40. The Shell Island component is in place of the previously selected Shell Island alternative 3, a two island alternative with no renourishment. The U.S. Fish and Wildlife Service (Service) provided recommendations on the previously proposed TSP to the Corps in an April 30, 2009, Draft Fish and Wildlife Coordination Act (FWCA) Report and on the revised TSP with renourishment on Caminada in an August 5, 2010 supplemental FWCA Report. This letter supplements those reports and is submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) but does not constitute the report of the Secretary of the Interior as required by Section 2(b) of that Act.

The Service also provided concurrence with the Corps' determination that the previously proposed TSP was not likely to adversely affect the threatened piping plover (*Charadrius melodus*) and its designated critical habitat in a letter dated May 11, 2009. Due to the currently proposed changes to the TSP, the Service also offers the following comments in accordance with provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

TAKE PRIDE IN AMERICA

A description of the study area and a discussion of the significant fish and wildlife resources (including habitats) that occur within that study area are contained in our April 2009 report. For brevity, that information and discussion is incorporated by reference herein. The renourishment component to the TSP per the 2004 LCA report included near-shore recovery of 2 million cubic yards of sand every 10 years for the Caminada Headland.

Benefit impacts using Wetland Value Assessment (WVA) were previously evaluated on the original TSP for the BBBS project which yielded a total of 572 Average Annual Habitat Units (AAHUs) for both Caminada Headland and Shell Island. The Shell Island Alternative 5, single island, was previously evaluated while the Caminada Headland alternative 5 was reevaluated to include the renourishment component. The new TSP yields a total of 1719 AAHUs and 1684 acres for both islands.

The above described changes in the TSP also constitute a change in the scope and location of certain project features for which the Corps previously consulted with the Service. Potential effects to the piping plover and its critical habitat resulting from the proposed changes in the TSP were not considered in our previous analysis of project-related effects; thus, the Corps should reinitiate ESA consultation for the proposed project changes.

The Service is pleased to see the addition of renourishment to the Caminada headland and the single island alternative plus renourishment for Shell Island and agree the additional feature would result in greater overall benefits to the project. The Service feels the new TSP represents a significant gain in habitat for fish and wildlife resources over the project life. In fact, with the changes to the TSP two of our previous recommendations have been resolved and removed from the list below. The Service believes that the impact analysis and recommendations (presented below) provided in our April 2009 and August 5, 2010, FWCA Reports continue to remain valid with the addition of the first recommendation and the removal of the two recommendations mentioned above.

1. The Corps should reinitiate ESA consultation with the Service for the proposed renourishment, especially in regards to potential impacts to the piping plover and its critical habitat.

2. The Service, NMFS, and LDWF should be provided an opportunity to review and submit recommendations on future detailed planning reports and the draft plans and specifications on the Barataria Basin Barrier Shoreline Restoration Project addressed in this report.

3. Coordination should continue with the Service and NMFS on detailed contract specifications to avoid and minimize potential impacts to piping plover and their critical habitat, manatees, pallid sturgeon, and sea turtles.

4. Avoid adverse impacts to nesting seabird colonies through the careful design of project features and timing of construction. For colonies containing nesting gulls, terns, and/or black skimmers, all activity occurring within 650 feet of a rookery should be restricted to the non-nesting period (i.e., September 16 through April 1, exact dates may vary within this window depending on species present). Prior to any such work, surveys should be

conducted by qualified personnel during the colonial seabird nesting season to determine the presence and location of any such colonies. In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

5. If the proposed project has not been constructed within 1 year or if changes are made to the proposed project, the Corps should re-initiate Endangered Species Act consultation with the Service.

6. The newly created barrier headland/island and back-barrier marsh, as well as the surrounding habitats that may be indirectly benefited by long-shore transport and sediment overwash, should be monitored over the project life for effectiveness and the results should be provided to all resource agencies. Development of those monitoring plans should be coordinated with all natural resource agencies.

7. All containment features should be breached or degraded, if necessary to restore tidal connectivity, once the marsh creation/nourishment areas have at least 80% coverage of emergent vegetation.

8. Identification of additional borrow sites should be coordinated with the Service and other natural resource agencies.

Thank you for the opportunity to review this proposed revision to the LCA, Louisiana Ecosystem Restoration: Barataria Basin Barrier Shoreline Restoration, Feasibility Study. If the project scope or design changes, the Service requests that the Corps reinitiate FWCA coordination to ensure that the above recommendations remains valid. If you or your staff has any questions regarding this matter, please have them contact Catherine Breaux (504/862-2689) of this office.

Sincerely,

James F. Boggs
Supervisor
Louisiana Field Office

cc: LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
LA Dept. of Natural Resources (CMD), Baton Rouge, LA
OCPR, Baton Rouge, LA
National Marine Fisheries Service, Baton Rouge, LA
Environmental Protection Agency, Dallas, TX
Natural Resources Conservation Service, Alexandria, LA

United States Department of the Interior

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August 5, 2010

Colonel Edward R. Fleming
District Engineer
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Fleming:

Please reference the "Near-Term Ecosystem Restoration Plan (NTP) for Louisiana Coastal Area (LCA), Louisiana Ecosystem Restoration: Barataria Basin Barrier Shoreline (BBBS) Restoration, Feasibility Study". This study was originally authorized by resolutions adopted by the U.S. House of Representatives and Senate Committees on Public Works, on October 19, 1967, and April 19, 1967, respectively. Those resolutions sought to improve existing hurricane protection features and the ". . . prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and related water resource purposes." The BBBS Restoration Project was identified as a critical near-term restoration project in the NTP of the 2004 LCA Report. This project was recommended for authorization by the Chief of Engineers on January 31, 2005, and was authorized in Title VII of the Water Resources Development Act of 2007.

The U.S. Army Corps of Engineers (Corps) has recently redefined the Tentatively Selected Plan (TSP) to include renourishment of the Caminada Headland. The U.S. Fish and Wildlife Service (Service) provided recommendations on the previously proposed TSP to the Corps in a April 30, 2009, Draft Fish and Wildlife Coordination Act Report. This letter supplements that report and is submitted in accordance with provisions of the Fish and Wildlife Coordination Act (FWCA; 48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and constitutes the report of the Secretary of the Interior as required by Section 2(b) of that Act.

The Service also provided concurrence with the Corps' determination that the previously proposed TSP was not likely to adversely affect the threatened piping plover (*Charadrius melodus*) and its designated critical habitat in a letter dated May 11, 2009. Due to the currently proposed changes to the TSP, the Service also offers the following comments in accordance with provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

A description of the study area and a discussion of the significant fish and wildlife resources (including habitats) that occur within that study area are contained in our April 2009 report. For brevity, that information and discussion is incorporated by reference herein. The renourishment component to the TSP per the 2004 LCA report included near-shore recovery of 2 million cubic yards of sand every 10 years for the Caminada Headland.

TAKE PRIDE IN AMERICA

The new TSP will include renourishment for Caminada through the Corps operations and maintenance dredging of Bayou Lafourche bar channel which yields approximately 500,000 cubic yards of material every 1.5 to 2 years. This material will be placed in the littoral drift south of Bayou Moreau where long shore transport flows both east and west. The material will be placed unconfined between 100 and 300 feet from the top of bank, allowing the long shore transport and wave action to move and place the sediment along the headland. The material will be pumped in an area approximately 13,000 feet in length offshore of the nodal point. The material will be stacked no higher than + 6 feet MLG. Over each 10 year period, an estimated 2 million cubic yards of material will be returned to the headland, replacing 53% of the sediment lost from the headland. Approximately every fifth dredging cycle material will be disposed of west of the Belle Pass jetties; all other features of the plan will remain the same.

Benefit impacts using Wetland Value Assessment (WVA) were previously evaluated on the base plan (without renourishment) for the BBBS project which yielded a total of 572 Average Annual Habitat Units (AAHUs) for both Caminada Headland and Shell Island. The addition of a new component to the base feature would normally require additional benefits analysis. Given the short timeline from the decision to include renourishment to release of the EIS and Feasibility Report for public review, the Service agreed to a modified method applying a proportional loss rate adjustment to the base plan AAHUs. The Service will continue work to revise the WVAs with the additional renourishment component. The new benefits would be used to either validate the adjusted method numbers or if necessary to replace the adjusted benefits with the new WVA numbers prior to the final reports. Project benefits with the previous TSP compared to the future-without project conditions would initially create 2,066 acres and provide 269.1 AAHUs over the 50 year project life for the Caminada Headland. Project benefits on the Caminada Headlands with the revised TSP would increase the total AAHUs to an estimated 417.3 AAHUs and land is expected to remain at the end of the 50 year project life. Together with Shell Island the new total benefits for both Shell Island and the Caminada Headlands is 720.2 AAHUs.

The above described changes in the TSP also constitute a change in the scope and location of certain project features for which the Corps previously consulted with the Service. Potential effects to the piping plover and its critical habitat resulting from the proposed changes in the TSP were not considered in our previous analysis of project-related effects; thus, the Corps should reinitiate ESA consultation for the proposed project changes.

The Service is pleased to see the addition of renourishment to the Caminada portion of the BBBS project and agrees the additional feature would result in greater overall benefits to the project. The Service feels the new TSP with renourishment represents a significant gain in habitat for fish and wildlife resources over the project life. Therefore, the Service believes that the impact analysis and recommendations (presented below) provided in our April 2009, FWCA Report continue to remain valid with the addition of the first recommendation.

1. The Corps should reinitiate ESA consultation with the Service for the proposed renourishment, especially in regards to potential impacts to the piping plover and its critical habitat.

2. The Service, NMFS, and LDWF should be provided an opportunity to review and submit recommendations on future detailed planning reports and the draft plans and specifications on the Barataria Basin Barrier Shoreline Restoration Project addressed in this report.

3. Coordination should continue with the Service and NMFS on detailed contract specifications to avoid and minimize potential impacts to piping plover and their critical habitat, manatees, pallid sturgeon, and sea turtles.

4. Avoid adverse impacts to nesting seabird colonies through careful design project features and timing of construction. For colonies containing nesting gulls, terns, and/or black skimmers, all activity occurring within 650 feet of a rookery should be restricted to the non-nesting period (i.e., September 16 through April 1, exact dates may vary within this window depending on species present). Prior to any such work, surveys should be conducted by qualified personnel during the colonial seabird nesting season to determine the presence and location of any such colonies. In addition, we recommend that on-site contract personnel be informed of the need to identify colonial nesting birds and their nests, and should avoid affecting them during the breeding season.

5. If the proposed project has not been constructed within 1 year or if changes are made to the proposed project, the Corps should re-initiate Endangered Species Act consultation with the Service.

6. The newly created barrier headland/island and back-barrier marsh, as well as the surrounding habitats that may be indirectly benefited by long-shore transport and sediment overwash, should be monitored over the project life for effectiveness and the results should be provided to all resource agencies. Development of those monitoring plans should be coordinated with all natural resource agencies.

7. All containment features should be breached or degraded, if necessary to restore tidal connectivity, once the marsh creation/nourishment areas have at least 80% coverage of emergent vegetation.

7. The Service recommends that Caminada Alternative 5 and Shell Island Alternative 3 be re-analyzed as potential alternatives if: 1) the authorized funding limit is increased for this project, 2) if further planning studies are conducted, or 3) if significant modifications to the project are proposed.

8. During future maintenance events of the Empire Waterway the Corps should determine if the dredged material is suitable for placement on the beach/dune or in a feeder berm to help maintain Shell Island. The results of that determination and the placement of that material should be coordinated with the Service and other natural resource agencies. If suitable that material should be used accordingly.

9. Identification of additional borrow sites should be coordinated with the Service and other natural resource agencies.

Thank you for the opportunity to review this proposed revision to the LCA, Louisiana Ecosystem Restoration: Barataria Basin Barrier Shoreline Restoration, Feasibility Study. If the project scope or design changes, the Service requests that the Corps reinitiate FWCA coordination to ensure that the above recommendations remains valid. If you or your staff has any questions regarding this matter, please have them contact Catherine Breaux (504/862-2689) of this office.

Sincerely,

James F. Boggs
Supervisor
Louisiana Field Office

cc: LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
LA Dept. of Natural Resources (CMD), Baton Rouge, LA
OCPR, Baton Rouge, LA
National Marine Fisheries Service, Baton Rouge, LA
Environmental Protection Agency, Dallas, TX
Natural Resources Conservation Service, Alexandria, LA

LOUISIANA COASTAL AREA
BARATARIA BASIN BARRIER SHORELINE RESTORATION
FINAL CONSTRUCTION REPORT
AND
FINAL ENVIRONMENTAL IMPACT STATEMENT

APPENDIX D
ANNEX G

U.S. Fish and Wildlife Service Cooperating Agency Letter

U.S. Fish and Wildlife Service Scoping / Planning Aid Letter

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

May 9, 2005

Colonel J. Peter Rowan
District Engineer
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Rowan:

The U.S. Fish and Wildlife Service (Service) has received your May 2, 2005, letter, requesting the Service to serve as a cooperating agency in the development of an Environmental Impact Statement (EIS) for the Louisiana Coastal Area (LCA), Louisiana – Caminada Headland and Shell Island Restoration Study.

The Service agrees to assist as a Cooperating Agency, as defined in the National Environmental Policy Act (NEPA) implementing regulations for that study. Our role as a cooperating agency will be limited to: 1) participating in the EIS scoping phase; 2) reviewing the draft and final EIS; 3) providing technical assistance in the development of NEPA documents describing wetland impacts and impacts on federally listed threatened and endangered species (i.e., brown pelican [*Pelecanus occidentalis*], piping plover [*Charadrius melodus*], Gulf sturgeon [*Acipenser oxyrhynchus desotoi*], and West Indian manatee [*Trichechus manatus*]) and their critical habitat; and, 4) providing technical assistance in assessing project impacts on colonial-nesting wading birds and other Federal trust fish and wildlife resources.

We appreciate the opportunity to serve as a cooperating agency. Please contact Mr. Ronny Paille of this office (337/291-3117), if further information is needed.

Sincerely,

Russell C. Watson
Supervisor
Louisiana Field Office

cc: FWS, Arlington, VA [BFA(ERT)]
DOI Office of Environmental Policy and Guidance, Washington, DC
FWS Regional Office, Atlanta, GA

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

June 15, 2005

Dr. William P. Klein, Jr.
CEMVN-PM-RS
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Dr. Klein:

The U.S. Fish and Wildlife Service (Service) has reviewed the May 19, 2005, U.S. Army Corps of Engineers (Corps) Notice of Intent (NOI) to prepare a Draft Environmental Impact Statement (DEIS) for the Louisiana, Caminada Headland and Shell Island Restoration Feasibility Study, Lafourche, Jefferson, and Plaquemines Parishes, Louisiana. The study area is located in the southern end of the Barataria Basin, and includes: 1) the Caminada Headland Reach which encompasses the chenier ridges and marshes south of Louisiana Highway 1 and the barrier shoreline from the Caminada-Moreau Headland, extending from the mouth of Bayou Lafourche to Caminada Pass, and 2) the Shell Island Reach that extends from Grand Bayou pass to the Empire Jetties. That DEIS would analyze the direct and indirect impacts of restoring and/or creating ridges, wetlands, and barrier shoreline in the project area. The Service offers the following comments under provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), and the National Environmental Policy Act (NEPA) of 1969 (83 Stat. 852, as amended; 42 U.S.C. 4321- 4347).

Significant fish and wildlife resources that should be fully considered and addressed in the DEIS include migratory and resident shorebirds, wading birds, waterfowl, neotropical songbirds, threatened and endangered species (and designated critical habitat), estuarine-dependent fishes and shellfishes, and important coastal habitats such as emergent marsh, submerged aquatic vegetation, shallow open-water, beach, dune, maritime forest, and back-barrier marsh.

The proposed project would be located in an area where colonial nesting waterbirds may be present. Colonies that are not currently listed in the database maintained by the Louisiana Department of Wildlife and Fisheries may also occur in the study area. That database is updated primarily by monitoring the colony sites that were previously surveyed during the 1980s. Until a new, comprehensive coast-wide survey is conducted to determine the location of newly-established nesting colonies, we recommend that a qualified biologist inspect the proposed work site for the presence of undocumented nesting colonies during the nesting season.

Federally listed threatened and endangered species and/or their designated critical habitat are currently known to occur within or adjacent to the proposed project area. Those species include the brown pelican (*Pelecanus occidentalis*), the piping plover (*Charadrius melodus*) and its designated critical habitat, the West Indian manatee (*Trichechus* manatus), the Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), and several species of sea turtles.

Federally listed as endangered, brown pelicans are currently known to nest on Raccoon Point on Isles Dernieres, as well as Queen Bess Island, Plover Island (Baptiste Collette), Wine Island, Rabbit Island in Calcasieu Parish, and islands in the Chandeleur chain. Pelicans change nesting sites as habitat changes occur; thus, they may also be found nesting on mud lumps at the mouth of South Pass (Mississippi River Delta) and on small islands in St. Bernard Parish. In spring and summer, nests are built in mangrove trees or other shrubby vegetation, although occasional ground nesting may occur. Brown pelicans feed along the Louisiana coast in shallow estuarine waters, using sand spits and offshore sand bars as rest and roost areas. Major threats to this species include chemical pollutants, colony site erosion, disease, and human disturbance.

Federally listed as threatened, the piping plover, as well as its designated critical habitat, occur along the Louisiana coast. Piping plovers winter in Louisiana, and may be present for 8 to 10 months. They arrive from the breeding grounds as early as late July and remain until late March or April. Piping plovers feed extensively on intertidal beaches, mudflats, sandflats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting. Roosting areas may have debris, detritus, or micro-topographic relief offering refuge to plovers from high winds and cold weather. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed throughout the landscape, because the suitability of a particular site for foraging or roosting is dependant on local weather and tidal conditions. Plovers move among sites as environmental conditions change.

On July 10, 2001, the Service designated critical habitat for wintering piping plovers (Federal Register Volume 66, No. 132). Piping plover designated critical habitat identifies specific areas that are essential to the conservation of the species. The Caminada Headland Reach falls within Unit LA-5 of the designated critical habitat which includes the islands and headlands from Timbalier Island to East Grand Terre Island. The primary constituent elements for piping plover wintering habitat are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support those habitat components. Constituent elements are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), and associated dune systems and flats above annual high tide. Important components (or primary constituent elements) of intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting plovers. Major threats to this species include the loss and degradation of habitat due to development, disturbance by humans and pets, and predation.

Federally listed as endangered, West Indian manatees have been occasionally observed along the

Louisiana Gulf Coast during the summer months. The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. Cold weather and outbreaks of red tide may also adversely affect these animals.

The Gulf sturgeon, federally listed as a threatened species, is an anadromous fish that occurs in many rivers, streams, and estuarine waters along the northern Gulf coast between the Mississippi River and the Suwanee River, Florida. In Louisiana, Gulf sturgeon have been reported at Rigolets Pass, rivers and lakes of the Lake Pontchartrain basin, and adjacent estuarine areas. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Adults and sub-adults may be found in those rivers and streams until November, and in estuarine or marine waters during the remainder of the year. Sturgeon less than two-years-old appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations such as those caused by water control structures that limit and prevent spawning, poor water quality, and over-fishing have negatively affected this species.

On March 19, 2003, the Service and National Oceanic and Atmospheric Administration – National Marine Fisheries Service (NMFS) published a final rule in the Federal Register (Volume 68, No. 53) designating critical habitat for the Gulf sturgeon in Louisiana, Mississippi, Alabama, and Florida. Portions of the Pearl and Bogue Chitto Rivers, Lake Pontchartrain east of the Lake Pontchartrain Causeway, all of Little Lake, The Rigolets, Lake St. Catherine, and Lake Borgne within Louisiana were included in that designation. Although no Gulf sturgeon critical habitat occurs within the project area, Gulf sturgeon may occur in estuarine areas throughout the year.

Endangered and threatened sea turtles forage in the nearshore waters, bays and sounds of Louisiana. The NMFS is responsible for aquatic marine threatened or endangered species. Eric Hawk (727/570-5312) in St. Petersburg, Florida, should be contacted for information concerning these species.

All alternatives investigated in the DEIS should include measures that would avoid or significantly reduce the impacts of the proposed project on fish and wildlife resources, including threatened and endangered species, and their designated critical habitat. The forthcoming DEIS for the proposed project should contain the Corps' biological assessment and determination of whether the proposed alternatives are likely (or not likely) to adversely affect those threatened and endangered species and designated critical habitat listed above.

The Service recommends that all alternatives include measures to reduce the impacts of dredged material disposal to existing emergent marsh and back-barrier marsh and dune habitat, especially those areas supporting seabird and/or wading bird nesting colonies and piping plover critical habitat. We also recommend that the borrow-area impacts to bay and lake bottom habitats near the restoration sites be carefully considered. Significantly increasing depths in those areas could result in: 1) anoxic conditions detrimental to aquatic organisms, 2) increased tidal prism in adjacent marshes, and 3) increased wave erosion of adjacent shorelines. The potential for those impacts should be fully evaluated in the DEIS.

Under the January 22, 2003, Partnership Agreement for Water Resources and Fish and Wildlife, the Corps and the Service have formally committed to work together to conserve, protect, and restore fish and wildlife resources while ensuring the environmental sustainability of our Nation's water resources. Accordingly, the Service would be pleased to serve as a cooperating agency in developing the DEIS and final EIS for the proposed project in accordance with applicable NEPA/Council of Environmental Quality guidance. Our participation would be specifically limited to: 1) participating in meetings and field trips to obtain baseline information on project-area fish and wildlife resources; 2) evaluating the proposed project impacts to wetlands and associated fish and wildlife resources, and assisting in the development of measures to avoid, minimize, and/or compensate for those impacts; and, 3) providing technical assistance in the development of a Biological Assessment, if necessary, describing the impacts of the proposed activity on federally listed threatened or endangered species and/or their critical habitat.

We appreciate the opportunity to assist in the early planning stages of this proposed project and look forward to working closely with Corps in developing and evaluating the forthcoming DEIS. If you need further assistance or have questions regarding our letter, please contact Catherine Grouchy (504/862-2689) of this office.

Sincerely,

Russell C. Watson
Supervisor
Louisiana Field Office

cc: FWS, Washington, D.C. (BFA/ERT)
FWS, Atlanta, GA (AES)
DOI, OEPC, Albuquerque, NM
NMFS, Baton Rouge, LA
EPA, Dallas, TX
LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
LA Dept. of Natural Resources, Coastal Restoration Division, Baton Rouge, LA

LOUISIANA COASTAL AREA
BARATARIA BASIN BARRIER SHORELINE RESTORATION
FINAL CONSTRUCTION REPORT
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FINAL ENVIRONMENTAL IMPACT STATEMENT

PUBLIC COMMENTS AND RESPONSES
APPENDIX E

SUMMARY

This document presents the public's comments and the US Army Corps of Engineers, New Orleans District responses regarding the Louisiana Coastal Area (LCA), Barataria Basin Barrier Shoreline Restoration Integrated Construction Report Draft Environmental Impact Statement. This document also presents comments and responses of the Independent External Peer Review (IEPR), as required by the Water Resources Development Act (WRDA) of 2007, which was conducted to ensure the quality, credibility, and reliability of the scientific and engineering analyses contained within the documents.

In accordance with the National Environmental Policy Act (NEPA) of 1969, the District issued a Notice of Availability (NOA), dated June 23, 2011, inviting public participation to comment on the draft Integrated Construction Report and Draft Environmental Impact Statement for the Barataria Basin Barrier Shoreline Restoration. The US Environmental Protection Agency issued in the *Federal Register* Volume 76, Number 122, page 37112 dated June 24, 2011. The Draft Integrated Report and Draft Environmental Impact Statement were posted on the study web site at http: //www.lca.gov.

Comments on the Integrated Draft Construction Report and Draft Environmental Impact Statement were requested during the 45-day comment period from June 24, 2011, to August 8, 2011. In addition, written comments on the Integrated Draft Construction Report and the Draft Environmental Impact Statement (Draft Integrated Report) were requested by letter postmarked not later than August 8, 2011. Distribution of the Draft Integrated Report for review and comment included mailing the document to Federal, state, and local agencies; Tribes; libraries; and other interested parties. During the public comment period, two public meetings were held. A total of 58 people attended the public hearings with a total of 23 individuals offering oral comments. The District received 17 written comment emails, faxes, and letters postmarked within the comment period. A few of the comments had several attachments.

All substantive comments received on the Draft Integrated Report are included in this report whether or not the comment is thought to merit individual discussion in the text of the Final Integrated Construction Report and Final Environmental Impact Statement.

The oral testimonies were reviewed by the Planning Development Team (PDT) and were considered in the study process, in preparation of the Final Integrated Construction Report and Final Environmental Impact Statement. Salient comments, questions, and concerns expressed in both the written and oral comments were identified. Several comments warranted revisions to the Final Integrated Report. Although no major changes to the document content were warranted or conducted as a result of the public review, revisions to the text included clarifications and inclusion of updated and additional information. None of the changes made to the Final Integrated Report are believed to have any profound effect on the findings and conclusions that were presented in the Draft Integrated Construction Report and Draft Environmental Impact Statement.

All registered comment meeting participants, as well as those providing written comments, will be provided a copy of the Final Integrated Report and Final Environmental Impact Statement. In addition, the Final Integrated Report and Final Environmental Impact Statement will be posted on the study web site at http: //www.lca.gov.

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ACRONYMS AND ABBREVIATIONS

BOMER
BTEP Barataria-Terrebonne Estuary Program
CCA Coastal Conservation Association
CCMP Comprehensive Conservation Management Plan
CFR Code of Federal Regulations
CWPPRA Coastal Wetland Planning, Protection, and Restoration Act
CZM Coastal Zone Management
DEIS Draft Environmental Impact Statement
FEMA Federal Emergency Management Agency
FEIS Final Environmental Impact Statement
GIWW Gulf Intracoastal Waterway
LCA Louisiana Coastal Area
LDNR Louisiana Department of Natural Resources
LDWF Louisiana Department of Wildlife and Fisheries
NEPA National Environmental Policy Act
NGO Non-Government Organization
NMFS National Marine Fisheries Service (Department of Commerce)
NRCS Natural Resources Conservation Service
PDT Project Delivery Team
TSP Tentatively Selected Plan
USACE U.S. Army Corps of Engineers
USDA U.S. Department of Agriculture
USEPA U.S. Environmental Protection Agency
USFWS U.S. Fish and Wildlife Service
WRDA Water Resources Development Act

1.0 INTRODUCTION

The National Environmental Policy Act (NEPA) (40 CFR 1503.1) established The National Environmental Policy Act (NEPA) (40 CFR 1503.1) established a nationwide policy that after preparing a draft environmental impact statement (EIS) and before preparing a final EIS the agency shall:

- Obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved or which is authorized to develop and enforce environmental standards.
- Request the comments of:
    - Appropriate state and local agencies which are authorized to develop and enforce environmental standards;
    - Indian tribes, when the effects may be on a reservation; and
    - Any agency which has requested that it receive statements on actions of the kind proposed.
- Request comments from the public, affirmatively soliciting comments from those persons or organizations who may be interested or affected.

An agency may request comments on a final environmental impact statement before the decision is finally made. In any case, other agencies or persons may make comments before the final decision unless a different time is provided under Sec. 1506.10.

This document describes the public comments and the District's responses regarding the Draft Integrated Construction Report and Draft Environmental Impact Statement for the Louisiana Coastal Area, Barataria Basin Barrier Shoreline Restoration. In accordance with NEPA, the USEPA issued in the Federal Register Volume 76, Number 122, page 37112 dated June 24, 2011, a Notice of Availability inviting public participation to comment on the Draft Integrated Construction Report and Draft Environmental Impact Statement for the Louisiana Coastal Area, Barataria Basin Barrier Shoreline Restoration. The 45-day comment period for accepting written comments extended from June 24, 2011, to August 8, 2011. Distribution of the DPEIS for review and comment included mailing the document to Federal, state and local agencies, Tribes, and other interested parties. The full distribution mailing list is available from the USACE, New Orleans District upon request. Copies of the Draft Integrated Report were mailed to the following public libraries.

News releases announcing public hearings were distributed via VOCUS to 240 media outlets. News Release and Calendar Event were posted to www.lca.gov and www.mvn.usace.army.mil, as well as a post on MVN Facebook page. Ads for meetings placed in the following newspapers: Baton Rouge Advocate, Daily Comet, Plaquemines Gazette, and the Times-Picayune. Emails, with meeting notifications, were sent to non-governmental organizations (NGOs) that are actively involved in coastal restoration. Public hearings were also coordinated with Plaquemines Parish and Lafourche Parish President's Office and Coastal Zone Managers.

As an additional measure for providing public access to the document, the District made the DPEIS available for view and downloading from the world wide web at: http://www.lca.gov. No reports of user difficulty were reported to the webmaster for the site. The dates, locations and attendance of the public meetings are listed in Table 2. Nine public meetings were conducted by the USACE in July 2011. The meetings provided a forum for public expression of verbal statements regarding the proposed action and the content of findings of the Draft Integrated Construction Report and Draft Environmental Impact Statement. Each meeting also provided an opportunity for attendees to ask questions of USACE representatives regarding the Barataria Basin Barrier Shoreline Restoration Study.

Table 1. Public Hearings Information		
Date	Location	Attendees
July 26, 2011	Woodland Plantation 21997 Hwy 23, Port Sulphur, LA 70083	XX attendees signed in; 5 individuals offered comments
July 28, 2011	South Lafourche High School 16911 East Main St, Galliano, LA 70354	XX attendees signed in; 18 individuals offered comments

A court reporter recorded (using stenography and tape recorder) each of the public meetings and provided USACE with a written transcript of each meeting record. Those transcripts were summarized into meeting minutes. The comments taken from the minutes for each public meeting with USACE responses are provided in sections 2.1 through 2.2.

The public meetings format included an Open House from 6:00 to 6:30 pm where general information about the proposed Barataria Basin Barrier Shoreline Restoration effort and process was provided. From 6:30 to 7:00 pm, an overview of the proposed LCA Barataria Basin Barrier Shoreline Restoration Plan was presented. This was followed by a question and answer session. From about 7:30 pm until completion of the meeting, formal public comments on the Draft Integrated Report were received. The hearings provided a forum for public expression of verbal statements regarding the proposed action and the content and the findings of the Draft Integrated Construction Report and Draft Environmental Impact Statement for the Louisiana Coastal Area, Barataria Basin Barrier Shoreline Restoration. Provisions were also made so that comments could be written on comment cards and provided to the USACE during or following the meeting. A total of 23 meeting attendees provided verbal comments at the two public meetings.

Written comments on the Draft Integrated Report were requested by letter to be postmarked not later than August 8, 2011. A total of 17 comment letters, some with several attachments, were received by letter postmarked by the close of the comment period. A few comments were emailed, hand delivered, and/or faxed.

The NEPA also provides guidance (40 CFR 1503.4) on responding to comments. An agency preparing a FEIS shall assess and consider comments both individually and collectively, and shall respond by one or more of the means listed below, stating its response in the final statement. Possible responses are to:

- Modify alternatives including the proposed action.
- Develop and evaluate alternatives not previously given serious consideration by the agency.
- Supplement, improve, or modify its analyses.
- Make factual corrections.
- Explain why the comments do not warrant further agency response, citing the sources, authorities, or reasons which support the agency's position and, if appropriate, indicate those circumstances which would trigger agency reappraisal or further response.

All substantive comments received on the Draft Integrated Report are included in this report whether or not the comment is thought to merit individual discussion in the text of the statement. The oral testimonies and letters were reviewed by the LCA PDT and considered both in the study process and in preparation of the Final Integrated Report. Salient comments, questions and concerns were identified. Several comments warranted revision to the Draft Integrated Report in order to complete the Final Integrated Report. Although no major changes to the document content were warranted or conducted as a result of the public review, revisions to the text included minor clarifications and inclusions of updated and additional information. None

of these changes that were made to the text are believed to have any profound effect on the findings and conclusions that were presented in the Draft Integrated Report. All registered comment meeting participants, as well as those providing written comments, will be provided a copy of the Final Integrated PEIS. In addition, the Final Integrated Report will be posted on the study web site located at http://www.LCA.gov.

Verbal and written comments and USACE responses are presented in sections 2.0 and 3.0, respectively.

2.0 PUBLIC HEARING COMMENTS ON THE DRAFT INTEGRATED CONSTRUCTION REPORT AND DRAFT EIS

This section contains the oral comments and responses received at the two public meetings held for the Draft Integrated Construction Report and Draft Environmental Impact Statement for the proposed Louisiana Coastal Area, Barataria Basin Barrier Shoreline Restoration. Public hearings were held on July 26, 2011, at Woodland Plantation, 21997 Hwy 23, Port Sulphur, LA 70083; and on July 28, 2011, at South Lafourche High School, 16911 East Main St, Galliano, LA 70354.

The following five individuals provided comments on the Integrated Draft Construction Report and Draft EIS at the Woodland Plantation public hearing on July 26, 2011. A copy of the transcript of each comment and the USACE response is presented in Section 2.1.

Ms Marnie Winter
Mr. P.J. Hahn
Mr. Foster Creppel
Mr. Scott Eustis
Mr Larry Rousselle

The following individuals provided comments on the Integrated Draft Construction Report and Draft EIS at the South Lafourche High School public hearing on July 28, 2011. A copy of the transcript of each comment and the USACE response is presented in Section 2.2.

Mr. Rickey Cheramie
Mr. Nick Cheramie
Mr. Lorraine
Mr. Rodney Ducet
Ms Cathy Norman
Mr. Curtis Cotillion
Mr. Greg St. Amant
Mr. Rickey Plaisance
Mr. Adomitis
Mr. Gus Adomitis
Mr. Jerry Gisclair
Mr. Harry Gisclair
Mr. Jimmy Cantrelle
Ms Cathy Norman
Ms Margaret Curole
Mr. Wayne Martin
Mr. Adomitis
Mr. Jack Rodrigue
Mr. Dick Cheramie
Mr. Caillouet
Mr. Kevin Curole

2.1 Oral Comments from Public Hearing on July 26, 2011 at Woodland Plantation, 21997 Hwy 23, Port Sulphur, LA 70083

Marnie Winter (MW)

Marnie Winter, Jefferson Parish. We support both projects. We think they are great projects, much needed projects. We thank the Corps and the state for the study, and we urge that you move to the final and get it to congress and the President as soon as possible so we get funding. Thank you.	**RESPONSE** **MW 01:** Thank you for your comment.

1073

P.J. Hahn (PJH)

P.J. Hahn, representing Plaquemines Parish, and we, too, support this project very much, and we hope that we can get the funding to keep this thing going further into the construction phase because it means a lot to the marsh, the levees that the marsh protects, and so we are definitely in favor of this project and we think it's a wonderful project. Thank you.	**RESPONSE** **PJH 01:** Thank you for your comment.

Foster Creppel (FC)

I am Foster Creppel, and I completely approve and support this project as well. I think it's a wonderful project and if we can get the support and the money to go forward with it it will help us a lot in wetland restoration in the future.	**RESPONSE** **FC 01:** Thank you for your comment.

Scott Eustis (SE)

My name is Scott Eustis from the Gulf Restoration Network, and we fully support this project as a lines -- a line of defense, the first line of defense for coastal Louisiana. We will submit some language on hopefully advancing job creation within the area, but we support this project and we support allocating earlier restoration, moneys for this project as well as the future -- any futric [sp] in water I could find.	**RESPONSE** **SE 01:** Thank you for your comment.

1079

Larry Rousselle (LR)

My name is Larry Rousselle. I'm the Chairman of Plaquemines Water Conservation District for Plaquemines. I firmly support this project, but the only thing is it's 40 years too late.

UNIDENTIFIED AUDIENCE MEMBER:
Never too late.

RESPONSE

LR 01: Thank you for your comment.

1077

2.2 Oral Comments from Public Hearing on July 28, 2011 at and on July 28, 2011, at South Lafourche High School, 16911 East Main St, Galliano, LA 70354.

Rickey Cheramie (RC)

Rickey Cheramie, Sonth Lafourche Beachfront Development District Chairman. Many of the people in the audience here have heard the age-old question "If a trec falls in the forest and nobody is there to hear it fall, does it make any sound at all?" Well, I'm going to compare the development to that and say if we build this big, beautiful, white-sand beach with tax payers' dollars and nobody can get to it and see if and enjoy it, will it even exist? I've been authorized by my board to -- well, before I get into that, let he thank you all for coning here tonight. We really appreciate y'all coming down here. We appreciate the interest in our area, and it's not often that we get some of our tax dollars back, so it's really nice to see that finally this area will be treated, you know, this way. And again, I want to thank y'all for making the trip down here. For years and years and years the beach was open with unrestricted access to the beach. People would go down to the beach, drive on the beach, crab, fish scrimp. It became part of our culture, and you see the interest here tonight. If it wouldn't have been the first night of Tarpon Rodeo, you probably would have triple the people in here because so many people contacted me and said "Man, I want to go, bnt I've got a party tonight," or "I've got a business on Grand Isle" or a business in Leesville and it's their bnsiest time of the year. So it's kind of a bad night to have it, but I'm really impressed with the amount of people that showed up. My board anthorized me to request that y'all consider not limiting public access to the beach and also that y'all make attempts to acquire the property. We with the Beachfront Commission have tried. We've negotiated for three years with the landowners, and we've had limited success with one landowner and no success at all with the other landowner. So it's going to be a very difficult process getting the people on the beach once this big, beautiful area is open. So if we can get y'all to consider, you know, acquisition of the property through -- whether it be the State or the Corps. I don't guess the Corps can. Maybe the Federal Government can, bnt that's what we're going to ask that y'all do for us. And those are my comments. Thank you.

RESPONSE

RC 01: Real estate-- The Barataria Basin Barrier Shoreline Restoration study is authorized as an ecosystem restoration project. The purpose of a Civil Works ecosystem restoration project is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Protection may be included as part of Civil Works ecosystem restoration initiatives when such measures involve efforts to prevent future degradation of an ecosystem's structure and functions. The Government has the obligation to acquire sufficient real estate interests to construct the project and to protect the integrity of the project features. In order to ensure protection of project features, Corps of Engineers regulations indicate that fee title should be acquired for ecosystem restoration projects unless such protection can be accomplished through the acquisition of a lesser interest estate. At this time, a final decision has not been made as to whether fee interest or a permanent easement will be acquired for this project. However, regardless of which estate is acquired, the primary acquisition goal is to protect the project features. The possibility for public access to the project site will depend upon which real estate interest is acquired and will be dictated by State and Federal laws as they relate to ecosystem restoration projects. Any activity that could be allowed would have to be consistent with the project authorization and function.

Recreation --Recreation facilities may be authorized at water resources projects under authority of Section 4 of the Flood Control Act of 1944, as amended. Recreation features may be developed at ecosystem restoration projects if they are appropriate in scope and scale to the opportunity provided by the ecosystem restoration projects. The recreation shonld be compatible with the ecosystem restoration purpose of the project, but also enhance the visitation experience by taking advantage of the natural values. The social, cultural, scientific and educational values should be considered within the framework of the ecosystem restoration project purpose. For example, while educational valnes, i.e., nature study and interpretive signs, can be an integral part of ecosystem restoration projects, this does not mean it is appropriate to build recreation/visitor facilities that overwhelm the natural values.

1079

Rickey Cheramie (RC)

RESPONSE

RC 01 (continued): The recreation experience should build upon the ecosystem restoration objective and take advantage of the restored resources rather than distract from them. Standard designs should be consistent with the natural environment of the surrounding area and should not include embellishments such as decorative stone work planters, elaborate designs or be ostentatious. Recreation development at ecosystem restoration projects should take advantage of the education and recreation potential that the project is creating while not diminishing the ecosystem restoration purpose. The following excerpt is from the Corps' Principles and Guidelines Engineering Regulation (ER) 1105-2-100, Section VII and Recreation and Policy Guidance Letter No. 59, Recreation Development at Ecosystem Projects, CECW-AG, 11 June 1998: "Recreation development at an ecosystem restoration project should be totally ancillary. Recreation facilities may be added to take advantage of the education and recreation potential of the ecosystem project, but the project cannot be specifically formulated for a recreation purpose. The recreation potential may be satisfied only to the extent that recreation does not diminish the ecosystem restoration purpose. Where an ecosystem restoration project provides critical habitat for a federally listed threatened or endangered species, recreation facilities at that project should be precluded in the critical habitat and limited to only those facilities needed for minimum health and safety and/or natural resources interpretation. Where appropriate, recreation at ecosystem restoration projects should be designed for day use only, precluding the need of extensive night lighting. Whenever conflicts occur between the ecosystem restoration purpose and recreation, ecosystem restoration shall have priority. Plans should seek to optimize public use in harmony with the objectives of the restoration project over the period of analysis. Without a non-Federal sponsor to cost share recreation, ecosystem restoration projects should not encourage public use." The development of facilities for access, health and safety should not involve extensive structural modification of the terrain and may include rest areas and picnic facilities. Ideally these facilities would be a part of a larger non-Corps recreation plan such as a regional trail system or provide access to other non-Federal recreation facilities or areas.

1080

Rickey Cheramie (RC)

RESPONSE

RC 01 (continued): The Corps presents a limited checklist of recreation facilities that may be cost-shared, at new Corps ecosystem restoration projects, or that may be constructed by others at non-Federal expense at ecosystem projects. This check list may be fonnd in ER 1105-2-100, Appendix E, Exhibit E-3, and includes access and circulation, shelters and bathrooms, utilities, park furniture, interpretive signage and health and safety features (gates, cattle guards, fencing, entrance station, etc.)."

1081

Nick Cheramie (NC)

My name is Nick Cheramie. I own Fourchon Beachside RV Park. It's right in the foot of the Port Commission's Bridge, and I'm owner and operator. My wife and I do 100 percent of the maintenance on it, you know, that's allowable by law. And in the summertime, I bring my kids with me to my park and every time I bring my kids to the park, it's within a half of a mile to the beach and they ask to go the to beach and I got to tell me no. I don't lie to my kids when they ask me why they can't go on the beach. I tell them because of two greedy landowners. Period. Because I'm not going to lie to my kids. And this kid wants to go swimming on that beach. He wants to go fishing and crabbing on that beach, and he can't. And any landowner that can just decide that this kid doesn't have the right to be on that beach shouldn't even be belt with. You should just take their land and give us access. And that's pretty much all I have to say. And, I mean, I think the public needs to be on that beach. If our tax dollars are going to build it, I don't think it should even be an option that we're not allowed.

RESPONSE

NC 01: Thank you for your comment. Please see response under Rickey Cheramie (RC 01) on previous pages.

1082

Mr. Lorraine (ML)

I just want to give a background of the whole situation with the Parish and the Port Commission and the landowners. I won't be long. I want to thank the Corps for giving the people the opportunity to speak on this issues. As I said, this is probably one of the biggest projects that ever hit Lafourche. I'm 58 years old, and I can remember when I was a kid when I used to go to the beach and get on the seashore and do crabbing and fishing and swimming and it was an enjoyment for us. This is the culture. This is our culture and this is extremely important for this parish because you can get a lot of revenue if we have public access to that beach. You have two landowners to work with: The Caillouet Land Company and the Wisner Foundation. Five years ago, the Lafourche Parish Council created a Beachfront Commission and it was done through the council. The State allows you to do it. Okay? They had meetings with the Caillouets and the Wisners and they drew up long-range plans at their meetings and presented it to the two landowners. The Wisners are a lot easier to work with than the Caillouets. Whether they like it or not, that's what it is. And it's getting to the point where the Wisners are not working as good as they used to.

This is what the Comuission done: The Wisners let us use the beach in the summertime a few times. Unfortunately, we got hit by the oil spill and that killed everything for this year, but they did let us use a section of the beach on the west side. So the Port Commission policed the beach for the Commission at no expense to the landowners. They policed it, and let me tell you, I think there was only one that went on those dunes and tore them up and they caught them and they threw them out and they never went back and the people listened. The prisoners every Monday went there and cleaned that beach. The Port Commission put the liability insurance to use for the landowners. The Commission itself put a dumpster and put a port-o-let. Now, let me tell you, this is what the Port Commission got done over the years since I've been a kid: They're the ones that established the barges and the rocks. When you get to end of the beach and you see them barges and rocks, protected a lot of this land. They did that. They poured the cement pillars to protect the land. They filled in the old Fourchon Pass with permission from the State.

RESPONSE

ML 01: Please see response under Rickey Cheramie (RC 01) on previous pages.

1083

Mr. Lorraine (ML) (continued)

The pass to get to the Gulf was once right there where Chevron -- by that bridge to the right side, not where it's at today. They filled that in, and that's still State property. And I think the landowners are trying to claim it, but that's another story for another day. The Lafourche Parish Council paved the road along with Chevron. I told you that a while ago, 160,000, each 80,000. We have a 2,500 foot right-of-way that was done in 1971. I don't have a copy with me, but I'll get you one. I couldn't find it in my coat boxes.

The landowners done very little. What I just told you was done over the years, and I never seen the landowners do too much so that's a concern to me. And I believe in the nesting of the birds. You can always rope that off or block it and not let people go or whatever. I would like to see the Corps -- of course, she said they couldn't do it -- acquire the property from the landowners for recreation purposes. And also I would like to thank you, the Corps, and everybody that was involved and all of the people that came in from the public, thank yon for coming and God bless you and God bless America.

RESPONSE

ML 01 (continued): Please see response under Rickey Cheramie (RC 01) on previous pages.

ML 02: The CEMVN will ensure compliance with the Migratory Bird Treaty Act of 1918, as amended (MBTA). The MBTA, which provides protections for all colonial nesting wading and water birds, prohibits "Take" of these species. "Take" is defined as "means to pursue, hunt, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 CFR 10.12). The FWS provided the following guidance for advising the public on the MBTA as it relates to migratory bird nest destruction. "…while destruction of nests independently are not prohibited under the MBTA, harassment or nest destruction which results in the unpermitted take of migratory birds or their egg's, is illegal and fully prosecutable under the MBTA. Due to the biological and behavioral characteristics of some migratory bird species, destruction of their nests entails an elevated degree of risk of violating the MBTA. For example, colonial nesting birds are highly vulnerable to disturbance; the destruction of unoccupied nest during or near the nesting season could result in a significant level of take." USFWS Migratory Bird Permit Memorandum, 15 Apr 2003). In addition to the MBTA, the Endangered Species Act of 1973, as amended (ESA), provides protection for the piping plover and its critical habitat, which is a wintering resident of Louisiana. Protected critical habitat (unit LA 5) stretches from Timbalier Island to East Grand Terre Island. This habitat encompasses 2,321 ha(5,735 ac) of the beach habitat in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes. Under the provisions of the ESA, it is unlawful to "take" a threatened and endangered species. "Take" is defined as "to harass, harm, pursue, hunt, shoot, wound kill, trap, capture, or collect or attempt to engage in any such conduct." Excessive vehicular or pedestrian usage of protected areas, can cause piping plovers to spend less time roosting or foraging and more time in alert postures or fleeing from the disturbances.
-------See continued response on following page.

ML 03: Please see response under Rickey Cheramie (RC 01) on previous pages.

1084

Mr. Lorraine (ML) (continued)

	RESPONSE **ML 02 (continued):** Off-road vehicles, used to access beaches, can significantly degrade the piping plover's habitat or disrupt the birds' normal behavior patterns (Zonick 2000). Finally, Executive Order 13186 of 2001(Responsibilities of Federal Agencies to Protect Migratory Birds) requires that actions of Federal agencies be designed to avoid and minimize impacts to migratory birds. The BBBS project, has been developed to ensure that it is in compliance with the before mentioned statutes and executive orders.

1085

Rodney Doucet (RD)

I have something to say. First of all, it's going to be a comment. Rodney Doucet, Lafourche Parish Councilman, District 8. The first thing I have to say is, I think it's very rewarding to see that the Corps and the Federal Government and the State wants to come here and do this project for Caminada Headland because they realize the value of Port Fourchon. Are y'all aware of that? All of a sudden now, wait a minute, we need to protect this revenue engine that builds this country at Belle Pass. We need to do something to protect it because we're going to wind up losing it. So I don't know if you realize that, but that's what I just saw and that's what I'm hearing here. And I just really cannot see the emphasis of putting this much money and not letting public access. I just can't see it because it's public tax dollars that's doing this. And, look, the Federal Government should be funding this completely to protect that engine, and I really think that one day when this engine closes off the valve for about two weeks, that this country will say "What do you want, Louisiana? What do you want? Because we'll give you everything you want because you need to open the engine and open the valve." And my comment is, I want the Federal Government to realize this economic engine because I think they felt it with the moratorium. But really, the beach should be open to every person in the United States, not just this community because it is their money rebuilding it back. And that's what I have to say.

RESPONSE

RD 01: The importance of Port Fourchon and its facilities in relation to the rest of the nation is addressed in Section 4.19.3 of the main report. Although this project is an ecosystem restoration project and not a hurricane protection or flood risk reduction project, there will be impacts to infrastructure as well as to oil, gas, and mineral. Pertaining to Port Fourchon there will be both indirect and cumulative impacts, and these impacts are noted in sections 5.15.2.3.2, 5.15.2.3.3, 5.15.7.3.2, and 5.15.7.4.2.

The Barataria Basin Barrier Shoreline Restoration study is authorized as an ecosystem restoration project. The purpose of a Civil Works ecosystem restoration project is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Protection may be included as part of Civil Works ecosystem restoration initiatives when such measures involve efforts to prevent future degradation of an ecosystem's structure and functions. The Government has the obligation to acquire sufficient real estate interests to construct the project and to protect the integrity of the project features. In order to ensure protection of project features, Corps of Engineers regulations indicate that fee title should be acquired for ecosystem restoration projects unless such protection can be accomplished through the acquisition of a lesser interest estate. At this time, a final decision has not been made as to whether fee interest or a permanent easement will be acquired for this project. However, regardless of which estate is acquired, the primary acquisition goal is to protect the project features. Any activity that could be allowed would have to be consistent with the project authorization and function. The possibility for public access to the project site will depend upon which real estate interest is acquired and will be dictated by State and Federal laws as they relate to ecosystem restoration projects.

1089

Cathy Norman (CN)

I'm Cathy Norman. I represent the Edward Wisner Donation, and I just want to clarify a few points. We have never denied access to this beach until a year ago with the oil spill hit and it has been closed since that time for public safety reasons and for public health reasons. And we continue to encourage people to stay off the beach. It's dangerous. There's still work going on to clean up after the spill. Prior to that, we have never denied access. Ever. We've denied vehicular access, which is what this group is interested in, uot just access. At no time there has ever been a time when we've told people they couldn't go down to the beach.	**RESPONSE** **CN 01:** Thank you for your comment.

1087

Curtis Cotillion (CC)

My name is Curtis Cotillion from Raceland. I don't live down here. I went to Lafourche maybe twice in my whole life. My concern is, we get this Federal money, I'm not worried about recreation. I'm worried about flood protection for the parish. I'm not for Wisner. I'm not for Caillouet. I'm not for -- I'm for the recreation. I would love to see kids have their recreation on the beach, but we're losing our site here. Sixty years ago, that's the island that protected us from flooding with these hurricanes. Without rebuilding these islands, we won't have nothing. These beautiful levees we have in this State, the Gulf waves will be slapping against it in 20 more years because we need these islands build for coastal restoration. That's the main point of spending this Federal money. Thank you.

RESPONSE

CC 01: Thank you for your comment. The Barataria Basin Barrier Shoreline Restoration study is authorized as an ecosystem restoration project. The purpose of a Civil Works ecosystem restoration project is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Hurricane and flood risk damage (e.g., "protection") may be included as part of Civil Works ecosystem restoration initiatives when such measures involve efforts to prevent future degradation of an ecosystem's structure and functions.

1088

Greg St. Amant (GSA)

Greg St. Amant. I'm just a citizen. I've used the beach all of my life. I went fish, I went crabbing, the whole works, and I appreciate whoever owned the property for letting us use that property. In my opinion, a boundary needs to be set. You have to have a solid boundary. I own property and I let people use 30 feet of my property for many, many years. Well, now, I need my 30 feet, and I'm making my own recreational area for me and for people to use and for my business. I don't expect those people to say "You have always let us use this, so let us still use it." It's mine. What's mine is mine, and what's theirs is theirs, but if you set the boundary and you decide what is that land boundary before that is added in, like you say, before that -- it's not the object of a beach. We're not making a beach. We're making a protection. We're making the estuaries better. We're bringing in land. I don't consider it just being a beach. I would love to be able to use it, but where are those boundaries? I need to know where those boundaries are. And if that boundary is here and you add 20 feet, then that should be State property and we should be allowed to get onto it. If that's State boundary and that boundary says, no, that 20 feet you're adding is still going to be part of their boundary, that's where their boundary was, then fine with that too. I'm good with that also. As long as I know that this actually belonged to them. A friend of mine in Donaldsonville, he built this house right over his land. Okay? They turned around and said "That is not your land." The boundary 20 feet first further inside than what you built your house over. He said, "I didn't know that." Well, you need to know where your boundary is. His house was cut off and not a dime was given to him to redirect that water down here. And he's rebuilding that other portion of his house right now. He did not know his boundary and the State said, "It is not yours. It is ours." Same thing here, what is the Wisner or the Caillouet boundary? That's what I want to know. And if we add 20 feet and it's theirs, well, let's make it theirs. And if they let us use it, let's make a deal. If it's that valuable to us, we need to buy it. And if they ask an outrageous price, they got $15,000 an acre in North Louisiana for gas rights, 160 acres, people became millionaires overnight. Do we say, "That's not right. That was under the ground. That's ours"? No, it's not. If it's under the water, if it's theirs and it's under the water, it's still theirs. If it's under water and it's ours, it's ours. Set the boundaries.

RESPONSE

GSA 01: Thank you for your comment. The Corps cannot make a determination on what the State's position is on an exact boundary line between its waters aud private lands. Please refer to Louisiana statutory provisions La. C.C. Art 451 (definition of seashore); La. R.S. 41:1136 (official determination of boundary); and La. R.S. 41:1702 (reclamation of lands lost through erosion, compaction, subsidence, and sea level rise) which may address your commeut.

1089

Rickey Plaisance (RP)

My name is Rickey Plaisance. We all liked going to the beach and all and we got to preserve all of that, but unless we let some freshwater come and feed the whole system and all of the marsh dies, the beach ain't going to do us no good because everything is else going to be dead around us. We going to let some water come down aud feed the marsh. That's it.

RESPONSE

RP 01: Thank you for your comment. The existing Davis Pond Freshwater Diversion and the ongoing, proposed LCA Medium Diversion at Myrtle Grove with Dedicated Dredging, and the LCA Small Bayou Lafourche Reintroduction studies, if implemented, would address freshwater introduction into the region.

1090

Mr. Adomitis (MA)

I just have a couple of comments. I enjoyed some of the things like the Wisner Foundation because I do use the Wisner Wildlife Mansion area and have for years and Fourchon Beach and hope y'all stay open-minded and work with us so we can continue to use it and appreciate it and thank you for all of the good times I had before.	**RESPONSE** **MA 01:** Thank you for your comment.

1091

Gus Adomitis (GA)

Gus Adomitis from Golden Meadow. In regard to what the lady said about the construction and put it to Bayou Lafourche, which is going to be more nutrient rich and, like you said, about 25 percent sand and putting it offshore off the beach, all of the particular matter is going to just be washed away and is not going to serve anything, maybe just send it to the west. Keep in mind, you may want to consider putting that behind on the north part of the beach and put those nutrients through the rain and the water flow seep into the marsh and you get a total recovery of what you put there in expenses. You can't afford it from Ship Shoal where you might have 75 percent sand, triple the amount, you get to utilize all of the nutrients, all of the sand and it will be where it's not going to get wasted. I know from East Timbalier Island, which after Hurricane Andrew hit, what was called the Penthouse, they could have gone in there with two barges and excavators, pushed rock from the end, blocked off about a 50-yard gap from the north side and about a 100-yard gap on the south side. They didn't do that. The Corps of Engineers and the State let a gem disappear. It could have been real cheap to take care of it. Now, we have nothing. What comes out of there is sand on the tide and drew from between the rocks. It went into the Gulf never to be recovered again because it's deeper, just as she was saying. They dump that sand in and all of that particular matter out there, it's not going to make a difference. And then you about only 25 percent. Put that part of it to the bank and get the nutrients in the sand. Whenever the tide would go in, what little bit of sand is a slower flow, it could get the positive on the north part of Timbalier Island. So we did get some usage of it. Anything that went south of the tide had zero impact. It was just a total loss, and then all of the rocks sunk because of that. But that might help you on that part. Don't pump it out there on the Gulf. It's not going to benefit the beach at all.

RESPONSE

GA 01: The models utilized were STWAVE and GENESIS and they were applied to an array of current data from recent studies and 19 years of hindcast wave data from the nearest WIS buoy. The mean size of the material dredged from Belle Pass is 0.06 mm, which is fine sediment. In contrast, the Ship Shoal material that will be placed on the Headland by the Barataria Basin Barrier Shoreline Restoration Project has a mean grain size of 0.18 mm, which is fine sand. The historical dredging records provided by the U.S. Army Corps of Engineers indicate that the average volume of the maintenance dredging events is 620,000 cubic yards. Considering cross-shore and long-shore winnowing of this volume yields a final fill volume of 135,000 cubic yards. Placing this material along 6,800 feet of shoreline at the nodal point will result in shoreline advancement of 125 feet. If that renourishment is repeated on a two-year cycle the modeling predicted that over 40,000 feet of Headland beach will benefit by the end of the 50-year period of analysis. It should be remembered that the initial restoration will place coarser sediment (Ship Shoal sand) over the existing beach and that normal coastal processes, including post-construction equilibration/profile adjustment, will transport some of that sand laterally into Belle Pass. Depending upon the Pass maintenance dredging interval and the strength of the longshore transport, the sediment placed in the feeder beach template each renourishment event will be a blend of finer and coarser sediments, which will evolve and become coarser over time. The majority of that sediment is native beach sand and silt that has been carried into Belle Pass by wave action, littoral drift, and overwash. Maintenance dredging has hitherto placed it on the shoreline to the west of the Pass. This Project proposes to place that material along the Headland shoreline from the Mean High Water Line to a depth of 2 to 3 meters, which is still very much a part of the active beach system, which means it is not lost offshore and whatever nutrient value it has is retained in the system. It is important to understand that one of the goals of the agencies involved in the Louisiana Coastal Area projects is cost-effectiveness. Re-use of Belle Pass dredged material to enhance the longevity of the Headland restoration is much more cost-effective than mining additional sand from Ship Shoal and transporting it a long distance to the Caminada Headland.

1092

Gus Adomitis (GA)

RESPONSE

GA 01 (continued): As to the concern about the need for continued placement of dredged material on the beach to the west of Belle Pass, that area is the subject of an active Coastal Wetlands Planning, Protection, and Restoration Act project, the West Belle Pass Barrier Headland Restoration (TE-52), which proposes to restore about 9,300 feet of beach/dune and about 150 acres of marsh by placement of about 2 million cubic yards of sand and 1 million cubic yards of marsh-compatible sediment.

1093

Jerry Gisclair (JG)

Jerry Gisclair, private citizen and a State representative, District 54. Whenever a levee district constructs a levee system for the protection of the people, they actually buy the land and the landowners normally retain all royalties and perpetuity. I feel that this Headland project is going to be obviously a levee system or protection system for an estuary system on the inside, but also protecting Port Fourchon. If we're going to develop this levee system, this Headland project, I think that the State should own the property. I want to protect the landowners' rights as far as their royalties are concerned, but we are going to have to continuously improve on the system in decades to come, and I think the State needs to own this property versus allowing the landowners to have this big improvement at tax payers' expenses. And also, public access. I did my own fishing with my family in the Gulf from Elmer's Island all the way to Belle Pass, and it would be a shame not to have access for the public. Thank you.

RESPONSE

JG 01: The LCA BBBS study is authorized as an ecosystem restoration project. The purpose of a Civil Works ecosystem restoration project is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Protection may be included as part of Civil Works ecosystem restoration initiatives when such measures involve efforts to prevent future degradation of an ecosystem's structure and functions. The Government has the obligation to acquire sufficient real estate interests to construct the project and to protect the integrity of the project features. In order to ensure protection of project features, Corps of Engineers regulations indicate that fee title should be acquired for ecosystem restoration projects unless such protection can be accomplished through the acquisition of a lesser interest estate. At this time, a final decision has not been made as to whether fee interest or a permanent easement will be acquired for this project. However, regardless of which estate is acquired, the primary acquisition goal is to protect the project features. Any activity that could be allowed would have to be consistent with the project authorization and function. The possibility for public access to the project site will depend upon which real estate interest is acquired and will be dictated by State and Federal laws as they relate to ecosystem restoration projects.

1094

Harry Gisclair (HG)

Harry Gisclair, concerned citizen and member of the Greater Lafourche Port Commission. Danny has more or less said what the Port has done and we plan on doing more, but tonight, I'm talking as a concerned citizen and, actually, I'm just one of nine members on the board. Recreation is a necessity as far as I'm concerned in that area. It's a heritage. It's been there. I don't have any use for vandals or people who tear up private property, but at the same time, I think we need recreation in that area. I would also like to -- and I'm sure Rickey would -- put in written comments of what the Beachfront Development has as far as their goals, objectives and their future plans. They have it mapped out. It's written down, and I wish you would take that into consideration. And since the State is going to start their project first, the way it looked, that hopefully on a State level that we look at either a right-of-way, easement or purchase property in that area to assure recreation in that area. Secondly, in written comments, due to the Greater Lafourche Port Commission, I'm sure that I will make sure that you have all of the statistics on Port Fourchon with the percentages of natural gas imported and domestic oil coming through that oil corridor and the importance it is to the State of Louisiana and the United States of America because everything is coming through there, 50 percent. I will see that I get that done at their request and give that to you. And, Charlotte -- I don't know if she's still here, but the State does recognize in putting that 70 and 70, the 140 million dollars, the importance of Port Fourchon, and I hope the Federal Government at the same time recognizes by looking at the statistics and what's coming through there the importance of Port Fourchon and the importance of not only putting a barrier restoring our shoreline, but at the same time, it protects that economic engine that's running there. And at the same time, please, again, I ask you to recognize a recreation access to that area. Thank you.

RESPONSE

HG 01: The importance of Port Fourchon and its facilities in relation to the rest of the nation is addressed in Section 4.19.3 of the main report. Although this project is an ecosystem restoration project and not a hurricane protection or flood risk reduction project, there will be impacts to infrastructure as well as to oil, gas, and mineral. Pertaining to Port Fourchon there will be both indirect and cumulative impacts, and these impacts are noted in sections 5.15.2.3.2, 5.15.2.3.3, 5.15.7.3.2, and 5.15.7.4.2.

The Barataria Basin Barrier Shoreline Restoration study is authorized as an ecosystem restoration project. The purpose of a Civil Works ecosystem restoration project is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Protection may be included as part of Civil Works ecosystem restoration initiatives when such measures involve efforts to prevent future degradation of an ecosystem's structure and functions. The Government has the obligation to acquire sufficient real estate interests to construct the project and to protect the integrity of the project features. In order to ensure protection of project features, Corps of Engineers regulations indicate that fee title should be acquired for ecosystem restoration projects unless such protection can be accomplished through the acquisition of a lesser interest estate. At this time, a final decision has not been made as to whether fee interest or a permanent easement will be acquired for this project. However, regardless of which estate is acquired, the primary acquisition goal is to protect the project features. Any activity that could be allowed would have to be consistent with the project authorization and function. The possibility for public access to the project site will depend upon which real estate interest is acquired and will be dictated by State and Federal laws as they relate to ecosystem restoration projects.

1095

Jimmy Cantrelle (JC)

My name is Jimmy Cantrelle. I think the coucerns of the people here are trying to establish what we are really concerned about. Public access to the beach has to be a must, but also we use tax dollars to do this over here and we're going to also benefit -- I'm a large landowner, and we're going to benefit landowners too by doing this over here, so everybody needs to work together and look at the big pictnre and not the selfish interest in what's going on. I mean, we're going to protect the port. We've got flood protection. We have a levee system, but we also would like -- just as the man said, we need to make sure the landowners get their mineral rights and don't lose their mineral right. But they're also going to benefit from this over here. We're all going to benefit, so I think if we can all work together, I'm hoping that we could achieve to goal we set out to achieve, which is to build this beach, build it nice. Make sure the public can use it and make sure the landowners get some activity or some benefits from it also. So that's my comment, and I would like to see that we continue using the beach and everybody has a good, jolly time, but everybody do what we have to do.

RESPONSE

JC 01: The Barataria Basin Barrier Shoreline Restoration study is authorized as an ecosystem restoration project. The purpose of a Civil Works ecosystem restoratiou project is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Protection may be included as part of Civil Works ecosystem restoration initiatives when such measures involve efforts to prevent future degradation of an ecosystem's structure and functions. The Government has the obligation to acquire sufficient real estate interests to construct the project and to protect the integrity of the project features. In order to ensure protection of project features, Corps of Engineers regulations indicate that fee title should be acquired for ecosystem restoration projects unless such protection can be accomplished through the acquisition of a lesser interest estate. At this time, a final decision has not been made as to whether fee interest or a permanent easement will be acquired for this project. However, regardless of which estate is acquired, the primary acquisition goal is to protect the project features. Any activity that could be allowed would have to be consistent with the project authorization and function. The possibility for public access to the project site will depend upon which real estate interest is acquired and will be dictated by State and Federal laws as they relate to ecosystem restoration projects. It is the policy of the Corps of Engineers to exclude mineral interests from acquisition of real estate rights. Therefore, regardless of whether fee interest or a permanent easement is acquired for this project, mineral rights will not be acqnired.

1096

Cathy Norman (CN2)

Cathy Norman again. Under State law Act Number 734 2010, both levees and newly-created coastal restoration projects do not allow vehicular traffic on them, so riding and hauling on levees, prohibited. Both newly-created coastal restoration project on our levees. So what this basic issue, I know it's the elephant in the room, is cars on the beach, and I keep saying we don't want it. The other landowners keep saying we don't want it, and, unfortunately, access in the minds of South Lafourche Beachfront Development District is cars on the beach. It's prohibited by State law.

RESPONSE

CN2 01: The Barataria Basin Barrier Shoreline Restoration study is authorized as an ecosystem restoration project. The purpose of a Civil Works ecosystem restoration project is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Protection may be included as part of Civil Works ecosystem restoration initiatives when such measures involve efforts to prevent future degradation of an ecosystem's structure and functions. The Government has the obligation to acquire sufficient real estate interests to construct the project and to protect the integrity of the project features. In order to ensure protection of project features, USACE regulations indicate that fee title should be acquired for ecosystem restoration projects unless such protection can be accomplished through the acquisition of a lesser interest estate. At this time, a final decision has not been made as to whether fee interest or a permanent easement will be acquired for this project. However, regardless of which estate is acquired, the primary acquisition goal is to protect the project features. Any activity that could be allowed would have to be consistent with the project authorization and function. The possibility for public access to the project site will depend upon which real estate interest is acquired and will be dictated by State and Federal laws as they relate to ecosystem restoration projects.

Margaret Curole (MC)

Margaret Curole, private citizen. I think the one thing that everybody here is sidestepping and it needs to go on the record is that there seems to be a discrepancy as to where the landowners feel State seashore is and where it actually is or where the Beachfront Development and everybody else's survey that was recently done by BDO says the State seashore is. And I think that before the project moves any further, that that would have to be established to where both parties agreed and it would be a formal recognized survey as to where the State seashore actually is. And I would also like to make one more comment, and that as somebody who spends a lot of time on Fourchon Beach and has worked very closely with the Beachfront Development, I think everybody, at least the majority of people who spend time at Fourchon Beach, has no interest in putting cars on the beach. We actually want just a place we can park and we want access to walkways. We saw an improvement when there was no cars on the beach and we actually saw more people go to the beach. And we want that recognized and we also want to recognize that fact that the Beachfront Development did a great job in patrolling with lifeguards and with fire and rescue and with Harbor Patrol and that I felt safer on that beach than I've ever felt in my life. And I think that those two things are major matters that need to be taken into consideration, but mainly the establishment of exactly where that seashore is before one grain of sand of tax payer money is put on that beach.

RESPONSE

MC 01: The Barataria Basin Barrier Shoreline Restoration study is authorized as an ecosystem restoration project. The purpose of a Civil Works ecosystem restoration project is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Protection may be included as part of Civil Works ecosystem restoration initiatives when such measures involve efforts to prevent future degradation of an ecosystem's structure and functions. The Government has the obligation to acquire sufficient real estate interests to construct the project and to protect the integrity of the project features. In order to ensure protection of project features, Corps of Engineers regulations indicate that fee title should be acquired for ecosystem restoration projects unless such protection can be accomplished through the acquisition of a lesser interest estate. At this time, a final decision has not been made as to whether fee interest or a permanent easement will be acquired for this project. However, regardless of which estate is acquired, the primary acquisition goal is to protect the project features. Any activity that could be allowed would have to be consistent with the project authorization and function. The possibility for public access to the project site will depend upon which real estate interest is acquired and will be dictated by State and Federal laws as they relate to ecosystem restoration projects.

1098

Wayne Martin (WM)

Wayne Martin, South Lafourche Beachfront Development District. I would like to thank you all for coming here today and all of the people here as well. The board has been established for three years and we worked diligently to create a master plan and we have about four phases that breaks down that particular plan. We made this plan with the assumption that we would have access to this property. We had to just put aside all land issues, legal issues and all of those things. We've had this plan put together and we would like to get a copy to you guys so that y'all would be able to see what our master plan looks like. We're not going to be destroying the environment. We're not looking to ride on sand dunes. The plan incorporates routes that we would pass on and stay on and would bypass auy bird habitat. We had a resolution in our last meeting to honor all archeological sites, all the laws regarding that as well as any nesting areas for birds. We would be able to rope off and project these areas froun any human encroachment. What we're trying to do, and understand this, we have one entry point to a 14-mile stretch of -- well, a 10-mile stretch of beach, in essence, without being able to traverse along the shoreline and wet sand like we've done for scores of years. We are not causing any damage. I mean, there were times we weren't policing it may be they drove up on the sand dunes, but today, we've incorporated almost all parish services. Thanks to everybody from the DA to the Port Commission, providing enforcement of all ordinances. The fire district, who provided open water rescue. They've got 20 guys that operate. They're not considered lifeguards, but they're out there looking out for the public. We've made a lot efforts and we've met the landowners', at least the one who would work with us, all of the obligations that they've asked of us with the exception of one, and that was a liability issue. They asked for us to have insurance to protect them or hold them harmless. One of the requirements were so high, we knew that we couldn't meet them we couldn't meet it. The Parish couldn't meet it. The insurance company didn't even know how to qnote it. In fact, the requirement had us, if have had a policy in place, we would have been responsible for everyone that was on the beach for the cleanup from the oil spill, any pipeline survey work and anything else that would have gone on the beach. It was a ridiculous requirement of us. There was no way we could have met it, but we met every other requirement.

RESPONSE

WM 01: Approximately 13 miles of beach separate access between Port Fourchon and Elmer's Beach entry points.

Recreation facilities may be authorized at water resources projects under authority of Section 4 of the Flood Control Act of 1944, as amended. Recreation featnres may be developed at ecosystem restoration projects if they are appropriate in scope and scale to the opportunity provided by the ecosystem restoration projects. The recreation should be compatible with the ecosystem restoration purpose of the project, but also enhance the visitation experience by taking advantage of the natural values. The social, cultural, scientific and educational values should be considered within the framework of the ecosystem restoration project purpose. For example, while educational values, i.e., nature study and interpretive signs, can be an integral part of ecosystem restoration projects, this does not mean it is appropriate to build recreation/visitor facilities that overwhelm the natural values. The recreation experience should build upon the ecosystem restoration objective and take advantage of the restored resources rather than distract from them. Standard designs should be consistent with the natural environment of the surrounding area and should not include embellishments such as decorative stone work planters, elaborate designs or be ostentatious. Recreation development at ecosystem restoration projects should take advantage of the education and recreation potential that the project is creating while not diminishing the ecosystem restoration purpose. The following excerpt is from the Corps' Principles and Guidelines Engineering Regulatiou (ER) 1105-2-100, Section VII and Recreation and Policy Guidance Letter No. 59, Recreation Development at Ecosystem Projects, CECW-AG, 11 June 1998: "Recreation development at an ecosystem restoration project should be totally ancillary. Recreation facilities may be added to take advantage of the education and recreation potential of the ecosystem project, but the project cannot be specifically formulated for a recreation purpose. The recreation potential may be satisfied only to the extent that recreation does not diminish the ecosystem restoration purpose.

1099

Wayne Martin (WM) (continued)

RESPONSE

WM 01 (continued):
Where an ecosystem restoration project provides critical habitat for a federally listed threatened or endangered species, recreation facilities at that project should be precluded in the critical habitat and limited to only those facilities needed for minimum health and safety and/or natural resources interpretation. Where appropriate, recreation at ecosystem restoration projects should be designed for day use only, precluding the need of extensive night lighting. Whenever conflicts occur between the ecosystem restoration purpose and recreation, ecosystem restoration shall have priority. Plans should seek to optimize public use in harmony with the objectives of the restoration project over the period of analysis. Without a non-Federal sponsor to cost share recreation, ecosystem restoration projects should not encourage public use." The development of facilities for access, health and safety should not involve extensive structural modification of the terrain and may include rest areas and picnic facilities. Ideally these facilities would be a part of a larger non-Corps recreation plan such as a regional trail system or provide access to other non-Federal recreation facilities or areas. The Corps presents a limited checklist of recreation facilities that may be cost-shared, at new Corps ecosystem restoration projects, or that may be constructed by others at non-Federal expense at ecosystem projects. This check list may be found in ER 1105-2-100, Appendix E, Exhibit E-3, and includes access and circulation, shelters and bathrooms, utilities, park furniture, interpretive signage and health and safety features (gates, cattle guards, fencing, entrance station, etc.).

The Barataria Basin Barrier Shoreline Restoration study is authorized as an ecosystem restoration project. The purpose of a Civil Works ecosystem restoration project is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Protection may be included as part of Civil Works ecosystem restoration initiatives when such measures involve efforts to prevent future degradation of an ecosystem's structure and functions. The Government has the obligation to acquire sufficient real estate interests to construct the project and to protect the integrity of the project features.

1100

Wayne Martin (WM) (continued)

RESPONSE

WM 01 (continued):
In order to ensure protection of project features, Corps of Engineers regulations indicate that fee title should be acquired for ecosystem restoration projects unless such protection can be accomplished through the acquisition of a lesser interest estate. At this time, a final decision has not been made as to whether fee interest or a permanent easement will be acquired for this project. However, regardless of which estate is acquired, the primary acquisition goal is to protect the project features. Any activity that could be allowed would have to be consistent with the project authorization and function. The possibility for public access to the project site will depend upon which real estate interest is acquired and will be dictated by State and Federal laws as they relate to ecosystem restoration projects.

1101

Mr. Adomitis (MA)

There's an old Cajun band, I don't know the name of it, but Fourchon Beach is the name of the song. Y'all have heard it I'm sure on Ragin' Cajun.	**RESPONSE** **MA 01:** Thank you for your comment.

Jack Rodrigue (JR)

Jack Rodrigue, Larose, Louisiana. I've been to several of these meetings, and I say it every time and I'm going to say it again tonight, we do have a lot of things in place considering Davis Pond that changes the salinity of our water, which changes your pH and we saw when it was opened up for the oil spill that it made an improvement on the marsh lands. Particularly back here in the South Lafourche area, I witness it myself in the back of Cloverleaf Farms coming down the Barataria area place. Even spoke with an oysterman, I said that last time, how the freshwater got his oysters, and I personally will tell you I thonght it was good thing because the water got that far down. Utilize the things that we have in place. That's very important. A lot of people talking tonight about access to the beach, and, yes, I would love to see access to the beach, but either way, the project needs to take place because you've got the truck welders at Fourchon. I'm a landscaper. I'm a horticulturist. I don't work in the Fourchon Oyster Industry, but I do work for -- 90 percent of my people are directly related to owning boats or whatever that does it. But you have your fishermen, you have your trucker welders, you have your forklift operators, all of these thousands and thousauds of people that live on a 105 by 105 lot that make their living at Fourchon that wants it more protected for them to continue to make their living than worrying about if we're going to get on the beach or what. Now, that is important and I hear it's important to a lot of people for the tax payers' dollars, and I'm just going to sit here and say on behalf of all of these blue-collar men and woman who work down there at Fourchon to do whatever we can to save the place, not only for the oil and economic development throughout country, but for the people in our community that's making a living.

RESPONSE

JR 01: The importance of Port Fourchon and its facilities in relation to the rest of the nation is addressed in Section 4.19.3 of the main report. Although this project is an ecosystem restoration project and not a hurricane protection or flood risk reduction project, there will be impacts to infrastructure as well as to oil, gas, and mineral. Pertaining to Port Fourchon there will be both indirect and cumulative impacts, and these impacts are noted in sections 5.15.2.3.2, 5.15.2.3.3, 5.15.7.3.2, and 5.15.7.4.2.

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1103

Dick Cheramie (DC)

Dick Cheramie. You know, we keep hearing about these nesting shorebirds. You know, one of the landowners has probably a 50 to a 75-aere oil field company directly on the beach. What happens if one of those shorebirds flies over that fence and nests in that parking lot? Are they going to tell Chevron, "Y'all get out of here, y'all can't operate on our land anymore" because there's a nesting shorebird in their parking lot? I've lived in that port. Those birds nest everywhere. They don't nest in one small location. They nest on the coast. You know, the nesting shorebird deal is just a joke to me. You know, yes, we need to care about the shorebird, but there's a huge Chevron facility sitting directly on that beach and a bird doesn't know that that's Chevron and he can't nest there.

RESPONSE

DC 01: Thank you for your comment. The Corps of Engineers, New Orleans District will ensure compliance with the Migratory Bird Treaty Act of 1918, as amended (MBTA). The MBTA, which provides protections for all colonial nesting wading and water birds, prohibits "Take" of these species. "Take" is defined as "means to pursue, hunt, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 CFR 10.12). The USFWS provided the following guidance for advising the public on the MBTA as it relates to migratory bird nest destruction. *"... while destruction of nests independently are not prohibited under the MBTA, harassment or nest destruction which results in the unpermitted take of migratory birds or their egg's, is illegal and fully prosecutable under the MBTA. Due to the biological and behavioral characteristics of some migratory bird species, destruction of their nests entails an elevated degree of risk of violating the MBTA. For example, colonial nesting birds are highly vulnerable to disturbance; the destruction of unoccupied nest during or near the nesting season could result in a significant level of take."* USFWS Migratory Bird Permit Memorandum, 15 Apr 2003)

In addition to the MBTA, the Endangered Species Act of 1973, as amended (ESA), provides protection for the piping plover and its critical habitat, which is a wintering resident of Louisiana. Protected critical habitat (unit LA 5) stretches from Timbalier Island to East Grand Terre Island. This habitat encompasses 2,321 ha (5,735 ac) of the beach habitat in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes. Under provisions of the ESA, it is unlawful to "take" a threatened and endangered species. *"Take"* is defined as "*to harass, harm, pursue, hunt, shoot, wound kill, trap, capture, or collect or attempt to engage in any such conduct."* Excessive vehicular or pedestrian usage of protected areas, can cause piping plovers to spend less time roosting or foraging and more time in alert postures or fleeing from the disturbances. Off-road vehicles, used to access beaches, can significantly degrade the piping plover's habitat or disrupt the birds' normal behavior patterns (Zonick 2000).

1104

Mr. Caillouet (MRC)

Mr. Caillouet just wants to make his presence known.	**RESPONSE** **MRC 01:** Thank you for your comment.

1105

Kevin Curole (KC)

Kevin Curole, born and raised in Lafourche Parish, and I really think it's great that they got this project to help save the beach and the communities. Since I was a little boy, I could remember my grandparents use to bring us to the beach and we would get to crab and fish and just play in the water and to us, they were like gods for bringing us there, you know. And that's such a jewel for the whole world really. If you don't live by the coast, that's your dream in life is to make it there and see the ocean. But people who don't live near here, that's their goal in life is when they see the ocean to go play. Even if you're too scared to swim, you just put your feet in, you know. I think it would be horrible if we would lose that access and not allow our parish to continue enjoying playing on the beach. Thank you.

RESPONSE

KC 01: Thank you for your comment. The following excerpt is from the Corps' Principles and Guidelines Engineering Regulation (ER) 1105-2-100, Section VII and Recreation and Policy Guidance Letter No. 59, Recreation Development at Ecosystem Projects, CECW-AG, 11 June 1998: "Reercation development at an ecosystem restoration project shonld be totally ancillary. Recreation facilities may be added to take advantage of the education and recreation potential of the ecosystem project, but the project cannot be specifically formulated for a recreation purpose. The recreation potential may be satisfied only to the extent that recreation does not diminish the ecosystem restoration purpose. Where an ecosystem restoratiou project provides critical habitat for a federally listed threatened or endangered species, recreatiou facilities at that project should be precluded in the critical habitat and limited to only those facilities needed for minimum health and safety and/or natural resources interpretation.

Where appropriate, recreation at ecosystem restoration projects should be designed for day use only, precluding the need of extensive night lighting. Whenever conflicts occur between the ecosystem restoration purpose and recreation, ecosystem restoration shall have priority. Plans should seek to optimize public use in harmony with the objectives of the restoration project over the period of analysis. Without a non-Federal sponsor to cost share recreation, ecosystem restoration projects should not encourage public use." The development of facilities for access, health and safety should not involve extensive structural modification of the terrain and may include rest areas and picnic facilities. Ideally these facilities would be a part of a larger non-Corps recreation plan such as a regional trail system or provide access to other non-Federal recreation facilities or areas. The Corps presents a limited checklist of recreation facilities that may be cost-shared, at new Corps ecosystem restoration projects, or that may be constructed by others at non-Federal expense at ecosystem projects. This check list may be found in ER 1105-2-100, Appendix E, Exhibit E-3, and includes access and circulation, shelters and bathrooms, utilities, park furniture, interpretive signage and health and safety features (gates, cattle guards, fencing, entrance station, etc.).

11106

3.0 WRITTEN COMMENTS AND RESPONSES ON THE DRAFT INTEGRATED CONSTRUCTION REPORT AND DRAFT EIS

This section contains the written comments and responses received during the 45-day public comment period from June 24, 2011, to August 8, 2011, regarding the Draft Integrated Construction Report and Draft Environmental Impact Statement (EIS) for the proposed Louisiana Coastal Area, Barataria Basin Barrier Shoreline Restoration. In accordance with the NEPA, the USEPA issued in the Federal Register Volume 76, Number 122, page 37112 dated June 24, 2011, a Notice of Availability inviting public participation to comment on the Draft Integrated Construction Report and Draft Environmental Impact Statement for the Louisiana Coastal Area, Barataria Basin Barrier Shoreline Restoration.

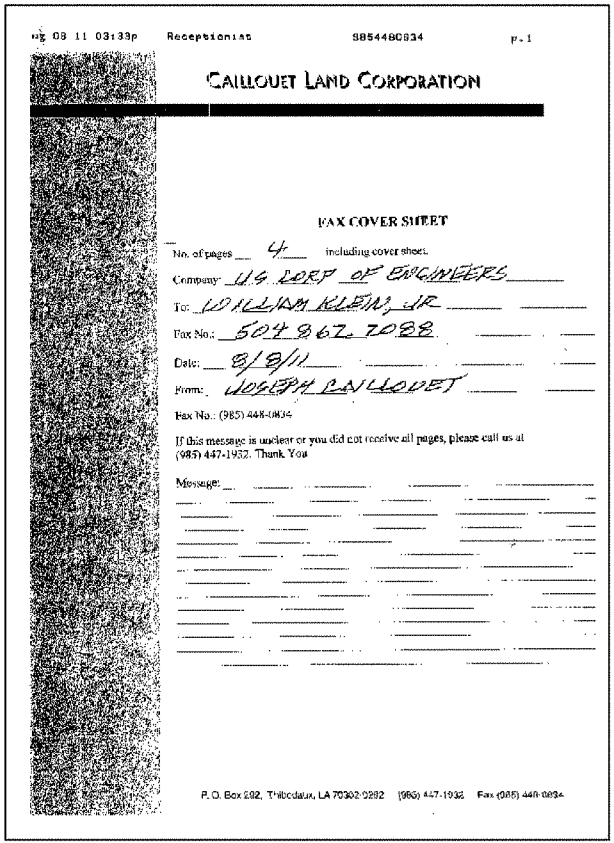
Distribution of the Draft Integrated Construction Report and Draft EIS for review and comment included mailing the document to Federal, state and local agencies, Tribes, and other interested parties. The full distribution mailing list is available from the USACE, New Orleans District upon request. Copies of the Draft Integrated Report were mailed to the following public libraries.

A total of 17 written comments were received during the comment period for the Integrated Draft Construction Report and Draft EIS. A few of the comments had several attachments:

Caillout Land Corporation fax and letter (CLC faxltr)
Edward Wisner Donation fax and letter August 8, 2011 1 (EWD faxltr)
Edward Wisner Donation attachment (EWD at)
Edward Wisner Donation public meeting comments (EWD pm)
Edward Wisner Donation attachment 1 (EWD at1)
Edward Wisner Donation attachment 2 (EWD at2)
Edward Wisner Donation attachment 3 (EWD at3)
Edward Wisner Donation attachment 4 (EWD at4)
Gulf Restoration Network (GRN)
Larry Campisi Memo of Conversation (LC moc)
Larry Campisi letter with Aqua Dam Attachment (LC ltr ada)
Larry Campisi Aqua Dam attachment (LC ada)
Loulan J. Pitre, Jr. (LJP)
Loulan J. Pitre, Jr. attachment (LJP at)
Louisiana Department of Environmental Quality email (LDEQ email)
Louisiana Department of Wildlife and Fisheries (LDWF ltr)
Louisiana Department of Wildlife and Fisheries (LDWF fax)
Mississippi River Delta Campaign (MRDC)
National Marine Fisheries Service (NMFS)
Tim Dantin email (TD email)
Tim Dantin postcard (TD pc)
Restore or Retreat (ROR)
U.S. Department of the Interior (DOI)
U.S. Environmental Protection Agency (EPA)

3.1 WRITTEN COMMENTS AND RESPONSES ON THE DRAFT INTEGRATED CONSTRUCTION REPORT AND DRAFT EIS

Caillouet Land Corporation fax & letter (CLC faxltr)



Aug 08 11 03:39p Receptionist 9854480834 p.1

CAILLOUET LAND CORPORATION

FAX COVER SHEET

No. of pages 4 including cover sheet.

Company: US CORP OF ENGINEERS

To: WILLIAM KLEIN, JR

Fax No.: 504 862 2088

Date: 8/8/11

From: JOSEPH CAILLOUET

Fax No.: (985) 448-0834

If this message is unclear or you did not receive all pages, please call us at (985) 447-1932. Thank You

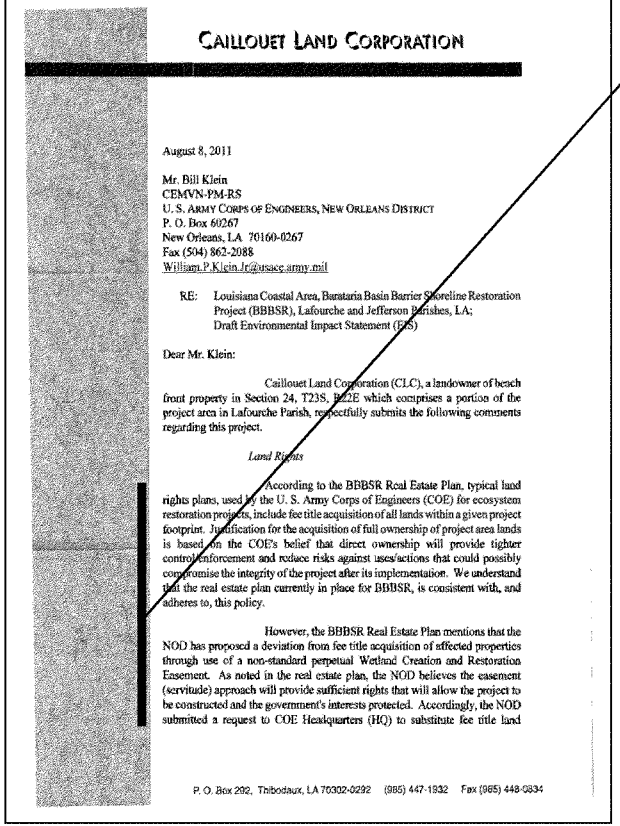
Message:

P.O. Box 292, Thibodaux, LA 70302-0292 (985) 447-1932 Fax (985) 448-0834

RESPONSE

1110

Caillouet Land Corporation fax and letter (CLC faxltr)



CAILLOUET LAND CORPORATION

August 8, 2011

Mr. Bill Klein
CEMVN-PM-RS
U. S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
P. O. Box 60267
New Orleans, LA 70160-0267
Fax (504) 862-2088
William.P.Klein.Jr@usace.army.mil

RE: Louisiana Coastal Area, Barataria Basin Barrier Shoreline Restoration Project (BBBSR), Lafourche and Jefferson Parishes, LA; Draft Environmental Impact Statement (EIS)

Dear Mr. Klein:

Caillouet Land Corporation (CLC), a landowner of beach front property in Section 24, T23S, R22E which comprises a portion of the project area in Lafourche Parish, respectfully submits the following comments regarding this project.

Land Rights

According to the BBBSR Real Estate Plan, typical land rights plans, used by the U. S. Army Corps of Engineers (COE) for ecosystem restoration projects, include fee title acquisition of all lands within a given project footprint. Justification for the acquisition of full ownership of project area lands is based on the COE's belief that direct ownership will provide tighter control/enforcement and reduce risks against uses/actions that could possibly compromise the integrity of the project after its implementation. We understand that the real estate plan currently in place for BBBSR, is consistent with, and adheres to, this policy.

However, the BBBSR Real Estate Plan mentions that the NOD has proposed a deviation from fee title acquisition of affected properties through use of a non-standard perpetual Wetland Creation and Restoration Easement. As noted in the real estate plan, the NOD believes the easement (servitude) approach will provide sufficient rights that will allow the project to be constructed and the government's interests protected. Accordingly, the NOD submitted a request to COE Headquarters (HQ) to substitute fee title land

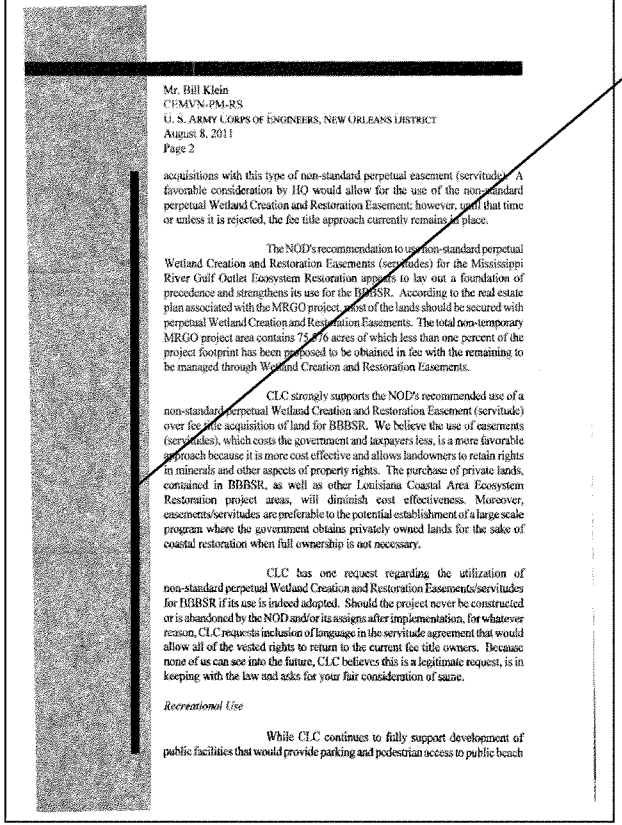
P. O. Box 292, Thibodaux, LA 70302-0292 (985) 447-1932 Fax (985) 448-0834

RESPONSE

CLC faxltr 01: Thank yon for your comment. The LCA BBBS Restoration study is authorized as an ecosystem restoration project. The purpose of a Civil Works ecosystem restoration project is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Protection may be included as part of Civil Works ecosystem restoration initiatives when such measures involve efforts to prevent future degradation of an ecosystem's structure and functions. The Government has the obligation to acquire sufficient real estate interests to construct the project and to protect the integrity of the project features. Iu order to ensure protection of project features, USACE regulations indicate that fee title should be acquired for ecosystem restoration projects unless such protection can be accomplished through the acquisition of a lesser interest estate. At this time, a final decision has not been made as to whether fee interest or a permanent easement will be acquired for this project. However, regardless of which estate is acquired, the primary acquisition goal is to protect the project features. Any activity that could be allowed would have to be consistent with the project authorization and function. The possibility for public access to the project site will depend upon which real estate interest is acquired and will be dictated by State and Federal laws as they relate to ecosystem restoration projects.

1111

Caillouet Land Corporation fax and letter (CLC faxltr)



Mr. Bill Klein
CEMVN-PM-RS
U. S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
August 8, 2011
Page 2

acquisitions with this type of non-standard perpetual easement (servitude). A favorable consideration by HQ would allow for the use of the non-standard perpetual Wetland Creation and Restoration Easement; however, until that time or unless it is rejected, the fee title approach currently remains in place.

The NOD's recommendation to use non-standard perpetual Wetland Creation and Restoration Easements (servitudes) for the Mississippi River Gulf Outlet Ecosystem Restoration appears to lay out a foundation of precedence and strengthens its use for the BBBSR. According to the real estate plan associated with the MRGO project, most of the lands should be secured with perpetual Wetland Creation and Restoration Easements. The total non-temporary MRGO project area contains 75,076 acres of which less than one percent of the project footprint has been proposed to be obtained in fee with the remaining to be managed through Wetland Creation and Restoration Easements.

CLC strongly supports the NOD's recommended use of a non-standard perpetual Wetland Creation and Restoration Easement (servitude) over fee title acquisition of land for BBBSR. We believe the use of easements (servitudes), which costs the government and taxpayers less, is a more favorable approach because it is more cost effective and allows landowners to retain rights in minerals and other aspects of property rights. The purchase of private lands, contained in BBBSR, as well as other Louisiana Coastal Area Ecosystem Restoration project areas, will diminish cost effectiveness. Moreover, easements/servitudes are preferable to the potential establishment of a large scale program where the government obtains privately owned lands for the sake of coastal restoration when full ownership is not necessary.

CLC has one request regarding the utilization of non-standard perpetual Wetland Creation and Restoration Easements/servitudes for BBBSR if its use is indeed adopted. Should the project never be constructed or is abandoned by the NOD and/or its assigns after implementation, for whatever reason, CLC requests inclusion of language in the servitude agreement that would allow all of the vested rights to return to the current fee title owners. Because none of us can see into the future, CLC believes this is a legitimate request, is in keeping with the law and asks for your fair consideration of same.

Recreational Use

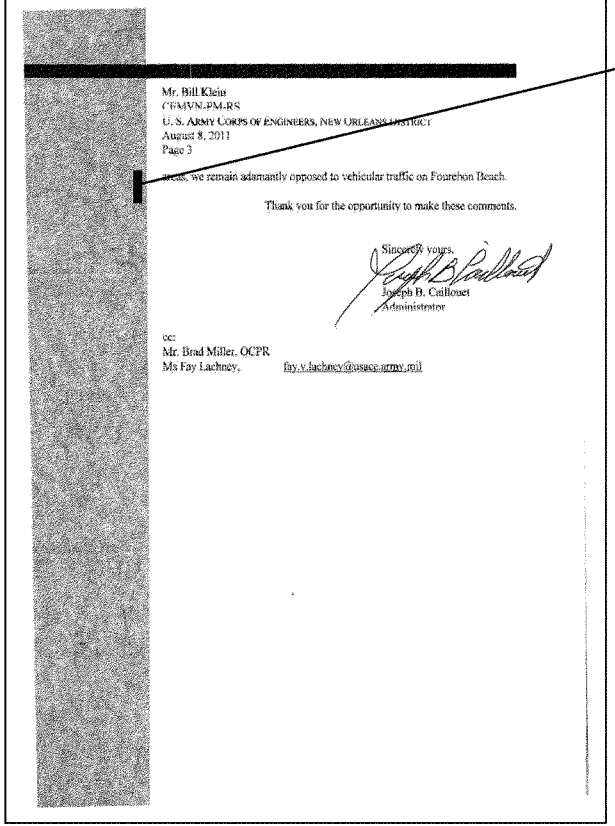
While CLC continues to fully support development of public facilities that would provide parking and pedestrian access to public beach

RESPONSE

CLC faxltr 01 (continued): see response on previous page.

1112

Caillouet Land Corporation fax and letter (CLC faxltr)



Mr. Bill Klein
CEMVN-PM-RS
U. S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
August 8, 2011
Page 3

[redacted] we remain adamantly opposed to vehicular traffic on Fourchon Beach.

Thank you for the opportunity to make these comments.

Sincerely yours,

Joseph B. Caillouet
Administrator

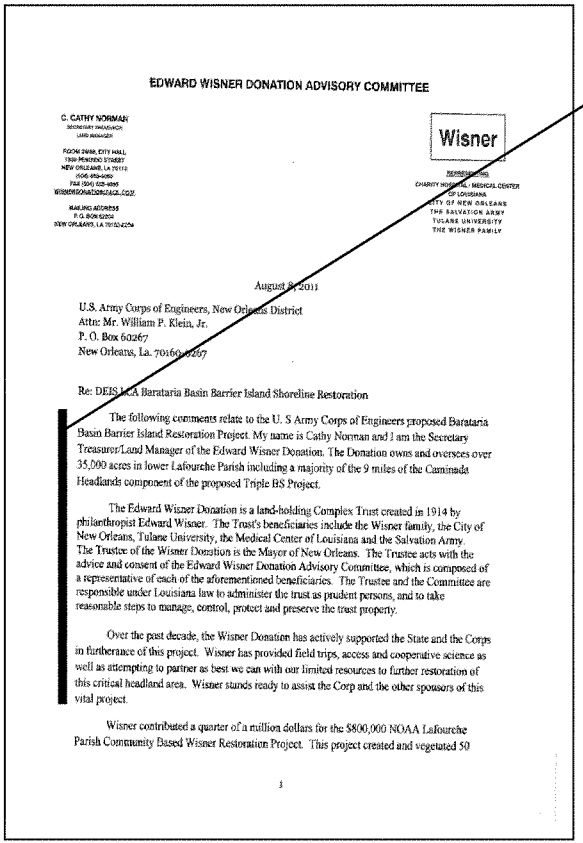
cc:
Mr. Brad Miller, OCPR
Ms Fay Lachney, fay.v.lachney@usace.army.mil

RESPONSE

CLC faxltr 01 (continued): see response on previous page.

1113

Edward Wisner Donation fax and letter August 8, 2011 (EWD faxltr)



EDWARD WISNER DONATION ADVISORY COMMITTEE

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Wisner

REPRESENTING
CHARITY HOSPITAL - MEDICAL CENTER OF LOUISIANA
CITY OF NEW ORLEANS
THE SALVATION ARMY
TULANE UNIVERSITY
THE WISNER FAMILY

August 8, 2011

U.S. Army Corps of Engineers, New Orleans District
Attn: Mr. William P. Klein, Jr.
P. O. Box 60267
New Orleans, La. 70160-0267

Re: DEIS LCA Barataria Basin Barrier Island Shoreline Restoration

The following comments relate to the U. S Army Corps of Engineers proposed Barataria Basin Barrier Island Restoration Project. My name is Cathy Norman and I am the Secretary Treasurer/Land Manager of the Edward Wisner Donation. The Donation owns and oversees over 35,000 acres in lower Lafourche Parish including a majority of the 9 miles of the Caminada Headlands component of the proposed Triple BS Project.

The Edward Wisner Donation is a land-holding Complex Trust created in 1914 by philanthropist Edward Wisner. The Trust's beneficiaries include the Wisner family, the City of New Orleans, Tulane University, the Medical Center of Louisiana and the Salvation Army. The Trustee of the Wisner Donation is the Mayor of New Orleans. The Trustee acts with the advice and consent of the Edward Wisner Donation Advisory Committee, which is composed of a representative of each of the aforementioned beneficiaries. The Trustee and the Committee are responsible under Louisiana law to administer the trust as prudent persons, and to take reasonable steps to manage, control, protect and preserve the trust property.

Over the past decade, the Wisner Donation has actively supported the State and the Corps in furtherance of this project. Wisner has provided field trips, access and cooperative science as well as attempting to partner as best we can with our limited resources to further restoration of this critical headland area. Wisner stands ready to assist the Corp and the other sponsors of this vital project.

Wisner contributed a quarter of a million dollars for the $800,000 NOAA LaFourche Parish Community Based Wisner Restoration Project. This project created and vegetated 50

1

RESPONSE

EWD faxltr 01: Thank you for your comment, your assistance in providing access and field trips to the Wisner Donation lands, and your efforts at partnering and providing science-related assistance in the coastal geomorphic dynamics and ecological aspects of the Caminada Headland system.

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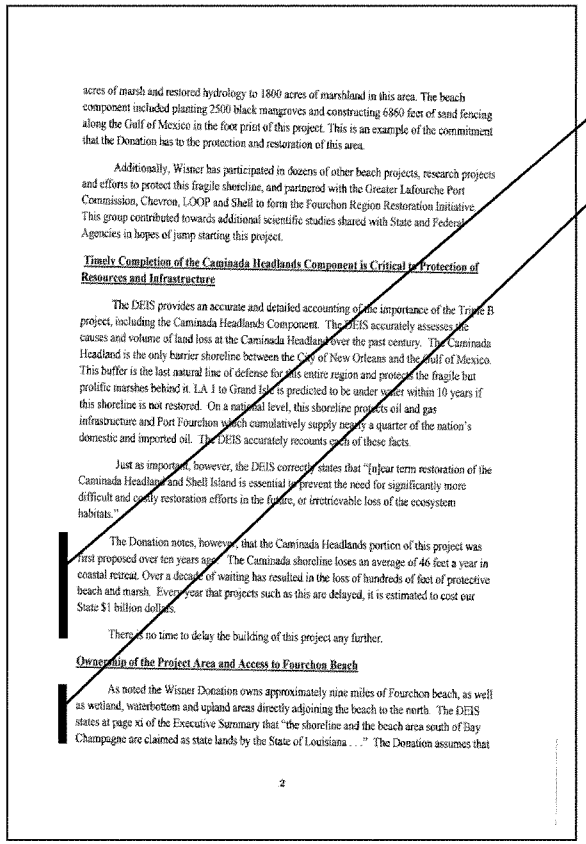
Edward Wisner Donation fax and letter August 8, 2011 (EWD faxltr)



acres of marsh and restored hydrology to 1800 acres of marshland in this area. The beach component included planting 2500 black mangroves and constructing 6860 feet of sand fencing along the Gulf of Mexico in the foot print of this project. This is an example of the commitment that the Donation has to the protection and restoration of this area.

Additionally, Wisner has participated in dozens of other beach projects, research projects and efforts to protect this fragile shoreline, and partnered with the Greater Lafourche Port Commission, Chevron, LOOP and Shell to form the Fourchon Region Restoration Initiative. This group contributed towards additional scientific studies shared with State and Federal Agencies in hopes of jump starting this project.

Timely Completion of the Caminada Headlands Component is Critical to Protection of Resources and Infrastructure

The DEIS provides an accurate and detailed accounting of the importance of the Triple B project, including the Caminada Headlands Component. The DEIS accurately assesses the causes and volume of land loss at the Caminada Headland over the past century. The Caminada Headland is the only barrier shoreline between the City of New Orleans and the Gulf of Mexico. This buffer is the last natural line of defense for this entire region and protects the fragile but prolific marshes behind it. LA 1 to Grand Isle is predicted to be under water within 10 years if this shoreline is not restored. On a national level, this shoreline protects oil and gas infrastructure and Port Fourchon which cumulatively supply nearly a quarter of the nation's domestic and imported oil. The DEIS accurately recounts each of these facts.

Just as important, however, the DEIS correctly states that "[n]ear term restoration of the Caminada Headland and Shell Island is essential to prevent the need for significantly more difficult and costly restoration efforts in the future, or irretrievable loss of the ecosystem habitats."

The Donation notes, however, that the Caminada Headlands portion of this project was first proposed over ten years ago. The Caminada shoreline loses an average of 46 feet a year in coastal retreat. Over a decade of waiting has resulted in the loss of hundreds of feet of protective beach and marsh. Every year that projects such as this are delayed, it is estimated to cost our State $1 billion dollars.

There is no time to delay the building of this project any further.

Ownership of the Project Area and Access to Fourchon Beach

As noted the Wisner Donation owns approximately nine miles of Fourchon beach, as well as wetland, waterbottom and upland areas directly adjoining the beach to the north. The DEIS states at page xi of the Executive Summary that "the shoreline and the beach area south of Bay Champagne are claimed as state lands by the State of Louisiana . . ." The Donation assumes that

2

RESPONSE

EWD faxltr 02: Concur on the importance of implementing the LCA BBBS project to restore the Caminada Headland as well as Shell Island components of the Barataria Basin barrier shoreline system.

EWD faxltr 03: with regard to boundaries between the State and landowners, per Article 451 of the Louisiana Civil Code, seashore is the space of land over which the waters of the sea spread in the highest tide during the winter season (Acts 1978, No. 728, §1).

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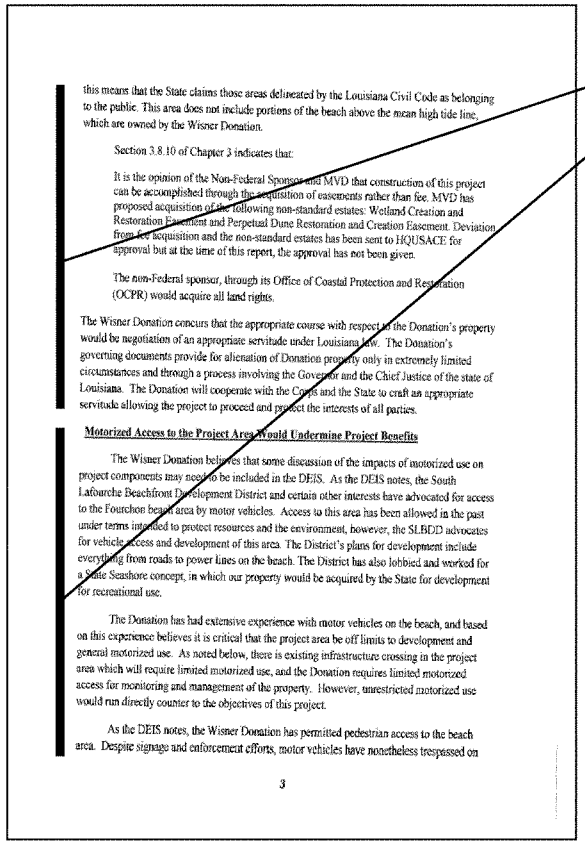
Edward Wisner Donation fax and letter August 8, 2011 (EWD faxltr)



this means that the State claims those areas delineated by the Louisiana Civil Code as belonging to the public. This area does not include portions of the beach above the mean high tide line, which are owned by the Wisner Donation.

Section 3.8.10 of Chapter 3 indicates that:

It is the opinion of the Non-Federal Sponsor and MVD that construction of this project can be accomplished through the acquisition of easements rather than fee. MVD has proposed acquisition of the following non-standard estates: Wetland Creation and Restoration Easement and Perpetual Dune Restoration and Creation Easement. Deviation from fee acquisition and the non-standard estates has been sent to HQUSACE for approval but at the time of this report, the approval has not been given.

The non-Federal sponsor, through its Office of Coastal Protection and Restoration (OCPR) would acquire all land rights.

The Wisner Donation concurs that the appropriate course with respect to the Donation's property would be negotiation of an appropriate servitude under Louisiana law. The Donation's governing documents provide for alienation of Donation property only in extremely limited circumstances and through a process involving the Governor and the Chief Justice of the state of Louisiana. The Donation will cooperate with the Corps and the State to craft an appropriate servitude allowing the project to proceed and protect the interests of all parties.

Motorized Access to the Project Area Would Undermine Project Benefits

The Wisner Donation believes that some discussion of the impacts of motorized use on project components may need to be included in the DEIS. As the DEIS notes, the South Lafourche Beachfront Development District and certain other interests have advocated for access to the Fourchon beach area by motor vehicles. Access to this area has been allowed in the past under terms intended to protect resources and the environment, however, the SLBDD advocates for vehicle access and development of this area. The District's plans for development include everything from roads to power lines on the beach. The District has also lobbied and worked for a State Seashore concept, in which our property would be acquired by the State for development for recreational use.

The Donation has had extensive experience with motor vehicles on the beach, and based on this experience believes it is critical that the project area be off limits to development and general motorized use. As noted below, there is existing infrastructure crossing in the project area which will require limited motorized use, and the Donation requires limited motorized access for monitoring and management of the property. However, unrestricted motorized use would run directly counter to the objectives of this project.

As the DEIS notes, the Wisner Donation has permitted pedestrian access to the beach area. Despite signage and enforcement efforts, motor vehicles have nonetheless trespassed on

3

RESPONSE

EWD faxltr 03 (continued): see response on previous page.

EWD faxltr 04: Concur that existing infrastructure in project area will require limited motorized access for operations and maintenance activities. However, the USACE believes that unrestricted motorized access would not be consistent with ecosystem restoration goals and objectives or with maintaining ecosystem viability of the restored project area.

1116

Edward Wisner Donation fax and letter August 8, 2011 (EWD faxltr)

Donation property. Four wheel drive vehicles and UTV's have routinely gone "joy riding" in coastal dunes, damaging and sometimes destroying these delicate systems. Joyriding of this kind has also damaged nesting habitat for numerous species of birds, including the endangered piping plover. An example of the impact of a trespassing vehicle is shown below:

As the Donation appreciates it, the Caminada Headlands project as proposed would not allow motorized access or development. If this is the case then discussion of the impact of allowing motor vehicle access would not be required. However, to the extent that any motorized access is contemplated, the consequences of such access, and the corresponding decrease in project benefits, should be discussed in the EIS.

The Donation notes that Act 734 was passed in 2010 prohibiting riding or hauling on integrated coastal protection projects. Wisner views this as imperative for future protection of the beach. There is currently a Parish right of way (road) that ends at the Gulf of Mexico. Local government and organizations believe that the continuation of this servitude, which is currently in the water, still exists and will be resurrected when this project is built. If this right of way/road is rebuilt, it will continue to allow vehicular access to and on the beach, which based on our experience will lead to substantial damage to the project itself. The Donation believes that

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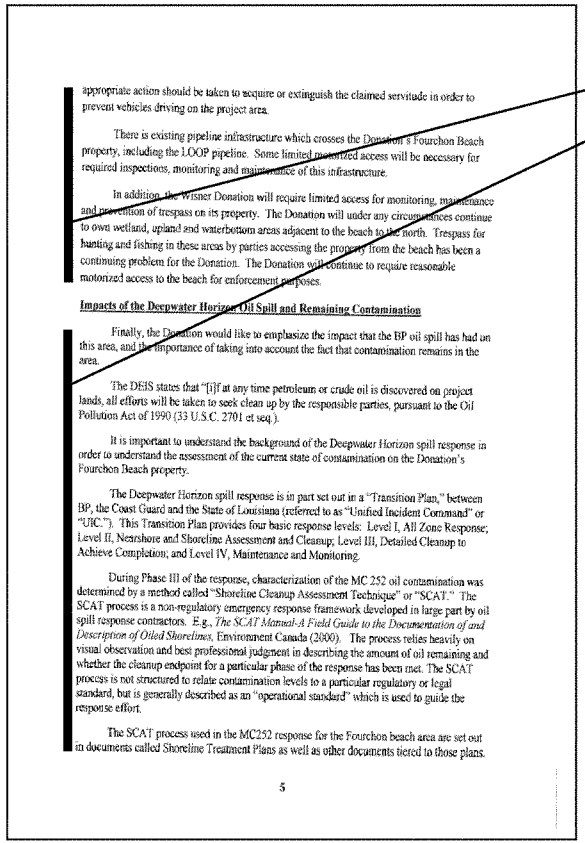
RESPONSE

EWD faxltr 04 (continued): see response on previous page.

1117

Edward Wisner Donation fax and letter August 8, 2011 (EWD faxltr)



appropriate action should be taken to acquire or extinguish the claimed servitude in order to prevent vehicles driving on the project area.

There is existing pipeline infrastructure which crosses the Donation's Fourchon Beach property, including the LOOP pipeline. Some limited motorized access will be necessary for required inspections, monitoring and maintenance of this infrastructure.

In addition, the Wisner Donation will require limited access for monitoring, maintenance and prevention of trespass on its property. The Donation will under any circumstances continue to own wetland, upland and waterbottom areas adjacent to the beach to the north. Trespass for hunting and fishing in these areas by parties accessing the property from the beach has been a continuing problem for the Donation. The Donation will continue to require reasonable motorized access to the beach for enforcement purposes.

Impacts of the Deepwater Horizon Oil Spill and Remaining Contamination

Finally, the Donation would like to emphasize the impact that the BP oil spill has had on this area, and the importance of taking into account the fact that contamination remains in the area.

The DEIS states that "[i]f at any time petroleum or crude oil is discovered on project lands, all efforts will be taken to seek clean up by the responsible parties, pursuant to the Oil Pollution Act of 1990 (33 U.S.C. 2701 et seq.).

It is important to understand the background of the Deepwater Horizon spill response in order to understand the assessment of the current state of contamination on the Donation's Fourchon Beach property.

The Deepwater Horizon spill response is in part set out in a "Transition Plan," between BP, the Coast Guard and the State of Louisiana (referred to as "Unified Incident Command" or "UIC."). This Transition Plan provides four basic response levels: Level I, All Zone Response; Level II, Nearshore and Shoreline Assessment and Cleanup; Level III, Detailed Cleanup to Achieve Completion; and Level IV, Maintenance and Monitoring.

During Phase III of the response, characterization of the MC 252 oil contamination was determined by a method called "Shoreline Cleanup Assessment Technique" or "SCAT." The SCAT process is a non-regulatory emergency response framework developed in large part by oil spill response contractors. E.g., *The SCAT Manual-A Field Guide to the Documentation of and Description of Oiled Shorelines*, Environment Canada (2000). The process relies heavily on visual observation and best professional judgment in describing the amount of oil remaining and whether the cleanup endpoint for a particular phase of the response has been met. The SCAT process is not structured to relate contamination levels to a particular regulatory or legal standard, but is generally described as an "operational standard" which is used to guide the response effort.

The SCAT process used in the MC252 response for the Fourchon beach area are set out in documents called Shoreline Treatment Plans as well as other documents tiered to those plans.

5

RESPONSE

EWD faxltr 04 (continued): see response on previous page.

EWD faxltr 05: Before the project can be implemented the USACE must confirm that the area is free of oil contamination pursuant to the Oil Pollution Act of 1990 (33 U.S.C. 2701 *et seq.*).

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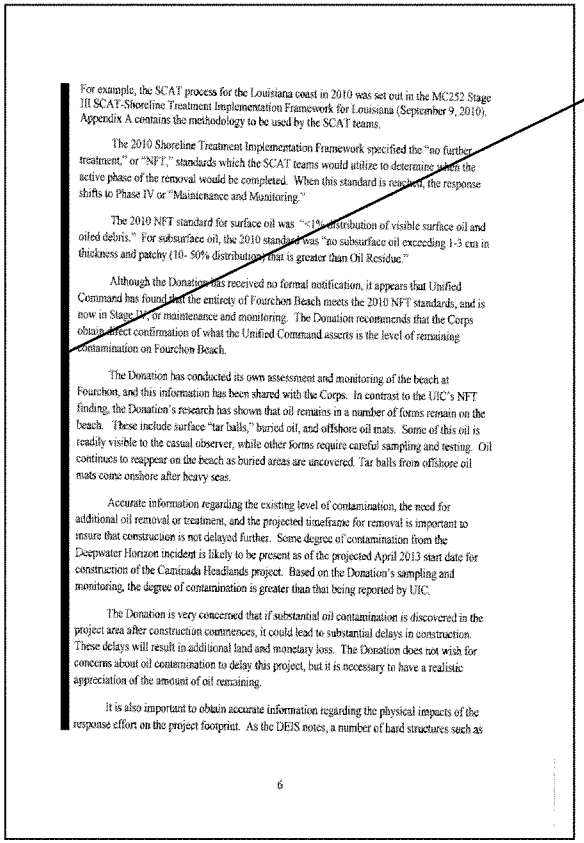
Edward Wisner Donation fax and letter August 8, 2011 (EWD faxltr)



For example, the SCAT process for the Louisiana coast in 2010 was set out in the MC252 Stage III SCAT-Shoreline Treatment Implementation Framework for Louisiana (September 9, 2010). Appendix A contains the methodology to be used by the SCAT teams.

The 2010 Shoreline Treatment Implementation Framework specified the "no further treatment," or "NFT," standards which the SCAT teams would utilize to determine when the active phase of the removal would be completed. When this standard is reached, the response shifts to Phase IV or "Maintenance and Monitoring."

The 2010 NFT standard for surface oil was "<1% distribution of visible surface oil and oiled debris." For subsurface oil, the 2010 standard was "no subsurface oil exceeding 1-3 cm in thickness and patchy (10- 50% distribution) that is greater than Oil Residue."

Although the Donation has received no formal notification, it appears that Unified Command has found that the entirety of Fourchon Beach meets the 2010 NFT standards, and is now in Stage IV, or maintenance and monitoring. The Donation recommends that the Corps obtain direct confirmation of what the Unified Command asserts is the level of remaining contamination on Fourchon Beach.

The Donation has conducted its own assessment and monitoring of the beach at Fourchon, and this information has been shared with the Corps. In contrast to the UIC's NFT finding, the Donation's research has shown that oil remains in a number of forms remain on the beach. These include surface "tar balls," buried oil, and offshore oil mats. Some of this oil is readily visible to the casual observer, while other forms require careful sampling and testing. Oil continues to reappear on the beach as buried areas are uncovered. Tar balls from offshore oil mats come onshore after heavy seas.

Accurate information regarding the existing level of contamination, the need for additional oil removal or treatment, and the projected timeframe for removal is important to insure that construction is not delayed further. Some degree of contamination from the Deepwater Horizon incident is likely to be present as of the projected April 2013 start date for construction of the Caminada Headlands project. Based on the Donation's sampling and monitoring, the degree of contamination is greater than that being reported by UIC.

The Donation is very concerned that if substantial oil contamination is discovered in the project area after construction commences, it could lead to substantial delays in construction. These delays will result in additional land and monetary loss. The Donation does not wish for concerns about oil contamination to delay this project, but it is necessary to have a realistic appreciation of the amount of oil remaining.

It is also important to obtain accurate information regarding the physical impacts of the response effort on the project footprint. As the DEIS notes, a number of hard structures such as

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RESPONSE

EWD faxltr 05 (continued): see response on previous page.

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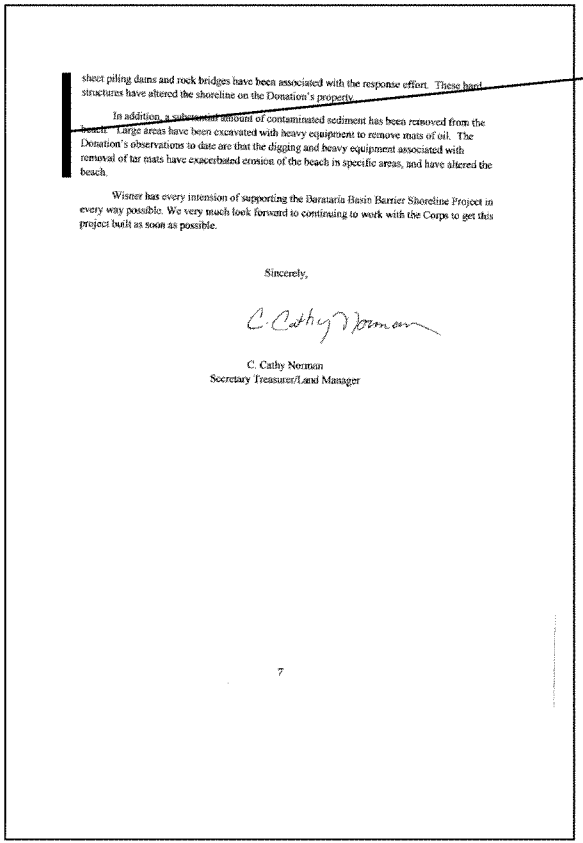
Edward Wisner Donation fax and letter August 8, 2011 (EWD faxltr)



sheet piling dams and rock bridges have been associated with the response effort. These hard structures have altered the shoreline on the Donation's property.

In addition, a substantial amount of contaminated sediment has been removed from the beach. Large areas have been excavated with heavy equipment to remove mats of oil. The Donation's observations to date are that the digging and heavy equipment associated with removal of tar mats have exacerbated erosion of the beach in specific areas, and have altered the beach.

Wisner has every intension of supporting the Barataria Basin Barrier Shoreline Project in every way possible. We very much look forward to continuing to work with the Corps to get this project built as soon as possible.

Sincerely,

C. Cathy Norman

C. Cathy Norman
Secretary Treasurer/Land Manager

7

RESPONSE

EWD faxltr 05 (continued): see response on previous page.

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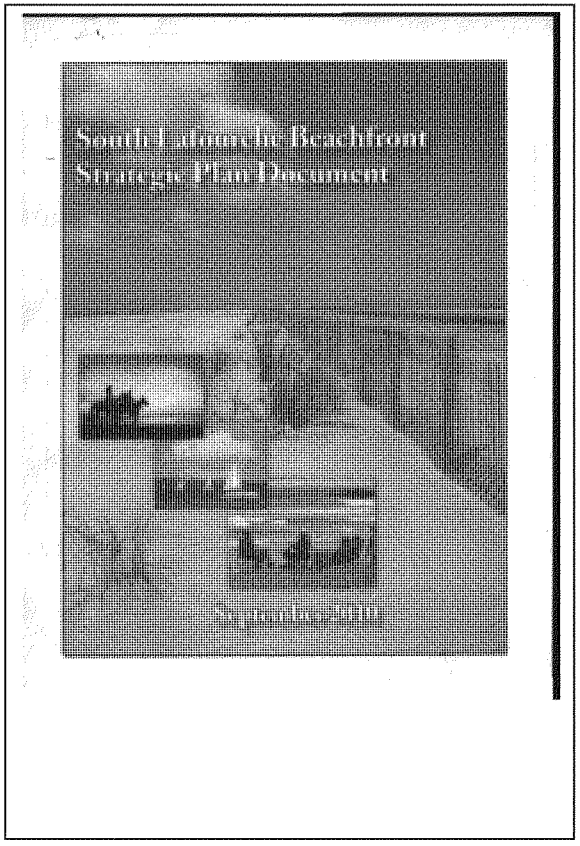
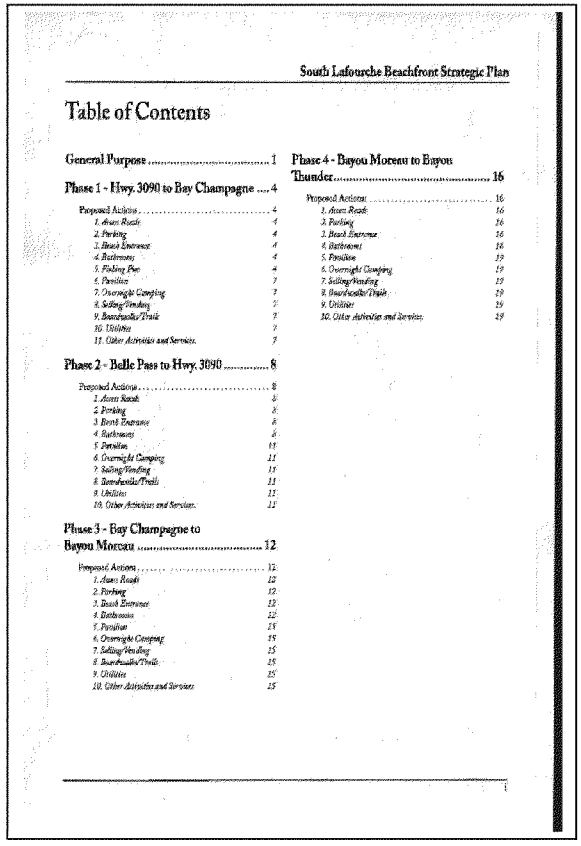
Edward Wisner Donation fax/letter attachment (EWD at)





South Lafourche Beachfront Strategic Plan

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1121

Edward Wisner Donation attachment (EWD at)

General Purpose

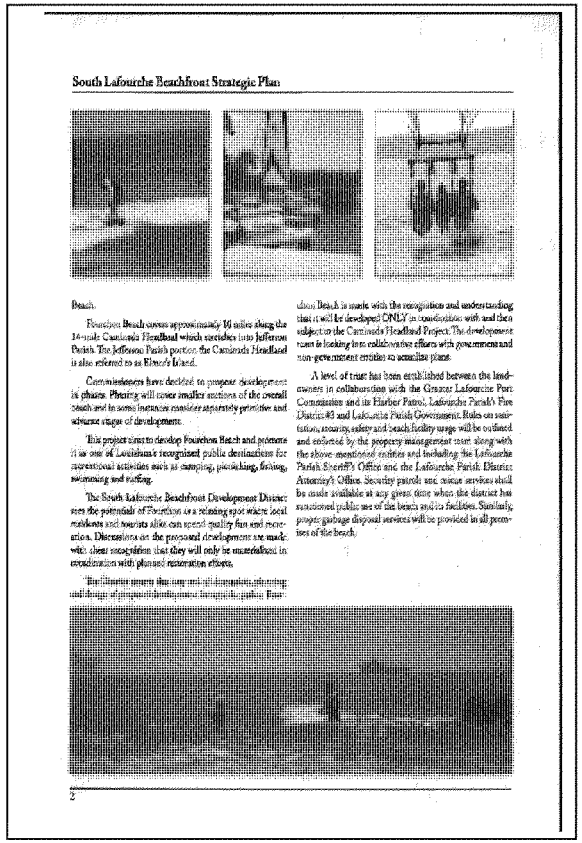
Historically, the beach was accessible from Hwy 3090, a Lafourche Parish road that begins at LA Hwy 1 and extends through Port Fourchon and then to the Gulf of Mexico. The public traditionally accessed the beach at the end of the public road with uncontrolled vehicular traffic increased littering and random vandalism have caused adjacent landowners to attempt to block vehicular access.

The creation of the South Lafourche Beachfront Development District is partly a reaction to limitations in public access. Negotiations among landowners, the Port and the Parish have been "in progress" since the mid-90's.

also by ensuring that any recreational development does not stop or delay beach restoration and nourishment.

The main objective of the South Lafourche Beachfront Development District shall be to maintain and preserve beaches for use and enjoyment of the citizens. The district aims to facilitate the development, operation and maintenance of recreational facilities while preserving outdoor activities and open space in harmony within the framework of wildlife and fisheries areas.

Edward Wisner Donation attachment (EWD at)



South Lafourche Beachfront Strategic Plan

Beach.

Fourchon Beach covers approximately 10 miles along the 14-mile Caminada Headland which stretches into Jefferson Parish. The Jefferson Parish portion the Caminada Headland is also referred to as Elmer's Island.

Commissioners have decided to propose development in phases. Phasing will cover smaller sections of the overall beach and in some instances consider separately primitive and advance stages of development.

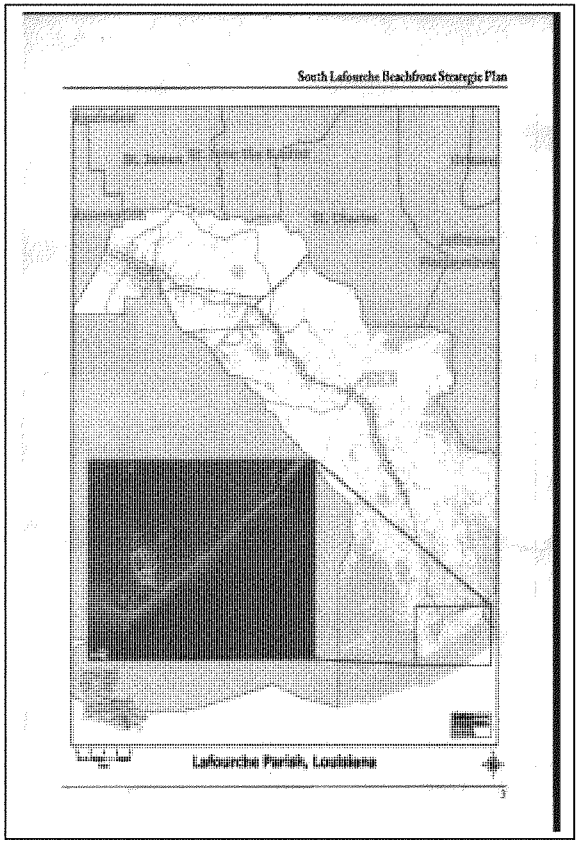
This project aims to develop Fourchon Beach and promote it as one of Louisiana's recognized public destinations for recreational activities such as sampling, picnicking, fishing, swimming and surfing.

The South Lafourche Beachfront Development District sees the potentials of Fourchon as a relaxing spot where local residents and tourists alike can spend quality fun and recreation. Discussions on the proposed development are made with clear recognition that they will only be materialized in coordination with planned restoration efforts.

[illegible] ...ing buildings, [illegible] ...ic park. Fourchon Beach is made with the recognition and understanding that it will be developed ONLY in coordination with and the subject to the Caminada Headland Project. The development team is looking into collaborative efforts with governments and non-government entities to actualize plans.

A level of trust has been established between the landowners in collaboration with the Greater Lafourche Port Commission and its Harbor Patrol, Lafourche Parish's Fire District #3 and Lafourche Parish Government. Rules on sanitation, security, safety and beach facility usage will be outlined and enforced by the property management team along with the above mentioned entities and including the Lafourche Parish Sheriff's Office and the Lafourche Parish District Attorney's Office. Security patrols and rescue services shall be made available at any given time when the district has sanctioned public use of the beach and its facilities. Similarly, proper garbage disposal services will be provided in all premises of the beach.

2



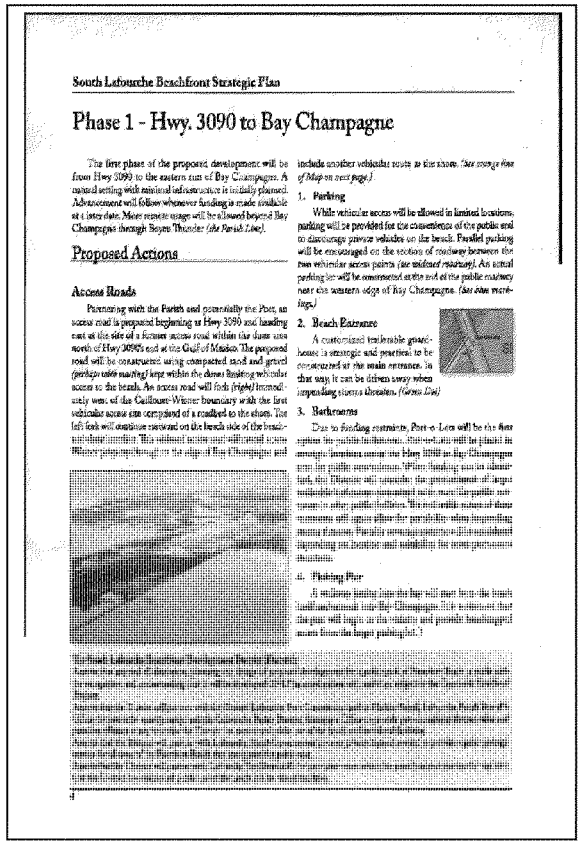
South Lafourche Beachfront Strategic Plan

Lafourche Parish, Louisiana

3

1123

Edward Wisner Donation attachment (EWD at)



South Lafourche Beachfront Strategic Plan

Phase 1 - Hwy. 3090 to Bay Champagne

The first phase of the proposed development will be from Hwy 3090 to the eastern rim of Bay Champagne. A natural setting with minimal infrastructure is initially planned. Advancement will follow whenever funding is made available at a later date. Motor vehicle usage will be allowed beyond Bay Champagne through Bayou Thunder *(the Parish Line)*.

Proposed Actions

Access Roads

Partnering with the Parish and potentially the Port, an access road is proposed beginning at Hwy 3090 and heading east on the site of a former access road within the dune area north of Hwy 3090's end at the Gulf of Mexico. The proposed road will be constructed using compacted sand and gravel *(perhaps coastal marling)* kept within the dunes limiting vehicular access to the beach. An access road will forth *(right)* immediately west of the Caillouet-Wisner boundary with the first vehicular access site comprised of a roadbed to the shore. The left fork will continue eastward on the beach side of the beach-ridge/dune ridge. The natural sand and natural state Wisner property bordering on the edge of Bay Champagne and include another vehicular route as the above. *(See orange line of Map on next page.)*

1. **Parking**

While vehicular access will be allowed in limited locations, parking will be provided for the convenience of the public and to discourage private vehicles on the beach. Parallel parking will be encouraged on the sections of roadway between the two vehicular access points *(the widened roadway)*. An actual parking lot will be constructed at the end of the public roadway near the western edge of Bay Champagne. *(See blue markings.)*

2. **Beach Entrance**

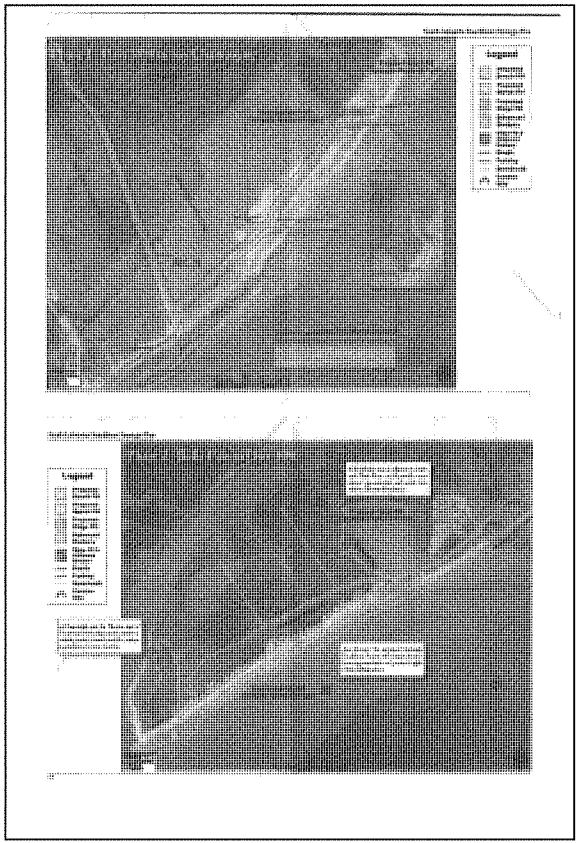
A customized trailerable guard-house is strategic and practical to be constructed at the main entrance. In that way, it can be driven away when impending storm threaten. *(Green line)*

3. **Bathrooms**

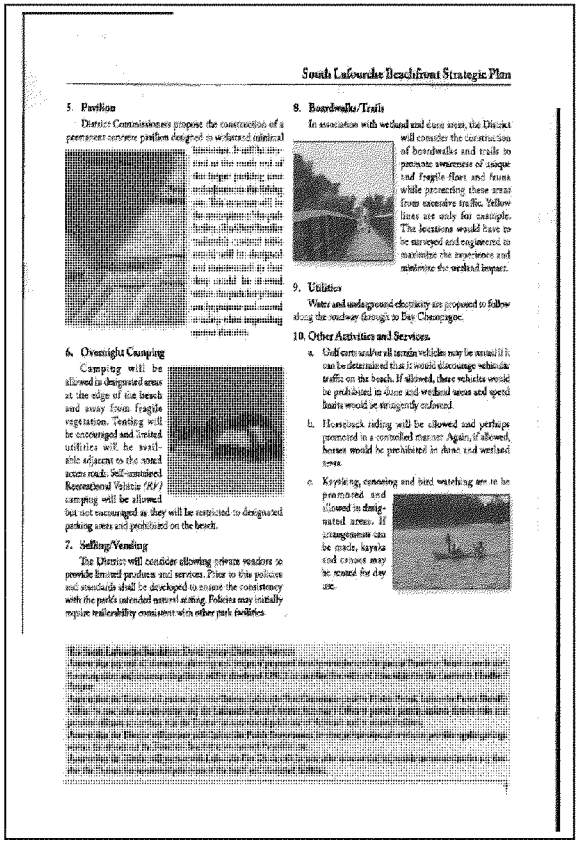
Due to funding restraints, Port-o-Lets will be the first option in public bathrooms. However, an effort to plan to provide bathroom facilities among the blue lines in Bay Champagne area for public convenience. Where funding can be identified, the District will consider the construction of larger multi-stall bathroom structures with more than public restrooms to other public facilities. The noticeable nature of these structures will cause effort for portable units impending storm threats. Portable units can be re-established operating on location and available for area permanent structures.

4. **Fishing Pier**

A walking fishing pier on the bay will start from the beach ridge/dune area into Bay Champagne. It is estimated that the pier will begin in the vicinity and provide handicapped access from the larger parking lot. *(*



Edward Wisner Donation attachment (EWD at)



South Lafourche Beachfront Strategic Plan

5. Pavilion

District Commissioners propose the construction of a permanent nature pavilion designed to withstand minimal hurricane. It will be situated on the south end of the large parking area [illegible] the fishing pier. This structure will be the orientation/info park facility. Shelter/facilities [illegible] restroom public access will be designed and maintained in such [illegible] it will be in keeping with the natural environment [illegible] impacting marine [illegible].

6. Overnight Camping

Camping will be allowed in designated areas at the edge of the beach and away from fragile vegetation. Tenting will be encouraged and limited utilities will be available adjacent to the paved access road. Self-contained Recreational Vehicle (RV) camping will be allowed but not encouraged as they will be restricted to designated parking areas and prohibited on the beach.

7. Selling/Vending

The District will consider allowing private vendors to provide limited products and services. Prior to this policies and standards shall be developed to ensure the consistency with the park's intended natural setting. Policies may initially require trailerability consistent with other park facilities.

8. Boardwalks/Trails

In association with wetland and dune areas, the District will consider the construction of boardwalks and trails to promote awareness of unique and fragile flora and fauna while protecting these areas from excessive traffic. Yellow lines are only for example. The locations would have to be surveyed and engineered to maximize the experience and minimize the wetland impact.

9. Utilities

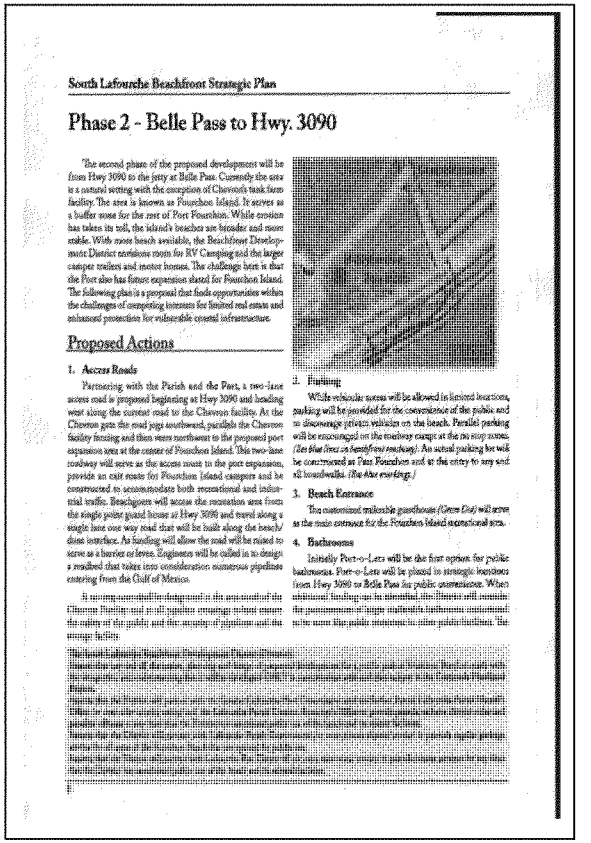
Water and underground electricity are proposed to follow along the roadway through to Bay Champagne.

10. Other Activities and Services

a. Golf carts and/or all terrain vehicles may be zoned if it can be determined that it would discourage vehicular traffic on the beach. If allowed, these vehicles would be prohibited in dune and wetland areas and speed limits would be stringently enforced.

b. Horseback riding will be allowed and perhaps promoted in a controlled manner. Again, if allowed, horses would be prohibited in dune and wetland areas.

c. Kayaking, canoeing and bird watching are to be promoted and allowed in designated areas. If arrangements can be made, kayaks and canoes may be rented for day use.



South Lafourche Beachfront Strategic Plan

Phase 2 - Belle Pass to Hwy. 3090

The second phase of the proposed development will be from Hwy 3090 to the jetty at Belle Pass. Currently the area is a natural setting with the exception of Chevron's tank farm facility. The area is known as Fourchon Island. It serves as a buffer zone for the east of Port Fourchon. While erosion has taken its toll, the island's beaches are broader and more stable. With more beach available, the Beachfront Development District envisions room for RV Camping and the larger camper trailers and motor homes. The challenge here is that the Port also has future expansion slated for Fourchon Island. The following plan is a proposal that finds opportunities within the challenges of competing interests for limited real estate and enhanced protection for vulnerable coastal infrastructure.

Proposed Actions

1. Access Roads

Partnering with the Parish and the Port, a two-lane access road is proposed beginning at Hwy 3090 and heading west along the current road to the Chevron facility. At the Chevron gate the road jogs southward, parallels the Chevron facility fencing and then veers northwest to the proposed port expansion area at the center of Fourchon Island. This two-lane roadway will serve as the access route to the port expansion, provide an exit route for Fourchon Island campers and be constructed to accommodate both recreational and industrial traffic. Beachgoers will access the recreation area from the single point guard house at Hwy 3090 and travel along a single lane one way road that will be built along the beach/dune interface. As funding will allow the road will be raised to serve as a barrier or levee. Engineers will be called in to design a roadbed that takes into consideration numerous pipelines entering from the Gulf of Mexico.

2. Parking

While vehicular access will be allowed in limited locations, parking will be provided for the convenience of the public and to discourage private vehicles on the beach. Parallel parking will be encouraged on the roadway except at the no stop zones. *(See blue lines on beachfront roadway).* An actual parking lot will be constructed at Pass Fourchon and at the entry to any and all boardwalks. *(See blue markings.)*

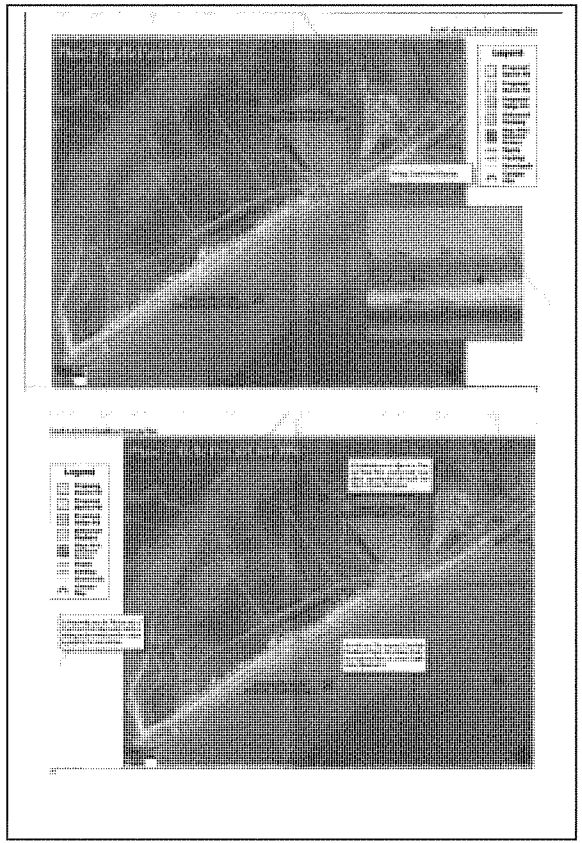
3. Beach Entrance

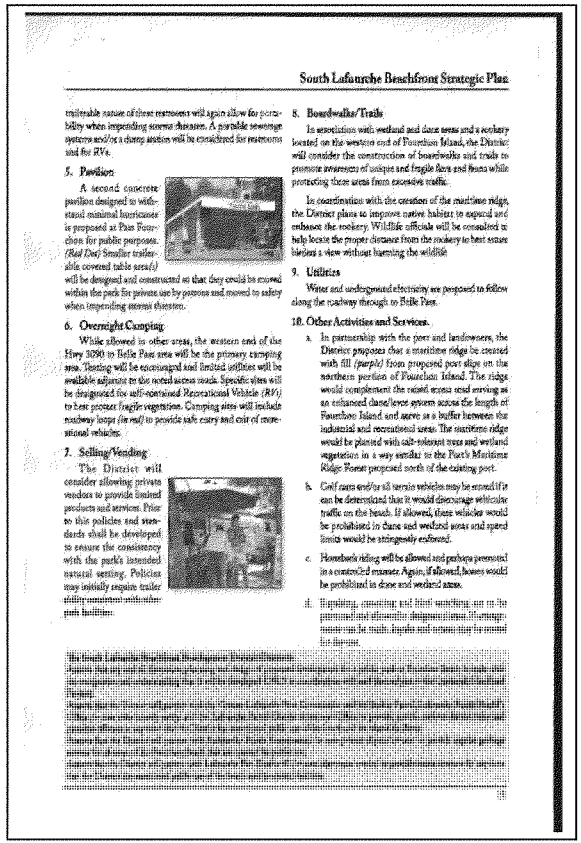
The customized inflatable guardhouse *(Green Dot)* will serve as the main entrance for the Fourchon Island recreational area.

4. Bathrooms

Initially Port-o-Lets will be the first option for public bathrooms. Port-o-Lets will be placed in strategic locations from Hwy 3090 to Belle Pass for public convenience. When additional funding is identified the District will consider the construction of more comfortable bathrooms constructed with more the public convenience in mind.

Edward Wisner Donation attachment (EWD at)





South Lafourche Beachfront Strategic Plan

trailerable nature of these restrooms will again allow for portability when impending storms threaten. A portable sewerage system and/or a dump station will be considered for restrooms and for RVs.

5. Pavilion

A second concrete pavilion designed to withstand minimal hurricanes is proposed at Pass Fourchon for public purposes. *(Red Dot)* Smaller trailerable covered table area(s) will be designed and constructed so that they could be moved within the park for private use by persons and moved to safety when impending storms threaten.

6. Overnight Camping

While allowed in other areas, the western end of the Hwy 3090 to Belle Pass area will be the primary camping area. Tenting will be encouraged and limited utilities will be available adjacent to the paved access roads. Specific sites will be designated for self-contained Recreational Vehicle *(RV)* to best protect fragile vegetation. Camping sites will include roadway loops *(in red)* to provide safe entry and exit of recreational vehicles.

7. Selling/Vending

The District will consider allowing private vendors to provide limited products and services. Prior to this policies and standards shall be developed to ensure the consistency with the park's intended natural setting. Policies may initially require trailer utility-mounted units-the park facilities.

8. Boardwalks/Trails

In association with wetland and dune areas and a rookery located on the western end of Fourchon Island, the District will consider the construction of boardwalks and trails to promote awareness of unique and fragile flora and fauna while protecting these areas from excessive traffic.

In coordination with the creation of the maritime ridge, the District plans to improve native habitat to expand and enhance the rookery. Wildlife officials will be consulted to help locate the proper distance from the rookery to best assure birders a view without harming the wildlife

9. Utilities

Water and underground electricity are proposed to follow along the roadway through to Belle Pass.

10. Other Activities and Services.

a. In partnership with the port and landowners, the District proposes that a maritime ridge be created with fill *(purple)* from proposed port slips on the northern portion of Fourchon Island. The ridge would complement the raised access road serving as an enhanced dune/levee system across the length of Fourchon Island and serve as a buffer between the industrial and recreational areas. The maritime ridge would be planted with salt-tolerant trees and wetland vegetation in a way similar to the Port's Maritime Ridge Forest proposed south of the existing port.

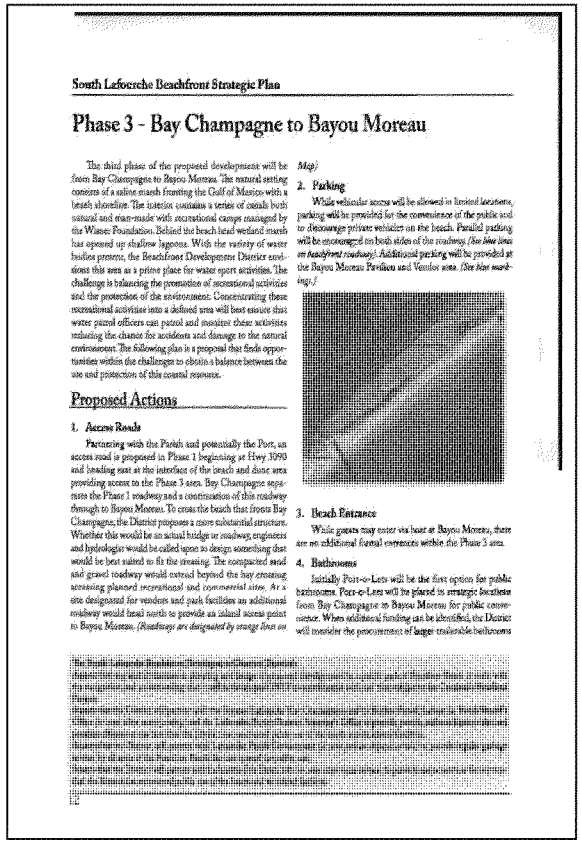
b. Golf carts and/or all terrain vehicles may be rented if it can be determined that it would discourage vehicular traffic on the beach. If allowed, these vehicles would be prohibited in dune and wetland areas and speed limits would be stringently enforced.

c. Horseback riding will be allowed and perhaps promoted in a controlled manner. Again, if allowed, horses would be prohibited in dune and wetland areas.

d. Kayaking, canoeing and bird watching are to be promoted and allowable designated areas. Parkage must be built. Signs and access may be created for these.

1126

Edward Wisner Donation attachment (EWD at)



South Lafourche Beachfront Strategic Plan

Phase 3 - Bay Champagne to Bayou Moreau

The third phase of the proposed development will be from Bay Champagne to Bayou Moreau. The natural setting consists of a saline marsh fronting the Gulf of Mexico with a beach shoreline. The interior contains a series of canals both natural and man-made with recreational camps managed by the Wisner Foundation. Behind the beach head wetland marsh has opened up shallow lagoons. With the variety of water bodies present, the Beachfront Development District envisions this area as a prime place for water sport activities. The challenge is balancing the promotion of recreational activities and the protection of the environment. Concentrating these recreational activities into a defined area will best ensure that water patrol officers can patrol and monitor these activities reducing the chance for accidents and damage to the natural environment. The following plan is a proposal that finds opportunities within the challenges to obtain a balance between the use and protection of this coastal resource.

Proposed Actions

1. Access Roads

Partnering with the Parish and potentially the Port, an access road is proposed in Phase 1 beginning at Hwy 3090 and heading east at the interface of the beach and dune area providing access to the Phase 3 area. Bay Champagne separates the Phase 1 roadway and a continuation of this roadway through to Bayou Moreau. To cross the beach that flows Bay Champagne, the District proposes a crave substantial structure. Whether this would be an actual bridge or roadway, engineers and hydrologist would be called upon to design something that would be best suited to fit the crossing. The compacted sand and gravel roadway would extend beyond the bay crossing accessing planned recreational and commercial sites. At a site designated for vendors and park facilities an additional roadway would head north to provide an inland access point to Bayou Moreau. *(Roadways are designated by orange lines on Map)*

2. Parking

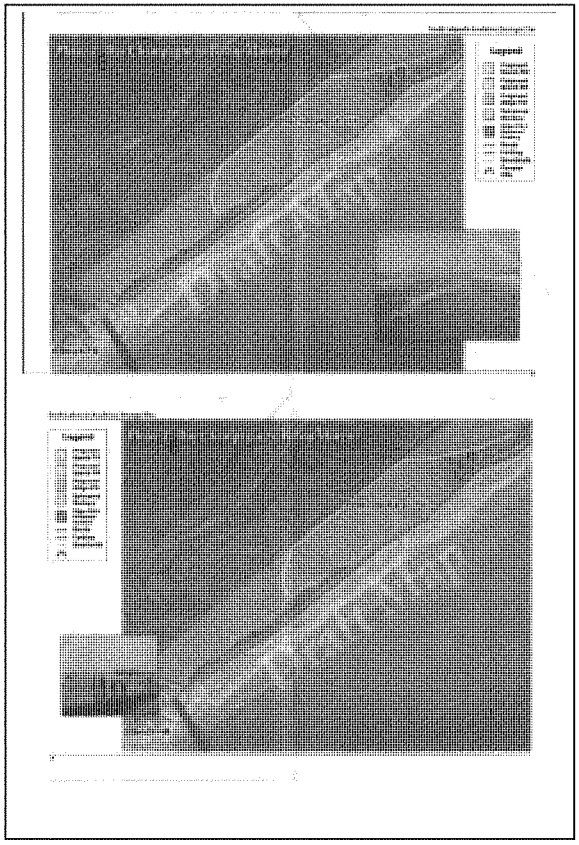
While vehicular access will be allowed in limited locations, parking will be provided for the convenience of the public and to discourage private vehicles on the beach. Parallel parking will be encouraged on both sides of the roadway *(See blue lines on beachfront roadway)*. Additional parking will be provided at the Bayou Moreau Pavilion and Vendor area. *(See blue markings.)*

3. Beach Entrance

While guests may enter via boat at Bayou Moreau, there are no additional formal entrances within the Phase 3 area.

4. Bathrooms

Initially Port-o-Lets will be the first option for public bathrooms. Port-o-Lets will be placed in strategic locations from Bay Champagne to Bayou Moreau for public convenience. When additional funding can be identified, the District will consider the procurement of larger trailerable bathrooms



Edward Wisner Donation attachment (EWD at)

...constructed to be more like public restrooms in other public facilities. The trailerable nature of these restrooms will again allow for portability when impending storm threaten. Long-term plans include replacing the trailerable bathrooms with a *fully freestanding bathhouse (Purple Dot).*

5. Pavilion

A third concrete pavilion designed to withstand extreme hurricanes is proposed at Bayou Moreau for public purposes. *(Red Dot)* Smaller trailerable covered table areas *(4)* will be designed and constructed so that they could be moved within the park for private use by patrons and moved to safety when impending storm threaten.

6. Overnight Camping

To maximize the beach area for recreational activities, no tent or RV Camping will be allowed in this area.

7. Selling/Vending

The District will consider allowing private vendors to provide limited products and services. An area near the mouth of Bayou Moreau will be designated for vendors. The expansion of the District is that along with food and other concessions this area would house rental areas for canoes, kayaks, wave runners and other water sport related activities. Prior to the development of this area policies and standards shall be developed to ensure the consistency with the park's intended natural setting. Policies may initially require trailer ability consistent with other park facilities.

8. Boardwalks/Trails

In association with wetland and dune areas, the District will consider the construction of boardwalks to promote awareness of unique and fragile flora and fauna while protecting these areas from excessive traffic.

9. Utilities

Water and underground electricity are proposed to follow along the roadway through to Bayou Moreau.

10. Other Activities and Services

a. The Bay Champagne to Bayou Moreau Phase of Development will be designed to concentrate water sport activities. Motorized activities will be allowed on the beach, in the Gulf waters, in Bayou Moreau and in the navigable canals. These activities may include but are not limited to parasailing, skiing and boating. If it can be arranged, the rental of wave runners and other watercraft may be made available.

b. Non-motorized activities will be encouraged within Bay Champagne, the pond area behind the dunes and in the interconnecting canals. Again if arrangements can be made, kayaks, canoes, paddleboats and other non-motorized vehicles may be made available. As the inland waterways connect, policies will be developed to promote safety where both motorized and non-motorized activities are allowed.

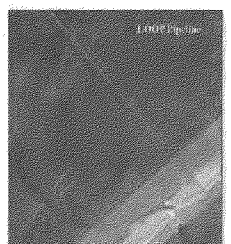
c. On land golf carts and/or all terrain vehicles may be rented if arrangements can be made and if it can be determined that it would discourage vehicular traffic on the beach. If allowed, these vehicles would be prohibited in dune and wetland areas and speed limits would be stringently enforced.

d. Horseback riding will be allowed and promoted in a controlled manner. Horses would be prohibited in dune and wetland areas.

e. While not prohibited, swimming, fishing, crabbing, surfing and bird watching will be discouraged in this area.

Phase 4 - Bayou Moreau to Bayou Thunder

The fourth phase of the proposed development will be from Bayou Moreau through to the parish line at Bayou Thunder. The natural setting consists of a tedge marsh fronting the Gulf of Mexico with a beach shoreline. The nearly four (4) mile stretch is remote and includes the Loop Pipeline crossing which is sensitive environmentally and for purposes of Homeland Security. Similar to Phase 3, the challenge is balancing the use and protection of this sensitive area. The vision of this area is the primitive use of a natural environment with limited access and limited amenities. Private vehicles will be prohibited from traveling across this stretch of beachfront. Traffic will be limited to park vehicles to transport guests to their destination, service vehicles to maintain and patrol the area and emergency vehicles. The following plan is a proposal that finds opportunities and unique methods to provide access amidst a sensitive and natural environment.



Proposed Actions:

1. Access Roads

Harmonizing with the Parish and potentially the Port, a trail will be constructed in a manner similar to the access road proposed in Phases 1 & 3. Somewhat narrower than the road-ways of Phases 1 & 3, the trail will extend through to Bayou Thunder with beach and dune finishing unique areas and views. For emergency purposes the trail will have ramp accesses, rest stops, and be open to the beach. While private vehicles will be prohibited, the trail will be designed to accommodate emergency, service and park vehicles. Engineers will be consulted to determine the best method to cross Bayou Moreau addressing the hydrology and necessity for access and to cross the Loop Pipeline ensuring that any trail for *residential* access any and all security and structural measures necessary to protect the pipeline.

2. Parking

With private vehicles prohibited, parking will be provided at Bayou Moreau for the convenience of the public and to discourage private vehicles on the beach. Parallel parking will be encouraged on both sides of Bayou Moreau. *(See blue marker).*

3. Beach Entrance

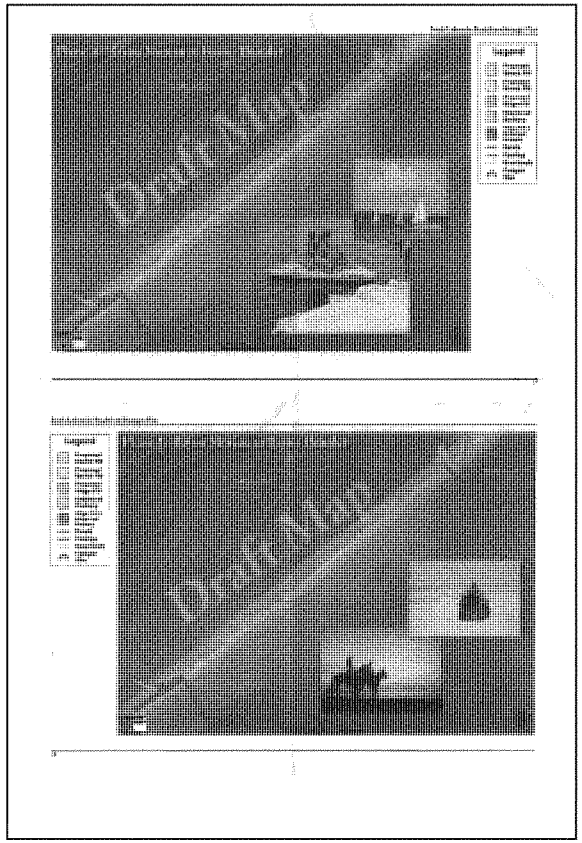
There are no additional formal entrances within the Phase 4 area.

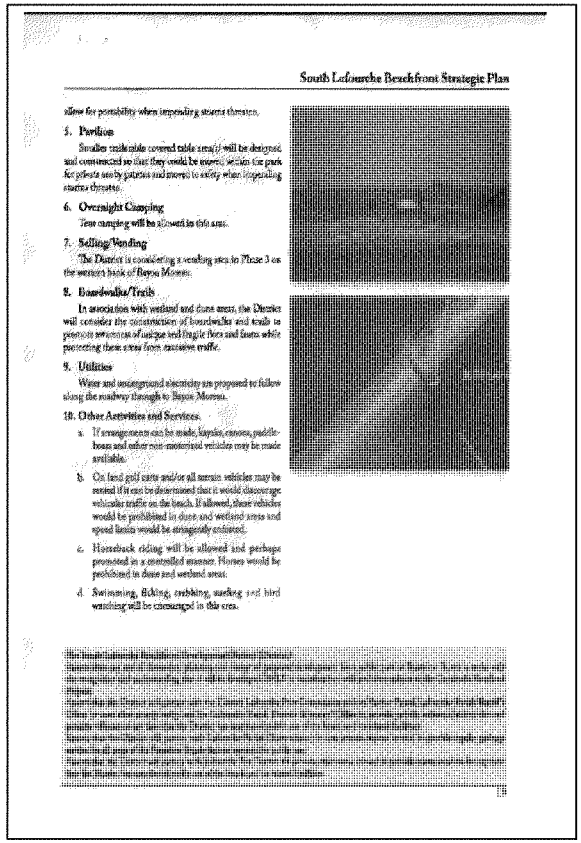
4. Bathrooms

Initially Port-o-Lets will be the first option for public bathrooms. Port-o-Lets will be placed in strategic locations from Bayou Moreau to Bayou Thunder for public convenience. When additional funding can be identified, the District will consider the procurement of larger trailerable bathrooms constructed to be more like public restrooms in other public facilities. The trailerable nature of these restrooms will again

The South Lafourche Beachfront Development District (District).
Asserts that any and all discussion, planning and design of proposed development for a public park at Four Isle Beach is made with the recognition and understanding that it will be developed ONLY in coordination with and then subject to the Coastwide Hurricane Project.
Asserts that the District will partner with the Greater Lafourche Port Commission and its Harbor Patrol, Lafourche Parish Sheriff's Office (or some other security entity) and the Lafourche Parish District Attorney's Office to provide patrols, enforce district rules and penalties offenses at any time that the District has an authorized public use of the beach and its related facilities.
Asserts that the District will partner with Lafourche Parish Government (or some private disposal service) to provide regular garbage service for all areas of the Beaches that are opened for public use.
Asserts that the District will partner with Lafourche Fire District #3 (or some other rescue service) to provide rescue services for any time that the District has an allowed public use of the beach and its related facilities.

Edward Wisner Donation attachment (EWD at)





South Lafourche Beachfront Strategic Plan

allow for possibility when impending storm threaten.

5. Pavilion

Smaller trailerable covered table area(s) will be designed and constructed so that they could be moved within the park for private use by patrons and moved to safety when impending storms threaten.

6. Overnight Camping

Tent camping will be allowed in this area.

7. Selling/Vending

The District is considering a vending area in Phase 3 on the western bank of Bayou Moreau.

8. Boardwalks/Trails

In association with wetland and dune areas, the District will consider the construction of boardwalks and trails to promote awareness of unique and fragile flora and fauna while protecting these areas from excessive traffic.

9. Utilities

Water and underground electricity are proposed to follow along the roadway through to Bayou Moreau.

10. Other Activities and Services.

a. If arrangements can be made, kayaks, canoes, paddleboats and other non-motorized vehicles may be made available.

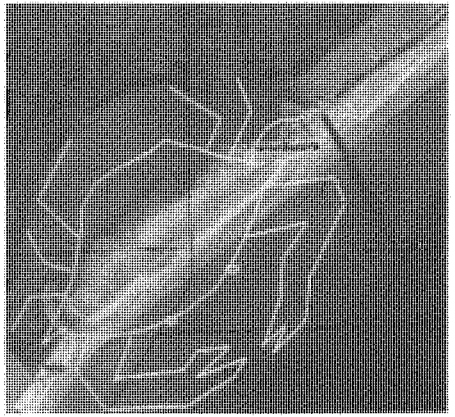
b. On land golf carts and/or all terrain vehicles may be rented if it can be determined that it would discourage vehicular traffic on the beach. If allowed, these vehicles would be prohibited in dune and wetland areas and speed limits would be stringently enforced.

c. Horseback riding will be allowed and perhaps promoted in a controlled manner. Horses would be prohibited in dune and wetland areas.

d. Swimming, fishing, crabbing, surfing and bird watching will be encouraged in this area.

Edward Wisner Donation attachment (EWD at)

South Lafourche Beachfront Strategic Plan



Alternate Boardwalk Configuration

PICCIOLA & ASSOCIATES, INC.

CIVIL ENGINEERS · LAND SURVEYORS · NAVAL ARCHITECTS · MARINE ENGINEERS

J.C. PICCIOLA, II, P.E., L.S.

South Lafourche Beach Front Development Commission
Strategic Plan Phase I
Construction Cost Estimate
July 20, 2011

1. Aggregate Roadway Construction & Engineering	$	965,000.00
2. Waterline Construction & Engineering	$	116,000.00
3. Electrical Construction & Engineering	$	172,500.00
4. Fencing Construction & Engineering	$	45,540.00
5. Pavilion Construction & Engineering	$	120,750.00
6. Fishing Pier Construction & Engineering	$	183,000.00
7. Signage Construction & Engineering	$	5,750.00
8. Guardhouse Construction & Engineering	$	28,750.00
Total Phase I	$	1,937,250.00

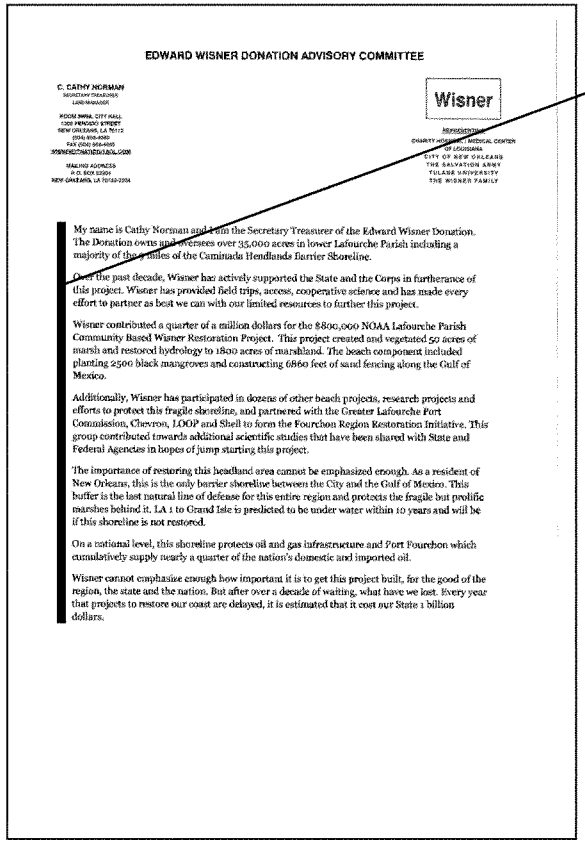
Submitted by:

Joseph C. Picciola, II, P.E.

P.O. BOX 697 · C.J.T. CITY, LOUISIANA 70345 · 115 PICCIOLA PARKWAY · PICCIOLA COMPLEX
PHONE: (985) 850-5766 · FAX: (985) 850-2407 · E-MAIL: [illegible]

1130

Edward Wisner Donation public meeting comments (EWD pm)



EDWARD WISNER DONATION ADVISORY COMMITTEE

C. CATHY NORMAN
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LAND MANAGER

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NEW ORLEANS, LA 70152-2904

Wisner

REPRESENTING
CHARITY HOSPITAL/ MEDICAL CENTER OF LOUISIANA
CITY OF NEW ORLEANS
THE SALVATION ARMY
TULANE UNIVERSITY
THE WISNER FAMILY

My name is Cathy Norman and I am the Secretary Treasurer of the Edward Wisner Donation. The Donation owns grant of servitudes over 35,000 acres in lower Lafourche Parish including a majority of the 9 miles of the Caminada Headlands Barrier Shoreline.

Over the past decade, Wisner has actively supported the State and the Corps in furtherance of this project. Wisner has provided field trips, access, cooperative science and has made every effort to partner as best we can with our limited resources to further this project.

Wisner contributed a quarter of a million dollars for the $800,000 NOAA Lafourche Parish Community Based Wisner Restoration Project. This project created and vegetated 50 acres of marsh and restored hydrology to 1800 acres of marshland. The beach component included planting 2500 black mangroves and constructing 6860 feet of sand fencing along the Gulf of Mexico.

Additionally, Wisner has participated in dozens of other beach projects, research projects and efforts to protect this fragile shoreline, and partnered with the Greater Lafourche Port Commission, Chevron, LOOP and Shell to form the Fourchon Region Restoration Initiative. This group contributed towards additional scientific studies that have been shared with State and Federal Agencies in hopes of jump starting this project.

The importance of restoring this headland area cannot be emphasized enough. As a resident of New Orleans, this is the only barrier shoreline between the City and the Gulf of Mexico. This buffer is the last natural line of defense for this entire region and protects the fragile but prolific marshes behind it. LA 1 to Grand Isle is predicted to be under water within 10 years and will be if this shoreline is not restored.

On a national level, this shoreline protects oil and gas infrastructure and Port Fourchon which cumulatively supply nearly a quarter of the nation's domestic and imported oil.

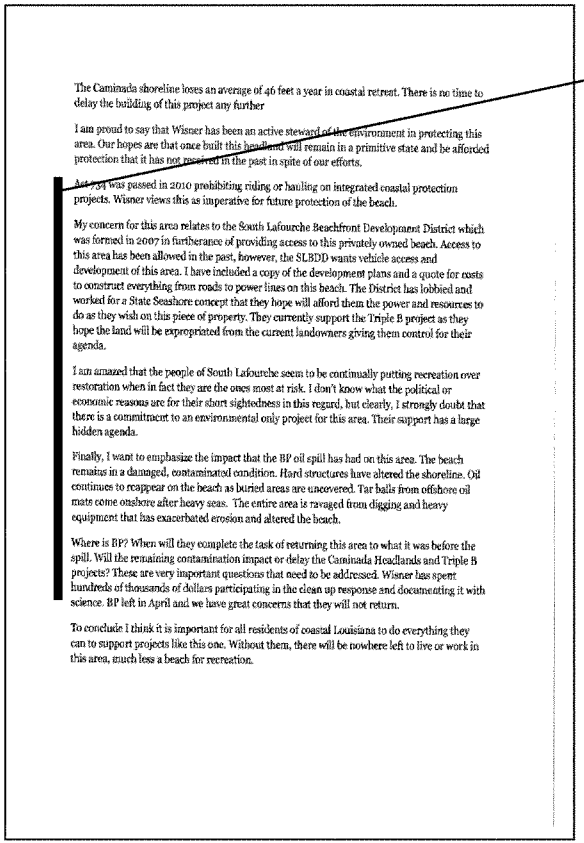
Wisner cannot emphasize enough how important it is to get this project built, for the good of the region, the state and the nation. But after over a decade of waiting, what have we lost. Every year that projects to restore our coast are delayed, it is estimated that it cost our State 1 billion dollars.

RESPONSE

EWD pm 01: Thank you for your comment.

1131

Edward Wisner Donation public meeting comments (EWD pm)



The Caminada shoreline loses an average of 46 feet a year in coastal retreat. There is no time to delay the building of this project any further

I am proud to say that Wisner has been an active steward of the environment in protecting this area. Our hopes are that once built this headland will remain in a primitive state and be afforded protection that it has not received in the past in spite of our efforts.

Act 731 was passed in 2010 prohibiting riding or hauling on integrated coastal protection projects. Wisner views this as imperative for future protection of the beach.

My concern for this area relates to the South Lafourche Beachfront Development District which was formed in 2007 in furtherance of providing access to this privately owned beach. Access to this area has been allowed in the past, however, the SLBDD wants vehicle access and development of this area. I have included a copy of the development plans and a quote for costs to construct everything from roads to power lines on this beach. The District has lobbied and worked for a State Seashore concept that they hope will afford them the power and resources to do as they wish on this piece of property. They currently support the Triple B project as they hope the land will be expropriated from the current landowners giving them control for their agenda.

I am amazed that the people of South Lafourche seem to be continually putting recreation over restoration when in fact they are the ones most at risk. I don't know what the political or economic reasons are for their short sightedness in this regard, but clearly, I strongly doubt that there is a commitment to an environmental only project for this area. Their support has a large hidden agenda.

Finally, I want to emphasize the impact that the BP oil spill has had on this area. The beach remains in a damaged, contaminated condition. Hard structures have altered the shoreline. Oil continues to reappear on the beach as buried areas are uncovered. Tar balls from offshore oil mats come onshore after heavy seas. The entire area is ravaged from digging and heavy equipment that has exacerbated erosion and altered the beach.

Where is BP? When will they complete the task of returning this area to what it was before the spill. Will the remaining contamination impact or delay the Caminada Headlands and Triple B projects? These are very important questions that need to be addressed. Wisner has spent hundreds of thousands of dollars participating in the clean up response and documenting it with science. BP left in April and we have great concerns that they will not return.

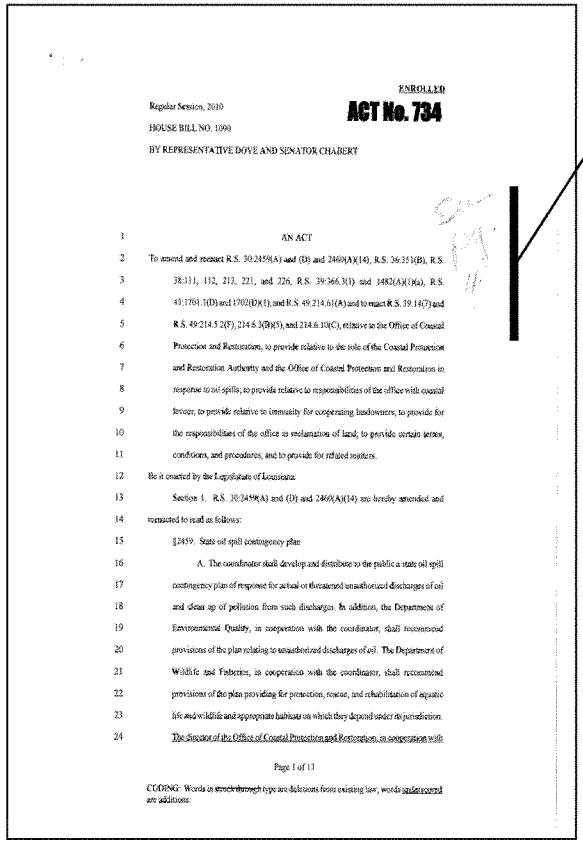
To conclude I think it is important for all residents of coastal Louisiana to do everything they can to support projects like this one. Without them, there will be nowhere left to live or work in this area, much less a beach for recreation.

RESPONSE

EDW pm 02: Thank you for your comment. The Barataria Basin Barrier Shoreline Restoration study is authorized as an ecosystem restoration project. The purpose of a Civil Works ecosystem restoration project is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Protection may be included as part of Civil Works ecosystem restoration initiatives when such measures involve efforts to prevent future degradation of an ecosystem's structure and functions. The Government has the obligation to acquire sufficient real estate interests to construct the project and to protect the integrity of the project features. In order to ensure protection of project features, Corps of Engineers regulations indicate that fee title should be acquired for ecosystem restoration projects unless such protection can be accomplished through the acquisition of a lesser interest estate. At this time, a final decision has not been made as to whether fee interest or a permanent easement will be acquired for this project. However, regardless of which estate is acquired, the primary acquisition goal is to protect the project features. Any activity that could be allowed would have to be consistent with the project authorization and function. The possibility for public access to the project site will depend upon which real estate interest is acquired and will be dictated by State and Federal laws as they relate to ecosystem restoration projects.

1132

Edward Wisner Donation attachment 1 (EWD at1)



ENROLLED

Regular Session, 2010

ACT No. 734

HOUSE BILL NO. 1090

BY REPRESENTATIVE DOVE AND SENATOR CHABERT

AN ACT

To amend and reenact R.S. 30:2459(A) and (D) and 2460(A)(14), R.S. 36:351(B), R.S. 38:111, 112, 213, 221, and 226, R.S. 39:366.3(1) and 1482(A)(1)(a), R.S. 49:1703.1(D) and 1702(D)(1), and R.S. 49:214.61(A) and to enact R.S. 39:14(F) and R.S. 49:214.5.2(F), 214.6.3(D)(5), and 214.6.10(C), relative to the Office of Coastal Protection and Restoration, to provide relative to the role of the Coastal Protection and Restoration Authority and the Office of Coastal Protection and Restoration in response to oil spills; to provide relative to responsibilities of the office with coastal forces; to provide relative to immunity for cooperating landowners; to provide for the responsibilities of the office in reclamation of land; to provide certain terms, conditions, and procedures; and to provide for related matters.

Be it enacted by the Legislature of Louisiana:

Section 1. R.S. 30:2459(A) and (D) and 2460(A)(14) are hereby amended and reenacted to read as follows:

§2459. State oil spill contingency plan

A. The coordinator shall develop and distribute to the public a state oil spill contingency plan of response for actual or threatened unauthorized discharges of oil and clean up of pollution from such discharges. In addition, the Department of Environmental Quality, in cooperation with the coordinator, shall recommend provisions of the plan relating to unauthorized discharges of oil. The Department of Wildlife and Fisheries, in cooperation with the coordinator, shall recommend provisions of the plan providing for protection, rescue, and rehabilitation of aquatic life and wildlife and appropriate habitats on which they depend under its jurisdiction. The director of the Office of Coastal Protection and Restoration, in cooperation with

Page 1 of 11

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RESPONSE

EDW at1 01: Thank you for your comment.

1133

Edward Wisner Donation attachment 1 (EDW at1)

HB NO. 1090 **ENROLLED**

the coordinator, shall recommend provisions of the plan for providing for the protection and restoration of the coastal areas of the state. The Department of Natural Resources, in cooperation with the coordinator, shall recommend provisions of the plan providing for protection and rehabilitation of appropriate resources under its jurisdiction. The Department of Public Safety and Corrections, in cooperation with the coordinator, shall recommend provisions of the plan providing for emergency response coordination to protect life and property, excluding prevention, abatement, containment, and removal of pollution from an unauthorized discharge.

* * *

D. Prior to adopting the state oil spill contingency plan, the coordinator shall adopt a fully delineated inland boundary for coastal waters as defined in this Chapter, which boundary shall be based upon data provided by, including but not limited to the United States Army Corps of Engineers, United States Department of the Interior, Minerals Management Service, the Coastal Protection and Restoration Authority, the Louisiana Department of Natural Resources, and the oil and gas industry. The coordinator shall be authorized to amend the boundary by rule as conditions may warrant. The boundary, as adopted, shall be clearly marked on large scale maps or charts, official copies of which shall be available for public inspection in the Office of Coastal Protection and Restoration, the office of coastal restoration and management in the Department of Natural Resources, in each agency comprising the interagency council, and in the parish seat of each parish located within the boundary.

§2460. Contingency plan provisions

A. The plan shall include all of the following:

* * *

(14) Procedures established in cooperation with the Department of Environmental Quality, Department of Wildlife and Fisheries, the Coastal Protection and Restoration Authority, and Department of Natural Resources for assessment of natural resources damages and plans for mitigation of damage to and restoration, protection, rehabilitation, or replacement of damaged natural resources. Pursuant to

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RESPONSE

1134

Edward Wisner Donation attachment 1 (EWD at1)

HB NO. 1090 **ENROLLED**

R.S. 49:214.1 et seq., the Coastal Protection and Restoration Authority is responsible for integrated coastal protection in the coastal area of the state, therefore, the Coastal Protection and Restoration Authority and the Office of Coastal Protection and Restoration shall assist the coordinator in a primary role in assessing natural resource damages in the coastal area.

* * *

Section 2. R.S.36:351(B) is hereby amended and reenacted to read as follows:

§351. Department of Natural Resources; creation, domicile; composition; purposes and functions

* * *

B. The Department of Natural Resources, through its offices and officers, shall be responsible for the conservation, management, and development of water, minerals, and other such natural resources of the state, including coastal ~~conservation~~ and management, except timber and fish and wildlife and their habitats.

* * *

Section 3. R.S. 38:114, 112, 213, 221, and 226 are hereby amended and reenacted to read as follows:

§111. Contracts by drainage districts, levee boards, and political subdivisions with Department of Public Works or the Office of Coastal Protection and Restoration

Any drainage or subdrainage district, gravity drainage, or gravity subdrainage district, levee board, or political subdivision may contract with the Department of Public Works or, for projects in the coastal area as defined in R.S. 49:214.2(3), the Office of Coastal Protection and Restoration, upon any terms for the payment of the cost of the drainage and reclamation projects within the confines of the district or districts involved proportionately by the Department of Public Works, or the Office of Coastal Protection and Restoration, and the districts as may be agreed upon between the Department of Public Works, or the Office of Coastal Protection and Restoration, and the governing authorities of the districts entering into any contract.

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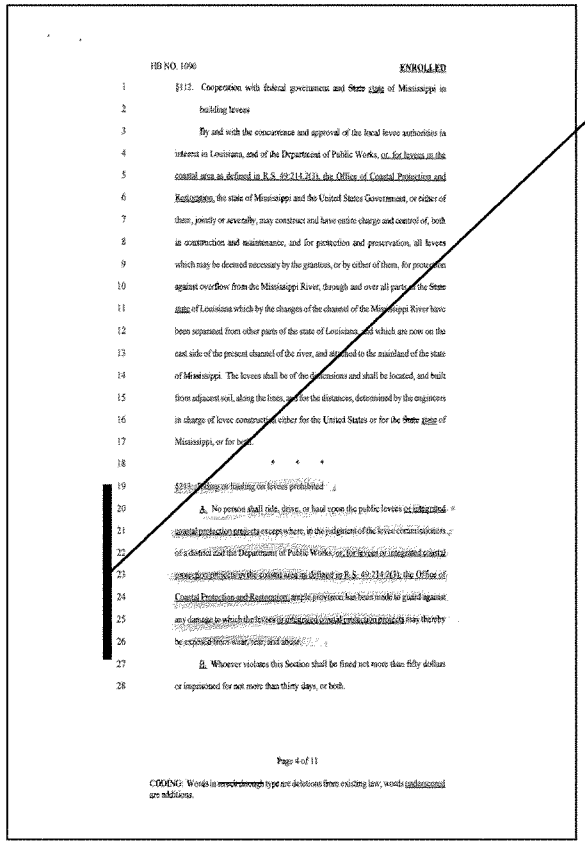
RESPONSE

1135

Edward Wisner Donation attachment 1 (EWD at1)



HB NO. 1090 ENROLLED

§312. Cooperation with federal government and State state of Mississippi in building levees

By and with the concurrence and approval of the local levee authorities in interest in Louisiana, and of the Department of Public Works, or, for levees in the coastal area as defined in R.S. 49:214.2(3), the Office of Coastal Protection and Restoration, the state of Mississippi and the United States Government, or either of them, jointly or severally, may construct and have entire charge and control of, both in construction and maintenance, and for protection and preservation, all levees which may be deemed necessary by the grantees, or by either of them, for protection against overflow from the Mississippi River, through and over all parts of the State state of Louisiana which by the changes of the channel of the Mississippi River have been separated from other parts of the state of Louisiana and which are now on the east side of the present channel of the river, and attached to the mainland of the state of Mississippi. The levees shall be of the dimensions and shall be located, and built from adjacent soil, along the lines, and for the distances, determined by the engineers in charge of levee construction either for the United States or for the State state of Mississippi, or for both.

* * *

§313. Riding or loading on levees prohibited

A. No person shall ride, drive, or haul upon the public levees or integrated coastal protection projects except where, in the judgment of the levee commissioners of a district and the Department of Public Works, or, for levees or integrated coastal protection projects in the coastal area as defined in R.S. 49:214.2(3), the Office of Coastal Protection and Restoration, specific provision has been made to guard against any damage to which the levees or integrated coastal protection projects may thereby be exposed from wear, tear, and abuse.

B. Whoever violates this Section shall be fined not more than fifty dollars or imprisoned for not more than thirty days, or both.

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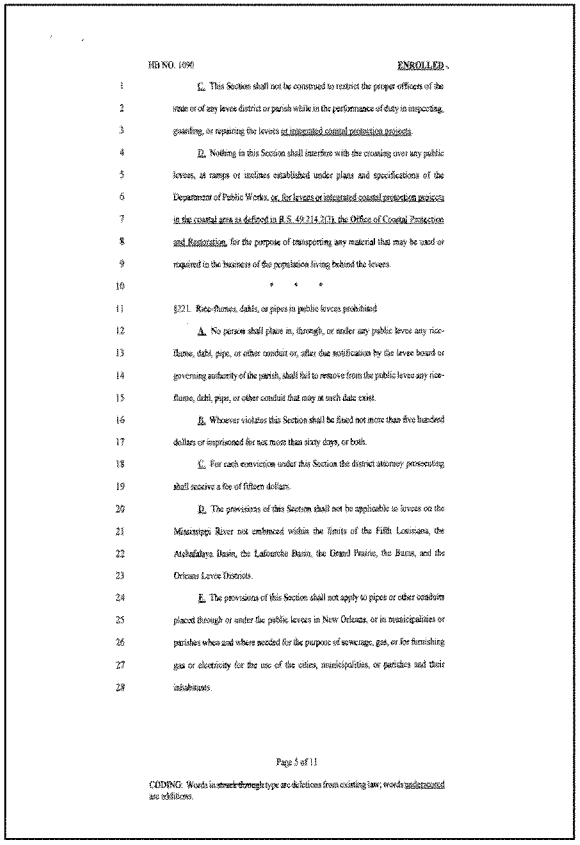
RESPONSE:

EWD at1 02: Thank you for your comment.

1136

Edward Wisner Donation attachment 1 (EWD at1)



HB NO. 1090 ENROLLED

C. This Section shall not be construed to restrict the proper officers of the state or of any levee district or parish while in the performance of duty in inspecting, guarding, or repairing the levees or integrated coastal protection projects.

D. Nothing in this Section shall interfere with the crossing over any public levees, at ramps or inclines established under plans and specifications of the Department of Public Works, or, for levees or integrated coastal protection projects in the coastal area as defined in R.S. 49:214.2(3), the Office of Coastal Protection and Restoration, for the purpose of transporting any material that may be used or required in the business of the population living behind the levees.

* * *

§321. Rice-flumes, dahls, or pipes in public levees prohibited

A. No person shall place in, through, or under any public levee any rice-flume, dahl, pipe, or other conduit or, after due notification by the levee board or governing authority of the parish, shall fail to remove from the public levee any rice-flume, dahl, pipe, or other conduit that may at such date exist.

B. Whoever violates this Section shall be fined not more than five hundred dollars or imprisoned for not more than sixty days, or both.

C. For each conviction under this Section the district attorney prosecuting shall receive a fee of fifteen dollars.

D. The provisions of this Section shall not be applicable to levees on the Mississippi River not embraced within the limits of the Fifth Louisiana, the Atchafalaya Basin, the Lafourche Basin, the Grand Prairie, the Barns, and the Orleans Levee Districts.

E. The provisions of this Section shall not apply to pipes or other conduits placed through or under the public levees in New Orleans, or in municipalities or parishes when and where needed for the purpose of sewerage, gas, or for furnishing gas or electricity for the use of the cities, municipalities, or parishes and their inhabitants.

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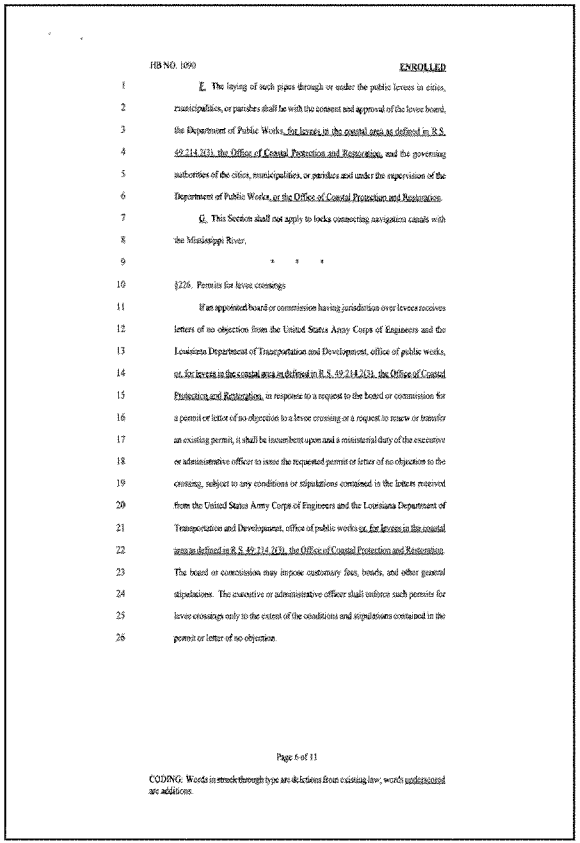
RESPONSE

1137

Edward Wisner Donation attachment 1 (EWD at1)



HB NO. 1090 ENROLLED

E. The laying of such pipes through or under the public levees in cities, municipalities, or parishes shall be with the consent and approval of the levee board, the Department of Public Works, for levees in the coastal area as defined in R.S. 49:214.2(3), the Office of Coastal Protection and Restoration, and the governing authorities of the cities, municipalities, or parishes and under the supervision of the Department of Public Works, or the Office of Coastal Protection and Restoration.

G. This Section shall not apply to locks connecting navigation canals with the Mississippi River.

* * *

§226. Permits for levee crossings

If an appointed board or commission having jurisdiction over levees receives letters of no objection from the United States Army Corps of Engineers and the Louisiana Department of Transportation and Development, office of public works, or, for levees in the coastal area as defined in R.S. 49:214.2(3), the Office of Coastal Protection and Restoration, in response to a request to the board or commission for a permit or letter of no objection to a levee crossing or a request to renew or transfer an existing permit, it shall be incumbent upon and a ministerial duty of the executive or administrative officer to issue the requested permit or letter of no objection to the crossing, subject to any conditions or stipulations contained in the letters received from the United States Army Corps of Engineers and the Louisiana Department of Transportation and Development, office of public works or, for levees in the coastal area as defined in R.S. 49:214.2(3), the Office of Coastal Protection and Restoration. The board or commission may impose customary fees, bonds, and other general stipulations. The executive or administrative officer shall enforce such permits for levee crossings only to the extent of the conditions and stipulations contained in the permit or letter of no objection.

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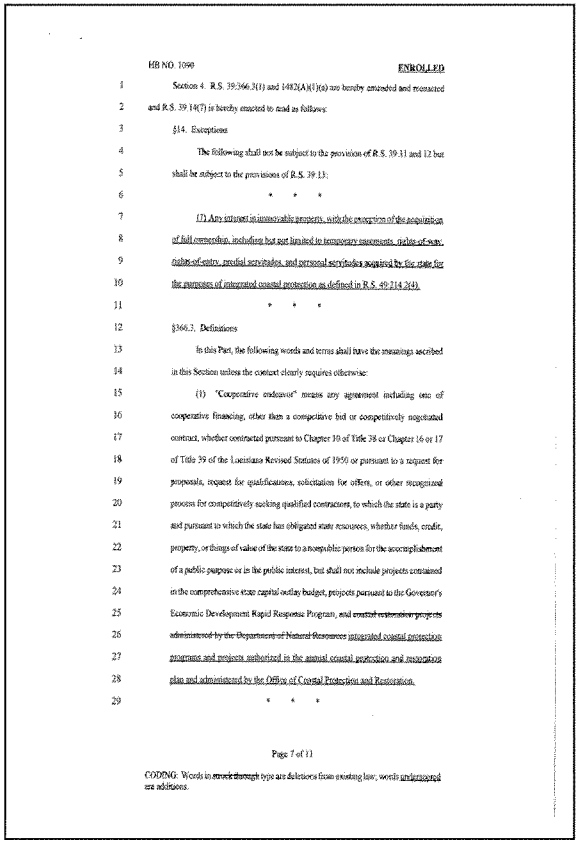
RESPONSE

1138

Edward Wisner Donation attachment 1 (EWD at1)



HB NO. 1090 **ENROLLED**

Section 4. R.S. 39:366.3(1) and 1482(A)(1)(a) are hereby amended and reenacted and R.S. 39:19(7) is hereby enacted to read as follows:

§14. Exceptions

The following shall not be subject to the provision of R.S. 39:11 and 12 but shall be subject to the provisions of R.S. 39:13:

* * *

(7) Any interest in immovable property, with the exception of the acquisition of full ownership, including but not limited to temporary easements, rights-of-way, rights-of-entry, predial servitudes, and personal servitudes acquired by the state for the purposes of integrated coastal protection as defined in R.S. 49:214.2(4).

* * *

§366.3. Definitions

In this Part, the following words and terms shall have the meanings ascribed in this Section unless the context clearly requires otherwise:

(1) "Cooperative endeavor" means any agreement including one of cooperative financing, other than a competitive bid or competitively negotiated contract, whether contracted pursuant to Chapter 10 of Title 38 or Chapter 16 or 17 of Title 39 of the Louisiana Revised Statutes of 1950 or pursuant to a request for proposals, request for qualifications, solicitation for offers, or other recognized process for competitively seeking qualified contractors, to which the state is a party and pursuant to which the state has obligated state resources, whether funds, credit, property, or things of value of the state to a nonpublic person for the accomplishment of a public purpose or in the public interest, but shall not include projects contained in the comprehensive state capital outlay budget, projects pursuant to the Governor's Economic Development Rapid Response Program, and ~~coastal restoration projects administered by the Department of Natural Resources~~ integrated coastal protection programs and projects authorized in the annual coastal protection and restoration plan and administered by the Office of Coastal Protection and Restoration.

* * *

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RESPONSE

1139

Edward Wisner Donation attachment 1 (EWD at1)

HB NO. 1090 **ENROLLED**

§1482. Application of the Chapter

A. Except as otherwise provided herein, this Chapter shall apply to every expenditure of public funds in excess of two thousand dollars by the executive branch of this state for professional, personal, consulting, and social services procurement. However, this Chapter shall not apply to the following procurements:

(1)(a) Professional services for engineering design contracts, construction contracts, or contracts for surveying pertaining to the maintenance and construction of roads and bridges, flood control, integrated coastal protection, aviation, public transportation, or public works entered into by the Department of Transportation and Development as provided in Part XIII-A of Chapter 1 of Title 48 of the Louisiana Revised Statutes of 1950.

* * *

Section 5. R.S. 41:1701.1(D) and 1702(D)(1) are hereby amended and reenacted to read as follows:

§1701.1. State Land Office; powers, duties, functions, and responsibilities

* * *

D. The State Land Office shall identify all public lands and water bottoms within the state and develop and maintain a current master list of those lands and water bottoms. All state agencies, including but not limited to Department of Culture, Recreation and Tourism, the Department of Natural Resources, the Office of Coastal Protection and Restoration, the Department of Wildlife and Fisheries, the Department of Transportation and Development, the Louisiana Geological Survey, the state's colleges and universities, all levee boards, drainage boards, parish governing authorities, and any districts created under the jurisdiction of levee boards, drainage boards, or parish governing authorities, shall cooperate with the State Land Office in developing the master list.

* * *

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RESPONSE

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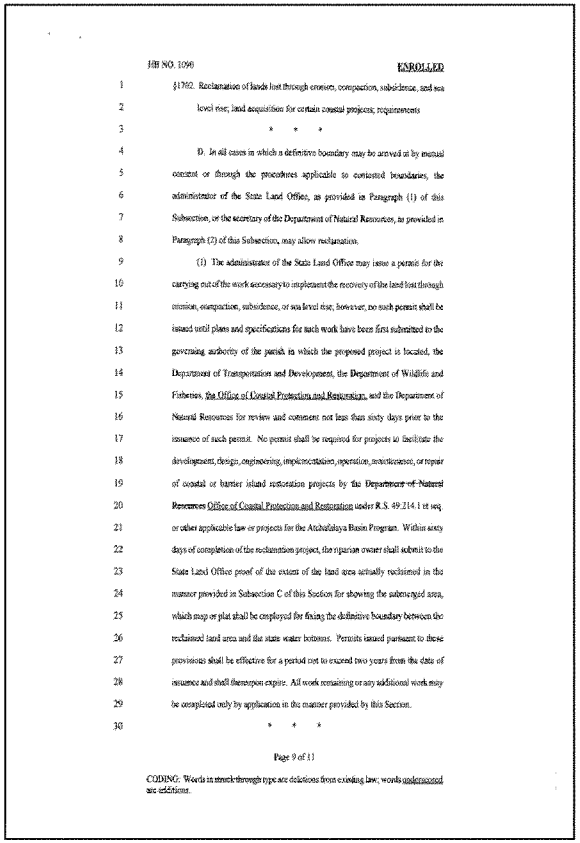
Edward Wisner Donation attachment 1 (EWD at1)



HB NO. 1090 **ENROLLED**

§1702. Reclamation of lands lost through erosion, compaction, subsidence, and sea level rise; land acquisition for certain coastal projects; requirements

* * *

D. In all cases in which a definitive boundary may be arrived at by mutual consent or through the procedures applicable to contested boundaries, the administrator of the State Land Office, as provided in Paragraph (1) of this Subsection, or the secretary of the Department of Natural Resources, as provided in Paragraph (2) of this Subsection, may allow reclamation.

(1) The administrator of the State Land Office may issue a permit for the carrying out of the work necessary to implement the recovery of the land lost through erosion, compaction, subsidence, or sea level rise; however, no such permit shall be issued until plans and specifications for such work have been first submitted to the governing authority of the parish in which the proposed project is located, the Department of Transportation and Development, the Department of Wildlife and Fisheries, the Office of Coastal Protection and Restoration, and the Department of Natural Resources for review and comment not less than sixty days prior to the issuance of such permit. No permit shall be required for projects to facilitate the development, design, engineering, implementation, operation, reactivation, or repair of coastal or barrier island restoration projects by the ~~Department of Natural Resources~~ Office of Coastal Protection and Restoration under R.S. 49:214.1 et seq. or other applicable law or projects for the Atchafalaya Basin Program. Within sixty days of completion of the reclamation project, the riparian owner shall submit to the State Land Office proof of the extent of the land area actually reclaimed in the manner provided in Subsection C of this Section for showing the submerged area, which map or plat shall be employed for fixing the definitive boundary between the reclaimed land area and the state water bottoms. Permits issued pursuant to these provisions shall be effective for a period not to exceed two years from the date of issuance and shall thereupon expire. All work remaining or any additional work may be completed only by application in the manner provided by this Section.

* * *

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RESPONSE

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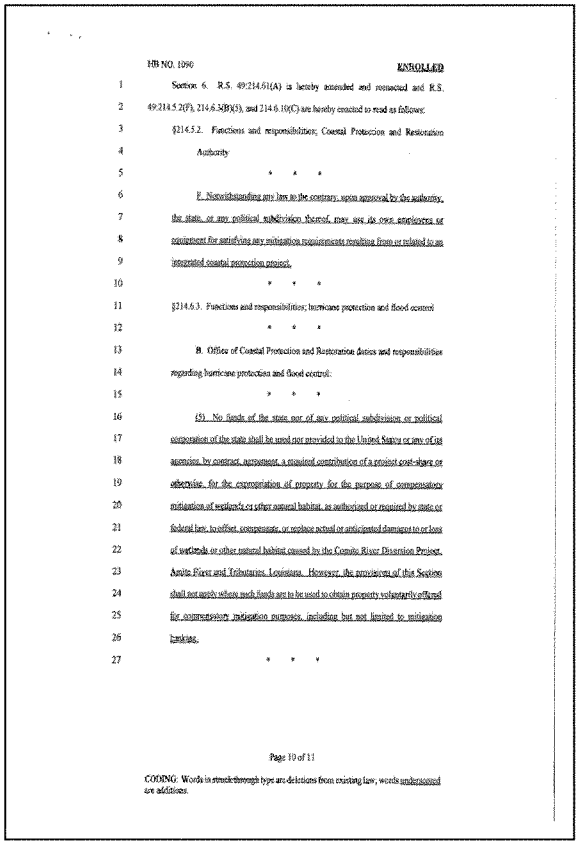
Edward Wisner Donation attachment 1 (EWD at1)



HB NO. 1090 **ENROLLED**

Section 6. R.S. 49:214.61(A) is hereby amended and reenacted and R.S. 49:214.5.2(F), 214.6.3(B)(5), and 214.6.10(C) are hereby created to read as follows:

§214.5.2. Functions and responsibilities; Coastal Protection and Restoration Authority

* * *

F. Notwithstanding any law to the contrary, upon approval by the authority, the state, or any political subdivision thereof, may use its own employees or equipment for satisfying any mitigation requirements resulting from or related to an integrated coastal protection project.

* * *

§214.6.3. Functions and responsibilities; hurricane protection and flood control

* * *

B. Office of Coastal Protection and Restoration duties and responsibilities regarding hurricane protection and flood control:

* * *

(5) No funds of the state nor of any political subdivision or political corporation of the state shall be used nor provided to the United States or any of its agencies, by contract, agreement, a required contribution of a project cost-share or otherwise, for the expropriation of property for the purpose of compensatory mitigation of wetlands or other natural habitat, as authorized or required by state or federal law, to offset, compensate, or replace actual or anticipated damages to or loss of wetlands or other natural habitat caused by the Comite River Diversion Project, Amite River and Tributaries, Louisiana. However, the provisions of this Section shall not apply where such funds are to be used to obtain property voluntarily offered for compensatory mitigation purposes, including but not limited to mitigation banking.

* * *

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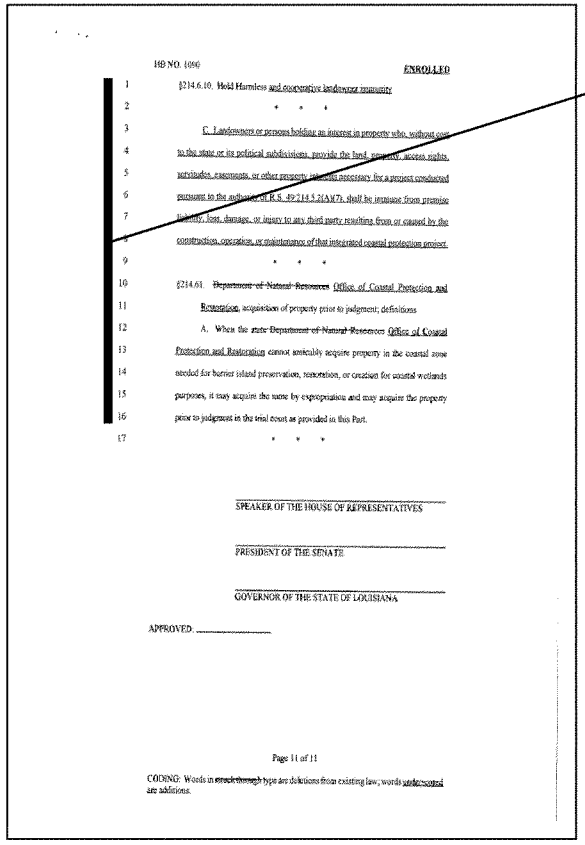
RESPONSE

1142

Edward Wisner Donation attachment 1 (EWD at1)



HB NO. 1090 **ENROLLED**

§214.6.10. Hold Harmless and cooperative landowner immunity

* * *

C. Landowners or persons holding an interest in property who, without cost to the state or its political subdivisions, provide the land, property, access rights, servitudes, easements, or other property rights/title necessary for a project conducted pursuant to the authority of R.S. 49:214.5.2(A)(7), shall be immune from premise liability, loss, damage, or injury to any third party resulting from or caused by the construction, operation, or maintenance of that integrated coastal protection project.

* * *

§214.61. ~~Department of Natural Resources~~ Office of Coastal Protection and Restoration, acquisition of property prior to judgment; definitions

A. When the ~~state Department of Natural Resources~~ Office of Coastal Protection and Restoration cannot amicably acquire property in the coastal zone needed for barrier island preservation, restoration, or creation for coastal wetlands purposes, it may acquire the same by expropriation and may acquire the property prior to judgment in the trial court as provided in this Part.

* * *

SPEAKER OF THE HOUSE OF REPRESENTATIVES

PRESIDENT OF THE SENATE

GOVERNOR OF THE STATE OF LOUISIANA

APPROVED: _____

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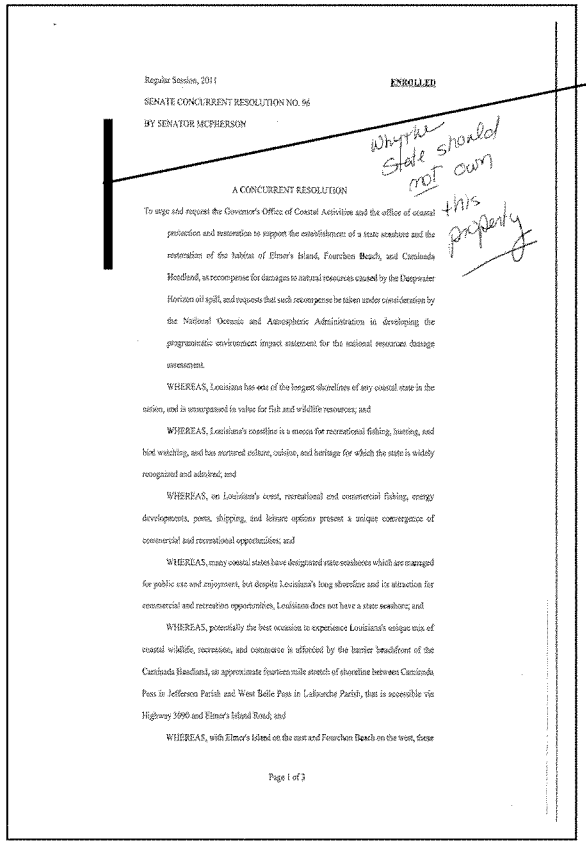
RESPONSE

EWD at1 03: Thank you for your comment.

1143

Edward Wisner Donation attachment 2 (EWD at2)



Regular Session, 2011 **ENROLLED**

SENATE CONCURRENT RESOLUTION NO. 96

BY SENATOR MCPHERSON

Why the State should NOT own this property

A CONCURRENT RESOLUTION

To urge and request the Governor's Office of Coastal Activities and the office of coastal protection and restoration to support the establishment of a state seashore and the restoration of the habitat of Elmer's Island, Fourchon Beach, and Caminada Headland, as recompense for damages to natural resources caused by the Deepwater Horizon oil spill, and requests that such recompense be taken under consideration by the National Oceanic and Atmospheric Administration in developing the programmatic environment impact statement for the national resources damage assessment.

WHEREAS, Louisiana has one of the longest shorelines of any coastal state in the nation, and is unsurpassed in value for fish and wildlife resources; and

WHEREAS, Louisiana's coastline is a mecca for recreational fishing, hunting, and bird watching, and has nurtured culture, cuisine, and heritage for which the state is widely recognized and admired; and

WHEREAS, on Louisiana's coast, recreational and commercial fishing, energy developments, ports, shipping, and leisure options present a unique convergence of commercial and recreational opportunities; and

WHEREAS, many coastal states have designated state seashores which are managed for public use and enjoyment, but despite Louisiana's long shoreline and its attraction for commercial and recreation opportunities, Louisiana does not have a state seashore; and

WHEREAS, potentially the best occasion to experience Louisiana's unique mix of coastal wildlife, recreation, and commerce is afforded by the barrier headfront of the Caminada Headland, an approximate fourteen mile stretch of shoreline between Caminada Pass in Jefferson Parish and West Belle Pass in Lafourche Parish, that is accessible via Highway 3090 and Elmer's Island Road; and

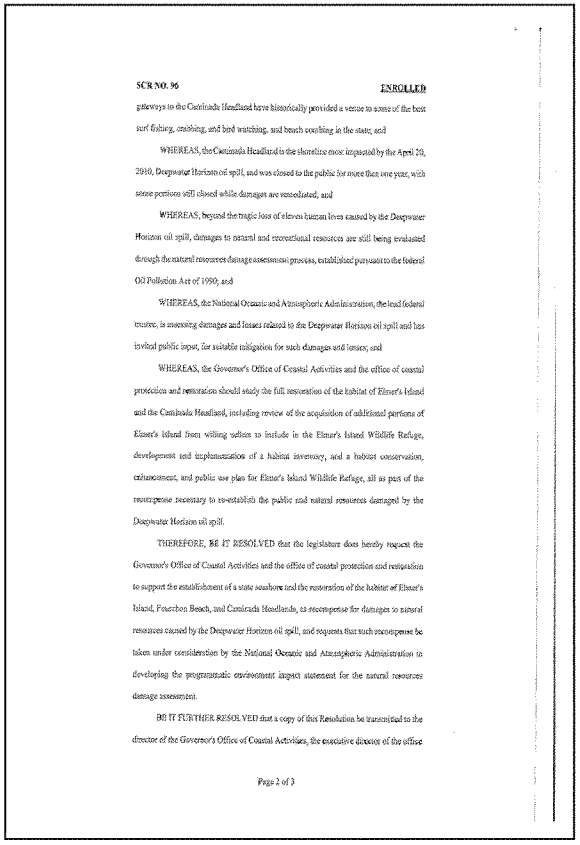
WHEREAS, with Elmer's Island on the east and Fourchon Beach on the west, these

Page 1 of 3

RESPONSE

EWD at2 01: Thank you for your comment.

Edward Wisner Donation attachment 2 (EWD at2)



SCR NO. 96 ENROLLED

gateways to the Cantwell Headland have historically provided a venue to some of the best surf fishing, crabbing, and bird watching, and beach combing in the state; and

WHEREAS, the Cantwell Headland is the shoreline most impacted by the April 20, 2010, Deepwater Horizon oil spill, and was closed to the public for more than one year, with some portions still closed while damages are remediated; and

WHEREAS, beyond the tragic loss of eleven human lives caused by the Deepwater Horizon oil spill, damages to natural and recreational resources are still being evaluated through the natural resources damage assessment process, established pursuant to the federal Oil Pollution Act of 1990; and

WHEREAS, the National Oceanic and Atmospheric Administration, the lead federal trustee, is assessing damages and losses related to the Deepwater Horizon oil spill and has invited public input, for suitable mitigation for such damages and losses; and

WHEREAS, the Governor's Office of Coastal Activities and the office of coastal protection and restoration should study the full restoration of the habitat of Elmer's Island and the Cantwell Headland, including review of the acquisition of additional portions of Elmer's Island from willing sellers to include in the Elmer's Island Wildlife Refuge, development and implementation of a habitat inventory, and a habitat conservation, enhancement, and public use plan for Elmer's Island Wildlife Refuge, all as part of the recompense necessary to re-establish the public and natural resources damaged by the Deepwater Horizon oil spill.

THEREFORE, BE IT RESOLVED that the legislature does hereby request the Governor's Office of Coastal Activities and the office of coastal protection and restoration to support the establishment of a state seashore and the restoration of the habitat of Elmer's Island, Fourchon Beach, and Cantwell Headlands, as recompense for damages to natural resources caused by the Deepwater Horizon oil spill, and requests that such recompense be taken under consideration by the National Oceanic and Atmospheric Administration in developing the programmatic environment impact statement for the natural resources damage assessment.

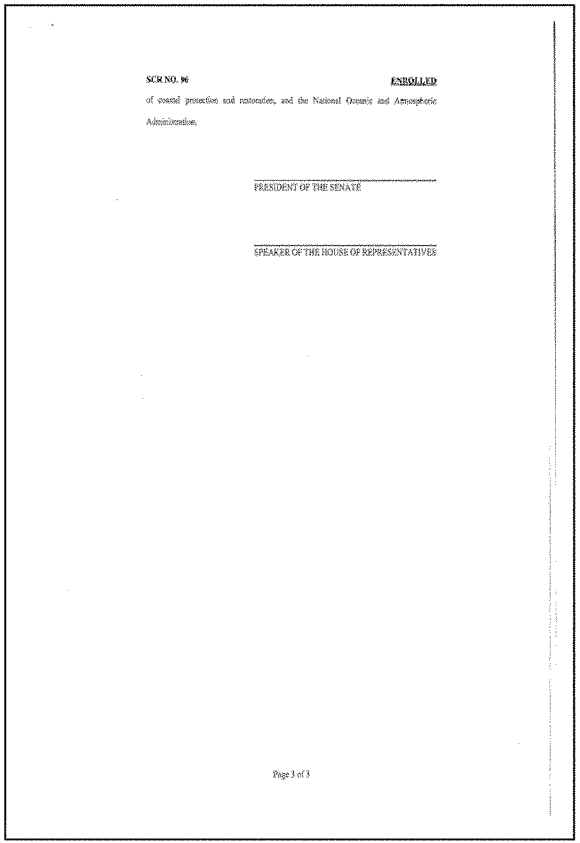
BE IT FURTHER RESOLVED that a copy of this Resolution be transmitted to the director of the Governor's Office of Coastal Activities, the executive director of the office

Page 2 of 3

RESPONSE

1145

Edward Wisner Donation attachment 2 (EWD at2)



SCR NO. 96 ENROLLED

of coastal protection and restoration, and the National Oceanic and Atmospheric Administration.

PRESIDENT OF THE SENATE

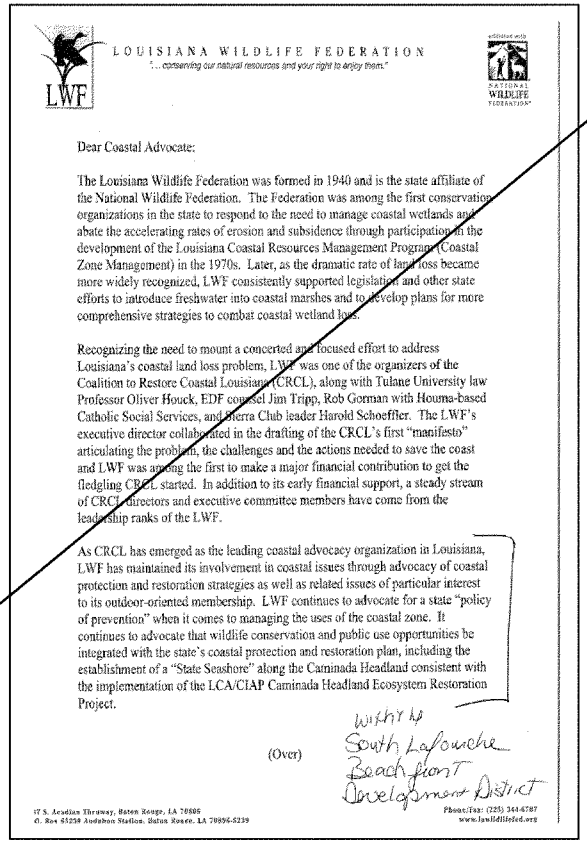
SPEAKER OF THE HOUSE OF REPRESENTATIVES

Page 3 of 3

RESPONSE

1146

Edward Wisner Donation attachment 3 (EWD at3)



LOUISIANA WILDLIFE FEDERATION

"...conserving our natural resources and your right to enjoy them."

LWF

affiliated with NATIONAL WILDLIFE FEDERATION

Dear Coastal Advocate:

The Louisiana Wildlife Federation was formed in 1940 and is the state affiliate of the National Wildlife Federation. The Federation was among the first conservation organizations in the state to respond to the need to manage coastal wetlands and abate the accelerating rates of erosion and subsidence through participation in the development of the Louisiana Coastal Resources Management Program (Coastal Zone Management) in the 1970s. Later, as the dramatic rate of land loss became more widely recognized, LWF consistently supported legislation and other state efforts to introduce freshwater into coastal marshes and to develop plans for more comprehensive strategies to combat coastal wetland loss.

Recognizing the need to mount a concerted and focused effort to address Louisiana's coastal land loss problem, LWF was one of the organizers of the Coalition to Restore Coastal Louisiana (CRCL), along with Tulane University law Professor Oliver Houck, EDF counsel Jim Tripp, Rob Gorman with Houma-based Catholic Social Services, and Sierra Club leader Harold Schoeffler. The LWF's executive director collaborated in the drafting of the CRCL's first "manifesto" articulating the problem, the challenges and the actions needed to save the coast and LWF was among the first to make a major financial contribution to get the fledgling CRCL started. In addition to its early financial support, a steady stream of CRCL directors and executive committee members have come from the leadership ranks of the LWF.

As CRCL has emerged as the leading coastal advocacy organization in Louisiana, LWF has maintained its involvement in coastal issues through advocacy of coastal protection and restoration strategies as well as related issues of particular interest to its outdoor-oriented membership. LWF continues to advocate for a state "policy of prevention" when it comes to managing the uses of the coastal zone. It continues to advocate that wildlife conservation and public use opportunities be integrated with the state's coastal protection and restoration plan, including the establishment of a "State Seashore" along the Caminada Headland consistent with the implementation of the LCA/CIAP Caminada Headland Ecosystem Restoration Project.

(Over)

Within the South Lafourche Beach front Development District

17 S. Acadian Thruway, Baton Rouge, LA 70806
P. O. Box 65238 Audubon Station, Baton Rouge, LA 70896-5238

Phone/Fax: (225) 344-6707
www.lawildlifefed.org

RESPONSE

EWD at3 01: Thank you for your comment.

11147

Edward Wisner Donation attachment 3 (EWD at3)

Coastal Advocate, Page 2

LWF was a primary advocate of a state coastal forest reserve program that is now in the early stages of implementation via the CIAP-funded Coastal Forest Conservation Initiative. It has been a major advocate of restoring the whooping crane to the coastal wetlands of Southwest Louisiana. A formal proposal to do just that is expected to be announced by the US Fish & Wildlife Service in the coming days. LWF has recently advocated the integration of a "no net loss of oyster growing capacity" with the state's coastal protection and restoration plan and is ramping up a new effort to recruit and focus the advocacy of Louisiana sportsmen for coastal restoration.

LWF is dedicated to conserving the still-vast and remarkably productive (though rapidly shrinking) habitats of the Louisiana coast, and to fairly and practically restore what has been lost to achieve sustainable coastal living for people and wildlife. Please contribute to this effort by making a tax-deductible contribution. Donations may be made online at www.lawildlifefed.org or by mailing a check to LWF at P. O. Box 65239; Baton Rouge, LA 70896-5239. Thanks for your consideration and support. If you have any questions you are welcome to call the LWF office at 225-344-6762 or email us at lwf@lawildlifefed.org.

Yours in conservation,

Ken Dancak

Ken Dancak, LWF President

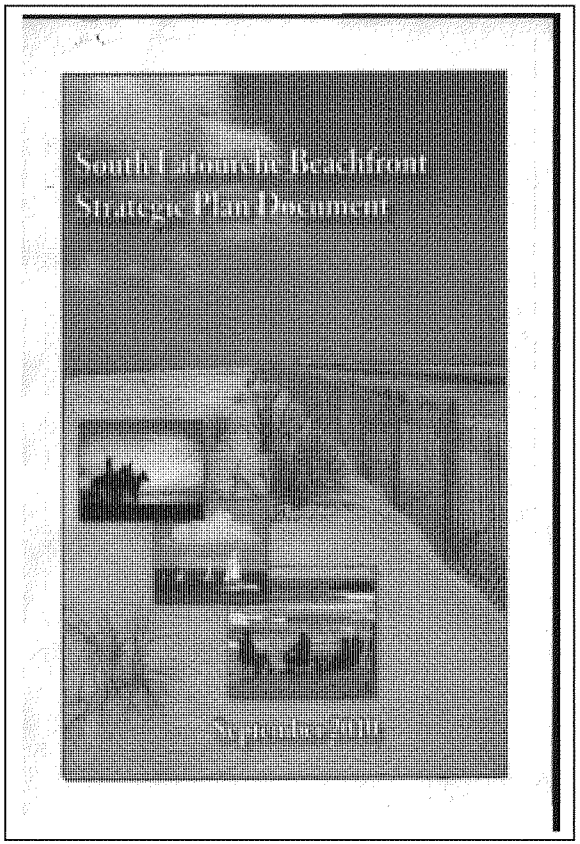
BJ Callahan

Barney Callahan, Chairman
LWF Coastal Restoration & Protection Committee

RESPONSE

1148

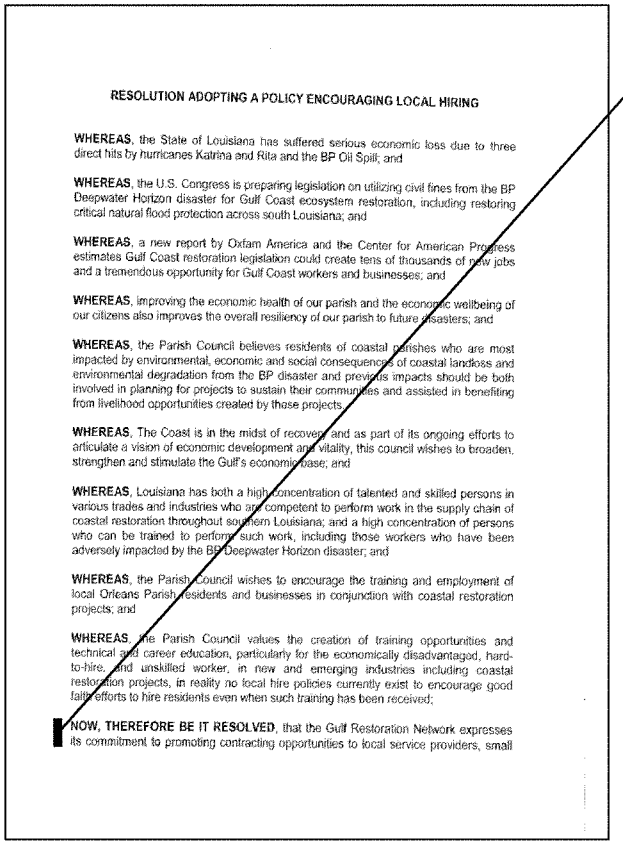
Edward Wisner Donation attachment 4 (EWD at4)



EWD at4: Thank you for your comment. This document was included in previous comment submitted by the Edward Wisner Donation.

1149

Gulf Restoration Network (GRN)



RESOLUTION ADOPTING A POLICY ENCOURAGING LOCAL HIRING

WHEREAS, the State of Louisiana has suffered serious economic loss due to three direct hits by hurricanes Katrina and Rita and the BP Oil Spill; and

WHEREAS, the U.S. Congress is preparing legislation on utilizing civil fines from the BP Deepwater Horizon disaster for Gulf Coast ecosystem restoration, including restoring critical natural flood protection across south Louisiana; and

WHEREAS, a new report by Oxfam America and the Center for American Progress estimates Gulf Coast restoration legislation could create tens of thousands of new jobs and a tremendous opportunity for Gulf Coast workers and businesses; and

WHEREAS, improving the economic health of our parish and the economic wellbeing of our citizens also improves the overall resiliency of our parish to future disasters; and

WHEREAS, the Parish Council believes residents of coastal parishes who are most impacted by environmental, economic and social consequences of coastal landloss and environmental degradation from the BP disaster and previous impacts should be both involved in planning for projects to sustain their communities and assisted in benefiting from livelihood opportunities created by those projects;

WHEREAS, The Coast is in the midst of recovery and as part of its ongoing efforts to articulate a vision of economic development and vitality, this council wishes to broaden, strengthen and stimulate the Gulf's economic base; and

WHEREAS, Louisiana has both a high concentration of talented and skilled persons in various trades and industries who are competent to perform work in the supply chain of coastal restoration throughout southern Louisiana; and a high concentration of persons who can be trained to perform such work, including those workers who have been adversely impacted by the BP Deepwater Horizon disaster; and

WHEREAS, the Parish Council wishes to encourage the training and employment of local Orleans Parish residents and businesses in conjunction with coastal restoration projects; and

WHEREAS, the Parish Council values the creation of training opportunities and technical and career education, particularly for the economically disadvantaged, hard-to-hire, and unskilled worker, in new and emerging industries including coastal restoration projects, in reality no local hire policies currently exist to encourage good faith efforts to hire residents even when such training has been received;

NOW, THEREFORE BE IT RESOLVED, that the Gulf Restoration Network expresses its commitment to promoting contracting opportunities to local service providers, small

RESPONSE

GRN 01: Thank you for your comment. The Federal Acquisition Regulations details the rules on competition in Part 6; https://www.acquisition.gov/far/05-30/html/FARTOCP06.html. Here is the Unites States Policy:

Subpart 6.1—Full and Open Competition

6.100 Scope of subpart.

This subpart prescribes the policy and procedures that are to be used to promote and provide for full and open competition.

6.101 Policy.

(a) 10 U.S.C. 2304 and 41 U.S.C. 253 require, with certain limited exceptions (see Subpart 6.2 and 6.3), that contracting officers shall promote and provide for full and open competition in soliciting offers and awarding Government contracts.

(b) Contracting officers shall provide for full and open competition through use of the competitive procedure(s) contained in this subpart that are best suited to the circumstances of the contract action and consistent with the need to fulfill the Government's requirements efficiently (10 U.S.C. 2304 and 41 U.S.C. 253).

6.102 Use of competitive procedures.

The competitive procedures available for use in fulfilling the requirement for full and open competition are as follows:

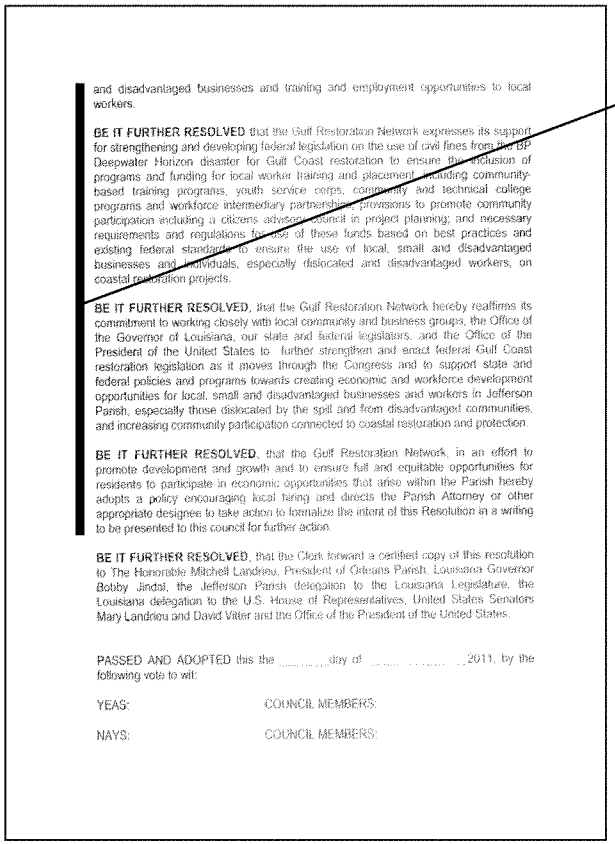
(a) Sealed bids. (See 6.401(a).)

(b) Competitive proposals. (See 6.401(b).) If sealed bids are not appropriate under paragraph (a) of this section, contracting officers shall request competitive proposals or use the other competitive procedures under paragraph (c) or (d) of this section.

(c) Combination of competitive procedures. If sealed bids are not appropriate, contracting officers may use any combination of competitive procedures (e.g., two-step sealed bidding).

1150

Gulf Restoration Network (GRN)



and disadvantaged businesses and training and employment opportunities to local workers.

BE IT FURTHER RESOLVED that the Gulf Restoration Network expresses its support for strengthening and developing federal legislation on the use of civil fines from the BP Deepwater Horizon disaster for Gulf Coast restoration to ensure the inclusion of programs and funding for local worker training and placement, including community-based training programs, youth service corps, community and technical college programs and workforce intermediary partnerships; provisions to promote community participation including a citizens advisory council in project planning; and necessary requirements and regulations for use of these funds based on best practices and existing federal standards to ensure the use of local, small and disadvantaged businesses and individuals, especially dislocated and disadvantaged workers, on coastal restoration projects.

BE IT FURTHER RESOLVED, that the Gulf Restoration Network hereby reaffirms its commitment to working closely with local community and business groups, the Office of the Governor of Louisiana, our state and federal legislators, and the Office of the President of the United States to further strengthen and enact federal Gulf Coast restoration legislation as it moves through the Congress and to support state and federal policies and programs towards creating economic and workforce development opportunities for local, small and disadvantaged businesses and workers in Jefferson Parish, especially those dislocated by the spill and from disadvantaged communities, and increasing community participation connected to coastal restoration and protection.

BE IT FURTHER RESOLVED, that the Gulf Restoration Network, in an effort to promote development and growth and to ensure full and equitable opportunities for residents to participate in economic opportunities that arise within the Parish hereby adopts a policy encouraging local hiring and directs the Parish Attorney or other appropriate designee to take action to formalize the intent of this Resolution in a writing to be presented to this council for further action.

BE IT FURTHER RESOLVED, that the Clerk forward a certified copy of this resolution to The Honorable Mitchell Landrieu, President of Orleans Parish, Louisiana Governor Bobby Jindal, the Jefferson Parish delegation to the Louisiana Legislature, the Louisiana delegation to the U.S. House of Representatives, United States Senators Mary Landrieu and David Vitter and the Office of the President of the United States.

PASSED AND ADOPTED this the _____ day of _____, 2011, by the following vote to wit:

YEAS: COUNCIL MEMBERS:

NAYS: COUNCIL MEMBERS:

RESPONSE

GRN 01 (continued):
(d) Other competitive procedures.
(1) Selection of sources for architect-engineer contracts in accordance with the provisions of 40 U.S.C. 1102 et seq. is a competitive procedure (see Subpart 36.6 for procedures).
(2) Competitive selection of basic and applied research and that part of development not related to the development of a specific system or hardware procurement is a competitive procedure if award results from—
(i) A broad agency announcement that is general in nature identifying areas of research interest, including criteria for selecting proposals, and soliciting the participation of all offerors capable of satisfying the Government's needs; and
(ii) A peer or scientific review.
(3) Use of multiple award schedules issued under the procedures established by the Administrator of General Services consistent with the requirement of 41 U.S.C. 259(b)(3)(A) for the multiple award schedule program of the General Services Administration is a competitive procedure.

1151

Gulf Restoration Network (GRN)

ABSENT: COUNCIL MEMBERS:

ABSTAIN: COUNCIL MEMBERS:

CLERK

RESPONSE

1152

Larry Campisi Memo of Conversation (LC moc)

Memo of Conversation

August 1, 2011

Mr. Larry Campisi telephoned regarding LCA Barataria Basin Barrier Shoreline Restoration study with recommendation to use Aqua Dams. Mr. Campisi provided brief history of use of aqua dams in flood fighting and suggested may be able to use aqua dams for ecosystem restoration such as restoring mud flats and as containment dikes. Mr. Campisi indicated he would provide written information and requested I present his information to Engineering Department for consideration. Mr. Campisi indicated to include his comments as formal comments on the LCA BBBS draft EIS. Mr. Campisi provided a follow-up email with specific information on Aqua Dams used to control water movement in wetlands. Both this memo of conversation and Mr. Campisi's email and attachment will be included in the formal comments for the draft EIS for the LCA BBBS.

William P. Klein, Jr.

RESPONSE

LC moc: Thank you for your comment and the information on Aqua Dams. The USACE will consider use of these, as well as other products, during the detailed design/plans and specifications (PED) phase of the project.

1153

Larry Campisi letter with Aqua Dam Attachment (LC ltr ada)

-----Original Message-----
From: Larry Campisi [mailto:larry@gulfrim.com]
Sent: Monday, August 01, 2011 5:03 PM
To: Klein, William P Jr MVM
Cc: 'Gary Parker'
Subject: Aqua Dams
Importance: High

Good Afternoon Bill. Thank you for taking time to speak with me this afternoon. As we discussed I sincerely feel there may be a place for Aqua Dams in Wetland Management and Coastal Restoration work planned by the USACE. I enjoyed the meeting in Galliano, LA concerning the Barataria Basin Barrier Shoreline Restoration Project. I can envision Aqua Dams possibly being used for a small segment of that project in the marshes.

I have attached above some information on existing work being done on the east coast with an explanation of Aqua Dams history. Our company has partnered with Aqua Dams as the sole distributors for the Gulf of Mexico Region of the US. We are anxious to explore possible uses of Aqua Dams with the USACE. As I mentioned Aqua Dams have a proven history for use in marsh restoration projects, including Containment Dikes.

Please forward to your Engineering Departments and should you or they need any additional information please contact me. In additional at the request of General Landreneau of the LA National Guard, we will be doing a live Aqua Dam deployment demonstration at Twin Lakes inside Camp Beauregard, Pineville, LA later this month. Once we have a firm date and time, I will contact you with the information and possibly someone from the Corps could be present.

Thanks again for your time and discussion and I hope that together we can help save one of most valuable resources, our wetlands and coastline. Best regards, Larry

Larry J. Campisi

President

GulfRim Navigation

Aviation & Marine Navigation Aids

1401 South State Street

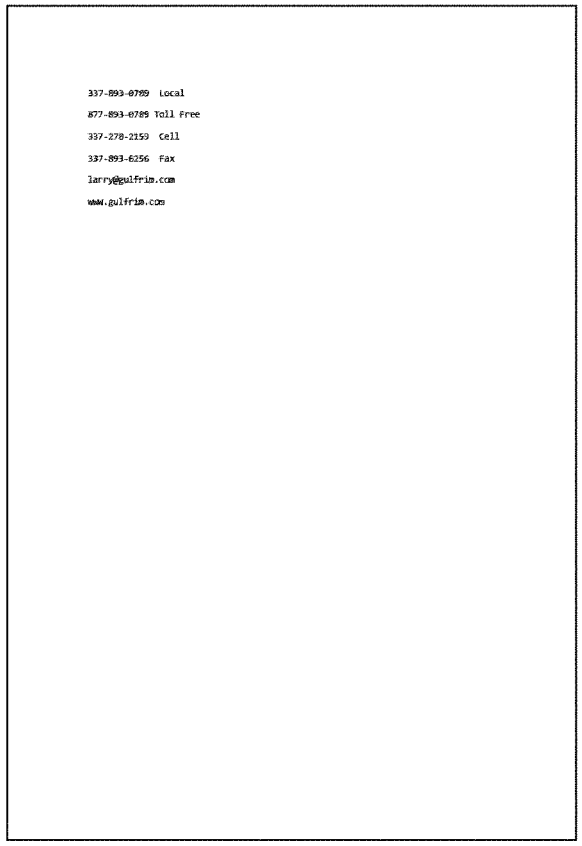
Abbeville, LA 70510

RESPONSE

LC ltr ada: Thank you for the information on Aqua Dams. The USACE will consider use of these, as well as other products, during the detailed design/plans and specifications (PED) phase of the project.

1154

Larry Campisi letter with Aqua Dam Attachment (LC ada)



337-893-0789 Local

877-893-0789 Toll Free

337-278-2159 Cell

337-893-6256 Fax

larry@gulfrim.com

www.gulfrim.com

RESPONSE

1155

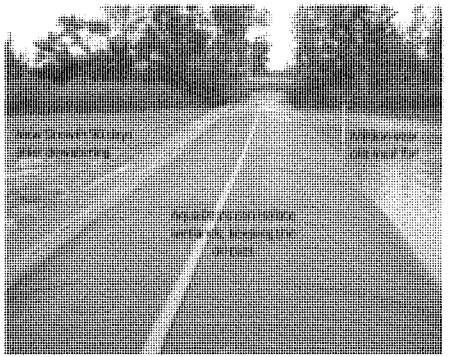
Larry Campisi Aqua Dam attachment (LC ada)

AquaDam used to control water movement in wetlands

Gulf Coast Aqua Dams
1401 S. State Street
Abbeville, LA 70510
1-877-893-0789
1-337-893-0789
http://aquadam.gulfrim.com

Larry Campisi
Sales
larry@gulfrim.com

Water-Filled AquaDams
Water Controlling Water



How AquaDams can help protect wetlands

Water-filled AquaDams can help on-shore protection efforts by isolating wetlands and beaches from oil-contaminated waters. Thousands of feet of AquaDam can be installed in a single day. AquaDams are environmentally friendly, and can be reused, and when no longer needed, can be easily and inexpensively disposed of. AquaDams are basically two water-tight tubes wrapped in a larger geotextile fabric tube. When filled, the weight of the contained water forms a seal against the ground. The AquaDam can rise several feet or more above the surrounding water, which gives it enough mass to control the height of the water being retained, making an instant cofferdam that can be dewatered behind and which can overcome wave and wind action, and is much superior to a Styrofoam booms. Vehicles can drive on top of AquaDams 3' and higher. They are very strong and durable.

How AquaDams are constructed

AquaDams are made with two water-tight extruded polyethylene interior tubes, surrounded by one or more layers of 300lb/sq in. burst strength geotextile fabric. Tube diameter determines height, and length is usually hundreds of feet. AquaDams can be connected to each other to form miles of continuous AquaDam cofferdam protection. One end of the AquaDam is closed, the other has fill tubes extending past the geotextile fabric used to connect one unit to another. Water pumped into the AquaDam provides weight and mass, sealing against the underlying soil.

History of AquaDams

AquaDams were first used in the early 1980's and were invented by David Doolaege. At that time, concern over environmental damage was in the public spotlight. Sandbagging was the method of choice to control floodwater, but sandbags also presented many problems

1156

Larry Campisi Aqua Dam Attachment (LC ada)

to anyone trying to implement them. Sandbagging was slow, costly, and labor intensive. There had to be a modern solution to flooding, one of mankind's oldest dilemmas.

Doolaege realized that all sandbags represent is weight and mass. So why not fill a bag with water? It weighs a lot too, and there is plenty of it in any flood situation. Why not use the on-site water that is causing the problem and make it part of the solution?

He created the first water structure out of three long party balloons in his bathtub. Two balloons were placed inside a third balloon. The two inner balloons were then filled with water. They stretched from one side of the tub to the other, and effectively blocked one side off until the water level rose above it's height (4 in) and spilled over the top to the other side. This was the first structure ever to use water to control water.

Since then AquaDams have been improved, resulting in the worlds largest water-filled cofferdams being produced by Aqua Dam Inc.

Equipment needed to place AquaDams

Sand berms require heavy equipment, which may cause as much damage as the oil spill they're meant to protect against. AquaDams only require water pumps, and a few men to direct the AquaDam as it fills and unrolls. AquaDams are stored and shipped as rolls. Because AquaDams are buoyant (or close to buoyant), they can be floated into place in wetlands during high tide still rolled up, then deployed. When one is deployed, it is unrolled a short distance, then water pumps are used to fill it with water. The internal water pressure does the hard work of unrolling the AquaDam over vegetation and across the wetlands. Vegetation should be at least partially removed, to facilitate a good seal between the bottom of the AquaDam and the wetlands. No equipment except for pumps is needed. AquaDams can be rerolled and removed by hand.

Use of AquaDams

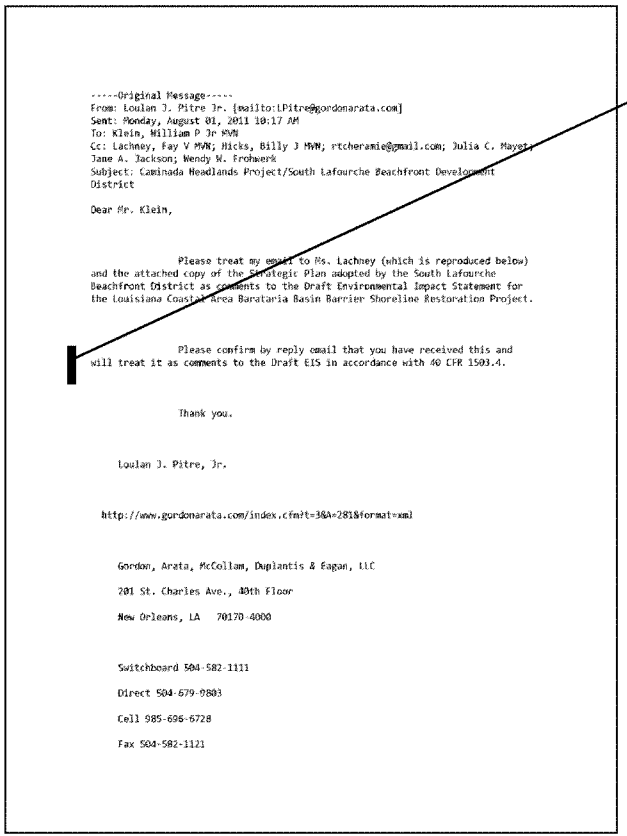
AquaDams have been used in all 50 states in the US, Africa, Australia, England, Canada, and many other locations. AquaDams are preferred for working in environmentally delicate areas, because they do not contaminate either contained or surrounding water. After use, AquaDams can be decontaminated and recycled, or disposed of in an ecologically-conscious manner. AquaDams have been used in Everglades National Park, Lacassine National Park, South Lake Tahoe wetlands remediation, and in other national parks and wildlife refuges. www.aquadam.net has an extensive amount of photo and video documentation of AquaDams in use on hundreds of different job sites.

Past projects include Everglades Nat'l Park, Yosemite Nat'l Park, Smoky Mtn. Nat'l Park, Glacier Nat'l Park, Lacassine National Wildlife Refuge, Ottawa Nat'l Wildlife Refuge, and others. A complete list of projects can be found on our website: http://www.aquadam.net/Construction/pictorials.html

RESPONSE

1157

Loulan J. Pitre, Jr. (LJP)



-----Original Message-----
From: Loulan J. Pitre Jr. [mailto:LPitre@gordonarata.com]
Sent: Monday, August 01, 2011 10:17 AM
To: Klein, William P Jr MVN
Cc: Lachney, Fay V MVN; Hicks, Billy J MVN; rtcheramie@gmail.com; Julia C. Mayer; Jane A. Jackson; Wendy W. Frohwerk
Subject: Caminada Headlands Project/South Lafourche Beachfront Development District

Dear Mr. Klein,

Please treat my email to Ms. Lachney (which is reproduced below) and the attached copy of the Strategic Plan adopted by the South Lafourche Beachfront District as comments to the Draft Environmental Impact Statement for the Louisiana Coastal Area Barataria Basin Barrier Shoreline Restoration Project.

Please confirm by reply email that you have received this and will treat it as comments to the Draft EIS in accordance with 40 CFR 1503.4.

Thank you.

Loulan J. Pitre, Jr.

http://www.gordonarata.com/index.cfm?t=3&A=281&format=xml

Gordon, Arata, McCollam, Duplantis & Eagan, LLC

201 St. Charles Ave., 40th Floor

New Orleans, LA 70170-4000

Switchboard 504-582-1111

Direct 504-679-9803

Cell 985-696-6728

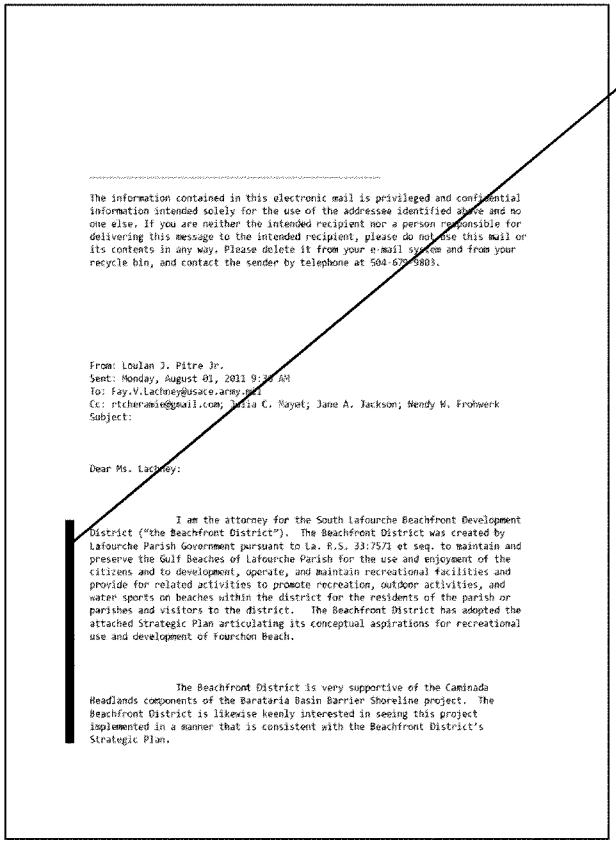
Fax 504-582-1121

RESPONSE

LJP 01: Thank you for your comment. Receipt of email was confirmed by William P. Klein, Jr., per your request on 1 August 2011.

1158

:Loulan J. Pitre, Jr. (LJP)



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From: Loulan J. Pitre Jr.
Sent: Monday, August 01, 2011 9:36 AM
To: Fay.V.Lachney@usace.army.mil
Cc: ptcheramie@gmail.com; Julia C. Mayet; Jane A. Jackson; Wendy W. Frohwerk
Subject:

Dear Ms. Lachney:

I am the attorney for the South Lafourche Beachfront Development District ("the Beachfront District"). The Beachfront District was created by Lafourche Parish Government pursuant to La. R.S. 33:7571 et seq. to maintain and preserve the Gulf Beaches of Lafourche Parish for the use and enjoyment of the citizens and to development, operate, and maintain recreational facilities and provide for related activities to promote recreation, outdoor activities, and water sports on beaches within the district for the residents of the parish or parishes and visitors to the district. The Beachfront District has adopted the attached Strategic Plan articulating its conceptual aspirations for recreational use and development of Fourchon Beach.

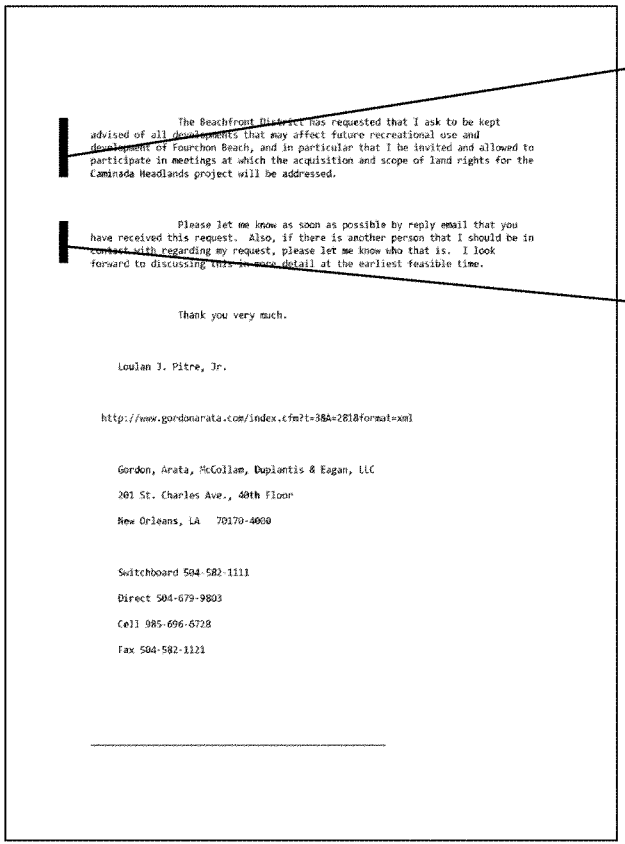
The Beachfront District is very supportive of the Caminada Headlands components of the Barataria Basin Barrier Shoreline project. The Beachfront District is likewise keenly interested in seeing this project implemented in a manner that is consistent with the Beachfront District's Strategic Plan.

RESPONSE

LJP 02: Thank you for your comment.

1159

Loulan J. Pitre, Jr. (LJP)



The Beachfront District has requested that I ask to be kept advised of all developments that may affect future recreational use and development of Fourchon Beach, and in particular that I be invited and allowed to participate in meetings at which the acquisition and scope of land rights for the Caminada Headlands project will be addressed.

Please let me know as soon as possible by reply email that you have received this request. Also, if there is another person that I should be in contact with regarding my request, please let me know who that is. I look forward to discussing this in more detail at the earliest feasible time.

Thank you very much.

Loulan J. Pitre, Jr.

http://www.gordonarata.com/index.cfm?t=3&A=2818&format=xml

Gordon, Arata, McCollam, Duplantis & Eagan, LLC

201 St. Charles Ave., 40th Floor

New Orleans, LA 70170-4000

Switchboard 504-582-1111

Direct 504-679-9803

Cell 985-696-6728

Fax 504-582-1121

RESPONSE

LJP 03: Thank you for your comment and interest in the planning and real estate process for the Barataria Basin Barrier Shoreline Restoration project. Due to Army regulations, we are unable to honor your request to participate in meetings regarding real estate acquisition for this project. Ms Judy Gutierrez with the Real Estate Division of the New Orleans District, USACE will work as your point of contact for these matters and will provide you with timely information throughout the process. Please feel free to contact Ms Gutierrez; she may be reached at telephone: 504-862-2575 and email: Judith.Y.Gutierrez@usace.army.mil

LJP 04: Receipt of email was confirmed by William P. Klein, Jr., per your request on 1 August 2011.

1160

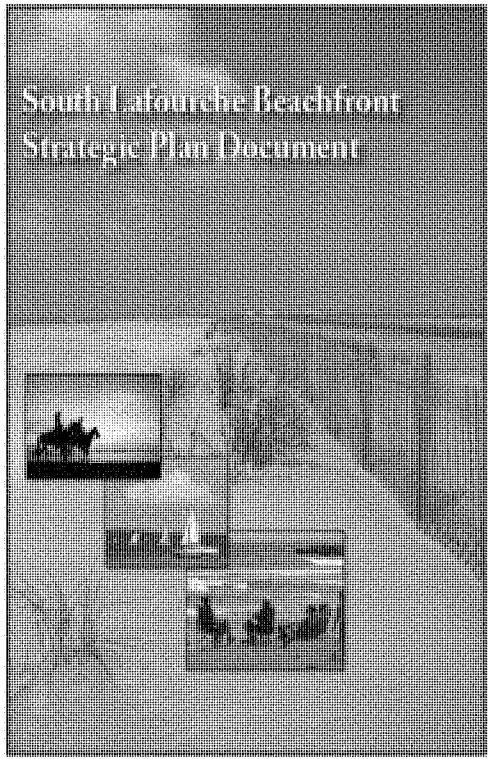
Loulan J. Pitre, Jr. (LJP)

The information contained in this electronic mail is privileged and confidential information intended solely for the use of the addressee identified above and no one else. If you are neither the intended recipient nor a person responsible for delivering this message to the intended recipient, please do not use this mail or its contents in any way. Please delete it from your e-mail system and from your recycle bin, and contact the sender by telephone at 504-679-9803.

RESPONSE

1161

Loulan J. Pitre, Jr. attachment (LJP at1)



RESPONSE

LJP at1: Thank you for your comment. Project induced impacts to recreation are addressed in section 5.17 Recreation Resources. Recreation facilities may be authorized at water resources projects under authority of Section 4 of the Flood Control Act of 1944, as amended. Recreation features may be developed at ecosystem restoration projects if they are appropriate in scope and scale to the opportunity provided by the ecosystem restoration projects. The recreation should be compatible with the ecosystem restoration purpose of the project, but also enhance the visitation experience by taking advantage of the natural values. The social, cultural, scientific and educational values should be considered within the framework of the ecosystem restoration project purpose. For example, while educational values, i.e., nature study and interpretive signs, can be an integral part of ecosystem restoration projects, this does not mean it is appropriate to build recreation/visitor facilities that overwhelm the natural values. The recreation experience should build upon the ecosystem restoration objective and take advantage of the restored resources rather than distract from them. Standard designs should be consistent with the natural environment of the surrounding area and should not include embellishments such as decorative stone work planters, elaborate designs or be ostentatious. Recreation development at ecosystem restoration projects should take advantage of the education and recreation potential that the project is creating while not diminishing the ecosystem restoration purpose. The following excerpt is from the Corps' Principles and Guidelines Engineering Regulation (ER) 1105-2-100, Section VII and Recreation and Policy Guidance Letter No. 59, Recreation Development at Ecosystem Projects, CECW-AG, 11 June 1998: "Recreation development at an ecosystem restoration project should be totally ancillary. Recreation facilities may be added to take advantage of the education and recreation potential of the ecosystem project, but the project cannot be specifically formulated for a recreation purpose. The recreation potential may be satisfied only to the extent that recreation does not diminish the ecosystem restoration purpose.

See following page for continued response to LJP at01.

1162

Loulan J. Pitre, Jr. attachment (LJP at1)

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Future Phasing

Bayou Thunder to Jefferson Parish Line

Without the construction of a bridge or boardwalk, the area between Bayou Thunder and the Parish Line is accessible only from Elmers Island. The District will discuss and determine how to address and access this remote section of Fourchon Beach at a later date.

West Belle Pass

CWPPRA will be rebuilding the beachead dunes and back bay wetlands at West Belle Pass. The District will address this island-like beach area for future development at a later date.

The Beachfront Development District is comprised of five board members:

Chairmain, Al Danos

Vice Chair, Rickey Cheramie

Board Members:

Wayne Martin

Randy Chiasson *(replaced Doug Cheramie in March 2010)*

Sammy Rebstock *(Replaced Edmond Cheramie in August 2010)*

RESPONSE

LJP at1 (Continued): Where an ecosystem restoration project provides critical habitat for a federally listed threatened or endangered species, recreation facilities at that project should be precluded in the critical habitat and limited to only those facilities needed for minimum health and safety and/or natural resources interpretation. Where appropriate, recreation at ecosystem restoration projects should be designed for day use only, precluding the need of extensive night lighting. Whenever conflicts occur between the ecosystem restoration purpose and recreation, ecosystem restoration shall have priority. Plans should seek to optimize public use in harmony with the objectives of the restoration project over the period of analysis. Without a non-Federal sponsor to cost share recreation, ecosystem restoration projects should not encourage public use." The development of facilities for access, health and safety should not involve extensive structural modification of the terrain and may include rest areas and picnic facilities. Ideally these facilities would be a part of a larger non-Corps recreation plan such as a regional trail system or provide access to other non-Federal recreation facilities or areas. The Corps presents a limited checklist of reereation facilities that may be cost-shared, at new Corps ecosystem restoration projects, or that may be constructed by others at non-Federal expense at ecosystem projects. This check list may be found in ER 1105-2-100, Appendix E, Exhibit E-3, and includes access and circulation, shelters and bathrooms, utilities, park furniture, interpretive signage and health and safety features (gates, cattle guards, fencing, entrance station, etc.).

1163

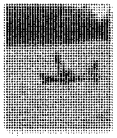
Loulan J. Pitre, Jr. attachment (LJP at1)

General Purpose

Historically, the beach was accessible from Hwy 3090, a Lafourche Parish road that begins at LA Hwy 1 and extends through Port Fourchon and then to the Gulf of Mexico. The public traditionally accessed the beach at the end of the public road with uncontrolled vehicular traffic. Increased littering and random vandalism have caused adjacent landowners to attempt to block vehicular access.

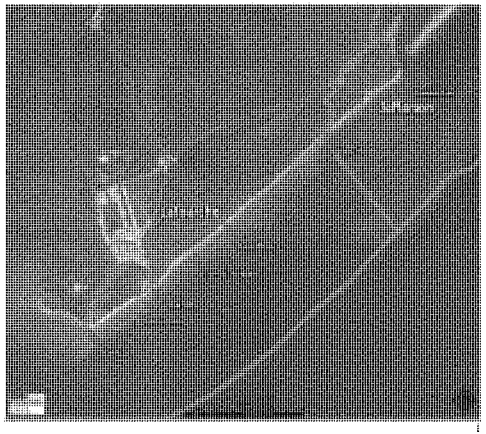
The creation of the South Lafourche Beachfront Development District is partly a reaction to limitations in public access. Negotiations among landowners, the Port and the Parish have been "in progress" since the mid-'90s.

Since the inception of the Beachfront Development District, more progress has been made due to the respect and attention paid to landowners of both camps *(Winner and Guillaud)*. The best way to further the goal of assuring access **is to continue establishing a respectful communication and demonstrating sincere actions as guardians of the land and also by assuring that any recreational development does not stop or delay beach restoration** and nourishment.



The main objective of the South Lafourche Beachfront Development District shall be to maintain and preserve beaches for use and enjoyment of the citizens. The district aims **to facilitate the development, operation and maintenance of** recreational facilities while promoting outdoor activities and water sports on beaches within the District for the residents and visitors to enjoy.

While the District encompasses an area roughly equal to the southern end of Lafourche Parish, the scope of the initial Strategic Plan is the area otherwise known as Fourchon Beach.



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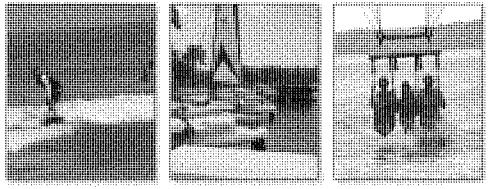


Fourchon Beach covers approximately 10 miles along the 14-mile Caminada Headland which stretches into Jefferson Parish. The Jefferson Parish portion the Caminada Headland is also referred to as Elmer's Island.

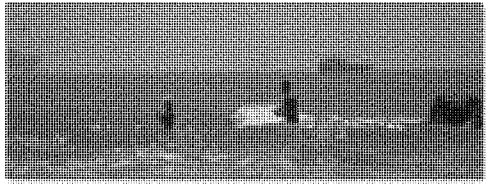
Commissioners have decided to propose development in phases. Phasing will cover smaller sections of the overall beach and in some instances consider separately primitive and advance stages of development.

This project aims to develop Fourchon Beach and promote it as one of Louisiana's recognized public destinations for recreational activities such as camping, picnicking, fishing, swimming and surfing.

The South Lafourche Beachfront Development District sees the potentials of Fourchon as a relaxing spot where local residents and tourists alike can spend quality fun and recreation. Discussions on the proposed development are made with sheer recognition that they will only be materialized in coordination with planned restoration efforts.

The District asserts that any and all discussion, planning and design of proposed development for a public park at Fourchon Beach is made with the recognition and understanding that it will be developed ONLY in coordination with and then subject to the Caminada Headland Project. The development team is looking into collaborative efforts with government and non-government entities to actualize plans.

A level of trust has been established between the landowners in collaboration with the Greater Lafourche Port Commission and its Harbor Patrol, Lafourche Parish's Fire District #3 and Lafourche Parish Government. Rules on sanitation, security, safety and beach facility usage will be outlined and enforced by the property management team along with the above-mentioned entities and including the Lafourche Parish Sheriff's Office and the Lafourche Parish District Attorney's Office. Security patrols and rescue services shall be made available at any given time when the district has sanctioned public use of the beach and its facilities. Similarly, proper garbage disposal services will be provided in all premises of the beach.



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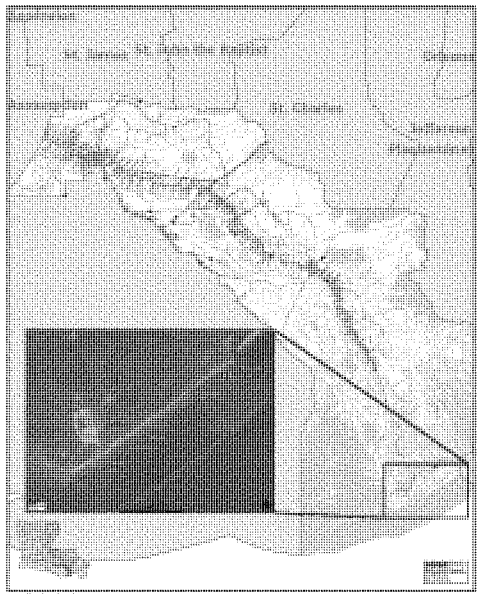
1164

Loulan J. Pitre, Jr. attachment (LJP at1)



Phase 1 - Hwy. 3090 to Bay Champagne

The first phase of the proposed development will be from Hwy 3090 to the eastern rim of Bay Champagne. A natural setting with minimal infrastructure is initially planned. Advancement will follow whenever funding is made available at a later date. More remote usage will be allowed beyond Bay Champagne through Bayou Thunder and the Parish Line.

Proposed Actions

Access Roads

Partnering with the Parish and potentially the Port, an access road is proposed beginning at Hwy 3090 and heading east at the site of a former access road within the dune area north of Hwy 3090's end at the Gulf of Mexico. The proposed road will be constructed using compacted sand and gravel *(perhaps with matting)* kept within the dunes limiting vehicular access to the beach. An access road will fork *(right)* immediately west of the Caillouet-Wisner boundary with the first vehicular access site comprised of a roadbed to the shore. The left fork will continue eastward on the beach side of the beach-and-dune interface. This widened access road will extend across Wisner property through to the edge of Bay Champagne and include another vehicular route to the shore. *(See orange line of Map on next page.)*

1. Parking

While vehicular access will be allowed in limited locations, parking will be provided for the convenience of the public and to discourage private vehicles on the beach. Parallel parking will be encouraged on the section of roadway between the two vehicular access points *(see widened roadway)*. An actual parking lot will be constructed at the end of the public roadway near the western edge of Bay Champagne. *(See blue markings.)*

2. Beach Entrance

A customized trailerable guardhouse is strategic and practical to be constructed at the main entrance. In that way, it can be driven away when impending storms threaten. *(Green Dot)*

3. Bathrooms

Due to funding restraints, Port-o-Lets will be the first option for public bathrooms. Port-o-Lets will be placed in strategic locations across the Hwy 3090 to Bay Champagne area for public convenience. When funding can be identified, the District will consider the procurement of larger trailerable bathrooms customized to be more like public restrooms in other public facilities. The trailerable nature of these restrooms will again allow for portability when impending storms threaten. Portable sewerage systems will be considered depending on location and suitability for more permanent structures.

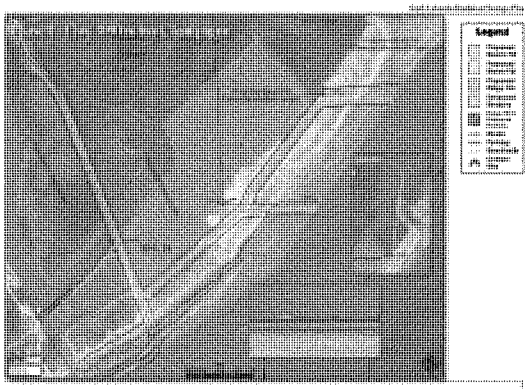
4. Fishing Pier

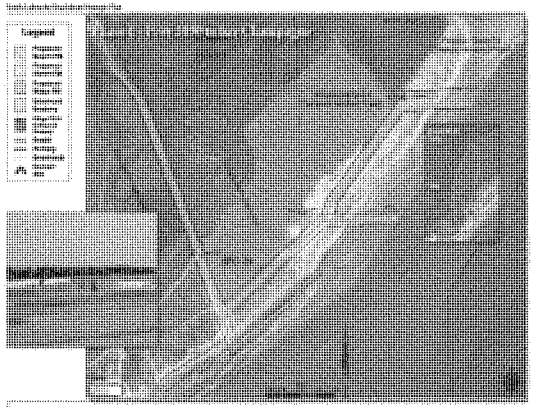
A walkway jutting into the bay will start from the beach itself and extends into Bay Champagne. It is envisioned that the pier will begin in the vicinity and provide handicapped access from the larger parking lot.)

The South Lafourche Beachfront Development District (District):
Asserts that any and all discussion, planning and design of proposed development for a public park at Fourchon Beach is made with the recognition and understanding that it will be developed ONLY in coordination with and then subject to the Caminada Headland Project;
Asserts that the District will partner with the Greater Lafourche Port Commission and its Harbor Patrol, Lafourche Parish Sheriff's Office *(or some other security entity)* and the Lafourche Parish District Attorney's Office to provide patrols, enforce district rules and penalize offenses at any time that the District has sanctioned public use of the beach and its related facilities;
Asserts that the District will partner with Lafourche Parish Government *(or some private disposal service)* to provide regular garbage service for all areas of the Fourchon Beach that are opened for public use;
Asserts that the District will partner with Lafourche Fire District #3 *(or some other rescue service)* to provide rescue services for any time that the District has sanctioned public use of the beach and its related facilities.

11165

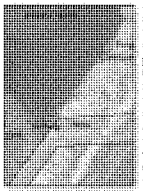
Loulan J. Pitre, Jr. attachment (LJP at1)





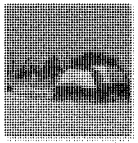
5. Pavilion

District Commissioners propose the construction of a permanent concrete pavilion designed to withstand minimal hurricanes. It will be situated on the north end of the larger parking area and adjacent to the fishing pier. This structure will be the centerpiece of the park facility *(Red Dot)* Smaller trailerable covered table area*(s)* will be designed and constructed so that they could be moved within the park for private use by patrons and moved to safety when impending storms threaten.



6. Overnight Camping

Camping will be allowed in designated areas at the edge of the beach and away from fragile vegetation. Tenting will be encouraged and limited utilities will be available adjacent to the noted accessroads. Self-contained Recreational Vehicle *(RV)* camping will be allowed but not encouraged as they will be restricted to designated parking areas and prohibited on the beach.

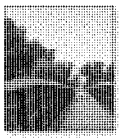


7. Selling/Vending

The District will consider allowing private vendors to provide limited products and services. Prior to this policies and standards shall be developed to ensure the consistency with the park's intended natural setting. Policies may initially require trailerability consistent with other park facilities.

8. Boardwalks/Trails

In association with wetland and dune areas, the District will consider the construction of boardwalks and trails to promote awareness of unique and fragile flora and fauna while protecting these areas from excessive traffic. Yellow lines are only for example. The locations would have to be surveyed and engineered to maximize the experience and minimize the wetland impact.



9. Utilities

Water and underground electricity are proposed to follow along the roadway through to Bay Champagne.

10. Other Activities and Services.

a. Golf carts and/or all terrain vehicles may be rented if it can be determined that it would discourage vehicular traffic on the beach. If allowed, these vehicles would be prohibited in dune and wetland areas and speed limits would be stringently enforced.

b. Horseback riding will be allowed and perhaps promoted in a controlled manner. Again, if allowed, horses would be prohibited in dune and wetland areas.

c. Kayaking, canoeing and bird watching are to be promoted and allowed in designated areas. If arrangements can be made, kayaks and canoes may be rented for day use.

The South Lafourche Beachfront Development District (District):

Asserts that any and all discussion, planning and design of proposed development for a public park at Fourchon Beach is made with the recognition and understanding that it will be developed ONLY in coordination with and then subject to the Cominda Headland Project;

Asserts that the District will partner with the Greater Lafourche Port Commission and its Harbor Patrol, Lafourche Parish Sheriff's Office *(or some other security entity)* and the Lafourche Parish District Attorney's Office to provide patrols, enforce district rules and penalize offenses at any time that the District has sanctioned public use of the beach and its related facilities;

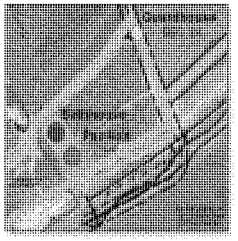
Asserts that the District will partner with Lafourche Parish Government *(or some private disposal service)* to provide regular garbage service for all areas of the Fourchon Beach that are opened for public use;

Asserts that the District will partner with Lafourche Fire District #3 *(or some other rescue service)* to provide rescue services for any time that the District has sanctioned public use of the beach and its related facilities.

Loulan J. Pitre, Jr. attachment (LJP at1)

Phase 2 - Belle Pass to Hwy. 3090

The second phase of the proposed development will be from Hwy 3090 to the jetty at Belle Pass. Currently the area is a natural setting with the exception of Chevron's tank farm facility. The area is known as Fourchon Island. It serves as a buffer zone for the rest of Port Fourchon. While erosion has taken its toll, the island's beaches are broader and more stable. With more beach available, the Beachfront Development District envisions room for RV Camping and the larger camper trailers and motor homes. The challenge here is that the Port also has future expansion slated for Fourchon Island. The following plan is a proposal that finds opportunities within the challenges of competing interests for limited real estate and enhanced protection for vulnerable coastal infrastructure.



Proposed Actions

1. Access Roads

Partnering with the Parish and the Port, a two-lane access road is proposed beginning at Hwy 3090 and heading west along the current road to the Chevron facility. At the Chevron gate the road jogs southward, parallels the Chevron facility fencing and then veers northwest to the proposed port expansion area at the center of Fourchon Island. This two-lane roadway will serve as the access route to the port expansion, provide an exit route for Fourchon Island campers and be constructed to accommodate both recreational and industrial traffic. Beachgoers will access the recreation area from the single point guard house at Hwy 3090 and travel along a single lane one way road that will be built along the beach/dune interface. As funding will allow the road will be raised to serve as a barrier or levee. Engineers will be called in to design a roadbed that takes into consideration numerous pipelines entering from the Gulf of Mexico.

A no-stop zone shall be designated in the area south of the Chevron Facility and at all pipeline crossings to best ensure the safety of the public and the security of pipelines and the storage facility.

2. Parking

While vehicular access will be allowed in limited locations, parking will be provided for the convenience of the public and to discourage private vehicles on the beach. Parallel parking will be encouraged on the roadway except at the no stop zones. *(See blue lines on beachfront roadway.)* An actual parking lot will be constructed at Pass Fourchon and at the entry to any and all boardwalks. *(See blue markings.)*

3. Beach Entrance

The customized trailerable guardhouse *(Green Dot)* will serve as the main entrance for the Fourchon Island recreational area.

4. Bathrooms

Initially Port-o-Lets will be the first option for public bathrooms. Port-o-Lets will be placed in strategic locations from Hwy 3090 to Belle Pass for public convenience. When additional funding can be identified, the District will consider the procurement of larger trailerable bathrooms customized to be more like public restrooms in other public facilities. The

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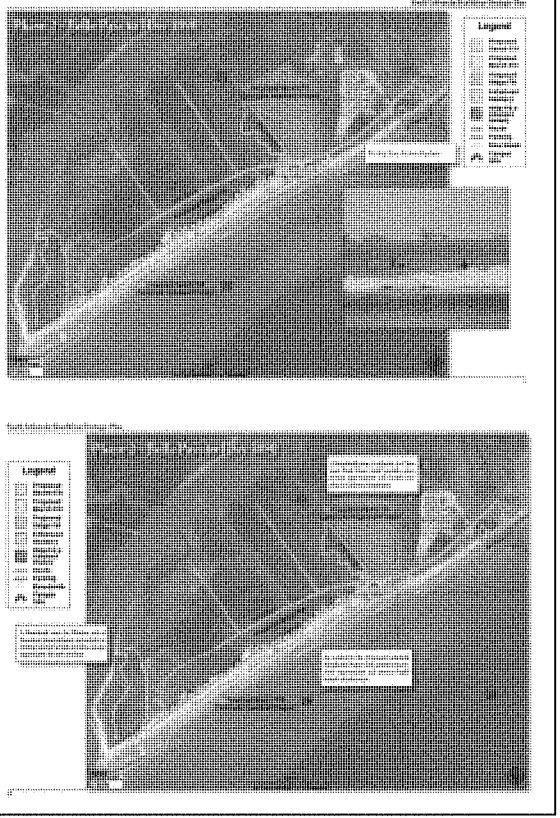

Loulan J. Pitre, Jr. attachment (LJP at1)

trailerable nature of these restrooms will again allow for portability when impending storms threaten. A portable sewerage systems and/or a dump station will be considered for restrooms and for RVs.

5. Pavilion

A second concrete pavilion designed to withstand minimal hurricanes is proposed at Pass Fourchon for public purposes. *(Red Dot)* Smaller trailerable covered table area*(s)* will be designed and constructed so that *they* could be moved within the park for private use by patrons and moved to safety when impending storms threaten.

6. Overnight Camping

While allowed in other areas, the western end of the Hwy 3090 to Belle Pass area will be the primary camping area. Tenting will be encouraged and limited utilities will be available adjacent to the noted access roads. Specific sites will be designated for self-contained Recreational Vehicle *(RV)* to best protect fragile vegetation. Camping sites will include roadway loops *(in red)* to provide safe entry and exit of recreational vehicles.

7. Selling/Vending

The District will consider allowing private vendors to provide limited products and services. Prior to this policies and standards shall be developed to ensure the consistency with the park's intended natural setting. Policies may initially require trailer ability consistent with other park facilities.

8. Boardwalks/Trails

In association with wetland and dune areas and a rookery located on the western end of Fourchon Island, the District will consider the construction of boardwalks and trails to promote awareness of unique and fragile flora and fauna while protecting these areas from excessive traffic.

In coordination with the creation of the maritime ridge, the District plans to improve native habitat to expand and enhance the rookery. Wildlife officials will be consulted to help locate the proper distance from the rookery to best assure birders a view without harming the wildlife

9. Utilities

Water and underground electricity are proposed to follow along the roadway through to Belle Pass.

10. Other Activities and Services.

a. In partnership with the port and landowners, the District proposes that a maritime ridge be created with fill *(purple)* from proposed port slips on the northern portion of Fourchon Island. The ridge would complement the raised access road serving as an enhanced dune/levee system across the length of Fourchon Island and serve as a buffer between the industrial and recreational areas. The maritime ridge would be planted with salt-tolerant trees and wetland vegetation in a way similar to the Port's Maritime Ridge Forest proposed north of the existing port.

b. Golf carts and/or all terrain vehicles may be rented if it can be determined that it would discourage vehicular traffic on the beach. If allowed, these vehicles would be prohibited in dune and wetland areas and speed limits would be stringently enforced.

c. Horseback riding will be allowed and perhaps promoted in a controlled manner. Again, if allowed, horses would be prohibited in dune and wetland areas.

d. Kayaking, canoeing and bird watching are to be promoted and allowed in designated areas. If arrangements can be made, kayaks and canoes may be rented for day use.

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Asserts that the District will partner with Lafourche Parish Government *(or some private disposal service)* to provide regular garbage service for all areas of the Fourchon Beach that are opened for public use;
Asserts that the District will partner with Lafourche Fire District #3 *(or some other rescue service)* to provide rescue services for any time that the District has sanctioned public use of the beach and its related facilities.

Phase 3 - Bay Champagne to Bayou Moreau

The third phase of the proposed development will be from Bay Champagne to Bayou Moreau. The natural setting consists of a saline marsh fronting the Gulf of Mexico with a beach shoreline. The interior contains a series of canals both natural and man-made with recreational camps managed by the Wisner Foundation. Behind the beach head wetland marsh has opened up shallow lagoons. With the variety of water bodies present, the Beachfront Development District envisions this area as a prime place for water sport activities. The challenge is balancing the promotion of recreational activities and the protection of the environment. Concentrating these recreational activities into a defined area will best ensure that water patrol officers can patrol and monitor these activities reducing the chance for accidents and damage to the natural environment. The following plan is a proposal that finds opportunities within the challenges to obtain a balance between the use and protection of this coastal resource.

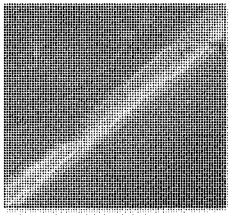
Proposed Actions

1. Access Roads

Partnering with the Parish and potentially the Port, an access road is proposed in Phase 1 beginning at Hwy 3090 and heading east at the interface of the beach and dune area providing access to the Phase 3 area. Bay Champagne separates the Phase 1 roadway and a continuation of this roadway through to Bayou Moreau. To cross the beach that fronts Bay Champagne, the District proposes a more substantial structure. Whether this would be an actual bridge or roadway, engineers and hydrologist would be called upon to design something that would be best suited to fit the crossing. The compacted sand and gravel roadway would extend beyond the bay crossing accessing planned recreational and commercial sites. At a site designated for vendors and park facilities an additional roadway would head north to provide an inland access point to Bayou Moreau. *(Roadways are designated by orange lines on Map)*

2. Parking

While vehicular access will be allowed in limited locations, parking will be provided for the convenience of the public and to discourage private vehicles on the beach. Parallel parking will be encouraged on both sides of the roadway. *(See blue lines on beachfront roadway)*. Additional parking will be provided at the Bayou Moreau Pavilion and Vendor area. *(See blue markings.)*



3. Beach Entrance

While guests may enter via boat at Bayou Moreau, there are no additional formal entrances within the Phase 3 area.

4. Bathrooms

Initially Port-o-Lets will be the first option for public bathrooms. Port-o-Lets will be placed in strategic locations from Bay Champagne to Bayou Moreau for public convenience. When additional funding can be identified, the District will consider the procurement of larger trailerable bathrooms

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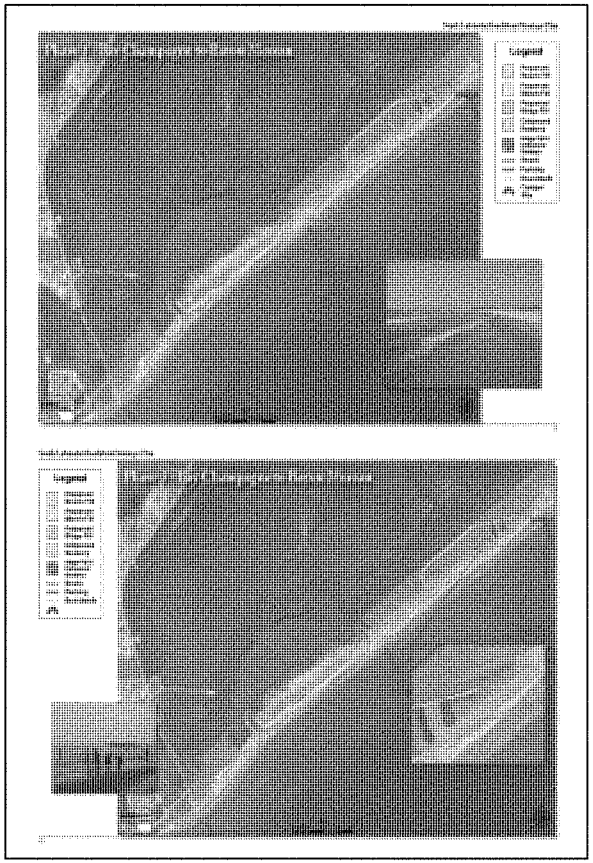
Asserts that the District will partner with Lafourche Parish Government *(or some private disposal service)* to provide regular garbage service for all areas of the Fourchon Beach that are opened for public use;
Asserts that the District will partner with Lafourche Fire District #3 *(or some other rescue service)* to provide rescue services for any time that the District has sanctioned public use of the beach and its related facilities.

1168

Loulan J. Pitre, Jr. attachment (LJP at1)



customized to be more like public restrooms in other public facilities. The trailerable nature of these restrooms will again allow for portability when impending storms threaten. Long-term plans include replacing the trailerable bathrooms with a fully functioning bathhouse *(Purple Dot)*.

5. Pavilion

A third concrete pavilion designed to withstand minimal hurricanes is proposed at Bayou Moreau for public purposes. *(Red Dot)* Smaller trailerable covered table area*(s)* will be designed and constructed so that they could be moved within the park for private use by patrons and moved to safety when impending storms threaten.

6. Overnight Camping

To maximize the beach area for recreational activities, no tent or RV Camping will be allowed in this area.

7. Selling/Vending

The District will consider allowing private vendors to provide limited products and services. An area near the mouth of Bayou Moreau will be designated for vendors. The expectation of the District is that along with food and other conveniences this area would house rental areas for canoes, kayaks, wave runners and other water sport related activities. Prior to the development of this area policies and standards shall be developed to ensure the consistency with the park's intended natural setting. Policies may initially require trailer ability consistent with other park facilities.

8. Boardwalks/Trails

In association with wetland and dune areas, the District will consider the construction of boardwalks to promote awareness of unique and fragile flora and fauna while protecting these areas from excessive traffic.

9. Utilities

Water and underground electricity are proposed to follow along the roadway through to Bayou Moreau.

10. Other Activities and Services

a. The Bay Champagne to Bayou Moreau Phase of Development will be designed to concentrate water sport activities. Motorized activities will be allowed on the beach, in the Gulf waters, in Bayou Moreau and in the navigable canals. These activities *may* include but are not limited to parasailing, skiing and boating. If it can be arranged, the rental of wave runners and other watercraft may be made available.

b. Non-motorized activities will be encouraged within Bay Champagne, the pond area behind the dunes and in the interconnecting canals. Again if arrangements can be made, kayaks, canoes, paddleboats and other non-motorized vehicles may be made available. As the inland waterways connect, policies will be developed to promote safety where both motorized and non-motorized activities are allowed.

c. On land golf carts and/or all terrain vehicles may be rented if arrangements can be made and if it can be determined that it would discourage vehicular traffic on the beach. If allowed, these vehicles would be prohibited in dune and wetland areas and speed limits would be stringently enforced.

d. Horseback riding will be allowed and promoted in a controlled manner. Horses would be prohibited in dune and wetland areas.

e. While not prohibited, swimming, fishing, crabbing, surfing and bird watching will be discouraged in this area.

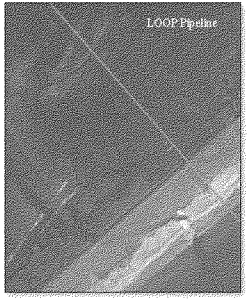
The South Lafourche Beachfront Development District (District):
Asserts that any and all discussion, planning and design of proposed development for a public park at Fourchon Beach is made with the recognition and understanding that it will be developed ONLY in coordination with and then subject to the Caminada Headland Project;
Asserts that the District will partner with the Greater Lafourche Port Commission and its Harbor Patrol, Lafourche Parish Sheriff's Office *(or some other security entity)* and the Lafourche Parish District Attorney's Office to provide patrols, enforce district rules and penalize offenses at any time that the District has sanctioned public use of the beach and its related facilities;
Asserts that the District will partner with Lafourche Parish Government *(or some private disposal service)* to provide regular garbage service for all areas of the Fourchon Beach that are opened for public use;
Asserts that the District will partner with Lafourche Fire District #3 *(or some other rescue service)* to provide rescue services for any time that the District has sanctioned public use of the beach and its related facilities.

11169

Loulan J. Pitre, Jr. attachment (LJP at1)

Phase 4 - Bayou Moreau to Bayou Thunder

The fourth phase of the proposed development will be from Bayou Moreau through Bayou Thunder. The natural setting consists of a saline marsh fronting the Gulf of Mexico with a beach shoreline. The nearly four *(4)* mile stretch is remote and includes the Loop Pipeline crossing which is sensitive environmentally and for purposes of Homeland Security. Similar to Phase 3, the challenge is balancing the use and protection of this sensitive area. The vision of this area is the primitive use of a natural environment with limited access and limited amenities. Private vehicles will be prohibited from traveling across this stretch of beachfront. Traffic will be limited to park vehicles to transport guests to their destination, service vehicles to maintain and patrol the area and emergency vehicles. The following plan is a proposal that finds opportunities and unique methods to provide access amidst a sensitive and natural environment.



Proposed Actions:

1. Access Roads

Partnering with the Parish and potentially the Port, a trail will be constructed in a manner similar to the access road proposed in Phases 1 & 3. Somewhat narrower than the roadways of Phases 1 & 3, the trail will extend through to Bayou Thunder with bends and turns finding unique areas and vistas. For emergency purposes the trail will have turn arounds, rest stops, and be open to the beach. While private vehicles will be prohibited, the trail will be designed to accommodate emergency service and park vehicles. Engineers will be consulted to determine the best method to cross Bayou Moreau addressing the hydrology and necessity for access and to cross the Loop Pipeline ensuring that any trail *(or roadway)* meets any and all security and structural measures necessary to protect the pipeline.

2. Parking

With private vehicles prohibited, parking will be provided at Bayou Moreau for the convenience of the public and to discourage private vehicles on the beach. Parallel parking will be encouraged on both sides of Bayou Moreau. *(See blue markings).*

3. Beach Entrance

There are no additional formal entrances within the Phase 4 area.

4. Bathrooms

Initially Port-o-Lets will be the first option for public bathrooms. Port-o-Lets will be placed in strategic locations from Bayou Moreau to Bayou Thunder for public convenience. When additional funding can be identified, the District will consider the procurement of larger trailerable bathrooms customized to be more like public restrooms in other public facilities. The trailerable nature of these restrooms will again

The South Lafourche Beachfront Development District (District):
Asserts that any and all discussion, planning and design of proposed development for a public park at Fourchon Beach is made with the recognition and understanding that it will be developed ONLY in coordination with and then subject to the Caminada Headland Project;
Asserts that the District will partner with the Greater Lafourche Port Commission and its Harbor Patrol, Lafourche Parish Sheriff's Office *(or some other security entity)* and the Lafourche Parish District Attorney's Office to provide patrols, enforce district rules and penalize offenses at any time that the District has sanctioned public use of the beach and its related facilities;
Asserts that the District will partner with Lafourche Parish Government *(or some private disposal service)* to provide regular garbage service for all areas of the Fourchon Beach that are opened for public use;
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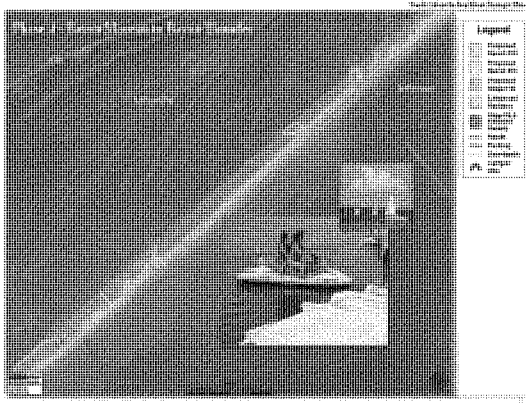

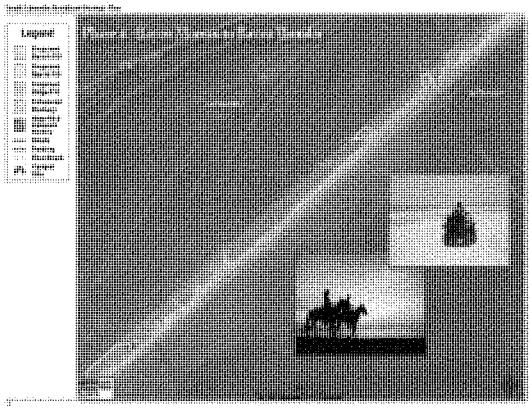

1170

Loulan J. Pitre, Jr. attachment (LJP at1)

allow for portability when impending storms threaten.

5. Pavilion

Smaller trailerable covered table area(s) will be designed and constructed so that they could be moved within the park for private use by patrons and moved to safety when impending storms threaten.

6. Overnight Camping

Tent camping will be allowed in this area.

7. Selling/Vending

The District is considering a vending area in Phase 3 on the western bank of Bayou Moreau.

8. Boardwalks/Trails

In association with wetland and dune areas, the District will consider the construction of boardwalks and trails to promote awareness of unique and fragile flora and fauna while protecting these areas from excessive traffic.

9. Utilities

Water and underground electricity are proposed to follow along the roadway through to Bayou Moreau.

10. Other Activities and Services.

a. If arrangements can be made, kayaks, canoes, paddle-boats and other non-motorized vehicles may be made available.

b. On land golf carts and/or all terrain vehicles may be rented if it can be determined that it would discourage vehicular traffic on the beach. If allowed, these vehicles would be prohibited in dune and wetland areas and speed limits would be stringently enforced.

c. Horseback riding will be allowed and perhaps promoted in a controlled manner. Horses would be prohibited in dune and wetland areas.

d. Swimming, fishing, crabbing, surfing and bird watching will be encouraged in this area.

The South Lafourche Beachfront Development District (District):

Asserts that any and all discussion, planning and design of proposed development for a public park at Fourchon Beach is made with the recognition and understanding that it will be developed ONLY in coordination with and then subject to the Caminada Headland Project;

Asserts that the District will partner with the Greater Lafourche Port Commission and its Harbor Patrol, Lafourche Parish Sheriff's Office *(or some other security entity)* and the Lafourche Parish District Attorney's Office to provide patrols, enforce district rules and penalize offenses at any time that the District has sanctioned public use of the beach and its related facilities;

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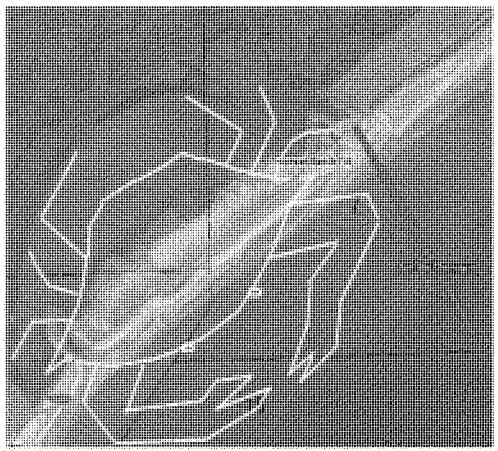


Alternate Boardwalk Configuration

1171

Louisiana Department of Environmental Quality email (LDEQ email)

-----Original Message-----
From: Beth Altazan-Dixon [mailto:Beth.Dixon@LA.GOV]
Sent: Friday, July 01, 2011 9:23 AM
To: Klein, William P Jr MVN
Subject: DEQ SOV 110628/1755 DOA-Barataria Basin Barrier Shoreline

July 1, 2011

Joan M. Exnicios, Chief
USACE Environ. Planning Branch
P.O. Box 60267
New Orleans, LA 70160-0267

william.p.klein.jr@usace.army.mil
<mailto:william.p.klein.jr@usace.army.mil>

RE: 110628/1755
DOA-Barataria Basin Barrier Shoreline
On disk
Restoration-Draft Construction Report and Draft EIS Lafourche, Jefferson and Plaquemines Parishes

Dear Ms. Exnicios:

The Department of Environmental Quality (LDEQ), Business and Community Outreach Division has received your request for comments on the above referenced project.

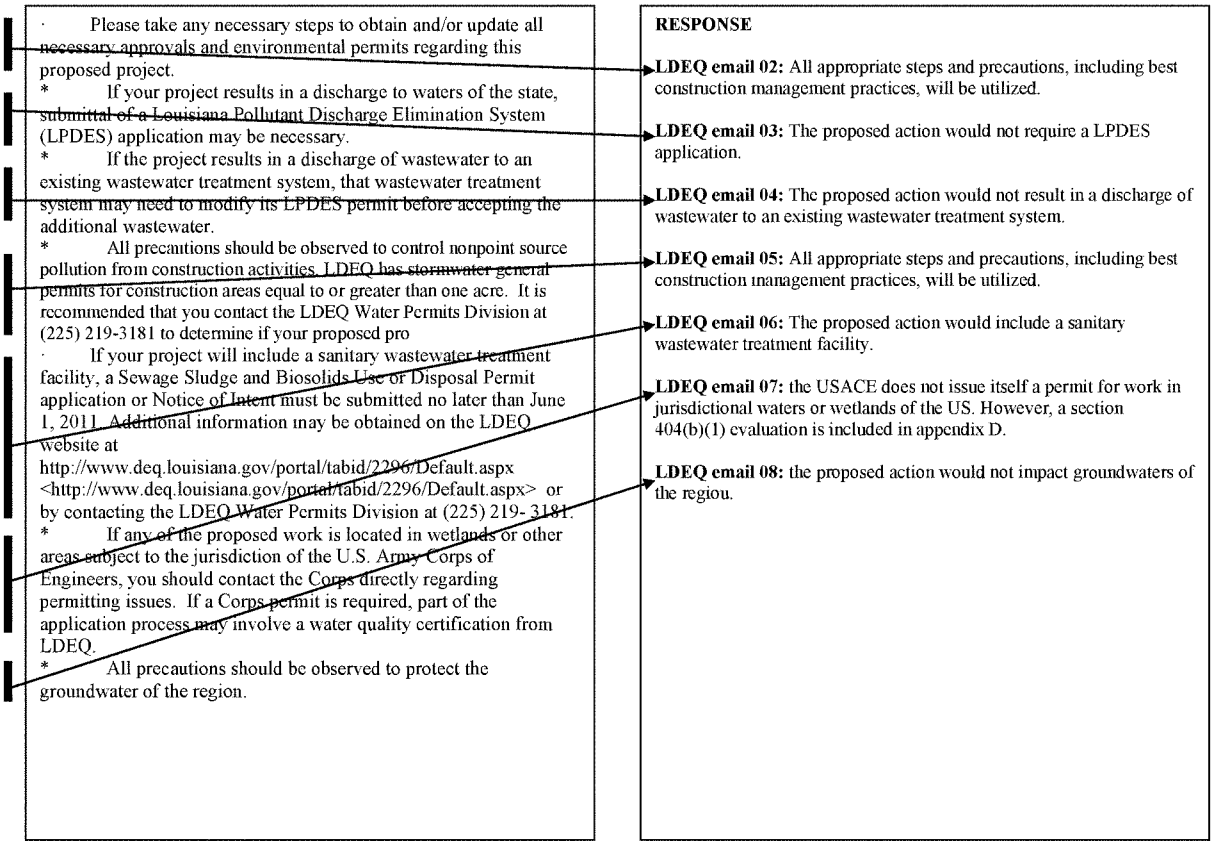
After reviewing your request, the department has no objections based on the information provided in your submittal. However, for your information, the following general comments have been included. Please be advised that if you should encounter a problem during the implementation of this project, you should immediately notify LDEQ's Single-Point-of-contact (SPOC) at (225) 219-3640.

RESPONSE

LDEQ 01: Thank you for your comment.

11172

Louisiana Department of Environmental Quality email (LDEQ email)



1173

Louisiana Department of Environmental Quality email (LDEQ email)

* Please be advised that water softeners generate wastewaters that may require special limitations depending on local water quality considerations. Therefore if your water system improvements include water softeners, you are advised to contact the LDEQ Water Permits to determine if special water quality-based limitations will be necessary.

* Any renovation or remodeling must comply with LAC 33:III.Chapter 28, Lead-Based Paint Activities; LAC 33:III.Chapter 27, Asbestos-Containing Materials in Schools and State Buildings (includes all training and accreditation); and LAC 33:III.5151, Emission Standard for Asbestos for any renovations or demolitions.

* If any solid or hazardous wastes, or soils and/or groundwater contaminated with hazardous constituents are encountered during the project, notification to LDEQ's Single-Point-of-Contact (SPOC) at (225) 219-3640 is required. Additionally, precautions should be taken to protect workers from these hazardous constituents.

Currently, Lafourche, Jefferson and Plaquemines Parishes are classified as attainment with the National Ambient Air Quality Standards and have no general conformity determination obligations.

Please send all future requests to my attention. If you have any questions, please feel free to contact me at (225) 219-3958 or by email at beth.dixon@la.gov <mailto:beth.dixon@la.gov> .

Sincerely,
Beth Altazan-Dixon
Performance Management
LDEQ/Business and Community Outreach Division Office of the Secretary
P.O. Box 4301 (602 N. 5th Street)
Baton Rouge, LA 70821-4301
Phone: 225-219-3958
Fx: 225-325-8148
Email: beth.dixon@la.gov

RESPONSE

LDEQ email 09: the proposed action would not include water system improvement or the use of water softeners.

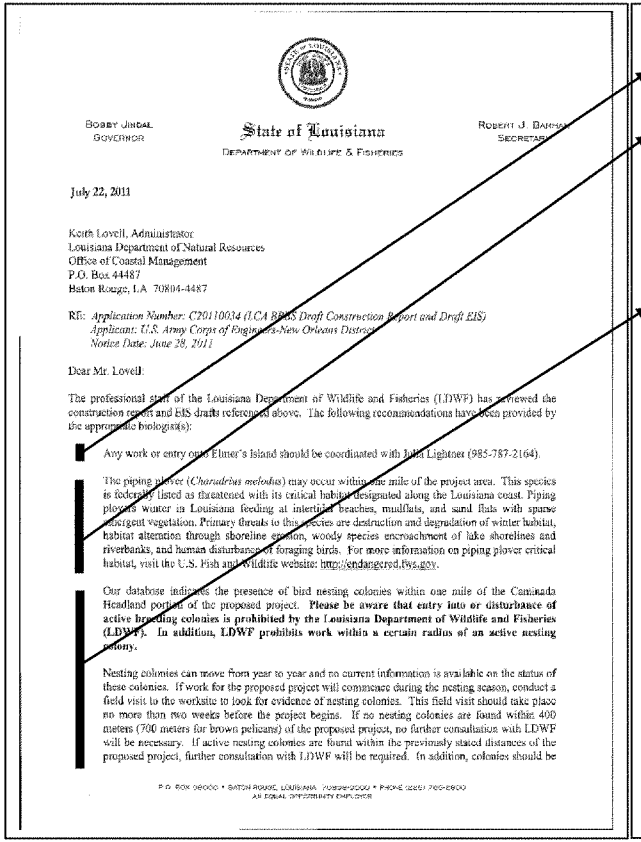
LDEQ email 10: the proposed action would not include any renovation or remodeling involving lead-based paint or asbestos.

LDEQ email 11: LDEQ's Single-Point-of-Contact will be contacted if any hazardous wastes or soils or ground water contaminated with hazardous constituents are encountered during construction of the project. All appropriate precautions will be taken to protect workers from these hazardous constituents. A Phase 1 Hazardous, Toxic and Radioactive Wastes assessment will be completed as described in Section 5.19.

LDEQ email 12: potential project-induced impacts to air quality are presented in section 5.20 Air Quality.

1174

Louisiana Department of Wildlife and Fisheries (LDWF ltr)



BOBBY JINDAL
GOVERNOR

State of Louisiana
DEPARTMENT OF WILDLIFE & FISHERIES

ROBERT J. BARHAM
SECRETARY

July 22, 2011

Keith Lovell, Administrator
Louisiana Department of Natural Resources
Office of Coastal Management
P.O. Box 44487
Baton Rouge, LA 70804-4487

RE: *Application Number: C20110034 (LCA BBBS Draft Construction Report and Draft EIS)*
Applicant: U.S. Army Corps of Engineers-New Orleans District
Notice Date: June 28, 2011

Dear Mr. Lovell:

The professional staff of the Louisiana Department of Wildlife and Fisheries (LDWF) has reviewed the construction report and EIS drafts referenced above. The following recommendations have been provided by the appropriate biologist(s):

Any work or entry onto Elmer's Island should be coordinated with Julia Lightner (985-787-2164).

The piping plover (*Charadrius melodus*) may occur within one mile of the project area. This species is federally listed as threatened with its critical habitat designated along the Louisiana coast. Piping plovers winter in Louisiana feeding at intertidal beaches, mudflats, and sand flats with sparse emergent vegetation. Primary threats to this species are destruction and degradation of winter habitat, habitat alteration through shoreline erosion, woody species encroachment of lake shorelines and riverbanks, and human disturbance of foraging birds. For more information on piping plover critical habitat, visit the U.S. Fish and Wildlife website: http://endangered.fws.gov.

Our database indicates the presence of bird nesting colonies within one mile of the Caminada Headland portion of the proposed project. **Please be aware that entry into or disturbance of active breeding colonies is prohibited by the Louisiana Department of Wildlife and Fisheries (LDWF). In addition, LDWF prohibits work within a certain radius of an active nesting colony.**

Nesting colonies can move from year to year and no current information is available on the status of these colonies. If work for the proposed project will commence during the nesting season, conduct a field visit to the worksite to look for evidence of nesting colonies. This field visit should take place no more than two weeks before the project begins. If no nesting colonies are found within 400 meters (700 meters for brown pelicans) of the proposed project, no further consultation with LDWF will be necessary. If active nesting colonies are found within the previously stated distances of the proposed project, further consultation with LDWF will be required. In addition, colonies should be

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RESPONSE

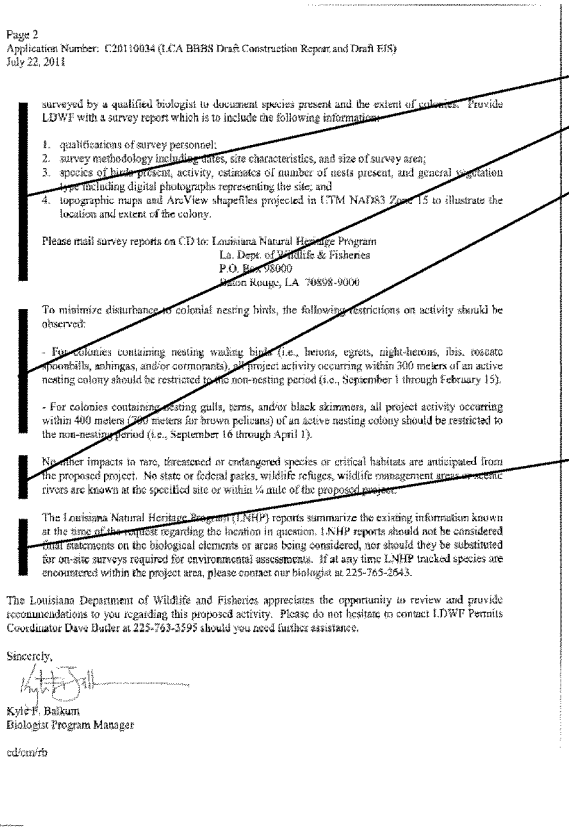
LDWF ltr 01: Thank you for your comment. Concur, that any work or entry onto Elmer's Island will be coordinated with Julia Lightner.

LDWF ltr 02: Concur that threatened piping plover and critical habitat exist within study area. The USACE has coordinated potential impacts of the piping plover and its critical habitat. The USACE has prepared a Biological Assessment regarding potential project-induced impacts to threatened and endangered species and their designated critical habitat within the study area. In their Biological Opinion, the USFWS concurs with the USACE findings.

LDWF ltr 03: Concur. The USACE is aware of LDWF prohibition of entry into or disturbance of active breeding bird colonies. USACE is also aware that LDWF prohibits work within a certain radius of active nesting colony (400 meters of nesting colonies; 700 meters for brown pelicans). The USACE will conduct field visits and coordinate with LDWF as well as the USFWS.

1175

Louisiana Department of Wildlife and Fisheries (LDWF ltr)



Page 2
Application Number: C20110034 (LCA BBBS Draft Construction Repeat and Draft EIS)
July 22, 2011

surveyed by a qualified biologist to document species present and the extent of colonies. Provide LDWF with a survey report which is to include the following information:

1. qualifications of survey personnel;
2. survey methodology including dates, site characteristics, and size of survey area;
3. species of birds present, activity, estimates of number of nests present, and general vegetation type including digital photographs representing the site; and
4. topographic maps and ArcView shapefiles projected in UTM NAD83 Zone 15 to illustrate the location and extent of the colony.

Please mail survey reports on CD to: Louisiana Natural Heritage Program
La. Dept. of Wildlife & Fisheries
P.O. Box 98000
Baton Rouge, LA 70898-9000

To minimize disturbance to colonial nesting birds, the following restrictions on activity should be observed:

- For colonies containing nesting wading birds (i.e., herons, egrets, night-herons, ibis, roseate spoonbills, anhingas, and/or cormorants), all project activity occurring within 300 meters of an active nesting colony should be restricted to the non-nesting period (i.e., September 1 through February 15).

- For colonies containing nesting gulls, terns, and/or black skimmers, all project activity occurring within 400 meters (300 meters for brown pelicans) of an active nesting colony should be restricted to the non-nesting period (i.e., September 16 through April 1).

No other impacts to rare, threatened or endangered species or critical habitats are anticipated from the proposed project. No state or federal parks, wildlife refuges, wildlife management areas or scenic rivers are known at the specified site or within ¼ mile of the proposed project.

The Louisiana Natural Heritage Program (LNHP) reports summarize the existing information known at the time of the request regarding the location in question. LNHP reports should not be considered final statements on the biological elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments. If at any time LNHP tracked species are encountered within the project area, please contact our biologist at 225-765-2643.

The Louisiana Department of Wildlife and Fisheries appreciates the opportunity to review and provide recommendations to you regarding this proposed activity. Please do not hesitate to contact LDWF Permits Coordinator Dave Butler at 225-763-5595 should you need further assistance.

Sincerely,

Kyle F. Balkum
Biologist Program Manager

cd/em/rb

RESPONSE

LDWF ltr 03: see previous page.

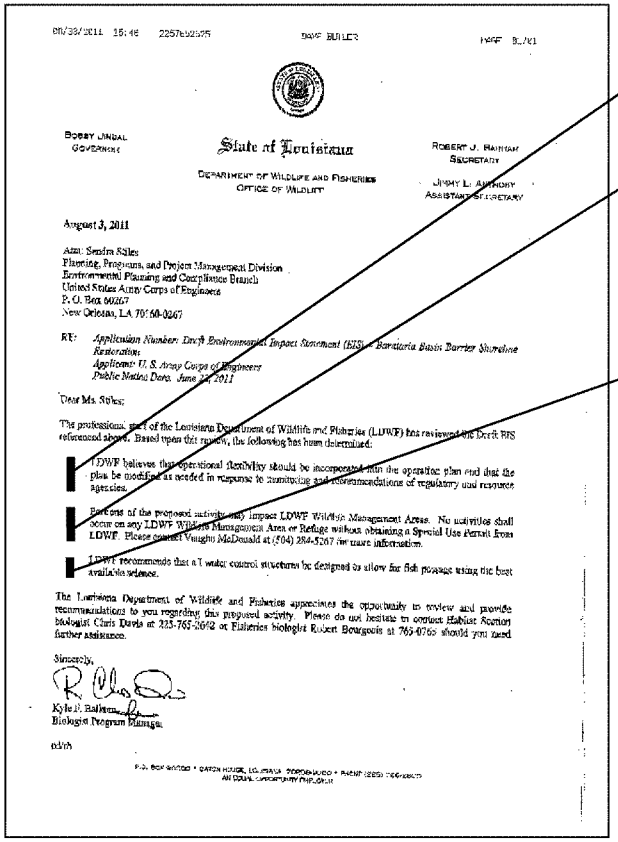
LDWF ltr 04: Concur. The USACE will take appropriate actions to avoid and minimize disturbance to colonial nesting birds.

LDWF ltr 05: Potential impacts to rare, threatened and endangered species or critical habitats are described in the USACE Biological Assessment (Appendix D) and have been coordinated with the USFWS (see their Biological Opinion in Appendix D) and the National Marine Fisheries Service. The recently designated LDWF Elmer's Island Wildlife Refuge would be directly impacted by the proposed restoration actions on the Caminada Headland. The USACE has been in coordination with Messrs Glen Thomas and Vaughn McDonald as well as with Ms Heather Finley and Julia Lightner. The USACE will continue coordination with the LDWF and its designated POC's Julia Lightner and Vaughn McDonald, as well as securing a Special Use Permit for work on the LDWF Elmer's Island Wildlife Refuge.

LDWF ltr 06: concur that if at any time LNHP tracked species are encountered within the project area, the USACE will contact LNHP biologist at 225-765-2643.

1179

Louisiana Department of Wildlife and Fisheries (LDWF fax)



08/30/2011 15:46 2257625975 BOBBY JINDAL PAGE 01/01

Bobby Jindal
Governor

State of Louisiana

Department of Wildlife and Fisheries
Office of Wildlife

Robert J. Barham
Secretary

Jimmy L. Anthony
Assistant Secretary

August 3, 2011

Attn: Sandra Sykes
Planning, Programs, and Project Management Division
Environmental Planning and Compliance Branch
United States Army Corps of Engineers
P. O. Box 60267
New Orleans, LA 70160-0267

RE: *Application Number: Draft Environmental Impact Statement (EIS) – Barataria Basin Barrier Shoreline Restoration;*
Applicant: U.S. Army Corps of Engineers
Public Notice Date: June 24, 2011

Dear Ms. Sykes;

The professional staff of the Louisiana Department of Wildlife and Fisheries (LDWF) has reviewed the Draft EIS referenced above. Based upon this review, the following has been determined:

- LDWF believes that operational flexibility should be incorporated into the operation plan and that the plan be modified as needed in response to monitoring and recommendations of regulatory and resource agencies.
- Portions of the proposed activity may impact LDWF Wildlife Management Areas. No activities shall occur on any LDWF Wildlife Management Area or Refuge without obtaining a Special Use Permit from LDWF. Please contact Vaughn McDonald at (504) 284-5267 for more information.
- LDWF recommends that all water control structures be designed to allow for fish passage using the best available science.

The Louisiana Department of Wildlife and Fisheries appreciates the opportunity to review and provide recommendations to you regarding this proposed activity. Please do not hesitate to contact Habitat Section biologist Chris Davis at 225-765-2642 or Fisheries biologist Robert Bourgeois at 765-0765 should you need further assistance.

Sincerely,

Kyle P. Balkum
Biologist Program Manager

kpb/rb

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RESPONSE

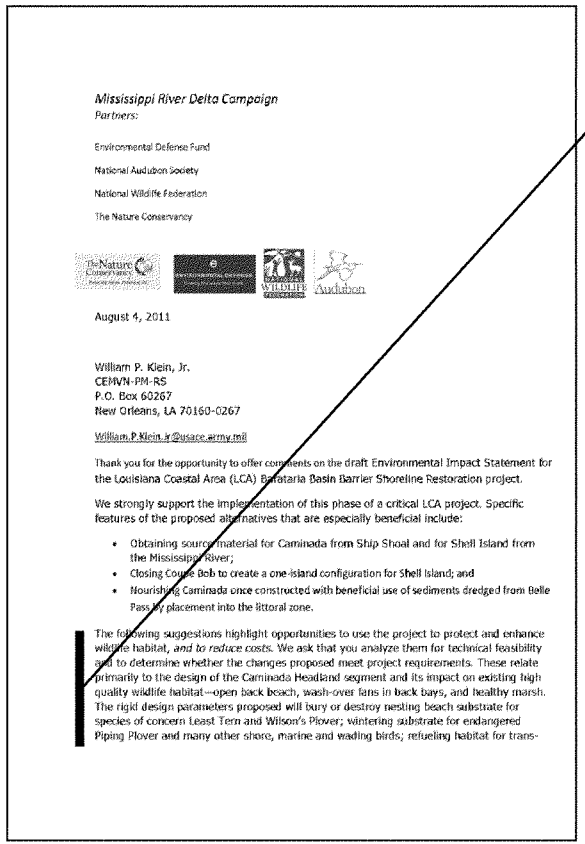
LDWF fax 01: Thank yon for your comment. Concur, the proposed operational plan will be modified as needed in response to monitoring and recommendations of regulatory and resources agencies. USACE actions regarding this include:

LDWF fax 02: The recently designated LDWF Elmer's Island Wildlife Refuge would be directly impacted by the proposed restoration actions on tlie Caminada Headland. The USACE has been in coordination with Messrs Glen Thomas and Vaughn McDonald as well as with Ms Heather Finley and Julia Lightner. The USACE will continue coordination with the LDWF and its designated POC's Julia Lightner and Vaughn McDonald, as well as securing a Special Use Permit for work on the LDWF Elmer's Islaud Wildlife Refuge.

LDWF fax 03: The proposed action, restoration of the Caminada Headland and Shell Island, would not include any water control structures.

1177

Mississippi River Delta Campaign (MRDC)



Mississippi River Delta Campaign
Partners:

Environmental Defense Fund

National Audubon Society

National Wildlife Federation

The Nature Conservancy

August 4, 2011

William P. Klein, Jr.
CEMVN-PM-RS
P.O. Box 60267
New Orleans, LA 70160-0267

William.P.Klein.jr@usace.army.mil

Thank you for the opportunity to offer comments on the draft Environmental Impact Statement for the Louisiana Coastal Area (LCA) Barataria Basin Barrier Shoreline Restoration project.

We strongly support the implementation of this phase of a critical LCA project. Specific features of the proposed alternatives that are especially beneficial include:

- Obtaining source material for Caminada from Ship Shoal and for Shell Island from the Mississippi River;
- Closing Coupe Bob to create a one-island configuration for Shell Island; and
- Nourishing Caminada once constructed with beneficial use of sediments dredged from Belle Pass by placement into the littoral zone.

The following suggestions highlight opportunities to use the project to protect and enhance wildlife habitat, *and to reduce costs*. We ask that you analyze them for technical feasibility and to determine whether the changes proposed meet project requirements. These relate primarily to the design of the Caminada Headland segment and its impact on existing high quality wildlife habitat—open back beach, wash-over fans in back bays, and healthy marsh. The rigid design parameters proposed will bury or destroy nesting beach substrate for species of concern Least Tern and Wilson's Plover; wintering substrate for endangered Piping Plover and many other shore, marine and wading birds; refueling habitat for trans-

RESPONSE

MRDC 01: Thank yon for your comment. More detailed construction design and costs analysis, considering design with uatural forces will be considered during PED phase. Potential impacts to existing wildlife habitats and resources are presented in Section 5.8 Wildlife Resources: Birds, Mammals, Amphibians and Reptiles. Potential impacts to threatened and endangered species, such as the piping plover, are presented in Section 5.13 Threatened and Endangered Species as well as in the Biological Assessment Appendix D. The USACE has coordinated with the USFWS and NMFS regarding potential impacts to threatened and endangered species and designated critical habitats. The USFWS Biological Opinion, presented in Appendix D, concurs with the USACE Biological Assessment. The USACE agrees with the terms and conditions provided by the USFWS Biological Opinion, as well as the NMFS regional Biological Opinion. The USACE will implement the reasonable and prudent measures recommended by the USFWS and NMFS beginning in PED.

1178

Mississippi River Delta Campaign (MRDC)

gulf migratory shorebirds; and salt-marsh, nesting habitat for Clapper Rails, Marsh Wrens and Seaside Sparrows, and wintering habitat for other rails and Nelson's Sparrow.

We suggest instead that you analyze the possibility of a less rigid design, one that allows natural forces to gradually shape the replenished shoreline and provide substrate for marsh recruitment. These changes would also allow significant cost savings and could be the basis for a wildlife recovery plan.

Barrier Beach

The current plan proposes building a wide platform to a pre-determined height and slope that buries prime Least Tern and Wilson's Plover nesting substrate. In the spring of 2010 hundreds of Least Terns and dozens of Wilson's Plovers nested on the headland, largely upon habitat created by recent tropical storm events, perhaps especially Hurricane Gustav in 2008, which had flattened the dune field and widened the platform by spreading sand over the back marsh and open water. (pers. obs. David P, Muth, May 25, 2011, over 500 Least Terns and over 50 Wilson's Plovers recorded.)

We propose instead that you consider placement of the Ship Shoal material just behind the front beach in the fore-dune area in a narrower, higher strip. This fill need not be shaped beyond the requirements of moving the discharge pipe. Instead, natural forcing by wind, waves, and (eventually) surge will distribute the material gradually across the dune field and back beach.

Natural forces will redistribute this material in any case, which begs the question as to why precious funds should be spent in a futile effort to achieve a predetermined elevation, width and slope that will begin to change before the project is completed. Presumably, volume of sand is the critical variable in determining the potential increases in the longevity of the headland structure, not the shape of the placed material. Natural re-distribution should allow continued utilization of nesting substrate.

Project sand fencing and plantings could be used strategically behind this unconsolidated material to encourage future dune formation. Plantings and fencing should not be distributed in such a way as to speed the conversion of nesting substrate on the back beach to a fully vegetated state. Natural succession toward increased vegetative cover will continue to degrade the quality of nesting habitat (ideally bare firm sand pan with exposed shell and scattered vegetation forming isolated small dunes). Only a new wash-over event will interrupt this successional process, but the project need not speed up this process unnecessarily.

If for technical reasons, or because of failure to meet project requirements for surge attenuation, the proposed un-consolidated placement of fill volume is found to be unworkable, then the design of the raised fill platform should allow for the development of open nesting substrate. This might be accomplished by concentrating sand fencing and plantings near the beach, allowing the back of the platform to begin in the earliest successional state. Once wind has created areas of firm sand pan with exposed shell, terns and plovers might begin nesting.

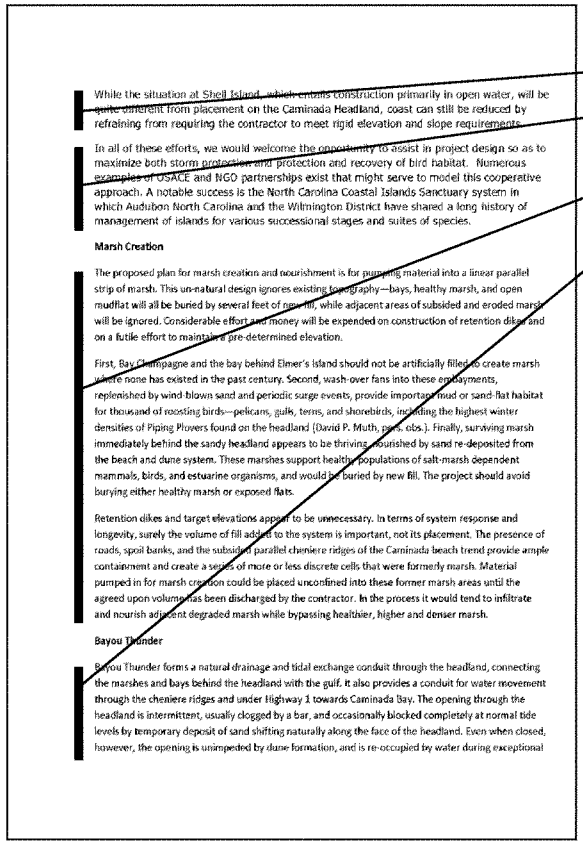
RESPONSE:

MRDC 01 (continued): see response on previous page.

MRDC 02: Placement of dredged material will occur directly on the beach front.

1179

Mississippi River Delta Campaign (MRDC)



While the situation at Shell Island, which entails construction primarily in open water, will be quite different from placement on the Caminada Headland, coast can still be reduced by refraining from requiring the contractor to meet rigid elevation and slope requirements.

In all of these efforts, we would welcome the opportunity to assist in project design so as to maximize both storm protection and protection and recovery of bird habitat. Numerous examples of USACE and NGO partnerships exist that might serve to model this cooperative approach. A notable success is the North Carolina Coastal Islands Sanctuary system in which Audubon North Carolina and the Wilmington District have shared a long history of management of islands for various successional stages and suites of species.

Marsh Creation

The proposed plan for marsh creation and nourishment is for pumping material into a linear parallel strip of marsh. This un-natural design ignores existing topography—bays, healthy marsh, and open mudflat will all be buried by several feet of new fill, while adjacent areas of subsided and eroded marsh will be ignored. Considerable effort and money will be expended on construction of retention dikes and on a futile effort to maintain a pre-determined elevation.

First, Bay Champagne and the bay behind Elmer's Island should not be artificially filled to create marsh where none has existed in the past century. Second, wash-over fans into these embayments, replenished by wind-blown sand and periodic surge events, provide important mud or sand-flat habitat for thousand of roosting birds—pelicans, gulls, terns, and shorebirds, including the highest winter densities of Piping Plovers found on the headland (David P. Muth, pers. obs.). Finally, surviving marsh immediately behind the sandy headland appears to be thriving, nourished by sand re-deposited from the beach and dune system. These marshes support healthy populations of salt-marsh dependent mammals, birds, and estuarine organisms, and would be buried by new fill. The project should avoid burying either healthy marsh or exposed flats.

Retention dikes and target elevations appear to be unnecessary. In terms of system response and longevity, surely the volume of fill added to the system is important, not its placement. The presence of roads, spoil banks, and the subsided parallel chenière ridges of the Caminada beach trend provide ample containment and create a series of more or less discrete cells that were formerly marsh. Material pumped in for marsh creation could be placed unconfined into these former marsh areas until the agreed upon volume has been discharged by the contractor. In the process it would tend to infiltrate and nourish adjacent degraded marsh while bypassing healthier, higher and denser marsh.

Bayou Thunder

Bayou Thunder forms a natural drainage and tidal exchange conduit through the headland, connecting the marshes and bays behind the headland with the gulf. It also provides a conduit for water movement through the chenière ridges and under Highway 1 towards Caminada Bay. The opening through the headland is intermittent, usually clogged by a bar, and occasionally blocked completely at normal tide levels by temporary deposit of sand shifting naturally along the face of the headland. Even when closed, however, the opening is unimpeded by dune formation, and is re-occupied by water during exceptional

RESPONSE

MRDC 02 (continued): see response on previous page.

MRDC 03: These methods will be considered during PED phase of the project.

MRDC 04: see response MRDC 03.

MRDC 05: see response MRDC 03.

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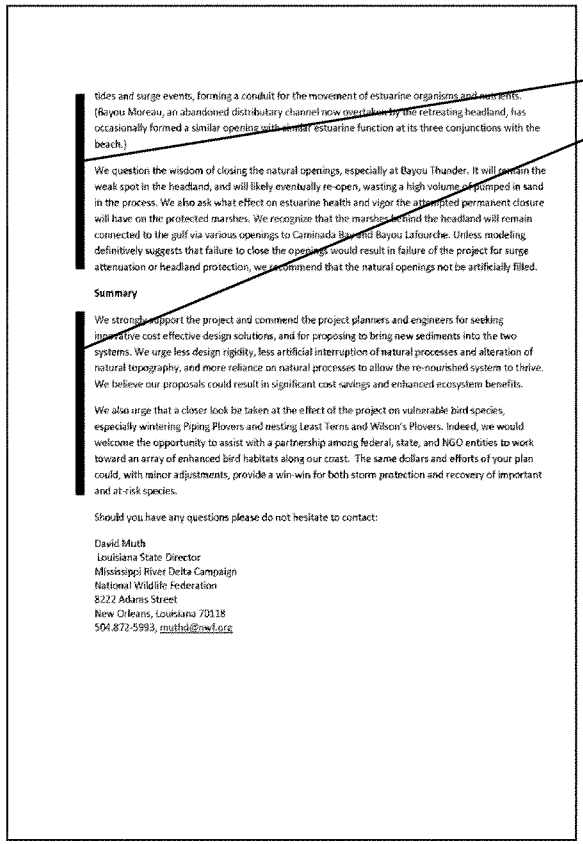
Mississippi River Delta Campaign (MRDC)



tides and surge events, forming a conduit for the movement of estuarine organisms and nutrients. (Bayou Moreau, an abandoned distributary channel now overtaken by the retreating headland, has occasionally formed a similar opening with similar estuarine function at its three conjunctions with the beach.)

We question the wisdom of closing the natural openings, especially at Bayou Thunder. It will remain the weak spot in the headland, and will likely eventually re-open, wasting a high volume of pumped in sand in the process. We also ask what effect on estuarine health and vigor the attempted permanent closure will have on the protected marshes. We recognize that the marshes behind the headland will remain connected to the gulf via various openings to Caminada Bay and Bayou Lafourche. Unless modeling definitively suggests that failure to close the openings would result in failure of the project for surge attenuation or headland protection, we recommend that the natural openings not be artificially filled.

Summary

We strongly support the project and commend the project planners and engineers for seeking innovative cost effective design solutions, and for proposing to bring new sediments into the two systems. We urge less design rigidity, less artificial interruption of natural processes and alteration of natural topography, and more reliance on natural processes to allow the re-nourished system to thrive. We believe our proposals could result in significant cost savings and enhanced ecosystem benefits.

We also urge that a closer look be taken at the effect of the project on vulnerable bird species, especially wintering Piping Plovers and nesting Least Terns and Wilson's Plovers. Indeed, we would welcome the opportunity to assist with a partnership among federal, state, and NGO entities to work toward an array of enhanced bird habitats along our coast. The same dollars and efforts of your plan could, with minor adjustments, provide a win-win for both storm protection and recovery of important and at-risk species.

Should you have any questions please do not hesitate to contact:

David Muth
Louisiana State Director
Mississippi River Delta Campaign
National Wildlife Federation
8222 Adams Street
New Orleans, Louisiana 70118
504.872-5993, muthd@nwf.org

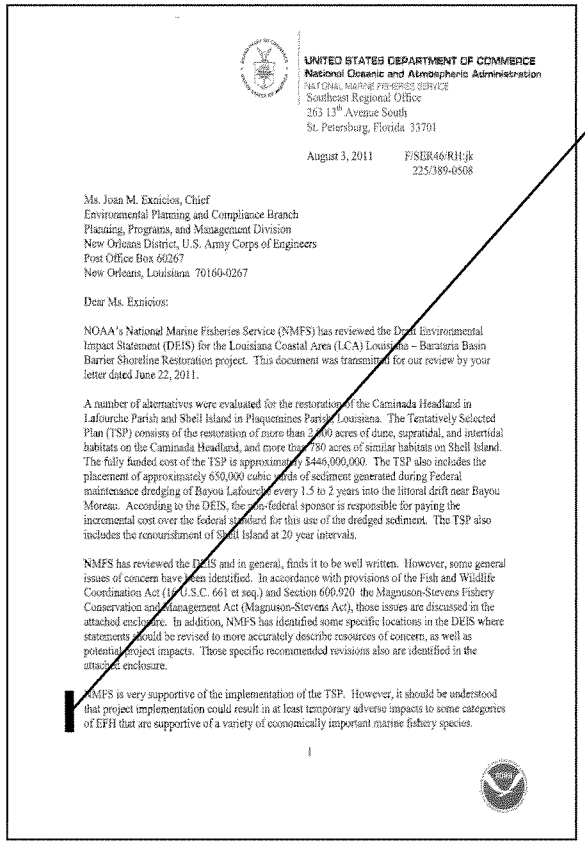
RESPONSE

MRDC 05 (continued): see response on previous page.

MRDC 06: see responses MRDC 01-05

1181

National Marine Fisheries Service (NMFS)



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701

August 3, 2011 F/SER46/RH:jk
225/389-0508

Ms. Joan M. Exnicios, Chief
Environmental Planning and Compliance Branch
Planning, Programs, and Management Division
New Orleans District, U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Ms. Exnicios:

NOAA's National Marine Fisheries Service (NMFS) has reviewed the Draft Environmental Impact Statement (DEIS) for the Louisiana Coastal Area (LCA) Louisiana – Barataria Basin Barrier Shoreline Restoration project. This document was transmitted for our review by your letter dated June 22, 2011.

A number of alternatives were evaluated for the restoration of the Caminada Headland in Lafourche Parish and Shell Island in Plaquemines Parish, Louisiana. The Tentatively Selected Plan (TSP) consists of the restoration of more than 2,000 acres of dune, supratidal, and intertidal habitats on the Caminada Headland, and more than 780 acres of similar habitats on Shell Island. The fully funded cost of the TSP is approximately $446,000,000. The TSP also includes the placement of approximately 650,000 cubic yards of sediment generated during Federal maintenance dredging of Bayou Lafourche every 1.5 to 2 years into the littoral drift near Bayou Moreau. According to the DEIS, the non-federal sponsor is responsible for paying the incremental cost over the federal standard for this use of the dredged sediment. The TSP also includes the renourishment of Shell Island at 20 year intervals.

NMFS has reviewed the DEIS and in general, finds it to be well written. However, some general issues of concern have been identified. In accordance with provisions of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) and Section 600.920 the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), those issues are discussed in the attached enclosure. In addition, NMFS has identified some specific locations in the DEIS where statements should be revised to more accurately describe resources of concern, as well as potential project impacts. Those specific recommended revisions also are identified in the attached enclosure.

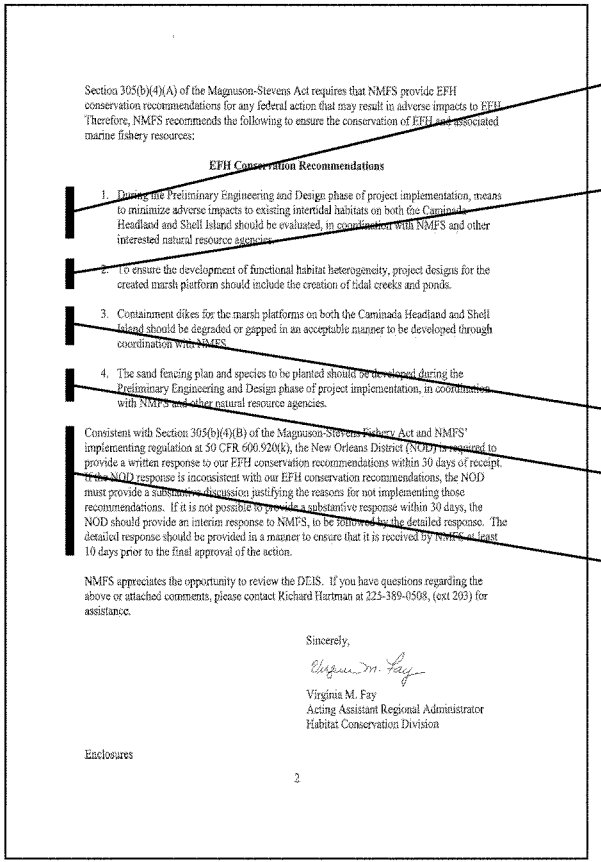
NMFS is very supportive of the implementation of the TSP. However, it should be understood that project implementation could result in at least temporary adverse impacts to some categories of EFH that are supportive of a variety of economically important marine fishery species.

RESPONSE

NMFS 01: Concur that implementation of proposed action could result in temporary adverse impacts to some categories of EFH that are supportive of a variety of important fisheries species. Potential project-induced impacts to EFH are described in section 5.10 "Essential Fish Habitat (EFH)."

1182

National Marine Fisheries Service (NMFS)



Section 305(b)(4)(A) of the Magnuson-Stevens Act requires that NMFS provide EFH conservation recommendations for any federal action that may result in adverse impacts to EFH. Therefore, NMFS recommends the following to ensure the conservation of EFH and associated marine fishery resources:

EFH Conservation Recommendations

1. During the Preliminary Engineering and Design phase of project implementation, means to minimize adverse impacts to existing intertidal habitats on both the Caminada Headland and Shell Island should be evaluated, in coordination with NMFS and other interested natural resource agencies.
2. To ensure the development of functional habitat heterogeneity, project designs for the created marsh platform should include the creation of tidal creeks and ponds.
3. Containment dikes for the marsh platforms on both the Caminada Headland and Shell Island should be degraded or gapped in an acceptable manner to be developed through coordination with NMFS.
4. The sand fencing plan and species to be planted should be developed during the Preliminary Engineering and Design phase of project implementation, in coordination with NMFS and other natural resource agencies.

Consistent with Section 305(b)(4)(B) of the Magnuson-Stevens Fishery Act and NMFS' implementing regulation at 50 CFR 600.920(k), the New Orleans District (NOD) is required to provide a written response to our EFH conservation recommendations within 30 days of receipt. If the NOD response is inconsistent with our EFH conservation recommendations, the NOD must provide a substantive discussion justifying the reasons for not implementing those recommendations. If it is not possible to provide a substantive response within 30 days, the NOD should provide an interim response to NMFS, to be followed by the detailed response. The detailed response should be provided in a manner to ensure that it is received by NMFS at least 10 days prior to the final approval of the action.

NMFS appreciates the opportunity to review the DEIS. If you have questions regarding the above or attached comments, please contact Richard Hartman at 225-389-0508, (ext 203) for assistance.

Sincerely,

Virginia M. Fay
Acting Assistant Regional Administrator
Habitat Conservation Division

Enclosures

2

RESPONSE

NMFS 02: Concur; during PED phase additional means to minimize adverse impacts to existing intertidal habitats on both the Caminada Headland and Shell Island will be considered and coordinated with the NMFS and other natural resource agencies.

NMFS 03: Do not concur that project design should include tidal creeks and ponds on restored Shell Island barrier island habitats or the Caminada Headland. Including such design features into barrier islands aud the beach/dune/supratidal/intertidal erosional zone of the Caminada Headland fronting the Gulf of Mexico would initiate and rapidly increase barrier habitat fragmentation to restored areas in this high energy Gulf of Mexico barrier system. Such features will naturally develop over time due to the different natural sediment densities of the borrow material and differential settlement and consolidation of the borrow material over time, along with natural processes.

NMFS 04: Concur. Consistent with previous ecosystem restoration efforts, containment dikes are anticipated to degrade and gap naturally.

NMFS 05: Concur. Refinement, during the PED Phase, of the sand fencing plan and vegetative species to be planted will be further coordinated with the NMFS and other natural resource agencies.

NMFS 06: Concur. The New Orleans District will provide a written response regarding the proposed EFH conservation recommendations in a manner to ensure that it is received by NMFS at least 10 days prior to the final approval of the action.

1183

National Marine Fisheries Service (NMFS)

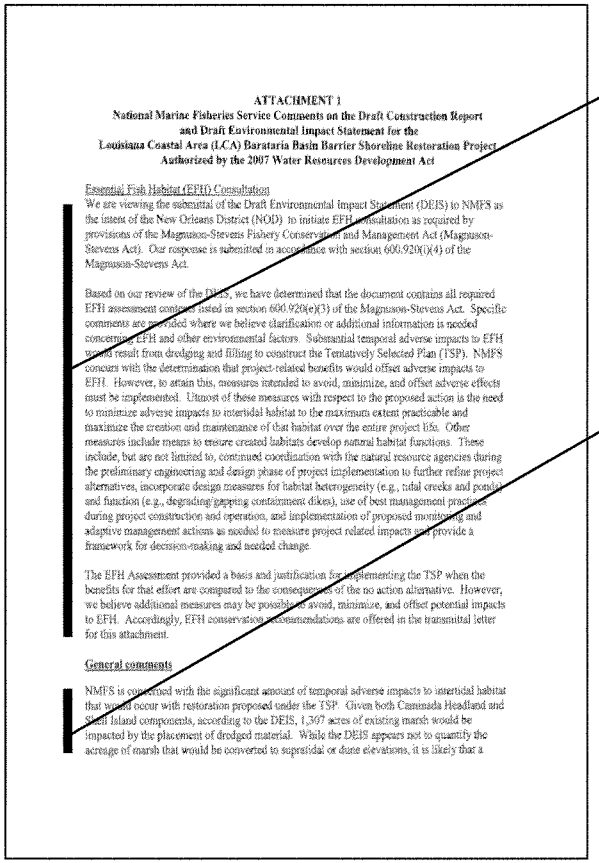
cc:
FWS, Lafayette, Walther
EPA, Dallas, Ettinger
LA DNR, Consistency, Lovell
F/SER46, Swafford
F/SER4, Dale
F/SER PRD, Bernhart
NOAA PPI, Reid
Files

3

RESPONSE

1184

National Marine Fisheries Service (NMFS)



ATTACHMENT 1
National Marine Fisheries Service Comments on the Draft Construction Report and Draft Environmental Impact Statement for the Louisiana Coastal Area (LCA) Barataria Basin Barrier Shoreline Restoration Project Authorized by the 2007 Water Resources Development Act

Essential Fish Habitat (EFH) Consultation

We are viewing the submittal of the Draft Environmental Impact Statement (DEIS) to NMFS as the intent of the New Orleans District (NOD) to initiate EFH consultation as required by provisions of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). Our response is submitted in accordance with section 600.920(i)(4) of the Magnuson-Stevens Act.

Based on our review of the DEIS, we have determined that the document contains all required EFH assessment contents listed in section 600.920(e)(3) of the Magnuson-Stevens Act. Specific comments are provided where we believe clarification or additional information is needed concerning EFH and other environmental factors. Substantial temporal adverse impacts to EFH would result from dredging and filling to construct the Tentatively Selected Plan (TSP). NMFS concurs with the determination that project-related benefits would offset adverse impacts to EFH. However, to attain this, measures intended to avoid, minimize, and offset adverse effects must be implemented. Utmost of these measures with respect to the proposed action is the need to minimize adverse impacts to intertidal habitat to the maximum extent practicable and maximize the creation and maintenance of that habitat over the entire project life. Other measures include means to ensure created habitats develop natural habitat functions. These include, but are not limited to, continued coordination with the natural resource agencies during the preliminary engineering and design phase of project implementation to further refine project alternatives, incorporate design measures for habitat heterogeneity (e.g., tidal creeks and ponds) and function (e.g., degrading/gapping containment dikes), use of best management practices during project construction and operation, and implementation of proposed monitoring and adaptive management actions as needed to measure project related impacts and provide a framework for decision-making and needed change.

The EFH Assessment provided a basis and justification for implementing the TSP when the benefits for that effort are compared to the consequences of the no action alternative. However, we believe additional measures may be possible to avoid, minimize, and offset potential impacts to EFH. Accordingly, EFH conservation recommendations are offered in the transmittal letter for this attachment.

General comments

NMFS is concerned with the significant amount of temporal adverse impacts to intertidal habitat that would occur with restoration proposed under the TSP. Given both Caminada Headland and Shell Island components, according to the DEIS, 1,307 acres of existing marsh would be impacted by the placement of dredged material. While the DEIS appears not to quantify the acreage of marsh that would be converted to supratidal or dune elevations, it is likely that a

RESPONSE

NMFS 07: Concur. The draft EIS is provided, in part, as part of the EFH consultation as required by the Magnuson-Stevens Fishery Conservation Act. Additional appropriate measures to avoid, minimize and offset potential adverse short term effects related to construction of the proposed action would be further considered and developed during PED Phase, especially with regard to minimizing adverse impacts to intertidal habitats. In addition, the USACE will continue, during the PED Phase, to further refine, develop, and include, to the maximum extent practicable, measures to ensure created habitats develop natural habitat functions and that maximize the creation and maintenance of barrier habitats. The USACE also intends to implement proposed monitoring and adaptive management measures as needed to measure project related impacts and to provide a framework for decision-making and needed change.

NMFS 08: Concur. The following has been added to Section 5.10.2 Essential Fish Habitat (EFH):
"Table 5.7 presents the number of acres existing habitat types converted to other habitat types following implementation of the proposed action. For the Caminada Headland the number of acres of existing water bottoms converted to Gulf subtidal equals 223 acres, converted to beach equals 58 acres, converted dune equals 231 acres, converted to supratidal equals 0 acres, and converted to marsh equals 413 acres. The number of acres of existing marsh on the Caminada Headland converted to Gulf subtidal equals 0 acres, converted to beach equals 0 acres, converted dune equals 101 acres, converted to supratidal equals 103 acres, and converted to (remain) marsh equals 773 acres.

For Shell Island the number of acres of existing water bottoms converted to Gulf subtidal equals 0 acres, converted to beach equals 53 acres, converted dune equals 152 acres, converted to supratidal equals 164 acres, and converted to marsh equals 404 acres. The number of acres of existing marsh on Shell Island converted to Gulf subtidal equals 0 acres, converted to beach equals < 1 acre, converted dune equals < 1 acre, converted to supratidal equals 2 acres, and converted to (remain) marsh equals 8 acres." See following page for continued response.

1185

National Marine Fisheries Service (NMFS)

RESPONSE

NMFS 08 (continued):
The acreage of various EFH habitats expected to remain subaerial by 2050.

For the Caminada Headland the total number of acres equals 2,492 acres at TY0. These acres evolve to a total of 1,023 acres: comprised of 245 acres of gulf intertidal, 345 acres of supratidal, and 433 acres of marsh at 2050. For Shell Island the total number of acres equals acres at TY0. These acres evolve to a total of 469 acres: comprised of 48 aeres of beach, 148 acres of supratidal, 0 acres of dune, and 273 acres of marsh.

RESPONSE

NMFS 08 (continued):

Table 5-7. Number of acres of existing habitats converted to other habitat types following implementation of the proposed action.

EFH Habitat Types	Existing Acres (TY 0)	Converted Acres (TY1)
Caminada Headland		
Existing Open Water	925 ac	Gulf subtidal = 223 ac Beach (Gulf intertidal) = 58 ac Dune = 231 ac Supratidal = 0 ac Marsh = 413 ac
Existing Marsh	977 ac	Gulf subtidal = 0 ac Beach (Gulf Intertidal) = 0 ac Dune = 101 ac Supratidal = 103 ac Marsh = 773 ac
Shell Island		
Existing Open Water	773 ac	Gulf subtidal = 0 ac Beach (Gulf intertidal) = 53 ac Dune = 152 ac Supratidal = 164 ac Marsh = 404 ac
Existing Marsh	10 ac	Gulf subtidal = 0 ac Beach (Gulf intertidal) = < 1 ac Dune = <1 ac Supratidal = 2 ac Marsh = 8 ac

1186

National Marine Fisheries Service (NMFS)

significant amount of the existing wetland acreage will be converted to higher elevations providing little functional habitat supportive of marine fishery resources. The Final Environmental Impact Statement (FEIS) should quantify the acreage of existing marsh that would be converted to uplands, as well as that acreage that will remain intertidal in nature. The FEIS also should discuss the temporal period of time between the initiation of construction activities and the likely period of time that the created marsh habitat would be fully supportive of marine fishery resources.

The DEIS appears to be missing an evaluation of the potential impact dredging of the Caminada and Empire marsh borrow sites could have on wave elevations and wave energy impacting adjacent shorelines. Given their locations, NMFS believes the FEIS should include such an analysis. In addition, NMFS believes the Empire borrow site may be the same borrow site intended to be used to construct the Pelican Island project under the auspices of the Coastal Wetlands, Planning, Protection and Restoration Act (CWPPRA) program. Initiation of construction for that project is expected to begin this year. The FEIS may need to be revised to identify and evaluate an alternative borrow source for marsh fill on Shell Island.

In addition, the DEIS does not discuss the likely dredging and construction methodology for Ship Shoal and the Caminada Headland. Given the distance between Ship Shoal and the Caminada Headland, hopper dredges may be the preferred dredging methodology. Hopper dredges have a much greater potential to adversely impact threatened and endangered sea turtles. The DEIS does not discuss this potential impact to those resources. In addition, hopper dredges may deposit their dredged material into open water adjacent to the Caminada Headland for subsequent redredging and placement into the fill template, or they could pump the dredged material directly onto the project area. The potential placement of dredged material into open water for later placement into the project area has not been identified or evaluated in the DEIS. NMFS believes the NOD should evaluate the likely construction methodologies and revise the FEIS to include all potential alternatives and their impacts.

The following specific comments address sections in the DEIS where clarification or additional information is needed.

Specific comments

EXECUTIVE SUMMARY
Project Description

Page vii, paragraph 1. This paragraph provides a summary of the acres of each habitat type to be created for the Caminada Headland project, and quantifies the acres of existing beach/dune and marsh to be impacted by fill placement. However, it does not indicate how many acres of existing marsh would be converted to beach/dune habitat. This information should be provided in the FEIS.

Page viii, paragraph 2. This paragraph provides a summary of the acres of each habitat type to be created for the Shell Island project component, and quantifies the acres of existing beach/dune

RESPONSE

NMFS 08 continued: see response on previous page

NMFS 09: The borrow sites were located at a distance sufficiently far enough away from the barrier shorelines so as not to significantly change or alter wave dynamics. With regard to use of Ship Shoal, any impacts of wave energy from project implementation would be temporary in nature and wonld not have lasting negative impacts on adjacent shorelines. Stone et al. (2004) indicates that removal of Ship Shoal sands for barrier/coastal restoration efforts would not significantly influence wave conditions in the nearshore because the expected increase in wave energy is liunited to the leeward flank of the shoal.

The Empire borrow site may have been used on previous CWPPRA projects. However, the USACE believes there will be enough material from here, as well as other borrow sources listed in the report that will accommodate the dredge material needs of this project. Additional analysis of marsh habitat will be conducted in PED phase of this project.

NMFS 10: Concur. Detailed dredging and construction methodology regarding Ship Shoal, the potential for placement of dredged material into open water for later placement into the fill template have not been identified. Additional engineering design is required before the environmental impacts analysis may be conducted. Additional construction methodology will be considered in the PED phase of this project. Dredging and placement methodology can be found in the Engineering Appendix A.

NMFS 11: Concur. See response to NMFS 08 comment.

NMFS 12: Concur. See response to NMFS 08 comment.

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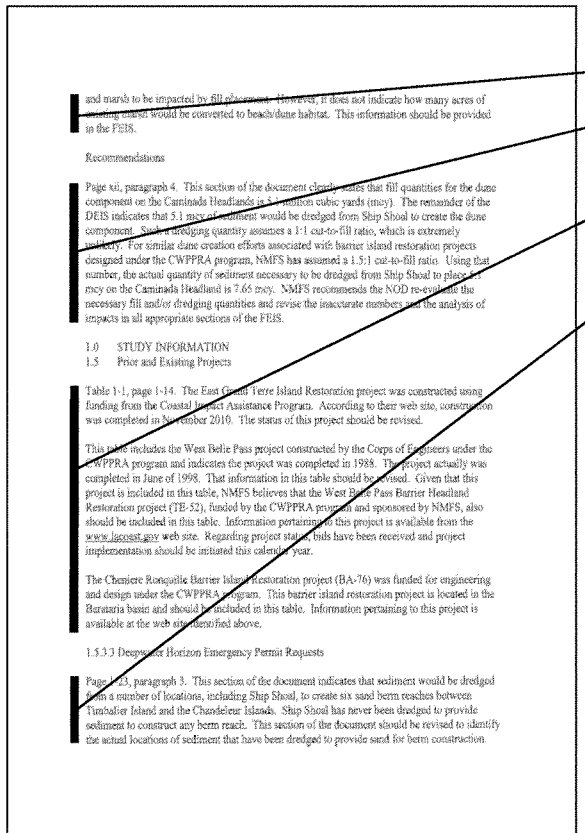
National Marine Fisheries Service (NMFS)



and marsh to be impacted by fill placement. However, it does not indicate how many acres of existing marsh would be converted to beach/dune habitat. This information should be provided in the FEIS.

Recommendations

Page xii, paragraph 4. This section of the document clearly states that fill quantities for the dune component on the Caminada Headlands is 5.7 million cubic yards (mcy). The remainder of the DEIS indicates that 5.1 mcy of sediment would be dredged from Ship Shoal to create the dune component. Such a dredging quantity assumes a 1:1 cut-to-fill ratio, which is extremely unlikely. For similar dune creation efforts associated with barrier island restoration projects designed under the CWPPRA program, NMFS has assumed a 1.5:1 cut-to-fill ratio. Using that number, the actual quantity of sediment necessary to be dredged from Ship Shoal to place 5.7 mcy on the Caminada Headland is 7.65 mcy. NMFS recommends the NOD re-evaluate the necessary fill and/or dredging quantities and revise the inaccurate numbers and the analysis of impacts in all appropriate sections of the FEIS.

1.0 STUDY INFORMATION
1.5 Prior and Existing Projects

Table 1-1, page 1-14. The East Grand Terre Island Restoration project was constructed using funding from the Coastal Impact Assistance Program. According to their web site, construction was completed in September 2010. The status of this project should be revised.

This table includes the West Belle Pass project constructed by the Corps of Engineers under the CWPPRA program and indicates the project was completed in 1988. The project actually was completed in June of 1998. That information in this table should be revised. Given that this project is included in this table, NMFS believes that the West Belle Pass Barrier Headland Restoration project (TE-52), funded by the CWPPRA program and sponsored by NMFS, also should be included in this table. Information pertaining to this project is available from the www.lacoast.gov web site. Regarding project status, bids have been received and project implementation should be initiated this calendar year.

The Cheniere Ronquille Barrier Island restoration project (BA-76) was funded for engineering and design under the CWPPRA program. This barrier island restoration project is located in the Barataria basin and should be included in this table. Information pertaining to this project is available at the web site identified above.

1.5.3.3 Deepwater Horizon Emergency Permit Requests

Page 1-23, paragraph 3. This section of the document indicates that sediment would be dredged from a number of locations, including Ship Shoal, to create six sand berm reaches between Timbalier Island and the Chandeleur Islands. Ship Shoal has never been dredged to provide sediment to construct any berm reach. This section of the document should be revised to identify the actual locations of sediment that have been dredged to provide sand for berm construction.

RESPONSE

NMFS 12 (continued): see response on previous page.

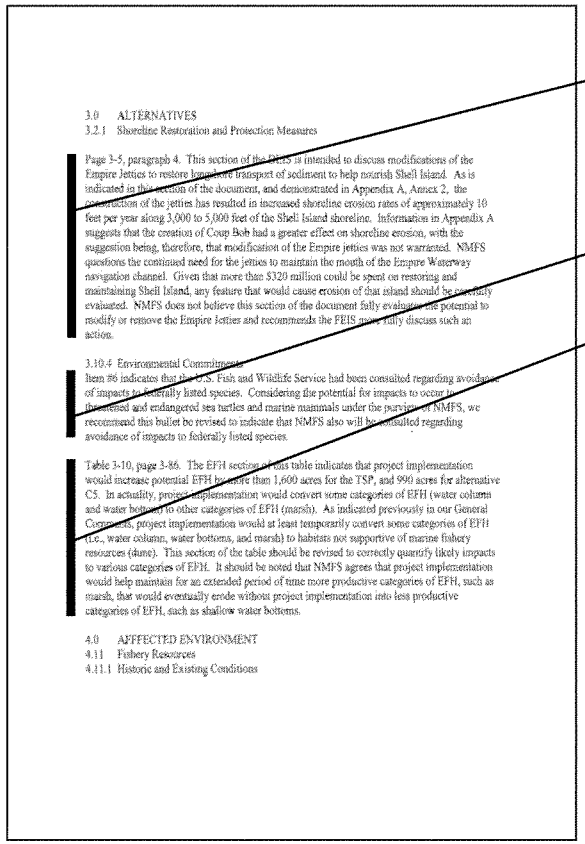
NFMS 13: Appendix A provides description of the cut to fill ratios. The Caminada Headland cut to fill for beach is 1:13; marsh ratio is 1:6. For Shell Island the beach cut to fill ratio is 1:5 and marsh ratio is 2:1.

NMFS 14: Concur. The West Belle Pass Barrier Headland Restoration Project (TE-52) and Cheniere Ronquille Barrier Island Restoration project (BA-76) will be included in Table 1-1.

NMFS 15: Concur. This section will be updated with the following revision: *"Material to construct the berms would be dredged from the Mississippi River Offshore Disposal Site, Pass a Loutre, and Hewes Point."*

1188

National Marine Fisheries Service (NMFS)



3.0 ALTERNATIVES
3.2.1 Shoreline Restoration and Protection Measures

Page 3-5, paragraph 4. This section of the FEIS is intended to discuss modifications of the Empire Jetties to restore longshore transport of sediment to help nourish Shell Island. As is indicated in this section of the document, and demonstrated in Appendix A, Annex 2, the construction of the jetties has resulted in increased shoreline erosion rates of approximately 10 feet per year along 3,000 to 5,000 feet of the Shell Island shoreline. Information in Appendix A suggests that the creation of Coup Bob had a greater effect on shoreline erosion, with the suggestion being, therefore, that modification of the Empire jetties was not warranted. NMFS questions the continued need for the jetties to maintain the mouth of the Empire Waterway navigation channel. Given that more than $320 million could be spent on restoring and maintaining Shell Island, any feature that would cause erosion of that island should be carefully evaluated. NMFS does not believe this section of the document fully evaluates the potential to modify or remove the Empire Jetties and recommends the FEIS more fully discuss such an action.

3.10.4 Environmental Commitments
Item #6 indicates that the U.S. Fish and Wildlife Service had been consulted regarding avoidance of impacts to federally listed species. Considering the potential for impacts to occur to threatened and endangered sea turtles and marine mammals under the purview of NMFS, we recommend this bullet be revised to indicate that NMFS also will be consulted regarding avoidance of impacts to federally listed species.

Table 3-10, page 3-86. The EFH section of this table indicates that project implementation would increase potential EFH by more than 1,600 acres for the TSP, and 900 acres for alternative C5. In actuality, project implementation would convert some categories of EFH (water column and water bottoms) to other categories of EFH (marsh). As indicated previously in our General Comments, project implementation would at least temporarily convert some categories of EFH (i.e., water column, water bottoms, and marsh) to habitats not supportive of marine fishery resources (dune). This section of the table should be revised to correctly quantify likely impacts to various categories of EFH. It should be noted that NMFS agrees that project implementation would help maintain for an extended period of time more productive categories of EFH, such as marsh, that would eventually erode without project implementation into less productive categories of EFH, such as shallow water bottoms.

4.0 AFFECTED ENVIRONMENT
4.11 Fishery Resources
4.11.1 Historic and Existing Conditions

RESPONSE

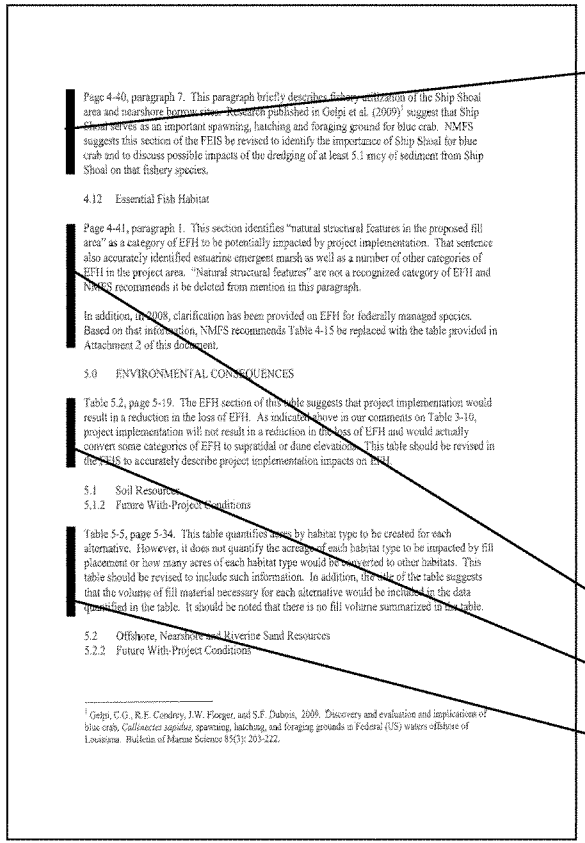
NMFS 16: Do not concur. The referenced section provides sufficient description of the planning considerations of removing and modifying the Empire jetties as a feature of the Shell Island restoration plan. However, due to the potential impacts of the Empire jetties on the proposed Shell Island restoration features additional detailed analysis and considerations of tying-in the eastern most portion of the Shell Island restoration features to the Empire jetties during the PED phase.

NMFS 17: Concur. Bullet item #6 will be revised to indicate that the NMFS will also be consulted regarding avoidance of potential adverse impacts to federally listed species under its jurisdiction.

NMFS 18: Concur. The following has been added to the table:
C5/S5 (TSP/NER): The 1,698 acres existing water bottoms converted to Gulf subtidal = 223 acres, converted to beach = 111 acres, converted dune = 383 acres, converted to supratidal = 164 acres, and converted to marsh = 817 acres. The 987 acres of existing marsh on the converted to Gulf subtidal equals 0 acres, converted to beach equals <1 acre, converted dune equals 102 acres, converted to supratidal equals 105 acres, and converted to (remain) marsh equals 781 acres.
C5: The 925 acres existing water bottoms converted to Gulf subtidal = 223 acres, converted to beach = 58 acres, converted dune = 231 acres, converted to supratidal = 0 acres, and converted to marsh = 413 acres. The 977 acres of existing marsh on the Caminada Headland converted to Gulf subtidal equals 0 acres, converted to beach equals 0 acres, converted dune equals 101 acres, converted to supratidal equals 103 acres, and converted to (remain) marsh equals 773 acres.

11189

National Marine Fisheries Service (NMFS)



Page 4-40, paragraph 7. This paragraph briefly describes fishery utilization of the Ship Shoal area and nearshore borrow sites. Research published in Gelpi et al. (2009)[1] suggest that Ship Shoal serves as an important spawning, hatching and foraging ground for blue crab. NMFS suggests this section of the FEIS be revised to identify the importance of Ship Shoal for blue crab and to discuss possible impacts of the dredging of at least 5.1 mcy of sediment from Ship Shoal on that fishery species.

4.12 Essential Fish Habitat

Page 4-41, paragraph 1. This section identifies "natural structural features in the proposed fill area" as a category of EFH to be potentially impacted by project implementation. That sentence also accurately identified estuarine emergent marsh as well as a number of other categories of EFH in the project area. "Natural structural features" are not a recognized category of EFH and NMFS recommends it be deleted from mention in this paragraph.

In addition, in 2008, clarification has been provided on EFH for federally managed species. Based on that information, NMFS recommends Table 4-15 be replaced with the table provided in Attachment 2 of this document.

5.0 ENVIRONMENTAL CONSEQUENCES

Table 5.2, page 5-19. The EFH section of this table suggests that project implementation would result in a reduction in the loss of EFH. As indicated above in our comments on Table 3-10, project implementation will not result in a reduction in the loss of EFH and would actually convert some categories of EFH to supratidal or dune elevations. This table should be revised in the FEIS to accurately describe project implementation impacts on EFH.

5.1 Soil Resources
5.1.2 Future With-Project Conditions

Table 5-5, page 5-34. This table quantifies acres by habitat type to be created for each alternative. However, it does not quantify the acreage of each habitat type to be impacted by fill placement or how many acres of each habitat type would be converted to other habitats. This table should be revised to include such information. In addition, the title of the table suggests that the volume of fill material necessary for each alternative would be included in the data quantified in the table. It should be noted that there is no fill volume summarized in the table.

5.2 Offshore, Nearshore and Riverine Sand Resources
5.2.2 Future With-Project Conditions

[1] Gelpi, C.G., K.E. Condrey, J.W. Fleeger, and S.F. Dubois, 2009. Discovery and evaluation and implications of blue crab, *Callinectes sapidus*, spawning, hatching, and foraging grounds in Federal (US) waters offshore of Louisiana. Bulletin of Marine Science 85(3): 203-222.

RESPONSE

NMFS 19: Concur in part. The following has been added to Section 4.11.1 describing fishery resources at Ship Shoal:
Recent study of the continental shelf sandy shoals located along Louisiana (Condrey and Gelpi, 2010; Gelpi et al., 2009; and Dubois et al., 2009) found that the Ship and Trinity Shoals support major shrimp fisheries and form an important offshore spawning/hatching/foraging ground for a large segment of the Gulf of Mexico blue crab fishery from at least April-October. These researchers found that mature female blue crabs appear to be in a continuous spawning cycle, producing new broods approximately every 21 days while actively foraging on the Shoals. These researchers conclude that sand mining on the Shoal is expected to result in some decline in blue crab fecundity and condition factor due to a reduction in food supply. In addition, increases in suspended sediments associated with sand mining may potentially increase the mortality of crab larvae. These researchers recommend that sand mining practices which minimize these potentially negative impacts should be carefully considered, along with regulations which will protect the contribution these crabs make to the stability of Louisiana's traditional inshore fishery."
Do not concur that section 4.11.1 is the appropriate place to describe the potential impacts of dredging 5.1 mcy of sediment from Ship Shoal on blue crab fishery. Rather, potential impacts to blue crab fishery will be presented in Section 5.9.2. See response to comment NMFS 26 for response regarding potential impacts of implementing the proposed action on blue crab fishery.

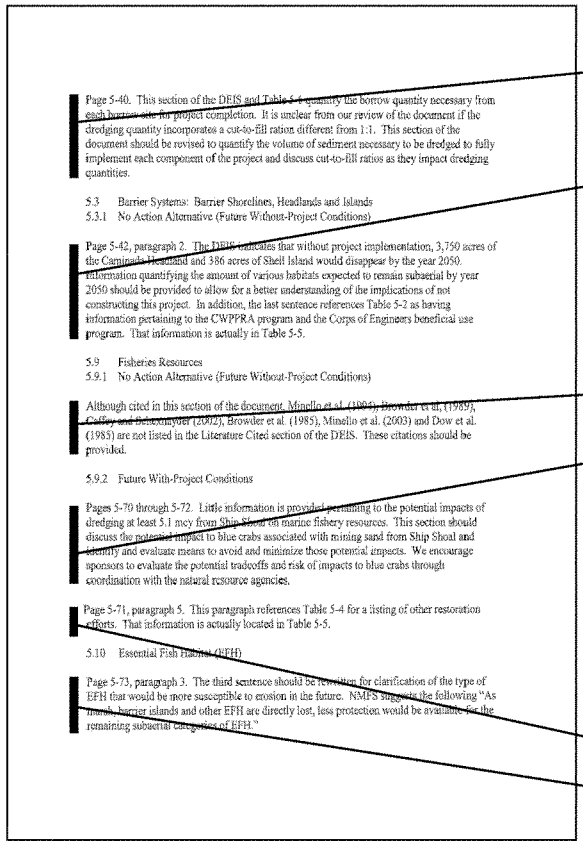
NMFS 20: Concur. Table 4-15 will be replaced with updated table provided by the NMFS.

NMFS 21: Concur. Table 5.2 will be revised to indicate conversion of EFH types see response to comment NMFS 18.

NMFS 22: Do not concur. The table is a summary table; the requested detailed habitat type information is not readily available.

11190

National Marine Fisheries Service (NMFS)



Page 5-40. This section of the DEIS and Table 5-4 quantify the borrow quantity necessary from each borrow site for project completion. It is unclear from our review of the document if the dredging quantity incorporates a cut-to-fill ration different from 1:1. This section of the document should be revised to quantify the volume of sediment necessary to be dredged to fully implement each component of the project and discuss cut-to-fill ratios as they impact dredging quantities.

5.3 Barrier Systems: Barrier Shorelines, Headlands and Islands
5.3.1 No Action Alternative (Future Without-Project Conditions)

Page 5-42, paragraph 2. The DEIS indicates that without project implementation, 3,750 acres of the Caminada Headland and 386 acres of Shell Island would disappear by the year 2050. Information quantifying the amount of various habitats expected to remain subaerial by year 2050 should be provided to allow for a better understanding of the implications of not constructing this project. In addition, the last sentence references Table 5-2 as having information pertaining to the CWPPRA program and the Corps of Engineers beneficial use program. That information is actually in Table 5-5.

5.9 Fisheries Resources
5.9.1 No Action Alternative (Future Without-Project Conditions)

Although cited in this section of the document, Minello et al. (1994), Browder et al. (1989), Coffey and Schexnayder (2002), Browder et al. (1985), Minello et al. (2003) and Dow et al. (1985) are not listed in the Literature Cited section of the DEIS. These citations should be provided.

5.9.2 Future With-Project Conditions

Pages 5-70 through 5-72. Little information is provided pertaining to the potential impacts of dredging at least 5.1 mcy from Ship Shoal on marine fishery resources. This section should discuss the potential impact to blue crabs associated with mining sand from Ship Shoal and identify and evaluate means to avoid and minimize those potential impacts. We encourage sponsors to evaluate the potential tradeoffs and risk of impacts to blue crabs through coordination with the natural resource agencies.

Page 5-71, paragraph 5. This paragraph references Table 5-4 for a listing of other restoration efforts. That information is actually located in Table 5-5.

5.10 Essential Fish Habitat (EFH)

Page 5-73, paragraph 3. The third sentence should be rewritten for clarification of the type of EFH that would be more susceptible to erosion in the future. NMFS suggests the following "As marsh, barrier islands and other EFH are directly lost, less protection would be available for the remaining subaerial categories of EFH."

RESPONSE

NMFS 23: Caminada Appendix A cut to fill for beach is 1:13, marsh is 1:6. For Shell Island beach is 1:5 and marsh is 2:1. The volumes of sediment necessary to implement each component of the project will be further refined during PED phase.

NMFS 24: Concur. The following information will be added to the text: *"For the Caminada Headland the total number of acres equals 2,492 acres at TY0. These acres evolve to a total of 1,023 acres: comprised of 245 acres of gulf intertidal, 345 acres of supratidal, and 433 acres of marsh at 2050. For Shell Island the total number of acres equals acres at TY0. These acres evolve to a total of 469 acres: comprised of 48 acres of beach, 148 acres of supratidal, 0 acres of dune, and 273 acres of marsh."* The last sentence will be corrected and revised to reference Table 5-5 and not Table 5-2.

NMFS 25: Concur. The missing citations will be provided in the Section 9.0 References. 9.1 Literature Cited.

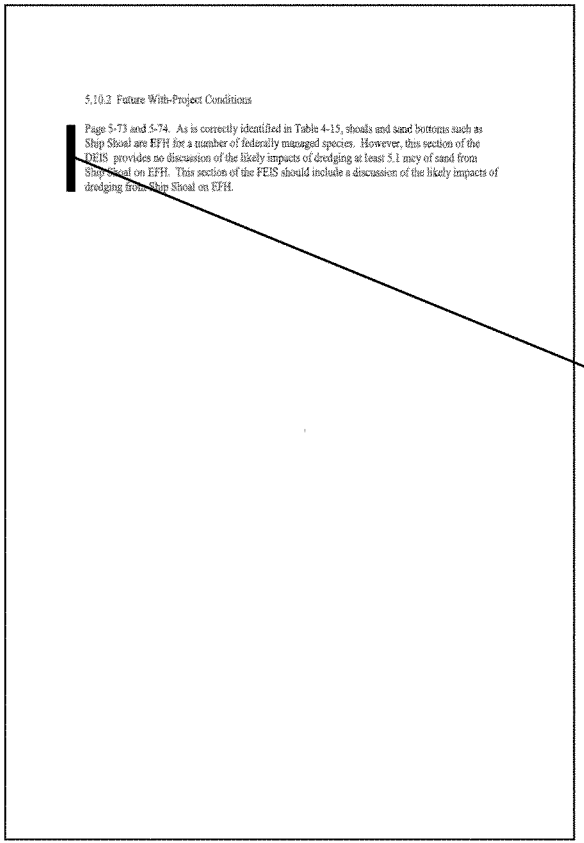
NMFS 26: Concur. The following information will be added to Section 5.9.2—*"For example, Palmer et al. (2008) reported significant sand-mining related declines in macrofaunal abundance, biomass, and diversity within coastal Louisiana. Condrey and Gelpi (2010) report that sand mining may have negative impacts on spawning blue crabs on Ship Shoal and that sand-mining disturbance and subsequent reduction in available macrofauna prey would result in negative effects on spawning blue crab health and fecundity. Specifically, Condrey and Gelpi (2010) indicate that sand mining on the Ship/Trinity/and Tiger Shoal Complex (STTSC) is expected to result in some decline in blue crab fecundity and condition factor through a reduction in food supply. In addition, increases in suspended sediments associated with sand mining may increase the mortality of crab larvae. ..."*

NMFS 27: see responses on the following page.

NMFS 28: see response on the following page.

1191

National Marine Fisheries Service (NMFS)



5.10.2 Future With-Project Conditions

Page 5-73 and 5-74. As is correctly identified in Table 4-15, shoals and sand bottoms such as Ship Shoal are EFH for a number of federally managed species. However, this section of the DEIS provides no discussion of the likely impacts of dredging at least 5.1 mcy of sand from Ship Shoal on EFH. This section of the FEIS should include a discussion of the likely impacts of dredging from Ship Shoal on EFH.

RESPONSE

NMFS 26 (continued): *"... Condrey and Gelpi (2010) further indicate that sand mining practices which minimize these potentially negative impacts should be carefully considered, along with regulations which will protect the contribution these crabs make to the stability of Louisiana's traditional inshore fishery. A continuance of the cautious approach to sand mining being exhibited by MMS for the STTSC is recommended by Condrey and Gelpi (2010), given the possibility that fecundity of blue crab on the STTSC becomes seasonally limited by prey abundance under prevailing natural conditions."*

NMFS 27: Concur. The reference will be corrected in the text to "Table 5-5."

NMFS 28: Concur. The third sentence will be revised per suggestion.

NMFS 29: the following information will be included in section 5.10. 2 .1.2 -- *"Potential impacts of small scale sand mining on biological and physical interactions, such as EFH, have been investigated by several researchers including Kobashi and Stone (2009); Gelpi et al., (2009); Dubois et al., (2009); and Stone et al. 2009. Kobashi and Stone (2009) indicate substantial scientific uncertainties still exist as to whether and how significant depth changes (i.e. sand mining), sediment size and composition affect shoal bio-physical interactions as well as benthic biological habitats. Kobashi and Stone (2009) and Kobashi et al. (2009) conclude that large-scale sand mining that causes abrupt changes in bathymetry would have a profound impact on shoal physical and biological processes and is not recommended. Whereas, small scale sand mining (e.g., removal of about 5 million cy of sands for restoration of the Caminada Headland) is expected not to cause significant adverse impacts on the physical or biological processes. These researchers caution, however, that post-mining monitoring is crucial as substantial scientific uncertainties still exist."*

11192

Tim Dantin email (TD email)

-----Original Message-----
From: tim dantin [mailto:timdantin@hotmail.com]
Sent: Sunday, July 31, 2011 8:08 PM
To: Klein, William P Jr MVN
Subject: comment barataria basin barrier

7-31-11

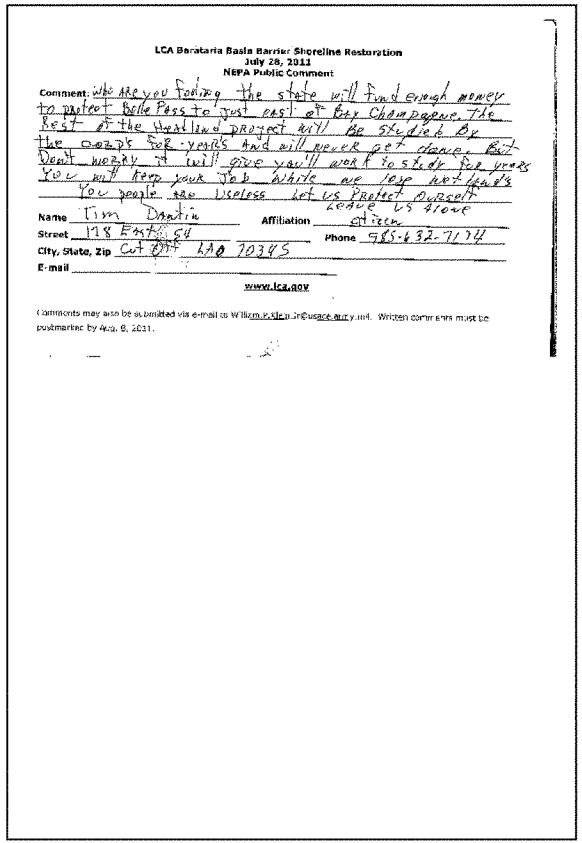
who are you fooling, on the caminada headland project the state will fund enough money to protect port fourchon(there interest) from belle pass to just east of bay champagne then the corps will study for years which will give you a job for years.no futher work on headland project will get done. you'll get to keep you'll job and we get to lose our wetlands. 30 years i've been following your studies but see no progress. move dirt ' you should let us dumb cajun be in charge of wetlands. we would protect our land. and save taxpayers money

RESPONSE

TD email 01: Thank you for your comment.

1193

Tim Dantin postcard (TDpc)



LCA Barataria Basin Barrier Shoreline Restoration
July 28, 2011
NEPA Public Comment

Comment: Who are you fooling the state will fund enough money to protect Belle Pass to just east of Bay Champagne. The Rest of the Heartland project will be studied By the corps for years and will never get done. But Don't worry it will give you'll work to study for years You will keep your Job While we lose our lands You people are Useless Let us Protect Ourself leave us alone

Name Tim Dantin Affiliation citizen
Street 118 East St Phone 985-632-7174
City, State, Zip Cut Off LA 70345
E-mail

www.lca.gov

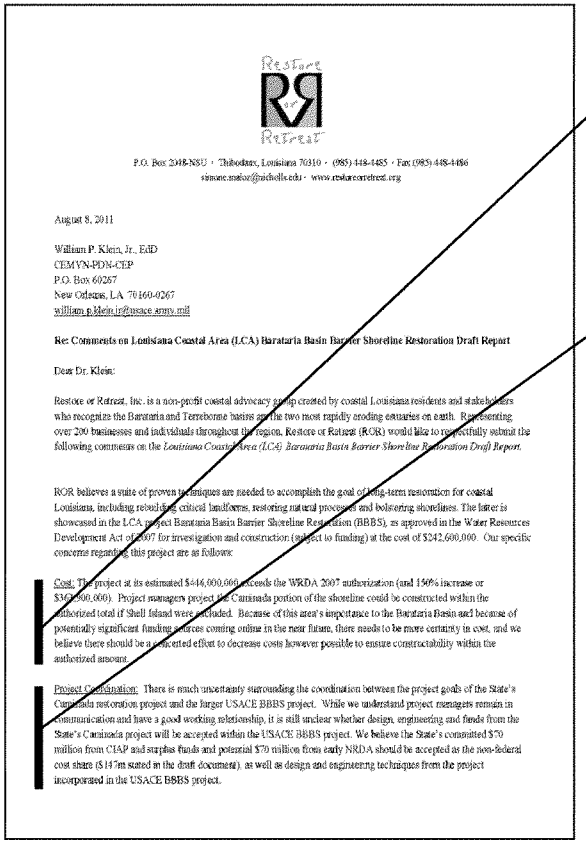
Comments may also be submitted via e-mail to William.K.Klein@usace.army.mil. Written comments must be postmarked by Aug. 8, 2011.

RESPONSE

TDpc 01: Thank you for your comment.

1194

Restore or Retreat (ROR)



Restore or Retreat

P.O. Box 2048-NSU · Thibodaux, Louisiana 70310 · (985) 448-4485 · Fax (985) 448-4486
simone.mateo@nicholls.edu · www.restoreorretreat.org

August 8, 2011

William P. Klein, Jr., EdD
CEMVN-PDN-CEP
P.O. Box 60267
New Orleans, LA 70160-0267
william.p.klein.jr@usace.army.mil

Re: Comments on Louisiana Coastal Area (LCA) Barataria Basin Barrier Shoreline Restoration Draft Report

Dear Dr. Klein:

Restore or Retreat, Inc. is a non-profit coastal advocacy group created by coastal Louisiana residents and stakeholders who recognize the Barataria and Terrebonne basins are the two most rapidly eroding estuaries on earth. Representing over 200 businesses and individuals throughout the region, Restore or Retreat (ROR) would like to respectfully submit the following comments on the *Louisiana Coastal Area (LCA) Barataria Basin Barrier Shoreline Restoration Draft Report.*

ROR believes a suite of proven techniques are needed to accomplish the goal of long-term restoration for coastal Louisiana, including rebuilding critical landforms, restoring natural processes and bolstering shorelines. The latter is showcased in the LCA project Barataria Basin Barrier Shoreline Restoration (BBBS), as approved in the Water Resources Development Act of 2007 for investigation and construction (subject to funding) at the cost of $242,600,000. Our specific concerns regarding this project are as follows:

Cost: The project at its estimated $446,000,000 exceeds the WRDA 2007 authorization (and 150% increase or $303,900,000). Project managers project the Caminada portion of the shoreline could be constructed within the authorized total if Shell Island were excluded. Because of this area's importance to the Barataria Basin and because of potentially significant funding sources coming online in the near future, there needs to be more certainty in cost, and we believe there should be a concerted effort to decrease costs however possible to ensure constructability within the authorized amount.

Project Coordination: There is much uncertainty surrounding the coordination between the project goals of the State's Caminada restoration project and the larger USACE BBBS project. While we understand project managers remain in communication and have a good working relationship, it is still unclear whether design, engineering and funds from the State's Caminada project will be accepted within the USACE BBBS project. We believe the State's committed $70 million from CIAP and surplus funds and potential $70 million from early NRDA should be accepted as the non-federal cost share ($147m stated in the draft document), as well as design and engineering techniques from the project incorporated in the USACE BBBS project.

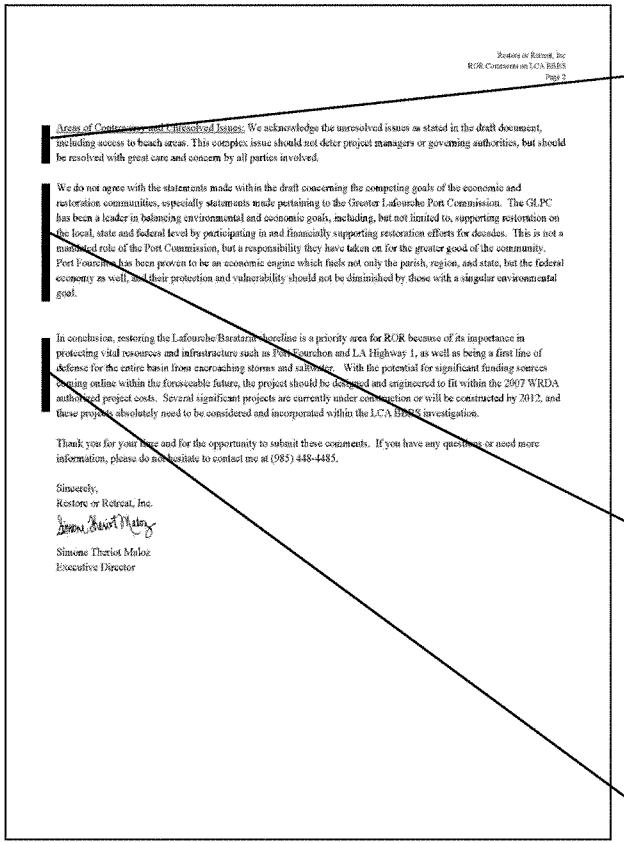
RESPONSE:

ROR 01: Thank you for your comment. The Caminada Headland is the recommended component of the NER Plan per Title VII of the WRDA of 2007, P.L. 110-114, Section 7006(c)(1)(C). However, the USACE considers Shell Island to also be a significant component for the NER Plan due to its contribution to the sustainability of the Barataria Basin barrier shoreline system. Therefore the PDT does not consider it a viable option to remove the Shell Island component from the recommended restoration plan. Project costs will be further refined during PED Phase. During detailed design we will investigate methods to reduce the construction cost.

ROR 02: Concur that there is uncertainty with regard to implementing the State's Caminada Headland Restoration CIAP project in conjunction with implementing the LCA BBBS project. The USACE cannot make a determination at this time on crediting the State's Caminada Headland Restoration CIAP project as part of the LCA BBBS study. Although the USACE may accept work-in-kind for feasibility studies (such as the LCA BBBS Feasibility Study), the USACE is prohibited (Title VII of the WRDA of 2007, P.L. 110-114, Section 7006(c)(1)(C)) from accepting construction work-in-kiud.

11195

Restore or Retreat (ROR)



Restore or Retreat, Inc
ROR Comments on LCA BBBS
Page 2

Areas of Controversy and Unresolved Issues: We acknowledge the unresolved issues as stated in the draft document, including access to beach areas. This complex issue should not deter project managers or governing authorities, but should be resolved with great care and concern by all parties involved.

We do not agree with the statements made within the draft concerning the competing goals of the economic and restoration communities, especially statements made pertaining to the Greater Lafourche Port Commission. The GLPC has been a leader in balancing environmental and economic goals, including, but not limited to, supporting restoration on the local, state and federal level by participating in and financially supporting restoration efforts for decades. This is not a mandated role of the Port Commission, but a responsibility they have taken on for the greater good of the community. Port Fourchon has been proven to be an economic engine which fuels not only the parish, region, and state, but the federal economy as well, and their protection and vulnerability should not be diminished by those with a singular environmental goal.

In conclusion, restoring the Lafourche/Barataria shoreline is a priority area for ROR because of its importance in protecting vital resources and infrastructure such as Port Fourchon and LA Highway 1, as well as being a first line of defense for the entire basin from encroaching storms and saltwater. With the potential for significant funding sources coming online within the foreseeable future, the project should be designed and engineered to fit within the 2007 WRDA authorized project costs. Several significant projects are currently under construction or will be constructed by 2012, and these projects absolutely need to be considered and incorporated within the LCA BBBS investigation.

Thank you for your time and for the opportunity to submit these comments. If you have any questions or need more information, please do not hesitate to contact me at (985) 448-4485.

Sincerely,
Restore or Retreat, Inc.

Simone Thériot Maloz
Executive Director

RESPONSE:

ROR 03: The Barataria Basin Barrier Shoreline Restoration study is authorized as an ecosystem restoration project. The purpose of a Civil Works ecosystem restoration project is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Protection may be included as part of Civil Works ecosystem restoration initiatives when such measures involve efforts to prevent future degradation of an ecosystem's structure and functions. The Government has the obligation to acquire sufficient real estate interests to construct the project and to protect the integrity of the project features. In order to ensure protection of project features, Corps of Eugineers regulations indicate that fee title should be acquired for ecosystem restoration projects unless such protection can be accomplished through the acquisition of a lesser interest estate. At this time, a final decision has not been made as to whether fee interest or a permanent easement will be acquired for this project. However, regardless of which estate is acquired, the primary acquisition goal is to protect the project features. Any activity that could be allowed would have to be consistent with the project authorization and function. The possibility for public access to the project site will depend upon which real estate interest is acquired and will be dictated by State and Federal laws as they relate to ecosystem restoration projects.

ROR 04 Concur: The last paragraph on page 8-1 of the Final Integrated Report will be modified as follows:
"There is also controversy resulting from the competing goals of the economic, hurricane and storm damage risk reduction, and restoration special interest groups. Some parties are primarily concerned with hurricane and storm damage risk reduction and shoreline erosion. Other groups are primarily interested in environmental restoration, especially restoration of the Caminada Headland beach, dune, and marsh ecosystems. Some interested parties are primarily concerned with the economic goals such as recreation and oil and gas interests in the Port Fourchon area. ... "
See response ROR 04 continued on following page.

ROR 05: see response on following page.

11196

RESPONSE:

ROR 04 (continued): *"... Consequently, the economic (e.g., recreation and oil and gas interest) and hurricane and flood damage risk reduction goals sometimes conflict with the ecosystem restoration goals of the LCA BBBS to restore the Caminada Headland barrier shoreline, dune, and marsh habitats and associated essential fish and wildlife species."*

ROR 05: Concur that the Caminada Headland is an important component of the Barataria Basin barrier shoreline system. See response to comment ROR 02 regarding consideration of other funding sources and Title VII of the WRDA of 2007, P.L. 110-114, Section 7006(c)(1)(C) authorized funding. The USACE considers conceptual, proposed, and unauthorized studies as part of its alternative plan formulation. However, in our costs analysis the USACE only considers existing funded construction projects in the area.

11197

US Department of the Interior (DOI)

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
1001 Indian School Road NW, Suite 348
Albuquerque, New Mexico 87104

TAKE PRIDE IN AMERICA

ER 11/560
File 9043.1

July 27, 2011

William P. Klein, Jr.
U.S. Army Corps of Engineers
New Orleans District
PO Box 60267
New Orleans, Louisiana 70160-0267

Subject: Draft Environmental Impact Statement (DEIS) for the Louisiana Coastal Area (LCA) Barataria Basin Barrier Shoreline (BBBS) Restoration, Lafourche, Jefferson, and Plaquemines Parishes, Louisiana

Dear Mr. Klein:

The U.S. Department of the Interior has reviewed the subject DEIS. The following comments are provided for your use as you prepare the final document.

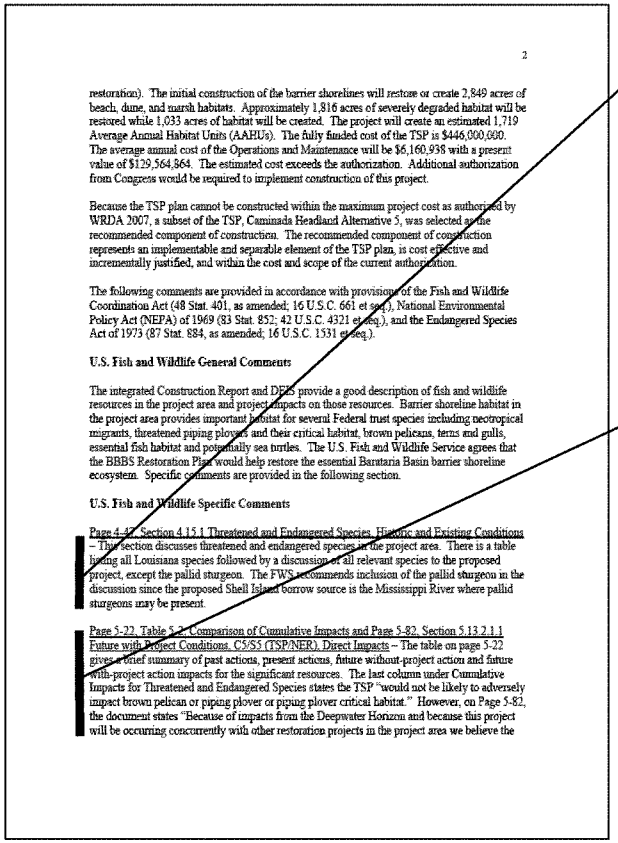
The BBBS Restoration Study was identified as a critical near-term restoration project in the LCA, Louisiana Ecosystem Restoration Study Report (LCA Report 2004). As a component of this report, the project was recommended for conditional authorization by the Chief of Engineers on January 31, 2005. The Assistant Secretary of the Army for Civil Works (ASA-CW), after obtaining the concurrence of the Office of Management and Budget, provided his report on the LCA to Congress on November 18, 2005. Title VII of the Water Resources Development Act (WRDA) of 2007, P.L. 110-114, Section 7006(c)(1) authorizes construction of the BBBS project in accordance with the restoration plan in the Report of the Chief of Engineers dated January 2005, contingent on completion of a construction report documenting any modifications to the Chief's Report, approval of the Secretary of the Army, and submission to the House Transportation and Infrastructure Committee and Senate Environment and Public Works Committee. Section 7006(c)(4) of WRDA 2007 states that the cost of a project shall not exceed 150 percent of the cost of such project set forth in Section 7006(c)(1)(C) of WRDA 2007 which is listed as $242,600,000. Therefore, as currently authorized, the BBBS alternatives are limited to a cost of $363,900,000.

The Tentatively Selected Plan (TSP) is a combination of Caminada Headland Alternative 5 (restore the headland dune to +7 feet NAVD88 and the backbarrier marsh to +2 feet NAVD88) and Shell Island Alternative 5 (restore Shell Island as one island including dune and marsh

RESPONSE

11198

US Department of Interior (DOI)



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restoration). The initial construction of the barrier shorelines will restore or create 2,849 acres of beach, dune, and marsh habitats. Approximately 1,816 acres of severely degraded habitat will be restored while 1,033 acres of habitat will be created. The project will create an estimated 1,719 Average Annual Habitat Units (AAHUs). The fully funded cost of the TSP is $446,000,000. The average annual cost of the Operations and Maintenance will be $6,160,938 with a present value of $129,564,864. The estimated cost exceeds the authorization. Additional authorization from Congress would be required to implement construction of this project.

Because the TSP plan cannot be constructed within the maximum project cost as authorized by WRDA 2007, a subset of the TSP, Caminada Headland Alternative 5, was selected as the recommended component of construction. The recommended component of construction represents an implementable and separable element of the TSP plan, is cost effective and incrementally justified, and within the cost and scope of the current authorization.

The following comments are provided in accordance with provision of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), National Environmental Policy Act (NEPA) of 1969 (83 Stat. 852; 42 U.S.C. 4321 et seq.), and the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

U.S. Fish and Wildlife General Comments

The integrated Construction Report and DEIS provide a good description of fish and wildlife resources in the project area and project impacts on those resources. Barrier shoreline habitat in the project area provides important habitat for several Federal trust species including neotropical migrants, threatened piping plovers and their critical habitat, brown pelicans, terns and gulls, essential fish habitat and potentially sea turtles. The U.S. Fish and Wildlife Service agrees that the BBBS Restoration Plan would help restore the essential Barataria Basin barrier shoreline ecosystem. Specific comments are provided in the following section.

U.S. Fish and Wildlife Specific Comments

Page 4-47, Section 4.15.1 Threatened and Endangered Species, Historic and Existing Conditions – This section discusses threatened and endangered species in the project area. There is a table listing all Louisiana species followed by a discussion of all relevant species to the proposed project, except the pallid sturgeon. The FWS recommends inclusion of the pallid sturgeon in the discussion since the proposed Shell Island borrow source is the Mississippi River where pallid sturgeons may be present.

Page 5-22, Table 5-2 Comparison of Cumulative Impacts and Page 5-82, Section 5.13.2.1.1 Future with Project Conditions, C5/S5 (TSP/NER), Direct Impacts – The table on page 5-22 gives a brief summary of past actions, present actions, future without-project action and future with-project action impacts for the significant resources. The last column under Cumulative Impacts for Threatened and Endangered Species states the TSP "would not be likely to adversely impact brown pelican or piping plover or piping plover critical habitat." However, on Page 5-82, the document states "Because of impacts from the Deepwater Horizon and because this project will be occurring concurrently with other restoration projects in the project area we believe the

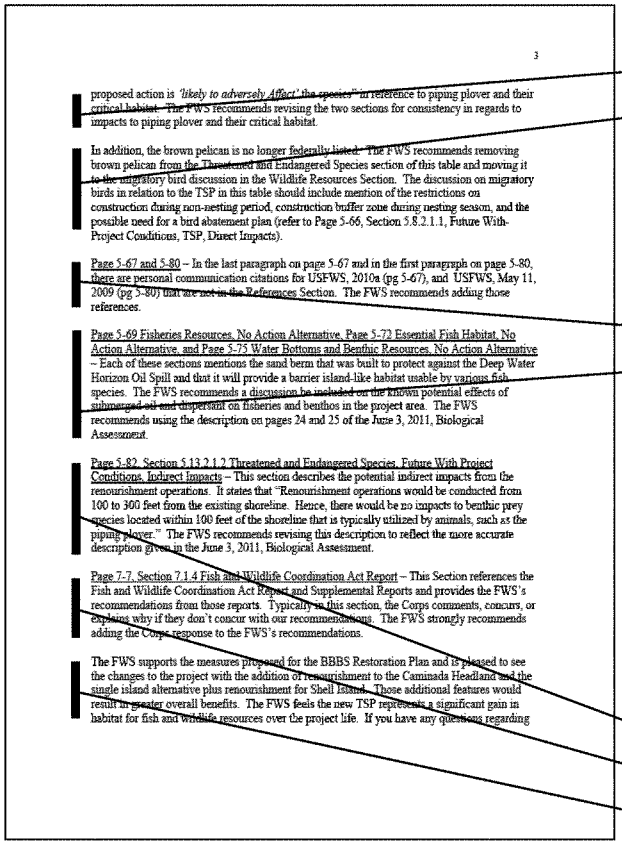
RESPONSE

DOI 01: Thank you for your comment. Concur, Section 4.15.1 and the Biological Assessment have been revised to include a discussion on the pallid sturgeon. Following is the revision that has been made in the EIS: *"... Species that may be found in the study area include the piping plover which winters in coastal Louisiana, frequenting outer beaches and occasionally foraging on mudflats within the study area. The West Indian manatee has been reported in the Lake Pontchartrain system, during the summer months and may be a rare visitor in the study area. The pallid and shovelnose sturgeon are known to inhabit the lower Mississippi River, but recent sampling efforts conducted by ERDC have not been able to document their presence south of river mile 85 above Head of Passes. It is believed that their presence within the vicinity of the Mississippi River borrow area is rare."*

DOI 02: Concur, Table 5-2 has been revised so that it is consistent with the impact assessment in Section 5.13.2.1.1, Threatened and Endangered Species, Cumulative Impacts. Following is the revision to reflect the anticipated impacts to piping plover at its critical habitat. *"C5/S5 (TSP/NER): would be likely to adversely impact piping plover and/or piping plover critical habitat;....."*

11199

US Department of Interior (DOI)



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proposed action is *'likely to adversely Affect' the species"* in reference to piping plover and their critical habitat. The FWS recommends revising the two sections for consistency in regards to impacts to piping plover and their critical habitat.

In addition, the brown pelican is no longer federally listed. The FWS recommends removing brown pelican from the Threatened and Endangered Species section of this table and moving it to the migratory bird discussion in the Wildlife Resources Section. The discussion on migratory birds in relation to the TSP in this table should include mention of the restrictions on construction during non-nesting period, construction buffer zone during nesting season, and the possible need for a bird abatement plan (refer to Page 5-66, Section 5.8.2.1.1, Future With-Project Conditions, TSP, Direct Impacts).

Page 5-67 and 5-80 – In the last paragraph on page 5-67 and in the first paragraph on page 5-80, there are personal communication citations for USFWS, 2010a (pg 5-67), and USFWS, May 11, 2009 (pg 5-80) that are not in the References Section. The FWS recommends adding those references.

Page 5-69 Fisheries Resources, No Action Alternative, Page 5-72 Essential Fish Habitat, No Action Alternative, and Page 5-75 Water Bottoms and Benthic Resources, No Action Alternative – Each of these sections mentions the sand berm that was built to protect against the Deep Water Horizon Oil Spill and that it will provide a barrier island-like habitat usable by various fish species. The FWS recommends a discussion be included on the known potential effects of submerged oil and dispersant on fisheries and benthos in the project area. The FWS recommends using the description on pages 24 and 25 of the June 3, 2011, Biological Assessment.

Page 5-82, Section 5.13.2.1.2 Threatened and Endangered Species, Future With Project Conditions, Indirect Impacts – This section describes the potential indirect impacts from the renourishment operations. It states that "Renourishment operations would be conducted from 100 to 300 feet from the existing shoreline. Hence, there would be no impacts to benthic prey species located within 100 feet of the shoreline that is typically utilized by animals, such as the piping plover." The FWS recommends revising this description to reflect the more accurate description given in the June 3, 2011, Biological Assessment.

Page 7-7, Section 7.1.4 Fish and Wildlife Coordination Act Report – This Section references the Fish and Wildlife Coordination Act Report and Supplemental Reports and provides the FWS's recommendations from those reports. Typically in this section, the Corps comments, concurs, or explains why if they don't concur with our recommendations. The FWS strongly recommends adding the Corps response to the FWS's recommendations.

The FWS supports the measures proposed for the BBBS Restoration Plan and is pleased to see the changes to the project with the addition of renourishment to the Caminada Headland and the single island alternative plus renourishment for Shell Island. Those additional features would result in greater overall benefits. The FWS feels the new TSP represents a significant gain in habitat for fish and wildlife resources over the project life. If you have any questions regarding

RESPONSE

DOI 02: see previous page response.

DOI 03: Concur, discussion of the brown pelican has been removed from the Threatened and Endangered section and moved to the Wildlife Resources section. The following revisions have been made to Table 5-2 Wildlife Resources Section, Cumulative Impacts: *"To comply with the Migratory Bird Treaty Act of 1918, the implementation of the TSP would require that the Corp comply with restrictions on construction during non-nesting periods, implement construction buffer zones during nesting season, and the development of a Nesting Prevention Plan. A detailed discussion of these requirements can be found in Section 5.8.2.1.1."*

DOI 04: Concur, references have been added.

DOI 05: Concur, Language from the BA has been added to section 5.9.1, Fisheries Resources, No Action Alternative (FWOP). The last paragraph been replaced by the following language: *"In response to the 2010 Deepwater Horizon oil spill the barrier berm project was initiated in an attempt to protect Louisiana's coastal marshes from being severely impacted by oil. In the vicinity of the Shell Island component; berm number W8 has currently received approximately 1.3 million cubic yards of sandy fill material. This material is placed in a linear fashion and is stacked with a slope of approximately 25:1. Impacts to the existing conditions are not known at this time. As this sandy berm is reworked by tidal forces impacts to water depth or sediment composition could result in the project area. It is believed that as this sand is reworked it will provide a barrier island-like habitat (sand spits) usable by various fish species."*

See following pages for continued response to DOI 05.

DOI 06: see following pages for response

DOI 07: see following pages for response.

DOI 08: see following pages for response.

1200

US Department of Interior (DOI)

our comments, please contact Catherine Breaux of the FWS Ecological Services Field Office, Lafayette, LA, at (504) 862-2689.

U.S. Geological Survey Comments

Pages 4-94 and 5-62: Suggest that the Final EIS include a discussion of the criteria for selection of species for restoration. Information on mangrove dynamics, restoration, usefulness in sediment trapping and the impacts of no action alternatives can be found in the following references.

Kumara, M.P., L.P. Jayatissa, K.W. Krauss, D.H. Phillips, & M. Huxham. 2010. High density enhances sediment accretion, surface elevation and tree survival in mangrove stands. Oecologia 164: 545-553.

Doyle, T.W., K.W. Krauss, W.H. Conner & A.S. From. 2010. Predicting the retreat and migration of tidal forests of the northern Gulf Coast, USA, under sea-level rise. Forest Ecology and Management 259: 770-777.

Krauss, K.W., C.E. Lovelock, K.L. McKee, L. López-Hoffman, S.M.L. Ewe & W.P. Sousa. 2008. Environmental drivers in mangrove establishment and early development: a review. Aquatic Botany 89: 105-127.

Conner, W.H., T.W. Doyle & K.W. Krauss, Eds., 2007. Ecology of Tidal Freshwater Forested Wetlands of the Southeastern United States. Springer. 505 p.

Krauss, K.W. & J.A. Allen. 2003. Factors influencing the regeneration of the mangrove, *Bruguiera gymnorrhiza* (L.) Lamk., on a tropical Pacific island. Forest Ecology and Management 176: 49-60.

If you have any questions concerning USGS comments, please contact Gary LeCain, USGS Coordinator for Environmental Document Reviews, at (303) 236-1475 or at gdlecain@usgs.gov.

We appreciate the opportunity to provide comments on the Integrated Construction Report and DEIS.

Sincerely,

Stephen R. Spencer
Regional Environmental Officer

RESPONSE

DOI 08: see following pages for response.

DOI 05 (continued): "*Other direct, indirect, and cumulative impacts related to the 2010 Deepwater Horizon oil spill are still being determined. It is likely that these impacts would be similar to previous oil spill impacts. For example, a study conducted on the Amoco Cadiz spill in 1978 revealed that "light oil" resulted in considerable detrimental impacts to the benthic communities. However, a separate study revealed that the benthic organisms were contaminated, but were not adversely impacted, from a spill of heavy crude (University of Delaware, 2010). In 2003, Donlan et al. assessed the impacts of the North Cape oil spill on communities of piping plover in Rhode Island. The study first examined the abundance of prey species on Moonstone Beach (the oiled island) and compared it to that of an adjacent, un-oiled beach (Goosewing). Although the abundance of benthic organisms was not significantly different between the two beaches, the species composition was considerably dissimilar. For example, only two Amphilporeia were found in the sampling station on Moonstone, compared to 456 at Goosewing. This reinforced the common belief that amphipods are the first group of organisms to disappear and one of the last to recolonize once exposed to oil. Between 1990 and 1995, Jewett et al. assessed the impacts of the Exxon Valdez oil spill on the benthic communities in Prince Williams Sound, Alaska. The metrics of the study included concentrations of hydrocarbons and benthic community composition, diversity, biomass, and abundance. These metrics were compared between a number of reference sites and oiled sites. The comparison was conducted in 1990 (approximately 16 months after the spill), 1991, 1993, and 1995. According to the authors, the "total abundance and biomass of epifauna were generally higher at oiled sites, primarily because of higher densities of epifaunal bivalves. Otherwise, there were few consistent community-wide responses to oiling in diversity, richness, total abundance, total biomass, or the abundances of major taxonomic groups (e.g. polychaetes or bivalves)." The lack of a stronger community-wide response was attributed to the varying sensitivities of benthic organisms.*

(See following page for continued response to DOI 05.)

1201

US Department of Interior (DOI)

RESPONSE

DOI 05 (continued): *"Other direct, indirect, and cumulative impacts related to the 2010 Deepwater Horizon oil spill are still being determined. It is likely that these impacts would be similar to previous oil spill impacts. For example, oil-sensitive amphipods such as Isaeidaes and Phoxocephalidaes were found in lower concentrations at the oiled sites. These impacts were evident throughout the duration of the study (i.e. 6 years after the spill). However, stress-tolerant and opportunistic organisms such as polychaetes were found in higher concentrations at the oiled sites due to organic enrichment. The study also revealed that hydrocarbon concentrations in the sediment were high (up to 15,300 ng/g) in eel grass beds immediately adjacent to the oiled shorelines, but sharply declined after 1990 (Jewett et all, 1999). Although the benthic organisms and habitat types within Prince Williams Sound vary from that of the Project Area (eelgrass beds versus sand beds and mud flats), the study does provide an indication of the resiliency and recovery rates of benthic communities as a whole. Furthermore, the results of the study indicate that the species composition of the benthic communities is expected to shift as a result of the Deepwater Horizon oil spill. Additional impact to water bottoms and benthic organisms within coastal Louisiana resulted from the construction of the 83,258 lf sand berm designed to protect against the BP Oil Spill (2010). The sand berm project required 19.7 million CY of material to be dredged primarily from Hewes Point and then placed at various re-handling sites further impacting Gulf waterbottoms and benthic resources."*

DOI 06: Concur, Language from the BA has been added to Section 5.13.2.1.2, Threatened and Endangered Species, FWP, Indirect Impacts. The following section has been revised to read: *"Potential project-induced indirect impacts would consist of temporary displacement to nearby suitable habitats and temporary loss of benthic prey species within the project footprint. Renourishment operations would be conducted from 100 to 300 feet from the existing shoreline.*

(See following page for continued response to DOI 06.)

1202

RESPONSE

DOI 06 (continued): *Temporary indirect impacts to the piping plover and other species that forage in the intertidal zone, would include a reduction in the abundance and diversity of benthic prey species which would be smothered by renourishment sediments as they washed on to the shoreline. Benthic prey species smothered by restoration activities would naturally recolonize the area within 6 months to 2 years post-construction.*
These impacts would be offset, to some degree, by restoration of a net total of about 990 acres of barrier habitats on the Caminada Headland, thereby increasing critical wintering habitat for piping plovers as well as potential foraging and loafing habitat for other shore birds such as terns, gulls, skimmers, and pelicans over the 50 year period of analysis."

DOI 07: Concur, the USACE responses to the USFWS's recommendations in the FWCAR have been added to Section 7.1.4 Fish and Wildlife Coordination Act Report.

DOI 08: Do not concur that the Final EIS include a description of criteria for selection of species for restoration. EP 1165-2-502 "Ecosystem Restoration – Supporting Policy Information" (1999) specifies that ecosystem restoration in the Civil Works program use a systems view in assessing and addressing restoration needs and opportunities. Section 7 "Ecosystem Restoration and Philosophy" subsection f of the environmental policy states:
"f. System Context. Restoration projects should be conceived in a systems context, considering aquatic (including marine, estuarine and riverine), wetland and terrestrial complexes, as appropriate, in order to improve their potential for long-term survival as self-sustaining, functioning systems. Fish and wildlife resources are dependent on, and functionally related to, other ecosystem components and therefore interactions among all relevant ecosystem components need to be described and assessed during a ecosystem restoration study."

(See following page for continued response to DOI 08.)

1203

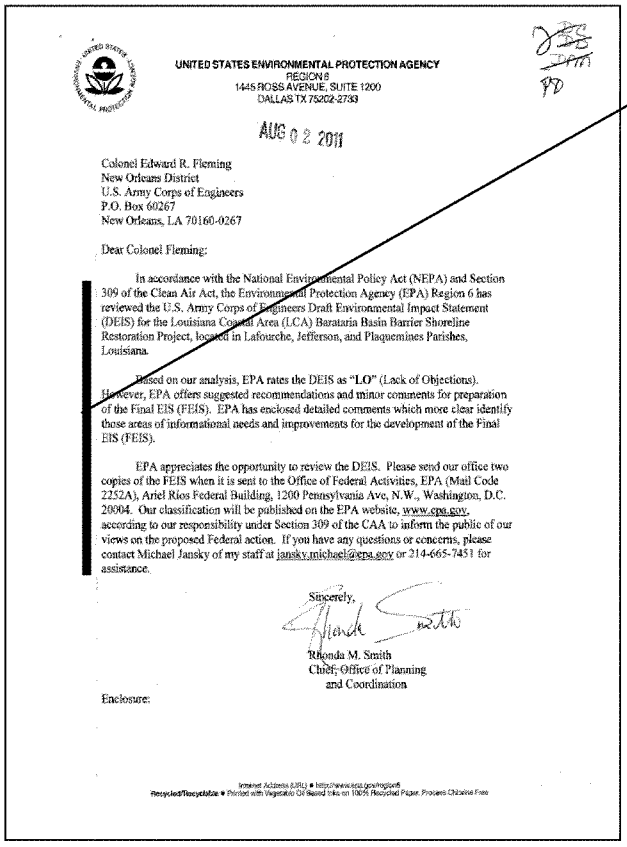
US Department of Interior (DOI)

RESPONSE

DOI 08 (continued): *"Rather than limiting objectives to habitat for a single species or resource commodity, such as mallard ducks or bass harvest, ecosystem restoration inititatives* **[s]** *will consider interrelationships of plant and animal communities and their habitats in a larger ecosystem context. This is a more systemic approach for addressing problems associated with disturbed and degraded ecosystem resources than focusing only on fish and wildlife habitat. When restoration planning focuses on optimizing habitat for a particular species, the framework for evaluating the natural system is limited to those aspects of the habitat for the species being considered."*

1204

US Environmental Protection Agency (EPA)



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS TX 75202-2733

AUG 02 2011

Colonel Edward R. Fleming
New Orleans District
U.S. Army Corps of Engineers
P.O. Box 60267
New Orleans, LA 70160-0267

Dear Colonel Fleming:

In accordance with the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the Environmental Protection Agency (EPA) Region 6 has reviewed the U.S. Army Corps of Engineers Draft Environmental Impact Statement (DEIS) for the Louisiana Coastal Area (LCA) Barataria Basin Barrier Shoreline Restoration Project, located in Lafourche, Jefferson, and Plaquemines Parishes, Louisiana.

Based on our analysis, EPA rates the DEIS as "**LO**" (Lack of Objections). However, EPA offers suggested recommendations and minor comments for preparation of the Final EIS (FEIS). EPA has enclosed detailed comments which more clear identify those areas of informational needs and improvements for the development of the Final EIS (FEIS).

EPA appreciates the opportunity to review the DEIS. Please send our office two copies of the FEIS when it is sent to the Office of Federal Activities, EPA (Mail Code 2252A), Ariel Rios Federal Building, 1200 Pennsylvania Ave, N.W., Washington, D.C. 20004. Our classification will be published on the EPA website, www.epa.gov, according to our responsibility under Section 309 of the CAA to inform the public of our views on the proposed Federal action. If you have any questions or concerns, please contact Michael Jansky of my staff at jansky.michael@epa.gov or 214-665-7451 for assistance.

Sincerely,

Rhonda M. Smith
Chief, Office of Planning
and Coordination

Enclosure:

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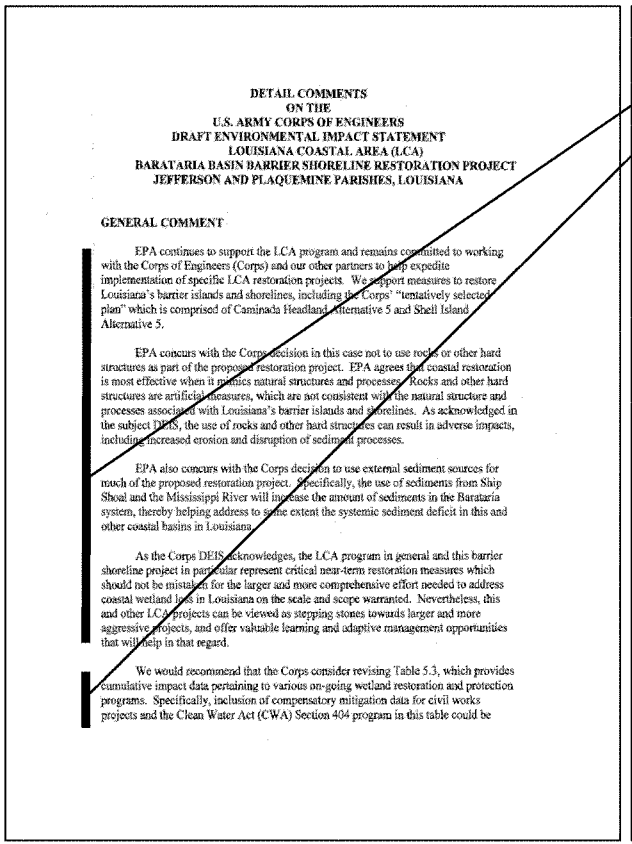
RESPONSE

EPA 01: Thank you for your comment.

1205

US Environmental Protection Agency (EPA)



DETAIL COMMENTS
ON THE
U.S. ARMY CORPS OF ENGINEERS
DRAFT ENVIRONMENTAL IMPACT STATEMENT
LOUISIANA COASTAL AREA (LCA)
BARATARIA BASIN BARRIER SHORELINE RESTORATION PROJECT
JEFFERSON AND PLAQUEMINE PARISHES, LOUISIANA

GENERAL COMMENT

EPA continues to support the LCA program and remains committed to working with the Corps of Engineers (Corps) and our other partners to help expedite implementation of specific LCA restoration projects. We support measures to restore Louisiana's barrier islands and shorelines, including the Corps' "tentatively selected plan" which is comprised of Caminada Headland Alternative 5 and Shell Island Alternative 5.

EPA concurs with the Corps decision in this case not to use rocks or other hard structures as part of the proposed restoration project. EPA agrees that coastal restoration is most effective when it mimics natural structures and processes. Rocks and other hard structures are artificial measures, which are not consistent with the natural structure and processes associated with Louisiana's barrier islands and shorelines. As acknowledged in the subject DEIS, the use of rocks and other hard structures can result in adverse impacts, including increased erosion and disruption of sediment processes.

EPA also concurs with the Corps decision to use external sediment sources for much of the proposed restoration project. Specifically, the use of sediments from Ship Shoal and the Mississippi River will increase the amount of sediments in the Barataria system, thereby helping address to some extent the systemic sediment deficit in this and other coastal basins in Louisiana.

As the Corps DEIS acknowledges, the LCA program in general and this barrier shoreline project in particular represent critical near-term restoration measures which should not be mistaken for the larger and more comprehensive effort needed to address coastal wetland loss in Louisiana on the scale and scope warranted. Nevertheless, this and other LCA projects can be viewed as stepping stones towards larger and more aggressive projects, and offer valuable learning and adaptive management opportunities that will help in that regard.

We would recommend that the Corps consider revising Table 5.3, which provides cumulative impact data pertaining to various on-going wetland restoration and protection programs. Specifically, inclusion of compensatory mitigation data for civil works projects and the Clean Water Act (CWA) Section 404 program in this table could be

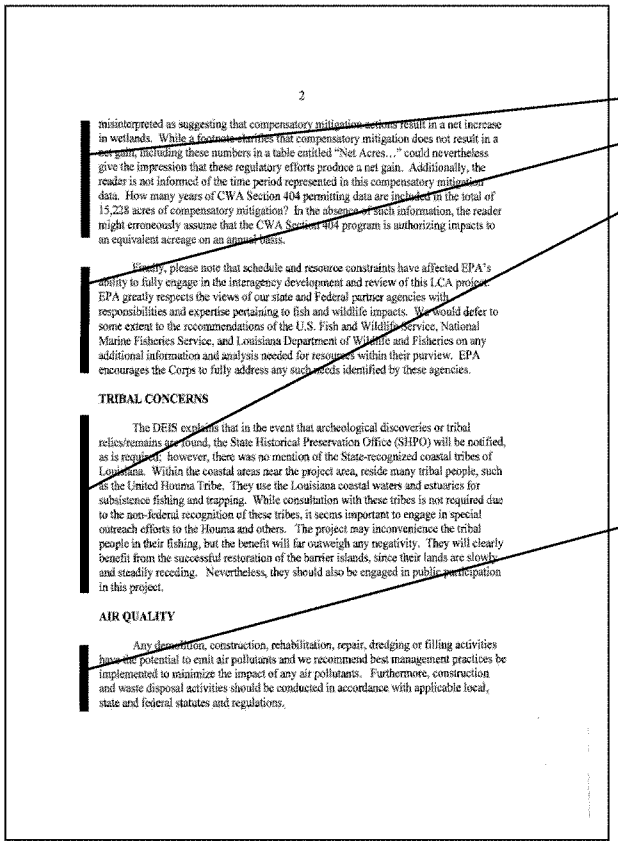
RESPONSE

EPA 01 (continued): see response on previous page.

EPA 02: Concnr. The title of Table 5-3 has been revised for clarification as follows:
"Table 5-3 Net Acres Created, Restored, and/or Protected by Other Federal, State, Local, and Private Restoration and Regulatory Permitting Mitigation Efforts."
Inclusion of net acres associated with Regulatory permits and associated mitigation is provided as part of the cumulative impacts assessment. The table provides cumulative impacts for not only restoration net acres created, restored and/or protected by other restoration actions, but also provides information about the number of acres regarding regulatory permits and associated mitigation efforts. In addition, Footnote #2 in the table clearly describes that it is not the intent to imply that compensatory mitigation acres contribute to no net wetland loss. Rather, the information is included as part of the cumulative impacts to wetland acres.
" [2]*In the best-case scenario, compensatory mitigation (for civil works projects and regulatory permits) results in no net loss of wetlands. Hence, it is not the intent to imply that compensatory mitigation acreages would contribute to a net increase in wetlands as a result of the Clean Water Act Section 404 program. Rather, these figures represent an accounting of the various cumulative impacts to coastal wetlands from Federal, state, local, and private restoration efforts."*

1206

US Environmental Protection Agency (EPA)



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misinterpreted as suggesting that compensatory mitigation actions result in a net increase in wetlands. While a footnote clarifies that compensatory mitigation does not result in a net gain, including these numbers in a table entitled "Net Acres…" could nevertheless give the impression that these regulatory efforts produce a net gain. Additionally, the reader is not informed of the time period represented in this compensatory mitigation data. How many years of CWA Section 404 permitting data are included in the total of 15,228 acres of compensatory mitigation? In the absence of such information, the reader might erroneously assume that the CWA Section 404 program is authorizing impacts to an equivalent acreage on an annual basis.

Finally, please note that schedule and resource constraints have affected EPA's ability to fully engage in the interagency development and review of this LCA project. EPA greatly respects the views of our state and Federal partner agencies with responsibilities and expertise pertaining to fish and wildlife impacts. We would defer to some extent to the recommendations of the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and Louisiana Department of Wildlife and Fisheries on any additional information and analysis needed for resources within their purview. EPA encourages the Corps to fully address any such needs identified by these agencies.

TRIBAL CONCERNS

The DEIS explains that in the event that archeological discoveries or tribal relics/remains are found, the State Historical Preservation Office (SHPO) will be notified, as is required; however, there was no mention of the State-recognized coastal tribes of Louisiana. Within the coastal areas near the project area, reside many tribal people, such as the United Houma Tribe. They use the Louisiana coastal waters and estuaries for subsistence fishing and trapping. While consultation with these tribes is not required due to the non-federal recognition of these tribes, it seems important to engage in special outreach efforts to the Houma and others. The project may inconvenience the tribal people in their fishing, but the benefit will far outweigh any negativity. They will clearly benefit from the successful restoration of the barrier islands, since their lands are slowly and steadily receding. Nevertheless, they should also be engaged in public participation in this project.

AIR QUALITY

Any demolition, construction, rehabilitation, repair, dredging or filling activities have the potential to emit air pollutants and we recommend best management practices be implemented to minimize the impact of any air pollutants. Furthermore, construction and waste disposal activities should be conducted in accordance with applicable local, state and federal statutes and regulations.

RESPONSE

EPA 02: Concur--see response on previous page.

EPA 03: Concur, the USACE will continue to coordinate with the EPA as well as other Federal and State natural resource agencies.

EPA 04: Your concerns regarding significant impacts are specifically addressed in the NEPA document pertaining to cultural resources (Section 5.14), essential fish habitat (section 5.10), wildlife resources (Section 5.8) and fisheries resources (section 5.9). In accordance with the regulations implementing Section 106 of the National Historic Preservation Aet, as a state recognized tribe, the Houma Indians may participate as consulting parties (36 CFR 800.2(c)(5)). Under the NEPA process, your suggestion to engage in special outreach efforts to the Houma and others would necessitate an equal outreach effort to all interested parties. In accordance with NEPA, Federal, state, parish and local government agencies, Indian tribes, and interested parties were notified through the Federal Register (cite publication here). Any interested party may request a copy of the FEIS. Thank you for giving us the opportunity to address your comments.

EPA 05: Concur, best construction management actions will be taken to avoid and minimize potential adverse impacts to air quality in accordance with applicable local, state, and federal statutes and regulations. Section 5.20 describes potential project-induced impacts on air quality.

1207