E C O L O G I C A L   R E V I E W

Pelican Island and Pass La Mer to Chaland Pass Restoration
CWPPRA Priority Project List 11
State No. BA-38

December 3, 2003

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This document reflects the project design as of the 95% Design Review meeting, incorporates all comments and recommendations received following the meeting, and is current as of December 3, 2003.

Ecological Review

Pelican Island and Pass La Mer to Chaland Pass Restoration

In August 2000, the Louisiana Department of Natural Resources (LDNR) initiated the Ecological Review to improve the likelihood of restoration project success. This is a process whereby each restoration project's biotic benefits, goals, and strategies are evaluated prior to granting construction authorization. This evaluation utilizes monitoring and engineering information, as well as applicable scientific literature, to assess whether or not, and to what degree, the proposed project features will cause the desired ecological response.

I. Introduction

The Pelican Island and Pass La Mer to Chaland Pass Restoration (BA-38) is located in Plaquemines Parish, Louisiana (Figure 1). The proposed project was developed as part of the comprehensive Barataria Shoreline Complex Project that was tasked with restoring the entire Barataria island chain. Historic land loss figures are provided in Appendix A. Two island sub-reaches within that complex project, Pelican Island and Pass La Mer to Chaland Pass, have sustained substantial losses due to pipeline canal construction, subsidence, constant sea-level rise, sediment deficits, and marine and wind-induced shoreline erosion on the gulf and bay sides [National Marine Fisheries Service (NMFS)/LDNR 2001]. The purpose of the Pelican Island and Pass La Mer to Chaland Pass Restoration project is to rebuild and nourish these two particular barrier shorelines (Figure 1). Coast 2050 has identified the restoration of the barrier shoreline as a Region 2 ecosystem strategy that will maintain the integrity of the estuarine system [Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation Restoration Authority (LCWCRTF & WCRA 1998)]. These barrier islands support coastal fisheries, provide wildlife habitat and shelter for wetlands and aquatic habitats, and protect coastal infrastructure. The abatement of the wetland loss and shoreline erosion will be accomplished through strategically placing dedicated dredged material on the islands using one or a combination of three proposed design alternatives. The design alternatives have been evaluated through the use of hydrodynamic models to determine which is the most suitable for nourishing and rebuilding each island. The alternatives vary primarily in proposed orientation with respect to existing island features but have a common purpose. In general the alternatives are identified as landward (marsh only), seaward (marsh and beach berm), and hybrid (less marsh than landward and more beach than seaward).

Due to high rates of relative subsidence and a diminishing sediment supply, combined with repeated storm impacts, Louisiana's barrier shorelines are the fastest eroding shorelines in the nation. In some locations, erosion of Louisiana barrier islands exceeds 65 feet per year (Penland and Boyd 1981). During the last 100 years, Louisiana's barrier islands have naturally decreased in land mass by approximately 40% (Monteferrante and Mendelssohn 1982). The Barataria Barrier Island System has been hit or brushed by hurricanes, on the average, once every 2.69 years and directly hit once every 7.76 years (Hurricane City 2003).

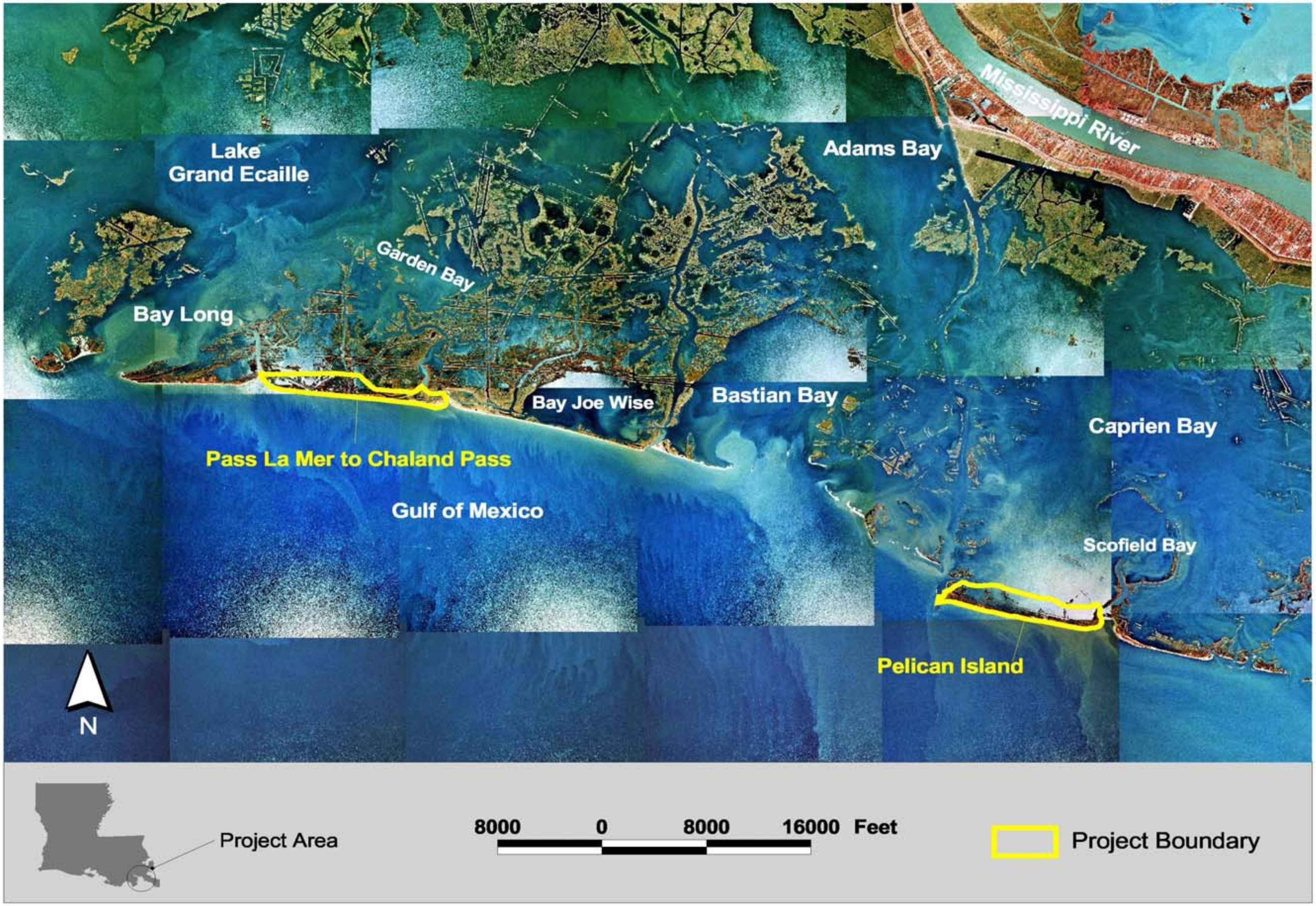

Figure 1. Pass La Mer to Chaland Pass and Pelican Island, BA-38 project area.

Pelican Island is approximately 2.6 miles long, and extends from Fontanelle Pass to Scofield Pass in the Barataria Basin. It is located approximately eight miles south of Sunrise, Louisiana. Historically, the island was a headland that has eroded and accreted land depending on the time frame evaluated on both the western and eastern portions due to realignment of the Gulf shoreline. Overall, the island has retreated and has been retreating at a rate of 10 feet per year since 1988 (Tetra Tech and Coastal Planning and Engineering 2003). Periodic accretion that may be attributed to the impoundments from the Empire Jetties has been documented along the island. Losses on the eastern half of the island are due to the channel shifting at Scofield Pass and a rapid landward migration on the eastern end of the island [Tetra Tech and (CPE) 2003].

The Chaland Headland barrier island extends from Pass La Mer east to Chaland Pass and is 2.8 miles in length. It is situated approximately 15 miles south of Diamond, Louisiana (CPE 2003). Beaches near this island have been and continue to erode at an alarming rate. The rate of retreat since 1988 has been approximately 11 feet per year. Portions of this island have also been known to accrete land but overall the island continues to erode. The gains may be attributed to the shoaling of Pass La Mer (Tetra Tech and CPE 2003).

II. Goal Statement

1. Nourish and rebuild the barrier shoreline system.
2. Approximately 25% of the marsh creation area would be 80% vegetated after the first complete growing season following construction and 100% of the creation area would be vegetated after three complete growing seasons.
3. Reduce land loss rates by 50% for TY01-10 and by 25% for TY11-20
    - Reduce Pelican Island land loss rates from 4.36% per year to 2.18% per year for TY01-10 and from 4.79% to 3.59% for TY11-20.
    - Reduce Pass La Mer to Chaland Pass land loss rates from 3.4% per year to 1.7% for TY01-10 and from 3.7% to 2.77% for TY11-20.
4. Create 6 one-acre tidal ponds and associated tidal creeks in the marsh creation area.

III. Strategy Statement

1. Dredged material will be used to create a marsh platform, beach berms, and gulfward beach to increase island width and average height thus prolonging the integrity of the island.
2. Sand fences and vegetation plantings will be used to stabilize placed dredged material.
3. Restore tidal connection through pre- or post-construction excavation of placed material and breaching of containment dikes to create tidal creeks and ponds.

IV. Strategy-Goal Relationship

Dredged material will be placed on the bayside of both islands at an elevation of +2.5 feet NAVD-88 for Chaland and 2.6 feet NAVD-88 for Pelican Island to create 264 acres of marsh platform on each island. If sufficient quantity and quality sand is available, it too will be dredged and placed on the existing island profile creating berms with an elevation of +6 feet NAVD-88. The marsh platform will act as a receptacle for sediment during overwash events while the berm should minimize the impacts of high velocity waves that the island encounters. Created berm and marsh areas, under all designed alternatives, would be planted with sand fences placed atop the berms to maximize sediment retention (Appendix C contains the species planted and the planting schedule).

V. Project Feature Evaluation

Three alternatives are being evaluated for both islands through use of hydrodynamic models to determine which is the more suitable for island renourishment. They are a landward (marsh only), a seaward (marsh and berm), and a hybrid alternative (less marsh than the marsh only alternative and more beach than the seaward alternative). The landward alternative consists of backfilling areas of open water on the bayside of the island. In-situ material would be used to build containment structures to allow dewatering of the placed material, and to protect oysters from secondary impacts as a result of increased turbidity from construction. The seaward alternative would consist of building a dune and filling gulfward to form a beach. The hybrid alternative meshes both the landward and seaward alternatives together by proposing to build a marsh platform smaller than the landward alternative but larger than the platform built with the seaward alternative. The hybrid alternative would also add less volume to the beach component of the seaward alternative.

The borrow area analysis revealed sufficient material to build the marsh creation components for all three alternatives in the Quatre Bayou, Empire and Scofield sites. The analysis of the Quatre Bayou site also yielded sufficient sand quantities to build the seaward alternatives for the Pass La Mer to Chaland Pass sub-reach. Neither Empire nor Scofield evaluations revealed sufficient sand quantities to restore Pelican Island. Sand deposits were present but were scarce and scattered amongst pipelines in the area. The lack of quality sand at Empire and Scofield prompted further geotechnical investigations to be conducted at Sandy Point to determine if that area is viable for completion of the Pelican Island sub-reach. The disadvantage of using this sand source is that increasing the distance between the site and the borrow area increases the cost of the project.

A. <u>Geotechnical Investigation</u>

The geological/geotechnical investigation consisted of compiling existing literature and data, conducting hydrographic and geophysical investigations (bathymetry, side scan, seismic, and magnetometer), and analyzing vibracores to determine the availability of quality material (Figure 2; CPE 2003). The investigations were conducted by CPE in three offshore areas: Quatre Bayou, Empire, and Scofield study areas. A total of 81 vibracores were retrieved from the three study areas (40 from Quatre Bayou, 31 from Empire, and 10 from Scofield; CPE 2003). These vibracores revealed that significant quality overburden (i.e. grain size sufficient for marsh creation) persists in all three areas, and eliminated the Empire and Scofield sites as viable sand borrow areas. CPE does not recommend using the sand deposits located within the Empire or Scofield units for the barrier island restoration project although the highly variable deposits located within the study area may be used for back barrier and marsh restoration (CPE

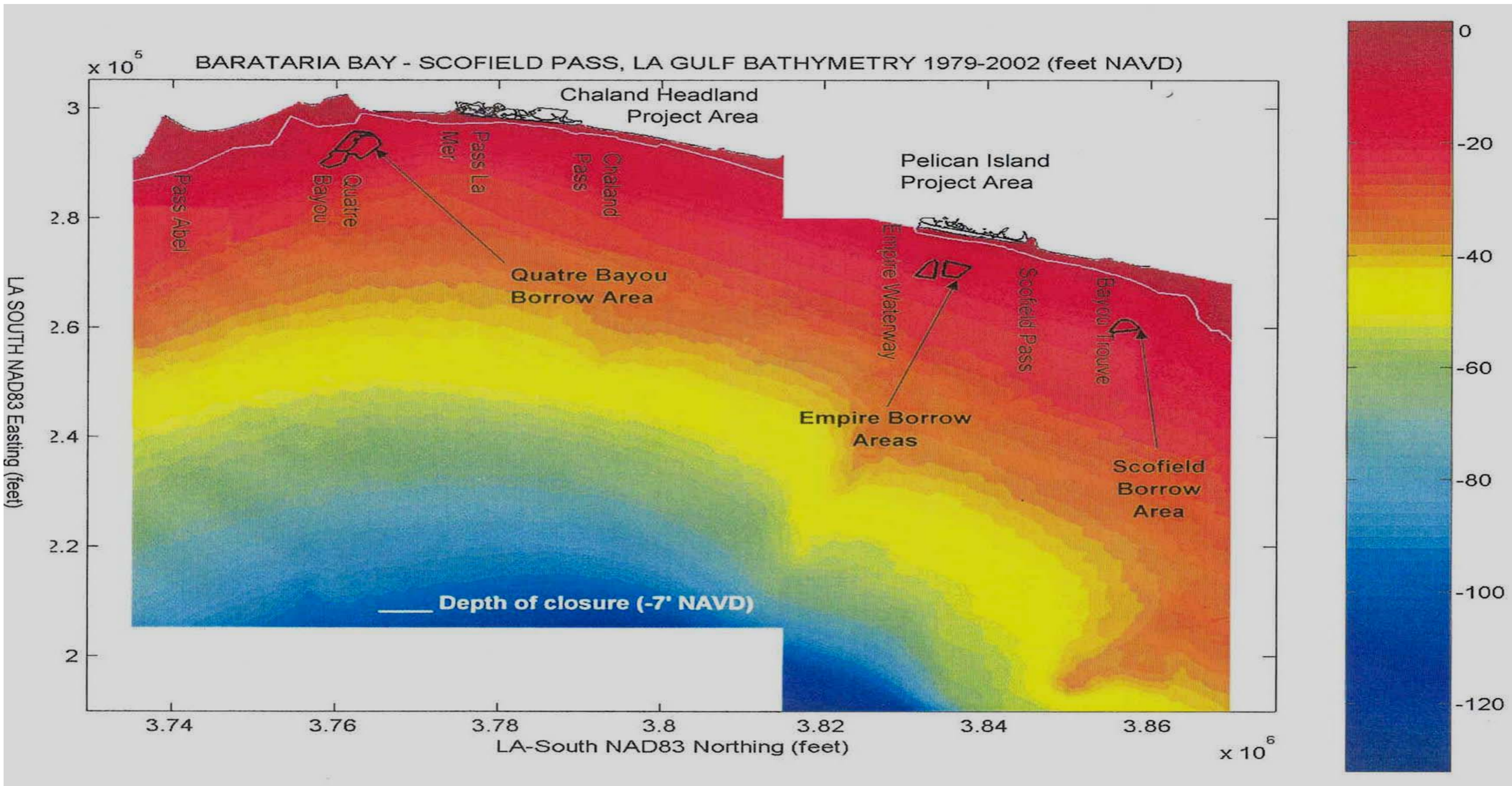

Figure 2. Locations of the geotechnical study areas (Tetra Tech and CPE 2003).

2003). Results obtained from the Quatre Bayou study area indicate that it contains sufficient sand volumes to meet the volumetric requirements of the Pass La Mer to Chaland Pass barrier shoreline restoration project (CPE 2003). Since the Empire and Scofield sites contain insufficient sand quantities, a fourth potential sediment source at Sandy Point had to be investigated to meet the volumetric requirements for Pelican Island. This borrow area is located at a greater distance from the Pelican Island project site than the two originally proposed borrow areas (Figure 3; CPE 2003).

Sandy Point was identified by Kindiger et al. (2001) as potentially the largest deposit offshore of the Plaquemines Barrier Shoreline Restoration Project. The Sandy Point borrow area was investigated through the collection of 35 vibracores which were analyzed daily to better guide the geological/geophysical investigation. It was estimated that between 80% and 90% of these sediments had a mean grain size between 0.02 mm to 0.18mm. Analysis and mapping results conducted by CPE also indicated that the Sandy Point deposit contains highly variable sedimentary facies. The borrow area has both adequate mud overburden and sand resources to complete the construction of Pelican Island.

The borrow areas selected for island construction were chosen based on their proximity to the two distinct islands and their ability to adequately provide material resources for island and marsh creation and nourishment. The borrow areas will be mined using a hydraulic dredge with the addition of booster pumps for the sites of increased distance from the project area. The pumping distance from Sandy Point to Pelican Island is excessive but could be minimized with the use of a hopper dredge. Figure 4 shows the bathymetry of the areas after the proposed excavations. An evaluation of potential impacts of borrow area excavation has been conducted and indicates that excavating the borrow areas to currently proposed depths will have minimal impact on the natural conditions of the area (Tetra Tech and CPE 2003).

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Quatre Bayou Borrow Area

Preliminary dredging depth cuts (which allow for efficient dredging while maximizing the volume of available material) have been designed for the Quatre Bayou, Scofield and Empire borrow areas allocating 500 foot buffers around any pipelines or cultural resources in the areas. The Quatre Bayou borrow area is divided into two flat cut zones of -29.0 feet and -32.0 feet NAVD-88. The Quatre Bayou area will be dredged and the material placed on the shoreline of the Pass La Mer to Chaland Pass Island reach (Chaland Headland). The borrow area is located approximately 2 miles southwest of the headland and contains mean grain sizes ranges of 0.08 to 0.18 mm which is congruent to or better than native island sand. The amount of sand within the borrow area is 3,669,800 cubic yards and lies under a mud overburden. Removal of the overburden material will be required to utilize the sand deposit for island construction but the overburden material can be used beneficially to create marsh. The total volume of overburden available for marsh construction within the Quatre Bayou cuts is approximately 8.3 million cubic yards while the total volume of available island material is 4.8 million cubic yards of

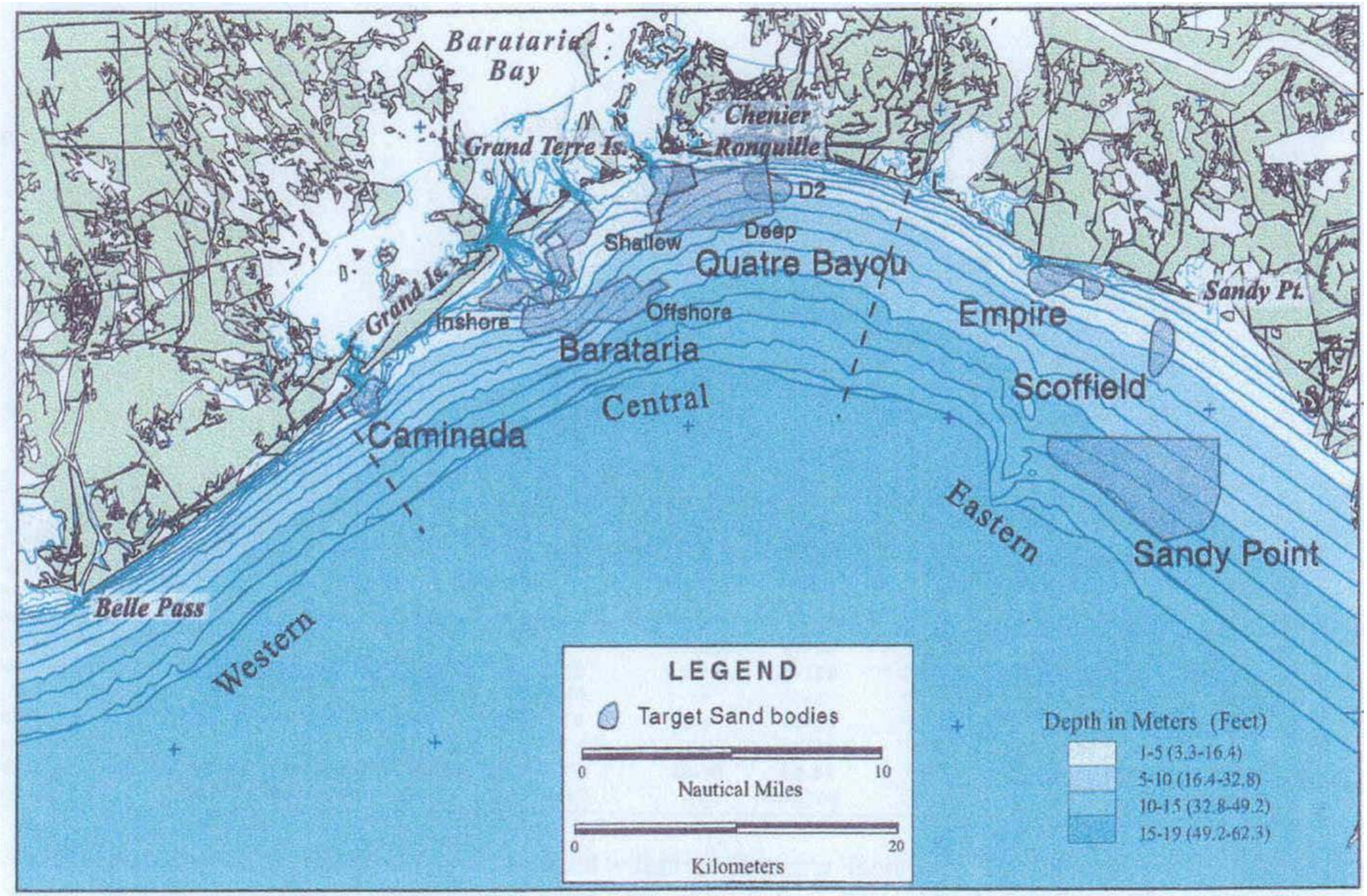

Figure 3. Sand deposits identified by Kindinger, *et al* 2001 in the Barataria Basin Region.

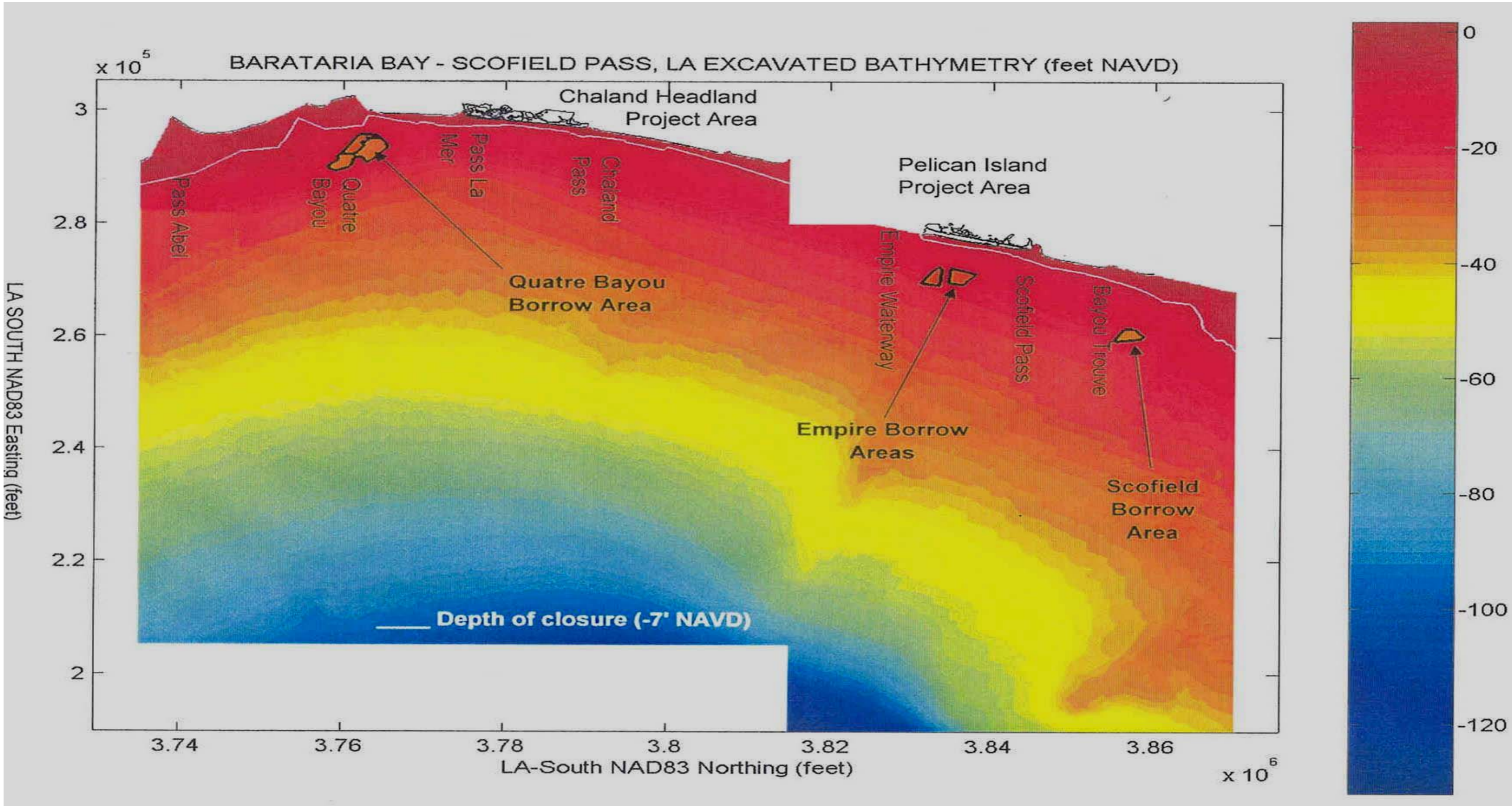

Figure 4. Location of excavated borrow areas in association with their proximity to the depth of closure (Tetra Tech and CPE 2003).

which approximately 3.7 million cubic yards is sand sufficient for beach and berm construction at the Pass La Mer to Chaland Pass sub-reach (Tetra and CPE 2003, IN DRAFT).

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Sandy Point Borrow Area

Geotechnical investigations determined that adequate sand reserves were located in the Sandy Point borrow area in two distinct regions of the overall borrow site. The site has since been separated into two sub-areas (Northwest and Southeast) and will be used as the primary sand excavation site for Pelican Island. The borrow areas are located approximately 8 - 9.5 miles offshore of Pelican Island and contain sand grain sizes that range from 0.11 to 0.12 mm, or fine grained sands. Approximately 3,619,500 cubic yards of clean sand and 3,018,000 cubic yards of mud overburden were found within the two sub-areas. Preliminary dredging cuts for these borrow areas have been determined to be -74.5 ft NAVD-88 for the Northwest area and -79.5 ft NAVD-88 for the Southeastern area. While pipelines are in the vicinity, none appear to cross either of the borrow areas. The volume of overburden removed for marsh construction within the Sandy Point cuts will be left up to the dredging contractor as an estimated 600,000 cubic yards of mud overburden is available in each of the borrow areas but all of it may not be necessary to complete the marsh construction component (Tetra and CPE 2003, IN DRAFT).

Empire and Scofield Borrow Areas (Marsh Creation)

The Empire and Scofield sites will be used to supplement marsh creation material if necessary. Two pipelines cross the Empire borrow area splitting it into three total sections with two viable for dredging at flat cuts to -27.0 feet NAVD-88. The Scofield borrow area is comprised of a single cut to -35.0 ft NAVD-88. The combined estimated volume of overburden available for marsh construction in the Empire cuts is 3.7 million cubic yards. Scofield contains an estimated volume of 3.1 million cubic yards of overburden available for marsh creation (Tetra Tech and CPE 2003). The amounts of overburden present at the Empire and Scofield sites should be sufficient for the marsh creation component of the alternatives proposed for Pelican Island but sand material for the beach and berm components will be dredged from the Sandy Point Borrow Area.

B. <u>Depth of Closure</u>

The depth of closure may be determined through visual comparisons between past and present sandy beach profiles. It may also be estimated using Birkemeier's (1985) equation:

$h_c = 1.75H_e – 57.9(H_e^2 /gT_e^2)$

H_e = nearshore significant wave height exceeded 12 hours per year.

T_e = wave period corresponding to H_e.

g = acceleration of gravity constant, 32.3 ft/sec.^{2}

Based on the 1976-1995 hindcast at WIS Node G1058, located approximately 20 miles south of Pass La Mer to Chaland Pass sub-reach, the offshore values of H_e and T_e are 17.4 feet and 11 seconds respectively. In order to determine the nearshore value of H_e, the offshore wave was transformed using the RefDif 2.5 refraction model (Kirby and Dalrymple 1994), which considers refraction, diffraction, wave breaking, and porous bottom damping. Given a nearshore H_e on the order of 4 feet, the resulting depth of closure is -7 feet NAVD-88. The DOC is not a large concern for this project because the borrow area impacts are minimized due to their proximity to the sites. The borrow areas for these sub-reaches are beyond the DOC closure in either a pass or an offshore area. This value compares favorably with the 2000 and 2002 beach profiles, and is appropriate only for sand-dominated shoreline systems. Areas with a significant mud fraction are likely to not conform to this concept of a nearshore depth of closure (Tetra Tech and CPE 2003). Post excavation bathymetry can be seen in Figure 5.

C. <u>Other Factors Contributing to Project Design</u>

The passage of Tropical Storm Isidore and Hurricane Lili allowed for a study of storm impacts in the form of shoreline changes, dune changes, and volumetric changes. As a result of these storms, the shoreline eroded an average of 27 feet along Chaland Headland and 20 feet along Pelican Island. Dunes were lowered an average of 1 foot at Chaland Headland and 0.8 feet at Pelican Island, with corresponding dune retreats of 27 and 57 feet. Dune overwash, estimated by calculating the volume change landward of the post-storm dune crest, totaled 79,800 cubic yards on Chaland Headland and 42,000 cubic yards on Pelican Island. Given current conditions, the design dune elevation should exceed +4.1 feet NAVD-88 to avoid breaching or +7.3 feet NAVD-88 to avoid damages to structures landward of the dune (Tetra Tech and CPE 2003).

Waves impacting the project areas are generated primarily by local winds, although significant wave events may occur due to distant storms. The restricted fetch of the Gulf of Mexico basin, however, limits the size and associated period of significant storm events (Tetra Tech and CPE 2003). Wave statistics generated for the project areas utilized the 1976-1995 hindcast at WIS Node G1058 (WIS 1997). The average wave height is 2.6 feet, with a corresponding period and direction of 4.6 seconds and southeast. The largest storm waves occur in August and October during hurricane season. With the exception of tropical storm events, the highest waves under normal conditions occur in March, and the lowest occur in July and August. The wave direction varies from east-northeast in January to south in July. The largest and longest waves under normal conditions come from the south to south-southeasterly direction (Tetra Tech and CPE 2003). Information relevant to wave direction, height, and velocity are intricate in the designing of a stable island, one that is able to withstand seasonal as well as storm-generated intensified wave types.

A breach has developed on the eastern side of the Empire Jetties between the structure and Pelican Island. While this breach is currently small the risk of a major breach developing within this area is significant. Formation of a major breach has the potential to sever the link between the island and the eastern empire jetty terminal structure. This would result in a rapid recession of the western portion of Pelican Island into the Empire Waterway (Tetra and CPE 2003, IN DRAFT). The plan has been modified to provide additional island volume within this area to maintain the connection between the island and the eastern empire jetty. The island cross section has been extended to the jetty and a more seaward orientation of the island has been adopted. While this island orientation reduces the risk of breach formation and flanking of the structure, this orientation increases the risk of movement of sand over and through the structure into the Empire Waterway. The loss of sand from the island into the waterway poses a potential impediment to navigation and could require an increase in maintenance dredging requirements or the modification (sand tightening) of the jetty structure. The risk posed to channel navigability due to diffusion of sand from the island, however, is considered to be significantly less than the risk posed due to the formation of a breach in this area (Tetra and CPE 2003, IN DRAFT).

D. Back-bay Berm

The 1988-2002 sediment budgets developed for each island provide a basis for barrier island volume requirements. Given a design project life of 20 years, a volume of 1.0 million cubic yards is required for Pelican Island and 1.2 million cubic yards is required for Pass La Mer to Chaland Pass to account for anticipated losses over the life of the project. Cross-sections for each island were developed based on these volumetric quantities. Since the primary goal of this project is to stabilize the islands to create habitat, the choice of a lower elevation which maximizes platform area per unit volume was deemed appropriate. Based on results from the SBEACH modeling, a minimum elevation of +5 NAVD-88 was adopted. This elevation provides sufficient protection to prevent island breaching for a 20-year return period or shorter return period storm event. Overtopping of the design is anticipated during significant storm events greater than a 5 year return interval. The actual design elevations of the berms and marsh platforms for Pass La Mer to Chaland Pass and Pelican Island are +6 NAVD-88 and +3 NAVD-88, respectively.

Design island elevations for previously approved Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) projects have ranged from +4 to +8 ft NAVD-88. The design elevations for Pelican Island and Pass La Mer to Chaland Pass fall within the limits of the range of these design elevations for past CWPPRA projects. Nevertheless, to date, monitoring of previously constructed projects has not provided a clear indication as to the optimum design elevation.

A 1:45 foreshore and backshore slope was adopted based on the attained profile slope (for sand) measured at the recently constructed Holly Beach nourishment project. Island crest width varied for each alternative to provide an overall island design volume greater than the required sediment budget values. A semi-contained placement of island fill is anticipated. This will require the construction of containment diking at the discretion of the dredging contractor. Semi-contained placement will allow selective sorting of the placed material with the coarser (sand) fractions deposited within the island fill template and the finer fractions deposited within the marsh areas. The choice of a lower island elevation supports the use of a semi-contained placement approach, as the dredging contractor can more easily attain a lower island elevation (Tetra Tech and CPE 2003).

E. <u>Containment Structures</u>

The dredging contractor will be required to extensively use temporary retaining dikes composed of dredged spoil to contain placed material and attain the construction cross-section. These structures will be graded into the construction cross-section prior to the sponsors accepting the as-built. Bulldozers will be used in conjunction with necessary and appropriate surveying techniques to construct dikes to contain the material on the beach and to shape the beach to the appropriate construction dimensions (Tetra and CPE 2003, IN DRAFT). Where possible existing spoil dike features will be used for marsh containment. Notching of these features will be required at some locations to allow adequate distribution of placed marsh material and allow post construction tidal exchange within the constructed marsh (Tetra and CPE 2003, IN DRAFT). In addition to containment, the primary dike will provide erosion protection to the constructed marsh from bayside wave attack during the material stabilization process. Following marsh stabilization, the primary containment dikes will be degraded and notched (Tetra and CPE 2003, IN DRAFT). The existing 'W' canal located on the Chaland Headland will be closed at 3 locations to allow for containment of marsh material. A breach within the island will also require closure.

Excavation of an approximately 3,374 foot long canal is included within the plan to provide access to existing oil infrastructure following project construction. This canal will require the excavation of 94,400 cubic yards of material (in-situ volume). This volume will be used to supplement spoil volumes required for primary dike construction and for containment closure of the existing 'W' canal. The anticipated volume from the canal excavation is in excess of the estimated volumetric need for primary dike construction of 52,800 cubic yards. Excess spoil material for construction of the oil infrastructure access canal will be placed within an area designated within the existing 'W' canal and marsh fill template (Tetra and CPE 2003, IN DRAFT).

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Dike construction will occur within protected waters primarily on the western side of the project. Approximately 15,400 linear feet of primary dikes will be required to contain marsh fill on the headland. Another 30,800 feet of secondary diking may be necessary to help prevent impacts to oyster leases. These dikes will be degraded after template construction to encourage hydrologic interaction (Tetra and CPE 2003, IN DRAFT). The primary containment dikes will be left in place following construction until dewatering and stabilization of the marsh material has occurred. Marsh material stabilization will take a period from one to several years to complete.

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The Pelican Island marsh design requires the construction of 17,000 linear feet of primary dikes within a relatively exposed shallow water area (-1 to -2 NAVD-88) and approximately 30,800 feet of secondary dikes. To reduce bayside erosion of the constructed marsh on Pelican Island, preservation of diking structures was suggested with breaches placed in strategic locations to return tidal influence to the marsh, increasing the habitat value of the marsh (Tetra Tech and CPE 2003). The dike should be constructed with 1(V):4(H) slopes for levees with up to 3 feet of freeboard (except for the South and North levees) and 1(V):8(H) for levees not on the beach ridge (STE 2003). The existing spoil features will be degraded in the western portion of the project to connect the canal to the barge access excavation required to construct dike containment. This will hydraulically link the two features and provide increased post construction tidal exchange within the constructed marsh (Tetra and CPE 2003, IN DRAFT). Emphasis will be placed on the northwest corner of the project where the excavation canals constructed during dike construction connect to the construction access canal. Removal of diking in this area will provide a hydraulic link between the canal excavation and external tidal forcing. Primary dikes adjacent to constructed tidal features will also be degraded (Tetra and CPE 2003, IN DRAFT).

F. <u>Marsh Platform</u>

Marsh construction along the Chaland Headland will consist of placement of approximately 1,281,300 cubic yards of fill at a construction elevation of +3 feet NAVD-88 and 1,110,900 cubic yards of fill at the same elevation on Pelican Island. Excess overburden will be discharged into designated overflow areas adjacent to the created marsh cells on each island. Both marsh platforms will dewater down to an elevation of +1.5 feet NAVD-88, which is consistent with existing marsh elevations.

A survey of existing healthy marsh was conducted for both project areas. This survey yielded an average target marsh elevation of +1.34 feet NAVD-88 for Pelican Island and +1.01 feet NAVD-88 for Chaland Headland. Given the significant loss of marsh areas observed within these areas and the high rate of subsidence, a more conservative target elevation of +1.5 feet NAVD-88 was adopted for both project areas. In order for the marsh elevation to attain this elevation mid-way through the project life, an additional 0.5 feet is required to account for relative sea level rise. A preliminary evaluation of post construction elevation loss due to material desiccation and consolidation suggests that the placement of an additional 2 feet of marsh material may be required to account for these losses. The sum of these factors results in a construction marsh elevation of +2.5 feet NAVD-88 for Chaland Headland and +2.6 feet NAVD-88 for Pelican at the request of NMFS/LDNR. Stacking to approximately +3 feet NAVD-88 would create marsh just above the existing marsh elevation after dewatering and consolidation approximately one year post-construction (Tetra and CPE 2003, IN DRAFT).

Considering the width (~1,000 feet) of the proposed marsh platforms, the inclusion of hydraulic features (inlets and tidal creeks) to increase the tidal interaction and habitat quality of the marsh has been recommended. Various approaches have been evaluated for the inclusion of hydraulic features within the proposed constructed marsh design. Given the limited ability to manipulate the material anticipated to be used during construction, creation of tidal features post- construction was determined to be the most cost effective approach (Tetra Tech and CPE 2003).

G. Construction of Tidal Creeks

Tidal creeks will be incorporated into the project during construction as well as post-construction. The existing 'W' canal within the marsh fill template will result in a differential settlement of placed marsh material creating a tidal creek feature within the constructed marsh on Chaland Headland, this will provide a linking of the project area to external tidal forcing. Formation of additional drainage features within the placed material is anticipated due to variations in material qualities and consolidation (Tetra and CPE 2003, IN DRAFT).

The canal excavations required for primary dike construction on Pelican Island will result in a differential settlement of placed marsh material creating a tidal creek feature along the project boundary. This feature will be linked to the existing canal feature currently present within the marsh construction in the southwest portion of the marsh area. Differential settlement of marsh material will occur within this feature as well, and the connection of this feature to the canal excavations will provide a tidal feature extending along the boundary and through the middle of the marsh construction.

Two additional tidal features have been added to the eastern marsh platform. These features extend into the marsh platform and are linked to the canal excavations. Formation of post-construction drainage features within the placed material is anticipated due to variations in material qualities and consolidation (Tetra and CPE 2003, IN DRAFT).

Post construction development of additional tidal features is anticipated following consolidation and dewatering of the marsh material. Marsh buggies or similar equipment will be used to increase the number and extent of tidal features present within the marsh platform. Inherent drainage features produced during the consolidation process will likely be used as a basis for the construction of tidal features (Tetra and CPE 2003, IN DRAFT).

H. Vegetation Planting

Vegetation plantings will not be included in the initial construction phase of the project, but a separate contract will be issued for the work. The dune will be aerially seeded approximately 1 year after the initial construction phase to allow time for dewatering and to coordinate planting during the growing season. Louisiana native species, bitter panicum [*Panicum amarum* (4" containers, 20 rows)], gulf cordgrass [*Spartina spartinae* (4" containers, 3.5 rows)], marshhay cordgrass [*Spartina patens* (4" containers, 1 row), and sea oats [U*niola paniculata* (gallon, .5 rows)] will be planted along the dune. Smooth cordgrass [*Spartina alterniflora* (plugs, rows 10' apart, plants 5' on center)], matrimony vine [*Lycium carolinianum* (4" container, planted at foot of dune)], and black mangrove [*Avicennia germinans* (tube, planted at higher areas)] will be planted on the marsh platform (Figure 5). Vegetation is desirable for both its potential as wildlife habitat and dune stabilization properties. The plantings will bind the deposited sediments and assist in the accretion of wind-blown sand. The plantings schemes presented in the parentheses above refer to the way the plants will be placed on both islands.

PELICAN ISLAND
AND
PASS CHALAND TO PASS LA MER (BA-38)
VEGETATION PLANTINGS
7 OCTOBER 2003

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Preliminary Planting Schedule

<u>Pelican Island</u>

Dune Planting: Based on 15,000 l.f. dune, approximately 210-280 feet wide with two parallel sand fences on the dune.

Bitter Panicum	60,000	4" Containers, 20 Rows
Gulf Cordgrass	10,500	4" Containers, 3.5 Rows
Spartina patens	3,000	4" Containers, 1 Row
Sea Oats	1,500	Gallon, .5 Row

Marsh Planting: Based on 220 acres of created marsh, with tidal creek features.

Spartina alterniflora	190,000	Plugs, Rows 10' apart, plants 5' o.c.
Matrimony Vine	6,000	4" Container, Planted at foot of dune
Mangrove	3,000	Tube, Planted at higher areas

<u>Pass Chaland to Pass La Mer</u>

Dune Planting: Based on 15,000 l.f. dune, approximately 210-280 feet wide with two parallel sand fences on the dune.

Bitter Panicum	60,000	4" Containers, 20 Rows
Gulf Cordgrass	10,500	4" Containers, 3.5 Rows
Spartina patens	3,000	4" Containers, 1 Row
Sea Oats	1,500	Gallon, .5 Row

Marsh Planting: Based on 248 acres of created marsh, with tidal creek features.

Spartina alterniflora	215,000	Plugs, Rows 10' apart, plants 5' o.c.
Matrimony Vine	6,000	4" Container, Planted at foot of dune
Mangrove	3,000	Tube, Planted at higher areas

Figure 5. Revised planting scheme, schedule, and plant varieties that will be used to vegetate the dune and marsh platforms.

I. <u>Sand Fencing</u>

Approximately 29,900 feet of sand fencing will be installed on Pelican Island and approximately 27,300 feet will be installed on the Chaland Headland immediately following construction to provide protection to dune features (Tetra and CPE 2003, IN

DRAFT). This feature, designed to capture and accumulate fine-grained sand transported by the wind, is an integral part of dune restoration projects. Two lines of parallel fencing will be aligned roughly parallel to the island orientation and along the dune crests of each island.

J. Project Alternative Discussion

Three alternatives were considered for each project reach, with the alternative that provided the best balance between project benefits and constructability being selected during the 30% design review meeting in June 2003. In general, the alternatives vary from construction landward of the existing island to primarily seaward of the existing island (Tetra Tech and CPE 2003). A discussion of the hydrodynamic models used to evaluate the alternatives follows:

- Storm Induced Beach Change Model (SBEACH) is a one dimensional, empirically based numerical model, formulated using both field data and the results of large-scale physical models to simulate beach profile changes that result from varying storm waves and water levels. Cross-shore storm impact evaluations for the project areas were conducted using SBEACH. Significant beach erosion and shoreline recession often occurs during storm events as a result of cross-shore sediment transport processes. These impacts must be taken into account in the design of the restoration project (Tetra Tech and CPE 2003). SBEACH assumes that the simulated profile changes are produced only by cross-shore processes and neglects longshore sediment transport processes. These profile changes include the formation and movement of morphological features such as longshore bars, troughs, berms, and dunes (Tetra Tech and CPE 2003). The omission of the longshore transport system causes the model to underestimate losses to the system. The most valid interpretation of how much the model has underestimated loss by excluding longshore transport for this project has yet to be determined. The model does; however, provide an adequate assessment of the remaining losses to the system beyond those lost via longshore transport.

- The Generalized Model for Simulating Shoreline Change (GENESIS) (Gravens, et al., 1991) determines shoreline changes based on wave-driven, longshore sediment transport. The model is able to incorporate seawalls, groins, breakwaters, beach fills, bypassing operations, and to consider offshore bathymetry. This model when used in conjunction with SBEACH can provide a sufficient analysis of volume change via all conduits to loss. The GENESIS model assumes that the shoreline changes are directly correlated to the volume changes. Transport rates are calculated using the method summarized in the *Shore Protection Manual* (USACE 1984). Two coefficients (K_1 and K_2) in the longshore transport equation can be adjusted to calibrate the model based on historical shoreline changes (Gravens *et al*. 1991; Tetra Tech and CPE 2003). However, GENESIS modeling for this project also underestimates volume change by assuming that all the loss is due to longshore transport only.

- STWAVE is a spectral wave model that evaluates the refracted wave height and wave angle based on spectrum of waves instead of a single, monochromatic wave. Wave refraction estimates for the study area were made by utilizing the STWAVE model. Results from this model help determine the intensity, direction, and height of waves which helps decipher just how the designed island will attenuate storm surges (Tetra Tech and CPE 2003). The model utilizes linear wave theory, assuming negligible bottom friction and steady-state waves, winds, and currents. Inputs to the STWAVE model include the bathymetry, the wave spectra, and the water levels.

PELICAN ISLAND DESIGN ALTERNATIVES

Alternative 1(marsh only construction) would utilize available marsh compatible material to construct a marsh platform behind the existing island. No additional island construction is included within the alternative. This alternative does not significantly improve island shoreline performance, but may provide some resistance to island disintegration from the bay side (Tetra Tech and CPE 2003). The Alternative 1 constructed shoreline position would be identical to existing conditions. The with-project shoreline changes would thus be identical to the without-project shoreline changes (Tetra Tech and CPE 2003).

Alternative 2 (seaward island construction) retains the marsh component of Alternative 1 and adds island components of increased berm height and beach fill (Tetra Tech and CPE 2003). Alternative 2 advances the shoreline seaward about 300 feet. Near the Empire Waterway jetties, the fill is expected to remain stable. Erosion is expected along the central third of the island but not at a rate that would exceed the added shoreline width. The eastern third of the island will lose all of its added shoreline width, with erosion landward of the existing shoreline by the end of the 20 year project lifespan. The most severe loss will take place near Scofield Pass, as the island continues to realign itself (Figure 6, Tetra Tech and CPE 2003).

Alternative 3 (hybrid island construction) decreases the marsh component of the project with dike locations closer to the existing island profile. It too has an additional berm and beach fill component that extends further seaward than the beach fill design of Alternative 2 (Tetra Tech and CPE 2003). Alternative 3 advances the shoreline seaward about 200 feet. Near the Empire jetties the fill is expected to remain stable but to the east the island is expected to lose all of its added shoreline width, with erosion landward of the existing shoreline starting between Years 10 and 20. Similar to Alternative 2, severe erosion will take place near Scofield Pass, as the island continues to realign itself (Tetra Tech and CPE 2003).

PASS LA MER TO CHALAND PASS DESIGN ALTERNATIVES

Alternative 1 (seaward island construction) would result in island construction primarily seaward of the existing island berm/dune feature. Marsh construction would occur behind the existing island (Tetra Tech and CPE 2003). Alternative 1 (seaward) advances the shoreline approximately 275 feet seaward. Over the next 20 years, it is expected that the western half of the project area will lose all of its added width, while the eastern half is likely to retain the majority of the placed fill (Tetra Tech and CPE 2003).

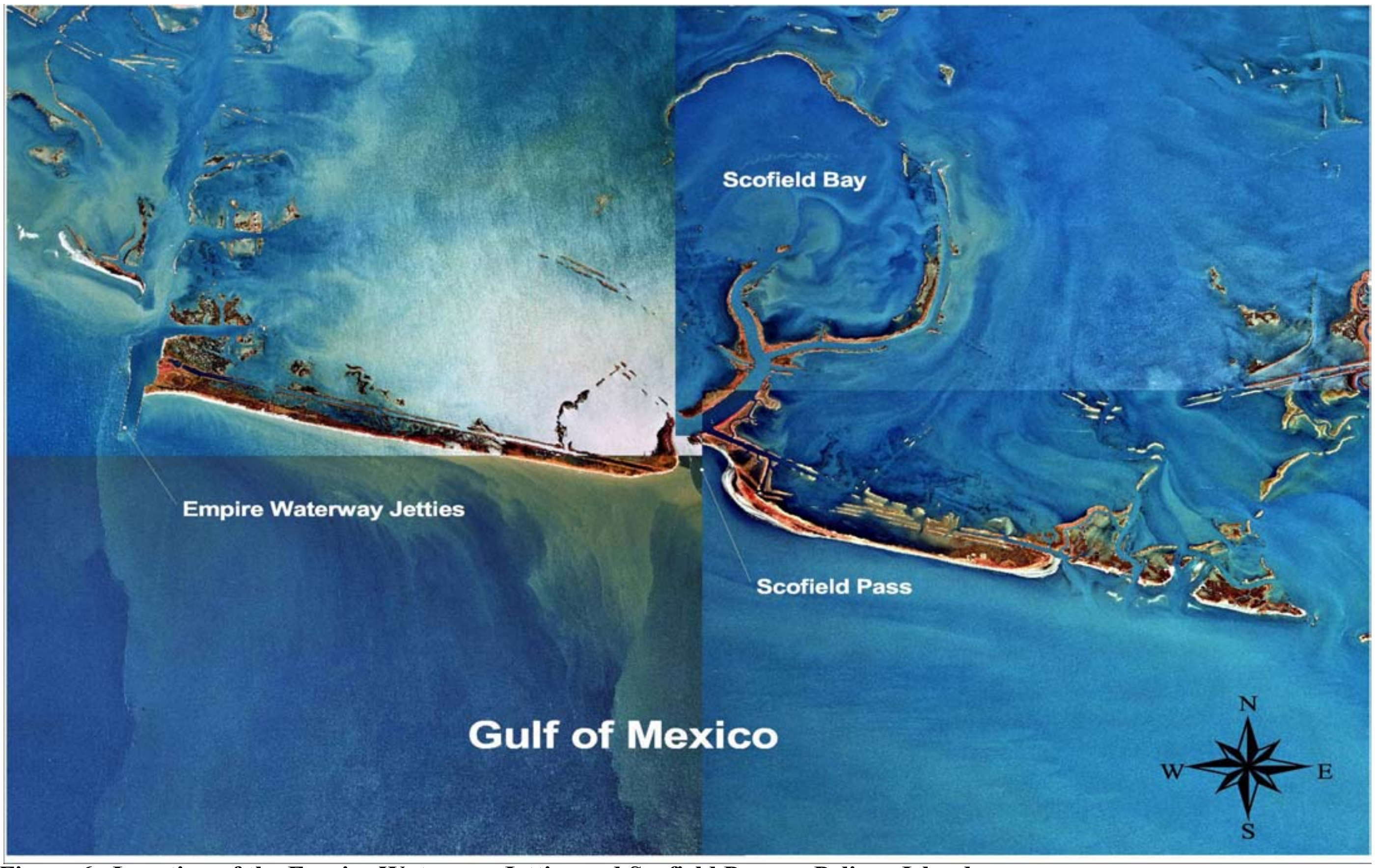

Figure 6. Location of the Empire Waterway Jetties and Scofield Pass on Pelican Island.

Alternative 2 (landward island construction) results in island construction primarily behind (landward) the existing island berm/dike feature. The marsh component would be placed in the same area as in Alternative 1 except that the footprint of the island reduces total marsh acreage and seaward extension (Tetra Tech and CPE 2003). Alternative 2 (landward) advances the shoreline 50 to 100 feet along the western half of the project area, and 200 to 300 feet along the eastern half of the project area. The increased advance in shoreline on the eastern portion is required to avoid existing oil infrastructure. Similar to Alternative 1, the fill is expected to remain stable near the eastern portion of the project area. However, most of the site will lose all of its added shoreline width. Erosion landward of the existing shoreline will begin around Year 5 near the western third and between Years 5 and 10 near the central third (Tetra Tech and CPE 2003).

Alternative 3 (hybrid island construction) falls between the seaward and landward alternatives and results in island construction on the existing island berm/dune feature. The marsh component is designed with the same orientation as in Alternatives 1 and 2 with less beach volume than Alternative 1 and less marsh than Alternative 2 (Tetra Tech and CPE 2003). Alternative 3 (hybrid) advances the shoreline 200 to 220 feet and should remain stable around the eastern portion of the project. However, most of the site will lose all of its added shoreline width beginning between Years 10 and 20 with an increased erosion pattern along the western portion of the project area (Tetra Tech and CPE 2003).

K. Model Predictions and Recommendations

Over the next 20 years the Gulf shorelines of Pass La Mer to Chaland Pass will retreat an average of 220 feet without the proposed project. Although the model indicated accretion near the inlets, it is not able to properly model the current-driven shoreline changes at these locations. Model results on this reach are highly uncertain, but indicative of general trends. The Gulf shoreline of Pelican Island will remain stable near the Empire Waterway and retreat 548 feet near Scofield Pass. This trend reflects the influence of the Empire jetties and the ongoing realignment of the island. The average retreat over Pelican Island will be 239 feet (Tetra Tech and CPE 2003).

Volumetric changes were evaluated between the landward dune toe (+1.535 feet NAVD-88) and the nearshore zone. Losses from the onshore and nearshore beach were 166,300 cubic yards (11.5 c.y./foot) at Chaland Headland and 77,200 cubic yards (5.6 c.y./foot) at Pelican Island. Volumetric changes were also evaluated between the landward dune toe and the seaward survey limit. However, due to biases in the offshore surveys, the corresponding gains and losses are uncertain (Tetra Tech and CPE 2003). These volume changes were used to determine the amount of retreat that may occur over the twenty year project life and to determine which alternative would best attenuate the rates of retreat.

PELICAN ISLAND

The marsh only alternative scores well in terms of cost and constructability, but fairs poorly in long term project performance. It is also important to note that the future predictions for this alternative assume a stable island throughout the project life. Given the current poor condition of the island, island disintegration could occur without reinforcement of the existing island; thus, this scenario is discounted in favor of the other project alternatives (Tetra Tech and CPE 2003). The performances of Alternatives 2 and 3 are similar enough that either approach could be justified, with the primary differences being the amount of marsh created and the extent of seaward construction. Alternative 2 provides the greater extent of marsh creation, seaward construction, and is better in terms of shoreline position and final acreage while Alternative 3 costs less to construct, lowers impacts to oyster leases and results in a relatively better volumetric performance.

Given the technical and engineering challenges inherent within projects of this type and the difficulties to date encountered with similar CWPPRA restoration projects, the constructability of each design has been identified as the primary factor in differentiating between the three alternatives. In terms of constructability, Alternative 3 was preferred due to the more landward construction alignment of the material and the smaller planform extent of marsh creation; therefore, it has been chosen as the preferred alternative for Pelican Island [Figures 7A, 7B, and 7C (Tetra Tech and CPE 2003)].

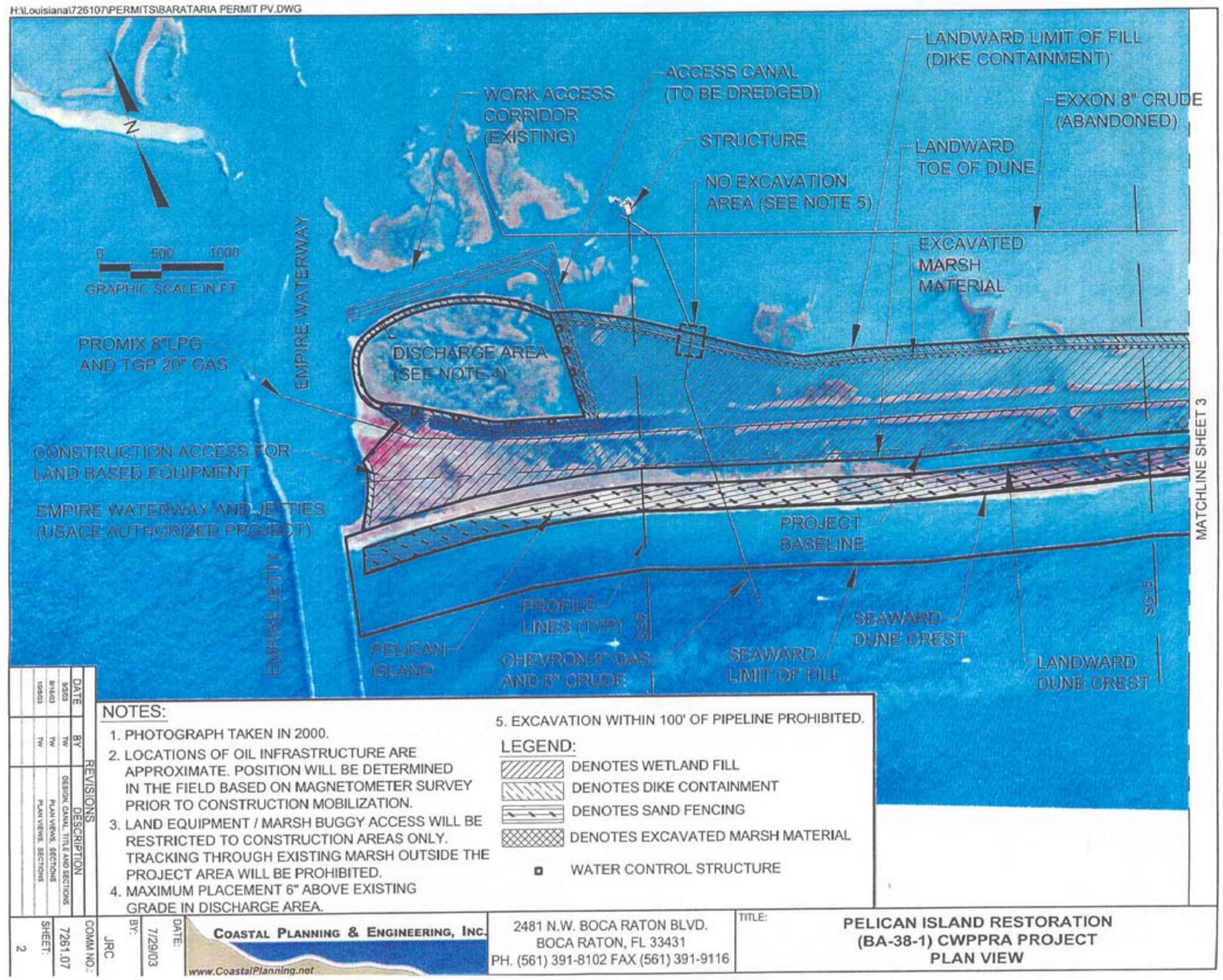

Figure 7A. Western end of Pelican Island restoration template (Tetra and CPE 2003, IN DRAFT)

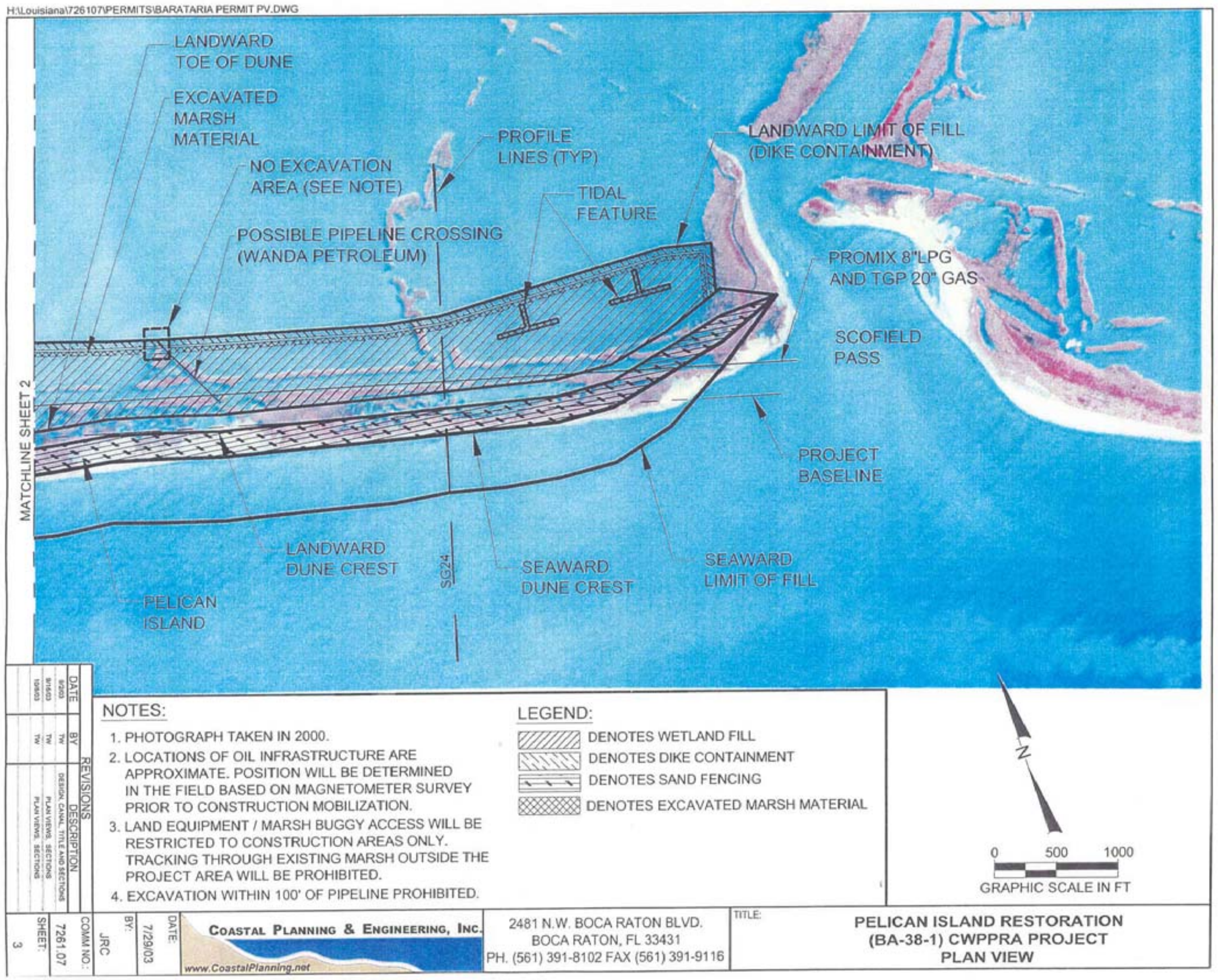

Figure 7B. Eastern end of Pelican Island restoration template (Tetra and CPE 2003, IN DRAFT)

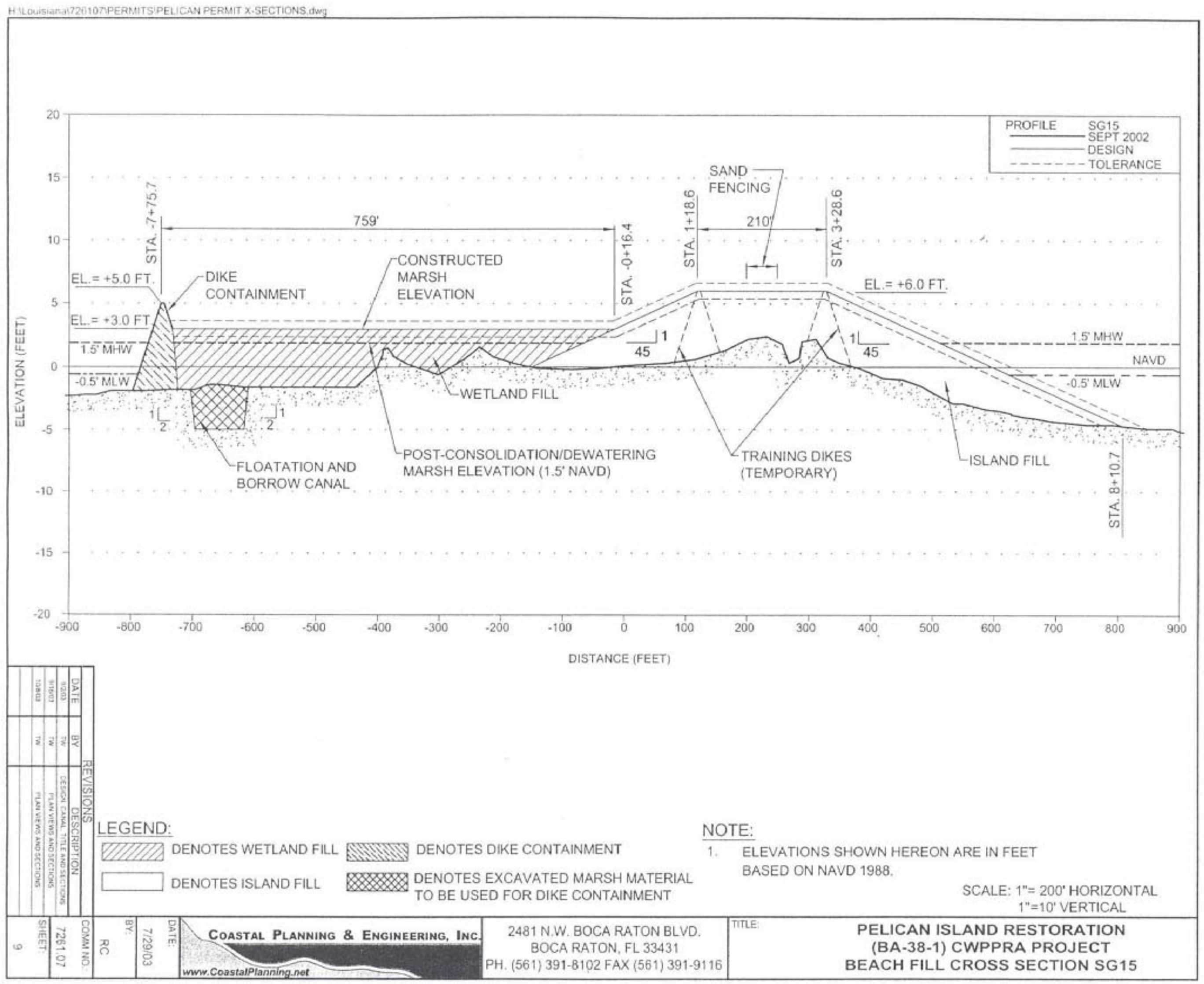

Figure 7C. Typical cross-section for the Pelican Island Restoration Project Site (Tetra and CPE 2003, IN DRAFT)

PASS LA MER TO CHALAND PASS

Given the constraints of the existing project area morphology and oil infrastructure, variation in marsh alternatives are limited for this project reach. Consequently, the range in cost and performance exhibited by the three alternatives is small. The primary difference between alternatives is the orientation of the island construction relative to the existing island. Alternative 1 provides the most seaward island orientation and thus results in the most seaward shoreline position at the end of the project life and the greatest amount of marsh acreage retained. Alternative 2 results in the most landward shoreline position and least amount of acreages retained. Performance results for Alternative 3 fall in between those of Alternatives 1 and 2. While the seaward alternative provides the greatest potential benefit, it also poses the greatest technical and engineering challenge. Given the generally fine nature of the borrow area sand, the constructability of the project alternatives is key to the determination of a preferred alternative. Thus, Alternative 2 has been adopted as the preferred alternative given this alternative's ease of constructability and the more landward construction orientation [Figures 8A, 8B, and 8C (Tetra Tech and CPE 2003)). Templates of the selected alternatives' alignment are located in Appendix B.

VI. Assessment of Goal Attainability

The Assessment of Goal Attainability focuses on the proposed project features (i.e., the dune and marsh platform, sand fencing, and vegetation plantings) and how each has been designed in order to achieve the project goals. Relevant monitoring data and scientific literature were utilized to assess the likelihood of project goal attainability.

Dune and Marsh Platform Building

Beach nourishment, or fill, generally can be defined as the artificial addition of suitable quality sediment to a beach area that has a sediment deficiency in order to rebuild and maintain that beach at a width that provides storm protection and a recreation area (Campbell and Spadone 1982). In the past, the success and failure of beach nourishment projects were (and still remain) difficult to assess due to the lack of pre- and post-construction monitoring data to allow for objective project assessment and necessary adjustment of design (Davison et al. 1992). Dixon and Pilkey (2001) recently inventoried beach replenishment projects in the Gulf of Mexico and found very little data available for analysis. Because barrier islands and dunes provide protection against hurricanes (Stone and McBride 1998; Stone et al. 1997; vanHeerden and DeRouen 1997; List and Hansen 1992) and salt marshes offer opportunities as nurseries for many estuarine-dependent fishes (Beck et al. 2001; Halpin 2000; Williams and Zedler. 1999; Minello and Webb 1997; vanHeerden and DeRouen 1997; Baltz et al. 1993; Minello and Zimmerman 1992), it is important to restore these habitats. The following items are a summary of available information from constructed Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) projects and other scientific studies and numerical models performed on barrier islands located in coastal Louisiana.

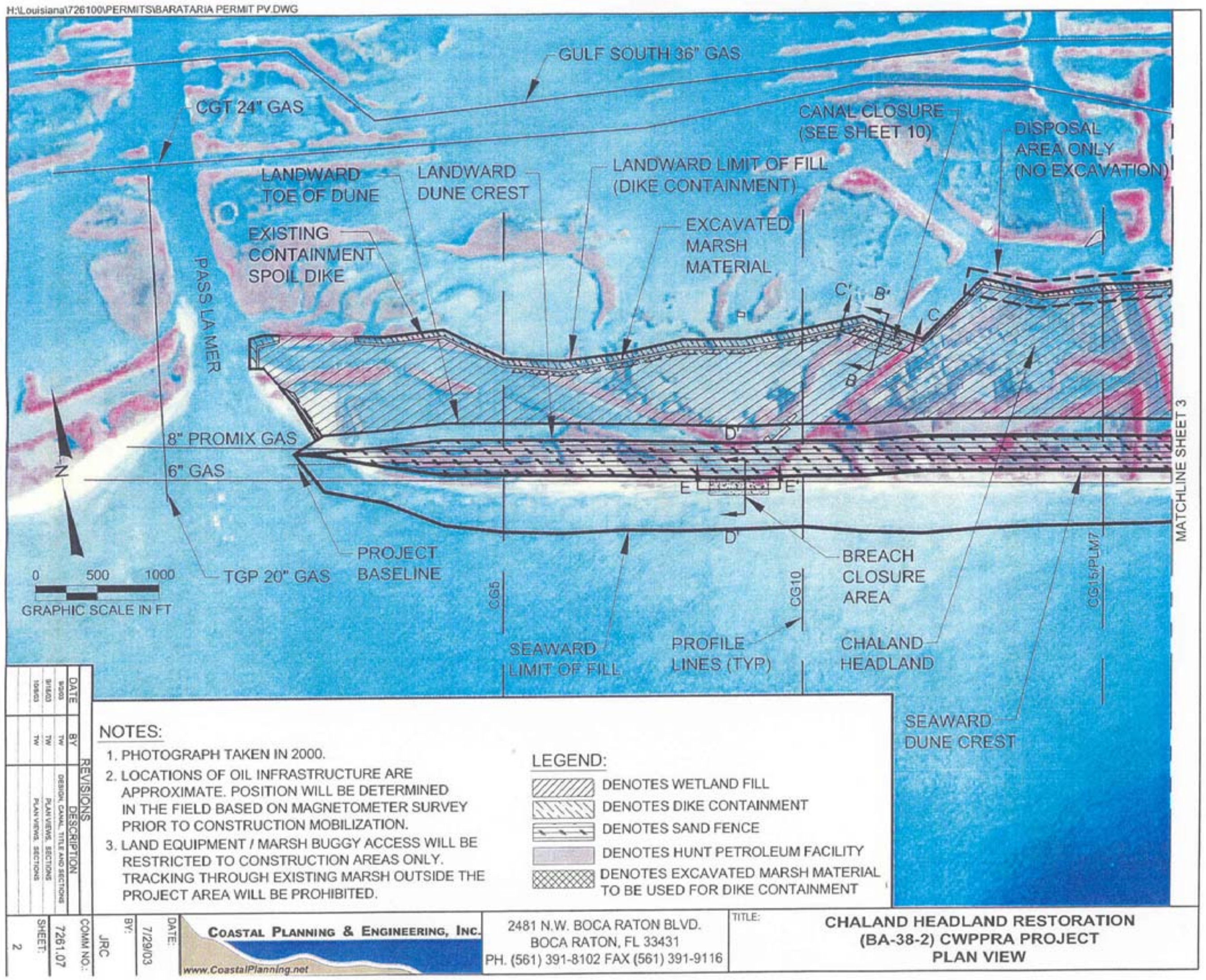

Figure 8A. Western end of the Chaland Headland restoration template (Tetra and CPE 2003, IN DRAFT)

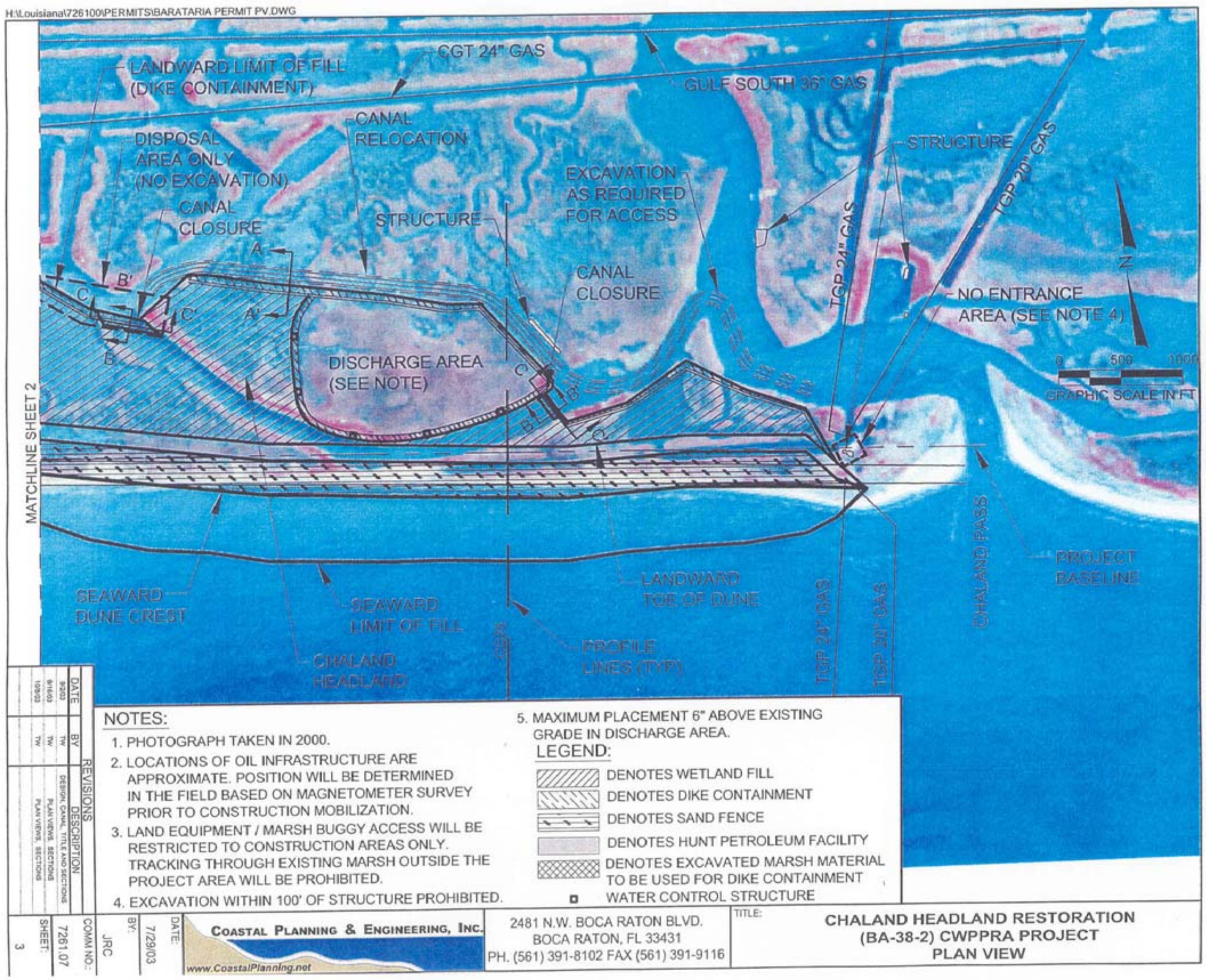

Figure 8B. Eastern end of the Chaland Headland restoration template (Tetra and CPE 2003, IN DRAFT)

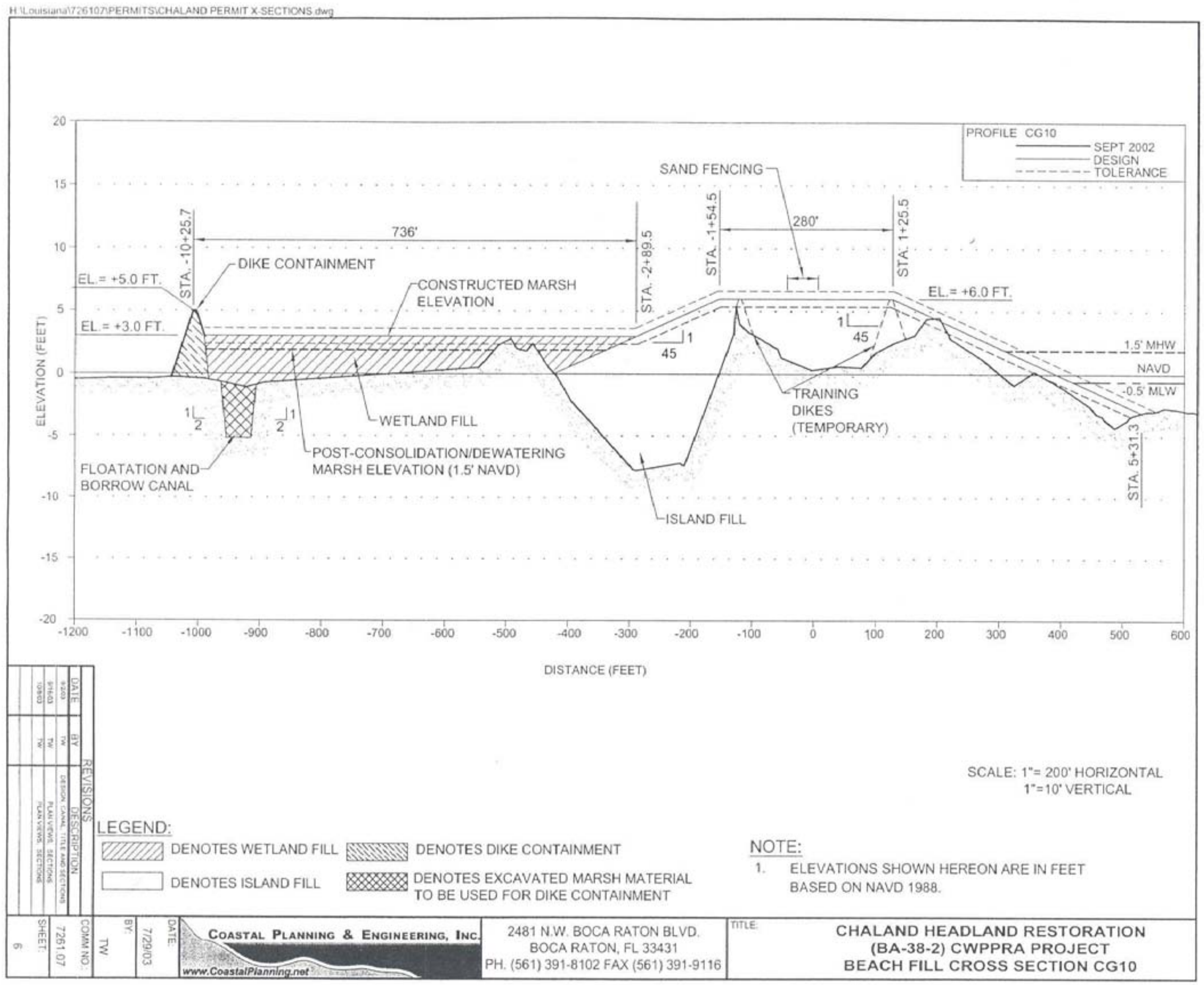

Figure 8C. Typical cross-section for the Chaland Headland Restoration Project Site (Tetra and CPE 2003, IN DRAFT)

General Findings

- A study by Minello and Webb (1997) concluded that marsh elevation and tidal flooding, both key characteristics affecting use of nekton and other aquatic organisms, should be considered in marsh creation projects. They found that man-made marshes typically flood less than natural marshes do, and that fish densities within the vegetation of the created marshes were significantly lower than in the natural marshes. Similarly, Williams and Zedler (1999) recommended that projects be designed to more closely mimic natural marsh hydrogeomorphology.

CWPPRA Projects

There are several recently constructed CWPPRA projects that have design features for dune and marsh platforms. Because all were constructed within the last four years, it remains difficult to compare results from project designs.

- Preliminary results of pre- and post-construction surveys, represented by Digital Elevation Models for East Timbalier Island (TE-25; TE-30), indicate a shift from predominantly subtidal (<0.10 ft; beach, dune, and barrier flat) to supratidal (1.02 ft - 3.3 ft; beach and marsh) habitat for both projects with a general increase in dune height (LDNR 2001a; 2001b). The post-construction elevation increases are a result of dune building as a result of the project and will require extensive monitoring to determine project effectiveness (Krumrine and Brass 2003).

- The Whiskey Island Restoration (TE-27) project, completed in spring of 1999, included the creation of approximately 355 acres of supratidal and intertidal habitat using sediment dredged from Whiskey Pass. The project has immediately increased the height and width of the eastern and central section of Whiskey Island; however, it is too early to ascertain if the primary goal of strengthening and stabilizing the island has been met (Krumrine and Brass 2003).

<u>Vegetation Plantings and Sand Fencing</u>

Factors that may affect vegetation planting projects include soil characteristics, wave fetch, herbivore threats, and many other site specific conditions (Bahlinger 1995). The following studies support the use of vegetation plantings in barrier island restoration projects, when used in combination with sand fencing. The United States Department of Agriculture (USDA) recommended the use of both marshhay cordgrass and bitter panicum in dune restoration projects (USDA 1992).

- Mendelssohn et al. (1991) demonstrated the success of effectively building dunes in low sediment supply systems such as Pass La Mer to Chaland Pass and Pelican Island by combining vegetation plantings with sand fencing to decrease wind velocity along the dune. The three species of plants used in the study were bitter panicum, sea oats, and seashore paspalum (*Paspalum vaginatum*).

- In 1992, the LDNR performed a restoration study which incorporated the use of marshhay cordgrass planted on 1-foot centers at Trinity Island, one of the four islands within Isles Dernieres. By 1994, this and other native vegetation such as salicornia (*Salicornia virginica*), baccharis (*Baccharis halimifolia*), black mangrove (*Avicennia germinans*), and seaside goldenrod (*Solidago sempervirens*) spread to assist in stabilizing the island (Bahlinger 1995).

- Louisiana Department of Natural Resources conducted a five-year project, Timbalier Island Planting Demonstration (TE-18), which incorporated the use of both sand fencing and vegetation planting. Marshhay cordgrass and bitter panicum were planted on the bay side of the fences between the perpendicular fence spurs. Both species displayed excellent transplant survival and growth when sand fences remained intact (Townson et al. 1999). Sand fencing and vegetation plantings were proven to be a success, particularly in the first year of the study; however, after three to four years, the beach was found to be narrowing, and unable to dissipate wave energies.

- Preliminary analyses of data from two similar CWPPRA barrier island projects showed only a slight increase in vegetation cover two years following construction. At Eastern Isles Dernieres Restoration, East Island (TE-20), there was a slight increase in vegetation from 1999 (immediate post-construction) to 2001 (2 year post-construction) for bay, spur, and areas left unplanted. Data for Eastern Isles Dernieres, Trinity Island (TE-24) showed that vegetation slightly increased in cover between 1999 (immediate post-construction) and 2001 (2 year post-construction) for unplanted areas, and for bay, dune, and spur (Krumrine and Brass 2003).

- Success of marshhay cordgrass has been demonstrated in many studies but high mortality rates occurred in planting for TE-25 and TE-30 on East Timbalier Island. The drought conditions of 2001 could have negatively affected the vegetation in these projects. A site visit in 2001 revealed that bitter panicum was vigorous in most areas. The advantages of bitter panicum as stabilizing vegetation far outweigh those of marshhay cordgrass, thus bitter panicum is planted more often (Personal Communication with Keith Lovell).

- Mendelssohn et al. (1991) concluded that straight fences with spurs were initially more successful at accumulating sand and promoting dune height. Additionally, straight fences arranged parallel to the shoreline were more effective overall when compared to those arranged angled (perpendicularly) to the shoreline.

- The Whiskey Island Restoration (TE-27) project demonstrated the importance of installing sand fences. This project, planted in 1999, did not initially include sand fencing. Monitoring results from 2001 indicated that vegetation survival and cover was low (28% and <14%, respectively), and that the area exhibited severe wind-induced erosion (Armbruster et al. 2001). However, the drought conditions of 2001 may have also affected vegetation growth for this project.

- A study conducted in 1984 by Hester et al. (1994) on Timbalier Island evaluated the effect of herbivory on bitter panicum plantings. The study consisted of planting bitter panicum in protected and unprotected plots. The study suggested that herbivory could be an important cause of transplant failure on barrier islands in Louisiana; however, Keith Lovell and Kenneth Bahlinger (personal communication) of the LDNR, Coastal Restoration Division, indicated that the effects of herbivory on vegetation of nearby barrier islands have not been significant.

Tidal Creeks

The sustainability of any created or managed marshes requires that the marsh substrate build vertically at a rate at least equal to local rates of relative sea-level rise. In coastal salt marshes, natural processes of sediment deposition are the dominant means by which this is achieved (Frey and Basan 1985). Studies of marshes where impaired tidal hydrology has been restored show that the recovery of salt marsh functions (e.g. fish utilization and vegetative community) is dependent upon the degree of flooding depth, duration and frequency (Burdick et al. 1997). While marsh elevation in the tidal frame is the essential control of these hydroperiod parameters, sedimentation rates in newly re-flooded intertidal areas are the critical determinant of elevation as well as being important in the long-term sustainability of the systems. Haltiner et al. (1997) however, has documented that poor designing of tidal creeks in a marsh created with dredged material, in combination with a low marsh elevation, resulted in erosion rather than sedimentation in parts of the marsh system (Reed et al 1999). Evidence persists for the necessity of tidal creeks in marsh restoration to return estuarine areas from a declined state back to their natural state, but care should be taken to ensure proper design and implantation.

Summary and Conclusions

The information presented herein has led the LDNR Restoration Technology Section (RTS) to conclude that beach nourishment via dune building and marsh creation are viable means of rebuilding and maintaining barrier islands. Numerical models designed to evaluate project design alternatives and mimic the surrounding hydrology of the islands have also depicted the expected impacts of the proposed project features have on island stability. Analysis of the models provide a conduit to make well-educated decisions on which alternatives to place under further review and how to proceed after the best alternative has been selected. Literature reviews of past projects similar in nature and design to the Pelican Island and Pass La Mer to Chaland Pass project have shown that sand fences and vegetation plantings are a major component of successfully restoring barrier island environments. Both sand fences and vegetation plantings help sustain dune integrity and strength while providing habitat for wildlife. The findings as presented in the Assessment of Goal Attainability section show the potential for success of this project and the need for action if Pelican Island and Pass La Mer to Chaland Pass are desired for future generations.

Recommendations

95*% Ecological Review Recommendations:*

Based on the investigations of similar restoration projects and a review of engineering principles, the proposed strategies of the Pelican Island and Pass La Mer to Chaland Pass Barrier Shoreline Restoration project will likely achieve most of the desired ecological goals. Upon thorough analysis of the recommendations presented by Tetra

Tech EM, Inc. and CPE, Inc. in the Final 30% Design Review document, the LDNR concurs with the selection of Alternative 3 (hybrid) for Pelican Island and Alternative 2 (landward) for Chaland Headland based on their constructability and ability to maintain shoreline seaward for longer time periods.

Since the conclusion of the 30% Design Review meeting, a revised planting scheme and schedule has been devised by the LDNR Coastal Engineering Division, Planting Section to address concerns of unattainable vegetation targets/goals that have previously been set for dune and marsh planting projects. Also, Darin Lee, LDNR Biological Monitoring Section has provided project team members with the most recent data and anecdotal information regarding optimal sand-fence orientation and construction timing to enhance sand trapping and dune stabilization.

In response to the 30% Design Review recommendation for better monitoring (engineering) of barrier island projects, the LDNR Biological Monitoring Section along with Syed Khalil (Geologist, LDNR) prepared a comprehensive monitoring plan to address the lack of quality monitoring data collected for barrier restoration projects. At the present time the Barrier Island Comprehensive Monitoring Program (BICM) is still in draft form. This program proposes to collect data necessary to better plan, implement, and monitor barrier projects.

The current level of design warrants continued progress toward the Phase II funding request. However, LDNR recommends that additional consultation with Tetra Tech EM, Inc. and Coastal Planning and Engineering, Inc. be conducted to adequately address the remaining issues. Some of these points may be addressed during the 95% Design Review meeting.

1. The revised planting scheme and schedule, as recommended by the LDNR Coastal Engineering Division Planting Section, should be implemented to improve the likelihood of achieving the vegetation goals/targets.

2. Substantial evidence attesting to the ability of the selected alternatives to achieve land loss rate targets.

3. As stated at the 30% Design Review, further analysis is needed to evaluate if wider and shorter dune profiles provide longer island longevity due to their ability to roll-over onto themselves. This recommendation was derived from preliminary analyses of recently constructed barrier island projects.

4. An experimental design should be devised and implemented by project team members to test the viability of constructing tidal creeks pre or post-construction.

5. The net marsh created post-construction needs to be quantified. The total amount of marsh covered by the alternatives has not been identified. The net

creation criterion is necessary to assess the capability of the proposed alternatives to attain the stated goals.

6. During a recent field trip, it was suggested that more sand is available in the borrow areas and that it could be possibly used to strengthen the marsh platform bottoms thus further sustaining the island. Is this still a viable option? If modest quantities of sand are available the proper use of such material needs to be clearly defined. If those sands are to be used as support for the constructed mud overburden/marsh platform the approach and extent need to be quantified.

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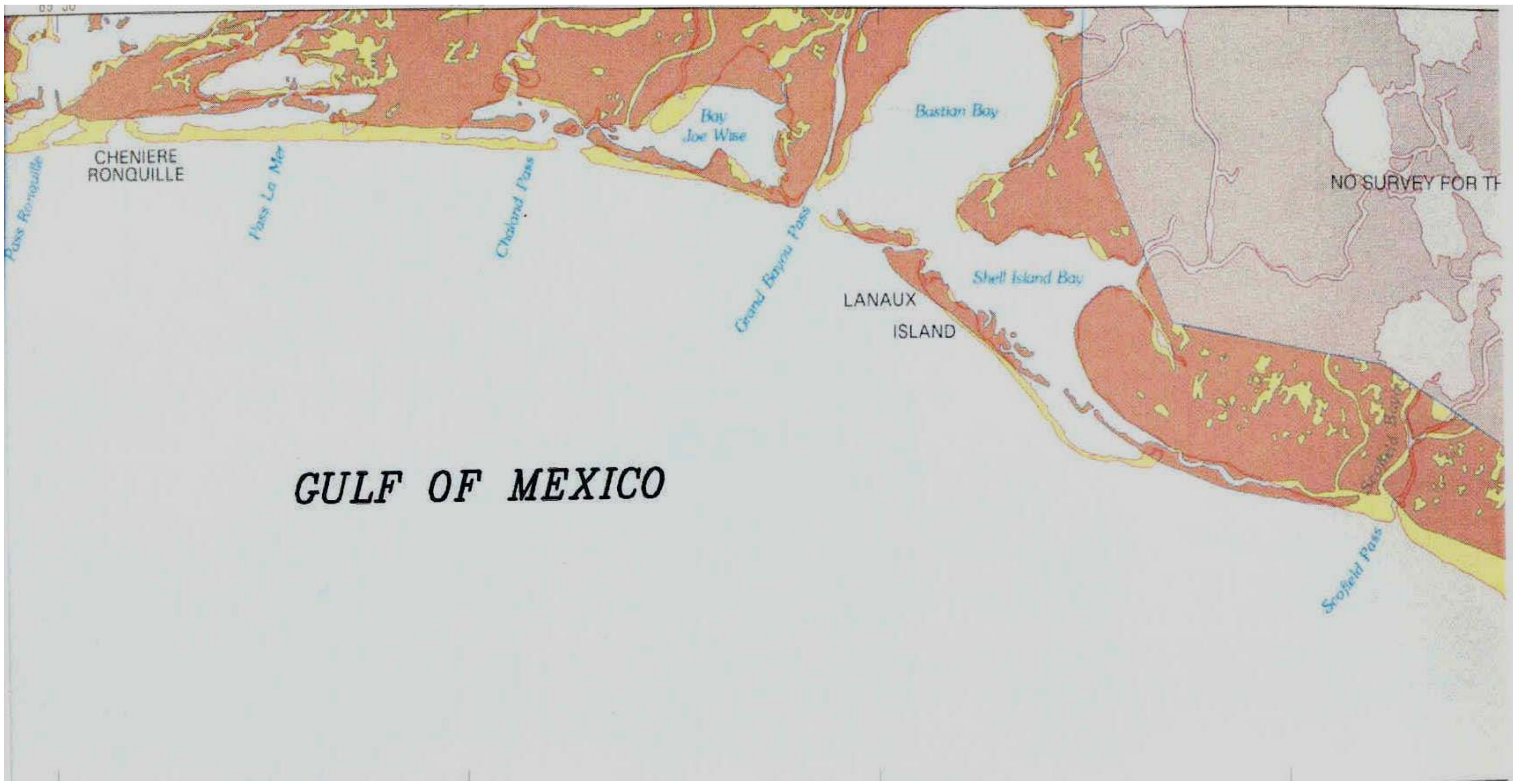
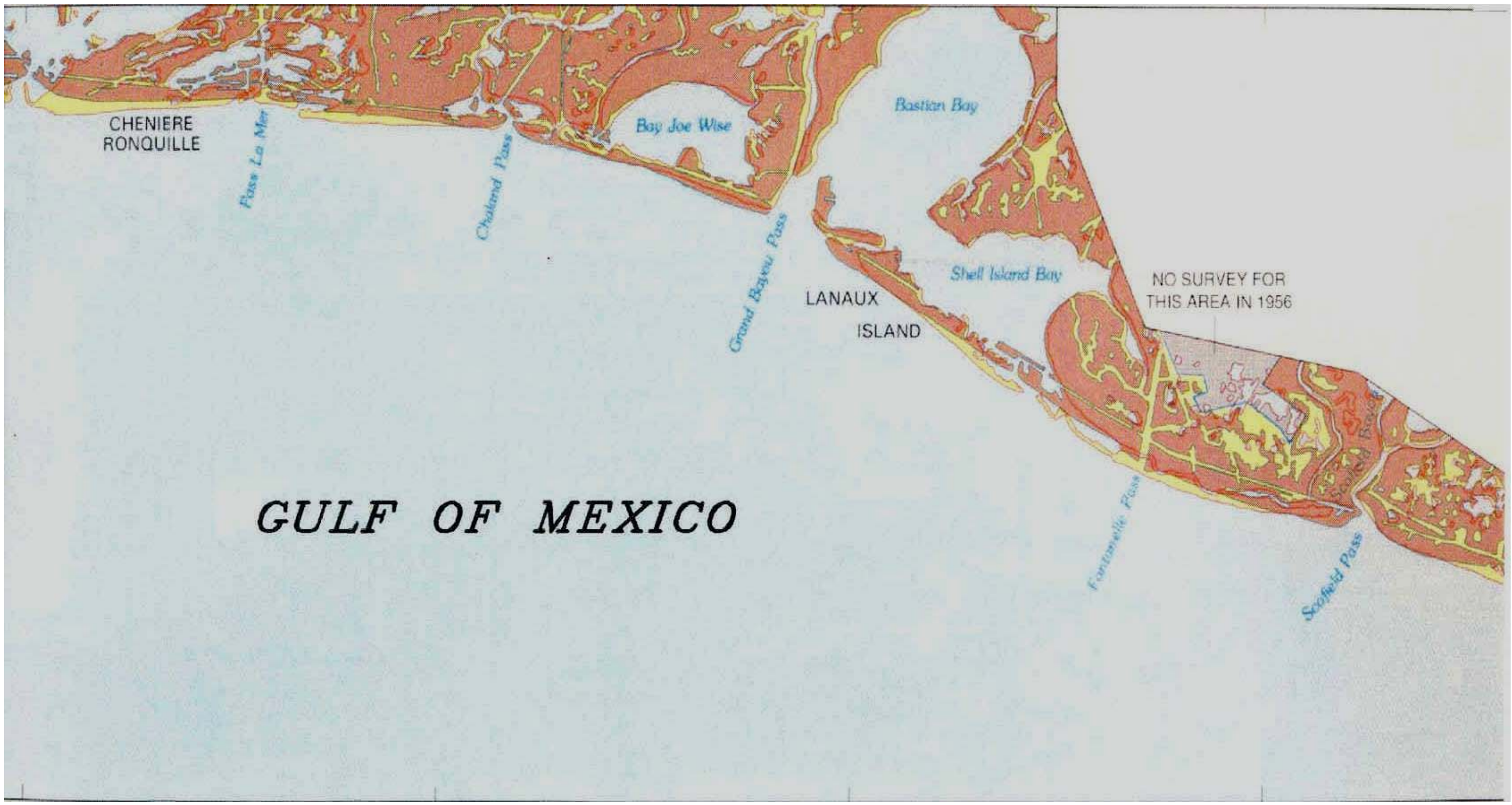
APPENDICES
Historic Land Loss Maps



Barataria/Plaquemines land loss, 1884-1932 (Williams, *et al*. 1992)



Barataria/Plaquemines land loss, 1932-1956 (Williams, *et al*. 1992)

Barataria/Plaquemines land loss, 1956-1973 (Williams, *et al*. 1992)

Barataria/Plaquemines land loss, 1973-1988 (Williams, *et al*. 1992)