MONITORING PLAN

PROJECT NO. ME-19 (PME-18)
GRAND-WHITE LAKE LAND BRIDGE PROTECTION

August 7, 2003

Project Description

The Grand-White Lake Land Bridge Protection project is a shoreline protection project from the 10th priority list of the Coastal Wetlands Planning, Protection, and Restoration Act, comprised of 1,530 acres (619 ha) of fresh marsh and open water in Cameron Parish, Louisiana. The project area includes Round Lake, a portion of the southwest Grand Lake shoreline, and the northern half of the shoreline of Collicon Lake. The project is located in the Mermentau Basin Lake's Sub-basin on the southeast shoreline of Grand Lake, from the old Gulf Intracoastal Waterway (GIWW) to the level of the northern edge of Round Lake, and eastward above Corp Mound Bayou to the eastern shore of Collicon Lake (figure 1). Currently, 29% (451 acres/183 ha) of the project area is classified as fresh marsh, 71% (1,079 ac/437 ha) is open water, and less than 1% as bottomland shrub/scrub (United States Geological Survey/National Wetlands Research Center [USGS/NWRC] 1988/90).

Wind induced erosion of the southeast shoreline of Grand Lake (15 mi/24.1 km northwest fetch) and the west shoreline of Collicon Lake (2 mi/3.2 km southeast fetch) has removed the lake rims and is endangering the narrow land bridge between the two lakes. The 3,000 ac (1,214 ha) Collicon Lake is in danger of breaching (< 500 ft) into the eastern portion of Grand Lake endangering the 13,281 acre (5374.6 ha) Grand-White Lake Land Bridge area. Should this breach occur, the size of Grand Lake will increase by over 4,800 acres (1,943 ha) and the size of the land bridge will be reduced by 2 miles (3.2 km). The small strip of marsh separating Collicon and Round Lake would also be lost and the entire 1,530 ac (619 ha) project area will become part of Grand Lake. Shoreline erosion would accelerate in the marsh between the former Collicon Lake and Alligator Lake and Lake le Bleu which will also be in jeopardy of being converted to the open waters of Grand Lake. Measurements of shoreline loss at 10 transects at the southeast portion of Grand Lake yielded loss rates from 23.9/7.3 to 36.2/11 ft/m per year (Clark et al. 1999).

Soils in the area between Grand Lake, Collicon Lake, and adjacent to the old GIWW are Larose muck. The northeastern shore of Collicon Lake consists of Allemands muck. Both Larose muck and Allemands Muck are very poorly drained soils with Allemands being organic (United States Department of Agriculture [USDA 1995]). In 1949, O'Neil classified the entire project and reference area as a *Cladium jamaicense* (sawgrass) marsh. Sawgrass primarily grows in shallow, freshwater marshes, although it occasionally grows in and may even dominate some brackish water areas (Penfound and Hathaway 1938). Subsequent vegetation maps classify the project and reference area as fresh marsh (Chabreck and Linscombe 1978, 1988, 1997; Chabreck et al. 1968).

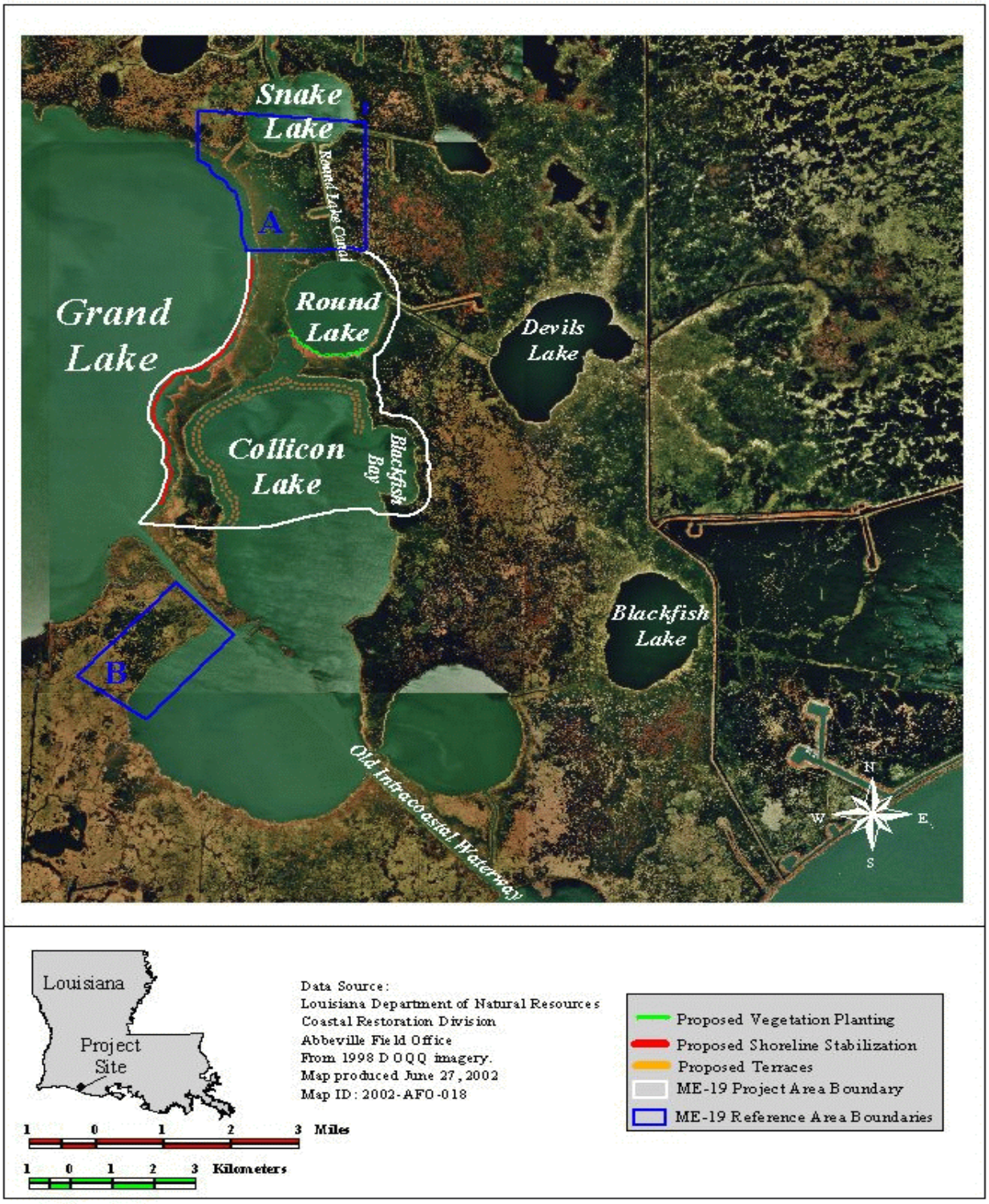

Figure 1. Grand-White Lake Land Bridge Protection (ME-19/PME-18) project and reference area showing proposed shoreline planting, shoreline stabilization, and terrace locations.

Dominant emergent vegetation in the project area is *Sagittaria lancifolia* (bulltongue) with traces of *Sesbania drummondii* (rattlebox), *Triadica sebifera* (Chinese Tallow), *Colocasia esculenta* (elephant ear), *Iris giganticaerulea* (giant blue iris), *Hibiscus moscheutos* L. ssp. *lasiocarpos* (crimsoneyed rosemallow), and *Hymenocallis caroliniana* (Carolina spiderlily) [Clark et al. 1999]. Aquatic vegetation was not recorded but may consist of *Lemna spp.* (duckweed), *Myriophyllum spicatum* (milfoil), *Hydrocotyle* sp. (pennywort), *Eichhornia crassipes* (water hyacinth), *Nymphaea spp.* (waterlily), and *Ceratophyllum demersum* (coontail) [USDA 1995].

Project Goals and Objectives/Coast 2050 Strategies Addressed

CWPPRA projects are reviewed prior to authorization of construction funds for compatibility of project goals with those in Coast 2050 (LCWCRTF and WCRA 1998), and for the probability that proposed restoration strategies will accomplish those goals.

Project Goal:

The goal of this project is to prevent the coalescence of Grand and Collicon lakes by:

a. Stopping erosion along the southeastern shoreline of Grand Lake and the north and western shorelines of Collicon Lake over the 20 year project life.
b. Creating a total of 17 acres of emergent marsh along the southeastern shoreline of Grand Lake and 10 acres of emergent marsh along the north and western shorelines of Collicon Lake over the 20 year project life.
c. Reducing erosion along the southern shoreline of Round Lake by 50 % over the 20 year project life.

Project Strategies:

1) Retain separation of Grand and Collicon Lakes by an isthmus of marsh greater than 500 ft (152.4 m) wide by construction of approximately 12,000 feet (3,657.6 m) of shoreline protection along the southeastern shore of Grand Lake. Create marsh between the foreshore dike and the Grand Lake shoreline by using spoil material from dredging of access channel and accretion of sediments from periodic wave overwash.

2) Create or restore 32 acres (12.95 ha) of fresh marsh by constructing earthen terraces and subsequent accretion of sediments between the northern and western Collicon Lake shoreline, the first row of terraces and between terrace rows.

3) Reduce shoreline erosion along southern Round Lake through planting of 4,000 ft (1,219.2 m) of vegetation.

Project Features

The proposed project features, specifically shoreline protection and terracing, were identified by the Region 4, Regional Planning Team, as part of Coast 2050, as strategies that will directly benefit the Grand-White Lake Land Bridge Mapping Unit (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority [LCWCRTF & WCRA] 1999; Belhadjali et al. 2002).

There are two construction units included in the project as described below (figure 2).

Unit 1 - Grand Lake Shoreline Stabilization

Unit 1 includes installation and maintenance of approximately 12,000 feet of hard shoreline stabilization material lakeward of, and parallel to, the present Grand Lake southeastern shoreline. Approximately 17–22 acres (6.88–8.9 ha) of fresh marsh will be created in open water behind the hard shoreline stabilization material with access channel spoil dredged during construction. More specifically, construction in this unit would include the following items.

1. Excavation of a barge access canal (7 ft/2.13 m deep by 70–80 ft/21.34–24.38 m wide) 40 ft (12.19 m) lakeward of and parallel to, the foreshore dike.

2. Placement of approximately 12,000 ft (3,657.6 m) of limestone rock as a foreshore dike150–250 ft (45.72–76.2 m) lakeward of the shoreline, with 25 ft (7.62 m) gaps every 700–1,000 ft (213.36–304.8 m). The rock [+2.5 ft NAVD 88] will be placed on geotextile fabric to a height of 1 ft (0.30 m) above average water level along the minus 1–2 ft depth contour. The foreshore dike would have an initial height of 4 ft (2.5–3 feet NAVD 88), a 3 ft wide crown, a 29 ft (8.84 m) or less base width, and 3:1 side slopes. The 4 ft (1.22 m) initial height includes allowance for a maximum 2 ft (0.61 m) water depth, 1 ft (0.3 m) of subsidence, and 1 ft or less of freeboard above mean water level. Shoreline stabilization will extend from 1,000 ft (304.8 m) north of the Old GIWW to a point even with the north shore of Round Lake. The gaps left in the foreshore dike and marsh creation area will provide for water exchange and fish access.

3. Use of the access canal spoil to create marsh (approximately 17–22 acres/6.88– 8.9 ha) behind the foreshore dike; the material will be seeded to reduce erosion and enhance marsh establishment (Clark and Dubois 2002).

Unit 2 - Collicon Lake Terraces

Earthen terraces will be established in Collicon Lake to create marsh, facilitate marsh building by trapping suspended sediments in adjacent shallow open water, stimulate the growth of submerged aquatic vegetation, and reduce erosion of fringing fresh marsh. Unit 2 construction features consist of the following items.

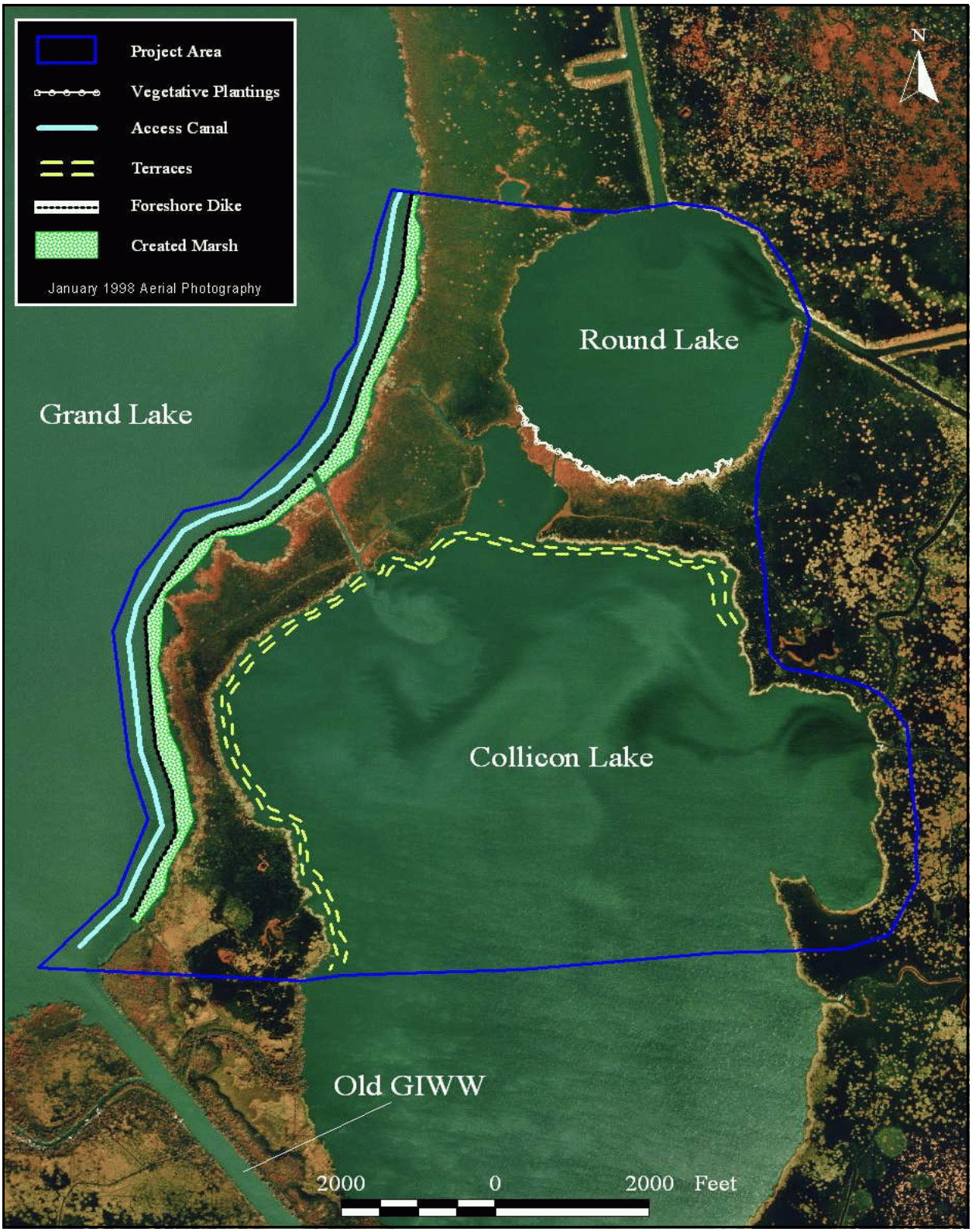

Figure 2. Project features for Grand-White Lake Land Bridge Protection (ME-19, PME-18) project (Clark and Dubois 2002).

1. Construction of two rows of 200 ft (60.96 m) long terrace segments (approximately 112 segments), with 50 ft (15.24 m) gaps between each segment. Total length will be 25,000 ft/7,620 m (2 rows, each 10,000 ft/3,048 m long) plus 5,000 ft/1,524 m (approximately 2,500 ft/762 m in each row) of 50 ft (15.24 m) long gaps between terraces.

2. Planting of terrace tops with three rows of 4-inch diameter containers of *Paspalum vaginatum* (seashore paspalum) planted on 5 ft (1.52 m) centers. The crowns (8 feet wide for inner terraces and 10 feet wide for outer terraces) and slopes (3:1) of the terraces will also be seeded with a mixture of *Echinochloa esculenta* (Japanese millet) and *Panicum ramosum* (brown top millet), as a temporary erosion control measure pending establishment of native species. Terrace side slopes will be planted with gallon containers of *Zizaniopis miliacea* (giant cutgrass) in one row on 5 ft (1.52 m) centers. The side slope facing Collicon Lake will have two rows on 5 ft (1.52 m) centers.

3. Vegetation planting along the southern shoreline of Round Lake to include planting one or two rows of gallon containers of *Z. miliacea* (giant cutgrass) or other suitable vegetation on 5 ft (1.52 m) centers for a total distance of 4,000 ft (1,219.2 m).

Monitoring Goals

Priorities:

The Grand-White Lake Landbridge Protection project is classified as a shoreline protection project. However, the Wetland Value Assessment, Draft Environmental Assessment, and other documents state that the project is also expected to create marsh by constructing terraces and increase the frequency and occurrence of SAV within the shallow open water areas of the project. There are insufficient resources for an evaluation of all anticipated project benefits, and the primary purpose of this project is reducing or reversing the erosive loss of marsh between Grand and Collicon Lakes. Therefore, monitoring efforts will focus on evaluating project effects on land/water ratios, shoreline change, and vegetation planting success on the terraces. SAV and structural integrity of the rock dike and terraces will only be monitored via visual inspections by the Engineering Section of CRD during O&M surveys and by CRD Monitoring personnel during shoreline and vegetation surveys. Changes in shoreline at the south end of Round lake will be evident from aerial photography, but no specific monitoring of those plantings is anticipated. Any variation from expected results will be documented and evaluated.

Specific Monitoring Goals:

1) Evaluate changes in Land:Water ratios.
2) Evaluate rate of erosion along the eastern shoreline of Grand Lake and the north western shoreline of Collicon Lake.
3) Evaluate establishment of emergent vegetation on planted terraces.
4) Evaluate changes in elevation and landscape integrity due to the accumulation and erosion of sediments in landbridge areas.

Reference Area:

Monitoring on both project and reference area provides a means to achieve statistically valid comparisons, and is therefore the most effective means of evaluating project effectiveness. The main criteria for selecting a reference area are similarities in vegetative community, soil type, and hydrology, similarities in shoreline erosion rates, and proximity to the project area.

Two proposed reference locations were chosen for evaluating and comparing changes in shoreline based on the aforementioned criteria. Reference site A is located north of Round Lake and includes the southern portion of Snake Lake (figure 1). Shoreline change along this stretch of the eastern edge of Grand Lake will be compared to that along the project area where the proposed foreshore dike in Unit 1 will be constructed. Land/water ratios in Reference site A and the project area also will be compared. Reference site B is located south of the Old GIWW on the south western portion of Collicon Lake (figure 1) and will be used to compare changes in shoreline erosion of the north western shore of Collicon Lake where the terraces will be constructed.

The intensive re-vegetation methods used for the terraces (planting slopes, crowns, and seeding), small number of terraces created, and the high energy environment (lake fetch) makes this area unsuitable for the comparison of vegetated to non-vegetated terraces as was described in the Pecan Island Terracing project (Louisiana Department of Natural Resources [LDNR 2001]). Consequently, there is no reference comparison for this project feature.

Monitoring Strategies

The following monitoring elements will provide the information necessary to evaluate the specific goals listed above:

1. Aerial Photography — To evaluate the extent of marsh creation and erosion adjacent to project features, near-vertical, color-infrared aerial photography (1:12,000 scale) will be obtained in project and reference areas as-built, and in post-construction year 2013. The photography will be georectified, mosaicked, and land/water ratios determined using standard operating procedures described in Steyer et al. (1995, revised 2000).

2. Shoreline Survey — To document annual shoreline movement, differential GPS will be used to map the shoreline in both the project and reference areas. Differential GPS will be used as described in Steyer et al. (1995). Differentially corrected GPS data sets will be obtained 2003 (as built rock) and 2004 (as built terraces), and post-construction in years 2006, 2008, 2013, and 2021. GPS data will be taken during the spring of each monitoring year to minimize errors associated with taking data at different times of the year, not accounting for seasonal changes that might occur to the shoreline.

3. Terrace Vegetation — The condition of the natural emergent, seeded, and planted vegetation on the terraces over the life of the project, will be monitored at sampling stations established systematically on 10% of the total planted terraces using a modified Braun-Blanquet sampling method as outlined in Steyer et al. (1995). Plots will be established across selected terraces to include both high and low energy environments. Four sampling plots will be established on selected terraces which will include a plot on the inner and outer slope and 2 plots on the crown. Twelve terraces will be selected; one beginning at the north east portion of Collicon Lake where the terraces are located and ending at the north west portion of the lake. At each station, percent cover, dominant plant heights, and species composition will be documented in a 4 m^2 sample area. Each plot will be marked with 2 corner poles to allow for revisiting the sites over time. Vegetation will be evaluated at the sampling sites in the fall of 2004 (as built) 2005, and in the fall of 2008, 2013, and 2021. Following a site visit to establish permanent sampling stations, a sampling station map will be prepared and added to this monitoring plan.

4. Elevation — In order to monitor elevation changes due to the movement of sediment over time, elevation profiles of the project and reference sites (e.g., between Grand Lake and Collicon Lake, Grand Lake and Round Lake, round Lake and Collicon Lake, and Grand Lake and Snake Lake) will be generated using GIS (three dimensional topographic grids). Three transect lines will be established at each location and elevations will be recorded at 10 ft (3.05 m) intervals starting 50 ft (15.24 m) lakeward of each project feature to the existing shoreline, and at 100 ft (30.48 m) intervals across the existing landbridge, and at any significant change in elevation within those intervals. Elevations will be tied to the North American Vertical Datum of 1988 (NAVD 88). Elevation surveys will be conducted as-built, and during years 2006 and 2013 concurrent with the shoreline surveys and Operation and Maintenance (O&M) surveys. The analysis of these profile data will be beneficial in evaluating the rate of gain or loss of wetland acreage and the volumetric amount of retention of the shoreline sediments during post-construction years. See note 5.

Anticipated Analyses and Hypotheses

The following describes comparisons, hypotheses, and statistical tests, if applicable, used to evaluate each of the Monitoring goals and thus effectiveness of the project.

1. Aerial Photography: Descriptive and summary statistics from color-infared aerial photography collected pre- and post-construction will be used to estimate land/water ratios and changes in marsh loss/gain in the project. Marsh loss/gain will be compared between pre- and post-construction in the project area and between project and reference areas.

   Goal: 1) Evaluate changes in Land:Water ratios.

2. Shoreline survey: Shoreline erosion rates will be evaluated by comparing the shoreline position between pre- and post-construction in the project and reference areas.

   Goal: 2) Evaluate rate of erosion along the eastern shoreline of Grand Lake and western shoreline of Collicon Lake.

3. Terrace Vegetation: To determine if marsh vegetation has been established and maintained or increased, we will use ANOVA to compare % occurrence and % cover of vegetation species.

   Goals: 3) Evaluate establishment of emergent vegetation on planted terraces.

   Hypotheses:

   H_o: Mean % occurrence and mean % cover of marsh vegetation species on planted terraces after construction will not be significantly greater at time *i* than mean % occurrence and mean % cover of marsh vegetation species at the time of project construction.

   H_a: Mean % occurrence and mean % cover of marsh vegetation species on planted terraces after construction at time *i* will be significantly greater than mean % occurrence and mean % cover of marsh vegetation species at the time of project construction

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4. In order to evaluate the accumulation (or erosion) of sediments between project features and the existing vegetated shoreline, data will be collected using a three dimensional GIS grid, and a volumetric difference of the sediments will be evaluated between years 2003 (being start of project), 2006, and 2013. Sediment volume will be compared between project and reference sites between years 2003 and 2006, 2006 and 2013, and 2003 and 2013.

   Goal: 4) Evaluate changes in elevation and landscape integrity due to the accumulation and erosion of sediments in landbridge areas.

Notes

1.	Proposed Implementation:	Start Construction:	
		Phase I (rock)	July 2003
		Phase II (terraces)	March 2004
		End Construction:	
		Phase I (rock)	November 2003
		Phase II (terraces)	August 2004
2.	USFWS Project Manager:	Darryl Clark	(337) 291-3111
3.	DNR Project Manager:	Ralph Libersat	(225) 342-1952
	DNR Construction/O&M Manager:	Melvin Guidry	(337) 482-0682
	DNR Design Engineer:	Amanda Phillips	(225) 219-0380
	DNR Biological Monitoring Manager:	Christine Thibodeaux	(337) 482-0655
	DNR Ecological Review Manager:	Karim Belhadjali	(225) 342-4123

4. The twenty year monitoring plan development and implementation budget for this project is $186,403. Comprehensive reports will be coordinated with the Mermentau Basin reports scheduled for every three years beginning in 2005, and continuing every three years for the life of the project, in 2008, 2011, 2014, 2017, 2020. These reports will describe the status and effectiveness of the project.

5. Presently, there are insufficient funds to monitor elevation profiles. However, should funds become available over the twenty year project life span this monitoring element will be addressed..

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