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

**Bayou Dupont Marsh and Ridge Creation**
CWPPRA Priority Project List 17
State No. BA-48

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David C. Lindquist
Environmental Section
Planning Division
Office of Coastal Protection and Restoration

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 November 10, 2010.

**ECOLOGICAL REVIEW**
Bayou Dupont Marsh and Ridge Creation

*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 Bayou Dupont Marsh and Ridge Creation (BA-48) project is located in the Barataria Basin approximately 5.2 miles southeast of Lafitte along the south bank of Bayou Dupont (Figure 1). Bayou Dupont is a shallow waterway that flows southeast from Bayou Barataria, a historic distributary of the Mississippi River. This distributary system carried seasonal floodwaters into the basin, where overbank flooding deposited coarser sediments and gradually formed natural levees (or "ridges") parallel to the channels. An 1880 report by the United States Army Corps of Engineers describes the natural levees south of Lafitte as averaging two feet in height with a heavy growth of live oaks (Douglas 1881). However, the distributaries have since been disconnected from seasonal floodwaters and without regular sediment inputs the natural levees, as well as adjacent wetlands, have subsided. Saltwater intrusion, dredging, and wave-driven erosion, have also contributed to the land loss rates in the area, which have been estimated at -1.72% per year (National Marine Fisheries Service [NMFS] 2007). As a result, the project area now comprises 117 acres of brackish marsh and 200 acres of water (NMFS 2007).

The goals of the BA-48 project are to create and nourish approximately 317 acres of brackish marsh through pipeline delivery of bedload sediment from the Mississippi River, as well as to create approximately 15 acres of ridge habitat (NMFS 2007). This project will re-establish a portion of the Bayou Dupont bankline, partially restoring the function of the historic natural levee as a buffer for interior wetlands and infrastructure. These strategies are consistent with the *Coast 2050* plan, which recommends the dedicated dredging of sediment for wetland creation and the restoration of ridge function as Region 2 ecosystem strategies to restore and sustain wetlands (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority 1999). The project is also consistent with Louisiana's Comprehensive Master Plan for a Sustainable Coast (Coastal Protection and Restoration Authority of Louisiana 2007). Because ridge restoration is a relatively new concept, as compared to marsh creation which has fewer uncertainties, the following review will focus on the ridge creation portion of the BA-48 project.

## II. Project Features (from Coco 2010)

Ridge Creation

- The ridge will be constructed along the south bank of Bayou Dupont using material excavated from the adjacent marsh creation cells.
- The dredged material will be shaped to an initial elevation of +4.5 feet NAVD 88, a crest width of 30 feet, and 1(V):4(H) side slopes. Sandy material pipeline-delivered from the Mississippi River for marsh creation will subsequently be deposited on the marsh-side of the ridge to create a 1(V):20(H) slope from the ridge crest to the created marsh platform.

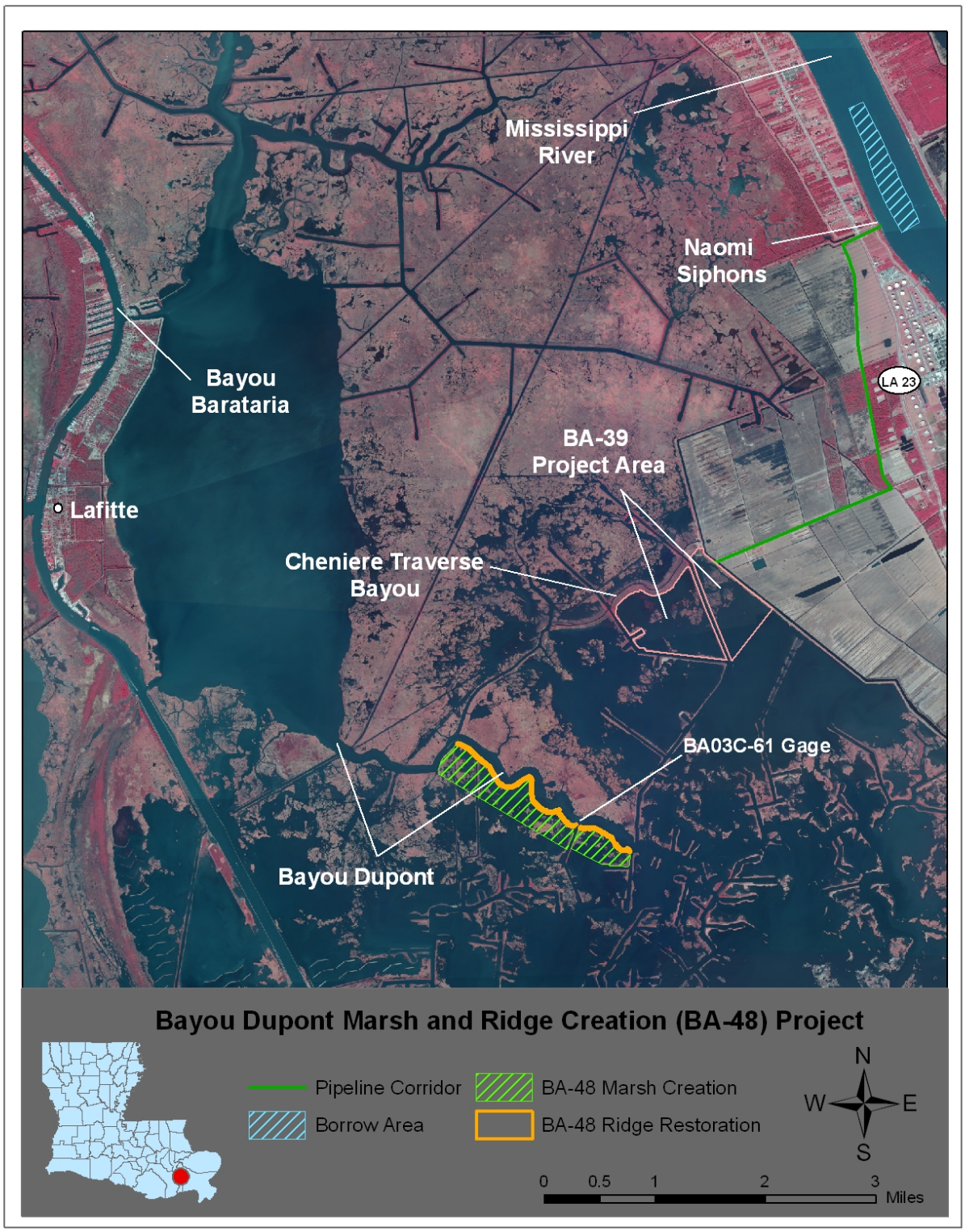


**Figure 1. The Bayou Dupont Marsh and Ridge Creation (BA-48) project area and features.**

- The constructed ridge is projected to settle to approximately +2.5 feet NAVD 88 at year 5 and +1.8 feet NAVD 88 at the end of the 20-year project life (URS Corporation 2009).
- The ridge will be planted with woody and herbaceous species starting one year after construction. In addition, treatment plans will be implemented to prevent the proliferation of invasive Chinese tallow tree (*Triadica sebifera*).

Marsh Creation

- Sediment will be hydraulically-dredged from the same borrow area used for the Mississippi River Sediment Delivery System – Bayou Dupont (BA-39) project. The BA-48 project will also utilize the BA-39 pipeline corridor from the Naomi Siphons to the Plaquemines Parish back levee, at which point the pipeline will be extended down existing canals to the BA-48 project area.
- The sediment will be deposited in the project's marsh creation cells to an initial elevation of +3.0 feet NAVD 88, and is projected to settle to an elevation of +1.3 feet NAVD 88 (healthy marsh elevation for the area) approximately five years after construction.
- Containment dikes should degrade naturally; however, they will be breached as needed after construction to return natural hydrology to the created marshes.
- The created marshes will be planted with native vegetation.

## III. Assessment of Goal Attainability

Because ridge restoration is a relatively new concept, the number of prior projects from which useful information can be obtained is limited. The only known example in Louisiana is the maritime ridge that was constructed north of Port Fourchon in the summer of 2004. This project beneficially used dredge material from the port's expansion to create a 400-foot wide ridge/salt marsh corridor with maximum elevations of +8 feet NAVD 88 for the ridge and +1.6 feet NAVD 88 for the marsh platform (Barataria-Terrebonne National Estuary Program 2006). Initial plantings of the ridge were impacted by the 2005 hurricanes and following drought, which permitted soil salinities to remain high and prevented many plantings from becoming established (Barataria-Terrebonne National Estuary Program 2006). Subsequent plantings, however, have been more successful and efforts are continuing to increase vegetative cover and monitor soil and vegetation development.

In addition to the Port Fourchon project, there have been several studies of the vegetation communities of coastal ridges and ridge-like features in Louisiana (Monte 1978, Neyland and Meyer 1997, Wall and Darwin 1999, Didier 2007). These studies have found that elevation gradient, and specifically the hydroperiod dictated by the gradient, is the most important factor influencing species composition and diversity. At higher elevations, soils are less inundated, better drained, and more aerated, thus providing suitable conditions for the development of a bottomland forest community that is clearly distinct from adjacent marsh.

Soil and vegetation characteristics were investigated along elevation gradients on the Caminada-Moreau maritime beach ridges (Didier 2007). Elevation was negatively correlated with moisture content, soil salinity, loss on ignition (a measure of the soil organic content), total nitrogen, total phosphorus, and total carbon within the top one foot of the soil; whereas elevation was positively correlated with bulk density and pH (Didier 2007). These results reflect the greater hydroperiod at the lower elevations, where due to the relative lack of oxygen in flooded soils organic matter accumulates rather than decomposes. Vegetation communities were also correlated with elevation on the ridges, i.e., herbaceous marsh species dominated the lower, more frequently-inundated elevations; whereas shrubs and trees (e.g., marsh elder (*Iva frutescens*), yaupon (*Ilex vomitoria*), and live oak (*Quercus virginiana*)) were primarily found at higher

elevations (Didier 2007). Live oak, in particular, occurred at an average elevation of +1.6 feet NAVD 88. However, considering that this elevation is near local mean high water, these trees likely represent relict, unsustainable stands. High soil salinities are more harmful to live oak seedlings than mature trees, and without regeneration this species will disappear from the Caminada-Moreau ridges after the mature trees succumb (Williams et al. 1999).

Similar relationships between elevation and vegetation were observed during a study of spoil banks along Bayou Lafourche (Monte 1978). This study found that an elevation increase of as little as one foot above local marsh elevation was enough to promote conditions suitable for bottomland forest vegetation. Furthermore, surveys of spoil banks of various ages suggested that a community shift from herbaceous-dominated to shrub and tree-dominated occurred with time, and that this succession occurred at a faster rate in freshwater environments than in more saline environments (Monte 1978). Slower succession in brackish and saline environments may have been due to the need for excess salts to leach from the dredged soils before non-halophyte plants could colonize. A more recent assessment revealed that many of the former tree-dominated banks reverted to herbaceous-dominated communities. Spoil banks that still supported trees were either in freshwater habitats or were the higher elevation (initially 5.5-6.0 feet above marsh level) brackish and saline banks. This suggests that as the banks subsided trees were eliminated by increased soil salinities.

The vegetation community of the BA-48 ridge should develop much like the spoil banks studied by Monte (1978). The marsh soils that will predominantly comprise the ridge are similarly fine-grained and organic and, therefore, should have sufficient nutrients and moisture retention to facilitate rapid plant establishment and development (Broome et al. 1988). Oxidation of the organics may initially lower soil pH to detrimental levels; however, the pH should stabilize and rebound within one to two years post-construction (Monte 1978). After soil conditions moderate, herbaceous species and then wetland shrubs should rapidly colonize the ridge considering propagules of these plants are abundant in the surrounding habitats. By comparison, seeds of desirable bottomland tree species are less abundant locally, and as a result it could take 15 to 20 years for extensive tree cover to develop on the ridge given favorable environmental conditions (Monte 1978). Under these circumstances, the proposed vegetative plantings should help expedite natural succession, as well as help protect the ridge from erosion during the first few years after construction.

Compared with most of the spoil banks studied by Monte (1978), the BA-48 ridge will be relatively low in elevation and thus more exposed to the local hydroperiod. Consequently, the capacity of the ridge to support tree development will be largely dependent on local salinities. Seedlings of live oak and hackberry (*Celtis laevigata*) have the ability to survive temporary exposure to salinities greater than 5 ppt provided the soils are subsequently flushed with freshwater; however, they are unlikely to survive frequent, repeated exposure to such conditions (Williams et al. 1998, Williams et al. 1999). Based on recent hydrologic conditions, soils in the upper one foot of the BA-48 ridge, which approximates the root zone, would be frequently inundated with tidal water for much of the project life (Figure 2). While the frequency of inundation may cause occasional waterlogging stress, the salinities do not appear detrimental to seedling survival and growth, except possibly during 2006 when salinities remained around 10 ppt throughout most of the year. Once trees become established and mature they should be able to tolerate such high salinity events, though in general lower salinities should be maintained to ensure that trees persist for as long as the ridge remains an elevated feature, at which point the trees will succumb to the effects of increased soil waterlogging.

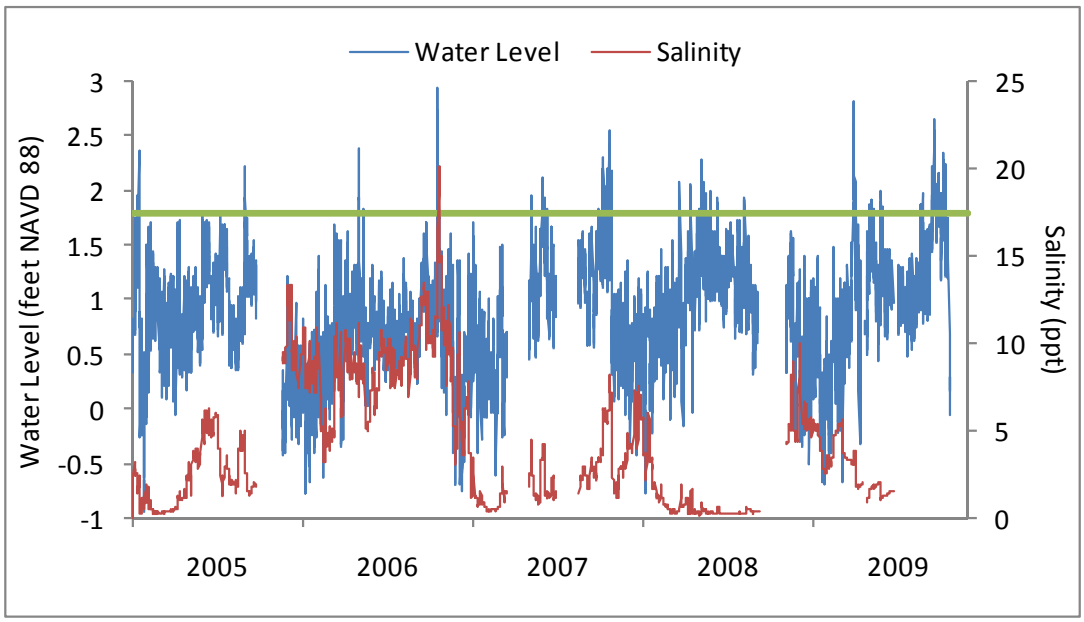


**Figure 2. Water level and salinity data from the nearby BA03C-61 gage for the years 2005 to 2009. The green line depicts the projected crest elevation of the BA-48 ridge (approx. +1.8 feet NAVD 88) at the end of the 20-year project life.**

Because of the environmental conditions, the BA-48 ridge is likely to develop a scrub-shrub community dominated by flood- and salt-tolerant shrubs such as marsh elder and groundselbush (*Baccharis halimifolia*) with scattered trees on the highest elevations. Such a ridge, however, should provide greater habitat diversity, which would support a corresponding diversity of local wildlife. Migratory birds, in fact, selected scrub-shrub over more available habitats on Horn Island, Mississippi, possibly due to the combination of abundant food resources and refuge from predators (Moore et al. 1990). In addition to the habitat that will be created, the BA-48 ridge, combined with the marsh creation platforms, will help prevent the continuing coalescence of the bayou with adjacent water bodies, re-establish the bayou's bankline, and thus restore the natural hydrology of the area. Interior wetlands will also be protected from increased erosion due to tidal scour and wave action.

## IV. Recommendations

Based on the evaluation of available ecological, geological, and engineering information, and a review of scientific literature and similar restoration projects, the proposed strategies of the Bayou Dupont Marsh and Ridge Creation (BA-48) project will likely achieve the desired ecological goals. At this time, it is recommended that this project be considered for Phase 2 authorization. However, it is recommended that ridge soil conditions be monitored following construction to ensure that soil salinities and pH are suitable for planting.

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