

95% DESIGN REVIEW  
DESIGN REPORT  
TE-46 WEST LAKE BOUDREAUX  
TERREBONNE PARISH, LOUISIANA

## **INTRODUCTION**

The TE-46 West Lake Boudreaux project was approved relative to the eleventh CWPPRA Priority List. The United States Fish and Wildlife Service (USFW) is the federal sponsor for this project and the Louisiana Department of Natural Resources (DNR) is the local sponsor.

The objective of this project is to protect critically eroding portions of the western bank of Lake Boudreaux and provide marsh creation within the existing marsh interior. The phase 0 proposed project protection consisted of a rock shoreline structure and contained dredge fill as marsh creation. The phase 0 proposed protected shoreline reach length was approximately two miles long and the created marsh area is approximately 124 acres.

Design surveys were performed through out the project area. NRCS performed shoreline surveys for the rock structure. PENSCO (DNR A/E) performed the marsh creation surveys that extended to the lake shoreline.

From the survey data; the rock dike and the marsh creation containment alignments were determined. A geotechnical investigation was performed along these alignments with soil borings taken at approximately 1000' intervals.

The design is primarily based on the geotechnical investigation/analysis, predicted subsidence rates, the Shore Protection Manual incorporating usage of the ACES program, EM 1110-2-5027 and historical knowledge of existing similar projects.

### **Recommendation of project features:**

It is recommended that the shore line protection feature be a foreshore rock dike. It is recommended that the marsh creation be fully contained. See the remaining sections for supporting documents.

### **Phase 0 Approved Projects vs. Designed Project:**

There are no significant feature changes for this project from the Phase 0 approved project. The proposed Phase 0 interior plugs are located in the area where marsh creation will now be placed due to erosion that has occurred since the project was authorized. Therefore, the interior plugs have been eliminated from the project. The marsh creation area has been increased from 124 acres to 284 acres.

### **Design Surveys:**

Design surveys have been completed and are included in this report. The NRCS surveys were completed using GPS Receivers operating in RTK (Real-Time Kinematic) mode. See the Design Surveys section of this report for the NRCS survey report and the PENSCO/ DNR survey report.

### **Construction Drawings:**

95% preliminary construction drawings have been completed and are included as attachments in this report.

### **Pipeline Investigations:**

Magnetometer surveys have been completed. The magnetometer survey is included in the PENSCO/DNR survey report. See **Construction Drawings** for all other established pipeline information.

### **Geotechnical Investigation and Analysis:**

Geotechnical investigation and analyses have been performed. The geotechnical report is included in this report.

The report consists of analyses of settlement and stability for a rock dike, composite light weight aggregate dike, containment dike for marsh creation and the settlement/consolidation of created marsh.

From cost comparisons of a rock dike vs. composite light weight aggregate dike it was determined that a rock dike was the most economical shore line treatment.

Due to the varying soil properties the northern segment of the rock dike will have a 2 1/2H:1V side slope. The central and southern segments of dike will have a 2H:1V side slope; see the **Construction Drawings** for location and details.

Additional geotechnical analyses have been performed to determine the behavioral characteristics of the marsh creation borrow material and evaluate the stability of an increased containment dike height. The analyses of the borrow material will be used to more accurately determine the borrow volume to slurry fill volume ratio and self weight consolidation of the slurry fill. This additional analysis was done by use of a column settling test and such test data as recommended in the US Army Corps of Engineers, EM 1110-2-5027, Confined Disposal of Dredged Material.

The results from the additional geotechnical analyses indicate that the borrow material has a calculated Bulking Factor between 1.82 and 1.94 depending on the depth of cut in the borrow area. These bulking factors were determined from a 15 day retention time in the column settling test device.

Two models developed by ERDC were used to evaluate the data obtained from the column settling test and associated self weight consolidation test. The in-situ borrow quantities were determined for the marsh creation fill requirements using the data output from the models and by ratio and proportion. See the Addendum report for a full discussion and data.

The results of the stability analysis of the containment dike indicate that a seven foot high dike will be stable on 3H:1V side slopes with geotextile reinforcement.

## **Rock Dike Section Design**

The geotechnical design section for the rock dike has been evaluated for structural stability relative to wave impacts. A design 70 MPH wind was compared to LA DNR/NRCS (January 7, 2000) guideline criteria. These guidelines governed the rock section geometry and gradation requirements. The side slope generated by the geotech analysis with a 3.0' top width set at an elevation of 3.5' NAVD 88 was determined to be adequate. See the construction drawings for typical sections.

## **Marsh Creation Design**

The desired target marsh creation height at 20 years post construction was determined to be 1.3' NAVD 88 during the 30% design phase for this project. This was determined by project team members comprised of LA DNR, USFWS and NRCS.

The settlement curves as shown in the first geotech report (posted for the 30% review meeting) plus a subsidence rate of 0.7'/20 years and bulking factor of 1.5 were used to establish the fill height of dredge material for the marsh creation. The initial fill height is set at 3.2' NAVD 88 to achieve the desired 20 year marsh elevation. A shrinkage factor of 30% for the newly placed dredge fill was used in the geotech report that was posted for the 30% design review.

Upon receiving the final supplemental Addendum report from the column settling test, additional information is available relative to self weight consolidation (shrinkage). The proposed fill height of 3.2 feet NAVD 88 as presented in the Addendum report indicates the 20 year settled height will be approximately 0.8 feet NAVD 88 rather than 1.3 feet as was estimated during the 30% design. Due to delays caused by Hurricane Katrina the Addendum report was not received until October 21, 2005. Therefore, coordination has not been possible between the project team to consider this discrepancy and make a decision on the possibility of increasing the fill height to achieve the target height of 1.3 feet or an alternate target height. The fill height and borrow quantities will be adjusted to reflect the information presented in the Addendum report if the project team determines it is reasonable and feasible to increase the fill height within the containment areas.

See the Addendum report Table 8 for approximate fill sediment height elevations and associated 20 year target elevations. The information in Table 8 is calculated as if the dredge fill is placed in one large 284 acre containment area and is approximate for our project. Table 9 provides dredging data relative to dredge placement in each individual containment area (as is the case for our project) with a 20 year target elevation of 1.3 feet NAVD 88. By ratio and proportion of the data presented in these two tables the in-situ borrow quantities, dredge time, fill height and 20 year target height can be closely approximated for a range of fill heights.

The containment dike alignment was developed as to fully contain the dredge fill material.

See the construction drawings and geotech reports for more detail and information.

## **Earthen Containment Dike Design**

As stated in the Geotechnical Investigation and Analysis section above, the earthen containment dike stability design is as recommended in the supplemental Addendum geotechnical report.

The material to construct the containment dikes that are not adjacent to the rock dike will be borrowed from the marsh creation area interior. The material to construct the containment dikes that are adjacent to the rock dike will be borrowed from the access flotation channel.

An analysis was performed with the ACES program to determine the minimum free board required for the containment dike constructed to an elevation of +6.0 feet NAVD 88. A free board of 1.5 feet was determined to be conservative to prevent overtopping of the containment dike for both an average peak gust wind of 54.25 MPH and the 90 percentile wind of 26.8 MPH.

With a minimum free board of 1.5 feet, the obtainable ponding depths for solids retention are as follows:

Ponding depth = 2.0 feet for fill heights up to 2.5 feet NAVD 88 (based on the 54.25 MPH wind).

Ponding depth = 1.5 feet for fill heights up to 3.0 feet NAVD 88 (based on the 54.25 MPH wind).

Ponding depth = 1.0 feet for fill heights up to 3.5 feet NAVD 88 (based on the 54.25 MPH wind; a ponding depth of 1.5 can be maintained here for a 26.8 MPH wind).

The ponding depths are based on the minimum depth of water over the newly placed dredged slurry. There will be zones within each containment area that have not been filled throughout the construction performance time yielding ponding depths in excess of those listed above. This will allow for additional retention time of the effluent in turn reducing the concentration of solids in the effluent. The EM 1110-2-5027 recommends a minimum ponding depth of 2.0 feet. In our case this will be achieved for most of the dredge fill placement considering the additional zones not filled as stated above. For the time period that the ponding depth is less than 2.0 feet, the effluent will have somewhat greater solids concentration than that of the deeper ponding depth. However, the discharge control structures will be located along the western perimeter of the containment areas. Any discharge of solids rich effluent is considered to be marsh nourishment within this western area between the marsh creation areas and the inland/back bay shoreline.

The information contained in the Addendum report indicates that a ponding depth of 1.0 feet is sufficient to maintain an effluent concentration of 2g/L. At the end of construction the freeboard and ponding depth can be relaxed to 0.7 feet and 0.5 feet respectively if a dredge fill height greater than 3.5 is selected so as to achieve a 20 year target height greater than 0.8 feet NAVD 88.

#### **Borrow Area for Marsh Creation Fill Material**

The borrow material required for the marsh creation will be obtained from the borrow site shown on the construction drawings. The average depth of cut below the existing

lake bottom in this area is approximately 15.0 feet, which equates to an elevation of -20 feet NAVD88. This material is represented by composite sample no. 2 as discussed in the Addendum Report.

Information provided by the USFWS relative to observations of other excavations within Lake Boudreaux indicate that the borrow pit will fill with sediments in a short period of time.

**Modeling Report:**

Modeling is not applicable for this project.

**Ecological Review:**

See the ecological review section that follows in this report.

**Land Ownership Investigation:**

The land ownership process has been started. See the land ownership section that follows in this report for a Land Ownership Map, a Pipeline and Well Map, and a text document providing land ownership, pipeline, and oyster lease information.

**Preliminary Cultural Resources Assessment:**

A cultural resources assessment has been performed. See the cultural resources assessment section that follows in this report.

**Oyster Leases:**

See the oyster leases review section that follows in this report.

**Revised Project Construction Cost Estimate:**

The revised construction cost estimate with 25% contingency is **\$11,271,563**.