Preliminary (30%) Design Report April 2012

Bayou Bonfouca Marsh Creation Project

St. Tammany Parish, Louisiana

PO-104

Louisiana Coastal Protection and Restoration Authority

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Bayou Bonfouca Marsh Creation (PO-104)
Preliminary Design Report

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1.0 INTRODUCTION

The Bayou Bonfouca Marsh Creation Project (PO-104) is located in the Lake Pontchartrain Basin along the northeastern corner of Lake Pontchartrain as shown in Figure 1. The Louisiana Coastal Wetlands Planning, Protection and Restoration Task Force designated PO-104 as part of the 20th Priority Project List. The United States Fish and Wildlife Service (USFWS) was designated as the lead federal sponsor with funding approved through the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) of 1990 by the United States Congress and the Wetlands Conservation Trust Fund by the State of Louisiana. The Louisiana Coastal Protection and Restoration Authority (CPRA) is serving as the local sponsor and will also be providing engineering and design services.

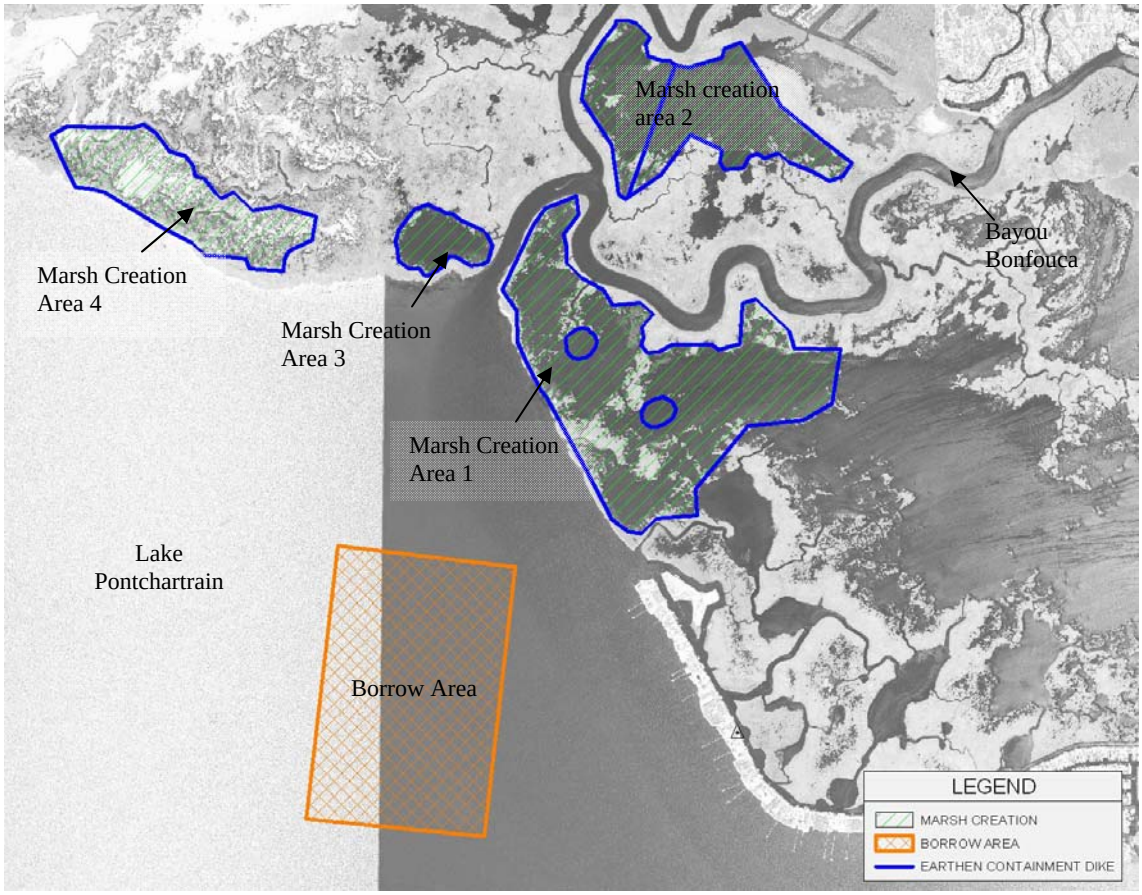

Figure 1 – Project Layout

The primary goal of PO-104 is to re-create and nourish approximately 639 acres of low salinity brackish marsh in open waters adjacent to Bayou Bonfouca with sediment dredged from Lake Pontchartrain.

The poor condition of this marsh is due to a combination of subsidence, hurricanes causing interior ponding, shoreline erosion. Although the shoreline erosion rates are relatively low, only a narrow strip of shoreline currently exists between Lake

Pontchartrain and the interior ponds. Several breaches are known to exist along the shoreline. Should shoreline breaching and enlargement of tidal channels allow high tidal energy to intrude into the interior ponds of the project area, the interior marshes will experience accelerated loss rates. Restoration of the marsh adjacent to Lake Pontchartrain would provide vital protection to the interior marsh to the north.

The project team, consisting of members of USFWS, CPRA, St. Tammany Parish Government, and Big Branch Marsh National Wildlife Refuge, performed an on-site kick-off meeting on April 21, 2011. Based on that meeting, a plan was developed to identify and address all of the project requirements. The engineering and design, environmental compliance, real estate negotiations, operation/maintenance planning, and cultural resources investigation have been completed to the preliminary (30%) design level as required by the CWPPRA Standard Operating Procedures.

2.0 EXISTING CONDITIONS

2.1 Tidal Conditions

Tidal variations can be considered as being comprised of periodic and apparent secular trends. In order to evaluate these variations, a specific 18.6-year period based upon the Metonic Cycle should be selected so that all tidal datum determinations will have a common reference period. This period is termed a tidal epoch. Unfortunately, Hurricane

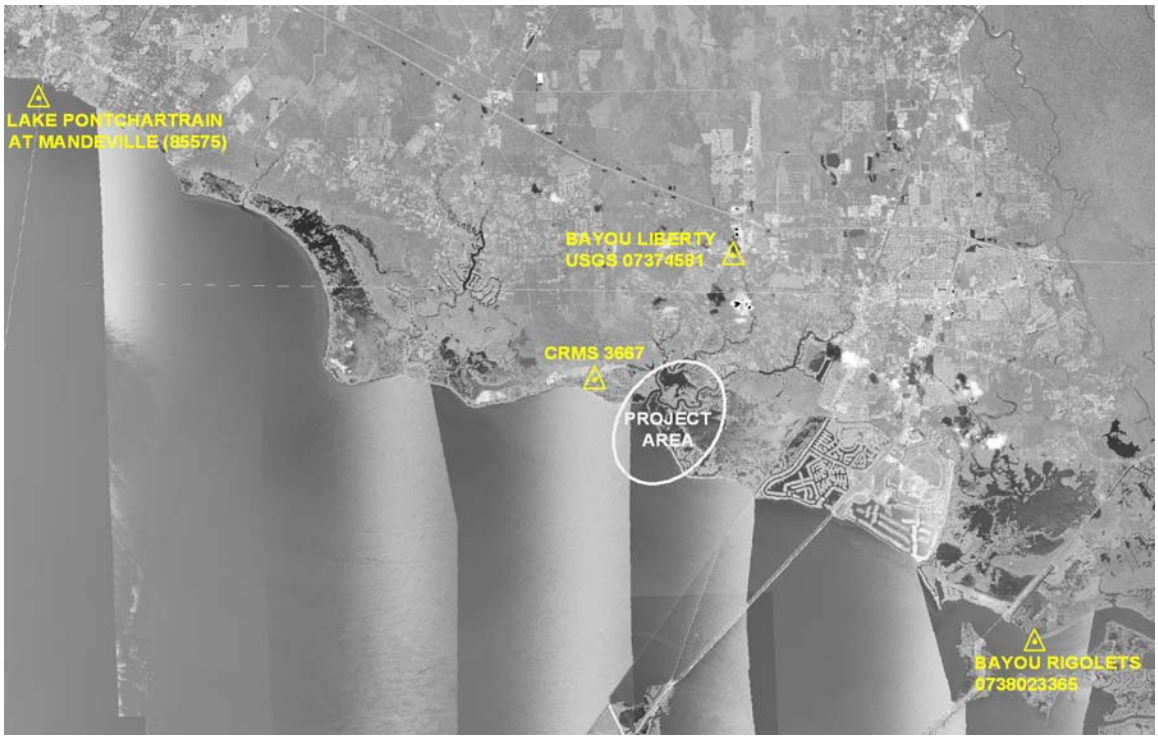

Figure 2: Gage Locations

Katrina destroyed all tidal gages in Lake Pontchartrain; therefore, obtaining a continuous up-to-date tidal epoch in the area was not possible. Data from 4 gages was evaluated for calculation of Mean High Water (MHW) and Mean Low Water (MLW). The gage locations are shown in figure 2. They were the United States Geological Survey (USGS) stations at Bayou Rigolets #0738023365 and Bayou Liberty #07374581, CPRA's Coastwide Reference Monitoring Station (CRMS) 3667, and the United States Army Corps of Engineers (USACE) Mandeville gage 85575. The Grand Isle gage is the closest gage that contains a continuous epoch. However, its large tidal ranges would skew the local tidal data in the Bonfouca project area. Therefore, no techniques to standardize the data such as the Range-Ratio method were utilized. A summary of the MHW and MLW levels, adjusted to NAVD 88, for each of the four gages mentioned above is shown in table 1.

Table 1: Tidal Gage Data

Gage	Date Range	MHW (ft)	MLW (ft)
Bayou Rigolets USGS 0738023365	10/94 - 8/05	1.19	0.23
Bayou Liberty USGS 07374581	1/01 - 10/11	1.31	0.64
Lake Pontchartrain-Mandeville USACE 85575	1/95 - 9/11	0.92	0.37
CRMS 3667	1/07 - 12/10	1.07	0.75
(PO- 33) Goose Point Marsh Creation Project	NA	1.08*****	0.48*****

***Calculated using the Range-Ratio Method and Grand Isle Gage**

The MHW and MLW levels shown in Table 1 demonstrate the tidal variability near the project area. This variability is believed to be related to the gages' location and hydraulic connectivity to the more dynamic Gulf system. The larger ranges occur in areas governed by Gulf tides while the lowest range occurs at the CRMS 3667 gage which is located in the interior marsh. The average MHW and MLW of the four sites is 1.1 feet and 0.5 feet respectively. These values are similar to the values calculated for the PO-33 Goose Point Marsh Creation Project located immediately to the west of this project.

To demonstrate the effects of location on the various tidal gages, a comparison of the tidal heights between the Bayou Rigolets and Bayou Liberty gages during the 48- hour period of October 17 & 18, 2007 is shown in Figure 3. A large difference in amplitude and a tidal lag exists between the two gages. The Bayou Rigolets gage is located in between Lakes Borgne and Pontchartrain and are very tidally influenced. In contrast, the Bayou Liberty gage is located farther away and, therefore, is less controlled by the shifting of the tides.

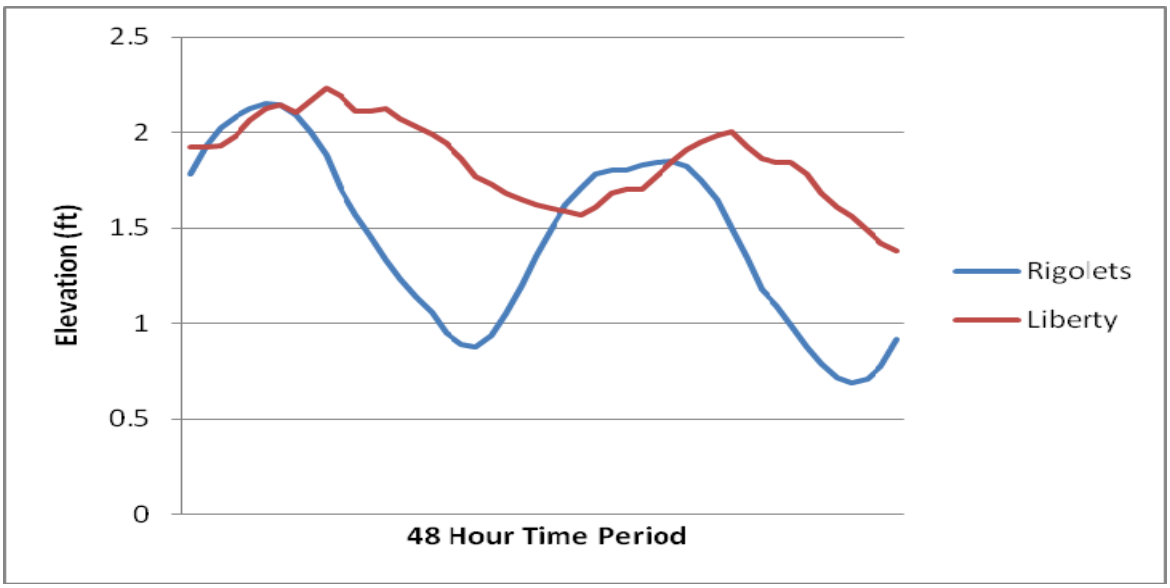

Figure 3: Comparison of Bayous Rigolets and Liberty's tidal graphs

2.2 Winds

Wind data was analyzed from 3 stations around Lake Pontchartrain, including New Orleans Lakefront Airport (KNEW) from 1996-2011, Slidell Airport (KASD) from 1999-2010, Louis Armstrong New Orleans International Airport (KMSY) from 1996-2011. All 3 wind roses, located in Appendix H, show the maximum wind speeds coming from the north and south directions, with some additional strong winds coming from the

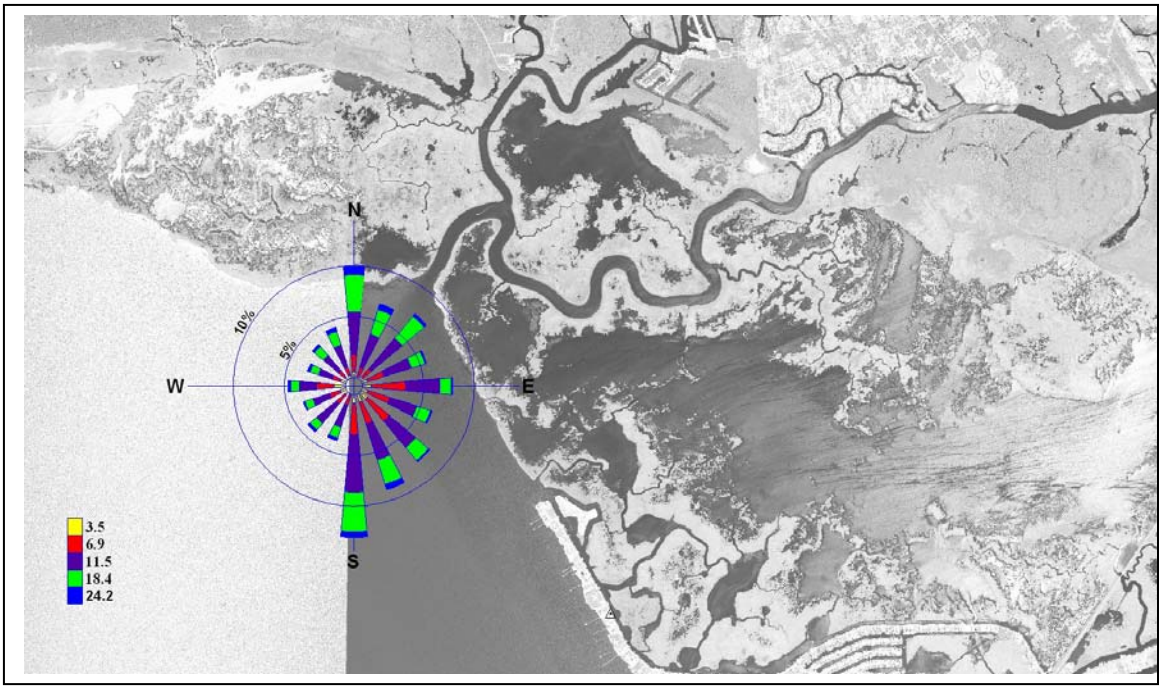

Figure 4: Louis Armstrong Airport Wind Rose

southeast direction. Figure 4 shows how the west and southwest directions, which represent the largest fetch, have some of the lower wind speeds. The maximum wind speed recorded was 69 mph at the Slidell Airport station. This wind speed suggests that the upper range of wind speeds is not collected due to instrumentation limitations since the data time period extended through several major hurricanes. The statistical wind speeds will be lower than actual due to the missing wind data. Based on a statistical analysis of the available hourly wind data, the 90th percentile wind direction was determined to be 166.8˚ clockwise from north (south-southeast). The wind speed associated with the 90th percentile wind direction was calculated to be 13.8 miles per hour. The 50th percentile wind direction was evaluated to be approximately 170˚ clockwise from north with an associated wind speed of 9.21 miles per hour. In order to capture the effects of an average daily wind on the project site, the 50% wind speed was used to develop the wave analysis below.

The percentile wind speeds for all these stations were calculated and determined to be consistent as shown in Tables 2 through 4 below.

DEGREES FROM TRUE NORTH

	130-150	160-180	190-210	220-240	250-280
% Less Than	Wind Speed mi/hr	Wind Speed mi/hr	Wind Speed mi/hr	Wind Speed mi/hr	Wind Speed mi/hr
100(max)	69.06	33.38	32.23	24.17	26.47
95	14.96	17.27	13.81	11.51	12.66
90	13.81	14.96	12.66	10.36	11.51
75	11.51	11.51	10.36	8.06	9.21
50	8.06	9.21	8.06	6.91	6.91
25	5.76	6.91	5.76	4.60	4.60

Table 2: Slidell Airport- KASD (Slidell, LA) -- Wind Data (1999-2010)

DEGREES FROM TRUE NORTH

	130-150	160-180	190-210	220-240	250-280
% Less Than	Wind Speed mi/hr	Wind Speed mi/hr	Wind Speed mi/hr	Wind Speed mi/hr	Wind Speed mi/hr
100(max)	35.68	40.29	35.68	32.23	37.98
95	17.27	18.42	19.57	17.27	20.79
90	14.96	16.11	17.27	14.96	17.27
75	11.51	11.51	12.66	11.51	12.66
50	8.06	8.06	9.21	9.21	9.21
25	5.76	5.76	5.76	6.91	5.76

Table 3: New Orleans Lakefront Airport- KNEW (New Orleans, LA – Wind Data (1996-2011)

DEGREES FROM TRUE NORTH

	130-150	160-180	190-210	220-240	250-280
% Less Than	Wind Speed mi/hr	Wind Speed mi/hr	Wind Speed mi/hr	Wind Speed mi/hr	Wind Speed mi/hr
100(max)	29.93	31.08	37.98	29.93	40.29
95	16.11	18.42	17.27	14.96	17.27
90	13.81	16.11	14.96	12.66	13.81
75	10.36	12.66	11.51	10.36	10.36
50	8.06	9.21	9.21	8.06	6.91
25	5.76	5.76	6.91	5.76	4.60

Table 4: Louis Armstrong New Orleans International Airport- KMSY (Kenner, LA) Wind Data (1996-2011)

2.3 Waves

Three wave generating scenarios were analyzed as shown in Table 5. The wind across the longest fetch was evaluated using the 50th percentile winds at 260^{o} clockwise from north. The direction of fetch associated with the 90th percentile winds was evaluated using both the 50th and 90th percentile wind speeds. The U.S. Army Corps of Engineers Coastal Engineering Manual (USACE CEM) was utilized to develop the deep water wave height for all three scenarios.

The maximum height to which a wave will run up onto the shoreline can be estimated taking the sum of the setup, mean high water level and the wave height at a point near the shoreline. This number is identified in Table 5 as absolute wave height. For a conservative estimate the wave height at the -0.1ft contour was used.

Table 5: Calculated Wave Heights using Slidell Airport Data

Wind Direction (TN)	Wind Speed (MPH)	Wave Height (H) ft	Absolute Wave Height (H + setup + MHW) ft
260^{o}	8.06 (50%)	0.34	1.59
170^{o}	9.21 (50%)	0.49	1.69
170^{o}	20.2 (90%)	1.1	1.99

As shown in Figure 1, this project requires dredging of a borrow area approximately 3,000 feet from the existing shoreline. As part of the borrow area impact analysis, the numerical model SWAN (**S**imulating **WA**ves **N**earshore) was used to assess both existing and post-dredge wave environments. SWAN is a spectral, two-dimensional wave generation and transformation model. Coast and Harbor Engineering, Inc. (CHE) performed this task for CPRA. Technical information regarding the SWAN modeling is available in Appendix C.

The input conditions for the CHE numerical wave model were developed in coordination with CPRA for a total of 8 different scenarios, which are summarized in Table 6. The conditions consisted of the existing and dredged bathymetry scenarios, two water levels – mean high water (MHW) and mean low water (MLW), and the 50th percentile wind

speed for two directions - 170° and 260° from true north (from nearby wind gages). Wave heights were then extracted at 3 points from the SWAN results to quantify the change in magnitude of the wave heights near the shoreline.

Table 6: Scenarios for SWAN Input Conditions

Wind Direction (TN)	Wind Speed (MPH)	Water level	Bathymetry Condition
260°	8.06	MHW	Existing
260°	8.06	MHW	Dredged
260°	8.06	MLW	Existing
260°	8.06	MLW	Dredged
170°	9.21	MHW	Existing
170°	9.21	MHW	Dredged
170°	9.21	MLW	Existing
170°	9.21	MLW	Dredged

Modeling showed that the excavation of the borrow area did not increase wave energy in any appreciable amount at the existing shoreline. The direction of waves around the edges of the borrow area are slightly changed due to wave refraction, but the magnitude of change is small. The maximum increase in wave height occurred at MLW for both wind directions analyzed, which resulted in only a 1 cm increase in wave height (~2% increase). The magnitude of change in wave heights computed by SWAN is determined to be insignificant due to the relative accuracy of bathymetry measuring instruments and

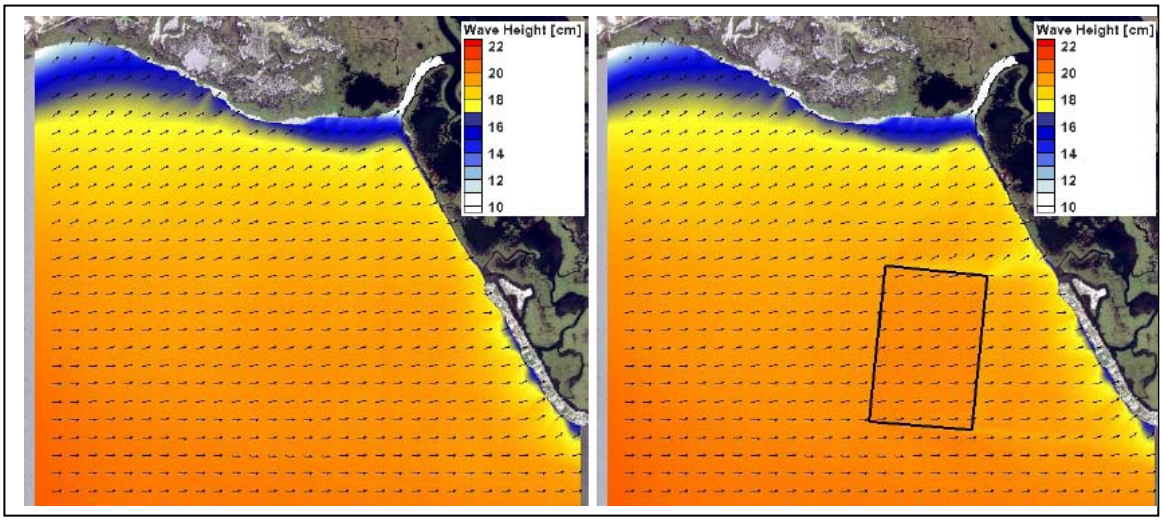

Figure 5: Wave Heights computed by SWAN for runs at MLW and 8.06 MPH winds from 260° for (a) existing and (b) dredged bathymetry conditions

within the natural variability of waves at the project site. Figures 7a and 7b show the predicted wave heights and set up with and without the excavation of the borrow area. The small magnitude of change is not expected to cause any significant shift in the existing morphological conditions at the project site.

When added to the MHW of 1.1 feet, the wave heights without excavation of the borrow area, 0.56 feet (17cm) = 1.66 feet, are consistent with the heights calculated using the USACE CEM.

3.0 SURVEYS

3.1 Topographic, Bathymetric and Magnetometer Surveys

C & C Technologies, Inc. performed the surveys of the borrow area, marsh creation areas and pipeline corridor from August 11, 2011 through October 11, 2011. Elevations were

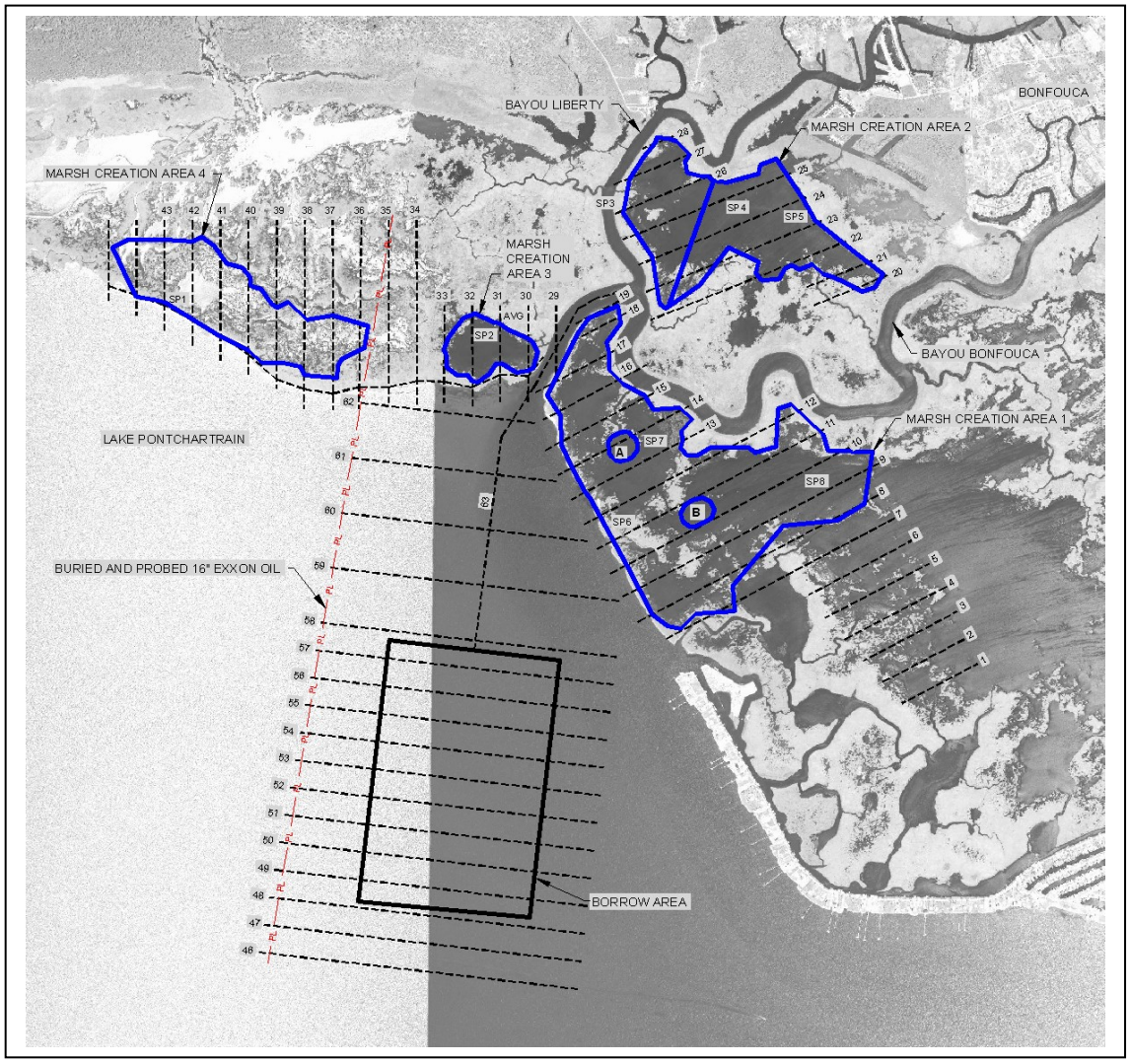

Figure 6: Survey Transect locations

obtained at twenty five foot (25') intervals (approx.) along the prescribed transects as shown in Figure 8.

The hydrographic and magnetometer survey was conducted utilizing C-Nav differentially corrected GPS, Winfrog navigation software, single beam fathometer and cesium

magnetometer to collect data on designated transects. Top of water elevations were recorded utilizing RTK GPS each day and compared to the local tide gage Bayou Bonfouca, Route 433, LA Station Id: 8761473. The magnetometer was towed at the stern of the vessel. The magnetometer dataset was collected at a sampling rate of 10 Hz and a very high sensitivity of less than 0.1 gammas.

The magnetometer identified 218 magnetic anomalies within the borrow area and did not correlate to any existing known infrastructure. The magnetic anomalies exhibit amplitudes between 5 and 1,806 gammas and durations between 11 and 93 feet. The amplitude and duration of a magnetic anomaly are dependent on several factors such as the ferromagnetic content of the object, its shape, size, and distance from the sensor. Some of the magnetic anomalies are relatively small (less than 10 gammas) and are likely geologic in origin or noise. The locations of all magnetic anomalies should be taken into consideration during the planned dredging-related activities.

Geophysical operations were conducted by the M/V *C-Star* on August 11 and 12, 2011. Geophysical instruments utilized for the shallow hazards survey included an Edgetech SB-424 Chirp Seismic Profiler (4 to 24 kHz), an Odom Hydrotrac Fathometer, and a Geometrics 882 Cesium Magnetometer. Survey vessel positioning was accomplished using Leica Geosystems' SmartNet real-time kinematic (RTK) GPS and provided RTK positions in real time with centimeter accuracy. In addition, C & C Technologies' C-NAV® L-Band globally corrected differential GPS (DGPS) was employed as a secondary positioning system and provided DGPS positions in real time with sub-meter accuracy and provided vessel positions if RTK signal was lost.

The subbottom profiler transducer was towed from a davit arm mounted on the bow of the vessel. Chesapeake Technology, Inc.'s SonarWiz.SBP software and Seismic Micro Technology's Kingdom Suite 2d/3d PAK program were used for data collection and interpretation of the subbottom dataset, respectively.

One 16 inch Exxon pipeline was identified in the project area (see Figure 8). The magnetometer records the pipeline as high-amplitude monopole and diopoles.

The uppermost lake floor sediments were recorded by the subbottom profiler as one seismic stratigraphic unit which is continuous throughout the study area. The subbottom profiler records show an area exhibiting chaotic bedding reflections. The acoustically chaotic bedded sediment area is interpreted to consist of reworked coarse-grained sediment (e.g., sandy-silty muds). The limited penetration is potentially due to the chaotic sediments. In addition, the subbottom profiler data is also attenuated by the presence of biogenic gas. Biogenic gas occurs in marsh environments and results from the decay of organic matter. The gas consists of low concentrations of carbon dioxide. The low pressure gas attenuates seismic signals and may reduce the shear strength of the soils where present. Bayou Bonfouca may be providing a source of the organic matter being deposited in the borrow area.

Numerous relic submarine channels were identified throughout the project area. The subbottom profiler records show the relic submarine channels as dipping reflectors with an infill of high amplitude reflections. These high amplitude reflections suggest the channel fill is coarser sediment than the surrounding sediment and underlying channel. The relic submarine channels occur just below the mudline with associated thalwegs depths ranging from 1 to 4 feet below the lakefloor.

3.2 Healthy Marsh Elevation Survey

Elevations from survey transects that appeared to have healthy marsh were utilized to determine an average elevation of healthy marsh. Additionally, elevations were collected from an area that appeared healthy but lacked transects data. This data was combined with the healthy marsh transects to calculate an average elevation of healthy marsh as shown in Table 7 below. The average of all sites is 0.94 ft which is consistent with healthy marsh elevation of the neighboring Goose Point (PO-33) Project. The location of the healthy marsh elevation survey is shown in the preliminary design drawings in Appendix F.

Table 7: Healthy Marsh Elevations

Location	Avg. Elev. (ft)
Transect 17	1.14
Transect 16	0.90
Transect 24	0.91
General Marsh Survey	0.80
Average	**0.94**

3.3 Survey Control Monument

The secondary monument 876 1534 B TIDAL is located to the east of the project site and was utilized as a control for the project. It is located near Carr Drive at coordinates 30°13’44.3989 N, 089°51’05.24823 W. A static GPS session was performed at the monument site during each day. The information was then downloaded into the NOAA Online Positioning User Service (OPUS) to confirm the elevation of the monument. The data sheet for the monument is located in Appendix A.

4.0 GEOTECHNICAL ANALYSIS

In order to determine the suitability and physical characteristics of the soils in the PO-104 project area, a geotechnical investigation and analysis was conducted by GeoEngineers Inc. GeoEngineers Inc. was tasked to collect soil borings, perform laboratory tests to determine soil characteristics, perform stability analysis of proposed containment dikes, calculate the settlement of the proposed containment dikes and marsh creation areas, determine an adequate cut-to-fill ratio for the dredge and fill operations, and to identify positions of the Goose Point Fault.

4.1 Soils Investigation

Soil conditions were evaluated in the marsh creation areas by advancing nine (nine) soil borings to depths ranging from approximately 40 to 60 feet below existing mudline and performing two field vane shear tests at each boring location. Five (5) additional soil borings were advanced to an approximate depth of 20 feet below mudline within the confines of the proposed borrow area. The approximate soil boring locations are shown in Figure 9.

The soil borings were performed in 0.5 to 11.5 feet of water. Samples were collected continuously in the upper 20-feet of the soil and on 5-foot centers thereafter to boring completion depths. The borings were completed between August 30 and September 13, 2011 using pontoon- and marsh buggy-mounted drill rigs. A geologist from GeoEngineers managed the drilling on a full time basis, examined and classified the soils encountered, obtained representative samples, and prepared a log of each borehole. Soil characteristics observed during drilling and laboratory test results are located on the soil boring logs in Appendix D.

After transport to GeoEngineers' soil mechanics laboratory, Shelby tube samples were tested for miniature vane shear strength and removed from their tubes. Laboratory tests included soil compressive strength, moisture content, organic content, grain size anaylysis, specific gravity, consolidation with rebound, and Atterberg limits.

Figure 7 – Soil Borings Locations

4.2 General Geologic Evaluation

Subsurface conditions vary widely across the project area. Generally there is very soft organic clay and peat followed by inorganic clay, silt, or sand. Interface depths vary significantly from boring to boring. In all but two of the borings, medium to stiff clays were encountered within the top 20 feet of the soil profile and continued through the completion depth of the boring, except where interrupted by sand and silt layers. This is consistent with geological maps of the area which place the surface of Pleistocene deposits within 20 feet of the ground surface. Clay samples from soil borings B-2 and B-3 remained very soft through the completion depth of the borings. This may indicate the presence of an ancient channel through the Pleistocene materials which subsequently filled with softer Holocene material.

4.3 Subsidence and Sea Level Rise

To determine a most likely change in sea level over time, CPRA utilized its Louisiana Applied Coastal Engineering and Science (LACES) Division to assist with calculating this value. LACES attempted to bracket this rate by providing a lower and higher value to account for uncertainty. To calculate subsidence LACES used the ranges of subsidence values shown in Figure 10. The figure was created using some of the lowest and highest subsidence rates found in those areas by researchers. The Bayou Bonfouca

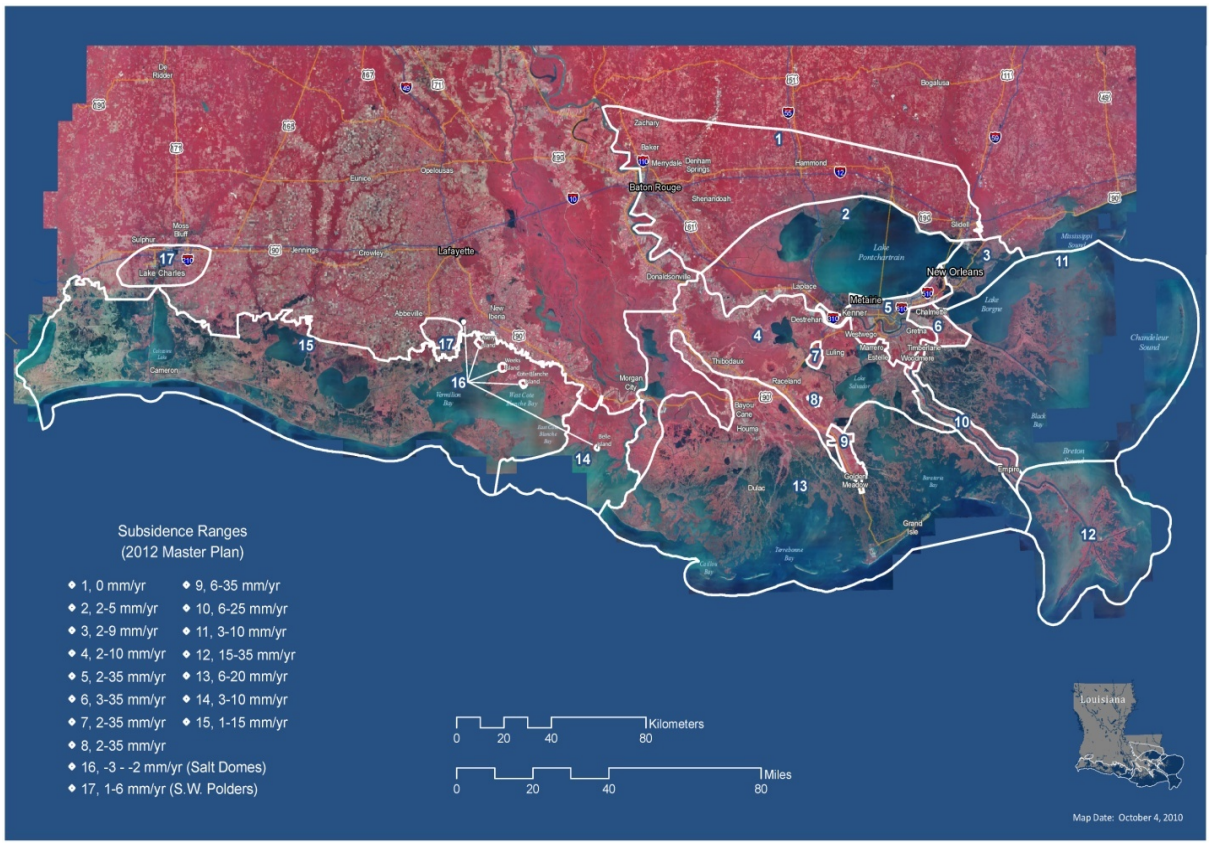

Figure 8: Map of Projected Subsidence Ranges for South Louisiana Generated by the Subsidence Advisory Panel for the Louisiana CPRA Master Plan 2012

area has some of the lowest subsidence rates (2-5mm/yr) seen in coastal Louisiana. The range for possible relative sea-level rise by 2032 calculated by LACES is 0.1304 m – 0.2412 m**.** This equates to a combined subsidence and sea level rise of approximately 5 to 10 inches over the 20 year design life of this project.

The information provided by LACES represents the relative sea level rise (RSLR) that will occur at a specific location and incorporates both Global Sea Level Rise (GSLR) and subsidence. The RSLR was included in the marsh fill settlement analysis as shown in figure 12. However, studies indicate that historic rates of accretion would likely be sufficient to keep up with the predicted RSLR in the area over the project life (Reed et al. 2009).

4.4 Slope Stability Analysis

Slope stability analyses were performed on proposed earthen containment dikes. The slope stability of any embankment or dike has two types of driving forces: (1) the forces induced by the soil weight, and (2) any seepage forces which tend to cause the soil to slide. In response to these driving forces, the subsurface soils have a resistant force in the form of shear strength, which attempts to keep the slope from sliding. Both the driving forces and the resisting forces are dependant on the geometry of the situation: the "Failure Surface". GeoEngineers, Inc. performed stability analyses that compute factors of safety, against potential failure based on limit equilibrium theory.

As evidenced by the soil properties in the boring logs, the Bayou Bonfouca Marsh Creation Project rests over relatively shallow Pleistocene deposits. The close proximity of low-moisture, low-organic content, and over consolidated soils Pleistocene soils typically present in coastal marsh environments ensures good soil stability and low settlement potential for most of the project area. The profiles from two of the soil borings appear to be exceptions. Soil borings B2 and B3 may be in a historical channel in the Pleistocene deposits, and do not appear to share the design benefits afforded to the other soil boring locations. This is especially noticeable in the settlements estimated for these two borings relative to the estimated settlements at all the other locations.

Table 8 shows the results of slope stability calculations based on proposed construction marsh fill elevations. No geo-textile reinforcement was required to attain the factors of safety.

Table 8: Earthen Containment Dike Slope Stability

Soil Boring identification	Proposed Construction Marsh Fill Elevations (ft)	Design Crown Elevation (ft, NAVD 88)	Assumed Foundation Elevation (ft, NAVD 88)	Acceptable Crown Width (ft)	Acceptable Side Slopes	Slope Stability Factor of Safety
B-1	2.5	4.0	0	5	3H:1V	1.84
B-2	3.0	4.0	0	5	3H:1V	1.22
B-3	2.5	5.0	0	5	3H:1V	1.47
B-4	2.5	5.0	-1.5	5	3H:1V	1.13
B-5	2.5	4.0	0	5	3H:1V	2.45
B-6	2.7	4.0	0	5	3H:1V	1.77
B-8	2.7	4.0	-1	1	7H:1V	1.14
B-9	2.7	4.0	-1	5	5H:1V	1.46

In order to minimize potential stability problems during construction of the earthen containment dikes, Construction should be performed in two or more lifts to ensure gentle application of pressure on area soils. Stockpiling of fill material in one location to allow it to dewater will not be allowed, as a large pile of soil with steep slopes could result in bearing failure of the foundation soils.

Two duck ponds have been included for Marsh Creation Area 1, at the request of one of the landowners. A fill differential of only 2 feet was used in calculating the stability of the containment dike for these features. Refer to Section 5.3 for the construction process necessary to limit the fill differential.

4.5 Marsh Fill Settlement Analysis

A settlement analysis was performed to determine the construction fill elevation of the marsh creation area and the total volume of material required to fill the area. The final elevation of the marsh fill (at year twenty) is governed by two forms of settlement: (1) the settlement of the underlying soils in the marsh creation areas caused by the loading exerted by the placement of the dredged material, and (2) the self-weight consolidation of the dredged material (See Figure 11). Data from low pressure consolidation tests were used to calculate the time-rate of settlement of the underlying soils of the marsh creation areas. Self-weight consolidation tests were performed on a composite sample from the borrow area material (borings B-10 through B-14) to determine the consolidation of the dredged material.

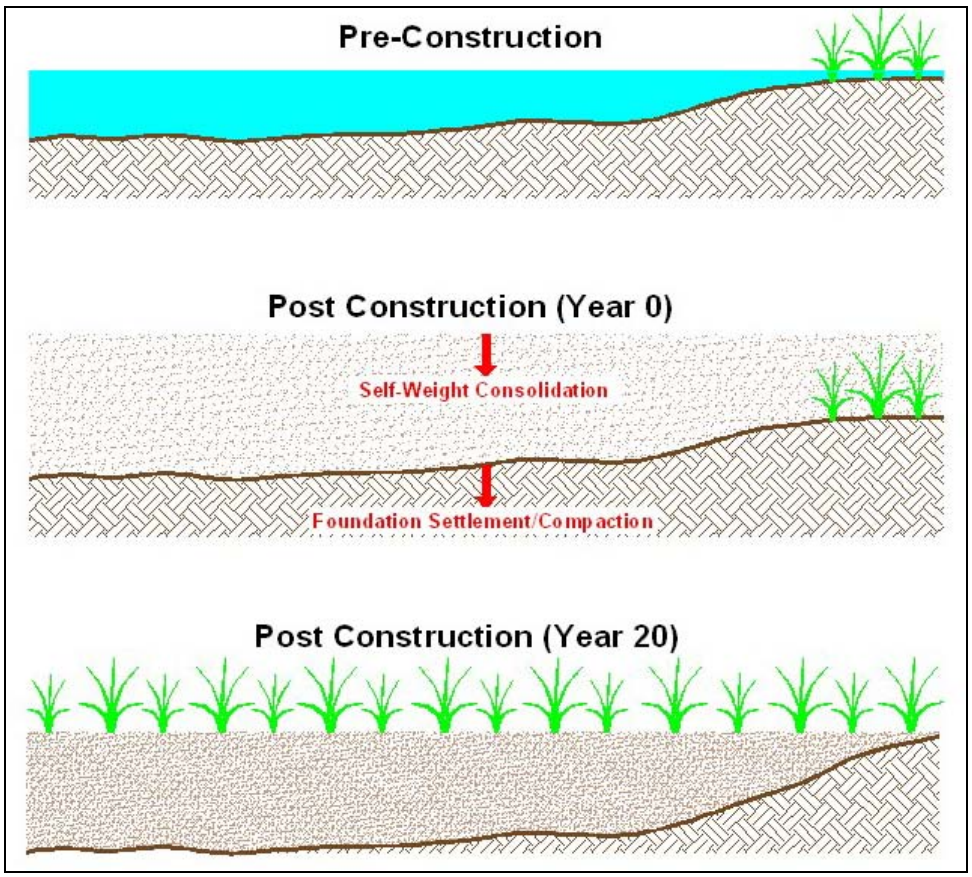

Figure 9: Marsh Fill Settlement

Settlement curves were developed in 0.5ft increments for proposed construction fill elevations ranging from 2.0 feet to 4.5 feet NAVD 88. These settlement curves show the changes in elevation over the 20 year design life of the project and were used to compare different fill elevations.

The settlement for Boring B-7 which is located on the western portion of Marsh Creation Area 1 is shown in Figure 12. There is very little settlement after 6 months, which is favorable for the project over the 20 year project life. The elevation of each marsh creation area is adjusted to the settlement curves associated with that area.

For Marsh Creation Area 1, the marsh creation area bordering Lake Pontchartrain, a construction fill elevation of 2.7 feet will be sufficient to reach the final target marsh elevation. For Marsh Creation Area 2, a construction fill elevation of +2.5 feet can be used on the east side; however, the western portion of Marsh Creation Area 2 is slightly more complicated. A single lift to a construction fill elevation of +4.0 would be required to reach the final targeted marsh elevation. CPRA tasked GeoEngineers to evaluate a two lift scenario to decrease the volumes necessary for a successful filling of this marsh creation area. Using 2 separate lifts to a construction fill elevation of +2.5, with a minimum retention time of 30 days, would provide the final targeted marsh elevation after settlement. Since this allows for the same containment dike structure as the eastern

side, and a decrease in volume from the single lift system, the two lift scenario will be utilized for Marsh Creation Area 2-West. For Marsh Creation Area 3, a construction marsh fill to elevation +3.0 feet will be sufficient to reach the final target marsh elevation while Marsh Creation Area 4 will require a construction fill elevation of +2.5 feet.

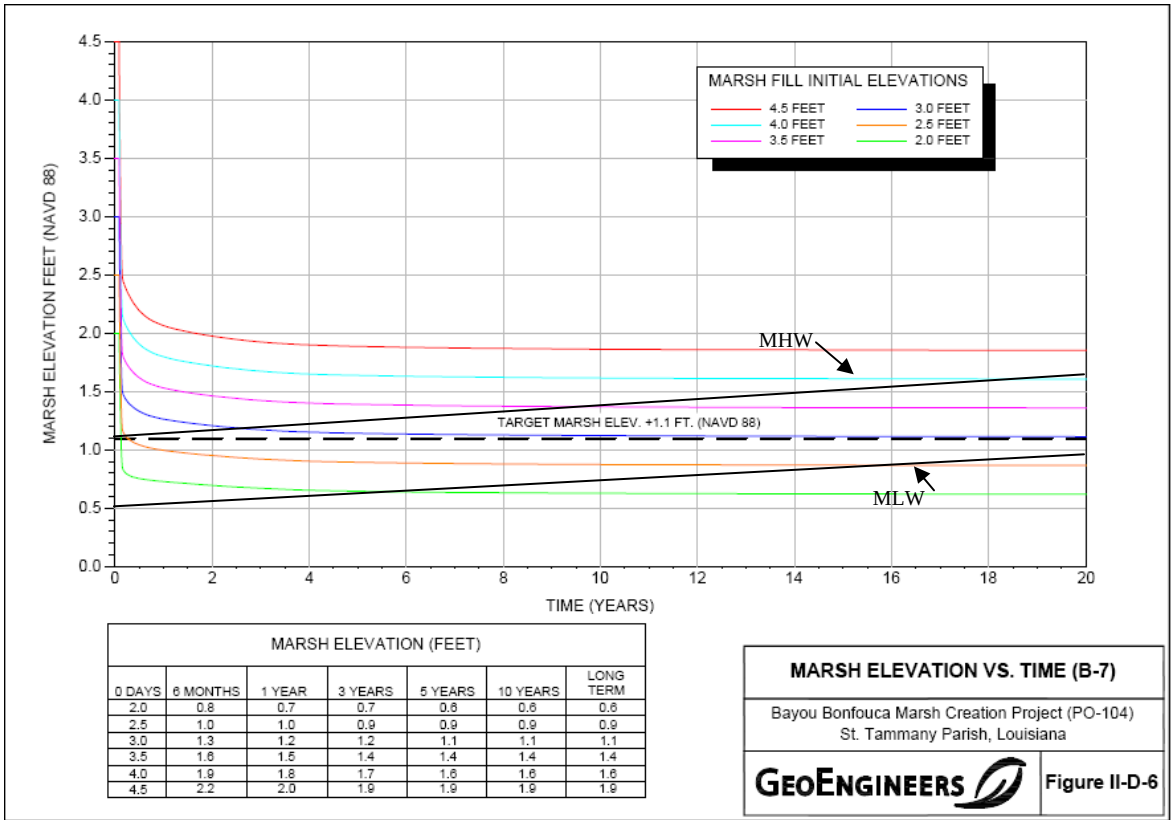

Figure 10: Settlement Curves for Boring 7

4.6 Earthen Containment Dike Settlement Analysis

Settlements of the foundation soils beneath the earthen containment dikes were computed based on the dike geometries determined from the slope stability analyses. Reducing the crown elevation and width will decrease the amount of settlement under the earthen containment dikes. Settlement factors include regional subsidence, self weight consolidation, and elastic settlement of the in situ soils. Self weight consolidation is dependent on several factors, including organic content, natural moisture content, and construction methods. Elastic settlement of the in situ soils will occur quickly and will likely result in an increase in the quantity of fill required to reach the design construction elevation.

Settlement for the containment dikes was performed using an elevation of +4.5 feet NAVD 88. The actual design elevations ranged from +3.2 to +4.0 feet NAVD 88 and are located in figure 10.

4.7 Cut to Fill Ratio Recommendations

A cut to fill ratio was determined in order to account for losses due to dredging, containment, and dewatering. A cut to fill ratio was determined using the settling column test and the method outlined in the United States Army Corps of Engineers' EM-1110-2-5027. However, this method provided a fill to cut ratio of approximately 2.2. Since this project is expected to be consistent with previous marsh creation projects having similar soil types which have yielded cut-to-fill ratio of 1.3, a cut to fill ratio of 1.3 will be applied for all marsh fill sediment. Similarly, previous projects have experienced a cut-to fill ratio of 1.5 to 2.0 on mechanical dredging of containment dikes. The lower ratio of 1.5 will be used for mechanical dredging since that is approximately what was seen on the PO-33 Goose Point Project.

4.8 Goose Point Fault

The borrow area for the PO-104 project lies just north of the Goose Point Fault, which is an extension of the Baton Rouge-Denham Springs Fault system that lies near the north shore of Lake Pontchartrain. The approximate location of the Goose Point fault in relation to the project area is shown in Figure 9. The borrow area does not appear to cross the fault line.

5.0 MARSH CREATION DESIGN

The marsh creation design was broken into four (4) components: the marsh creation areas, the dredge borrow area, duck ponds, and the containment dikes. The design of each component is discussed in the sections below.

5.1 Marsh Creation Area Design

The main design component of PO-104 involves the calculation of the marsh creation area volumes. Before this could be accomplished, a construction fill elevation had to be determined. This elevation was governed by several factors including the final target marsh elevation considering healthy marsh elevations obtained, the tidal datum, the physical properties of the borrow material, and the bearing capacity of the foundation soils in each marsh creation area.

Determination of the construction fill elevation involved an examination of the existing marsh conditions. The marsh elevation survey revealed that the average healthy marsh elevation throughout the entire project area is approximately +1.0 ft. NAVD 88 (Section 3.2). The calculated tidal datum (MHW=1.1 ft., MLW=0.5 ft.) verifies that the existing marsh predominantly falls in the upper portion of the project inter-tidal zone, defined as the range of elevations that lie in between the upper and lower extents of the tidal datum.

In order to evaluate the performance of the created marsh over the 20 year project design life the project team decided that the final target marsh elevation would be the criteria to judge the success of the this project. Ideally, biologists from both USFWS and CPRA

would like the created marsh to be as close as possible to the existing marsh conditions and within the inter-tidal zone. This means that the final target marsh elevation (after initial consolidation and long term settlement) would fall within the upper range of the MHW and MLW. To achieve this, the marsh platform will initially have to be pumped to an elevation higher than MHW during construction and settle into the inter-tidal zone over the 20 year design life of the project.

After determining the construction fill elevations, the total volume of each marsh creation area is calculated by using AutoCAD Civil software. The software creates a 3-Dimensional surface based on XYZ coordinate data from the survey cross sections. This surface is known as a Triangulated Irregular Network (TIN). The TIN model represents a surface as a set of contiguous, non-overlapping triangles. Both a TIN surface containing the 2011 survey data from C&C Technologies and a flat TIN surface at the fill construction elevation was generated by AutoCAD. AutoCAD then uses the XYZ differences of each surface to calculate the volume of each marsh creation area. Since the containment borrow must be refilled, the volume required to build containment dikes is then added to the volume required to fill the marsh creation areas. The cut-to-fill ratio of 1.3 is then applied, resulting in a final estimate of volumes for each marsh creation area. Table 9 summarizes the fill volumes for each marsh creation area within the PO-104 project.

Table 9: Summary of Fill Acreage and volume

Marsh Creation Area	Fill Height (ft)	Area (Acres)	Volume of Fill (yd^3)
1	2.7	331.6	2,260,636
2 West	2.5	63.4	590,668
2 East	2.5	97.2	647,509
3	3.0	31.6	220,643
4	2.5	115.9	605,115

5.2 Earthen Containment Dike Design

The primary design parameters associated with the earthen containment dike design include crown elevation, crown width, and side slopes. One foot of freeboard will be used to contain the dredge slurry within the marsh creation areas. Therefore, the earthen containment dikes will be constructed to an elevation between 3.5 and 4.0 ft NAVD88.

The width of the crown of the earthen containment dikes provide a minimum factor of safety of 1.2 in regards to bearing capacity. All outer earthen containment dikes will be constructed using crown width of 5 feet.

Table 10: Summary of Earthen Containment Dike Design

Marsh Creation Area	Design Height (ft)	Side Slopes	Crown Width (ft)
1	3.7	3H : 1V*	5
2 West	3.5	3H : 1V	5
2 East	3.5	3H : 1V	5
3	4	3H : 1V	5
4	3.5	3H : 1V	5
Duck Ponds	3.2	2H : 1V	2

*Back segment requires 6H: 1V (refer to Preliminary Design Drawings)

A side slope of 3 feet horizontal for every foot of vertical rise (3H:1V) was utilized for containment of most of the marsh creation areas. One exception is on the eastern side of Marsh Creation Area 1 which will require side slopes of 6H: 1V. Earthen containment dikes for the proposed duck ponds will have 0.5 feet of freeboard, 2 foot crest width and a 2H: 1V side slope.

The earthen containment dikes for all marsh creation areas shall be constructed using in-situ material from inside each marsh creation area. For the purposes of slope stability the dike borrow pits will be located at a minimum of 25 feet from the toe of the dike. Furthermore, 3:1 side slopes will be used in the earthen containment dike borrow area with a 10 foot maximum cut.

5.3 Duck Ponds

A stipulation from a landowner for part of Marsh Creation Area 1 was that two duck ponds be provided in the marsh creation area. Two duck ponds, each 5 acres in size, will be created in the western portion of the marsh creation area. In order to accomplish this, the earthen containment dikes will be constructed with two (2) small openings opposite each other. Dredged settlement will be placed into Marsh Creation Area 1 allowing the slurry to fill both inside and outside of the duck ponds. After an elevation +1.5 feet is reached, the gaps in the earthen containment dike will be closed and the remaining portion of Marsh Creation Area 1 will be filled to the construction marsh fill elevation of +2.7 feet. Earthen containment dikes for the duck ponds will only have six (6) inches of freeboard since some overtopping into the duck ponds is permissible.

6.0 BORROW AREA DESIGN

According to the Lake Pontchartrain Basin Foundation (LPBF), grass beds in Lake Pontchartrain constitute the lake's most productive underwater habitat. They provide critical food and shelter for juvenile fish and shellfish, and are responsible for about 25 percent of the Lake's fishing industry (LPBF, 2012). In order to protect these critical grass beds, the borrow area was located near the -10 foot contour.

Gulf Sturgeon, a fish listed as threatened under the Endangered Species Act in 1991, are known to exist in this area. The USFWS has identified sand on the surface of Lake Pontchartrain as a beneficial area for Gulf Sturgeon and therefore the borrow area was located to avoid such areas.

In and effort to minimize redundant geotechnical work and cost, a preliminary qualitative sediment review of the lake bed was performed by the CPRA. In the preliminary sediment survey, core samples were collected and classified in several locations where the lake bottom was near the -10 foot contour. The samples were collected using a PVC coring device designed and constructed to sample the top 5 to 10 cm of the lake bottom. The locations of the samples are shown in Figure 12.

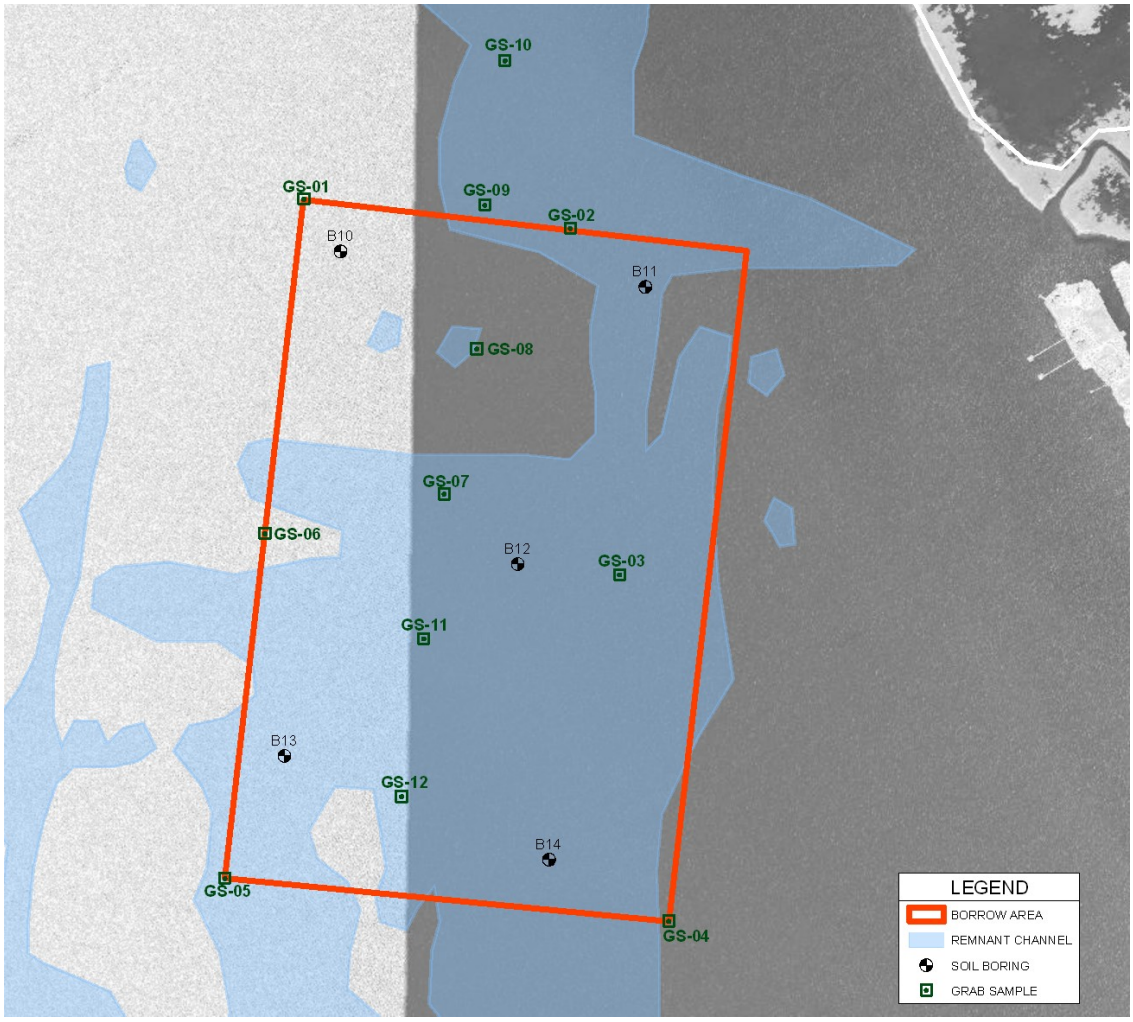

Figure 11: Locations of Boring and Lake Bottom Grab Samples

All of the samples can be characterized as primarily "mud" consisting mostly of clay, silts and organic matter. Some sand was present but no attempt was made to determine the ratio of mud to sand in the samples. The sand size component of the samples was evaluated using U.S. Standard Sieve Series #50 and #200, The #50 sieve will not allow particles larger than 0.297 mm to pass through the sieve and the #200 will not allow

particles larger than 0.074 mm to pass the sieve. These two particle size limits correspond in size terms, using the Wentworth grain size classification nomenclature, to "very fine sand" at between 0.0625 mm - 0.125 mm for the #200 sieve and "medium sand" at between 0.25 mm - 0.5 mm for the #50 sieve. If both sieves captured sand then the sample would be termed a "very fine to medium sandy mud". If no sand was recovered in the #50 sieve but was recovered in the #200 sieve, then the sample would be termed a "very fine to fine sandy mud". Again, using the Wentworth scale, it was assumed that "fine sand", 0.125 mm - 0.25 mm, was captured in the #200 sieve, along with the "very fine sand". The determination of color can be subjective (color charts were not used) but is a basic part of any lithologic classification. Samples that smelled of hydrogen sulfide or contained what appeared to be, fine organic material or both, were termed "organic" mud. The term "slightly" implies the component is a small part of the sample. Bivalve shells, Rangia, and small shell fragments were a relatively common but small component of the samples.

This data was compared with boring data and it was determined that only one boring, boring B-12, contained sand on the lake bottom. More work may be required to delineate the limits of the sand near boring B-12 during the next phase of design.

Table 11

Description of Sediment Samples from Site Visit to Lake Pontchartrain, 5/18/11.	
#01	grey, slightly shelly, very fine sandy mud
#02	grey, very fine to medium sandy mud
#03	dark grey, slightly very fine sandy, organic mud
#04	grey, very fine to medium sandy mud (w/ bivalves)
#05	dark grey and brown, very fine to fine sandy organic mud
#06	dark grey, very fine to medium sandy, organic mud
#07	dark grey and brown, very fine to medium sandy, organic mud (w/ included bivalves)
#08	grey, very fine to medium mud (w/ bivalves)
#09	grey, very fine to medium sandy mud
#10	dark grey to black, slightly very fine sandy, organic mud
#11	dark grey and brown, very fine to medium sandy, organic mud
#12	grey, very fine to medium sandy, organic mud

The proposed borrow area is approximately 331 acres with a maximum allowable cut depth to elevation -25 feet. Maintaining side slopes of 3H: 1V will provide approximately 7,752,600 cubic yards of available borrow volume.

7.0 ARCHEOLOGICAL REVIEW

According to information received from the Louisiana State Historic Preservation Office (SHPO), at least three archeological sites are known to exist near the PO-104 project area. The sites are located on the lake ridge and along the banks of Bayous Bonfouca and Liberty. These are predominately shell midden sites with a light to moderate artifact

density, at best. Additional information regarding the archeological sites can be found in appendix G. A formal consultation will be requested of SHPO prior to the completion of 95% design.

8.0 CONSTRUCTION

8.1 Duration

Due to Gulf Sturgeon habitat issues, the Goose Point Project, (PO-33), was given an initial dredging window from May to September which was later modified to include October. An approximate construction duration was developed using the CDS Dredge Production and Cost Estimation Software. A 25% downtime rate was used for general maintenance and weather, since the dredge window runs through hurricane season. Assuming earthen containment dikes would be built prior to the start of the dredge window and using a 30 inch dredge the dredge time would be approximately 4 months as compared 6.5 months with a 24 inch dredge.

8.2 Cost Estimate

A cost estimate for the PO-104 project was prepared using the CWPPRA PPL 21 spread sheet. Adjustments will be made prior to completion of 95% design that will represent the most up to date quantities cost.

Table 12: Preliminary Construction

Bayou Bonfouca Marsh Creation	2/6/2012	Date	Revised:	14-Mar-12
Work or Material	**Quantity**	**Unit**	**Unit Cost**	**Amount**
Mobilization/Demobilization	1	LS	$2,042,900	$2,042,900
Marsh Creation	4,324,571	CY	$3.75	$16,217,141
Earthen Containment Dikes	175,941	CY	$3.25	$571,808
Settlement Plates	8	EA	$3,500	$28,000
Gapping Containment Dikes	3,014	CY	$3.25	$9,796
Construction Surveys	1	LS	$394,373.99	$394,374

ESTIMATED CONSTRUCTION COST	**$19,264,019**
ESTIMATED CONSTRUCTION COST + 25%	**$24,080,024**

9.0 MODIFICATIONS TO APPROVED PHASE 0 PROJECT

As a result of Phase 1 activities, a few changes have been made to the approved Phase 0 project. During further consultation with the USFWS staff at Big Branch Marsh National Wildlife Refuge, the design team was informed of a new breach along the rim of Lake Pontchartrain, west of the Phase 0 project footprint. The PO-104 project team recognized that adjustments should be made to protect the lake rim. Therefore, a new marsh creation

area, Marsh Creation Area 4, was added and a comparable area was removed from the eastern side of Marsh Creation Area 1. The modified footprint is now 639 acres as compared to 591 acres proposed in Phase 0. The changes to the size and placement of the marsh creation areas will increase the overall size of the project by 48 acres.

During consultation with the landowners of Marsh Creation Area 1, one of the land owners was concerned about turning all open water into land because he leases the land to duck hunters. Therefore two shallow duck ponds were included in Marsh Creation Area 1 that will maintain a hydraulic connection with Bayou Bonfouca.

The borrow area was moved from its Phase 0 location to the current location farther into the lake to eliminate damage to grass beds on the lake bottom.

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Appendix A:
Secondary Monument Data Sheet

VICINITY MAP Not to Scale Reproduced from Louisiana 2005 DOQQ

Station Name: "876 1534 B TIDAL"

Location: Described by National Ocean and Atmospheric Administration 1982, to reach the site proceed west on Carr Drive approximately 2.4 mi (3.9 km) from its intersection with US Highway 11 on the north shore of Lake Ponchartrain to the private residence of Ms. Lucille R. Mocklin, 387 Carr Drive. The station is on the private dock at the rear of the residence. The benchmark is located 261 ft (79.6 m) ease-northeast of the north shore of Lake Ponchartrain, 31 ft (9.4 m) north-northwest of the centerline of a boat ramp north of Carr Drive, 19 ft (5.8 m) east-northeast of the centerline of Carr Drive, 15 ft (4.6 m) west-southwest of the high water mark on the southwest shore of Facine Canal.

Monument Description: Tidal Station Disk on top of stainless steel rod driven 65.6 feet to refusal encased in a PVC pipe.

Stamping: 1534 B 1982

Installation Date: 1982 **Date of Survey:** August 2007

Monument Established By: NOAA

For: NOAA

Adjusted NAD83 Geodetic Position (NSRS2007)
Lat. 30°13'44.39891" N
Long. 089°51'05.24823" W

Adjusted NAD83 Datum LSZ (1702) Ft (NSRS2007)
N= 631,798.38
E= 3,748,804.16

Adjusted NAVD88 Height (2006.81)
Elevation = 2.56 feet (0.780 mtrs)

Ellipsoid Height = -25.879 mtrs.
Geoid03 Height = -26.659 mtrs. (2004.65)

NO PHOTO AVAILABLE

Adjusted Position Established John Chance Land Surveys, Inc. for the Coastal Protection & Restoration Authority of Louisiana, OCPR

Appendix B:
C&C Technologies, Inc. Survey Drawings

UNIDENTIFIED MAGNETIC ANOMALIES		
NUMBER	AMPLITUDE	DURATION
1	1606	29
2	7	13
3	410	27
4	16	16
5	10	33
6	6	29
7	5	27
8	5	27
9	131	30
10	14	20
11	14	19
12	27	11
13	73	34
14	147	23
15	25	19
16	14	19
17	17	23
18	43	23
19	138	31
20	8	22
21	36	24
22	15	21
23	14	15
24	33	33
25	12	26
26	10	19
27	9	27
28	5	17
29	9	15
30	5	18
31	5	17
32	8	26
33	52	37
34	93	59
35	12	32
36	14	20
37	19	23
38	15	32
39	68	44
40	413	52
41	11	27
42	156	49
43	31	28
44	45	23
45	11	26
46	8	24
47	35	20
48	68	35
49	6	17
50	28	24
51	44	27
52	27	20
53	12	25
54	10	19
55	75	34
56	66	36
57	15	26
58	10	23
59	7	23
60	7	19
61	8	33
62	35	42
63	44	33
64	11	25
65	81	24
66	23	28
67	9	16
68	15	32
69	10	16
70	21	28
71	57	29
72	28	30
73	5	22
74	49	39
75	7	24
76	34	56
77	52	33
78	23	46
79	90	58
80	5	45
81	27	40
82	39	21
83	5	25
84	16	31
85	14	27
86	222	80
87	9	23
88	17	23
89	9	22
90	25	21
91	20	18
92	65	53
93	59	93
94	36	22
95	19	44
96	69	58
97	34	43
98	39	23
99	6	18
100	45	45
101	13	26
102	5	29
103	81	49
104	6	20
105	18	25
106	30	19
107	9	29
108	10	28
109	63	54

UNIDENTIFIED MAGNETIC ANOMALIES		
NUMBER	AMPLITUDE	DURATION
110	19	35
111	32	40
112	12	38
113	21	18
114	42	45
115	9	33
116	6	31
117	16	28
118	29	33
119	16	38
120	9	25
121	24	22
122	15	22
123	9	27
124	14	44
125	12	23
126	13	25
127	33	40
128	6	24
129	12	26
130	15	33
131	15	28
132	15	21
133	5	33
134	26	50
135	58	27
136	62	42
137	11	26
138	49	30
139	42	33
140	42	56
141	12	19
142	17	24
143	82	57
144	57	38
145	17	30
146	15	26
147	15	23
148	10	25
149	29	48
150	9	21
151	29	35
152	10	19
153	16	32
154	38	36
155	43	29
156	5	39
157	9	28
158	10	35
159	16	22
160	11	35
161	70	24
162	12	33
163	8	28
164	14	29
165	21	24
166	33	41
167	14	26
168	15	33
169	8	28
170	6	25
171	10	28
172	13	28
173	88	49
174	30	44
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176	11	42
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178	10	31
179	21	59
180	18	21
181	106	35
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183	42	34
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190	29	34
191	89	21
192	36	25
193	20	18
194	12	16
195	106	36
196	68	26
197	42	25
198	29	46
199	203	40
200	8	18
201	44	21
202	5	23
203	10	41
204	70	17
205	15	28
206	24	44
207	21	15
208	33	53
209	37	29
210	24	44
211	16	39
212	180	72
213	25	40
214	28	26
215	26	52
216	42	33
217	120	76
218	71	36

IDENTIFIED MAGNETIC ANOMALIES		
NUMBER	AMPLITUDE	DURATION
219	289	153
220	932	104
221	360	62
222	116	103
223	814	177
224	615	90
225	120	41
226	76	32
227	467	179
228	445	93
229	215	62
230	308	165
231	904	62
232	560	55
233	289	57
234	324	230
235	267	123

612-4 2.81' SET 90 PENNY NAIL
X= 3,744,733.47' (83)
Y= 639,644.06'
Lat= 30°15'02.575"N
Lon= 89°51'50.501"W
X= 2,463,931.52' (27)
Y= 578,936.17'
Lat= 30°15'01.870"N
Lon= 89°51'50.261"W

612-592 3.43' SET 90 PENNY NAIL
X= 3,748,797.09' (83)
Y= 631,831.16'
Lat= 30°13'44.724"N
Lon= 89°51'05.324"W
X= 2,467,994.983' (27)
Y= 571,123.439'
Lat= 30°13'44.018"N
Lon= 89°51'05.087"W

612-592
1534 B TIDAL

1534 B TIDAL (NGS UPDATE) +2.56' EL.
X= 3,748,804.23' (83)
Y= 631,798.41' (83)
Lat= 30°13'44.399"N
Lon= 89°51'05.247"W
X= 2,468,002.12' (27)
Y= 571,090.69' (27)
Lat= 30°13'43.693"N
Lon= 89°51'05.010"W

MARSH CREATION AREA 2
MARSH CREATION AREA 3
MARSH CREATION AREA 1
TRENASSE B
TRENASSE A
PROP. BORE SITE
PROPOSED PONDS
RIDGE LINE SURVEY >>
Point du Chien
LAKE PONTCHARTRAIN
EXXON 18" PIPE
NAVIGATIONAL CHANNEL
BORROW AREA
North Shore Beach
Big Point
North Shore
Bonfouca
Liberty
Bayou
Chien
T9S-R13E
T9S-R14E
EP14
EP15

RONALD E. PRATHER
PROFESSIONAL LAND SURVEYOR
LOUISIANA REGISTRATION NO. 4643

2010 AERIAL PHOTO
1000' 0' 1000' 2000'
SCALE IN FEET

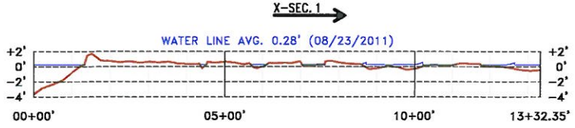
LAMBERT GRID NORTH
NAD 1983 LA. S.Z.

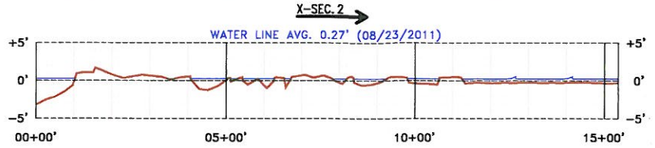
STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION

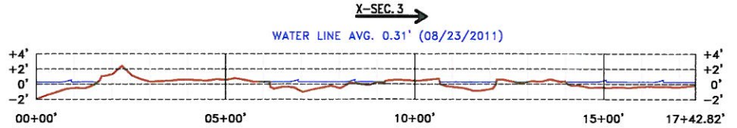
TOPOGRAPHIC, BATHYMETRIC, AND MAGNETOMETER SURVEY
BAYOU BONFOUCA MARSH CREATION (PO-104)
ST. TAMMANY PARISH, LOUISIANA

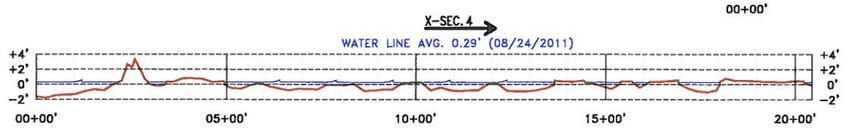
PREPARED BY: C&C Technologies SURVEY SERVICES

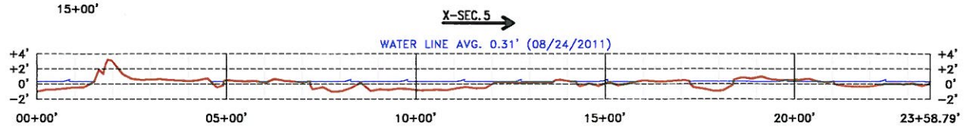
JOB NO. 110494	DWG:PBH	CHK: BCH	REVISED:	DATE: 10/26/2011
L:\dm\110494\110494_BONFOUCA_PLAN.dwg				SHEET 1 OF 5

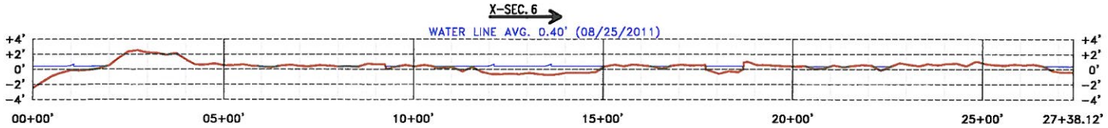


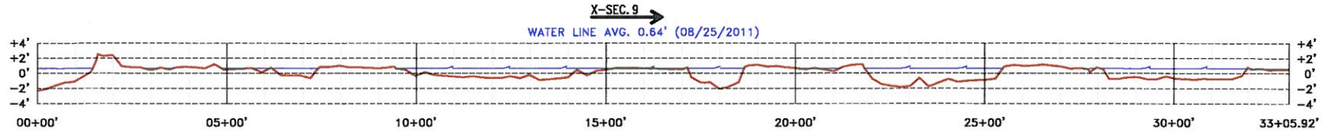


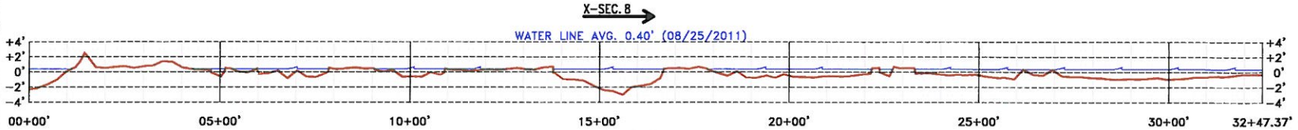


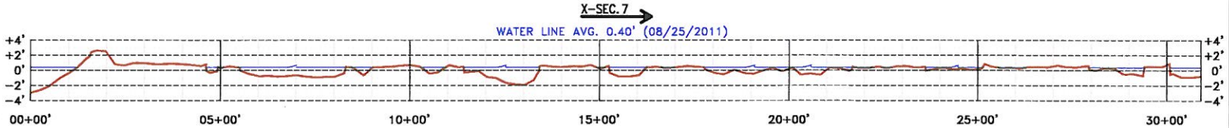


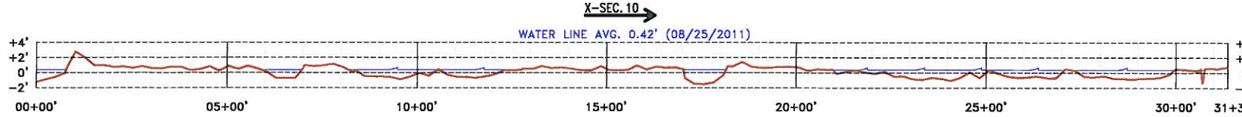


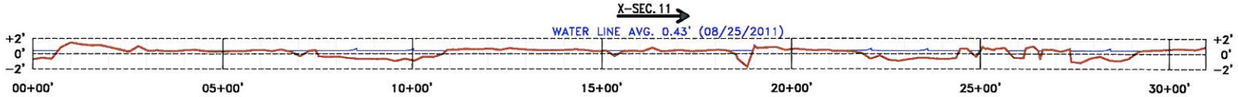


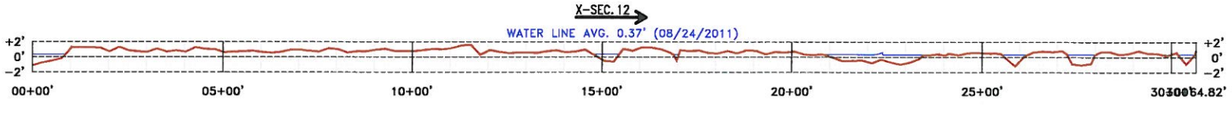


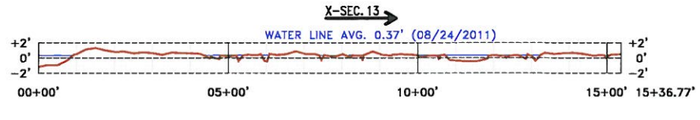


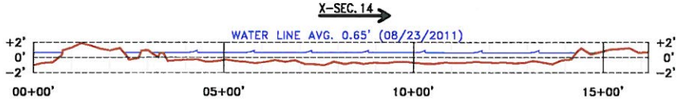


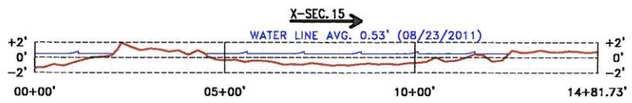


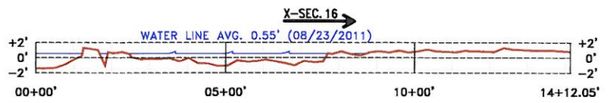


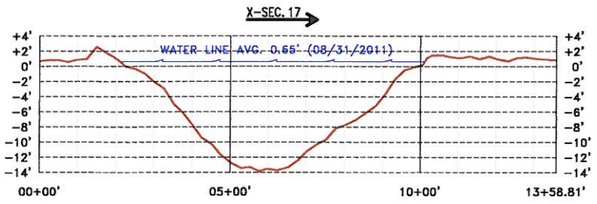


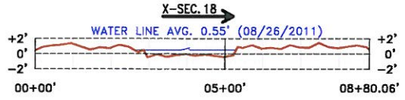


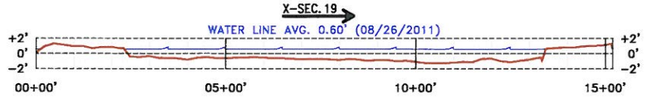


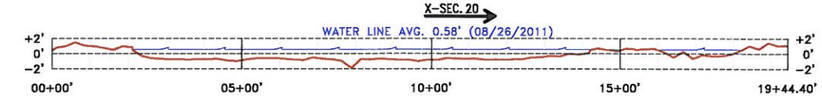


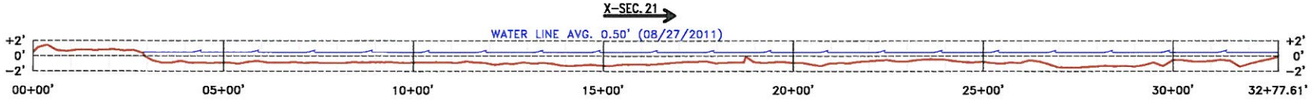


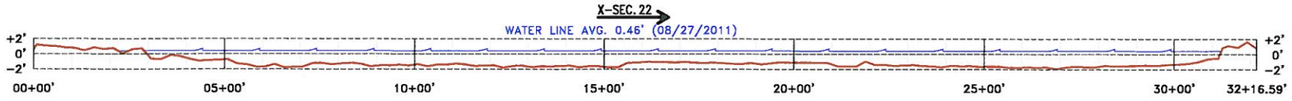


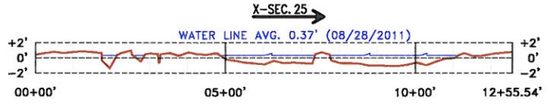


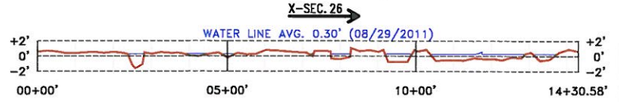


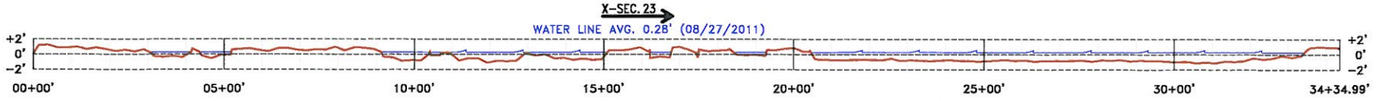


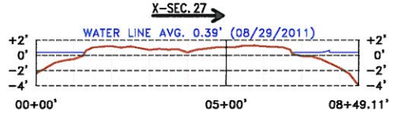


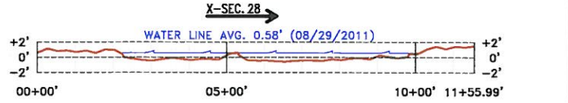


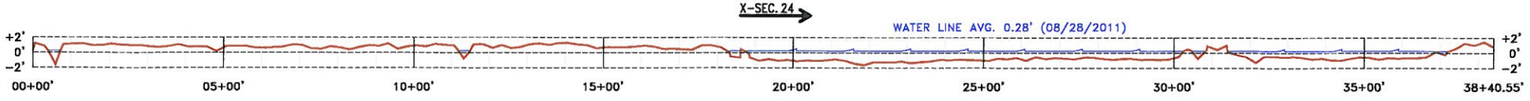












ALL X-SECTIONS
VERTICAL DATUM: NAVD 88
VERTICAL EXAGGERATION 10:1

HORIZONTAL
200' 0' 200'
SCALE IN FEET
VERTICAL
10' 0' 10'
SCALE IN FEET

CPRA Coastal Protection and Restoration Authority of Louisiana

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION

TOPOGRAPHIC, BATHYMETRIC, AND MAGNETOMETER SURVEY
BAYOU BONFOUCA MARSH CREATION (PO-104)
ST. TAMMANY PARISH, LOUISIANA

PREPARED BY: C&C Technologies SURVEY SERVICES

JOB NO. 110494	DWG:PBH	CHK: BHK	REVISED:	DATE: 10/26/2011
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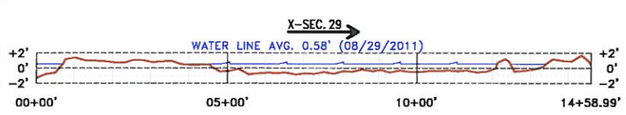

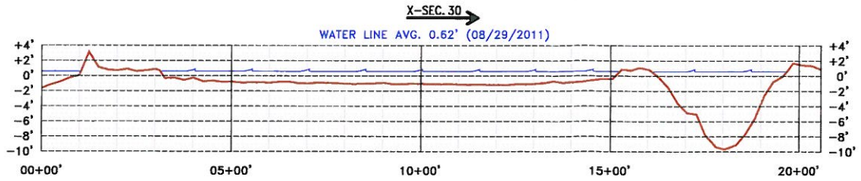

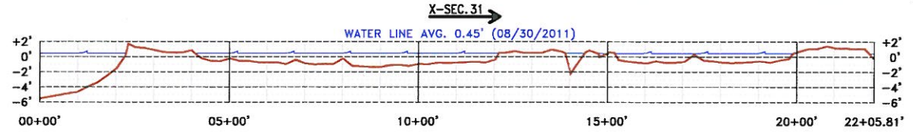

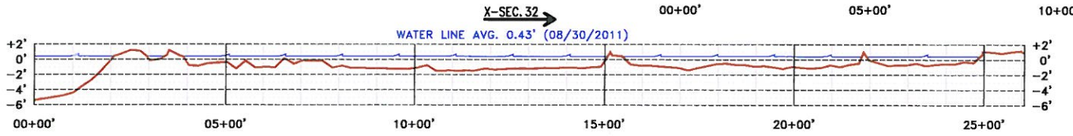

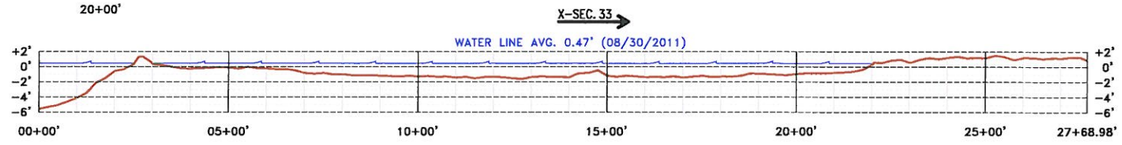

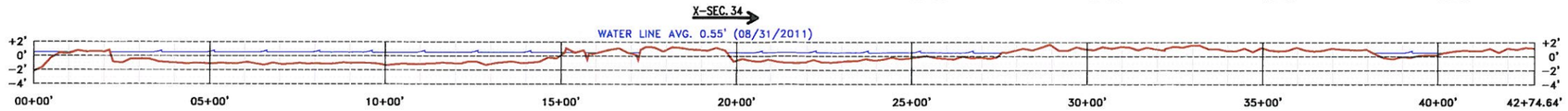

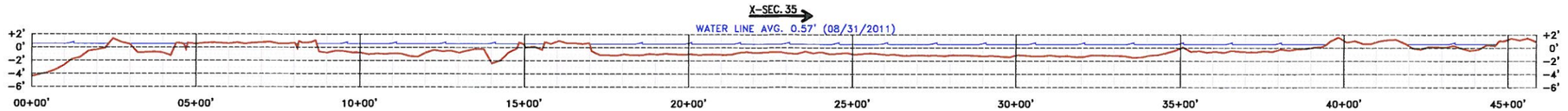

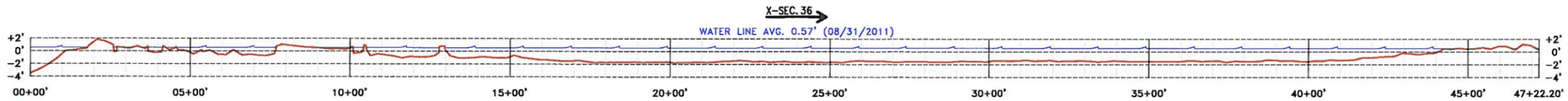

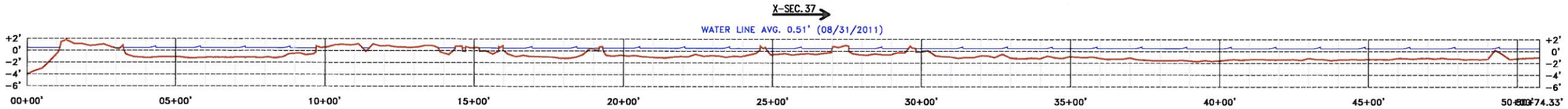

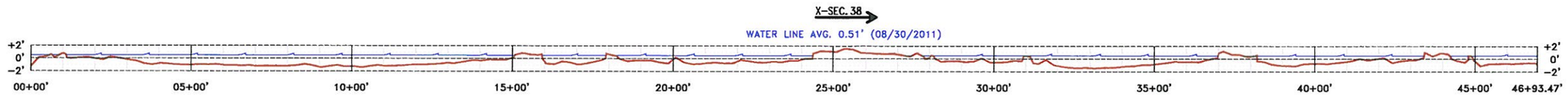

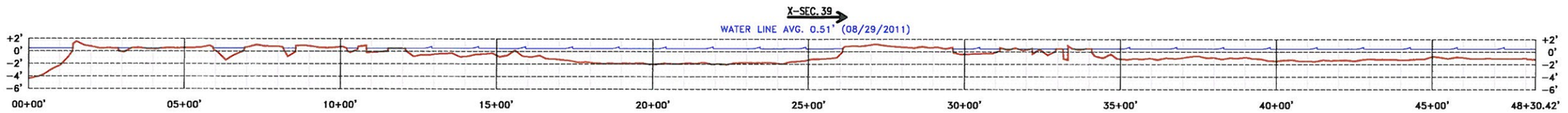

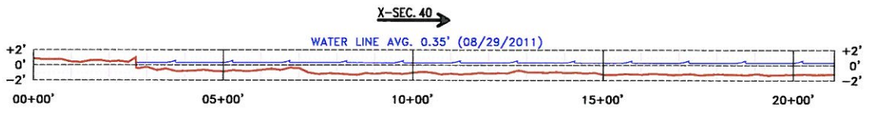

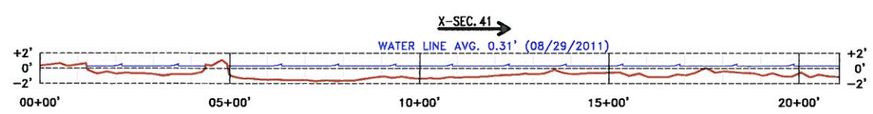

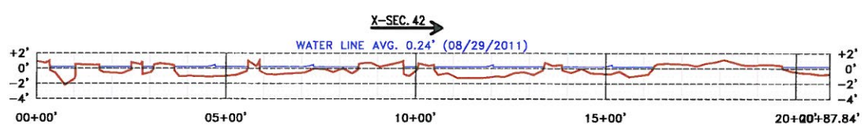

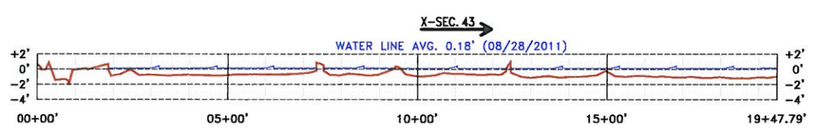

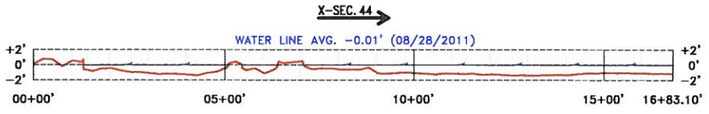

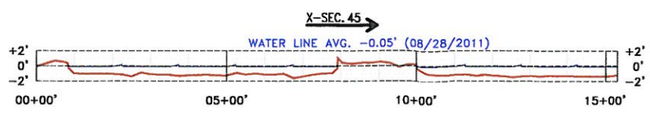

ALL X-SECTIONS
VERTICAL DATUM: NAVD 88
VERTICAL EXAGGERATION 10:1

HORIZONTAL
200' 0' 200'
SCALE IN FEET

VERTICAL
10' 0' 10'
SCALE IN FEET

STATE OF LOUISIANA
OFFICE OF COASTAL PROTECTION AND RESTORATION

TOPOGRAPHIC, BATHYMETRIC, AND MAGNETOMETER SURVEY
BAYOU BONFOUCA MARSH CREATION (PO-104)
ST. TAMMANY PARISH, LOUISIANA

PREPARED BY: C&C Technologies SURVEY SERVICES

JOB NO. 110494	DWG:PBH	CHK: BCH	REVISED:	DATE: 10/26/2011
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Appendix C:
Coast & Harbor Engineering, Inc. SWAN Model Technical Letter

COAST & HARBOR ENGINEERING

January 31, 2012

Joseph Guillory
450 Laurel Street, 11th Floor
Baton Rouge, LA 70804

Dear Mr. Guillory:

This technical letter summarizes the results of the work conducted by Coast & Harbor Engineering, Inc. (CHE) under Task 1 of the Scope of Work in accordance with the Coastal Protection and Restoration Authority of Louisiana (CPRA) Contract No. 2503-12-16 for the Bayou Bonfuca Marsh Creation Project (PO-104) – Numerical Wave Modeling Assistance.

Background

The project involves dredging of a borrow area approximately 3,000 feet offshore from the existing shoreline and marsh creation site at Bayou Bonfuca. A borrow area impact analysis was conducted using the numerical wave model SWAN to assess the impact of the borrow area on local wave energies impacting the existing shoreline. This technical letter describes the results of the wave modeling conducted for this project.

Input Conditions

The input conditions for the numerical wave model were developed in coordination with CPRA for a total of 8 different scenarios, which are summarized in Table 1. The conditions consisted of the existing and dredged bathymetry scenarios, two water levels – mean higher high water (MHHW) and mean lower low water (MLLW), and the 50% wind speed for two directions - 170° and 260° TN (from nearby wind gages).

Table 1. Modeling scenarios evaluated using the numerical wave model

Wind Direction [TN]	Wind Speed [mph]	Water Level	Bathymetry Condition
260°	8.06	MHHW	Existing
260°	8.06	MHHW	Dredged
260°	8.06	MLLW	Existing
260°	8.06	MLLW	Dredged
170°	9.21	MHHW	Existing
170°	9.21	MHHW	Dredged
170°	9.21	MLLW	Existing
170°	9.21	MLLW	Dredged

Numerical Wave Modeling

The borrow area impact analysis was conducted using the spectral, two-dimensional wave generation and transformation model SWAN (Simulating WAves Nearshore). Bathymetry and wind grids were used to generate and transform waves into the nearshore environment. The SWAN modeling results for the existing and dredged bathymetry conditions run at MLLW for 8.06 mph winds from 260°TN are shown in Figure 1a and b respectively. The

wave modeling results show that the creation of dredged pit increases wave heights less than approximately 1 cm over the borrow area. The direction of waves around the edges of the borrow area are slightly changed due to wave refraction, but the magnitude of change is small.

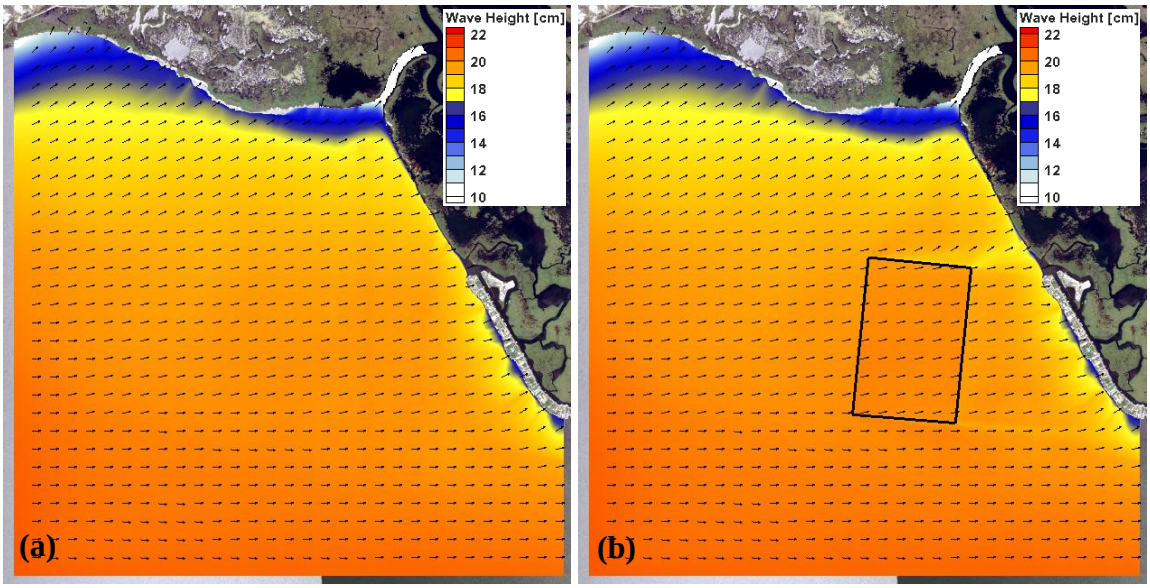

Figure 1. Wave heights computed by SWAN for runs at MLLW and 8.06 mph winds from 260°TN for (a) existing and (b) dredged bathymetry conditions.

Wave heights were extracted at 3 points from the SWAN results to quantify the change in magnitude of the wave heights near the shoreline. Figure 2a and b shows the choice of extraction points for the runs with winds from 260°TN and 170°TN respectively. Table 2 summarizes the measured wave heights at the extraction points for all the SWAN runs. Wave modeling indicated that for any modeling scenario, the change in the wave height due to the creation of the borrow area was 1 cm or less.

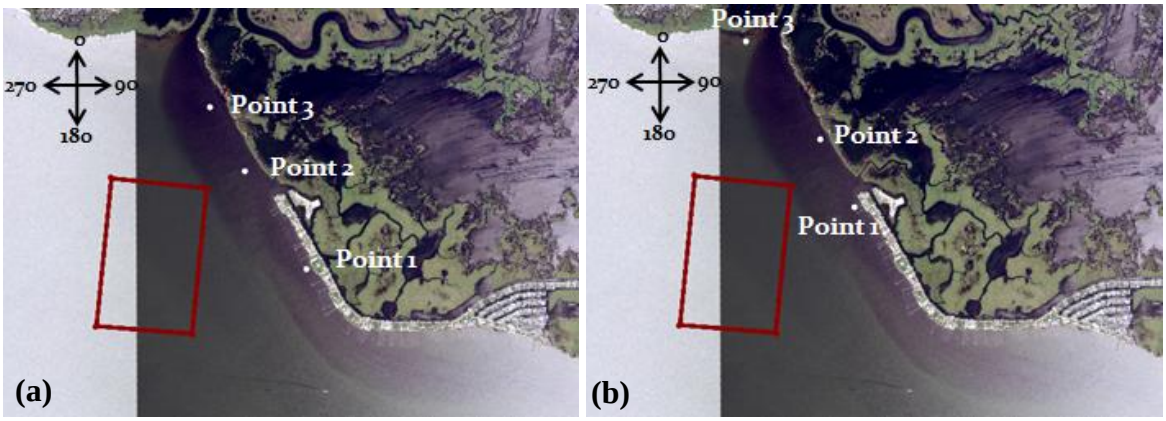

Figure 2. Extraction points used for comparison of nearshore wave heights for cases with winds from (a) 260°TN and (b) 170°TN

Table 2. Measured wave heights at the extraction points for the SWAN model runs

Wind	Water Level	Bathymetry Condition	Wave Height [cm]		
			Point 1	Point 2	Point 3
8.06 mph from 260°TN	MHHW	Existing	18	18	18
		Dredged	18	17	18
	MLLW	Existing	16	18	18
		Dredged	16	17	18
9.21 mph from 170°TN	MHHW	Existing	14	15	16
		Dredged	14	15	16
	MLLW	Existing	13	15	15
		Dredged	14	14	16

Conclusions

The borrow area did not increase wave energy in any appreciable amounts at the existing shoreline. The maximum increase in wave height occurred at MLLW for both wind directions, which resulted in only 1 cm in wave height increase (~2% increase). The magnitude of change in wave heights computed by SWAN is determined to be insignificant due to the relative accuracy of bathymetry measuring instruments (+/- 0.5 feet) and within the natural variability of waves at the project site. Overall the change in wave heights due to the dredged pit are so small in magnitude that it is not expected to cause any significant shift in existing morphological conditions at site.

Thank you for the opportunity to provide this analysis. If you have questions or need more information, please contact me at matt@coastharboreng.com or by phone at 512.342.9716.

Sincerely,

COAST & HARBOR ENGINEERING, INC.

Matt Campbell, P.E.
Coastal Engineer

Appendix D:
GeoEngineers Boring Logs

P:\16\16715023\00\CAD\Boring Location Plan.dwg\TAB:Layout1 modified on Dec 22, 2011 - 7:57am

JMP : KMC

Legend

- B-1 — Borehole Location
- A A' — Cross Section
- Approximate Goose Point Fault
- Marsh Creation Areas
- Ponds
- Borrow Area

N
W E
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3000 0 3000
FEET

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Aerial image taken form Google Earth Pro, Licensed to GeoEngineers Inc., Dated 3/22/2010

BORING LOCATION PLAN

Bayou Bonfouca Marsh Creation Project (PO-104)
St. Tammany Parish, Louisiana

GeoEngineers

Figure II-2

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	CC	Cement Concrete
	AC	Asphalt Concrete
	CR	Crushed Rock/ Quarry Spalls
	TS	Topsoil/ Forest Duff/Sod

Measured groundwater level at time noted on log

Initial groundwater level observed at time of exploration

Perched water observed at time of exploration

Graphic Log Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Material Description Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

A "P" indicates sampler pushed using the weight of the drill rig.

Laboratory / Field Tests

%F	Percent fines
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
OC	Organic content
PM	Permeability or hydraulic conductivity
PP	Pocket penetrometer
SA	Sieve analysis
UU	Triaxial compression
UC	Unconfined compression
VS	Vane shear

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO EXPLORATION LOGS

GeoEngineers

FIGURE A-1

Drilled: Start 8/31/2011 End 8/31/2011	Total Depth (ft): 44	Logged By: RMB Checked By: VT	Driller: Specialized Environmental Resources, LLC	Drilling Method: Wet Rotary	
Surface Elevation (ft) Vertical Datum: Undetermined		Hammer Data: N/A		Drilling Equipment: Marsh Buggy-Mounted Drill Rig	
Latitude: N30° 15' 15.1" Longitude: W89° 53' 05.3"		System Datum: Geographic NAD83 (feet)		Groundwater: Date Measured / Depth to Water (ft) / Elevation (ft)	

Notes: See Figure A-1 for explanation of symbols.
Cement-bentonite grout backfill top 25 feet.

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
	0								Zero (0) feet top of deck									
						▽			Water									
									Mudline									
					1			OH	Very soft tan and gray organic clay									
	5	10			2				Very soft tan and gray organic clay with sand traces (organic content - 17%; specific gravity - 2.57)	128	36	0.16	0.17	15	141	99	0.338	
					3				Very soft tan and gray organic clay									
	10	10			4				Tan and gray organic clay with large vertical sand streak on half of sample (organic content - 2.5%)	101					173	107	0.21	
					5			SM	Gray silty sand									
	15	6			6			SC	Firm gray clayey sand with large organic clay streak									
		9			7			CH	Stiff tan and gray clay	25	100.5	1.33	0.75	15	53	33		
		11			8				Medium tan and gray clay with organic matter; sand streaks and ferrous nodules	28	98.6	0.55		15				
	20	12			9				Stiff tan and gray clay with sand pockets and shells	27	95.8	1.01		15	68	46		
		10			10				Stiff tan and gray clay with sand pockets	30	94.1	1.44		13				
	25	10			11				Stiff tan and gray clay with gravel (SLS)	41	81.2	1.11		3	84	55		
	30	12			12				Stiff tan and gray clay (SLS)	45	78.1	1.17		3				
	35																	

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-1

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-2

Elevation (feet) / Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF) [1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
35																
	6		13				Stiff tan and gray clay	46					82	50		
40						CL										
	14		14				Medium tan and gray clay with sand and shell	49	77	0.54 0.55*		2 11	46	28		

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-1 (continued)

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-2
Sheet 2 of 2

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	8/31/2011	8/31/2011	44	RMB	VT	Specialized Environmental Resources, LLC	Wet Rotary

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	N/A	Drilling Equipment	Marsh Buggy-Mounted Drill Rig
Latitude Longitude	N30° 15' 08.4" W89° 52' 03.6"	System Datum	Geographic NAD83 (feet)	Groundwater Date Measured	Depth to Water (ft) / Elevation (ft)

Notes: See Figure A-1 for explanation of symbols.
Cement-bentonite grout backfill top 25 feet.

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
	0								Zero (0) feet top of deck									
						▽			Water									
									Mudline									
		9			1			OH	Very soft dark gray organic clay and peat (organic content - 30%)	523	11.3	0.16	0.058	12			0.088	
	5	10			2			PT	Very soft black peat	397	13	0.11	0.17	10	503	293	0.115	
		9			3			OH	Very soft gray organic clay	190	25.6	0.13	0.29	11			0.05	
	10	9			4				Very soft gray organic clay (organic content - 29%; specific gravity - 2.19; [1]FV @ 10' - 0.018 ksf)	157	30.8				150	115	0.063	
		10			5				Very soft gray organic clay	163	32.6	0.09	0.52	14	154	115	0.113	
		8			6				Very soft gray organic clay (organic content - 17%; FV @ 14' - 0.049 ksf)	153	32.6	0.09	0.63	10			0.221	
	15	5			7				Very soft gray and brown organic clay with sand	177					159	112	0.09	
		5			8				Very soft brown very soft organic clay with organic matter	94					216	173	0.079	
		7			9				Very soft gray organic clay with sand traces	108	51.7	0.07	0.98	13			0.086	
	20	10			10				Very soft gray organic clay with sand traces	257	29.2	0.13	1.09	15	61	41	0.174	
	25																	
		11			11				Very soft tan and gray organic clay	119	45.8	0.02		15			0.21	
	30							CH										
		9			12				Very soft tan and gray clay with organic matter	25	71.9	0.11		14	119	79	0.183	
	35																	

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-2

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-3

Elevation (feet) / Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
35																
	10		13				Very soft tan and gray clay with organic matter	42	72.6	0.06		15			0.223	
40						CL										
	8		14				Very soft gray very silty clay with organic matter	24	100.7	0.13		15	29	15	0.295	

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-2 (continued)

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-3
Sheet 2 of 2

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	9/1/2011	9/1/2011	44	RMB	VT	Specialized Environmental Resources, LLC	Wet Rotary

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	N/A	Drilling Equipment	Marsh Buggy-Mounted Drill Rig
Latitude Longitude	N30° 15' 32.9" W89° 51' 33.5"	System Datum	Geographic NAD83 (feet)	Groundwater Date Measured	Depth to Water (ft) / Elevation (ft)

Notes: See Figure A-1 for explanation of symbols.
Cement-bentonite grout backfill top 25 feet.

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
0	0								Zero (0) feet top of deck									
						▽			Water									
									Mudline									
	5	12			1			OH	Very soft dark gray organic clay with peat (organic content - 35%)	396	14.7	0.12	0.06	6			0.126	
		9			2				Very soft gray organic clay with peat	339	16.8	0.12	0.17	15	245	150	0.117	
		11			3				Very soft gray organic clay	124	36.1	0.10	0.29	15			0.074	
	10	12			4				Very soft gray organic clay ([1]FV @ 14' - 0.026 ksf)	183	29.6	0.15	0.40	15	110	72	0.101	
		8.5			5				Very soft gray organic clay	136	36	0.12	0.52	13			0.304	
		12			6				Very soft gray organic clay	114	38.7	0.16	0.63	15	135	98	0.153	
	15	10			7				Very soft gray organic clay	111	42	0.17	0.75	13			0.165	
		9			8			CH	Very soft gray clay with silt, sand pockets and organic matter ([1]FV @ 18' - 0.065 ksf)	56	65.1	0.16	0.86	15	66	41	0.142	
	20	9			9			OH	Very soft gray organic clay with silt lenses	88	53	0.12	0.98	14			0.133	
		18			10				Very soft gray organic clay (specific gravity - 2.06)	101	43.6	0.10		13	107	77		
	25							CH										
		16.5			11				Very soft gray clay with organic matter and 2½" sand layer	83	58.8	0.17	1.38	14	67	45	0.128	
	30							ML										
		8			12				Firm gray silt with clay and sand traces									
	35																	

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-3

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Elevation (feet) / Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
35																
	19		13				Firm gray sandy silt									61
40																
	11		14				Firm gray sandy silt with clay streaks									

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-3 (continued)

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-4
Sheet 2 of 2

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	9/1/2011	9/1/2011	44	RMB	VT	Specialized Environmental Resources, LLC	Wet Rotary

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
Undetermined	N/A	Marsh Buggy-Mounted Drill Rig

Latitude / Longitude	System Datum	Groundwater: Date Measured	Depth to Water (ft)	Elevation (ft)
N30° 15' 30.6" / W89° 51' 12.8"	Geographic NAD83 (feet)			

Notes: See Figure A-1 for explanation of symbols.
Cement-bentonite grout backfill top 25 feet.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
0	0					▽			Zero (0) feet top of deck Water									
									Mudline									
					1			PT	Brown peat with gray clay and sand									
	5	11			2			ML	Loose gray sandy silt with organic matter and clay traces								0.225	
		3.5			3				Loose gray sandy silt with clay traces ([1]FV @ 9' - 0.048 ksf)									
	10	19			4				Loose gray sandy silt with clay streaks									
		11			5			CL	Loose gray sandy clay with ferrous nodules and organic matter	24	106.1	0.76	0.52	15	37	20		
		8.5			6				Stiff gray very sandy clay with ferrous nodules and organic matter	16	110.2	1.13		5	31	17		
	15	14			7				Stiff gray sandy clay with sand streaks, 2" sandy silt layer at bottom, organic matter and ferrous nodules ([1]FV @ 16' - 0.179 ksf)	19	107.2	1.72		15	38	24		
		7			8				Medium gray clay with sand streaks	20	106.8	0.60		4				
	20	4.5			9				Stiff gray sandy clay with 2" sand layer	22					38	18		
		14			10				Stiff gray clay with large sand pockets	29	95.3	1.19		4				
	25							CH										
		9			11				Medium tan and light gray clay with sand streaks and silt lenses	35	82.9	0.60		3	79	48		
	30																	
		7.5			12				Medium tan and light gray clay with silt streaks	41	79.7	0.93		6				
	35																	

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-4

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-5

Elevation (feet) / Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF) [1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
35																
	15.5		13				Stiff tan and gray clay with sand streaks and ferrous nodules (specific gravity = 2.64)	32	88	1.21		4	72	45		
										1.28*		7				
40																
	9		14				Medium tan and gray clay with 3" sand layer	41	80.7	0.93		6				

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-4 (continued)

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-5
Sheet 2 of 2

Drilled	Start 9/1/2011	End 9/1/2011	Total Depth (ft) 64	Logged By RMB / Checked By VT	Driller Specialized Environmental Resources, LLC	Drilling Method Wet Rotary
Surface Elevation (ft) Vertical Datum	Undetermined		Hammer Data	N/A	Drilling Equipment	Marsh Buggy-Mounted Drill Rig
Latitude / Longitude	N30° 15' 30.4" / W89° 50' 55.7"		System Datum	Geographic NAD83 (feet)	Groundwater: Date Measured	Depth to Water (ft) / Elevation (ft)

Notes: See Figure A-1 for explanation of symbols.
Cement-bentonite grout backfill top 25 feet.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
	0					▽			Zero (0) feet top of deck Water line									
									Mudline									
		10			1			SM	Loose gray silty sand with organic matter	28	96.7	0.31	0.058	9			0.16	
5		10.5			2			SC	Loose gray clayey sand	38	91.8	0.42	0.17	9	26	7	0.223	
		8.5			3			SM	Loose gray silty sand									
10		9			4			SC	Loose gray clayey sand									
		10			5				Loose gray clayey sand	20	109.5	0.23	0.52	10	17	5		
		14			6			CL	Soft tan and gray very sandy clay with ferrous nodules (organic content - 2.4%; specific gravity - 2.63; [1]FV @ 14' - 0.168 ksf)	24	101.4	0.47		15	33	19		
15		10			7				Soft gray sandy clay	23	103.3	0.29	0.75	15				
		10.5			8				Very soft gray very silty clay with ferrous nodules	22	102	0.22		15	22	8		
20		9			9				Medium gray sandy clay with ferrous nodules ([1]FV @ 20' - 0.24 ksf)	22	100.4	0.50		15				
		10			10			CH	Medium tan and gray clay with sand pockets and lenses (SLS)	32	91.3	0.98		6	69	48		
25																		
		12			11				Stiff gray clay with sand and 5 inch sand with clay layer at bottom (SLS)	22	98.9	1.26		6				
												1.17*		14				
30																		
		13			12				Stiff gray clay with sand pockets	29	94.3	1.43		8	69	48		
35																		

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-5

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-6
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
	35																
		10		13				Stiff light gray clay with sand streaks and pockets	30	91.5	1.17		4				
	40						SC										
		9.5		14				Firm brown clayey sand									
	45						CL										
		18		15				Medium gray clay with silt lenses	40	82.3	0.91		5	44	23	0.658	
	50																
		10.5		16				Medium gray clay with silt (SLS) and shells	32	89	0.70		6	42	24		
	55						CH										
		10.5		17				Medium gray clay with shells	46	74.3	0.60		6				
	60																
		4		18				Medium gray clay	45					68	44	0.311	

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-5 (continued)

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-6
Sheet 2 of 2

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	8/31/2011	8/31/2011	64	RMB	VT	Specialized Environmental Resources, LLC	Wet Rotary

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	N/A	Drilling Equipment	Marsh Buggy-Mounted Drill Rig
Latitude Longitude	N30° 14' 37.9" W89° 51' 37.9"	System Datum	Geographic NAD83 (feet)	Groundwater Date Measured	Depth to Water (ft) / Elevation (ft)

Notes: See Figure A-1 for explanation of symbols.
Cement-bentonite grout backfill top 25 feet.

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
0	0					▽			Zero (0) feet top of deck Water line									
									Mudline									
5	5	10			1			OH	Very soft dark gray organic clay with peat (organic content - 14%)	191	30	0.21	0.06	7	123	90	0.07	
		9			2				Very soft dark gray organic clay with peat	357	17.7	0.11	0.17	14			0.117	
		9.5			3				Very soft dark gray organic clay with peat ([1]FV @ 9' - 0.036 ksf)	311	19.2	0.08	0.29	7			0.101	
10	10	10			4				Very soft gray organic clay (specific gravity - 2.23)	149	33				125	77	0.128	
		8			5			PT	Very soft gray peat	425					358	211	0.176	
		10			6				Very soft gray peat ([1]FV @ 14' - 0.036 ksf)	376	15.7	0.17	0.63	7			0.237	
15	15	10			7			SM	Firm gray silty sand with clay								0.248	39
		10			8			CL-ML	Soft gray clayey silt with organic matter traces ([1]FV @ 19' - 0.108 ksf)	21	105.2	0.29	0.86	12	19	5	0.349	
20	20	10.5			9			CL	Medium gray sandy clay	19	109.5	0.96		15				
		8			10			CH	Stiff tan and gray clay with sand streaks and pockets	30	93.2	1.07		5	66	45		
25	25	13			11				Medium tan and gray clay with sand lenses, pockets and streaks	30	92.3	0.73		3				
30	30	12			12				Medium tan and gray clay (SLS)	49	75.4	0.93		5	86	56		
												0.96*		6				
35	35																	

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-6

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-7

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
	35	15		13				Stiff tan and gray clay (SLS)	47	75.4	1.03		3				
	40	13		14			CL	Medium tan and gray very sandy clay with sand pockets	27					27	12		
	45	10		15				Medium tan and gray clay with sand lenses and pockets	36	86.3	0.84		7			0.757	
	50	15		16			CH	Medium gray clay with sand lenses and pockets	42	78.7	0.71		5	52	32	0.527	
	55			17				Stiff gray clay									
	60	16		18				Medium gray clay with sand streaks and pockets	37	84.3	0.54		5	58	37	0.518	

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-6 (continued)

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-7
Sheet 2 of 2

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	8/30/2011	8/30/2011	44	RMB	VT	Specialized Environmental Resources, LLC	Wet Rotary

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	N/A	Drilling Equipment	Marsh Buggy-Mounted Drill Rig
Latitude Longitude	N30° 14' 50.2" W89° 51' 31.9"	System Datum	Geographic NAD83 (feet)	Groundwater Date Measured	Depth to Water (ft) / Elevation (ft)

Notes: See Figure A-1 for explanation of symbols.
Cement-bentonite grout backfill top 25 feet.

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
0	0								Zero (0) feet top of deck									
									Water line									
									Mudline									
		10			1			PT	Very soft brown peat								0.081	
5	5	11			2			OH	Very soft brown organic clay with peat								0.09	
		9			3				Very soft brown organic clay with peat (organic content - 21%)	243					208	149	0.099	
10	10	6			4				Very soft brown organic clay with peat	294	18.1	0.13	0.40	6			0.063	
		6			5				Very soft brown organic clay with peat (specific gravity - 1.66)	160	33.6				323	220	0.068	
		9			6				Very soft brown organic clay with peat	320	18.3	0.04	0.63	15	290	182	0.092	
15	15	12			7				Very soft brown organic clay with organic matter ([1]FV @ 16' - 0.05 ksf)	228	25.2	0.16	0.75	7			0.192	
		8			8				Very soft brown organic clay	184					157	117		
20	20	12			9				Very soft brown clay with organic matter and 2" sandy clay layer ([1]FV @ 20' = 0.05 ksf)	166	40	0.15	0.98	6				
		11			10			CL	Medium gray silty clay with 2" sand layer	30	96.8	0.72		15				
25	25							CH										
		12			11				Stiff tan and gray clay with sand streaks	31	95.5	1.42		15	57	38		
30	30																	
		11			12				Stiff tan and gray clay with silt streaks	44	84.1	1.04		5				
35	35																	

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-7

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-8

Elevation (feet) / Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
35																
	11		13				Stiff tan and gray clay	42	80.9	1.38		4				
40																
	9		14				Medium tan and gray clay	43	77.5	0.58		15	88	60		

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-7 (continued)

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-8
Sheet 2 of 2

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	8/30/2011	8/30/2011	44	RMB	VT	Specialized Environmental Resources, LLC	Wet Rotary

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	N/A	Drilling Equipment	Marsh Buggy-Mounted Drill Rig
Latitude Longitude	N30° 14' 42.9" W89° 50' 59.2"	System Datum	Geographic NAD83 (feet)	Groundwater Date Measured / Depth to Water (ft) / Elevation (ft)	

Notes: See Figure A-1 for explanation of symbols.
Cement-bentonite grout backfill top 25 feet.

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
	0								Zero (0) feet top of deck									
						▽			Water line									
									Mudline									
		11			1			PT	Very soft dark gray peat	469	11.4	0.05	0.06	5	641	449	0.043	
	5	10			2				Very soft dark gray peat	430	13.1	0.07	0.17	3			0.047	
		11			3				Very soft dark gray peat ([1]FV @ 9' - 0.022 ksf)	697	9.8	0.06	0.40	2	382	246	0.126	
	10	8			4			CH	Very soft gray clay with organic traces	91	40.8	0.06	0.29	4	63	36	0.201	
		12			5				Soft gray clay with silt ([1]FV @ 13.5' - 0.214 ksf)	20	107	0.40	0.52	15				
		9			6				Medium gray clay with silt pockets	24	103.4	0.57	0.63	14			0.536	
	15	12			7			CL	Medium tan and gray very sandy clay	21	106.6	0.98		15	30	17		
		12			8				Stiff tan and gray sandy clay	19	108.9	1.25		15	37	24		
	20	8			9				Stiff tan and gray clay with sand streaks and pockets	22	106.6	1.04		5				
		11			10			CH	Stiff tan and gray clay with sand streaks and pockets	59								
	25							CL										
		11			11				Stiff tan and gray clay with sand streaks and pockets	23	103.8	1.96		10				
	30							CH										
		8			12				Stiff tan and gray clay	43					80	52		
	35																	

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-8

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-9

Elevation (feet) / Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
35																
	12		13				Stiff tan and gray clay (SLS)	47	77.9	1.17		3				
40																
	11		14				Stiff tan and gray clay (SLS)	37	82.2	0.88		6			0.618	
										1.02*		4				

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-8 (continued)

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-9
Sheet 2 of 2

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	8/30/2011	8/31/2011	62.5	RMB	VT	Specialized Environmental Resources, LLC	Wet Rotary

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	N/A	Drilling Equipment	Marsh Buggy-Mounted Drill Rig
Latitude	N30° 14' 31.7"	System Datum	Geographic	Groundwater	
Longitude	W89° 50' 36.0"		NAD83 (feet)	Date Measured / Depth to Water (ft) / Elevation (ft)	

Notes: See Figure A-1 for explanation of symbols.
Cement-bentonite grout backfill top 25 feet.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
	0								Zero (0) feet top of deck									
						▽			Water line									
									Mudline									
					1			PT	Very soft dark gray peat (no usable recovery)									
	5	9			2				Very soft dark gray peat (organic content - 57%)	394	12.8	0.09	0.17	10			0.088	
		5			3				Very soft black peat	736					606	435	0.079	
	10	7			4				Very soft dark gray peat ([1]FV @ 10' - 0.027 ksf)	562	11.4	0.12	0.40	2			0.029	
		8			5			CL	Very soft dark gray clay with silt and 1" peat layer ([1]FV unable to penetrate soil at 12' depth)	27	84.4	0.13	0.52	6	49	29	0.074	
		9			6				Very soft gray very silty clay with organic matter (specific gravity - 2.67)	26	96.7				27	14	0.025	
	15	10.5			7				Soft gray silty clay with silt pockets and ferrous nodules	29	89.9	0.26	0.75	15			0.379	
		12			8				Medium gray clay with silt	20	106.8	0.73		15	42	21		
	20	9			9				Stiff gray clay with sand	21	106.4	1.65		15				
		4			10				Stiff gray clay with sand streaks	20					43	27		
	25																	
		10			11				Stiff tan and gray clay with sand streaks and pockets	21	106.2	1.47		10				
	30																	
		10			12				Medium tan and gray clay with sand streaks and pockets	23	104.8	0.88		15			0.309	
	35																	

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-9

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-10
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
	35																
		6		13				Soft tan and gray very sandy clay with shells	29	96.4	0.38		11	28	11	0.397	
	40																
		9		14				Medium tan and gray clay with sand streaks, pockets and shells	26	97.6	0.90		15			0.525	
	45																
		9.5		15				Medium tan and gray clay with sand pockets and shells	23	96.8	0.87		6			0.631	
	50						CH										
		3		16				Medium gray clay	60					70	46		
	55																
		20		17				Soft gray clay with sand pockets and streaks	37	84.2	0.39		15				
	60																
		9		18				Soft tan and gray clay with sand pockets	40	83.1	0.42		7	54	33		

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-9 (continued)

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-10
Sheet 2 of 2

Drilled	Start 9/12/2011	End 9/12/2011	Total Depth (ft)	31.5	Logged By	SM	Driller	Specialized Environmental Resources, LLC	Drilling Method	Wet Rotary
					Checked By	VT				

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data	N/A	Drilling Equipment	Pontoon Barge-Mounted Drill Rig
Latitude	N30° 14' 13.0"	System Datum	Geographic NAD83 (feet)	Groundwater	
Longitude	W89° 52' 20.0"			Date Measured	Depth to Water (ft) / Elevation (ft)
Notes: See Figure A-1 for explanation of symbols.				9/12/2011	1.0

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
	0					▽			Zero (0) feet top of deck Water line									
	5																	
	10								Mudline									
		3			1			CL	Very soft dark gray clay with silt	30					44	27		
		12			2				Medium gray silty clay with ferrous nodules								0.284	
	15	13			3				Soft gray very silty clay with ferrous nodules	25					26	12		
		8			4				Stiff gray silty clay with ferrous nodules									
	20	11			5				Stiff gray silty clay with ferrous nodules	24					40	22		
		13			6				Stiff gray silty clay with ferrous nodules									
		3			7			CH	Medium gray clay with ferrous nodules	38					53	34		
	25	9			8			CL	Medium gray silty clay with ferrous nodules									
		19			9			CH	Medium gray clay with ferrous nodules	34					84	55		
	30	13			10			CL	Medium gray silty clay with ferrous nodules									

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-10

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-11
Sheet 1 of 1

Drilled: Start 9/12/2011 End 9/12/2011	Total Depth (ft): 30	Logged By: SM Checked By: VT	Driller: Specialized Environmental Resources, LLC	Drilling Method: Wet Rotary	
Surface Elevation (ft) Vertical Datum: Undetermined		Hammer Data: N/A		Drilling Equipment: Pontoon Barge-Mounted Drill Rig	
Latitude: N30° 14' 10.6" Longitude: W89° 51' 56.1"		System Datum: Geographic NAD83 (feet)		Groundwater: Date Measured 9/12/2011; Depth to Water (ft) 1.0; Elevation (ft)	
Notes: See Figure A-1 for explanation of symbols.					

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
	0					▽			Zero (0) feet top of deck Water line									
	5																	
	10	7			1			CL	Mudline Very soft gray silty clay with ferrous nodules									
		9			2				Soft gray very silty clay with ferrous nodules	24					31	17		
		8.5			3				Medium gray sandy clay with ferrous nodules									
	15	13			4				Medium gray very sandy clay with ferrous nodules	24					28	14		
		9			5			CH	Medium brown and gray clay with ferrous nodules									
	20	11			6				Medium green and gray clay with calcareous and ferrous nodules	25					70	49		
		6			7				Stiff green and gray clay with ferrous nodules									
		12			8				Stiff green and gray clay with ferrous nodules	27					69	49		
	25	5			9				Stiff green and gray clay with ferrous nodules									
		6			10			CL	Stiff green and gray clay with silt, sand pockets and ferrous nodules	28					47	33		
	30																	

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-11

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-12
Sheet 1 of 1

Drilled	Start 9/12/2011	End 9/12/2011	Total Depth (ft) 31	Logged By SM / Checked By VT	Driller Specialized Environmental Resources, LLC	Drilling Method Wet Rotary
Surface Elevation (ft) Vertical Datum	Undetermined		Hammer Data	N/A	Drilling Equipment	Pontoon Barge-Mounted Drill Rig
Latitude	N30° 13' 52.0"		System Datum	Geographic NAD83 (feet)	Groundwater Date Measured	Depth to Water (ft) 1.0 / Elevation (ft)
Longitude	W89° 52' 06.0"				9/12/2011	

Notes: See Figure A-1 for explanation of symbols.

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
0	0				▽			Zero (0) feet top of deck Water line									
	5																
	10							Mudline									
		7		1			SC	Very soft dark gray clayey sand with shells	22					29	10		21
		9		2			CL	Very soft dark gray sandy clay with shells									
	15	10		3				Medium gray clay with silt, ferrous nodules and sand pockets	25					44	26		
		11		4				Medium gray silty clay with calcareous and ferrous nodules									
		12		5			CH	Medium gray clay with calcareous and ferrous nodules	23					54	34		
	20	2.5		6			CL	Medium gray silty clay with calcareous and ferrous nodules									
		11		7			CL-ML	Medium gray clayey silt with calcareous nodules	25					25	6		
	25	10		8			CL	Medium brown and gray silty clay with sand pockets and ferrous nodules									
		6.5		9				Medium tan and gray clay with silt pockets, lenses and ferrous nodules	34					49	29		
	30	9		10				Medium gray silty clay with silt pockets and ferrous nodules									

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-12

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-13
Sheet 1 of 1

Drilled: Start 9/12/2011 End 9/12/2011	Total Depth (ft): 31	Logged By: SM Checked By: VT	Driller: Specialized Environmental Resources, LLC	Drilling Method: Wet Rotary	
Surface Elevation (ft) Vertical Datum: Undetermined		Hammer Data: N/A		Drilling Equipment: Pontoon Barge-Mounted Drill Rig	
Latitude: N30° 13' 39.0" Longitude: W89° 52' 25.0"		System Datum: Geographic NAD83 (feet)		Groundwater: Date Measured 9/12/2011; Depth to Water (ft) 1.0; Elevation (ft)	
Notes: See Figure A-1 for explanation of symbols.					

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
0	0				▽			Zero (0) feet top of deck Water line									
	5																
	10							Mudline									
		9		1			CL	Very soft dark gray very sandy clay with sand pockets	33					31	14		
		10		2				Loose dark gray sandy clay with shells									
	15	11		3				Soft gray very sandy clay with ferrous nodules	17					23	11		
		4		4				Soft gray very sandy clay with ferrous nodules									
		12		5				Medium gray very silty clay with ferrous nodules	18					30	18		
	20	13		6				Medium gray silty clay with ferrous nodules									
		13		7			CH	Medium gray clay with ferrous nodules, sand pockets and lenses	35					70	47		
	25	12		8				Medium gray clay with ferrous nodules									
		9		9				Medium gray clay with ferrous nodules	31					67	47		
		12		10			CL	Medium gray clay with silt pockets, lenses and ferrous nodules	22					42	25		
	30																

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-13

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-14
Sheet 1 of 1

Drilled: Start 9/12/2011 End 9/12/2011	Total Depth (ft): 31	Logged By: SM Checked By: VT	Driller: Specialized Environmental Resources, LLC	Drilling Method: Wet Rotary	
Surface Elevation (ft) Vertical Datum: Undetermined		Hammer Data: N/A		Drilling Equipment: Pontoon Barge-Mounted Drill Rig	
Latitude: N30° 13' 31.6" Longitude: W89° 52' 04.5"		System Datum: Geographic NAD83 (feet)		Groundwater: Date Measured 9/12/2011; Depth to Water (ft) 1.0; Elevation (ft)	
Notes: See Figure A-1 for explanation of symbols.					

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	LABORATORY DATA: Water Content, %	Dry Density, (pcf)	Compressive Strength (TSF)[1]	Confining Pressure (KSF)	Strain, %	Liquid Limit (LL), %	Plasticity Index (PI), %	MiniVane Shear Strength (KSF)	Passing No. 200 Sieve, %
	0					▽			Zero (0) feet top of deck Water line									
	10								Mudline									
		9			1			CL	Very soft dark gray sandy clay									
		2			2				Very soft dark gray sandy clay with ferrous nodules	31								
	15	8			3			CH	Very soft gray clay with ferrous nodules and shells									
		8.5			4				Very soft tan and gray clay with ferrous nodules	34					58	38		
		6.5			5				Very soft gray clay with ferrous nodules									
	20	8			6				Very soft tan and gray clay with ferrous nodules	30					75	53		
		0			7				Medium gray clay with sand pockets, lenses and ferrous nodules (cuttings)									
	25	4			8				Stiff tan and gray clay with ferrous and calcareous nodules	42					76	53		
		9			9				Medium brown and gray clay with ferrous nodules									
		9.5			10				Stiff brown and gray clay with silt pockets and ferrous nodules	34					63	44		
	30																	

*Indicates a remold was used for strength testing.
[1]FV = Field Vane shear strength corrected for material characteristics.

Log of Boring B-14

GeoEngineers

Project: Bayou Bonfouca Marsh Creation Project (PO-104)
Project Location: St. Tammany Parish, Louisiana
Project Number: 16715-023-00

Figure A-15
Sheet 1 of 1

Appendix E:
GeoEngineers Settlement Curves

P:\16\16715023\00\CAD\Boring Location Plan.dwg\TAB:Layout1 modified on Mar 21, 2012 - 2:25pm

JMP : KMC

Legend

- B-1 — Borehole Location
- A A' — Cross Section
- Approximate Goose Point Fault
- Marsh Creation Areas
- Ponds
- Borrow Area

N
W E
S

3000 0 3000
FEET

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

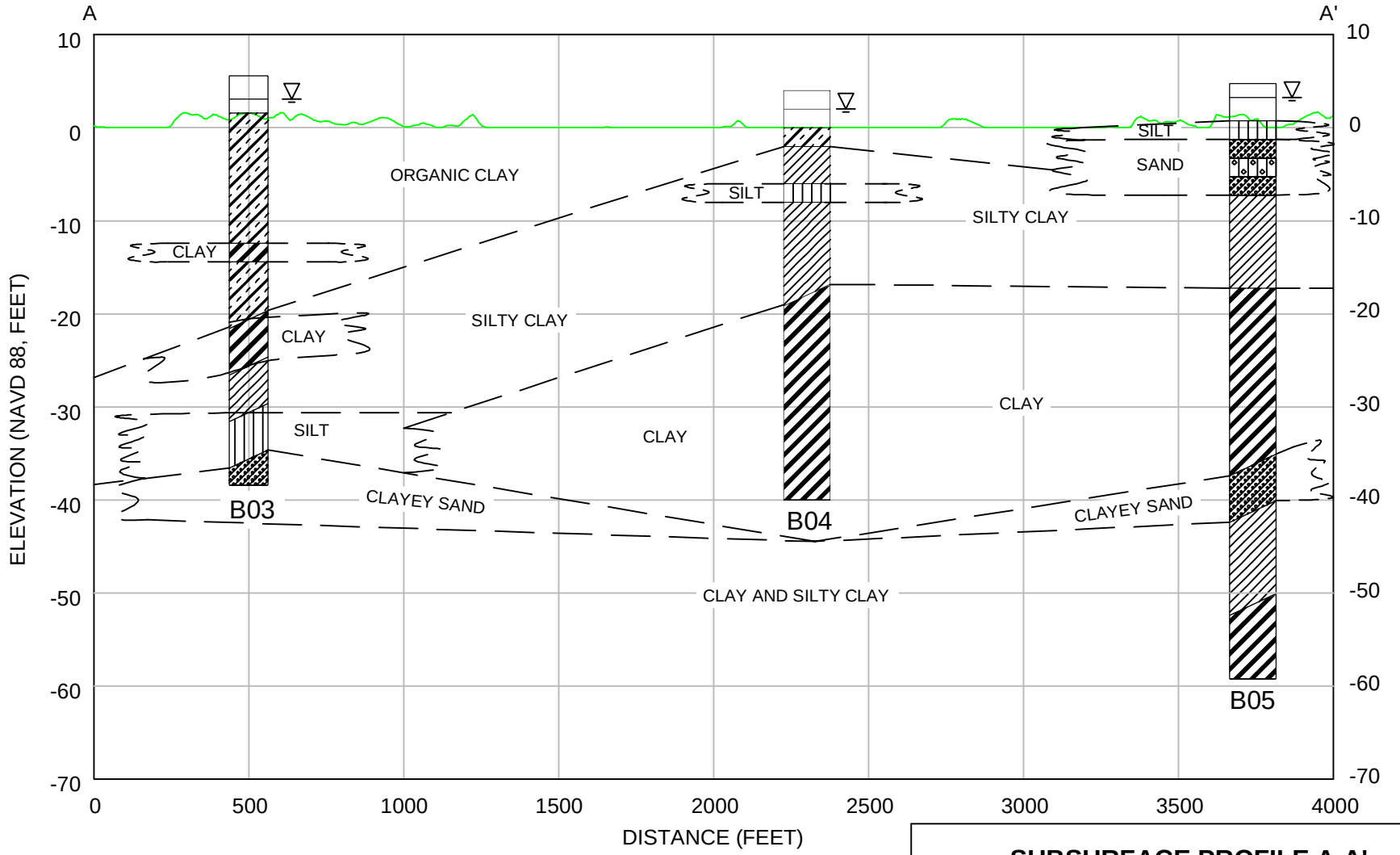
Reference: Aerial image taken form Google Earth Pro, Licensed to GeoEngineers Inc., Dated 3/22/2010

BORING LOCATION PLAN

Bayou Bonfouca Marsh Creation Project (PO-104)
St. Tammany Parish, Louisiana

GeoEngineers

Figure II-2



Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

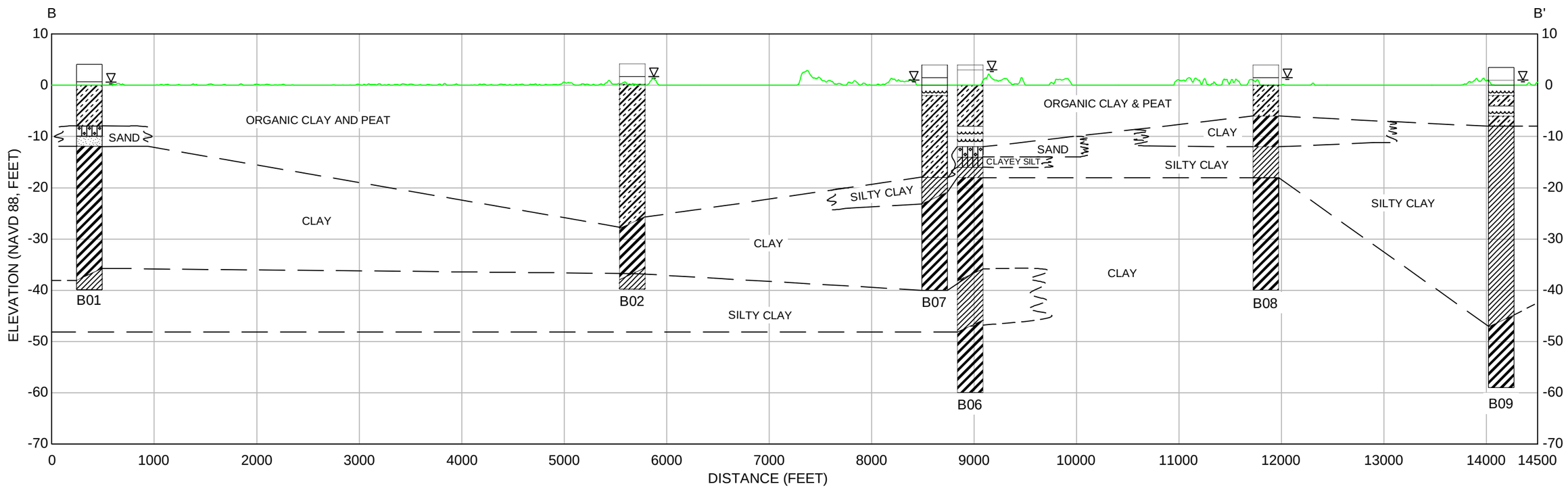
Reference: Elevation data taken from USGS, State of Louisiana, 1999-2006, 1/9-Arc Second National Elevation Dataset, Dated 8/2/2008

SUBSURFACE PROFILE A-A'

Bayou Bonfouca Marsh Creation Project (PO-104)
St. Tammany Parish, Louisiana

GeoEngineers

Figure II-3



Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Elevation data taken from USGS, State of Louisiana, 1999-2006, 1/9-Arc Second National Elevation Dataset, Dated 8/2/2008

SUBSURFACE PROFILE B-B'

Bayou Bonfouca Marsh Creation Project (PO-104)
St. Tammany Parish, Louisiana

GeoEngineers

Figure II-4

Settlement Calculation Approach for the Dredged Fill Marsh Creation Area
Bayou Bonfouca Marsh Creation (PO-104)

1. Settlement parameters were developed for each soil layer for all borings as shown in the parameter spreadsheets provided in this Appendix. Settlement parameters for Borings B-1 through B-5 and B-7 through B-9 were used for settlement estimates for the marsh creation area. Settlement parameters were developed as follows.
    (a) One consolidation test was done for each of the above mentioned soil borings and the samples for the consolidation tests were selected from varying depths and materials.
    (b) Consolidation test results were analyzed and graphs were reconstructed to determine compression (C_c), recompression (C_r), and vertical consolidation (C_v) coefficients, initial void ratios (e_0) and maximum past pressures (P_c).
    (c) Correlations presented in equations 1 through 3 (shown in the spreadsheets in Appendix III-E) were used to calculate e_0 and C_c for all the soil layers.
    (d) GeoEngineers developed different correlations based on the analyses of the consolidation test results as follows:
        (i) Void Ratio (e_o) was estimated based on water content test results for various samples and the best fit curve drawn through plotted points from consolidation test results.
        (ii) Moisture Content (w) Vs. C_v: A best fit curve was drawn through the plotted points from this and other coastal projects and C_v for the soil layers were obtained depending upon the moisture content.
        (iii) w Vs. C_c: C_c=0.0054*((w*S.G.)-35) was found to provide sufficient accuracy based on the test data for this and other projects for all compressible soil types; C_c was obtained for the soil layers based on the moisture content.
        (iv) C_r was taken to be 10% of C_c for all cohesive and semi-cohesive soils.
    (e) For the soil layers without a representative consolidation test, the above mentioned correlations were used to estimate C_c, C_r , C_v, and e_0.
    (f) Past previous pressure (P_c) were obtained from the consolidation test curves for the soil layers with a representative consolidation test. For other soil layers, the overconsolidation ratio (OCR) was estimated from the equation OCR = (c/(P_0' * 0.22))^(1/0.8). This equation was taken from Figure 7.1 of "Recommended practice for soft ground site characterization," by Charles Ladd and Don DeGroot. P_c was estimated by multiplying the overburden pressure (P_0) by OCR.
    (g) In cases where P'$_0$ was greater than P_c, P_0' was used as the maximum past pressure under the assumption that the soil is normally consolidated.
2. In this area, clay shear strength for a normally consolidated soil profile will be approximately 22% of the effective overburden pressure. This relationship is shown as the C/P line on the shear strength profiles. Based on this relationship, it appears that the top 20 feet of the soil profile is over-consolidated throughout the design profiles. For all but two of the borings (B-2 and B-3), the top 40 feet are overconsolidated. Beyond 40 feet depth, some of the layers are still overconsolidated. This affects the settlement parameters selected for design.
3. Due to the broad fill area, the drainage is vertical for all the soil layers. Drainage to the phreatic surface or to the nearest granular soil layer has been considered for these soil layers. The presence of small sand and silt layers within clay was considered in the drainage path evaluation.

Settlement of the marsh creation area consists primarily of two separate processes: consolidation of the dredged fill and consolidation of the foundation soils. Consolidation of the dredged fill was modeled using PSDDF (Primary Consolidation, Secondary Compression, and Desiccation of Dredged Fill), a program created for the United States Army Corps of Engineers to simulate finite strain consolidation in dredged fill materials. Consolidation of the foundations soils was modeled iteratively using a one-dimensional consolidation program.

To account for the effects of progressive dredged fill densification and submergence below the waterline caused by foundation soil settlement, we re-computed effective vertical stress and corresponding settlement at various time intervals after fill placement. The typical steps at some time = t were as follows:

1. Calculate settlement for soil beneath the fill based on the elapsed time and the effective stress calculated for the application of a single lift of fill and determine the new mudline elevation.
2. From PSDDF determine the change in thickness of the dredged fill to calculate the fill density and the new fill surface elevation. The new fill surface elevation is influenced by both the foundation settlement and the change in fill thickness computed by PSDDF.
3. Re-compute the effective vertical stress based on the new elevations of the fill surface and mudline, and a constant water elevation of 0.8 feet NAVD 88.
4. Use the new lower effective stress to re-compute settlement.

This was repeated at days 45, 60, 90, 180, 365, 1095 (3 years), 1825 (5 years), 3650 (10 years), and 7300 (20 years). Day 1 of the PSDDF calculation was taken as 30 days after the start of filling, allowing 30 days to complete placement of the hydraulic fill. Therefore, day 30 for foundation soil settlement calculations is day 1 for PSDDF calculations.

The sum of the dredged fill settlement and the underlying soil settlement was used to determine the total settlement at the surface of the dredge fill area after filling is complete. Settlement of dredged fill evaluations were performed for a single lift scenario with fill placed in a range of elevations from +2.0 to +4.5 feet. Results were plotted at 0.5-foot intervals (based on initial constructed fill elevation) alongside a line representing the marsh target elevation (+1.1 ft) to establish the best estimate for initial fill elevation.

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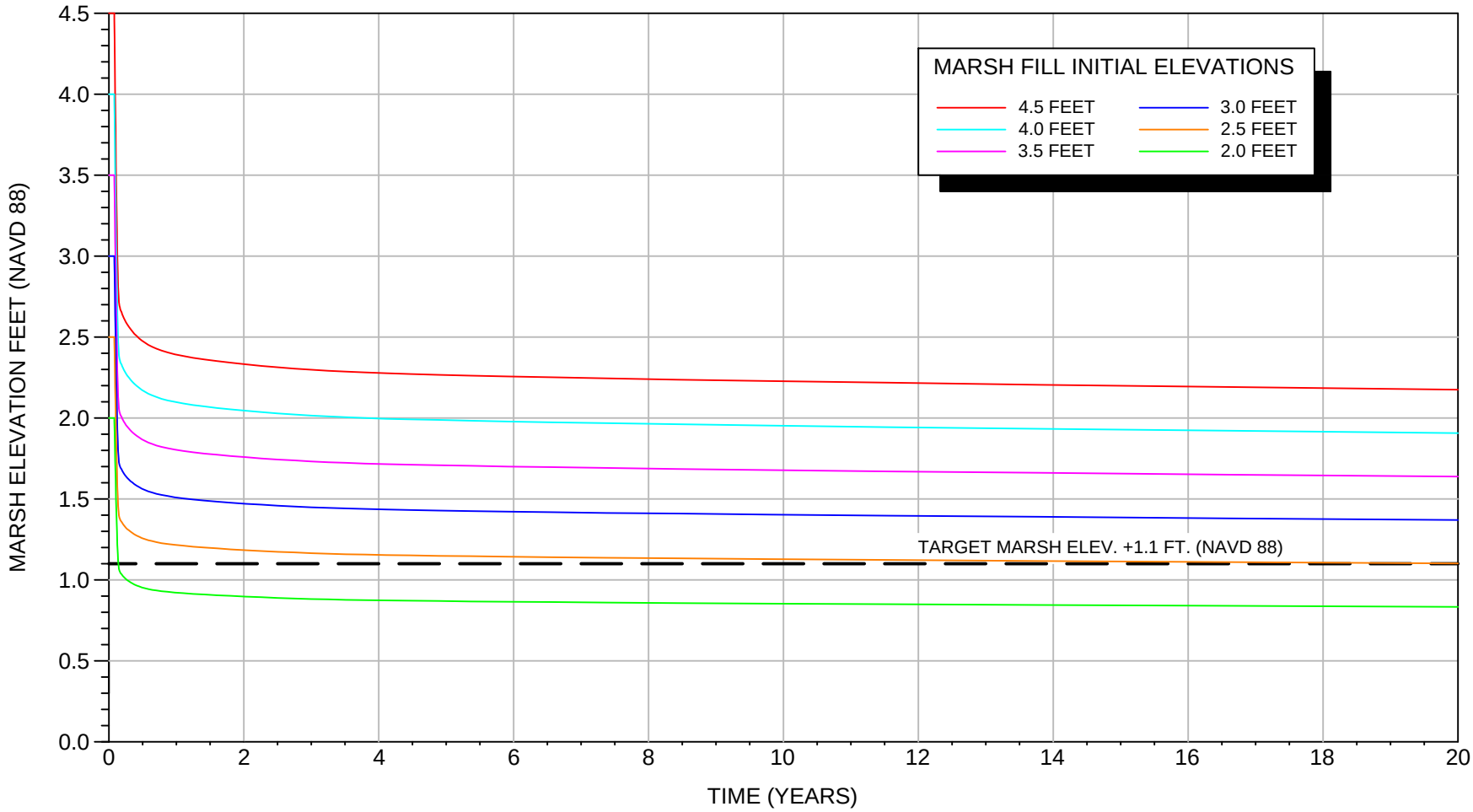

MARSH ELEVATION (FEET)						
0 DAYS	6 MONTHS	1 YEAR	3 YEARS	5 YEARS	10 YEARS	LONG TERM
2.0	0.9	0.9	0.9	0.9	0.9	0.8
2.5	1.2	1.2	1.2	1.1	1.1	1.1
3.0	1.6	1.5	1.4	1.4	1.4	1.4
3.5	1.9	1.8	1.7	1.7	1.7	1.6
4.0	2.2	2.1	2.0	2.0	1.9	1.9
4.5	2.5	2.4	2.3	2.3	2.2	2.2

MARSH ELEVATION VS. TIME (B-1)

Bayou Bonfouca Marsh Creation Project (PO-104)
St. Tammany Parish, Louisiana

GeoEngineers

Figure II-D-1

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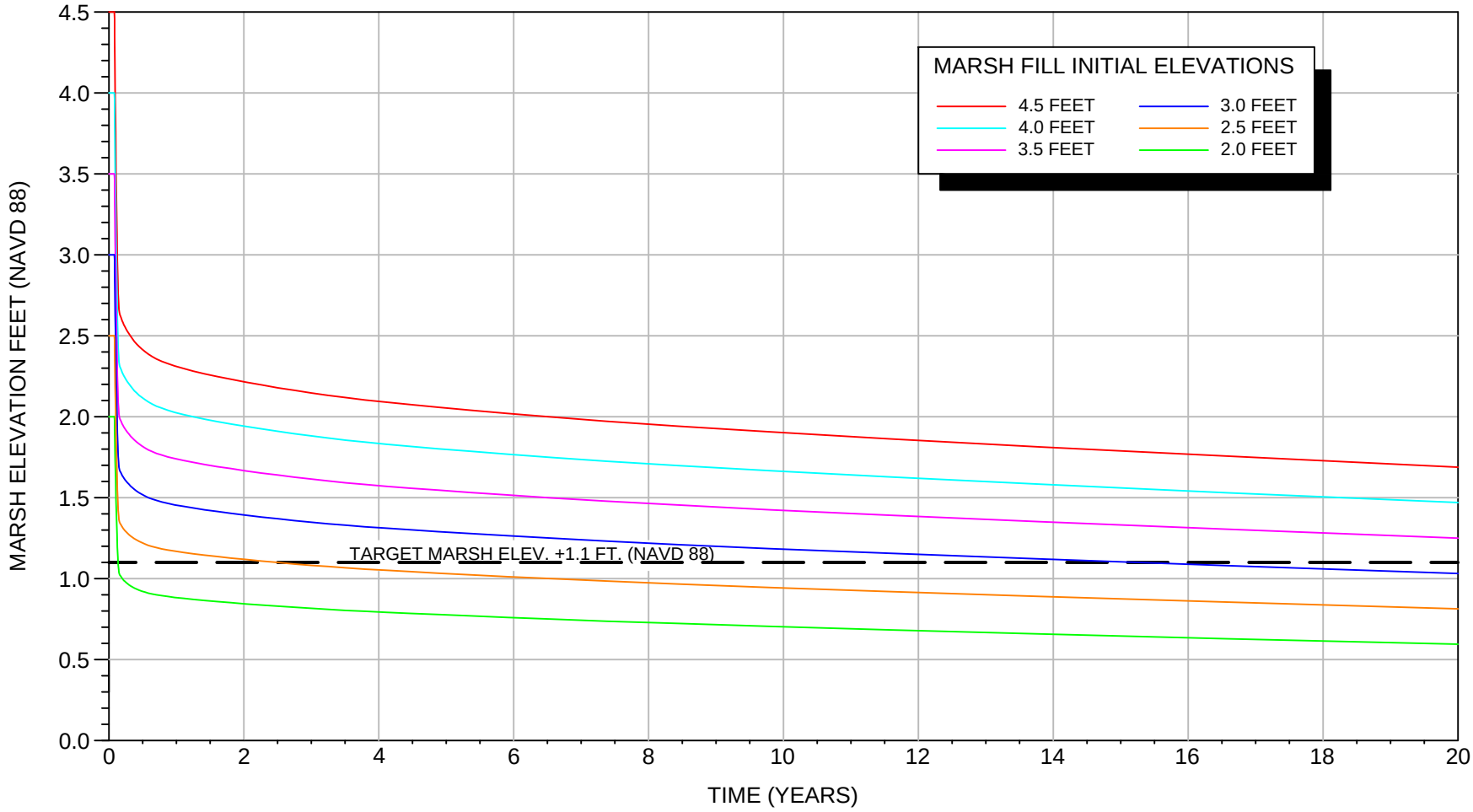

MARSH ELEVATION (FEET)						
0 DAYS	6 MONTHS	1 YEAR	3 YEARS	5 YEARS	10 YEARS	LONG TERM
2.0	0.9	0.9	0.8	0.8	0.7	0.6
2.5	1.2	1.2	1.1	1.0	0.9	0.8
3.0	1.5	1.4	1.3	1.3	1.2	1.0
3.5	1.8	1.7	1.6	1.5	1.4	1.3
4.0	2.1	2.0	1.9	1.8	1.6	1.5
4.5	2.4	2.3	2.1	2.0	1.9	1.7

MARSH ELEVATION VS. TIME (B-2)

Bayou Bonfouca Marsh Creation Project (PO-104)
St. Tammany Parish, Louisiana

GeoEngineers

Figure II-D-2

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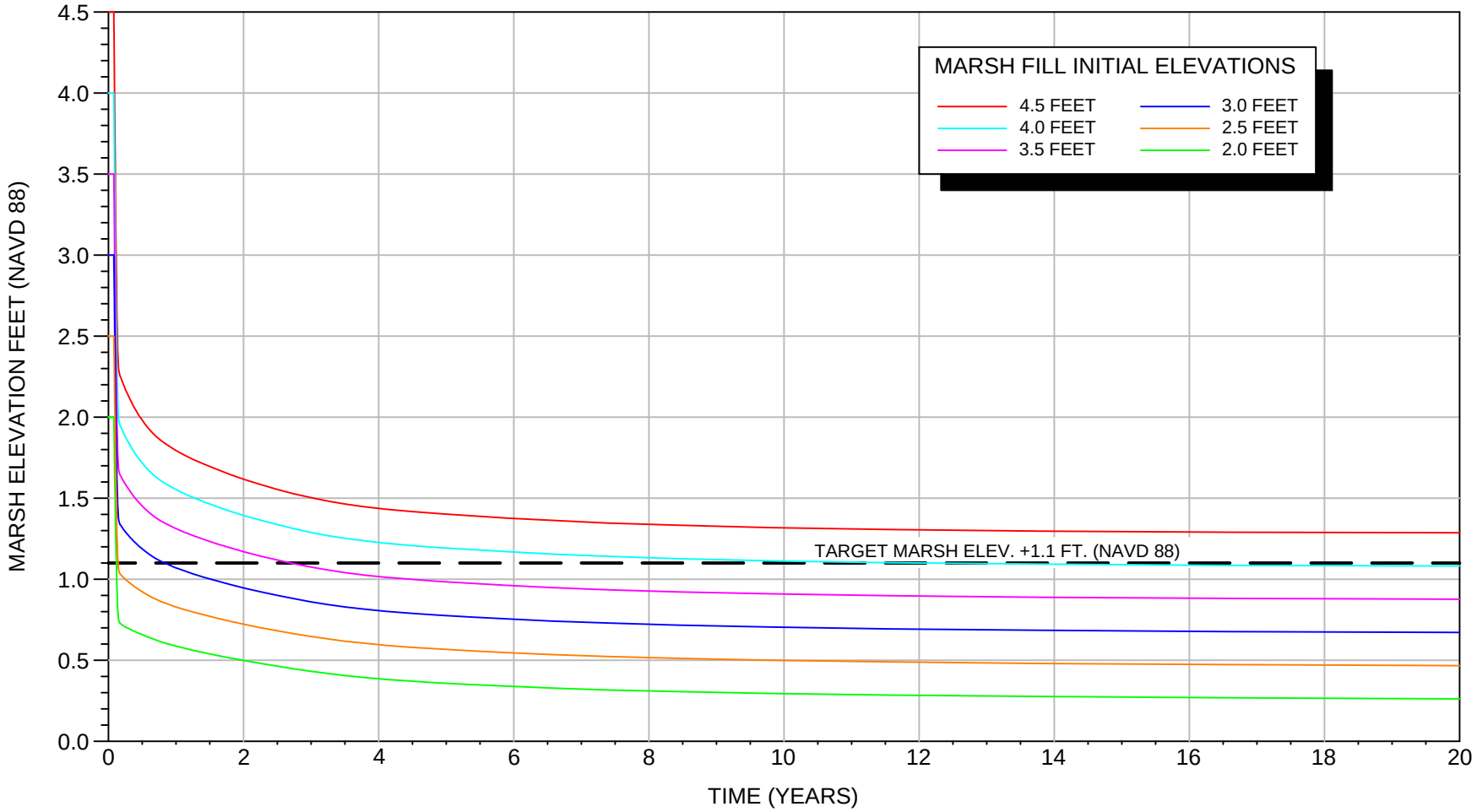


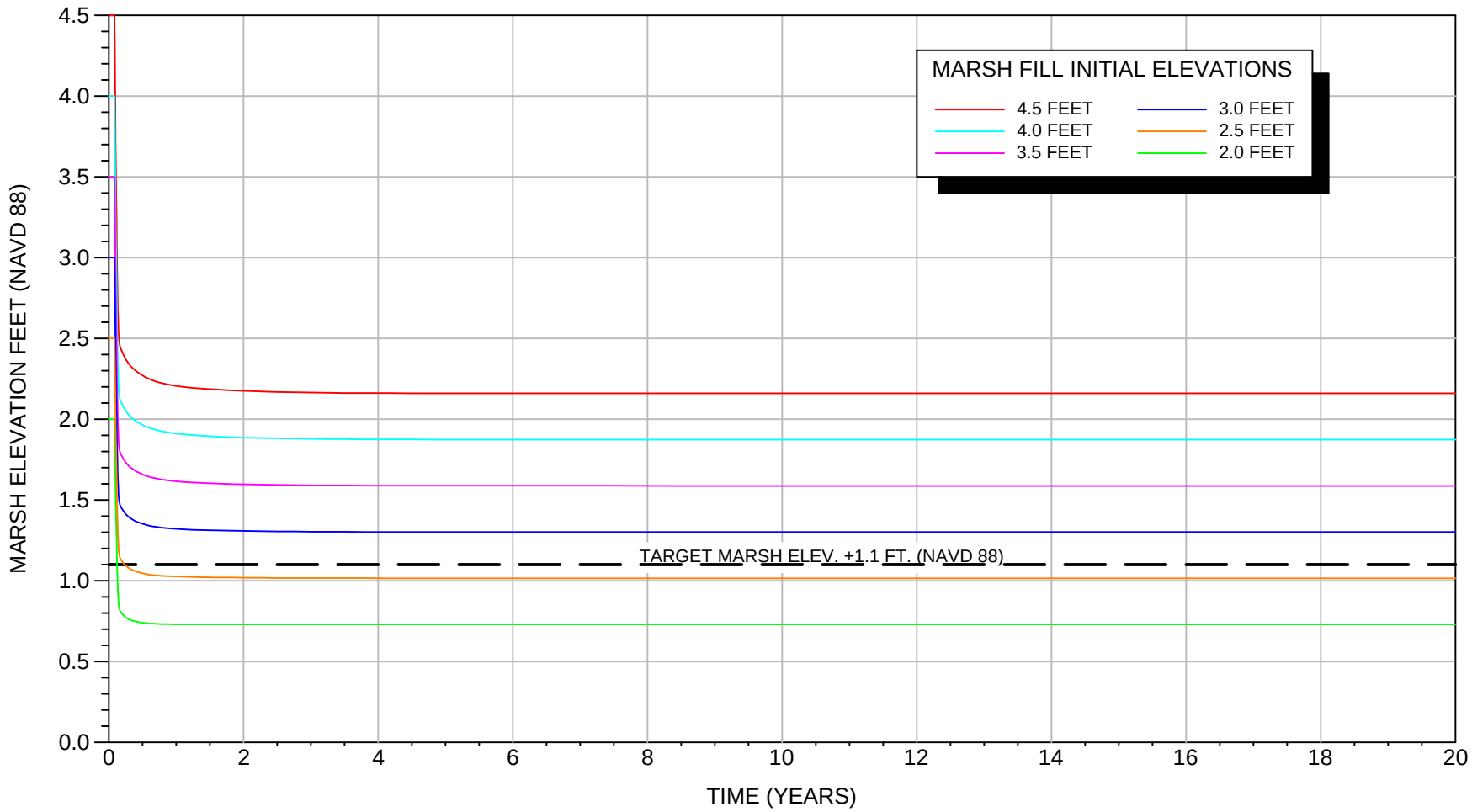
MARSH ELEVATION (FEET)						
0 DAYS	6 MONTHS	1 YEAR	3 YEARS	5 YEARS	10 YEARS	LONG TERM
2.0	0.7	0.6	0.4	0.3	0.3	0.3
2.5	0.9	0.8	0.6	0.6	0.5	0.5
3.0	1.2	1.0	0.8	0.8	0.7	0.7
3.5	1.4	1.3	1.0	1.0	0.9	0.9
4.0	1.7	1.5	1.3	1.2	1.1	1.1
4.5	2.0	1.8	1.5	1.4	1.3	1.3

MARSH ELEVATION VS. TIME (B-3)

Bayou Bonfouca Marsh Creation Project (PO-104)
St. Tammany Parish, Louisiana

GeoEngineers

Figure II-D-3



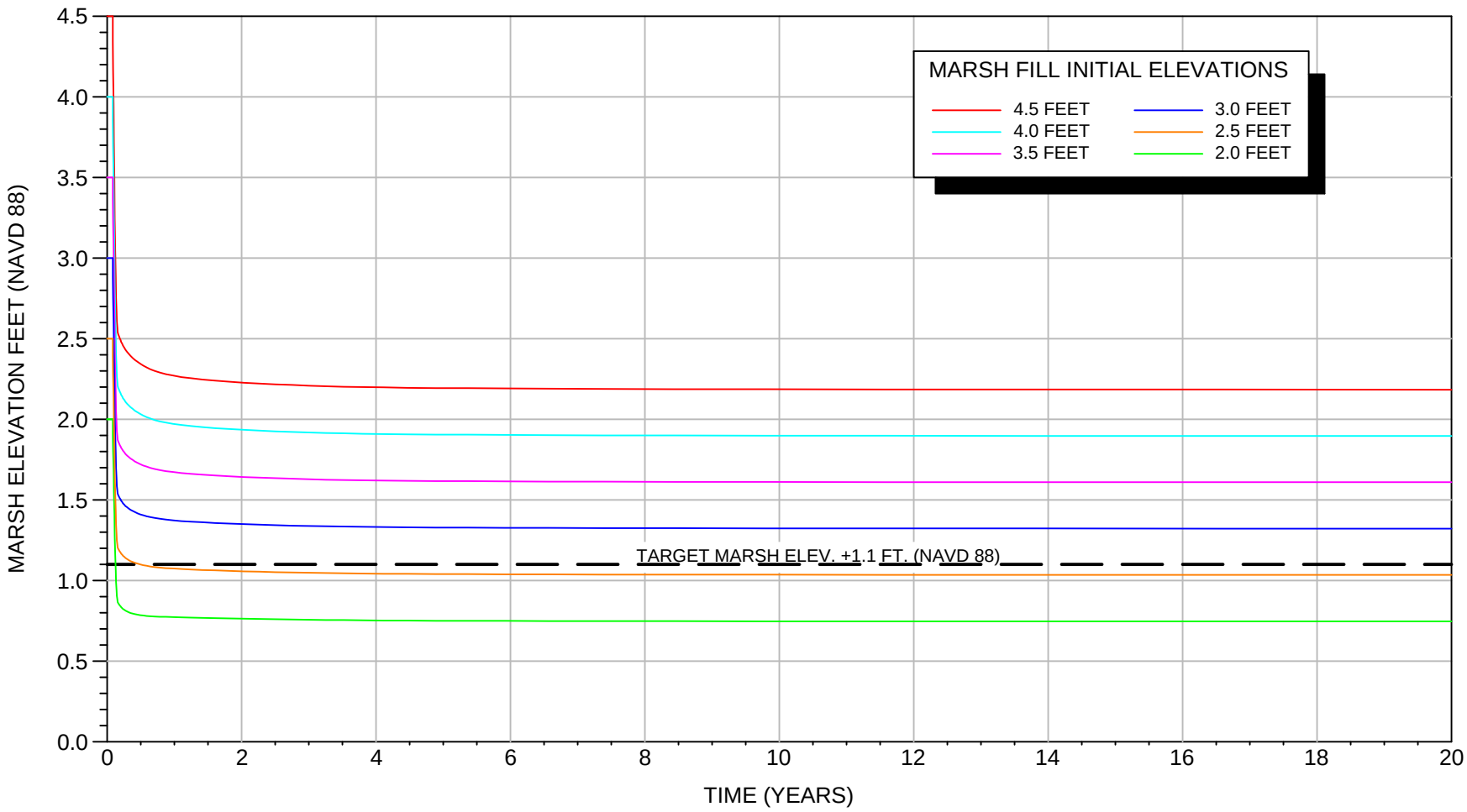
MARSH ELEVATION (FEET)						
0 DAYS	6 MONTHS	1 YEAR	3 YEARS	5 YEARS	10 YEARS	LONG TERM
2.0	0.7	0.7	0.7	0.7	0.7	0.7
2.5	1.0	1.0	1.0	1.0	1.0	1.0
3.0	1.3	1.3	1.3	1.3	1.3	1.3
3.5	1.6	1.6	1.6	1.6	1.6	1.6
4.0	2.0	1.9	1.9	1.9	1.9	1.9
4.5	2.3	2.2	2.2	2.2	2.2	2.2

MARSH ELEVATION VS. TIME (B-4)

Bayou Bonfouca Marsh Creation Project (PO-104)
St. Tammany Parish, Louisiana

GeoEngineers

Figure II-D-4



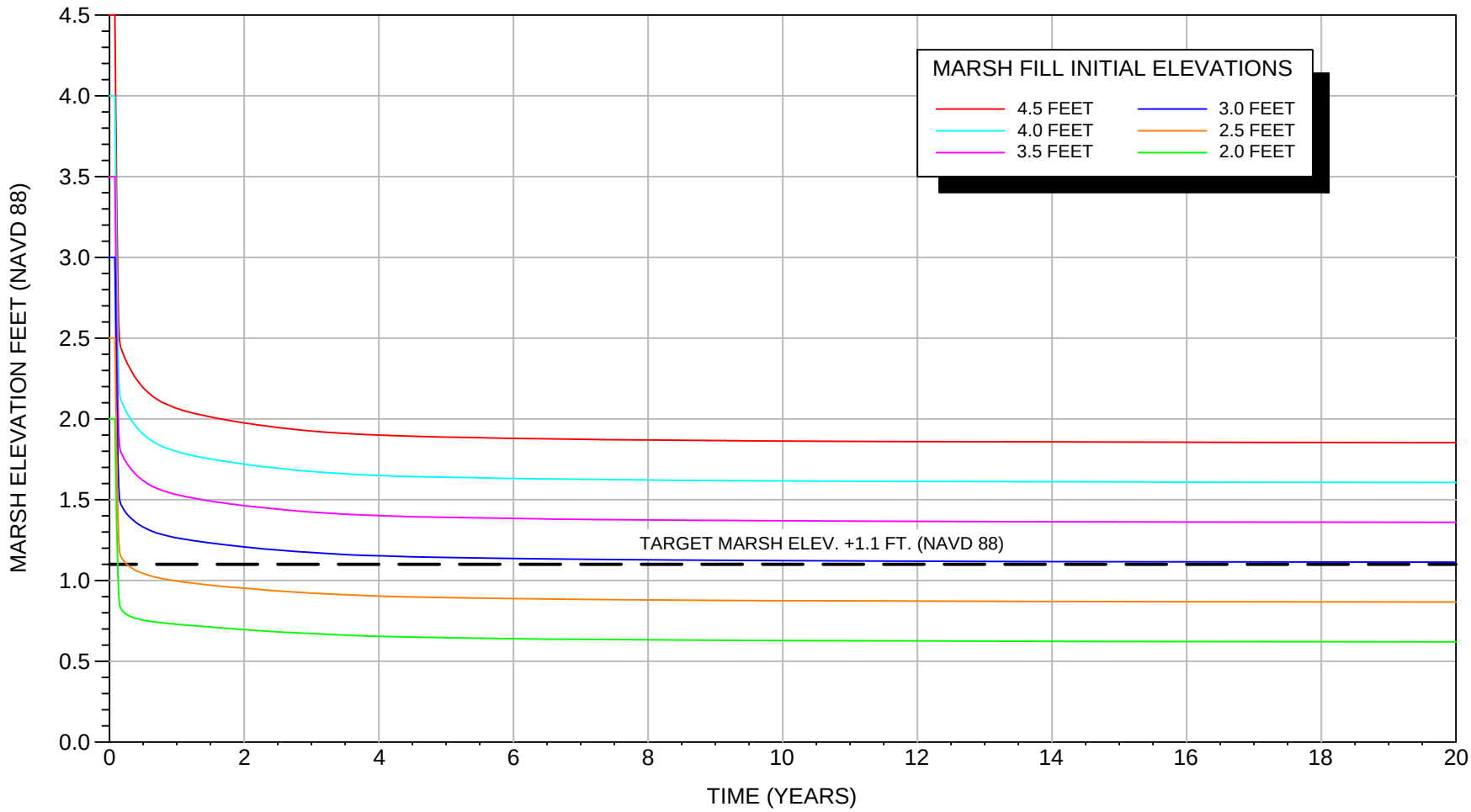
MARSH ELEVATION (FEET)						
0 DAYS	6 MONTHS	1 YEAR	3 YEARS	5 YEARS	10 YEARS	LONG TERM
2.0	0.8	0.8	0.8	0.7	0.7	0.7
2.5	1.1	1.1	1.0	1.0	1.0	1.0
3.0	1.4	1.4	1.3	1.3	1.3	1.3
3.5	1.7	1.7	1.6	1.6	1.6	1.6
4.0	2.0	2.0	1.9	1.9	1.9	1.9
4.5	2.3	2.2	2.2	2.2	2.2	2.2

MARSH ELEVATION VS. TIME (B-5)

Bayou Bonfouca Marsh Creation Project (PO-104)
St. Tammany Parish, Louisiana

GeoEngineers

Figure II-D-5



MARSH ELEVATION (FEET)						
0 DAYS	6 MONTHS	1 YEAR	3 YEARS	5 YEARS	10 YEARS	LONG TERM
2.0	0.8	0.7	0.7	0.6	0.6	0.6
2.5	1.0	1.0	0.9	0.9	0.9	0.9
3.0	1.3	1.2	1.2	1.1	1.1	1.1
3.5	1.6	1.5	1.4	1.4	1.4	1.4
4.0	1.9	1.8	1.7	1.6	1.6	1.6
4.5	2.2	2.0	1.9	1.9	1.9	1.9

MARSH ELEVATION VS. TIME (B-7)

Bayou Bonfouca Marsh Creation Project (PO-104)
St. Tammany Parish, Louisiana

GeoEngineers

Figure II-D-6

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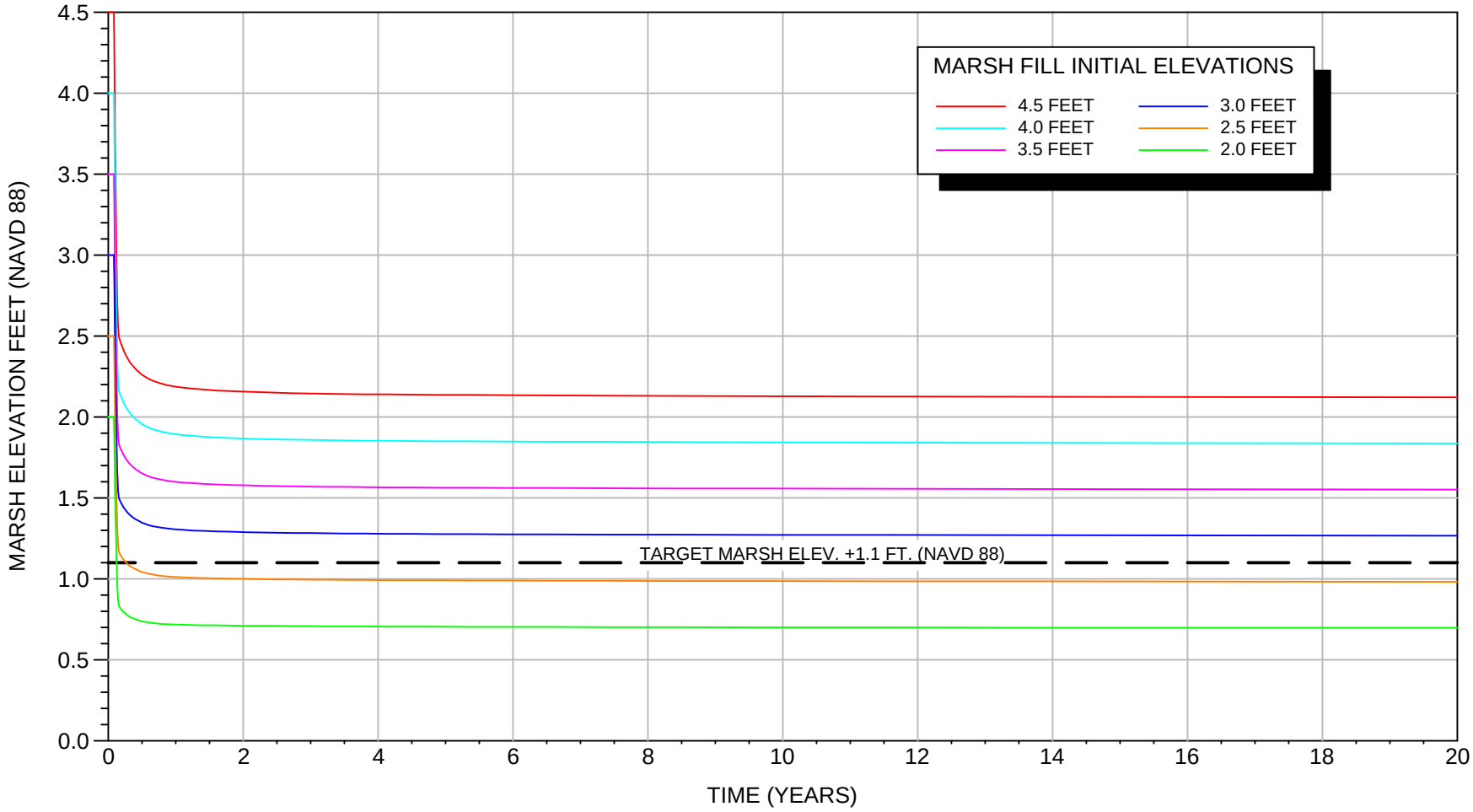

MARSH ELEVATION (FEET)						
0 DAYS	6 MONTHS	1 YEAR	3 YEARS	5 YEARS	10 YEARS	LONG TERM
2.0	0.7	0.7	0.7	0.7	0.7	0.7
2.5	1.0	1.0	1.0	1.0	1.0	1.0
3.0	1.3	1.3	1.3	1.3	1.3	1.3
3.5	1.6	1.6	1.6	1.6	1.6	1.6
4.0	1.9	1.9	1.9	1.8	1.8	1.8
4.5	2.2	2.2	2.1	2.1	2.1	2.1

MARSH ELEVATION VS. TIME (B-8)

Bayou Bonfouca Marsh Creation Project (PO-104)
St. Tammany Parish, Louisiana

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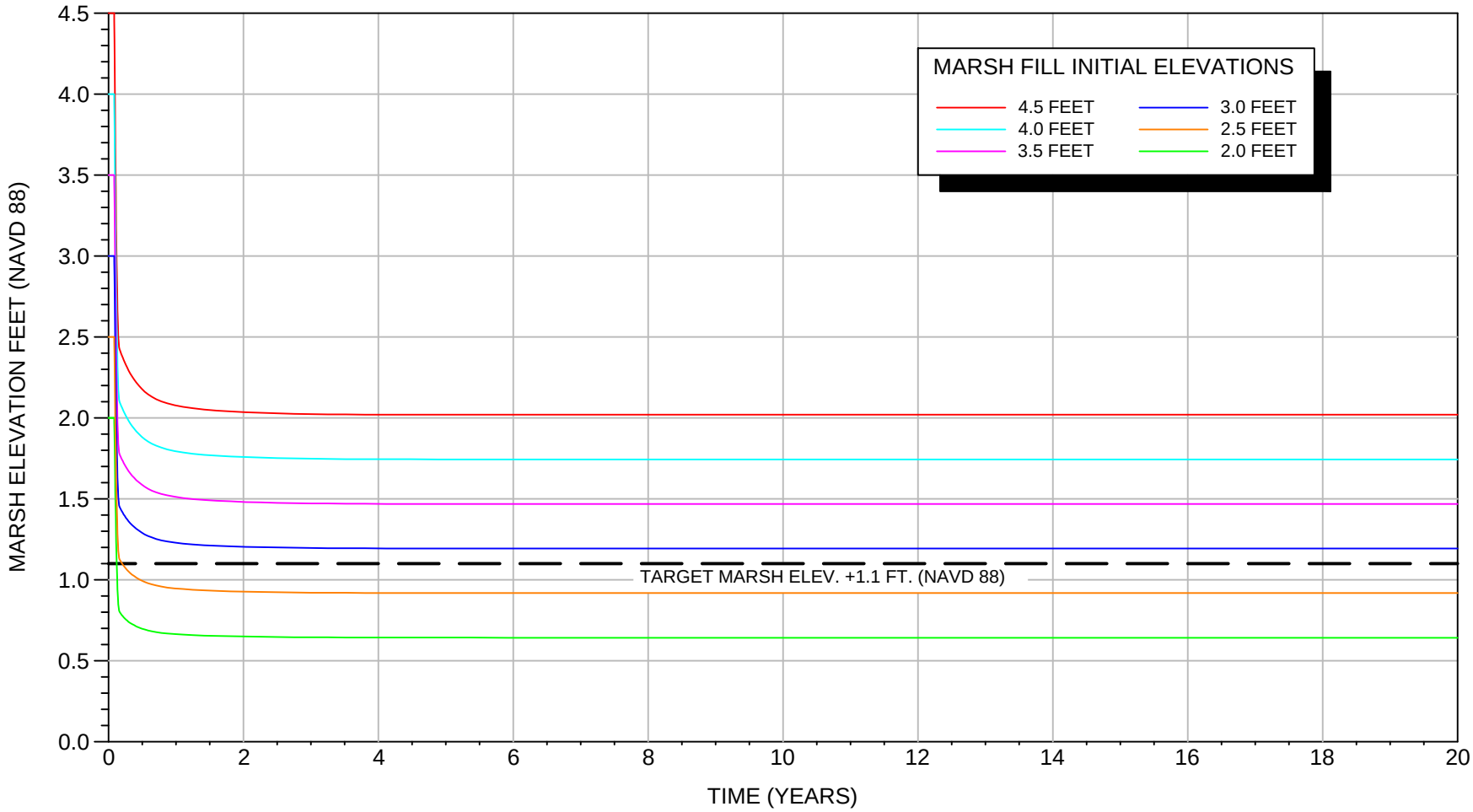
Figure II-D-7



MARSH ELEVATION (FEET)						
0 DAYS	6 MONTHS	1 YEAR	3 YEARS	5 YEARS	10 YEARS	LONG TERM
2.0	0.7	0.7	0.6	0.6	0.6	0.6
2.5	1.0	0.9	0.9	0.9	0.9	0.9
3.0	1.3	1.2	1.2	1.2	1.2	1.2
3.5	1.6	1.5	1.5	1.5	1.5	1.5
4.0	1.9	1.8	1.7	1.7	1.7	1.7
4.5	2.2	2.0	2.0	2.0	2.0	2.0

MARSH ELEVATION VS. TIME (B-9)

Bayou Bonfouca Marsh Creation Project (PO-104)
St. Tammany Parish, Louisiana

GeoEngineers

Figure II-D-8

Appendix F:
Archeological Information

SITE RECORD FORM

Site Name: Bonfouca 2 State Survey No.:16ST168
Other Site Designations: **Instructions for Reaching Site:** Shell midden at the mouth of Bonfouca on Lake Pontchatrain **Parish** St Tammany
USGS Quad (name, date, series): North Shore,7.5 ' series (32 Qb)
of the of the of Section 23 Township 9S Range 13E
UTM Coordinates: Zone 15 Easting 224070 Northing 33479780

PHYSICAL SETTING

Land Form: beach ridge Slope: none
Geologic Processes: wave washed, subsidence Elevation: 0-5 ft AMSL
Site Position with Respect to Terrain: in the lake and along bayou banks
Nearest Water: Lake Pontchatrain Flooding: frequent
Soil Characteristics: Lafitte. level, very poorly drained soils that have a mucky surface layer and clayey and mucky underlying matrial; in brackish marshes
Floral Communities: plants and animals associated with lake shore

Faunal Communities:
Other Potential Resources:
Nearest Known Site: 16ST3/27

SITE DESCRIPTION

Site Size: c. 60 x 90 m(200 x 300 ft) Plan:
Orientation: Stratigraphy: shell midden
Artifact Density: light to moderate Artifact Distribution:very scattered by wave action
Cultural Features:
Cultural Affiliation: Marksville (based on Marksville Incised) and Plaquemine/Mississippian (based on possible Pontchetrain Checked Stamp and shell tempered sherd)
Presumed Function: camp?

COLLECTIONS

Survey Method: grab surface
Assessment of Collecting Conditions:moderate to good, depending on depth of lake and bayou
Description of Material: 33 sherds including 3 possible Pontchrartrain Check Stamp, 1 Mazique Incised, 1 Marksville Incised, and 1 shell tempered sherd; 2 Gary and 2 Kent points, 1 drill

CONDITIONS

Present Use Erosion or Disturbance: highly eroded by lake wave action, also area may be used to dump historic debris (many bricks on site)
Probable Future Destruction: likely destruction through subsidence and wave action

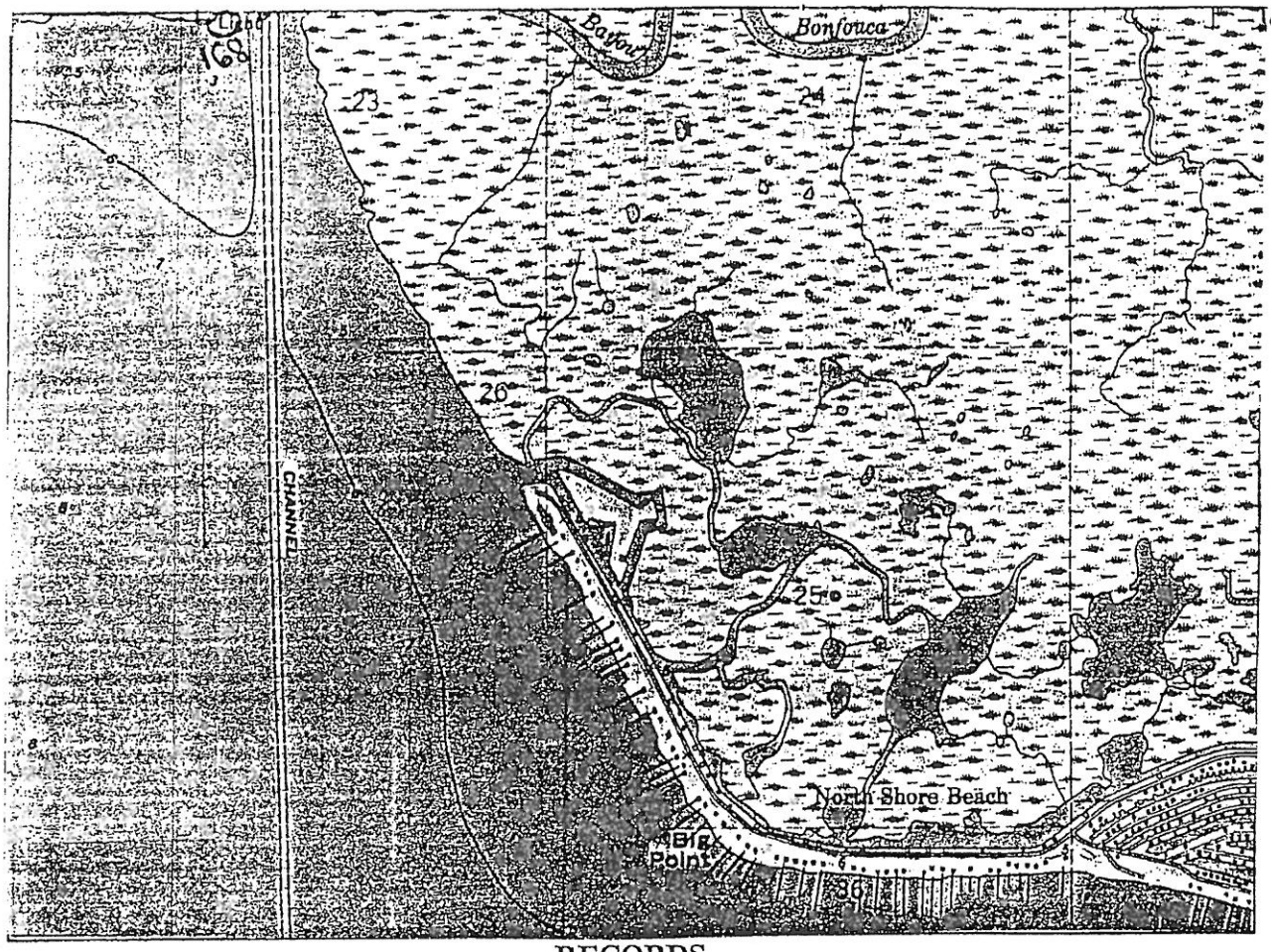
(2 of 3)
16ST168

SITE EVALUATION

Research Potential: probably poor given its eroded condition
State or National Register Eligibility (Criteria D): unknown
Recommendations: monitor

QUAD MAP OF SITE AREA

16ST168



RECORDS

Owner and Address:
Tenant and Address:
Informants: Joey Grubaugh
Previous Investigations:
Previous Collections and Availability: collection with J. Grubaugh
References: 22-1913
Photographs and Maps: photograph of site (see Continuation form) and photograph of Grubaugh collection: LSU H95-L1-11 thru 13
Remarks:
Recorded by: Chris Hays (RAP-LSU) based on interview with J. Grubauagh Date: 7/12/95

DRAFT

STATE OF LOUISIANA SITE RECORD UPDATE FORM

Site Name: Point au Chien **Site Number: 16ST33**

Other Site Designations: none
Parish: St. Tammany
Instructions for Reaching the Site: Launch into Bayou Liberty at the St. Genevieve Church ramp in Bonfouca La. Travel SW down Bayou Liberty into Lake Pontchartrain, travel west/northwest along the north shore of Lake Pontchartrain approximately 0.94 miles, site is located on the north shore of Lake Pontchartrain at this point.
7.5' USGS Quadrangle (name, date): Lacombe, 1971 (1994); Slidell, 1971 (1994)
_____¼ of the _____¼ of the _____¼ of Irreg ☒ **Section:** 21 and 22 **Township:** 9S **Range:** 13E

UTM CP Coordinates
(Beach Ridge): **Zone:** 16 **Easting:** 223029 **Northing:** 3350130 **NAD:** NAD 83

UTM CP Coordinates
(Shell midden): **Zone:** 16 **Easting:** 222858 **Northing:** 3350134 **NAD:** NAD 83

Geographical Coordinates: Latitude: _____ Longitude: _____

Geographical Setting

Landform: marsh/relic beach ridge
Distance and Direction to Nearest Water: on north shore of Lake Pontchartrain
Soil Series: Lafitte Muck

Site Investigation and Description

Survey Method(s): visual inspection
Site Size: shell midden stretches approximately 1,866 meters along north shore of Lake Pontchartrain
Site Shape/Plan: linear along the shore of Lake Pontchartrain
Representative Stratigraphy: none observed
Depth of Deposit: unknown
Cultural Features: shell midden on lake shore/earth and shell midden on relic beach ridge
Cultural Affiliation: unknown prehistoric; Coles Creek
Site Function: camp/extraction locale
Description of Material: shell, aboriginal pottery, projectile point, and faunal bone observed but not collected

Site Condition

Present Use: open marsh land
Disturbance: Yes ☒ No ☐ please explain in the Narrative

Site Evaluation

Research Potential: good
Recommend Further Work: Yes ☒ No ☐ please explain in the Narrative

Records

Owner and Address/Contact Info: Big Branch National Wildlife Refuge, 61389 Hwy. 434 Lacombe, LA 70445. Phone Number: 985-882-2000
References: 22-1380
Permanent Disposition of Current Collection: no collections made

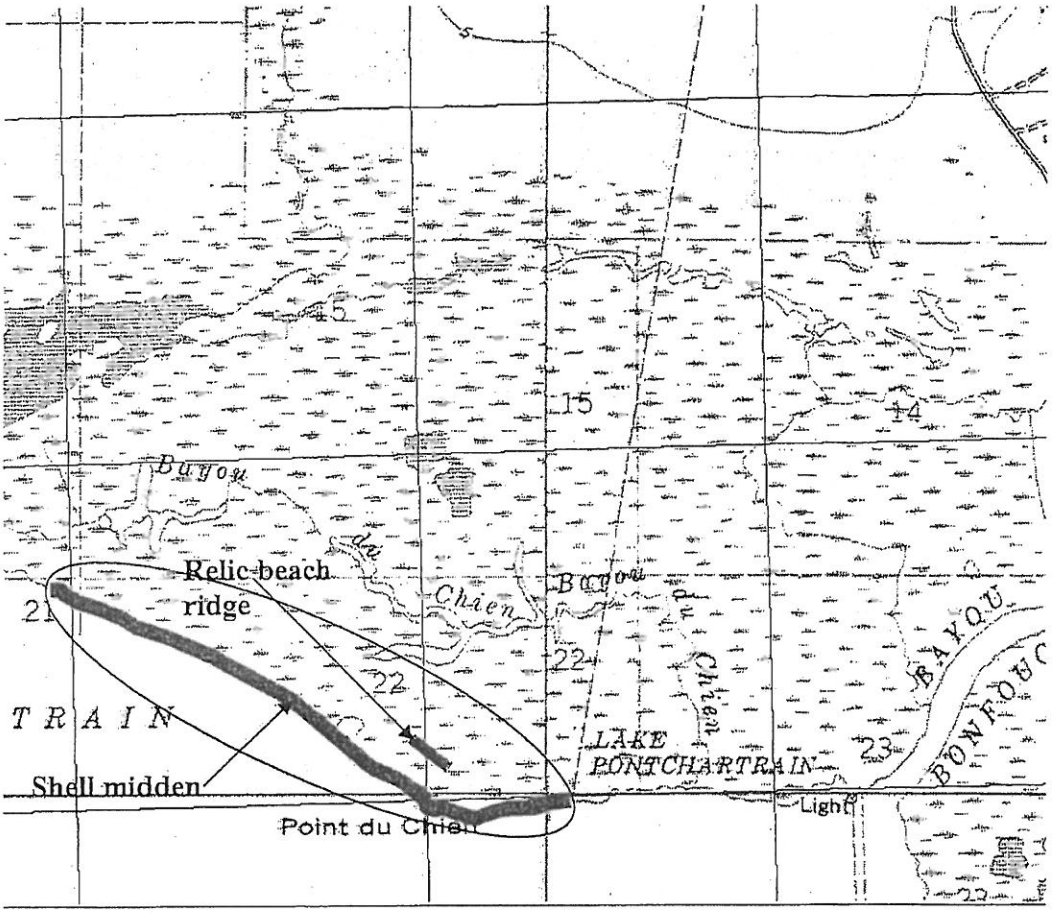
Recorded By: R. Mann
Company/Organization Contact Info: LSU
Date: 09/21/2010

STATE OF LOUISIANA MAP PAGE

Site Name: Point au Chien

Site Number: 16ST33

USGS 7.5' Quadrangle Map of Site Area



STATE OF LOUISIANA NARRATIVE PAGE

Site Name: Point au Chien Site Number: 16ST33

Please provide a brief summary of the geographical setting and site condition. This information may include site elevation, slope, other potential resources, other nearby sites, past/current environmental information, site orientation on the landscape, collecting conditions such as ground visibility, and any possible future threats to the site. Also use this page to elaborate on any of the sections on the site form, including additional UTM coordinates for the site boundaries.

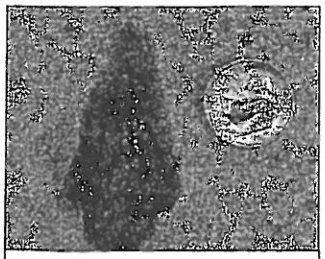
My visit to the Big Branch Marsh NWR was spurred by reports of an unrecorded mound associated with a large shell midden site along the north shore of Lake Pontchartrain. In conversations with Mr. Bill Baker, a local collector and fisherman, I initially thought he was referring to Bonfouca 2 (16ST168), a shell midden located where the mouth of Bayous Bonfouca/Liberty empty into Lake Pontchartrain. This site was recorded by Chris Hays in 1995 based on an interview with a local collector and LAS Delta Chapter member named Joey Grubaugh. Hays (1995:33) did not visit the site but did inventory and photograph Grubaugh's surface collection from the site.

Because the site had not been visited by a professional archaeologist and Mr. Baker was concerned about the amount of erosion occurring along the north shore of Lake Pontchartrain, especially in the years following Hurricane Katrina, I made arrangements with Mr. Daniel Breaux, Manager of the Big Branch NWR, to visit the area. We put in at Boufouca and traveled down Bayou Liberty to Lake Pontchartrain. At this point it became clear that the site Mr. Baker was referring to was not Bonfouca 2 (16ST168). In fact, we saw no evidence of this site at its plotted location. It may be that is it now submerged or has completely eroded away. However, since this turned out not to be the primary area of interest, we did not make a systematic effort to locate this site. An additional trip to the area should be able to clear up the present status of the site.

The site Mr. Baker was concerned with turned out to be Point au Chien (16ST33). This site was also originally recorded by Saucier and Gagliano in 1958. As originally recorded the site was described as an elongated shell (rangia) midden located on a relic beach ridge approximately 500 feet (152.4 m) north of the shore of Lake Pontchartrain. The site was updated by Beavers, Lamb, and Greene in 1988. They also note that the site is located on a "beach ridge extending above the marsh" and likewise plotted the site north of the shore of Lake Pontchartrain. It is unclear if they saw midden deposits or artifacts eroding from the marsh on the shore of Lake Pontchartrain. Presently, however, an extensive shell midden is actively eroding from the marsh on the north shore of Lake Pontchartrain. The relict beach ridge, which rises slightly above the marsh, is covered with scrub and several large live oaks. The elongated midden reported by Saucier and Gagliano and Beavers, Lamb, and Greene is still present here and I saw artifacts (pottery) and rangia shell in the root ball of a recently uprooted live oak. The relic beach ridge is what Mr. Baker was referring to as a mound. This is the site recorded as Point au Chien (16ST33). However, the site seems to be much more extensive than previously recorded if the shell (rangia and some oyster) midden now eroding from the shore line of Lake Pontchartrain is considered part of the site. Based on aerial images of the area, the shell midden extends for approximately1866.8 m along the north shore of Lake Pontchartrain. We were able to only inspect a small portion of the midden during my visit, but it is evident that artifact density is fairly high throughout the midden. Diagnostic pottery types that I observed (e.g. Pontchartrain Check Stamped, *var. unspecified*, Mazique Incised, *var. unspecified*) suggest a strong Coles Creek component present on the site. A stemmed dart point was also observed (see figure). Mr. Baker reports that he has found Tchefuncte pottery and microdrills at the site, but I have not seen

his collection. Faunal bone was also present on the surface; I saw no obvious human bone. No collections were made during our visit, artifacts were photographed on site.

My visit to the Point au Chien site (16ST33) has revealed a much more extensive shell midden than previously recorded as being present at this location. It seems possible, given the amount of shore line erosion that has taken place since Hurricane Katrina, that this midden deposit has only recently become so prominently exposed. Investigators visiting the site in 1988 certainly did not give the impression that such an extensive shell midden was visible on the shore of Lake Pontchartrain. Additional survey and testing of this midden is recommended in order to accurately record the nature and extent of this deposit, its cultural affiliation(s), and its precise relationship to the midden deposits located on the relic beach ridge. These investigations are necessary before the NRHP status of this impressive site can be determined.



Projectile point on surface of the Point au Chien site.

STATE OF LOUISIANA

SITE RECORD UPDATE FORM

Site Name Point au Chien State Survey No. 16 ST 33

Other Site Designations

Instructions for Reaching Site By boat down Bayou Bonfouca to Lake Pontchartrain, west along lake shore to Bayou du Chien

Parish St. Tammany

USGS Quad: (name, date series) Slidell, La. (31Qc)

of the SW ¼ of the SW ¼ of Section 22 Township 9 S Range 13 E

UTM Coordinates: Zone Easting Northing

Geographical Coordinates: Latitude 30° 15' 55" N Longitude 89° 5' 18" W

PHYSICAL SETTING

Land Form Beach ridge Geologic Processes Erosion

Elevation

Slope Site Position with Respect to Terrain Beach ridge extending above marsh

Nearest Water Lake Pontchartrain & B. du Chien Flooding Yes

Soil Characteristics Sand

Floral Communities

Faunal Communities

Other Potential Resources

Nearest Known Site 16 ST 34

SITE DESCRIPTION

Site Size 450' x 45' Plan

Orientation east-west along shore Stratigraphy

Artifact Density Sparse Artifact Distribution

Cultural Features

Cultural Affiliation Late Marksville

Presumed Function Fishing & collecting station

COLLECTIONS

Survey Method Close order pedestrian

Assessment of Collecting Conditions Good - sherds eroding along shore

Description of Material Baytown Plain var. Unspecified, French Fork Incised var. Larkin, Marksville Incised var. Manny, Marksville Incised var. Unspecified. Variety of faunal material, including deer, turtle, alligator and fish

CONDITIONS

Present Use None Erosion or Disturbance Erosion

Probable Future Destruction Continued erosion

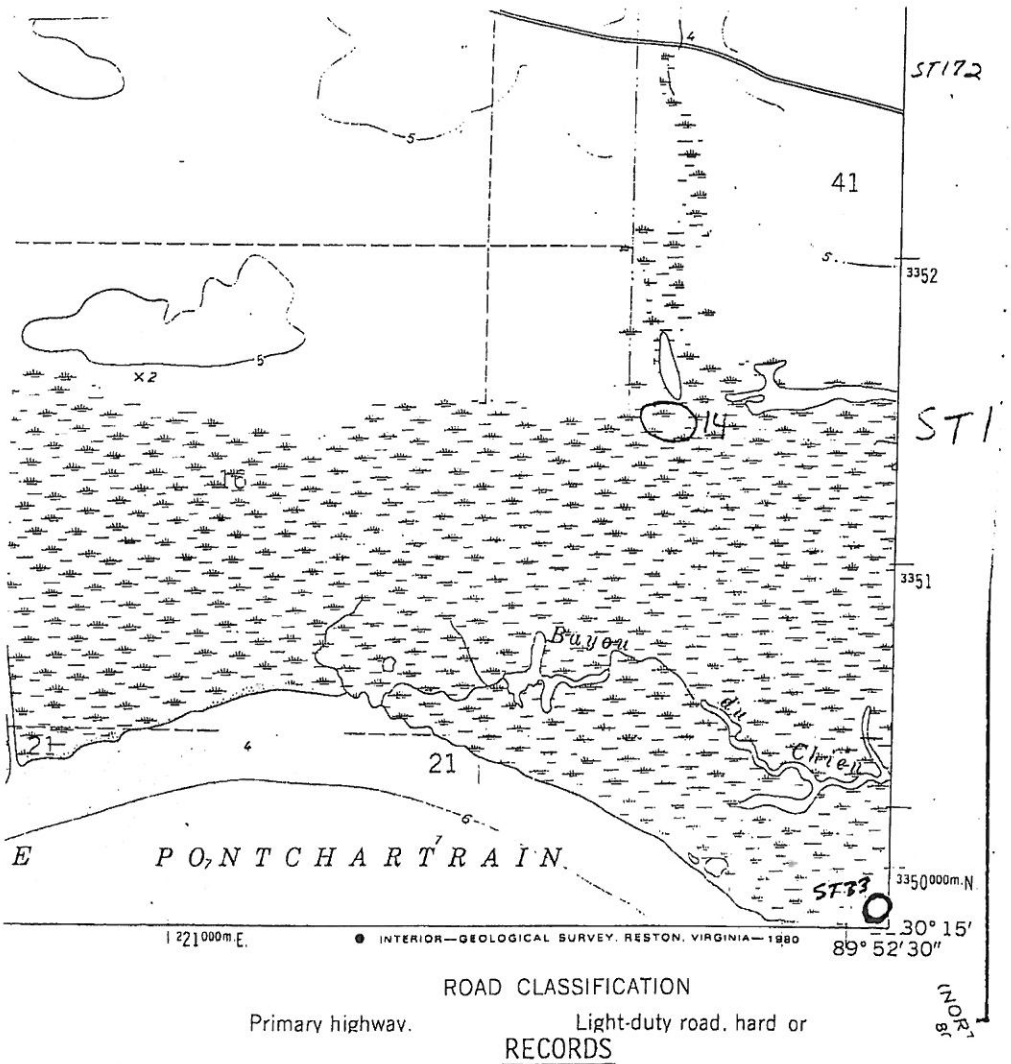
SITE EVALUATION

Research Potential Fair

State or National Register Eligibility Probable state eligibility

Recommendations Further testing may indicate National Register potential

QUAD MAP OF SITE AREA



RECORDS

Owner and Address

Tenant and Address

Informants

Previous Investigations

Previous Collections and Availability

References (22-1380) Beavers, Lamb & Greene, 1988 "Prelim. Arch Survey, Bayous Liberty & Bonfouca

Photographs and Maps University of New Orleans, Archaeological Research Program

Remarks

Recorded by Beavers, Lamb & Greene Date 6/20/88

(1 of 3)

STATE OF LOUISIANA
SITE RECORD FORM

ite Name: Point Auchien — State Survey No: 16ST33
Other Site Designation: — Parish: St. Tammany
Instructions for Reaching Site:
On Point Auchien on N shore of Lake Pontchartrain about 500' N of shore and about 4400' W of mouth of Bayou Bonfouca
USGS Quad (Name, date, series): Slidell (1950) 15'
Quad No: 31-Q E quarter of the IR quarter of Section 22 Township 9S Range: 13E
UTM Coordinates: Zone: 16 Easting: Northing:
Geographical Coordinates: Latitude: Longitude:

PHYSICAL SETTING

Land Form: Beach ridge — Slope:
Geologic Processes: — Elev. ft AMSL: -2
Site Position: Subsided beneath marsh on a beach ridge
Near Water: — Flooding:
Soil Characteristics: Medium silty sand w/ some shell below midden
Floral Communities: Live oaks, hackberry
Faunal Communities:
Other Potential Resources:
Nearest Known Site:

SITE DESCRIPTION

Site Size: 450' x 45' x 2'high — Plan:
Orientation: E-W — Stratigraphy:
Artifact Density: — Artifact Distribution:
Cultural Features:
Elongated shell midden - Rangia cuneata
Cultural Affiliation:
Neo-Indian (unknown)
Presumed Function: Prehistoric (unknown)

COLLECTIONS

Survey Meth: Grab surface collection, test units
Assessment of Collecting Conditions:
Description of Material:
Bone sample collected for C14 dating, pottery, shell

CONDITIONS

Present Use:
Erosion or Disturbance: Subsidence
Probable Future Destruction:

(243)

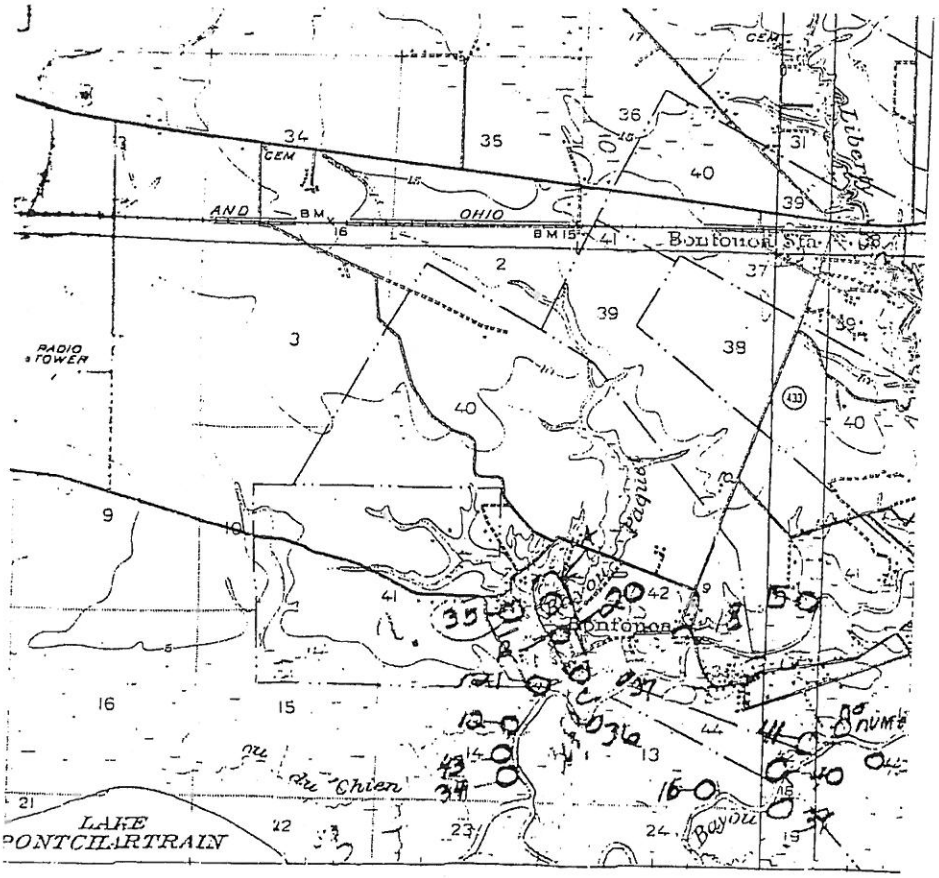
SITE EVALUATION

Site Number: 16ST33

Research Potential:

State/National Register Eligibility: Unknown
Recommendations:

QUAD MAP OF SITE AREA



RECORDS

Owner and Address:

Tenant and Address:

Informants:
Prev. Invest:
Previous Collections and Availability:
Fair collections LSU Cat. No. 58-594
References: Heartfield, et al (1981); Neuman (1977); Saltus (1988)
Photos and Maps:
Remarks:

Recorder: Saucier & Gagliano Date: 3/58

STATE OF LOUISIANA

SITE RECORD UPDATE FORM

Site Name _____ State Survey No. 16 ST 43

Other Site Designations _____

Instructions for Reaching Site By boat along Bayou Liberty

_____

_____ Parish St. Tammany

USGS Quad: (name, date series) Slidell, La. (310d)

_____ of the _____ of the _____ of Section 14 Township 9S Range 13E

UTM Coordinates: Zone _____ Easting _____ Northing _____

Geographical Coordinates: Latitude 30° 15' 52" N Longitude 89° 51'19" W

PHYSICAL SETTING

Land Form Marsh Geologic Processes erosion, subsidence

_____ Elevation _____

Slope _____ Site Position with Respect to Terrain right descending bank of bayou

_____

Nearest Water Bayou Liberty Flooding Yes

Soil Characteristics _____

Floral Communities marsh grasses

Faunal Communities _____

Other Potential Resources _____

Nearest Known Site 16 ST 34

SITE DESCRIPTION

Site Size Unknown Plan Site appears to be totally subsided

Orientation _____ Stratigraphy _____

_____

Artifact Density _____ Artifact Distribution _____

_____ Cultural Features _____

_____

Cultural Affiliation _____

Presumed Function _____

COLLECTIONS

Survey Method close order pedestrian

Assessment of Collecting Conditions Poor - site is completely subsided below marsh

Description of Material None recovered. No evidence of site located

_____

_____

_____

CONDITIONS

Present Use None Erosion or Disturbance Destroyed

Probable Future Destruction _____

(2of2)
16ST43

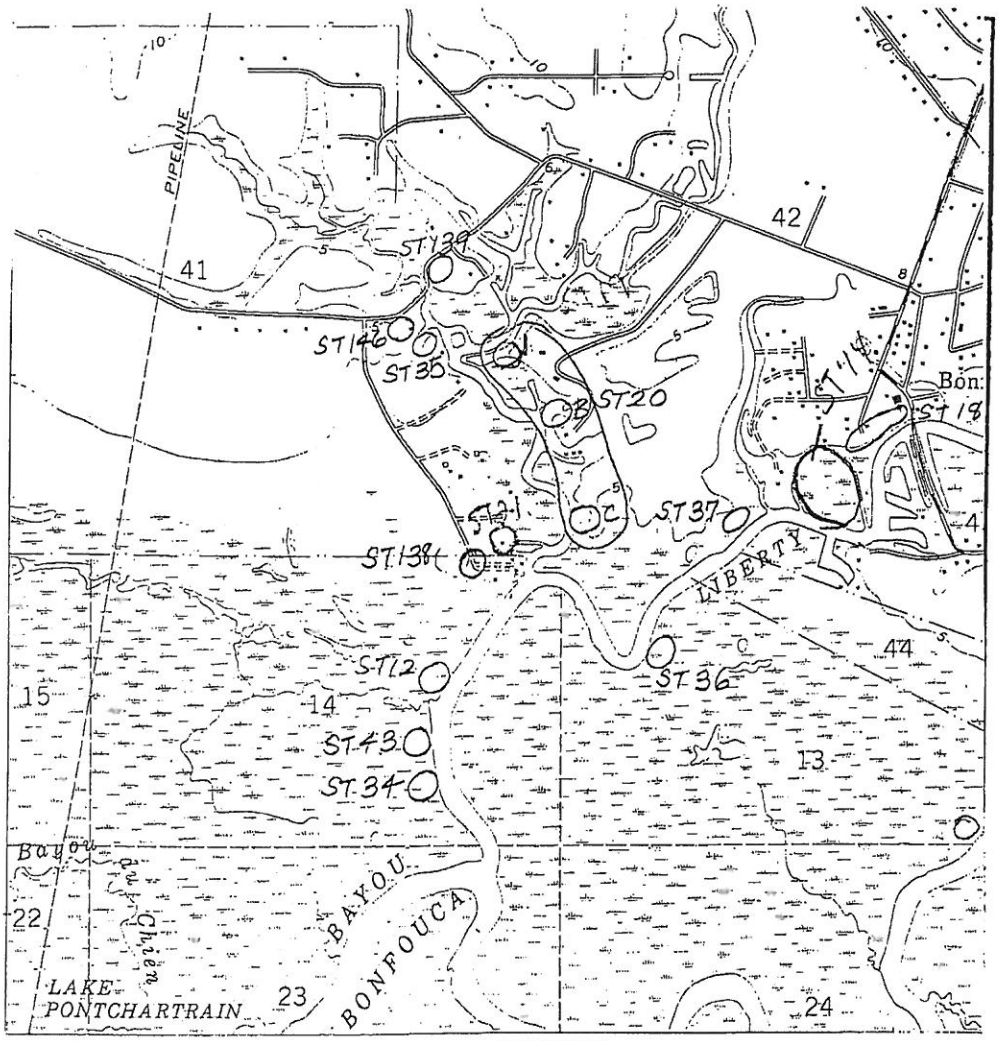
SITE EVALUATION

Research Potential None - site is subsided below marsh

State or National Register Eligibility

Recommendations

QUAD MAP OF SITE AREA



16ST43

RECORDS

Owner and Address

Tenant and Address

Informants

Previous Investigations Saucier and Gagliano 7/25/54

Previous Collections and Availability

References (22-1380) Beavers, Lamb & Greene, 1988, "Prelim Arch Survey, Bayous Liberty & Bonfou

Photographs and Maps University of New Orleans, Archaeological Research Program

Remarks Originally noted in 1954 as visible only at extreme low water, this site has apparently continued to subside for the last 24 years and is now inexcessible

Recorded by Beavers, Lamb and Greene Date 6/9/88

STATE OF LOUISIANA
SITE RECORD FORM

Site Name: Bayou Liberty
State Survey No: 16ST43
Other Site Designation:
Parish: St. Tammany
Instructions for Reaching Site:
About 880' SW from site 16ST12 in marsh by bayou
USGS Quad (Name, date, series): Slidell (1950) 15'
Quad No: 31-Q E quarter of the IR quarter of Section 14 Township 8S Range: 13E
UTM Coordinates: Zone: 16 Easting: Northing:
Geographical Coordinates: Latitude: Longitude:

PHYSICAL SETTING

Land Form: Buried beach ridge
Slope:
Geologic Processes:
Elev. ft AMSL:
Site Position: In marsh by bayou
Near Water:
Flooding:
Soil Characteristics: Marsh
Floral Communities: Marsh grass
Faunal Communities:
Other Potential Resources:
Nearest Known Site:

SITE DESCRIPTION

Site Size:
Plan:
Orientation:
Stratigraphy: Cream (cont)
Artifact Density:
Artifact Distribution:
Cultural Features:
1/5' organic matter over shell, shell mixed with sand and about 1' thick
Cultural Affiliation:
Prehistoric (unknown)
Presumed Function: Prehistoric (unknown)

COLLECTIONS

Survey Meth: Auger testing
Assessment of Collecting Conditions: During extreme low water, shell visible in bank
Description of Material:
Shell

CONDITIONS

Present Use:
Erosion or Disturbance: Underwater
Probable Future Destruction:

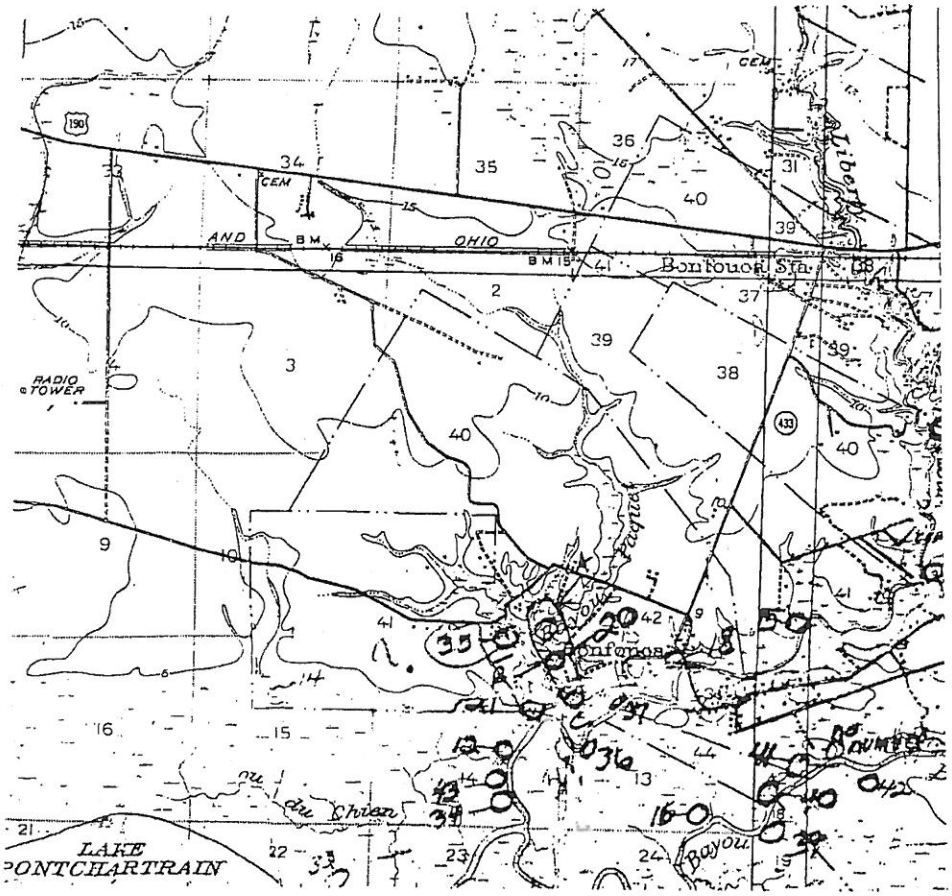
SITE EVALUATION

Site Number: 16ST43

Research Potential:

State/National Register Eligibility: Unknown
Recommendations:

QUAD MAP OF SITE AREA



RECORDS

Owner and Address:

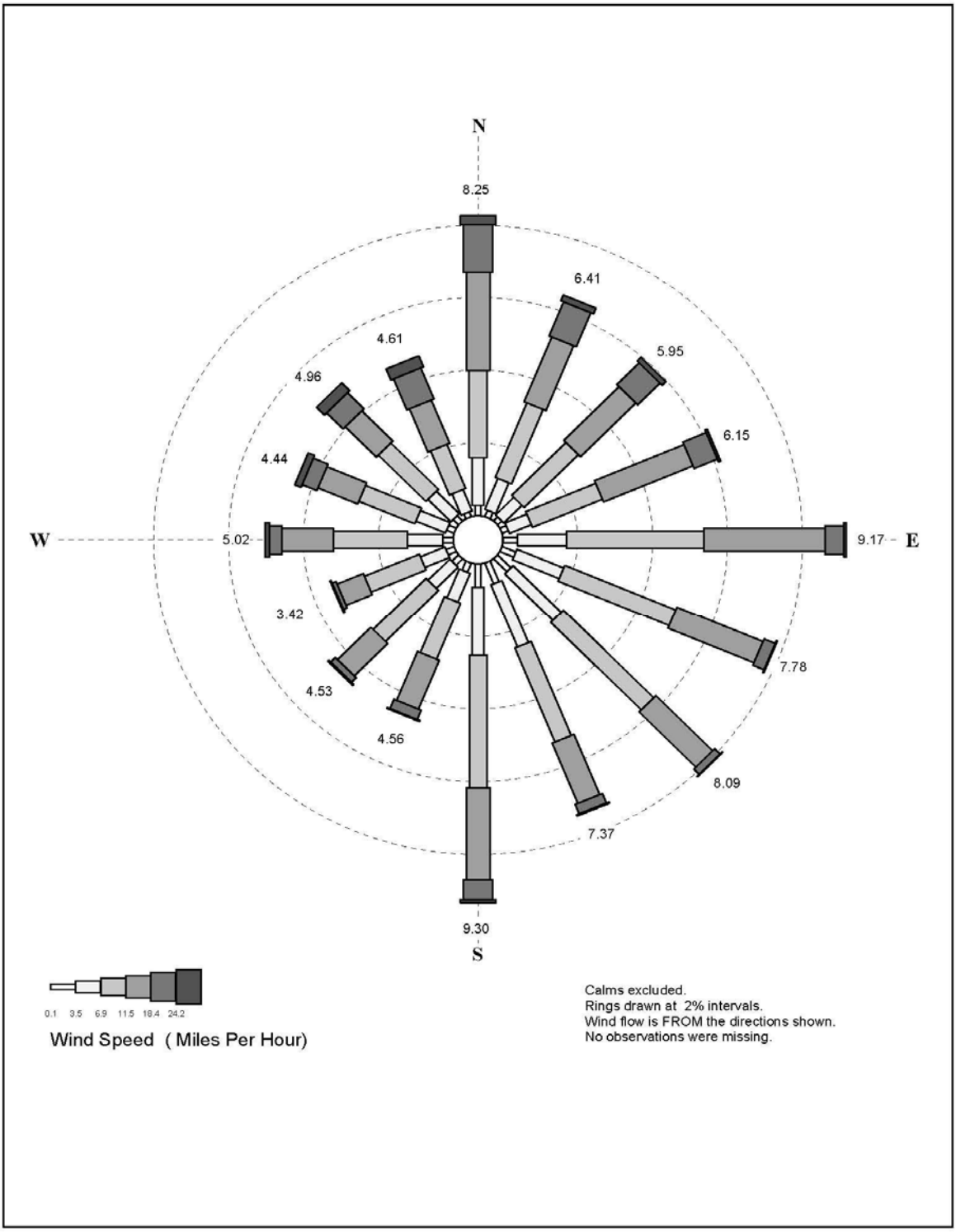
Tenant and Address:

Informants:
Prev. Invest:
Previous Collections and Availability:
LSU Cat. No. 58-604
References: Heartfield, et al (1981); Neuman (1977)
Photos and Maps:
Remarks:

Recorder: Saucier & Gagliano

Date: 7/25/54

Appendix G:
Wind Roses



New Orleans Lakefront 1996-2011

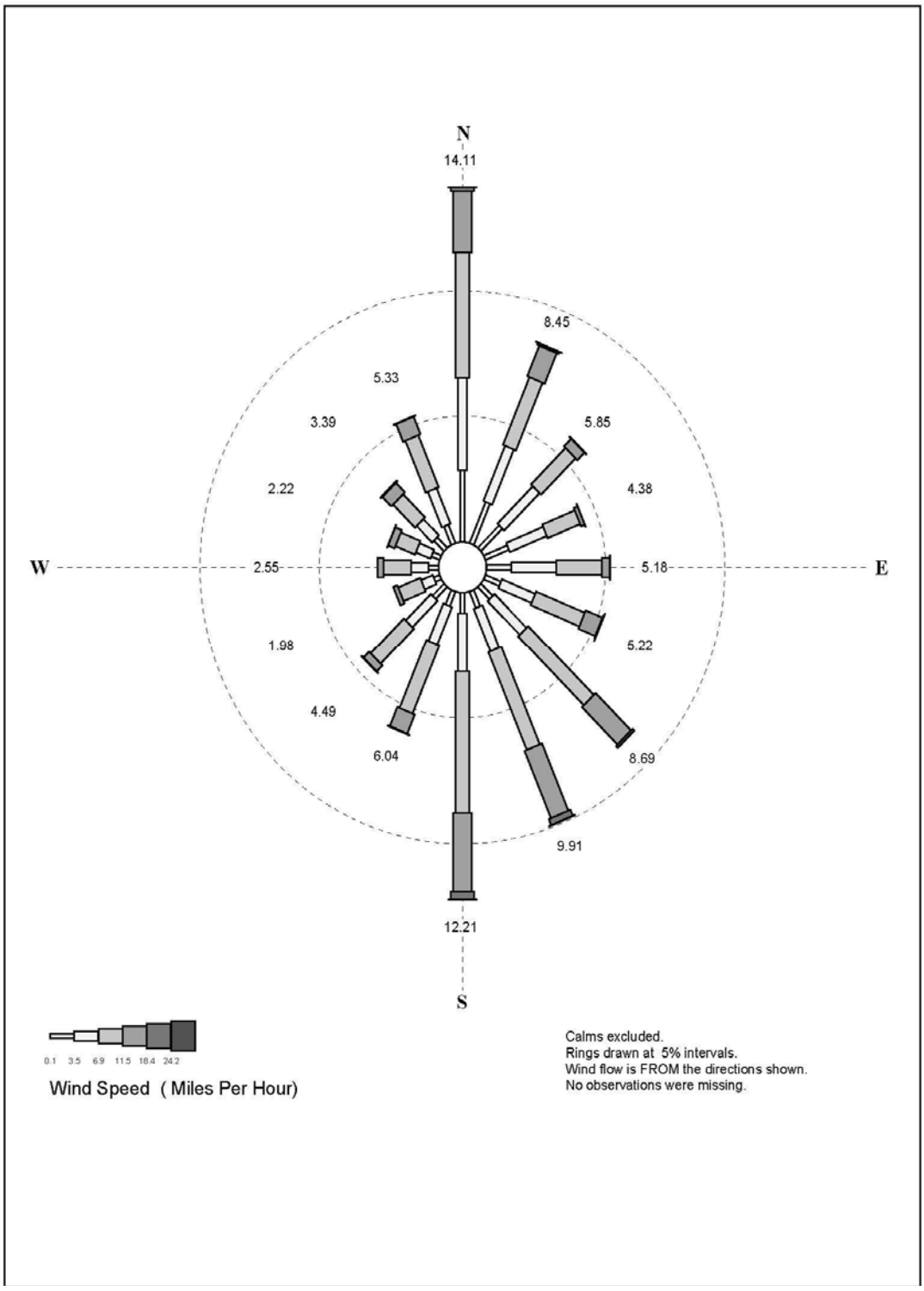


Figure 5: Slidell Airport 1999-2010

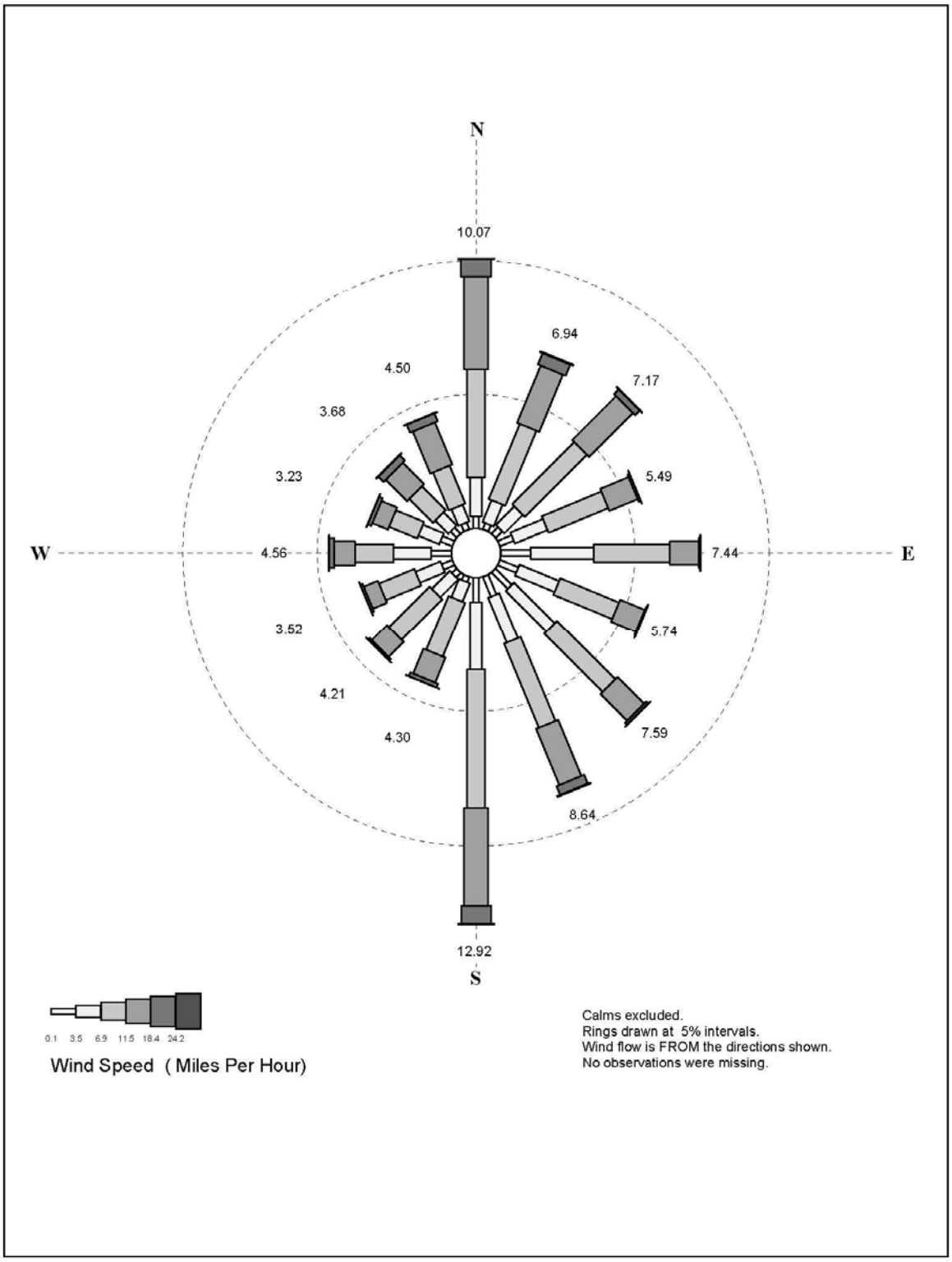


Figure 6: Louis Armstrong Airport 1996-2010

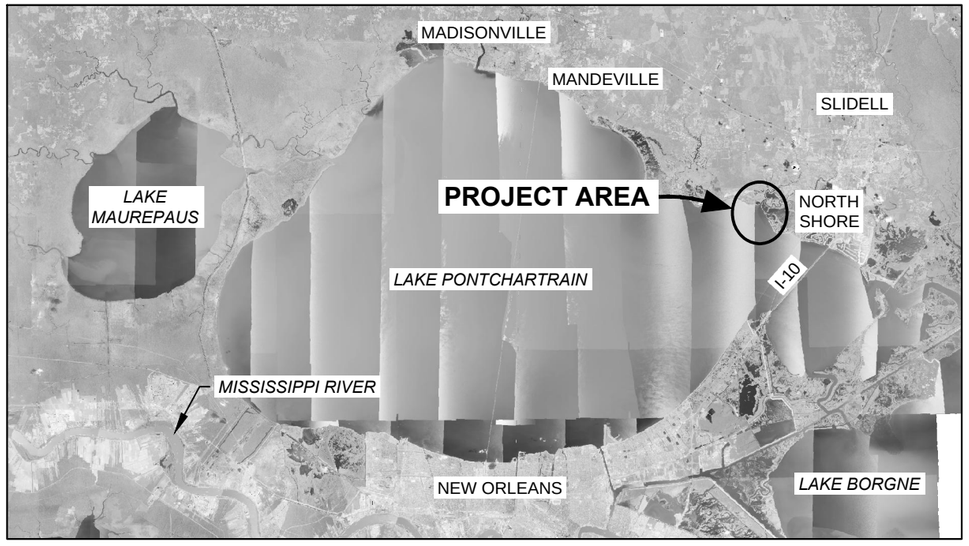
Appendix H:
Preliminary Design Drawings

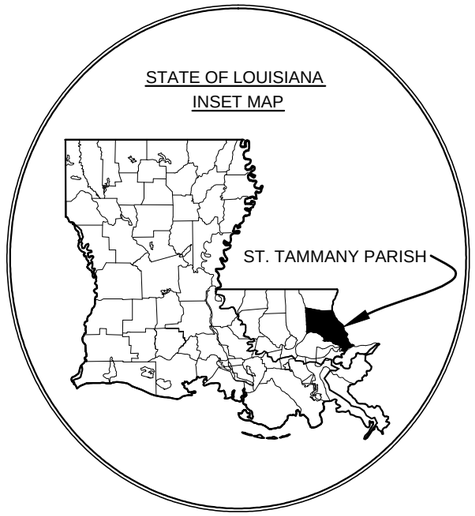
INDEX TO SHEETS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	GENERAL NOTES
3	PROJECT LAYOUT
4	BORROW AREA LAYOUT
5	MARSH CREATION AREA 1 LAYOUT
6	MARSH CREATION AREA 2 LAYOUT
7	MARSH CREATION AREA 3 LAYOUT
8	MARSH CREATION AREA 4 LAYOUT
9 - 10	TYPICAL SECTIONS
11 - 12	TYPICAL DETAILS
13	SURVEY LAYOUT
14 - 27	SECTIONS

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY

BAYOU BONFOUCA
MARSH CREATION PROJECT
PO-104
ST. TAMMANY PARISH





PRELIMINARY

DOCUMENTS ARE NOT TO BE USED FOR CONSTRUCTION, BIDDING, RECORDATION, CONVEYANCE, SALES, OR AS THE BASIS FOR THE ISSUANCE OF A PERMIT.

U.S. FISH & WILDLIFE SERVICE — DEPARTMENT OF THE INTERIOR

STATE OF LOUISIANA — UNION • JUSTICE • CONFIDENCE

CPRA — Louisiana Coastal Protection and Restoration Authority

RESTORATION ENGINEERING CHIEF

ENGINEER MANAGER

PROJECT ENGINEER

LICENSURE CLASSIFICATION REQUIREMENTS

MAJOR CATEGORY: HEAVY CONSTRUCTION
SUBCLASSIFICATION: DREDGING

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

DRAWN BY: KRISTI CANTU | DESIGNED BY: JOSEPH GUILLORY, E.I. | APPROVED BY: SHANNON HAYNES, P.E.

BAYOU BONFOUCA MARSH CREATION PROJECT

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

TITLE SHEET

SHEET 1 OF 27

G:\Users\Autocad\BASINS\PO\PO-104 Bayou Bonfouca\Plan Set\01Title Sheet.dwg

GENERAL NOTES

1. ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88) U.S. SURVEY FEET. ALL HORIZONTAL COORDINATES ARE GIVEN IN THE NORTH AMERICAN DATUM OF 1983 (NAD 83, LOUISIANA STATE PLANE SOUTH ZONE U.S. FEET). ELEVATIONS ARE BASED ON THE FOLLOWING SECONDARY MONUMENT:

SECONDARY MONUMENT	ELEVATION	NORTHING	EASTING
876 1534 B TIDAL	2.60'	631,798.38	3,748,804.16

2. MARSH CREATION AND BORROW AREA ELEVATIONS SHOWN ON THE PLANS ARE BASED ON THE SURVEYS PERFORMED BETWEEN AUGUST 11, 2011 AND OCTOBER 11, 2011, BY C&C TECHNOLOGIES, INC. FOR CPRA.

3. MEAN HIGH WATER (MHW) AND MEAN LOW WATER (MLW) WERE CALCULATED FROM THE GAGE CR3667 LOCATED IN LAKE PONTCHARTRAIN. DATA FROM JANUARY 2007 TO DECEMBER 2010 WAS USED. ELEVATIONS ARE REFERENCED TO NAVD 88, US FEET. MHW=1.10' AND MLW =0.50'.

4. THE CONTRACTOR SHALL FOLLOW THE SPECIFIED DREDGE PIPELINE CORRIDOR AND SHALL NOT, AT ANYTIME, TRAVERSE EXISTING MARSH OR VEGETATIVE WETLANDS OUTSIDE MARSH CREATION AREAS UNLESS OTHERWISE DIRECTED BY THE CONSTRUCTION ENGINEER.

5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IDENTIFYING SAFE ACCESS TO THE PROJECT SITE AND FOR NAVIGATING WITHIN THE LIMITS OF THE PROJECT SITE. ALL EQUIPMENT SHALL BE FLOATING AT ALL TIMES DURING TRANSIT TO AND FROM THE PROJECT SITE. THE ENGINEER OR HIS REPRESENTATIVE SHALL MONITOR THE LOCATION OF EQUIPMENT DURING CONSTRUCTION.

6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING PIPELINE OPERATORS FIVE (5) WORKING DAYS IN ADVANCE OF THE WORK. ALL PIPELINES SHALL BE MARKED WITH BUOYS BY THE CONTRACTOR. THE CONTRACTOR SHALL MAINTAIN BUOYS DURING CONSTRUCTION OR HAVE ADEQUATE NAVIGATIONAL EQUIPMENT ON THE DREDGE TO AVOID DREDGING IN RESTRICTED AREAS. THE CONTRACTOR SHALL NOT ANCHOR OR EXCAVATE WITHIN 500 FEET OF ANY PIPELINE. **CALL LOUISIANA ONE CALL AT 1-800-272-3020 48 HOURS PRIOR TO ANY EXCAVATION AND/OR DREDGING TO LOCATE ALL PIPELINES OR UTILITIES.**

   EXXONMOBILE PIPELINE COMPANY
   MR. DOOLEY G. OUBRE
   RIGHT OF WAY & CLAIMS
   P.O. BOX 1989
   DENHAM SPRINGS, LA 70727
   OFFICE PHONE: (225) 271-3914
   CELL PHONE: (225) 715-9381
   FAX: (225) 271-3848

7. THE CONTRACTOR SHALL CONTACT MR. DANNY BREAUX OF THE BIG BRANCH MARSH NATIONAL WILDLIFE REFUGE AT LEAST FIVE (5) WORKING DAYS PRIOR TO ACCESSING THE SITE TO OBTAIN A SPECIAL USE PERMIT. MR. BREAUX CAN BE REACHED AT (985) 882-2030.

8. PLANS AND SPECIFICATIONS ARE COMPLEMENTARY; WHAT IS REQUIRED BY ONE IS BINDING AS IF REQUIRED BY ALL. CLARIFICATIONS AND INTERPRETATIONS OF, OR NOTIFICATIONS OF MINOR VARIATIONS AND DEVIATIONS IN THE CONTRACT DOCUMENTS, WILL BE ISSUED IN WRITING BY THE ENGINEER.

9. ANY DAMAGE TO EXISTING U.S. COAST GUARD NAVIGATION AIDS OR PRIVATE NAVIGATION AIDS SHALL BE REPAIRED BY THE CONTRACTOR TO U.S. COAST GUARD STANDARDS AT THE EXPENSE OF THE CONTRACTOR.

10. THE MARSH CREATION AREAS AND BORROW AREA MAY BE REVISED BY ENGINEER DURING CONSTRUCTION TO REFLECT CHANGES IN FIELD CONDITIONS.

11. ESTIMATED HYDRAULIC DREDGING QUANTITIES SHOWN ARE FOR BIDDING PURPOSES ONLY AND WERE CALCULATED ACCORDING TO CONDITIONS SURVEYED FROM AUGUST 11, 2011 AND OCTOBER 11, 2011. QUANTITIES WERE CALCULATED USING AUTOCAD AND AERIAL PHOTOGRAPHY. THE OWNER RESERVES THE RIGHT TO ADJUST QUANTITIES HIGHER OR LOWER WITHOUT ADJUSTMENT OF THE UNIT PRICE.

12. THE CONTRACTOR SHALL PERFORM A MAGNETOMETER SURVEY OF THE BORROW AREA AND ALL PROPOSED ACCESS CORRIDORS PRIOR TO MOBILIZATION FOR CONSTRUCTION. DRAWINGS SHOWING THE TRACK LINES, ANY MAGNETOMETER HITS, COORDINATES, AMPLITUDE, SIGNATURE TYPE, AND SIGNATURE WIDTH OF ALL MAGNETOMETER HITS SHALL BE SUBMITTED TO THE ENGINEER PRIOR TO MOBILIZATION. ALSO, MAGNETOMETER LINES SHALL BE RUN ALONG THE CENTERLINE ALIGNMENT OF THE PROPOSED EARTHEN CONTAINMENT DIKES BORROW AREAS. ADDITIONAL MAGNETOMETER LINES SHALL BE RUN PERPENDICULAR TO THE EARTHEN CONTAINMENT DIKE LOCATIONS. THESE LINES SHALL BEGIN AT THE PROPOSED CENTERLINE OF THE EARTHEN CONTAINMENT DIKE AND EXTEND 25' PAST THE EARTHEN CONTAINMENT DIKES BORROW PIT AND SHALL BE SPACED A MAXIMUM OF 250' APART. MAGNETOMETER LINES IN THE BORROW AREA SHALL FORM A GRID PATTERN WITH A MAXIMUM OFFSET OF 500' APART AND SHALL BE ORIENTED NORTH/SOUTH AND EAST/WEST. THE MAGNETOMETER DRAWINGS SHALL BE STAMPED BY A REGISTERED PROFESSIONAL SURVEYOR LICENSED IN LOUISIANA.

13. THE CONTRACTOR IS RESPONSIBLE FOR CONTAINING ALL DREDGED MATERIAL WITHIN THE BOUNDARIES OF THE PROPOSED MARSH CREATION AREAS.

SUMMARY OF ESTIMATED QUANTITIES

ITEM No.	DESCRIPTION	UNIT	ESTIMATED QUANTITY
1	MOBILIZATION AND DEMOBILIZATION	LUMP SUM	1
2	HYDRAULIC DREDGING (BORROW CUT VOLUME)*	CUBIC YARD	4,324,571
3	EARTHEN CONTAINMENT DIKES (CD-1)**	LINEAR FOOT	15,543
4	EARTHEN CONTAINMENT DIKES (CD-2)**	LINEAR FOOT	5,403
5	EARTHEN CONTAINMENT DIKES (CD-3)**	LINEAR FOOT	3,401
6	EARTHEN CONTAINMENT DIKES (CD-4)**	LINEAR FOOT	28,363
7	EARTHEN CONTAINMENT DIKES (CD-5)**	LINEAR FOOT	4,720
8	GRADE STAKES	EACH	113
9	SURVEYS	LUMP SUM	1
10	SETTLEMENT PLATES	EACH	8
11	GAPPING DIKES	CUBIC YARD	3,014

* **A SPECIAL DREDGING WINDOW EXISTS FOR THIS PROJECT TO PROTECT ENDANGERED SPECIES. THE DREDGING WINDOW FOR THIS PROJECT SHALL BE MAY 1ST TO SEPTEMBER 30TH (153 DAYS) OF A CALENDAR YEAR. NO DREDGING IS TO OCCUR OUTSIDE THIS DESIGNATED TIMEFRAME UNLESS OTHERWISE APPROVED.**

**THE TOTAL LINEAR FEET OF CONTAINMENT DIKES WAS ESTIMATED FOR CONSTRUCTION USING AERIAL PHOTOGRAPHY, FIELD SURVEYS, AND AUTOCAD.

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

DRAWN BY: KRISTI CANTU | DESIGNED BY: JOSEPH GUILLORY, E.I.

BAYOU BONFOUCA MARSH CREATION PROJECT

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

APPROVED BY: SHANNON HAYNES, P.E.

GENERAL NOTES

DATE: APRIL 2012

QUANTITIES		
	VOLUME (CY)	AREA (ACRES)
BORROW AREA	7,752,608	331

MARSH CREATION		
AREA	VOLUME (CY)	AREA (ACRES)
1	2,187,309	331
1 POND A	33,493	
1 POND B	39,834	
2	1,238,177	159
3	220,643	32
4	605,115	116
TOTAL	**4,324,571**	**638**

EARTHEN CONTAINMENT DIKE		
MARSH CREATION	VOLUME (CY)	LENGTH (FT)
AREA 1: CD-1	39,926	15,543
AREA 1: CD-2	35,669	5,403
AREA 1: CD-3	9,206	3,401
AREA 2: CD-4	48,237	16,757
AREA 3: CD-5	16,217	4,720
AREA 4: CD-4	26,688	11,606
TOTAL	**175,943**	**57,430**

BAYOU LIBERTY ROAD

BONFOUCA

BAYOU LIBERTY

BAYOU LIBERTY MARINA
58047 BAYOU LIBERTY ROAD
SLIDELL, LA 70460

MARSH CREATION AREA 2

MARSH CREATION AREA 4

BAYOU BONFOUCA

MARSH CREATION AREA 3

PROPOSED ACCESS AND DREDGE PIPELINE CENTERLINE

POND A

MARSH CREATION AREA 1

POND B

LAKE PONTCHARTRAIN

BURIED AND PROBED 16" EXXON OIL

SOUTHERN NATURAL GAS PIPELINES

BORROW AREA

876 1534 B TIDAL
N 631,798.38
E 3,748,804.16

LEGEND

- MARSH CREATION AREA
- BORROW AREA
- EARTHEN CONTAINMENT DIKE
- PROPOSED ACCESS & DREDGE PIPELINE CENTERLINE
- PL — PIPELINE
- SECONDARY MONUMENT

NOTES:
1. BACKGROUND IMAGERY WAS TAKEN IN 2010.
2. PIPELINE INFORMATION SHOWN ON PLANS IS APPROXIMATE. THE CONTRACTOR SHALL VERIFY EXACT LOCATIONS PRIOR TO BEGINNING CONSTRUCTION.
3. ALL PIPELINES LOCATED WITHIN 150' OF THE DIKE ALIGNMENTS, MARSH CREATION AREAS, OR BORROW AREAS SHALL BE PROBED AND THEIR LOCATIONS MARKED FOR THE DURATION OF CONSTRUCTION ACTIVITIES.
4. SEE APPENDIX OF SPECIFICATIONS FOR SECONDARY MONUMENT DATA SHEETS.

2000' 1000' 0' 2000' 4000'

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA MARSH CREATION PROJECT

PROJECT LAYOUT

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU

DESIGNED BY: JOSEPH GUILLORY, E.I.

APPROVED BY: SHANNON HAYNES, P.E.

SHEET 3 OF 27

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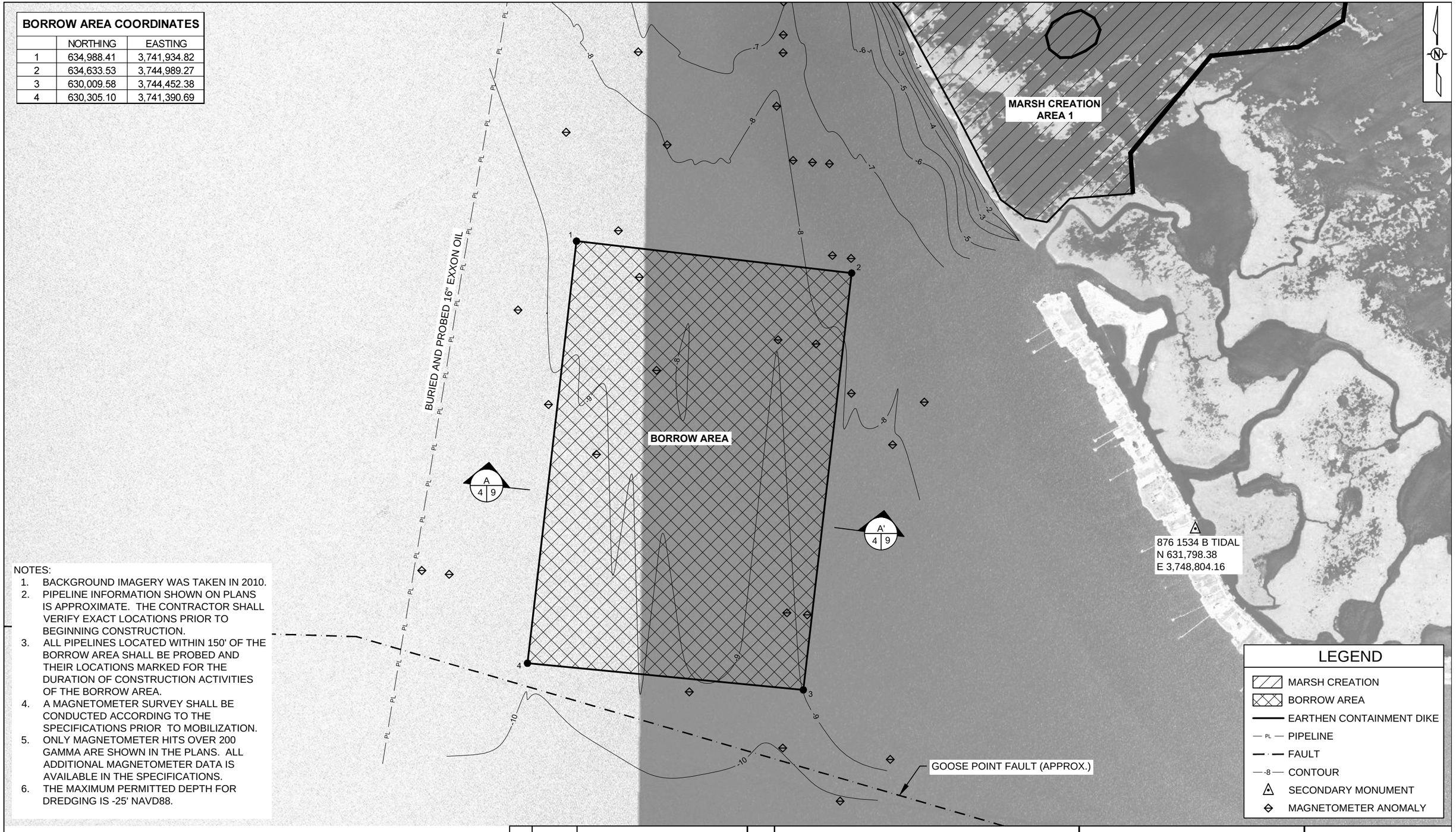
BORROW AREA COORDINATES		
	NORTHING	EASTING
1	634,988.41	3,741,934.82
2	634,633.53	3,744,989.27
3	630,009.58	3,744,452.38
4	630,305.10	3,741,390.69



NOTES:

1. BACKGROUND IMAGERY WAS TAKEN IN 2010.
2. PIPELINE INFORMATION SHOWN ON PLANS IS APPROXIMATE. THE CONTRACTOR SHALL VERIFY EXACT LOCATIONS PRIOR TO BEGINNING CONSTRUCTION.
3. ALL PIPELINES LOCATED WITHIN 150' OF THE BORROW AREA SHALL BE PROBED AND THEIR LOCATIONS MARKED FOR THE DURATION OF CONSTRUCTION ACTIVITIES OF THE BORROW AREA.
4. A MAGNETOMETER SURVEY SHALL BE CONDUCTED ACCORDING TO THE SPECIFICATIONS PRIOR TO MOBILIZATION.
5. ONLY MAGNETOMETER HITS OVER 200 GAMMA ARE SHOWN IN THE PLANS. ALL ADDITIONAL MAGNETOMETER DATA IS AVAILABLE IN THE SPECIFICATIONS.
6. THE MAXIMUM PERMITTED DEPTH FOR DREDGING IS -25' NAVD88.

LEGEND

- MARSH CREATION
- BORROW AREA
- EARTHEN CONTAINMENT DIKE
- PL — PIPELINE
- FAULT
- -8 — CONTOUR
- SECONDARY MONUMENT
- MAGNETOMETER ANOMALY

1000' 500' 0' 1000' 2000'

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA
MARSH CREATION PROJECT

BORROW AREA LAYOUT

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU | DESIGNED BY: JOSEPH GUILLORY, E.I. | APPROVED BY: SHANNON HAYNES, P.E.

SHEET 4 OF 27

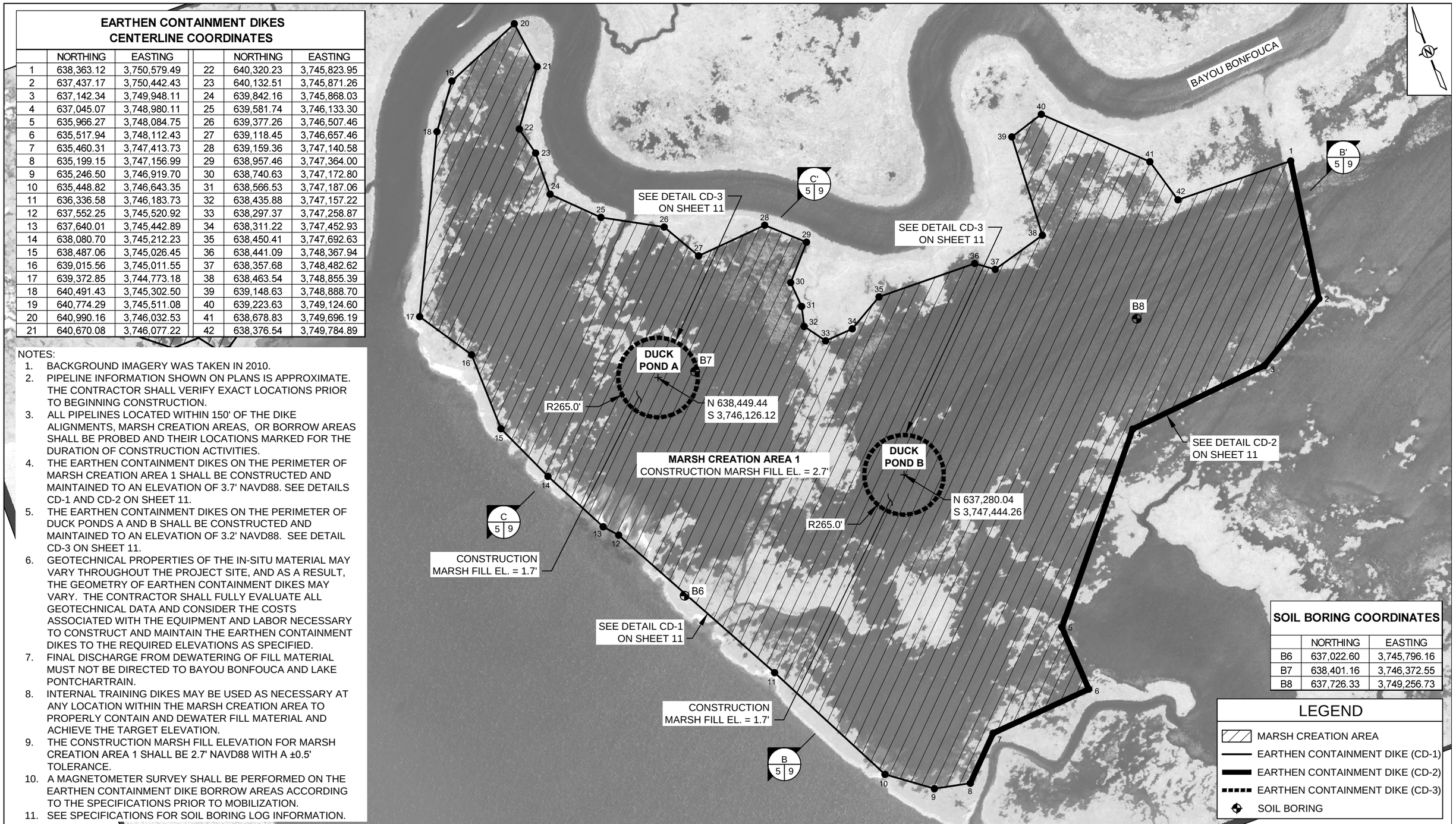
G:\Users\Autocad\BASINS\PO\PO-104 Bayou Bonfouca\Plan Set\04 Borrow Area Layout.dwg

EARTHEN CONTAINMENT DIKES CENTERLINE COORDINATES

	NORTHING	EASTING		NORTHING	EASTING
1	638,363.12	3,750,579.49	22	640,320.23	3,745,823.95
2	637,437.17	3,750,442.43	23	640,132.51	3,745,871.26
3	637,142.34	3,749,948.11	24	639,842.16	3,745,868.03
4	637,045.07	3,748,980.11	25	639,581.74	3,746,133.30
5	635,966.27	3,748,084.75	26	639,377.26	3,746,507.46
6	635,517.94	3,748,112.43	27	639,118.45	3,746,657.46
7	635,460.31	3,747,413.73	28	639,159.36	3,747,140.58
8	635,199.15	3,747,156.99	29	638,957.46	3,747,364.00
9	635,246.50	3,746,919.70	30	638,740.63	3,747,172.80
10	635,448.82	3,746,643.35	31	638,566.53	3,747,187.06
11	636,336.58	3,746,183.73	32	638,435.88	3,747,157.22
12	637,552.25	3,745,520.92	33	638,297.37	3,747,258.87
13	637,640.01	3,745,442.89	34	638,311.22	3,747,452.93
14	638,080.70	3,745,212.23	35	638,450.41	3,747,692.63
15	638,487.06	3,745,026.45	36	638,441.09	3,748,367.94
16	639,015.56	3,745,011.55	37	638,357.68	3,748,482.62
17	639,372.85	3,744,773.18	38	638,463.54	3,748,855.39
18	640,491.43	3,745,302.50	39	639,148.63	3,748,888.70
19	640,774.29	3,745,511.08	40	639,223.63	3,749,124.60
20	640,990.16	3,746,032.53	41	638,678.83	3,749,696.19
21	640,670.08	3,746,077.22	42	638,376.54	3,749,784.89

NOTES:

1. BACKGROUND IMAGERY WAS TAKEN IN 2010.
2. PIPELINE INFORMATION SHOWN ON PLANS IS APPROXIMATE. THE CONTRACTOR SHALL VERIFY EXACT LOCATIONS PRIOR TO BEGINNING CONSTRUCTION.
3. ALL PIPELINES LOCATED WITHIN 150' OF THE DIKE ALIGNMENTS, MARSH CREATION AREAS, OR BORROW AREAS SHALL BE PROBED AND THEIR LOCATIONS MARKED FOR THE DURATION OF CONSTRUCTION ACTIVITIES.
4. THE EARTHEN CONTAINMENT DIKES ON THE PERIMETER OF MARSH CREATION AREA 1 SHALL BE CONSTRUCTED AND MAINTAINED TO AN ELEVATION OF 3.7' NAVD88. SEE DETAILS CD-1 AND CD-2 ON SHEET 11.
5. THE EARTHEN CONTAINMENT DIKES ON THE PERIMETER OF DUCK PONDS A AND B SHALL BE CONSTRUCTED AND MAINTAINED TO AN ELEVATION OF 3.2' NAVD88. SEE DETAIL CD-3 ON SHEET 11.
6. GEOTECHNICAL PROPERTIES OF THE IN-SITU MATERIAL MAY VARY THROUGHOUT THE PROJECT SITE, AND AS A RESULT, THE GEOMETRY OF EARTHEN CONTAINMENT DIKES MAY VARY. THE CONTRACTOR SHALL FULLY EVALUATE ALL GEOTECHNICAL DATA AND CONSIDER THE COSTS ASSOCIATED WITH THE EQUIPMENT AND LABOR NECESSARY TO CONSTRUCT AND MAINTAIN THE EARTHEN CONTAINMENT DIKES TO THE REQUIRED ELEVATIONS AS SPECIFIED.
7. FINAL DISCHARGE FROM DEWATERING OF FILL MATERIAL MUST NOT BE DIRECTED TO BAYOU BONFOUCA AND LAKE PONTCHARTRAIN.
8. INTERNAL TRAINING DIKES MAY BE USED AS NECESSARY AT ANY LOCATION WITHIN THE MARSH CREATION AREA TO PROPERLY CONTAIN AND DEWATER FILL MATERIAL AND ACHIEVE THE TARGET ELEVATION.
9. THE CONSTRUCTION MARSH FILL ELEVATION FOR MARSH CREATION AREA 1 SHALL BE 2.7' NAVD88 WITH A ±0.5' TOLERANCE.
10. A MAGNETOMETER SURVEY SHALL BE PERFORMED ON THE EARTHEN CONTAINMENT DIKE BORROW AREAS ACCORDING TO THE SPECIFICATIONS PRIOR TO MOBILIZATION.
11. SEE SPECIFICATIONS FOR SOIL BORING LOG INFORMATION.



SOIL BORING COORDINATES

	NORTHING	EASTING
B6	637,022.60	3,745,796.16
B7	638,401.16	3,746,372.55
B8	637,726.33	3,749,256.73

LEGEND

- MARSH CREATION AREA
- EARTHEN CONTAINMENT DIKE (CD-1)
- EARTHEN CONTAINMENT DIKE (CD-2)
- EARTHEN CONTAINMENT DIKE (CD-3)
- SOIL BORING

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA MARSH CREATION PROJECT

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

MARSH CREATION AREA 1 LAYOUT

DRAWN BY: KRISTI CANTU | DESIGNED BY: JOSEPH GUILLORY, E.I. | APPROVED BY: SHANNON HAYNES, P.E.

DATE: APRIL 2012

SHEET 5 OF 27

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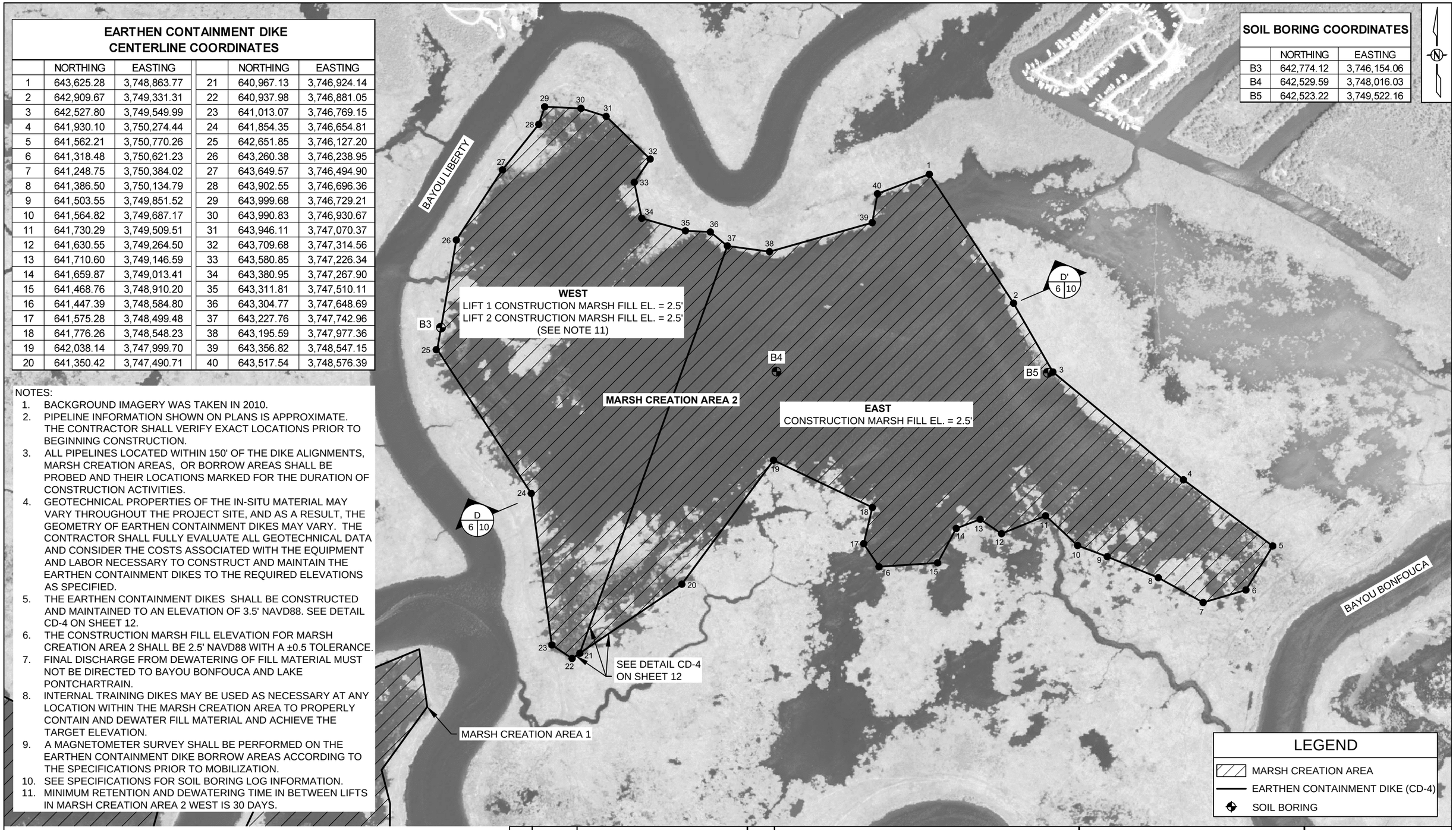
EARTHEN CONTAINMENT DIKE CENTERLINE COORDINATES

	NORTHING	EASTING		NORTHING	EASTING
1	643,625.28	3,748,863.77	21	640,967.13	3,746,924.14
2	642,909.67	3,749,331.31	22	640,937.98	3,746,881.05
3	642,527.80	3,749,549.99	23	641,013.07	3,746,769.15
4	641,930.10	3,750,274.44	24	641,854.35	3,746,654.81
5	641,562.21	3,750,770.26	25	642,651.85	3,746,127.20
6	641,318.48	3,750,621.23	26	643,260.38	3,746,238.95
7	641,248.75	3,750,384.02	27	643,649.57	3,746,494.90
8	641,386.50	3,750,134.79	28	643,902.55	3,746,696.36
9	641,503.55	3,749,851.52	29	643,999.68	3,746,729.21
10	641,564.82	3,749,687.17	30	643,990.83	3,746,930.67
11	641,730.29	3,749,509.51	31	643,946.11	3,747,070.37
12	641,630.55	3,749,264.50	32	643,709.68	3,747,314.56
13	641,710.60	3,749,146.59	33	643,580.85	3,747,226.34
14	641,659.87	3,749,013.41	34	643,380.95	3,747,267.90
15	641,468.76	3,748,910.20	35	643,311.81	3,747,510.11
16	641,447.39	3,748,584.80	36	643,304.77	3,747,648.69
17	641,575.28	3,748,499.48	37	643,227.76	3,747,742.96
18	641,776.26	3,748,548.23	38	643,195.59	3,747,977.36
19	642,038.14	3,747,999.70	39	643,356.82	3,748,547.15
20	641,350.42	3,747,490.71	40	643,517.54	3,748,576.39

NOTES:
1. BACKGROUND IMAGERY WAS TAKEN IN 2010.
2. PIPELINE INFORMATION SHOWN ON PLANS IS APPROXIMATE. THE CONTRACTOR SHALL VERIFY EXACT LOCATIONS PRIOR TO BEGINNING CONSTRUCTION.
3. ALL PIPELINES LOCATED WITHIN 150' OF THE DIKE ALIGNMENTS, MARSH CREATION AREAS, OR BORROW AREAS SHALL BE PROBED AND THEIR LOCATIONS MARKED FOR THE DURATION OF CONSTRUCTION ACTIVITIES.
4. GEOTECHNICAL PROPERTIES OF THE IN-SITU MATERIAL MAY VARY THROUGHOUT THE PROJECT SITE, AND AS A RESULT, THE GEOMETRY OF EARTHEN CONTAINMENT DIKES MAY VARY. THE CONTRACTOR SHALL FULLY EVALUATE ALL GEOTECHNICAL DATA AND CONSIDER THE COSTS ASSOCIATED WITH THE EQUIPMENT AND LABOR NECESSARY TO CONSTRUCT AND MAINTAIN THE EARTHEN CONTAINMENT DIKES TO THE REQUIRED ELEVATIONS AS SPECIFIED.
5. THE EARTHEN CONTAINMENT DIKES SHALL BE CONSTRUCTED AND MAINTAINED TO AN ELEVATION OF 3.5' NAVD88. SEE DETAIL CD-4 ON SHEET 12.
6. THE CONSTRUCTION MARSH FILL ELEVATION FOR MARSH CREATION AREA 2 SHALL BE 2.5' NAVD88 WITH A ±0.5 TOLERANCE.
7. FINAL DISCHARGE FROM DEWATERING OF FILL MATERIAL MUST NOT BE DIRECTED TO BAYOU BONFOUCA AND LAKE PONTCHARTRAIN.
8. INTERNAL TRAINING DIKES MAY BE USED AS NECESSARY AT ANY LOCATION WITHIN THE MARSH CREATION AREA TO PROPERLY CONTAIN AND DEWATER FILL MATERIAL AND ACHIEVE THE TARGET ELEVATION.
9. A MAGNETOMETER SURVEY SHALL BE PERFORMED ON THE EARTHEN CONTAINMENT DIKE BORROW AREAS ACCORDING TO THE SPECIFICATIONS PRIOR TO MOBILIZATION.
10. SEE SPECIFICATIONS FOR SOIL BORING LOG INFORMATION.
11. MINIMUM RETENTION AND DEWATERING TIME IN BETWEEN LIFTS IN MARSH CREATION AREA 2 WEST IS 30 DAYS.

SOIL BORING COORDINATES

	NORTHING	EASTING
B3	642,774.12	3,746,154.06
B4	642,529.59	3,748,016.03
B5	642,523.22	3,749,522.16



500' 250' 0' 500' 1000'

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA MARSH CREATION PROJECT

MARSH CREATION AREA 2 LAYOUT

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU | DESIGNED BY: JOSEPH GUILLORY, E.I. | APPROVED BY: SHANNON HAYNES, P.E.

SHEET 6 OF 27

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EARTHEN CONTAINMENT DIKE CENTERLINE COORDINATES

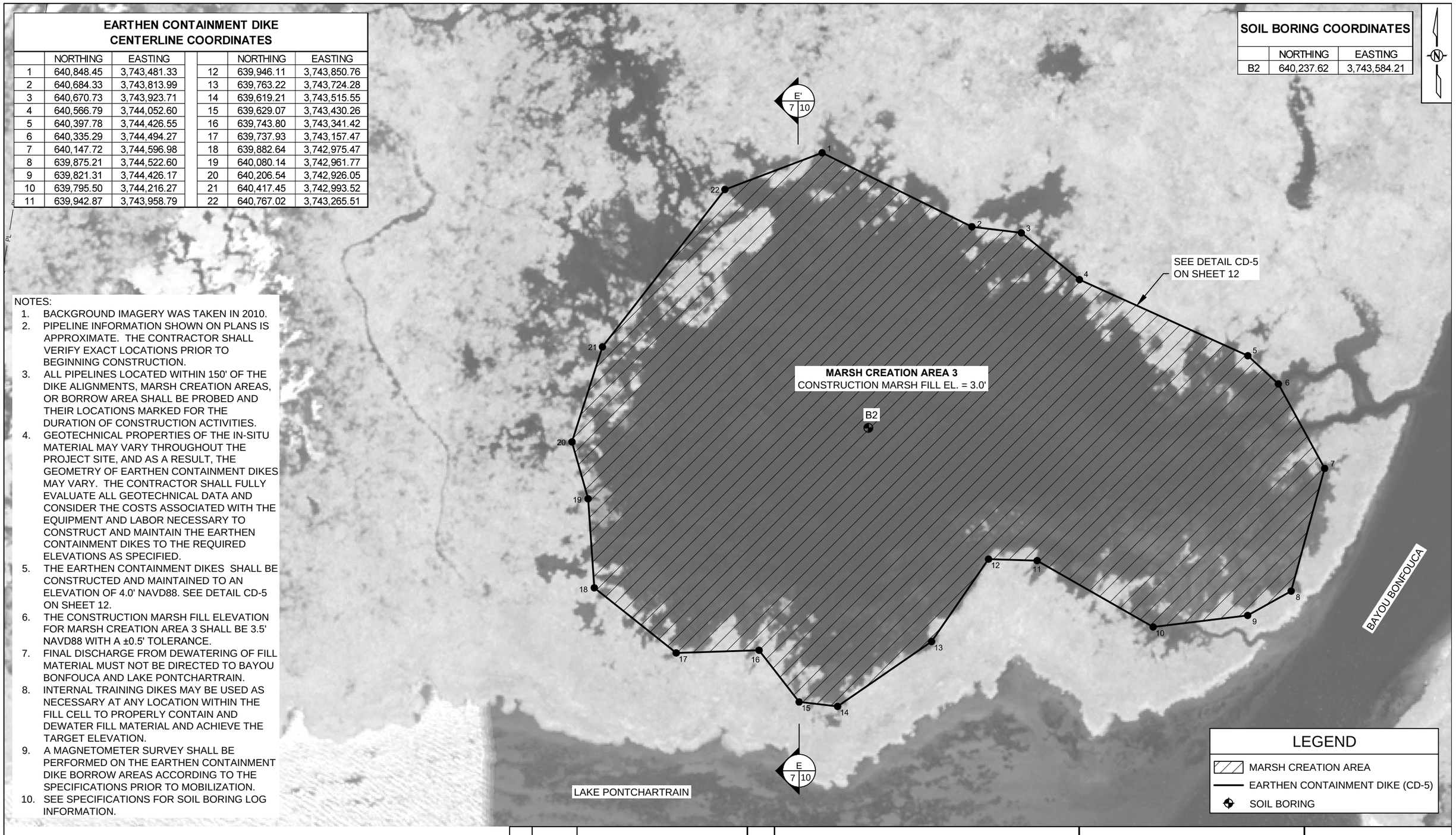
	NORTHING	EASTING		NORTHING	EASTING
1	640,848.45	3,743,481.33	12	639,946.11	3,743,850.76
2	640,684.33	3,743,813.99	13	639,763.22	3,743,724.28
3	640,670.73	3,743,923.71	14	639,619.21	3,743,515.55
4	640,566.79	3,744,052.60	15	639,629.07	3,743,430.26
5	640,397.78	3,744,426.55	16	639,743.80	3,743,341.42
6	640,335.29	3,744,494.27	17	639,737.93	3,743,157.47
7	640,147.72	3,744,596.98	18	639,882.64	3,742,975.47
8	639,875.21	3,744,522.60	19	640,080.14	3,742,961.77
9	639,821.31	3,744,426.17	20	640,206.54	3,742,926.05
10	639,795.50	3,744,216.27	21	640,417.45	3,742,993.52
11	639,942.87	3,743,958.79	22	640,767.02	3,743,265.51

SOIL BORING COORDINATES

	NORTHING	EASTING
B2	640,237.62	3,743,584.21

NOTES:

1. BACKGROUND IMAGERY WAS TAKEN IN 2010.
2. PIPELINE INFORMATION SHOWN ON PLANS IS APPROXIMATE. THE CONTRACTOR SHALL VERIFY EXACT LOCATIONS PRIOR TO BEGINNING CONSTRUCTION.
3. ALL PIPELINES LOCATED WITHIN 150' OF THE DIKE ALIGNMENTS, MARSH CREATION AREAS, OR BORROW AREA SHALL BE PROBED AND THEIR LOCATIONS MARKED FOR THE DURATION OF CONSTRUCTION ACTIVITIES.
4. GEOTECHNICAL PROPERTIES OF THE IN-SITU MATERIAL MAY VARY THROUGHOUT THE PROJECT SITE, AND AS A RESULT, THE GEOMETRY OF EARTHEN CONTAINMENT DIKES MAY VARY. THE CONTRACTOR SHALL FULLY EVALUATE ALL GEOTECHNICAL DATA AND CONSIDER THE COSTS ASSOCIATED WITH THE EQUIPMENT AND LABOR NECESSARY TO CONSTRUCT AND MAINTAIN THE EARTHEN CONTAINMENT DIKES TO THE REQUIRED ELEVATIONS AS SPECIFIED.
5. THE EARTHEN CONTAINMENT DIKES SHALL BE CONSTRUCTED AND MAINTAINED TO AN ELEVATION OF 4.0' NAVD88. SEE DETAIL CD-5 ON SHEET 12.
6. THE CONSTRUCTION MARSH FILL ELEVATION FOR MARSH CREATION AREA 3 SHALL BE 3.5' NAVD88 WITH A ±0.5' TOLERANCE.
7. FINAL DISCHARGE FROM DEWATERING OF FILL MATERIAL MUST NOT BE DIRECTED TO BAYOU BONFOUCA AND LAKE PONTCHARTRAIN.
8. INTERNAL TRAINING DIKES MAY BE USED AS NECESSARY AT ANY LOCATION WITHIN THE FILL CELL TO PROPERLY CONTAIN AND DEWATER FILL MATERIAL AND ACHIEVE THE TARGET ELEVATION.
9. A MAGNETOMETER SURVEY SHALL BE PERFORMED ON THE EARTHEN CONTAINMENT DIKE BORROW AREAS ACCORDING TO THE SPECIFICATIONS PRIOR TO MOBILIZATION.
10. SEE SPECIFICATIONS FOR SOIL BORING LOG INFORMATION.



200' 100' 0' 200' 400'

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA MARSH CREATION PROJECT

MARSH CREATION AREA 3 LAYOUT

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU | DESIGNED BY: JOSEPH GUILLORY, E.I. | APPROVED BY: SHANNON HAYNES, P.E.

SHEET 7 OF 27

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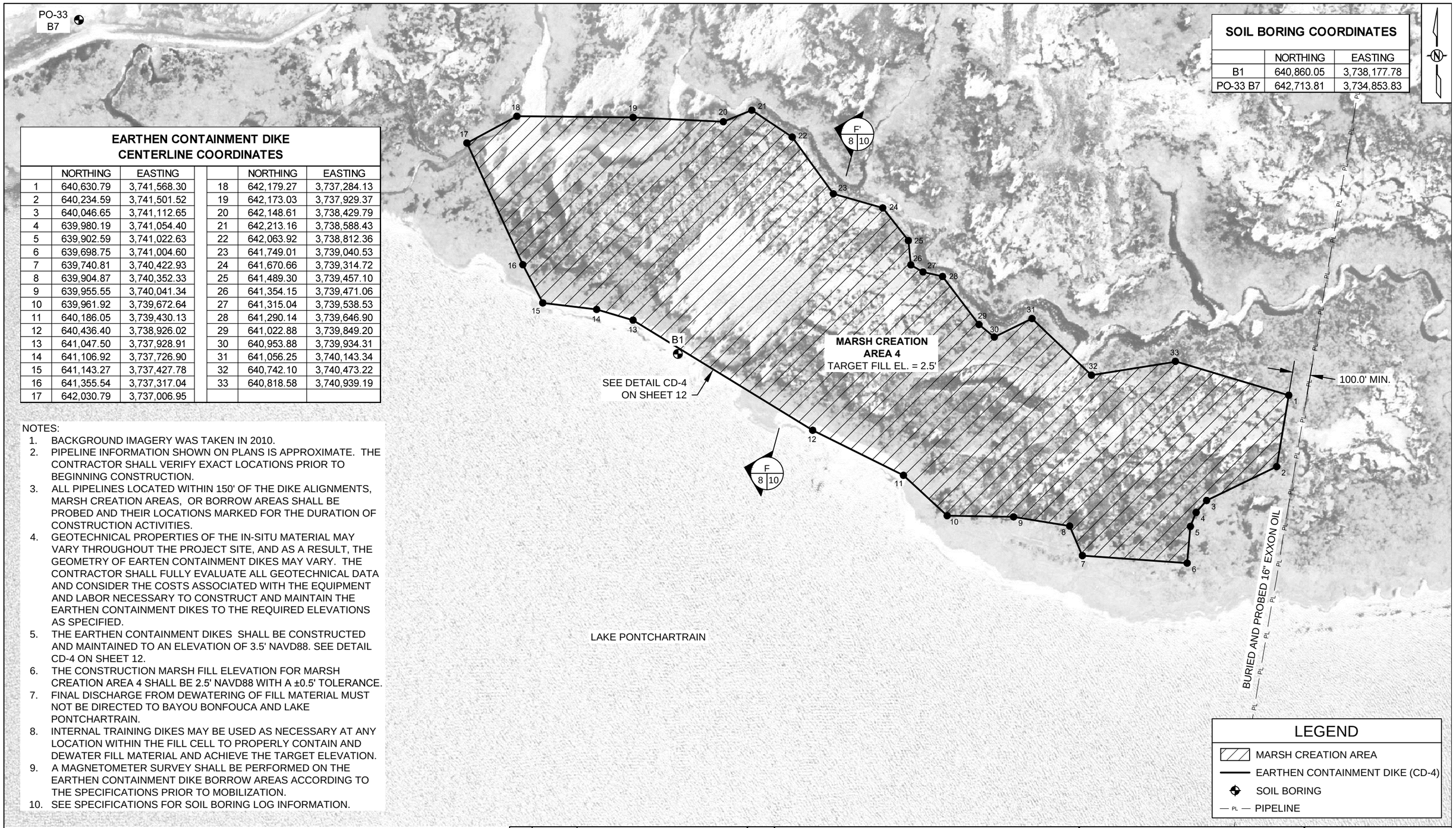

SOIL BORING COORDINATES

	NORTHING	EASTING
B1	640,860.05	3,738,177.78
PO-33 B7	642,713.81	3,734,853.83

EARTHEN CONTAINMENT DIKE CENTERLINE COORDINATES

	NORTHING	EASTING		NORTHING	EASTING
1	640,630.79	3,741,568.30	18	642,179.27	3,737,284.13
2	640,234.59	3,741,501.52	19	642,173.03	3,737,929.37
3	640,046.65	3,741,112.65	20	642,148.61	3,738,429.79
4	639,980.19	3,741,054.40	21	642,213.16	3,738,588.43
5	639,902.59	3,741,022.63	22	642,063.92	3,738,812.36
6	639,698.75	3,741,004.60	23	641,749.01	3,739,040.53
7	639,740.81	3,740,422.93	24	641,670.66	3,739,314.72
8	639,904.87	3,740,352.33	25	641,489.30	3,739,457.10
9	639,955.55	3,740,041.34	26	641,354.15	3,739,471.06
10	639,961.92	3,739,672.64	27	641,315.04	3,739,538.53
11	640,186.05	3,739,430.13	28	641,290.14	3,739,646.90
12	640,436.40	3,738,926.02	29	641,022.88	3,739,849.20
13	641,047.50	3,737,928.91	30	640,953.88	3,739,934.31
14	641,106.92	3,737,726.90	31	641,056.25	3,740,143.34
15	641,143.27	3,737,427.78	32	640,742.10	3,740,473.22
16	641,355.54	3,737,317.04	33	640,818.58	3,740,939.19
17	642,030.79	3,737,006.95			

NOTES:

1. BACKGROUND IMAGERY WAS TAKEN IN 2010.
2. PIPELINE INFORMATION SHOWN ON PLANS IS APPROXIMATE. THE CONTRACTOR SHALL VERIFY EXACT LOCATIONS PRIOR TO BEGINNING CONSTRUCTION.
3. ALL PIPELINES LOCATED WITHIN 150' OF THE DIKE ALIGNMENTS, MARSH CREATION AREAS, OR BORROW AREAS SHALL BE PROBED AND THEIR LOCATIONS MARKED FOR THE DURATION OF CONSTRUCTION ACTIVITIES.
4. GEOTECHNICAL PROPERTIES OF THE IN-SITU MATERIAL MAY VARY THROUGHOUT THE PROJECT SITE, AND AS A RESULT, THE GEOMETRY OF EARTEN CONTAINMENT DIKES MAY VARY. THE CONTRACTOR SHALL FULLY EVALUATE ALL GEOTECHNICAL DATA AND CONSIDER THE COSTS ASSOCIATED WITH THE EQUIPMENT AND LABOR NECESSARY TO CONSTRUCT AND MAINTAIN THE EARTHEN CONTAINMENT DIKES TO THE REQUIRED ELEVATIONS AS SPECIFIED.
5. THE EARTHEN CONTAINMENT DIKES SHALL BE CONSTRUCTED AND MAINTAINED TO AN ELEVATION OF 3.5' NAVD88. SEE DETAIL CD-4 ON SHEET 12.
6. THE CONSTRUCTION MARSH FILL ELEVATION FOR MARSH CREATION AREA 4 SHALL BE 2.5' NAVD88 WITH A ±0.5' TOLERANCE.
7. FINAL DISCHARGE FROM DEWATERING OF FILL MATERIAL MUST NOT BE DIRECTED TO BAYOU BONFOUCA AND LAKE PONTCHARTRAIN.
8. INTERNAL TRAINING DIKES MAY BE USED AS NECESSARY AT ANY LOCATION WITHIN THE FILL CELL TO PROPERLY CONTAIN AND DEWATER FILL MATERIAL AND ACHIEVE THE TARGET ELEVATION.
9. A MAGNETOMETER SURVEY SHALL BE PERFORMED ON THE EARTHEN CONTAINMENT DIKE BORROW AREAS ACCORDING TO THE SPECIFICATIONS PRIOR TO MOBILIZATION.
10. SEE SPECIFICATIONS FOR SOIL BORING LOG INFORMATION.

LEGEND

- MARSH CREATION AREA
- EARTHEN CONTAINMENT DIKE (CD-4)
- SOIL BORING
- — PL — PIPELINE

500' 250' 0' 500' 1000'

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA
MARSH CREATION PROJECT

MARSH CREATION AREA 4 LAYOUT

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU | DESIGNED BY: JOSEPH GUILLORY, E.I. | APPROVED BY: SHANNON HAYNES, P.E.

SHEET 8 OF 27

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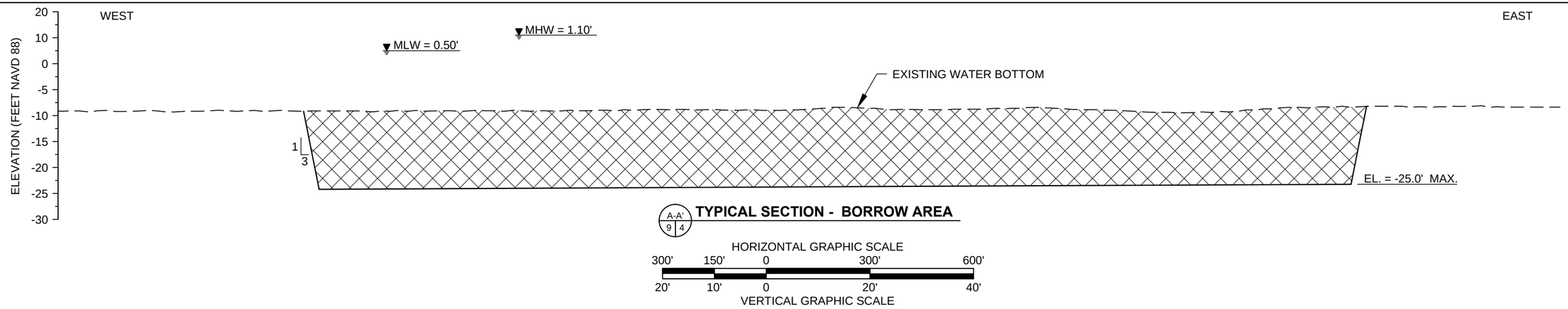


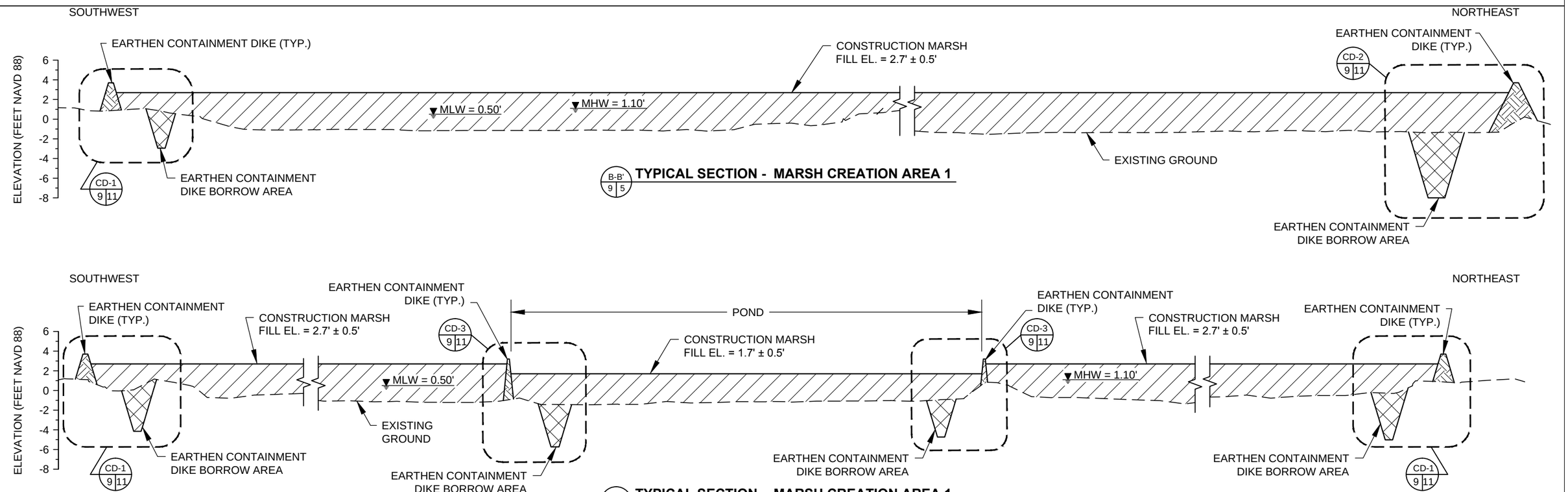
A-A' 9 4 **TYPICAL SECTION - BORROW AREA**

HORIZONTAL GRAPHIC SCALE

300' 150' 0 300' 600'

20' 10' 0 20' 40'

VERTICAL GRAPHIC SCALE



HORIZONTAL GRAPHIC SCALE

100' 50' 0 100' 200'

10' 5' 0 10' 20'

VERTICAL GRAPHIC SCALE

NOTE:
DISCHARGE SHALL BE DIRECTED TO RETAIN AS MUCH MATERIAL AS POSSIBLE.

LEGEND

- EARTHEN CONTAINMENT DIKE
- EARTHEN CONTAINMENT DIKE BORROW AREA
- MARSH CREATION FILL
- EXISTING GROUND\WATER BOTTOM

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA MARSH CREATION PROJECT

TYPICAL SECTIONS

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU | DESIGNED BY: JOSEPH GUILLORY, E.I. | APPROVED BY: SHANNON HAYNES, P.E.

SHEET 9 OF 27

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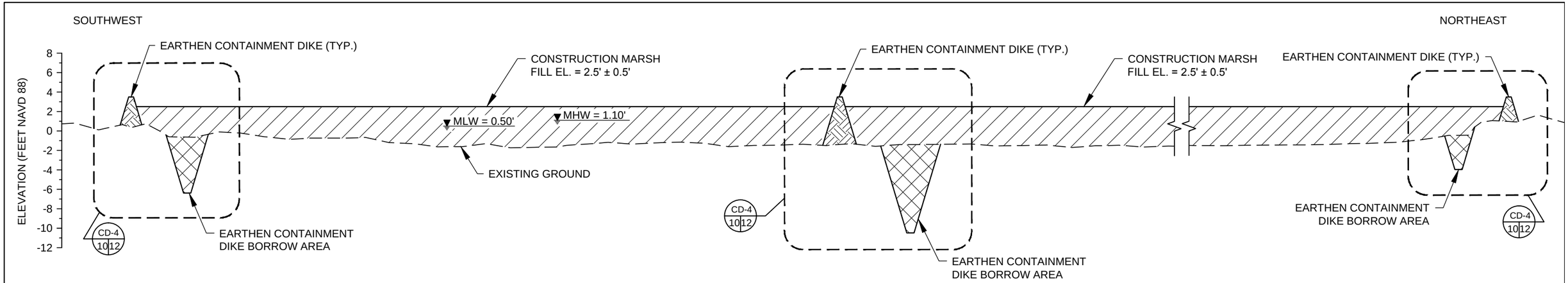
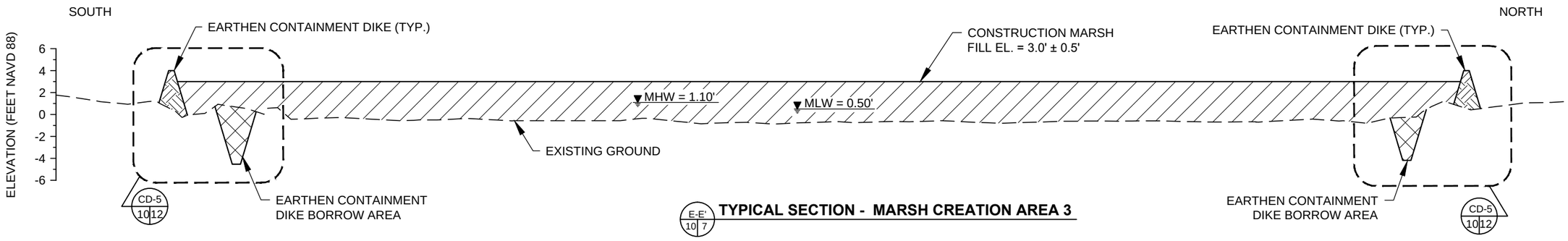


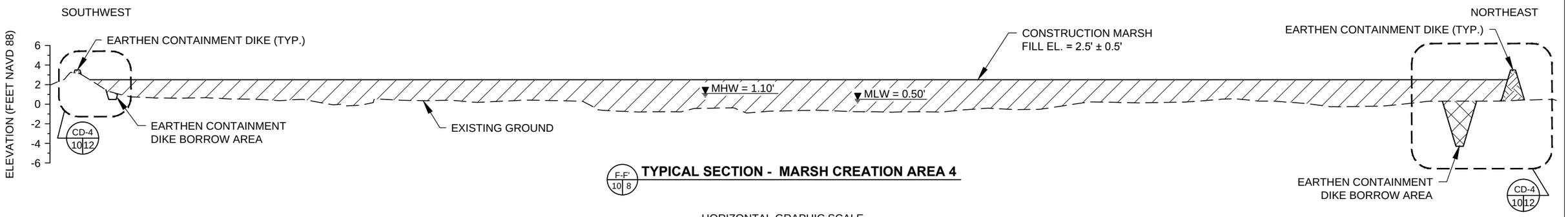
D-D'
10 6

TYPICAL SECTION - MARSH CREATION AREA 2



E-E'
10 7

TYPICAL SECTION - MARSH CREATION AREA 3



F-F'
10 8

TYPICAL SECTION - MARSH CREATION AREA 4

HORIZONTAL GRAPHIC SCALE

100' 50' 0 100' 200'

10' 5' 0 10' 20'

VERTICAL GRAPHIC SCALE

LEGEND

- EARTHEN CONTAINMENT DIKE
- EARTHEN CONTAINMENT DIKE BORROW AREA
- MARSH CREATION FILL
- EXISTING GROUND

NOTE:
DISCHARGE SHALL BE DIRECTED TO
RETAIN AS MUCH MATERIAL AS POSSIBLE.

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA
MARSH CREATION PROJECT

TYPICAL SECTIONS

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU | DESIGNED BY: JOSEPH GUILLORY, E.I. | APPROVED BY: SHANNON HAYNES, P.E.

SHEET 10 OF 27

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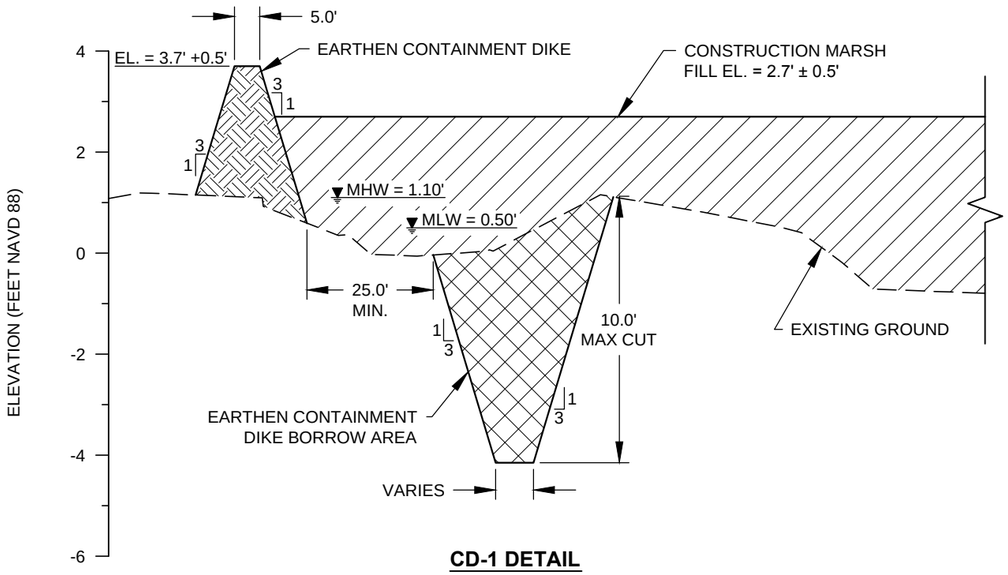
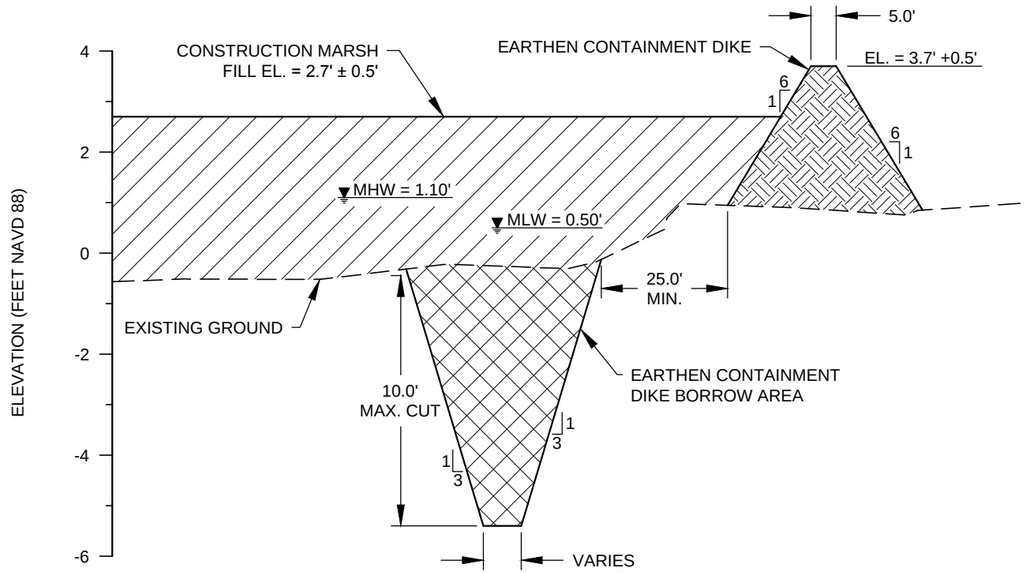
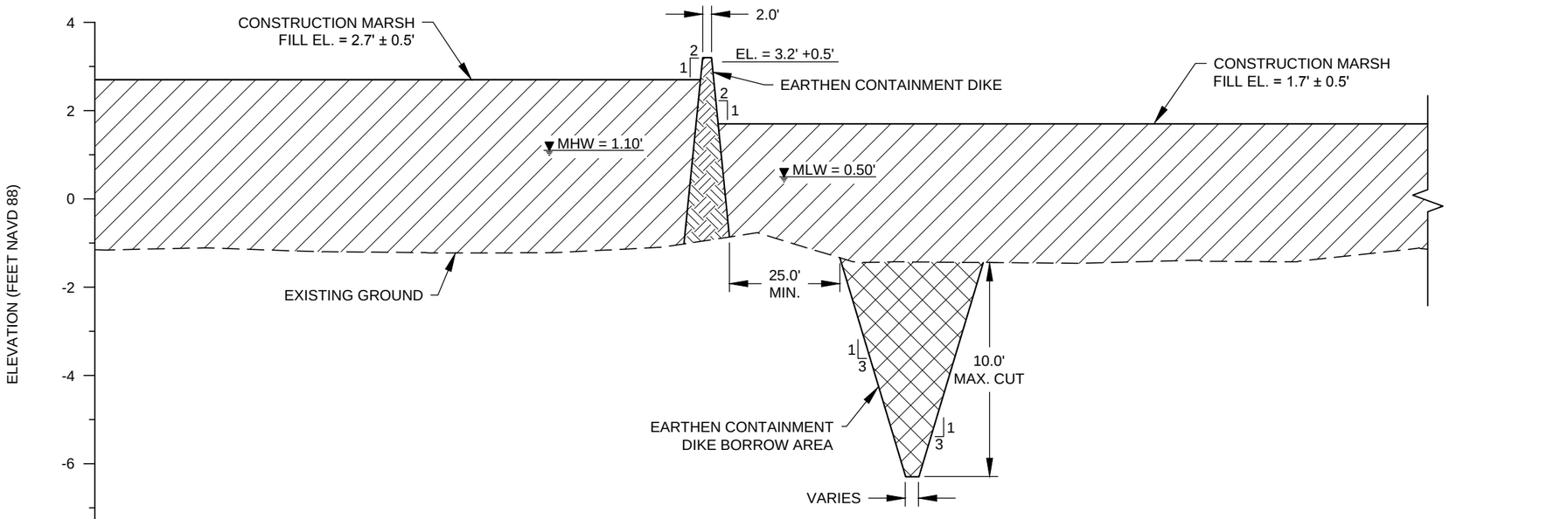


CD-1 DETAIL



CD-2 DETAIL



CD-3 DETAIL

NOTES:

1. EARTHEN CONTAINMENT DIKES SHALL BE CONSTRUCTED USING IN-SITU MATERIAL. SEE SHEETS 5 - 8 FOR EARTHEN CONTAINMENT DIKE LOCATIONS.
2. THE LENGTHS OF EARTHEN CONTAINMENT DIKES WERE ESTIMATED USING AUTOCAD AND AERIAL PHOTOGRAPHY.

LEGEND

- EARTHEN CONTAINMENT DIKE
- EARTHEN CONTAINMENT DIKE BORROW AREA
- MARSH CREATION FILL
- EXISTING GROUND

HORIZONTAL GRAPHIC SCALE
30' 15' 0 30' 60'
3' 1.5' 0 3' 6'
VERTICAL GRAPHIC SCALE

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA
MARSH CREATION PROJECT

TYPICAL DETAILS

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU

DESIGNED BY: JOSEPH GUILLORY, E.I.

APPROVED BY: SHANNON HAYNES, P.E.

SHEET 11 OF 27

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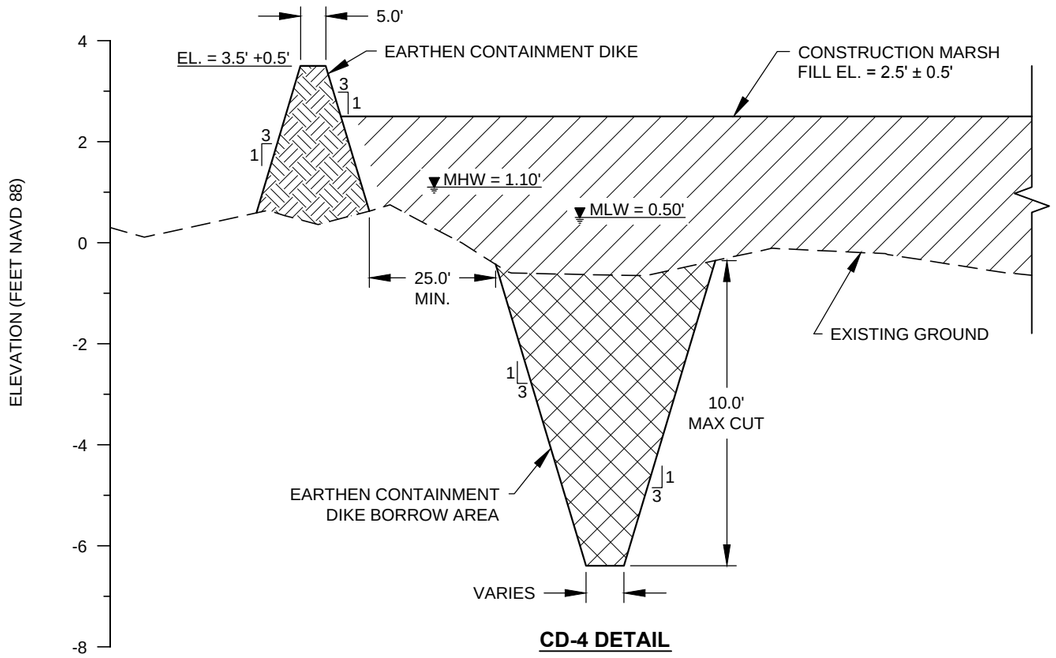
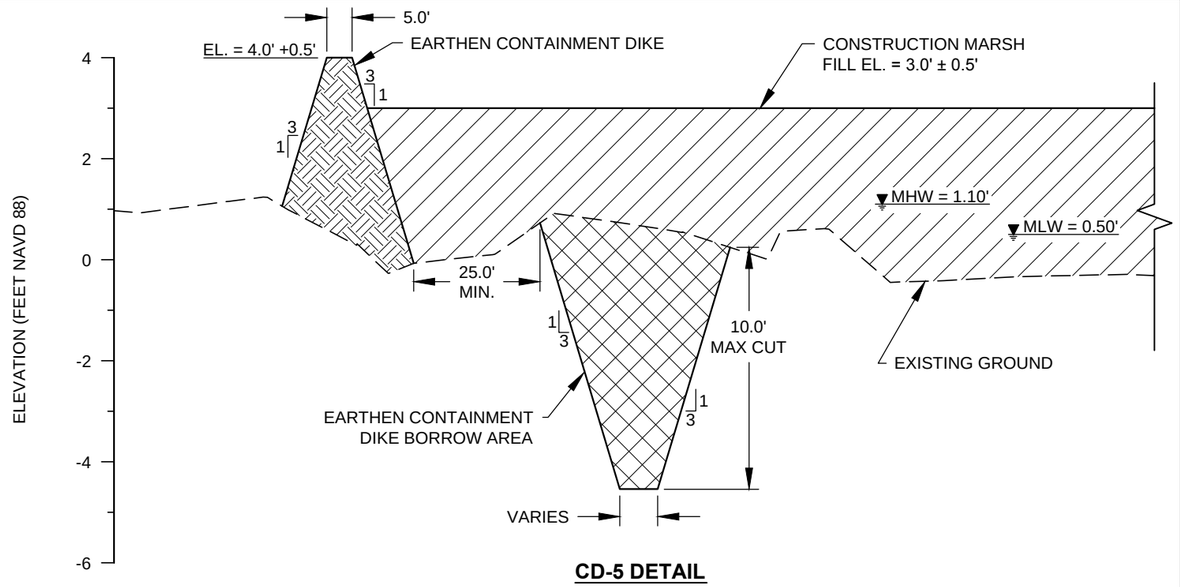


CD-4 DETAIL



CD-5 DETAIL

NOTES:
1. EARTHEN CONTAINMENT DIKES SHALL BE CONSTRUCTED USING IN-SITU MATERIAL. SEE SHEETS 5 - 8 FOR EARTHEN CONTAINMENT DIKE LOCATIONS.
2. THE LENGTHS OF EARTHEN CONTAINMENT DIKES WERE ESTIMATED USING AUTOCAD AND AERIAL PHOTOGRAPHY.

HORIZONTAL GRAPHIC SCALE

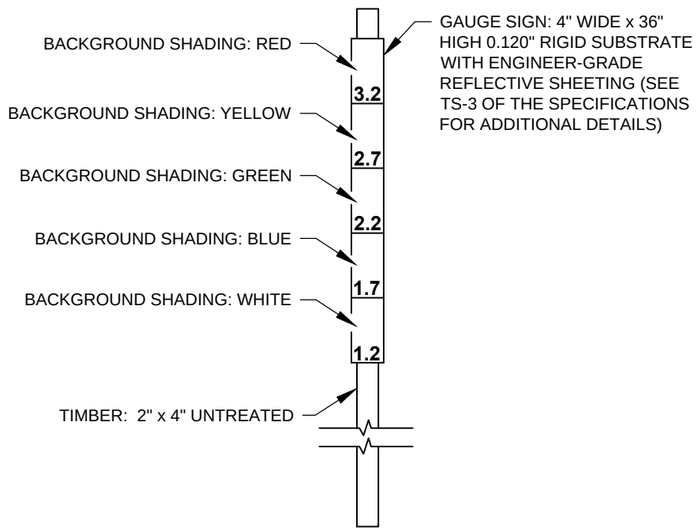
30' 15' 0 30' 60'

3' 1.5' 0 3' 6'

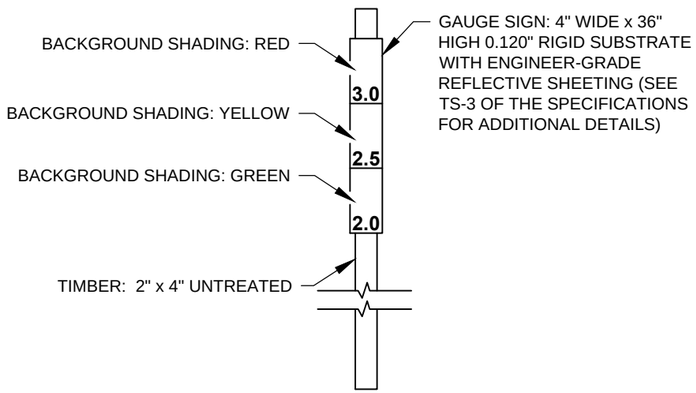
VERTICAL GRAPHIC SCALE

LEGEND

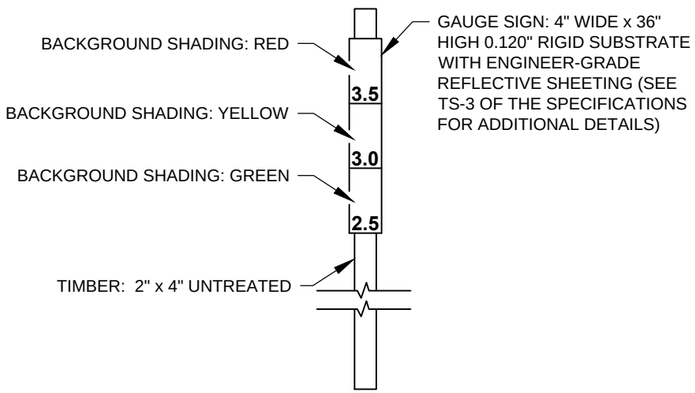
- EARTHEN CONTAINMENT DIKE
- EARTHEN CONTAINMENT DIKE BORROW AREA
- MARSH CREATION FILL
- EXISTING GROUND



MARSH CREATION AREA 1
GRADE STAKE DETAIL
NOT TO SCALE



MARSH CREATION AREAS 2 AND 4
GRADE STAKE DETAIL
NOT TO SCALE



MARSH CREATION AREA 3
GRADE STAKE DETAIL
NOT TO SCALE

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

DRAWN BY: KRISTI CANTU | DESIGNED BY: JOSEPH GUILLORY, E.I.

BAYOU BONFOUCA
MARSH CREATION PROJECT

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

APPROVED BY: SHANNON HAYNES, P.E.

TYPICAL DETAILS

DATE: APRIL 2012

SHEET 12 OF 27

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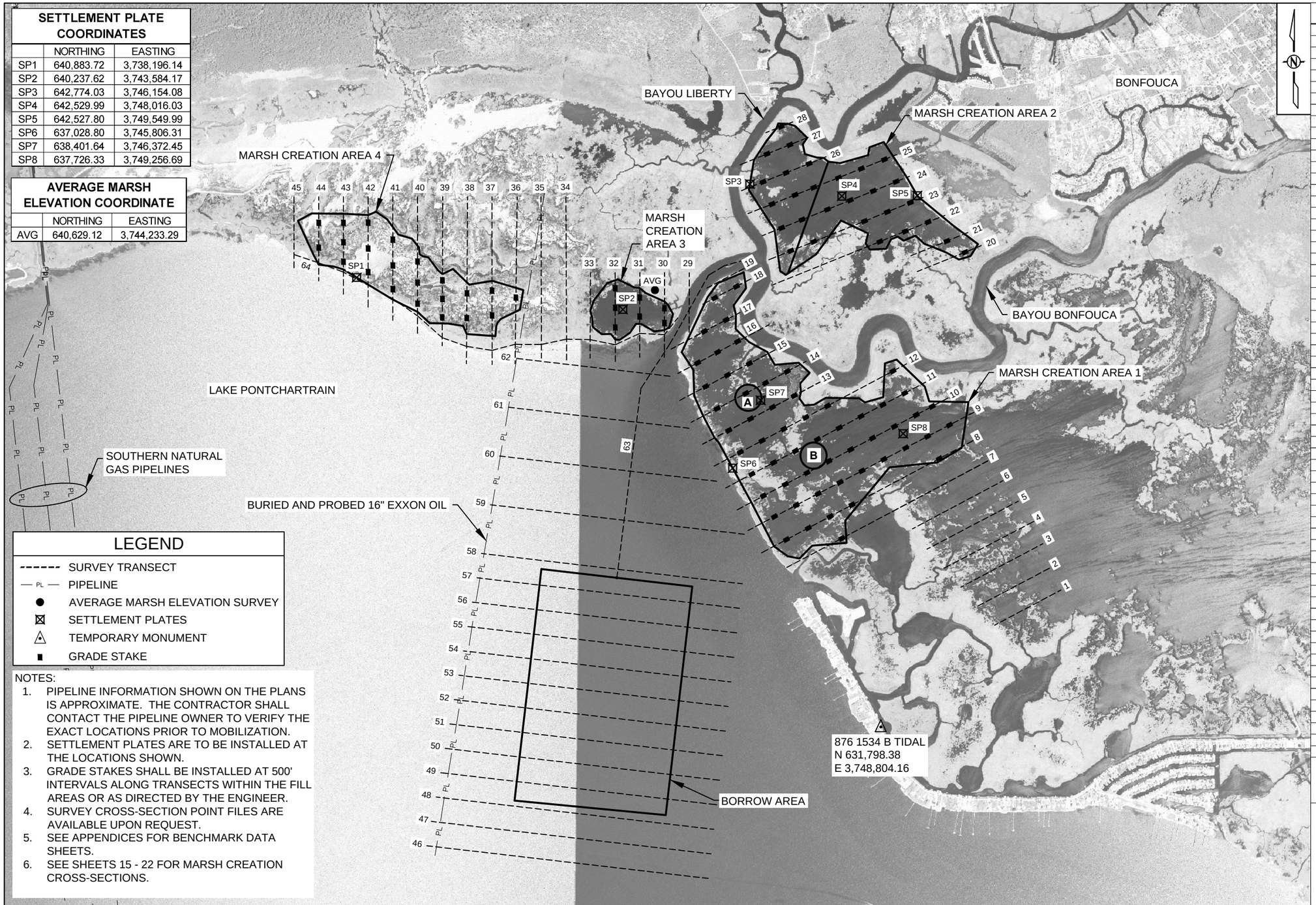

SETTLEMENT PLATE COORDINATES

	NORTHING	EASTING
SP1	640,883.72	3,738,196.14
SP2	640,237.62	3,743,584.17
SP3	642,774.03	3,746,154.08
SP4	642,529.99	3,748,016.03
SP5	642,527.80	3,749,549.99
SP6	637,028.80	3,745,806.31
SP7	638,401.64	3,746,372.45
SP8	637,726.33	3,749,256.69

AVERAGE MARSH ELEVATION COORDINATE

	NORTHING	EASTING
AVG	640,629.12	3,744,233.29

LEGEND

- SURVEY TRANSECT
- PL — PIPELINE
- AVERAGE MARSH ELEVATION SURVEY
- SETTLEMENT PLATES
- TEMPORARY MONUMENT
- GRADE STAKE

NOTES:

1. PIPELINE INFORMATION SHOWN ON THE PLANS IS APPROXIMATE. THE CONTRACTOR SHALL CONTACT THE PIPELINE OWNER TO VERIFY THE EXACT LOCATIONS PRIOR TO MOBILIZATION.
2. SETTLEMENT PLATES ARE TO BE INSTALLED AT THE LOCATIONS SHOWN.
3. GRADE STAKES SHALL BE INSTALLED AT 500' INTERVALS ALONG TRANSECTS WITHIN THE FILL AREAS OR AS DIRECTED BY THE ENGINEER.
4. SURVEY CROSS-SECTION POINT FILES ARE AVAILABLE UPON REQUEST.
5. SEE APPENDICES FOR BENCHMARK DATA SHEETS.
6. SEE SHEETS 15 - 22 FOR MARSH CREATION CROSS-SECTIONS.

TRANSECT COORDINATES

	BEGINNING		ENDING	
	NORTHING	EASTING	NORTHING	EASTING
1	633,852.11	3,751,108.40	634,563.35	3,752,451.94
2	634,236.24	3,750,765.35	635,005.25	3,752,218.01
3	634,620.38	3,750,422.30	635,500.53	3,752,084.92
4	635,003.23	3,750,080.40	635,949.84	3,751,902.32
5	635,389.00	3,749,738.24	636,360.79	3,751,589.77
6	635,799.86	3,749,443.75	636,772.98	3,751,276.28
7	635,019.42	3,746,901.36	637,173.17	3,750,971.92
8	635,315.12	3,746,387.72	637,589.37	3,750,685.58
9	635,767.89	3,746,116.61	638,158.39	3,750,686.71
10	636,184.96	3,745,897.41	638,445.06	3,750,161.16
11	636,627.86	3,745,664.65	638,767.86	3,749,711.49
12	637,069.97	3,745,432.29	639,136.42	3,749,324.80
13	637,512.93	3,745,199.50	638,768.58	3,747,571.43
14	637,955.53	3,744,966.89	639,186.61	3,747,292.42
15	638,398.13	3,744,734.28	639,419.56	3,746,663.78
16	638,944.40	3,744,698.39	639,927.88	3,746,539.67
17	639,438.42	3,744,562.03	640,175.85	3,745,955.04
18	640,342.73	3,745,201.60	640,858.75	3,746,176.36
19	640,668.91	3,745,283.41	641,067.77	3,746,036.85
20	641,002.38	3,749,539.94	641,529.41	3,750,839.71
21	641,323.58	3,749,410.23	641,793.35	3,750,568.60
22	640,734.90	3,746,617.02	642,141.73	3,750,100.73
23	641,242.34	3,746,538.30	642,504.18	3,749,662.96
24	641,726.81	3,746,402.68	642,931.33	3,749,385.43
25	642,175.82	3,746,115.54	643,367.31	3,749,120.26
26	642,641.36	3,745,984.75	643,325.77	3,747,697.23
27	643,165.43	3,745,959.26	643,717.07	3,747,334.43
28	644,029.97	3,747,019.81	643,812.37	3,746,477.35
29	639,629.98	3,744,923.88	640,981.97	3,744,927.73
30	639,268.94	3,744,422.85	640,983.39	3,744,427.74
31	639,270.36	3,743,922.85	640,984.82	3,743,927.74
32	639,182.54	3,743,430.43	640,984.82	3,743,427.74
33	639,252.80	3,742,920.42	640,984.82	3,742,927.74
34	639,217.67	3,742,445.59	642,517.16	3,742,430.75
35	639,252.80	3,741,935.58	642,517.16	3,741,929.03
36	639,142.05	3,741,401.87	642,517.16	3,741,444.96
37	639,124.19	3,740,936.87	642,517.16	3,740,933.71
38	639,142.05	3,740,418.21	642,517.16	3,740,439.69
39	639,505.39	3,739,927.74	642,517.16	3,739,936.99
40	639,752.39	3,739,427.74	642,517.16	3,739,427.74
41	640,017.79	3,738,927.74	642,517.16	3,738,927.74
42	640,283.20	3,738,427.74	642,517.16	3,738,427.74
43	640,548.60	3,737,927.74	642,517.16	3,737,927.74
44	640,814.01	3,737,427.74	642,517.16	3,737,427.74
45	641,079.41	3,736,927.74	642,517.16	3,736,927.74
46	629,391.19	3,739,615.36	628,729.53	3,745,310.22
47	629,883.66	3,739,709.06	629,226.19	3,745,367.92
48	630,376.14	3,739,802.76	629,722.85	3,745,425.62
49	630,868.62	3,739,896.46	630,219.51	3,745,483.33
50	631,361.33	3,739,988.14	630,716.17	3,745,541.03
51	631,854.04	3,740,079.80	631,212.83	3,745,598.74
52	632,346.76	3,740,171.46	631,709.49	3,745,656.44
53	632,839.47	3,740,263.11	632,206.15	3,745,714.14
54	633,332.19	3,740,354.77	632,702.81	3,745,771.85
55	633,824.90	3,740,446.43	633,199.47	3,745,829.55
56	634,317.61	3,740,538.09	633,696.12	3,745,887.26
57	634,810.33	3,740,629.74	634,192.78	3,745,944.96
58	635,303.04	3,740,721.40	634,689.44	3,746,002.66
59	636,288.47	3,740,904.71	635,691.52	3,746,042.72
60	637,273.90	3,741,088.03	636,763.42	3,745,481.77
61	638,259.33	3,741,271.34	637,835.32	3,744,920.81
62	639,246.87	3,741,436.48	638,886.42	3,744,538.89
63	641,212.70	3,746,271.55	641,224.63	3,746,002.78
	641,123.17	3,745,638.43	640,930.44	3,745,317.97
	639,562.30	3,744,548.11	638,638.58	3,743,947.61
	634,810.97	3,743,462.04		
64	641,346.36	3,736,927.74	639,532.84	3,741,406.86
	641,179.19	3,737,427.74	639,532.84	3,741,935.02
	640,993.84	3,737,927.74	639,637.93	3,742,443.70
	640,726.34	3,738,427.74	639,626.67	3,742,922.00
	640,456.61	3,738,927.74	639,523.44	3,743,429.92
	640,106.95	3,739,427.74	639,754.83	3,743,924.23
	639,666.03	3,739,928.23	639,727.58	3,744,424.16
	639,491.30	3,740,420.44	640,066.00	3,744,693.82
	639,410.10	3,740,936.60		

2000' 1000' 0' 2000' 4000'

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA MARSH CREATION PROJECT

SURVEY LAYOUT

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU | DESIGNED BY: JOSEPH GUILLORY, E.I. | APPROVED BY: SHANNON HAYNES, P.E.

SHEET 13 OF 27

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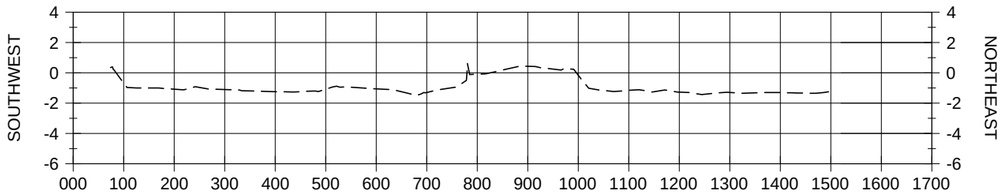

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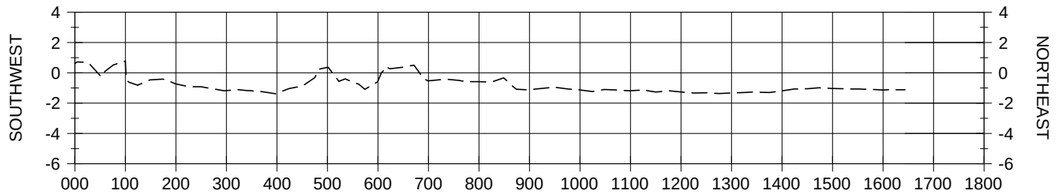

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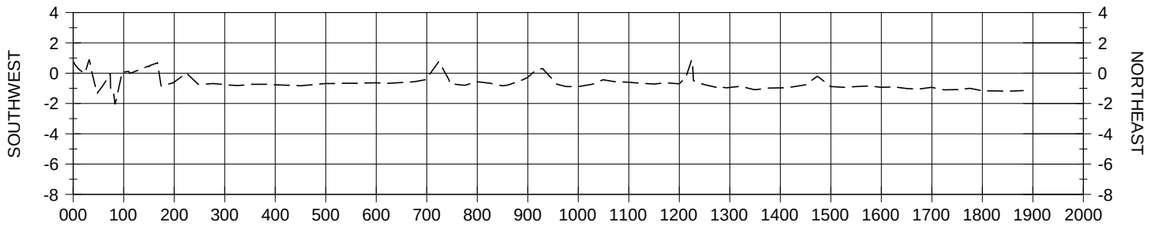

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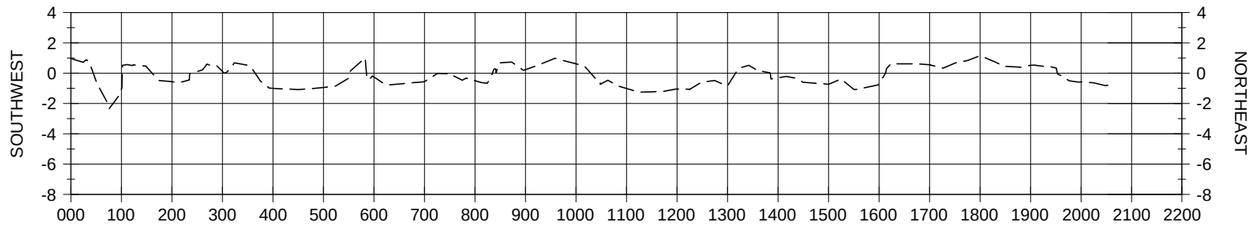

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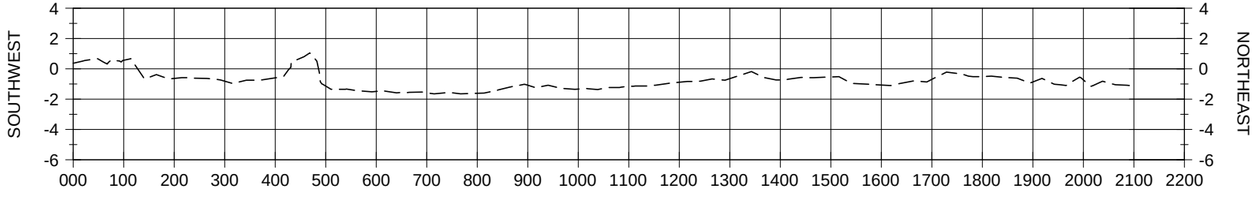

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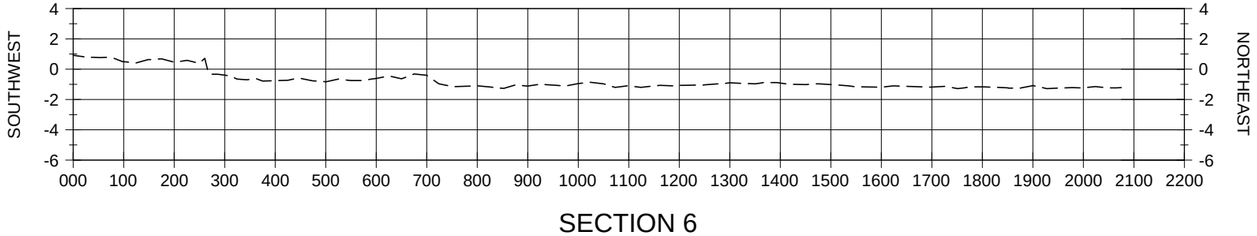

SECTION 6

HORIZONTAL GRAPHIC SCALE
300' 150' 0 300' 600'
10' 5' 0 10' 20'
VERTICAL GRAPHIC SCALE

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

LEGEND

------ EXISTING GROUND

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA
MARSH CREATION PROJECT

SECTIONS

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU

DESIGNED BY: JOSEPH GUILLORY, E.I.

APPROVED BY: SHANNON HAYNES, P.E.

SHEET 14 OF 27

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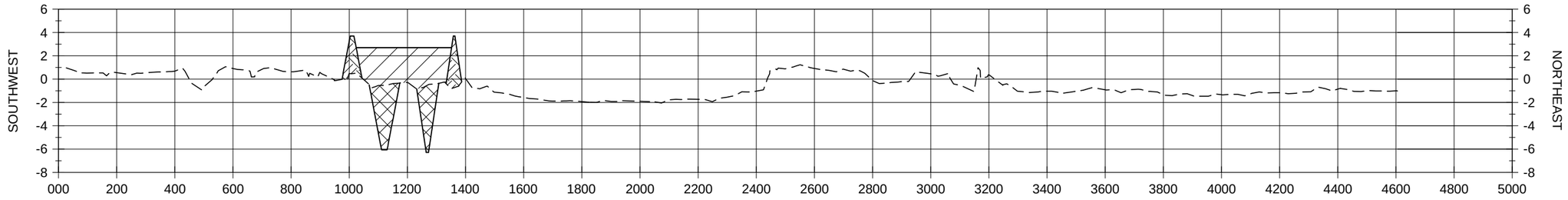

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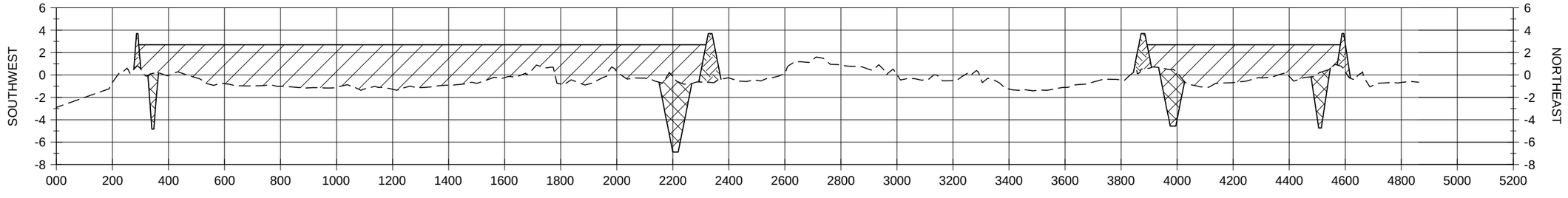

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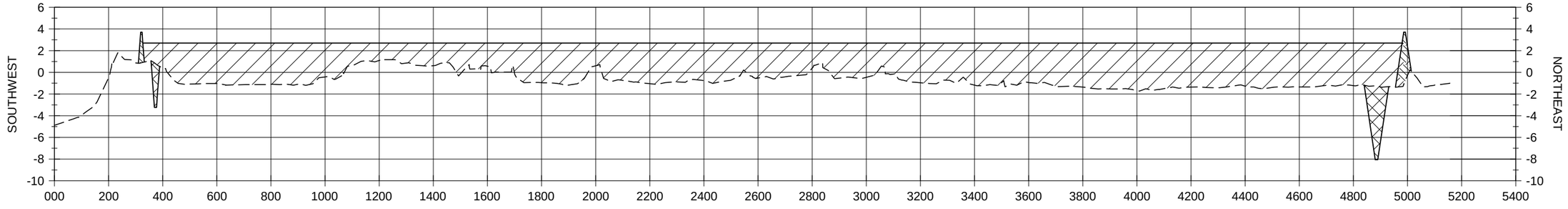

SECTION 9

HORIZONTAL GRAPHIC SCALE

400' 200' 0 400' 800'

10' 5' 0 10' 20'

VERTICAL GRAPHIC SCALE

LEGEND

- MARSH CREATION AREA
- EARTHEN CONTAINMENT DIKE
- EARTHEN CONTAINMENT DIKE BORROW AREA
- EXISTING GROUND

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA
MARSH CREATION PROJECT

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

SECTIONS

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU

DESIGNED BY: JOSEPH GUILLORY, E.I.

APPROVED BY: SHANNON HAYNES, P.E.

SHEET 15 OF 27

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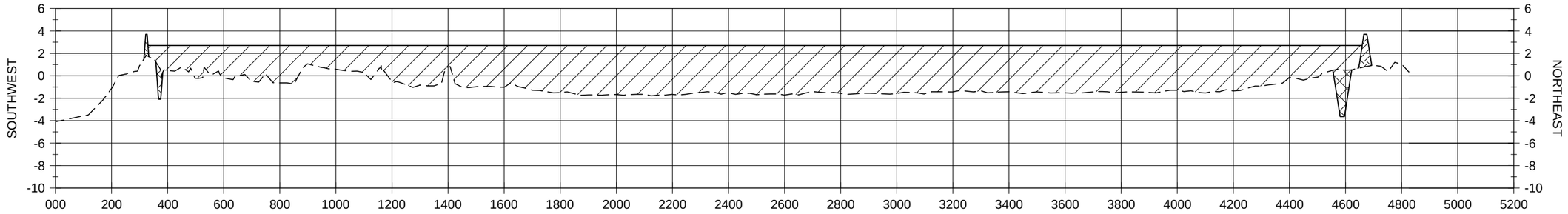

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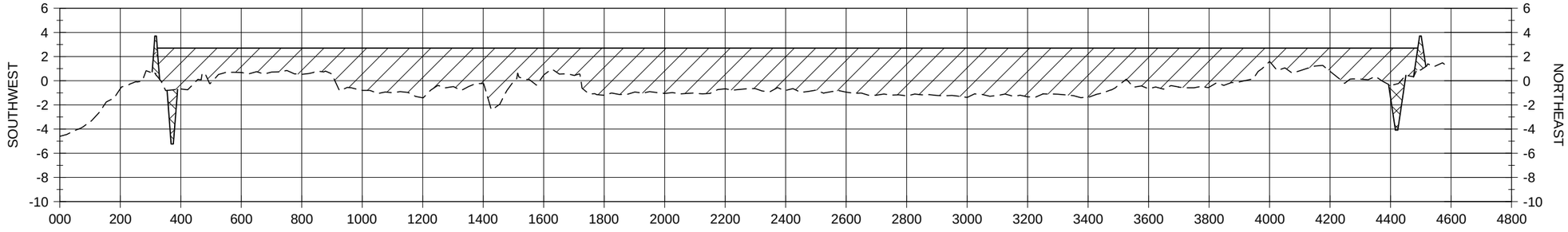

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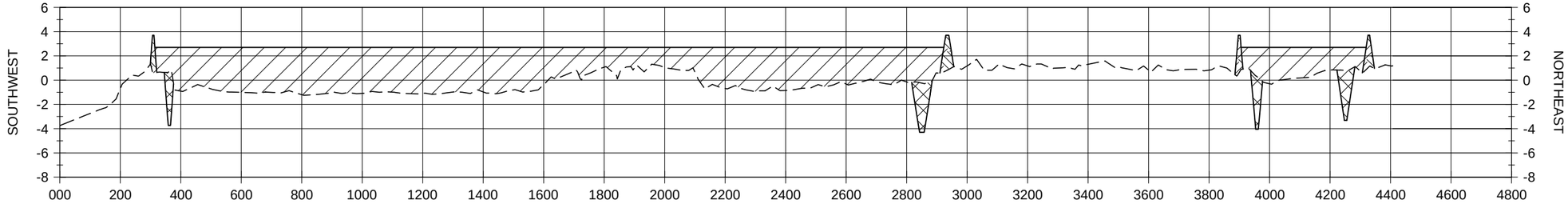

SECTION 12

HORIZONTAL GRAPHIC SCALE

400' 200' 0 400' 800'

10' 5' 0 10' 20'

VERTICAL GRAPHIC SCALE

LEGEND

- MARSH CREATION AREA
- EARTHEN CONTAINMENT DIKE
- EARTHEN CONTAINMENT DIKE BORROW AREA
- EXISTING GROUND

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA
MARSH CREATION PROJECT

SECTIONS

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU

DESIGNED BY: JOSEPH GUILLORY, E.I.

APPROVED BY: SHANNON HAYNES, P.E.

SHEET 16 OF 27

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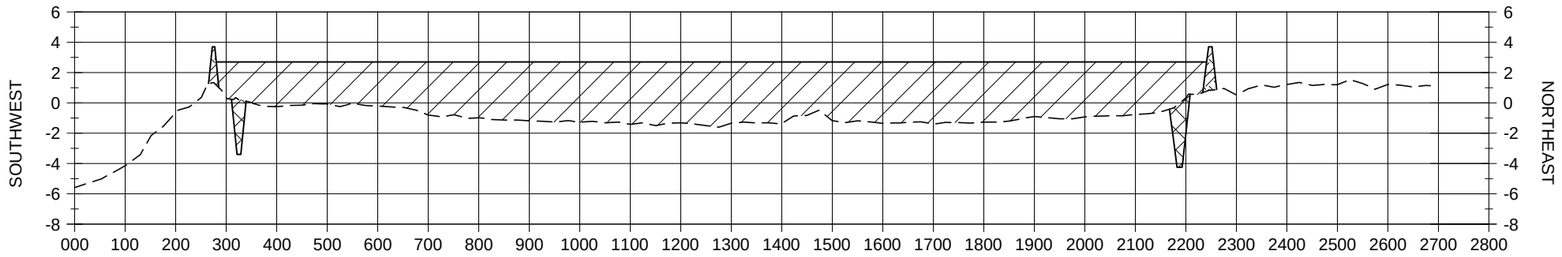

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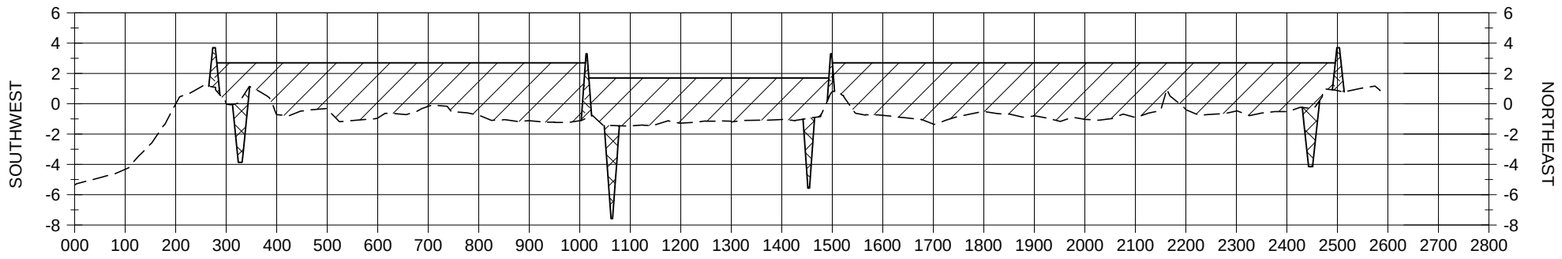

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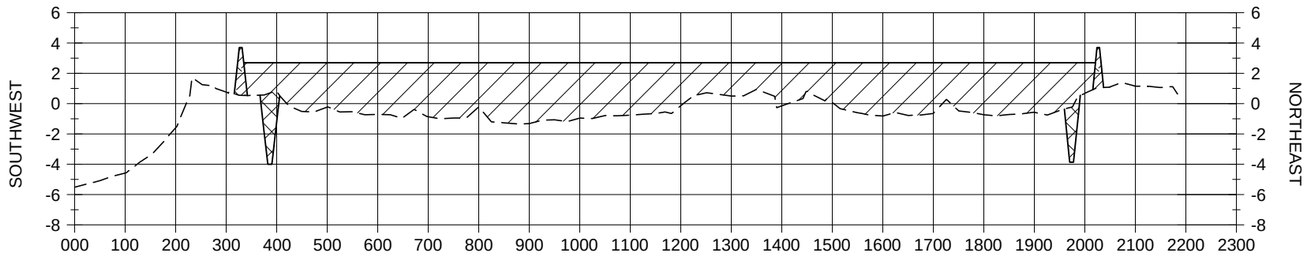


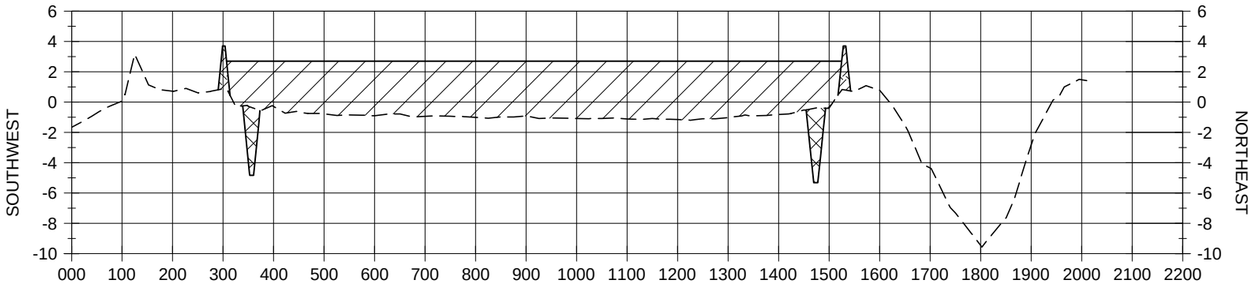
SECTION 15

HORIZONTAL GRAPHIC SCALE

300' 150' 0 300' 600'

10' 5' 0 10' 20'

VERTICAL GRAPHIC SCALE



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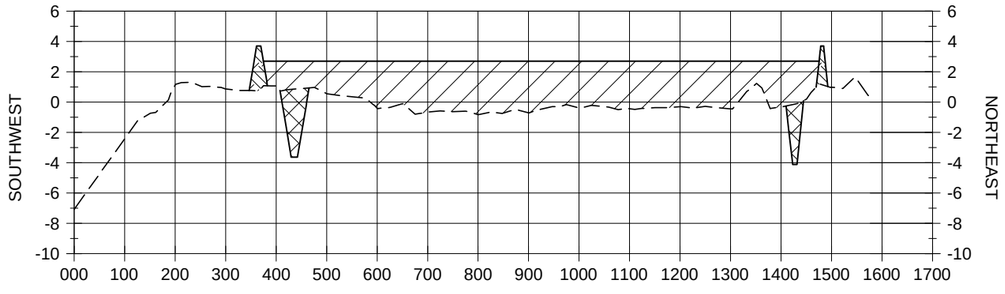

SECTION 17

LEGEND

- MARSH CREATION AREA
- EARTHEN CONTAINMENT DIKE
- EARTHEN CONTAINMENT DIKE BORROW AREA
- EXISTING GROUND

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA
MARSH CREATION PROJECT

SECTIONS

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU

DESIGNED BY: JOSEPH GUILLORY, E.I.

APPROVED BY: SHANNON HAYNES, P.E.

SHEET 17 OF 27

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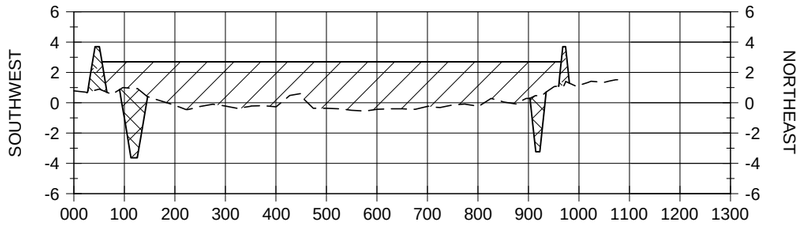

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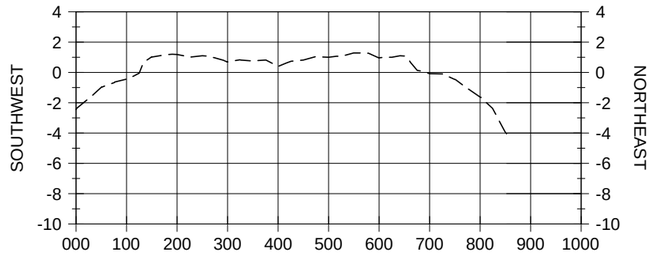

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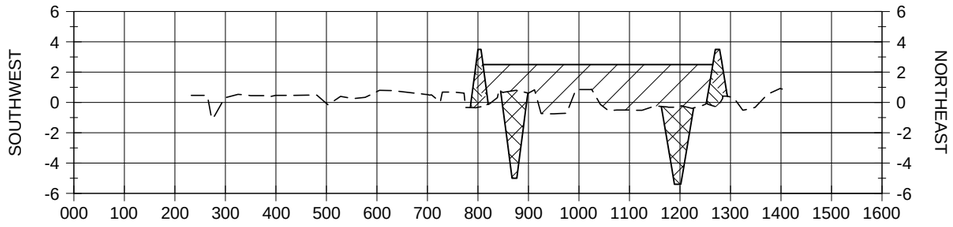

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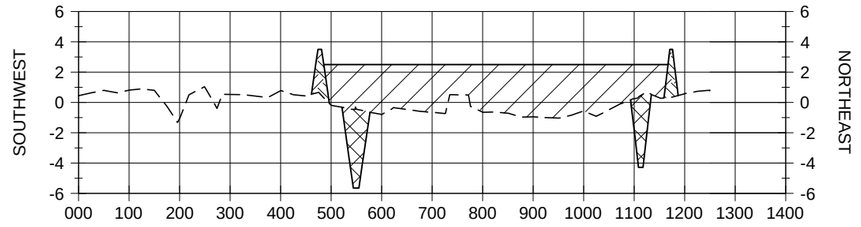

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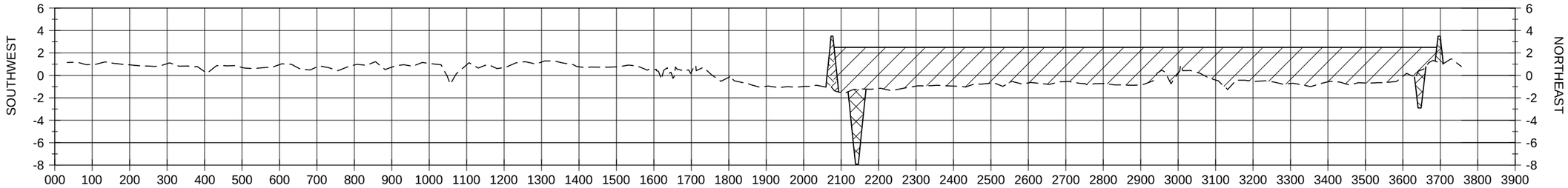

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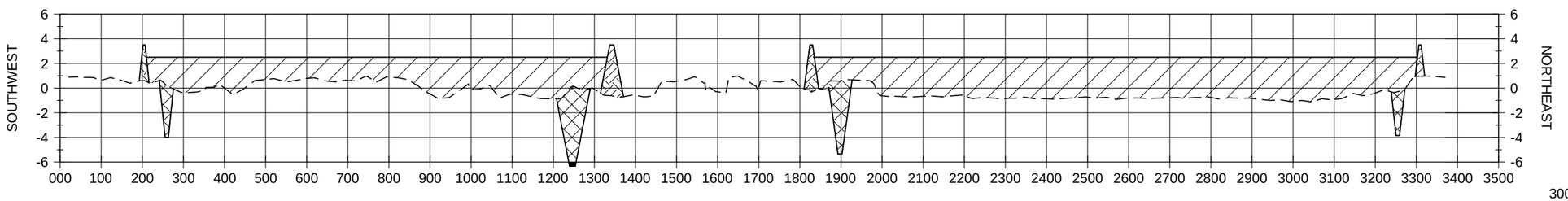

SECTION 23

HORIZONTAL GRAPHIC SCALE
300' 150' 0 300' 600'
10' 5' 0 10' 20'
VERTICAL GRAPHIC SCALE

LEGEND

- MARSH CREATION AREA
- EARTHEN CONTAINMENT DIKE
- EARTHEN CONTAINMENT DIKE BORROW AREA
- EXISTING GROUND

NOTE:
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REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
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BAYOU BONFOUCA
MARSH CREATION PROJECT

SECTIONS

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU

DESIGNED BY: JOSEPH GUILLORY, E.I.

APPROVED BY: SHANNON HAYNES, P.E.

SHEET 18 OF 27

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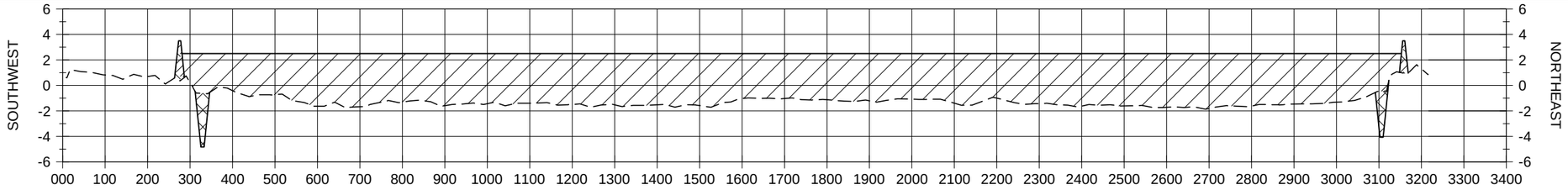

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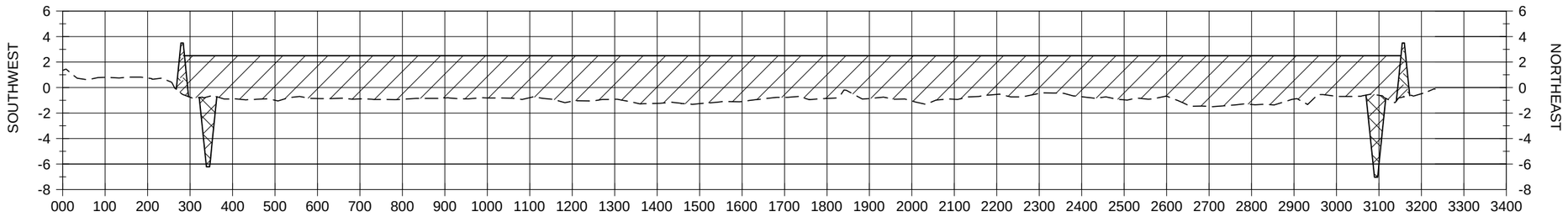

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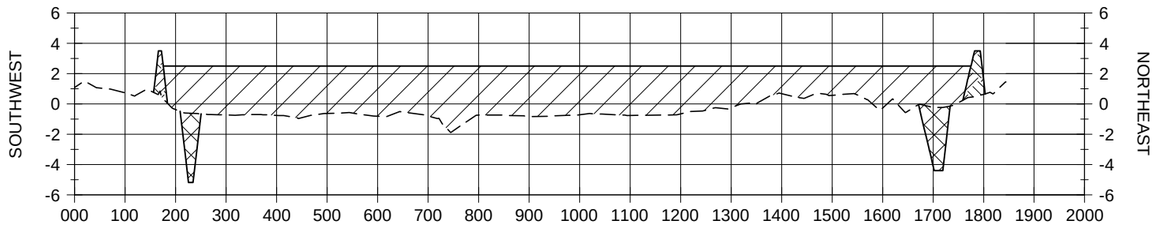

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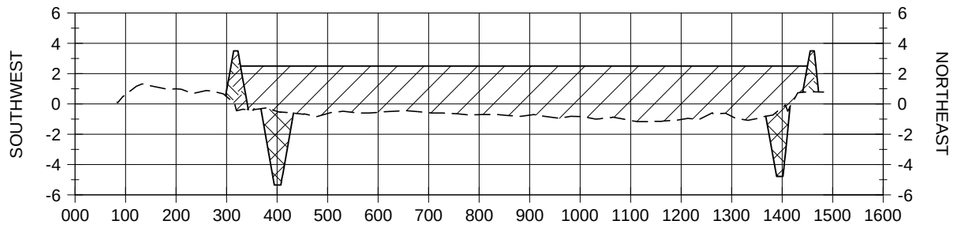

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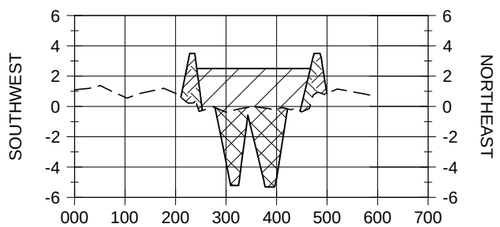

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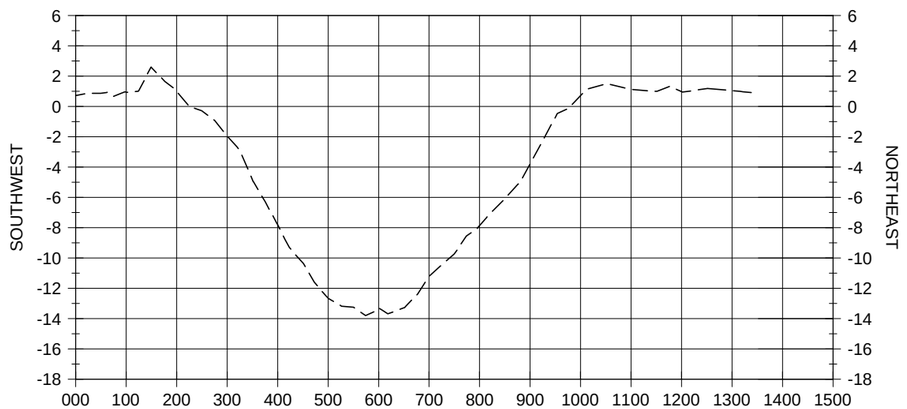

SECTION 29

HORIZONTAL GRAPHIC SCALE
300' 150' 0 300' 600'
10' 5' 0 10' 20'
VERTICAL GRAPHIC SCALE

LEGEND

- MARSH CREATION AREA
- EARTHEN CONTAINMENT DIKE
- EARTHEN CONTAINMENT DIKE BORROW AREA
- EXISTING GROUND

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA
MARSH CREATION PROJECT

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

SECTIONS

DRAWN BY: KRISTI CANTU | DESIGNED BY: JOSEPH GUILLORY, E.I.

APPROVED BY: SHANNON HAYNES, P.E.

DATE: APRIL 2012

SHEET 19 OF 27

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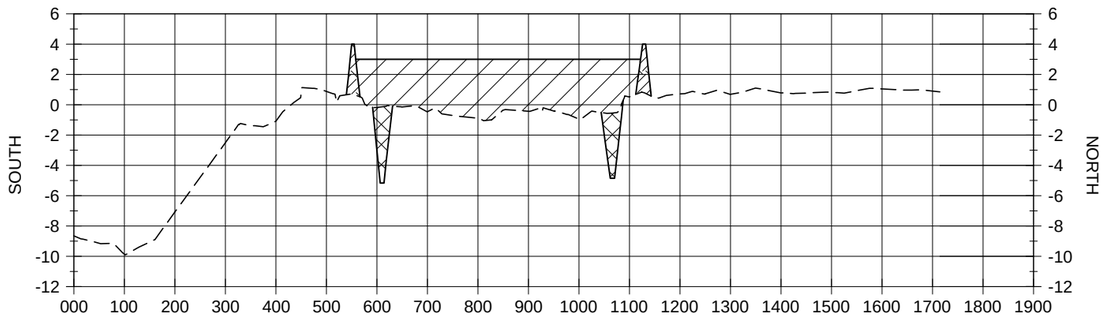

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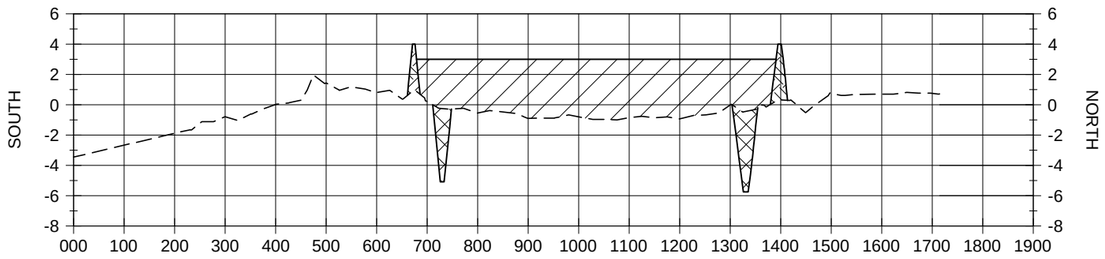

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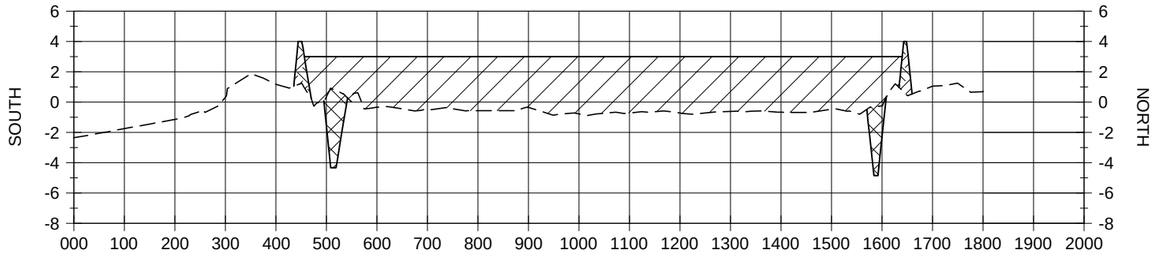

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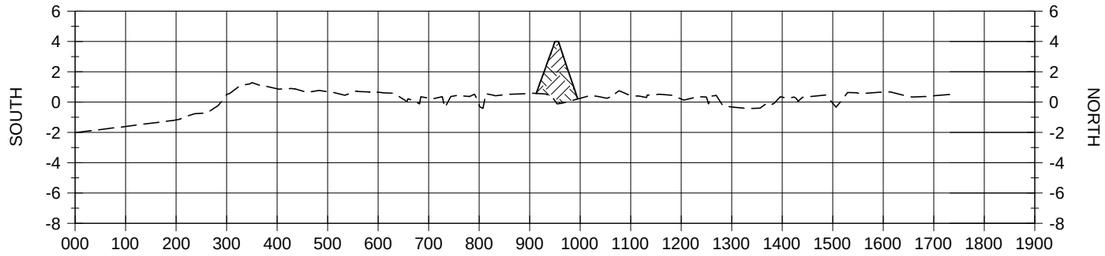

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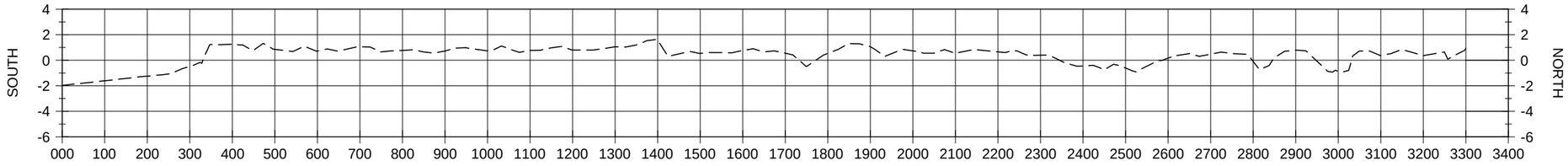

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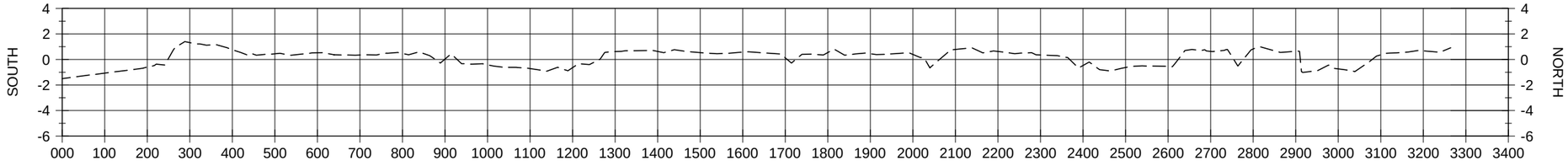

SECTION 35

HORIZONTAL GRAPHIC SCALE
300' 150' 0 300' 600'
10' 5' 0 10' 20'
VERTICAL GRAPHIC SCALE

LEGEND

- MARSH CREATION AREA
- EARTHEN CONTAINMENT DIKE
- EARTHEN CONTAINMENT DIKE BORROW AREA
- EXISTING GROUND

NOTE:
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REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

DRAWN BY: KRISTI CANTU
DESIGNED BY: JOSEPH GUILLORY, E.I.
APPROVED BY: SHANNON HAYNES, P.E.

BAYOU BONFOUCA
MARSH CREATION PROJECT

STATE PROJECT NUMBER: PO-104
FEDERAL PROJECT NUMBER:

SECTIONS

DATE: APRIL 2012
SHEET 20 OF 27

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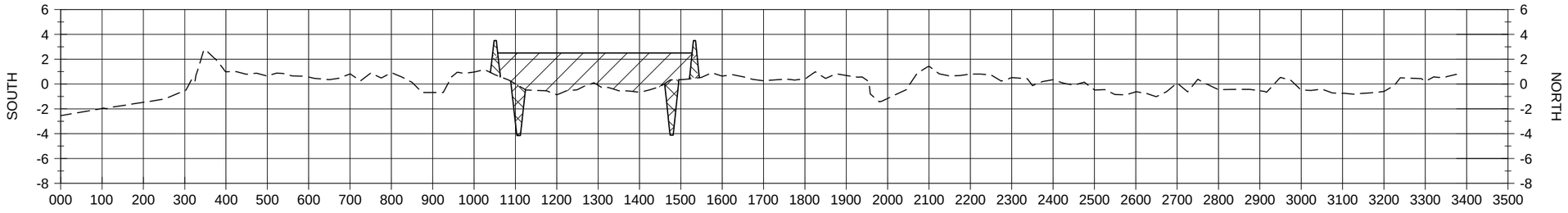

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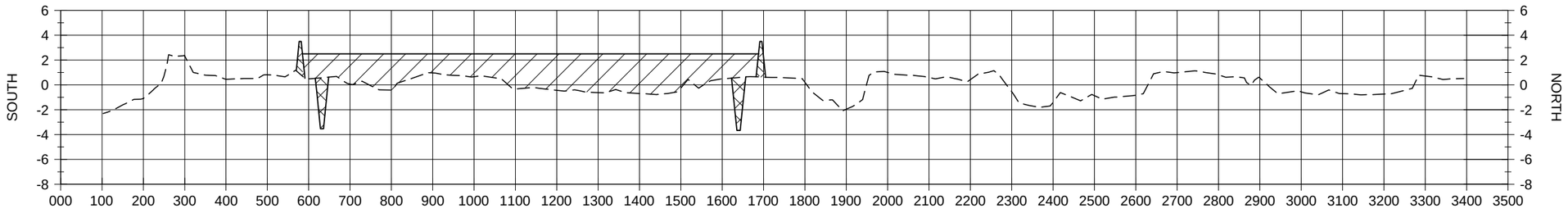

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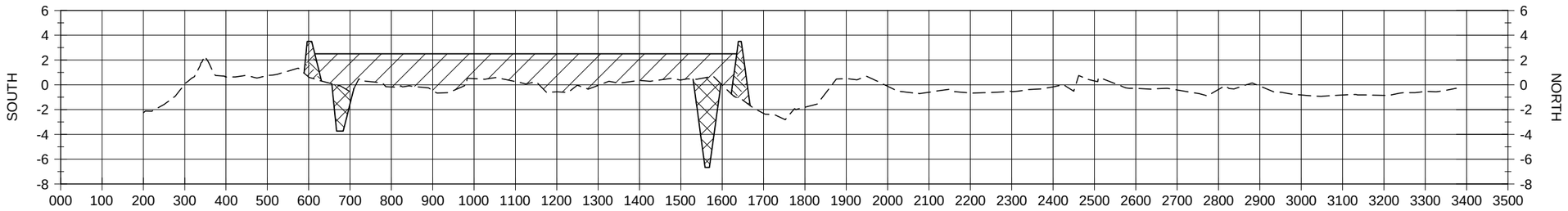

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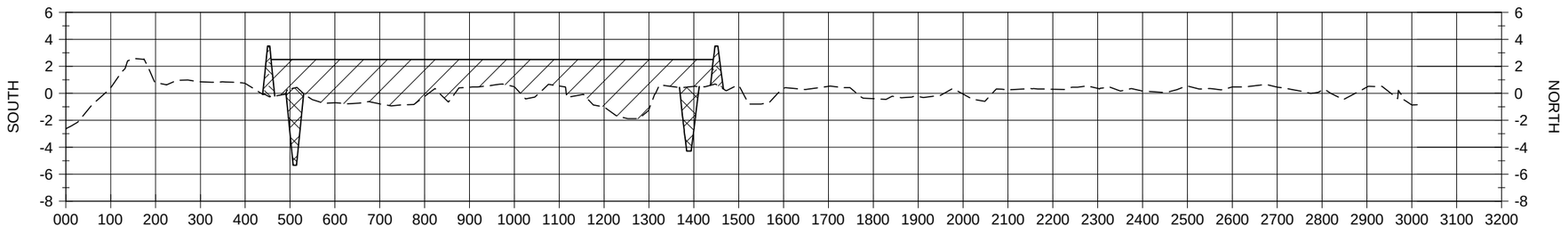

SECTION 39

HORIZONTAL GRAPHIC SCALE

300' 150' 0 300' 600'

10' 5' 0 10' 20'

VERTICAL GRAPHIC SCALE

LEGEND

- MARSH CREATION AREA
- EARTHEN CONTAINMENT DIKE
- EARTHEN CONTAINMENT DIKE BORROW AREA
- EXISTING GROUND

NOTE:
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BAYOU BONFOUCA
MARSH CREATION PROJECT

SECTIONS

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU

DESIGNED BY: JOSEPH GUILLORY, E.I.

APPROVED BY: SHANNON HAYNES, P.E.

SHEET 21 OF 27

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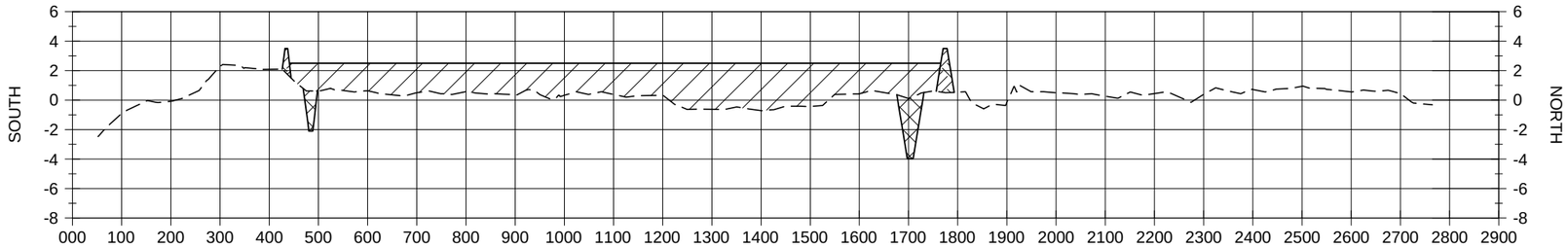

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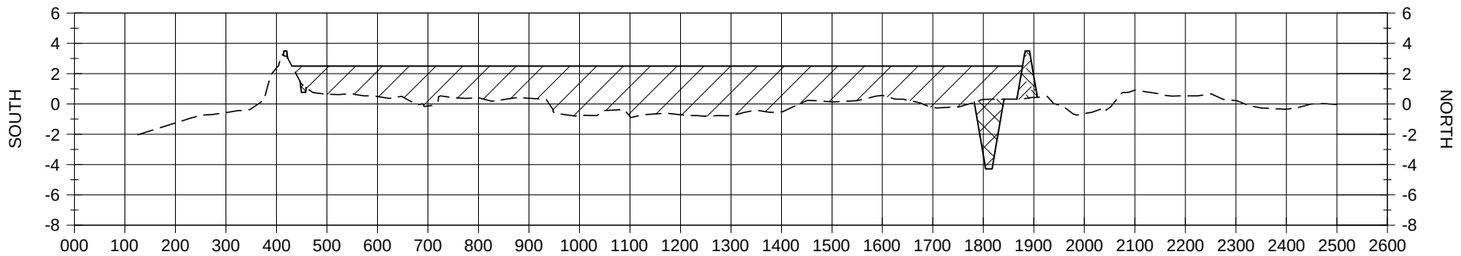

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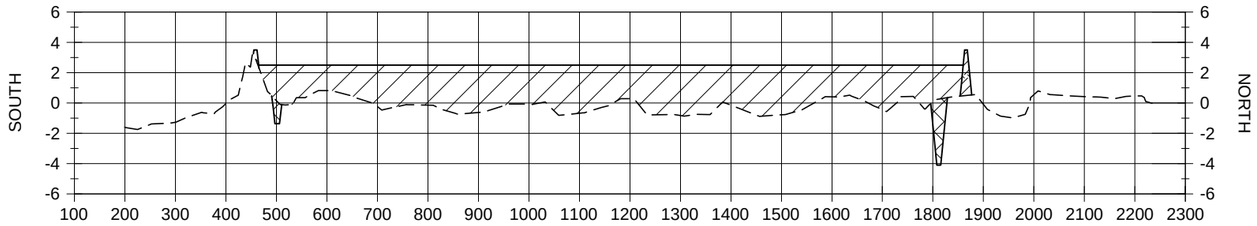

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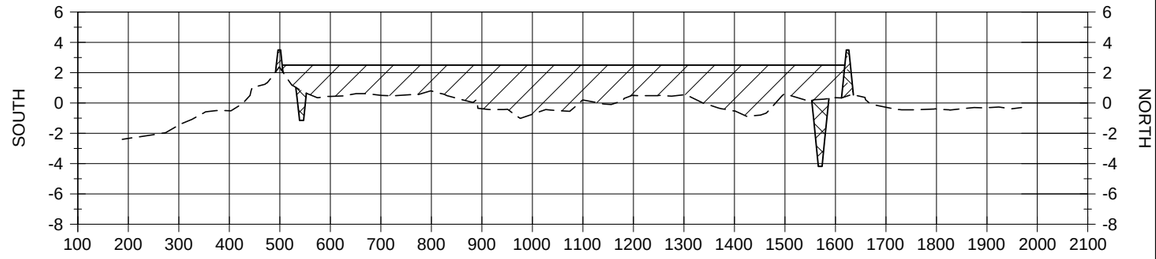

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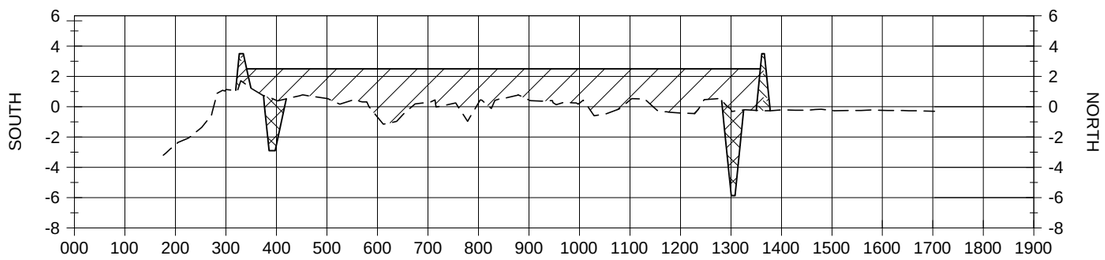

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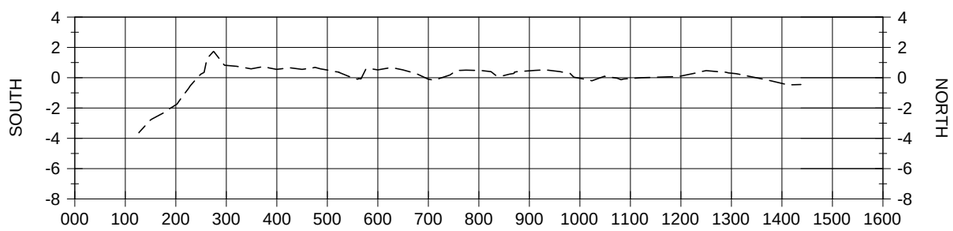

SECTION 45

HORIZONTAL GRAPHIC SCALE

300' 150' 0 300' 600'

VERTICAL GRAPHIC SCALE

10' 5' 0 10' 20'

LEGEND

- MARSH CREATION AREA
- EARTHEN CONTAINMENT DIKE
- EARTHEN CONTAINMENT DIKE BORROW AREA
- EXISTING GROUND

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA
MARSH CREATION PROJECT

SECTIONS

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU | DESIGNED BY: JOSEPH GUILLORY, E.I. | APPROVED BY: SHANNON HAYNES, P.E.

SHEET 22 OF 27

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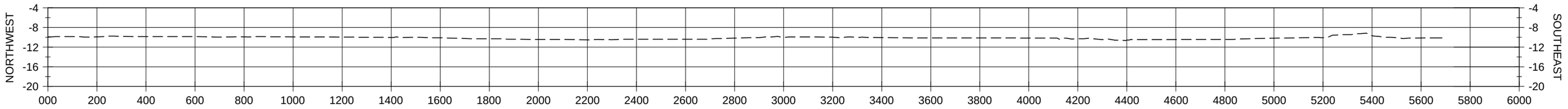

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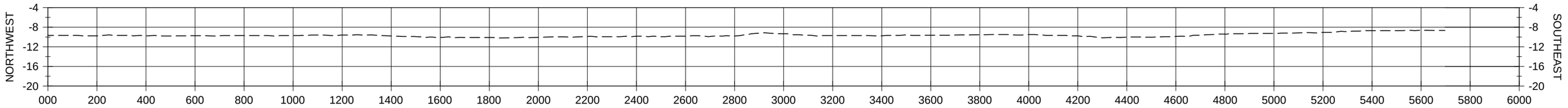

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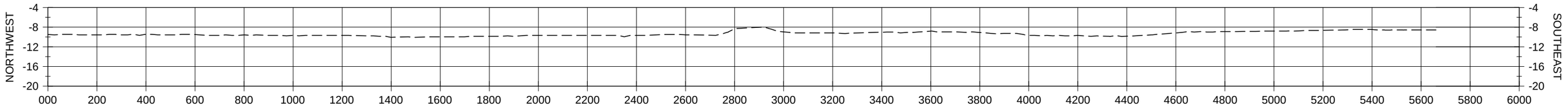

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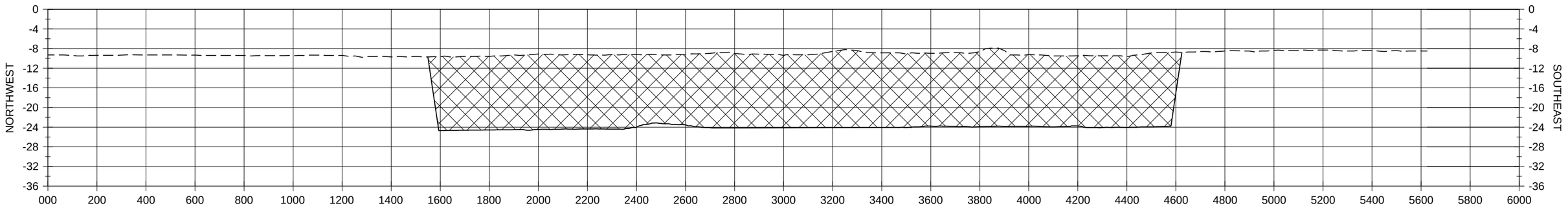

SECTION 49

HORIZONTAL GRAPHIC SCALE

400' 200' 0 400' 800'

10' 5' 0 10' 20'

VERTICAL GRAPHIC SCALE

LEGEND

BORROW AREA

EXISTING GROUND

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
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BAYOU BONFOUCA
MARSH CREATION PROJECT

SECTIONS

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FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

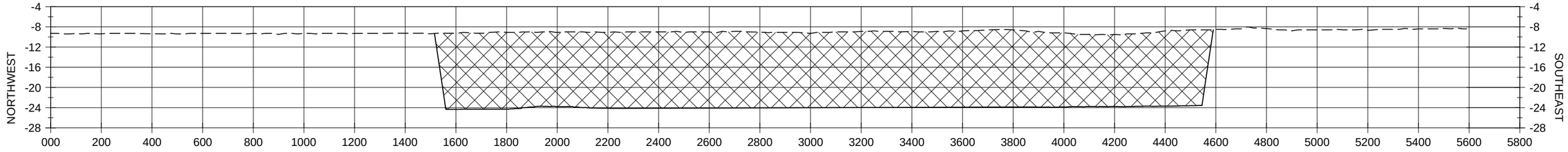
DRAWN BY: KRISTI CANTU

DESIGNED BY: JOSEPH GUILLORY, E.I.

APPROVED BY: SHANNON HAYNES, P.E.

SHEET 23 OF 27

G:\Users\Autocad\BASINS\PO\PO-104 Bayou Bonfouca\Plan Set\14 Sections.dwg



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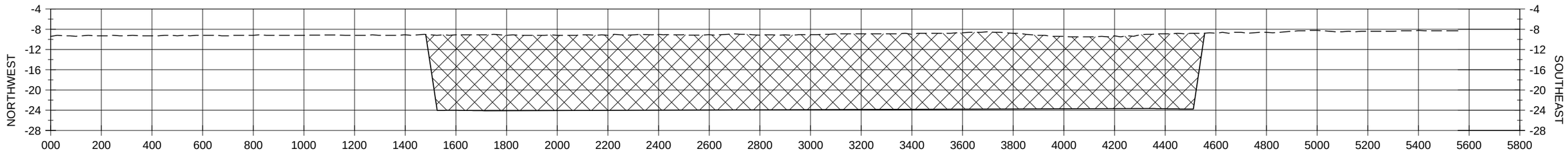

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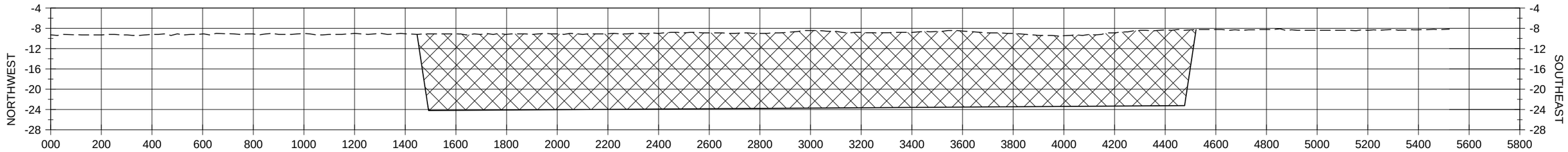

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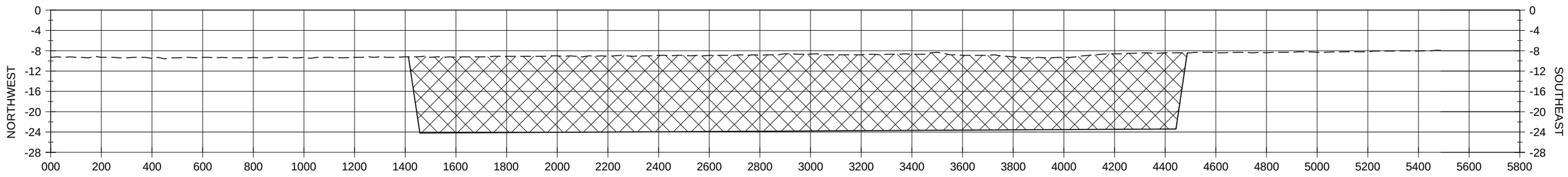

SECTION 53

HORIZONTAL GRAPHIC SCALE

400' 200' 0 400' 800'

10' 5' 0 10' 20'

VERTICAL GRAPHIC SCALE

LEGEND

BORROW AREA

EXISTING GROUND

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

REV.	DATE	DESCRIPTION	BY

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BAYOU BONFOUCA
MARSH CREATION PROJECT

SECTIONS

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FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU

DESIGNED BY: JOSEPH GUILLORY, E.I.

APPROVED BY: SHANNON HAYNES, P.E.

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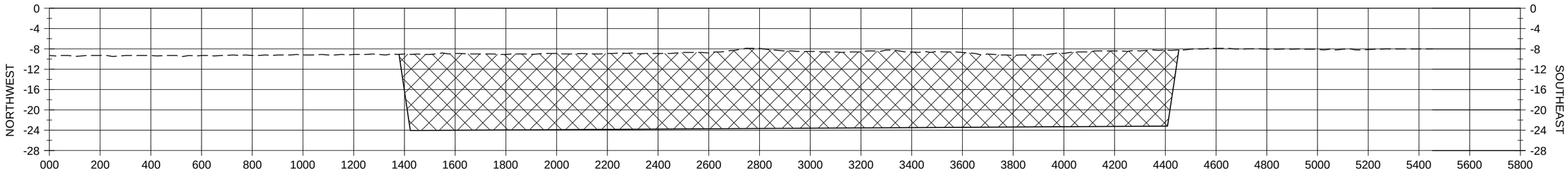

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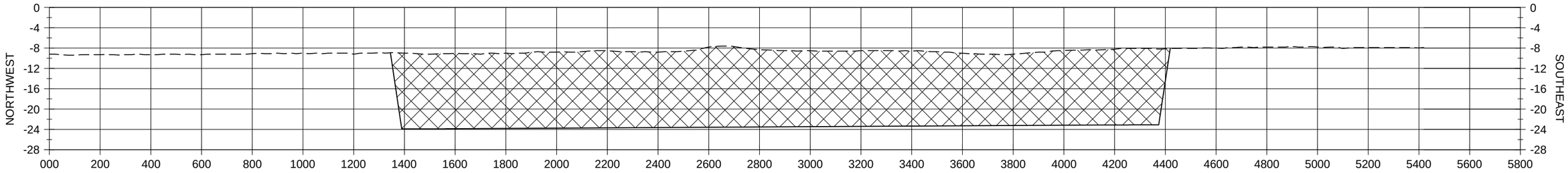

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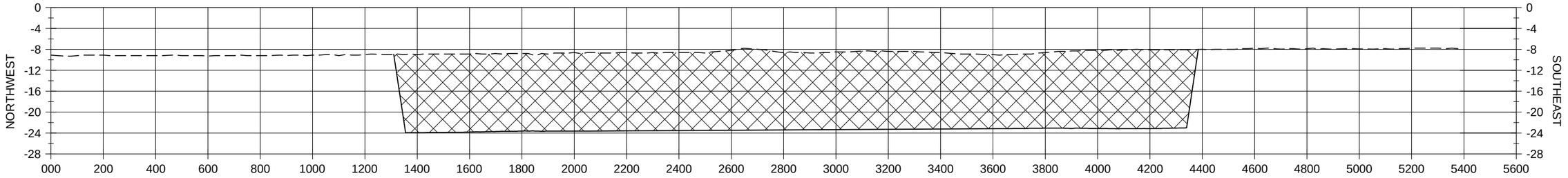

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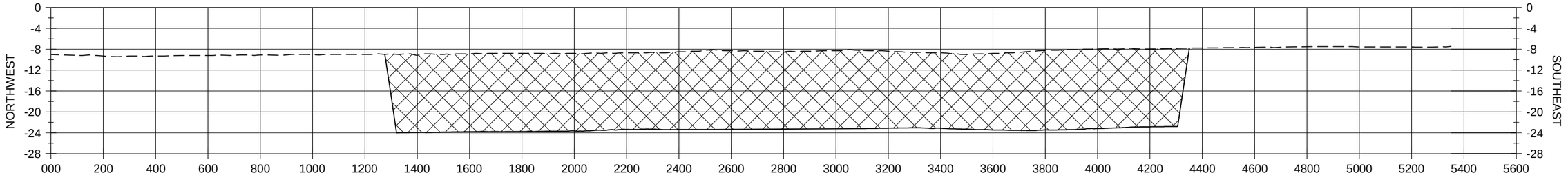

SECTION 57

HORIZONTAL GRAPHIC SCALE
400' 200' 0 400' 800'
10' 5' 0 10' 20'
VERTICAL GRAPHIC SCALE

LEGEND
- BORROW AREA
- EXISTING GROUND

NOTE:
ALL ELEVATIONS ARE GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

REV.	DATE	DESCRIPTION	BY

COASTAL PROTECTION AND RESTORATION AUTHORITY
450 LAUREL STREET
BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA
MARSH CREATION PROJECT

SECTIONS

STATE PROJECT NUMBER: PO-104

FEDERAL PROJECT NUMBER:

DATE: APRIL 2012

DRAWN BY: KRISTI CANTU

DESIGNED BY: JOSEPH GUILLORY, E.I.

APPROVED BY: SHANNON HAYNES, P.E.

SHEET 25 OF 27

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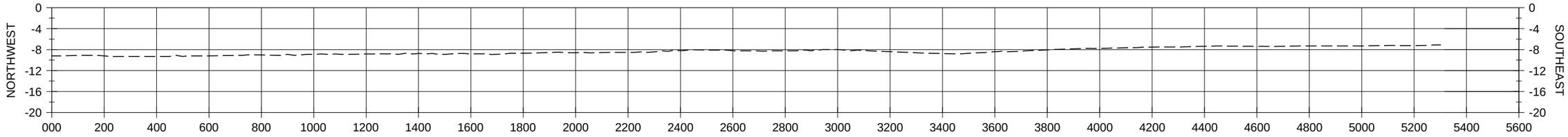
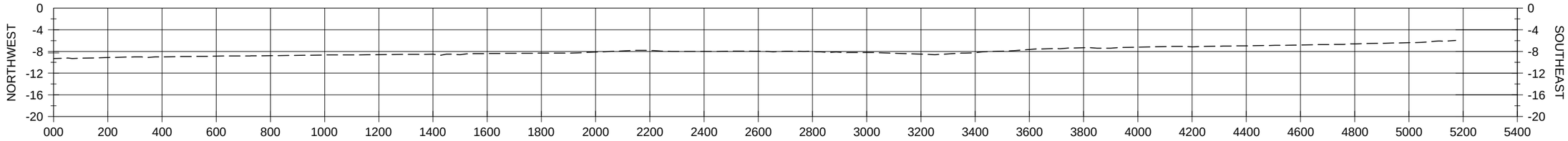


SECTION 58



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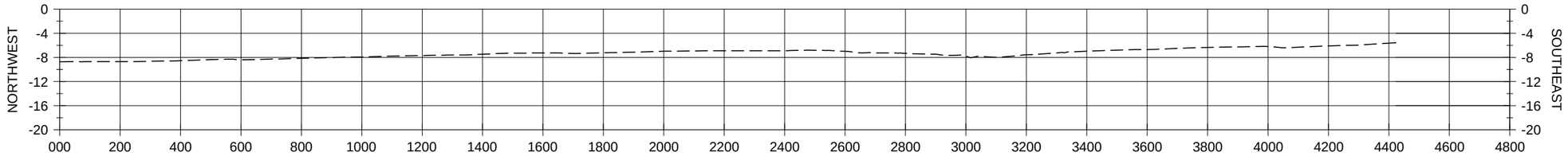

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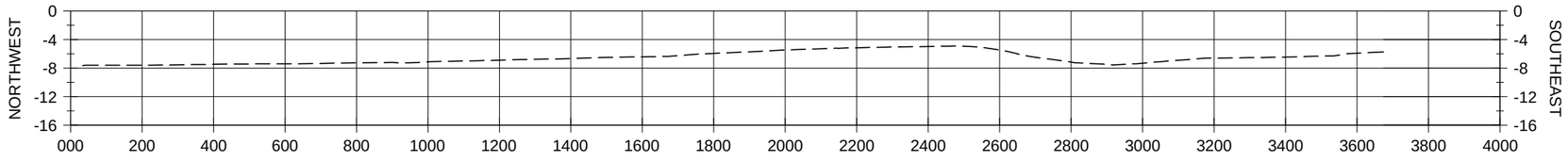

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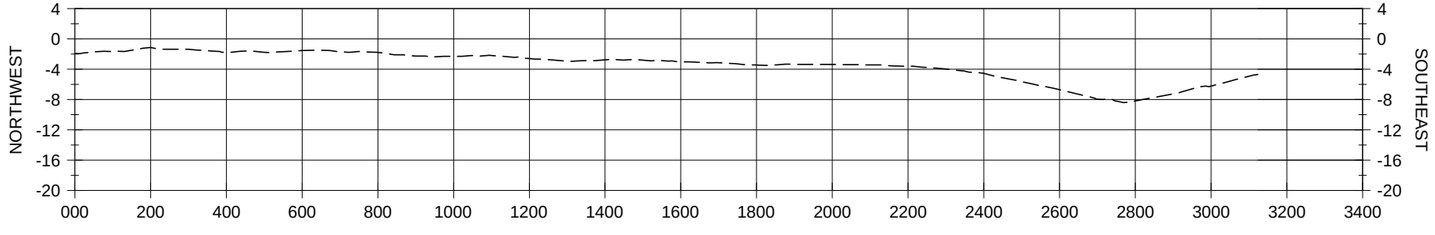

SECTION 62

HORIZONTAL GRAPHIC SCALE
400' 200' 0 400' 800'
10' 5' 0 10' 20'
VERTICAL GRAPHIC SCALE

LEGEND
------ EXISTING GROUND

NOTE:
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BATON ROUGE, LOUISIANA 70801

BAYOU BONFOUCA
MARSH CREATION PROJECT

STATE PROJECT NUMBER: PO-104

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SECTIONS

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DATE: APRIL 2012

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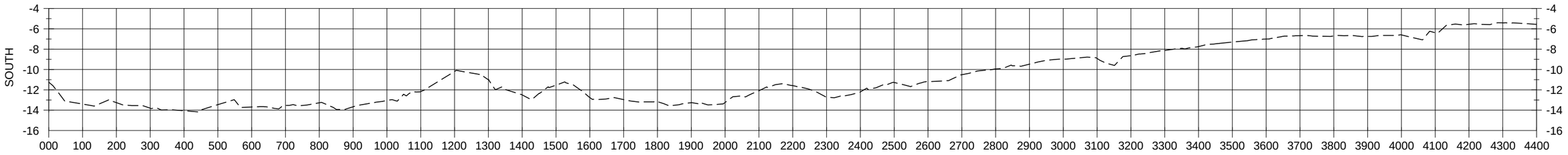

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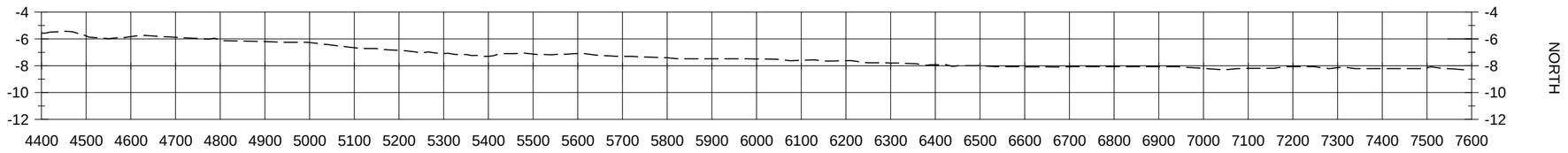

SECTION 63

HORIZONTAL GRAPHIC SCALE
300' 150' 0 300' 600'
10' 5' 0 10' 20'
VERTICAL GRAPHIC SCALE

LEGEND

------ EXISTING GROUND

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