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4 April 2003

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Attention Mr. John O'Connor
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Gentlemen:

Geotechnical Investigation
State of Louisiana
Little Lake Shoreline Protection and Marsh Creation
Lafourche Parish, Louisiana
DNR Contract No. 2503-02-33
State/Federal Project No. BA-37
Eustis Engineering Project No. 17623

Transmitted are two copies (one bound and one unbound) of our engineering report covering a geotechnical investigation for the subject project. A copy of this report is also being sent via email. In addition, one copy of this report is being sent to Mr. Clark Allen of the State of Louisiana, Department of Natural Resources, Baton Rouge, Louisiana.

Thank you for asking us to perform these services.

Yours very truly,

EUSTIS ENGINEERING COMPANY, INC.

Gwen P. Sanders

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GEOTECHNICAL INVESTIGATION

STATE OF LOUISIANA

LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION

LAFOURCHE PARISH, LOUISIANA

DNR CONTRACT NO. 2503-02-33

STATE/FEDERAL PROJECT NO. BA-37

EUSTIS ENGINEERING PROJECT NO. 17623

FOR
PERRIN & CARTER, INC.
METAIRIE, LOUISIANA

STATE OF LOUISIANA
DEPARTMENT OF NATURAL RESOURCES
BATON ROUGE, LOUISIANA

By
Eustis Engineering Company, Inc.
Metairie, Louisiana

4 APRIL 2003

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GEOTECHNICAL INVESTIGATION

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INTRODUCTION

1. This report contains the results of a geotechnical investigation performed for the Little Lake Shoreline Protection and Marsh Creation project to be located in Lafourche Parish, Louisiana. The investigation was performed in accordance with Eustis Engineering Company, Inc.'s proposal dated 27 September 2002. Authorization to proceed was given on 23 October 2002 by Mr. John G. O'Connor, P.E. representing Perrin & Carter, Inc., Metairie, Louisiana.

2. This report has been prepared in accordance with generally accepted geotechnical engineering practice for the exclusive use of the State of Louisiana, Department of Natural Resources. and their designated representatives for specific application to the subject site. In the event of any changes in the nature, design, or location of the proposed shoreline protection and marsh creation, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report are modified and verified in writing. Should these data be used by anyone other than the State of Louisiana, Department of Natural Resources, and their designated representatives, they should contact Eustis Engineering for interpretation of data and to secure any other information pertinent to this project.

3. The analyses and recommendations contained in this report are based in part on data obtained from the soil borings. The nature and extent of variations in subsoil conditions between and away from the boring locations may not become evident until construction. If variations then appear, it will be necessary to reevaluate the recommendations contained in this report.

4. Recommendations and conclusions contained in this report are to some degree subjective and should be used for design purposes only. This report should not be included in the contract plans and specifications. However, the results of the soil borings and laboratory tests contained in the Appendix of this report may be included in the plans and specifications.

SCOPE

5. The investigation included the drilling of soil test borings to determine subsoil conditions and stratification, and to obtain samples of the various substrata. Soil mechanics laboratory tests performed on samples obtained from the borings were used to evaluate the physical properties of the subsoils. Engineering analyses, based on the soil borings and laboratory test results, were made to evaluate the stability of the foundation support for the proposed shoreline protection structures and marsh creation features. With respect to marsh creation features, analyses were performed to determine cut to fill ratios, maximum earthen containment levee height constructed from in situ materials, and estimated settlement of dewatered fill material including substrate settlement. For shoreline protection, analyses were performed to develop recommendations for a typical section for a foreshore rock dike, comparison of the short and long term settlement of a rock dike versus a composite section consisting of lightweight aggregate capped with rock, and to evaluate the use of geotextile fabrics to support the dikes.

SOIL BORINGS

6. Seventeen undisturbed sample type soil test borings, each drilled to a depth of 20 feet below the mudline, were made on 20 February 2003 at the approximate locations shown on Figure 1. The borings were located in the field using a hand held GPS unit. The corresponding X-Y coordinates in NAD 83 are shown on the boring logs. Borings BORR-1 through 7 and SHORE-1 through 6 were made with a skid mounted rotary type drill rig mounted on a shallow draft boat. Borings FILL-1 through 4 were made using hand equipment consisting of a 2-in. diameter piston sampler or 3-in. diameter Shelby tubes pushed by hand from an airboat. Upon completion of drilling operations, the borings were backfilled in accordance with the laws of the State of Louisiana. Detailed descriptive logs of the borings are shown in both tabular and graphical form in Appendix I.

7. Samples of cohesive or semi-cohesive subsoils were obtained at close intervals or changes in stratum using a 3-in. diameter thinwall Shelby tube sampling barrel. The samples from Borings BORR-1 through 7 and SHORE-1 through 6 were immediately extruded from the sampling barrel, inspected, and visually classified by Eustis Engineering's soil technician. Pocket penetrometer tests were performed on the soil samples to give a general indication of their shear strength or consistency. The results of these tests are shown on the boring logs under the column heading "PP." Representative portions were then promptly placed in moisture proof containers and sealed for preservation of their natural moisture content. Samples from Borings FILL-1 through 4 were left in the tubes for transportation to our laboratory where they were then extruded, inspected, and visually classified by a laboratory technician. The samples were then placed in moisture proof containers and sealed for preservation of their natural moisture content.

LABORATORY TESTS

8. Soil mechanics laboratory tests consisting of natural water content, unit weight, and either unconfined compression shear (UC) or one-point unconsolidated undrained triaxial compression shear (OB) were performed on undisturbed samples obtained from the borings. Torvane and miniature vane tests were also performed on selected samples to give an indication of their shear strengths. Both undisturbed (Und) and remolded (Rem) values are reported for the mini vane tests. In addition, Atterberg liquid and plastic limit tests were performed on selected representative samples to aid in classification of the subsoils and to give an indication of their relative compressibility. The test establishing the percent passing a No. 200 sieve was also performed on selected cohesionless soils to aid in their classification. The results of the laboratory tests are summarized on the boring logs in Appendix I.

9. Specific gravity tests were also performed on selected samples obtained from the borings. In addition, organic content tests were performed on selected samples obtained from the borings to determine the amount of organic matter in the samples. The results of these tests are shown on the boring logs.

10. Consolidation tests (CON) were performed on selected samples to determine their compressibility and stress history. Grain size analyses were performed on selected samples obtained from the borings to determine their particle distribution (PD) curves. The results of these tests are shown on separate sheets following the boring logs in Appendix I.

11. Settling Column. One settling column test was performed on a composite sample from the borrow borings. The test was performed in an 8-in. diameter column using the furnished test procedure as modified in October 2002. A salinity test on the pore water indicated a salinity of 0.25 ppt. Therefore, the test was conducted using

fresh water. An initial concentration of approximately 120 grams/liter was selected to conduct the test. Samples were tested at 1, 2, 4, 6, and 12 hours and at 1, 2, 4, 7, 11, and 15 days. The test results are tabulated in Appendix II

DESCRIPTION OF SUBSOIL CONDITIONS

Stratigraphy

12. Shore Borings. Reference to the logs of borings SHORE-1 through 6 shows that the water depth at the boring locations varies from 3.5 to 6 feet. Approximately 6 to 12 inches of very soft brown and black humus and extremely soft to very soft dark gray sandy clay with organic matter and shells was encountered at the mudline. Below this, extremely soft to very soft gray clay, silty clay, and sandy clay continue to the final boring depths of 20 feet below the mudline. A layer of loose gray clayey silt with clay lenses intersperses the general stratigraphy of Boring SHORE-1 between the depths of 4 and 11 feet beneath the mudline. Very loose to loose gray sandy silt was encountered in Boring SHORE-4 between the depths of 3 and 11 feet below the mudline. The log of Boring SHORE-6 shows very loose gray fine sand with clay layers was encountered between the depths of 1 and 5 feet below the mudline and very loose to loose gray clayey sand was encountered between the depths of 17 and 20 feet below the mudline. In general, shell fragments were encountered beneath depths ranging from 11 to 18 feet below the mudline. This stratigraphy is shown on Figure 2.

13. Borrow Borings. Reference to the logs of borings BORR-1 through 7 shows that the water depth at the boring locations varies from 4.5 to 6.75 feet. Beginning at the mudline and continuing to the final boring depths of 20 feet below the mudline, extremely soft to soft gray clay, sandy clay, and silty clay with shell fragments were encountered. Loose gray clayey silt with clay lenses was encountered in Boring

BORR-1 between the depths of 2 and 7 feet below the mudline. In Boring BORR-2, loose gray clayey sand was encountered between the depths of 11 and 18 feet below the mudline. Loose gray fine sand with clay layers was encountered in Boring BORR-4 between the depths of 17 and 20 feet below the mudline. A graphical depiction of this stratigraphy is shown on Figure 3.

14. Fill Area Borings. Extremely soft to very soft brown, black, and gray humus, organic clay, and clay were encountered from the ground surface to depths ranging from 7 to 12 feet below the marsh surface. Beneath the 8-ft depth in Boring BORR-1, very loose to loose gray sandy silt with wood and clay lenses continues to the 17-ft depth followed by very soft gray clay with silt pockets and lenses to the final boring depth of 20 feet. Continuing in Boring BORR-2 beneath the 7-ft depth, very loose to loose gray sandy silt with roots and clay layers was encountered to the final boring depth of 20 feet. Very loose to loose gray silty sand with clay lenses continues beneath the 8-ft depth to the final boring depth of 20 feet in Boring FILL-3. Beneath the 6-ft depth in Boring FILL-4, extremely soft to very soft gray clay with silty sand lenses and layers continues to the 12-ft depth followed by very loose gray silty sand with clay lenses to the 17-ft depth. Boring FILL-4 was then terminated in a stratum of extremely soft to very soft gray clay with silty sand lenses and layers with shell fragments at a depth of 20 feet below the marsh surface. A subsoil profile illustrating this stratigraphy is also provided on Figure 3.

Ground Water

15. The borings for this project were drilled in either standing water or in the marsh with ground water at the ground surface. The area is subject to tidal variations that may be a hydraulic consideration in your design. Furnished information indicates the mean low water is at el 0.45 NAVD 88 and mean high water is at el 1.56.

FOUNDATION ANALYSES

Furnished Information

16. DNR has provided an aerial layout plan of the project site. The proposed project features will consist of a shoreline protection rock dike, a marsh containment dike, a borrow area, and a flotation channel. Topographic survey data including cross-sections were also provided.

17. Wind roses of the maximum wind, average wind speed, and mode wind speed based on data from the Houma airport were provided for the evaluation of the wave design criteria and rock gradation. The wind data included two bar graphs showing the wind speed distribution from two directions perpendicular to the rock alignment. A portion of NOAA Chart 11352_1 showing water depths in Little Lake were also provided.

18. Typical sections of the rock dike indicate two alternate configurations are being considered. These sections consist of either entirely riprap or riprap with a lightweight aggregate core. Two primary methods of construction have been used successfully to construct the lightweight aggregate core. These consist of the furrow method where the aggregate is confined by the riprap or by encapsulating the aggregate in geotextile fabric bags prior to placement. A marsh containment dike will be constructed onshore of in situ materials. Dredged fill materials will be placed behind the marsh containment dike. However, the rock dike is intended as shoreline protection rather than containment.

19. The mean low water level was furnished as el 0.45 NAVD 88 and mean high water level as el 1.56. Based on the furnished topographic data, the average mudline elevation in the vicinity of the shoreline rock dike is at el -2 to el -4. The average

mudline near the marsh dike is at el 0. The target minimum elevation for the marsh fill is approximate el 1.2. The maximum fill elevation is 1 foot below the containment levee. The minimum setback distance between the containment levee toe and the borrow channel is 25 feet.

Foundation Recommendations

20. We recommend the proposed flotation canal or borrow area be located a minimum of 45 feet from the shoreline protection rock dike to maintain stability during construction. Likewise, the marsh containment levee should be located a minimum of 25 feet from the borrow channel as proposed. Flattening of the unprotected side rock slopes will be required if dredged fill will be placed against the stone dike. If the full rock section is selected over the lightweight core section, we recommend a geogrid be considered to enhance the performance of this section. Details of these recommendations follow in this report.

Stability Analyses

21. Methodology. Stability analyses contained with this report were performed using GEO-SLOPE International, Ltd.'s program Slope/W Version 4.2. This program generally utilizes circular arcs to define the soil failure planes. These arcs are then divided into slices and the factor of safety computed by summing forces, summing moments, or both. For these analyses, the inter-slice forces are typically considered. The factors of safety presented with this report are based on Spencer's Method of Slices. A sample computation is shown in Appendix III.

22. Design Parameters. A geologic subsoil profile of the shore, borrow, and fill borings are shown on Figures 2 and 3. Plots of the soil design parameters used in our analyses of the shoreline protection are also included on Figure 2. Similar design

properties were utilized for the marsh creation containment dike based on the fill borings. We have assumed the rock dike and marsh containment levee will be constructed by mechanical methods and that the fill will be excavated and placed by hydraulic methods.

23. Stress History. Consolidation tests were performed in samples of the subsoils at the shore and fill borings. Based on these test results, the surficial organic deposits are slightly precompressed. However, the rate of consolidation indicated by the consolidation test is approximately 3 ft^2/yr. This is a relatively slow rate of consolidation when the drainage path is in one direction (single drainage). For the shoreline borings, single drainage has been assumed to estimate the time-rate of consolidation in these deposits. Due to the presence of sandy silt and silty sand deposits at the FILL borings, both single and double drainage were evaluated.

24. Beneath the upper peat and organic deposits, the underlying clays are slightly precompressed to normally consolidated to the full boring depth. The borings generally extended to depths of 20 feet below the existing mudline. For our evaluation of long term settlement of the rock and marsh features, we assumed the underlying deposits (below the boring depths) as clay to approximate el -66. These clay layers were assumed as slightly precompressed (OCR=1.2) with initial strengths equal to 0.25 of the existing overburden. This assumed precompression was based on similar projects where the foundation deposits were found to be precompressed as a result of the erosion and loss of previous land formations. Isolated lenses and layers of sands may be present beneath the boring depths, however, available geologic data is not conclusive. Therefore, we have assumed single drainage when estimating the rates of consolidation in these deposits.

25. Constructibility. Placement of the rock dike on the unconsolidated sediment will result in mud waves during construction. Removal of the mud waves inhibiting

placement of rock fill or a predredged bottom are recommended during construction. Construction techniques for installing the rock are critical to the constructibility and ultimate stability of this section. Our analyses assume the rock is placed as recommended and outlined subsequently in this report. We have estimated the amount of displacement which may occur during construction of the rock dike to assist in determining the anticipated fill quantities and cost estimates. The stability of the marsh containment levee constructed of in situ materials will also be dependent on the borrow materials used and the rate at which the dredged fill is placed. The highly organic materials encountered near the surface may be displaced during fill placement and dredging operations.

Shoreline Protection

26. Design Wave Height. Using the furnished wind data and water depths, the U.S. Army Corps of Engineer's Shore Protection Manual (SPM) was utilized to estimate the critical wave height for the design of the rock dike. This evaluation does not consider storm or hurricane events other than those included in the wind data. Many simplifying assumptions were used to estimate the effective fetch and wave heights. In addition, we understand the Corps' SPM has been replaced by their Coastal Engineering Manual (EM 1110-2-1100), however, the design guidelines have not yet been issued for public release. Therefore, we have not incorporated any new recommendations or methods in our evaluation.

27. Based on our assumptions, we estimate the effective fetch to be approximately 10,000 feet. For a shallow water depth of 5 feet and a wind speed of 38 to 176 mph, the wave heights are approximately 1.5 to 2.5 feet. Therefore, for a mean high water at el 1.5 and a critical wave height of 2.5 feet, we recommend a rock dike to el 4 to minimize overtopping. Our calculations and assumptions are included as Appendix IV.

28. Water Levels. The stability analyses presented on Figures 4 through 7 are based on the furnished low water levels. Extreme low or high water levels due to a storm event were not evaluated. Water levels above or below those analyzed may result in localized sloughing or failure of the recommended rock dike section. Long term maintenance should consider this potential. Otherwise, Eustis Engineering should be consulted to evaluate alternate water levels.

29. Riprap Section. An initial shoreline rock dike configuration, assuming displacement of the sediment during initial construction, was determined based on a factor of safety of 1.0. The results of these analyses are shown on Figure 4, Sheets 1 and 2 assuming a mudline at el -2 and -4, respectively. Based on these analyses, we recommend slopes no steeper than 1 vertical on 5 horizontal. An 8-ft crown width was utilized in our analyses. Actual displacements may vary from our estimates depending on the methods of construction as discussed subsequently in this report.

30. Borrow and Flotation Channel. To provide a factor of safety of 1.3 with respect to the borrow area or flotation channel, a minimum 45-ft setback is recommended for the rock dike. The results of these analyses are shown on Figure 5, Sheets 1 and 2. These analyses are based on a cut no deeper than el -12. If a deeper dredge depth is required, Eustis Engineering should be contacted to reevaluate the setback requirements.

31. Dredged Fill. Assuming dredged fill material will be placed against the rock dike, additional stability berms or flattened unprotected side slopes will be required to maintain stability of the rock dike. These analyses assume the dredged fill is placed by uncompacted methods in standing water. As shown on Figure 5, we recommend slopes of 1 vertical to 7 horizontal for the unprotected side rock dike.

32. Lightweight Core. Analysis of a lightweight aggregate core assuming construction by the furrow method is provided on Figure 6. We have assumed the outer containment dikes will be constructed to el 1.0 above the water surface as shown. The lightweight aggregate core will then be placed between the furrows and then capped with a minimum of 2.5 feet of riprap. This method results in minimal displacement during construction, hence less fill quantities. Long term settlement is also reduced by the lightweight material.

33. Geogrid Reinforcement. As an alternate to using the lightweight core, geogrid reinforcement could be used to enhance the performance of the section consisting entirely of rock. The geogrid will somewhat reduce the computed displacements and settlement. The geogrid may also enhance the stability of the section, particularly when used for containment as discussed below.

34. A preliminary evaluation of the use of geogrid reinforcement was performed to determine if the recommended rock dike configuration can be adjusted. The use of a biaxial geogrid (Tensar BX1500) does not improve the configurations presented on Figures 4 and 5. A uniaxial geogrid with an allowable long term load capacity of 4,910 lbs/ft in aggregate (Tensar UX1700HS) will provide limited benefits to the rock dike sections. However, these benefits may not be offset by the increased cost of this material. Our analyses for the uniaxial geogrid are shown on Figure 7.

35. Estimated Settlement. For the displaced section shown on Figure 4, we estimate approximately 22 to 28 inches of long term consolidation settlement will occur at the centerline of the rock dike. An estimated 4 to 5 inches of consolidation settlement is anticipated to occur at the toe of the rock section. For the configuration shown on Figure 6, we estimate 10 to 14 inches of settlement will occur at the centerline of the rock dike with lightweight core. These estimates of settlement are based on the available data and assumed stratigraphy. A graphical and tabular summary of

the anticipated settlement over time is given on Figure 8. The estimated time-rate of settlement assumed for these values is shown on Figure 9. A sample settlement calculation is included in Appendix V.

36. Other Considerations. Although the uniaxial or biaxial geogrid provides limited benefits to the proposed rock dike configuration based on stability, the use of these products should reduce riprap materials initially placed in the rock dike section and also reduce long term settlement of the rock dike sections. Even with the placement of a geotextile, irregular embedments of the riprap into the unconsolidated sediments will likely occur as the stone is placed. Variations of these embedments during initial placement and long term reduction of settlement have not been estimated for the recommended sections. The proposed configuration is recommended as an approximation of the potential for displacement of the sediments and should be used to estimate fill quantities for cost estimating purposes. Actual fill quantities will vary depending on the section selected and methods of construction.

Marsh Creation

37. Containment Dike. An initial fill configuration was assumed based on the rock dike crown elevation (el 4), available native materials, and construction methods. Based on these constraints, we do not recommend slopes steeper than 1 vertical on 3 horizontal. Remolded shear strengths were assumed in the fill materials for these analyses. Factors of safety greater than 1.3 were computed, however, due to the variability of the organic deposits and long term performance characteristics, we do not recommend steepening the containment slopes. The results of our analyses with and without the dredge fill are shown on Figures 10 and 11.

38. Estimated Settlement. For the sections shown on Figures 10 and 11, we estimate 6 to 10 inches of long term consolidation settlement will occur at the centerline of the earthen containment levee to el 4. We estimate 7 to 10 inches of settlement will occur beneath the fill to el 3 and 3½ to 5 inches for fill to el 1.2. These estimates of settlement are ultimate values assuming a fill area approximately 2000' x 4000' in plan dimensions and a uniform fill height. A graphical representation of the anticipated settlement over time is shown on Figure 12 for alternate fill heights. The estimated time rate of settlement is shown on Figure 13 for both single and double drainage conditions. Sample calculations are included in Appendix V.

39. Shrinkage. In addition to settlement of the underlying subsoils, settlement or "shrinkage" of the uncompacted fill will occur. Shrinkage is due to drying out, consolidation of the fill under its own weight, and deterioration due to biodegradation of organic fill materials inadvertently placed in the levee section. The desiccation of soft clays proceeds from the exposed surface inward and leads to formation of a crust that becomes thicker with age. Based on similar projects, we estimate volume loss, due to shrinkage of the fill, will be approximately 10% to 15% of the surficial crust formed by drying out of the soils.

40. Assuming a crust approximately 2.5 feet thick, we estimate an additional 3 to 5 inches of settlement will occur. The amount of time for shrinkage to occur will depend on the amount of organic matter present and variations in the moisture content of the fill. Moisture content is dependent on weather conditions, tidal fluctuations, and ground water levels. We anticipate shrinkage will occur relatively rapidly due to seasonal variations occurring the first year after fill placement. Due to variations in the organic matter present and moisture ranges, shrinkage will generally result in differential settlement along the levee alignment.

41. Cut to Fill Ratios. In general, the guidance provided in Section 5.332 of the SPM indicates a borrow material with the same grain size distribution as the native material, or one slightly coarser, will usually be suitable for fill and a borrow material finer than the native material will result in large losses by wave action subsequent to placement. However, the cut to fill ratios outlined in the SPM are primarily for beach restoration projects and do not appear to be applicable to this project.

42. Borrow Ratios. Estimates of the amount of borrow required to construct the proposed levee section were obtained from the Corps of Engineers based on data compiled on similar projects. Based on the available data, a typical ratio of borrow to levee fill is 2:1. For higher silt and organic contents, a borrow ratio of 3:1 or more may also occur. These borrow ratios do not include the volume of fill required due to settlement and shrinkage, which should be added to the theoretical volume prior to estimating the borrow required. In addition, any stripping or removal of organic materials is not included in the estimated borrow ratio. We understand the settling column data will be used to size the borrow area. The U.S. Army Corps of Engineers' Waterways Experiment Station, Technical Report D-78-56, Methodology for Design of Fine-Grained Dredged Material for Containment Areas for Solids Retention, December 1978, recommends a correction factor of 2.25 to account for nonideal flow in the containment area.

Construction Materials

43. Geotextile Separator. The geotextile separator fabric should meet or exceed the material requirements for Class D geotextile presented in Section 1019.01 of the Louisiana Standard Specifications for Roads and Bridges, 2000 edition (LSSRB). When used beneath the rock section, the geotextile should be able to retain the underlying soil without clogging. The particle size distribution curves and other laboratory test results should be used to evaluate potential geotextiles. When used

to encapsulate the lightweight aggregate, the apparent opening size (AOS) of the fabric should be no larger than 0.59 mm. Alternately, the AOS may be based on the material gradation selected for the project. Once the actual gradation is selected, Eustis Engineering may be contacted to evaluate the fabric requirements.

44. Geogrid Reinforcement. The product specifications for the two Tensar products evaluated are included in Appendix VI. If a geogrid is selected for the project, it should meet or exceed these values. The evaluation of the use of geogrid should also consider construction methods and settlement as discussed below.

45. Riprap. Using the maximum 2.5-ft wave height as computed from the SPM and furnished data, estimates for the minimum stone sizes were determined using Volume II, Chapter 7 of the SPM. Based on these analyses, the armor stone should have an average weight between approximately 115 and 190 pounds. Using correlations contained in the Soil Mechanics, Foundations, and Earth Structures, NAVDOCKS DM-7, Department of the Navy, Chapter 9, page 13, Figure 9-1, 1967, the average rock size should be 12 inches. The results of these analyses are included in Appendix VII.

46. The 130-lb riprap class defined in Section 711 of the LSSRB generally meets the gradation and size requirements given above. The 130-lb stone or larger should be used as armor for either the riprap or lightweight core sections. If alternate stone gradations are considered for use as a core, these materials should meet the requirements of a filter stone as shown on NAVDOCS Figure 9-1. Otherwise, as is the case with the lightweight aggregate, a separator fabric should be used between the alternate gradations. Eustis Engineering should be consulted to evaluate the compatibility of the stone gradations if more than one material is selected for the project.

47. Lightweight Aggregate. The total (wet) unit weight of the lightweight aggregate core shall not exceed 70 pounds per cubic foot at saturated surface dry conditions (SSD) based on ASTM C29 procedures. The gradation selected should be based on the geotextile filter and riprap gradations available. However, as a minimum, a grain size distribution having between 10 and 90% passing a U.S. Standard No. 4 sieve is recommended to achieve the unit weight and strength characteristics assumed in our stability analyses. The lightweight aggregate should also be durable and non-friable and meet the material requirements of ASTM C 330 and Section 1003.01(a)(2) of the LSSRB.

Construction Methods

48. Rock Dike Placement. Proper construction methods are critical to the performance of the rock dike section. The rock for the full riprap section should be placed along the centerline of the new section and worked outward. If a lighweight core is selected, the stone should be placed along the other edges to confine the aggregate (furrow method). Two alternate methods of subgrade preparation and riprap placement are proposed for the rock dike section as discussed below. A schematic drawing of our recommended installation is shown on Figure 14.

49. Riprap - Alternate 1. To minimize the anticipated mud waves, the sediments can be dredged prior to placement of the riprap. We recommend dredging be performed along the centerline of the section only. The dredged slopes should approximate the configurations shown on Figures 4 and 5. For this option, a layer of geotextile should be placed directly on the unconsolidated sediments in accordance with the manufacturer's construction recommendations prior to riprap placement. The geotextile should span the width of the dredging operations.

50. Riprap - Alternate 2. If dredging is not performed prior to riprap placement, removal of mud waves will be required as construction proceeds. For this option, we recommend the use of a geogrid rather than a geotextile fabric. A biaxial or uniaxial geogrid should be used as discussed above in "Geogrid Reinforcement." The geogrid placement should extend the full width of the proposed section but may require adjustment during construction. As stone placement is advanced from the center outward, the mud waves should be removed if stone placement is hindered. The frequency of mud wave removal will depend on how the riprap is placed. As a result, we do not recommend riprap be dropped or dumped from above the water surface. The riprap should be placed directly above the mudline.

51. Geogrid. The geogrid used with Alternate 2 should be a uniaxial or biaxial geogrid as determined by the stability analyses. The geogrid should meet the physical characteristics given in Appendix VI. We recommend the grid length perpendicular to the section centerline to minimize the number of seams and provide the appropriate tensile strength. (MD values shown in Appendix VI indicate the properties along the roll length, and XMD indicates properties along the roll width). Adjacent rolls of geogrid should be fastened with a positive mechanical interlock to minimize separation and maintain the tensile strength across seams equal to the tensile strength of the geogrid.

52. Riprap Placement. As previously indicated, the riprap should be advanced simultaneously forward along the centerline of the new section and worked outward perpendicular to the centerline. For both alternates, additional removal of mud waves may be required if the riprap is not placed in a center to outward manner. Mud waves extending beyond the toe of the section do not need to be removed. Riprap should be placed and not dumped below the water and in lifts no greater than 3 feet until the fill reaches above the water surface. Riprap placed above the

water surface should be placed in 2-ft lifts. A detail of the construction recommendations is shown on Figure 14.

53. Furrow Method. If the lightweight core section is selected for the rock dike construction, two confining riprap berms should initially be constructed for placement of the lightweight material. These berms should be constructed on a geotextile fabric to a crown elevation above the water surface. The analyses given on Figure 6 assume this to be el 1.0. Once the outer riprap is placed, a geotextile fabric separator should extend between the dikes to confine the lightweight aggregate. A separator fabric should also be used between the core and capping stone. A minimum of 2.5 feet of riprap should be used above the lightweight core.

54. Marsh Containment. The marsh containment levee will be constructed of in situ materials. Our stability analyses assume these materials will be excavated and placed by mechanical methods using a dragline, clamshell bucket, or similar mechanical equipment. The minimum setback distance shown on Figure 10 should be maintained even though the computed factors of safety indicate the levee and borrow channel could be closer. If alternate excavation and placement methods are considered, Eustis Engineering should be contacted to reevaluate stability.

55. Dredged Fill. We have assumed the borrow material will be excavated and placed using hydraulic methods. The placement limits of the hydraulic fill should be based on stability considerations as previously presented as well as construction constraints and environmental factors. For slope stability considerations, fill should be placed no higher than the limits shown on Figure 11. For your environmental concerns and settlement considerations, fill should be placed no lower than el 1.2. Actual fill heights may be varied between these limits based on the environmental goals such as interspersion.

56. If the dredged fill will be placed against the rock dike, a geotextile separator fabric should be placed between the riprap and dredged backfill to prevent migration of the fill and clogging of the stone. We do not recommend a permanent impermeable (clear plastic cover) separator. An impermeable barrier could result in inadequate drainage of the dredged fill rather than prevention of seepage through the rock dike.

57. Drainage Controls. During the placement of the hydraulic fill, the contractor should provide drainage control measures to facilitate construction operations. Drainage control measures could include weirs, pipes, drop inlets, as well as measures. The number, size, and location of these drainage control measures should be considered during the design of the borrow area and for the permit application. Some deciding factors will include the position of the dredge and flotation canal, natural slope of the lake or land formations, and the type and size of the dredging equipment.

58. Maintenance. Our stability analyses do not consider an overbuild to maintain the proposed crown elevation for either the rock dikes or marsh containment. Rather, long term maintenance may be required to accommodate the estimated settlement. This maintenance may consist of the addition of stone to the crown of the rock dike section above the water surface. A detail of this recommendation is shown on Figure 14. The marsh containment dike may require degrading to maintain tidal flows for the marsh restoration if actual settlements are not sufficient.

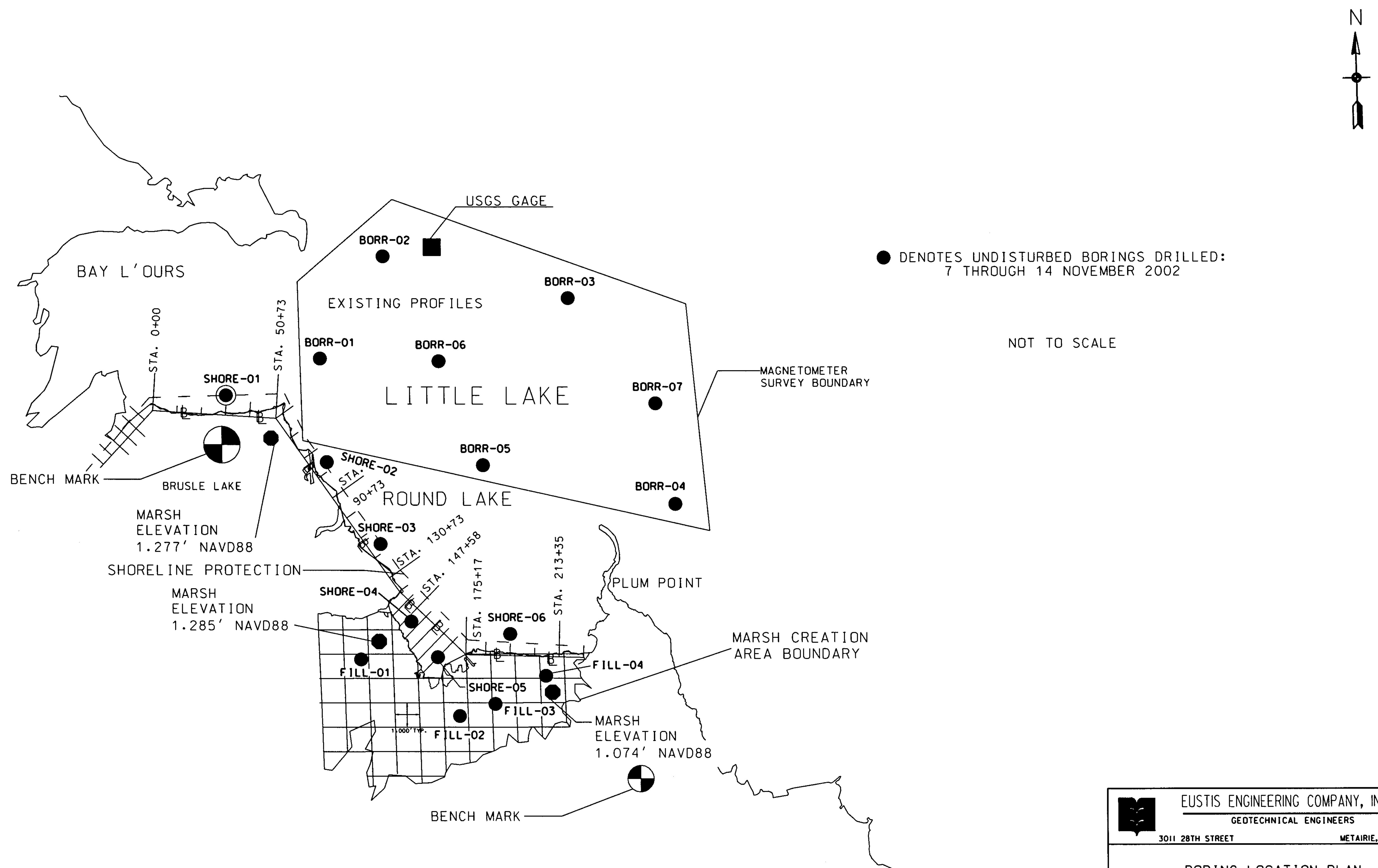
59. Monitoring. Consideration should be given to the use of settlement plates or other surveying methods to monitor the actual rates of settlement for the project. As indicated previously, our estimates of settlement and settlement time-rate are based on assumed conditions below the boring depths. Natural variations in the materials placed as well as the dessication and biodegradation of these deposits may also affect our estimates. In addition, construction of the shoreline protection and

containment area may affect water levels due to tidal fluctuations in areas of the project. Therefore, if the long term performance of the fill placement is to be evaluated, the monitoring should be performed at regular intervals to provide sufficient data.

ADDITIONAL GEOTECHNICAL SERVICES

60. To provide continuity between the investigation, design, and construction phases, Eustis Engineering should be retained to provide additional services during completion of the project. These services may include consultation during design and construction, reviewing construction sequences proposed by the contractor, testing and approval of proposed aggregate materials, and any other soil and materials testing services. Eustis Engineering offers a complete range of materials testing services which will provide quality control during construction and conformance to design specifications.

61. In summary, Eustis Engineering should be retained to monitor all geotechnical related work performed by the contractor. If construction problems arise, Eustis Engineering should be notified to participate in the development of solutions. This participation permits the geotechnical engineer to evaluate the effects of unanticipated conditions and propose solutions on the geotechnical design assumptions particular to the project. The design geotechnical engineer may also be able to judge how site specific soil and ground water conditions will affect the success of a proposed construction alternative.



● DENOTES UNDISTURBED BORINGS DRILLED:
7 THROUGH 14 NOVEMBER 2002

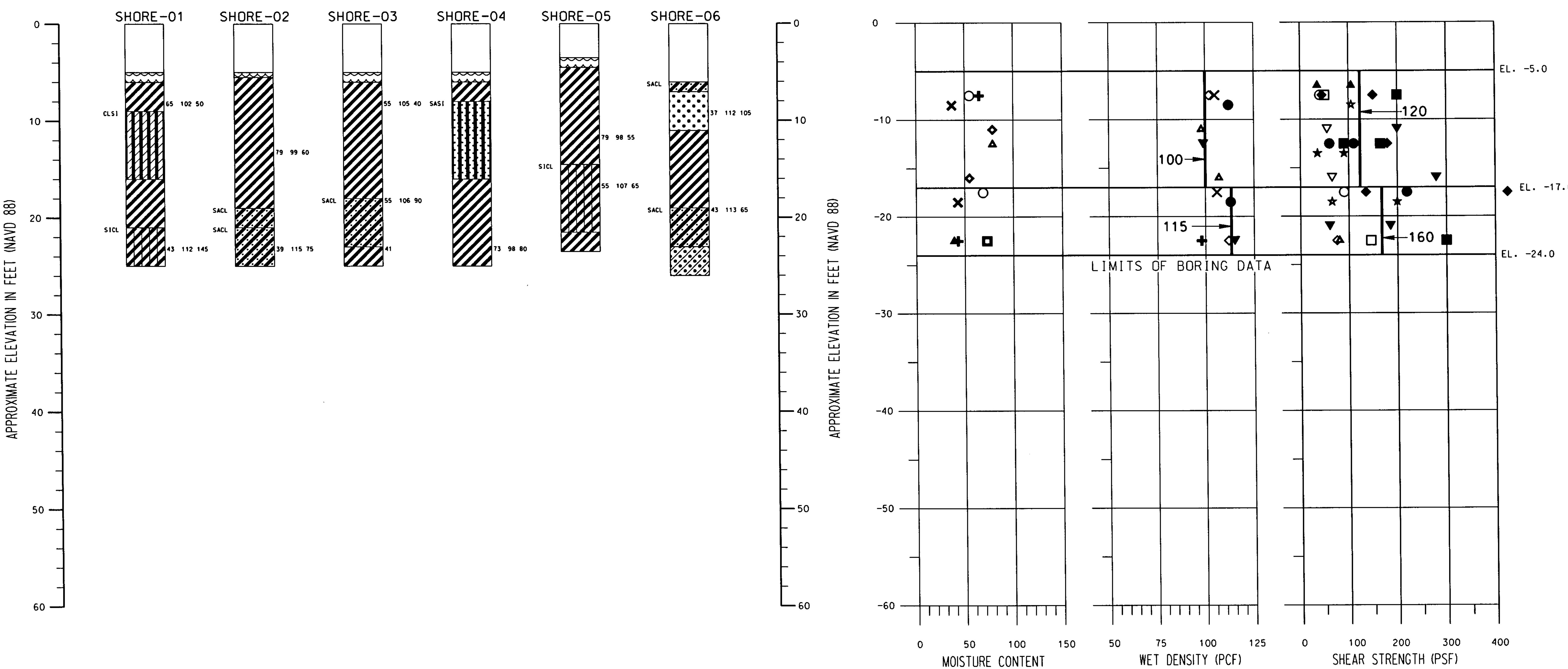
NOT TO SCALE

EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

BORING LOCATION PLAN

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION
AND MARSH CREATION
LAFOURCHED PARISH, LOUISIANA

DRAWN BY: D. LAFONT	PLOT DATE: 01 APR. 03	CADD FILE: FIGURE 1.DGN
CHECKED BY: G.P.S.	JOB NO.: 17623	FIGURE 1

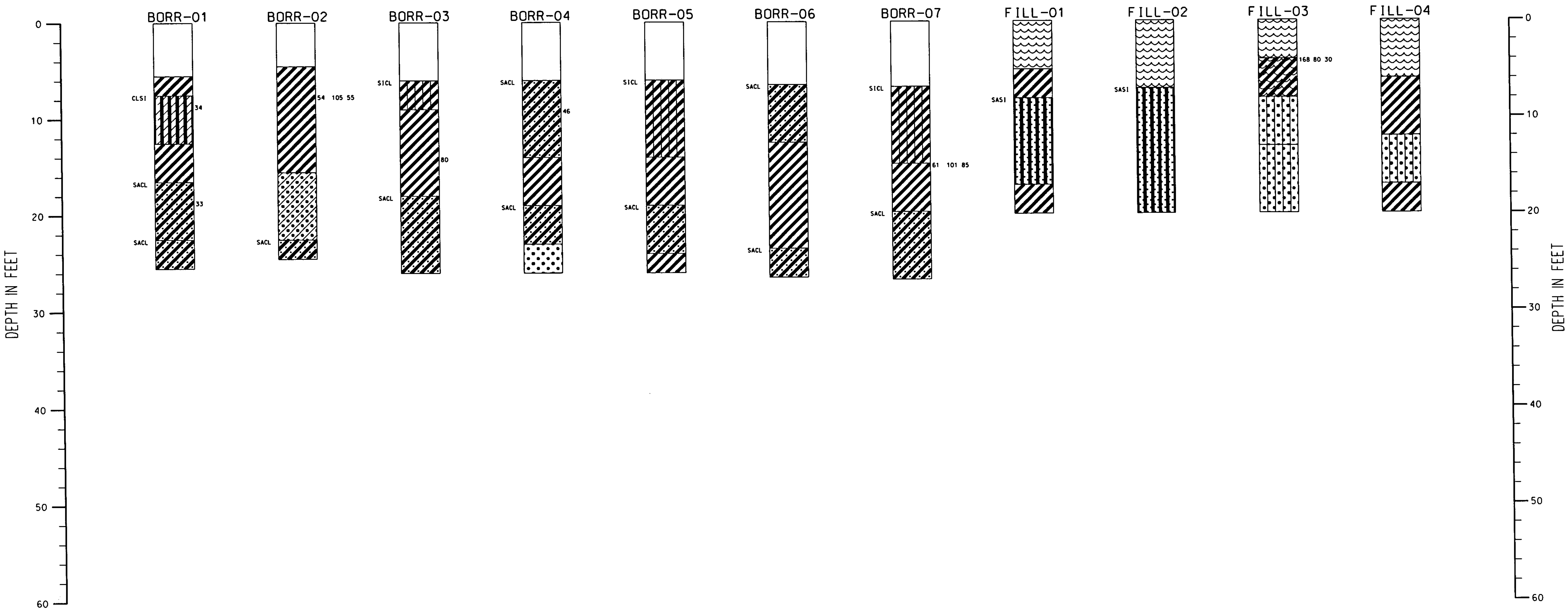


EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

SUBSOIL PROFILE AND DESIGN PARAMETERS
SHORE BORINGS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

DRAWN BY: D. LAFONT	PLOT DATE:03 APR. 03	CADD FILE: FIGURE 2.DGN
CHECKED BY: G.P.S.	JOB NO.: 17623	FIGURE 2

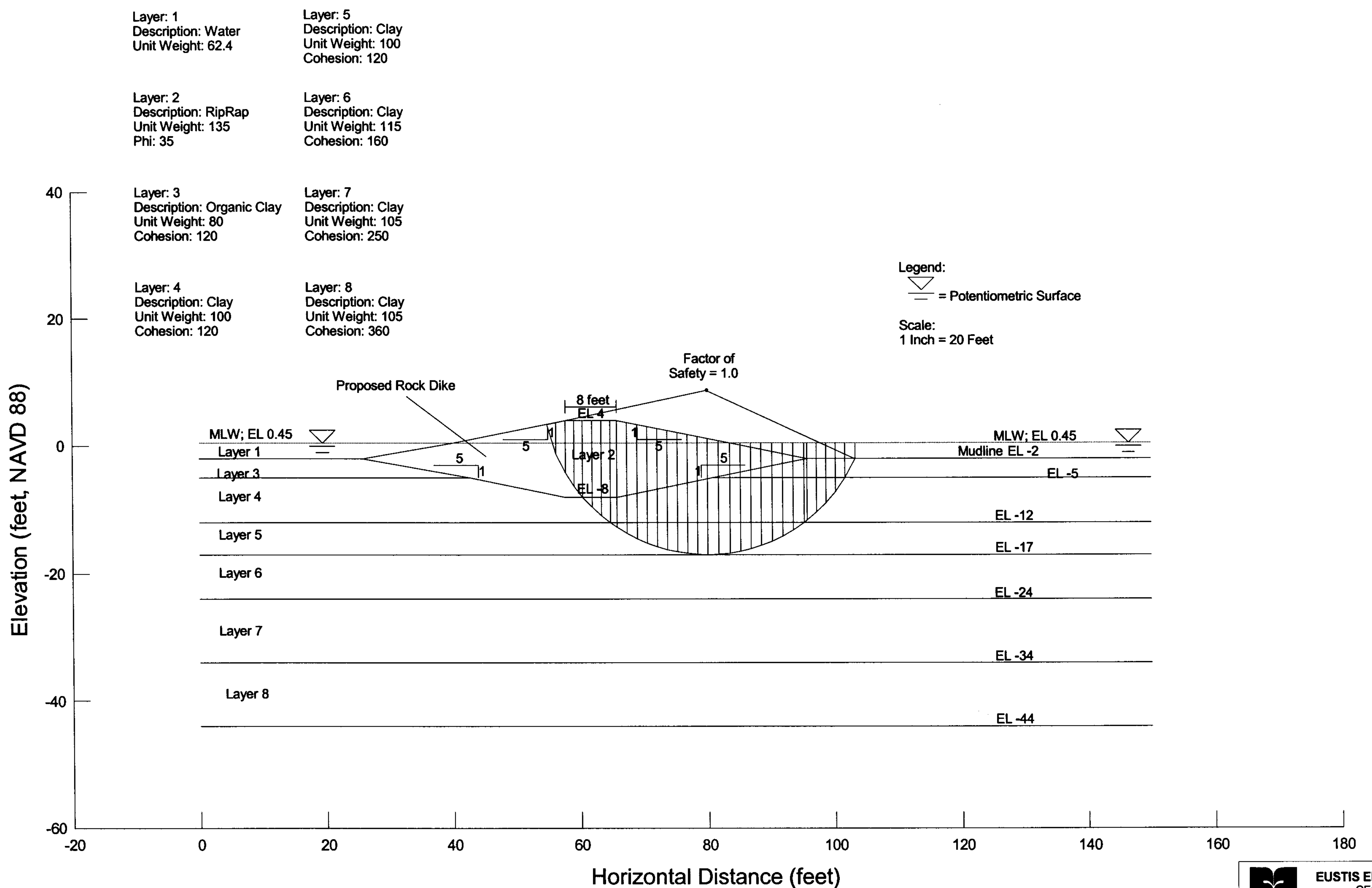


EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

SUBSOIL PROFILE
BORROW AND FILL BORINGS

STATE OF LOUSIANA
LITTLE LAKE SHORELINE PROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

DRAWN BY: D. LAFONT	PLOT DATE:03 APR. 03	CADD FILE: FIGURE 3.DGN
CHECKED BY: G.P.S.	JOB NO.: 17623	FIGURE 3

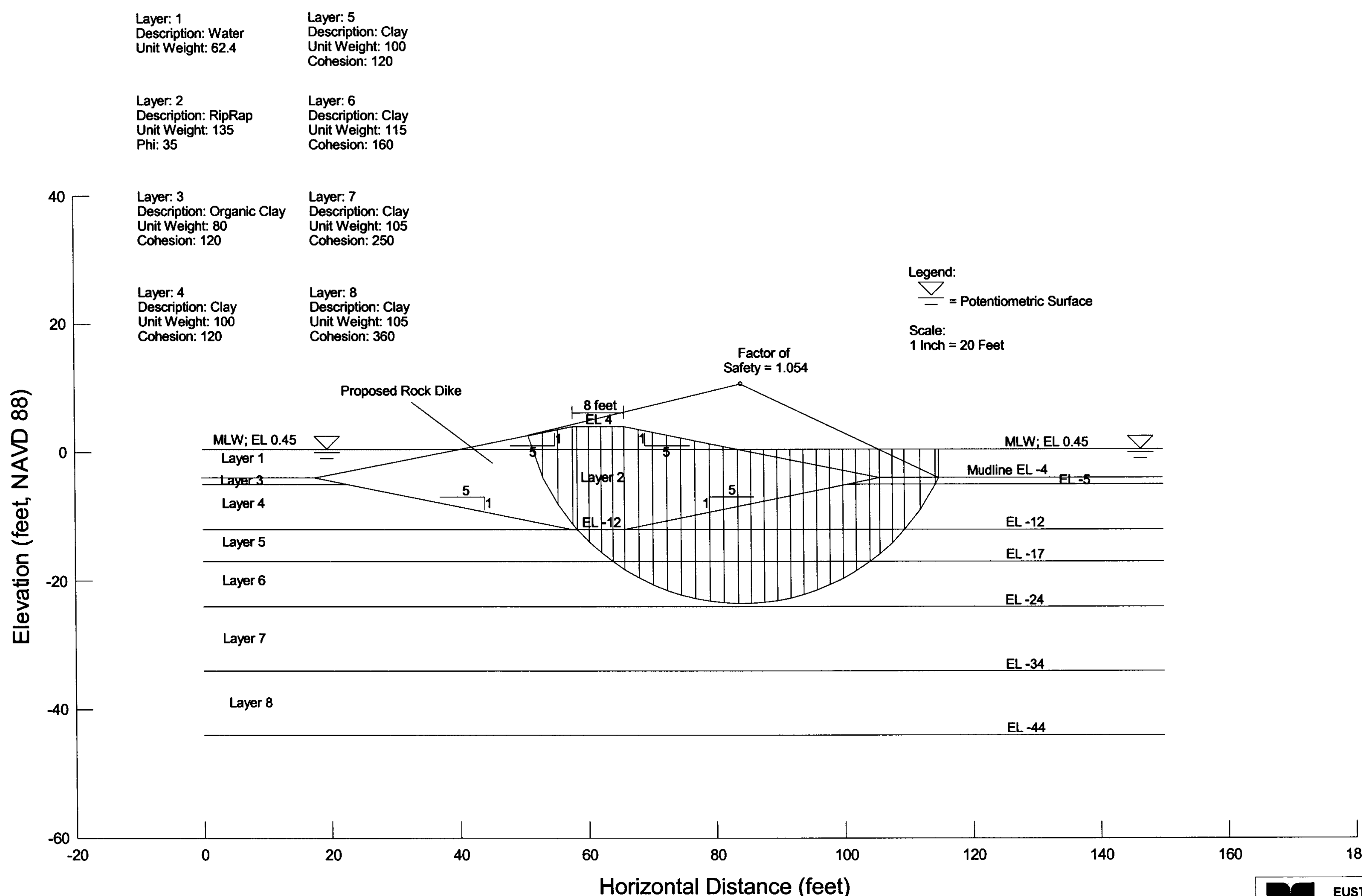


EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

SLOPE STABILITY ANALYSES
ROCK DIKE TO EL 4.0
MUDLINE AT EL -2.0

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

DRAWN BY: S.R.S.	28 MAR. 2003	FILE: ROCK2.SLP
CHECKED BY: G.P.S.	JOB NO.: 17623	FIGURE 4 SHEET 1

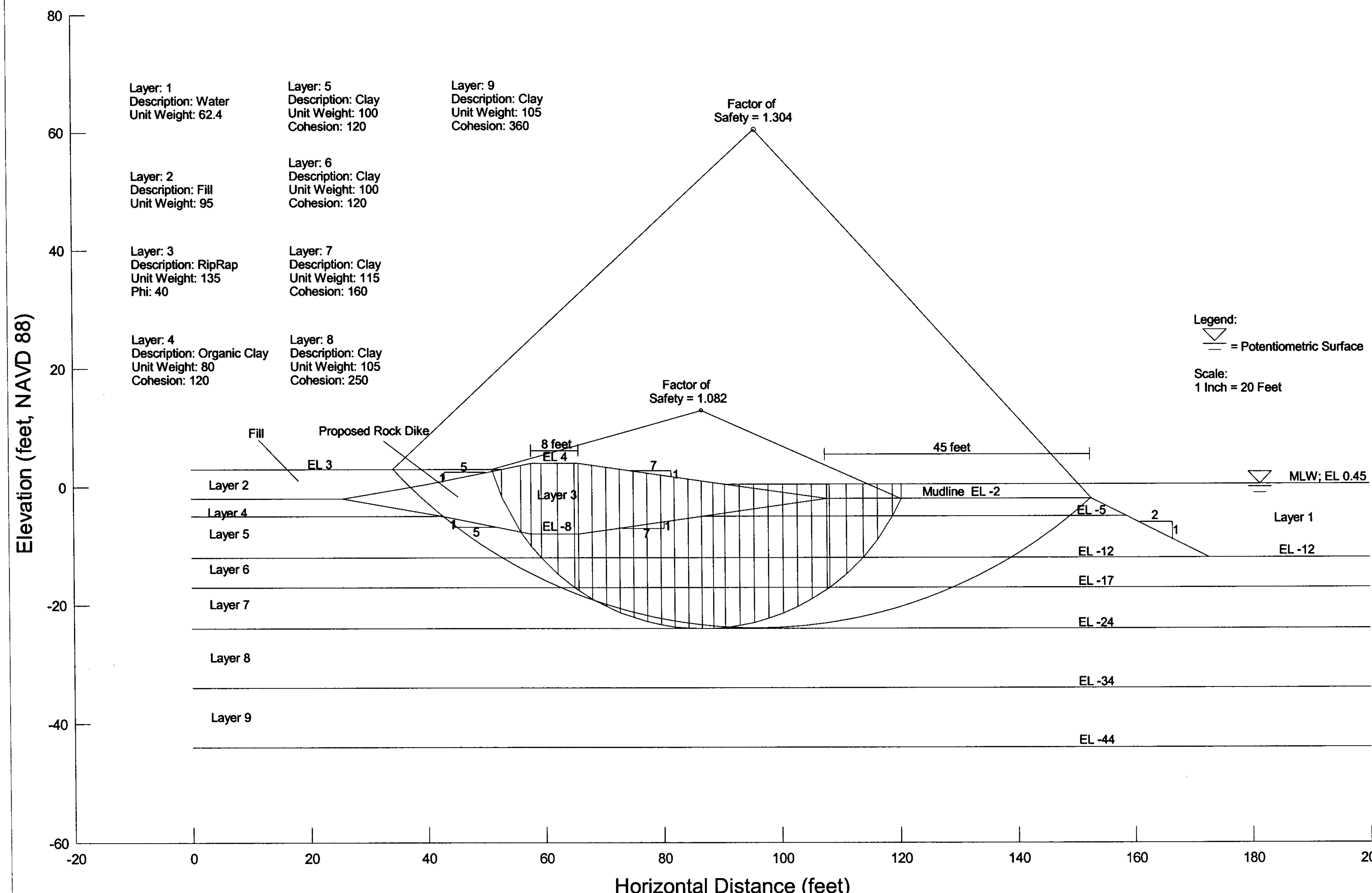


EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

SLOPE STABILITY ANALYSES
ROCK DIKE TO EL 4.0
MUDLINE AT EL -2.0

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

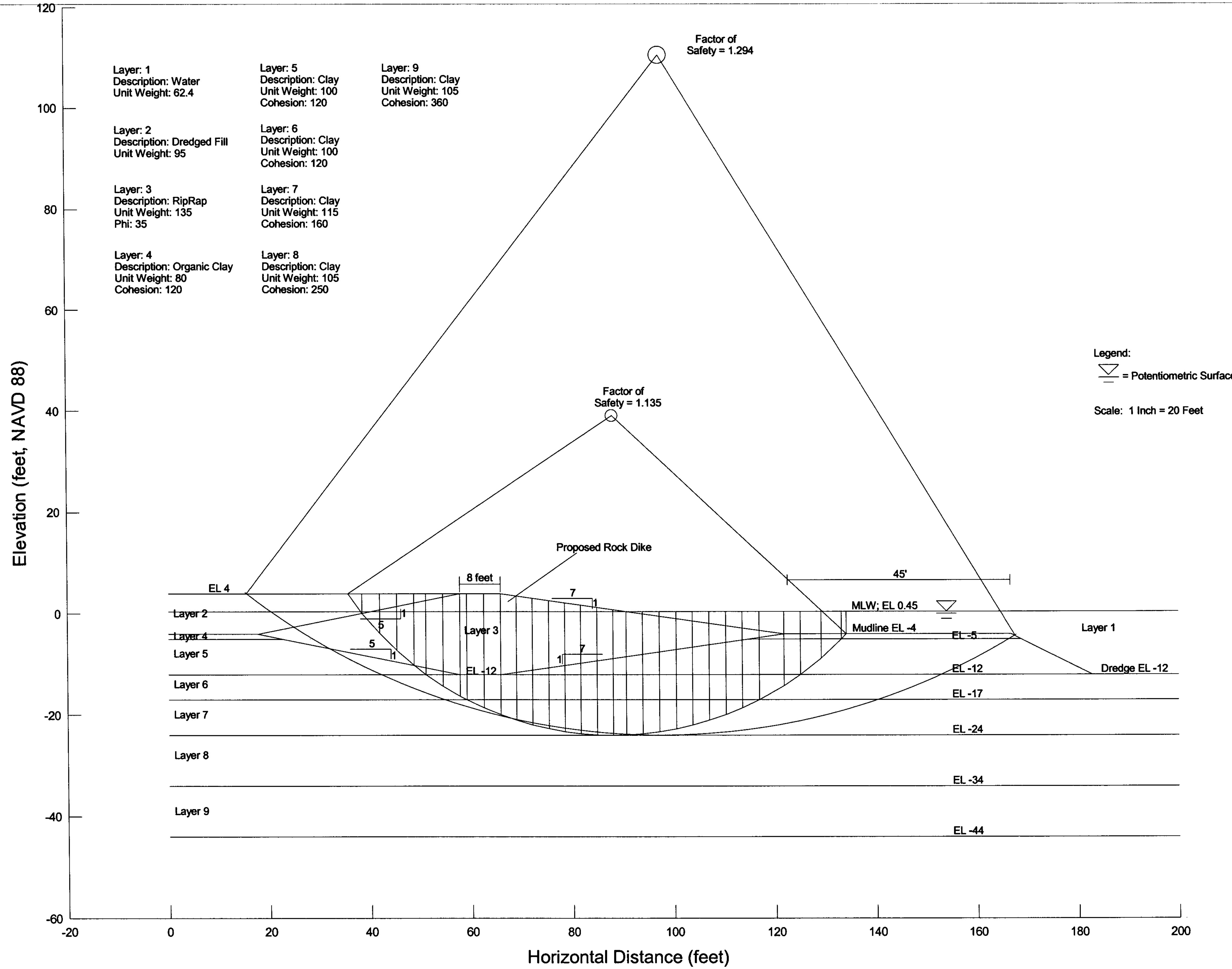
DRAWN BY: S.R.S.	28 MAR. 2003	FILE: ROCK1.SLP
CHECKED BY: G.P.S.	JOB NO.: 17623	FIGURE 4 SHEET 2



EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

SLOPE STABILITY ANALYSES
ROCK DIKE WITH FILL AND DREDGE
MUDLINE AT EL -2.0
STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

DRAWN BY: S.R.S.	31 MAR. 2003	FILE: ROCK2FILL1V7H.SLP
CHECKED BY: G.P.S.	JOB NO.: 17623	FIGURE 5 SHEET 1

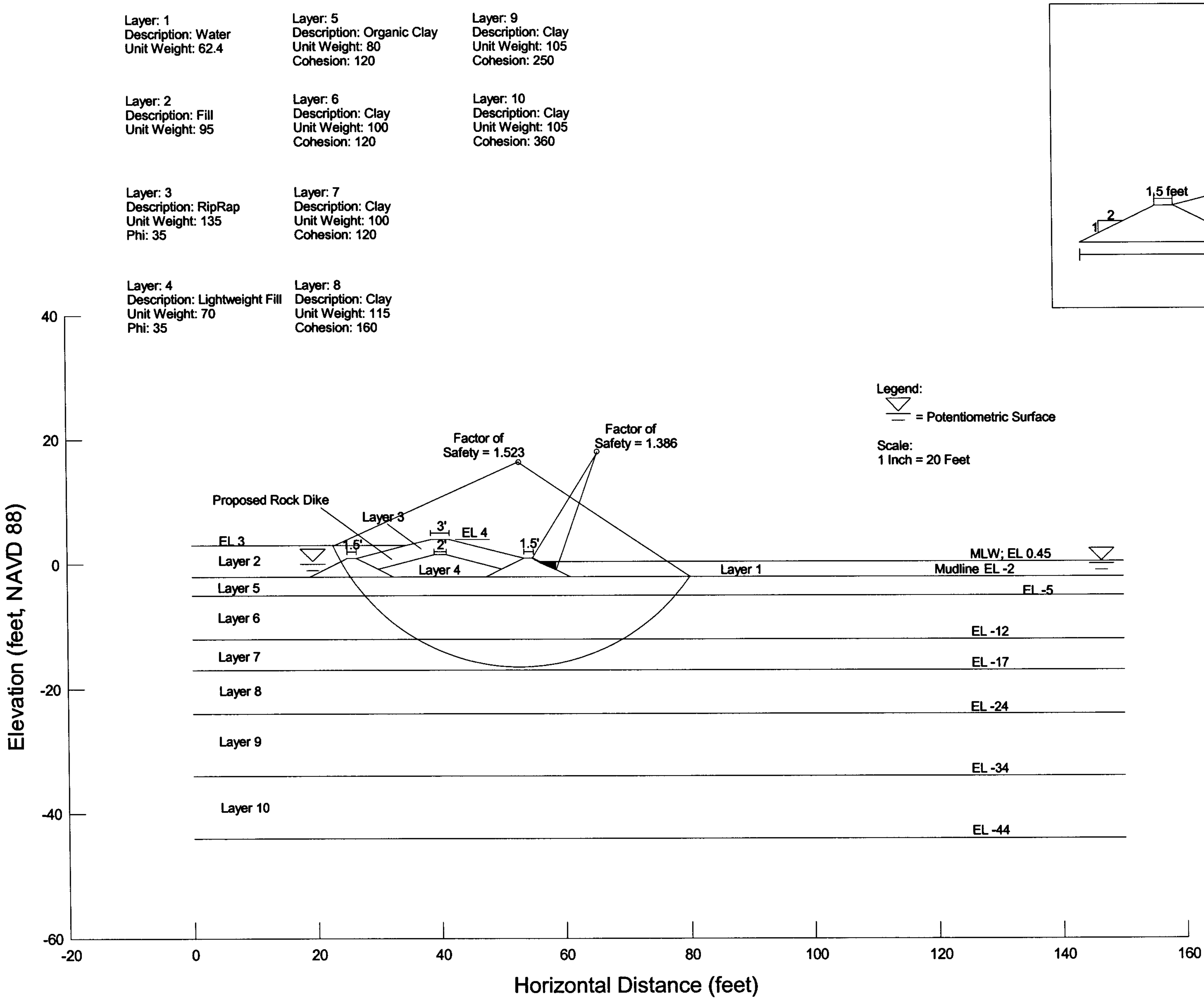


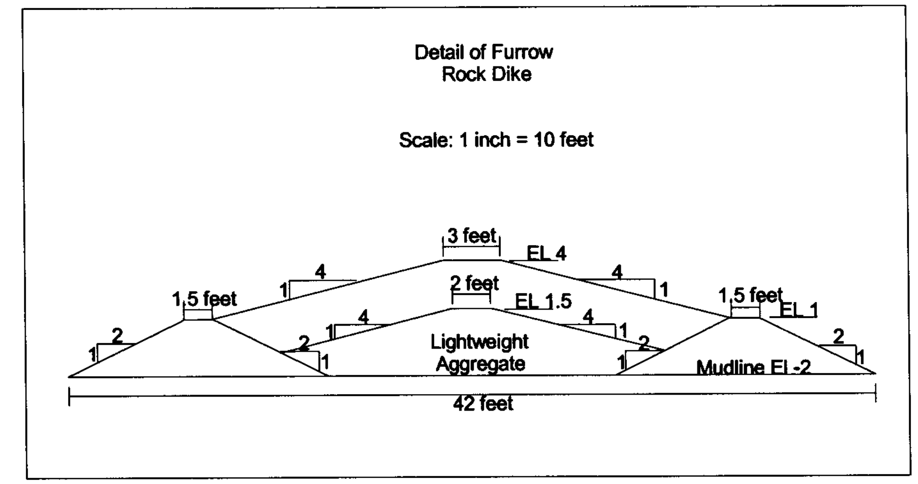
EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

SLOPE STABILITY ANALYSES
ROCK DIKE WITH FILL AND DREDGE
MUDLINE AT EL -4

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

DRAWN BY: S.R.S.	28 MAR. 2003	FILE: ROCKFILL1V7H DREDGE20B.SLP
CHECKED BY: G.P.S.	JOB NO.: 17623	FIGURE 5 SHEET 2



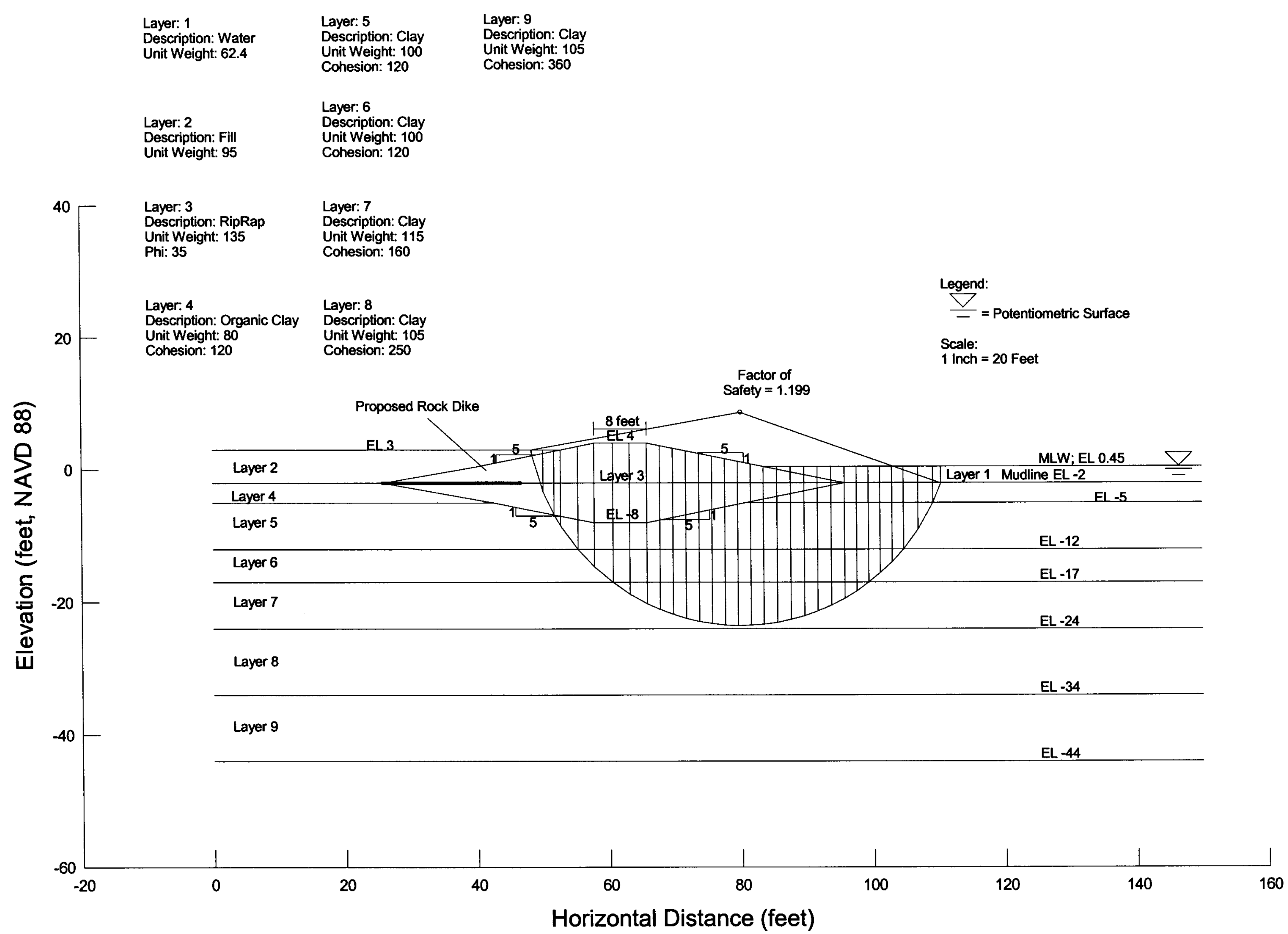


EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

SLOPE STABILITY ANALYSES
FURROW ROCK DIKE WITH FILL
MUDLINE AT EL -2

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

DRAWN BY: S.R.S.	31 MAR. 2003	FILE: ROCKFURROW CFILL2.SLP
CHECKED BY: G.P.S.	JOB NO.: 17623	FIGURE 6

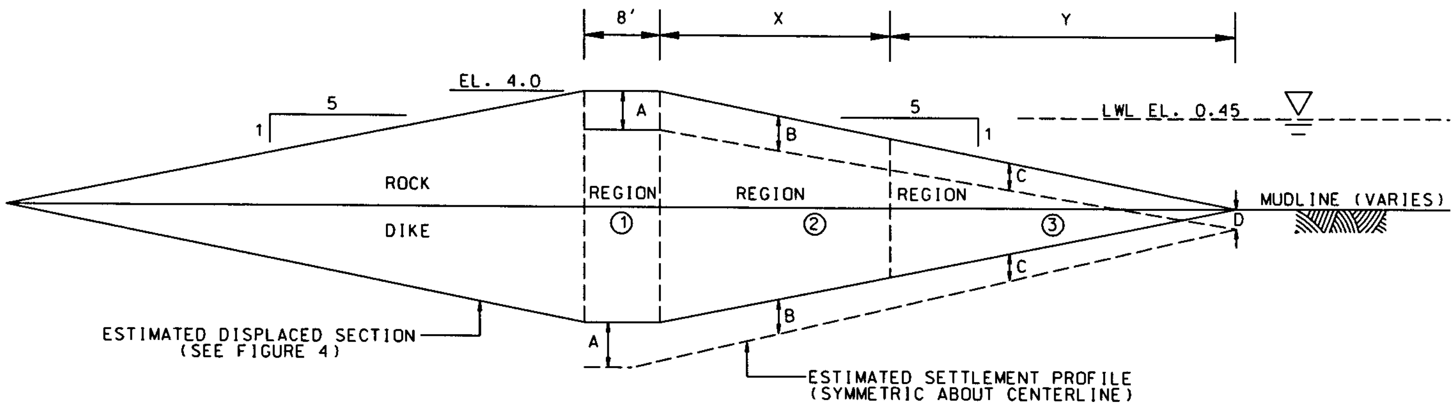


EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

SLOPE STABILITY ANALYSES
ROCK DIKE TO EL 4.0
MUDLINE AT EL -2.0 WITH GEOGRID REINFORCEMENT

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

DRAWN BY: S.R.S.	31 MAR. 2003	FILE: ROCK2FILLGRID.SLP
CHECKED BY: G.P.S.	JOB NO.: 17623	FIGURE 7



MUDLINE ELEVATION	X	Y
-2.0	12.0	18.0
-4.0	20.0	20.0

LOCATION	DIM.	ESTIMATED SETTLEMENT (INCHES) *					
		ULTIMATE	5-YR.	10-YR.	15-YR.	20-YR.	25-YR.
℄ ROCK DIKE (REGION 1)	A	25.1	2.4	5.9	8.2	9.7	10.8
℄ REGION 2	B	21.7	2.0	4.6	6.6	8.0	9.0
℄ REGION 3	C	7.6	1.5	2.1	2.6	2.9	3.2
TOE	D	4.6	1.1	1.4	1.7	1.9	2.1

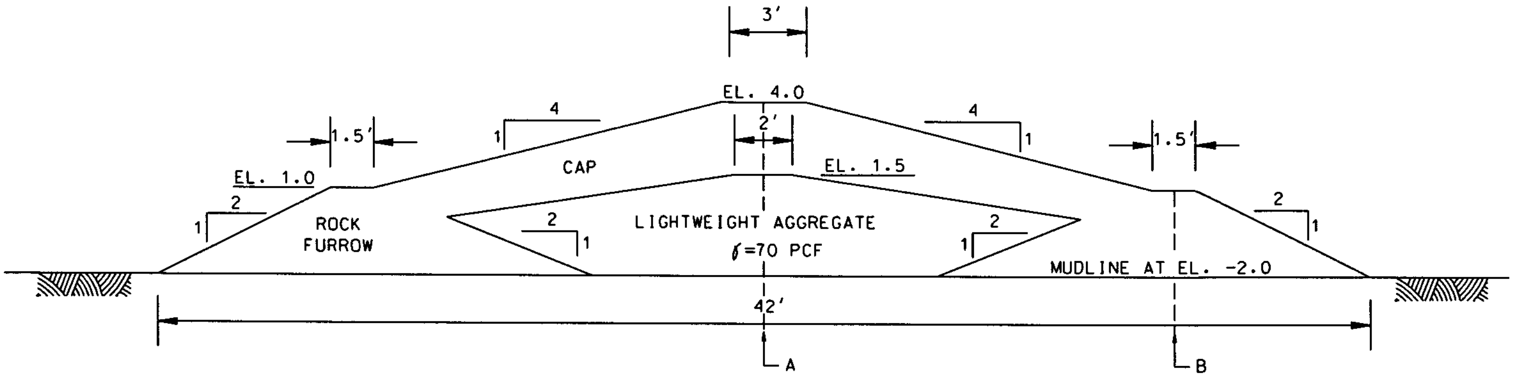
* AVERAGE OF VALUES COMPUTED FOR MUDLINES AT EL. -2.0 AND EL.-4.0 ACTUAL SETTLEMENT SHOULD BE ANTICIPATED TO VARY ±15% OF TABULATED VALUES

EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

ESTIMATED SETTLEMENT FOR ROCK DIKE

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

DRAWN BY: D. LAFONT	PLOT DATE: 03 APR. 03	CADD FILE: FIGURE 8.DGN
CHECKED BY: G.P.S.	JOB NO.: 17623	FIGURE 8 (SHEET 1 OF 2)



LOCATION	DIM.	ESTIMATED SETTLEMENT (INCHES) *					
		ULTIMATE	5-YR.	10-YR.	15-YR.	20-YR.	25-YR.
℄ ROCK DIKE	A	12.3	4.5	5.4	5.9	6.3	6.6
℄ FURROW	B	8.8	3.7	4.3	4.7	5.0	5.3

* ACTUAL SETTLEMENT SHOULD BE ANTICIPATED
TO VARY ± 15% OF TABULATED VALUES

EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

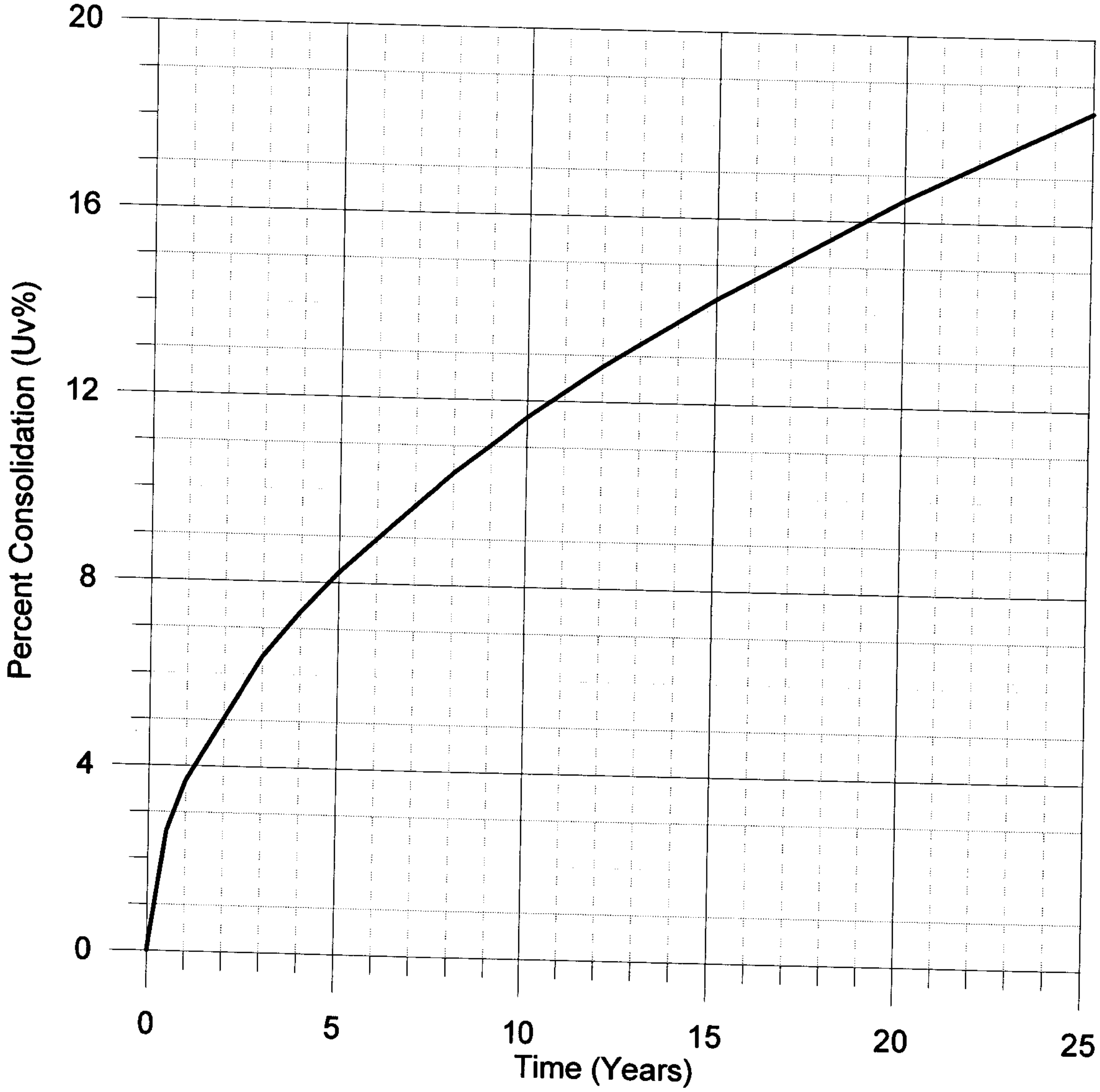
ESTIMATED SETTLEMENT
FOR LIGHTWEIGHT CORE

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

DRAWN BY: D. LAFONT	PLOT DATE:03 APR. 03	CADD FILE: FIGURE 8.DGN
CHECKED BY: G.P.S.	JOB NO.: 17623	FIGURE 8 (SHEET 2 OF 2)

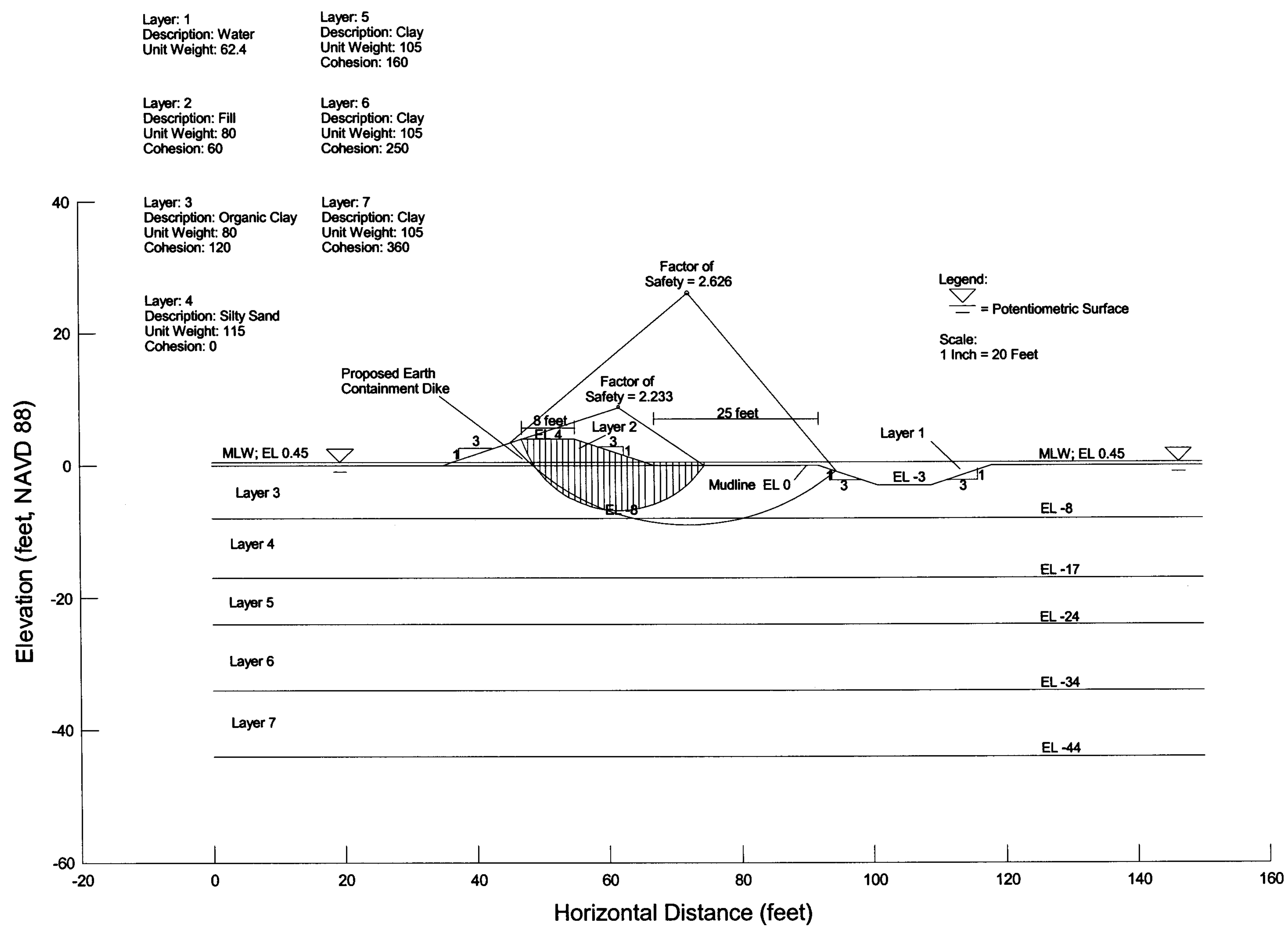
STATE OF LOUISIANA
LITTLE LAKE SHORELINE ROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

ESTIMATED TIME RATE OF SETTLEMENT
FOR THE PROPOSED ROCK DIKE



EUSTIS ENGINEERING COMPANY, INC.

FIGURE 9

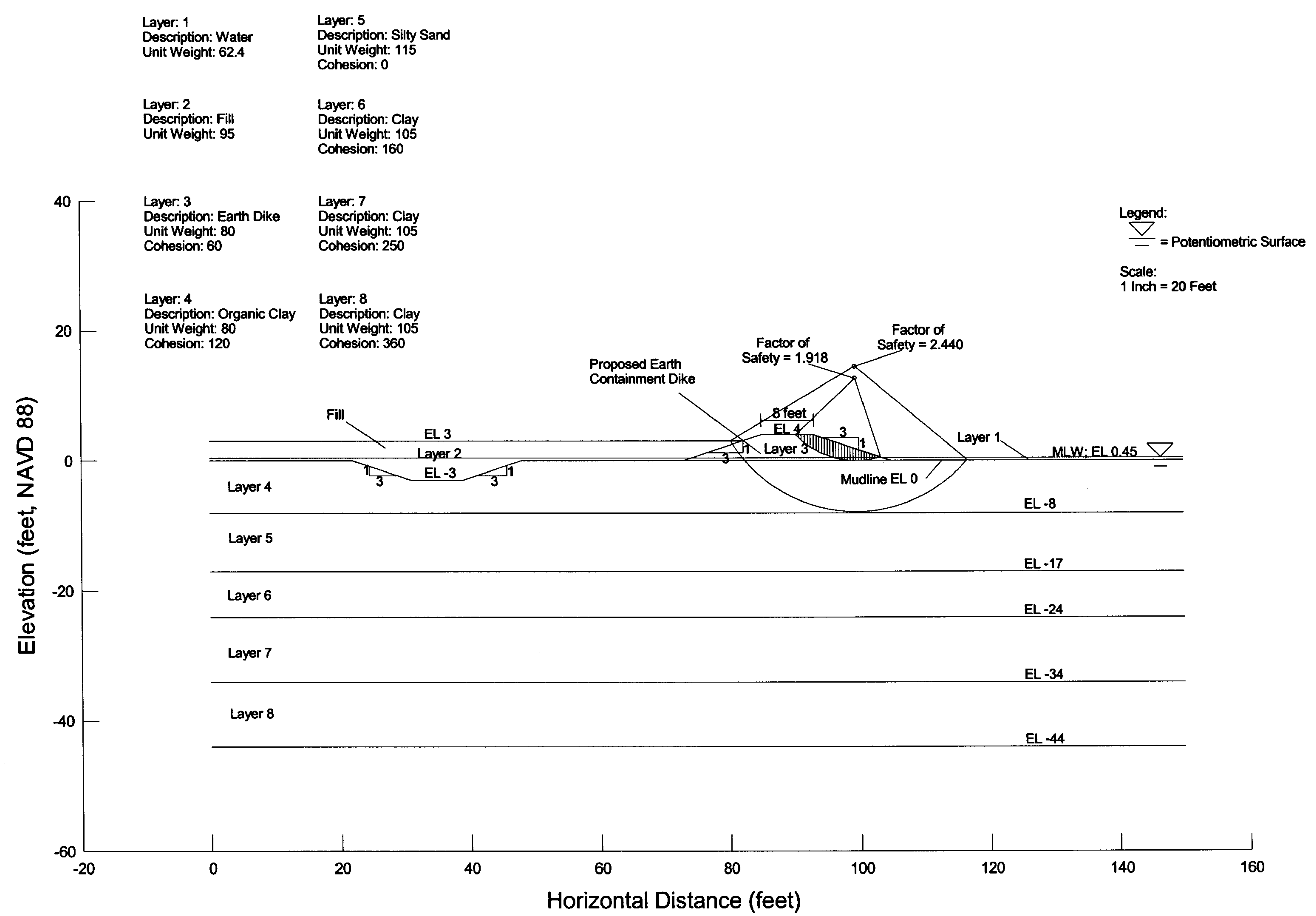


EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

SLOPE STABILITY ANALYSES
EARTH CONTAINMENT DIKE

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

DRAWN BY: S.R.S.	31 MAR. 2003	FILE: CONTAIN2.SLP
CHECKED BY: G.P.S.	JOB NO.: 17623	FIGURE 10



EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

SLOPE STABILITY ANALYSES
DREDGED FILL BEHIND
EARTH CONTAINMENT DIKE

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

DRAWN BY: S.R.S.	31 MAR. 2003	FILE: CONTAIN2FILLA.SLP
CHECKED BY: G.P.S.	JOB NO.: 17623	FIGURE 11

STATE OF LOUISIANA
LITTLE LAKE SHORELINE ROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

ESTIMATED TIME RATE OF SETTLEMENT
FOR THE MARSH CREATION
ASSUMING DOUBLE DRAINAGE

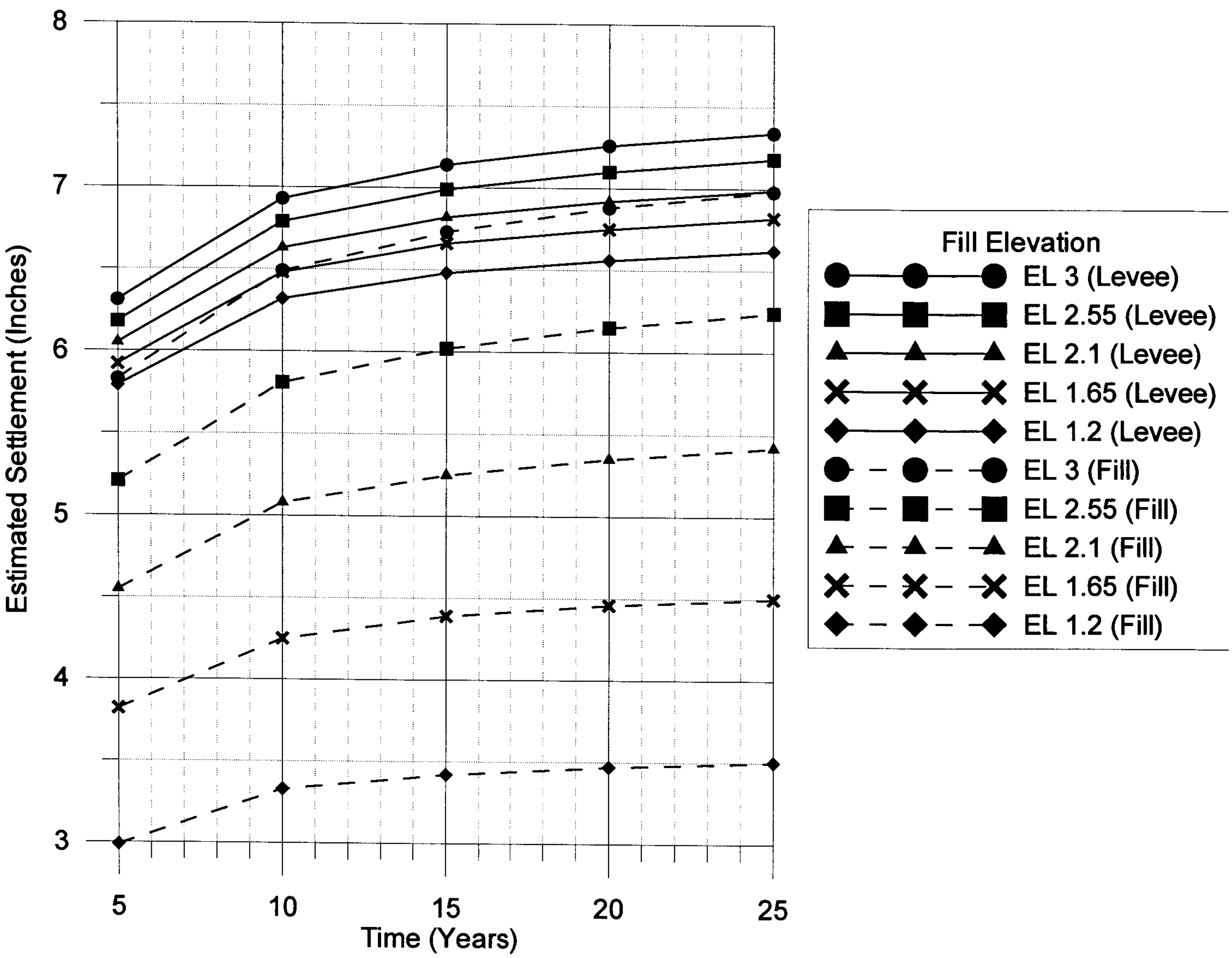


FIGURE 12
(SHEET 1 OF 2)

EUSTIS ENGINEERING COMPANY, INC.

STATE OF LOUISIANA
LITTLE LAKE SHORELINE ROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

ESTIMATED TIME RATE OF SETTLEMENT
FOR THE MARSH CREATION
ASSUMING SINGLE DRAINAGE

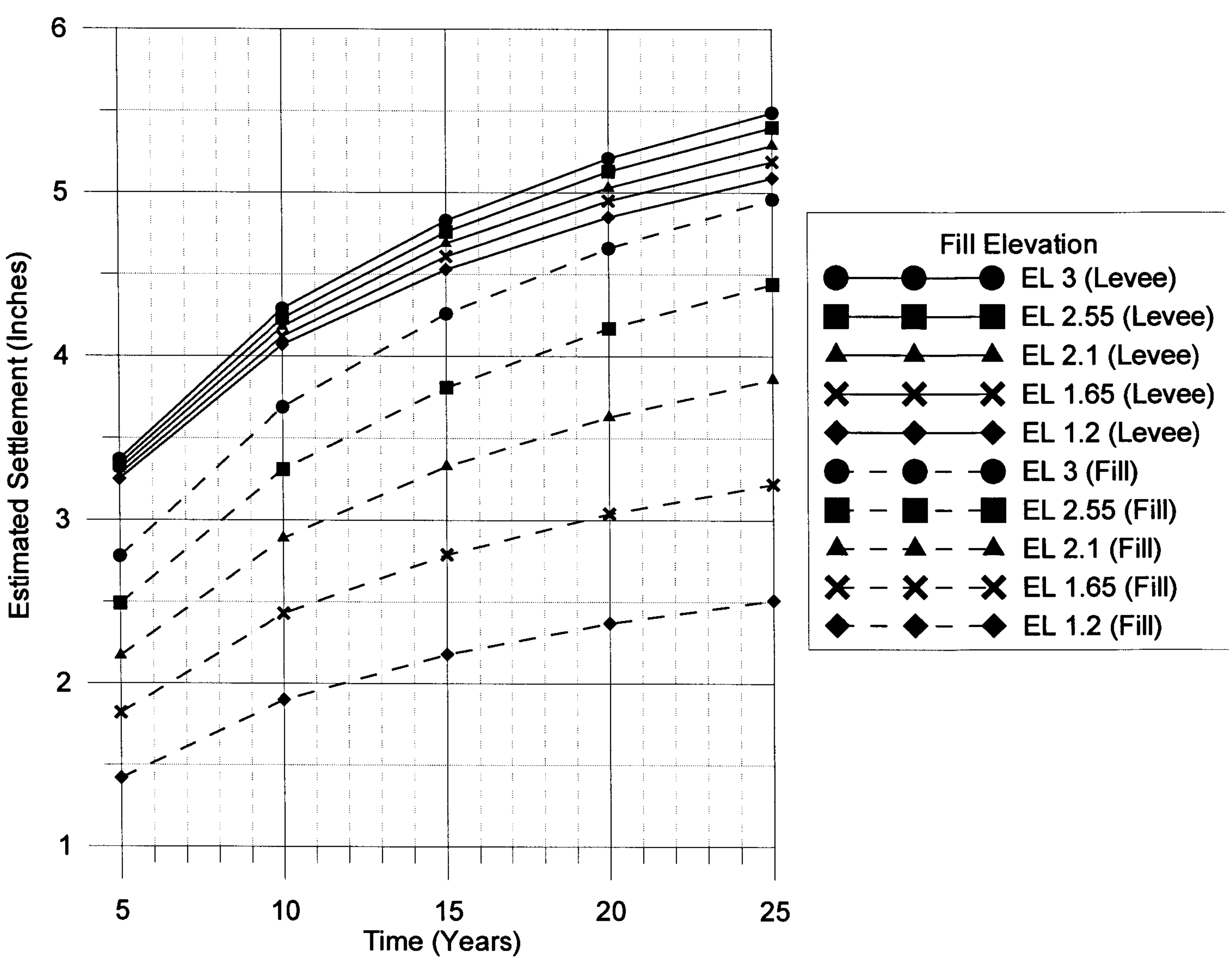


FIGURE 12
(SHEET 2 OF 2)

EUSTIS ENGINEERING COMPANY, INC.

STATE OF LOUISIANA
LITTLE LAKE SHORELINE ROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

ESTIMATED TIME RATE OF SETTLEMENT
FOR THE PROPOSED MARSH CREATION

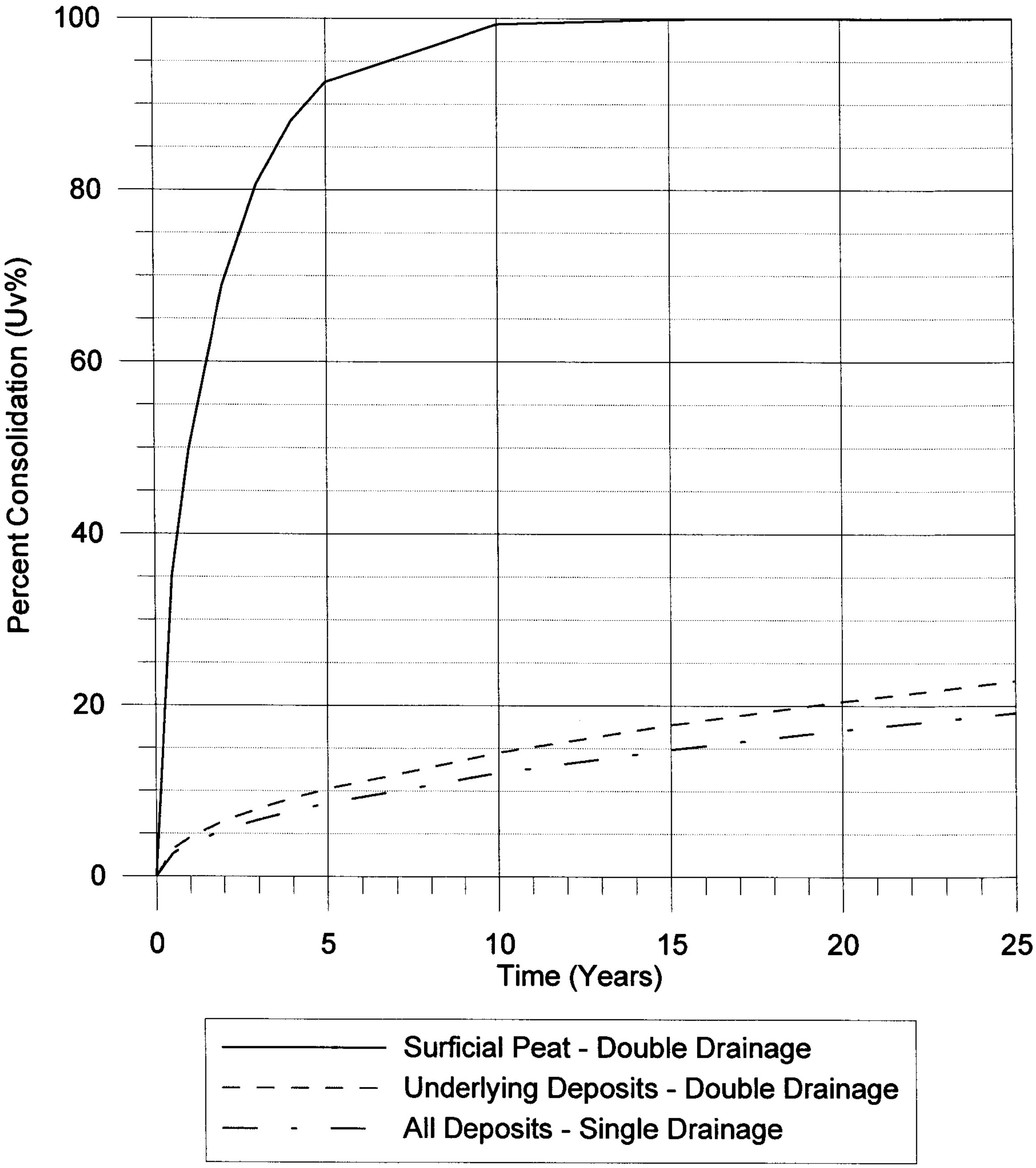


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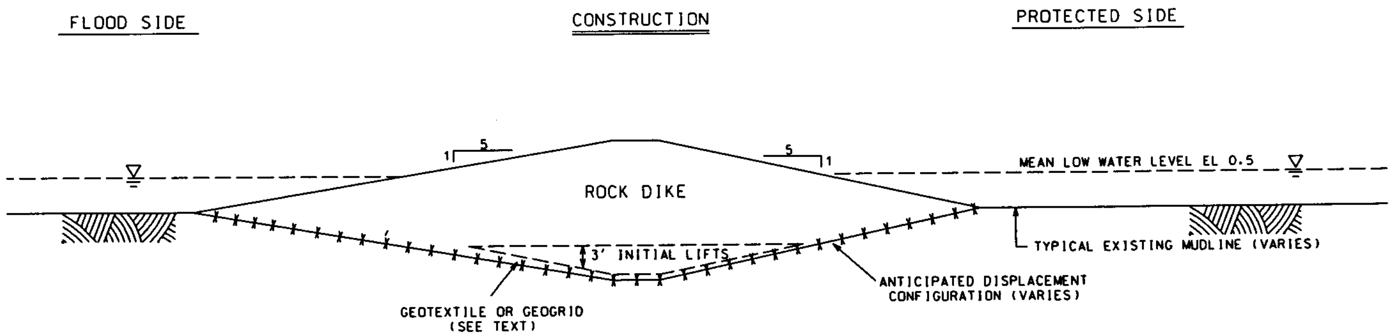
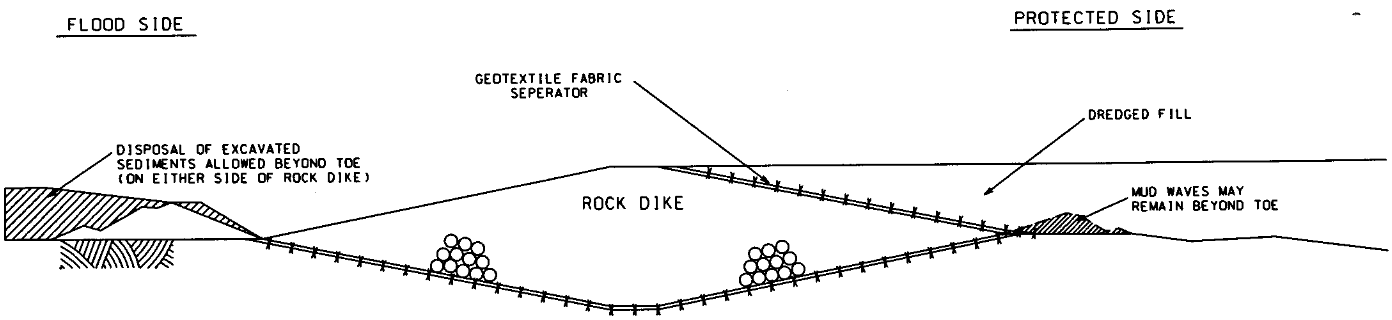
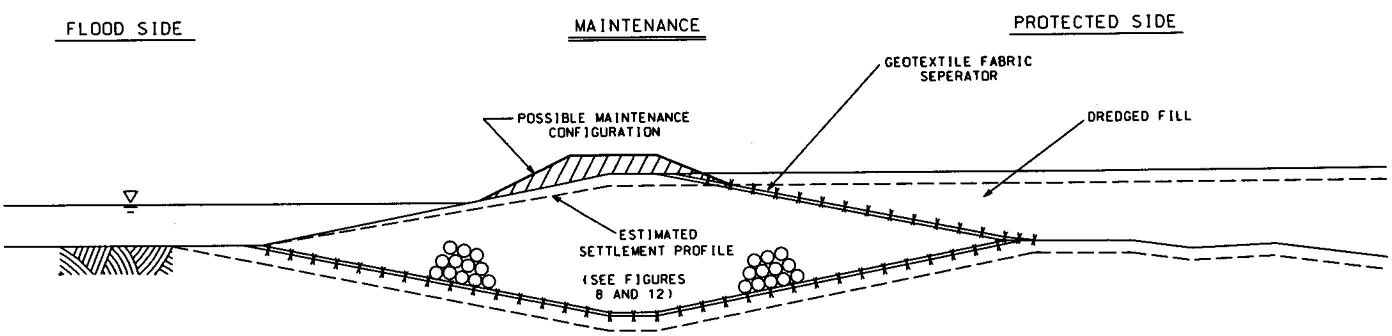
FIGURE 13







SCHEMATIC ONLY

NOT TO SCALE

EUSTIS ENGINEERING COMPANY, INC.
GEOTECHNICAL ENGINEERS
3011 28TH STREET METAIRIE, LOUISIANA

DREDGED FILL

CONSTRUCTION AND MAINTENANCE DETAILS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION
AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

DRAWN BY: D. LAFONT	PLOT DATE:03 APR. 03	CADD FILE: FIGURE 14.DGN
CHECKED BY: G.P.S.	JOB NO.: 17623	FIGURE 14

APPENDIX I

LEGEND AND NOTES FOR LOG OF BORING AND TEST RESULTS

PP	Pocket penetrometer resistance in tons per square foot
TV	Torvane shear strength in tons per square foot
SPT	Standard Penetration Test. Number of blows of a 140-lb. hammer dropped 30 inches required to drive 2-in O.D., 1.4-in. I.D. sampler a distance of one foot into the soil, after first seating it 6 inches
SPLR	Type of Sampling ■ Shelby ☒ SPT ⧄ Auger ☐ No Sample
SYMBOL	Clay Silt Sand Humus — Predominant type shown heavy; Modifying type shown light
DENSITY	Unit weight in pounds per cubic foot
USC	Unified Soil Classification

TYPE		
	UC	Unconfined compression shear
	OB	Unconsolidated undrained triaxial compression shear on one specimen confined at the approximate overburden pressure
	UU	Unconsolidated undrained triaxial compression shear
	CU	Consolidated undrained triaxial compression shear
	DS	Direct shear
	CON	Consolidation
	PD	Particle size distribution
	k	Coefficient of permeability in centimeters per second
	SP	Swelling pressure in pounds per square foot

ϕ	Angle of internal friction in degrees
c	Cohesion in pounds per square foot

Other laboratory test results reported on separate figure

Ground Water Measurements ▼ Initial ▽ Final

GENERAL NOTES

(1) At the time the borings were made, ground water levels were measured below existing ground surface. These observations are shown on the boring logs. However, ground water levels may vary due to seasonal and other factors. If important to construction, the depth to ground water should be determined by those persons responsible for construction, immediately prior to beginning work.

(2) While the individual logs of borings are considered to be representative of subsurface conditions at their respective locations on the dates shown, it is not warranted that they are representative of subsurface conditions at other locations and times.

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

(Sheet 1 of 1)

X = 3,642,708.25 **Y =** 367,536.79 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/14/02 **Boring:** BORR-01 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Mini Vane (psf) Und	Mini Vane (psf) Rem	<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
0					Water																		
					Very soft gray clay w/clayey silt lenses & organic matter	CH	1	5.5															
10					Loose gray clayey silt w/clay lenses	ML	2	8.5	34														
					Very soft gray clay w/clayey sand lenses	CH	3	13.5															
20					Very soft to soft gray sandy clay w/clay lenses	CL	4	18.5	33						31	16	15						
					Very soft gray sandy clay w/shells	CL	5	23.5															
30																							
40																							
50																							

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

X = 3,645,293.16 **Y =** 371,744.38 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/14/02 **Boring:** BORR-02 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density		Shear Tests			Atterberg Limits			Mini Vane (psf)		<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
										Dry	Wet	Type	ø	C	LL	PL	PI	Und	Rem				
0					Water																		
					Extremely soft to very soft gray clay w/sand lenses & organic matter	CH	1	4.5															
					w/silt lenses		2	7.5	54	68	105	UC	--	55									
10					w/sand lenses		3	12.5															
					Loose gray clayey sand w/shell fragments	SC	4	17.5															PD
20					Very soft to soft gray sandy clay w/clay lenses & shell fragments	CL	5	22.5															
30																							
40																							
50																							

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

X = 3,652,881.13 **Y =** 370,036.35 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/13/02 **Boring:** BORR-03 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density		Shear Tests			Atterberg Limits			Mini Vane (psf)		<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
										Dry	Wet	Type	ø	C	LL	PL	PI	Und	Rem				
0					Water																		
					Very soft gray silty clay w/shell fragments	CL	1	6															
10					Extremely soft to very soft gray clay w/sand lenses & shell fragments	CH	2	9															
					w/silt lenses & shell fragments		3	14	80						85	21	64						
					Very soft gray sandy clay w/shell fragments	CL	4	19															
20							5	24															
30																							
40																							
50																							

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

X = 3,657,251.72 **Y =** 361,579.51 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/13/02 **Boring:** BORR-04 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Mini Vane (psf) Und	Mini Vane (psf) Rem	<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
0					Water																		
					Extremely soft to very soft brown & gray sandy clay w/shell fragments	CL	1	6															
10							2	9	46						41	20	21						
					Very soft gray clay w/clayey silt lenses & pockets	CH	3	14															
20					Very soft gray sandy clay w/clayey sand lenses & pockets	CL	4	19															
					Loose gray fine sand w/clay layers	SP	5	24												9.4			
30																							
40																							
50																							

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

X = 3,649,371.90 **Y =** 363,162.56 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/14/02 **Boring:** BORR-05 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density		Shear Tests			Atterberg Limits			Mini Vane (psf)		<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
										Dry	Wet	Type	ø	C	LL	PL	PI	Und	Rem				
0					Water																		
					Very soft gray silty clay w/shell fragments	CL	1	6															
10					w/fine sand layers & lenses		2	9															
					Very soft gray clay w/clayey silt & fine sand lenses, shell fragments, & organic matter	CH	3	14															
20					Very soft gray sandy clay w/shell fragments	CL	4	19															
					Soft gray & brown clay w/fine sand lenses & pockets, organic matter & shell fragments	CH	5	24															
30																							
40																							
50																							

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

X = 3,647,561.43 **Y =** 367,426.26 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/14/02 **Boring:** BORR-06 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density		Shear Tests			Atterberg Limits			Mini Vane (psf)		<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
										Dry	Wet	Type	ø	C	LL	PL	PI	Und	Rem				
0					Water																		
					Very soft to soft gray sandy clay w/shell fragments	CL	1	6.5															
10							2	9.5														2.69	
					Very soft gray clay w/sand lenses & shell fragments	CH	3	14.5													7.2		
20							4	19.5															
					Very soft gray sandy clay w/shell fragments	CL	5	24.5															
30																							
40																							
50																							

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

X = 3,656,457.95 **Y =** 365,698.80 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/13/02 **Boring:** BORR-07 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Mini Vane (psf) Und	Mini Vane (psf) Rem	<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
0					Water																		
					Extremely soft to soft gray silty clay w/shells	CL	1	6.75															
10							2	9.75															
					Extremely soft to very soft gray clay w/sand lenses & shell fragments	CH	3	14.75	61	63	101	UC	--	85									
20					Very soft gray sandy clay w/clayey sand layers	CL	4	19.75															
							5	24.75															
30																							
40																							
50																							

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

(Sheet 1 of 1)

X = 3,638,838.18 **Y =** 366,019.39 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/11/02 **Boring:** SHORE-01 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density		Shear Tests			Atterberg Limits			Mini Vane (psf)		<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
										Dry	Wet	Type	ø	C	LL	PL	PI	Und	Rem				
0					Water																		
					Very soft brown & black humus	Pt	1	5													57.3		
					Extremely soft to very soft gray clay w/silty clay layers	CH	2	8	65	62	102	UC	--	50									
10					Loose gray clayey silt w/clay lenses	ML	3	13												97.2			
					Very soft gray clay w/silt lenses	CH	42	18										165	90				
20					Very soft gray silty clay w/clay lenses & shell fragments	CL	5	23	43	79	112	UC	--	145									
30																							
40																							
50																							

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

(Sheet 1 of 1)

X = 3,642,967.92 **Y =** 363,281.96 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/11/02 **Boring:** SHORE-02 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density		Shear Tests			Atterberg Limits			Mini Vane (psf)		<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
										Dry	Wet	Type	ø	C	LL	PL	PI	Und	Rem				
0					Water																		
					Very soft brown humus	Pt	1	5															
					Very soft gray clay w/silty clay layers	CH	2	8										150	45				
10																							
					w/silty sand layers & lenses		3	13	79	55	99	UC	--	60									
							4	18										425	135				
20					Very soft to soft gray sandy clay w/silty sand layers & shell fragments	CL																	
					Extremely soft to very soft gray sandy clay w/shell fragments	CL	5	23	39	83	115	UC	--	75									
30																							
40																							
50																							

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

(Sheet 1 of 1)

X = 3,645,149.94 **Y =** 359,925.66 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/12/02 **Boring:** SHORE-03 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Mini Vane (psf) Und	Mini Vane (psf) Rem	<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
0					Water																		
					Very soft brown & black humus	Pt	1	5													39.6		
					Extremely soft to very soft gray clay w/silty sand layers	CH	2	8	55	68	105	UC	--	40									
10					w/sandy silt lenses																		
							3	13							89	23	66	110	60				CON
					Extremely soft to very soft gray sandy clay w/clay lenses & shell fragments	CL	4	18	55	69	106	OB	--	90									
20																							
					Very soft gray clay w/shells	CH	5	23	41						87	22	65						
30																							
40																							
50																							

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

X = 3,646,393.66 Y = 356,749.77 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/12/02 **Boring:** SHORE-04 **Refer to "Legends & Notes"**

Visual Classification	USC
Water	
Very soft brown humus	Pt
Extremely soft to very soft gray clay w/organic matter & silt pockets	CH
Very loose to loose gray sandy silt	ML
Extremely soft to very soft gray clay w/silt lenses & shell fragments	CH
w/silty sand lenses & shell fragments	

Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Mini Vane (psf) Und	Mini Vane (psf) Rem	<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
1	4															
2	7										105	35				
3	13															PD
4	18													9.5		
5	23	73	57	98	UC	--	80	90	23	67						CON

Scale In Feet: 0, 10, 20, 30, 40, 50. Columns PP, SPT, SPLR, Symbol.

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

X = 3,647,465.66 **Y =** 355,285.90 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/12/02 **Boring:** SHORE-05 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density		Shear Tests			Atterberg Limits			Mini Vane (psf)		<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
										Dry	Wet	Type	ø	C	LL	PL	PI	Und	Rem				
0					Water																		
					Very soft brown humus	Pt	1	3.5															
					Extremely soft to very soft gray clay w/silty sand layers & lenses	CH	2	6.5													5.8		
10							3	11.5	79	55	98	UC	--	55									
					Extremely soft to very soft gray silty clay w/clay & sand lenses	CL	4	16.5	55	69	107	UC	--	65									
20					Very soft gray clay w/sand lenses & shell fragments	CH	5	21.5										185	60				
30																							
40																							
50																							

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

X = 3,650,443.35 Y = 356,245.20 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/12/02 **Boring:** SHORE-06 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Mini Vane (psf) Und	Mini Vane (psf) Rem	<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
0					Water																		
					Extremely soft to very soft dark gray sandy clay w/organic matter & shells	CL	1	6													10.4		
					Very loose gray fine sand w/clay layers	SP	2	9	37	81	112	OB	--	105									
10					Very soft gray clay w/sand lenses	CH	3	14										90	35				
20					Extremely soft to very soft gray sandy clay w/clayey sand lenses & shell fragments	CL	4	19	43	79	113	UC	--	65									
					Very loose to loose gray clayey sand w/shell fragments	SC	5	24												36.4			
30																							
40																							
50																							

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

X = 3,644,328.13 **Y =** 355,187.72 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/07/02 **Boring:** FILL-01 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density		Shear Tests			Atterberg Limits			Mini Vane (psf)		<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
										Dry	Wet	Type	ø	C	LL	PL	PI	Und	Rem				
0					Extremely soft brown humus & roots	Pt	1	0															
							2	4															
					Very soft gray clay w/humus	CH																	
					Very loose to loose gray sandy silt w/wood & clay lenses	ML	3	8												57.8			
10																							
							4	14															
					Very soft gray clay w/silt pockets & lenses	CH	5	18										195	95				
20																							
30																							
40																							
50																							

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

X = 3,648,360.32 **Y =** 352,869.66 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/07/02 **Boring:** FILL-02 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density		Shear Tests			Atterberg Limits			Mini Vane (psf)		<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
										Dry	Wet	Type	ø	C	LL	PL	PI	Und	Rem				
0					Very soft brown & black humus w/roots	Pt	1	0							360	137	223						CON
							2	4													83.1		
					Very loose to loose gray sandy silt	ML	3	8															
10																							
					w/clay layers		4	13															PD
							5	18															
20																							
30																							
40																							
50																							

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

X = 3,649,824.06 **Y =** 353,366.39 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/08/02 **Boring:** FILL-03 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density Dry	Density Wet	Shear Tests Type	Shear Tests ø	Shear Tests C	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Mini Vane (psf) Und	Mini Vane (psf) Rem	<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
0					Very soft brown humus w/roots	Pt	1	0															
					Extremely soft to very soft brown & gray organic clay w/roots	OH	2	4	168	30	80	UC	--	30									
10					Very loose gray silty sand w/clay lenses	SM	3	9															
					Loose gray silty sand	SM	4	14												14.6			
20					w/clay lenses		5	19															
30																							
40																							
50																							

Comments:

EUSTIS ENGINEERING COMPANY, INC.

LOG OF BORING AND TEST RESULTS

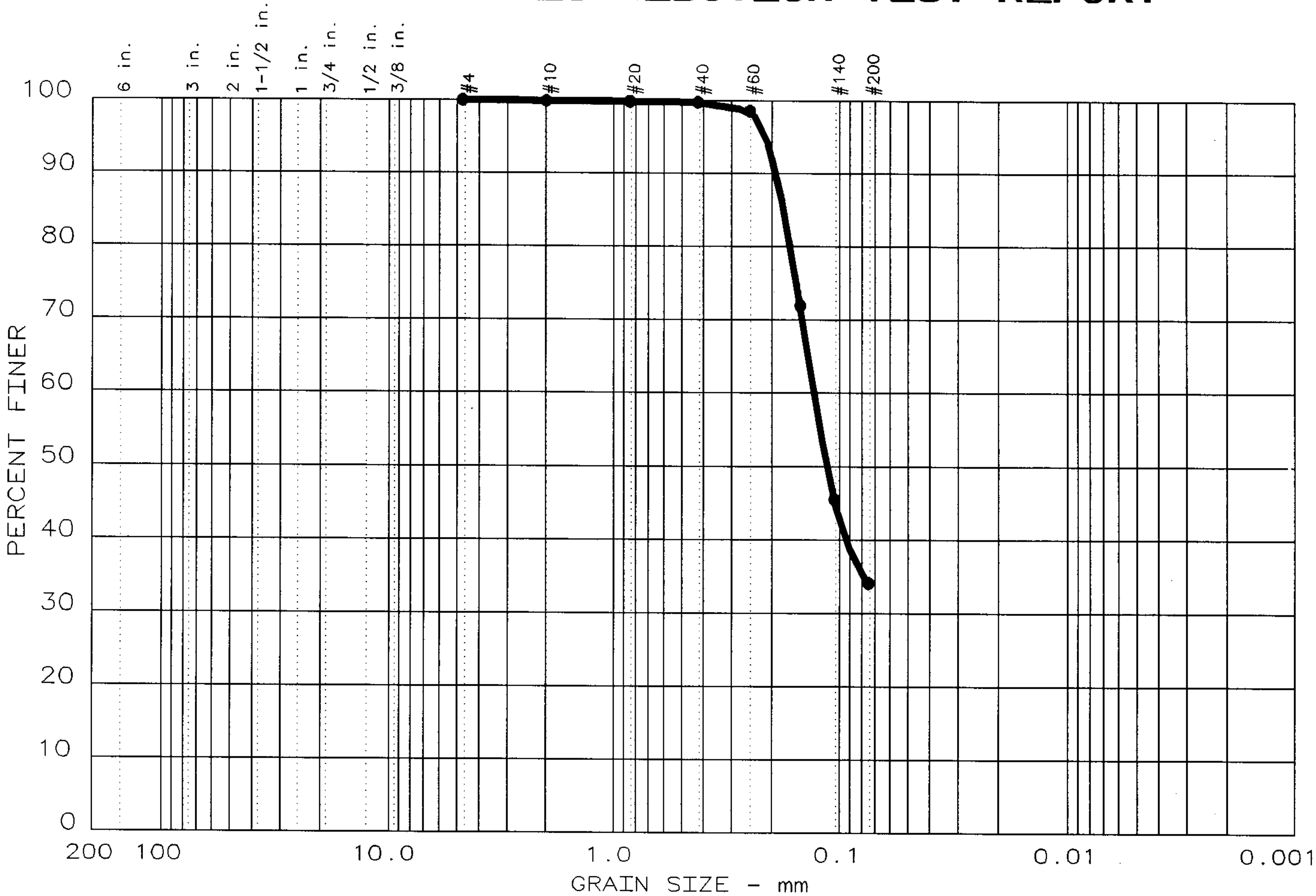
STATE OF LOUISIANA
LITTLE LAKE SHORELINE PROTECTION AND MARSH CREATION
LAFOURCHE PARISH, LOUISIANA

X = 3,651,895.39 **Y =** 354,525.42 **Datum:** NAD 83 FT **Job No.:** 17623 **Date Drilled:** 11/08/02 **Boring:** FILL-04 **Refer to "Legends & Notes"**

Scale In Feet	PP	SPT	SPLR	Symbol	Visual Classification	USC	Sample Number	Depth In Feet	Water Content Percent	Density		Shear Tests			Atterberg Limits			Mini Vane (psf)		<No.200 Sieve	Organic Content	Specific Gravity	Other Tests
										Dry	Wet	Type	ø	C	LL	PL	PI	Und	Rem				
0					Very soft brown humus w/roots, clay layers, & shell fragments	Pt	1	4										180	75				
10					Extremely soft to very soft gray clay w/silty sand layers & lenses	CH	2	9										135	45				
					Very loose gray silty sand w/clay lenses	SM	3	14															
20					Extremely soft to very soft gray clay w/silty sand lenses & layers, & shell fragments	CH	4	19							59	19	40						
30																							
40																							
50																							

Comments:

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	0.0	0.0	65.9	34.1		SC		

SIEVE inches size	PERCENT FINER ●		
	GRAIN SIZE		
D_{60}	0.13		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ●		
4	100.0		
10	99.9		
20	99.8		
40	99.8		
60	98.5		
100	72.0		
140	45.5		
200	34.1		

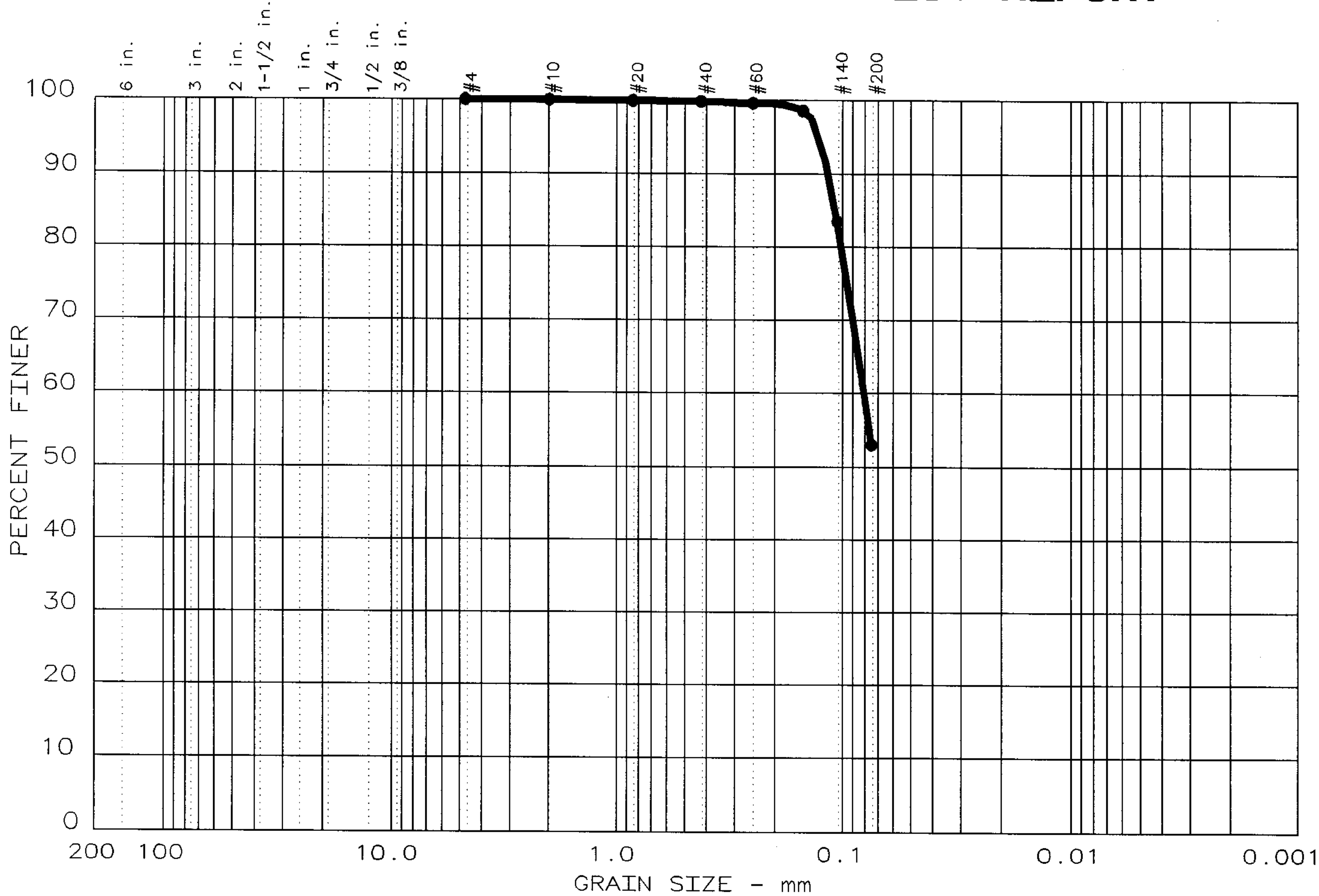
Sample information:
● BORR-02, Sample 4
Lo Gray CLAYEY SAND
w/ shell fragments

Remarks:
Sample depth 17.5'

Eustis Engineering Company, Inc.

Project No.: 17623
Project: Little Lake Shoreline Protection
Date: 12-11-03
Data Sheet No. ——

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	0.0	0.0	47.0	53.0		ML		

SIEVE inches size	PERCENT FINER ●		
	GRAIN SIZE		
D_{60}	0.08		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ●		
4	100.0		
10	100.0		
20	99.9		
40	99.8		
60	99.6		
100	98.5		
140	83.5		
200	53.0		

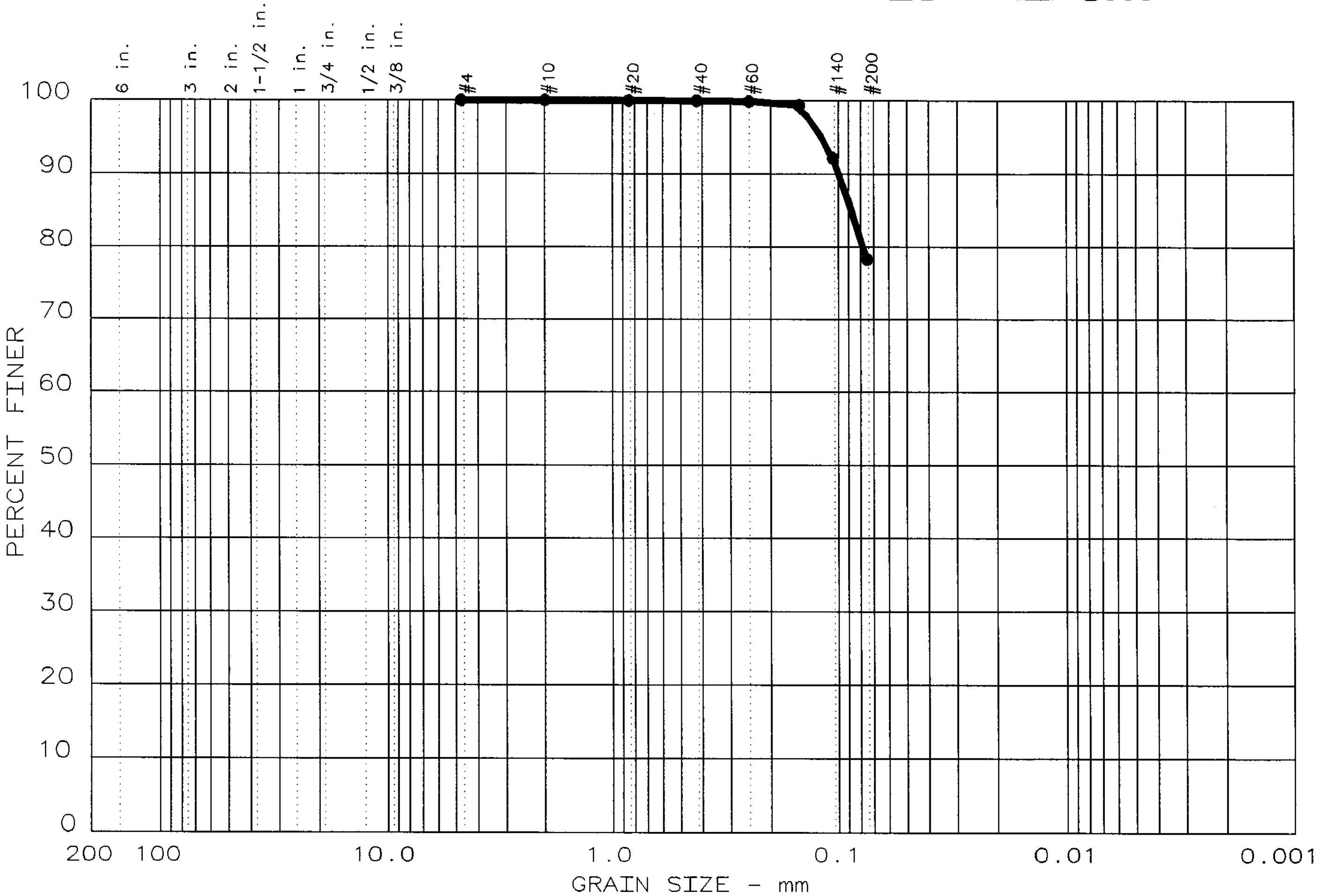
Sample information:
● SHORE-04, Sample 3
Lo Gray SANDY SILT

Remarks:
Sample depth 13.0'

Eustis Engineering Company, Inc.

Project No.: 17623
Project: Little Lake Shoreline Protection
Date: 12-12-03
Data Sheet No. ____

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	0.0	0.0	21.7	78.3		ML		

SIEVE inches size	PERCENT FINER ●		
	GRAIN SIZE		
D_{60} D_{30} D_{10}			
	COEFFICIENTS		
C_c C_u			

SIEVE number size	PERCENT FINER ●		
4	100.0		
10	100.0		
20	100.0		
40	99.9		
60	99.8		
100	99.3		
140	92.1		
200	78.3		

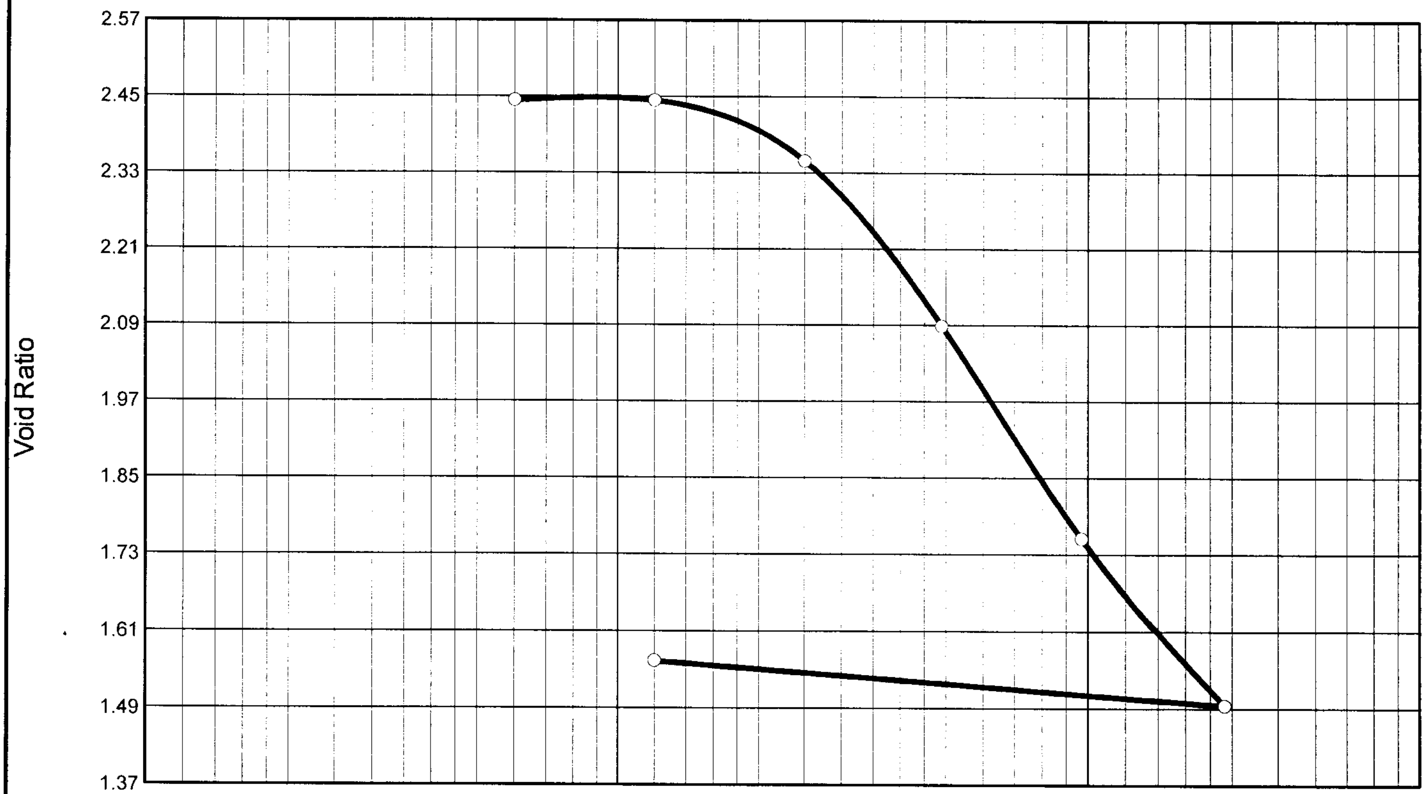
Sample information:
● FILL-02, Sample 4
vLo Gray SANDY SILT
w/ roots, clay layers

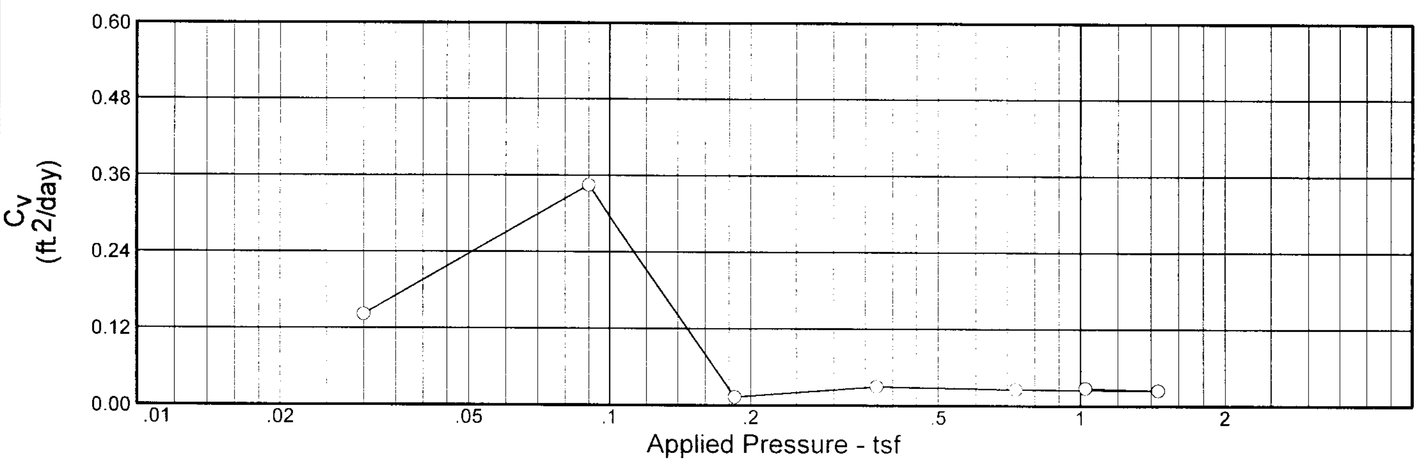
Remarks:
Sample depth 13.0'

Eustis Engineering Company, Inc.

Project No.: 17623
Project: Little Lake Shoreline Protection
Date: 12-12-03
Data Sheet No. ____

CONSOLIDATION TEST REPORT





Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (tsf)	C_c	Initial Void Ratio
Saturation	Moisture							
98.2 %	92.1 %	47.8	89	66	2.72	0.27	1.09	2.552

MATERIAL DESCRIPTION	USCS	AASHTO
vSo Gr CLAY w/ sasi len	CH	

Project No. 17623 **Client:** Perrin & Carter, Inc.

Project: Louisiana, State Of - Little Lake Shoreline Protection & Marsh Creation DNR Contract No. 2503-02-33

Source: Shore-03 **Sample No.:** 3 **Elev./Depth:** -12.0/13.0'

Remarks:
Tested by LWR

CONSOLIDATION TEST REPORT

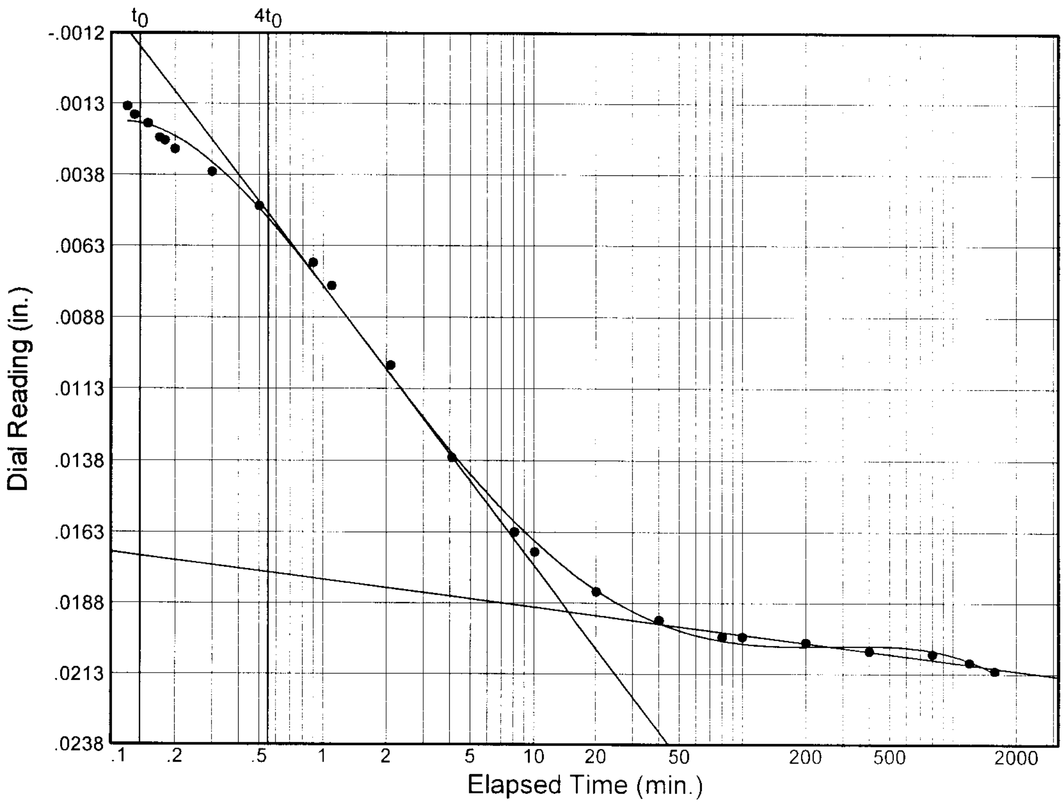
EUSTIS ENGINEERING COMPANY, INC.

Figure No.

Dial Reading vs. Time

Project No.: 17623
Project: Louisiana, State Of - Little Lake Shoreline Protection & Marsh Creation DNR Contract No. 2503-02-33

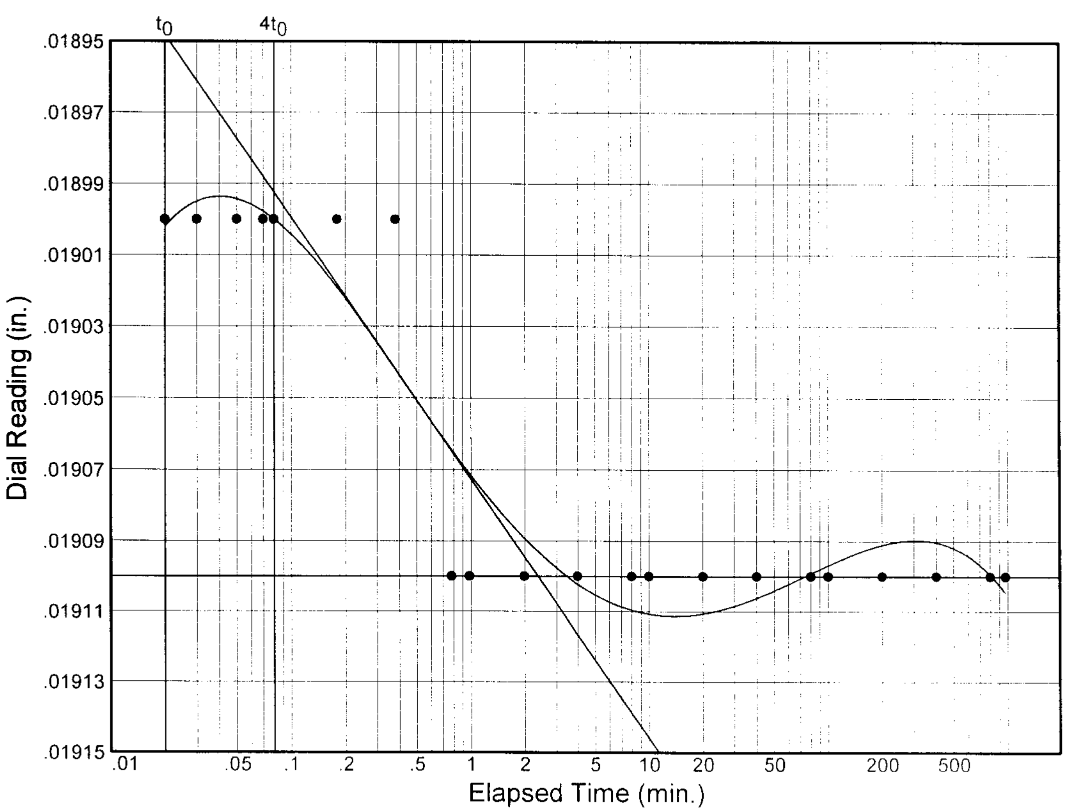
Source: Shore-03 Sample No.: 3 Elev./Depth: -12.0/13.0'



Load No.= 1
Load= 0.06 tsf
D_0 = -0.00137
D_{50} = 0.00887
D_{100} = 0.01911
T_{50} = 1.32 min.

C_v @ T_{50}
0.14 ft.^{2}/day

C_α = 0.002



Load No.= 2
Load= 0.12 tsf
D_0 = 0.01900
D_{50} = 0.01905
D_{100} = 0.01910
T_{50} = 0.52 min.

C_v @ T_{50}
0.34 ft.^{2}/day

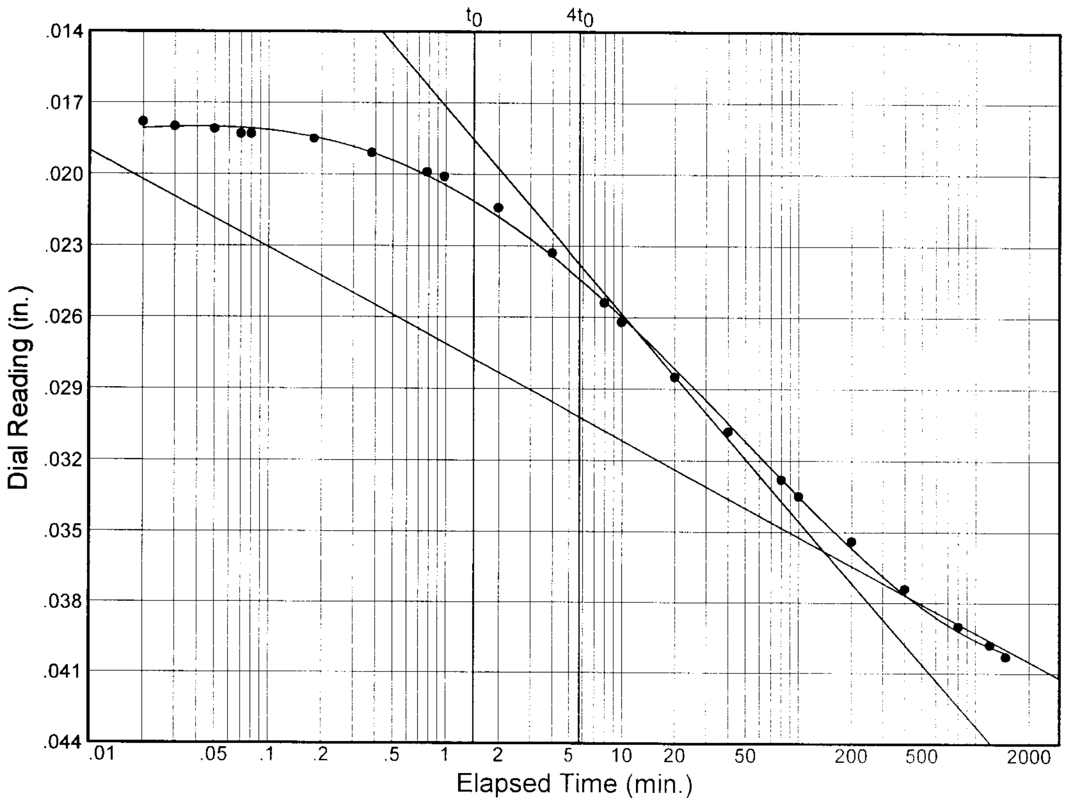
Figure No.

EUSTIS ENGINEERING COMPANY, INC.

Dial Reading vs. Time

Project No.: 17623
Project: Louisiana, State Of - Little Lake Shoreline Protection & Marsh Creation DNR Contract No. 2503-02-33

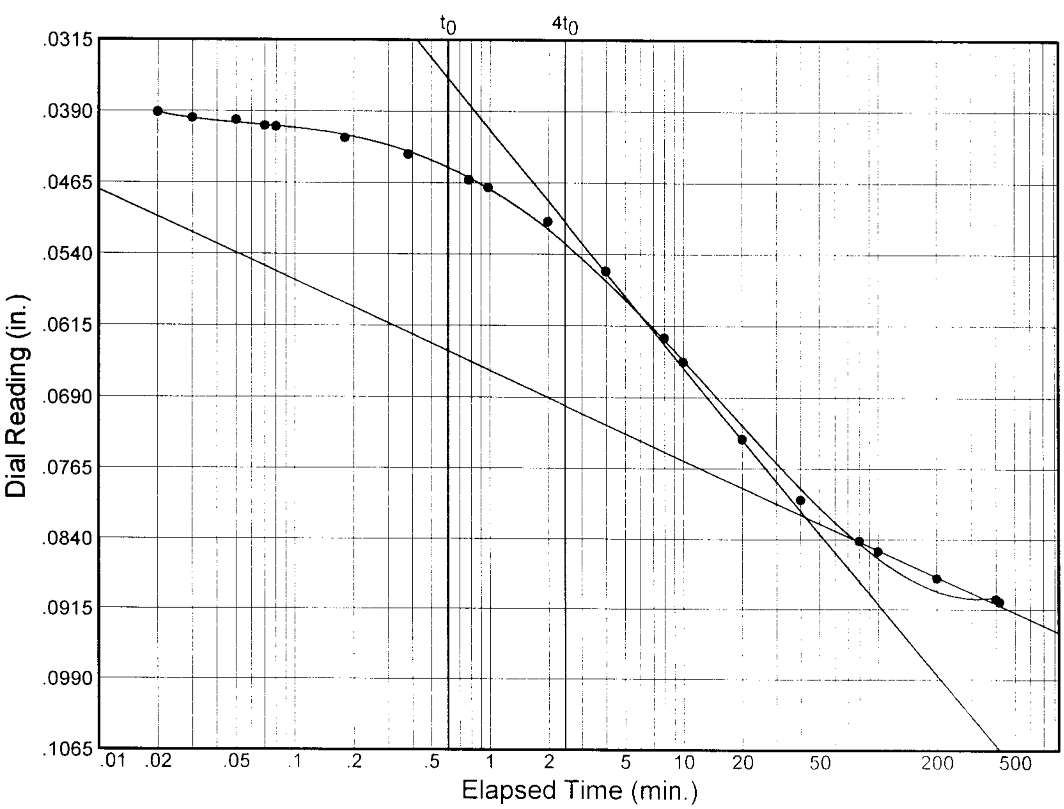
Source: Shore-03 | Sample No.: 3 | Elev./Depth: -12.0/13.0'



Load No.= 3
Load= 0.25 tsf
D_0 = 0.01784
D_{50} = 0.02683
D_{100} = 0.03582
T_{50} = 13.15 min.

C_v @ T_{50}
0.01 ft.^{2}/day

C_α = 0.007



Load No.= 4
Load= 0.49 tsf
D_0 = 0.03687
D_{50} = 0.05926
D_{100} = 0.08165
T_{50} = 5.32 min.

C_v @ T_{50}
0.03 ft.^{2}/day

C_α = 0.016

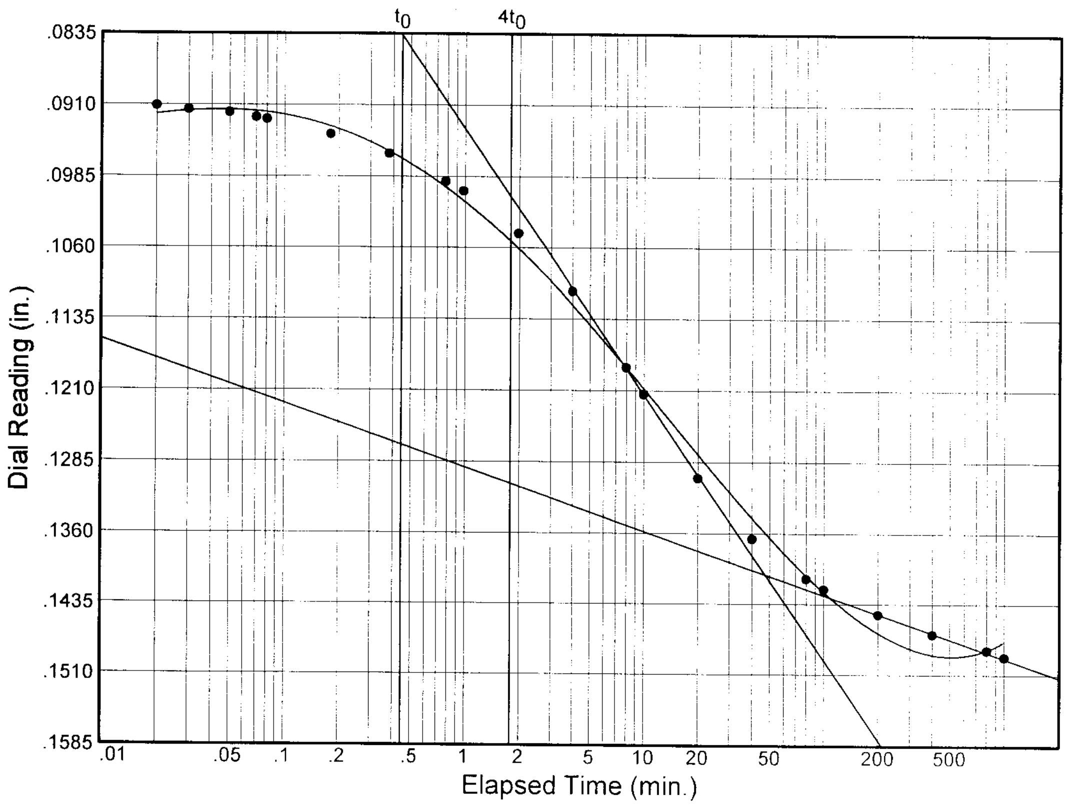
Figure No.

EUSTIS ENGINEERING COMPANY, INC.

Dial Reading vs. Time

Project No.: 17623
Project: Louisiana, State Of - Little Lake Shoreline Protection & Marsh Creation DNR Contract No. 2503-02-33

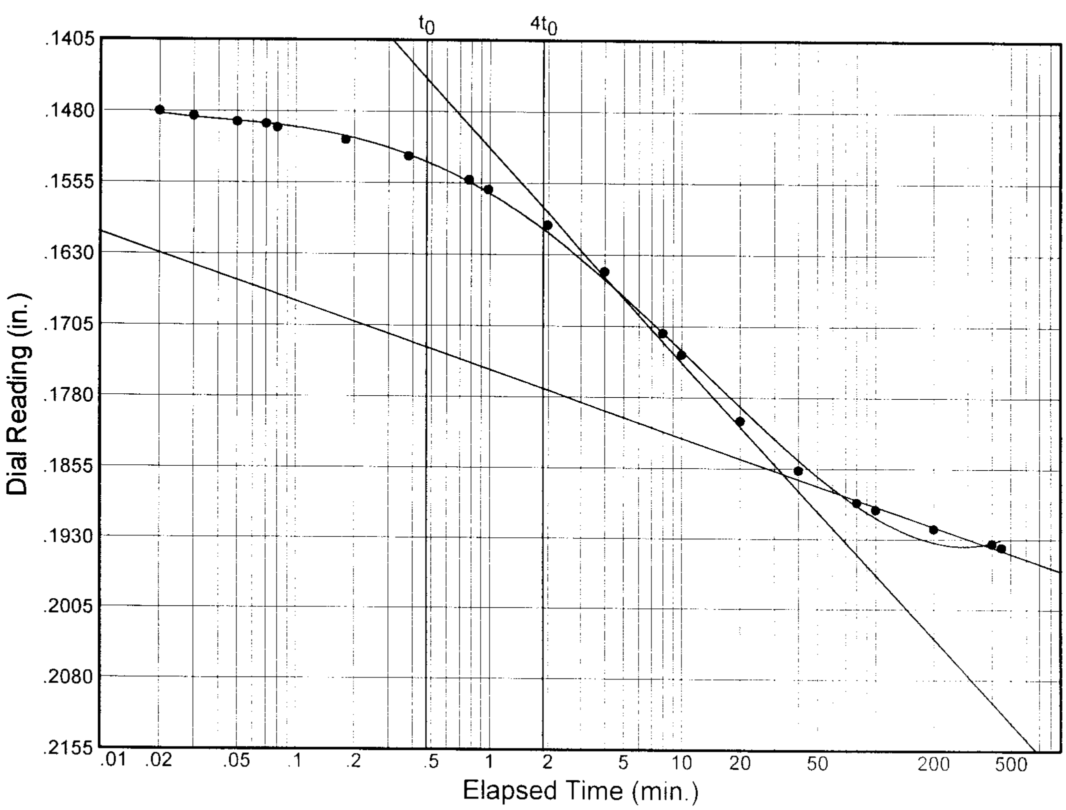
Source: Shore-03 | Sample No.: 3 | Elev./Depth: -12.0/13.0'



Load No.= 5
Load= 0.97 tsf
D_0 = 0.08790
D_{50} = 0.11413
D_{100} = 0.14037
T_{50} = 5.00 min.

C_v @ T_{50}
0.03 ft.^{2}/day

C_α = 0.013



Load No.= 6
Load= 1.93 tsf
D_0 = 0.14624
D_{50} = 0.16616
D_{100} = 0.18609
T_{50} = 4.28 min.

C_v @ T_{50}
0.02 ft.^{2}/day

C_α = 0.015

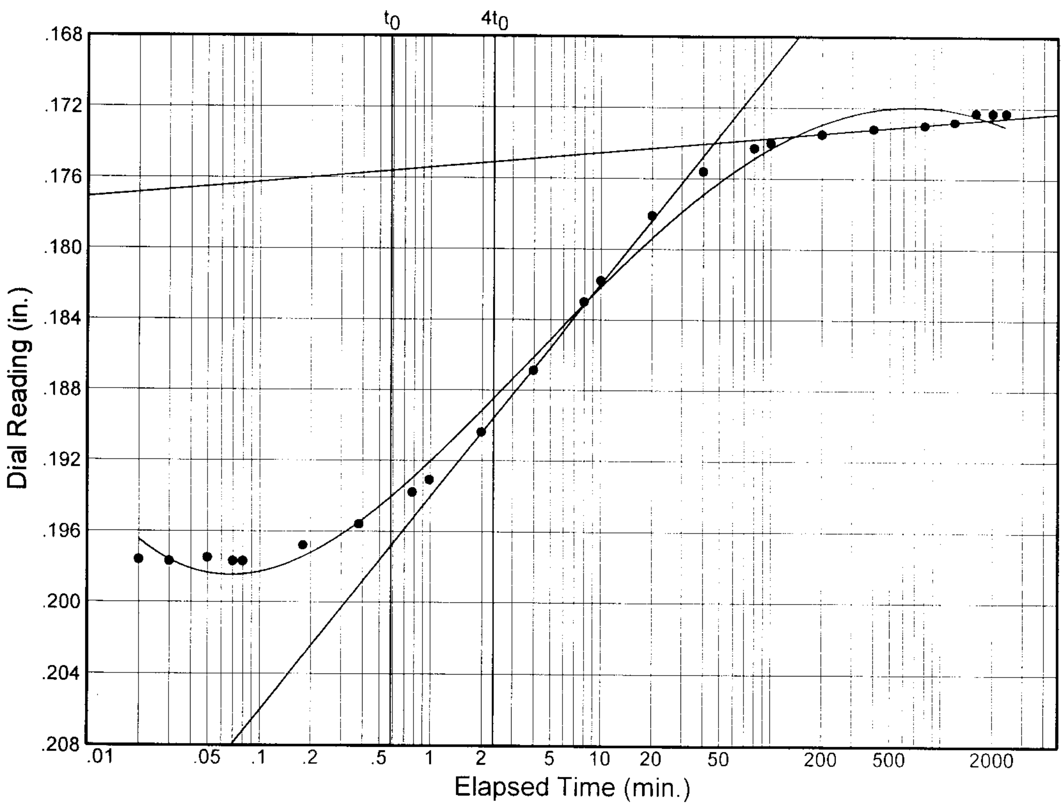
Figure No.

EUSTIS ENGINEERING COMPANY, INC.

Dial Reading vs. Time

Project No.: 17623
Project: Louisiana, State Of - Little Lake Shoreline Protection & Marsh Creation DNR Contract No. 2503-02-33

Source: Shore-03 Sample No.: 3 Elev./Depth: -12.0/13.0'



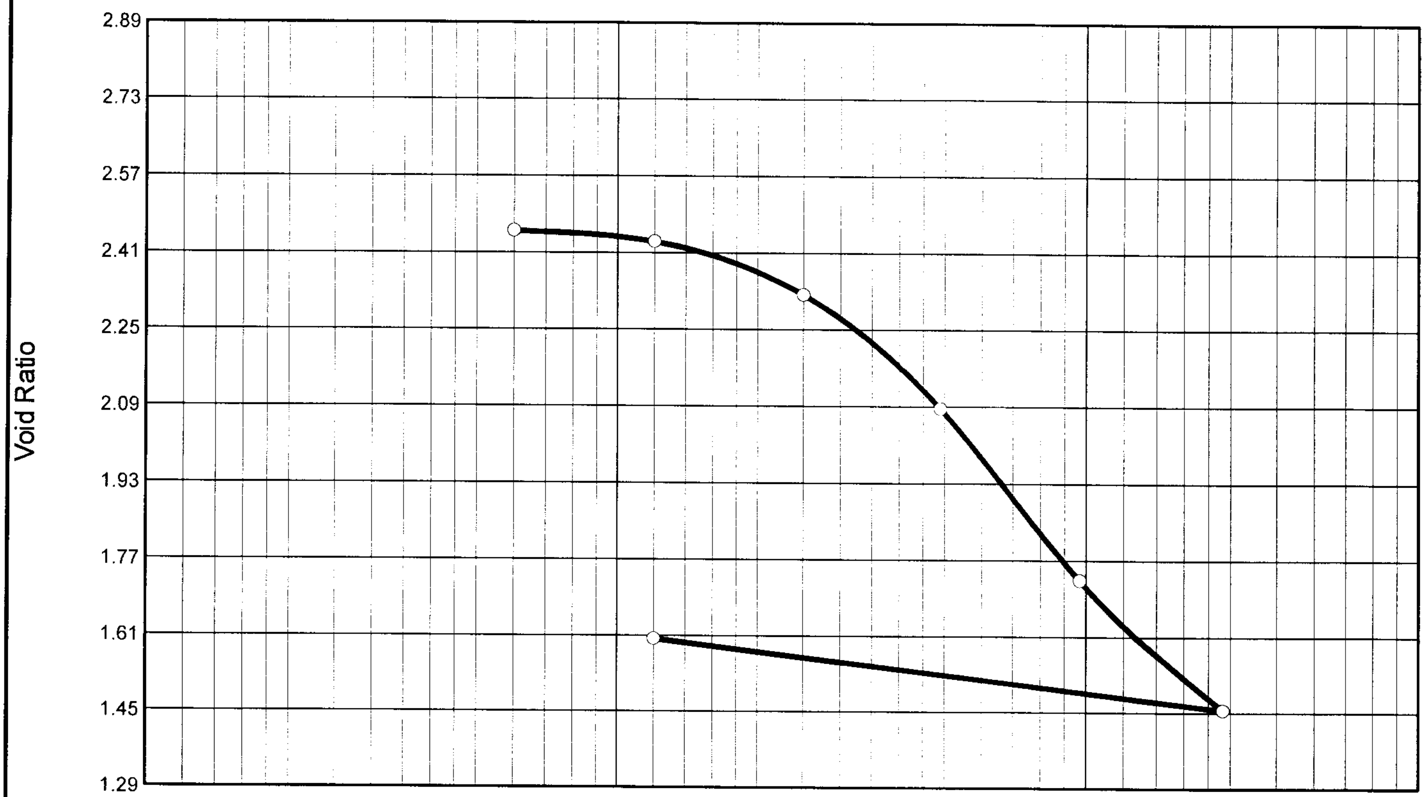
Load No.= 7
Load= 0.12 tsf
D_0 = 0.19967
D_{50} = 0.18684
D_{100} = 0.17400
T_{50} = 3.40 min.

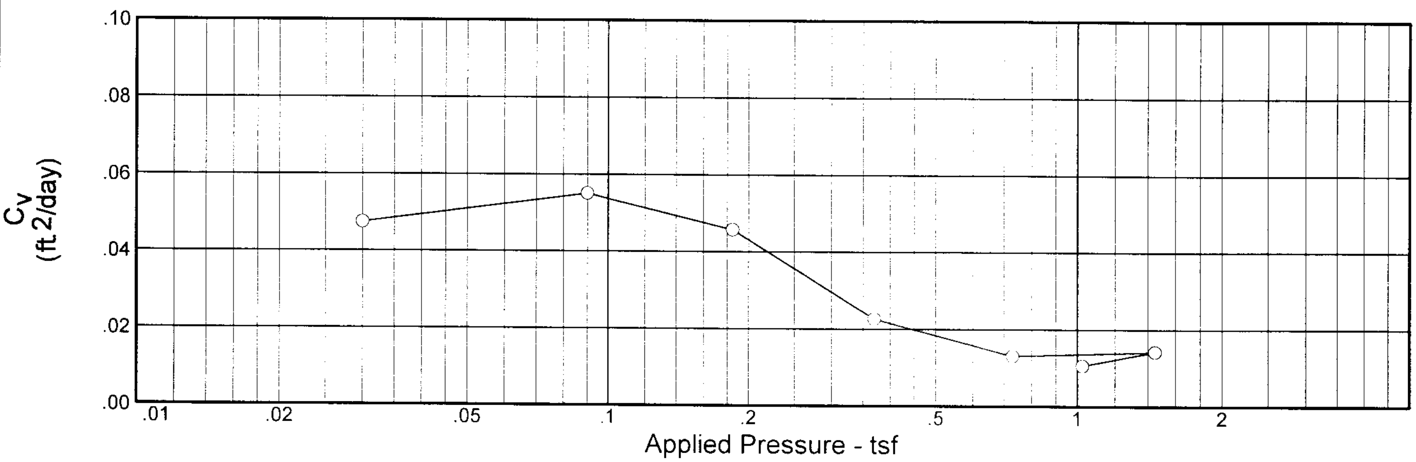
C_v @ T_{50}
0.03 ft.^{2}/day

Figure No.

EUSTIS ENGINEERING COMPANY, INC.

CONSOLIDATION TEST REPORT





Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (tsf)	C_c	Initial Void Ratio
Saturation	Moisture							
98.0 %	89.9 %	48.6	90	67	2.72	0.32	1.23	2.497

MATERIAL DESCRIPTION	USCS	AASHTO
xSo Gr CLAY w/ sisa len, sh frags	CH	

Project No. 17623 **Client:** Perrin & Carter, Inc.

Project: Louisiana, State Of - Little Lake Shoreline Protection & Marsh Creation DNR Contract No. 2503-02-33

Source: Shore-04 **Sample No.:** 5 **Elev./Depth:** -22.0/23.0'

CONSOLIDATION TEST REPORT

EUSTIS ENGINEERING COMPANY, INC.

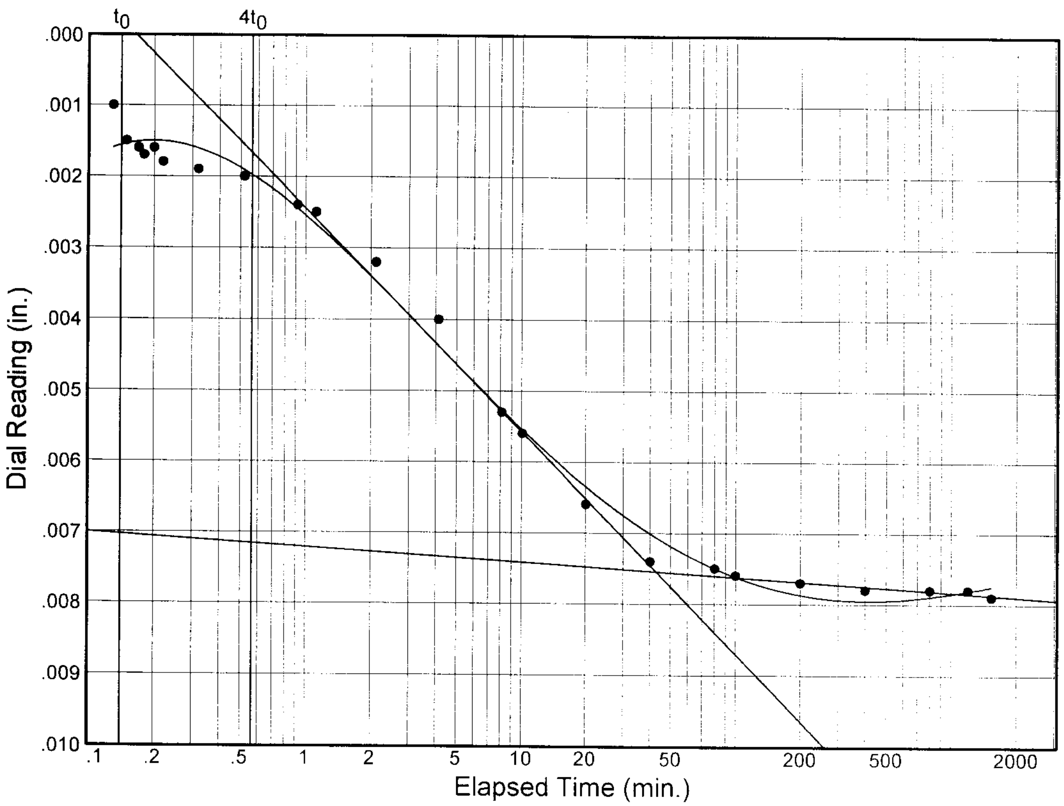
Remarks:
Tested by LWR

Figure No.

Dial Reading vs. Time

Project No.: 17623
Project: Louisiana, State Of - Little Lake Shoreline Protection & Marsh Creation DNR Contract No. 2503-02-33

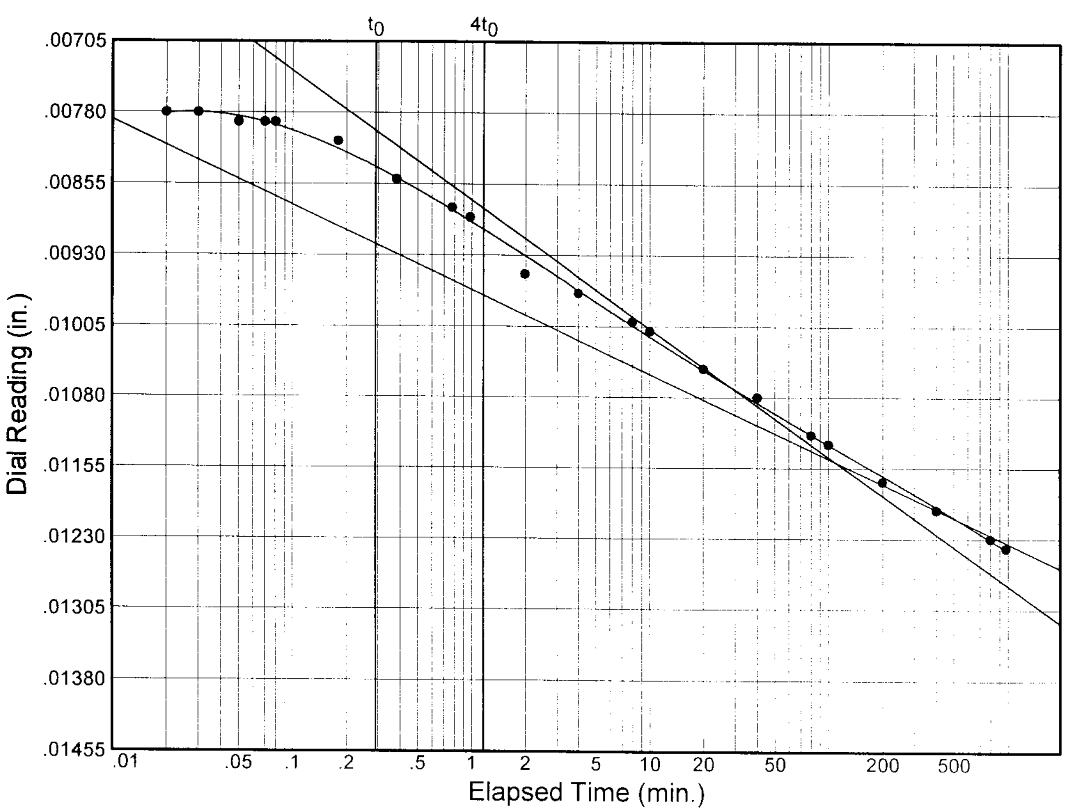
Source: Shore-04 | Sample No.: 5 | Elev./Depth: -22.0/23.0'



Load No.= 1
Load= 0.06 tsf
D_0 = 0.00115
D_{50} = 0.00435
D_{100} = 0.00755
T_{50} = 4.06 min.

C_v @ T_{50}
0.05 ft.^{2}/day

C_α = 0.000



Load No.= 2
Load= 0.12 tsf
D_0 = 0.00771
D_{50} = 0.00960
D_{100} = 0.01148
T_{50} = 3.45 min.

C_v @ T_{50}
0.06 ft.^{2}/day

C_α = 0.001

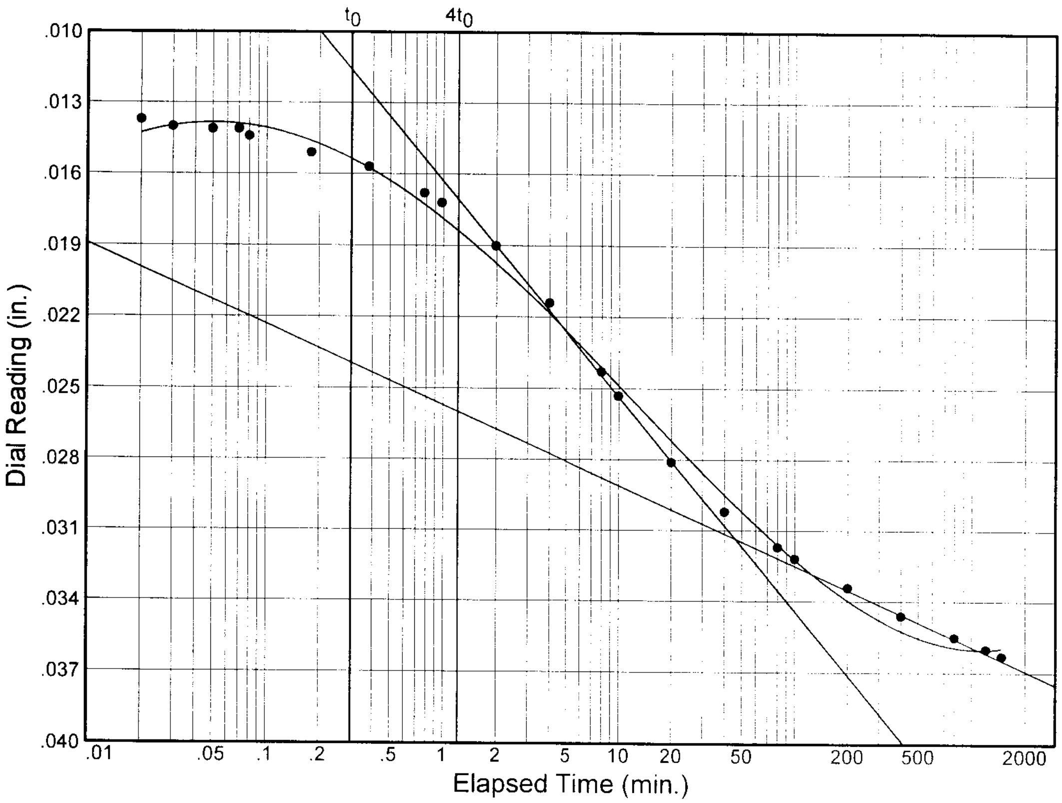
Figure No.

EUSTIS ENGINEERING COMPANY, INC.

Dial Reading vs. Time

Project No.: 17623
Project: Louisiana, State Of - Little Lake Shoreline Protection & Marsh Creation DNR Contract No. 2503-02-33

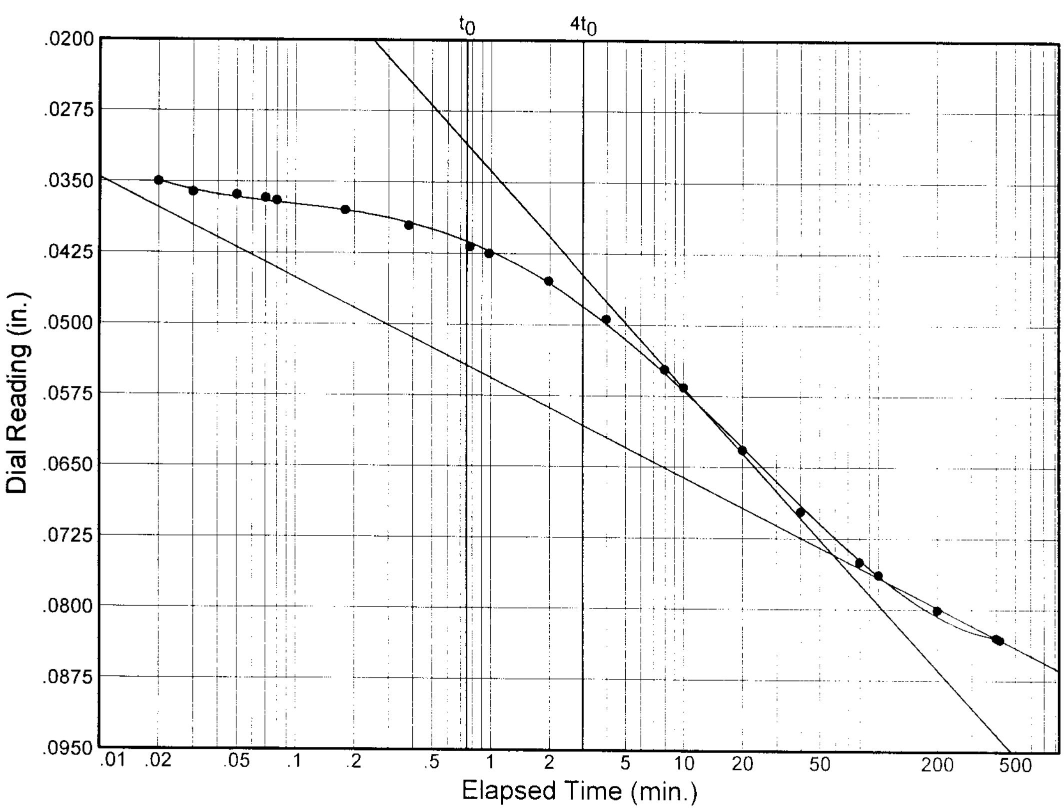
Source: Shore-04 Sample No.: 5 Elev./Depth: -22.0/23.0'



Load No.= 3
Load= 0.25 tsf
D_0 = 0.01235
D_{50} = 0.02186
D_{100} = 0.03137
T_{50} = 3.98 min.

C_v @ T_{50}
0.05 ft.^{2}/day

C_α = 0.006



Load No.= 4
Load= 0.49 tsf
D_0 = 0.03440
D_{50} = 0.05431
D_{100} = 0.07421
T_{50} = 7.22 min.

C_v @ T_{50}
0.02 ft.^{2}/day

C_α = 0.018

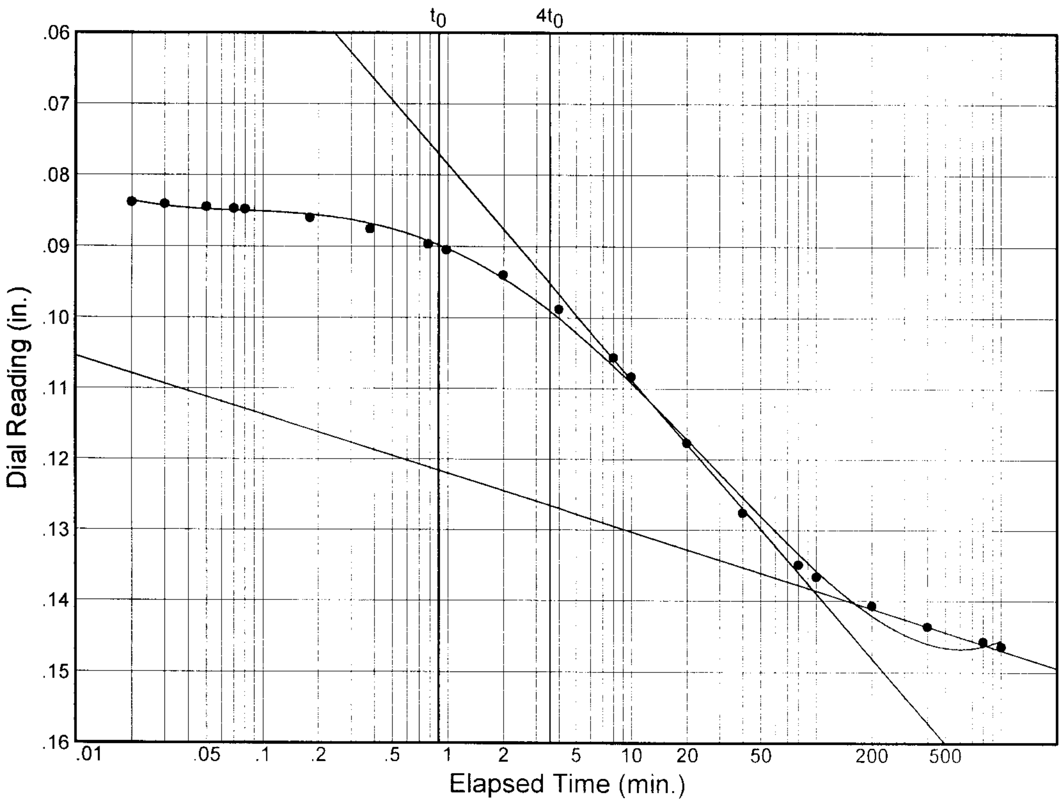
Figure No.

EUSTIS ENGINEERING COMPANY, INC.

Dial Reading vs. Time

Project No.: 17623
Project: Louisiana, State Of - Little Lake Shoreline Protection & Marsh Creation DNR Contract No. 2503-02-33

Source: Shore-04 | Sample No.: 5 | Elev./Depth: -22.0/23.0'



Load No.= 5

Load= 0.97 tsf

D_0 = 0.08055

D_{50} = 0.10951

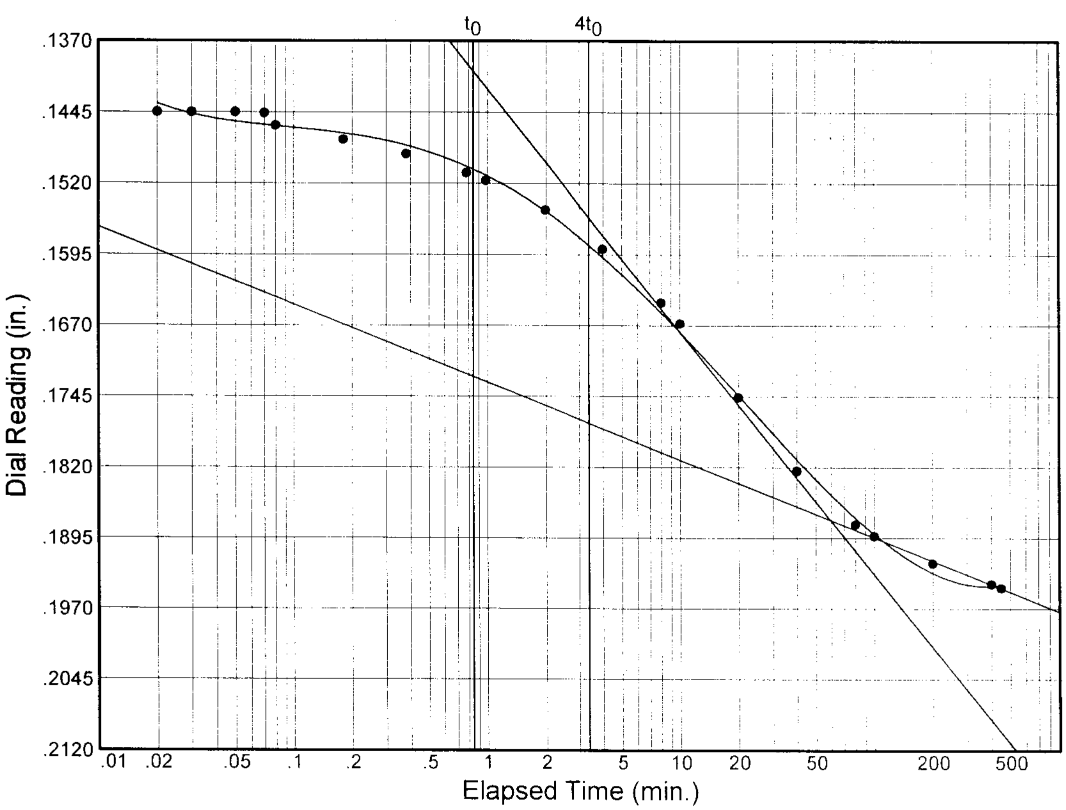
D_{100} = 0.13847

T_{50} = 10.25 min.

C_v @ T_{50}

0.01 ft.^{2}/day

C_α = 0.015



Load No.= 6

Load= 1.93 tsf

D_0 = 0.14252

D_{50} = 0.16506

D_{100} = 0.18761

T_{50} = 7.48 min.

C_v @ T_{50}

0.01 ft.^{2}/day

C_α = 0.017

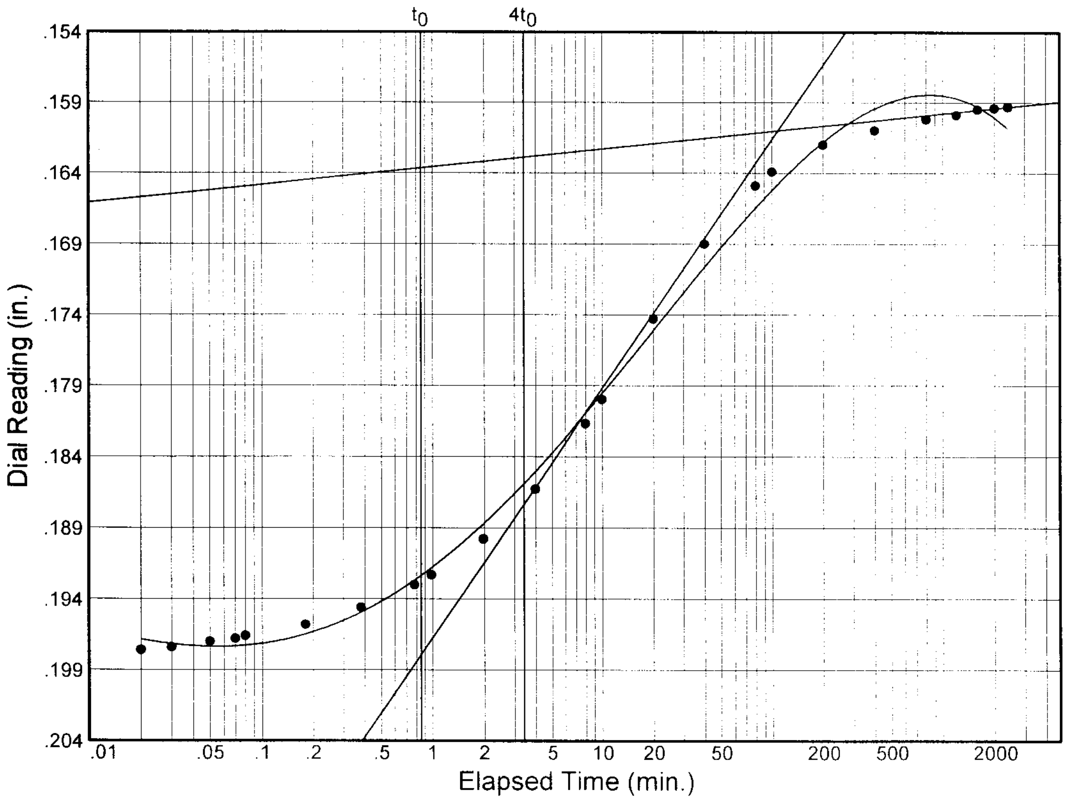
Figure No.

EUSTIS ENGINEERING COMPANY, INC.

Dial Reading vs. Time

Project No.: 17623
Project: Louisiana, State Of - Little Lake Shoreline Protection & Marsh Creation DNR Contract No. 2503-02-33

Source: Shore-04 Sample No.: 5 Elev./Depth: -22.0/23.0'



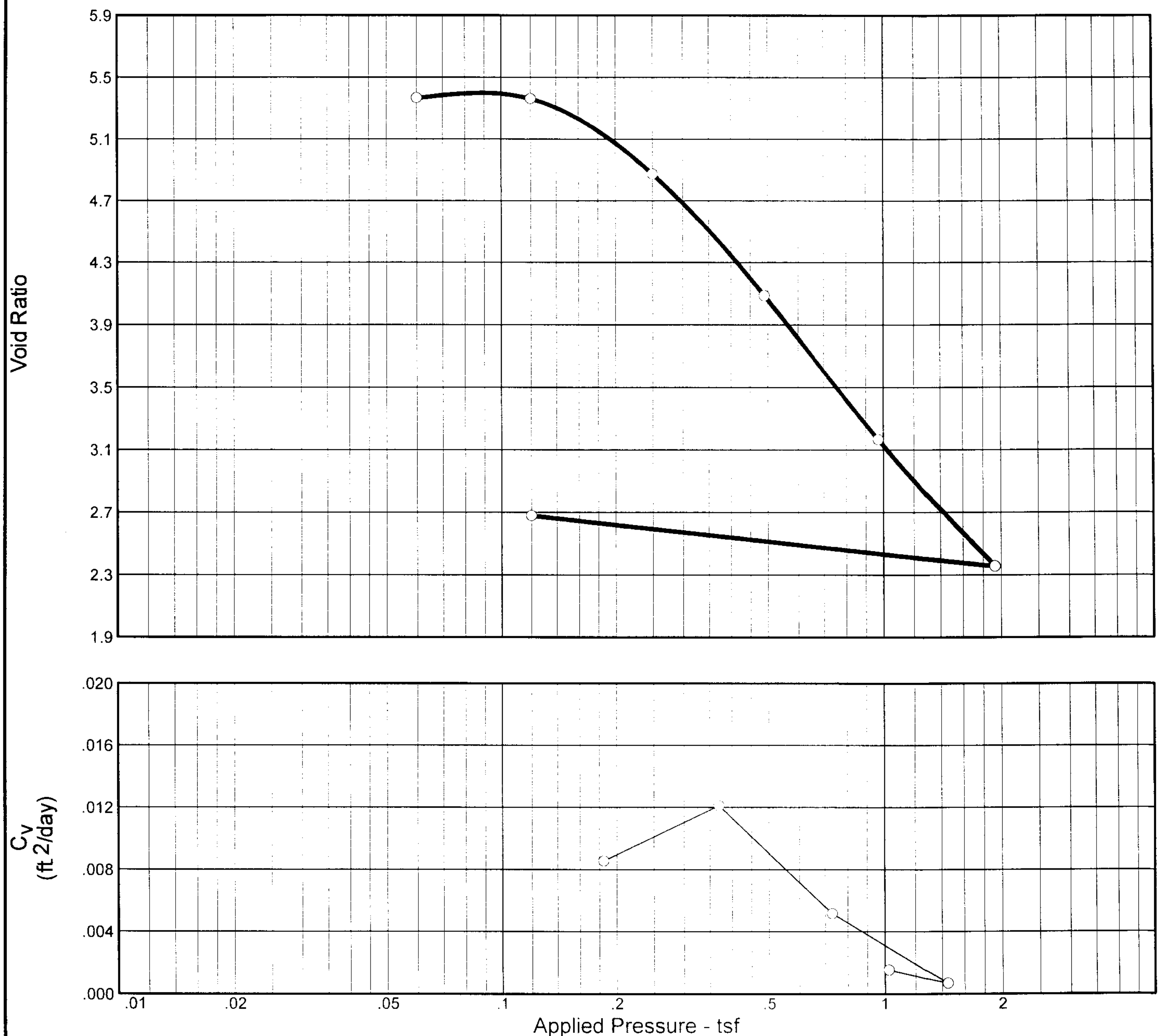
Load No.= 7
Load= 0.12 tsf
D_0 = 0.19882
D_{50} = 0.17991
D_{100} = 0.16100
T_{50} = 9.45 min.

C_v @ T_{50}
0.01 ft.^{2}/day

Figure No.

EUSTIS ENGINEERING COMPANY, INC.

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (tsf)	C_c	Initial Void Ratio
Saturation	Moisture							
96.8 %	342.8 %	15.2	360	223	1.80	0.24	3.04	6.374

MATERIAL DESCRIPTION	USCS	AASHTO
So Br HUMUS w/ rts	PT	

Project No. 17623 **Client:** Perrin & Carter, Inc.

Project: Louisiana, State Of - Little Lake Shoreline Protection & Marsh Creation DNR Contract No. 2503-02-33

Source: Fill-02 **Sample No.:** 1 **Elev./Depth:** -0.5/0.5'

Remarks:
Tested by LWR

CONSOLIDATION TEST REPORT

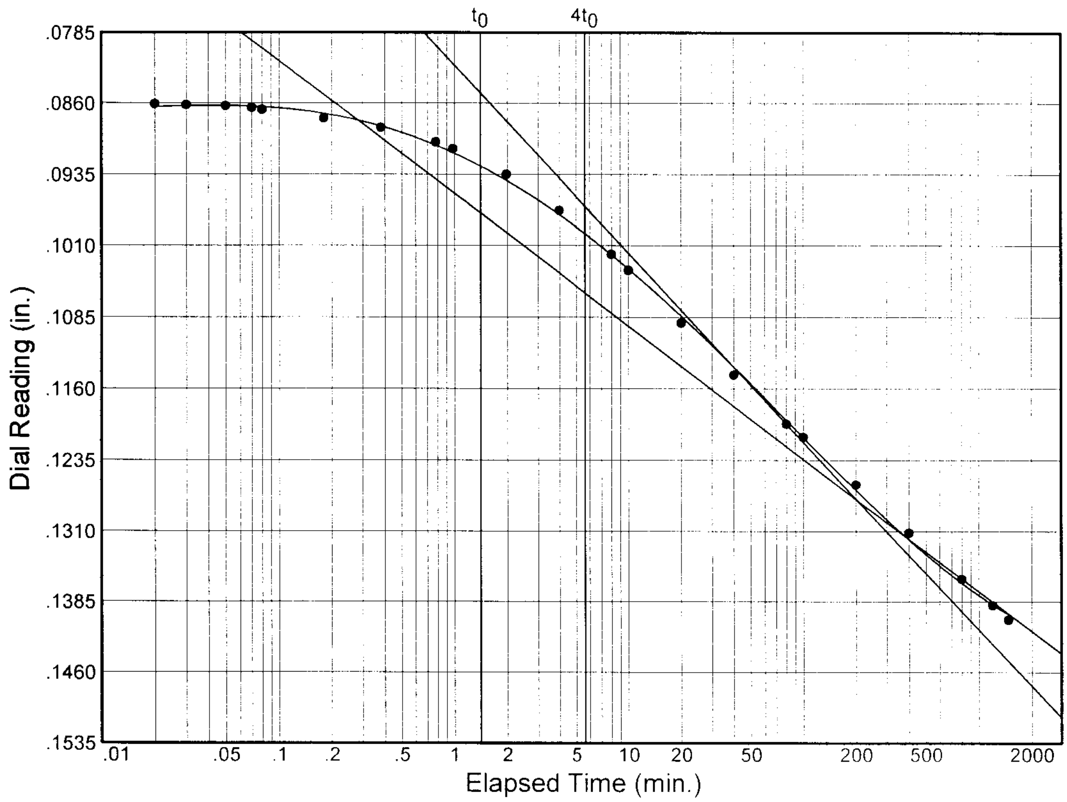
EUSTIS ENGINEERING COMPANY, INC.

Figure No.

Dial Reading vs. Time

Project No.: 17623
Project: Louisiana, State Of - Little Lake Shoreline Protection & Marsh Creation DNR Contract No. 2503-02-33

Source: Fill-02 Sample No.: 1 Elev./Depth: -0.5/0.5'



Load No.= 3

Load= 0.25 tsf

D_0 = 0.08548

D_{50} = 0.10661

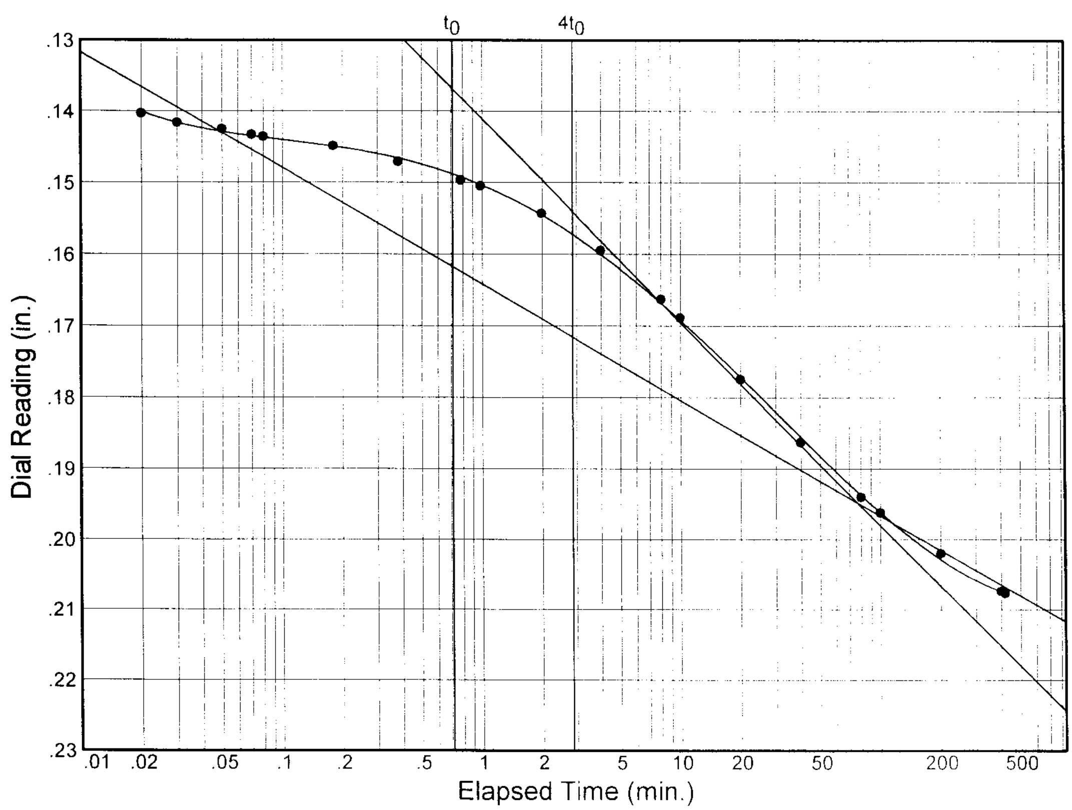
D_{100} = 0.12774

T_{50} = 15.65 min.

C_V @ T_{50}

0.01 ft.^{2}/day

C_α = 0.026



Load No.= 4

Load= 0.49 tsf

D_0 = 0.14038

D_{50} = 0.16762

D_{100} = 0.19487

T_{50} = 8.62 min.

C_V @ T_{50}

0.01 ft.^{2}/day

C_α = 0.033

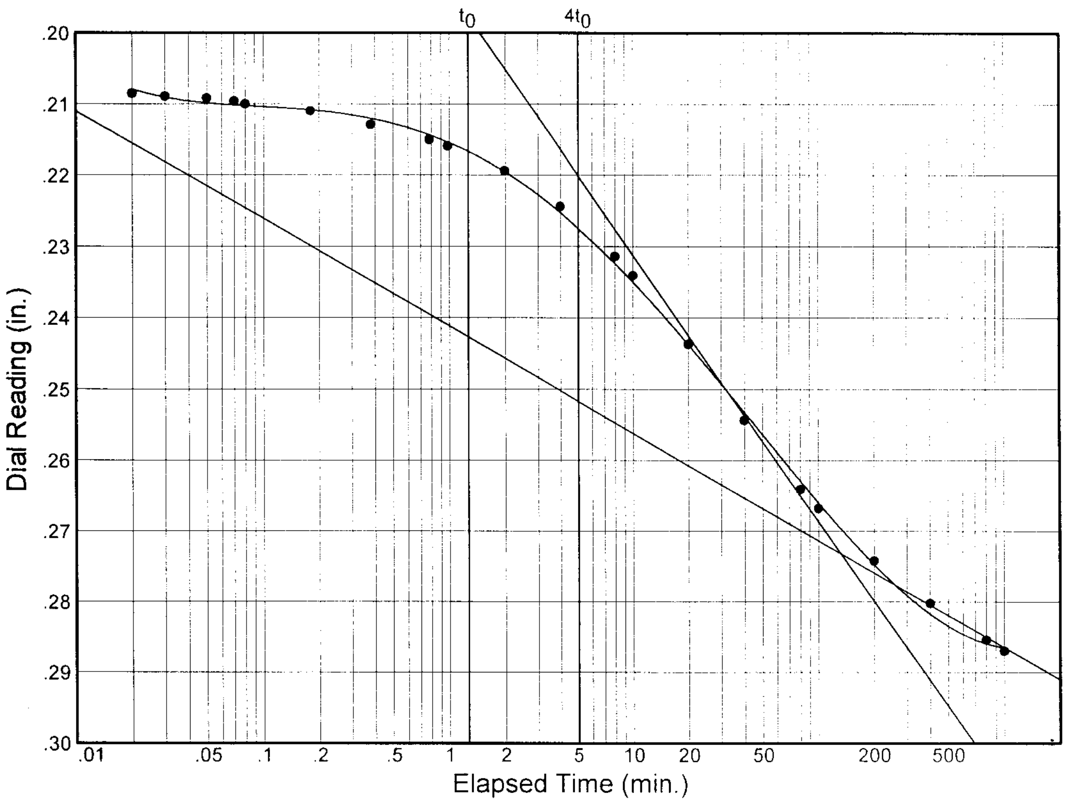
Figure No.

EUSTIS ENGINEERING COMPANY, INC.

Dial Reading vs. Time

Project No.: 17623
Project: Louisiana, State Of - Little Lake Shoreline Protection & Marsh Creation DNR Contract No. 2503-02-33

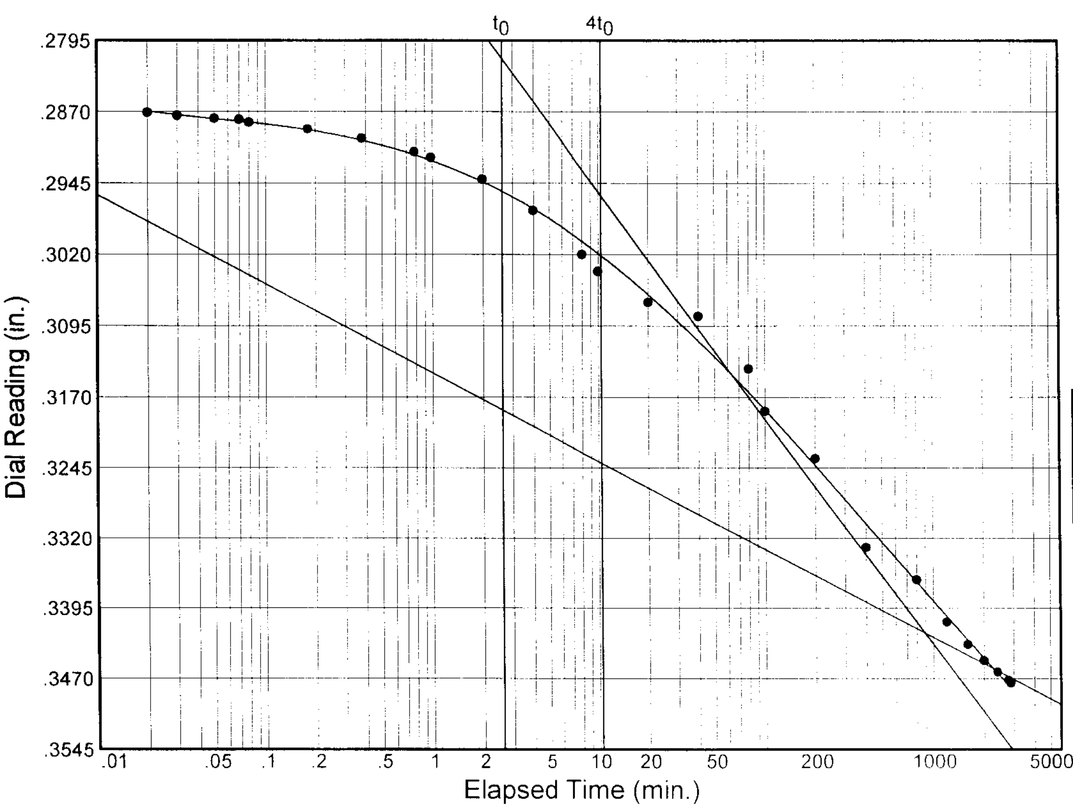
Source: Fill-02 Sample No.: 1 Elev./Depth: -0.5/0.5'



Load No.= 5
Load= 0.97 tsf
D_0 = 0.20581
D_{50} = 0.23951
D_{100} = 0.27322
T_{50} = 14.39 min.

C_v @ T_{50}
0.01 ft.^{2}/day

C_α = 0.036



Load No.= 6
Load= 1.93 tsf
D_0 = 0.28860
D_{50} = 0.31539
D_{100} = 0.34218
T_{50} = 69.78 min.

C_v @ T_{50}
0.00 ft.^{2}/day

C_α = 0.027

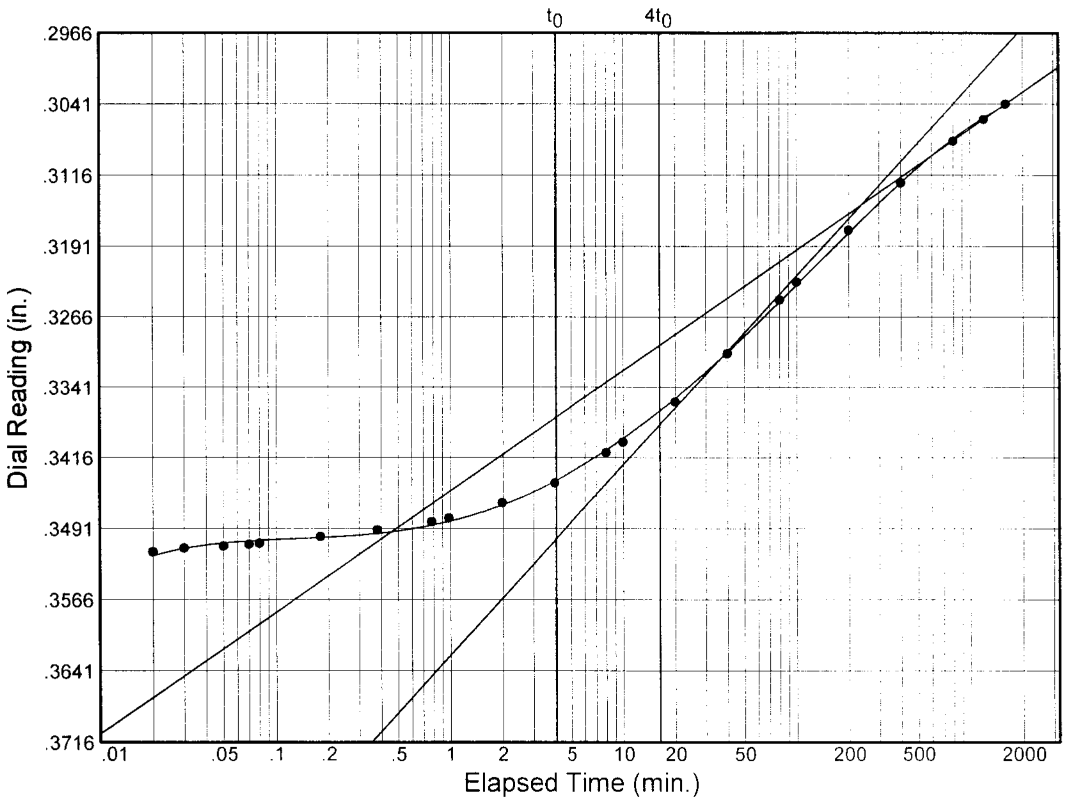
Figure No.

EUSTIS ENGINEERING COMPANY, INC.

Dial Reading vs. Time

Project No.: 17623
Project: Louisiana, State Of - Little Lake Shoreline Protection & Marsh Creation DNR Contract No. 2503-02-33

Source: Fill-02 | Sample No.: 1 | Elev./Depth: -0.5/0.5'



Load No.= 7

Load= 0.12 tsf

D_0 = 0.35143

D_{50} = 0.33305

D_{100} = 0.31467

T_{50} = 27.70 min.

C_v @ T_{50}

0.00 ft.^{2}/day

Figure No.

EUSTIS ENGINEERING COMPANY, INC.

APPENDIX II

ANALYSIS LABORATORIES, INC.
2932 LIME STREET • P. O. BOX 8666 • METAIRIE, LOUISIANA 70011
TELEPHONE (504) 889-0710 • FAX (504) 889-2613
LELAP CERTIFICATE #02079

January 14, 2003

03A-7766

Mr. Bobby Elkins
EUSTIS ENGINEERING
3011 28th Street
Metairie, LA 70002

Re: E. E. Project No. 17623
Marsh WaterA

WATER TESTING

A water sample submitted on January 9, 2003, was analyzed for pH, resistivity, sulfates and chlorides as requested. The results were as follows:

Sample Identification	pH @ 23°C Standard Units	Resistivity @ 25°C, ohm-cm	Concentration, mg/L Chlorides	Concentration, mg/L Sulfates
Marsh Water	7.48	1,930	118	22.0

Reference: Standard Methods for the Examination of Water and Wastewater, APHA, 18th Edition, 1992.

ANALYSIS LABORATORIES, INC.

Harley O. Albert
CHEMIST

ANALYSIS LABORATORIES, INC.
2932 LIME STREET • P. O. BOX 8666 • METAIRIE, LOUISIANA 70011
TELEPHONE (504) 889-0710 • FAX (504) 889-2613
LELAP CERTIFICATE #02079

January 17, 2003

03A-7766s

Mr. Bobby Elkins
EUSTIS ENGINEERING
3011 28th Street
Metairie, LA 70002

Re: E. E. Project No. 17623
Marsh Water

WATER TESTING

A water sample submitted on January 9, 2003, was analyzed for salinity as requested. The result was as follows:

Salinity @ 15°C = 0.25 ppt

Analyzed: 1-17-03/0840
Analyst: R.A.

Reference: Standard Methods for the Examination of Water and Wastewater, APHA, 18th Edition, 1992.

Method: 2520B

ANALYSIS LABORATORIES, INC.

Harley O. Albert
CHEMIST

By: L. Rome

SETTLING COLUMN DATA SHEET

Project ID: Little Lake - 17623

Date: 4-4-03

Analyst:

Initial Conc: 121 g/L

Salinity: 0.25 ppt

Specifc Gravity: 2.70

Date	Time	Elapsed Time	Surface Water Height	Solids Interface Height	Coarse Material Height	Ports Sampled/ Type of Analysis
3-12-03	0830	30 min	6.84	6.80	–	
	0900	60 min	6.84	6.78	–	
	1015	165 min	6.78	6.64	–	
	1200	240 min	6.78	6.53	–	
	1500	420 min	6.72	6.20	–	
	2000	720 min	6.64	5.72	–	
3-13-03	0800	1440 min	6.56	4.57	–	
	1200	1680 min	6.50	4.10	–	
	1630	1950 min	6.50	3.57	0.32	
	1900	2100 min	6.50	3.45	0.28 *	
3-14-03	0730	2850 min	6.50	3.30	–	
	1245	3165 min	6.43	3.22	–	
3-15-03	0800	4320 min	6.43	3.12	–	
3-17-03	0730	7170 min	6.34	2.92	–	
3-18-03	0730	8610 min	6.33	2.88	–	
3-22-03	0750	14,390 min	6.25	2.66	–	
3-24-03	0750	17,270 min	6.17	2.58	–	
3-26-03	0750	20,150 min	6.17	2.54	–	
3-27-03	0750	21,590 min	6.11	2.49	–	

* Coarse material height not clearly defined

Initial Start = 3-12-03 / 0800 / 6.84 = height of slurry in column

TOTAL SOLIDS REPORT SHEET

Project ID: Little Lake No: 17623

Sample Date: 3-12-03

Analyst: [illegible]

Salinity: 0.25 ppt

Specific Gravity: 2.70

Drying Time

Date: 3-12-03

Time In 12:00

Time Out 12:00 (3-13-03)

SAMPLE	INITIAL 6.0'	5.0'	4.0'	3.0'	2.0'	1.0'				
Tare No.	I-C/1	I-C/3	I-C/4	I-C/5	I-C/6	I-C/7				
Wet Sample + Tare Wt, g	137.83	115.52	131.30	133.73	123.31	136.31				
Dried Sample + Tare Wt, g	23.45	21.23	23.43	24.00	22.85	25.24				
Tare Wt, g	8.96	9.00	9.03	8.99	8.95	8.91				
Water Wt, g	114.38	94.29	107.87	109.73	100.46	111.07				
Dried Sample Wt, g	14.49	12.23	14.40	15.01	13.90	16.33				
Salt Wt, g	0.028	0.024	0.027	0.027	0.025	0.028				
Particulates Wt, g	14.49	12.23	14.40	15.01	13.90	16.33				
Particulates Conc. (g/L)	121.00	123.76	127.20	130.19	131.61	139.43				

TOTAL SOLIDS REPORT SHEET

Project ID: ______

Sample Date: 3-12-03

Analyst: S.E., J.B.

Salinity: 0.25 ppt

Specific Gravity: 2.70

Drying Time

Date: 3-12-03

Time In 15:30

Time Out 13:00 3-13-03

SAMPLE	6.0' 2 hrs	5.0' 2 hrs	4.0' 2 hrs	3.0' 2 hrs	2.0' 2 hrs					
Tare No.	A-1	A-2	A-3	A-4	A-5					
Wet Sample + Tare Wt, g	139.38	105.80	102.36	87.13	102.38					
Dried Sample + Tare Wt, g	20.32	17.75	17.55	16.32	18.01					
Tare Wt, g	8.98	9.06	9.01	8.98	8.90					
Water Wt, g	119.06	88.05	84.81	70.81	84.37					
Dried Sample Wt, g	11.34	8.69	8.54	7.34 ~~7.66~~	9.11					
Salt Wt, g	—	—	—	—	—					
Particulates Wt, g	11.34	8.69	8.54	7.34 ~~7.66~~	9.11					
Particulates Conc. (g/L)	92.00	95.21	97.07	99.83 ~~104.04~~	103.82					

TOTAL SOLIDS REPORT SHEET

Project ID: ______

Sample Date: 3-12-03

Analyst: [illegible]

Salinity: 0.25 ppt

Specific Gravity: 2.70

Drying Time
Date: 3-12-03
Time In 15:30
Time Out 13:00 3-13-03

SAMPLE	6.0' 4 hrs	5.0' 4 hrs	4.0' 4 hrs	3.0' 4 hrs	2.0' 4 hrs					
Tare No.	A-6	A-7	A-8	A-9	A-10					
Wet Sample + Tare Wt, g	95.53	106.68	107.62	103.34	104.33					
Dried Sample + Tare Wt, g	16.12	17.36	17.62	17.43	17.74					
Tare Wt, g	8.92	8.97	8.92	8.97	8.95					
Water Wt, g	79.41	89.32	90.42	85.91	86.59					
Dried Sample Wt, g	7.20	8.39	8.70	8.46	8.79					
Salt Wt, g	—	—	—	—	—					
Particulates Wt, g	7.20	8.39	8.70	8.46	8.79					
Particulates Conc. (g/L)	87.72	90.77	92.90	95.00	97.83					

TOTAL SOLIDS REPORT SHEET

Project ID:

Sample Date: 3-12-03

Analyst: E, J R.

Salinity: 0.25 ppt

Specific Gravity: 2.70

Drying Time
Date: 3-12-03
Time In: 15:30
Time Out: 1300 3-13-03

SAMPLE	6.0' 7 hrs	5.0' 7 hrs	4.0' 7 hrs	3.0' 7 hrs	2.0' 7 hrs					
Tare No.	A-11	A-12	A-13	A-14	A-15					
Wet Sample + Tare Wt, g	98.76	83.11	97.58	106.64	107.63					
Dried Sample + Tare Wt, g	16.18	15.13	16.54	17.92	18.10					
Tare Wt, g	8.94	8.94	8.97	9.25	9.20					
Water Wt, g	82.58	67.98	81.04	88.72	89.53					
Dried Sample Wt, g	7.24	6.19	7.57	8.67	8.90					
Salt Wt, g	—	—	—	—	—					
Particulates Wt, g	7.24	6.19	7.57	8.67	8.90					
Particulates Conc. (g/L)	84.91	88.08	90.28	94.31	95.88					

TOTAL SOLIDS REPORT SHEET

Project ID: ______

Sample Date: 3-12-03

Analyst: JE, JR.

Salinity: 0.25 ppt

Specific Gravity: 2.70

Drying Time
Date: 3-12-03
Time In 20:30
Time Out 1300 3-13-03

SAMPLE	5.5' 12 hrs	4.5' 12 hrs	3.5' 12 hrs	2.5' 12 hrs	1.5' 12 hrs					
Tare No.	A-16	A-17	A-18	A-19	A-20					
Wet Sample + Tare Wt, g	103.85	101.57	106.99	100.96	104.85					
Dried Sample + Tare Wt, g	16.78	16.81	17.51	17.15	17.49					
Tare Wt, g	9.19	9.21	9.22	9.21	9.23					
Water Wt, g	87.07	84.76	89.48	83.81	87.36					
Dried Sample Wt, g	7.58	7.60	8.29	7.94	8.26					
Salt Wt, g	—	—	—	—	—					
Particulates Wt, g	7.58	7.60	8.29	7.94	8.26					
Particulates Conc. (g/L)	84.44	86.78	89.57	91.52	91.35					

TOTAL SOLIDS REPORT SHEET

Project ID: ______________________ **Sample Date:** 3-13-03

Analyst: [illegible]

Salinity: 0.25 ppt

Specific Gravity: 2.70

Drying Time
Date: 3-13-03
Time In 1100
Time Out 1000 3-14-03

SAMPLE	4.0' 24 hrs	3.0' 24 hrs	2.0' 24 hrs	1.0' 24 hrs						
Tare No.	A-21	A-22	A-23	A-24						
Wet Sample + Tare Wt, g	107.18	103.62	111.37	107.67						
Dried Sample + Tare Wt, g	16.85	16.47	23.21	25.39						
Tare Wt, g	9.21	8.96	8.98	9.01						
Water Wt, g	90.33	87.15	88.16	82.28						
Dried Sample Wt, g	7.64	7.51	14.23	16.38						
Salt Wt, g	—	—	—	—						
Particulates Wt, g	7.64	7.51	14.23	16.38						
Particulates Conc. (g/L)	82.00	83.50	152.30	185.40						

TOTAL SOLIDS REPORT SHEET

Project ID: #17623

Sample Date: 3-14-03

Analyst: JR.

Salinity: 0.25 ppt

Specific Gravity: 2.70

Drying Time
Date:
Time In
Time Out

SAMPLE	3.0' 48 hrs	2.0 48 hr	1.0 48 hr							
Tare No.	A-25	A-26	A-27							
Wet Sample + Tare Wt, g	112.36	111.01	72.56							
Dried Sample + Tare Wt, g	23.09	24.20	19.73							
Tare Wt, g	8.94	9.04	8.95							
Water Wt, g	89.27	86.81	52.83							
Dried Sample Wt, g	14.15	15.16	10.78							
Salt Wt, g	—	—	—							
Particulates Wt, g	14.15	15.16	10.78							
Particulates Conc. (g/L)	149.72	164.03	189.72							

TOTAL SOLIDS REPORT SHEET

Project ID: # 17623

Sample Date: 3-15-03

Analyst: L R.

Salinity: 0.25 ppt

Specific Gravity: 2.70

Drying Time

Date: 3-15-03

Time In

Time Out

SAMPLE	3.0' / 72 hrs	2.0' / 72 hr	1.0' / 72 hr							
Tare No.	A-28	A-29	A-30							
Wet Sample + Tare Wt, g	128.93	119.67	125.99							
Dried Sample + Tare Wt, g	25.99	25.87	29.80							
Tare Wt, g	8.97	8.98	9.20							
Water Wt, g	102.94	93.80	96.19							
Dried Sample Wt, g	17.02	16.89	20.60							
Salt Wt, g	—	—	—							
Particulates Wt, g	17.02	16.89	20.60							
Particulates Conc. (g/L)	155.80	168.80	198.40							

TOTAL SOLIDS REPORT SHEET

Project ID: #17623

Sample Date: 3-18-03

Analyst: J.R.

Salinity: 0.25 ppt

Specific Gravity: 2.70

Drying Time

Date: 3-18-03

Time In:

Time Out:

SAMPLE	2.5' / 168 hr	1.5' / 168 hr	0.5' / 168 hr								
Tare No.	A-31	A-32									
Wet Sample + Tare Wt, g	106.89	124.39									
Dried Sample + Tare Wt, g	24.68	28.90									
Tare Wt, g	9.22	9.05									
Water Wt, g	82.09	95.49	could NOT Sample								
Dried Sample Wt, g	15.46	19.85									
Salt Wt, g	—	—									
Particulates Wt, g	15.46	19.85									
Particulates Conc. (g/L)	176.05	193.01									

TOTAL SOLIDS REPORT SHEET

Project ID: Little Lake # 17623

Sample Date: 3/22/03

Analyst: [signature]

Salinity: 0.25 ppt

Specific Gravity: 2.70

Drying Time

Date: 3-22-03

Time In 8:30

Time Out 8:30 (3-24-03)

SAMPLE	2.5' 264 hr	1.5' 264 hr	0.5' 264 hr							
Tare No.	A-1	A-3	A-4							
Wet Sample + Tare Wt, g	99.12	85.83	86.11							
Dried Sample + Tare Wt, g	23.09	22.65	29.19							
Tare Wt, g	8.99	9.01	8.99							
Water Wt, g	76.03	63.18	56.92							
Dried Sample Wt, g	14.10	13.64	20.20							
Salt Wt, g	—	—	—							
Particulates Wt, g	14.10	13.64	20.20							
Particulates Conc. (g/L)	173.53	199.91	313.65							

TOTAL SOLIDS REPORT SHEET

Project ID: # 17623

Sample Date: 3-26-03

Analyst: [signature]

Salinity: 0.25 ppt

Specific Gravity: 2.70

Drying Time
Date:
Time In
Time Out

SAMPLE	1.5 15 day	0.5 15 day								
Tare No.	A-33	A-16								
Wet Sample + Tare Wt, g	73.07	80.18								
Dried Sample + Tare Wt, g	21.03	27.95								
Tare Wt, g	9.03	9.19								
Water Wt, g	52.04	52.23								
Dried Sample Wt, g	12.00	18.76								
Salt Wt, g	—	—								
Particulates Wt, g	12.00	18.76								
Particulates Conc. (g/L)	212.44	317.00								

SUSPENDED SOLIDS REPORT SHEET

Project ID: Little Lake

Sample Date: 3-12-03

Analyst: Analysis Laboratories, Inc. / [illegible]

Date:

Time In

Time Out

SAMPLE	Initial 6.0									
Tare No.										
Dry Particulates + Filter Paper Wt, g										
Filter Paper Wt, g										
Dry Particulates Wt, g										
Volume (mL)										
Particulates TSS Conc. (mg/L)	76									
Turbidity (NTU)	100									

SUSPENDED SOLIDS REPORT SHEET

Project ID: Little Lake

Sample Date: 3-13-03

Analyst: Analysis Laboratories, Inc. / Ads

Date:

Time In

Time Out

SAMPLE	6.0	5.0								
Tare No.										
Dry Particulates + Filter Paper Wt, g										
Filter Paper Wt, g										
Dry Particulates Wt, g										
Volume (mL)										
Particulates TSS Conc. (mg/L)	108	313								
Turbidity (NTU)	71	191								

SUSPENDED SOLIDS REPORT SHEET

Project ID: Little Lake **Sample Date:** 3-14-03

Analyst: Analysis Laboratories, Inc. / [illegible]

Date:
Time In
Time Out

SAMPLE	6.0	5.0	4.0							
Tare No.										
Dry Particulates + Filter Paper Wt, g										
Filter Paper Wt, g										
Dry Particulates Wt, g										
Volume (mL)										
Particulates TSS Conc. (mg/L)	44	80	1,030							
Turbidity (NTU)	25.6	78.2	548							

SUSPENDED SOLIDS REPORT SHEET

Project ID: Little Lake

Sample Date: 3-15-03

Analyst: Analysis Laboratories, Inc. / ABS

Date:

Time In

Time Out

SAMPLE	6.0	5.0	4.0							
Tare No.										
Dry Particulates + Filter Paper Wt, g										
Filter Paper Wt, g										
Dry Particulates Wt, g										
Volume (mL)										
Particulates TSS Conc. (mg/L)	40	54	540							
Turbidity (NTU)	30	21.4	197							

SUSPENDED SOLIDS REPORT SHEET

Project ID: Little Lake **Sample Date:** 3-18-03

Analyst: Analysis Labor / [illegible]

Date:
Time In
Time Out

SAMPLE	6.0	5.0	4.0	3.0						
Tare No.										
Dry Particulates + Filter Paper Wt, g										
Filter Paper Wt, g										
Dry Particulates Wt, g										
Volume (mL)										
Particulates TSS Conc. (mg/L)	100	76	96	390						
Turbidity (NTU)	66	15.4	67.8	495						

SUSPENDED SOLIDS REPORT SHEET

Project ID: Little Lake

Sample Date: 3-22-03

Analyst: Analysis Laboratories, Inc. / AB

Date:

Time In

Time Out

SAMPLE	6.0	5.0	4.0	3.0						
Tare No.										
Dry Particulates + Filter Paper Wt, g										
Filter Paper Wt, g										
Dry Particulates Wt, g										
Volume (mL)										
Particulates TSS Conc. (mg/L)	28	34	144	280						
Turbidity (NTU)	7.2	16.4	189	258						

SUSPENDED SOLIDS REPORT SHEET

Project ID: Little Lake

Sample Date: 3-26-03

Analyst: Analysis Laboratories, Inc. / Ses

Date:

Time In

Time Out

SAMPLE	6.0	5.0	4.0	3.0						
Tare No.										
Dry Particulates + Filter Paper Wt, g										
Filter Paper Wt, g										
Dry Particulates Wt, g										
Volume (mL)										
Particulates TSS Conc. (mg/L)	23	40	204	280						
Turbidity (NTU)	14.6	16.3	99.3	298						

ANALYSIS LABORATORIES, INC.
2932 LIME STREET • P. O. BOX 8666 • METAIRIE, LOUISIANA 70011
TELEPHONE (504) 889-0710 • FAX (504) 889-2613
LELAP CERTIFICATE #02079

March 28, 2003

03A-0111

Mr. Bobby Elkins
EUSTIS ENGINEERING
3011 28th Street
Metairie, LA 70002

Re: E. E. Project No. 17623
Little Lake Settlement Column

WATER TESTING

Twenty-one water samples were submitted for testing on March 26, 2003, in order to determine the total suspended solids, TSS. The Analysis was performed using the protocol and 0.45 micron membrane filters supplied by Eustis Engineering. The results were as follows:

Sample Identification	mg/L Total Suspended Solids
6.0' Initial 3-12-02	76
6.0' 3-13-03	108, *104
5.0' 3-13-03	313
6.0' 3-14-03	44
5.0' 3-14-03	80
4.0' 3-14-03	1,030
6.0' 3-15-03	40
5.0' 3-15-03	54
4.0' 3-15-03	540
6.0' 3-18-03	100, *99
5.0' 3-18-03	76, *78
4.0' 3-18-03	96, *100
3.0' 3-18-03	390
6.0' 3-22-03	28
5.0' 3-22-03	34
4.0' 3-22-03	144, *148
3.0' 3-22-03	280
6.0' 3-26-03	23
5.0' 3-26-03	40
4.0' 3-26-03	204, *196
3.0' 3-26-03	280

* duplicate determination.

Analyzed: 3-27-03/0845
Analyst: R.A.

ANALYSIS LABORATORIES, INC.

Harley O. Albert
CHEMIST