GEOTECHNICAL ENGINEERING REPORT (REVISED)

STATE OF LOUISIANA

COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)

EAST DELACROIX MARSH CREATION PROJECT, PHASE II

ST. BERNARD PARISH, LOUISIANA

CONTRACT NO. 4400015385

CPRA PROJECT NO. BS-0037, TASK NO. 4

EUSTIS ENGINEERING PROJECT NO. 24431.01

FOR
STATE OF LOUISIANA, COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
BATON ROUGE, LOUISIANA

By
Eustis Engineering L.L.C.
Metairie, Louisiana

26 May 2021

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

GEOTECHNICAL ENGINEERING REPORT (REVISED)

STATE OF LOUISIANA

COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)

EAST DELACROIX MARSH CREATION PROJECT, PHASE II

ST. BERNARD PARISH, LOUISIANA

CONTRACT NO. 4400015385

CPRA PROJECT NO. BS-0037, TASK NO. 4

EUSTIS ENGINEERING PROJECT NO. 24431.01

INTRODUCTION

1. This revised report contains the results of geotechnical engineering analyses performed for the proposed East Delacroix Marsh Creation Project (Project No. BS-0037). This project is located in Region 2, Breton Basin, St. Bernard Parish, along the eastern side of the island of Delacroix in southeast Louisiana. Refer to Figure 1 for a site vicinity map. Our geotechnical services for the project were performed in accordance with our revised proposal, dated 8 February 2021. The project is funded under the Coastal Wetland Planning Protection and Restoration Act (CWPPRA) in Priority List 28. Authorization to proceed with our services was provided by the State of Louisiana, Coastal Protection and Restoration Authority (CPRA) in partnership with National Oceanic and Atmospheric Administration (NOAA). Notice to proceed was received from CPRA on 18 February 2021 under Amendment 1 of BS-0037 Task No. 4.

2. This geotechnical engineering report (GER) is based on data presented in our geotechnical data report (GDR) published on 11 December 2020. Additional information

regarding the tidal levee was furnished by CPRA after we published our GER on 16 April 2021. Additional engineering analyses based on this information for the tidal levee have been completed and are included in this revised GER. Other clarifications requested by CPRA have also been incorporated.

PROJECT PURPOSE

3. The objective of this project is to create, maintain, and nourish existing deteriorating wetlands by hydraulic dredging material from an inland borrow source located in Lake Lery. Specifically, 406 acres of confined marsh will be placed in designated marsh creation areas formed by constructing earthen containment dikes around the perimeter. Existing berms and the east Delacroix tidal protection levee will also be used as containment. Approximately 12,950 linear feet of terraces will also be strategically designed to serve as sediment retention features and reduce wake erosion adjacent to the marsh creation areas. Project features addressed in Phase II of this project comprise the Marsh Creation Cell, Earthen Containment Dikes (ECDs), tidal levee, and terrace field. Specifically, geotechnical engineering analyses and recommendations for the design and construction of these features are provided.

SCOPE OF SERVICE

4. We performed our scope of work in general accordance with “Addendum No. 1 to Scope of Services, for Geotechnical Services, Phase II: Engineering Services, East Delacroix Marsh Creation Project (BS-0037), St. Bernard Parish, Louisiana,” dated January 2021. The scope of service addendum provided the expectations for the Phase II portion of the geotechnical work and was divided into major work items as described in the following paragraphs. Note that Phase II is the engineering phase, and Phase I was the geotechnical data collection phase that was completed when our GDR was issued (11

December 2020). Regarding Phase II, all analyses were completed following the methodology described in the CPRA Geotechnical Standards. Our analyses follow the requirements outlined in the CPRA Marsh Creation Design Guidelines (MCDG.V1), dated 15 November 2017.

5. Soil Design Parameter Selection. Selection and documentation of the soil design parameters for the various project features required discussion and review by CPRA prior to completion of our analyses. Initial soil design parameters were approved by CPRA through correspondence on 25 February 2021. Additional edits were made following review of our preliminary analyses and were approved during a progress meeting on 23 March 2021.

6. Marsh Creation Fill Area Design. Our engineering analyses of the marsh creation cells included settlement estimates and settlement curves projecting settlement over the 20-year project life considering the combined effect of settlement of the subsurface soils, self-weight consolidation of the dredged fill material, and subsidence. Dewatering and shrinkage of the fill materials was also considered. The settlement curves show the top of fill elevation considering an assumed filling schedule. The top of fill elevation over time was plotted for the following time steps: end of construction, 30 days after construction, approximately 6 months after construction, and 1, 3, 5, 10, 15, and 20 years after construction. The scope of work requires analyses of self-weight consolidation using the USACE program: Primary Consolidation, Secondary Compression, Desiccation of Dredged Fill (PSDDF). Long-term foundation settlement analyses utilize Settle3 by Rocscience, Inc.

7. Earthen Containment Dikes Design. ECDs are required to contain the marsh creation fill. Our scope for the ECDs included a suitability assessment of the materials sampled for use in the construction of ECDs; slope stability analysis with and without marsh fill to

evaluate the geometry required for stable dike configuration; estimates of dike fill consolidation during construction; development of settlement estimates; cut to fill ratios for ECD construction; and general construction recommendations. Stability analyses were completed for all cases presented in the CPRA Marsh Creation Design Guidelines considering a minimum factor of safety of 1.2.

8. Tidal Levee. Our scope of service along for the existing Tidal Levee requires assessment of the materials based on the boring and cone penetration test (CPT) data obtained along the levee alignment. Additional analyses including assessment of the suitability of raising the tidal levees to the design grade of ECDs, stability evaluation of the levee with dredge fill placed to the crest, and settlement analyses for subsurface materials have been completed as part of our revised GER. These analyses were not included in our original GER.

9. Earthen Terraces. Our scope of service for the proposed terraces includes slope stability evaluation of the earthen terraces considering adjacent borrow canals, settlement analyses for immediate and long-term settlement due to the compression of subsurface soil consolidation, and general construction recommendations.

GEOTECHNICAL DATA REPORT

10. Please refer to our GDR, dated 11 December 2020, for discussion pertaining to our field exploration, soil boring logs, CPT logs, and detailed laboratory test data results including consolidation tests, column settling test, and self-weight consolidation tests. The locations of soil borings and CPTs are shown on Figure 2. The GDR provides a description of subsoil conditions that includes the area geology and the soil stratigraphy. The subsoil profiles from the GDR are included in this GER and are shown in Figures 3, 4 and 5.

SOIL DESIGN PARAMETERS

11. Subsurface Soil Parameters. The soil design parameters developed for the various project features are shown graphically on Figure 6 for the tidal levee and in Figure 7 for the marsh creation areas. The undrained shear strengths, total unit weights, moisture contents, and generalized soil strata descriptions are plotted on these sheets. Figure 7 includes three sheets to summarize selected consolidation parameters in addition to the shear strength, moisture content, and total unit weights. A summary of processed consolidation test data plotted on these sheets is included as Appendix I. Please refer to the GDR for the boring and CPT logs.

12. The design undrained shear strengths were established using data deemed of good quality (i.e., low sample disturbance) and with trend lines approximating ratio of undrained shear strength (cohesion) to vertical effective stress ratio (c/P_o) of 0.22. This ratio has been used by Eustis Engineering as a guide for evaluating undrained shear strength data in normally consolidated clay deposits with depth in southern Louisiana and is considered an appropriate relationship to aid in evaluating subsurface conditions at the project site.

13. Our boring and CPT through the existing Tidal levee were performed through the existing levee centerline. Soils beneath the levee centerline most likely experienced significant strength gain since the initial levee construction due to consolidation settlement. Therefore, we selected a set of centerline soil design parameters based on our interpretation of the CPT shear strength estimates and laboratory test data. We have also provided assumptions for in situ parameters beyond the levee section based on a ratio of undrained shear strength (cohesion) to vertical effective stress ratio (c/P_o) of 0.22. This estimate of in situ shear strength is conservative and was used in our stability analyses.

14. Dredge Material Parameters. Additional review and processing of completed settling column and low-pressure consolidation test are provided as part of Appendix II. This information was used to develop our input parameters for our PSDDF analyses.

FOUNDATION ANALYSES

Furnished Information

15. Histograms and desired design mudline elevations for the various project features were provided by CPRA during a progress meeting. Select slides from the presentation summarizing our design cases have been included as part of Appendix III. A summary of design elevations used in our report is provided in Table 1.

TABLE 1: SUMMARY OF FURNISHED MUDLINE ELEVATION DATA

DESIGN MUDLINE FOR VARIOUS PROJECT FEATURES	ELEVATION IN FEET (NAVD 88)
Marsh Nourishment Areas	+0.5
Marsh Creation Areas	-2.0
Earthen Containment Dikes	-2.5 and -3.0
Terrace Fields	-2.8

16. The target marsh elevation at the end of the 20-year project life is el +1. The annual subsidence rate is 4 mm per year.

17. The goal for the marsh creation and nourishment areas is that the top of fill elevation should remain between the 65% inundation and 10% inundation water elevations for a substantial portion of the 20-year project life. These water elevations and the mean water levels were provided by CPRA and have been included in Appendix III. Presented

water elevations throughout the project life include estimates of sea level rise furnished by CPRA.

Design Criteria

18. The project design criteria used in the geotechnical analyses are described in CPRA's MCDG. The design guideline requirements for factors of safety with regards to the containment dike is a minimum of 1.2 for all design cases. The guidelines require stability analyses of the containment dikes at the average mudline elevation and the lowest/critical mudline elevation.

19. ECD Geometric Considerations. The design guidelines require a minimum crown width of 5 feet and minimum side slopes of 4 horizontal to 1 vertical (4H:1V) for the containment dikes. A freeboard of between 1 and 2 feet should be considered between the constructed dike crown and the constructed marsh fill. A minimum 20-foot-wide bench offset from the edge of the borrow canal to the containment dike toe is also required by the MCDG.V1. Borrow canal side slopes typically range between 2H:1V and 4H:1V. A typical marsh buggy equipment ground pressure of 260 psf along the offset bench must be considered in the stability model.

20. Terrace Field Geometric Considerations. The proposed terraces for this project require a crown width of 10 feet having 5H:1V side slopes based on the furnished scope of service.

Design Recommendations

21. General. Our recommendations for the proposed project features are based on our findings from the GDR and the soil design parameters we developed.

22. Marsh Creation Cells. Based on our assumptions regarding dredge fill placement rates and properties, our estimates of settlement indicate acceptable performance for a constructed marsh fill elevation (CMFE) of approximately +3.5 feet at the end of construction considering a dredge fill placement rate corresponding to approximately 120 days of fill placement. The presented elevations in this report assume all flocculate and zone settling is complete. The final slurry elevation may be slightly higher depending on the concentration of the dredge material. We provide additional discussion later in this report. Figures 8, 9, and 10 summarize the anticipated settlement of the marsh creation and nourishment areas.

23. Earthen Containment Dikes and Ridges. The recommended dike crown elevations include an approximate 1.5 ft. freeboard above the constructed marsh fill elevation to allow for additional elevation due to slurry concentration (i.e., approximated ECD elevation of +5.0). Our analyses are based on the MCDG requirement of a 5-foot-wide ECD crown having 4H:1V side slopes and assume an approximate bench width of 30 feet from the borrow area. We have assumed the side slope of the borrow channel is approximately 3H:1V and extends from the mudline to el -10. Our recommendations are based on settlement analyses and stability analyses as described later in this report. Detailed recommendations regarding dike construction are given subsequently in this report.

24. Tidal Levee. Based on the latest information from CPRA, filling to elevation +5.0 is anticipate in select areas. Four cross-sections of existing grades were furnished for our

review and have been included in Appendix III. A single “composite” section was produced for our analyses, and we consider this to be a reasonable simplifying assumption. Filling was assumed to achieve el +5.0 with a 10-foot-wide crown. Side slopes were not furnished, and we have assumed the new fill will be blended into the existing levee template.

25. Terrace Field. Our analyses assume a 10-foot-wide terrace crown having 5H:1V side slopes and assume an approximate bench width of 30 feet from the borrow area. Based on completed settlement analyses, we have assumed a terrace crown at el +4.0. We have assumed the side slope of the borrow channel is approximately 3H:1V and extends from the mudline to el -10. Our recommendations are based on settlement analyses and stability analyses as described later in this report. Detailed recommendations regarding terrace field construction are given subsequently in this report.

Marsh Creation and Nourishment Areas

26. General. Settlement of the proposed marsh creation cells for this project will occur over time due to consolidation of the foundation soils and self-weight consolidation of the material itself. The near surface soils at the site are predominantly organic clays/peat/hummus underlain primarily by soft and fine-grained clays. Therefore, we expect significant initial consolidation of the foundation soils. Continuing settlement will occur over long periods of time at a diminishing rate.

27. Sedimentation Settling. Our analyses do not account for sedimentation and zone settling of placed dredge slurry. Our analyses are based on compression settlement of the dredge fill after a soil matrix has formed. Based on our review of lab test information, compression settlement of the dredge fill begins at an approximate

concentration of 285 g/L. Additional considerations will be required to confirm the necessary end of construction slurry elevations to account for lower concentrations.

28. Methodology and Assumptions. With respect to marsh fill settlement (creation and nourishment areas), we anticipate settlement to occur in four phases: discrete settling, flocculent settling, zone settling, and compression settling. The discrete, flocculent, and zone settling phases are part of the sedimentation process and will occur rapidly after placement of dredge material. These initial phases are dependent upon the contractors means and methods and are not addressed herein. Self-weight compression consolidation of the dredged fill material was evaluated using PSDDF to compute self-weight settlement during construction and throughout the project life. We performed settlement analyses of the foundation soils assuming stress distribution in accordance with Westergaard's theory using Settle3 by Rocscience instead of PSDDF. These analyses were completed in an iterative loop to determine a PSDDF filling sequence and corresponding Settle3 model which achieved the desired design grades. Mudlines for our evaluations match furnished information provided in Table 1.

29. Settlement During Construction. The marsh creation fill soils will be placed gradually using a dredge. This will impact the magnitude of settlement realized during and after construction. Our analyses consider an instantaneous placement marsh creation fill in discrete filling steps and an instantaneous loading of the foundation soils. To account for foundation settlement and lateral displacement during filling, we assume up to ⅓ of the foundation settlement computed by Settle3 occurs during construction of the marsh creation and nourishment areas.

30. Marsh Fill Material Properties. Fine-grained soils (clays and silts) will experience self-weight consolidation settlement when hydraulically dredged and pumped as sediment fill material within the containment areas. Based on the sampling of borrow source

material and the results of the settling column and low pressure, high strain consolidation tests, we estimated input parameters for PSDDF. A summary of selected design parameters is provided in Appendix IV. When estimating foundation settlement of the marsh fill, we considered an estimated unit weight of approximately 90 pcf for the final in place material after the completion of self-weight settlement. This value was based on the average void ratio of the marsh fill computed by PSDDF. Note, the majority of the self-weight settlement occurs withing 5 years of construction.

31. <u>Assumed Filling Sequence for PSDDF.</u> Based on correspondence with CPRA regarding our preliminary results, Eustis Engineering considered three assumed filling sequences in PSDDF to account for self-weight settlement during construction and to capture a range of potential filling rates for the marsh creation areas. These sequences result in the same amount of final in-place material using the same number of filling stages yet using different time intervals between stages. Each stage represents the instantaneous placement of new material on top of previously consolidated stages. As previously noted, the instantaneous placement corresponds to the beginning of consolidation settlement and sedimentation has not been considered. Longer filling sequences allow for a greater amount of self-weight consolidation settlement to manifest resulting in lower end of construction CMFEs. The three filling sequences considered for our analyses are presented in Table 2. The information in Table 2 was prepared simply to compute estimates of settlement during and after construction for the purposes of preparing the graphs we present on Figure 8. These filling stages should not dictate the contractor's means and methods and should be expected to vary from the assumptions we prepared for this report. Following additional correspondence, the 120-day option was selected for consideration of the marsh nourishment areas. Based on our review of the 120-day filling sequence, this corresponds to a 70-day filling sequence for the nourishment areas (i.e., the marsh creation area is filled to el +0.5 after approximately

50 days). A plot of the estimated CMFE at the end of construction is provided on Figure 8.

TABLE 2: ASSUMED MARSH FILLING STAGES

FILLING STAGE	INITIAL THICKNESS OF NEW FILL (IN FEET)	FILLING TIME (IN DAYS)		
		80	120	160
1	1	0	0	0
2	1	5	4	10
3	1	10	8	20
4	0.8	15	16	30
5	0.5	20	24	40
6	0.5	25	32	50
7	0.5	30	40	60
8	0.5	35	48	70
9	0.5	40	56	80
10	0.5	45	64	90
11	0.5	50	72	100
12	0.5	55	80	110
13	0.5	60	88	120
14	0.5	65	96	130
15	0.5	70	104	140
16	0.5	75	112	150
EOC	0.5	80	120	160

32. Foundation Settlement. Our analyses of foundation settlement were completed as described previously using settlement parameters presented on Figure 7. We evaluated foundation settlement with and without a sand foundation layer extending from el -27 to el -30. The computed foundation settlements with and without this layer were approximately the same. Results and analyses we present herein are for the “all clay” design case. The design water level for the marsh creation cells was set to el +1.5 to account for buoyancy over the design life of the project as well as the elevated water levels anticipated within the cells during decanting periods. Dredged fill was modeled in Settle3 based on the final fill thickness and approximate unit weight computed by PSDDF.

33. Desiccation Settlement. We anticipate marginal desiccation settlement in the marsh creation areas where the CMFE falls below the average water levels relatively quickly. For the higher marsh nourishment areas, we anticipate a maximum thickness of desiccation to extend no more than 1 foot into the dredge fill. We estimate this corresponds to 0.2 feet of desiccation settlement for the marsh nourishment areas.

34. Areal Subsidence. Our estimates of settlement include the effect of areal subsidence over the design life of the project. Areal subsidence is generally considered a background condition over which humans have no control and should be relatively uniform in the project area. Our analyses assume a subsidence rate of 4 mm/yr. based on information furnished by CPRA.

35. Total Settlement of Marsh Creation Cell. We provide the individual results of the completed PSDDF and Settle3 analyses, as well as detailed tables of the total settlement, in Appendix IV. Time-rate of settlement curves between 0 and 20 years after construction of the marsh creation and marsh nourishment areas summarizing our results are presented in Figures 9 and 10. Note, our analyses conservatively neglect the potential accretion of additional material.

Earthen Containment Dikes (ECD)

36. General. Proposed earthen containment dikes are necessary to retain placed dredge fill. The ECDs presented herein have been designed based on furnished geometric considerations and the proposed CMFE for the 120-day filling sequence. We have evaluated an ECD constructed to el +5 having a crown width of 5 feet and 4H:1V side slopes. We have assumed the adjacent borrow channel will have a bottom at approximate el -10 having 3H:1V side slopes to the existing ground surface. Water levels considered in our analyses are based on furnished information for project year 0.

37. <u>Design Parameters of Fill Material.</u> For the ECD fill material, we assumed a unit weight of 80 pcf and a cohesion (i.e., undrained shear strength) of 100 psf based on the soil encountered above el -10 during our exploration and guidance provided in CPRA's MCDG. These parameters consider dike fill obtained from an adjacent borrow channel and placed by uncompacted methods as discussed in the "Construction Recommendations" section of this report. We considered a unit weight of 75 pcf and a cohesion of 0 psf for the marsh fill material. The proposed unit weight is based on review of the completed PSDDF analyses. The selected cohesion is conservative, assuming this material is a slurry rather than in a solid state.

38. <u>ECD Soil Bearing Values.</u> We evaluated the ultimate soil bearing capacity of the earthen containment dikes considering a marsh elevation of -2.5. The near-surface material encountered at the site had laboratory-tested undrained shear strengths that are very weak and compressible. To achieve a bearing capacity factor of safety of 1 for the proposed containment dikes, an undrained shear strength of approximately 85 to 100 psf would be necessary. For the existing foundation shear strengths, we estimate the fill height would be limited to between 5 and 6 feet from the existing mudline at incipient failure (factor of safety ≈ 1.0). We anticipate these bearing capacity failures will propagate until sufficient material has been displaced beneath the proposed ECD location by competent fill materials to achieve a stable foundation for additional fill. The volume of material lost to such failures will vary along the alignment based on subsoil conditions, quality of fill material placed, and the exact means and methods of the contractor (e.g., drop height of excavated soils from the side cast, rate of placement of the excavated soils). The near surface soil strength encountered varied. Areas of sufficient soil strength to achieve design grades without bearing capacity failures may exist along the ECD alignment. We present our assumptions and calculations regarding bearing capacity in Appendix V.

39. ECD Stability Analyses. Stability analyses were performed using the GEO-SLOPE International, Ltd.'s SLOPE/W, slope stability program and Spencer's Method of Analysis. The analyses followed the design criteria provided in the MCDG. The proximity of the earthen containment dike toe to the edge of the borrow channel was assumed to be a minimum of 30 feet. This includes a 10 ft. offset from the edge of the borrow channel for the marsh buggy excavator. The results of our analyses are presented in Appendix VI. Results of our analyses indicate the proposed cross-section is stable. We assumed in our analyses a deformed section due to lateral displacement of the ECD during construction that extends to approximate el -7 (i.e., approximately 4.5-ft deep below the existing mudline of el -2.5).

40. Our minimum bench width estimate of 30 feet is based solely on the geotechnical characteristics of the soils (i.e., slope stability) and does not account for wave action or erosion/disturbance potential. The ground surface geometry between the dike and borrow channel may become lower and irregular due to construction activities. This may result in a higher risk of instability of the dike into the excavated borrow channel. A wider bench may offer more practicality for the contractor's operations.

41. Estimated Settlement of Containment Dikes. For the earthen containment dike fill materials, we assumed an average unit weight of 80 pcf. Assuming instantaneous loading, we estimate approximately 2 feet of consolidation settlement at the centerline of the earthen containment dike. However, a substantial portion of this settlement occurs within the top 5 to 10 feet of material which will undergo lateral spread as described in our "Construction Recommendations" section. Less than 6 inches of settlement is estimated in foundation materials beneath these soft surficial deposits. We recommend a 0.5 ft. overbuild during construction (i.e., construction to el +5.0) to account for this deeper foundation settlement assuming significant lateral spread during construction. Should measures be taken to limit lateral spread (i.e., a use of

geosynthetic reinforcement), please contact Eustis Engineering for revised estimates of foundation settlement for the ECDs.

42. Shrinkage of Earthen Containment Dikes. Settlement or “shrinkage” of the uncompacted fill will occur. Desiccation of soft clays proceeds from the exposed surface inward and leads to the formation of a crust that becomes thicker with age. 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 in the first year after fill placement. Due to variations in the organic clays and peat present and moisture ranges, shrinkage will generally result in differential settlement along the dike alignment.

43. The settlements described in this section were based on the assumptions the fill material is loaded instantaneously and without specific mention of construction means and methods. Additional consolidation settlement due to variation in subsoil materials and thicknesses, fluctuation in water levels, and construction means and methods should be anticipated.

44. Note that post-construction settlement evaluation of the ECDs may not be important to this project. This is because, following completion of marsh creation filling, portions of the ECD alignment may need to be degraded to match the CMFE of the marsh creation areas.

Tidal Levees

45. General. Eustis Engineering reviewed the available information for the tidal levee. Undrained shear strengths of foundation soils beneath the tidal levee are notably higher than those encountered in the open marsh due to consolidation strength gain beneath the existing levee fill.

46. Settlement of Tidal Levees. Based on the furnished drawings, existing grades are between el +3.5 and el +4.5. To achieve a levee crown of el +5.0, approximately 0.5 to 1.5 feet of fill will be required. Based on a review of the completed CPTs and borings we do not anticipate significant consolidation settlement due to this marginal amount of fill or placement of the adjacent marsh creation fill (less than 0.5 feet). Subsidence rates are anticipated to be similar to the surrounding area and future levee raises may be necessary. Settlement due to existing levee fill may be ongoing and has not been considered herein.

47. Stability of Tidal Levees. Cross-sections of the earthen levee were furnished at four locations. Based on our review of the furnished cross-sections, we have developed a single, worst case composite section for our analyses. Our evaluation of stability was performed using the GEO-SLOPE International, Ltd.'s SLOPE/W, slope stability program and Spencer's Method of Analysis. Our analysis assume fill to approximate el +5.0 and adjacent marsh creation fill to el +4.0. We have evaluated the stability of the tidal levee under top of levee loading (i.e., water to el +5.0) with low water at el -2.0 within the drainage canal. Please contact us if lower water levels are anticipated. Our analysis considers the levee centerline and toe parameters described previously in our report. We applied the levee centerline parameters at X=0. This higher strength is linearly reduced to an assumed levee toe at X=-30 and X=30. We present our analyses in

Appendix VII. Results of our analyses indicate the composite cross-section is stable and produces factors of safety in excess of 1.3.

Earthen Terraces

48. General. Earthen terraces are proposed to increase the sediment retention of the marsh creation areas. Terraces have been analyzed based on furnished geometric considerations. We have evaluated a terrace constructed to el +4 having a crown width of 10 feet and 5H:1V side slopes. We have assumed the adjacent borrow channel will have a bottom at approximate el -10 with 3H:1V side slopes to the existing ground surface. Low water levels considered in our analyses are based on furnished information for project year 0. We have not evaluated stability of the terrace under extreme differential water levels as we anticipate this will be an open terrace field. If the potential for a differential water level along the earthen terrace exists, please contact Eustis Engineering for additional recommendations.

49. Design Parameters of Fill Material. For the terrace fill material, we assumed soils will be taken from an adjacent borrow canal similar to the ECD. Our assumptions for unit weight and cohesion are consistent with those presented previously for the ECD fill material. These parameters consider fill obtained from an adjacent borrow channel and placed by uncompacted methods as discussed in the "Construction Recommendations" section of this report.

50. Terrace Soil Bearing Values. Our estimates of soil bearing values for the proposed terraces are approximately equal to estimates presented previously for the ECDs.

51. Terrace Stability Analyses. Stability analyses were performed using the GEO-SLOPE International Ltd.'s SLOPE/W, slope stability program and Spencer's Method of Analysis.

The proximity of the earthen terrace toe to the edge of the borrow channel was assumed to be a minimum of 30 feet. This includes a 10 ft. offset from the edge of the borrow channel for the marsh buggy excavator. The results of our analyses are presented in Appendix VIII. Results of our analyses indicate the proposed cross-section is stable and produces factors of safety in excess of 1.3.

52. Although a bench offset of 30 feet is acceptable based on our experience with dredging contractors, an offset zone less than 40 feet may still be susceptible to erosion of the mudline due to wave action and disturbance caused by the construction equipment. Therefore, the ground surface geometry between the terrace and borrow channel may become lower and irregular due to construction activities and wave action. This will result in a higher risk of instability of the terrace into the excavated borrow channel.

53. Estimated Settlement of the Terrace. For the terrace fill materials, we assumed an average unit weight of 80 pcf. Assuming instantaneous loading, we estimated consolidation settlement at the centerline of the terraces to be approximately 2 feet. However, a substantial portion of this settlement occurs within the top 5 to 10 feet of material which will undergo lateral spread as described in our "Construction Recommendations" section. Approximately 6 inches of settlement is estimated in foundation materials beneath these soft surficial deposits. We recommend this 0.5 ft. foundation settlement and areal subsidence be considered when evaluating the long-term settlement of the earthen terrace. This results in approximately 1 foot of total settlement corresponding to a surface elevation of +3 after 20 years for a crown built to el +4. This is approximately 1 foot above the maximum water level anticipated after 20 years. Should measures be taken to limit lateral spread (i.e., a use of geosynthetic reinforcement), please contact Eustis engineering for revised estimates of foundation settlement for the terraces.

54. Shrinkage of Earthen Terraces. Our recommendations regarding shrinkage of the ECD fill are applicable to the Terraces if they are constructed from adjacent borrow material.

55. The settlements described in this section were based on the assumptions that the fill material is loaded instantaneously and without specific mention of construction means and methods. Additional consolidation settlement due to variation in subsoil materials and thicknesses, fluctuation in water levels, and construction contractor's means and methods should be anticipated.

Construction Recommendations

56. Constructability. The organic and soft clay materials encountered near the proposed marsh creation surface will be partially displaced during fill placement and dredging operations. Construction techniques will be critical to the constructability and ultimate stability of the dike section. Our analyses assume the dike fills are placed as recommended and outlined subsequently in this report. We estimated the amount of displacement which may occur during construction to assist in determining the anticipated fill quantities and cost estimates. The stability of the earthen containment dike constructed of in situ materials will depend on the borrow materials used and the rate at which the dredged fill is placed.

57. Water Levels. Water levels along the project are subject to seasonal and tidal fluctuations. Site conditions should be evaluated immediately prior to initiating construction.

58. Placement of Uncompacted Fill. The borrow material will be placed by uncompacted methods for construction of the containment dikes and terraces. Our stability analyses assume these materials will be excavated and placed by mechanical methods using a

dragline, clamshell, or conventional bucket, or similar mechanical equipment. Uncompacted dike fill should be placed in lift thicknesses of no more than 3 feet. Depending on the depth of standing water and moisture content of the borrow materials, consideration should be given to placing an initial fill lift for the entire alignment (or at least a substantial portion) before proceeding to the next lifts to mitigate the potential for mud waves. This method will initiate consolidation of foundation soils as well as provide a means for the uncompacted fill to provide a sufficient bearing surface. This will decrease the potential for lateral spreading and slope failure within the fill as the containment dikes are constructed. Subsequent lifts will be constructed in long linear segments using the side-cast approach and will naturally result in a waiting time between lifts at a given location. Depending on the contractor's approach, the waiting time between lifts at a given location will be on the order of weeks which is reasonable from a geotechnical perspective.

59. Bulking of Uncompacted Fill. We anticipate mechanically and hydraulically dredged materials used for the construction of the ECDs and marsh fill areas, respectively, will experience bulking once taken from the in situ conditions. For the marsh creation areas, based on existing conditions and anticipated in place material properties, we estimate hydraulically dredged, fine-grained soils will experience bulking factors between 1.5 and 3 due to the additional water and disturbance involved in the dredging process. For the final in-place volumes following marsh fill settlement, these bulking factors may be reduced to between 1 and 1.5. For the ECDs, we estimate mechanically dredged, fine-grained soils will experience lower bulking factors of between 0.9 and 1.1. Note that these factors for ECDs are difficult to assess independently of the mud waves and lateral spreading that occurs when the ECDs are constructed. When considering the lateral spreading effect, the ECD fill volume is approximately 1.5 to 2.5 times the borrow volume as shown on the slope stability analysis pages in Appendix V.

60. Consideration of Mud Waves - Containment Dikes. The contractor should expect the creation of a “mud wave” during construction due to the low shear strength and unit weights of the surficial material. After the final design is completed, plans and specifications should alert the contractor to anticipate this phenomenon. Generally, the uncompacted fill should be placed from the centerline of the design section, outward to the toes, and parallel to the centerline to “push” the mud wave toward the outside of the dike section. Control of mud waves is a means and methods issue that is the responsibility of the construction contractor The contractor may identify additional options that are viable.

61. Maintenance of ECDs. Maintenance will be required to accommodate the estimated ongoing settlements or other impacts during the filling of the marsh creation. We have not evaluated erosion potential under wave action or damage due to overtopping. Localized areas of settlement in excess of our estimates may require additional fill placement to maintain required freeboard levels. Following completion of marsh creation filling, portions of the ECD alignment may need to be degraded to match the CMFE of the marsh creation areas.

62. Hydraulically Placed Fill (Marsh Fill). The borrow material for the marsh creation sites will be hydraulically dredged and transported using pipelines. 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 decanting considerations, fill should be placed no higher than 1 foot below the crown of the earthen containment dikes. Compaction of fill is not considered necessary within the marsh creation area. Shaping may be required to facilitate ongoing placement operations.

63. Consideration of Mud Waves - Marsh Creation Site. Mud waves will form at the leading edge where the pumped marsh fill is being placed. The contractor should consider placement techniques to control the size of this mud wave. Consideration of mud waves is a means and methods issue that is the responsibility of the construction contractor.

64. 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 hay bales, weirs, pipes, and drop inlets. The number, size, and location of these drainage control measures should be considered during the design of the borrow area (for the dike construction) and for the permit application. Some important factors include the position of the dredge and borrow canal, natural slope of the land formations, and the type and size of the dredging equipment.

65. Dewatering/Decanting. Self-weight consolidation of the marsh creation fill will create the ponding of water at the surface as the settlement occurs over time. Some of this water may be removed by evaporation but decanting of free surficial water by weirs should be considered if freeboard requirements cannot be met when pumping in additional dredge material slurry.

66. Monitoring. Consideration should be given to the use of an instrumentation program (i.e., instrumented settlement plates, vibrating wire piezometers, and pressure cells) that can evaluate the rate of consolidation, settlement, stress distribution, and pore pressure dissipation under fill loads. Settlement analyses can be performed by Eustis Engineering based on the data collected during construction to field calibrate the settlement and stability analyses presented in this report. Natural variations in the materials placed, as well as the desiccation and biodegradation of these deposits, may affect the actual settlements that could occur. In addition, construction of the

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

LIMITATIONS

67. This GER has been prepared in accordance with generally accepted geotechnical engineering practice for the exclusive use of CPRA and NOAA for specific application to the subject site. In the event of any changes in the nature or design requirements, or location of the proposed project features, the information contained in this report shall not be considered valid unless the changes are reviewed, and this report is modified and verified in writing. Should these data be used by anyone other than the CPRA or NOAA, the user should contact Eustis Engineering for interpretation of data and to secure any other information pertinent to this project.

68. Our findings and recommendations contained in this report are based on selected points of field exploration, laboratory testing, and our understanding of the proposed project. Furthermore, our findings and recommendations are based on the assumption soil conditions do not vary significantly from those found at specific exploratory locations. Variations in soil or ground water conditions could exist between and beyond the exploration points. The nature and extent of these variations may not become evident until construction. Variations in soil or ground water may require additional studies, consultation, and possible revisions to our recommendations.

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

borings, laboratory tests, and CPTs contained in the GDR, dated 11 December 2020, may be included in the plans and specifications.

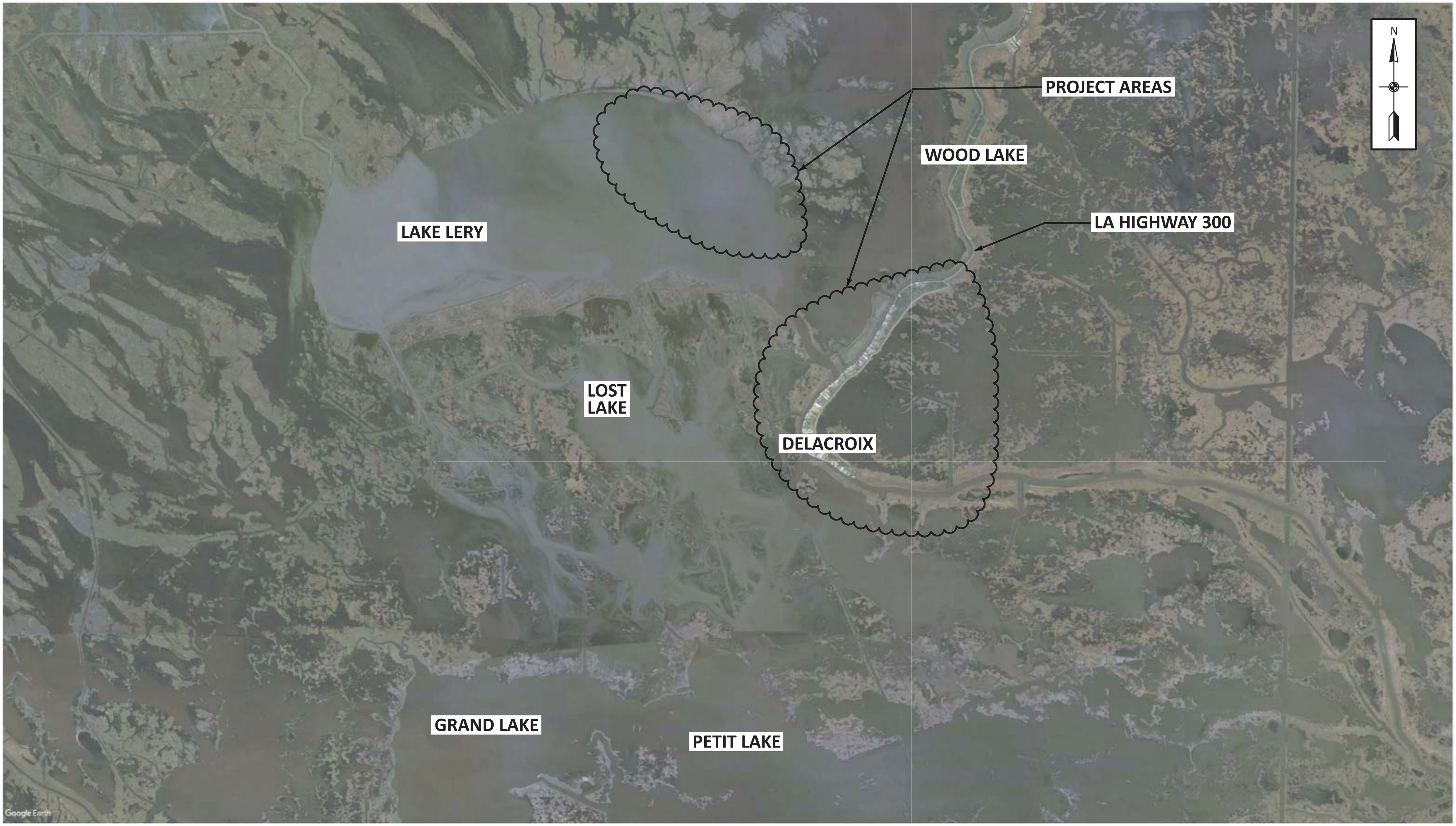
70. This report is issued with the understanding that the owner or the owner's representative has the responsibility to bring the information and recommendations contained herein to the attention of the scientists and engineers for the project so that they are incorporated into the plans and specifications for the project. The owner or the owner's representative also has the responsibility to take the necessary steps to see that the general contractor and all subcontractors follow such recommendations. It is further understood the owner or the owner's representative is responsible for submittal of this report to the appropriate governing agencies.

71. As the geotechnical engineer of record for this project, Eustis Engineering has provided our services in accordance with generally accepted geotechnical engineering practices in this locality at this time. No warranty or guarantee is expressed or implied.

72. Eustis Engineering should be provided the opportunity for a general review of the final design plans and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications. If Eustis Engineering is not accorded the privilege of making this recommended review, we can assume no responsibility for misinterpretation of our recommendations.

73. Although available through Eustis Engineering, the current scope of our service does not include an environmental assessment or an investigation for the presence or absence of wetlands; hazardous or toxic materials in the soil; surface water; ground water; or air on, below, or adjacent to the subject property. Furthermore, the scope does not include the investigation or detection of biological pollutants at the site. The term

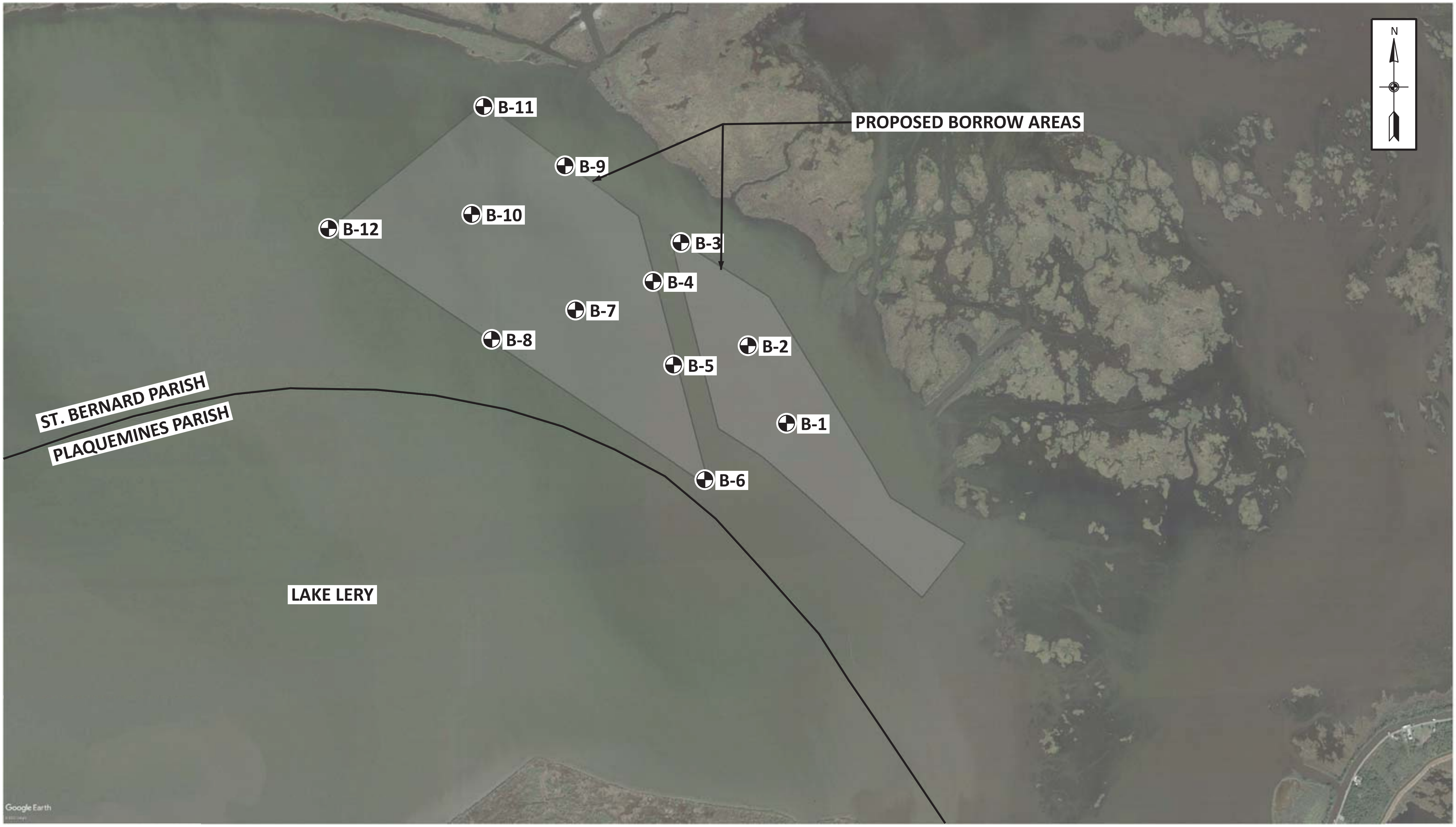
“biological pollutants” includes but is not limited to molds, fungi, spores, bacteria, viruses, and the byproducts of any such biological organisms.



SATELLITE IMAGERY DATED: 15 NOVEMBER 2019

NOT TO SCALE

SITE VICINITY MAP		
STATE OF LOUISIANA COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA) EAST DELACROIX MARSH CREATION, PHASE II ST. BERNARD, LOUISIANA CONTRACT NO. 4400015385 CPRA PROJECT NO. BS-0037 TASK NO. 4		
EUSTIS ENGINEERING L.L.C. SINCE 1946	DRAWN BY: S.T.S.	JOB NO.: 24431.01
	CHECKED BY: J.M.W.	DATE: 23 NOV 2020
	CADD FILE: VICINITY PLAN.DGN	FIGURE 1



SATELLITE IMAGERY DATED: 15 NOVEMBER 2019

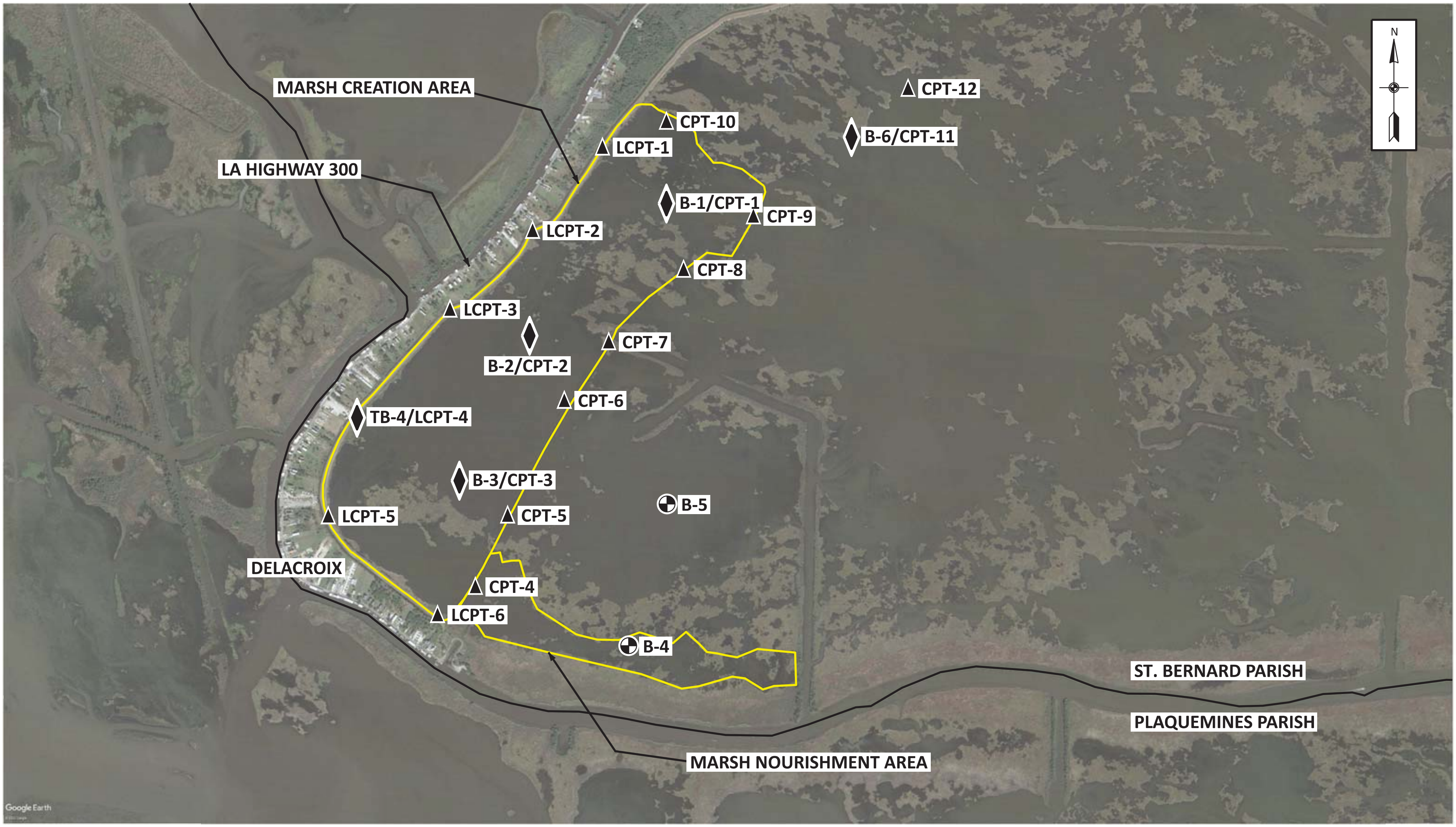
NOT TO SCALE

⊕ DENOTES LOCATIONS OF UNDISTURBED SOIL BORINGS DRILLED ON 3 AND 4 SEPTEMBER 2020

BORING AND CPT LOCATION PLAN
BORROW AREA

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT, PHASE II
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
CPRA PROJECT NO. BS-0037
TASK NO. 4

EUSTIS ENGINEERING L.L.C. SINCE 1946	DRAWN BY: S.T.S.	JOB NO.: 24431.01
	CHECKED BY: J.M.W.	DATE: 23 NOV 2020
	CADD FILE: LOCATION PLAN 1.DGN	FIGURE 2 (SHEET 1 OF 2)



SATELLITE IMAGERY DATED: 15 NOVEMBER 2019

NOT TO SCALE

◒ DENOTES LOCATIONS OF UNDISTURBED SOIL BORINGS DRILLED ON 8 AND 9 SEPTEMBER 2020

▲ DENOTES LOCATIONS OF CONE PENETRATION TESTS PERFORMED BETWEEN 10 SEPTEMBER AND 21 OCTOBER 2020

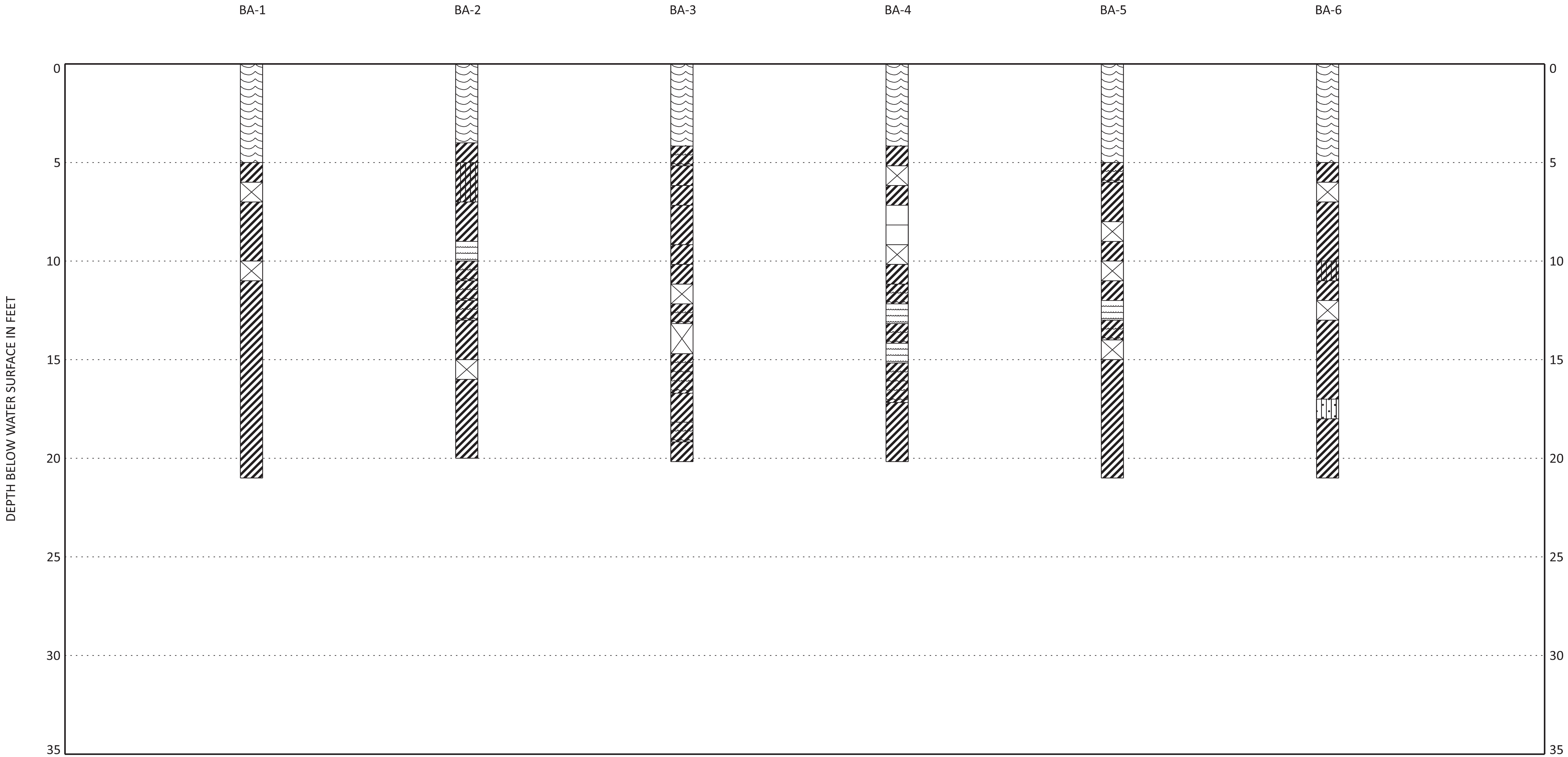
♦ DENOTES LOCATIONS OF CO-LOCATED UNDISTURBED SOIL BORINGS AND CONE PENETRATION TESTS PERFORMED ON 8 SEPTEMBER AND OCTOBER 21 2020

BORING AND CPT LOCATION PLAN
MARSH CREATION

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT, PHASE II
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
CPRA PROJECT NO. BS-0037
TASK NO. 4

EUSTIS ENGINEERING L.L.C. SINCE 1946

DRAWN BY: S.T.S.	JOB NO.: 24431.01
CHECKED BY: J.M.W.	DATE: 23 NOV 2020
CADD FILE: LOCATION PLAN 2.DGN	FIGURE 2 (SHEET 2 OF 2)



BORING MATERIAL GRAPHICS

- CLAY
- SILTY CLAY
- SILTY SAND
- ORGANIC CLAY
- PEAT/HUMUS
- WATER
- NO SAMPLE

NOTES:

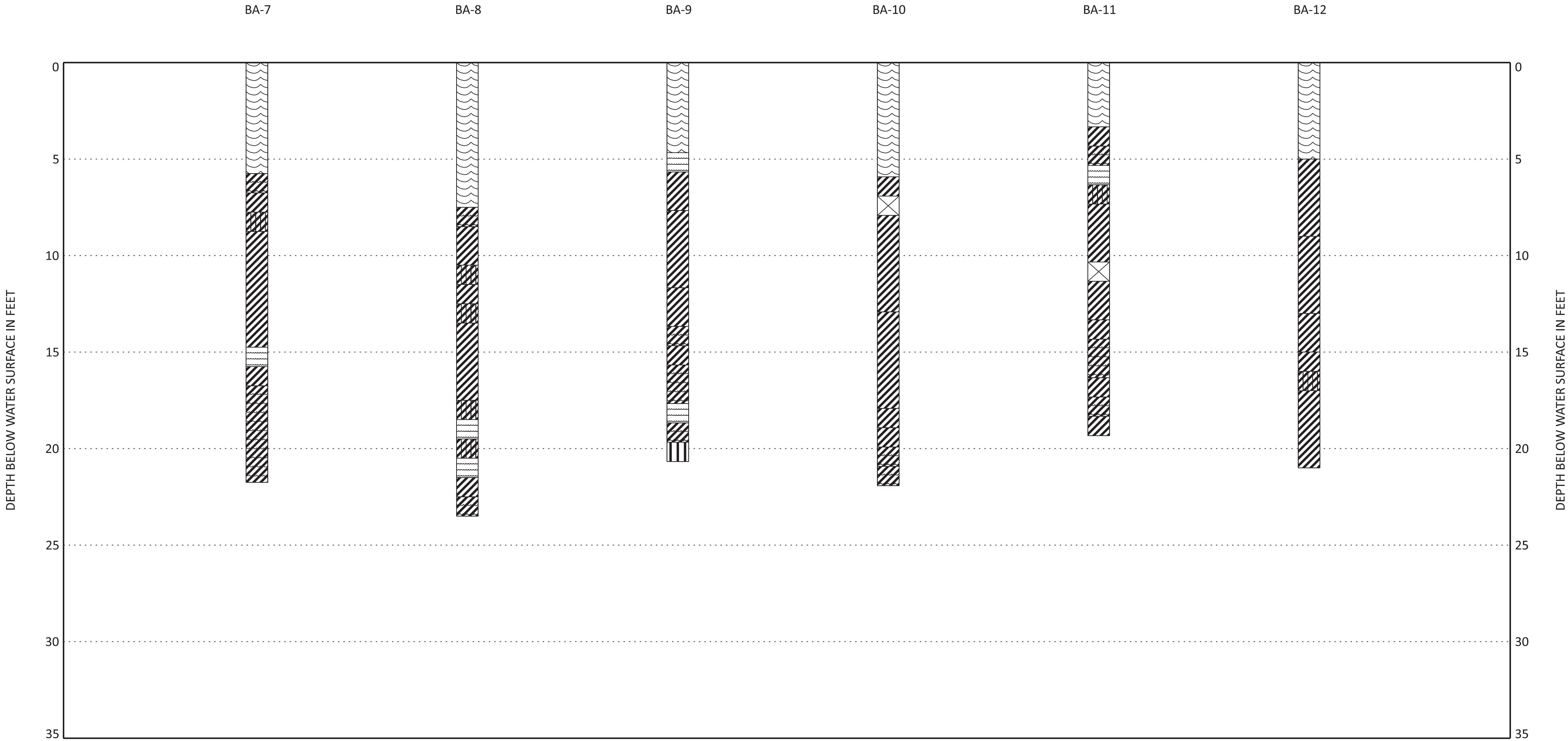
1. APPROXIMATE WATER SURFACE ELEVATION OF +0.5 FT (NAVD88) FURNISHED BY T. BAKER SMITH.
2. SURVEYED MUDLINE SURFACE ELEVATIONS, LATITUDE, AND LONGITUDE FROM SURVEY FURNISHED IN APPENDIX II.

SUBSURFACE PROFILE
BORROW AREA

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT, PHASE II
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
CPRA PROJECT NO. BS-0037
TASK NO. 4

EUSTIS ENGINEERING L.L.C. SINCE 1946

DRAWN BY: S.T.S.	JOB NO.: 24431.01
CHECKED BY: J.M.W.	DATE: 11 DEC 2020
CADD FILE: SUBSOIL 1.DGN	FIGURE 3 (SHEET 1 OF 2)



BORING MATERIAL GRAPHICS

- CLAY
- SILTY CLAY
- SILT
- ORGANIC CLAY
- PEAT/HUMUS
- WATER
- NO SAMPLE

NOTES:

1. APPROXIMATE WATER SURFACE ELEVATION OF +0.5 FT (NAVD88) FURNISHED BY T. BAKER SMITH.

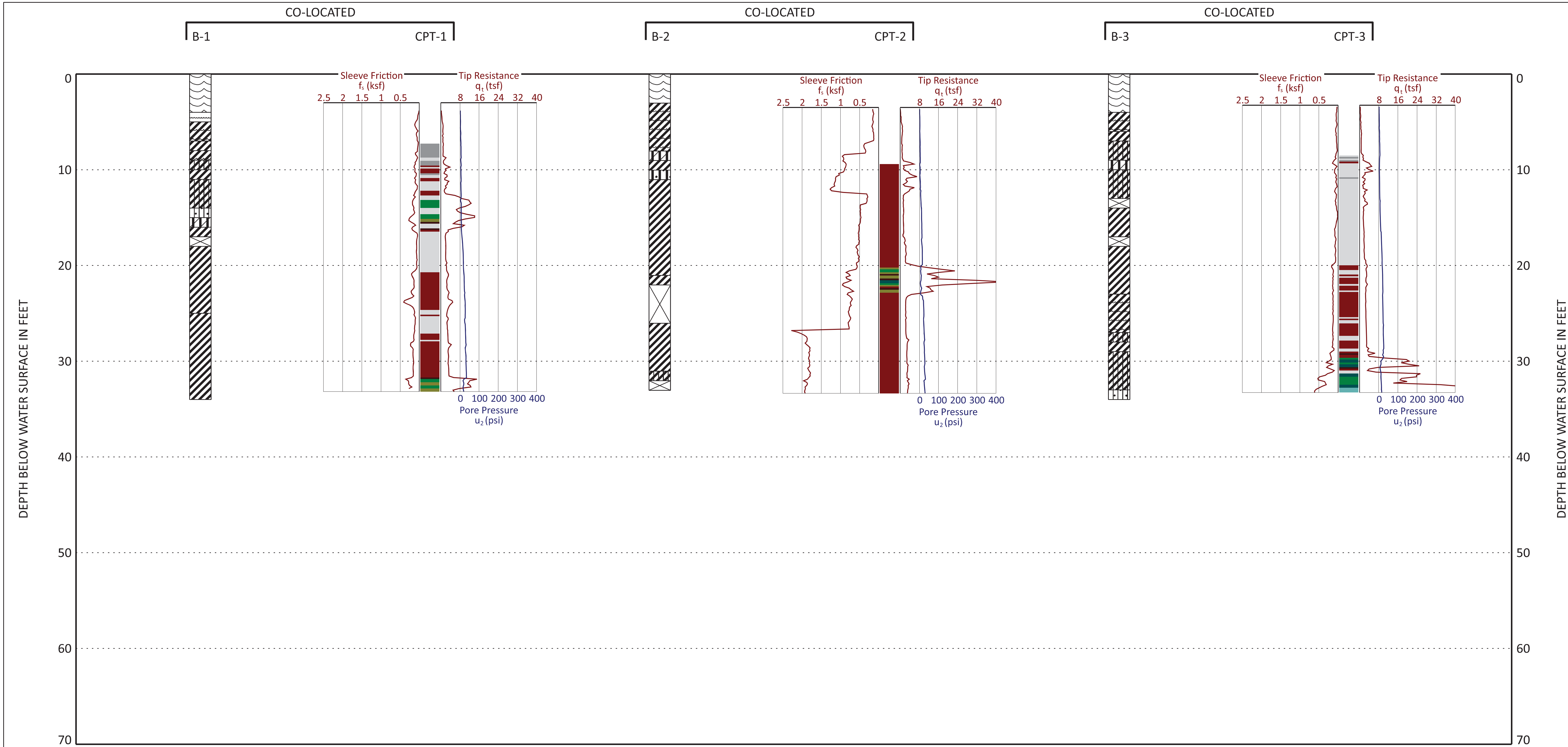
2. SURVEYED MUDLINE SURFACE ELEVATIONS, LATITUDE, AND LONGITUDE FROM SURVEY FURNISHED IN APPENDIX II.

SUBSURFACE PROFILE
BORROW AREA

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT, PHASE II
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
CPRA PROJECT NO. BS-0037
TASK NO. 4

EUSTIS ENGINEERING L.L.C. SINCE 1946

DRAWN BY: S.T.S.	JOB NO.: 24431.01
CHECKED BY: J.M.W.	DATE: 11 DEC 2020
CADD FILE: SUBSOIL 2.DGN	FIGURE 3 (SHEET 2 OF 2)



CPT MATERIAL GRAPHICS

- SENSITIVE FINE GRAINED
- ORGANIC SOILS, PEATS
- CLAY
- SILTY CLAY TO CLAY
- CLAYEY SILT TO SILTY CLAY
- SANDY SILT TO CLAYEY SILT
- SILTY SAND TO SANDY SILT
- SAND TO SILTY SAND
- SAND
- GRAVELLY SAND TO SAND
- VERY STIFF FINE GRAINED (*)
- SAND TO CLAYEY SAND (*)

* OVERCONSOLIDATED OR CEMENTED

Robertson et al (1986) q_c vs Rf

BORING MATERIAL GRAPHICS

- CLAY
- SILTY CLAY
- SILTY SAND
- SANDY SILT
- CLAYEY SILT
- ORGANIC CLAY
- PEAT/HUMUS
- WATER
- NO SAMPLE

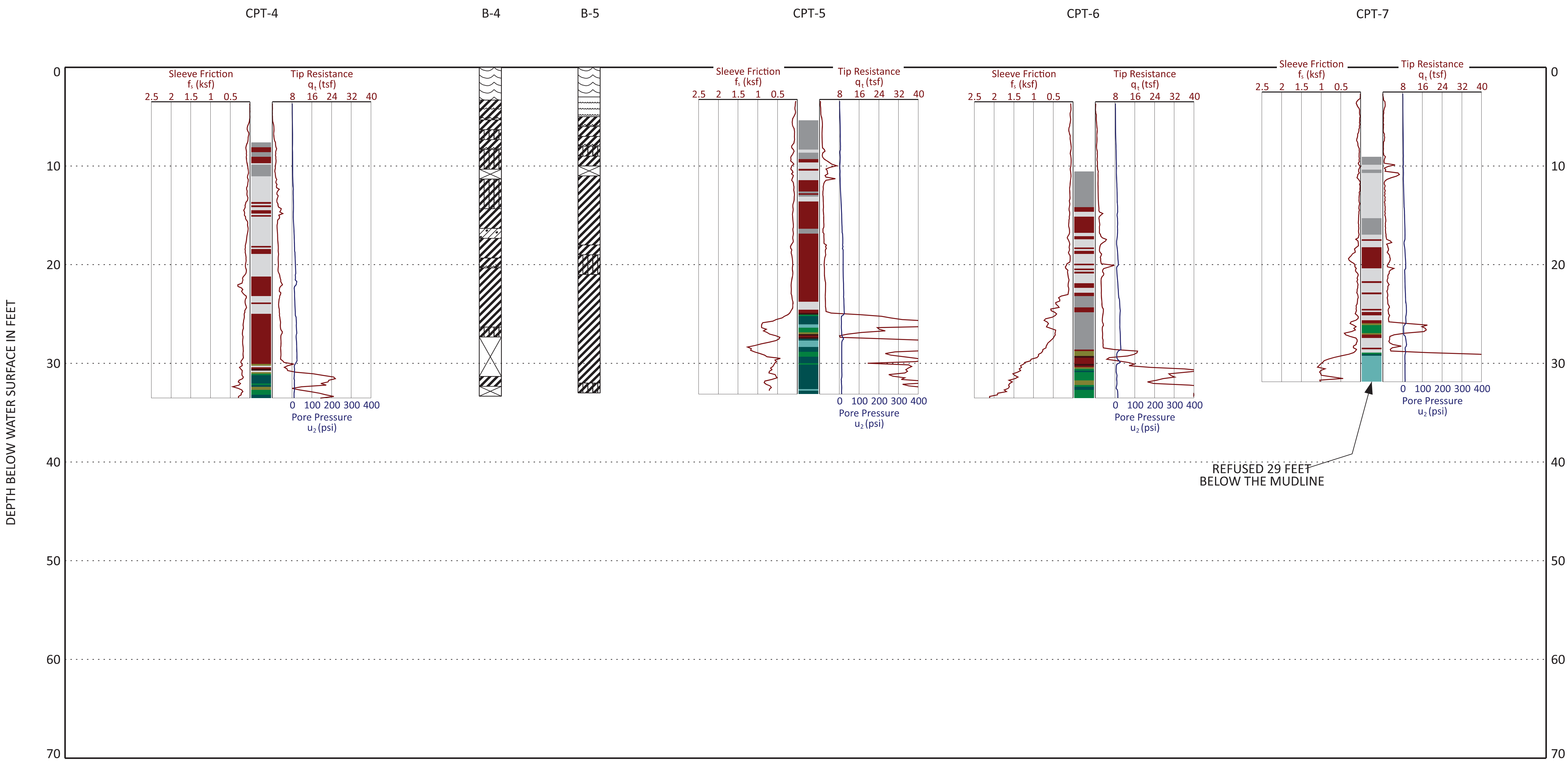
NOTES:

1. APPROXIMATE WATER SURFACE ELEVATION OF +0.5 FT (NAVD88) FURNISHED BY T. BAKER SMITH.
2. SURVEYED MUDLINE SURFACE ELEVATIONS, LATITUDE, AND LONGITUDE FROM SURVEY FURNISHED IN APPENDIX II.

SUBSURFACE PROFILE
MARSH CREATION AREA

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT, PHASE II
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
CPRA PROJECT NO. BS-0037
TASK NO. 4

EUSTIS ENGINEERING L.L.C. SINCE 1946	DRAWN BY: S.T.S.	JOB NO.: 24431.01
	CHECKED BY: J.M.W.	DATE: 11 DEC 2020
	CADD FILE: SUBSOIL 3.DGN	FIGURE 4 (SHEET 1 OF 3)



CPT MATERIAL GRAPHICS

- SENSITIVE FINE GRAINED
- ORGANIC SOILS, PEATS
- CLAY
- SILTY CLAY TO CLAY
- CLAYEY SILT TO SILTY CLAY
- SANDY SILT TO CLAYEY SILT
- SILTY SAND TO SANDY SILT
- SAND TO SILTY SAND
- SAND
- GRAVELLY SAND TO SAND
- VERY STIFF FINE GRAINED (*)
- SAND TO CLAYEY SAND (*)

* OVERCONSOLIDATED OR CEMENTED

Robertson et al (1986) q_c vs Rf

BORING MATERIAL GRAPHICS

- CLAY
- SILTY CLAY
- CLAYEY SAND
- ORGANIC CLAY
- PEAT/HUMUS
- WATER
- NO SAMPLE

NOTES:

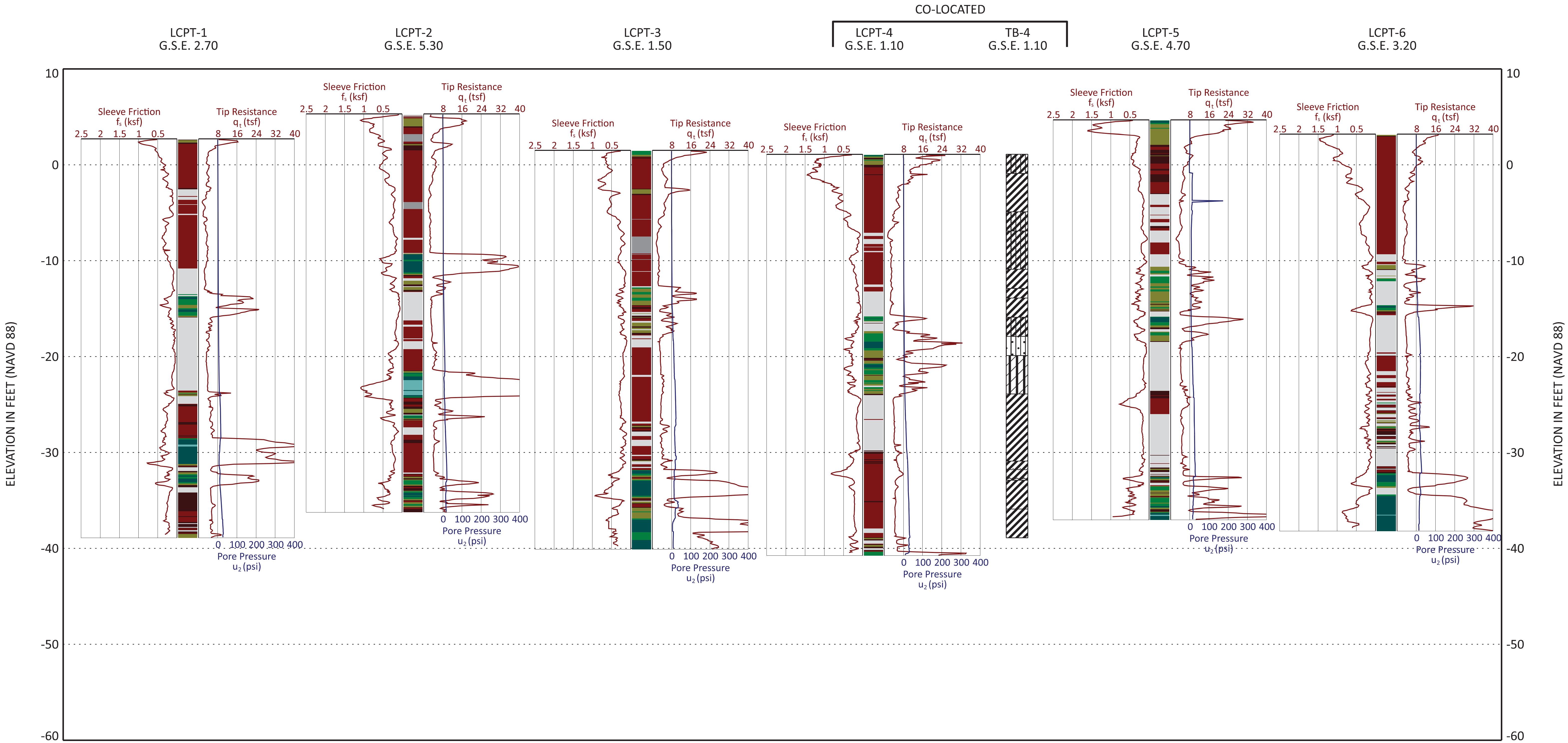
1. APPROXIMATE WATER SURFACE ELEVATION OF +0.5 FT (NAVD88) FURNISHED BY T. BAKER SMITH.
2. SURVEYED MUDLINE SURFACE ELEVATIONS, LATITUDE, AND LONGITUDE FROM SURVEY FURNISHED IN APPENDIX II.

SUBSURFACE PROFILE
MARSH CREATION AREA

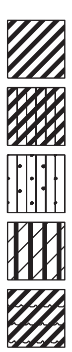
STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT, PHASE II
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
CPRA PROJECT NO. BS-0037
TASK NO. 4

EUSTIS ENGINEERING L.L.C. SINCE 1946

DRAWN BY: S.T.S.	JOB NO.: 24431.01
CHECKED BY: J.M.W.	DATE: 11 DEC 2020
CADD FILE: SUBSOIL 4.DGN	FIGURE 4 (SHEET 2 OF 3)



BORING MATERIAL GRAPHICS


- CLAY
- SILTY CLAY
- SILTY SAND
- CLAYEY SILT
- ORGANIC CLAY

NOTE:

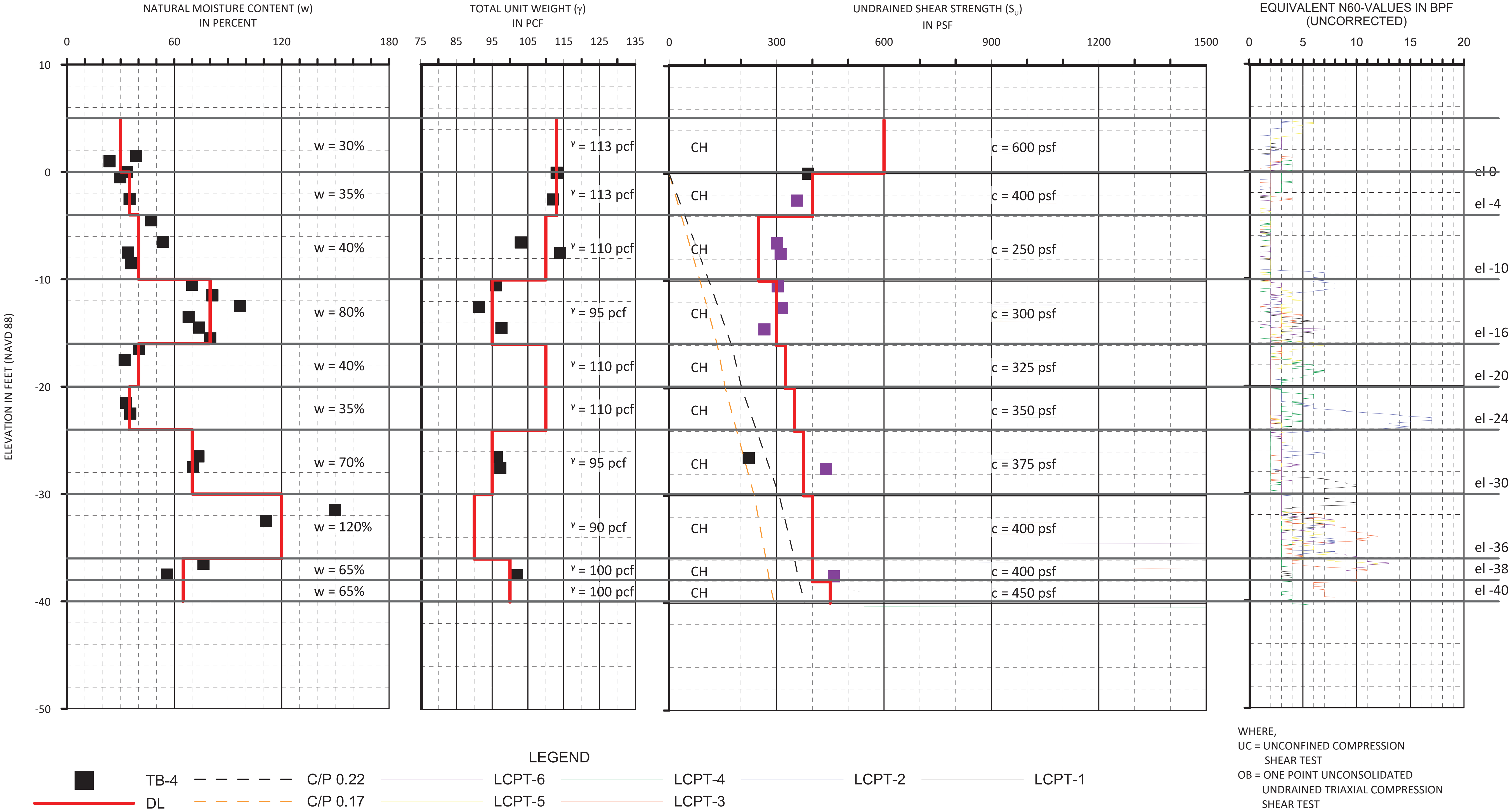
1. G.S.E = GROUND SURFACE ELEVATION FURNISHED BY T. BAKER SMITH.

SUBSURFACE PROFILE
TIDAL LEVEE

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
PROJECT NO. BS-0037
TASK NO. 4

EUSTIS ENGINEERING L.L.C. SINCE 1946

DRAWN BY: S.T.S.	JOB NO.: 24431
CHECKED BY: J.M.W.	DATE: 24 NOV 2020
CADD FILE: SUBSOIL 6.DGN	FIGURE 5



WHERE,
UC = UNCONFINED COMPRESSION SHEAR TEST
OB = ONE POINT UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION SHEAR TEST

OB TEST SHEAR STRENGTHS ARE PURPLE
UC SHEAR STRENGTHS, MOISTURE CONTENTS, N VALUES, AND UNIT WEIGHTS ARE **BLACK**

NOTES:

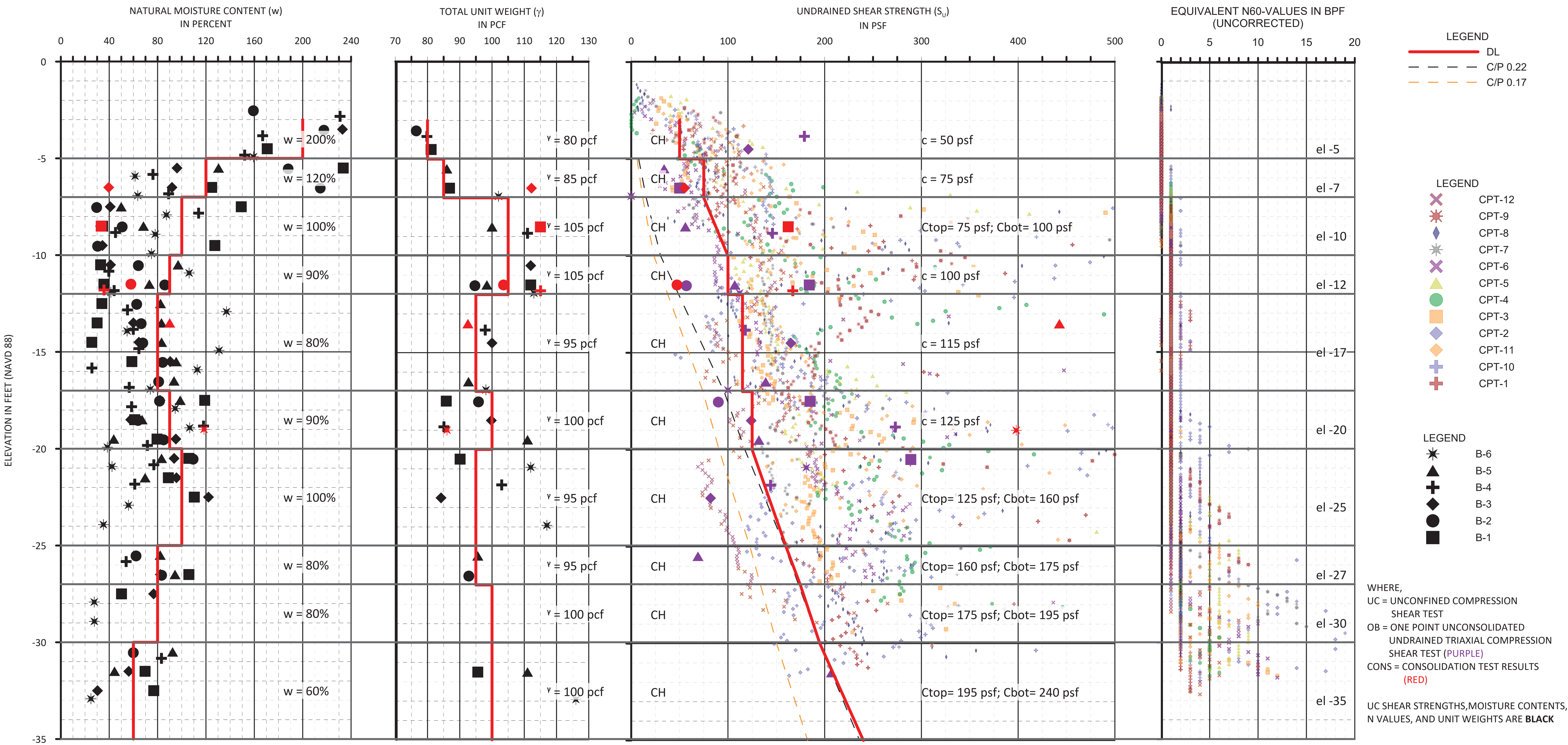
1. REFER TO FIGURE 2 FOR THE APPROXIMATE LOCATION OF THE BORINGS AND CPTS SHOWN ABOVE.
2. LOGS OF THE SOIL BORINGS AND CPT LOGS ARE PROVIDED IN OUR GEOTECHNICAL DATA REPORT.
3. DESIGN PROFILES SHOWN CANNOT FULLY ANTICIPATE ALL PARAMETERS WHICH MAY INFLUENCE SELECTION OF DESIGN VALUES FOR A SPECIFIC ANALYSIS. FOR THIS REASON, THE USER SHOULD CONTACT EUSTIS ENGINEERING, L.L.C. PRIOR TO USE OF DESIGN PROFILES IN ANY ANALYSES.
4. THE GROUND SURFACE ELEVATIONS AT EACH BORING ARE APPROXIMATE BASED ON FURNISHED SURVEY INFORMATION.
5. UNIT WEIGHTS SHOWN ARE TOTAL UNIT WEIGHTS AND MUST BE APPROPRIATELY REDUCED TO ESTIMATE EFFECTIVE STRESS STATES.
6. INTERPRETATIONS OF CPT UNDRAINED SHEAR STRENGTH ARE BASED ON Su(6).

SOIL PARAMETERS FOR
TIDAL LEVEE

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT, PHASE II
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
CPRA PROJECT NO. BS-0037, TASK NO. 4

EUSTIS ENGINEERING L.L.C. SINCE 1946

DRAWN BY: JMW	JOB NO: 24431.01
CHECKED BY: JJH	DATE: 2/21/21
FILE NAME: 24431 TIDAL.GRF	FIGURE 6



NOTES:

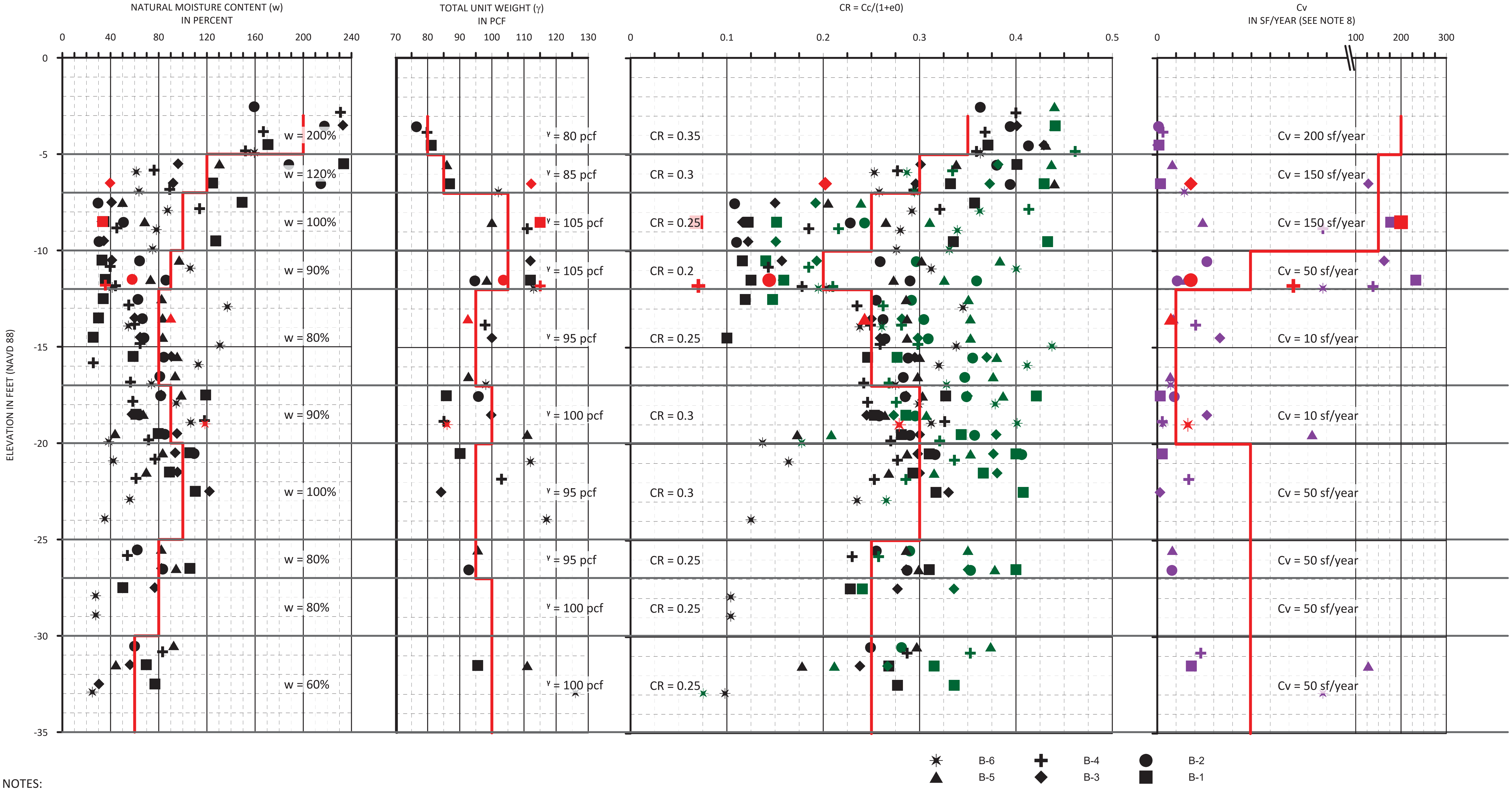
1. REFER TO FIGURE 2 FOR THE APPROXIMATE LOCATION OF THE BORINGS AND CPTS SHOWN ABOVE.
2. LOGS OF THE SOIL BORINGS AND CPT LOGS ARE PROVIDED IN OUR GEOTECHNICAL DATA REPORT.
3. DESIGN PROFILES SHOWN CANNOT FULLY ANTICIPATE ALL PARAMETERS WHICH MAY INFLUENCE SELECTION OF DESIGN VALUES FOR A SPECIFIC ANALYSIS. FOR THIS REASON, THE USER SHOULD CONTACT EUSTIS ENGINEERING, L.L.C. PRIOR TO USE OF DESIGN PROFILES IN ANY ANALYSES.
4. THE GROUND SURFACE ELEVATION AT EACH BORING ARE APPROXIMATE BASED ON FURNISHED SURVEY INFORMATION FROM TBS.
5. UNIT WEIGHTS SHOWN ARE TOTAL UNIT WEIGHTS AND MUST BE APPROPRIATELY REDUCED TO ESTIMATE EFFECTIVE STRESS STATES.
6. INTERPRETATIONS OF CPT UNDRAINED SHEAR STRENGTH ARE BASED ON Su(2) USING A Nkt VALUE EQUAL TO 15.
7. ADDITIONAL CONSIDERATION OF THE SAND DEPOSITS ENCOUNTERED BY SELECT BORINGS AND CONES WILL BE EVALUATED.

SOIL PARAMETERS FOR
MARSH CREATION AND TERRACE AREAS

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT, PHASE II
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
CPRA PROJECT NO. BS-0037, TASK NO. 4

EUSTIS ENGINEERING L.L.C. SINCE 1946

DRAWN BY: JMW	JOB NO: 24431.01
CHECKED BY: JJH	DATE: 2/23/21
FILE NAME: 24431 MCA SU2.GRF	FIGURE 7 SHEET 1 OF 3



NOTES:

1. REFER TO FIGURE 2 FOR THE APPROXIMATE LOCATION OF THE BORINGS AND CPTS SHOWN ABOVE.
2. LOGS OF THE SOIL BORINGS AND CPT LOGS ARE PROVIDED IN OUR PREVIOUS GEOTECHNICAL DATA REPORT.
3. DESIGN PROFILES SHOWN CANNOT FULLY ANTICIPATE ALL PARAMETERS WHICH MAY INFLUENCE SELECTION OF DESIGN VALUES FOR A SPECIFIC ANALYSIS. FOR THIS REASON, THE USER SHOULD CONTACT EUSTIS ENGINEERING, L.L.C. PRIOR TO USE OF DESIGN PROFILES IN ANY ANALYSES.
4. THE GROUND SURFACE ELEVATION AT EACH BORING ARE APPROXIMATE BASED ON FURNISHED SURVEY INFORMATION FROM TBS.
5. UNIT WEIGHTS SHOWN ARE TOTAL UNIT WEIGHTS AND MUST BE APPROPRIATELY REDUCED TO ESTIMATE EFFECTIVE STRESS STATES.
6. ADDITIONAL CONSIDERATION OF THE SAND DEPOSITS ENCOUNTERED BY SELECT BORINGS AND CONES WILL BE EVALUATED.
7. THE SELECTED DESIGN LINE FOR Cv HAS BEEN INCREASED ABOVE MEASURED DATA AND NAVFAC ESTIMATES TO ACCOUNT FOR ADDITIONAL DRAINAGE DUE TO SILT/SAND SEAM NOTED IN THE COMPLETED CPTS AND BORINGS.
8. ADDITIONAL DRAINAGE WILL BE CONSIDERED FOR LAYERS BELOW EL -20

WHERE,
MOISTURE CONTENTS, UNIT WEIGHTS AND ESTIMATES OF CR BASED ON EUSTIS ENGINEERING MOISTURE RELATIONSHIP ARE **BLACK;**

CONSOLIDATION TEST RESULTS ARE RED;

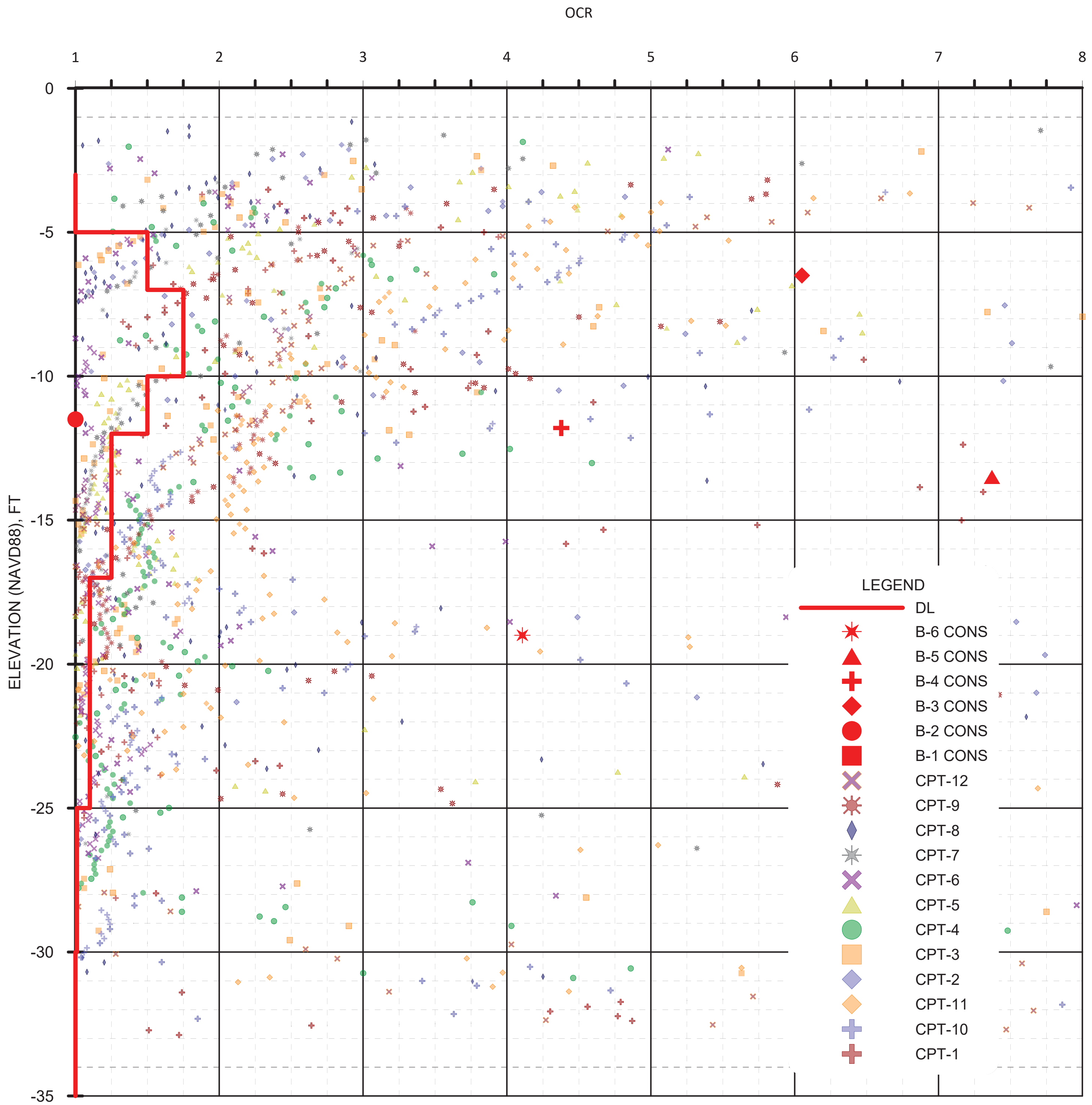
Cv ESTIMATES BASED ON NAVFAC SOIL MECHANICS DESIGN MANUAL 7.01 DATED 1 SEPT 1986 ARE PURPLE;

CR ESTIMATES BASED ON "CORRELATION OF COMPRESSION INDEX AND SOIL PROPERTIES OF NEW ORLEANS AREA CLAYS" DATED 04 SEPT 2011 ARE GREEN

SOIL PARAMETERS FOR
MARSH CREATION AND TERRACE AREAS
CONSOLIDATION PARAMETERS
STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT, PHASE II
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
CPRA PROJECT NO. BS-0037, TASK NO. 4

EUSTIS ENGINEERING L.L.C.
SINCE 1946

DRAWN BY: JMW	JOB NO: 24431
CHECKED BY: JJH	DATE: 2/23/21
FILE NAME: 24431 MCA CONS.GRF	FIGURE 7 SHEET 2 OF 3



NOTES:

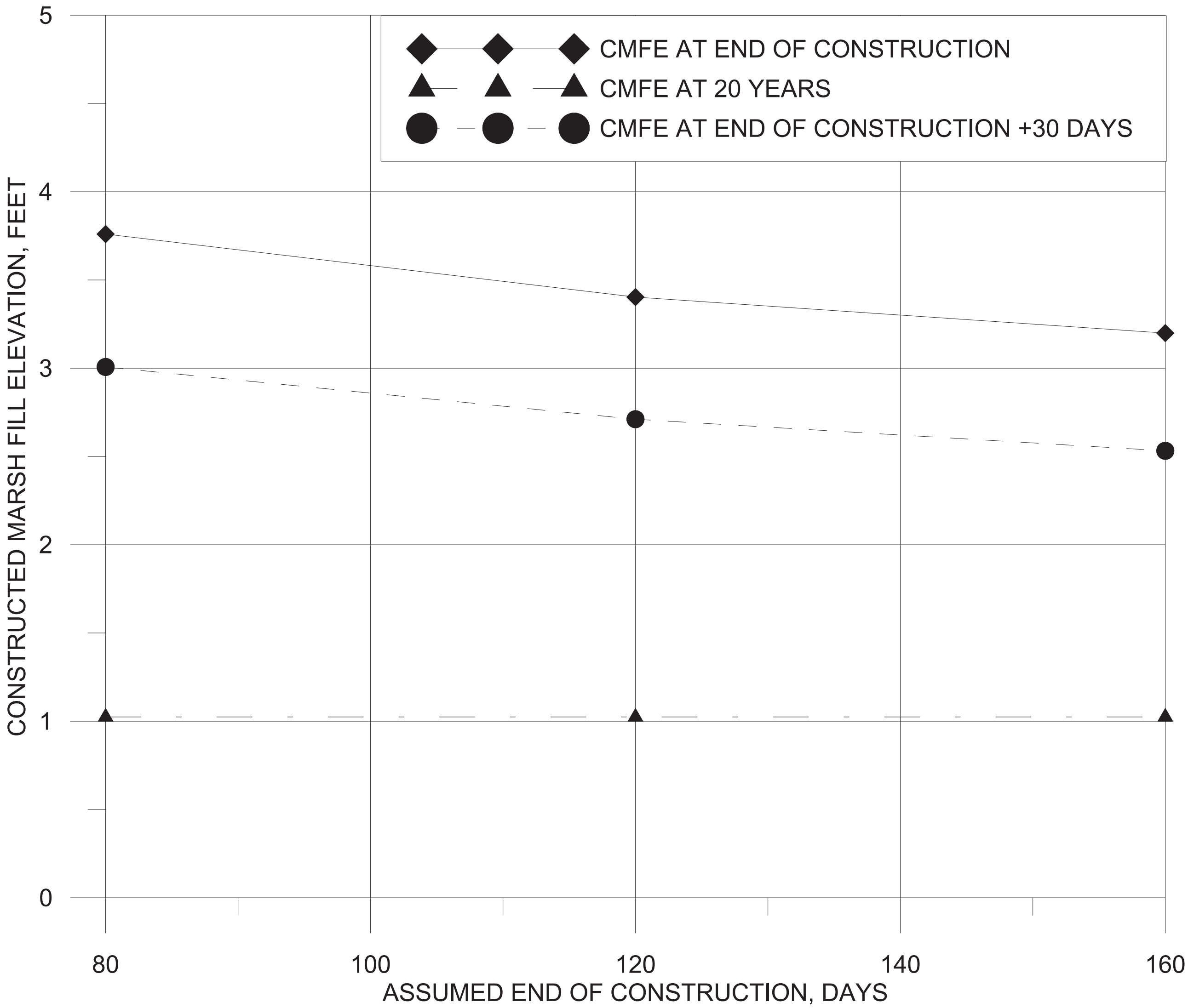
1. REFER TO FIGURE 2 FOR THE APPROXIMATE LOCATIONS OF THE BORINGS AND CPTS SHOWN ABOVE.
2. LOGS OF THE SOIL BORINGS AND CPT LOGS ARE PROVIDED IN OUR GEOTECHNICAL DATA REPORT.
3. INTERPRETATIONS OF CPT OCR ARE BASED ON OCR(1).

MARSH CREATION CELL OCR

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT, PHASE II
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
CPRA PROJECT NO. BS-0037, TASK NO. 4

EUSTIS ENGINEERING L.L.C. SINCE 1946

DRAWN BY: JMW	JOB NO.: 24431.01
CHECKED BY: JJH	DATE: 7 APRIL 2021
FILE NAME: 24431 OCR.GRF	FIGURE 7 SHEET 3 OF 3



NOTES:

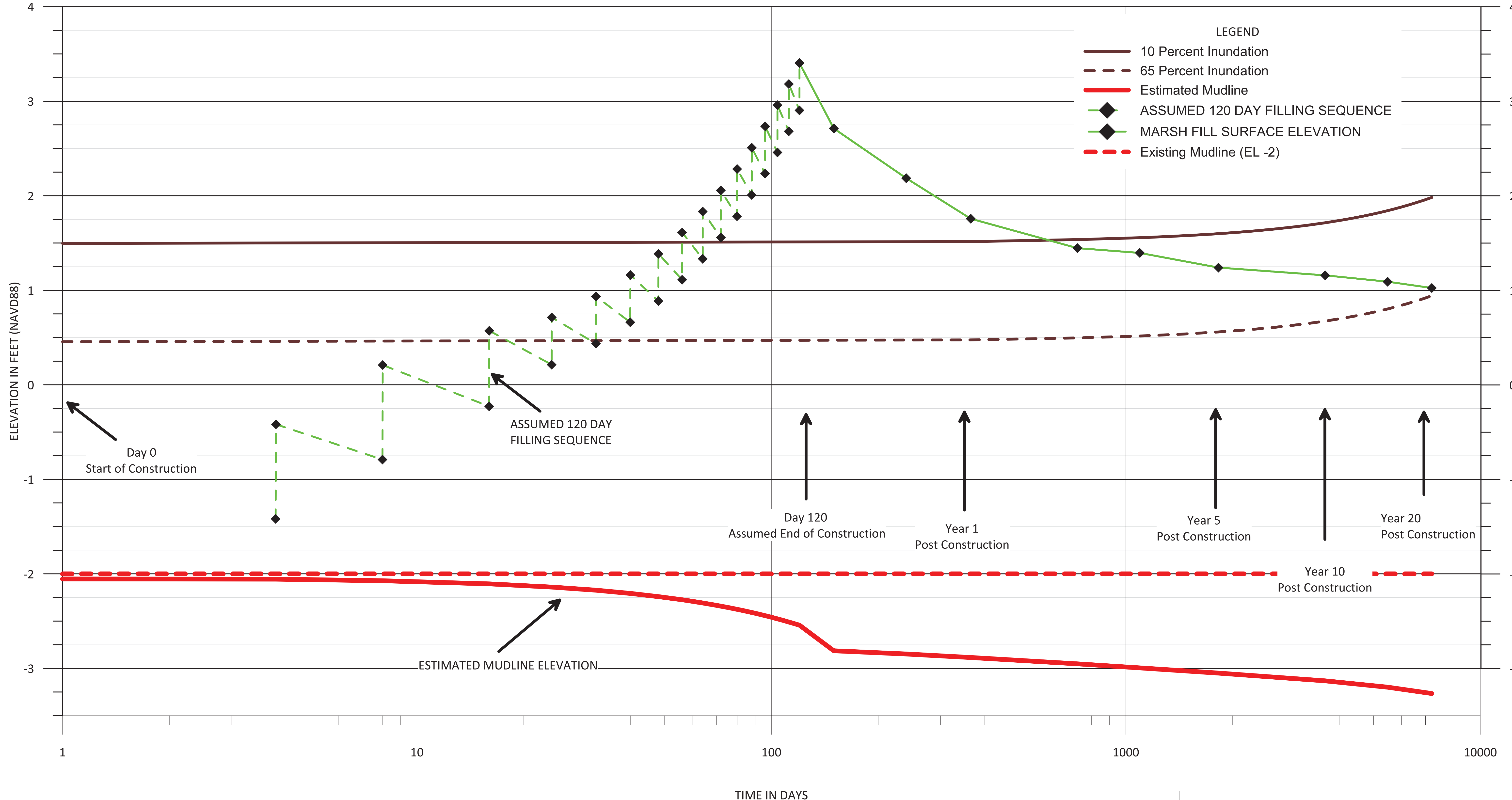
(1) A DESIGN MUDLINE ELEVATION AT -2.0 (NAVD 88) WAS SELECTED BASED ON INFORMATION FURNISHED BY CPRA.
(2) VARIATION IN SUBSURFACE FOUNDATION SOILS WILL EXIST BETWEEN AND BEYOND THE EXPLORATION POINTS WE PRESENT IN OUR GEOTECHNICAL DATA REPORT DATED 11 DECEMBER 2020.
(3) A SUBSIDENCE RATE OF 4 MM/YR WAS ACCOUNTED FOR IN THE SETTLEMENT ESTIMATES.
(4) PRESENTED MARSH FILL ELEVATIONS ARE BASED ON SOIL AT THE BEGINNING OF SELF WEIGHT CONSOLIDATION. OUR ANALYSES NEGLECT SEDIMENTATION SETTLEMENT OF THE MARSH CREATION SLURRY. END OF CONSTRUCTION SLURRY HEIGHTS WILL DEPEND ON THE CONCENTRATION OF THE DREDGED SLURRY. SELF WEIGHT SETTLEMENT BEGINS AT AN APPROXIMATE CONCENTRATION OF 285 g/L.
(5) SELFWEIGHT AND FOUNDATION SETTLEMENT DURING CONSTRUCTION ARE INCLUDED IN OUR ASSUMED FILLING SCHEDULE. WE ESTIMATE APPROXIMATELY 0.5 FT OF FOUNDATION SETTLEMENT DURING CONSTRUCTION DUE TO LATERAL SPREAD OF SOFT SURFICIAL DEPOSITS.

ASSUMED FILLING TIME VS CONSTRUCTED MARSH FILL ELEVATION
OF **MARSH CREATION FILL**

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT, PHASE II
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
CPRA PROJECT NO. BS-0037, TASK NO. 4

EUSTIS ENGINEERING L.L.C. SINCE 1946

DRAWN BY: JMW	JOB NO.: 24431.01
CHECKED BY: JJH	DATE: 6 APRIL 2021
FILE NAME: FILL TIME VS CMFE.GRF	FIGURE 8



NOTES:

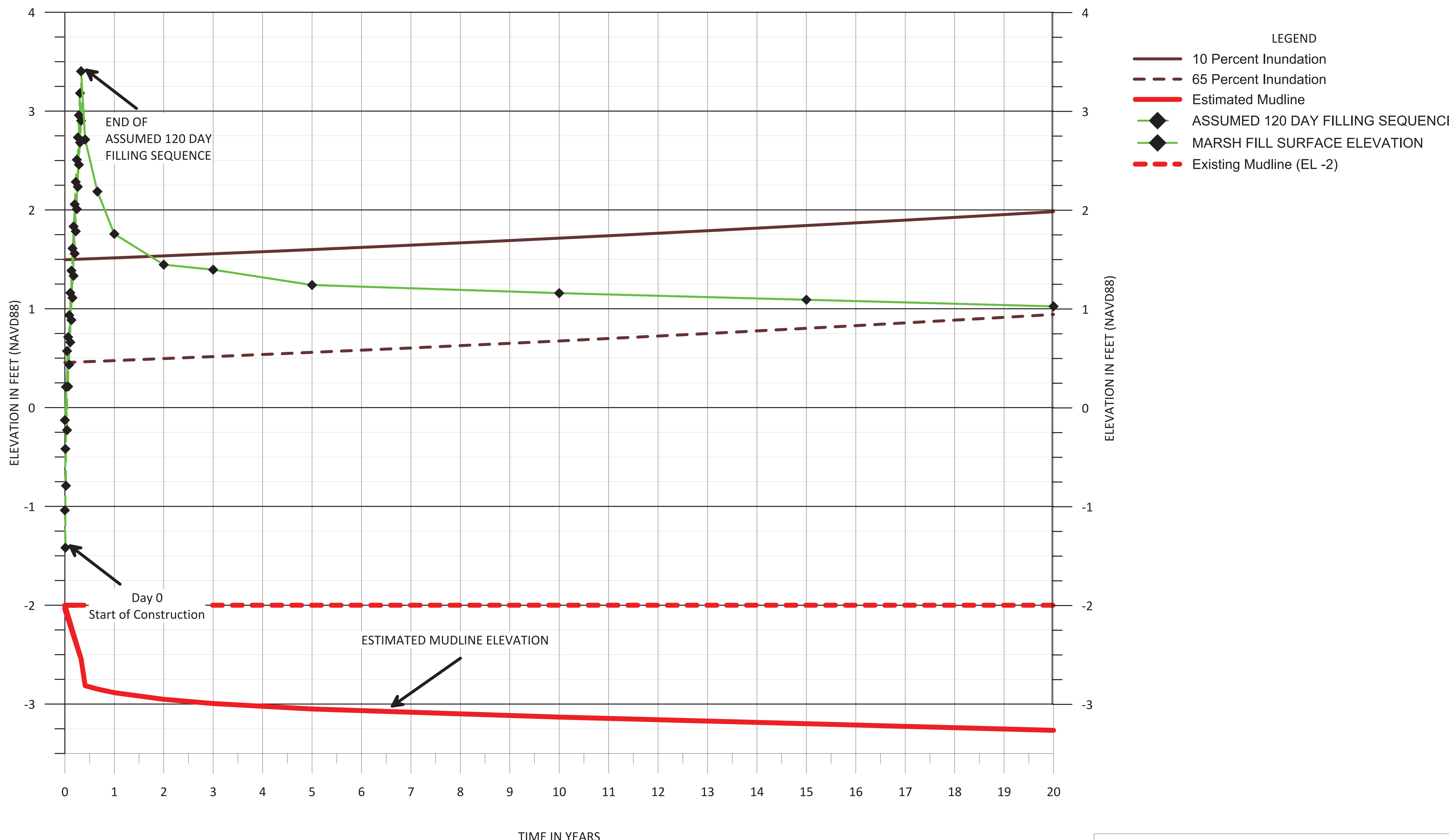
(1) A DESIGN MUDLINE ELEVATION AT -2 (NAVD 88) WAS SELECTED BASED ON INFORMATION FURNISHED BY CPRA.
(2) VARIATION IN SUBSURFACE FOUNDATION SOILS WILL EXIST BETWEEN AND BEYOND THE EXPLORATION POINTS WE PRESENT IN OUR GEOTECHNICAL DATA REPORT DATED 11 DECEMBER 2020.
(3) A SUBSIDENCE RATE OF 4 MM/YR WAS ACCOUNTED FOR IN THE SETTLEMENT CURVES.
(4) PRESENTED MARSH FILL ELEVATIONS ARE BASED ON SOIL AT THE BEGINNING OF SELF WEIGHT CONSOLIDATION. OUR ANALYSES NEGLECT SEDIMENTATION SETTLEMENT OF THE MARSH CREATION SLURRY. END OF CONSTRUCTION SLURRY HEIGHTS WILL DEPEND ON THE CONCENTRATION OF THE DREDGED SLURRY. SELF WEIGHT SETTLEMENT BEGINS AT AN APPROXIMATE CONCENTRATION OF 285 g/L.
(5) CONSTRUCTION OF THE ABOVE CURVES ARE BASED ON AN ASSUMED 120 DAY DREDGED FILLING PLAN AS DESCRIBED IN OUR REPORT. SELFWEIGHT AND FOUNDATION SETTLEMENT DURING CONSTRUCTION ARE INCLUDED IN OUR ASSUMED FILLING SCHEDULE. WE ESTIMATE APPROXIMATELY 0.5 FT OF FOUNDATION SETTLEMENT DURING CONSTRUCTION DUE TO LATERAL SPREAD OF SOFT SURFICIAL DEPOSITS.

ESTIMATED FINISHED ELEVATION IN LOGARITHMIC TIME SCALE
OF **MARSH CREATION FILL**
USING A 120 DAY FILLING PLAN

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT, PHASE II
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
CPRA PROJECT NO. BS-0037, TASK NO. 4

EUSTIS ENGINEERING L.L.C. SINCE 1946

DRAWN BY: J.M.W.	JOB NO.: 24431.01
CHECKED BY: J.J.H.	DATE: 6 APRIL 2021
FILE NAME: STAGED LOG.GRF	FIGURE 9, (SHEET 1 OF 2)



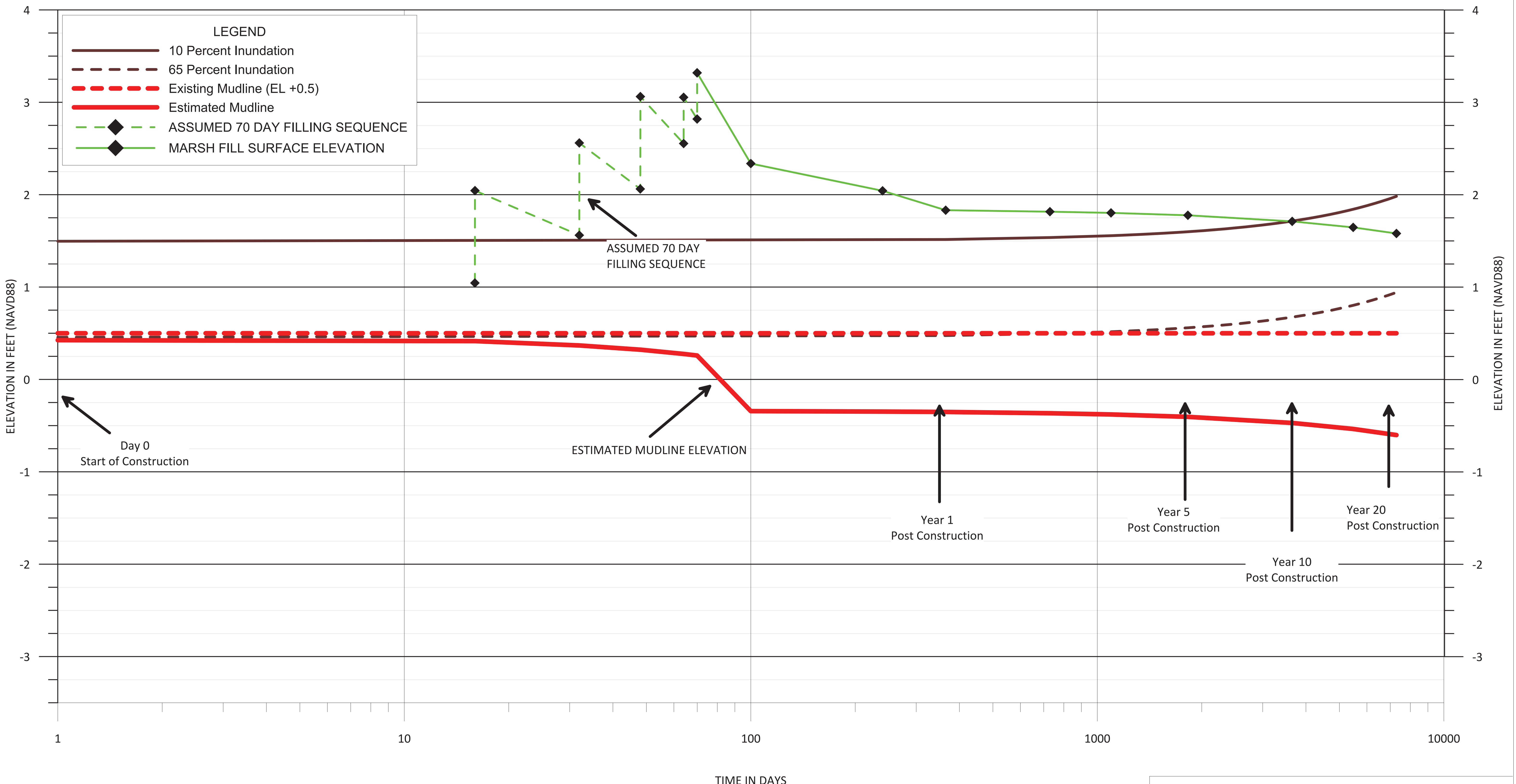
NOTES:

(1) A DESIGN MUDLINE ELEVATION AT -2 (NAVD 88) WAS SELECTED BASED ON INFORMATION FURNISHED BY CPRA.
(2) VARIATION IN SUBSURFACE FOUNDATION SOILS WILL EXIST BETWEEN AND BEYOND THE EXPLORATION POINTS WE PRESENT IN OUR GEOTECHNICAL DATA REPORT DATED 11 DECEMBER 2020.
(3) A SUBSIDENCE RATE OF 4 MM/YR WAS ACCOUNTED FOR IN THE SETTLEMENT CURVES.
(4) PRESENTED MARSH FILL ELEVATIONS ARE BASED ON SOIL AT THE BEGINNING OF SELF WEIGHT CONSOLIDATION. OUR ANALYSES NEGLECT SEDIMENTATION SETTLEMENT OF THE MARSH CREATION SLURRY. END OF CONSTRUCTION SLURRY HEIGHTS WILL DEPEND ON THE CONCENTRATION OF THE DREDGED SLURRY. SELF WEIGHT SETTLEMENT BEGINS AT AN APPROXIMATE CONCENTRATION OF 285 g/L.
(5) CONSTRUCTION OF THE ABOVE CURVES ARE BASED ON AN ASSUMED 120 DAY DREDGED FILLING PLAN AS DESCRIBED IN OUR REPORT. SELFWEIGHT AND FOUNDATION SETTLEMENT DURING CONSTRUCTION ARE INCLUDED IN OUR ASSUMED FILLING SCHEDULE. WE ESTIMATE APPROXIMATELY 0.5 FT OF FOUNDATION SETTLEMENT DURING CONSTRUCTION DUE TO LATERAL SPREAD OF SOFT SURFICIAL DEPOSITS.

ESTIMATED FINISHED ELEVATION IN LINEAR TIME SCALE
OF **MARSH CREATION FILL**
USING A 120 DAY FILLING PLAN

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT, PHASE II
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
CPRA PROJECT NO. BS-0037, TASK NO. 4

EUSTIS ENGINEERING L.L.C. SINCE 1946	DRAWN BY: J.M.W.	JOB NO.: 24431.01
	CHECKED BY: J.J.H.	DATE: 6 APRIL 2021
	FILE NAME: STAGED LOG.GRF	FIGURE 9, (SHEET 2 OF 2)



NOTES:

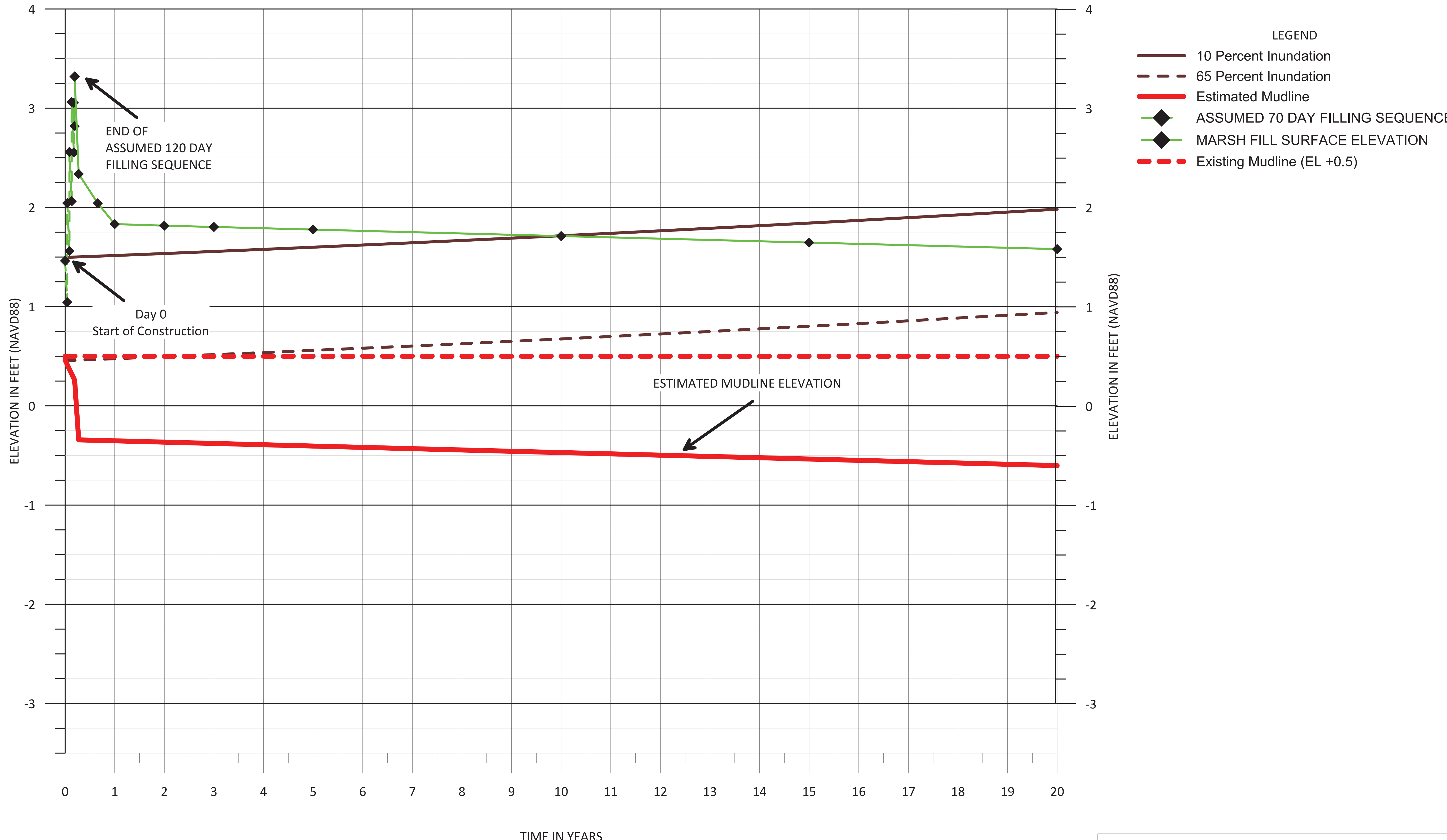
(1) A DESIGN MUDLINE ELEVATION AT +0.5 (NAVD 88) WAS SELECTED BASED ON INFORMATION FURNISHED BY CPRA.
(2) VARIATION IN SUBSURFACE FOUNDATION SOILS WILL EXIST BETWEEN AND BEYOND THE EXPLORATION POINTS WE PRESENT IN OUR GEOTECHNICAL DATA REPORT DATED 11 DECEMBER 2020.
(3) A SUBSIDENCE RATE OF 4 MM/YR WAS ACCOUNTED FOR IN THE SETTLEMENT CURVES.
(4) PRESENTED MARSH FILL ELEVATIONS ARE BASED ON SOIL AT THE BEGINNING OF SELF WEIGHT CONSOLIDATION. OUR ANALYSES NEGLECT SEDIMENTATION SETTLEMENT OF THE MARSH CREATION SLURRY. END OF CONSTRUCTION SLURRY HEIGHTS WILL DEPEND ON THE CONCENTRATION OF THE DREDGED SLURRY. SELF WEIGHT SETTLEMENT BEGINS AT AN APPROXIMATE CONCENTRATION OF 285 g/L.
(5) CONSTRUCTION OF THE ABOVE CURVES ARE BASED ON AN ASSUMED 70 DAY DREDGED FILLING PLAN AS DESCRIBED IN OUR REPORT. SELFWEIGHT AND FOUNDATION SETTLEMENT DURING CONSTRUCTION ARE INCLUDED IN OUR ASSUMED FILLING SCHEDULE. WE ESTIMATE APPROXIMATELY 0.1 FT OF FOUNDATION SETTLEMENT DURING CONSTRUCTION DUE TO LATERAL SPREAD OF SOFT SURFICIAL DEPOSITS.
(6) THE PRESENTED 70 DAY FILLING SCHEDULE WAS SELECTED TO MATCH THE FILLING OF MARSH CREATION AREAS AFTER ACHIEVING AN APPROXIMATE EL OF +0.5. THIS OCCURS AT APPROXIMATELY 50 DAYS ASSUMING A 120 DAY MARSH CREATION FILLING SCHEDULE.
(7) ANALYSES INCLUDE APPROXIMATELY 0.2 FT OF DESSICATION SETTLEMENT DURING THE 1ST 2 YEARS.

ESTIMATED FINISHED ELEVATION IN LOGARITHMIC TIME SCALE
OF **MARSH NOURISHMENT FILL**
USING A 120 DAY FILLING PLAN

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT, PHASE II
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
CPRA PROJECT NO. BS-0037, TASK NO. 4

EUSTIS ENGINEERING L.L.C. SINCE 1946

DRAWN BY: J.M.W.	JOB NO.: 24431.01
CHECKED BY: J.J.H.	DATE: 6 APRIL 2021
FILE NAME: STAGED LOG.GRF	FIGURE 10, (SHEET 1 OF 2)



NOTES:

(1) A DESIGN MUDLINE ELEVATION AT +0.5 (NAVD 88) WAS SELECTED BASED ON INFORMATION FURNISHED BY CPRA.
(2) VARIATION IN SUBSURFACE FOUNDATION SOILS WILL EXIST BETWEEN AND BEYOND THE EXPLORATION POINTS WE PRESENT IN OUR GEOTECHNICAL DATA REPORT DATED 11 DECEMBER 2020.
(3) A SUBSIDENCE RATE OF 4 MM/YR WAS ACCOUNTED FOR IN THE SETTLEMENT CURVES.
(4) PRESENTED MARSH FILL ELEVATIONS ARE BASED ON SOIL AT THE BEGINNING OF SELF WEIGHT CONSOLIDATION. OUR ANALYSES NEGLECT SEDIMENTATION SETTLEMENT OF THE MARSH CREATION SLURRY. END OF CONSTRUCTION SLURRY HEIGHTS WILL DEPEND ON THE CONCENTRATION OF THE DREDGED SLURRY. SELF WEIGHT SETTLEMENT BEGINS AT AN APPROXIMATE CONCENTRATION OF 285 g/L.
(5) CONSTRUCTION OF THE ABOVE CURVES ARE BASED ON AN ASSUMED 70 DAY DREDGED FILLING PLAN AS DESCRIBED IN OUR REPORT. SELFWEIGHT AND FOUNDATION SETTLEMENT DURING CONSTRUCTION ARE INCLUDED IN OUR ASSUMED FILLING SCHEDULE. WE ESTIMATE APPROXIMATELY 0.1 FT OF FOUNDATION SETTLEMENT DURING CONSTRUCTION DUE TO LATERAL SPREAD OF SOFT SURFICIAL DEPOSITS.
(6) THE PRESENTED 70 DAY FILLING SCHEDULE WAS SELECTED TO MATCH THE FILLING OF MARSH CREATION AREAS AFTER ACHIEVING AN APPROXIMATE EL OF +0.5. THIS OCCURS AT APPROXIMATELY 50 DAYS ASSUMING A 120 DAY MARSH CREATION FILLING SCHEDULE.
(7) ANALYSES INCLUDE APPROXIMATELY 0.2 FT OF DESSICATION SETTLEMENT DURING THE 1ST 2 YEARS.

ESTIMATED FINISHED ELEVATION IN LINEAR TIME SCALE
OF **MARSH NOURISHMENT FILL**
USING A 120 DAY FILLING PLAN

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)
EAST DELACROIX MARSH CREATION PROJECT, PHASE II
ST. BERNARD PARISH, LOUISIANA
CONTRACT NO. 4400015385
CPRA PROJECT NO. BS-0037, TASK NO. 4

EUSTIS ENGINEERING L.L.C. SINCE 1946	DRAWN BY: J.M.W.	JOB NO.: 24431.01
	CHECKED BY: J.J.H.	DATE: 6 APRIL 2021
	FILE NAME: STAGED LOG.GRF	FIGURE 10, (SHEET 2 OF 2)

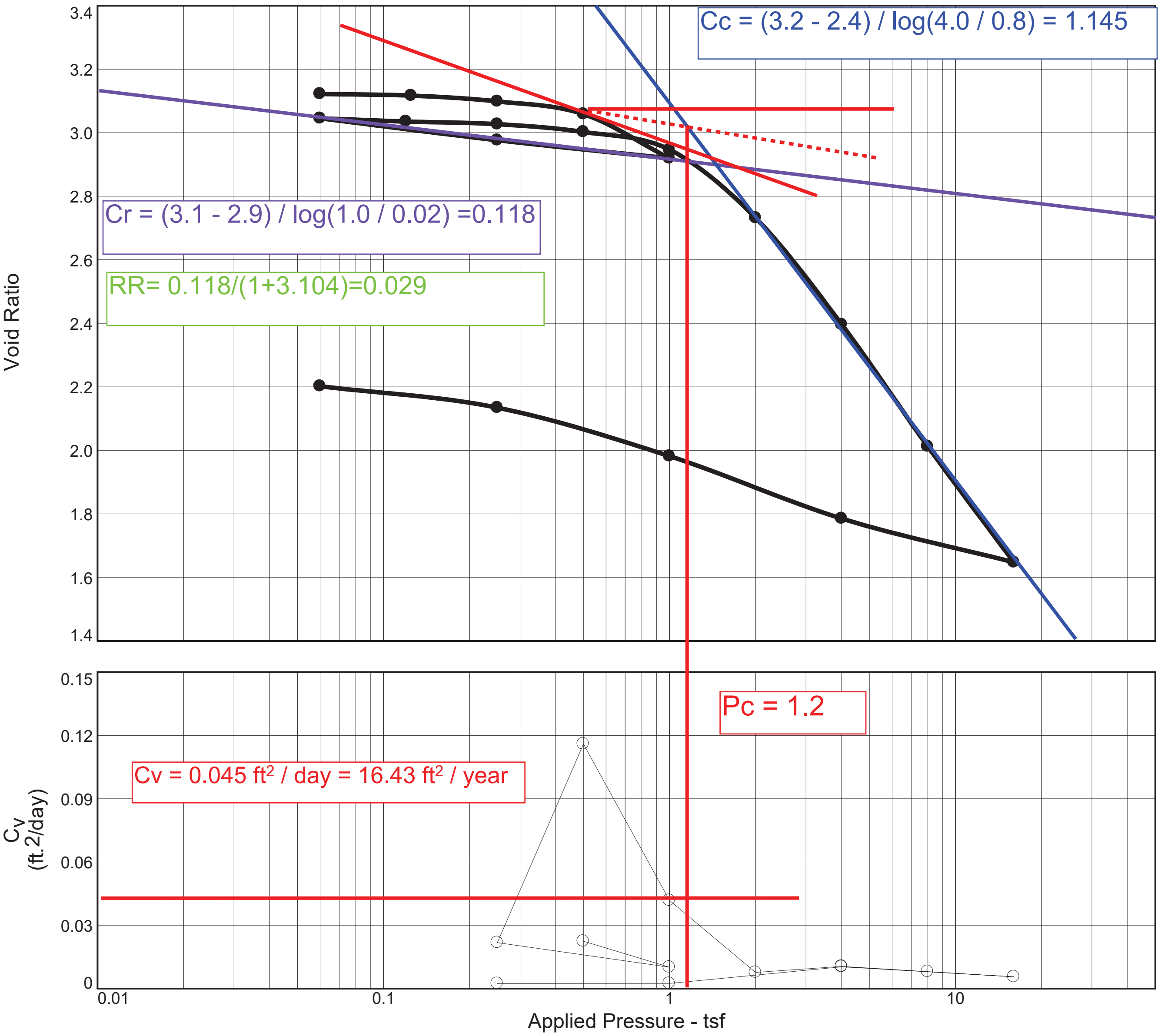
APPENDIX I
CONSOLIDATION TEST DATA

24431.01 EAST DELACROIX MARSH CREATION CONSOLIDATION TEST DATA SUMMARY

Consolidation Test Summary

No.	Boring	Boring El. (feet)	Sample Depth (feet)	Sample El. (feet)	USCS	Liquid Limit	Plasticity Index	w%	Cc	Cs	eo	CR	RR Based on Consol Test	Theoretical RR=.15*CR	Dry Unit Weight (pcf)	Moist Unit Weight, (pcf)	Approximate Po (Psf)	Approximate Po (tsf)	Approximate Pc (tsf)	OCR = Pc/Po	Su= Po*.22*(Pc/Po)^.80	Cv (sq.ft/year)
1	B-1 (3B)	0.5	9.0	-8.5	CL	33.0	13.0	33.4	0.130	0.006	0.902	0.068	0.003	0.010	86.2	115.0	121.0	0.06	0.58	9.59	162	200.00
2	B-2 (5A)	0.5	12.0	-11.5	CH	64.0	37.0	57.9	0.368	0.024	1.559	0.144	0.009	0.022	65.6	103.6	215.3	0.11	0.11	1.00	47	18.00
3	B-3 (2B)	0.5	7.0	-6.5	CL	37.0	16.0	39.6	0.420	0.017	1.081	0.202	0.008	0.030	80.4	112.2	59.5	0.03	0.18	6.05	55	18.00
4	B-4 (5B)	0.5	12.3	-11.8	CL	36.0	17.0	35.7	0.140	0.025	0.980	0.070	0.013	0.011	84.8	115.1	233.0	0.12	0.51	4.38	167	73.00
5	B-5 (6B)	0.5	14.0	-13.5	CH	95.0	77.0	90.0	0.844	0.029	2.472	0.243	0.008	0.036	48.7	92.5	407.0	0.20	1.50	7.37	443	7.30
6	B-6 (8A)	0.5	19.5	-19.0	CH	137.0	93.0	118.4	1.145	0.118	3.104	0.279	0.029	0.042	39.4	86.0	584.4	0.29	1.20	4.11	398	16.43

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (tsf)	C_c	Initial Void Ratio
Saturation	Moisture							
98.8 %	118.4 %	39.4	137	93	2.59	1.7	1.29	3.104

MATERIAL DESCRIPTION	USCS	AASHTO
XSO G & BR ORG CL W/ DEC WD	CH	

Project No. 24431 **Client:** STATE OF LOUISIANA, OFFICE OF COASTAL

Project: LOUISIANA, STATE OF - COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA),

Source of Sample: B-6 **Depth:** 19.42 **Sample Number:** 8A

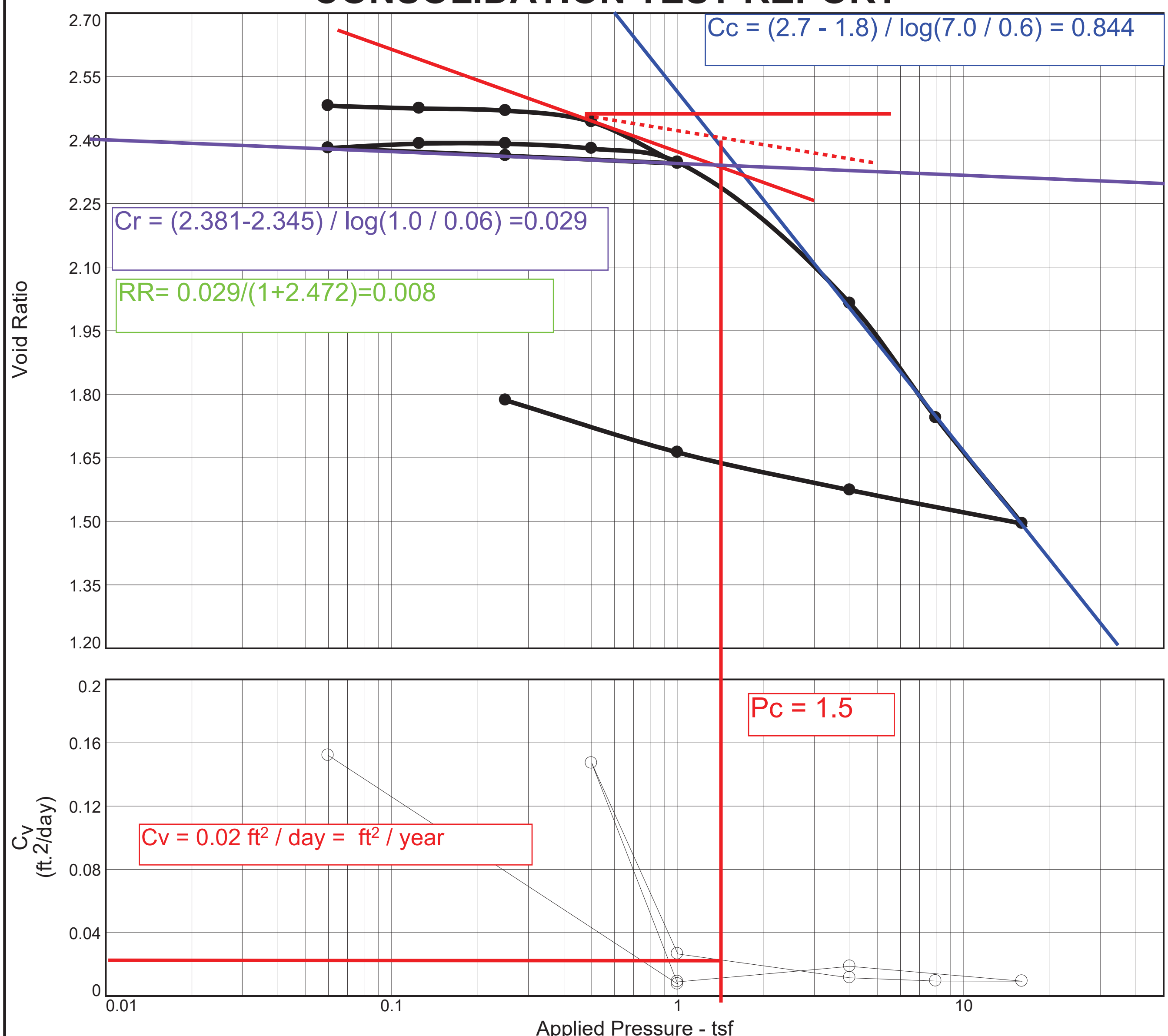
EUSTIS ENGINEERING SINCE 1946

Remarks:

Figure

Tested By: BH **Checked By:** RR

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (tsf)	C_c	Initial Void Ratio
Saturation	Moisture							
98.7 %	90.0 %	48.7	95	77	2.71	2.6	0.93	2.472

MATERIAL DESCRIPTION	USCS	AASHTO
XSO G CL W/ TR-SI POC & SH FRAG	CH	

Project No. 24431 **Client:** STATE OF LOUISIANA, OFFICE OF COASTAL

Project: LOUISIANA, STATE OF - COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA),

Source of Sample: B-5 **Depth:** 14 **Sample Number:** 6B

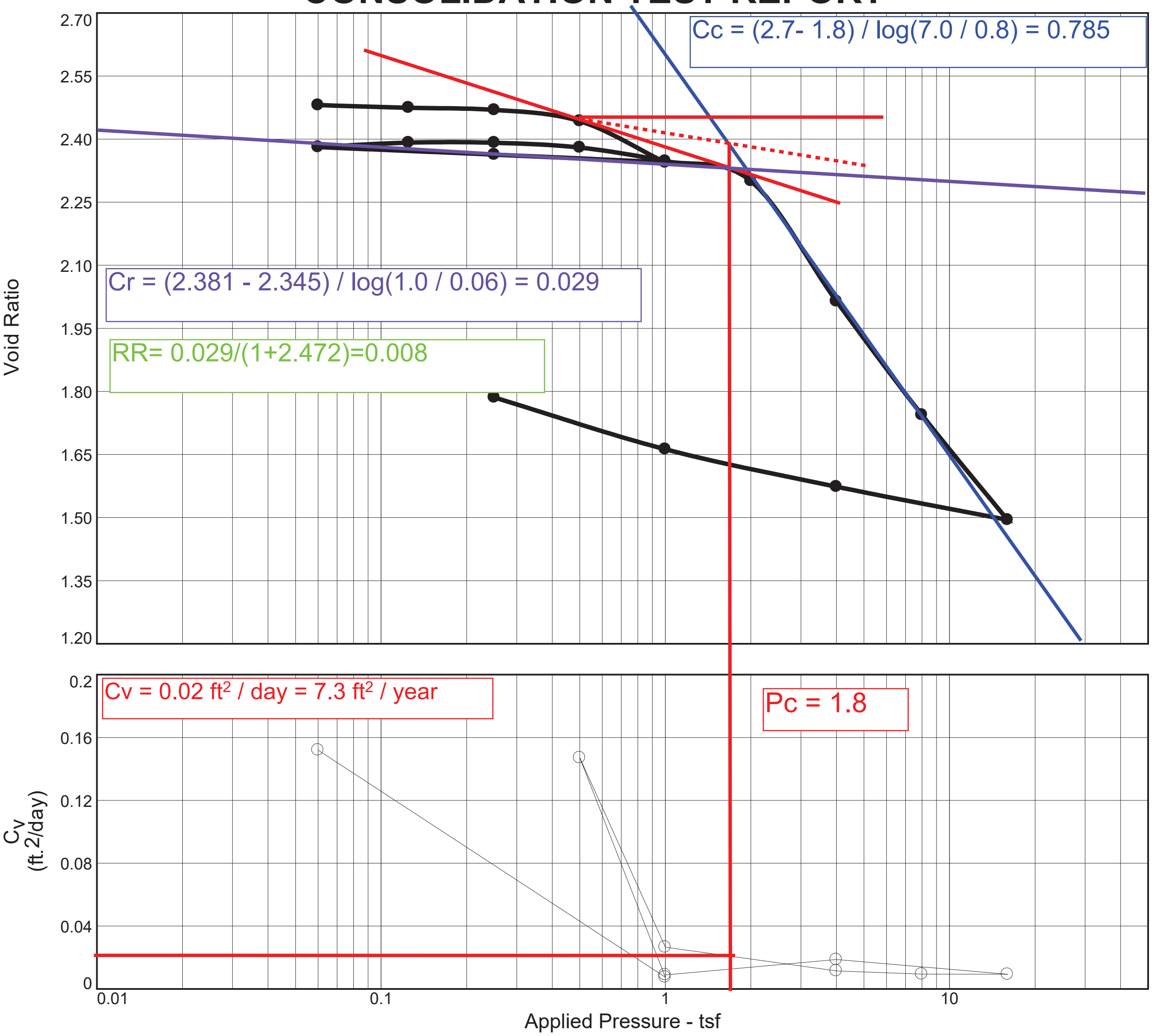
EUSTIS ENGINEERING SINCE 1946

Remarks:

Figure

Tested By: BH **Checked By:** RR

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (tsf)	C_c	Initial Void Ratio
Saturation	Moisture							
98.7 %	90.0 %	48.7	95	77	2.71	1.9	0.93	2.472

MATERIAL DESCRIPTION	USCS	AASHTO
XSO G CL W/ TR-SI POC & SH FRAG	CH	

Project No. 24431 **Client:** STATE OF LOUISIANA, OFFICE OF COASTAL

Project: LOUISIANA, STATE OF - COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA),

Source of Sample: B-5 **Depth:** 14 **Sample Number:** 6B

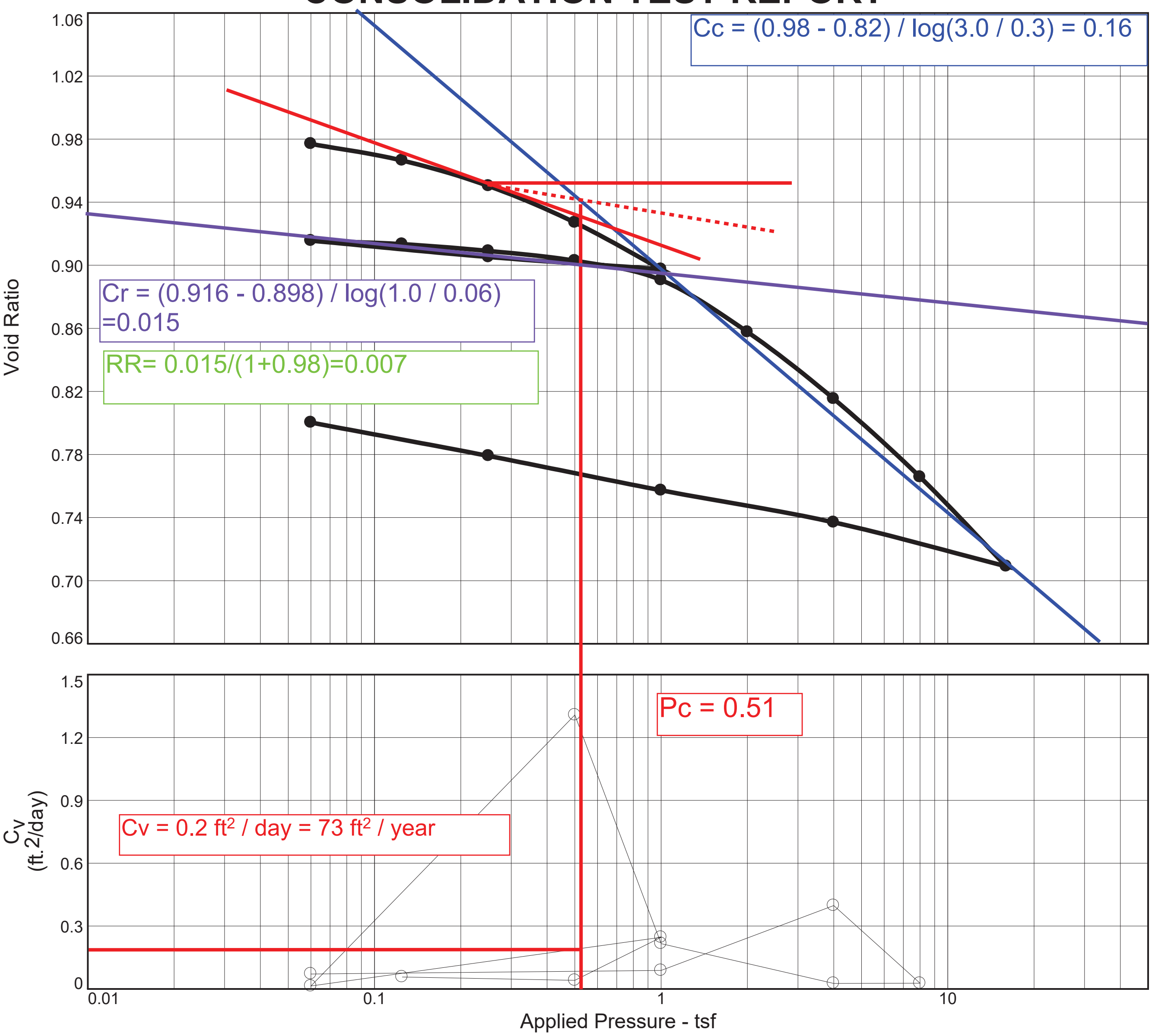
EUSTIS ENGINEERING SINCE 1946

Remarks:

Figure

Tested By: BH **Checked By:** RR

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (tsf)	C_c	Initial Void Ratio
Saturation	Moisture							
98.1 %	35.7 %	84.8	36	17	2.69	0.6	0.13	0.980

MATERIAL DESCRIPTION	USCS	AASHTO
XSO G SICL W/ TR-OM	CL	

Project No. 24431 **Client:** STATE OF LOUISIANA, OFFICE OF COASTAL

Project: LOUISIANA, STATE OF - COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA),

Source of Sample: B-4 **Depth:** 12.33 **Sample Number:** 5B

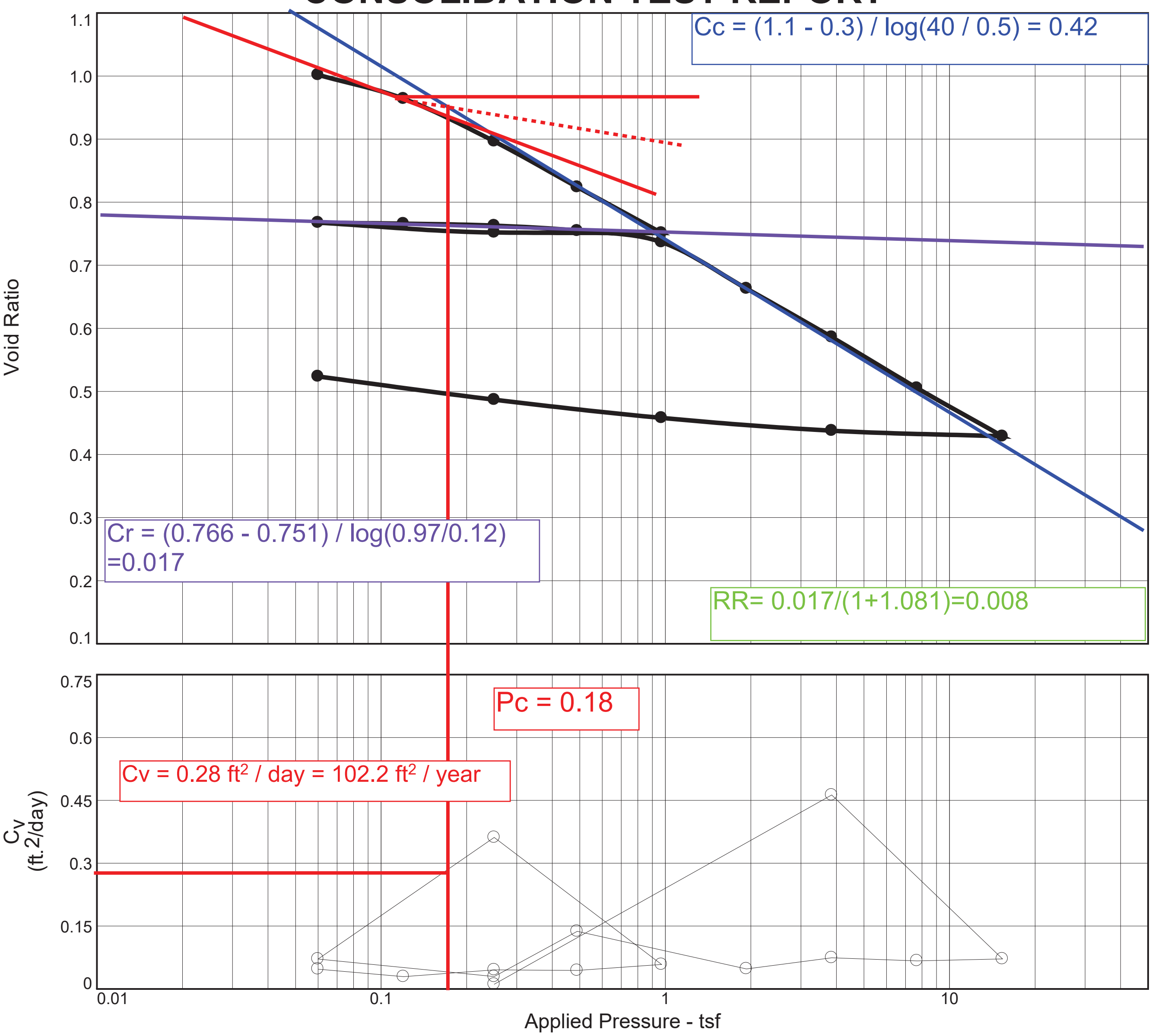
EUSTIS ENGINEERING SINCE 1946

Remarks:

Figure

Tested By: BH **Checked By:** RR

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (tsf)	C_c	Initial Void Ratio
Saturation	Moisture							
98.3 %	39.6 %	80.4	37	16	2.68	0.2	0.26	1.081

MATERIAL DESCRIPTION	USCS	AASHTO
VSO G SICL W/ TR-RTS, OM & RTS	CL	

Project No. 24431 **Client:** STATE OF LOUISIANA, OFFICE OF COASTAL

Project: LOUISIANA, STATE OF - COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA),

Source of Sample: B-3 **Depth:** 7 **Sample Number:** 2B

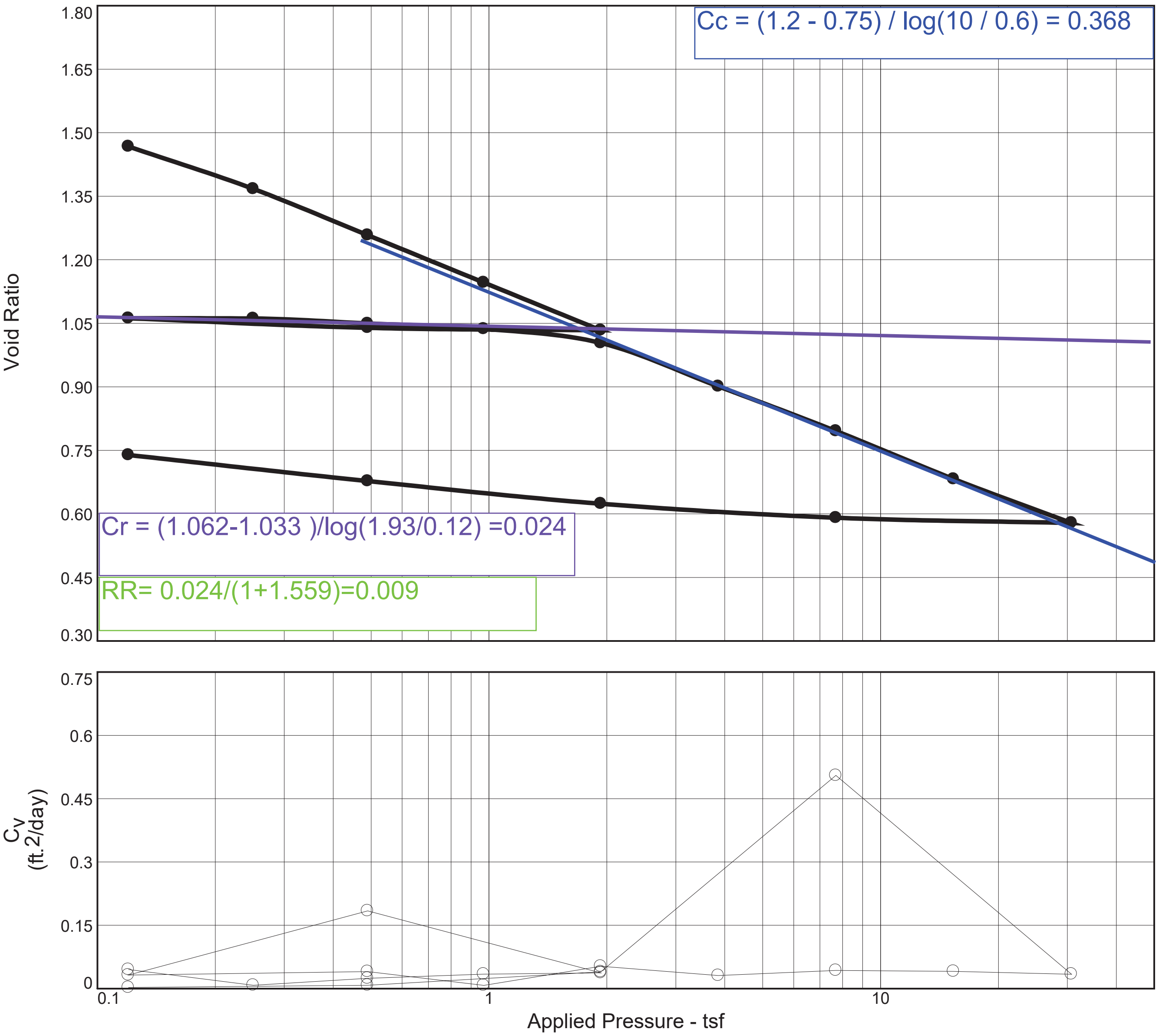
EUSTIS ENGINEERING SINCE 1946

Remarks:

Figure

Tested By: BH **Checked By:** RR

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (tsf)	C_c	Initial Void Ratio
Saturation	Moisture							
99.9 %	57.9 %	65.6	64	37	2.69	1.1	0.38	1.559

MATERIAL DESCRIPTION	USCS	AASHTO
VSO G CL W/ TR-SI POC & LEN, TR-SH FRAG	CH	

Project No. 24431 **Client:** STATE OF LOUISIANA, OFFICE OF COASTAL

Project: LOUISIANA, STATE OF - COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA),

Source of Sample: B-2 **Depth:** 12.04 **Sample Number:** 5A

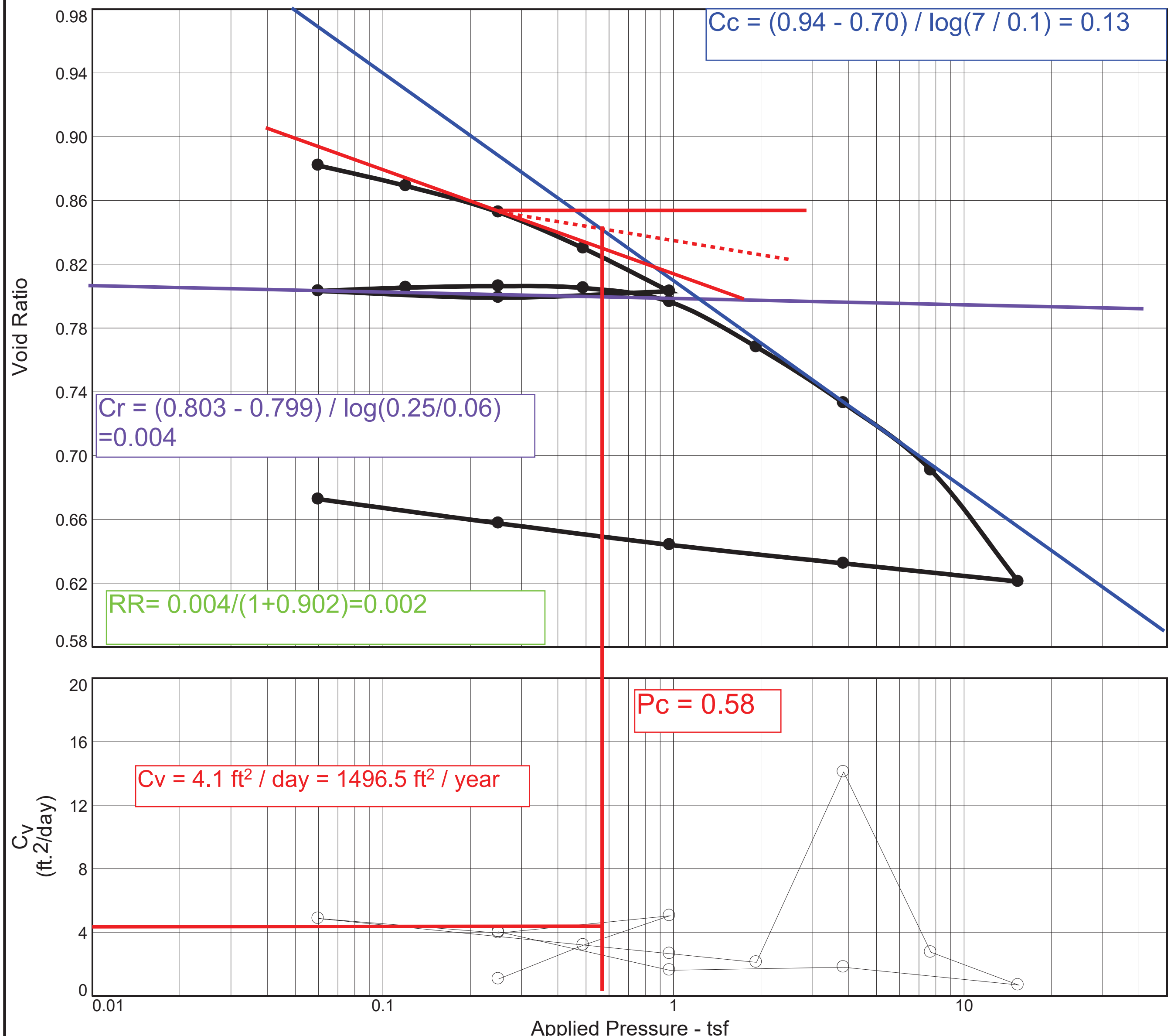
EUSTIS ENGINEERING SINCE 1946

Remarks:

Figure

Tested By: BH **Checked By:** RR

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (tsf)	C_c	Initial Void Ratio
Saturation	Moisture							
98.1 %	33.4 %	86.2	33	13	2.65	0.5	0.12	0.902

MATERIAL DESCRIPTION	USCS	AASHTO
SO G SICL W/ FISA POC, TR-OM	CL	

Project No. 24431 **Client:** STATE OF LOUISIANA, OFFICE OF COASTAL

Project: LOUISIANA, STATE OF - COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA),

Source of Sample: B-1 **Depth:** 9 **Sample Number:** 3B

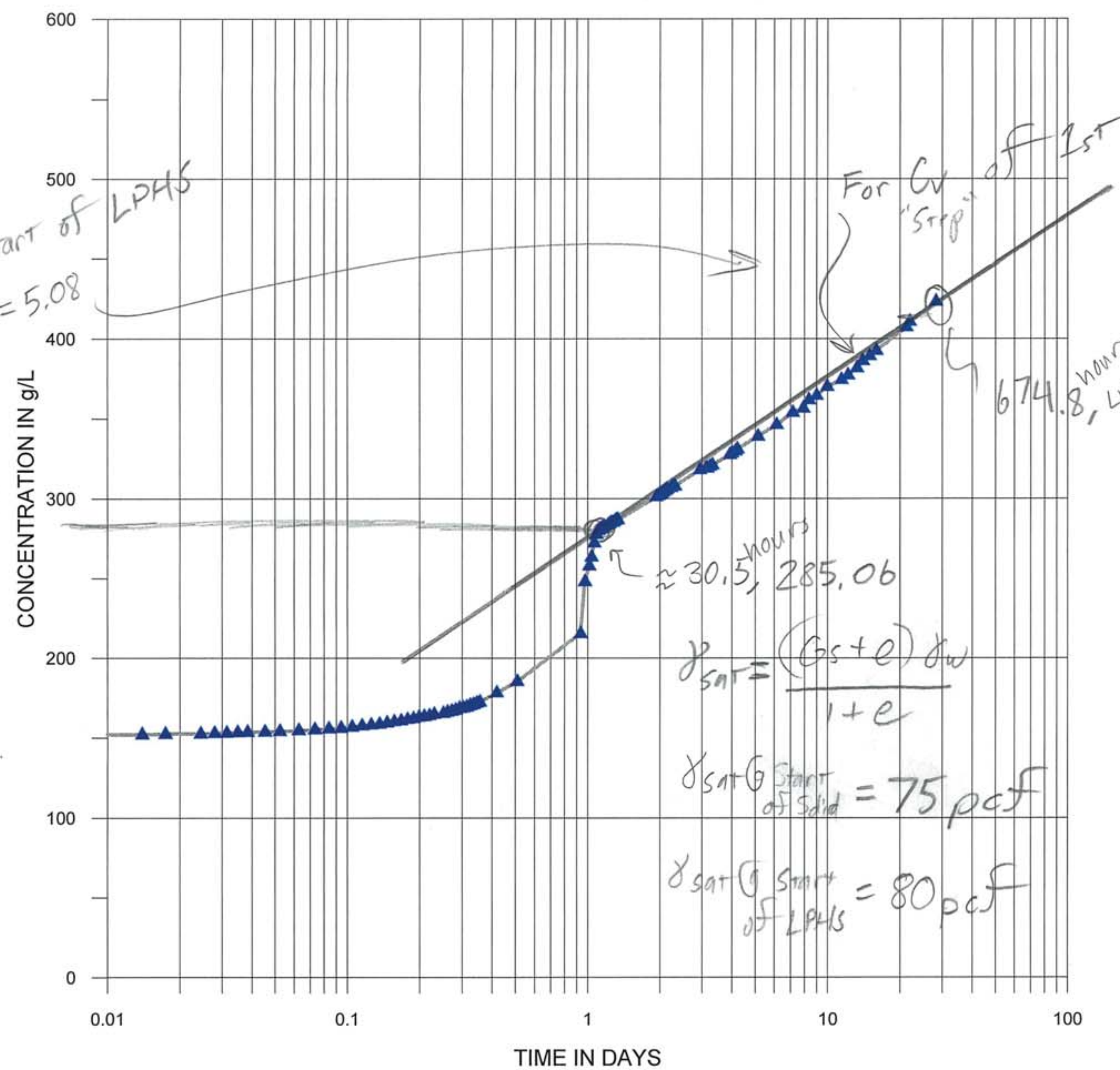
EUSTIS ENGINEERING SINCE 1946

Remarks:

Figure

Tested By: BH **Checked By:** RR

APPENDIX II
DREDGE MATERIAL TEST RESULTS



$C_v = \frac{0.197 * H_{dr}^2}{t_{50}} = 0.155$ ← seems high

$H_{dr} \approx 3.4'$ assuming 1 way Drainage

$t_{50} = \frac{1.271 \text{ days} + 28.2 \text{ days}}{2}$

NOTES:

1) THE SETTLING TEST WAS PERFORMED ON COMPOSITE SAMPLES OBTAINED FROM THE BA BORINGS: BA-5, BA-6, BA-7, BA-8, BA-10, BA-12.

2) AN INITIAL CONCENTRATION OF 151.2 GRAMS PER LITER WAS USED BASED ON TARGET CONCENTRATION OF 150 GRAMS PER LITER.

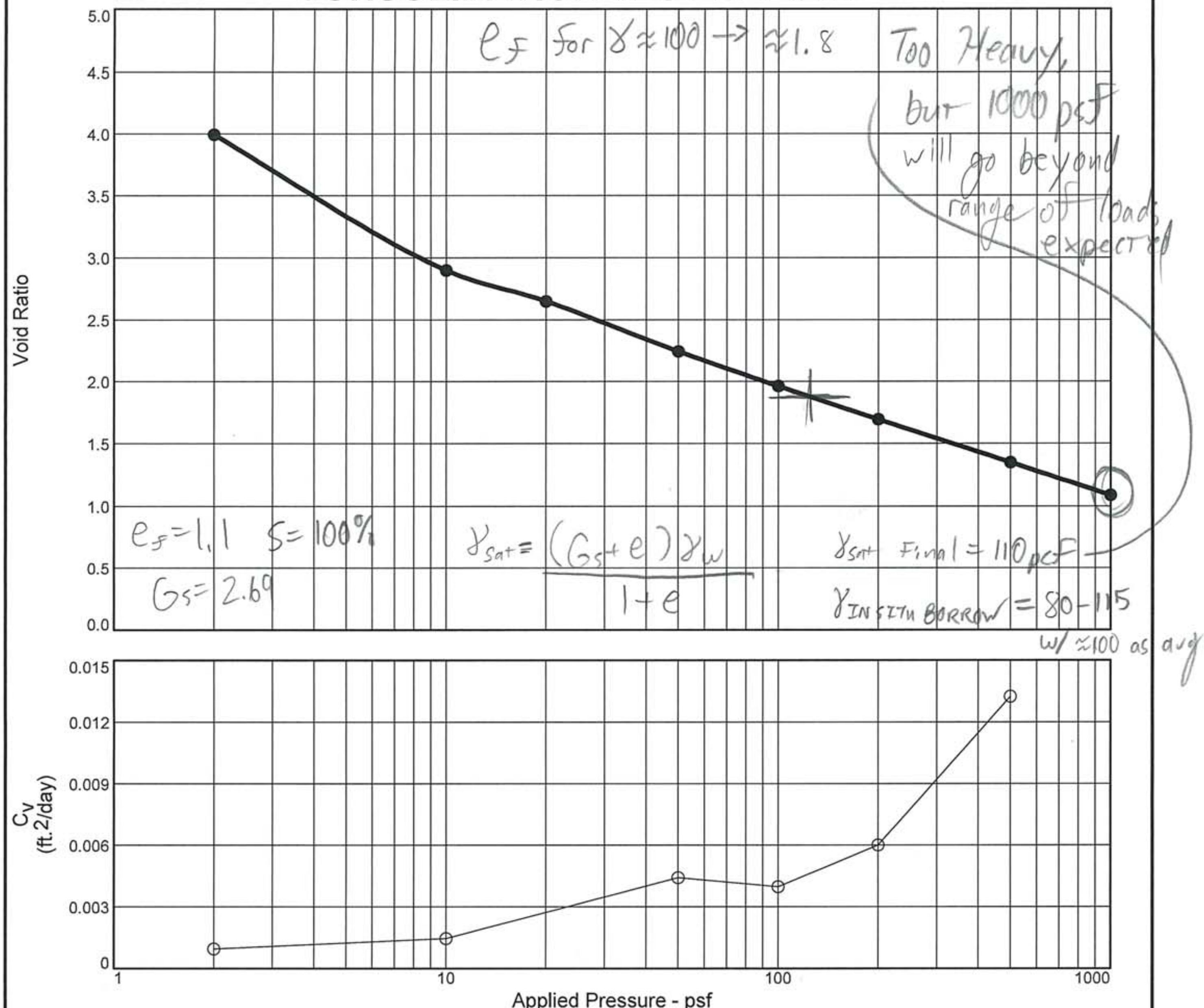
3) IN ACCORDANCE WITH CHAPTER 3 OF THE USACE ENGINEERING MANUAL EM 1110-2-5207, THE CONCENTRATIONS FOR VARIOUS INTERFACE HEIGHTS WERE CALCULATED USING EQUATION 3-11, $C_t = (C_O H_i)/H_t$, WHERE C_t IS THE SLURRY CONCENTRATION AT TIME t, C_O IS THE INITIAL SLURRY CONCENTRATION, H_i IS THE INITIAL SLURRY HEIGHT, AND H_t IS THE HEIGHT OF THE INTERFACE AT TIME t.

SETTLING COLUMN TEST RESULTS
INCREASE IN TOTAL SUSPENDED SOLIDS CONCENTRATION OVER TIME

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY
EAST DELACROIX MARSH CREATION PROJECT
PHASE I
ST. BERNARD PARISH, LOUISIANA
CPRA PROJECT NO. BS-0037

EUSTIS ENGINEERING SINCE 1946	DRAWN BY: J.M.W.	JOB NO.: 24431
	CHECKED BY: J.J.H.	DATE: 7 DEC 2020
	FILE NAME: 24431 full-scale_concentration vs log time curve.grf	

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (psf)	C_c	Initial Void Ratio
Saturation	Moisture							
104.4 %	197.2 %	27.6	59	38	2.69	0	0.92	5.081

MATERIAL DESCRIPTION	USCS	AASHTO
24431 East Delacroix Borrow Composite	CH	

Project No. 24431 **Client:** STATE OF LOUISIANA, COASTAL PROTECTION

Project: EAST DELACROIX MARSH CREATION PROJECT

EUSTIS ENGINEERING SINCE 1946

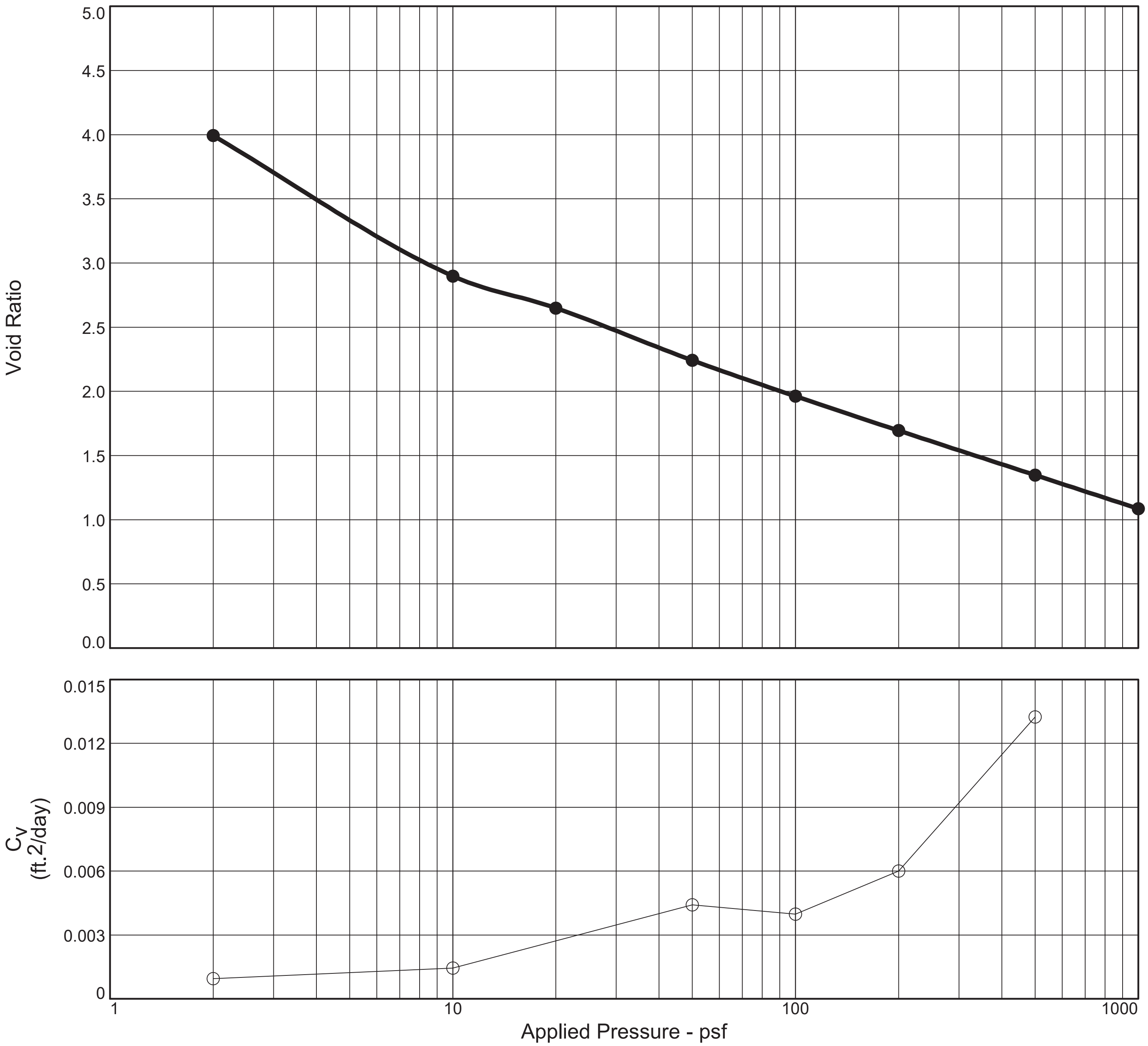
Remarks:

Low Pressure High Strain Test. Load Step 1 used machined cap with laser to record deflection. Initial concentration approximately 420 g/L

Figure

Tested By: JMW **Checked By:** RR

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (psf)	C_c	Initial Void Ratio
Saturation	Moisture							
104.4 %	197.2 %	27.6	59	38	2.69	0	0.92	5.081

MATERIAL DESCRIPTION	USCS	AASHTO
24431 East Delacroix Borrow Composite	CH	

Project No. 24431 **Client:** STATE OF LOUISIANA, COASTAL PROTECTION

Project: EAST DELACROIX MARSH CREATION PROJECT

EUSTIS ENGINEERING SINCE 1946

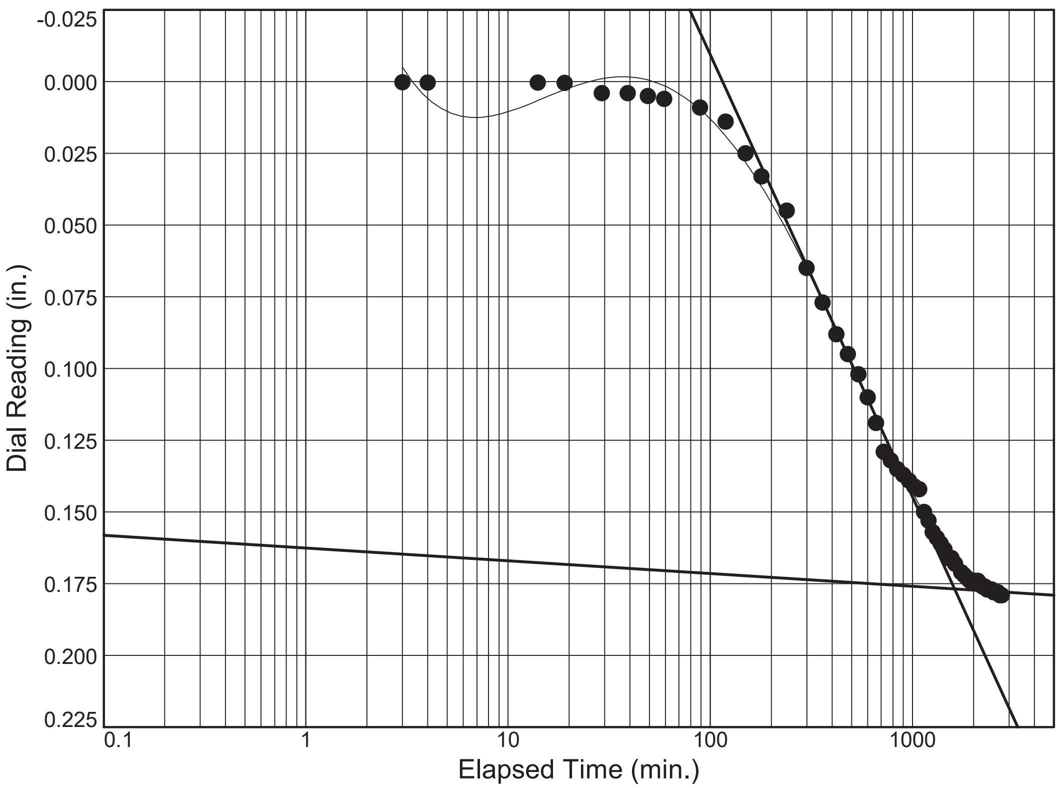
Remarks:
Low Pressure High Strain Test. Load Step 1 used machined cap with laser to record deflection. Initial concentration approximately 420 g/L

Figure

Tested By: JMW **Checked By:** RR

Pippette Reading vs. Time

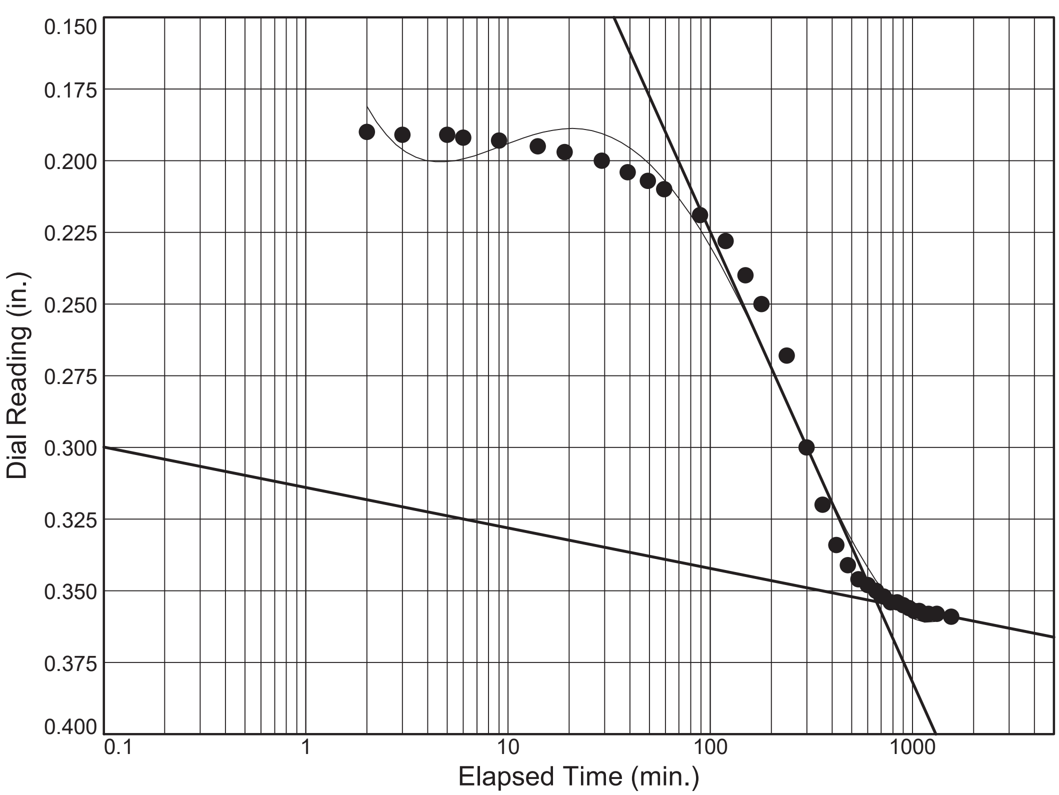
Project No.: 24431
Project: EAST DELACROIX MARSH CREATION PROJECT



Load No.= 1
Load= 2 psf
D_0 = 0.0001
D_{50} = 0.0885
D_{100} = 0.1768
T_{50} = 430.33 min.

C_v @ T_{50}
0.001 $ft.^2$/day

C_α = 0.027



Load No.= 2
Load= 10 psf
D_0 = 0.1790
D_{50} = 0.2664
D_{100} = 0.3538
T_{50} = 183.02 min.

C_v @ T_{50}
0.001 $ft.^2$/day

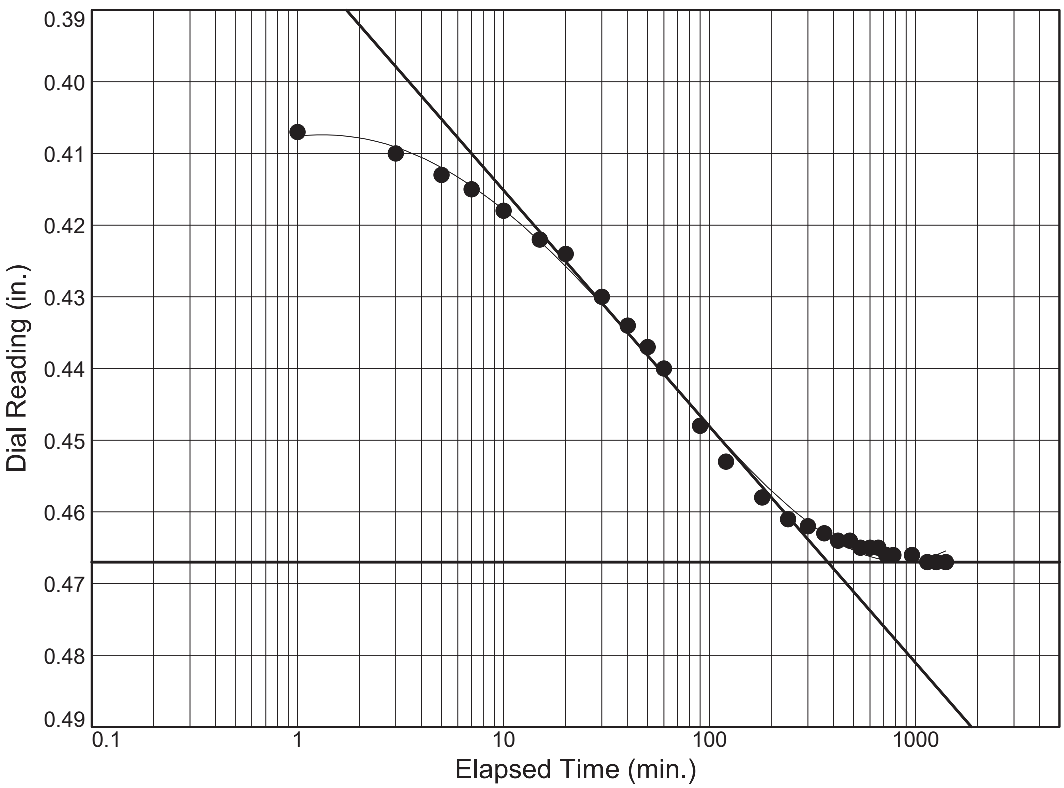
C_α = 0.086

Figure

EUSTIS ENGINEERING COMPANY, INC.

Pippette Reading vs. Time

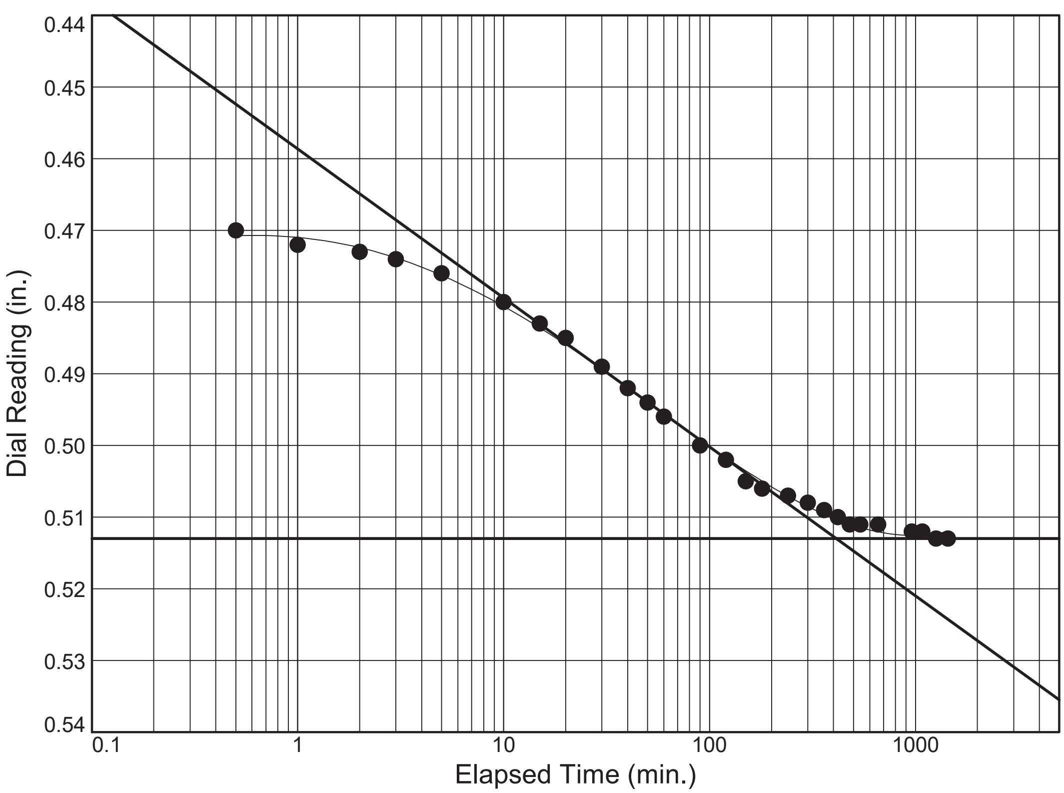
Project No.: 24431
Project: EAST DELACROIX MARSH CREATION PROJECT



Load No.= 4
Load= 50 psf
D_0 = 0.4000
D_{50} = 0.4335
D_{100} = 0.4670
T_{50} = 35.81 min.

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

C_α = 0.000



Load No.= 5
Load= 100 psf
D_0 = 0.4670
D_{50} = 0.4900
D_{100} = 0.5130
T_{50} = 32.21 min.

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

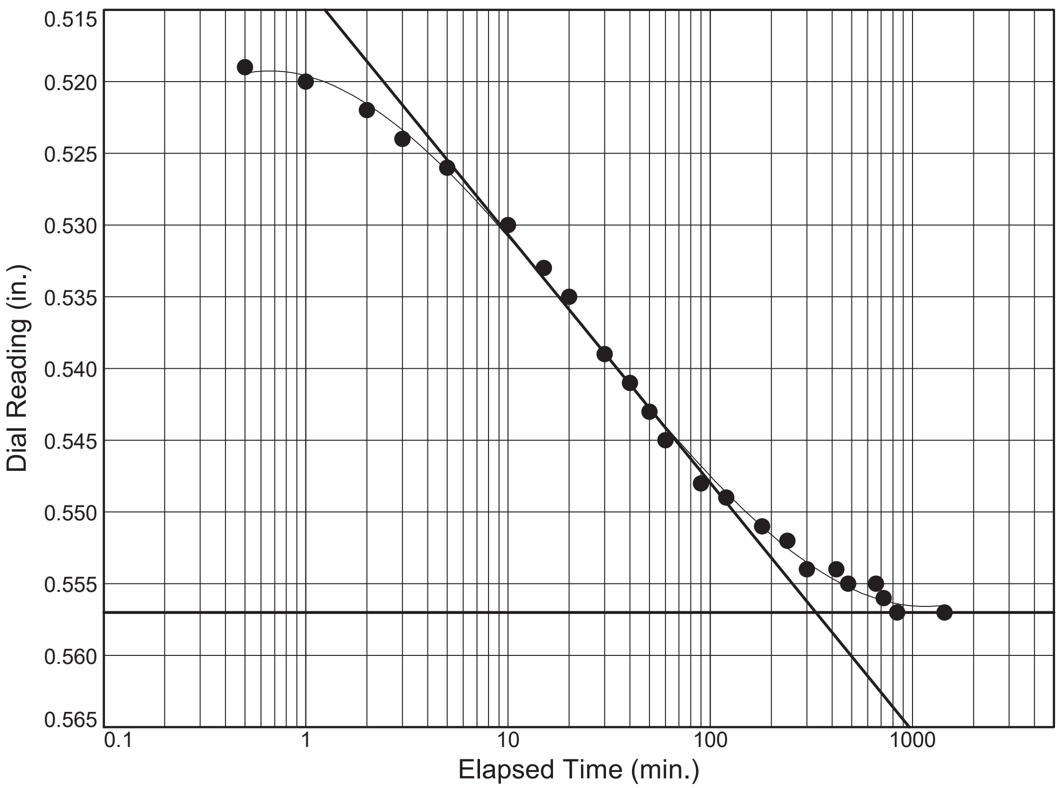
C_α = 0.000

Figure

EUSTIS ENGINEERING COMPANY, INC.

Pippette Reading vs. Time

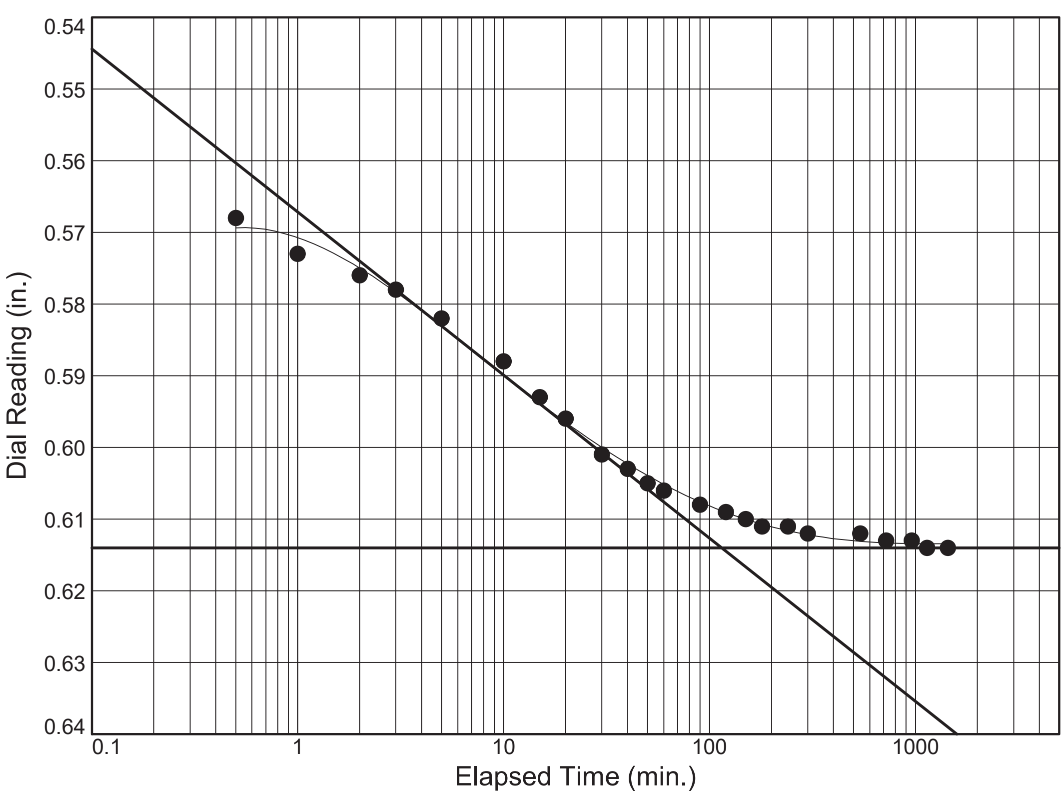
Project No.: 24431
Project: EAST DELACROIX MARSH CREATION PROJECT



Load No.= 6
Load= 200 psf
D_0 = 0.5130
D_{50} = 0.5350
D_{100} = 0.5570
T_{50} = 17.76 min.

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

C_α = 0.000



Load No.= 7
Load= 500 psf
D_0 = 0.5570
D_{50} = 0.5855
D_{100} = 0.6140
T_{50} = 6.39 min.

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

C_α = 0.000

Figure

EUSTIS ENGINEERING COMPANY, INC.

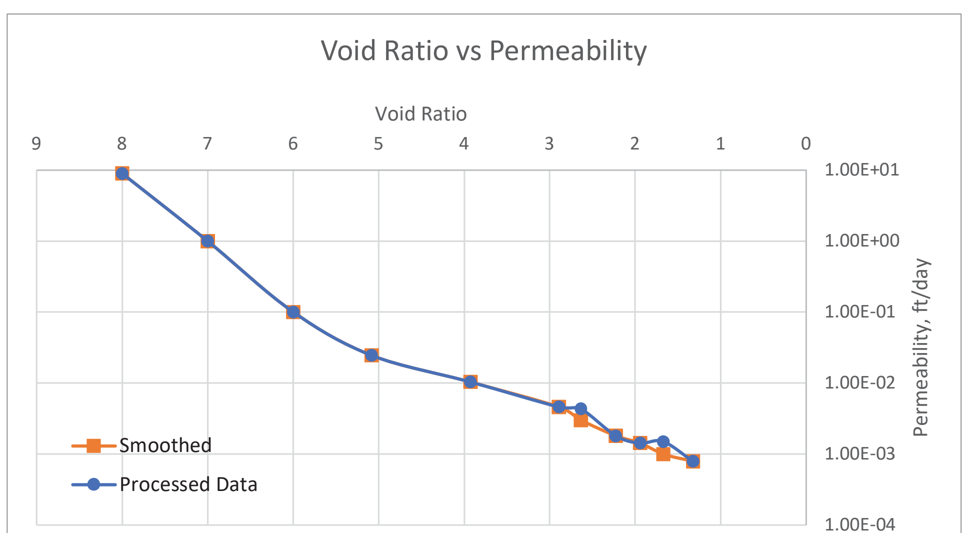
ESTIMATES BASED ON SETTLEMENT COLUMN							
e00	8.00	(Void Ratio at the start of self weight consolidation)					
To reach LPHS Void Ratio							
Hstart=	3.02	Estart	8	t50	13.42		days
Hend=	2.3	Efinal	5.08		19324.8		minutes
Havg	2.66	e avg	6.54				
	ft						

PROJECT NO	24431.01
ENGINEER	JMW
DATE	3/1/2021

	FROM LPHS TEST															
	Load	ΔH, in	e	Hstart	Hend	H av, in	Hav, ft	cv, ft2/day	t50, minute	t50, days	e avg	av (ft2/lb)	mv (ft2/lb)	k (USACE), ft/day	k (alt), ft/day	
(SPLICE)	0	0.00	5.08	1	1.00	31.92	2.66	0.16	19324.8	13.42	6.54	29.18965	3.871306	6.27E+00	3.74E+01	
	2	0.19	3.93	1.00	0.81	0.905	0.0754167	0.00	430	0.298611	4.503337	0.577698	0.104972	6.14E-03	6.55E-03	0.94
	10	0.36	2.89	0.81	0.64	0.725	0.0604167	0.001	183	0.127083	3.408751	0.129222	0.02931	2.59E-03	1.83E-03	1.41
	20	0.40	2.64	0.64	0.60	0.619	0.0515833	0.003	69.4	0.048194	2.764161	0.02554	0.006785	1.15E-03	1.27E-03	0.91
	50	0.47	2.23	0.60	0.53	0.5644073	0.0470339	0.004	35.8	0.024861	2.43218	0.013619	0.003968	1.09E-03	9.90E-04	1.10
	100	0.52	1.94	0.53	0.48	0.5074479	0.0422873	0.004	32.21	0.022368	2.085809	0.005684	0.001842	4.53E-04	4.60E-04	0.98
	200	0.56	1.67	0.48	0.44	0.4617184	0.0384765	0.006	17.76	0.012333	1.807726	0.00272	0.000969	3.57E-04	3.63E-04	0.99
	500	0.62	1.33	0.44	0.38	0.4108999	0.0342417	0.013	6.39	0.004438	1.498697	0.001154	0.000462	3.75E-04	3.75E-04	1.00
	1000	0.66	1.06	0.38	0.34	0.3609192	0.0300766	0.014	4.85	0.003368	1.194762	0.000524	0.000239	1.97E-04	2.08E-04	0.94

Comparison/ Sanity Check compared to a similar database soil from PSDDF

Initial Void Ratio	Effective Stress, psf	Permeability, ft/ day Computed/Estimated	Permeability, ft/ day Smoothed	Note
8	0	9.00E+00	9.00E+00	Initial Selected based on Sett. Column
7	2.00E-02	1.00E+00	1.00E+00	Assumed/Estiamted based on data from Stark 2005 PSDDF Material Properties Document
6	2.00E-01	1.00E-01	1.00E-01	Assumed/Estiamted based on data from Stark 2005 PSDDF Material Properties Document
5.08	2	2.46E-02	2.46E-02	
3.93	10	1.03E-02	1.03E-02	
2.89	20	4.61E-03	4.61E-03	
2.64	50	4.34E-03	3.00E-03	
2.23	100	1.81E-03	1.81E-03	
1.94	200	1.43E-03	1.43E-03	
1.67	500	1.50E-03	1.00E-03	
1.33	1000	7.88E-04	7.88E-04	Processed from Low Pressure Consolidation Test (Assumes Double Drainage)



APPENDIX III
FURNISHED INFORMATION

East Delacroix Marsh Creation and Terracing (BS-0037)

Project Update Meeting
February 18, 2021

committed to **our coast**

1

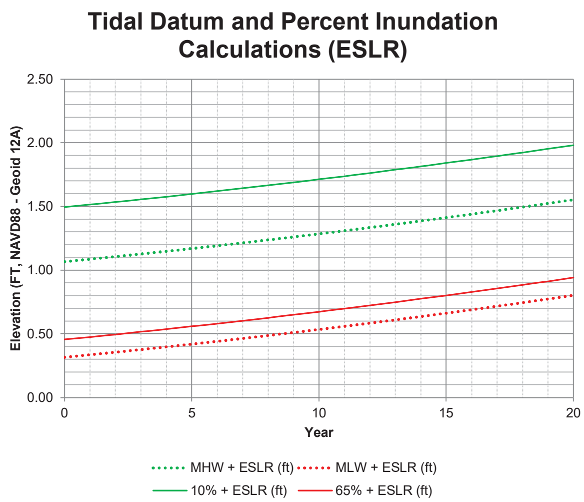
Discussion Topics

- Updated Water Level Data
- Mudline Elevations
- Construction Duration
    - Dredge Fill Placement Rates

Total Area = 458 acres measured from ECD centerline.

2

Water Level Data Summary

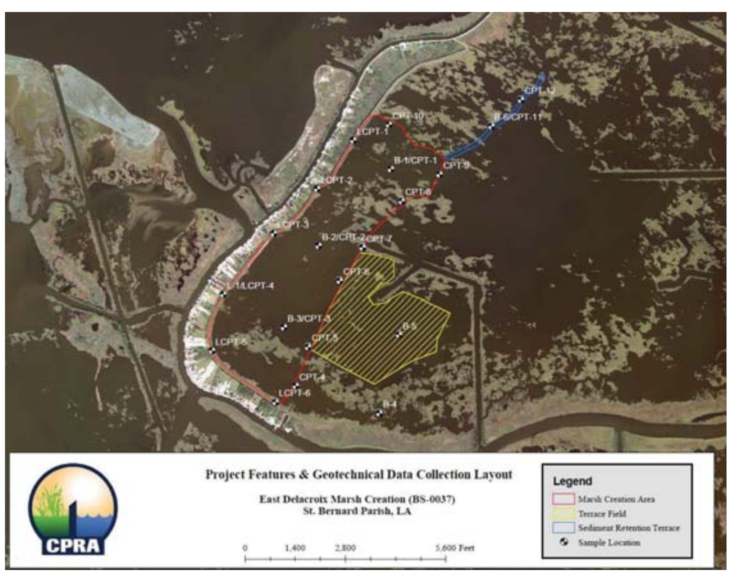


Percent Inundation Elevations with ESLR		
Percent Inundated	TY0 (2023) Marsh Elevation (ft.)	TY20 (2043) Marsh Elevation (ft.)
1%	+2.62	+3.10
10%	+1.50	+1.98
20%	+1.18	+1.66
30%	+0.98	+1.46
40%	+0.82	+1.30
50%	+0.67	+1.15
60%	+0.53	+1.01
65%	+0.46	+0.94
70%	+0.38	+0.86
80%	+0.19	+0.67
90%	-0.07	+0.41

Coastal Protection and Restoration Authority of Louisiana

3

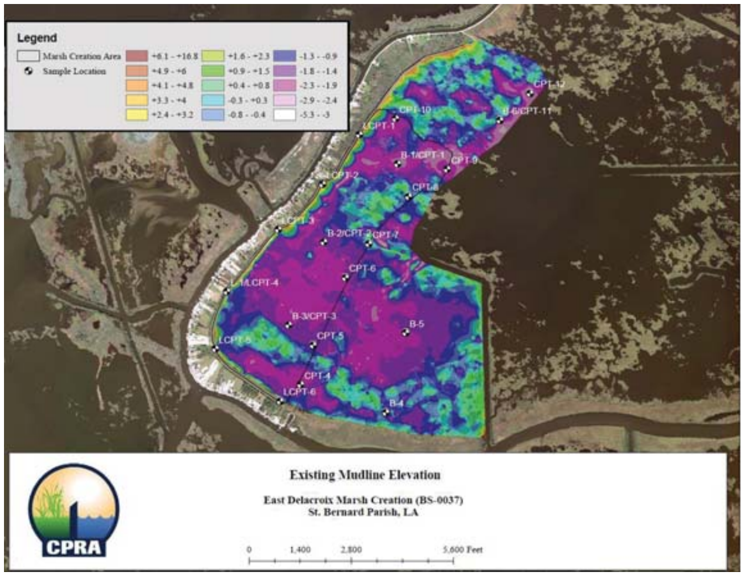
Project Features



Coastal Protection and Restoration Authority of Louisiana

4

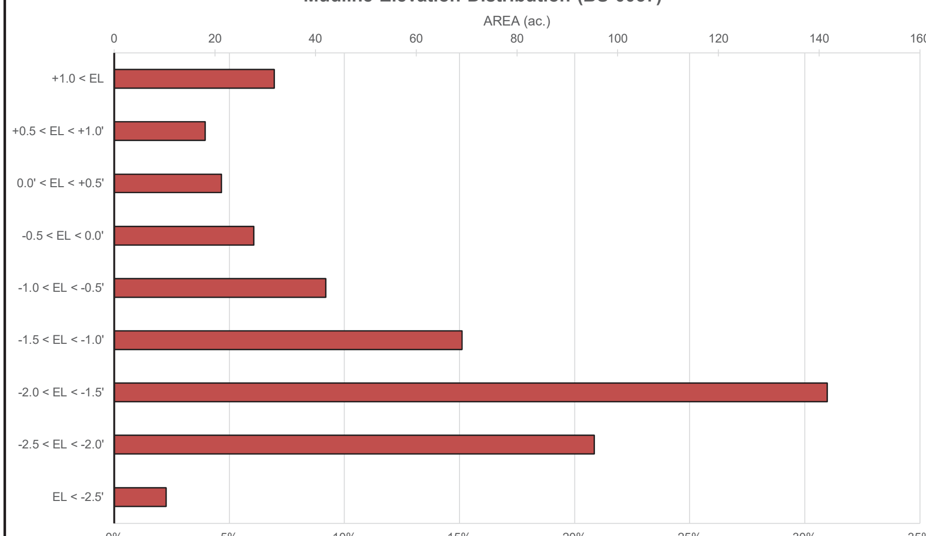
Marsh Fill Surface



Coastal Protection and Restoration Authority of Louisiana

5

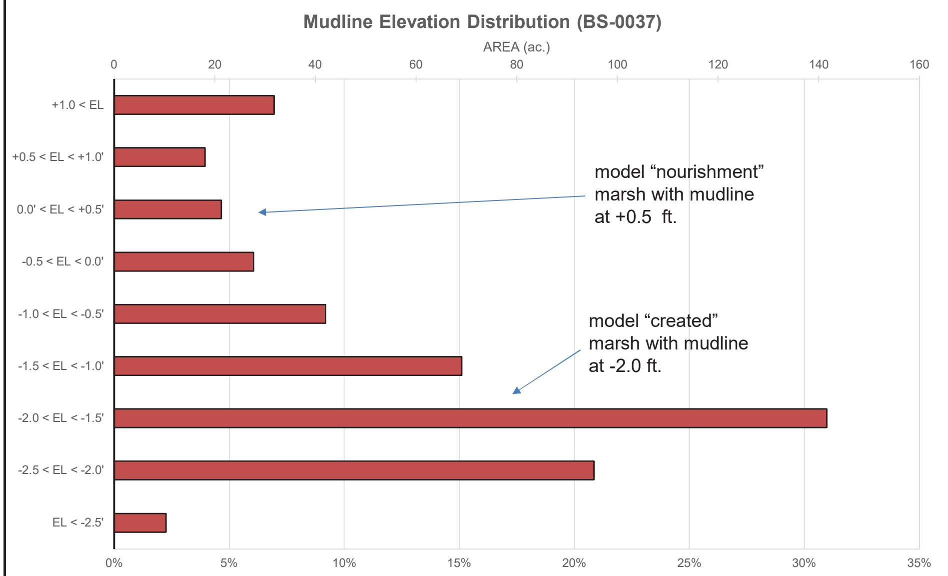
Mudline Elevation Distribution (BS-0037)



Notes:
1. Total Area = 458 acres measured from ECD centerline.
2. Average mudline elevation = -1.3 ft. NAVD88

Coastal Protection and Restoration Authority of Louisiana

6



Notes:
1. Total Area = 458 acres measured from ECD centerline.
2. Average mudline elevation = -1.3 ft. NAVD88

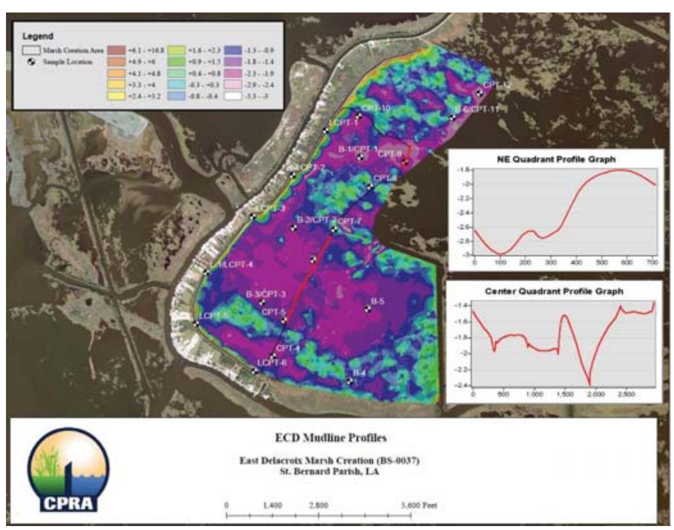
Coastal Protection and Restoration Authority of Louisiana

7

ECD/Terrace Mudlines

ECD
- Mudline around -2.0 ft. with the exception of:
  - NE Quadrant
    - -3.0 ft.
    - CPT-9, 11, 12
  - Center Quadrant
    - -2.5 ft.
    - CPT-6

Terraces
- Mudline around -2.5 ft.



Coastal Protection and Restoration Authority of Louisiana

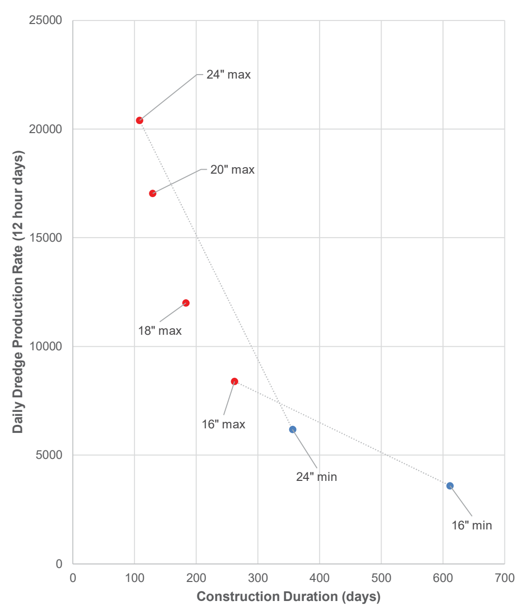
8

Geotechnical Analysis Parameters

- Water Levels (10% and 65% Percent inundation, MHW, MLW, ESLR)
- Cut/Fill Volume based on :
  - Subsidence (4.0 mm/year starting in 2021 ~0.30 ft.)
  - Estimated Foundation Settlement **[TBD by Eustis Engineering]** (0.45 ft.)
  - End of project Target Marsh Elevation (+1.0 ft. NAVD88)
- Dredge production rates
  - Total Fill Area = 450 acres
  - Localized fill placement rates

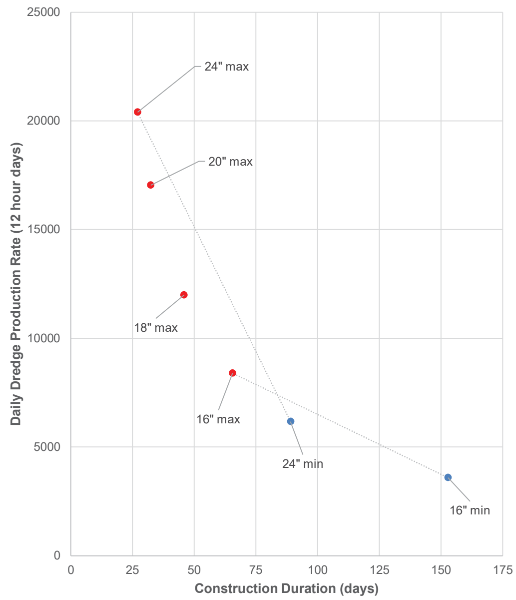
Total Construction Duration vs. Daily Dredge Production Rate

- Area = 450 acres
- Volume Fill = 2,200,000 CY
- 16” Duration >250 days
- 24” Duration >100 days



Localized Placement Duration vs. Daily Dredge Production Rate

- Area = 112.5 acres
- Volume Fill = 550,000 CY
- 16" Duration >65 days
- 24" Duration >25 days

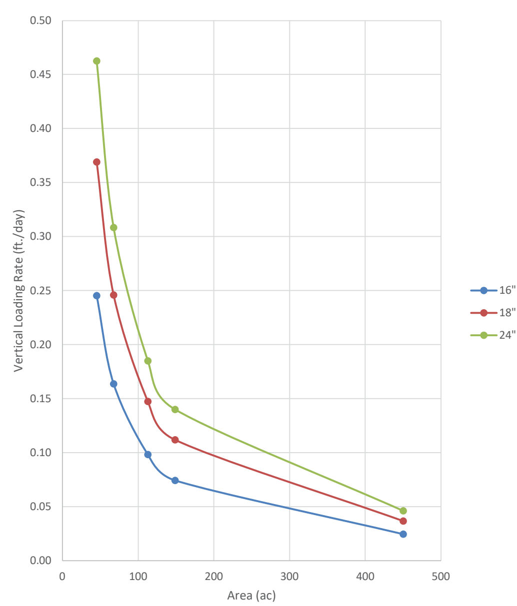


Coastal Protection and Restoration Authority of Louisiana

11

Vertical Loading Rates

- Gs of Composite Sample = 2.69
- Average In-situ Borrow E_o = 2.59
- Initial Void Ratio Placed = 7.0
- Solids Thickness = 3'
- Estimated Lift Thickness = 6.75'
- Vertical Loading Rates:
  - <u>16" – 0.10-0.25 ft./day</u>
  - 24" – 0.19-0.46 ft./day
- Estimated Void Ratio @ 20 years = 2.0-3.0
  - [**TBD** by Eustis Engineering]



Coastal Protection and Restoration Authority of Louisiana

12

SLR= sea level rise

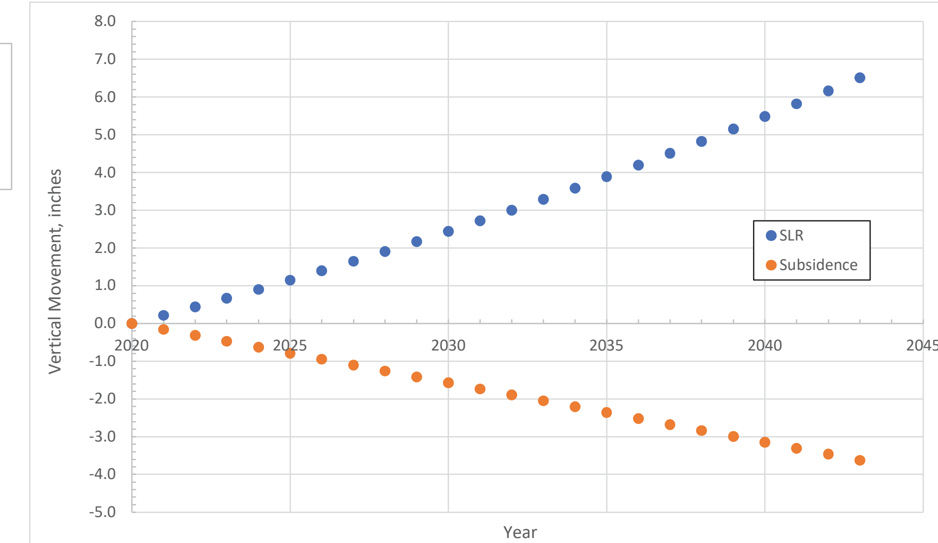
		0.00328	0.03937
	mm/yr	ft/yr	in/yr
Subsidence Rate	4	0.01312	0.15748
		3.28083	

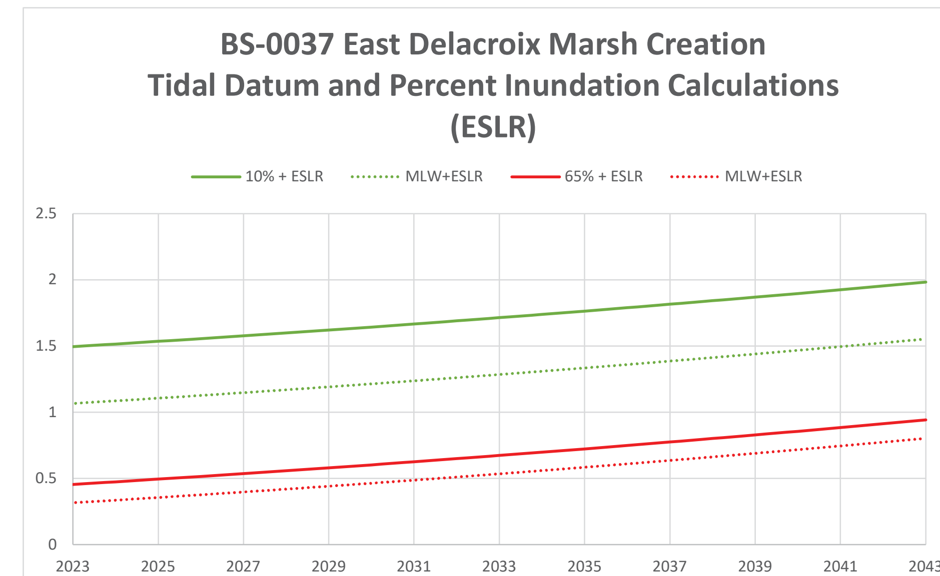
SLR
Subsidence

Notes:
Elevation Reference: NAVD88.
MHW = mean high water.
MLW = mean low water.
ESLR = eustatic sea level rise.

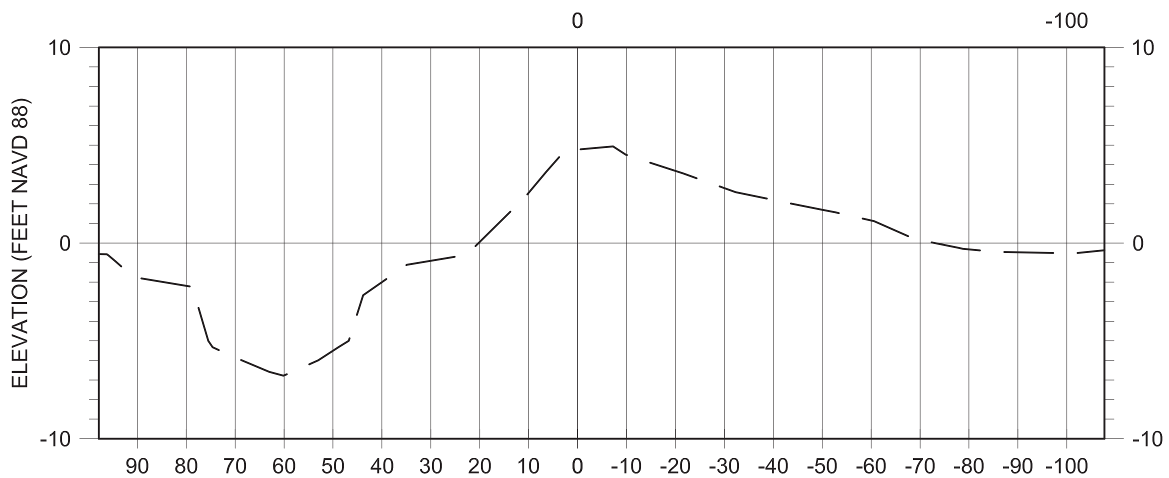
Annual Incremental Eustatic Sea Level Rise

Year	**Project Year**	**Sea Level Rise**			**Subsidence**			MLW+ESLR	MHW+ESLR	10% + ESLR	65% + ESLR
	TY	**m**	**ft**	**in**	**mm**	**in**	**ft**	ft. NAVD88	ft. NAVD88	ft. NAVD88	ft. NAVD88
2020	-3	0	0	0	0.000	0.000	0.000	0.261	1.011	1.44	0.4
2021	-2	0.006	0.018	0.217	4.000	-0.157	-0.013	0.279	1.029	1.458	0.418
2022	-1	0.011	0.037	0.440	8.000	-0.315	-0.026	0.298	1.048	1.477	0.437
2023	0	0.017	0.056	0.669	12.000	-0.472	-0.039	0.317	1.067	1.496	0.456
2024	1	0.023	0.075	0.905	16.000	-0.630	-0.052	0.336	1.086	1.515	0.475
2025	2	0.029	0.095	1.146	20.000	-0.787	-0.066	0.356	1.106	1.535	0.495
2026	3	0.035	0.116	1.393	24.000	-0.945	-0.079	0.377	1.127	1.556	0.516
2027	4	0.042	0.137	1.646	28.000	-1.102	-0.092	0.398	1.148	1.577	0.537
2028	5	0.048	0.159	1.905	32.000	-1.260	-0.105	0.420	1.170	1.599	0.559
2029	6	0.055	0.181	2.170	36.000	-1.417	-0.118	0.442	1.192	1.621	0.581
2030	7	0.062	0.203	2.441	40.000	-1.575	-0.131	0.464	1.214	1.643	0.603
2031	8	0.069	0.226	2.718	44.000	-1.732	-0.144	0.487	1.237	1.666	0.626
2032	9	0.076	0.250	3.001	48.000	-1.890	-0.157	0.511	1.261	1.690	0.650
2033	10	0.084	0.274	3.290	52.000	-2.047	-0.171	0.535	1.285	1.714	0.674
2034	11	0.091	0.299	3.585	56.000	-2.205	-0.184	0.560	1.310	1.739	0.699
2035	12	0.099	0.324	3.886	60.000	-2.362	-0.197	0.585	1.335	1.764	0.724
2036	13	0.106	0.349	4.193	64.000	-2.520	-0.210	0.610	1.360	1.789	0.749
2037	14	0.114	0.375	4.506	68.000	-2.677	-0.223	0.636	1.386	1.815	0.775
2038	15	0.123	0.402	4.825	72.000	-2.835	-0.236	0.663	1.413	1.842	0.802
2039	16	0.131	0.429	5.149	76.000	-2.992	-0.249	0.690	1.440	1.869	0.829
2040	17	0.139	0.457	5.480	80.000	-3.150	-0.262	0.718	1.468	1.897	0.857
2041	18	0.148	0.485	5.817	84.000	-3.307	-0.276	0.746	1.496	1.925	0.885
2042	19	0.156	0.513	6.160	88.000	-3.465	-0.289	0.774	1.524	1.953	0.913
2043	20	0.165	0.542	6.509	92.000	-3.622	-0.302	0.803	1.553	1.982	0.942



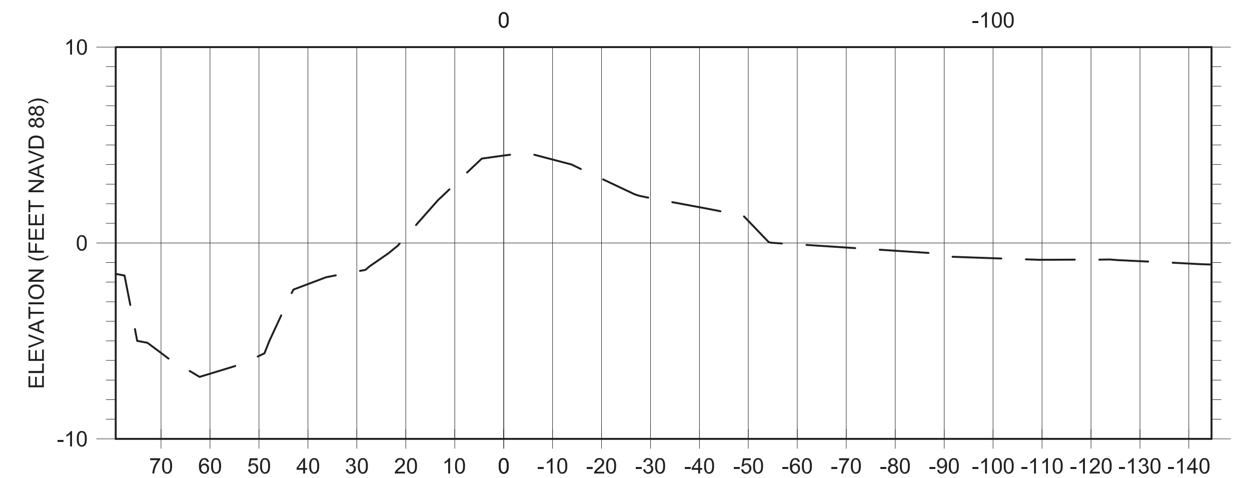


TIDAL LEVEE FURNISHED INFORMATION MAY 2021



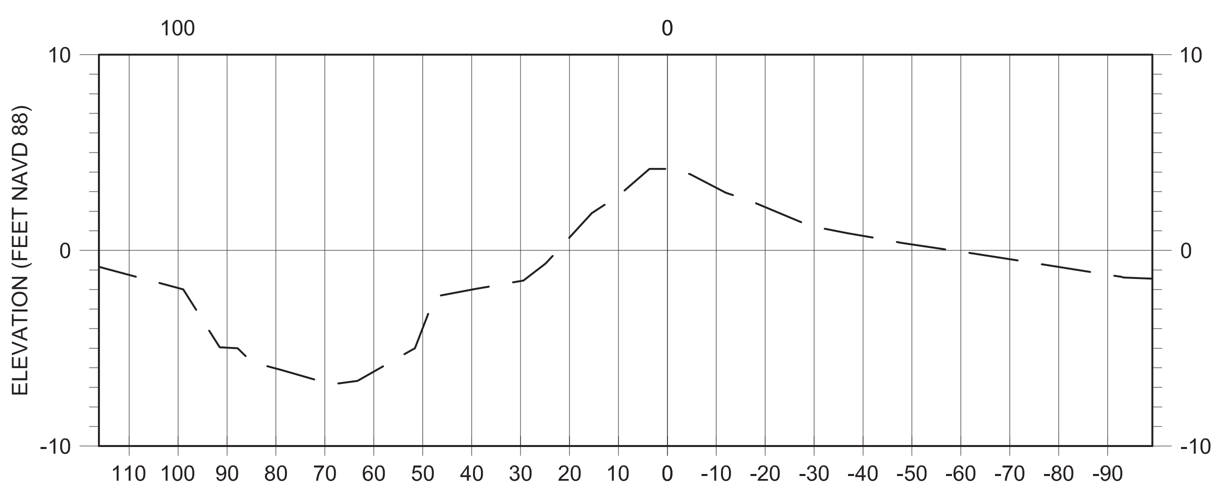
69+45.45

Cross-Section 1



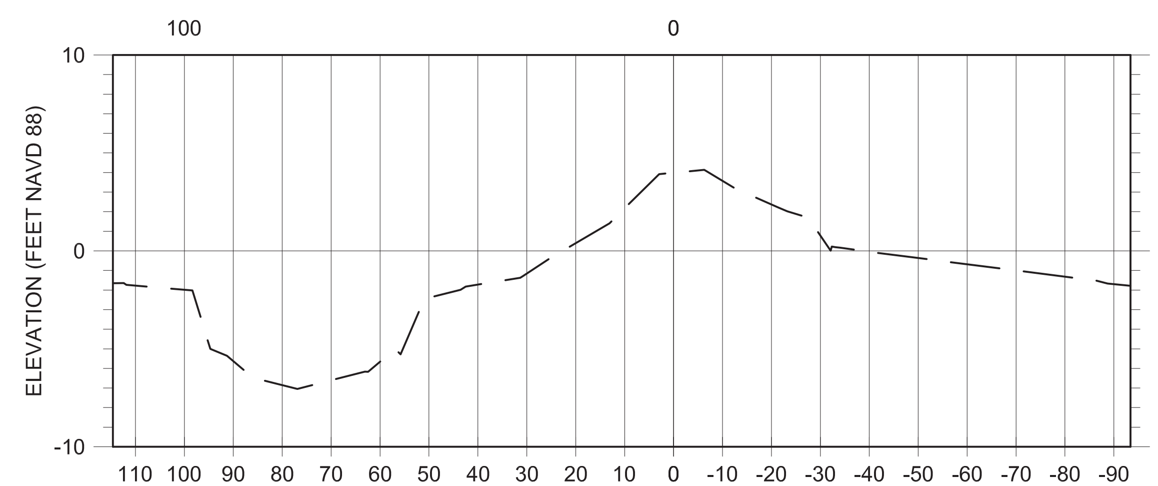
64+37.32

Cross-Section 2



28+84.70

Cross-Section 3



18+43.03

Cross-Section 4

APPENDIX IV
SETTLEMENT ANALYSES

COMBINED SETTLEMENT TABLES

Project No. 24431.01
Project Title East Delacroix
Analysis MCA - No Sand Foundation
Engineer JMW
Date 3/25/2021
PSDDF File MCA_160Days
Settle 3 File 24431.01 MCA no Sand

Initial Mudline -2
Lifts are of e00=8.0 material

		Time Days	Time, years	Lift Thickness, ft	Total Material Thickness (no selfweight sett), ft	Selfweight Settlement, ft	Material Thickness, ft	Estimated Foundation Construction Settlement	Foundation Settlement from Settle3	Foundation Settlement	Subsidence	Surface Elevation
Assumed Construction Sequence with Settlement	0	0.0001	0	1	1	0	1	0		0.00	0.039	-1.039
		9.99	0.02736986	1	1	0.371	0.629	0.0312		0.03	0.0394	-1.441574
	1	10	0.02739726	1	2	0.371	1.629	0.0312		0.03	0.0394	-0.441606
		19.99	0.05476712	1	2	0.776	1.224	0.0625		0.06	0.0397	-0.87818
	2	20	0.05479452	1	3	0.776	2.224	0.0625		0.06	0.0397	0.121788
		29.99	0.08216438	1	3	1.189	1.811	0.0937		0.09	0.0401	-0.322787
	3	30	0.08219178	0.8	3.8	1.189	2.611	0.0937		0.09	0.0401	0.477182
		39.99	0.10956164	0.8	3.8	1.529	2.271	0.1250		0.12	0.0404	0.105607
	4	40	0.10958904	0.5	4.3	1.529	2.771	0.1250		0.12	0.0404	0.605576
		49.99	0.1369589	0.5	4.3	1.782	2.518	0.1562		0.16	0.0408	0.321001
	5	50	0.1369863	0.5	4.8	1.782	3.018	0.1562		0.16	0.0408	0.820969
		59.99	0.16435616	0.5	4.8	2.034	2.766	0.1875		0.19	0.0411	0.537395
	6	60	0.16438356	0.5	5.3	2.034	3.266	0.1875		0.19	0.0411	1.037363
		69.99	0.19175342	0.5	5.3	2.287	3.013	0.2187		0.22	0.0415	0.752789
	7	70	0.19178082	0.5	5.8	2.287	3.513	0.2187		0.22	0.0415	1.252757
		79.99	0.21915068	0.5	5.8	2.54	3.26	0.2500		0.25	0.0418	0.968182
	8	80	0.21917808	0.5	6.3	2.54	3.76	0.2500		0.25	0.0418	1.468151
		89.99	0.24654795	0.5	6.3	2.79	3.51	0.2812		0.28	0.0422	1.186576
	9	90	0.24657534	0.5	6.8	2.79	4.01	0.2812		0.28	0.0422	1.686545
		99.99	0.27394521	0.5	6.8	3.041	3.759	0.3125		0.31	0.0426	1.40397
	10	100	0.2739726	0.5	7.3	3.041	4.259	0.3125		0.31	0.0426	1.903938
		109.99	0.30134247	0.5	7.3	3.292	4.008	0.3437		0.34	0.0429	1.621364
	11	110	0.30136986	0.5	7.8	3.292	4.508	0.3437		0.34	0.0429	2.121332
		119.99	0.32873973	0.5	7.8	3.544	4.256	0.3750		0.37	0.0433	1.837758
	12	120	0.32876712	0.5	8.3	3.544	4.756	0.3750		0.37	0.0433	2.337726
		129.99	0.35613699	0.5	8.3	3.8	4.5	0.4062		0.41	0.0436	2.050152
	13	130	0.35616438	0.5	8.8	3.8	5	0.4062		0.41	0.0436	2.55012
		139.99	0.38353425	0.5	8.8	4.05	4.75	0.4375		0.44	0.0440	2.268545
	14	140	0.38356164	0.5	9.3	4.05	5.25	0.4375		0.44	0.0440	2.768514
		149.99	0.41093151	0.5	9.3	4.303	4.997	0.4687		0.47	0.0443	2.483939
	15	150	0.4109589	0.5	9.8	4.303	5.497	0.4687		0.47	0.0443	2.983908
		159.99	0.43832877	0.5	9.8	4.556	5.244	0.5000		0.50	0.0447	2.699333
	EOC	160	0.43835616	0.5	10.3	4.556	5.744	0.5		0.50	0.0447	3.199301
Post Construction Settlement		190	0.52054795	0	10.3	4.953	5.347		1.27	0.77	0.0458	2.532066
		240	0.65753425	0	10.3	5.216	5.084		1.30	0.80	0.0475	2.236452
		365	1	0	10.3	5.634	4.666		1.33	0.83	0.052	1.780667
		730	2	0	10.3	5.902	4.398		1.39	0.89	0.066	1.446167
		1095	3	0	10.3	5.91	4.39		1.42	0.92	0.079	1.395167
		1825	5	0	10.3	6.01	4.29		1.45	0.95	0.105	1.24
		3650	10	0	10.3	6.01	4.29		1.46	0.96	0.171	1.158167
		5475	15	0	10.3	6.01	4.29		1.46	0.96	0.236	1.090667
		7300	20	0	10.3	6.01	4.29		1.46	0.96	0.302	1.023833

Project No.	24431.01
Project Title	East Delacroix
Analysis	MCA - No Sand Foundation
Engineer	JMW
Date	3/25/2021
PSDDF File	MCA_120Days
Settle 3 File	24431.01 MCA no Sand

Initial Mudline -2

Lifts are of e00=8.0 material

		Time Days	Time, years	Lift Thickness, ft	Total Material Thickness (no selfweight sett), ft	Selfweight Settlement, ft	Material Thickness, ft	Estimated Foundation Construction Settlement	Foundation Settlement from Settle3	Foundation Settlement	Subsidence	Surface Elevation	MUDLINE EL
Assumed Construction Sequence with Settlement	0	0.0001	0	1	1	0	1	0		0.00	0.039	-1.039	-2.04
		3.99	0.01093151	1	1	0.362	0.638	0.0166		0.02	0.0391	-1.417767	-2.06
	1	4	0.0109589	1	2	0.362	1.638	0.0167		0.02	0.0391	-0.417809	-2.06
		7.99	0.02189041	1	2	0.718	1.282	0.0333		0.03	0.0393	-0.790576	-2.07
	2	8	0.02191781	1	3	0.718	2.282	0.0333		0.03	0.0393	0.209382	-2.07
		15.99	0.04380822	1	3	1.122	1.878	0.0666		0.07	0.0396	-0.228194	-2.11
	3	16	0.04383562	0.8	3.8	1.122	2.678	0.0667		0.07	0.0396	0.571764	-2.11
		23.99	0.06572603	0.8	3.8	1.447	2.353	0.1000		0.10	0.0399	0.213188	-2.14
	4	24	0.06575342	0.5	4.3	1.447	2.853	0.1000		0.10	0.0399	0.713146	-2.14
		31.99	0.08764384	0.5	4.3	1.692	2.608	0.1333		0.13	0.0401	0.434569	-2.17
	5	32	0.08767123	0.5	4.8	1.692	3.108	0.1333		0.13	0.0401	0.934527	-2.17
		39.99	0.10956164	0.5	4.8	1.932	2.868	0.1666		0.17	0.0404	0.660951	-2.21
	6	40	0.10958904	0.5	5.3	1.932	3.368	0.1667		0.17	0.0404	1.160909	-2.21
		47.99	0.13147945	0.5	5.3	2.173	3.127	0.2000		0.20	0.0407	0.886333	-2.24
	7	48	0.13150685	0.5	5.8	2.173	3.627	0.2000		0.20	0.0407	1.386291	-2.24
		55.99	0.15339726	0.5	5.8	2.415	3.385	0.2333		0.23	0.0410	1.110714	-2.27
	8	56	0.15342466	0.5	6.3	2.415	3.885	0.2333		0.23	0.0410	1.610672	-2.27
		63.99	0.17531507	0.5	6.3	2.659	3.641	0.2666		0.27	0.0413	1.333096	-2.31
	9	64	0.17534247	0.5	6.8	2.659	4.141	0.2667		0.27	0.0413	1.833054	-2.31
		71.99	0.19723288	0.5	6.8	2.901	3.899	0.3000		0.30	0.0416	1.557478	-2.34
	10	72	0.19726027	0.5	7.3	2.901	4.399	0.3000		0.30	0.0416	2.057436	-2.34
		79.99	0.21915068	0.5	7.3	3.142	4.158	0.3333		0.33	0.0418	1.78286	-2.38
	11	80	0.21917808	0.5	7.8	3.142	4.658	0.3333		0.33	0.0418	2.282817	-2.38
		87.99	0.24106849	0.5	7.8	3.383	4.417	0.3666		0.37	0.0421	2.008241	-2.41
	12	88	0.24109589	0.5	8.3	3.383	4.917	0.3667		0.37	0.0421	2.508199	-2.41
		95.99	0.2629863	0.5	8.3	3.624	4.676	0.4000		0.40	0.0424	2.233623	-2.44
	13	96	0.2630137	0.5	8.8	3.624	5.176	0.4000		0.40	0.0424	2.733581	-2.44
		103.99	0.28490411	0.5	8.8	3.866	4.934	0.4333		0.43	0.0427	2.458005	-2.48
	14	104	0.28493151	0.5	9.3	3.866	5.434	0.4333		0.43	0.0427	2.957963	-2.48
		111.99	0.30682192	0.5	9.3	4.108	5.192	0.4666		0.47	0.0430	2.682386	-2.51
	15	112	0.30684932	0.5	9.8	4.108	5.692	0.4667		0.47	0.0430	3.182344	-2.51
		119.99	0.32873973	0.5	9.8	4.354	5.446	0.5000		0.50	0.0433	2.902768	-2.54
	EOC	120	0.32876712	0.5	10.3	4.354	5.946	0.5		0.50	0.0433	3.402726	-2.54
Post Construction Settlement		150	0.4109589	0	10.3	4.775	5.525		1.27	0.77	0.0443	2.711491	-2.81
		240	0.65753425	0	10.3	5.266	5.034		1.30	0.80	0.0475	2.186452	-2.85
		365	1	0	10.3	5.658	4.642		1.33	0.83	0.052	1.756667	-2.89
		730	2	0	10.3	5.902	4.398		1.39	0.89	0.066	1.446167	-2.95
		1095	3	0	10.3	5.91	4.39		1.42	0.92	0.079	1.395167	-2.99
		1825	5	0	10.3	6.01	4.29		1.45	0.95	0.105	1.24	-3.05
		3650	10	0	10.3	6.01	4.29		1.46	0.96	0.171	1.158167	-3.13
		5475	15	0	10.3	6.01	4.29		1.46	0.96	0.236	1.090667	-3.20
		7300	20	0	10.3	6.01	4.29		1.46	0.96	0.302	1.023833	-3.27

Project No.		24431.01
Project Title	East Delacroix	
Analysis	MCA - No Sand Foundation	
Engineer	JMW	
Date		3/25/2021
PSDDF File	MCA_80Days	
Settle 3 File	24431.01 MCA no Sand	
Initial Mudline		-2
Lifts are of e00=8.0 material		

		Time Days	Time, years	Lift Thickness, ft	Total Material Thickness (no selfweight sett), ft	Selfweight Settlement, ft	Material Thickness, ft	Estimated Foundation Construction Settlement	Foundation Settlement from Settle3	Foundation Settlement	Subsidence	Surface Elevation
Assumed Construction Sequence with Settlement	0	0.0001	0	1	1	0	1	0		0.00	0.039	-1.039
		4.99	0.01367123	1	1	0.368	0.632	0.0312		0.03	0.0392	-1.438365
	1	5	0.01369863	1	2	0.368	1.632	0.0312		0.03	0.0392	-0.438427
		9.99	0.02736986	1	2	0.733	1.267	0.0624		0.06	0.0394	-0.834793
	2	10	0.02739726	1	3	0.733	2.267	0.0625		0.06	0.0394	0.165144
		14.99	0.04106849	1	3	1.102	1.898	0.0937		0.09	0.0395	-0.235221
	3	15	0.04109589	0.8	3.8	1.102	2.698	0.0937		0.09	0.0395	0.564716
		19.99	0.05476712	0.8	3.8	1.396	2.404	0.1249		0.12	0.0397	0.239351
	4	20	0.05479452	0.5	4.3	1.396	2.904	0.1250		0.12	0.0397	0.739288
		24.99	0.06846575	0.5	4.3	1.613	2.687	0.1562		0.16	0.0399	0.490923
	5	25	0.06849315	0.5	4.8	1.613	3.187	0.1562		0.16	0.0399	0.99086
		29.99	0.08216438	0.5	4.8	1.827	2.973	0.1874		0.19	0.0401	0.745495
	6	30	0.08219178	0.5	5.3	1.827	3.473	0.1875		0.19	0.0401	1.245432
		34.99	0.09586301	0.5	5.3	2.044	3.256	0.2187		0.22	0.0402	0.997067
	7	35	0.09589041	0.5	5.8	2.044	3.756	0.2187		0.22	0.0402	1.497004
		39.99	0.10956164	0.5	5.8	2.259	3.541	0.2499		0.25	0.0404	1.250639
	8	40	0.10958904	0.5	6.3	2.259	4.041	0.2500		0.25	0.0404	1.750576
		44.99	0.12326027	0.5	6.3	2.474	3.826	0.2812		0.28	0.0406	1.50421
	9	45	0.12328767	0.5	6.8	2.474	4.326	0.2812		0.28	0.0406	2.004148
		49.99	0.1369589	0.5	6.8	2.691	4.109	0.3124		0.31	0.0408	1.755782
	10	50	0.1369863	0.5	7.3	2.691	4.609	0.3125		0.31	0.0408	2.255719
		54.99	0.15065753	0.5	7.3	2.908	4.392	0.3437		0.34	0.0410	2.007354
	11	55	0.15068493	0.5	7.8	2.908	4.892	0.3437		0.34	0.0410	2.507291
		59.99	0.16435616	0.5	7.8	3.128	4.672	0.3749		0.37	0.0411	2.255926
	12	60	0.16438356	0.5	8.3	3.128	5.172	0.3750		0.37	0.0411	2.755863
		64.99	0.17805479	0.5	8.3	3.346	4.954	0.4062		0.41	0.0413	2.506498
	13	65	0.17808219	0.5	8.8	3.346	5.454	0.4062		0.41	0.0413	3.006435
		69.99	0.19175342	0.5	8.8	3.563	5.237	0.4374		0.44	0.0415	2.75807
	14	70	0.19178082	0.5	9.3	3.563	5.737	0.4375		0.44	0.0415	3.258007
		74.99	0.20545205	0.5	9.3	3.781	5.519	0.4687		0.47	0.0417	3.008642
	15	75	0.20547945	0.5	9.8	3.781	6.019	0.4687		0.47	0.0417	3.508579
		79.99	0.21915068	0.5	9.8	3.998	5.802	0.4999		0.50	0.0418	3.260214
	EOC	80	0.21917808	0.5	10.3	3.998	6.302	0.5		0.50	0.0418	3.760151
Post Construction Settlement												
		110	0.30136986	0	10.3	4.481	5.819		1.27	0.77	0.0429	3.006916
		240	0.65753425	0	10.3	5.275	5.025		1.30	0.80	0.0475	2.177452
		365	1	0	10.3	5.663	4.637		1.33	0.83	0.052	1.751667
		730	2	0	10.3	5.902	4.398		1.39	0.89	0.066	1.446167
		1095	3	0	10.3	5.91	4.39		1.42	0.92	0.079	1.395167
		1825	5	0	10.3	6.01	4.29		1.45	0.95	0.105	1.24
		3650	10	0	10.3	6.01	4.29		1.46	0.96	0.171	1.158167
		5475	15	0	10.3	6.01	4.29		1.46	0.96	0.236	1.090667
		7300	20	0	10.3	6.01	4.29		1.46	0.96	0.302	1.023833

Project No.	24431.01
Project Title	East Delacroix
Analysis	MNA - 70 Day Filling
Engineer	JMW
Date	3/31/2021
PSDDF File	MNA70days
Settle 3 File	24431.01 MNA no Sand
Initial Mudline	0.5
Lifts are of e00=8.0 material	

		Time Days	Time, years	Lift Thickness, ft	Total Material Thickness (no selfweight sett), ft	Selfweight Settlement, ft	Material Thickness, ft	Estimated Foundation Construction Settlement	Foundation Settlement from Settle3	Foundation Settlement	Subsidence	Assumed Desiccation Settlement	Surface Elevation	MUDLINE EL	MUDLINE EL (NO SET
	0	0.0001	0	1	1	0	1	0		0.00	0.039		1.461	0.46	0.5
		15.99	0.04380822	1	1	0.371	0.629	0.0457		0.05	0.0396		1.043745003	0.41	0.5
	1	16	0.04383562	1	2	0.371	1.629	0.0457		0.05	0.0396		2.043716075	0.41	0.5
Assumed		31.99	0.08764384	1	2	0.808	1.192	0.0914		0.09	0.0401		1.560460789	0.37	0.5
Construction	2	32	0.08767123	1	3	0.808	2.192	0.0914		0.09	0.0401		2.560431861	0.37	0.5
Sequence with		47.99	0.13147945	1	3	1.26	1.74	0.1371		0.14	0.0407		2.062176574	0.32	0.5
Estimated	3	48	0.13150685	1	4	1.26	2.74	0.1371		0.14	0.0407		3.062147647	0.32	0.5
Settlement		63.99	0.17531507	1	4	1.722	2.278	0.1828		0.18	0.0413		2.55389236	0.28	0.5
	4	64	0.17534247	0.5	4.5	1.722	2.778	0.1829		0.18	0.0413		3.053863433	0.28	0.5
		69.99	0.19175342	0.5	4.5	1.94	2.56	0.2000		0.20	0.0415		2.81853578	0.26	0.5
	EOC	70	0.19178082	0.5	5	1.94	3.06	0.2		0.20	0.0415		3.318506852	0.26	0.5
		100	0.2739726	0	5	2.32	2.68		1.00	0.80	0.0426	0.0000	2.34	-0.34	0.5
		240	0.65753425	0	5	2.61	2.39		1.00	0.80	0.0475	0.0000	2.04	-0.35	0.5
Post		365	1	0	5	2.616	2.384		1.00	0.80	0.052	0.2	1.83	-0.35	0.5
Construction		730	2	0	5	2.618	2.382		1.00	0.80	0.066	0.2	1.82	-0.37	0.5
Settlement		1095	3	0	5	2.618	2.382		1.00	0.80	0.079	0.2	1.80	-0.38	0.5
		1825	5	0	5	2.618	2.382		1.00	0.80	0.105	0.2	1.78	-0.41	0.5
		3650	10	0	5	2.618	2.382		1.00	0.80	0.171	0.2	1.71	-0.47	0.5
		5475	15	0	5	2.618	2.382		1.00	0.80	0.236	0.2	1.65	-0.54	0.5
		7300	20	0	5	2.618	2.382		1.00	0.80	0.302	0.2	1.58	-0.60	0.5

MCA 120 day analyses Step 5 Reached went from an el of +0.5 to +3.4 using approximately 5' of fill material with a final thickness of 3 ft at EOC using 0.5' lifts over 8 day filling periods 70 of the 120 days
MCA analyses had included selfweight settlement of previously placed material and mudwave settlement of up to 0.5'. These considerations were not considered appropriate for MNA areas.
Presented analysis use the same 70 day window to achieve the same fill height with a simpler filling schedule (5 steps instead of 10). Total thickness of each stage has been adjusted to achieve a CMFE at approximately 3.4

PSDDF INPUT ASSUMPTIONS

Project No. and Title	24431.01 East Delacroix Marsh Creation
Engineer	JMW; Eustis Engineering
Date	3/4/2021
Analysis Case	MCA Dredge Material (ML EL -2) dredge material consolidation only

This file was prepared by JMW to assist in preparing/reviewing PSDDF Input files. It assumes the foundation materials are modeled as incompressible material and all foundation settlement will be evaluated with a separate program.
Values in red are input by the user and lines to input into a PSDDF text file are generated accordingly.
Note Lines produced are based on DOS version/manual groups. Windows version order is slightly different and file should be produced using PSDDF windows version input screens.

Row 1 - Problem Description (Group A/Table 8 of PSDDF USER MANUAL)

100	Line No.
'24431.01 E Delacroix'	Description of simulation which can be a maximum of any 60 characters except a single quote, i. e. ' .
1	Excess pore-water pressure at which the secondary compression model is activated. If secondary compression is not activated, PSDDF assigns the variable TOL a value of zero. If secondary compression is to be activated, TOL should be set to a value greater than zero in Data Input Group E. The excess pore-water pressure should be entered using consistent units, e.g., lbs/sq.ft.
1	1 = Output not saved in a continuation file. 2 = Output saved in a continuation file for subsequent restart of simulation

Line for File:	100 '24431.01 E Delacroix' 1 1

Row 2 - Program Execution Data (Group B/Table 9 of PSDDF User Manual)

101	Line No.
1	1= Complete Program Execution and print soil data, initial conditions, and current conditions for all times. 2= Complete Program Execution but do not print soil data and initial conditions. 3= Terminate Program Execution after printing soil data and initial conditions
2	1= Create output file for use with CAP Model 2= No output file for use with CAP model
1	1= English Units 2= SI Units (This excel file assumes english units)

Line for File:	101 1 2 1

Row 3 - Incompressible Foundation Data

102	Line No.
1	Void Ratio of Incompressible Foundation
0.01	Permeability of Incompressible Foundation, ft/day
20	Length of Incompressible Foundation Drainage Path, ft
-2	Elevation of the Top of the Incompressible Foundation, ft
0	Elevation of the water or ground water surface, ft
62.4	Unit Weight of Water, pcf
0	Pore Water Pressure for secondary compression (psf)

Line for File:	102 1 0.01 20 -2 0 62.4 0

Row 4 - Compressible Foundation Information
For this excel summary/input sheet an incompressible foundation is shown

Line for File: 103 0 0 1

Row 5 - Dredge Material Properties (Assume a Single Type of Dredge Material)

104	Line No.
1	Material Identification No.
2.69	Specific Gravity for Dredge Material
0.01	Ratio Between secondary compression index and compression index (0.01 to 0.05 typical)
0.15	Ration between recompression index and compression index (0.1 to 0.3 typical)
2.00	Dessication Limit (Computed on Separate Sheet)
2.86	Saturation Limit (Computed on Separate Sheet)
0.5	Maximum Crust Thickness, ft
0.6	Average Degree of Saturation as a fraction of 1.0 of dredged fill when dried to dessication limit (40 to 60%)
	Number of Points in void ratio, effective stress, perm data.

Line for File: 104 1 2.69 0.01 0.15 2 2.85678 0.5

Multiple Rows - Void Ratio, Effective Stress, Permeability Information
Lines Prepared on Separate Sheet Max of 40 rows assumed
Values are line no, void ratio, effective stress (psf), Perm (ft/day)

Lines for File:
105 8 0 9
106 7 0.02 1
107 6 0.2 0.1
108 5.08 2 0.0246
109 3.93 10 0.0103
110 2.89 20 0.00461
111 2.64 50 0.003
112 2.23 100 0.00181
113 1.94 200 0.00143
114 1.67 500 0.001
115 1.33 1000 0.000788

Precipitation and Evaporation Data - Group H Table 16

Lines for File:	134 0.1312336 0.375833333333333
	135 0.164042 0.408333333333333
	136 0.246063 0.4775
	137 0.3116798 0.3925
	138 0.3937008 0.39
	139 0.4265092 0.534166666666667
	140 0.3937008 0.5625
	141 0.328084 0.501666666666667
	142 0.2952756 0.475
	143 0.1968504 0.271666666666667
	144 0.164042 0.398333333333333
	145 0.1312336 0.37

Monthly Total Precipitation for ST BERNARD, LA

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1966	M	9.77	2.46	4.34	8.44	3.14	8.34	8.51	2.51	3.50	1.68	6.51	59.20
1967	3.51	6.52	1.86	2.34	2.47	5.09	6.18	5.70	4.63	10.75	0.24	9.97	59.26
1968	1.18	4.11	1.51	2.75	6.43	3.47	1.88	4.98	2.79	1.57	4.67	6.70	42.04
1969	5.54	3.73	8.25	4.99	6.15	0.63	8.46	8.78	0.48	0.84	2.05	6.36	56.26
1970	4.43	3.27	8.03	1.12	3.67	4.23	M	7.61	6.64	4.82	0.91	1.05	45.78
1971	2.87	6.08	4.80	1.03	0.69	8.89	12.20	5.14	14.46	0.37	M	5.30	61.83
1972	7.66	7.58	6.87	1.34	6.06	2.55	M	4.08	2.83	1.77	8.19	6.82	55.75
1973	4.77	4.95	10.40	8.94	2.77	1.64	3.37	5.33	10.54	3.73	4.95	4.44	65.83
1974	6.61	1.29	4.84	5.81	4.87	M	3.41	M	1.22	0.05	7.72	3.48	39.30
1975	3.07	1.35	5.00	M	8.60	11.65	8.64	10.19	8.61	3.83	6.92	2.70	70.56
1976	2.15	4.03	5.86	1.75	9.44	3.67	5.75	4.14	2.64	4.19	6.88	8.91	59.41
1977	5.75	2.73	5.35	1.82	2.88	1.24	6.19	15.52	9.99	4.84	9.17	3.70	69.18
1978	9.97	2.70	4.48	3.20	10.04	10.83	5.66	8.61	3.11	0.00	2.61	5.25	66.46
1979	4.32	12.88	7.11	6.20	6.40	1.98	10.50	7.51	5.86	0.52	3.87	2.52	69.67
1980	7.05	2.18	9.19	24.06	9.19	1.72	6.88	0.88	6.72	8.75	2.76	1.99	81.37
1981	0.77	12.91	1.69	0.94	2.70	2.69	3.77	4.11	4.28	0.54	1.38	5.60	41.38
1982	2.78	6.95	2.59	4.18	4.70	2.34	6.80	4.94	6.37	4.86	6.57	8.17	61.25
1983	5.59	9.83	5.28	16.01	3.81	13.38	8.57	4.79	7.48	2.13	5.03	6.50	88.40
1984	4.31	4.71	7.24	1.88	4.96	2.69	11.68	4.66	2.14	1.98	3.35	2.06	51.66
1985	4.08	5.03	4.23	0.71	1.78	4.63	10.19	7.80	8.58	12.81	1.76	2.49	64.09
1986	2.81	6.41	3.69	0.22	4.18	1.54	5.80	2.46	3.05	1.92	6.14	4.92	43.14
1987	6.10	6.44	4.59	1.13	3.36	8.35	6.62	7.56	2.25	0.28	3.48	2.48	52.64
1988	3.60	10.81	12.71	11.80	2.23	8.12	6.28	12.44	9.09	2.85	0.79	3.23	83.95
1989	3.10	1.02	3.41	5.41	5.52	3.01	4.88	3.06	4.51	2.35	24.00	8.40	68.67
1990	6.46	8.46	6.02	1.34	7.21	2.77	1.85	2.22	3.49	2.46	2.03	3.94	48.25
1991	14.82	2.48	8.22	20.34	13.04	7.90	13.37	3.85	2.30	3.17	3.02	3.55	96.06
1992	10.38	5.84	4.29	1.97	0.75	5.59	5.59	7.48	10.66	0.07	14.68	5.37	72.67
1993	12.79	2.53	6.88	5.17	4.71	5.69	4.03	2.44	5.50	6.16	2.14	3.13	61.17
1994	4.38	0.67	4.82	1.79	6.19	8.60	13.32	5.61	8.06	6.56	2.63	3.27	65.90
1995	2.73	2.78	12.32	1.05	5.55	1.37	7.38	5.18	1.08	3.47	6.14	2.60	51.65
1996	2.88	4.20	3.75	4.79	1.69	6.68	3.70	7.21	4.48	0.87	1.84	7.77	49.86
1997	1.13	M	2.80	3.95	3.02	4.30	5.20	4.30	M	1.60	3.80	2.05	32.15
1998	3.25	6.10	17.07	4.00	0.00	1.90	0.60	9.53	24.74	1.91	3.93	1.25	74.28
1999	1.35	0.55	4.35	0.30	5.50	13.70	4.52	4.80	4.25	4.30	M	M	43.62
2000	0.20	1.00	1.70	0.50	0.58	5.78	2.37	3.21	4.50	0.00	6.10	3.80	29.74
2001	1.30	0.89	8.53	0.25	0.65	26.35	6.00	10.50	2.75	6.00	3.00	2.75	68.97
2002	2.45	3.01	4.98	3.90	1.50	5.50	7.75	6.53	9.81	6.30	3.99	5.73	61.45
2003	0.00	1.95	M	6.80	0.00	26.70	10.57	M	2.17	0.00	2.70	2.99	53.88
2004	5.30	M	1.20	10.20	11.70	14.15	3.46	1.00	2.20	4.90	5.60	0.90	60.61
2005	M	8.40	5.00	5.50	3.65	5.40	14.90	M	M	M	M	M	42.85
2006	M	M	M	M	M	M	M	M	M	M	M	M	M
2007	M	M	M	M	M	M	M	M	M	M	M	M	M
2008	M	M	M	M	M	M	M	M	M	M	M	M	M
2009	M	M	M	M	M	M	M	M	M	M	M	M	M
2010	M	M	M	M	M	M	M	M	M	M	M	M	M

Mean	4.51	4.90	5.73	4.71	4.68	6.41	6.75	6.02	5.70	3.26	4.78	4.44	59.25
Max	14.82 1991	12.91 1981	17.07 1998	24.06 1980	13.04 1991	26.70 2003	14.90 2005	15.52 1977	24.74 1998	12.81 1985	24.00 1989	9.97 1967	96.06 1991
Min	0.00 2003	0.55 1999	1.20 2004	0.22 1986	0.00 2003	0.63 1969	0.60 1998	0.88 1980	0.48 1969	0.00 2003	0.24 1967	0.90 2004	29.74 2000

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2011	M	M	M	M	M	M	M	M	M	M	M	M	M
2012	M	M	M	M	M	M	M	M	M	M	M	M	M
2013	M	M	M	M	M	M	M	M	M	M	M	M	M
2014	M	M	M	M	M	M	M	M	M	M	M	M	M
2015	M	M	M	M	M	M	M	M	M	M	M	M	M
2016	M	M	M	M	M	M	M	M	M	M	M	M	M
2017	M	M	M	M	M	M	M	M	M	M	M	M	M
2018	M	M	M	M	M	M	M	M	M	M	M	M	M
2019	M	M	M	M	M	M	M	M	M	M	M	M	M
2020	M	M	M	M	M	M	M	M	M	M	M	M	M
2021	M	M	M	M	M	M	M	M	M	M	M	M	M
Mean	4.51	4.90	5.73	4.71	4.68	6.41	6.75	6.02	5.70	3.26	4.78	4.44	59.25
Max	14.82 1991	12.91 1981	17.07 1998	24.06 1980	13.04 1991	26.70 2003	14.90 2005	15.52 1977	24.74 1998	12.81 1985	24.00 1989	9.97 1967	96.06 1991
Min	0.00 2003	0.55 1999	1.20 2004	0.22 1986	0.00 2003	0.63 1969	0.60 1998	0.88 1980	0.48 1969	0.00 2003	0.24 1967	0.90 2004	29.74 2000

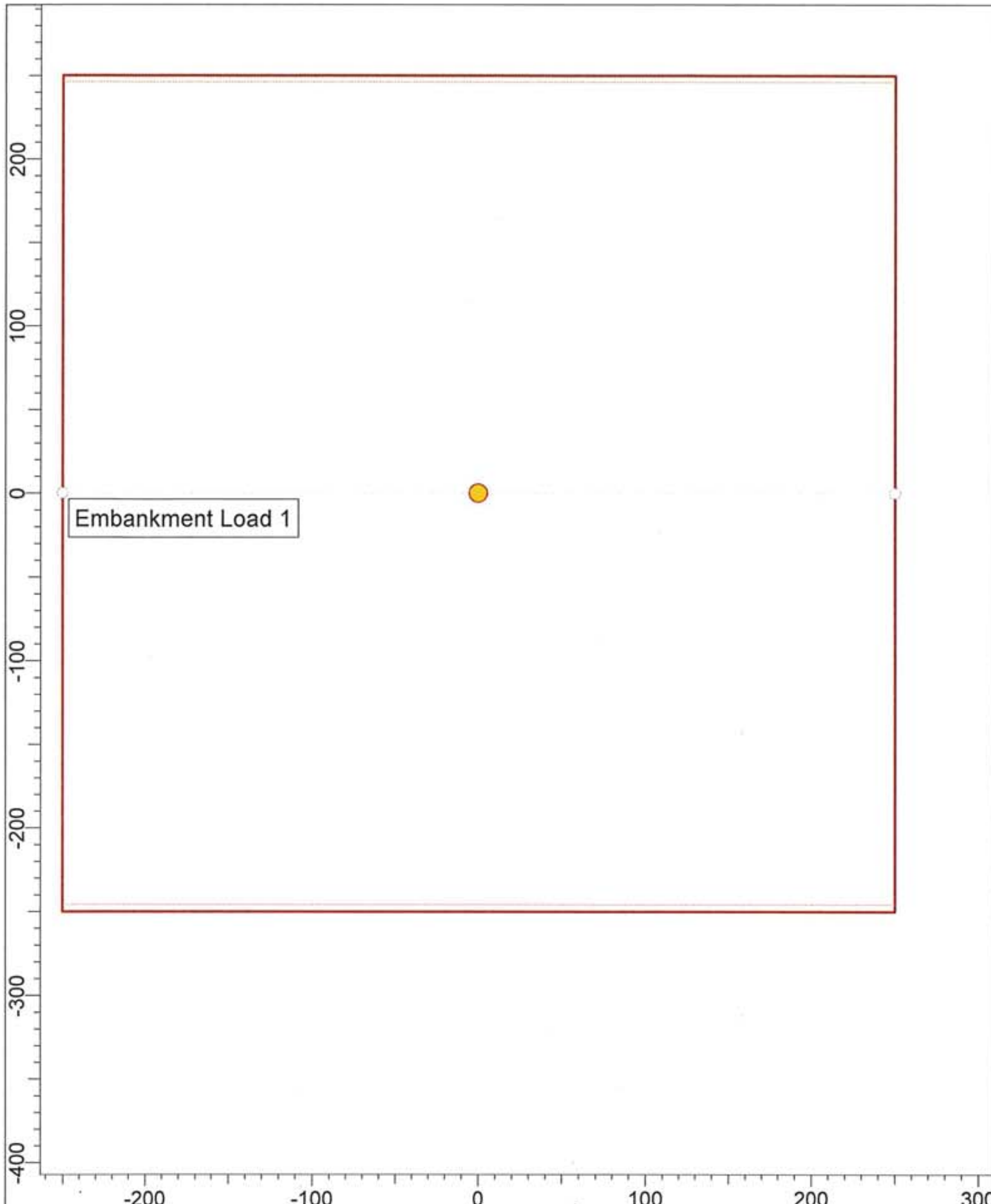
```
'24431.01 E Delacroix MNA'  1  1
 1  2  1
 1  0.01  20  0.5  0.5  62.4  0
 0  0  1
 1  2.69  0.01  0.15  2  2.86  0.5  0.6  11
08.00              0.00E+00        9.00E+00
07.00      2.00E-02        1.00E+00
06.00      2.00E-01        1.00E-01
05.08      2.00E+00        2.46E-02
03.93      1.00E+01        1.03E-02
02.89      2.00E+01        4.61E-03
02.64      5.00E+01        3.00E-03
02.23      1.00E+02        1.81E-03
01.94      2.00E+02        1.43E-03
01.67      5.00E+02        1.00E-03
01.33      1.00E+03        7.88E-04
 19
    1  7300  1  1  8  1  10
 16  1  7300  1  1  8  1  10
 32  1  7300  1  1  8  1  10
 48  1  7300  1  1  8  1  10
 64  0.5  7300  1  1  8  1  10
 70  0.5  7300  5  1  8  1  10
 71  0  7300  5  1
 75  0  7300  5  1
 80  0  7300  5  1
 85  0  7300  5  1
 100  0  7300  8  1
 240  0  7300  1  1
 365  0  7300  1  1
 730  0  7300  1  1
 1095  0  7300  1  1
 1825  0  7300  1  1
 3650  0  7300  1  1
 5475  0  7300  1  1
 7300  0  7300  1  1
 30  0.5  0.75
 0.13   0.38
 0.16   0.41
 0.25   0.48
 0.31   0.39
 0.39   0.39
 0.43   0.53
 0.39   0.56
 0.33   0.5
 0.3    0.48
 0.2    0.27
 0.16   0.4
 0.13   0.37
```

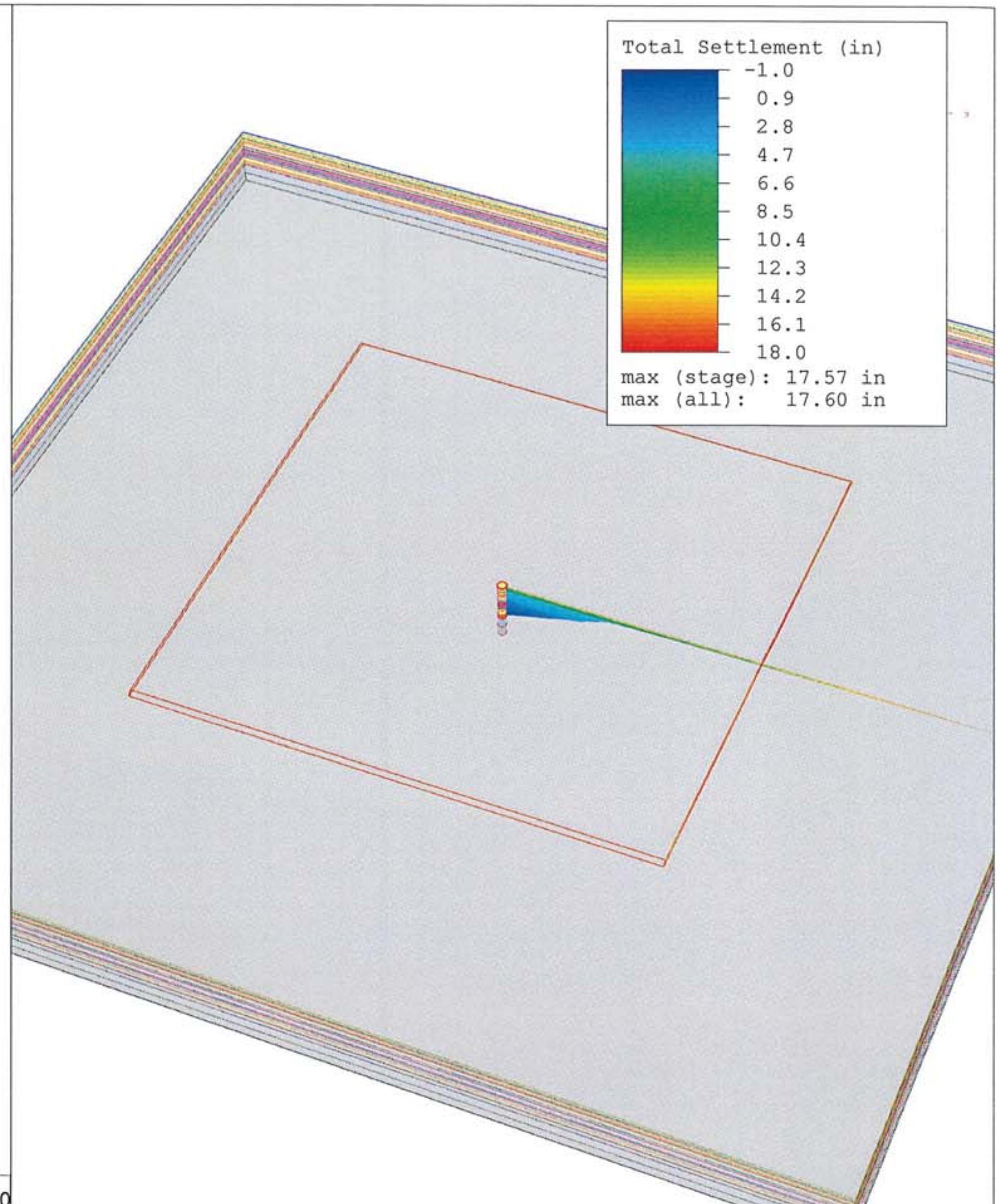
```
'24431.01 E Delacroix MCA'  1  1
 1  2  1
 1  0.01  20 -2  1.5  62.4  0
 0  0  1
 1  2.69  0.01  0.15  2  2.86  0.5  0.6  11
08.00              0.00E+00        9.00E+00
07.00      2.00E-02        1.00E+00
06.00      2.00E-01        1.00E-01
05.08      2.00E+00        2.46E-02
03.93      1.00E+01        1.03E-02
02.89      2.00E+01        4.61E-03
02.64      5.00E+01        3.00E-03
02.23      1.00E+02        1.81E-03
01.94      2.00E+02        1.43E-03
01.67      5.00E+02        1.00E-03
01.33      1.00E+03        7.88E-04
 28
    1  7300  1  1  8  1  10
 10  1  7300  1  1  8  1  10
 20  1  7300  1  1  8  1  10
 30  0.75  7300  1  1  8  1  10
 40  0.5  7300  1  1  8  1  10
 50  0.5  7300  1  1  8  1  10
 60  0.5  7300  1  1  8  1  10
 70  0.5  7300  1  1  8  1  10
 80  0.5  7300  1  1  8  1  10
 90  0.5  7300  1  1  8  1  10
 100  0.5  7300  1  1  8  1  10
 110  0.5  7300  1  1  8  1  10
 120  0.5  7300  1  1  8  1  10
 130  0.5  7300  5  1  8  1  10
 140  0.5  7300  1  1  8  1  10
 150  0.5  7300  1  1  8  1  10
 160  0.5  180  1  1  8  1  10
 161  0  7300  1  1
 190  0  7300  1  1
 220  0  7300  1  1
 240  0  7300  1  1
 365  0  7300  1  1
 730  0  7300  1  1
 1095  0  7300  1  1
 1825  0  7300  1  1
 3650  0  7300  1  1
 5475  0  7300  1  1
 7300  0  7300  1  1
 30  0.5  0.75
 0.13   0.38
 0.16   0.41
 0.25   0.48
 0.31   0.39
 0.39   0.39
 0.43   0.53
 0.39   0.56
 0.33   0.5
 0.3    0.48
 0.2    0.27
 0.16   0.4
 0.13   0.37
```

```
'24431.01 E Delacroix MCA'  1  1
 1  2  1
 1  0.01  20 -2  1.5  62.4  0
 0  0  1
 1  2.69  0.01  0.15  2  2.86  0.5  0.6  11
08.00              0.00E+00        9.00E+00
07.00      2.00E-02        1.00E+00
06.00      2.00E-01        1.00E-01
05.08      2.00E+00        2.46E-02
03.93      1.00E+01        1.03E-02
02.89      2.00E+01        4.61E-03
02.64      5.00E+01        3.00E-03
02.23      1.00E+02        1.81E-03
01.94      2.00E+02        1.43E-03
01.67      5.00E+02        1.00E-03
01.33      1.00E+03        7.88E-04
 28
    1  7300  1  1  8  1  10
 4  1  7300  1  1  8  1  10
 8  1  7300  1  1  8  1  10
 16  0.75  7300  1  1  8  1  10
 24  0.5  7300  1  1  8  1  10
 32  0.5  7300  1  1  8  1  10
 40  0.5  7300  1  1  8  1  10
 48  0.5  7300  1  1  8  1  10
 56  0.5  7300  1  1  8  1  10
 64  0.5  7300  1  1  8  1  10
 72  0.5  7300  1  1  8  1  10
 80  0.5  7300  1  1  8  1  10
 88  0.5  7300  1  1  8  1  10
 96  0.5  7300  5  1  8  1  10
 104  0.5  7300  1  1  8  1  10
 112  0.5  7300  1  1  8  1  10
 120  0.5  180  1  1  8  1  10
 121  0  7300  1  1
 150  0  7300  1  1
 180  0  7300  1  1
 240  0  7300  1  1
 365  0  7300  1  1
 730  0  7300  1  1
 1095  0  7300  1  1
 1825  0  7300  1  1
 3650  0  7300  1  1
 5475  0  7300  1  1
 7300  0  7300  1  1
 30  0.5  0.75
 0.13   0.38
 0.16   0.41
 0.25   0.48
 0.31   0.39
 0.39   0.39
 0.43   0.53
 0.39   0.56
 0.33   0.5
 0.3    0.48
 0.2    0.27
 0.16   0.4
 0.13   0.37
```

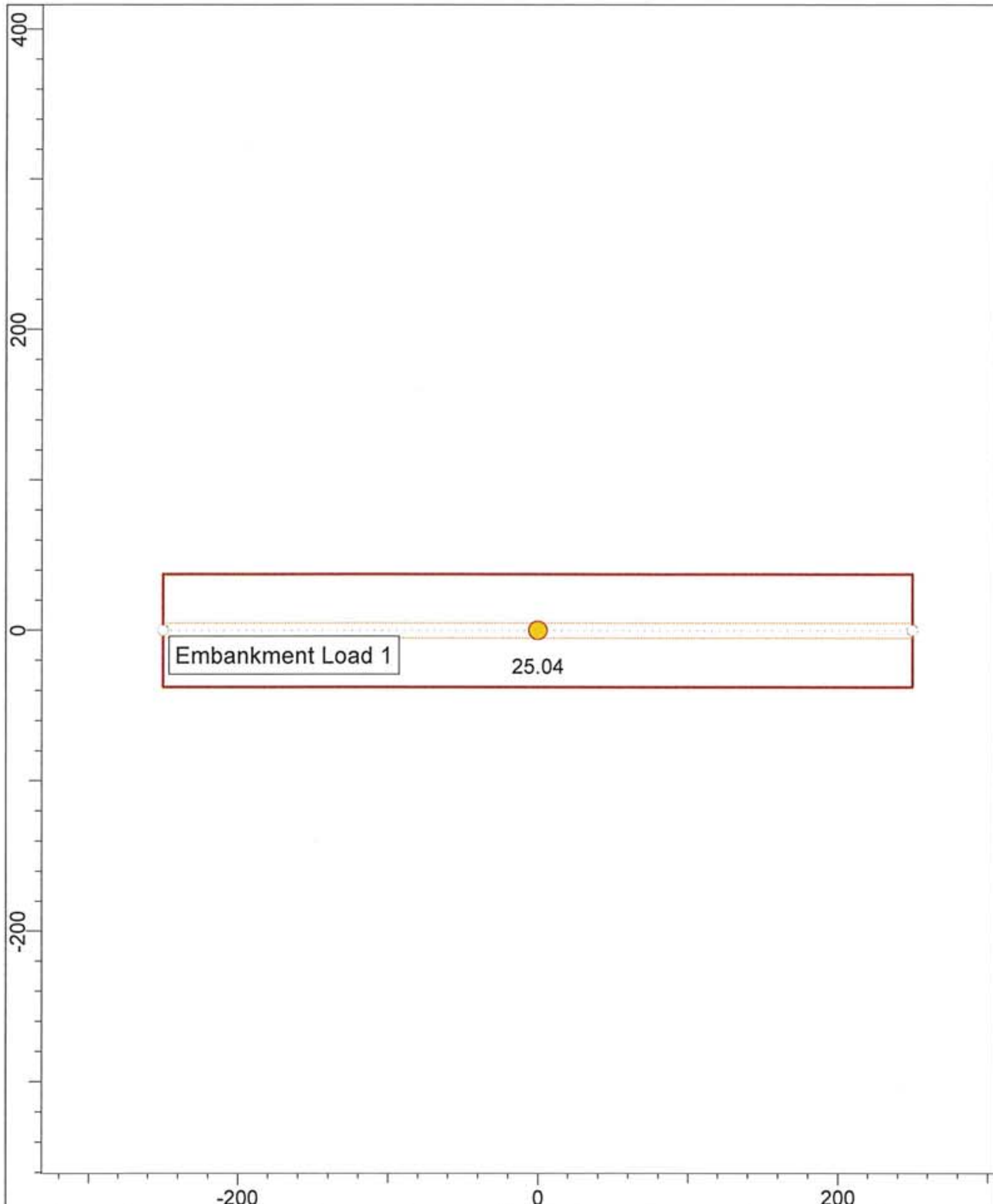
```
100 '24431.01 E Delacroix MCA'  1  1
101  1  2  1
102  1  0.01  20 -2  1.5  62.4  0
103  0  0  1
104  1  2.69  0.01  0.15  2  2.86  0.5  0.6  11
105 08.00              0.00E+00        9.00E+00
106 07.00      2.00E-02        1.00E+00
107 06.00      2.00E-01        1.00E-01
108 05.08      2.00E+00        2.46E-02
109 03.93      1.00E+01        1.03E-02
110 02.89      2.00E+01        4.61E-03
111 02.64      5.00E+01        3.00E-03
112 02.23      1.00E+02        1.81E-03
113 01.94      2.00E+02        1.43E-03
114 01.67      5.00E+02        1.00E-03
115 01.33      1.00E+03        7.88E-04
116  28
117     1  7300  1  1  8  1  10
118  5  1  7300  1  1  8  1  10
119  10  1  7300  1  1  8  1  10
120  15  0.75  7300  1  1  8  1  10
121  20  0.5  7300  1  1  8  1  10
122  25  0.5  7300  1  1  8  1  10
123  30  0.5  7300  1  1  8  1  10
124  35  0.5  7300  1  1  8  1  10
125  40  0.5  7300  1  1  8  1  10
126  45  0.5  7300  1  1  8  1  10
127  50  0.5  7300  1  1  8  1  10
128  55  0.5  7300  1  1  8  1  10
129  60  0.5  7300  1  1  8  1  10
130  65  0.5  7300  5  1  8  1  10
131  70  0.5  7300  1  1  8  1  10
132  75  0.5  7300  1  1  8  1  10
133  80  0.5  180  1  1  8  1  10
134  81  0  7300  1  1
135  110  0  7300  1  1
136  180  0  7300  1  1
137  240  0  7300  1  1
138  365  0  7300  1  1
139  730  0  7300  1  1
140  1095  0  7300  1  1
141  1825  0  7300  1  1
142  3650  0  7300  1  1
143  5475  0  7300  1  1
144  7300  0  7300  1  1
145  30  0.5  0.75
146  0.13   0.38
147  0.16   0.41
148  0.25   0.48
149  0.31   0.39
150  0.39   0.39
151  0.43   0.53
152  0.39   0.56
153  0.33   0.5
154  0.3    0.48
155  0.2    0.27
156  0.16   0.4
157  0.13   0.37
```

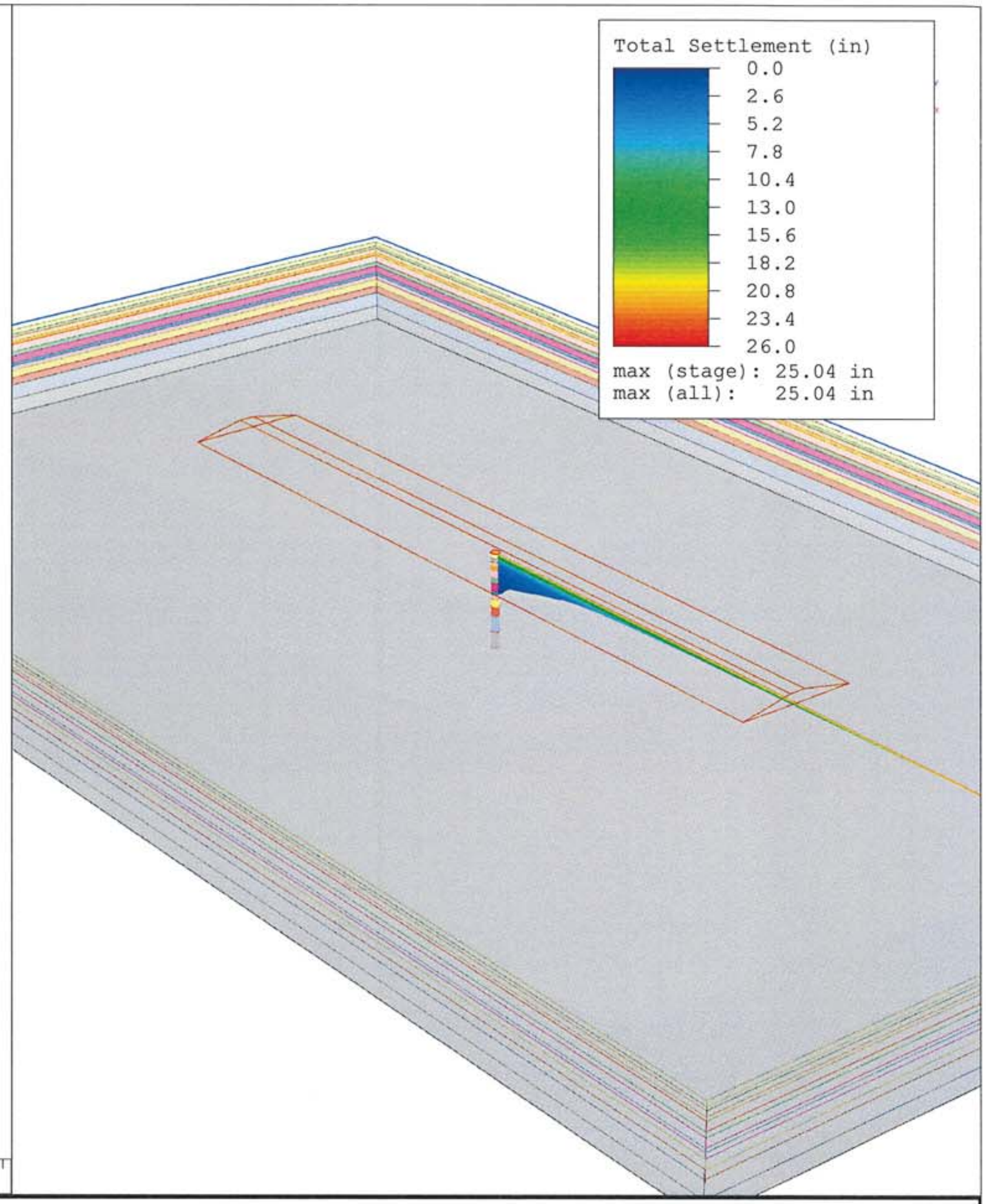
SETTLE3 OUTPUT FILES



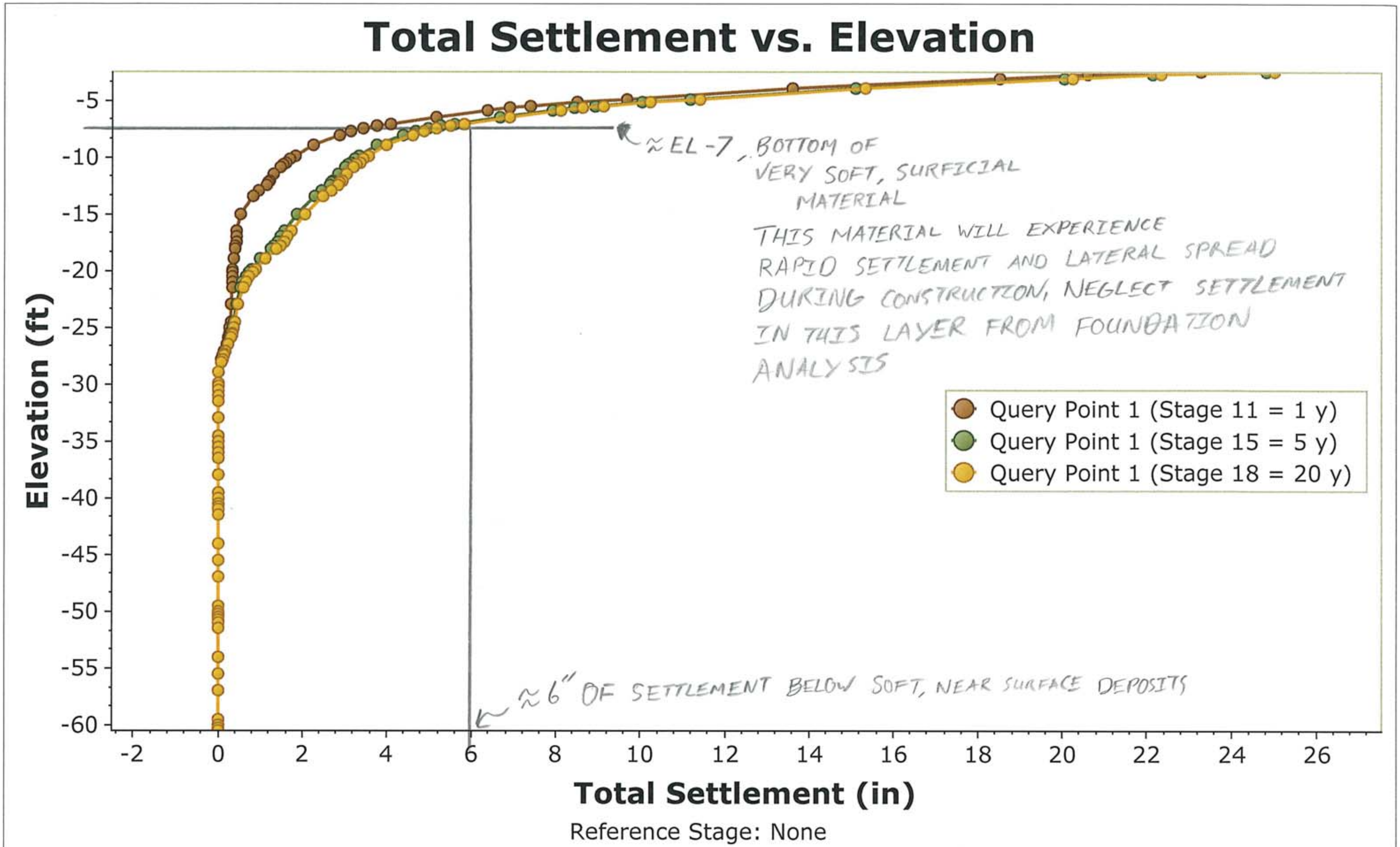


rocscience SETTLE3 5.009	*Project* 24431.01 East Delacroix - MCA		
	Analysis Description MCA Mudline EL -2		
	Drawn By	*Company*	
	Date 3/15/2021, 9:50:02 AM	*File Name* 24431.01 MCA ML EL -2 (3-18-21).s3z	



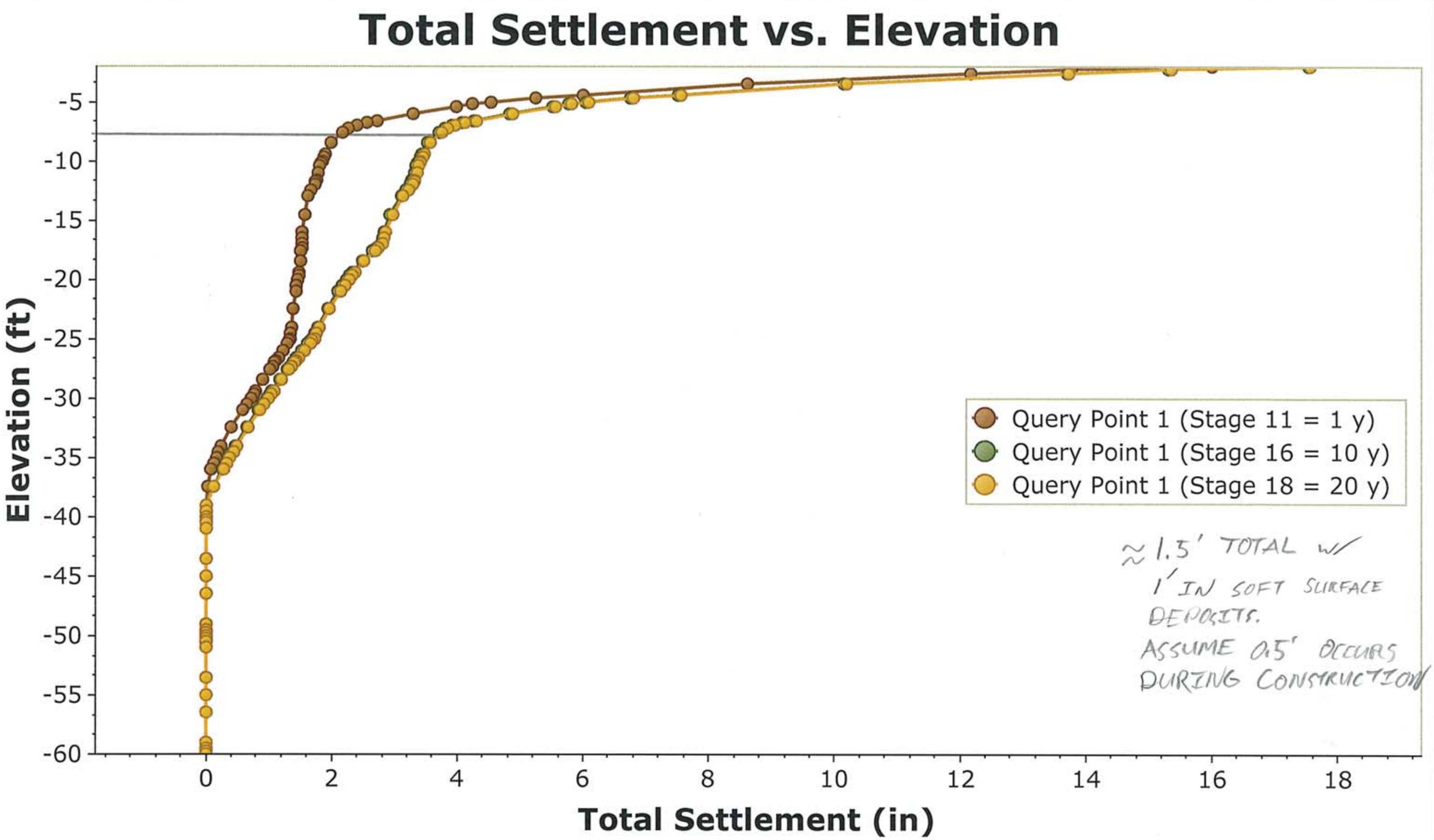


rocscience SETTLE3 5.009	*Project* 24431.01 East Delacroix – TERRACE		
	Analysis Description TERRACE ~~MCA~~ Mudline EL -2		
	Drawn By JMW	*Company*	
	Date 3/15/2021, 9:50:02 AM	*File Name* 24431.01 TERRACE ML EL -2.5 (3-18-21).s3z	



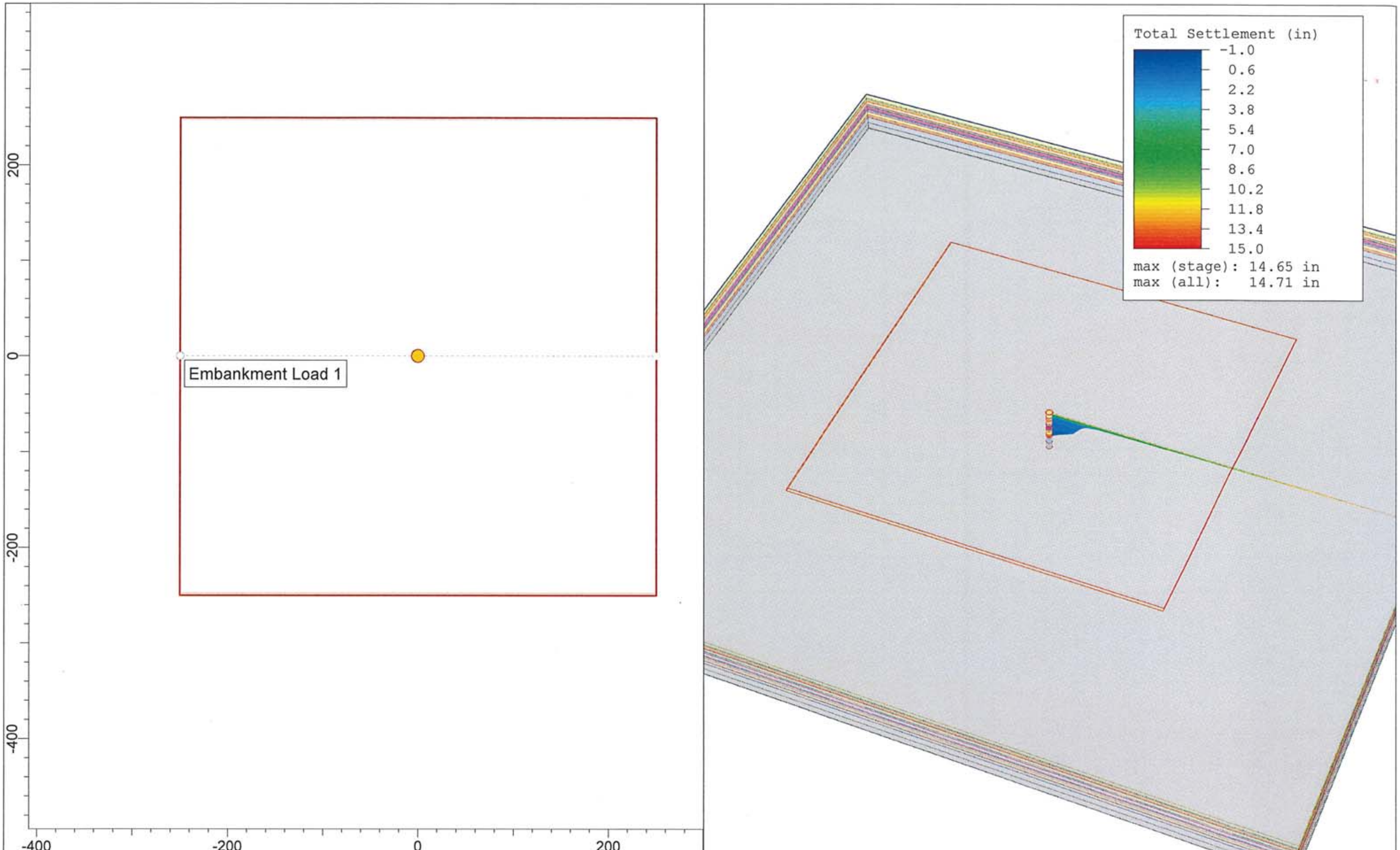
Project	24431.01 East Delacroix – TERRACE,
Analysis Description	TERRACE ~~MCA~~ Mudline EL -2
Drawn By	JMW
Company	
Date	3/15/2021, 9:50:02 AM
File Name	24431.01 TERRACE ML EL -2.5 (3-18-21).s3z

SETTLE3 5.009

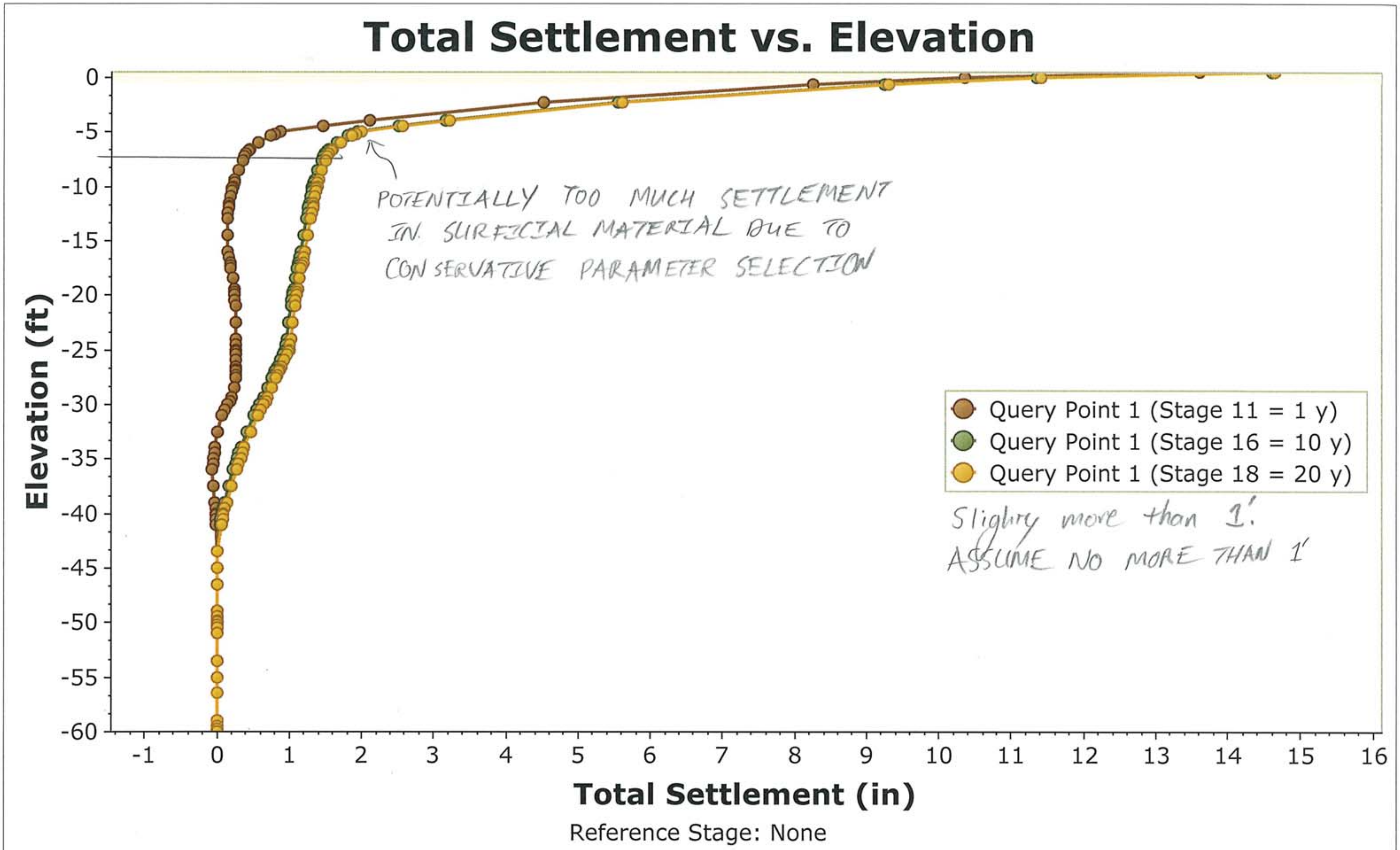


Reference Stage: None

rocscience	Project	24431.01 East Delacroix - MCA	
	Analysis Description	MCA Mudline EL -2	
	Drawn By		Company
SETTLE3 5.009	Date	3/15/2021, 9:50:02 AM	File Name: 24431.01 MCA ML EL -2 (3-18-21).s3z



SETTLE3 5.009	*Project* 24431.01 East Delacroix - MNA		
	Analysis Description MNA Mudline EL +0.5		
	Drawn By	*Company*	
	Date 3/15/2021, 9:50:02 AM	*File Name* 24431.01 MNA ML EL 0.5 (3-18-21).s3z	



rocscience	Project	24431.01 East Delacroix - MNA	
	Analysis Description	MNA Mudline EL +0.5	
	Drawn By		Company
SETTLE3 5.009	Date	3/15/2021, 9:50:02 AM	File Name: 24431.01 MNA ML EL 0.5 (3-18-21).s3z

rocscience

24431.01 East Delacroix - Terrace
Report Creation Date: 2021/04/07, 09:45:36

Settle3 Analysis Information

24431.01 East Delacroix - Terrace

Project Settings

Document Name	24431.01 TERRACE ML EL -2.5 (3-18-21).s3z
Project Title	24431.01 East Delacroix - Terrace
Analysis	TERRACE Mudline EL -2
Date Created	3/15/2021, 9:50:02 AM
Comments	
When Processing Assume 0.25-0.5' of Immediate Sett. During Placement	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/year
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Include buoyancy effect when material settles below water table	
Include vertical stress reduction due to settlement above a point	
Use properties from first layer to calculate layered stresses	
Improve consolidation accuracy	
Ignore negative effective stresses in settlement calculations	

Embankments

1. Embankment: "Embankment Load 1"

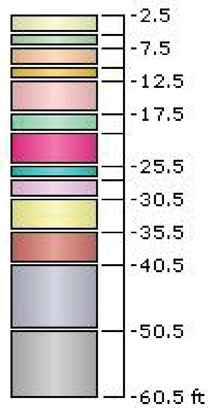
Label	Embankment Load 1
Center Line	(-250, 0) to (250, 0)
Near End Angle	90 degrees
Far End Angle	90 degrees
Number of Layers	1
Base Width	75

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft3)	Right Angle (deg)	Right Bench Width (ft)
1	Stage 9 = 0.19 y	0	11.31	6.5	0.09	11.31	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Elevation [ft]	Drained at Bottom
1	01. ML to EL -5	3	-2.5	No
2	02. EL -5 to EL -7	2	-5.5	No
3	03. EL -7 to -10	3	-7.5	Yes
4	04. EL -10 to -12	2	-10.5	No
5	05. EL -12 to -17	5	-12.5	No
6	06. EL -17 to -20	3	-17.5	No
7	07. EL -20 to -25	5	-20.5	No
8	08. EL -25 to -27	2	-25.5	No
9	09. EL -27 to -30	3	-27.5	Yes
10	10. EL -30 to -35	5	-30.5	No
11	ASSUMED -35 to -40	5	-35.5	No
12	ASSUMED -40 to -50	10	-40.5	No
13	ASSUMED -50 to -60	10	-50.5	No



Soil Properties

Property	01. ML to EL -5	02. EL -5 to EL -7	03. EL -7 to -10	04. EL -10 to -12
Color				
Unit Weight [kips/ft3]	0.08	0.085	0.105	0.105
Saturated Unit Weight [kips/ft3]	0.08	0.085	0.105	0.105
K0	1	1	1	1
Primary Consolidation	Enabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear	Non-Linear
Cce	0.35	0.3	0.25	0.2
Cre	0.06	0.06	0.04	0.03
e0	1.1	1.1	1.1	1.1
OCR	1	1.5	1.75	1.5
Cv [ft2/y]	200	150	150	50
Cvr [ft2/y]	200	150	150	50
B-bar	1	1	1	1
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1
Property	**05. EL -12 to -17**	**06. EL -17 to -20**	**07. EL -20 to -25**	**08. EL -25 to -27**
Color				
Unit Weight [kips/ft3]	0.095	0.1	0.095	0.095
Saturated Unit Weight [kips/ft3]	0.095	0.1	0.095	0.095
K0	1	1	1	1
Primary Consolidation	Enabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear	Non-Linear
Cce	0.25	0.3	0.3	0.25
Cre	0.04	0.05	0.05	0.04
e0	1.1	1.1	1.1	1.1
OCR	1.25	1.1	1.1	1.01
Cv [ft2/y]	10	10	50	50
Cvr [ft2/y]	10	10	50	50
B-bar	1	1	1	1
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1
Property	**09. EL -27 to -30**	**10. EL -30 to -35**	**ASSUMED -35 to -40**	**ASSUMED -40 to -50**

Color				
Unit Weight [kips/ft3]	0.1	0.1	0.1	0.1
Saturated Unit Weight [kips/ft3]	0.1	0.1	0.1	0.1
K0	1	1	1	1
Primary Consolidation	Enabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear	Non-Linear
Cce	0.25	0.25	0.25	0.2
Cre	0.04	0.04	0.1	0.01
e0	1.1	1.1	1.1	1.1
OCR	1.01	1	1	1
Cv [ft2/y]	50	50	10	10
Cvr [ft2/y]	50	50	10	10
B-bar	1	1	1	1
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1

Property	**ASSUMED -50 to -60**
Color	
Unit Weight [kips/ft3]	0.1
Saturated Unit Weight [kips/ft3]	0.1
K0	1
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.15
Cre	0.01
e0	1.1
OCR	1
Cv [ft2/y]	10
Cvr [ft2/y]	10
B-bar	1
Undrained Su A [kips/ft2]	0
Undrained Su S	0.2
Undrained Su m	0.8
Piezo Line ID	1

Groundwater

Groundwater method	Piezometric Lines
Water Unit Weight	0.064 kips/ft3

Piezometric Line Entities

ID	Elevation (ft)
1	1 ft

Query Points

Point #	Query Point Name	(X,Y) Location	Number of Divisions
1	Query Point 1	0, 0	Auto: 87

rocscience

24431.01 East Delacroix - MNA
Report Creation Date: 2021/04/07, 10:08:29

Settle3 Analysis Information

24431.01 East Delacroix - MNA

Project Settings

Document Name	24431.01 MNA ML EL 0.5 (3-18-21).s3z
Project Title	24431.01 East Delacroix - MNA
Analysis	MNA Mudline EL +0.5
Date Created	3/15/2021, 9:50:02 AM
Comments	
When Processing Assume 0.2' of Immediate Sett. During Placement	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/year
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Include buoyancy effect when material settles below water table	
Include vertical stress reduction due to settlement above a point	
Use properties from first layer to calculate layered stresses	
Improve consolidation accuracy	
Ignore negative effective stresses in settlement calculations	

Embankments

1. Embankment: "Embankment Load 1"

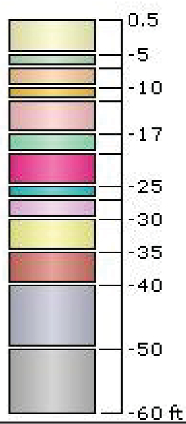
Label	Embankment Load 1
Center Line	(-250, 0) to (250, 0)
Near End Angle	90 degrees
Far End Angle	90 degrees
Number of Layers	1
Base Width	500

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft3)	Right Angle (deg)	Right Bench Width (ft)
1	Stage 9 = 0.19 y	0	45	2.5	0.09	45	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Elevation [ft]	Drained at Bottom
1	01. ML to EL -5	5.5	0.5	No
2	02. EL -5 to EL -7	2	-5	No
3	03. EL -7 to -10	3	-7	Yes
4	04. EL -10 to -12	2	-10	No
5	05. EL -12 to -17	5	-12	No
6	06. EL -17 to -20	3	-17	No
7	07. EL -20 to -25	5	-20	No
8	08. EL -25 to -27	2	-25	No
9	09. EL -27 to -30	3	-27	Yes
10	10. EL -30 to -35	5	-30	No
11	ASSUMED -35 to -40	5	-35	No
12	ASSUMED -40 to -50	10	-40	No
13	ASSUMED -50 to -60	10	-50	No



Soil Properties

Property	01. ML to EL -5	02. EL -5 to EL -7	03. EL -7 to -10	04. EL -10 to -12
Color				
Unit Weight [kips/ft3]	0.08	0.085	0.105	0.105
Saturated Unit Weight [kips/ft3]	0.08	0.085	0.105	0.105
K0	1	1	1	1
Primary Consolidation	Enabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear	Non-Linear
Cce	0.35	0.3	0.25	0.2
Cre	0.06	0.06	0.04	0.03
e0	1.1	1.1	1.1	1.1
OCR	1	1.5	1.75	1.5
Cv [ft2/y]	200	150	150	50
Cvr [ft2/y]	200	150	150	50
B-bar	1	1	1	1
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1

Property	05. EL -12 to -17	06. EL -17 to -20	07. EL -20 to -25	08. EL -25 to -27
Color				
Unit Weight [kips/ft3]	0.095	0.1	0.095	0.095
Saturated Unit Weight [kips/ft3]	0.095	0.1	0.095	0.095
K0	1	1	1	1
Primary Consolidation	Enabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear	Non-Linear
Cce	0.25	0.3	0.3	0.25
Cre	0.04	0.05	0.05	0.04
e0	1.1	1.1	1.1	1.1
OCR	1.25	1.1	1.1	1.01
Cv [ft2/y]	10	10	50	50
Cvr [ft2/y]	10	10	50	50
B-bar	1	1	1	1
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1

Property	09. EL -27 to -30	10. EL -30 to -35	ASSUMED -35 to -40	ASSUMED -40 to -50

Color				
Unit Weight [kips/ft3]	0.1	0.1	0.1	0.1
Saturated Unit Weight [kips/ft3]	0.1	0.1	0.1	0.1
K0	1	1	1	1
Primary Consolidation	Enabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear	Non-Linear
Cce	0.25	0.25	0.25	0.2
Cre	0.04	0.04	0.1	0.01
e0	1.1	1.1	1.1	1.1
OCR	1.01	1	1	1
Cv [ft2/y]	50	50	10	10
Cvr [ft2/y]	50	50	10	10
B-bar	1	1	1	1
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1

Property	**ASSUMED -50 to -60**
Color	
Unit Weight [kips/ft3]	0.1
Saturated Unit Weight [kips/ft3]	0.1
K0	1
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.15
Cre	0.01
e0	1.1
OCR	1
Cv [ft2/y]	10
Cvr [ft2/y]	10
B-bar	1
Undrained Su A [kips/ft2]	0
Undrained Su S	0.2
Undrained Su m	0.8
Piezo Line ID	1

Groundwater

Groundwater method	Piezometric Lines
Water Unit Weight	0.064 kips/ft3

Piezometric Line Entities

ID	Elevation (ft)
1	1.5 ft

Query Points

Point #	Query Point Name	(X,Y) Location	Number of Divisions
1	Query Point 1	0, 0	Auto: 87

24431.01 East Delacroix - MCA
Report Creation Date: 2021/04/07, 09:51:12

Embankments

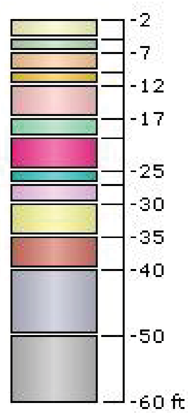
1. Embankment: "Embankment Load 1"

Label				Embankment Load 1			
Center Line				(-250, 0) to (250, 0)			
Near End Angle				90 degrees			
Far End Angle				90 degrees			
Number of Layers				1			
Base Width				500			
Layer	**Stage**	**Left Bench Width (ft)**	**Left Angle (deg)**	**Height (ft)**	**Unit Weight (kips/ft3)**	**Right Angle (deg)**	**Right Bench Width (ft)**
1	Stage 9 = 0.19 y	0	45	4	0.09	45	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Elevation [ft]	Drained at Bottom
1	01. ML to EL -5	3	-2	No
2	02. EL -5 to EL -7	2	-5	No
3	03. EL -7 to -10	3	-7	Yes
4	04. EL -10 to -12	2	-10	No
5	05. EL -12 to -17	5	-12	No
6	06. EL -17 to -20	3	-17	No
7	07. EL -20 to -25	5	-20	No
8	08. EL -25 to -27	2	-25	No
9	09. EL -27 to -30	3	-27	Yes
10	10. EL -30 to -35	5	-30	No
11	ASSUMED -35 to -40	5	-35	No
12	ASSUMED -40 to -50	10	-40	No
13	ASSUMED -50 to -60	10	-50	No



Soil Properties

Property	01. ML to EL -5	02. EL -5 to EL -7	03. EL -7 to -10	04. EL -10 to -12
Color				
Unit Weight [kips/ft3]	0.08	0.085	0.105	0.105
Saturated Unit Weight [kips/ft3]	0.08	0.085	0.105	0.105
K0	1	1	1	1
Primary Consolidation	Enabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear	Non-Linear
Cce	0.35	0.3	0.25	0.2
Cre	0.06	0.06	0.04	0.03
e0	1.1	1.1	1.1	1.1
OCR	1	1.5	1.75	1.5
Cv [ft2/y]	200	150	150	50
Cvr [ft2/y]	200	150	150	50
B-bar	1	1	1	1
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1
Property	**05. EL -12 to -17**	**06. EL -17 to -20**	**07. EL -20 to -25**	**08. EL -25 to -27**
Color				
Unit Weight [kips/ft3]	0.095	0.1	0.095	0.095
Saturated Unit Weight [kips/ft3]	0.095	0.1	0.095	0.095
K0	1	1	1	1
Primary Consolidation	Enabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear	Non-Linear
Cce	0.25	0.3	0.3	0.25
Cre	0.04	0.05	0.05	0.04
e0	1.1	1.1	1.1	1.1
OCR	1.25	1.1	1.1	1.01
Cv [ft2/y]	10	10	50	50
Cvr [ft2/y]	10	10	50	50
B-bar	1	1	1	1
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1
Property	**09. EL -27 to -30**	**10. EL -30 to -35**	**ASSUMED -35 to -40**	**ASSUMED -40 to -50**

Color				
Unit Weight [kips/ft3]	0.1	0.1	0.1	0.1
Saturated Unit Weight [kips/ft3]	0.1	0.1	0.1	0.1
K0	1	1	1	1
Primary Consolidation	Enabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear	Non-Linear
Cce	0.25	0.25	0.25	0.2
Cre	0.04	0.04	0.1	0.01
e0	1.1	1.1	1.1	1.1
OCR	1.01	1	1	1
Cv [ft2/y]	50	50	10	10
Cvr [ft2/y]	50	50	10	10
B-bar	1	1	1	1
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1

Property	**ASSUMED -50 to -60**
Color	
Unit Weight [kips/ft3]	0.1
Saturated Unit Weight [kips/ft3]	0.1
K0	1
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.15
Cre	0.01
e0	1.1
OCR	1
Cv [ft2/y]	10
Cvr [ft2/y]	10
B-bar	1
Undrained Su A [kips/ft2]	0
Undrained Su S	0.2
Undrained Su m	0.8
Piezo Line ID	1

Groundwater

Groundwater method	Piezometric Lines
Water Unit Weight	0.064 kips/ft3

Piezometric Line Entities

ID	Elevation (ft)
1	1.5 ft

Query Points

Point #	Query Point Name	(X,Y) Location	Number of Divisions
1	Query Point 1	0, 0	Auto: 87

APPENDIX V
BEARING CAPACITY CALCULATIONS

PROJECT TITLE: EAST DELACROIX MARSH CREATION	PAGE:	EUSTIS ENGINEERING L.L.C. SINCE 1946
SUBJECT: BEARING CAPACITY OF MARSH	JOB NO: 24431.01	
BY: JMW DATE: 5/17/21 CHECKED BY: [signature]	DATE: 5/18/21	

Cohesion of Top 10' of Material Varries B/T 50 + 150 PSF
ECO Material (or Terrace) Assumed to be 80 pcf

Top @ ≈ EL +5 Mudlines Typically +0.5 to −2.5 Water @ +0

Ultimate Bearing Capacity

$q_{ult} = 5.14\,c$ → C = 50 → $q_{ult} \approx 255$ psf
↳ c = 150 → $q_{ult} \approx 770$ psf

Loads

Nourishment Areas
$q_{applied} = \gamma' H = 80\,pcf * (5' - 0.5') = 360\,psf$

Creation Areas
$q_{applied} = \gamma' H = (80\,pcf)(5' - 0') + (80 - 64\,pcf)(0 - 2.5) = 440\,psf$

Factor of Safety Computation

Nourishment Areas
$FS = \frac{255\,psf}{360\,psf}$ to $\frac{770}{360}$ → 0.7 to 2.18
(0.7 ← Not Stable)

Creation Areas
$FS = \frac{255}{440}$ to $\frac{770}{440}$ → 0.57 to 1.75
(0.57 ← Not Stable)

Areas w/ FS < 1 will occur resulting in near surface bearing capacity failures

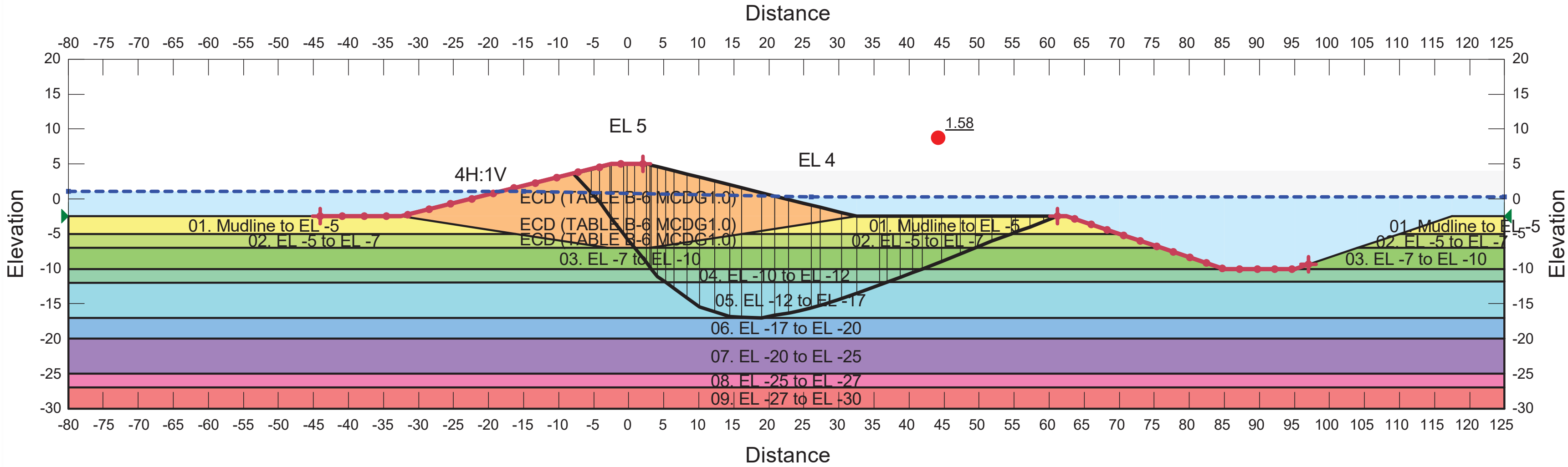
For a FS = 1.0

Nourishment Areas
$C = \frac{360}{5.14} = 70\,psf$

Creation Areas
$C = \frac{440}{5.14} = 85\,psf$

FOR Appendix 5

APPENDIX VI
ECD STABILITY



Color	Name	Model	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)
	01. Mudline to EL -5	Undrained (Phi=0)	80					50
	02. EL -5 to EL -7	Undrained (Phi=0)	85					75
	03. EL -7 to EL -10	S=f(datum)	105	75	8.33	100	-7	
	04. EL -10 to EL -12	Undrained (Phi=0)	105					100
	05. EL -12 to EL -17	Undrained (Phi=0)	95					115
	06. EL -17 to EL -20	Undrained (Phi=0)	100					125
	07. EL -20 to EL -25	S=f(datum)	95	125	7	160	-20	
	08. EL -25 to EL -27	S=f(datum)	95	160	7.5	175	-25	
	09. EL -27 to EL -30	S=f(datum)	100	175	7	195	-27	
	ECD (TABLE B-6 MCDG1.0)	Undrained (Phi=0)	80					100

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 04/07/2021
Last Solved Time: 10:33:07 AM

Method: Spencer
Direction of movement: Left to Right
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.58

NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE CROSS-SECTION SHOWN ABOVE IS BASED ON FURNISHED INFORMATION.
3) THIS IS NOT A CONSTRUCTION DRAWING.

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Case A-1 - Borrow Excavation Global (-2.5)

EE PROJECT No. 24431.01 - MCA ECD, EL -2.5 Mudline,

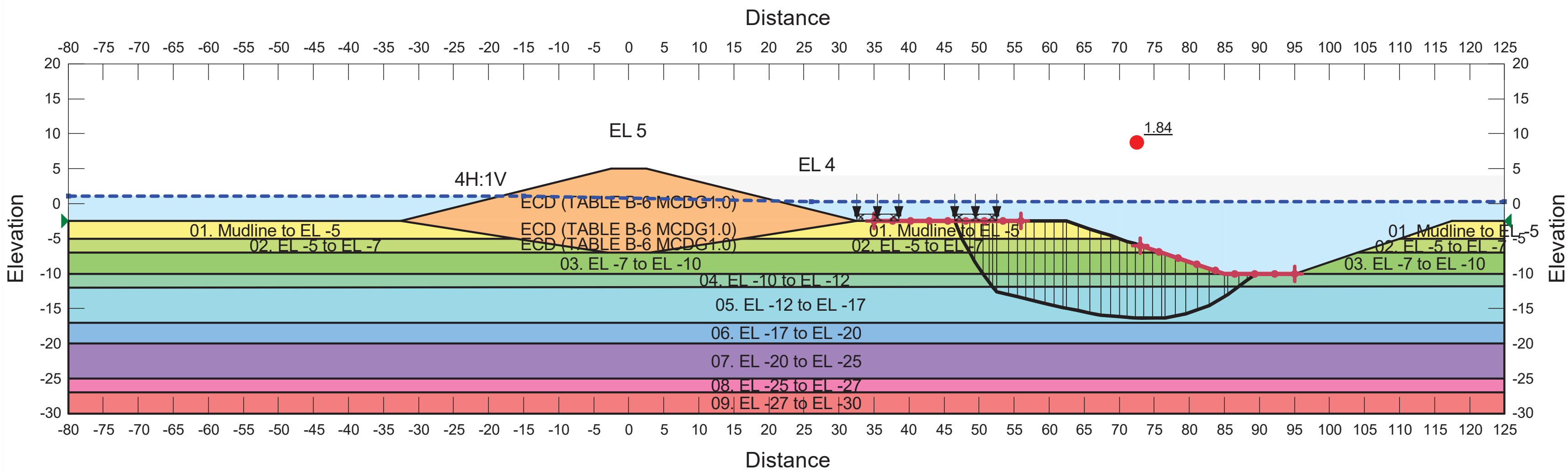
CHECKED BY:

FILENAME: 24431.01 MCA ECD.gsz

DRAWN BY: JMW

DATE: 04/07/2021

EUSTIS ENGINEERING L.L.C. SINCE 1946



Color	Name	Model	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)
	01. Mudline to EL -5	Undrained (Phi=0)	80					50
	02. EL -5 to EL -7	Undrained (Phi=0)	85					75
	03. EL -7 to EL -10	S=f(datum)	105	75	8.33	100	-7	
	04. EL -10 to EL -12	Undrained (Phi=0)	105					100
	05. EL -12 to EL -17	Undrained (Phi=0)	95					115
	06. EL -17 to EL -20	Undrained (Phi=0)	100					125
	07. EL -20 to EL -25	S=f(datum)	95	125	7	160	-20	
	08. EL -25 to EL -27	S=f(datum)	95	160	7.5	175	-25	
	09. EL -27 to EL -30	S=f(datum)	100	175	7	195	-27	
	ECD (TABLE B-6 MCDG1.0)	Undrained (Phi=0)	80					100

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 04/07/2021
Last Solved Time: 10:33:10 AM

Method: Spencer
Direction of movement: Left to Right
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.84

NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE CROSS-SECTION SHOWN ABOVE IS BASED ON FURNISHED INFORMATION.
3) THIS IS NOT A CONSTRUCTION DRAWING.

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Case A-2 - Borrow Excavation Local (-2.5)

EE PROJECT No. 24431.01 - MCA ECD, EL -2.5 Mudline,

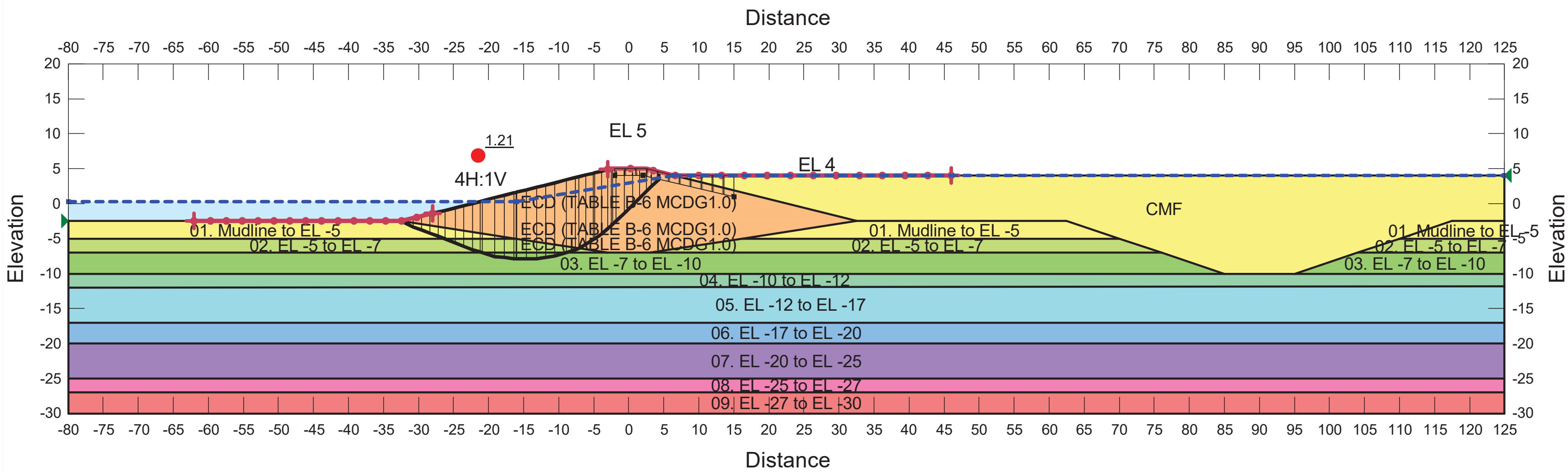
CHECKED BY:

FILENAME: 24431.01 MCA ECD.gsz

DRAWN BY: JMW

DATE: 04/07/2021

EUSTIS ENGINEERING L.L.C. SINCE 1946



Color	Name	Model	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)
	01. Mudline to EL -5	Undrained (Phi=0)	80					50
	02. EL -5 to EL -7	Undrained (Phi=0)	85					75
	03. EL -7 to EL -10	S=f(datum)	105	75	8.33	100	-7	
	04. EL -10 to EL -12	Undrained (Phi=0)	105					100
	05. EL -12 to EL -17	Undrained (Phi=0)	95					115
	06. EL -17 to EL -20	Undrained (Phi=0)	100					125
	07. EL -20 to EL -25	S=f(datum)	95	125	7	160	-20	
	08. EL -25 to EL -27	S=f(datum)	95	160	7.5	175	-25	
	09. EL -27 to EL -30	S=f(datum)	100	175	7	195	-27	
	CMF	Undrained (Phi=0)	75					0
	ECD (TABLE B-6 MCDG1.0)	Undrained (Phi=0)	80					100

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 04/07/2021
Last Solved Time: 10:33:08 AM

Method: Spencer
Direction of movement: Right to Left
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.21

NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE CROSS-SECTION SHOWN ABOVE IS BASED ON FURNISHED INFORMATION.
3) THIS IS NOT A CONSTRUCTION DRAWING.

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Case B-1 - Filled to CMFE (-2.5)

EE PROJECT No. 24431.01 - MCA ECD, EL -2.5 Mudline,

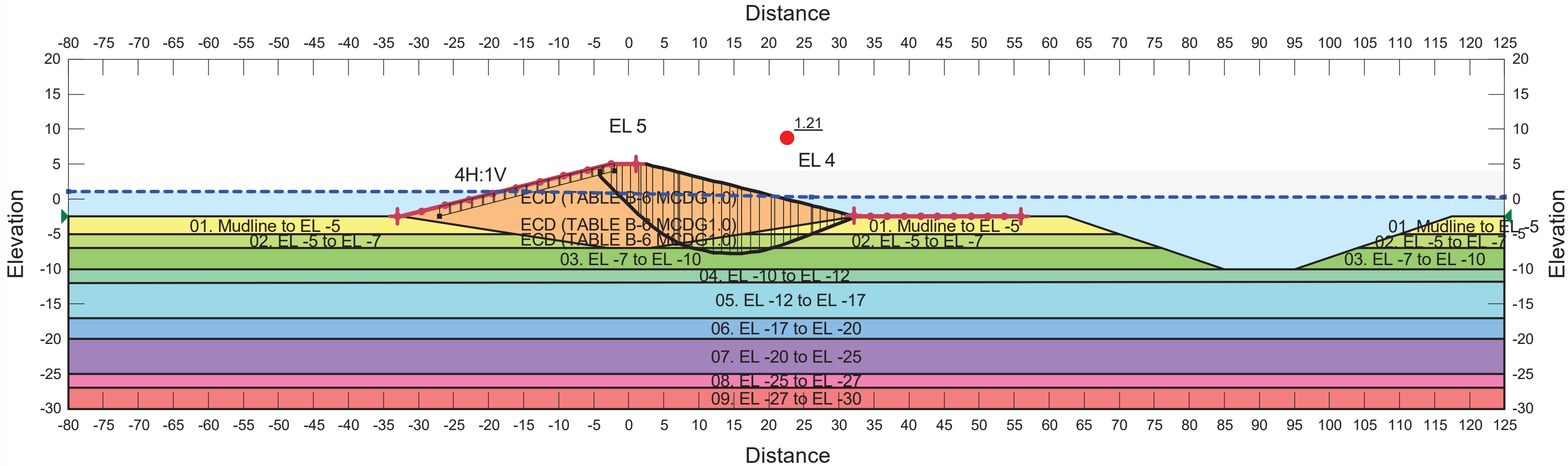
CHECKED BY:

FILENAME: 24431.01 MCA ECD.gsz

DRAWN BY: JMW

DATE: 04/07/2021

EUSTIS ENGINEERING L.L.C. SINCE 1946



Color	Name	Model	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)
	01. Mudline to EL -5	Undrained (Phi=0)	80					50
	02. EL -5 to EL -7	Undrained (Phi=0)	85					75
	03. EL -7 to EL -10	S=f(datum)	105	75	8.33	100	-7	
	04. EL -10 to EL -12	Undrained (Phi=0)	105					100
	05. EL -12 to EL -17	Undrained (Phi=0)	95					115
	06. EL -17 to EL -20	Undrained (Phi=0)	100					125
	07. EL -20 to EL -25	S=f(datum)	95	125	7	160	-20	
	08. EL -25 to EL -27	S=f(datum)	95	160	7.5	175	-25	
	09. EL -27 to EL -30	S=f(datum)	100	175	7	195	-27	
	ECD (TABLE B-6 MCDG1.0)	Undrained (Phi=0)	80					100

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 04/07/2021
Last Solved Time: 10:33:08 AM

Method: Spencer
Direction of movement: Left to Right
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.21

NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE CROSS-SECTION SHOWN ABOVE IS BASED ON FURNISHED INFORMATION.
3) THIS IS NOT A CONSTRUCTION DRAWING.

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Case C-1 - ECD Local Stability (-2.5)

EE PROJECT No. 24431.01 - MCA ECD,
EL -2.5 Mudline,

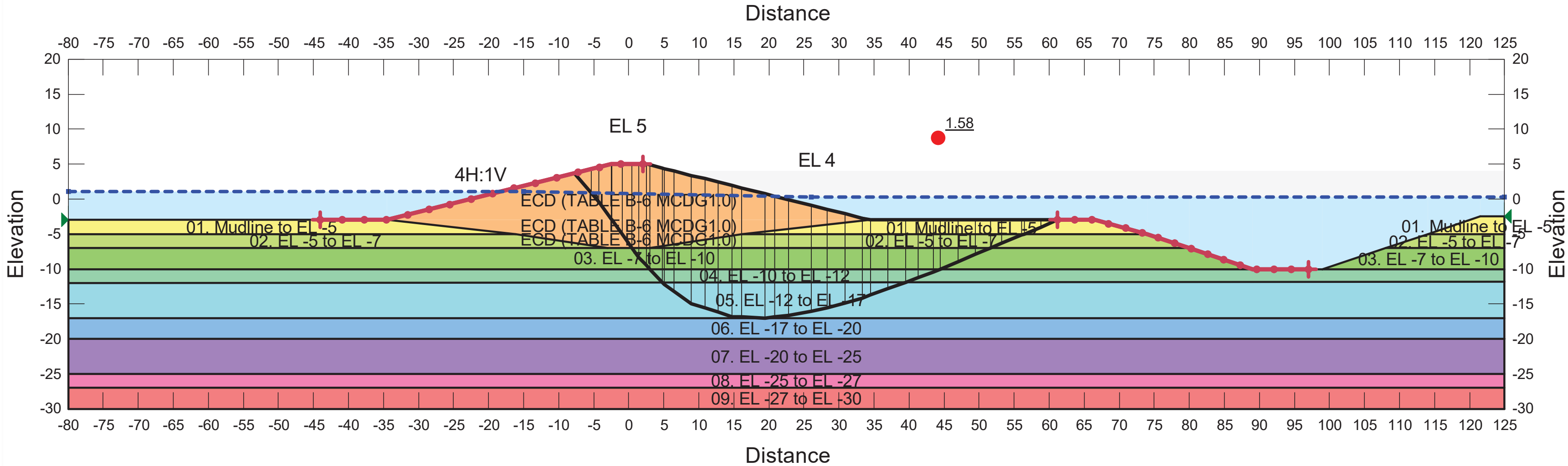
CHECKED BY:

FILENAME:
24431.01 MCA ECD.gsz

DRAWN BY:
JMW

DATE:
04/07/2021

EUSTIS
ENGINEERING L.L.C.
SINCE 1946



Color	Name	Model	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)
	01. Mudline to EL -5	Undrained (Phi=0)	80					50
	02. EL -5 to EL -7	Undrained (Phi=0)	85					75
	03. EL -7 to EL -10	S=f(datum)	105	75	8.33	100	-7	
	04. EL -10 to EL -12	Undrained (Phi=0)	105					100
	05. EL -12 to EL -17	Undrained (Phi=0)	95					115
	06. EL -17 to EL -20	Undrained (Phi=0)	100					125
	07. EL -20 to EL -25	S=f(datum)	95	125	7	160	-20	
	08. EL -25 to EL -27	S=f(datum)	95	160	7.5	175	-25	
	09. EL -27 to EL -30	S=f(datum)	100	175	7	195	-27	
	ECD (TABLE B-6 MCDG1.0)	Undrained (Phi=0)	80					100

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 04/07/2021
Last Solved Time: 10:33:14 AM

Method: Spencer
Direction of movement: Left to Right
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.58

NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE CROSS-SECTION SHOWN ABOVE IS BASED ON FURNISHED INFORMATION.
3) THIS IS NOT A CONSTRUCTION DRAWING.

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Case A-1 - Borrow Excavation Global (-3)

EE PROJECT No. 24431.01 - MCA ECD,
EL -3 Mudline,

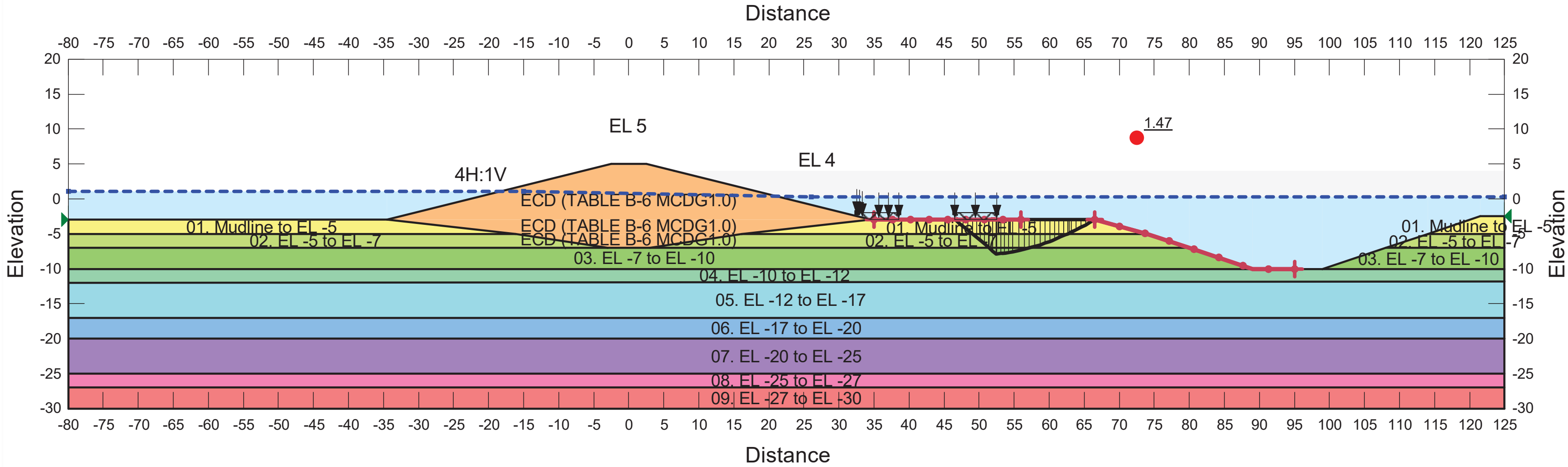
CHECKED BY:

FILENAME: 24431.01 MCA ECD.gsz

DRAWN BY: JMW

DATE: 04/07/2021

EUSTIS ENGINEERING L.L.C. SINCE 1946



Color	Name	Model	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)
	01. Mudline to EL -5	Undrained (Phi=0)	80					50
	02. EL -5 to EL -7	Undrained (Phi=0)	85					75
	03. EL -7 to EL -10	S=f(datum)	105	75	8.33	100	-7	
	04. EL -10 to EL -12	Undrained (Phi=0)	105					100
	05. EL -12 to EL -17	Undrained (Phi=0)	95					115
	06. EL -17 to EL -20	Undrained (Phi=0)	100					125
	07. EL -20 to EL -25	S=f(datum)	95	125	7	160	-20	
	08. EL -25 to EL -27	S=f(datum)	95	160	7.5	175	-25	
	09. EL -27 to EL -30	S=f(datum)	100	175	7	195	-27	
	ECD (TABLE B-6 MCDG1.0)	Undrained (Phi=0)	80					100

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 04/07/2021
Last Solved Time: 10:33:12 AM

Method: Spencer
Direction of movement: Left to Right
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.47

NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE CROSS-SECTION SHOWN ABOVE IS BASED ON FURNISHED INFORMATION.
3) THIS IS NOT A CONSTRUCTION DRAWING.

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Case A-2 - Borrow Excavation Local (-3)

EE PROJECT No. 24431.01 - MCA ECD, EL -3 Mudline,

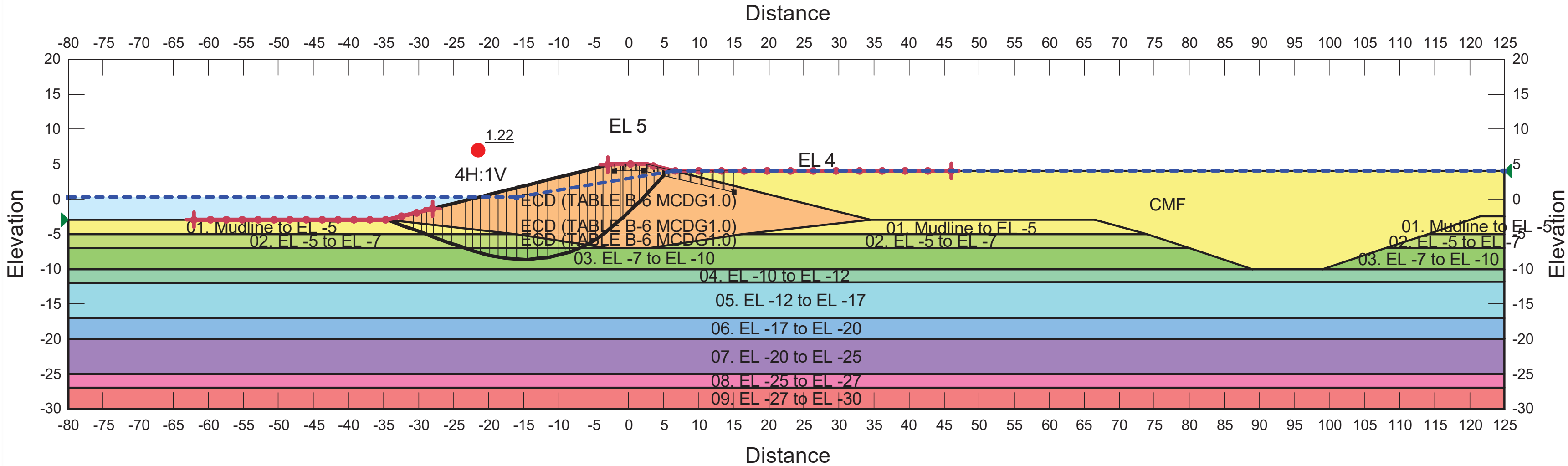
CHECKED BY:

FILENAME: 24431.01 MCA ECD.gsz

DRAWN BY: JMW

DATE: 04/07/2021

EUSTIS ENGINEERING L.L.C. SINCE 1946



Color	Name	Model	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)
	01. Mudline to EL -5	Undrained (Phi=0)	80					50
	02. EL -5 to EL -7	Undrained (Phi=0)	85					75
	03. EL -7 to EL -10	S=f(datum)	105	75	8.33	100	-7	
	04. EL -10 to EL -12	Undrained (Phi=0)	105					100
	05. EL -12 to EL -17	Undrained (Phi=0)	95					115
	06. EL -17 to EL -20	Undrained (Phi=0)	100					125
	07. EL -20 to EL -25	S=f(datum)	95	125	7	160	-20	
	08. EL -25 to EL -27	S=f(datum)	95	160	7.5	175	-25	
	09. EL -27 to EL -30	S=f(datum)	100	175	7	195	-27	
	CMF	Undrained (Phi=0)	75					0
	ECD (TABLE B-6 MCDG1.0)	Undrained (Phi=0)	80					100

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 04/07/2021
Last Solved Time: 10:33:15 AM

Method: Spencer
Direction of movement: Right to Left
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.22

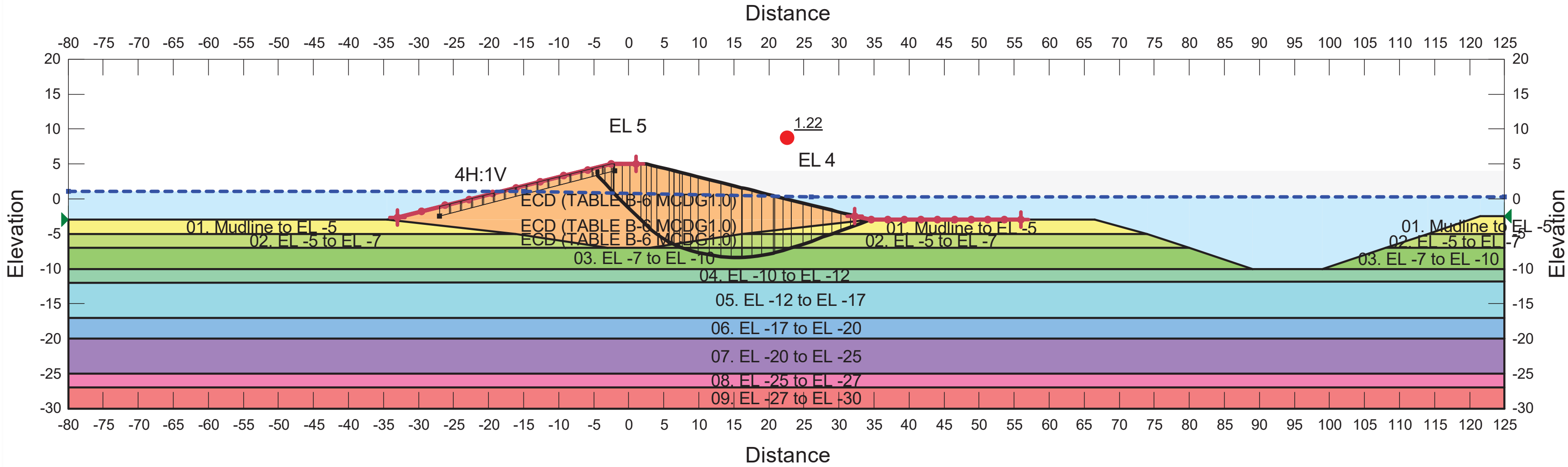
NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE CROSS-SECTION SHOWN ABOVE IS BASED ON FURNISHED INFORMATION.
3) THIS IS NOT A CONSTRUCTION DRAWING.

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Case B-1 - Filled to CMFE (-3)
EE PROJECT No. 24431.01 - MCA ECD,
EL -3 Mudline,

CHECKED BY:
FILENAME: 24431.01 MCA ECD.gsz
DRAWN BY: JMW
DATE: 04/07/2021

EUSTIS ENGINEERING L.L.C.
SINCE 1946



Color	Name	Model	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)
	01. Mudline to EL -5	Undrained (Phi=0)	80					50
	02. EL -5 to EL -7	Undrained (Phi=0)	85					75
	03. EL -7 to EL -10	S=f(datum)	105	75	8.33	100	-7	
	04. EL -10 to EL -12	Undrained (Phi=0)	105					100
	05. EL -12 to EL -17	Undrained (Phi=0)	95					115
	06. EL -17 to EL -20	Undrained (Phi=0)	100					125
	07. EL -20 to EL -25	S=f(datum)	95	125	7	160	-20	
	08. EL -25 to EL -27	S=f(datum)	95	160	7.5	175	-25	
	09. EL -27 to EL -30	S=f(datum)	100	175	7	195	-27	
	ECD (TABLE B-6 MCDG1.0)	Undrained (Phi=0)	80					100

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 04/07/2021
Last Solved Time: 10:33:15 AM

Method: Spencer
Direction of movement: Left to Right
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.22

NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE CROSS-SECTION SHOWN ABOVE IS BASED ON FURNISHED INFORMATION.
3) THIS IS NOT A CONSTRUCTION DRAWING.

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Case C-1 - ECD Local Stability (-3)

EE PROJECT No. 24431.01 - MCA ECD, EL -3 Mudline,

CHECKED BY:

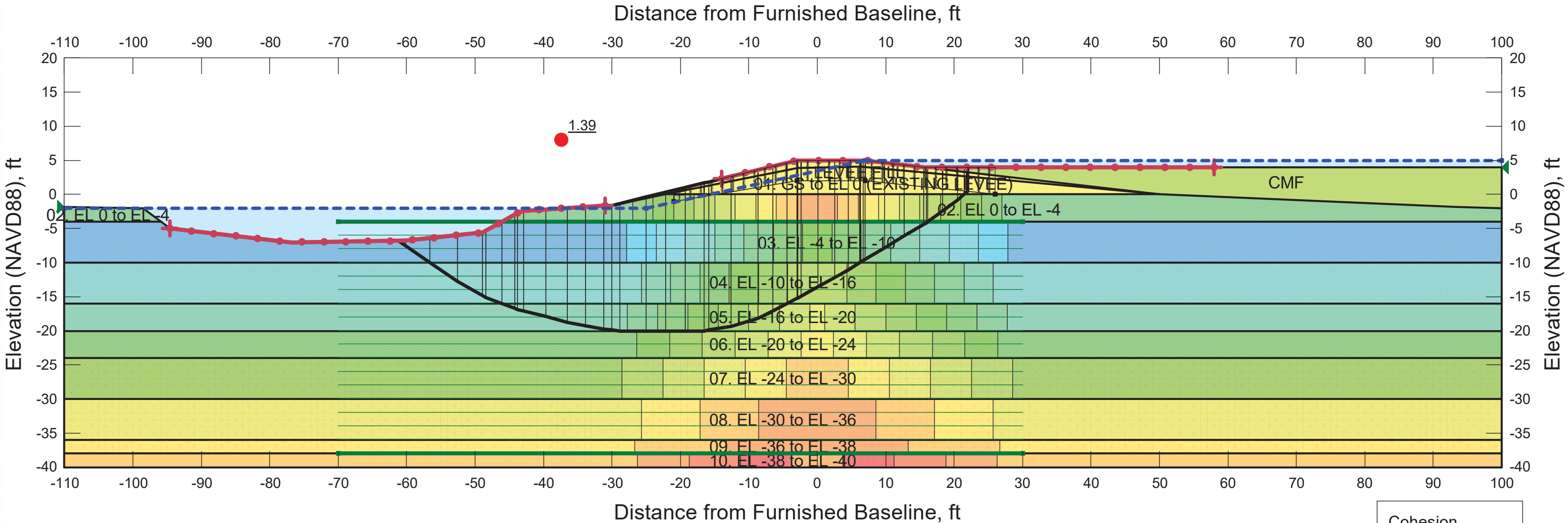
FILENAME: 24431.01 MCA ECD.gsz

DRAWN BY: JMW

DATE: 04/07/2021

EUSTIS ENGINEERING L.L.C. SINCE 1946

APPENDIX VII
TIDAL LEVEE STABILITY



Cohesion
- 100 - 120 psf
- 120 - 140 psf
- 140 - 160 psf
- 160 - 180 psf
- 180 - 200 psf
- 200 - 220 psf
- 220 - 240 psf
- 240 - 260 psf
- 260 - 280 psf
- 280 - 300 psf
- 300 - 320 psf
- 320 - 340 psf
- 340 - 360 psf
- 360 - 380 psf
- 380 - 400 psf
- 400 - 420 psf
- 420 - 440 psf

Color	Name	Model	Unit Weight (pcf)	Cohesion Fn	Phi' (°)	Cohesion (psf)
	01. GS to EL 0 (EXISTING LEVEE)	Undrained (Phi=0)	113			600
	02. EL 0 to EL -4	Spatial Mohr-Coulomb	113	EL 0 to -4	0	
	03. EL -4 to EL -10	Spatial Mohr-Coulomb	110	EL -4 to -10	0	
	04. EL -10 to EL -16	Spatial Mohr-Coulomb	95	EL -10 to -16	0	
	05. EL -16 to EL -20	Spatial Mohr-Coulomb	110	EL -16 to -20	0	
	06. EL -20 to EL -24	Spatial Mohr-Coulomb	110	EL -20 to -24	0	
	07. EL -24 to EL -30	Spatial Mohr-Coulomb	95	EL -24 to -30	0	
	08. EL -30 to EL -36	Spatial Mohr-Coulomb	90	EL -30 to -36	0	
	09. EL -36 to EL -38	Spatial Mohr-Coulomb	100	EL -36 to -38	0	
	10. EL -38 to EL -40	Spatial Mohr-Coulomb	100	EL -38 to -40	0	
	CMF	Undrained (Phi=0)	75			0
	LEVEE FILL	Undrained (Phi=0)	115			600

Method: Spencer
Direction of movement: Right to Left
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.39

NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE SECTION SHOWN ABOVE INCLUDES A LEVEE RAISE TO ELEVATION +5.
3) OUR ANALYSES INLCUDES MARSH CREATIONFILL TO EL +4 WITH A UNIT WEIGHT OF 75 PCF AND NO COHESION.
4) WE HAVE ASSUMED WATER TO THE TOP OF THE TIDAL LEVEE ON THE FLOODSIDE AND A LOW WATER LEVEL AT EL -2 WITHIN THE PROTECTED SIDE CANAL.
5) A TENSION CRACK FILLED WITH WATER WAS INCORPORATED INTO THE ANALYSES TO ELIMINATE NEGATIVE BASE NORMAL FORCES AND NEGATIVE INTERSLICE FORCES FOUND WITHIN THE ACTIVE ZONE SLICES.
6) THE CROSS-SECTION IS A COMPOSITE SECTION DEVELOPED USING FURNISHED INFORMATION.
7) THIS IS NOT A CONSTRUCTION DRAWING.

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 05/18/2021
Last Solved Time: 03:14:34 PM

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Circular - Top of Levee (EL +5) with CMF

EE PROJECT No. 24431.01 TIDAL LEVEE, COMPOSITE OF FURNISHED SECTIONS,

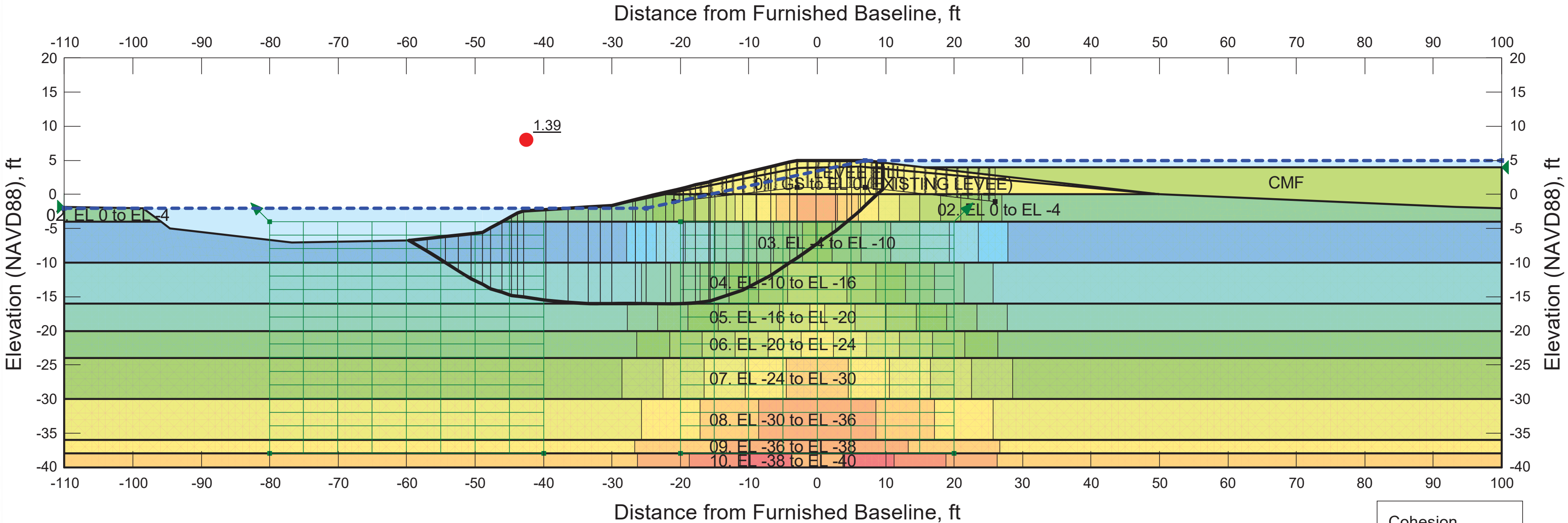
CHECKED BY:

FILENAME:

DRAWN BY: JMW

DATE: 05/18/2021

EUSTIS ENGINEERING L.L.C. SINCE 1946



Color	Name	Model	Unit Weight (pcf)	Cohesion Fn	Phi' (°)	Cohesion (psf)
	01. GS to EL 0 (EXISTING LEVEE)	Undrained (Phi=0)	113			600
	02. EL 0 to EL -4	Spatial Mohr-Coulomb	113	EL 0 to -4	0	
	03. EL -4 to EL -10	Spatial Mohr-Coulomb	110	EL -4 to -10	0	
	04. EL -10 to EL -16	Spatial Mohr-Coulomb	95	EL -10 to -16	0	
	05. EL -16 to EL -20	Spatial Mohr-Coulomb	110	EL -16 to -20	0	
	06. EL -20 to EL -24	Spatial Mohr-Coulomb	110	EL -20 to -24	0	
	07. EL -24 to EL -30	Spatial Mohr-Coulomb	95	EL -24 to -30	0	
	08. EL -30 to EL -36	Spatial Mohr-Coulomb	90	EL -30 to -36	0	
	09. EL -36 to EL -38	Spatial Mohr-Coulomb	100	EL -36 to -38	0	
	10. EL -38 to EL -40	Spatial Mohr-Coulomb	100	EL -38 to -40	0	
	CMF	Undrained (Phi=0)	75			0
	LEVEE FILL	Undrained (Phi=0)	115			600

Method: Spencer
Direction of movement: Right to Left
Slip Surface Option: Block
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.39

Cohesion
- 100 - 120 psf
- 120 - 140 psf
- 140 - 160 psf
- 160 - 180 psf
- 180 - 200 psf
- 200 - 220 psf
- 220 - 240 psf
- 240 - 260 psf
- 260 - 280 psf
- 280 - 300 psf
- 300 - 320 psf
- 320 - 340 psf
- 340 - 360 psf
- 360 - 380 psf
- 380 - 400 psf
- 400 - 420 psf
- 420 - 440 psf

NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE SECTION SHOWN ABOVE INCLUDES A LEVEE RAISE TO ELEVATION +5.
3) OUR ANALYSES INLCUDES MARSH CREATIONFILL TO EL +4 WITH A UNIT WEIGHT OF 75 PCF AND NO COHESION.
4) WE HAVE ASSUMED WATER TO THE TOP OF THE TIDAL LEVEE ON THE FLOODSIDE AND A LOW WATER LEVEL AT EL -2 WITHIN THE PROTECTED SIDE CANAL.
5) A TENSION CRACK FILLED WITH WATER WAS INCORPORATED INTO THE ANALYSES TO ELIMINATE NEGATIVE BASE NORMAL FORCES AND NEGATIVE INTERSLICE FORCES FOUND WITHIN THE ACTIVE ZONE SLICES.
6) THE CROSS-SECTION IS A COMPOSITE SECTION DEVELOPED USING FURNISHED INFORMATION.
7) THIS IS NOT A CONSTRUCTION DRAWING.

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 05/18/2021
Last Solved Time: 03:14:38 PM

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Non Circular - Top of Levee (EL +5) with CMF (2)

EE PROJECT No. 24431.01 TIDAL LEVEE, COMPOSITE OF FURNISHED SECTIONS,

CHECKED BY:

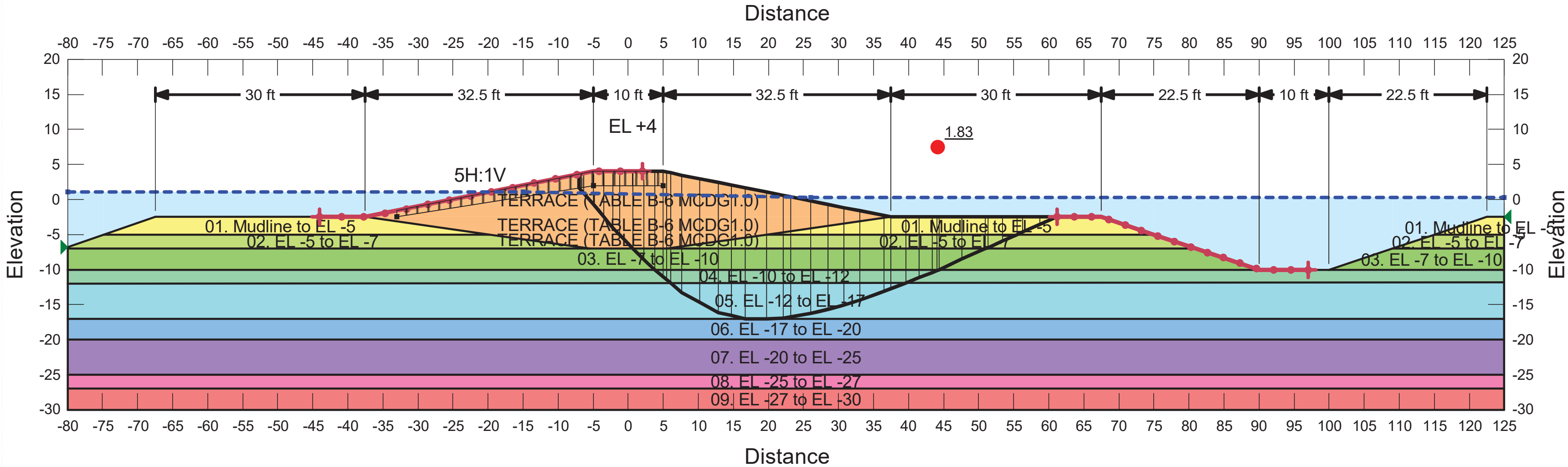
FILENAME:

DRAWN BY: JMW

DATE: 05/18/2021

EUSTIS ENGINEERING L.L.C. SINCE 1946

APPENDIX VII
TERRACE STABILITY



Color	Name	Model	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)
	01. Mudline to EL -5	Undrained (Phi=0)	80					50
	02. EL -5 to EL -7	Undrained (Phi=0)	85					75
	03. EL -7 to EL -10	S=f(datum)	105	75	8.33	100	-7	
	04. EL -10 to EL -12	Undrained (Phi=0)	105					100
	05. EL -12 to EL -17	Undrained (Phi=0)	95					115
	06. EL -17 to EL -20	Undrained (Phi=0)	100					125
	07. EL -20 to EL -25	S=f(datum)	95	125	7	160	-20	
	08. EL -25 to EL -27	S=f(datum)	95	160	7.5	175	-25	
	09. EL -27 to EL -30	S=f(datum)	100	175	7	195	-27	
	TERRACE (TABLE B-6 MCDG1.0)	Undrained (Phi=0)	80					100

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 04/07/2021
Last Solved Time: 10:47:55 AM

Method: Spencer
Direction of movement: Left to Right
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.83

NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE CROSS-SECTION SHOWN ABOVE IS BASED ON FURNISHED INFORMATION.
3) THIS IS NOT A CONSTRUCTION DRAWING.

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Case A-1 - Borrow Excavation Global

EE PROJECT No. 24431.01 - Terrace, 5H:1V Side Slopes,

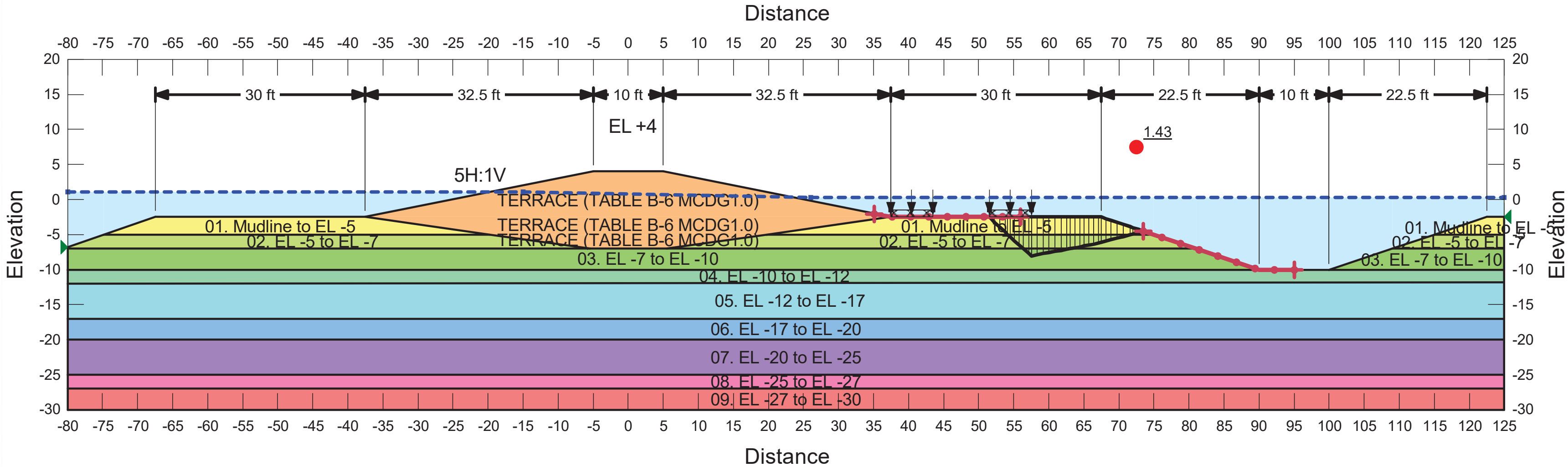
CHECKED BY:

FILENAME: 24431.01 Terraces.gsz

DRAWN BY: JMW

DATE: 04/07/2021

EUSTIS ENGINEERING L.L.C. SINCE 1946



Color	Name	Model	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)
	01. Mudline to EL -5	Undrained (Phi=0)	80					50
	02. EL -5 to EL -7	Undrained (Phi=0)	85					75
	03. EL -7 to EL -10	S=f(datum)	105	75	8.33	100	-7	
	04. EL -10 to EL -12	Undrained (Phi=0)	105					100
	05. EL -12 to EL -17	Undrained (Phi=0)	95					115
	06. EL -17 to EL -20	Undrained (Phi=0)	100					125
	07. EL -20 to EL -25	S=f(datum)	95	125	7	160	-20	
	08. EL -25 to EL -27	S=f(datum)	95	160	7.5	175	-25	
	09. EL -27 to EL -30	S=f(datum)	100	175	7	195	-27	
	TERRACE (TABLE B-6 MCDG1.0)	Undrained (Phi=0)	80					100

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 04/07/2021
Last Solved Time: 10:47:51 AM

Method: Spencer
Direction of movement: Left to Right
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.43

NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE CROSS-SECTION SHOWN ABOVE IS BASED ON FURNISHED INFORMATION.
3) THIS IS NOT A CONSTRUCTION DRAWING.

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Case A-2 - Borrow Excavation Local

EE PROJECT No. 24431.01 - Terrace, 5H:1V Side Slopes,

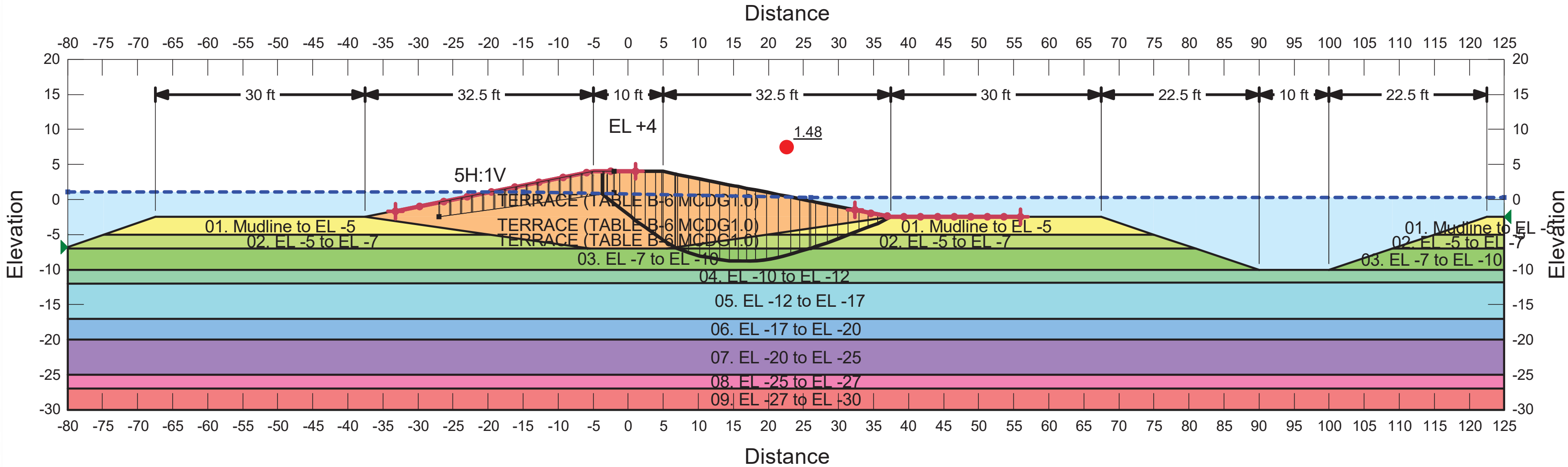
CHECKED BY:

FILENAME: 24431.01 Terraces.gsz

DRAWN BY: JMW

DATE: 04/07/2021

EUSTIS ENGINEERING L.L.C. SINCE 1946



Color	Name	Model	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)
	01. Mudline to EL -5	Undrained (Phi=0)	80					50
	02. EL -5 to EL -7	Undrained (Phi=0)	85					75
	03. EL -7 to EL -10	S=f(datum)	105	75	8.33	100	-7	
	04. EL -10 to EL -12	Undrained (Phi=0)	105					100
	05. EL -12 to EL -17	Undrained (Phi=0)	95					115
	06. EL -17 to EL -20	Undrained (Phi=0)	100					125
	07. EL -20 to EL -25	S=f(datum)	95	125	7	160	-20	
	08. EL -25 to EL -27	S=f(datum)	95	160	7.5	175	-25	
	09. EL -27 to EL -30	S=f(datum)	100	175	7	195	-27	
	TERRACE (TABLE B-6 MCDG1.0)	Undrained (Phi=0)	80					100

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 04/07/2021
Last Solved Time: 10:47:54 AM

Method: Spencer
Direction of movement: Left to Right
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.48

NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE CROSS-SECTION SHOWN ABOVE IS BASED ON FURNISHED INFORMATION.
3) THIS IS NOT A CONSTRUCTION DRAWING.

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Case B-1 - Terrace Local Stability

EE PROJECT No. 24431.01 - Terrace, 5H:1V Side Slopes,

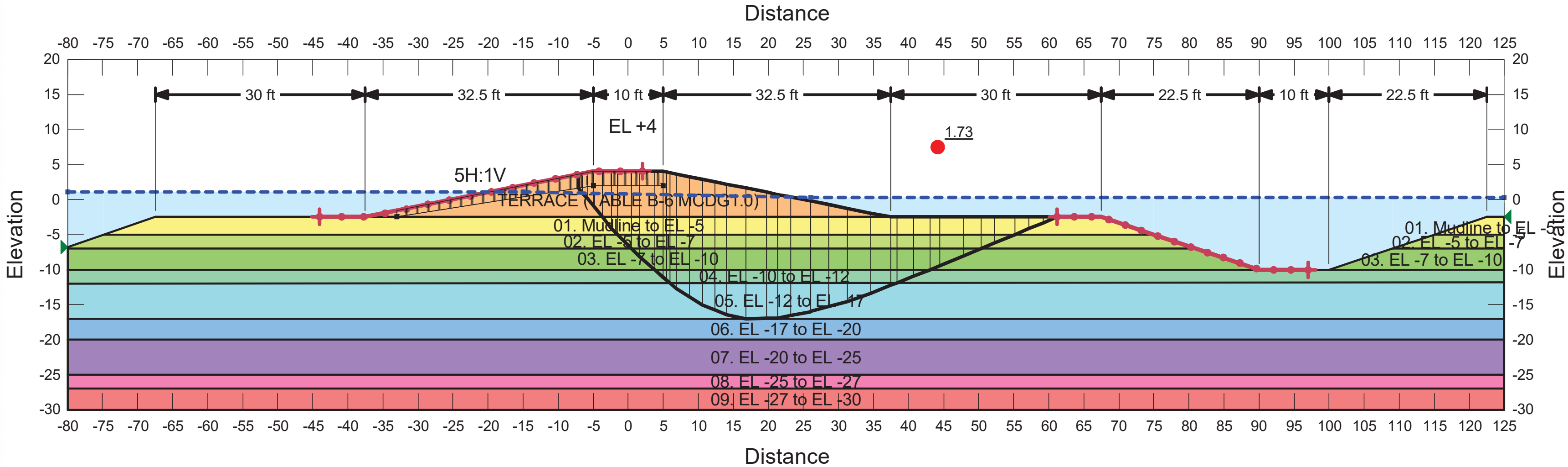
CHECKED BY:

FILENAME: 24431.01 Terraces.gsz

DRAWN BY: JMW

DATE: 04/07/2021

EUSTIS ENGINEERING L.L.C. SINCE 1946



Color	Name	Model	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)
	01. Mudline to EL -5	Undrained (Phi=0)	80					50
	02. EL -5 to EL -7	Undrained (Phi=0)	85					75
	03. EL -7 to EL -10	S=f(datum)	105	75	8.33	100	-7	
	04. EL -10 to EL -12	Undrained (Phi=0)	105					100
	05. EL -12 to EL -17	Undrained (Phi=0)	95					115
	06. EL -17 to EL -20	Undrained (Phi=0)	100					125
	07. EL -20 to EL -25	S=f(datum)	95	125	7	160	-20	
	08. EL -25 to EL -27	S=f(datum)	95	160	7.5	175	-25	
	09. EL -27 to EL -30	S=f(datum)	100	175	7	195	-27	
	TERRACE (TABLE B-6 MCDG1.0)	Undrained (Phi=0)	80					100

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 04/07/2021
Last Solved Time: 10:47:57 AM

Method: Spencer
Direction of movement: Left to Right
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.73

NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE CROSS-SECTION SHOWN ABOVE IS BASED ON FURNISHED INFORMATION.
3) THIS IS NOT A CONSTRUCTION DRAWING.

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Case A-1 - Borrow Excavation Global (2)

EE PROJECT No. 24431.01 - Terrace, 5H:1V Side Slopes (No Deformation),

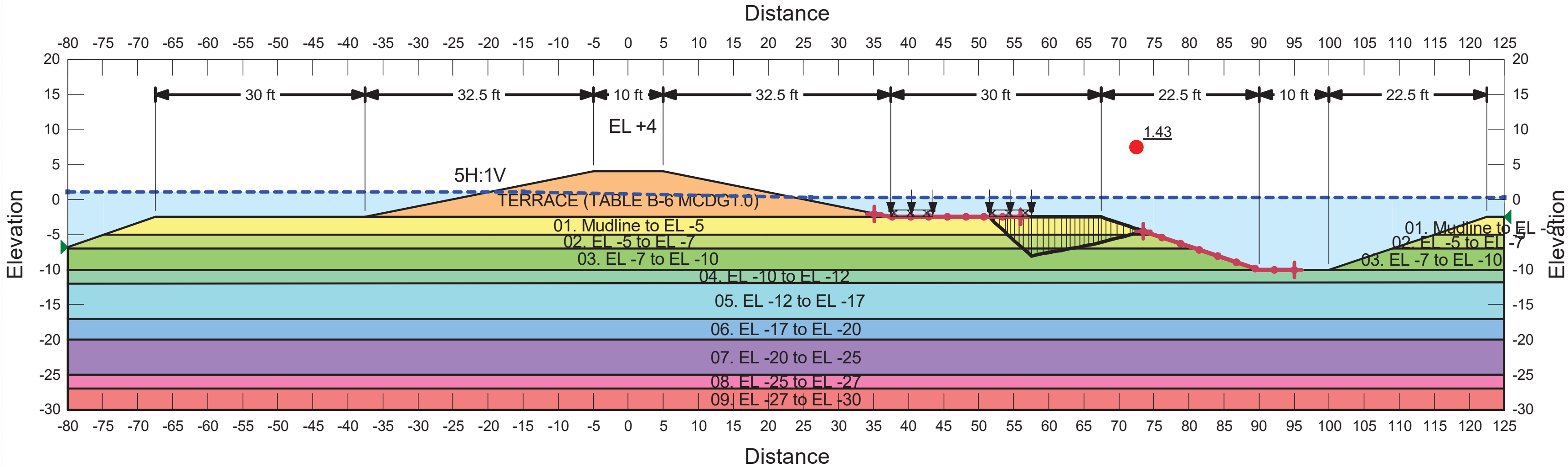
CHECKED BY:

FILENAME: 24431.01 Terraces.gsz

DRAWN BY: JMW

DATE: 04/07/2021

EUSTIS ENGINEERING L.L.C. SINCE 1946



Color	Name	Model	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)
	01. Mudline to EL -5	Undrained (Phi=0)	80					50
	02. EL -5 to EL -7	Undrained (Phi=0)	85					75
	03. EL -7 to EL -10	S=f(datum)	105	75	8.33	100	-7	
	04. EL -10 to EL -12	Undrained (Phi=0)	105					100
	05. EL -12 to EL -17	Undrained (Phi=0)	95					115
	06. EL -17 to EL -20	Undrained (Phi=0)	100					125
	07. EL -20 to EL -25	S=f(datum)	95	125	7	160	-20	
	08. EL -25 to EL -27	S=f(datum)	95	160	7.5	175	-25	
	09. EL -27 to EL -30	S=f(datum)	100	175	7	195	-27	
	TERRACE (TABLE B-6 MCDG1.0)	Undrained (Phi=0)	80					100

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 04/07/2021
Last Solved Time: 10:47:56 AM

Method: Spencer
Direction of movement: Left to Right
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.43

NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE CROSS-SECTION SHOWN ABOVE IS BASED ON FURNISHED INFORMATION.
3) THIS IS NOT A CONSTRUCTION DRAWING.

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Case A-2 - Borrow Excavation Local (2)

EE PROJECT No. 24431.01 - Terrace, 5H:1V Side Slopes (No Deformation),

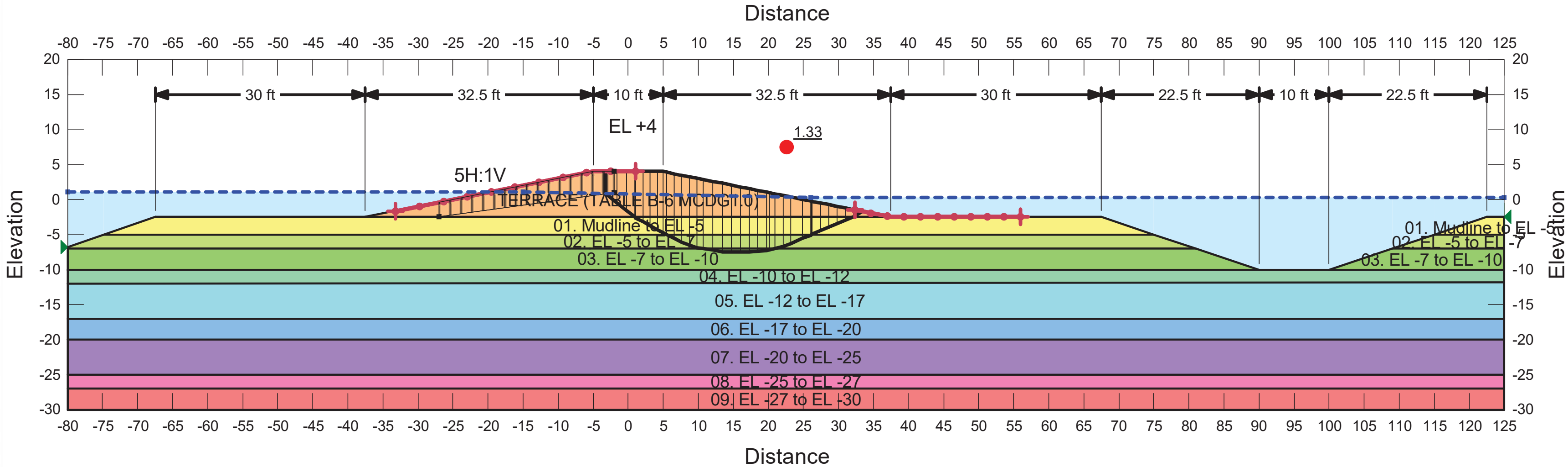
CHECKED BY:

FILENAME: 24431.01 Terraces.gsz

DRAWN BY: JMW

DATE: 04/07/2021

EUSTIS ENGINEERING L.L.C. SINCE 1946



Color	Name	Model	Unit Weight (pcf)	C-Datum (psf)	C-Rate of Change ((lbf/ft²)/ft)	C-Maximum (psf)	Datum (Elevation) (ft)	Cohesion (psf)
	01. Mudline to EL -5	Undrained (Phi=0)	80					50
	02. EL -5 to EL -7	Undrained (Phi=0)	85					75
	03. EL -7 to EL -10	S=f(datum)	105	75	8.33	100	-7	
	04. EL -10 to EL -12	Undrained (Phi=0)	105					100
	05. EL -12 to EL -17	Undrained (Phi=0)	95					115
	06. EL -17 to EL -20	Undrained (Phi=0)	100					125
	07. EL -20 to EL -25	S=f(datum)	95	125	7	160	-20	
	08. EL -25 to EL -27	S=f(datum)	95	160	7.5	175	-25	
	09. EL -27 to EL -30	S=f(datum)	100	175	7	195	-27	
	TERRACE (TABLE B-6 MCDG1.0)	Undrained (Phi=0)	80					100

Created By: James Williams
Last Edited By: James Williams
Last Solved Date: 04/07/2021
Last Solved Time: 10:47:57 AM

Method: Spencer
Direction of movement: Left to Right
Slip Surface Option: Entry and Exit
Optimize Critical Slip Surface Location: Yes

Factor of Safety: 1.33

NOTES:
1) DEEP-SEATED GLOBAL STABILITY ANALYSES PERFORMED BY SPENCER'S METHOD OF SLICES USING SLOPE/W SOFTWARE VERSION 10.01.
2) THE CROSS-SECTION SHOWN ABOVE IS BASED ON FURNISHED INFORMATION.
3) THIS IS NOT A CONSTRUCTION DRAWING.

DRAWING NOT TO SCALE
NOT FOR CONSTRUCTION USE

Case B-1 - Terrace Local Stability (2)

EE PROJECT No. 24431.01 - Terrace, 5H:1V Side Slopes (No Deformation),

CHECKED BY:

FILENAME: 24431.01 Terraces.gsz

DRAWN BY: JMW

DATE: 04/07/2021

EUSTIS ENGINEERING L.L.C. SINCE 1946