Geotechnical Engineering Services

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

for

Louisiana Coastal Protection and Restoration Authority

July 17, 2015

GeoEngineers
Earth Science + Technology

Geotechnical Engineering Services

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Terrebonne Parish, Louisiana

for
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July 17, 2015

GeoEngineers

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Island Road Marsh Creation and Nourishment
(TE-117)
Terrebonne Parish, Louisiana
File No. 16715-040-00

July 17, 2015

Prepared for:

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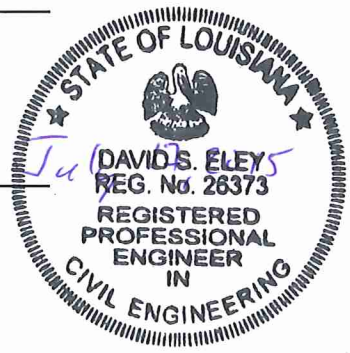

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Table of Contents

LIST OF FIGURES

APPENDICES

INTRODUCTION

This report presents the results of GeoEngineers, Inc.'s (GeoEngineers) geotechnical engineering services for the Island Road Marsh Creation and Nourishment (TE-117) project located in Terrebonne Parish, Louisiana. The project is located in southeast Terrebonne Parish approximately 7 miles southeast of Montegut, Louisiana, immediately southwest of the Pointe Aux Chenes marina located on Louisiana Highway 665, and immediately east-northeast of the Isle de Jean Charles marina located on Island Road as shown on Figures 1 and 2.

GeoEngineers' services for this project were performed under Contract No. 2503-14-26, Task Order 8, dated September 2, 2014. The Coastal Protection and Restoration Authority (CPRA) also issued purchase order 2000084247 Version 3, dated November 6, 2014 for the project.

All elevations described in this report, including figures and appendices, are referenced to the North American Vertical Datum of 1988 (NAVD 88), Geoid 12A.

PROJECT UNDERSTANDING

Our understanding of the project is based on the Scope of Services for In-shore Geotechnical Investigations dated July 2014, communications with CPRA and our August 27, 2014 proposal.

GeoEngineers understands the primary goal of this project is to create approximately 364 acres of marsh and to nourish 19 acres of marsh by hydraulic pumping of dredged sediment from a borrow source in or near Lake Felicity. Earthen containment dikes are proposed to contain the hydraulically dredged fill for marsh creation. Historically, projects in the coastal marshes of Terrebonne Parish have unfavorable soil conditions for construction of earthen containment dikes. Hence, the primary goal of these geotechnical services was to evaluate the constructability of earthen containment dikes in Cells A through D (Figure 2) for the proposed marsh creation and to identify possible alternate locations for marsh creation in Cell E. Field explorations, widely spaced on around 1,500 to 3,000 foot intervals, were performed across the site to evaluate the earthen containment dikes. Field explorations and laboratory testing performed for the project was included in the Geotechnical Data Report (GDR).

SITE CONDITIONS

Geology

As shown in the geology map on Figure 3, the area predominantly consists of marsh deposits with abandoned distributary channels running generally in the north-south direction. Pleistocene deposits are approximately 225 feet to 325 feet below grade within the project area. Natural levee deposits that may be present along distributary channels and typically provide better subsurface soil conditions than marsh deposits.

Surface Conditions

Based on the information provided by CPRA and our field exploration activities, the area in general is undeveloped with relatively wide open water areas with some areas covered with marsh grass.

As shown on Figure 2, there are pipelines in the area. Other features noted during our filed exploration included an overhead power line that followed the east side of Cell A. Based on a magnetometer survey performed by Lonnie G. Harper and Associates, Inc. (LGH), a few exploration locations (B-3/C-8 and C-10) were shifted about 100 feet from their original proposed location because of their proximity to underground anomalies. There are also pipeline canals within the proposed fill areas. C-16 had to be offset from the staked location because the water depth at the staked location in the canal was approximately 11 feet. In general, based on our field explorations the water depth across the site varied from approximately 1.4 feet to 3.2 feet, except at the location of C-16 which was in a canal.

Subsurface Conditions

The site predominantly consisted of very soft to soft soil with layers of sand, silt and clay at various depths. The soils in general were slightly over-consolidated in the upper 11 to 25 feet, but have low overburden pressures due to the submerged organic soil profile.

The site is divided in to five cells (Cells A through E, as shown on Figure 2). Cells A through D are located on the north side of the Twin Pipelines Canal and Cell E is south of the Twin Pipelines Canal. Given below are the subsurface conditions encountered in each cell. For details, refer to Figures 4 through 7.

Cell A (Figure 4)

Field explorations encountered very soft, high moisture peat and organic clay from the mudline to about 6 to 12 feet below the mudline. These were underlain by predominantly very soft clay and silty clay soil. Sand and silt layers were encountered at various depths in B-1 (12 to 14 feet, 18 to 21 feet, and 24 to 28 feet below the mudline), C-2 (9 to 16 feet, and 25 to 27 feet below the mudline), and C-3 (27 to 30 feet below the mudline). Soil boring B-7 did not encounter any notable sand or silt layers.

Cells B and C (Figure 5)

Field explorations encountered very soft, high moisture peat and organic clay from the mudline to about 7 to 11 feet below the mudline. Beneath the organic soil, C-4 and C-5 encountered a layer of very soft clay to 10 to 15 feet below mudline. Layered sand, silt and clay was encountered in all the explorations from about 8 to 15 feet to approximately 14 to 22 feet below mudline. Beneath the layers of sand, silt and clay, the explorations encountered very soft to soft clay down to their respective termination depths. Soil boring B-2 encountered a layer of organic clay from approximately 34 to 44 feet below the mudline.

Cell D (Figure 6)

Very soft, high moisture content peat and organic clay were encountered from the mudline to a depth of about 6 to 9 feet below the mudline. Beneath the organic soil, layered sand, silt and clay was encountered to approximately 12 to 21 feet below the mudline. Beneath these mixed layers of sand, silt and clay, very soft to soft clay was encountered to the completion depth at all explorations except B-3 and C-8. At soil boring B-3 a layer of organic clay was encountered at a depth of about 29 feet below mudline which extended to the boring completion depth of about 30 feet. C-8 encountered layers of silt and clay at a depth of approximately 44 to 48 feet below mudline. C-8 was terminated in clay soil at a depth of approximately 50 feet below the mudline.

Cell E (Figure 7)

Very soft, high moisture content peat and organic clay were encountered from the mudline to a depth of about 0 to 5 feet below the mudline. Beneath this organic soil, predominantly very soft clay was encountered to a depth varying from about 4 to 10 feet. Except at C-11 and C-16, explorations encountered layered sand, silt and clay beneath the very soft clay that extended to approximately 9 to 18 feet below mudline. Except B-5, C-14 and C-18, explorations encountered very soft to soft clay beneath the layered sand, silt and clay extending to their exploration depths. At B-5, C-14 and C-18, layers of sand and silt were encountered at a depth of about 19 to 24 feet and extended to their respective exploration completion depths.

CONCLUSIONS AND RECOMMENDATIONS

General

Based on geotechnical analyses results, it will likely be difficult to construct containment dikes for the proposed marsh creation areas at elevations required to achieve the long-term target marsh elevations. Analyses indicate variability in containment dike stability; however, there did not appear to be a specific area that was better. Results for slope stability and settlement analyses are presented below. Details of the analyses are presented in Appendices B and C.

Containment Dike Slope Stability and Bearing

GeoEngineers used soil properties and surveyed mudline elevations from each exploration location to evaluate stability of a containment dike with a 5-foot wide crown at elevation +4.0 feet (El. +4.0 ft.), 5 horizontal to 1 vertical (5H:1V) dike slopes, a 25-foot wide bench between the dike and borrow channel, and a borrow channel excavated to EL -10 ft. with 2H:1V side slopes by a marsh buggy excavator from the bench. Results for this analysis are summarized below. GeoEngineers recommends a factor of safety of 1.3 for slope stability, and 1.2 should be considered a minimum. For bearing, we recommend a factor of safety of 1.5.

As noted in Table 1 below, several locations were not stable with a dike elevation at +4.0 ft. and the elevation was lowered. Except at location C-3, our evaluation indicates a dike elevation of +3.0 ft. can be constructed in a single lift with a factor of safety of 1.2 or greater. At location C-3 the factor of safety for a dike constructed to El. +3.0 ft. in a single lift is 1.18 – condition 2, Figure B-3a, Appendix B (note that the factor of safety shown in Table 1 is for condition 3 – borrow channel

excavation, and that the dike – condition 2 – is 1.18). GeoEngineers believes two-lift construction will allow the containment dikes to be raised to El. +3.0 ft. and maintain stability.

The first lift should be constructed to the full design dike base width to El. +2.5 ft. The second lift should not be placed until the first lift is completed for the entire dike, and should be placed in the same sequence as the first lift to the full design elevation.

In many analyses, the weight of the marsh buggy on the bench caused a failure into the borrow channel (Condition 3, Table 1). This particular failure mode was not easily fixed by changing the channel geometry. We tried using a shallower borrow channel, but that did not significantly improve the factor of safety. GeoEngineers recommends using a barge-mounted excavator floating in the borrow channel to construct the containment dikes, instead of an excavator bearing on the bench. GeoEngineers evaluated shortening the bench width while using a barge-mounted excavator, and determined a bench width of 10 feet or greater will maintain stability of the dike for a failure from the dike into the borrow channel at a factor of safety greater than 1.2. Therefore, GeoEngineers recommends a design containment dike section as shown on Figure 8, assuming equipment will float in the channel and not bear on the bench.

Another alternative is to evaluate geotextile reinforcement. Preliminary evaluations by GeoEngineers indicate dikes can be constructed to El. +4.0 ft. if geotextile reinforcement with a 250 pound per inch tensile strength is used. This alternative will also require construction of the dike using a barge-mounted excavator as mentioned above.

With the exception of the B-1/C-2 location, slope stability controlled design. At the B-1/C-2 location bearing controlled, but by reducing the dike crown elevation from +4.0 ft. to +3.5 ft. an adequate factor of safety was achieved.

TABLE 1. CONTAINMENT DIKE STABILITY SUMMARY

Cell ID	Boring ID	Crown Elevation (feet)	Mudline Elevation (feet)	Bench Width (feet)	Borrow Channel Bottom Elevation (feet)	Controlling Slope Stability FOS (Condition)	Additional Evaluation		Bearing Capacity Factor of Safety
							A	B	
A	B-7/C-1	+4	-3.2	25	-10	1.42 (2)	1.50	1.28	1.98
	B-1/C-2	+4	-2.5	25	-10	1.21 (2)	1.23	1.16	1.34
		+3.5	-2.5	25	-10	NA	NA	1.30	1.52
	C-3	+3	-2.8	25	-10	1.09 (3)	NA	NA	NA
		+2.5	-2.8	25	-10	1.11 (3)	1.70	1.34	1.84
B	B-2/C-4	+3.5	-3.1	25	-10	1.08 (2)	NA	NA	NA
		+3	-3.1	25	-10	1.21 (2)	1.40	1.29	1.55

TABLE 1. CONTAINMENT DIKE STABILITY SUMMARY

Cell ID	Boring ID	Crown Elevation (feet)	Mudline Elevation (feet)	Bench Width (feet)	Borrow Channel Bottom Elevation (feet)	Controlling Slope Stability FOS (Condition)	Additional Evaluation		Bearing Capacity Factor of Safety
							A	B	
C	C-5	+4	-2.2	25	-10	1.03 (2)	NA	NA	NA
		+3	-2.2	25	-10	1.26 (2)	1.46	1.36	2.12
	C-6	+3.5	-2.2	25	-10	1.16 (2)	NA	NA	NA
		+3	-2.2	25	-10	1.18 (3)	1.47	1.34	1.74
D	C-7	+4	-2.5	25	-10	1.06 (3)	1.62	1.48	1.77
	B-3/C-8	+4	-3.4	25	-10	1.23 (2)	1.37	1.24	1.59
	C-9	+4	-3.2	25	-10	1.42 (2)	1.50	1.51	2.18
	C-10	+4	-3.0	25	-10	1.46 (2)	1.53	1.56	1.98
E	C-11	+3	-1.5	25	-10	1.20 (2)	1.39	1.36	1.69
	C-12	+3.5	-1.6	25	-10	1.19 (2)	NA	NA	NA
		+3	-1.6	25	-10	1.26 (3)	1.50	1.50	1.70
	B-4/C-13	+4	-3.2	25	-10	1.31 (3)	1.46	1.39	1.59
	B-5/C-14	+4	-2.2	25	-10	1.28 (3)	1.43	1.42	1.86
	C-15	+4	-3.1	25	-10	1.44 (2)	1.52	1.52	1.98
	C-16	Alternate containment feature (e.g. sheetpiling)							
	C-17	+3.5	-2.3	25	-10	1.15 (3)	NA	NA	NA
		+3	-2.3	25	-10	1.15 (3)	1.48	1.47	1.72
	B-6/C-18	+4	-2.8	25	-10	1.49 (2)	1.56	1.56	2.38

NA = Not Analyzed

Condition 1 –Dike to Excavation

Condition 2 –Dike to Marsh

Condition 3 – Marsh to Excavation

A = Global stability for high water condition on the exterior side of dike and low water condition prior to marsh fill

B = Global stability for low water condition on exterior side of dike with marsh fill on the interior

Containment Dike Settlement

GeoEngineers evaluated settlement for containment dikes constructed with crown elevations of +4.0 and +2.0 feet. Table 2 provides a summary of the settlement estimates. Appendix C (Figures C-1 though C-8) contains graphical and tabular summaries of settlement. Figure C-1 is an average of all evaluations with maximum and minimum ranges shown.

Settlement for earthen containment dikes has three components; 1) consolidation of underlying soil due to the additional loading imposed by the earthen dike; 2) immediate construction (elastic) settlement of soil during construction; and 3) shrinkage within the dike earthen fill. All three components must be added to obtain the total estimated settlement.

Construction, or elastic, settlement is the result of immediate compression of the underlying soil during placement of fill (i.e. during construction). Elastic settlement has been estimated as 20% of the long term consolidation settlement. This estimated number is based on professional judgment and experience. It is difficult to distinguish construction settlement from consolidation settlement during construction. Construction settlement will be offset by fill placement during construction and is not likely to be directly observed. It will, however, increase the fill quantity required to reach the design elevation and should be considered for fill quantity estimates.

Shrinkage of containment dike fill is a function of many variables, including fill material, construction practices, weather, and fill height. Shrinkage will not be uniform; the exterior of the dike, especially at higher elevations, is expected to shrink more than the interior, especially near the water level. Additionally, as hydraulic fill is placed within the contained area, the fill side of the dike will no longer be exposed to the atmosphere. Based on air-drying data collected by GeoEngineers for a variety of soil types, we recommend estimating shrinkage settlement as 10% of the containment dike height above the mean water design level.

For example, based on a mean water elevation of 0.6 feet and an earthen dike elevation of 3 feet, GeoEngineers recommends allowing for 3 inches of elevation loss due to shrinkage, in addition to consolidation settlement. It is expected shrinkage will occur within 3-6 months after construction depending upon the season. Dry and sunny weather will speed the shrinkage process, while wet and cloudy weather will slow the process. Another benefit of two-lift construction, is some shrinkage settlement will occur during the first lift construction, and be replaced by the second lift.

TABLE 2. EARTHEN CONTAINMENT DIKE SETTLEMENT ESTIMATES

Boring ID.	Crown Elevation (feet)[1]	Estimated Shrinkage Settlement (inches)[2]	Estimated Construction Settlement (inches)[3]	Estimated Foundation Soil Consolidation Settlement (inches)				
				6 Mo.	1 Yr.	5 Yrs.	10 Yrs.	Long-term (20 Years)
B-1	+4	4	7	32	33	33	33	33
	+2	2	3	14	16	16	16	16
B-2	+4	4	5	25	25	26	26	28
	+2	2	4	19	19	19	19	19
B-3	+4	4	3	13	14	16	16	16
	+2	2	2	8	10	10	10	10
B-4	+4	4	2	10	11	11	11	11
	+2	2	1	6	7	7	7	7
B-5	+4	4	2	11	12	12	12	12
	+2	2	2	7	7	7	7	7
B-6	+4	4	2	10	10	11	12	12
	+2	2	1	6	6	7	7	7
B-7	+4	4	7	26	29	34	35	35
	+2	2	4	17	18	20	20	22

(1) Crown elevation at end of earthen terrace construction.

(2) Shrinkage settlement = (Initial construction elevation-Assumed water elevation)*10%; Water at El. 0.6 feet, NAVD88 Geoid 12A.

(3) Estimated construction settlement is not included in the estimated consolidation settlement.

CONCLUSIONS

As graphically shown on Figure 2 there is no clearly defined area where containment dikes built to El. +4.0 have an adequate factor of safety. There may be some correlation between better factors of safety and distributary channel locations; however, there is not sufficient information to confirm this.

The sand/silt layers present in many of the exploration locations appear to be shallower in the middle portion of Cell E (B-5, C-14, C-13, B-4, C-15 & C-17), but these explorations are widely spaced and conditions may vary between the investigation points.

If CPRA wishes to explore the site more, we recommend focusing on distributary channels as possible better corridors for containment dikes, and perhaps in the central area of Cell E to see if a shallow bearing sand is consistent across the area.

CONSTRUCTION CONSIDERATIONS

Earthen containment dikes constructed from the organic surface soils present at this site will likely be difficult to place without substantial disturbance. Care must be taken to excavate and place the containment dike fill as gently as practical. Mud waves are likely to be generated as the fill is placed. Containment dike embankments should be constructed in lifts, starting from the center of the dike

footprint and moving outward to avoid trapping significant amounts of disturbed foundation material under the dike footprint.

Based on the site work and evaluations completed for this project, the following are offered with respect to construction.

- All our evaluations are based on a limited number of investigations over a wide area. CPRA should expect localized problem areas during construction that will require location specific remedies. GeoEngineers offers our services during construction to address issues that may come up.
- Based on our stability evaluations, two-lift construction is recommended for unreinforced earthen containment dikes. The first lift should be constructed to El. +2.5 ft. over the full width of the final design dike section. The second lift should not be placed until the first lift is completed for the entire dike and should be placed in same sequence as the first lift to the full design elevation. This will allow the soil to consolidate and gain strength after which the additional fill can be placed. We expect the second lift will be able to be placed to the full design elevation; however, if stability problems are encountered, an intermediate second lift may be required, followed by a third lift.
- The containment dikes should be constructed from barge-mounted equipment in the borrow channel, and the borrow channel should be maintained a minimum of 10 feet away from the design toe of the containment dike. The borrow channel must not be excavated below El. -10 ft. without additional stability evaluation. If track-mounted excavators are necessary to shape the containment dike, they should operate from the side of the dike opposite the borrow channel. There is not sufficient ground support to support a marsh buggy adjacent to the borrow channel without potentially failing the excavation slope.
- Maintenance should be expected for containment dikes throughout the project duration due to settlement, erosion, and other natural processes that will occur while placing hydraulic fill.
- The surficial soil at this site is predominantly peat and organic clay; both highly organic soil. These materials will be more difficult to use for construction purposes when compared to clay, silt, or sand; however, pilot study experience suggests these materials can be used successfully. CPRA should be aware that contractors are likely to try to excavate clay from beneath these organic soils, which will require a different evaluation by GeoEngineers to correctly model deeper excavations and heavier fill materials for dikes and terraces. Heavier fill is also likely to settle more, and cause more displacement of shallow organic material (i.e. mud waves).
- Water levels can significantly affect construction and dike/terrace stability. High water levels may increase erosion, while low water levels reduce fill buoyancy and can cause failures.
- GeoEngineers has shown pipeline and information on Figure 2 based on information provided by CPRA. The information on Figure 2 must be verified, and there may be additional pipelines and utilities at the site. Precautions must be taken to prevent pipeline damage during construction.
- There are property owner restrictions for site access. Contractors may need to take extra precaution while performing the work to reduce impacts to local wildlife.

LIMITATIONS

We have prepared this report for the exclusive use of the Louisiana Coastal Protection and Restoration Authority in support of design of the proposed Island Road Marsh Creation and Nourishment (TE-117) project in Terrebonne Parish, Louisiana.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, expressed or implied, should be understood.

Please refer to Appendix D titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

FIGURES

GeoEngineers

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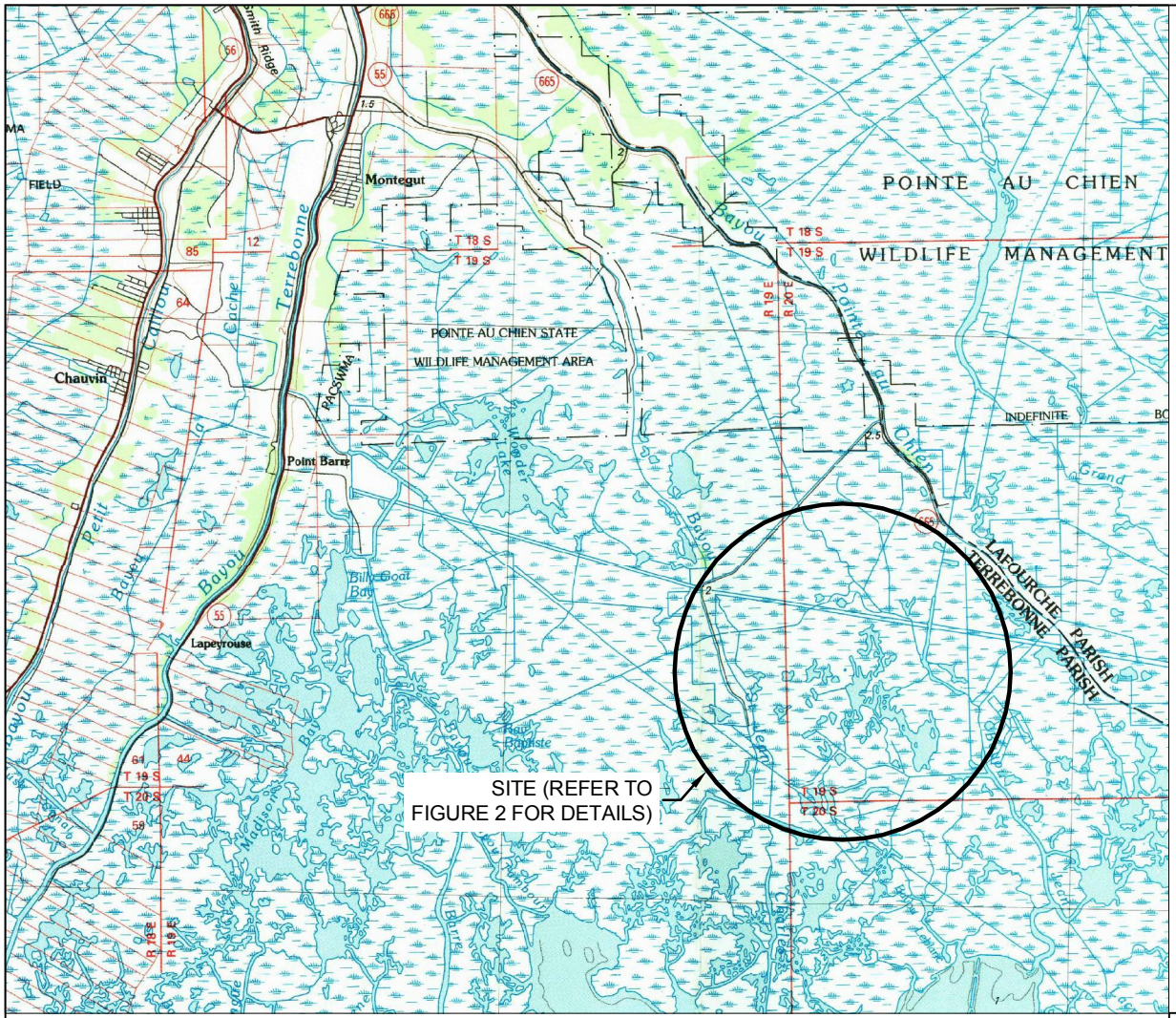
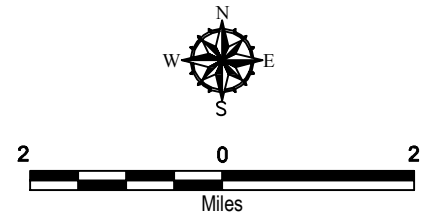




Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers,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

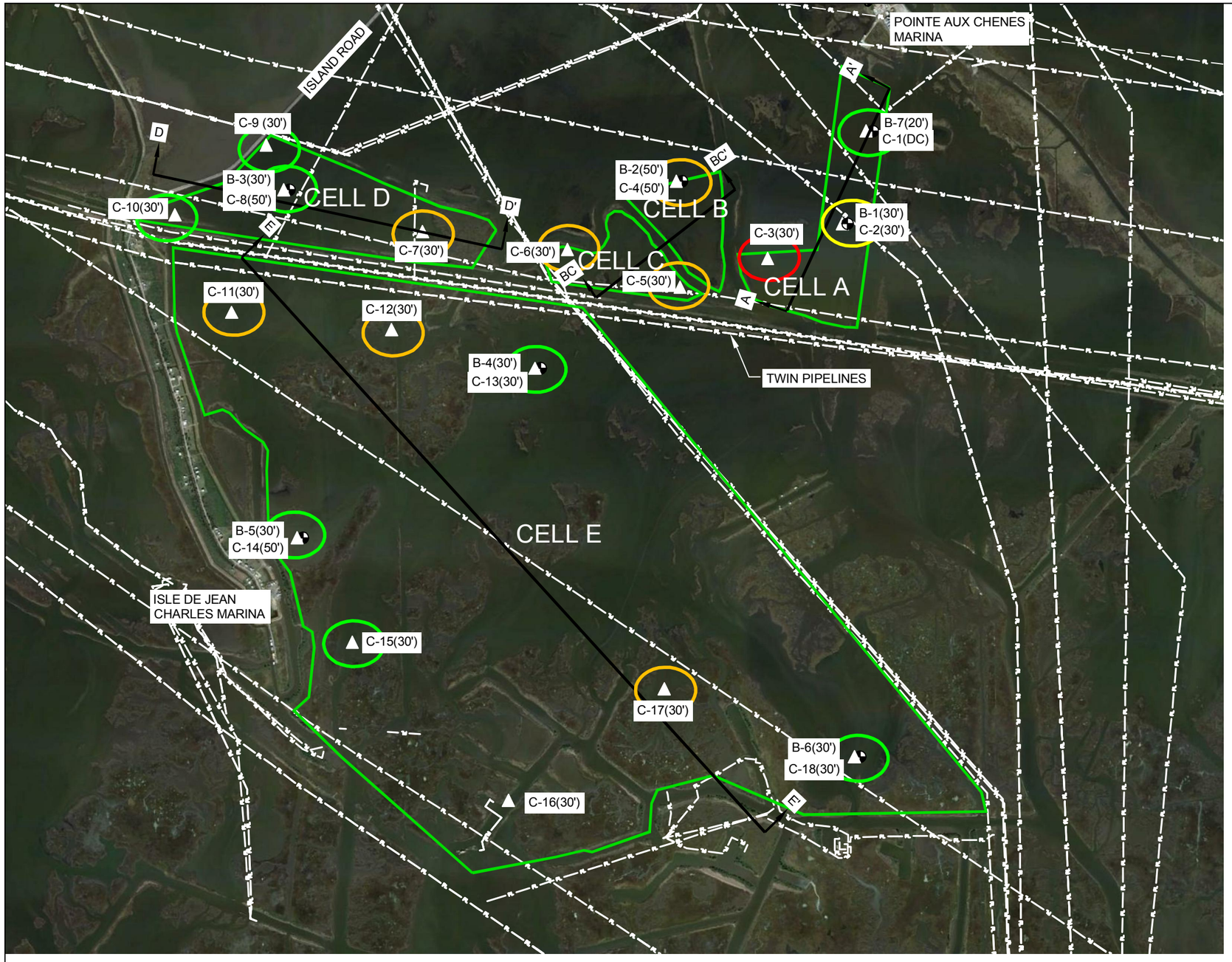
Reference: Topographic image was taken from USGS, 100K Template, Quad: Terrebonne Bay, Dated: 1983

VICINITY MAP

Island Road Marsh Creation
and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure 1



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CPT DETAILS			
CPT #	LATITUDE	LONGITUDE	DEPTH BELOW MUDLINE
C-1	N 29° 24' 38.3"	W 90° 26' 58.1"	50 FT.
C-2	N 29° 24' 22.8"	W 90° 27' 03.3"	30 FT.
C-3	N 29° 24' 15.6"	W 90° 27' 13.0"	30 FT.
C-4	N 29° 24' 30.6"	W 90° 27' 39.3"	50 FT.
C-5	N 29° 24' 11.5"	W 90° 27' 38.7"	30 FT.
C-6	N 29° 24' 17.8"	W 90° 28' 01.6"	30 FT.
C-7	N 29° 24' 21.3"	W 90° 28' 28.5"	30 FT.
C-8	N 29° 24' 27.8"	W 90° 28' 56.4"	50 FT.
C-9	N 29° 24' 36.3"	W 90° 29' 01.2"	30 FT.
C-10	N 29° 24' 25.1"	W 90° 29' 18.4"	30 FT.
C-11	N 29° 24' 07.8"	W 90° 29' 07.5"	30 FT.
C-12	N 29° 24' 04.1"	W 90° 28' 35.5"	30 FT.
C-13	N 29° 23' 57.0"	W 90° 28' 06.0"	30 FT.
C-14	N 29° 23' 26.3"	W 90° 28' 53.6"	23.5 FT.*
C-15	N 29° 23' 08.6"	W 90° 28' 43.5"	30 FT.
C-16	N 29° 22' 40.5"	W 90° 28' 11.2"	30 FT.
C-17	N 29° 23' 00.4"	W 90° 27' 40.6"	30 FT.
C-18	N 29° 22' 50.7"	W 90° 27' 01.7"	30 FT.

*UNABLE TO ADVANCE CONE TO FULL DEPTH DUE TO SAND LAYERS

SOIL BORING DETAILS			
BORING #	LATITUDE	LONGITUDE	DEPTH BELOW MUDLINE
B-1	N 29° 24' 22.8"	W 90° 27' 03.3"	30 FT.
B-2	N 29° 24' 30.6"	W 90° 27' 39.3"	50 FT.
B-3	N 29° 24' 27.8"	W 90° 28' 56.4"	30 FT.
B-4	N 29° 23' 57.0"	W 90° 28' 06.0"	30 FT.
B-5	N 29° 23' 26.3"	W 90° 28' 53.6"	30 FT.
B-6	N 29° 22' 50.7"	W 90° 27' 01.7"	30 FT.
B-7	N 29° 24' 38.3"	W 90° 26' 58.1"	20 FT.

LEGEND

- B-1 — Approximate Soil Boring Location
- C-1 — Approximate CPT Location
- Cell Location
- Pipeline
- A A' — Cross Section

Maximum Crown Elevation - Single Lift

+4 +3.5 +3 +2.5

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

Reference: 1. Aerial image was taken from Google Earth Pro., Licensed to GeoEngineers Inc., Imagery Dated: November 14, 2012
2. Cell locations were provided by CPRA, Base Map.dwg, St. Project # TE-117, Sheet 2-2, Dated July 2014
3. Soil Boring and CPT locations were staked and surveyed by Lonnie G. Harper & Associates, Dated February 23, 2015
4. Pipeline routes were provided by CPRA, Island Road Marsh Creation, State Project Number:TE-117, Sheet 2, Dated July 2014

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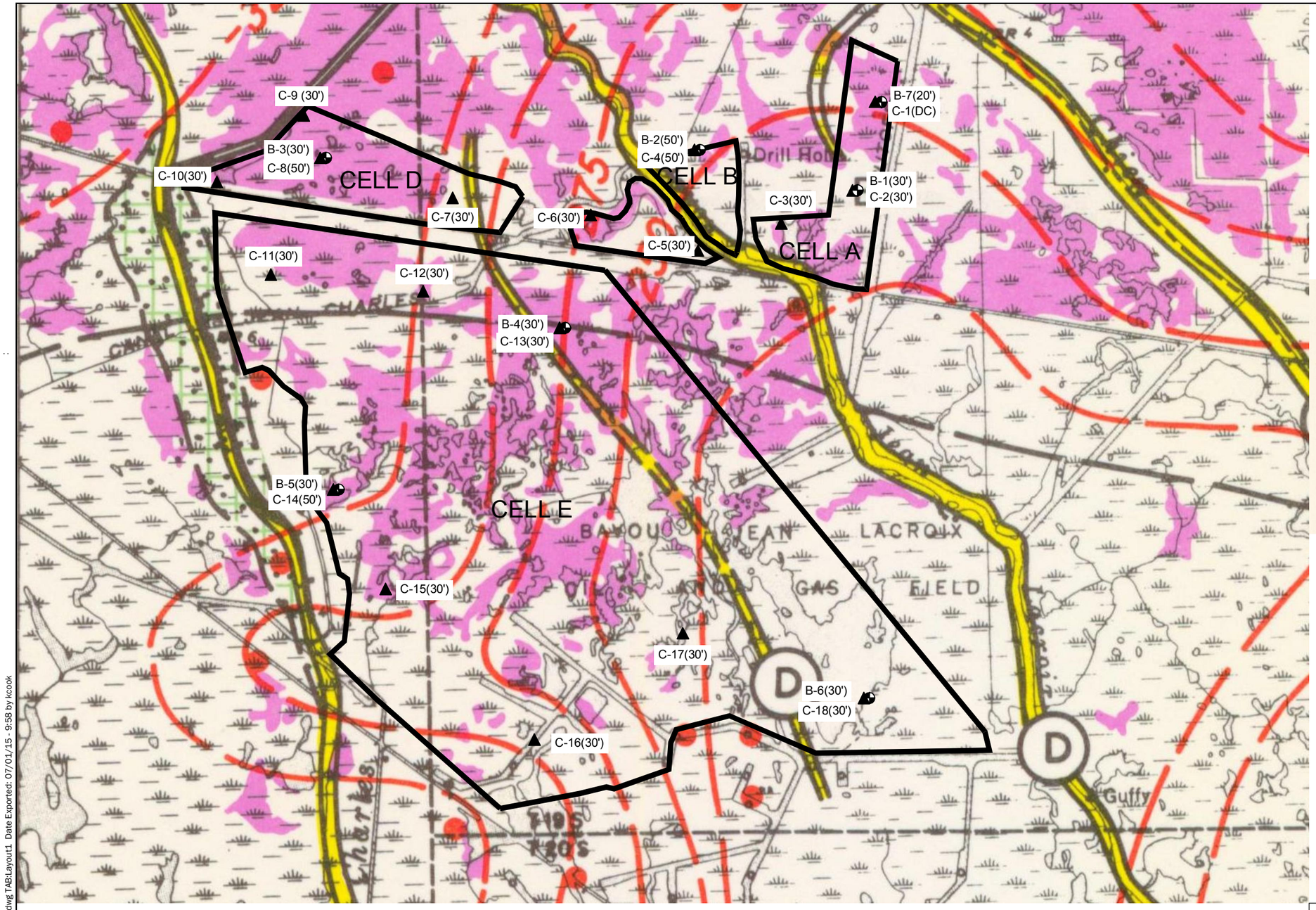
SITE PLAN

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure 2



LEGEND

- NATURAL LEVEE
- INTERDISTRIBUTARY
- ABANDONED DISTRIBUTARY
- CREVASSE CHANNEL
- LAND LOSS (1932–1983)
- INDEFINITE CONTACT
- –300– ELEVATION OF UPPER FINE-GRAINED PLEISTOCENE SURFACE IN FEET-MSL
- BORING USED TO CONTOUR UPPER FINE-GRAINED PLEISTOCENE SURFACE
- BORINGS USED ON CROSS SECTIONS

- B-1 Approximate Soil Boring Location
- C-1 Approximate CPT Location
- Cell Location

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

Reference: Geology map was taken from USACE, Alluvial Deposits Map, Quads: Lake Felicity, Dated 1986

N W E S

2000 0 2000
Feet

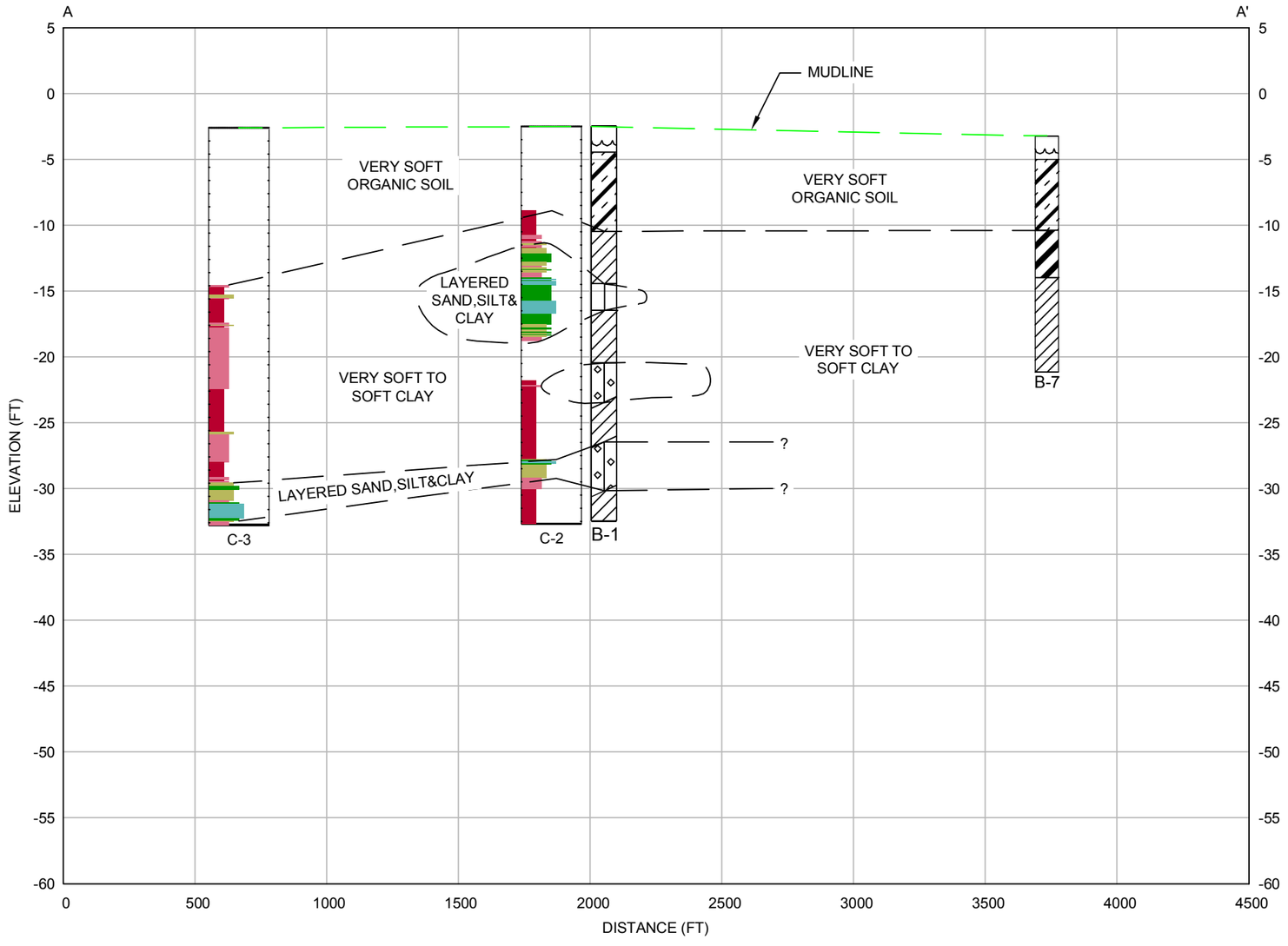
GEOLOGY MAP

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

FIGURE 3

P:\16\167 15040\00\CAD\Geology Map.dwg TAB:Layout1 Date Exported: 07/01/15 - 9:58 by kcook



Notes:
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Reference: Elevations were provided by Lonnie G Harper & Associates, Site Plan, Project # 2015-10, Dated 2/23/2015

CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands

BORING LEGEND

CL SILTY CLAY · PT PEAT · OH ORGANIC CLAY · ML SILT · SM SILTY SAND · CH CLAY · SC-SM SILTY CLAYEY SAND

SUBSURFACE PROFILE
CELL A

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure 4

VT : KMC

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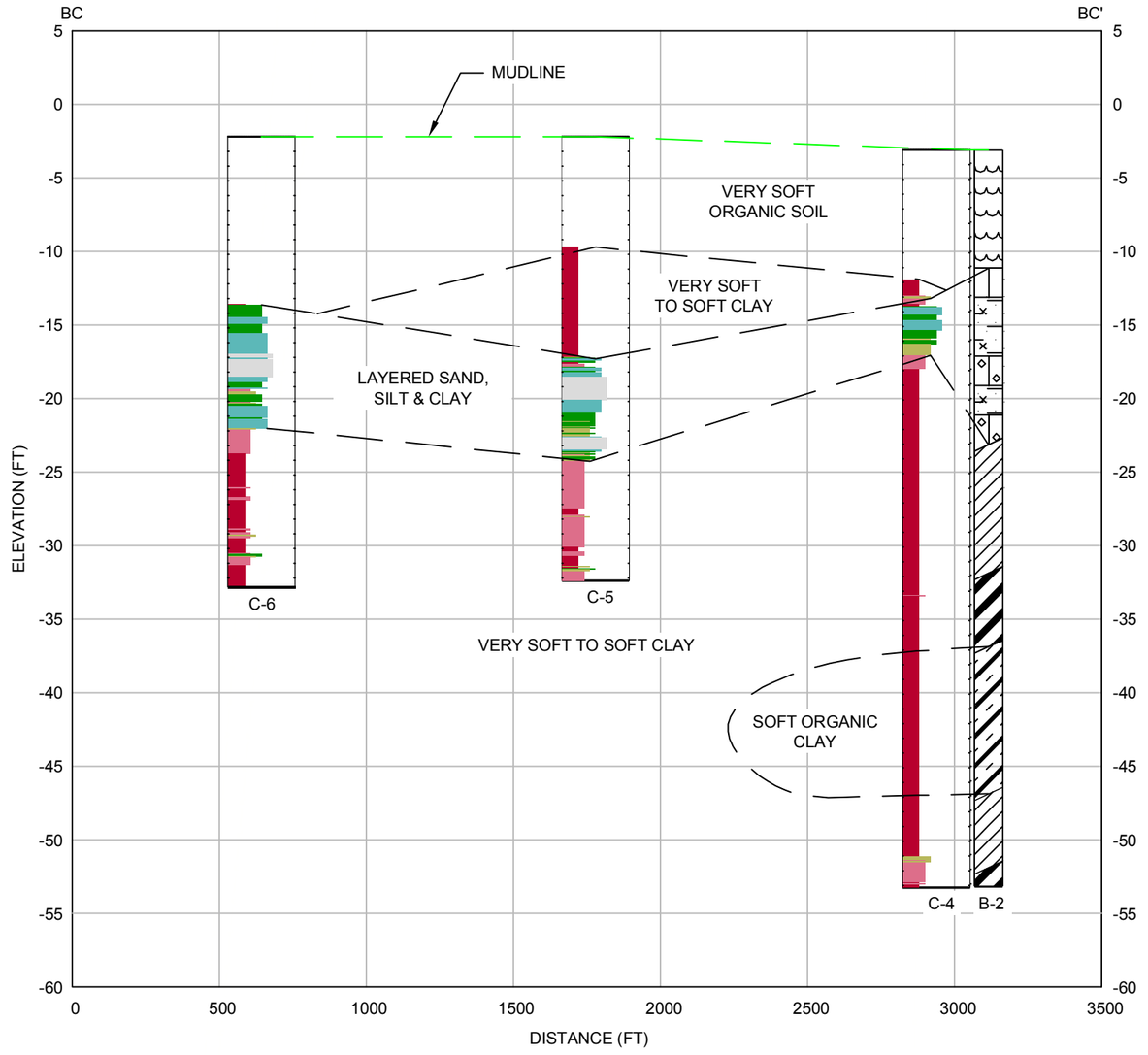

Notes:
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Reference: Elevations were provided by Lonnie G Harper & Associates, Site Plan, Project # 2015-10, Dated 2/23/2015

CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands

BORING LEGEND

CL SILTY CLAY · PT PEAT · OH ORGANIC CLAY · ML SILT · SM SILTY SAND · CH CLAY · SC-SM SILTY CLAYEY SAND

SUBSURFACE PROFILE
CELL B & C

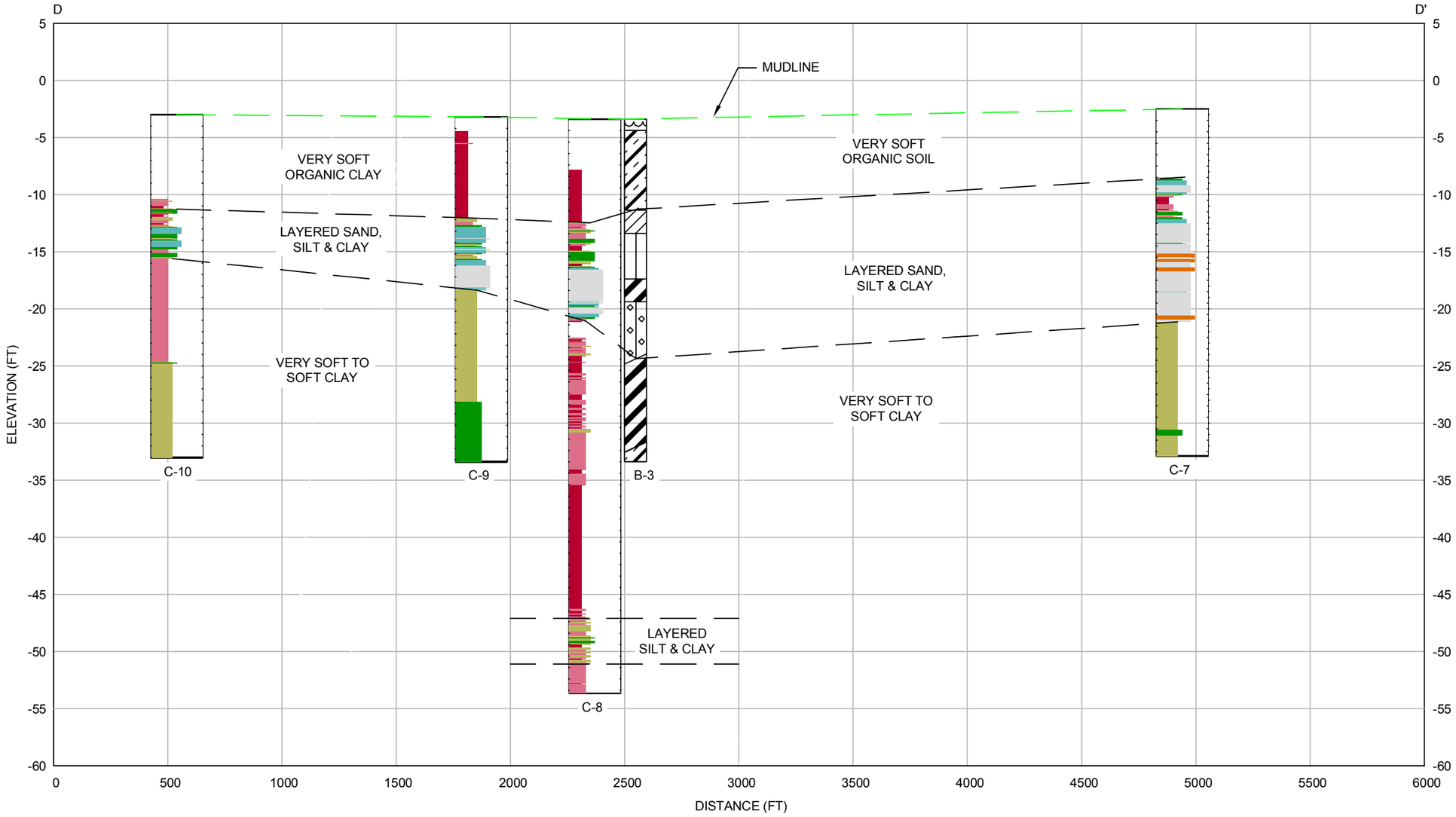
Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure 5

VT : KMC

P:\16\16715040\00\CAD\Base Map.dwg\TAB:Layout1 (3) modified on Jun 25, 2015 - 3:00pm



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

Reference: Elevations were provided by Lonnie G Harper & Associates, Site Plan, Project # 2015-10, Dated 2/23/2015

CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands

BORING LEGEND

CL SILTY CLAY | PT PEAT | OH ORGANIC CLAY

ML SILT | SM SILTY SAND | CH CLAY | SC-SM SILTY CLAYEY SAND

SUBSURFACE PROFILE
CELL D

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GEOENGINEERS

Figure 6

VT : KMC

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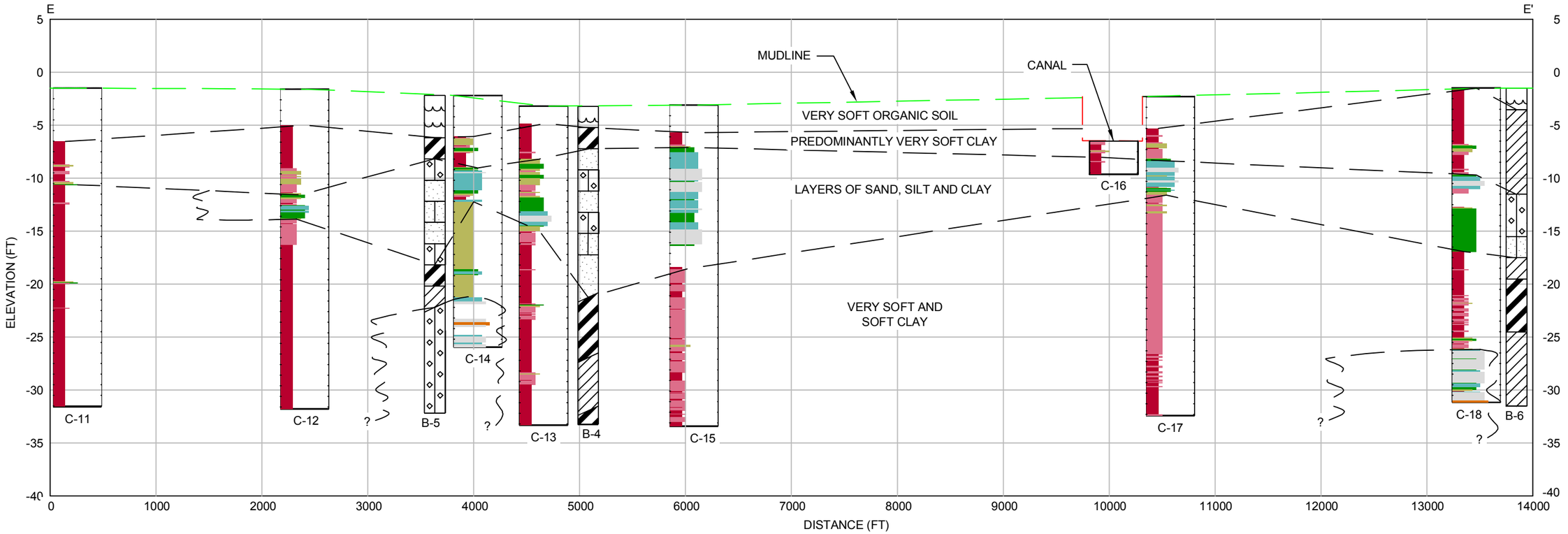

Notes:
1. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record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

Reference: Elevations were provided by Lonnie G Harper & Associates, Site Plan, Project # 2015-10, Dated 2/23/2015

CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands

BORING LEGEND

- CL SILTY CLAY
- PT PEAT
- OH ORGANIC CLAY
- SP-SM SAND WITH SILT
- ML SILT
- SM SILTY SAND
- CH CLAY
- SC-SM SILTY CLAYEY SAND

SUBSURFACE PROFILE
CELL E

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure 7

VT : KMC

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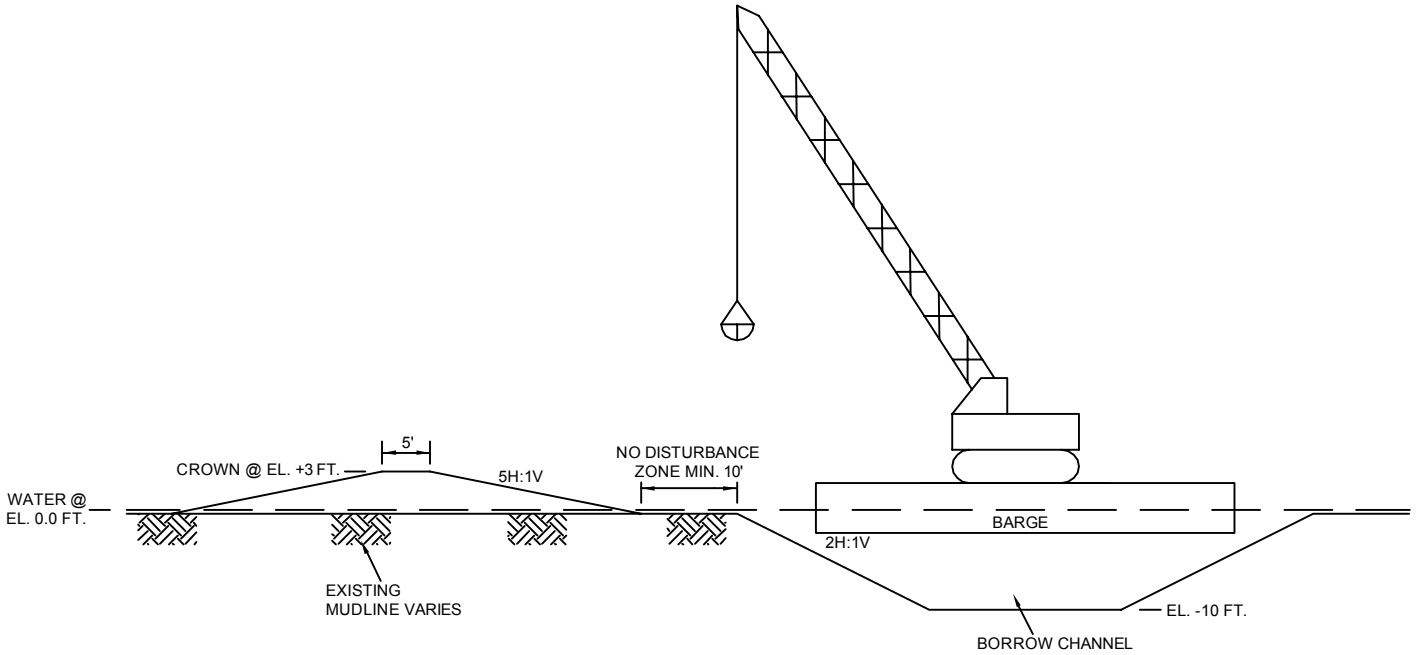


SCALE

20 0 20

Feet

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

EARTHEN CONTAINMENT DIKE DESIGN SECTION

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

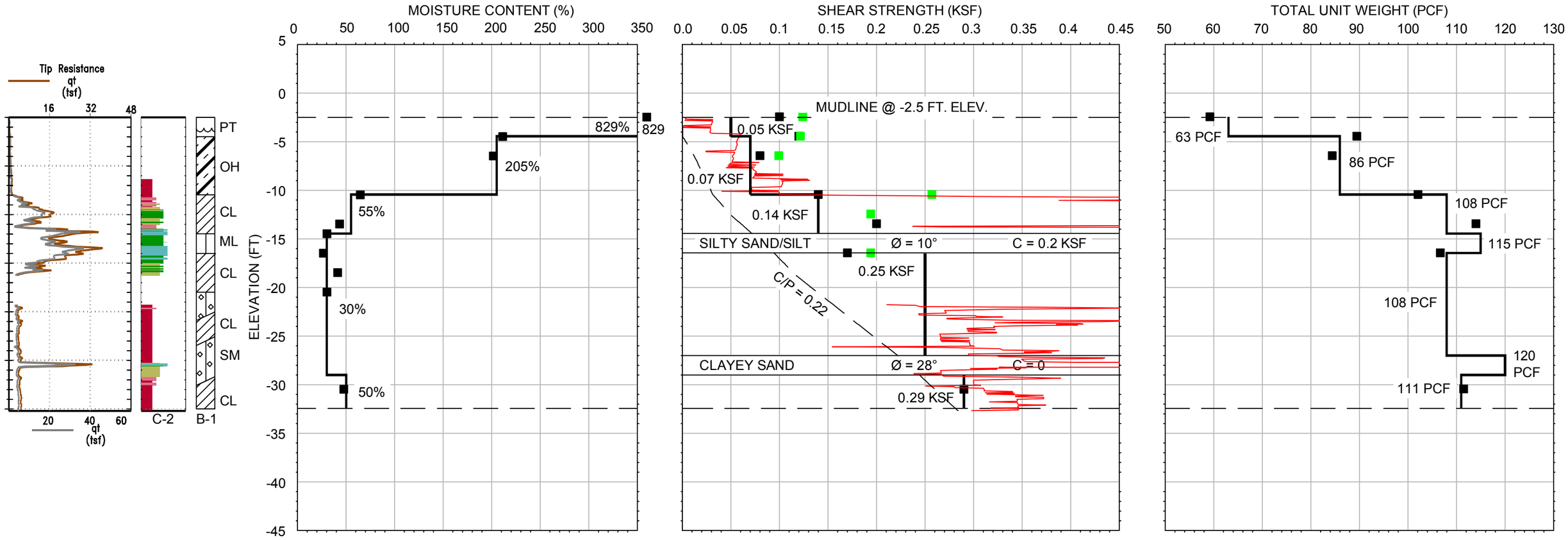
GeoEngineers

Figure 8

APPENDICES

GeoEngineers

APPENDIX A
Design Profiles



CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands

BORING LEGEND

- CL — SILTY CLAY
- PT — PEAT
- OH — ORGANIC CLAY
- ML — SILT
- SM — SILTY SAND

LEGEND

COMPRESSION TEST — MINIVANE TEST

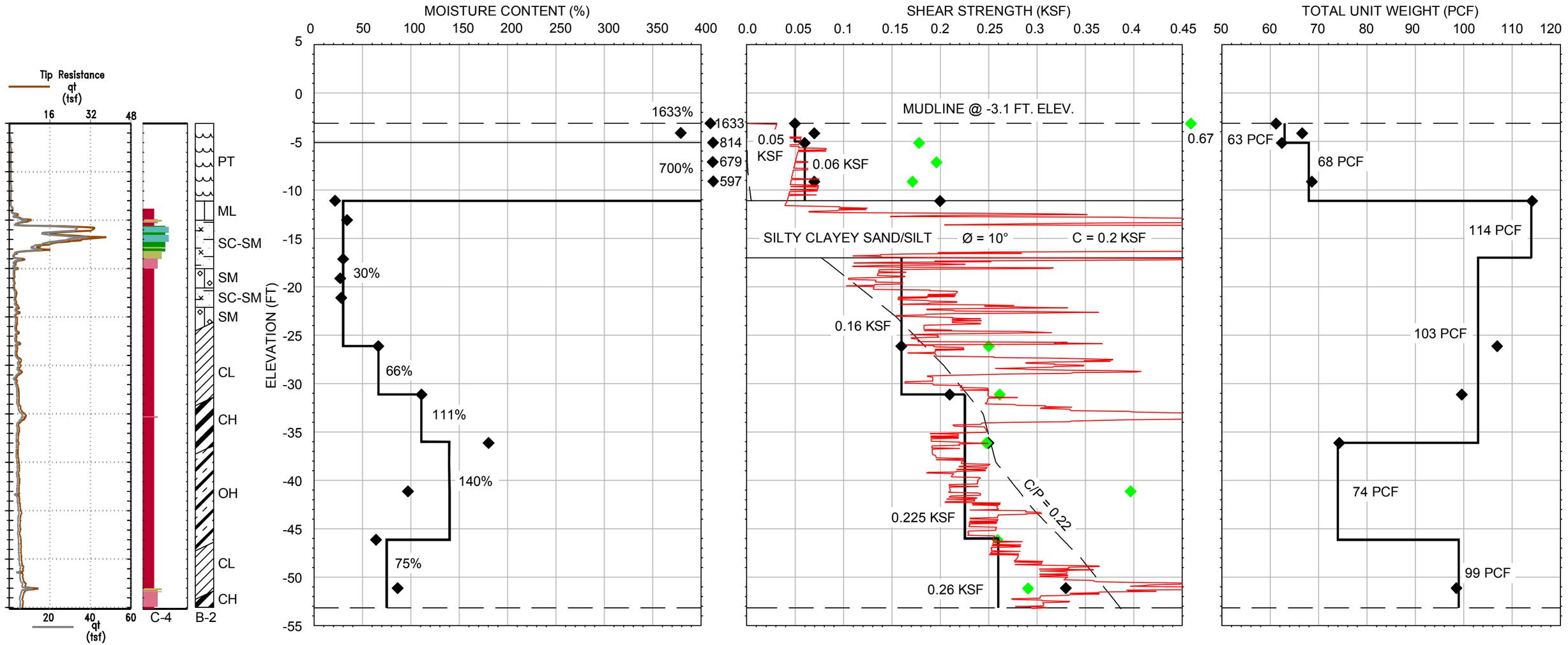
- B-1
- C-2
- DESIGN PROFILE

DESIGN PROFILE
B-1/C-2

Island Road Marsh Creation and
Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure A-1



CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands

BORING LEGEND

- CL — SILTY CLAY
- PT — PEAT
- OH — ORGANIC CLAY
- ML — SILT
- SM — SILTY SAND
- CH — CLAY
- SC-SM — SILTY CLAYEY SAND

LEGEND

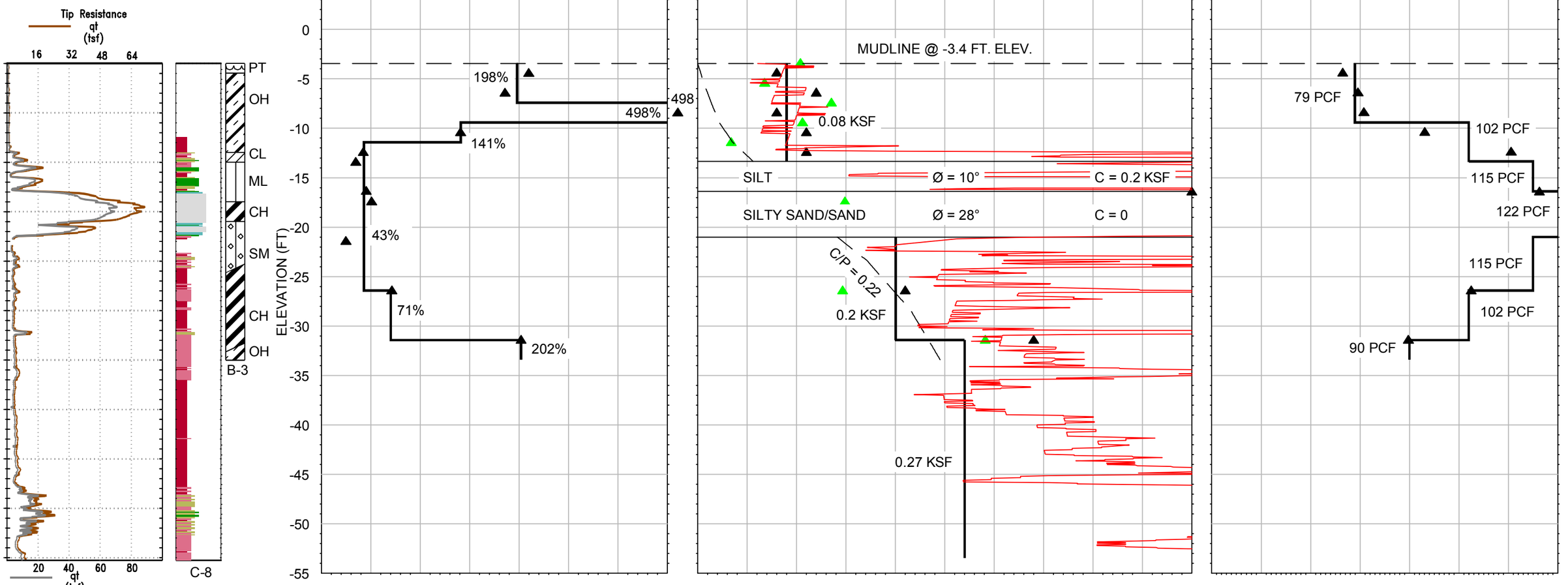
- COMPRESSION TEST
- MINIVANE TEST
- B-2
- C-4
- DESIGN PROFILE

DESIGN PROFILE
B-2/C-4

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure A-2



CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands

BORING LEGEND

- CL SILTY CLAY
- PT PEAT
- OH ORGANIC CLAY
- ML SILT
- SM SILTY SAND
- CH CLAY

LEGEND

COMPRESSION TEST ▲ MINIVANE TEST ▲

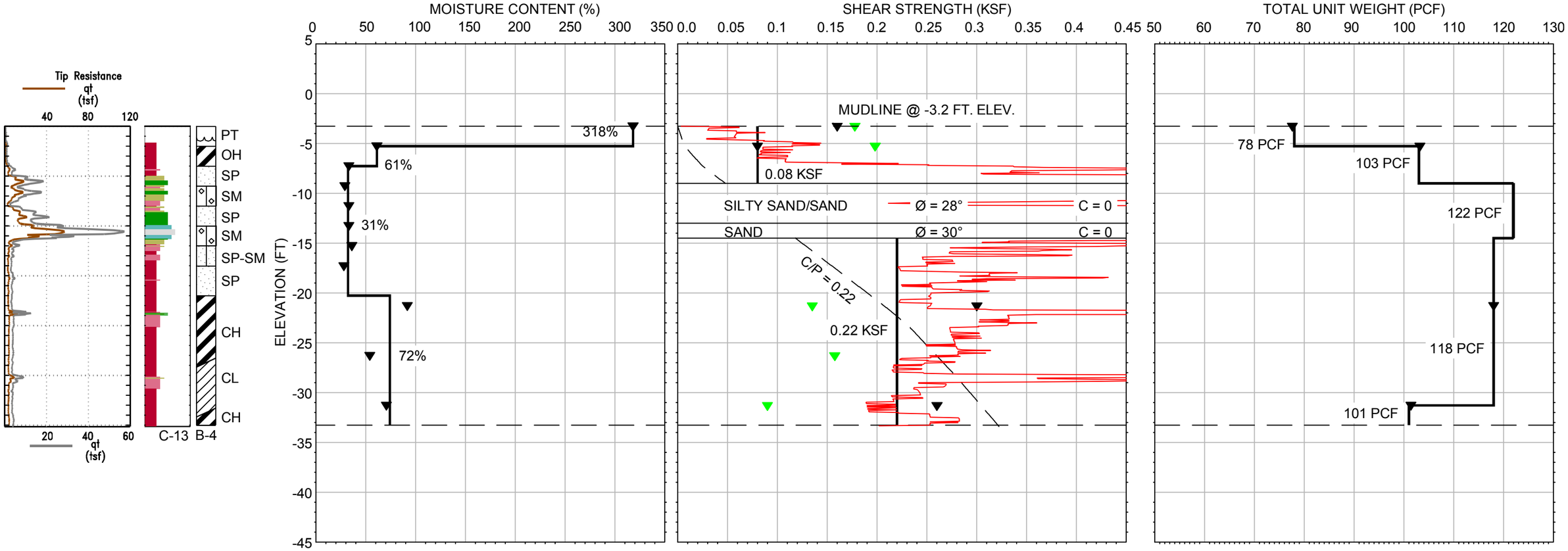
- B-3
- C-8
- DESIGN PROFILE

DESIGN PROFILE
B-3/C-8

LDNR-CPRA - Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure A-3



CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands

BORING LEGEND

- CL — SILTY CLAY
- PT — PEAT
- SP — SAND
- ML — SILT
- SM — SILTY SAND
- CH — CLAY
- SP-SM — SAND WITH SILT

LEGEND

COMPRESSION TEST ▼ MINIVANE TEST ▼

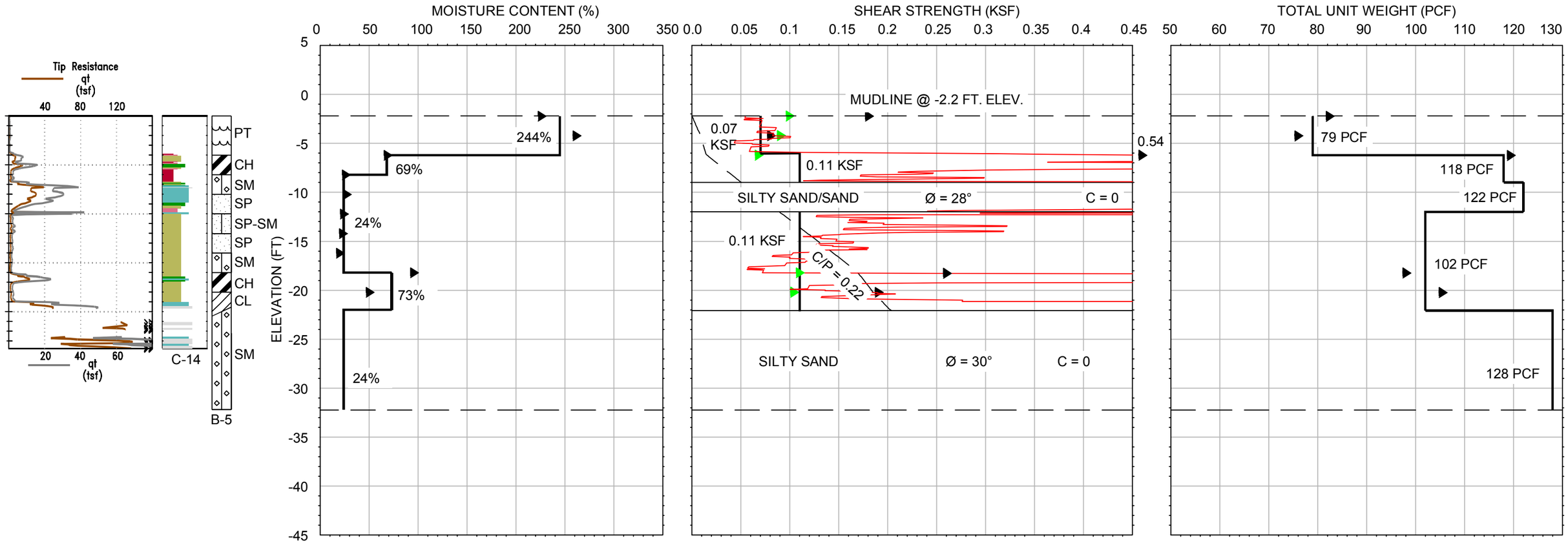
- B-4
- C-13
- DESIGN PROFILE

DESIGN PROFILE
B-4/C-13

LDNR-CPRA - Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure A-4



CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands
- 10 - Gravelly Sands to Sand
- 11 - Very Stiff Fine Grained (*)
- 12 - Sand to Clayey Sand (*)

BORING LEGEND

- CL — SILTY CLAY
- PT — PEAT
- SP — SAND
- ML — SILT
- SM — SILTY SAND
- CH — CLAY
- SP-SM — SAND WITH SILT

LEGEND

COMPRESSION TEST ▶ MINIVANE TEST ▶

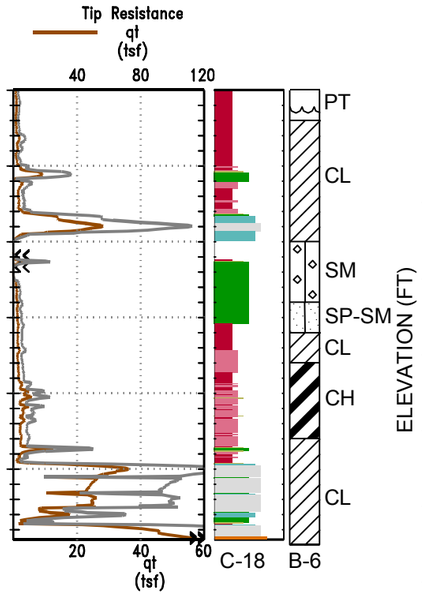
- B-5
- C-14
- DESIGN PROFILE

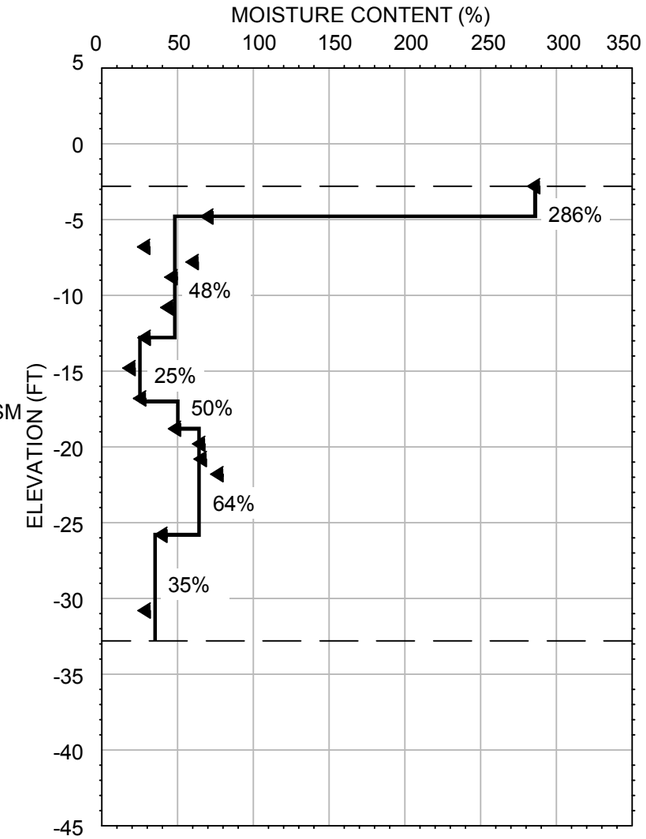
DESIGN PROFILE
B-5/C-14

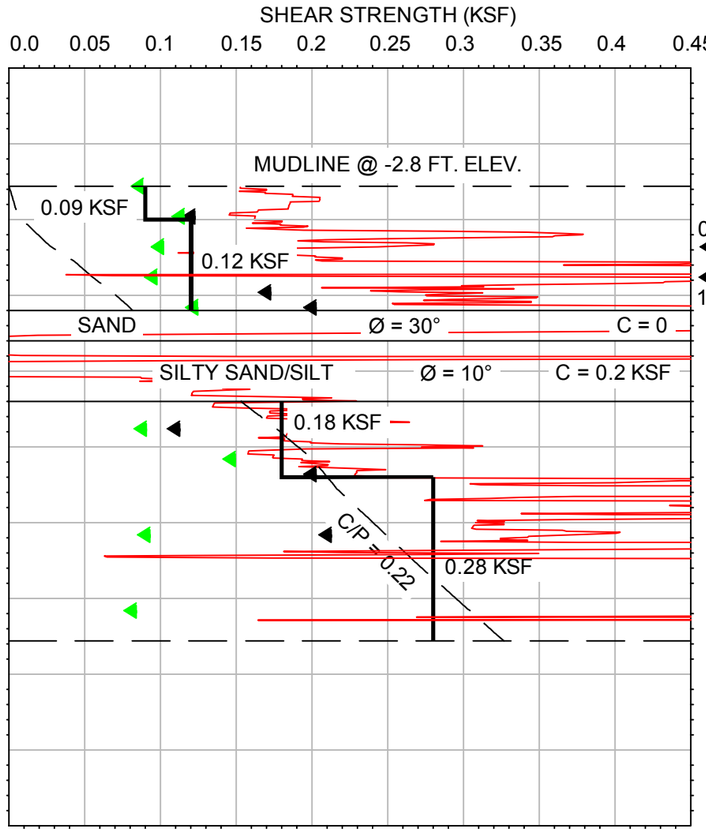
LDNR-CPRA - Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

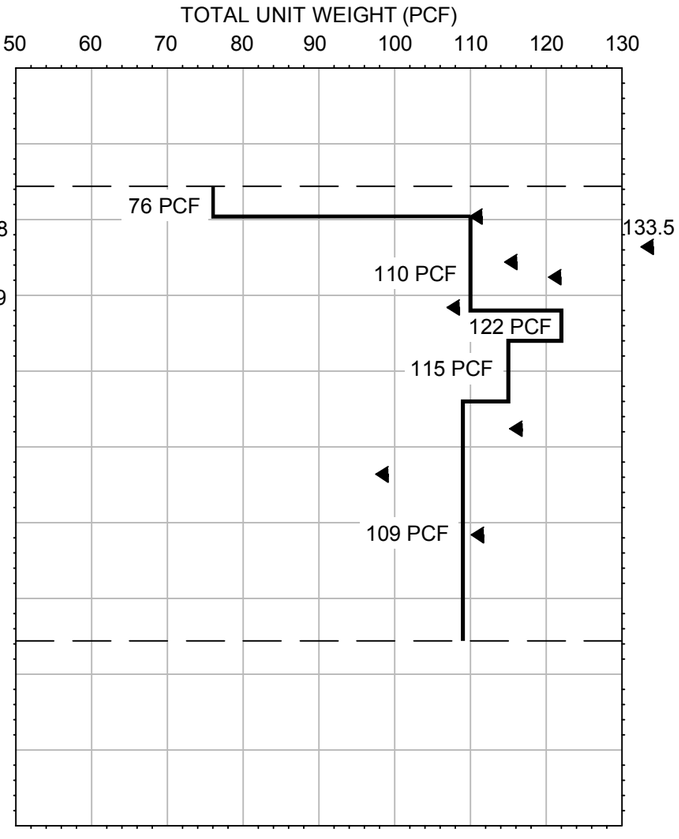
GeoEngineers

Figure A-5









CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands
- 10 - Gravelly Sands to Sand
- 11 - Very Stiff Fine Grained (*)
- 12 - Sand to Clayey Sand (*)

BORING LEGEND

- CL SILTY CLAY
- PT PEAT
- SP SAND
- ML SILT
- SM SILTY SAND
- CH CLAY
- SP-SM SAND WITH SILT

LEGEND

COMPRESSION TEST MINIVANE TEST

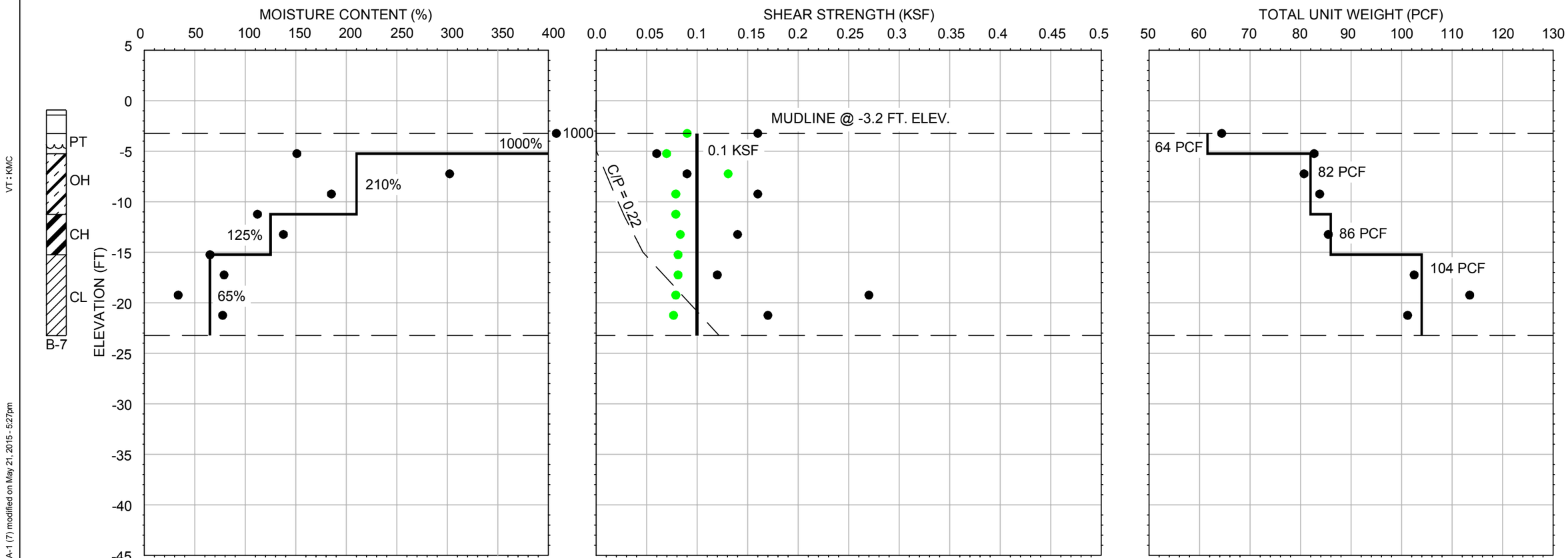
- B-6
- C-18
- DESIGN PROFILE

DESIGN PROFILE
B-6/C-18

LDNR-CPRA - Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure A-6



LEGEND

COMPRESSION TEST MINIVANE TEST

B-7

DESIGN PROFILE

DESIGN PROFILE
B-7

Island Road Marsh Creation and
Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure A-7

VT : KMC

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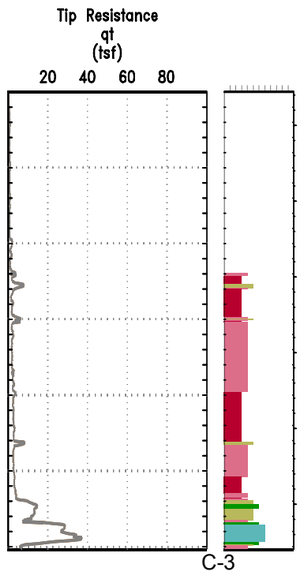
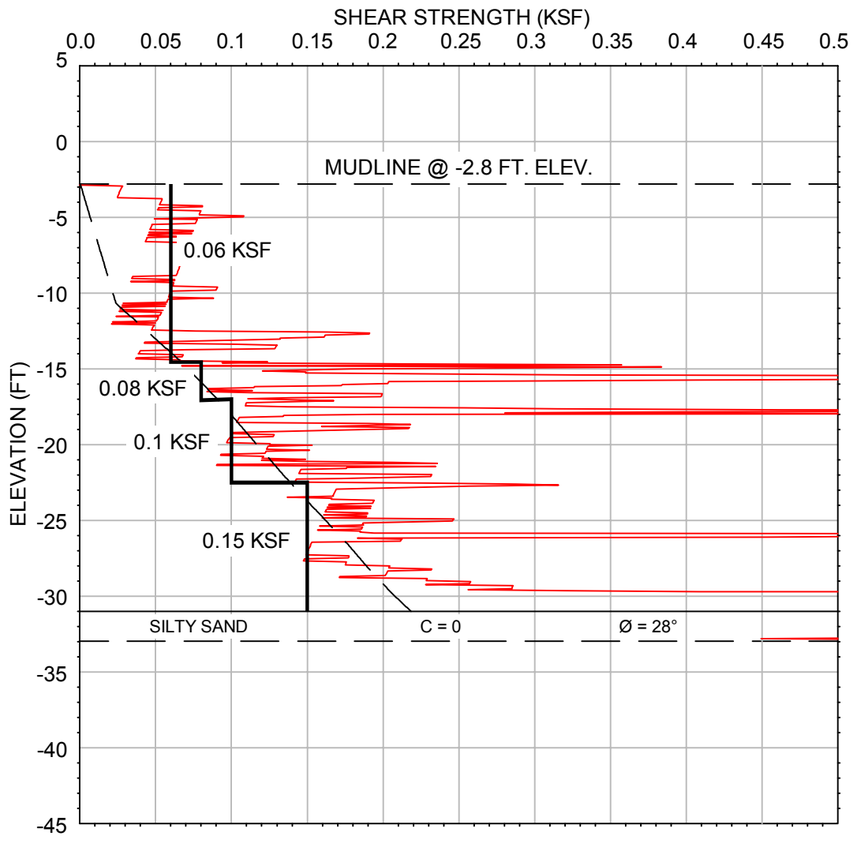
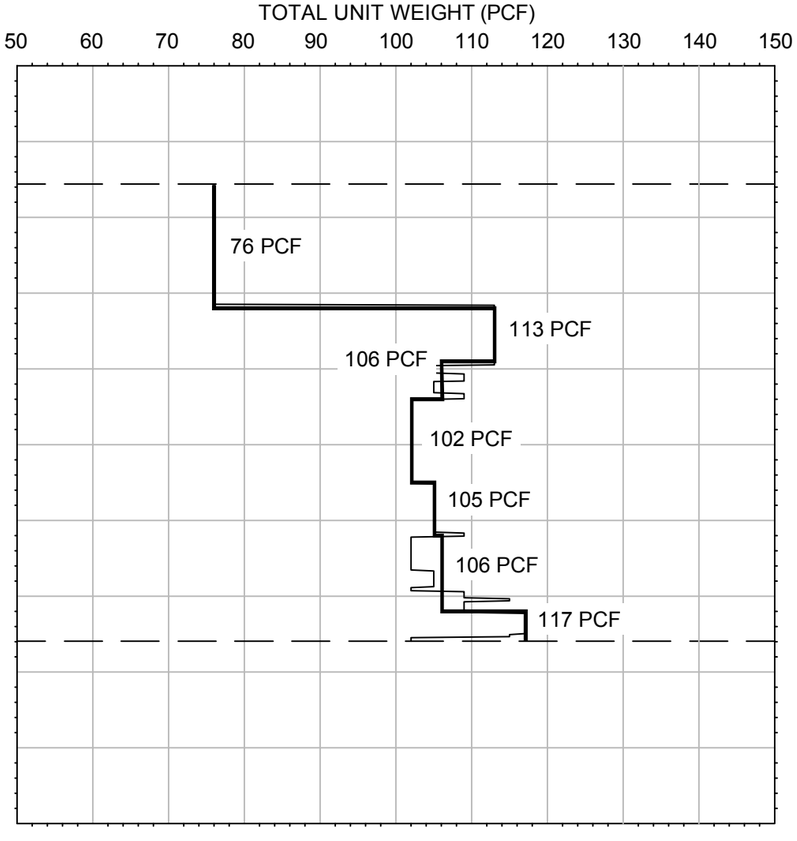






CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands

LEGEND

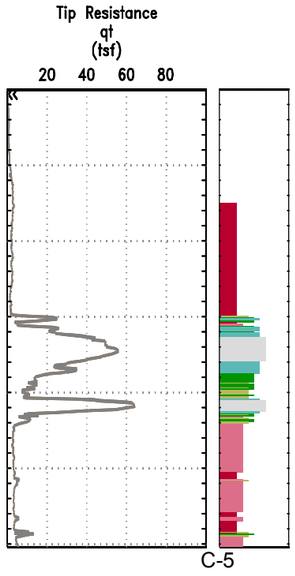
- C-3
- DESIGN PROFILE

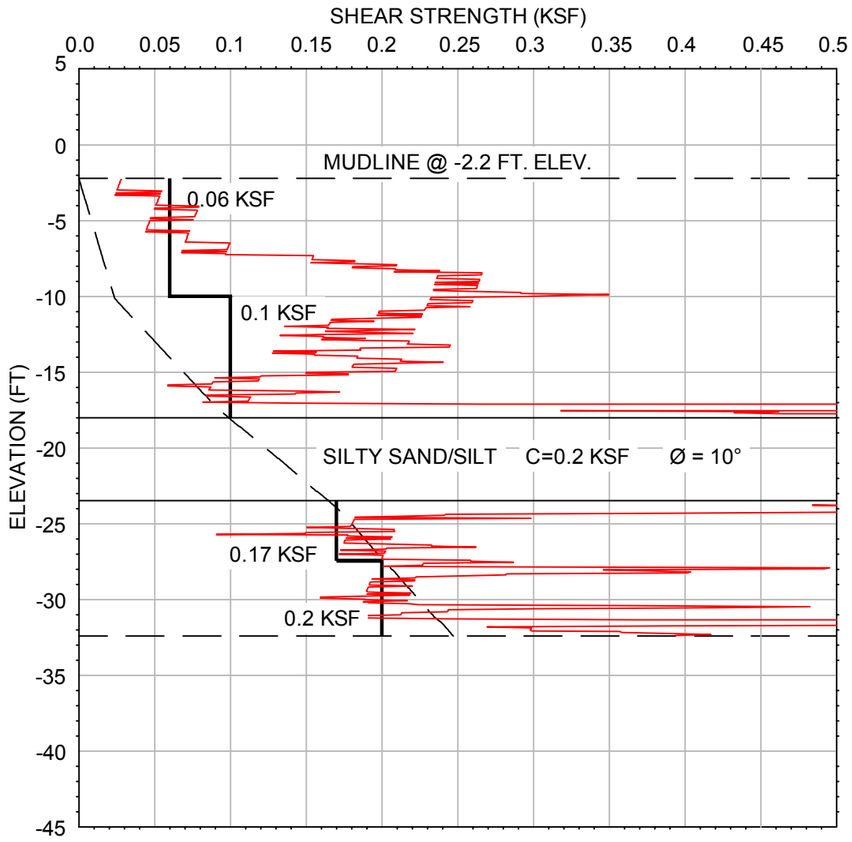
DESIGN PROFILE
C-3

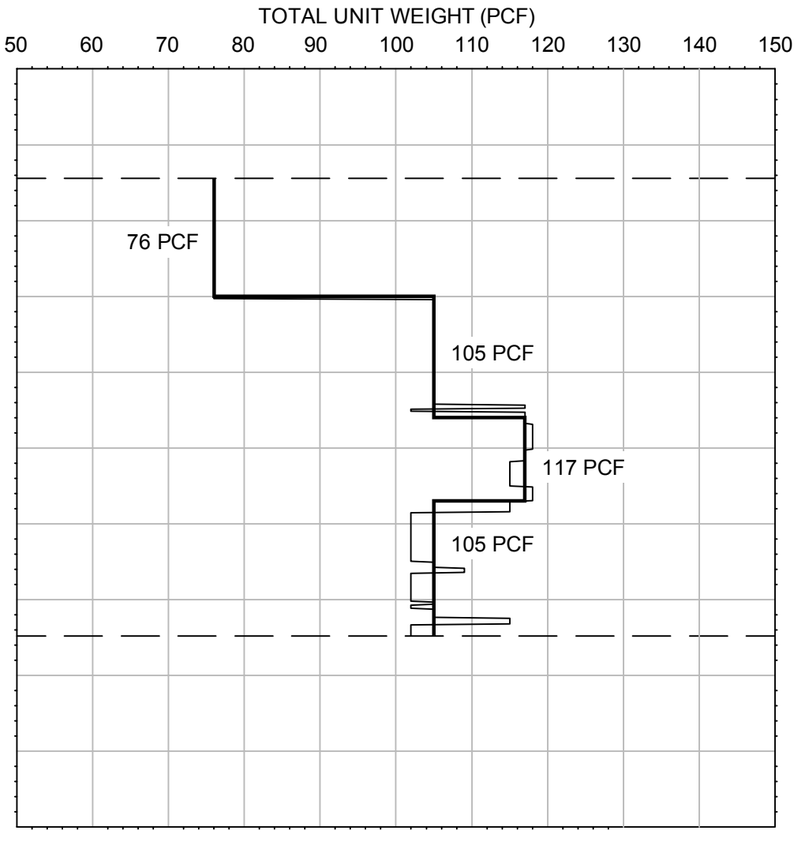
Island Road Marsh Creation and
Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure A-8







CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands

LEGEND

- C-5
- DESIGN PROFILE

DESIGN PROFILE
C-5
Island Road Marsh Creation and
Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure A-9

VT : KMC

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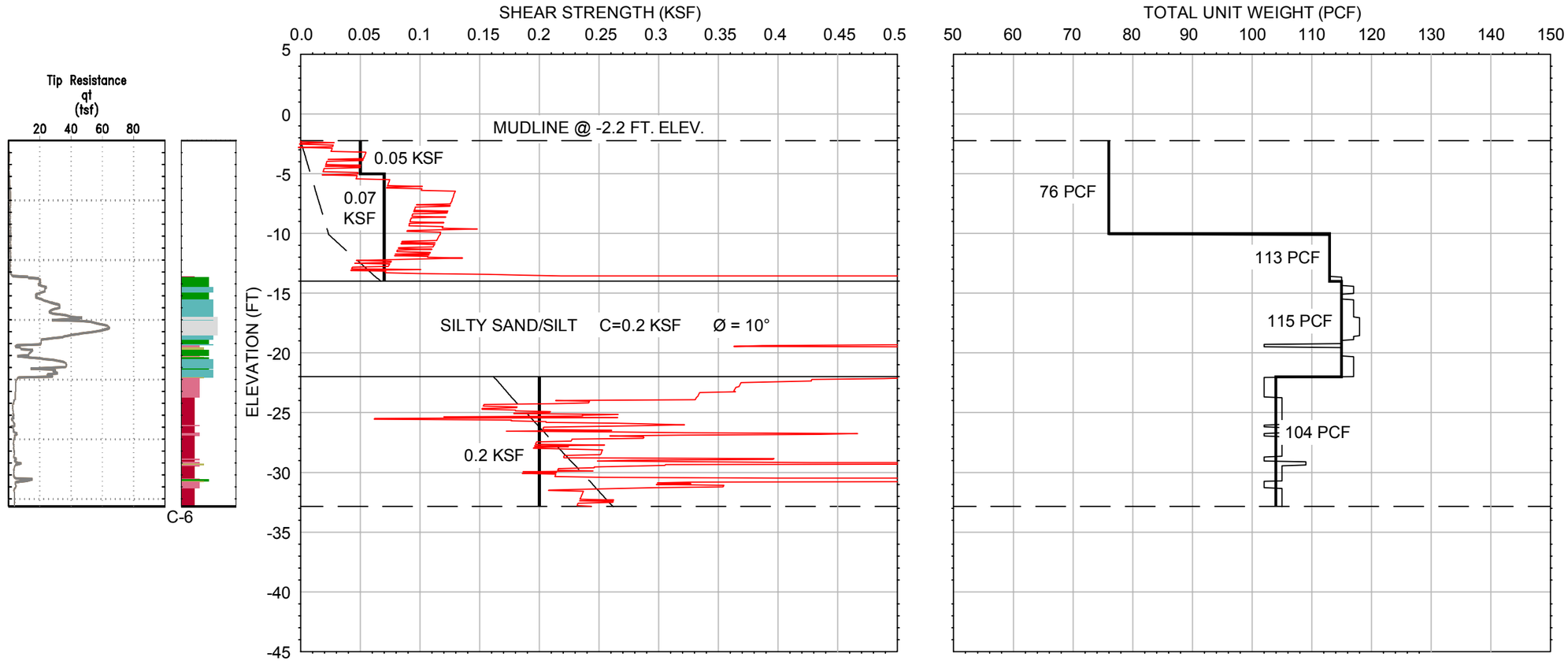


CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands

LEGEND

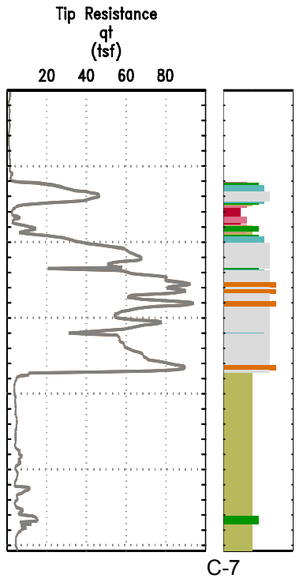
- C-6
- DESIGN PROFILE

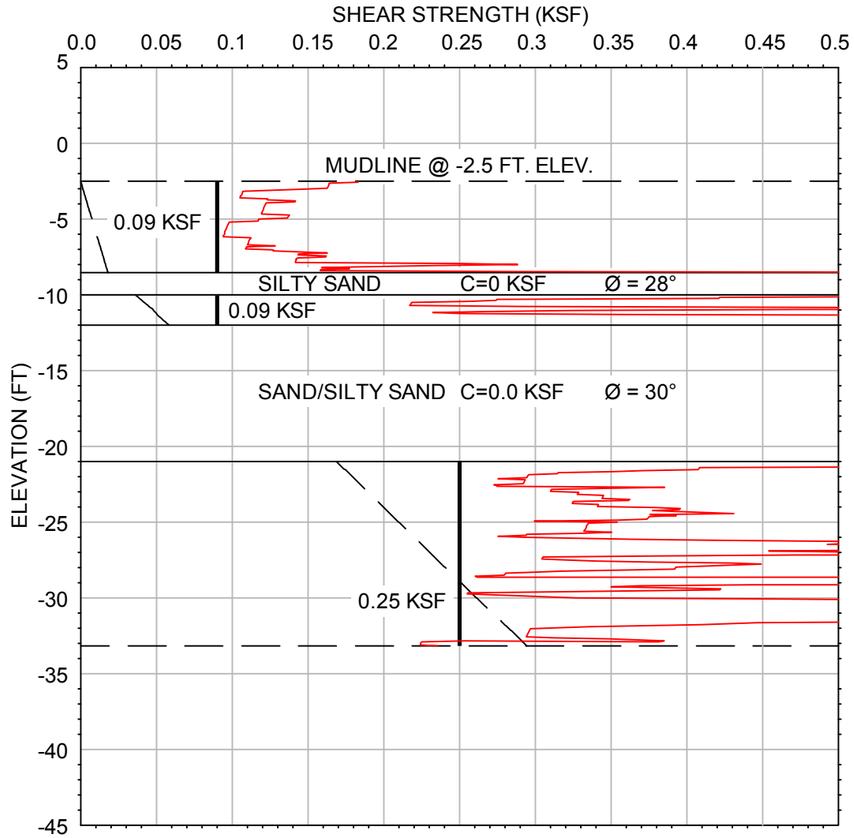
DESIGN PROFILE
C-6

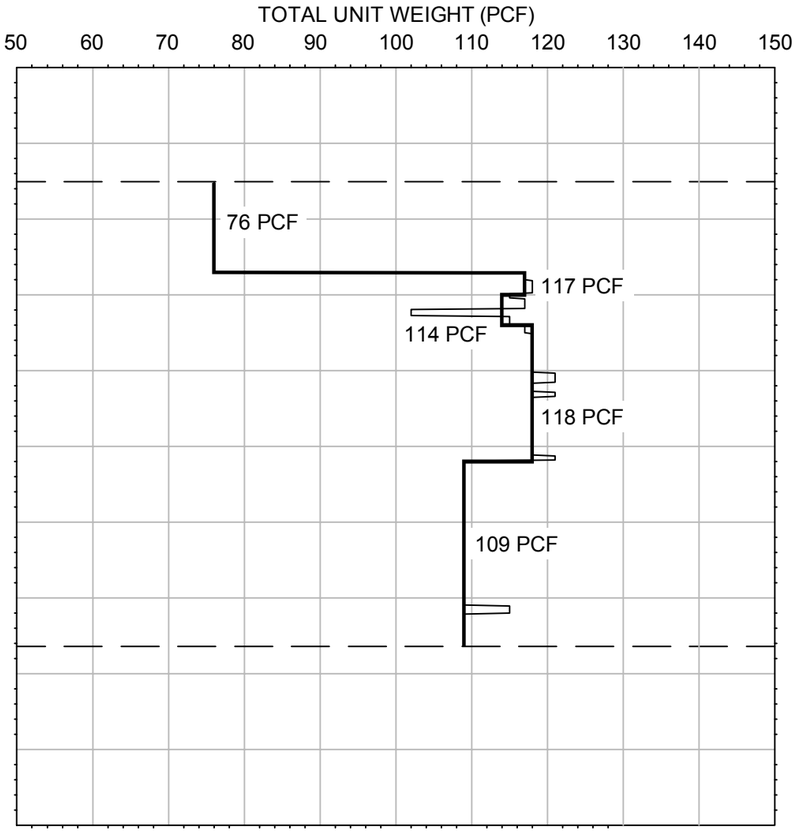
Island Road Marsh Creation and
Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure A-10







CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands

LEGEND

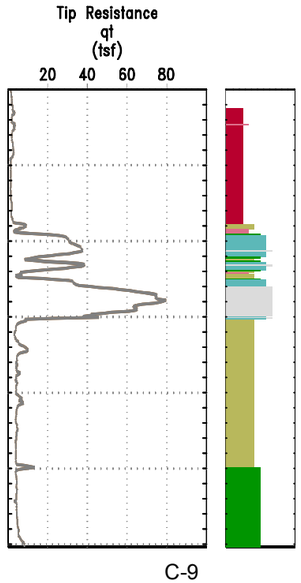
- C-7
- DESIGN PROFILE

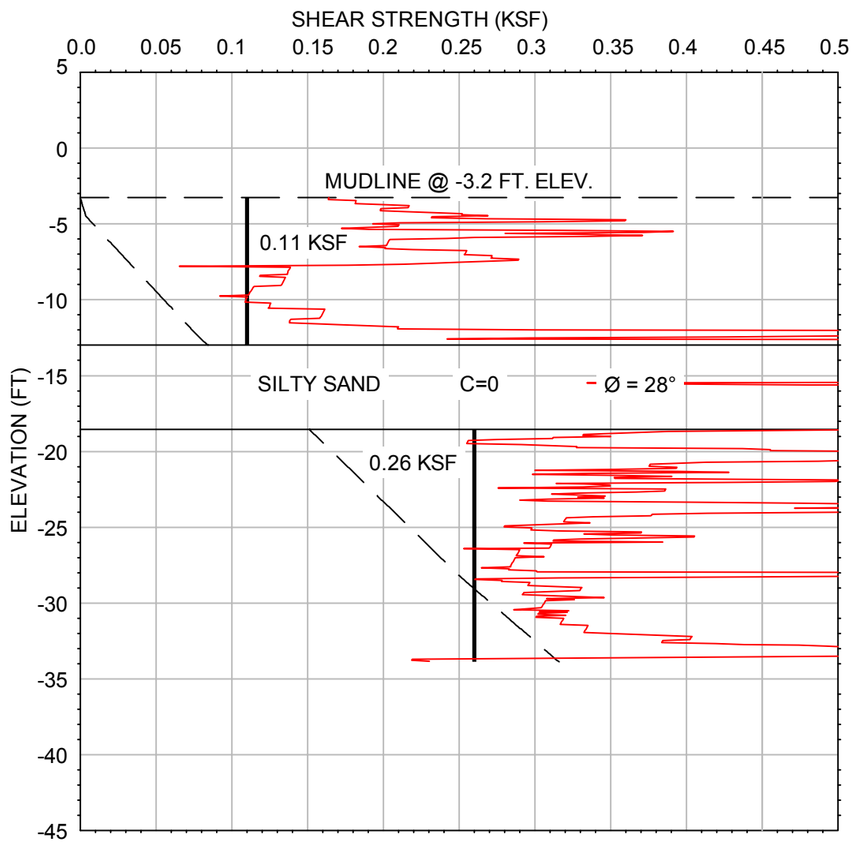
DESIGN PROFILE
C-7

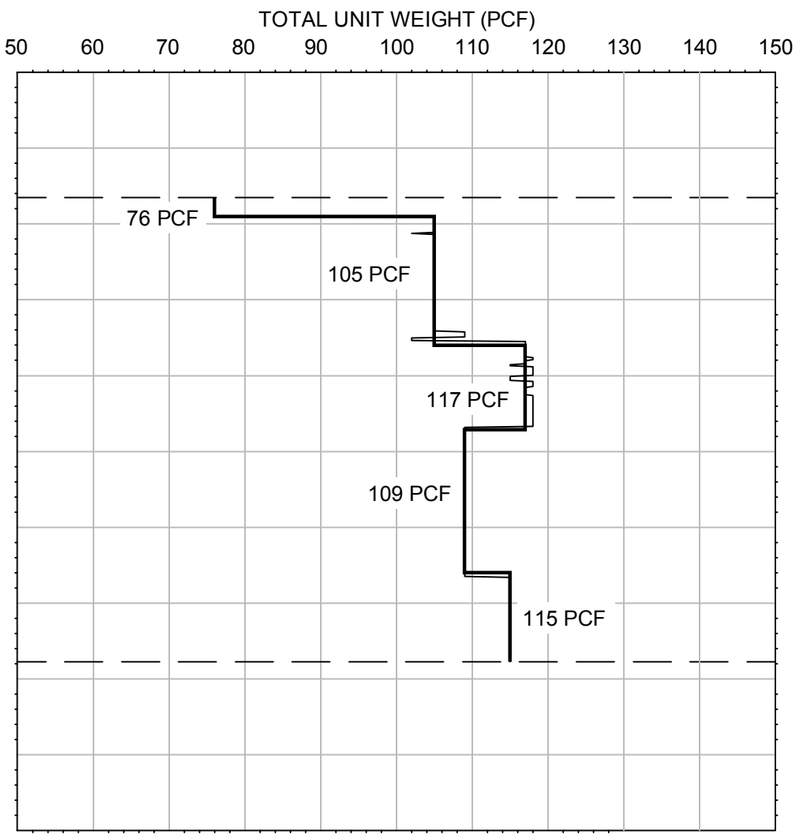
Island Road Marsh Creation and
Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure A-11







CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands

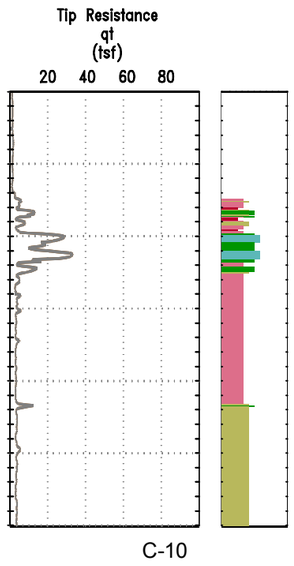
LEGEND

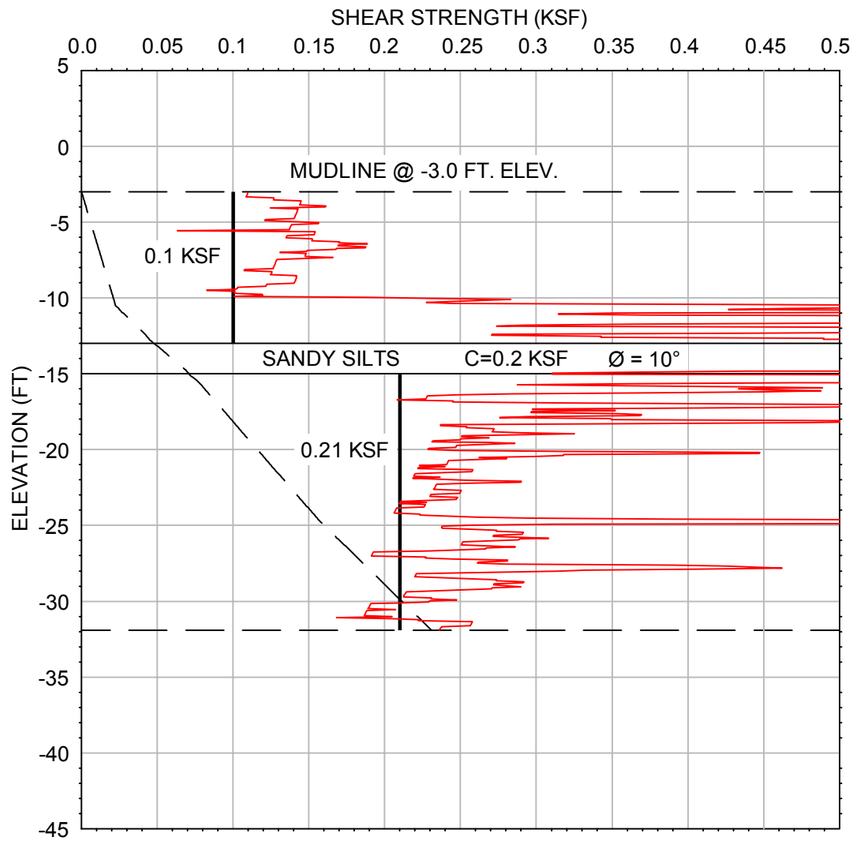
- C-9
- DESIGN PROFILE

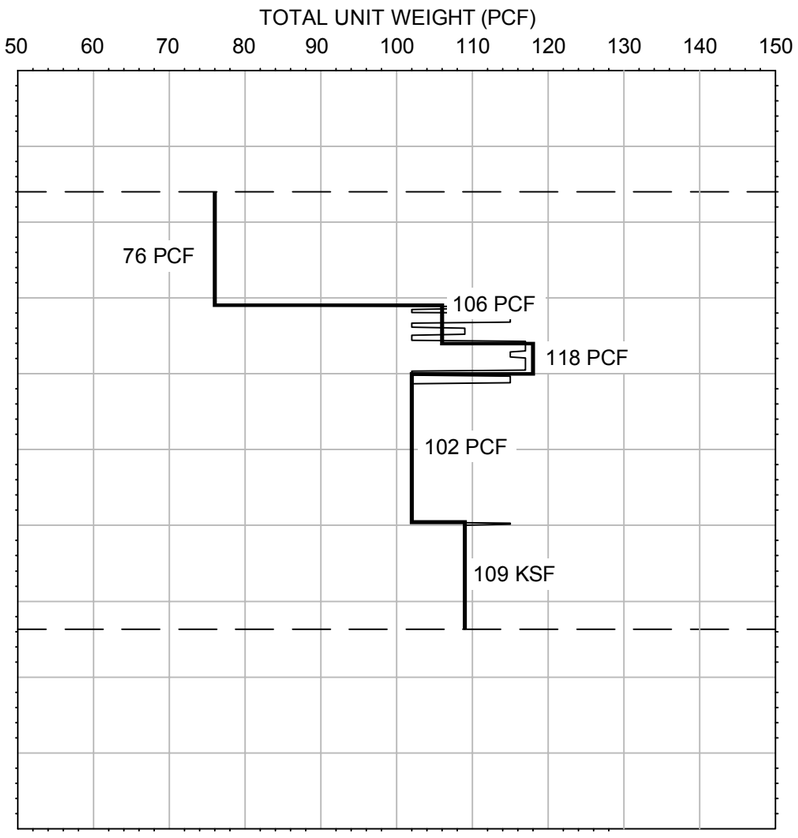
DESIGN PROFILE
C-9
Island Road Marsh Creation and
Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure A-12







CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
- 2 - Organic Soils, Peats
- 3 - Clay
- 4 - Clays & Silty Clays
- 5 - Clayey Silt & Silty Clays
- 6 - Sandy Silts & Clayey Silts
- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands

LEGEND

- C-10
- DESIGN PROFILE

DESIGN PROFILE
C-10

Island Road Marsh Creation and
Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure A-13

VT : KMC

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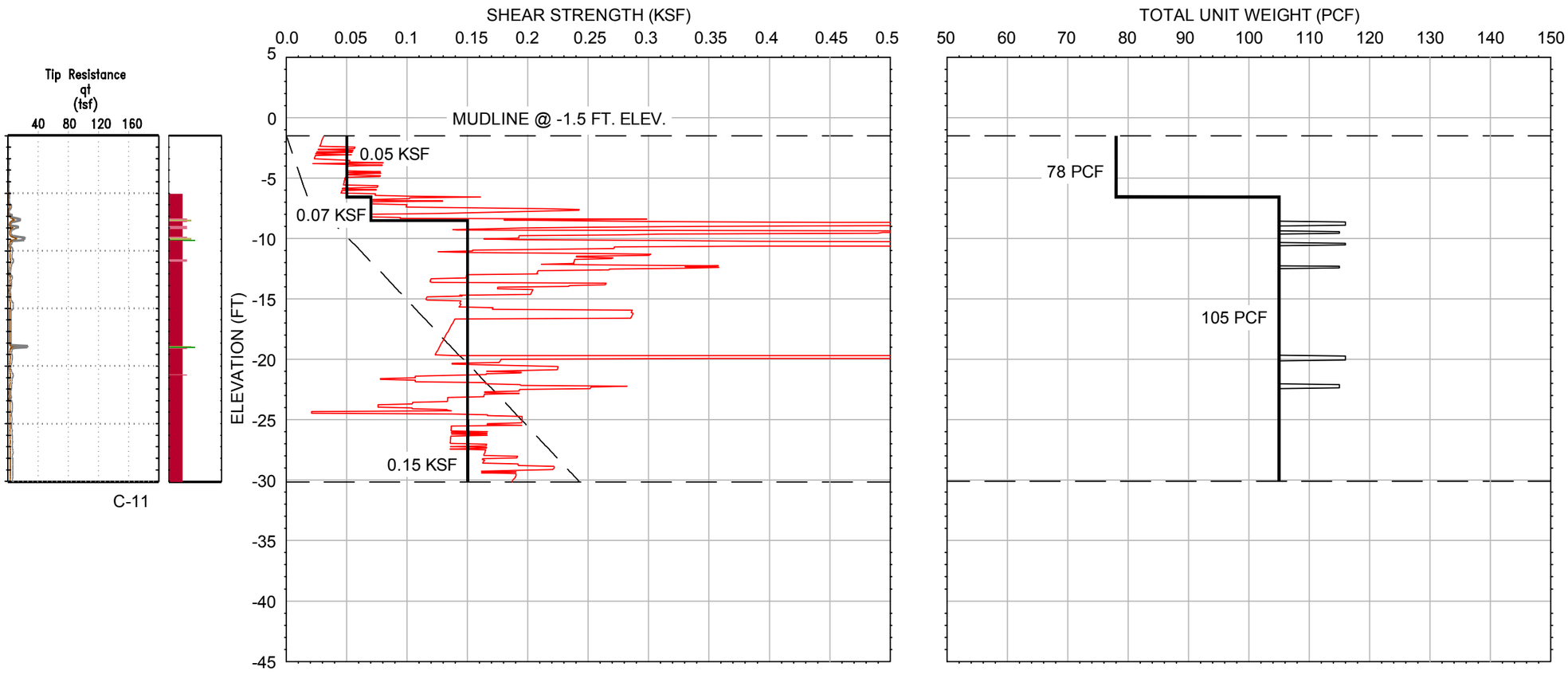

CPT LEGEND

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- 8 - Sands & Silty Sands
- 9 - Sands

LEGEND

- C-11
- DESIGN PROFILE

DESIGN PROFILE
C-11

Island Road Marsh Creation and
Nourishment (TE-117)
Terrebonne Parish, Louisiana

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Figure A-14

VT : KMC

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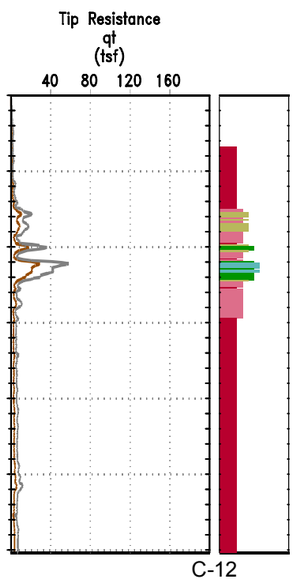

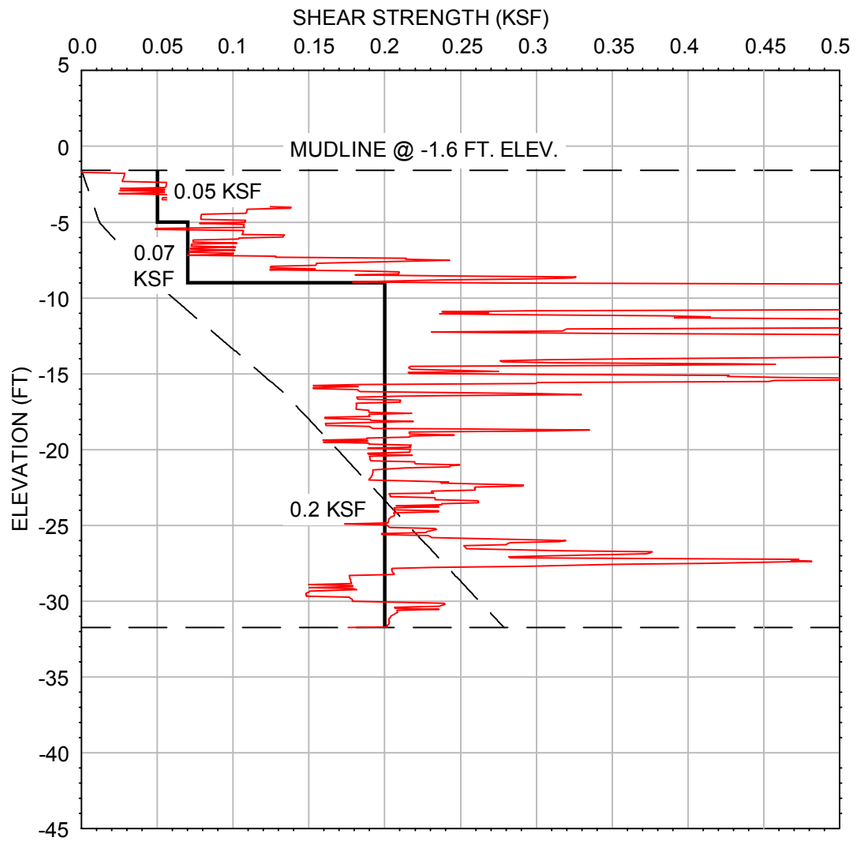

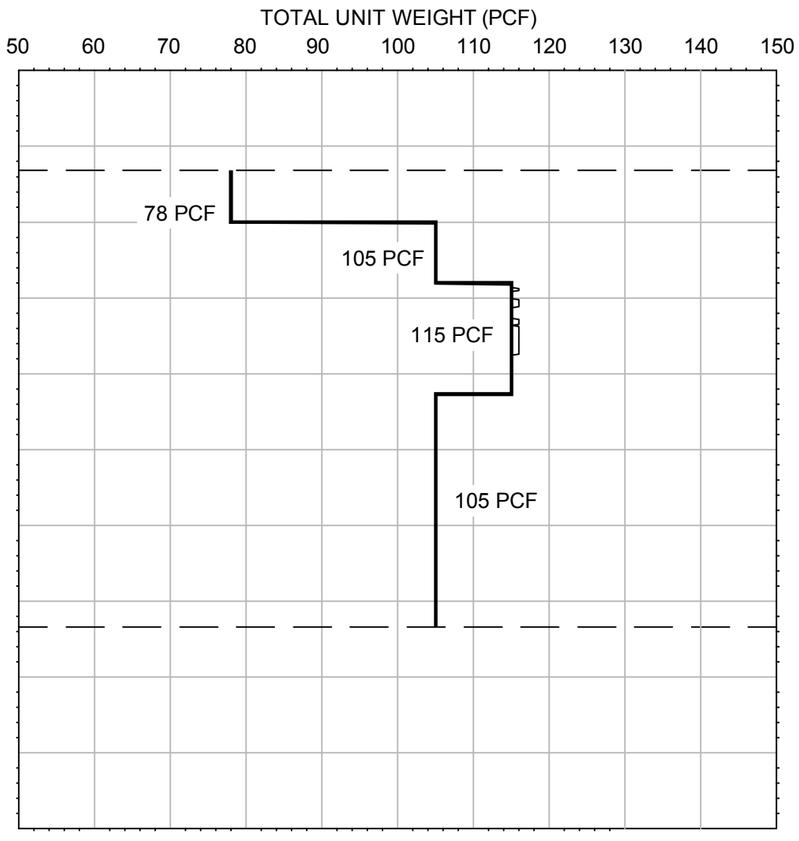

CPT LEGEND

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LEGEND

- C-12
- DESIGN PROFILE

DESIGN PROFILE
C-12

Island Road Marsh Creation and
Nourishment (TE-117)
Terrebonne Parish, Louisiana

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Figure A-15

VT : KMC

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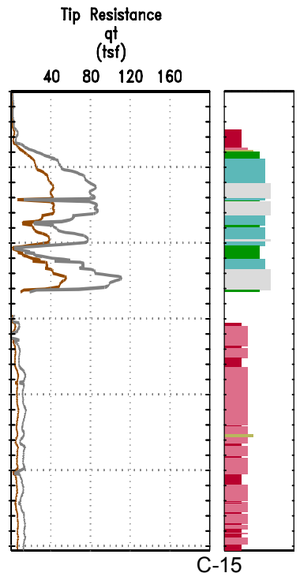

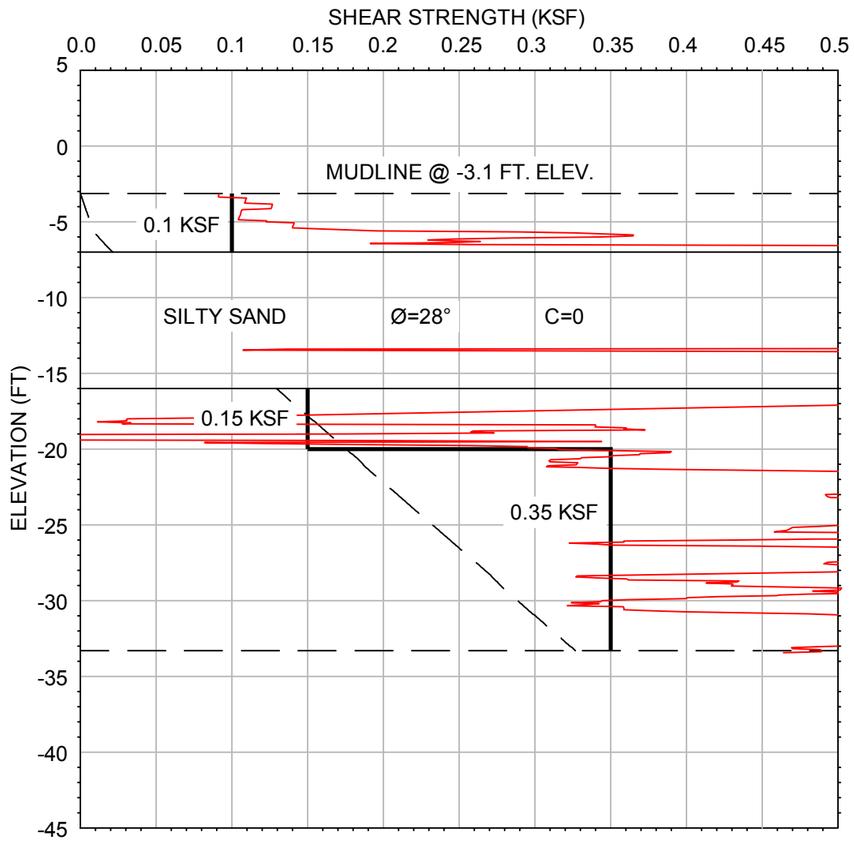

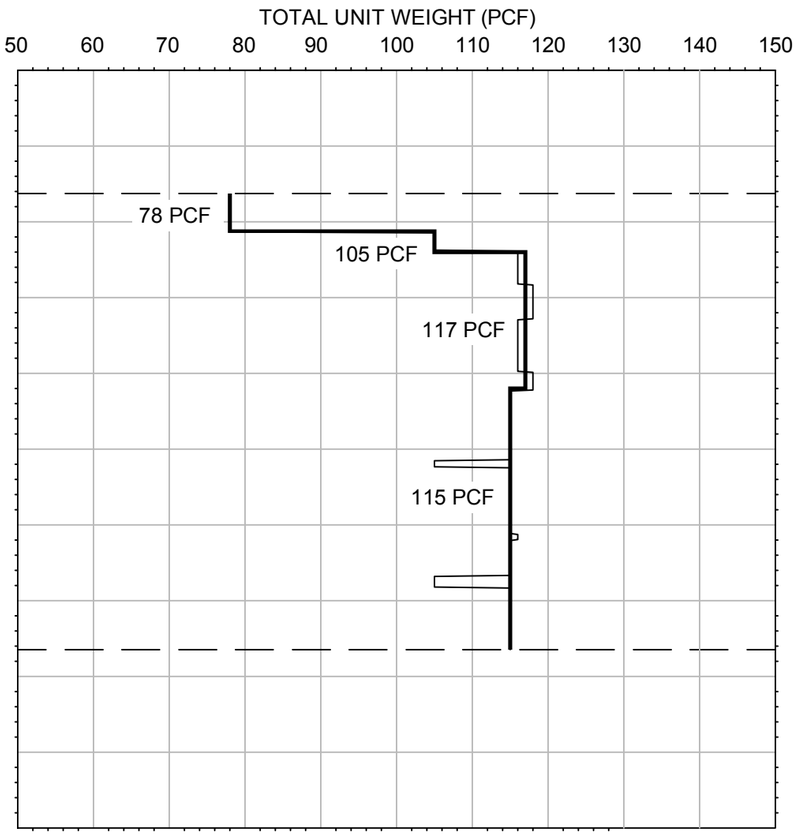

CPT LEGEND

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LEGEND

- C-15
- DESIGN PROFILE

DESIGN PROFILE
C-15
Island Road Marsh Creation and
Nourishment (TE-117)
Terrebonne Parish, Louisiana

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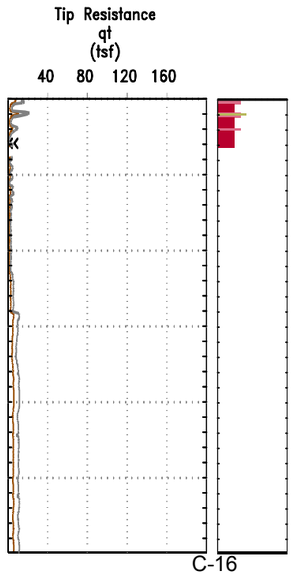
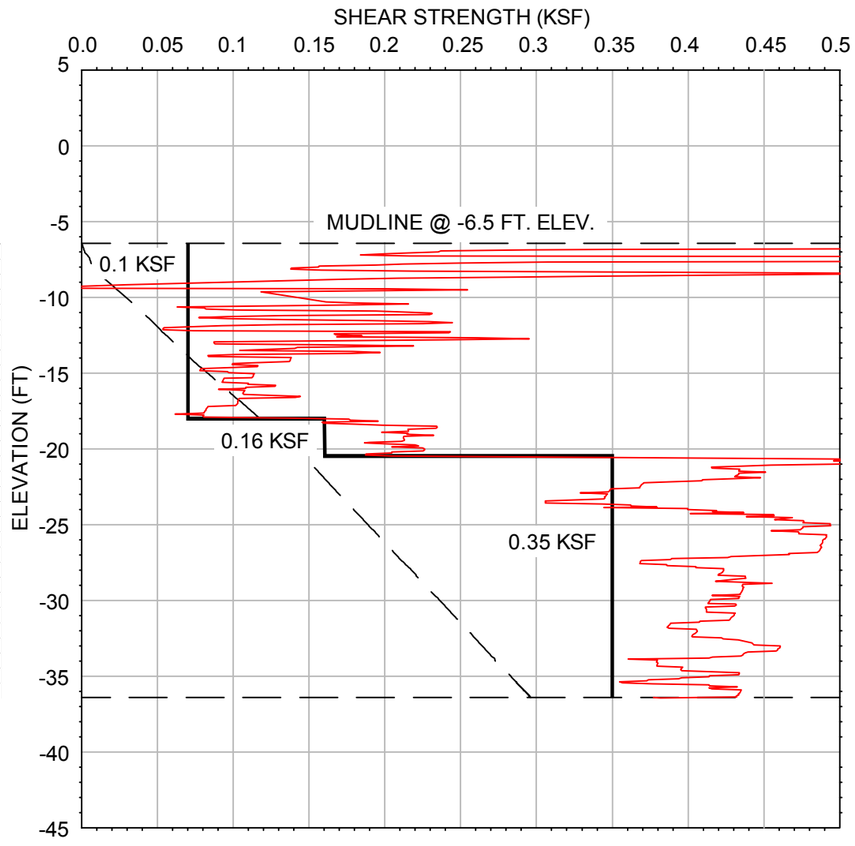
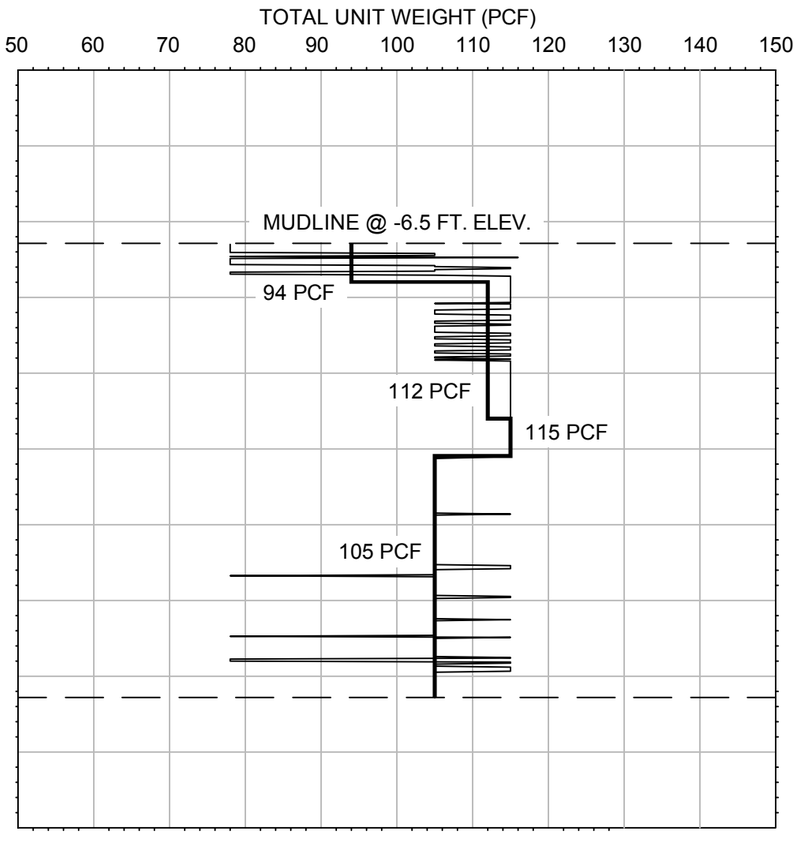
Figure A-16







CPT LEGEND

- 1 - Sensitive, Fine Grained Soils
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- 7 - Silty Sands & Sandy Silts
- 8 - Sands & Silty Sands
- 9 - Sands

LEGEND

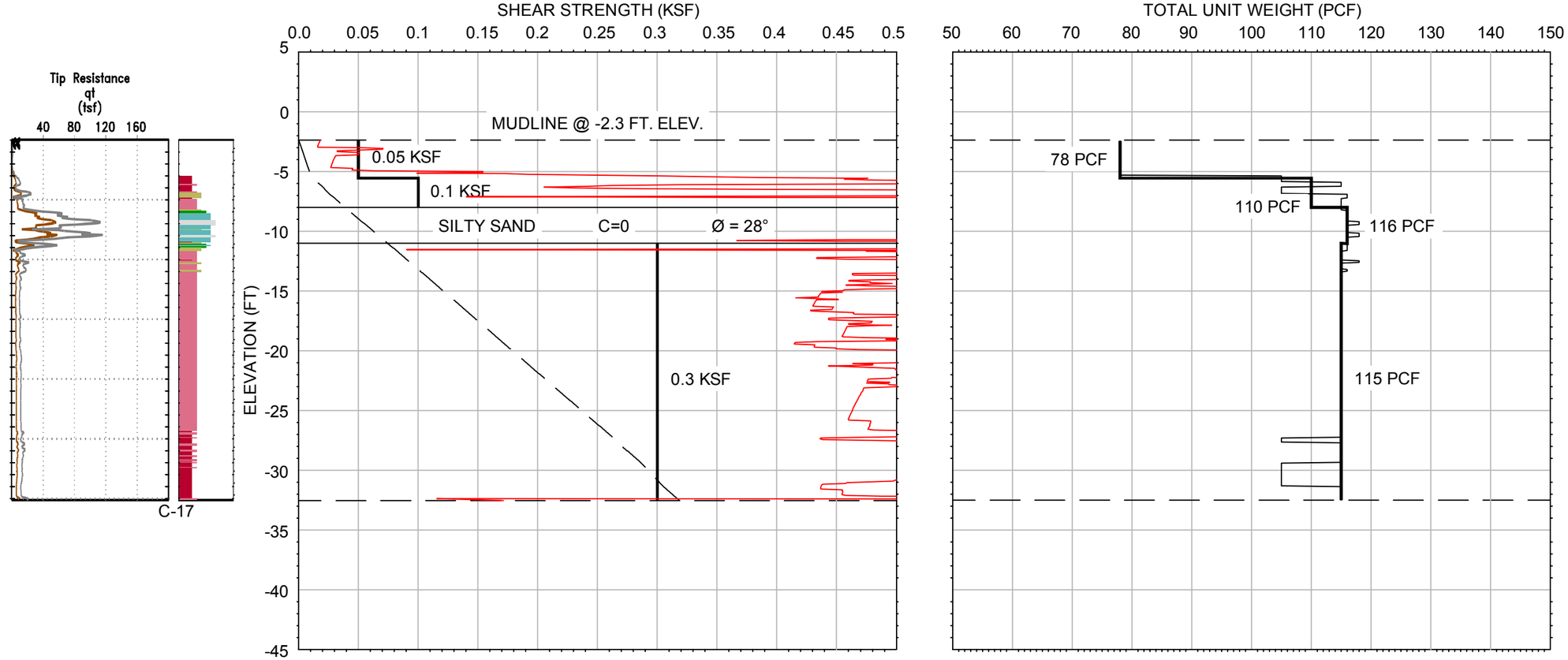
- C-16
- DESIGN PROFILE

DESIGN PROFILE
C-16

Island Road Marsh Creation and
Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure A-17



CPT LEGEND

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- 7 - Silty Sands & Sandy Silts
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- 9 - Sands

LEGEND

- C-17
- DESIGN PROFILE

DESIGN PROFILE
C-17

Island Road Marsh Creation and
Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure A-18

VT : KMC

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APPENDIX B
Slope Stability and Bearing Capacity

Calculation Checksheet

Project No. 16715-040-00 Project Title: Island Road Marsh Creation and Nourishment (TE-117)

Deliverable Title: Earthen Containment Dike Slope Stability

Calculations Description: Stability of the containment dikes were computed using Spencer's method and the computer program SLOPE/W by GeoSlope International, Inc. Stable geometries were established based on containment dikes constructed with in-situ soils with strength parameters similar to those of the upper soils found in the borrow area.

Originator: VT/ECK Checked by: ECK/VT Date: 05/20/2015

Checking method (describe): Checked the input parameters for each stability run and optimized the search for critical slip surface.

Comments:

Slope Stability Calculation Approach for the Earthen Containment Dike
Island Road Marsh Creation and Nourishment (TE-117)

- Design profiles were used for soil parameters.
- All elevations are referenced to the North American Vertical Datum of 1988 (NAVD88), Geoid 12A.
- Based on information provided by CPRA in the Scope of Services for In-shore Geotechnical Investigations dated July 2014 and subsequent communications about the project.
    - Used design water elevation of 0.0 feet, NAVD 88 Geoid 12A, mean high water (MHW) level of El. +1.9 feet, and mean low water (MLW) of El. +0.6 feet.
    - Used surveyed mudline elevation at each exploration for bottom elevation of the fill.
- Factor of safety for containment dike stability of 1.3 was desired with 1.2 as a minimum.
- Performed stability analyses for the earthen containment dike using the computer program SLOPE/W (2012 version), developed by GEO-SLOPE International Ltd. SLOPE/W is a software product that computes factors of safety against potential failure based on limit equilibrium theory to evaluate the stability of earth slopes. The factor of safety for the containment dike for various slopes was analyzed using the Spencer method. The Spencer method considers both shear and normal interslice forces. The method involves a circular search and takes into account both moment and force equilibrium. The critical failure surface obtained from using Spencer method is then optimized in Slope/W where the program uses statistical random walk procedure based on the Monte Carlo method.
- The stability for the earthen containment dike was initially evaluated for three conditions with design water elevation of 0.0 feet; Condition 1 - failure surface from dike to excavation with and without equipment load (whichever is the lowest); Condition 2 – failure surface from dike to marsh without equipment load and; Condition 3- failure surface from marsh to excavation with equipment load. The equipment load is to account for the load from a marsh buggy excavator that is assumed to be used to construct the containment dike.
- Based on review comments from CPRA, two additional slope stability analyses were run for all exploration locations except C-16. The additional analyses include 1) the global stability with high water conditions on the exterior side of the dike and low water conditions on the interior side and 2) the global stability with low water conditions on the exterior side of the dike and with marsh fill on the interior side. MHW (El +1.9 feet) and MLW (El +0.6 feet) levels were provided by CPRA for the additional analyses. The marsh fill was assumed to have a unit weight of 100 pcf and a shear strength of 60 psf. As the slope stability runs evaluated with a design water elevation of 0.0 feet yield conservative results as compared to El. +0.6 feet, CPRA requested to leave the initial runs as they are.

Given the distance between the field explorations performed for the project, variation of soil profile between the field explorations must be expected. The values for unit weight and shear strength for the containment dikes are dependent on the installation methods and can vary significantly depending on the amount of disturbance the soil undergoes during construction. Based on the design profiles developed for the project, a shear strength and unit weight combination of 60 psf and 80 pcf, respectively was assumed to determine the stability of the containment dikes.

Evaluation/Results

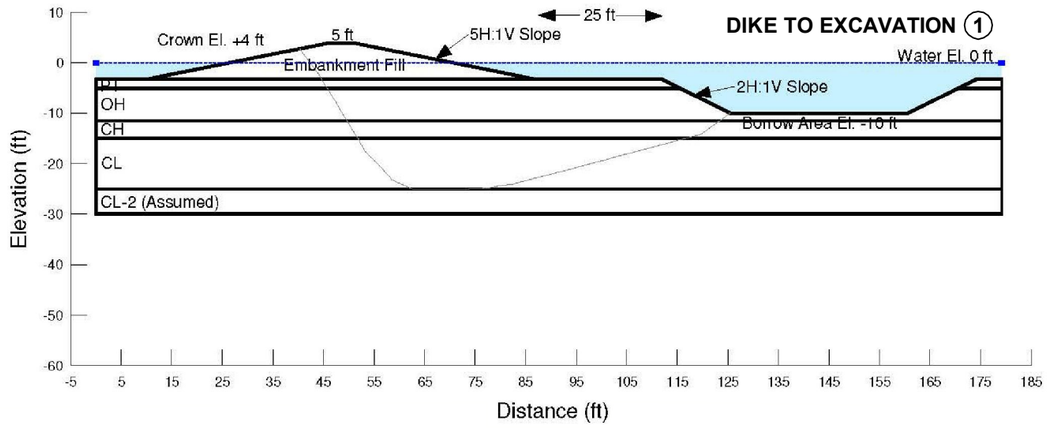
Initial slope stability analyses was performed for a containment dike with crown elevation +4 feet, crown width 5 feet, dike side slopes 5H:1V, minimum width of bench between toe of the dike and the top of excavation of 25 feet and the channel bottom elevation of -10 feet. The dike bench was limited to 25 feet to help keep the movement of the marsh buggy to a minimum. However, results indicated that in several locations the factor of safety for operating equipment on the bench is less than 1.2 indicating that the slopes of the borrow channel are prone to failure during construction of the containment dikes. The bench width could be increased to 30 feet to increase the slope stability factor of safety or the channel bottom elevation should be raised. Due to very soft soil in the upper 10 to 15 feet, any construction activity on bench will disturb the soil on the bench thus reducing the passive wedge supporting the containment dike. This will induce a dike failure and will make it hard to construct the containment dikes. Hence, evaluations were made to check for minimum required bench width for constructing the dikes from a barge in the borrow channel. Results indicate a 10 feet minimum bench should provide the required factor of safety when no load is applied on the bench.

In places where slope stability factor of safety was less than 1.2 for the containment dike, analyses was performed by reducing the crown elevation. In Cell A, the crown elevation for stability factor of safety greater than 1.2 varied from El. +2.5 to +4 feet. In Cells B and C, the maximum crown elevation was +3 feet for a stable containment dike. In Cell D, the containment dikes could be constructed to elevation +4 feet. In Cell E, the maximum crown elevation for a stable dike varied from El. +3 feet to El. +4 feet.

If containment dike is required to be constructed to higher elevation than that indicated by the slope stability analyses results, we recommend a staged construction approach or use geotextile reinforcement. When geotextile reinforcement with a minimum tensile strength at 5% strain of 250 pounds per inch or more is used, the dikes can be constructed to an elevation of +4 feet in single lift. However, settlement of the containment dikes will need to be considered.

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 64 pcf Cohesion': 100 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 82 pcf Cohesion': 100 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 86 pcf Cohesion': 100 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 100 psf Phi': 0 °
Name: CL-2 (Assumed) Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 150 psf Phi': 0 °

F of S: 1.535



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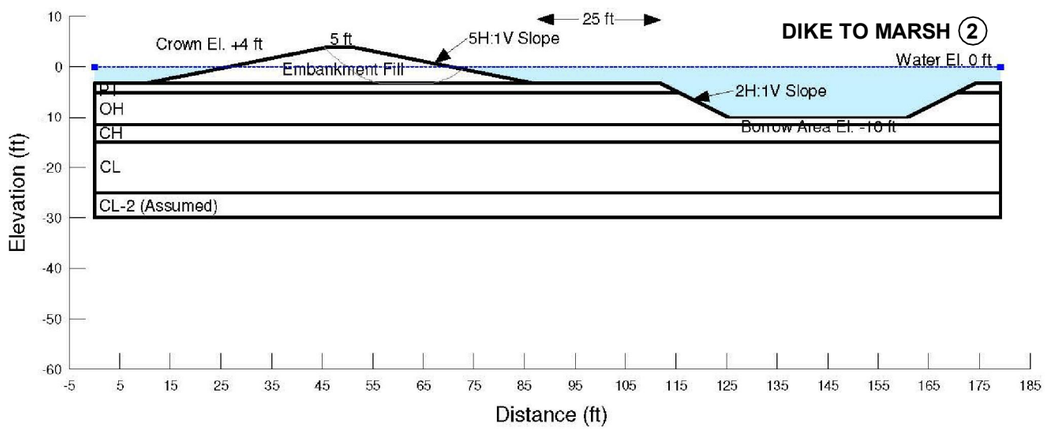
Name: PT Model: Mohr-Coulomb Unit Weight: 64 pcf Cohesion': 100 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 82 pcf Cohesion': 100 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 86 pcf Cohesion': 100 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 100 psf Phi': 0 °
Name: CL-2 (Assumed) Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 150 psf Phi': 0 °

F of S: 1.423



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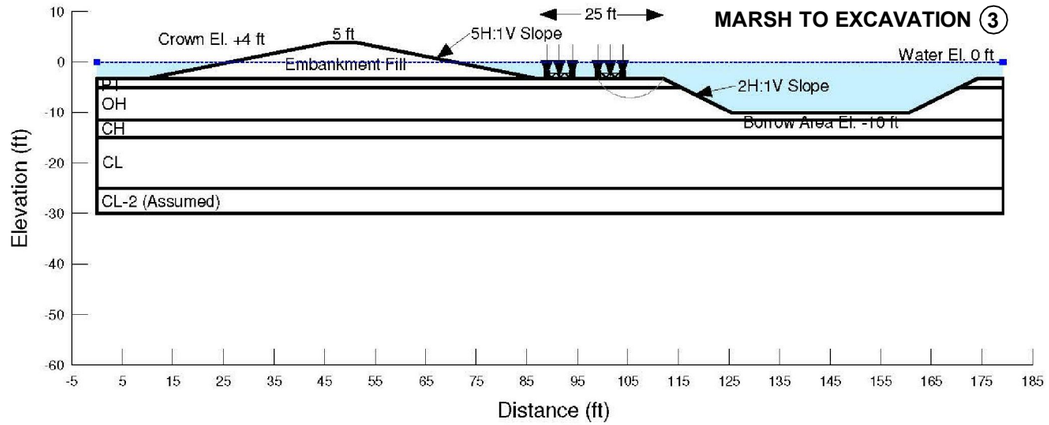
Name: PT Model: Mohr-Coulomb Unit Weight: 64 pcf Cohesion': 100 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 82 pcf Cohesion': 100 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 86 pcf Cohesion': 100 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 100 psf Phi': 0 °
Name: CL-2 (Assumed) Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 150 psf Phi': 0 °

F of S: 2.260



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

CONDITION ① DIKE TO EXCAVATION
CONDITION ② DIKE TO MARSH
CONDITION ③ MARSH TO EXCAVATION

SLOPE STABILITY - CELL A - B7/C1 - @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

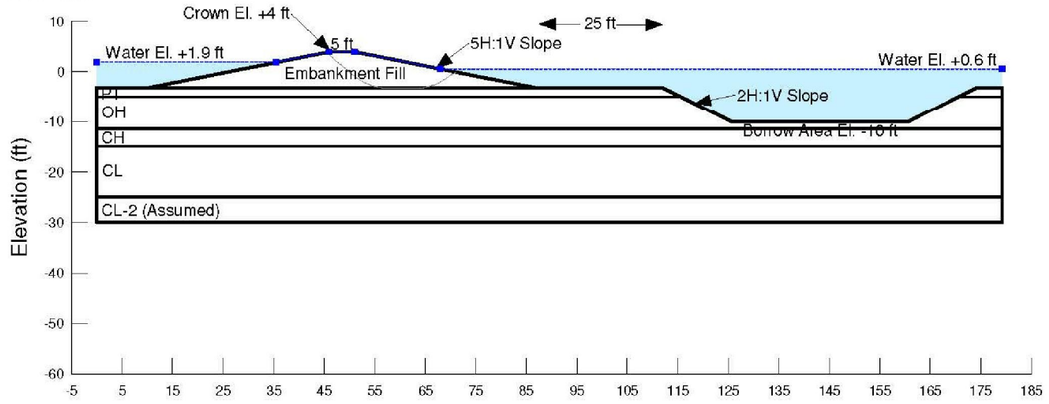
Figure B-1a

DPS : KMC

P:\16\16715040\00\CAD\Slope Stability_1_1_1784.sv$.dwg\TAB:B7 4.25 modified on Jun 30, 2015 - 9:06am

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 64 pcf Cohesion': 100 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 82 pcf Cohesion': 100 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 86 pcf Cohesion': 100 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 100 psf Phi': 0 °
Name: CL-2 (Assumed) Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 150 psf Phi': 0 °

F of S: 1.502



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 64 pcf Cohesion': 100 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 82 pcf Cohesion': 100 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 86 pcf Cohesion': 100 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 100 psf Phi': 0 °
Name: CL-2 (Assumed) Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 150 psf Phi': 0 °
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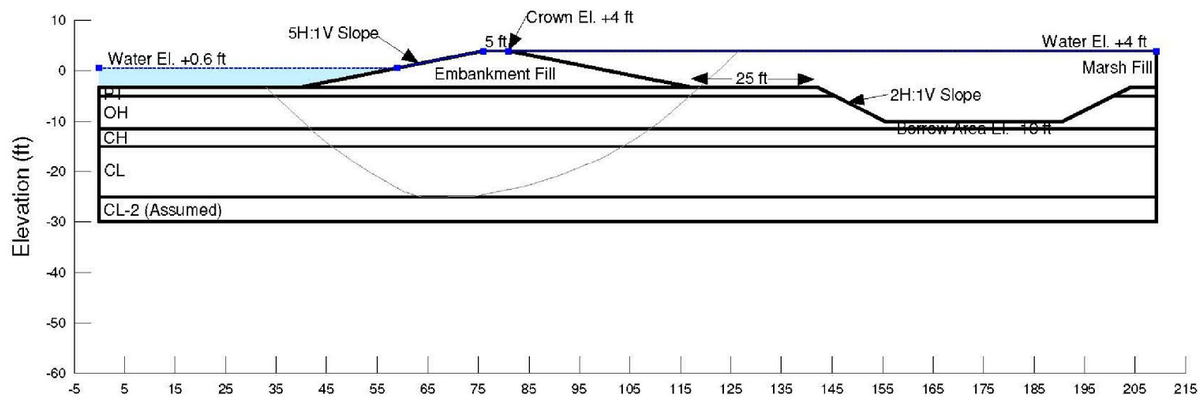
F of S: 1.280



WITH MARSH FILL

Notes:
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SLOPE STABILITY - CELL A - B7/C1 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

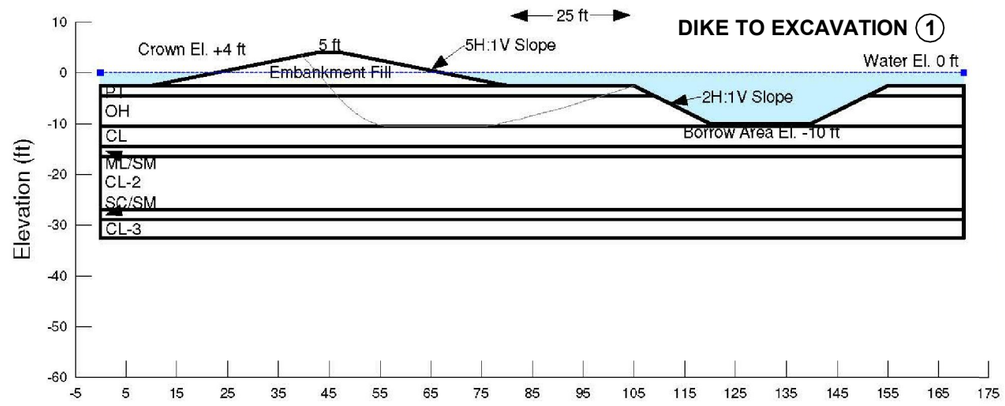
Figure B-1b

DPS : KMC

P:\16\16715040\00\CAD\Drawing3_1_1_4964.dwg\TAB:B-7 modified on Jun 30, 2015 - 9:07am

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 63 pcf Cohesion': 50 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 86 pcf Cohesion': 70 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 108 pcf Cohesion': 140 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2 Model: Mohr-Coulomb Unit Weight: 108 pcf Cohesion': 250 psf Phi': 0 °
Name: SC/SM Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 °
Name: CL-3 Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 290 psf Phi': 0 °

F of S: 1.411



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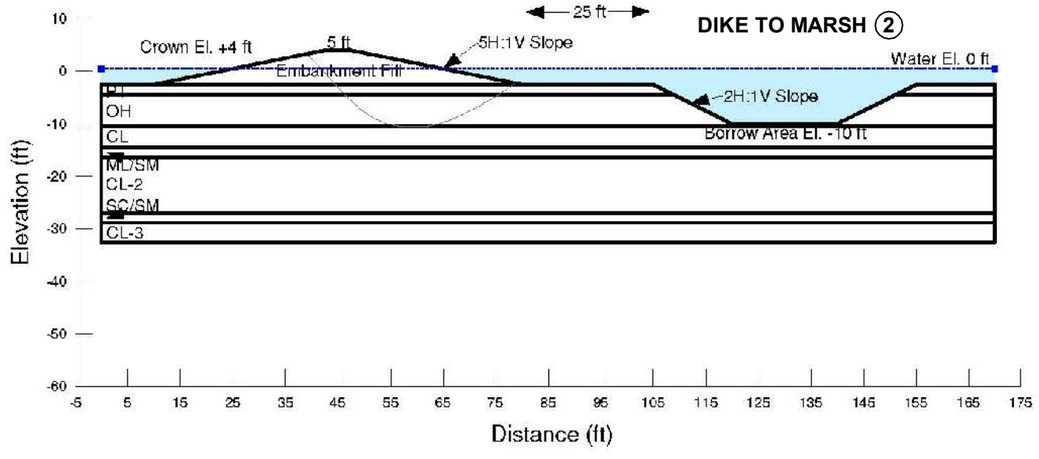
Name: PT Model: Mohr-Coulomb Unit Weight: 63 pcf Cohesion': 50 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 86 pcf Cohesion': 70 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 108 pcf Cohesion': 140 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2 Model: Mohr-Coulomb Unit Weight: 108 pcf Cohesion': 250 psf Phi': 0 °
Name: SC/SM Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 °
Name: CL-3 Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 290 psf Phi': 0 °

F of S: 1.212



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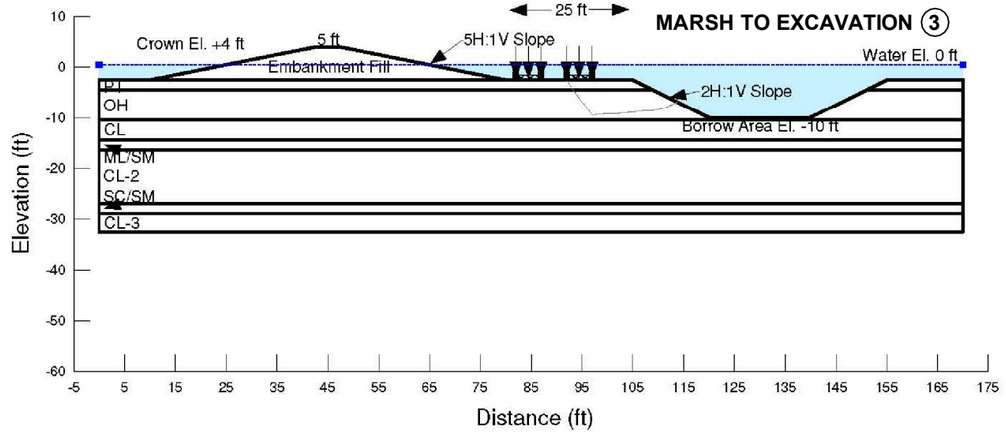
Name: PT Model: Mohr-Coulomb Unit Weight: 63 pcf Cohesion': 50 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 86 pcf Cohesion': 70 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 108 pcf Cohesion': 140 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2 Model: Mohr-Coulomb Unit Weight: 108 pcf Cohesion': 250 psf Phi': 0 °
Name: SC/SM Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 °
Name: CL-3 Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 290 psf Phi': 0 °

F of S: 1.312



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL A - B1/C2 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

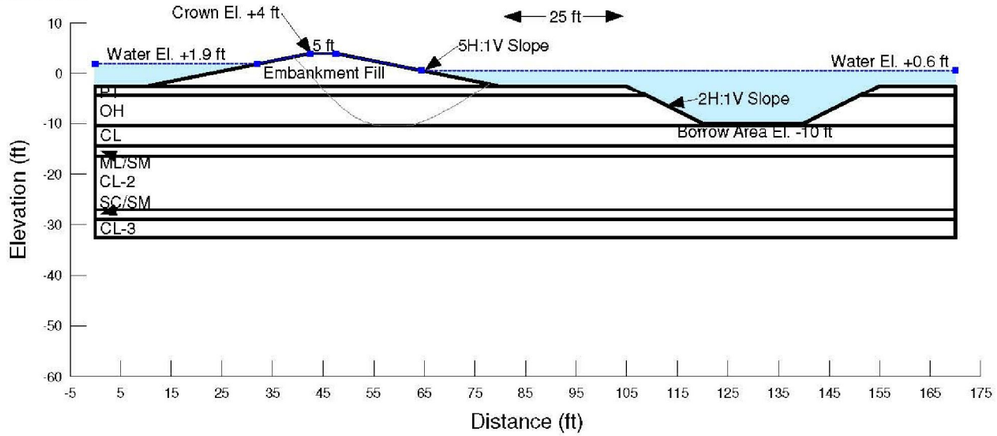
Figure B-2a

DPS : KMC

P:\16\16715040\00\CAD\Slope Stability_1_1_1784.sv$.dwg\TAB:B1C2 modified on Jun 30, 2015 - 9:07am

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 63 pcf Cohesion': 50 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 86 pcf Cohesion': 70 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 108 pcf Cohesion': 140 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2 Model: Mohr-Coulomb Unit Weight: 108 pcf Cohesion': 250 psf Phi': 0 °
Name: SC/SM Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 °
Name: CL-3 Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 290 psf Phi': 0 °

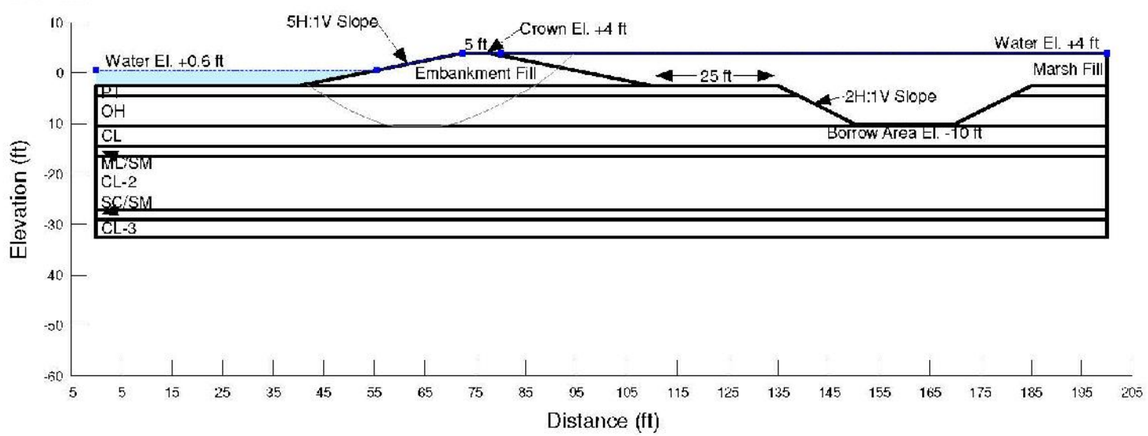
F of S: 1.233



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 63 pcf Cohesion': 50 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 86 pcf Cohesion': 70 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 108 pcf Cohesion': 140 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2 Model: Mohr-Coulomb Unit Weight: 108 pcf Cohesion': 250 psf Phi': 0 °
Name: SC/SM Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 °
Name: CL-3 Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 290 psf Phi': 0 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.159



WITH MARSH FILL

Notes:
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SLOPE STABILITY - CELL A - B1/C2 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

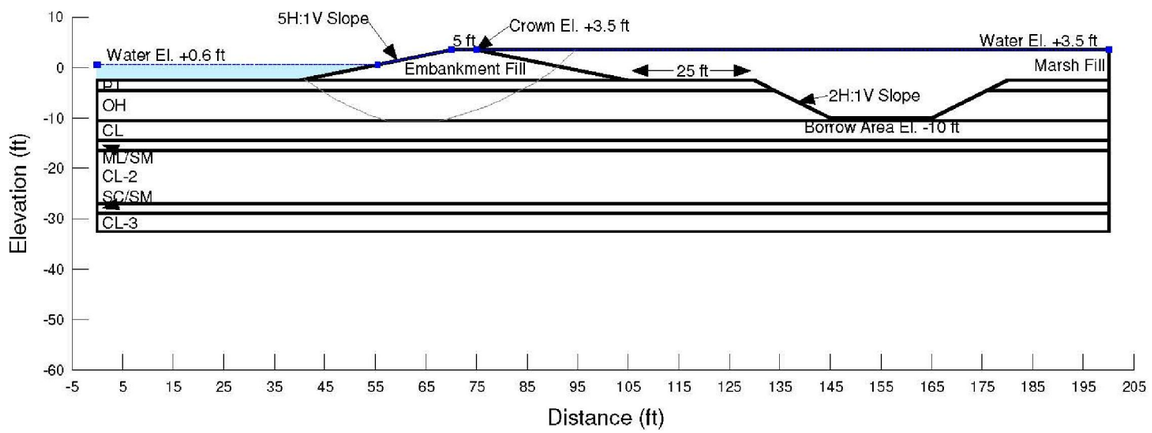
Figure B-2b

DPS : KMC

P:\16\16715040\00\CAD\Drawing3_1_1_4964.dwg\TAB:B-2a (2) modified on Jun 30, 2015 - 9:08am

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 63 pcf Cohesion': 50 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 86 pcf Cohesion': 70 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 108 pcf Cohesion': 140 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2 Model: Mohr-Coulomb Unit Weight: 108 pcf Cohesion': 250 psf Phi': 0 °
Name: SC/SM Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion': 0 psf Phi': 28 °
Name: CL-3 Model: Mohr-Coulomb Unit Weight: 111 pcf Cohesion': 290 psf Phi': 0 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.301



WITH MARSH FILL

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SLOPE STABILITY - CELL A - B1/C2 @ ELEV. +3.5 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

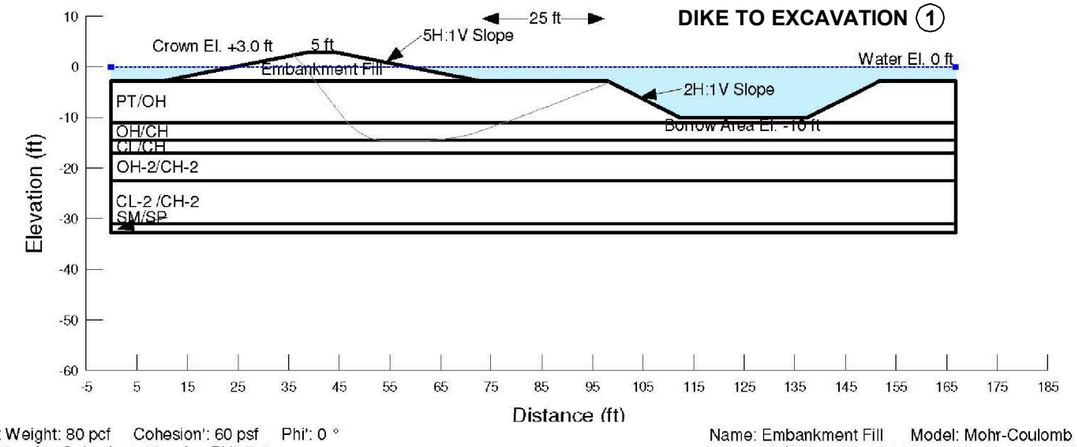
Figure B-2c

DPS : KMC

P:\16\16715040\00\CAD\Drawing3_1_1_4964.dwg\TAB:B-2a modified on Jun 30, 2015 - 9:08am

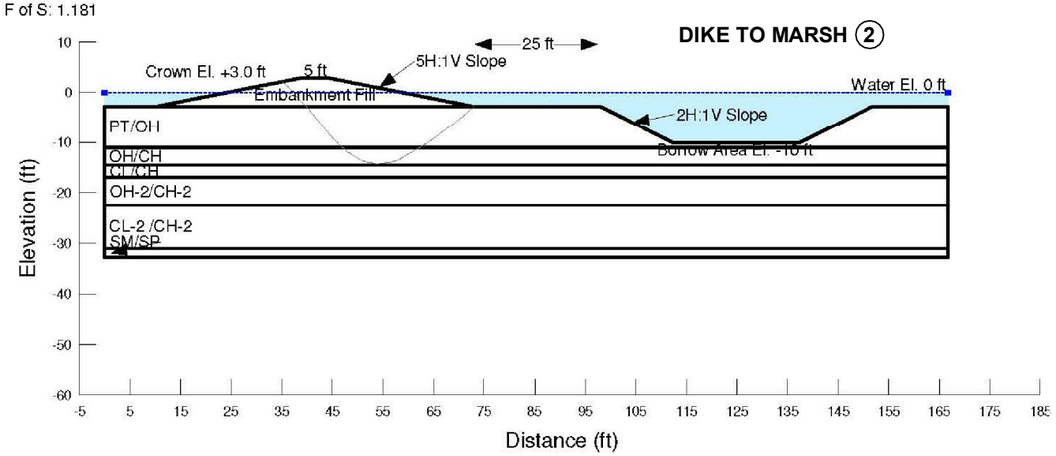
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 106 pcf Cohesion': 80 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 100 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °

F of S: 1.397



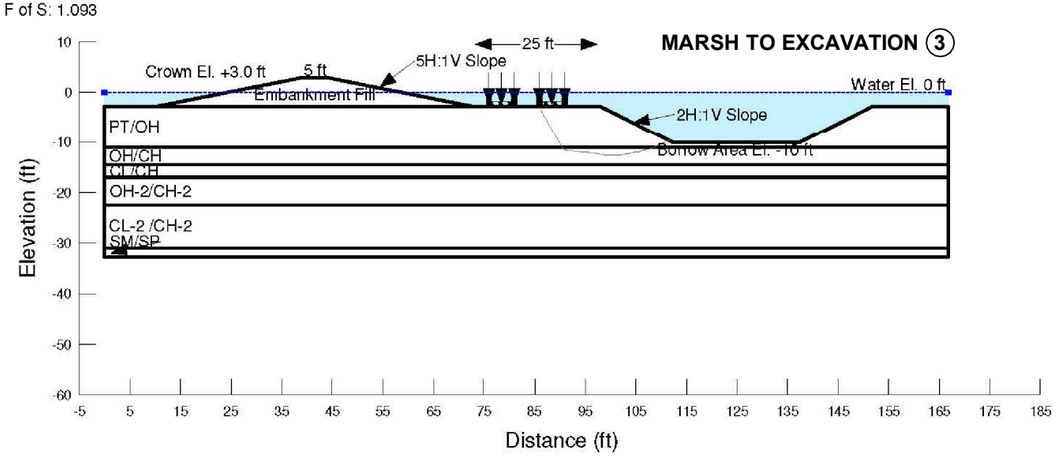
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 106 pcf Cohesion': 80 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 100 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °

F of S: 1.181



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 106 pcf Cohesion': 80 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 100 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °

F of S: 1.093



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL A - C3 @ ELEV. +3 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

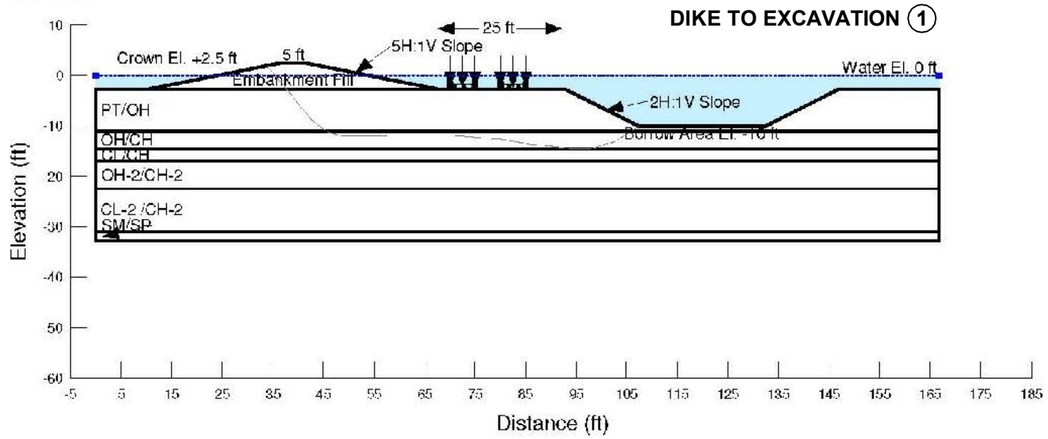
Figure B-3a

DPS : KMC

P:\16\16715040\00\CAD\Slope Stability.dwg\TAB:C3 3 modified on Jun 29, 2015 - 11:20am

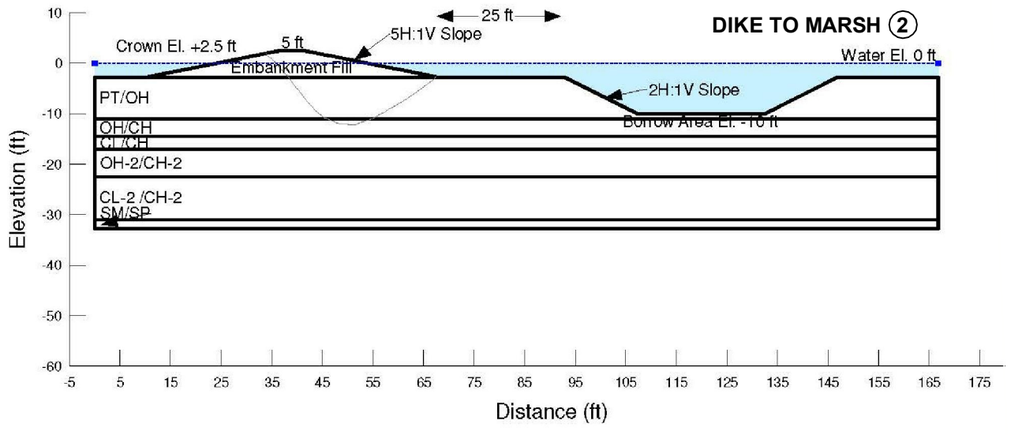
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 106 pcf Cohesion': 80 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 100 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °

F of S: 1.511



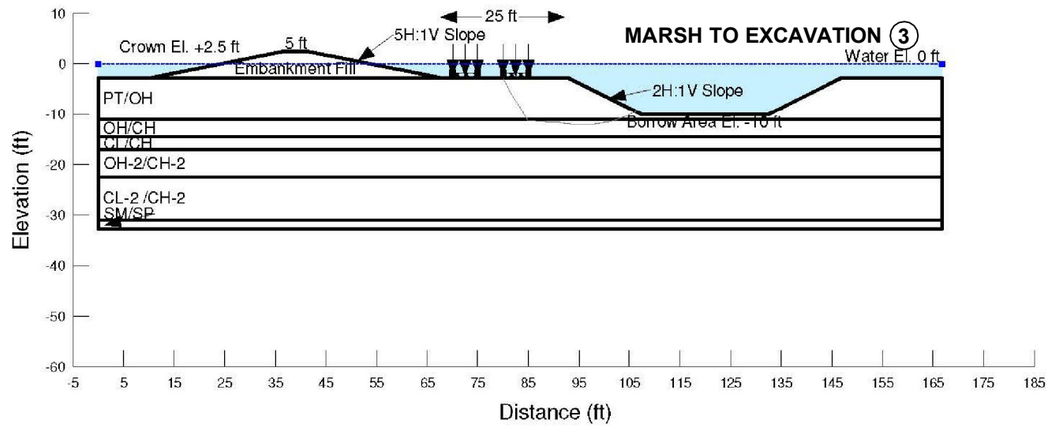
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 106 pcf Cohesion': 80 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 100 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °

F of S: 1.384



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 106 pcf Cohesion': 80 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 100 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °

F of S: 1.110



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL A - C3 @ ELEV. +2.5 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

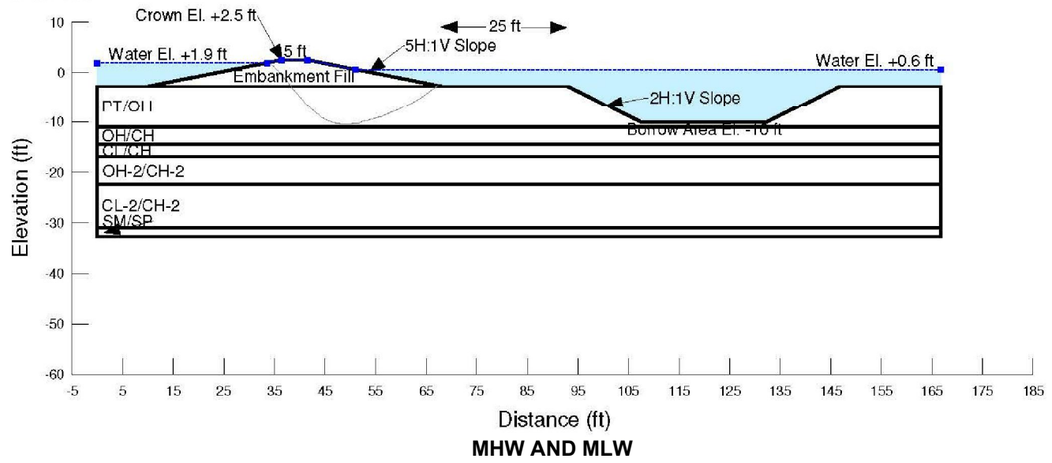
Figure B-3b

DPS : KMC

P:\16\16715040\00\CAD\Slope Stability.dwg\TAB:C3 modified on Jun 29, 2015 - 11:24am

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 106 pcf Cohesion': 80 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 100 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °

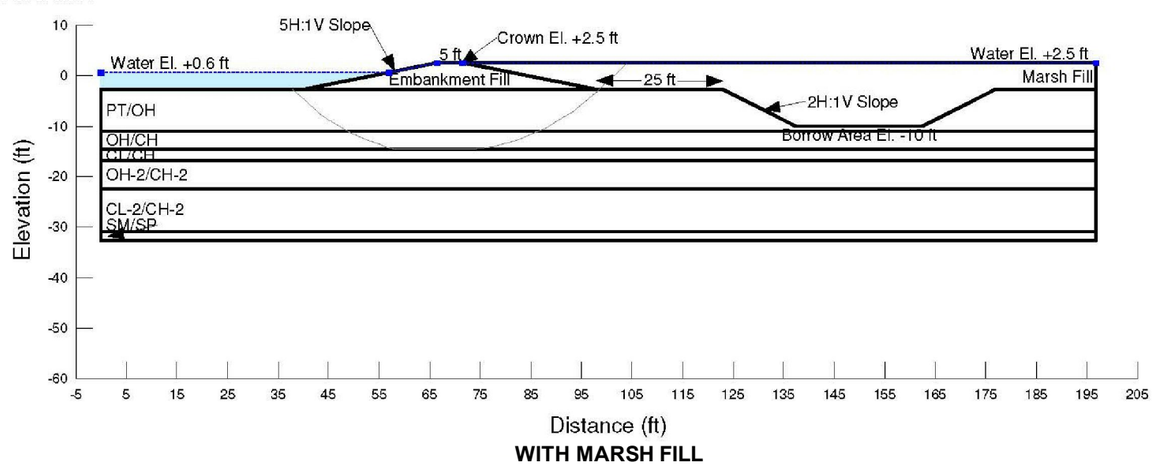
F of S: 1.704



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 106 pcf Cohesion': 80 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 100 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.344



WITH MARSH FILL

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SLOPE STABILITY - CELL A - C3
@ ELEV. +2.5 FT.

Island Road Marsh Creation and
Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

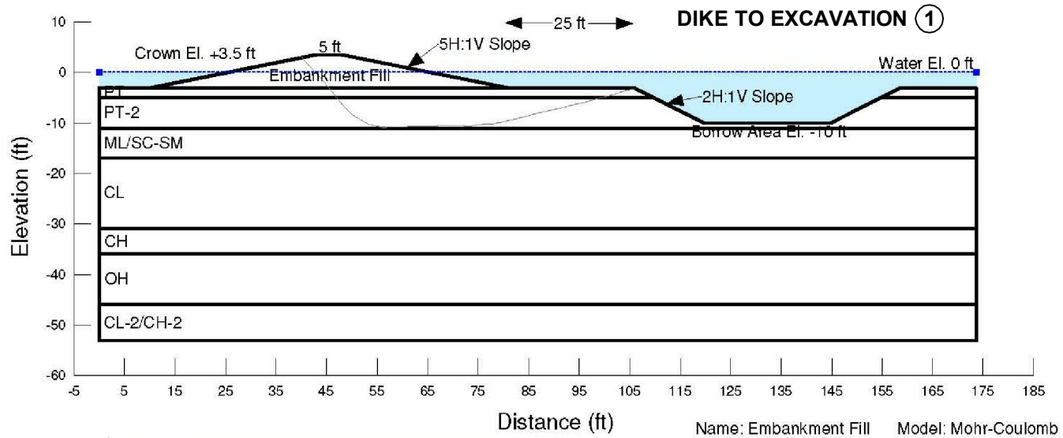
Figure B-3c

DPS : KMC

P:\16\16715040\00\CAD\Drawing3_1_1_4964_recover_1_1_7171.sv$.dwg\TAB:B-3D modified on Jun 30, 2015 - 2:59pm

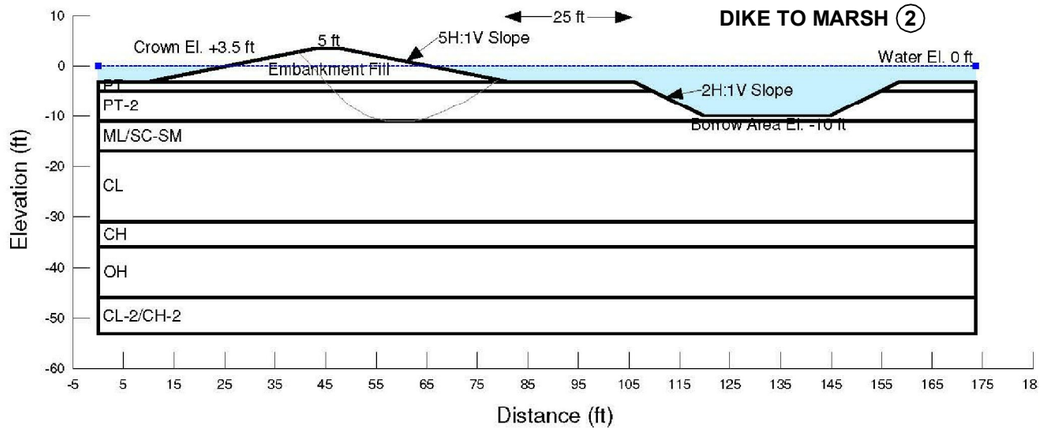
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 63 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2 Model: Mohr-Coulomb Unit Weight: 68 pcf Cohesion': 60 psf Phi': 0 °
Name: ML/SC-SM Model: Mohr-Coulomb Unit Weight: 114 pcf Cohesion': 200 psf Phi': 10 °
Name: CL Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 160 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 200 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 74 pcf Cohesion': 225 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 99 pcf Cohesion': 260 psf Phi': 0 °

F of S: 1.383



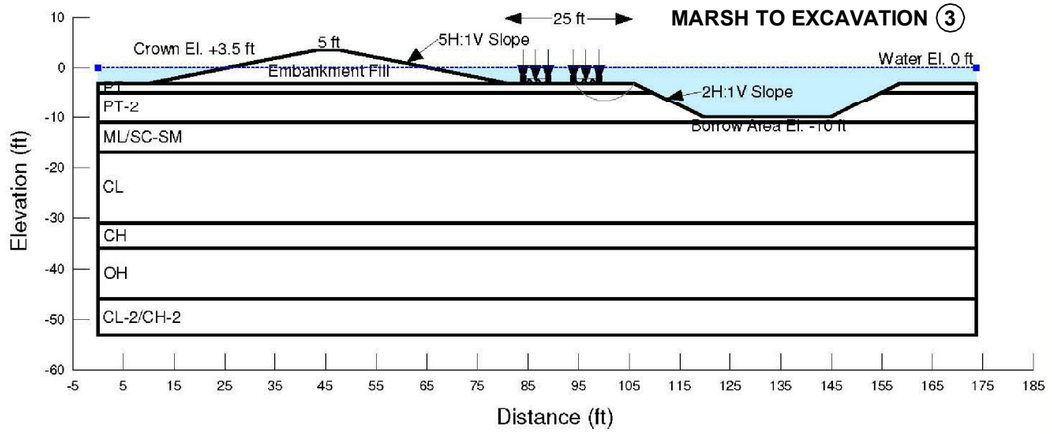
Name: PT Model: Mohr-Coulomb Unit Weight: 63 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2 Model: Mohr-Coulomb Unit Weight: 68 pcf Cohesion': 60 psf Phi': 0 °
Name: ML/SC-SM Model: Mohr-Coulomb Unit Weight: 114 pcf Cohesion': 200 psf Phi': 10 °
Name: CL Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 160 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 200 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 74 pcf Cohesion': 225 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 99 pcf Cohesion': 260 psf Phi': 0 °

F of S: 1.079



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 63 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2 Model: Mohr-Coulomb Unit Weight: 68 pcf Cohesion': 60 psf Phi': 0 °
Name: ML/SC-SM Model: Mohr-Coulomb Unit Weight: 114 pcf Cohesion': 200 psf Phi': 10 °
Name: CL Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 160 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 200 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 74 pcf Cohesion': 225 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 99 pcf Cohesion': 260 psf Phi': 0 °

F of S: 1.259



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL B - B2/C4 @ ELEV. +3.5 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

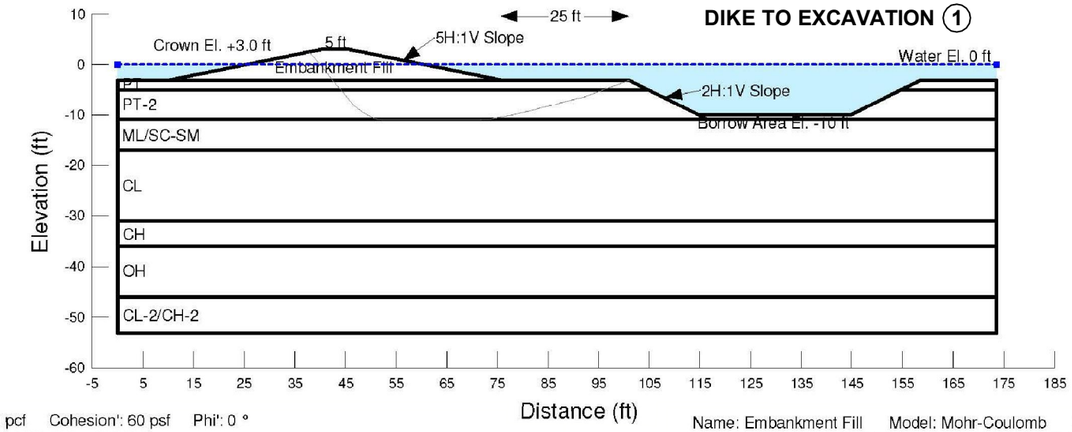
Figure B-4a

DPS : KMC

P:\16\16715040\00\CAD\Slope Stability.dwg\TAB:B2C4 modified on Jun 29, 2015 - 11:30am

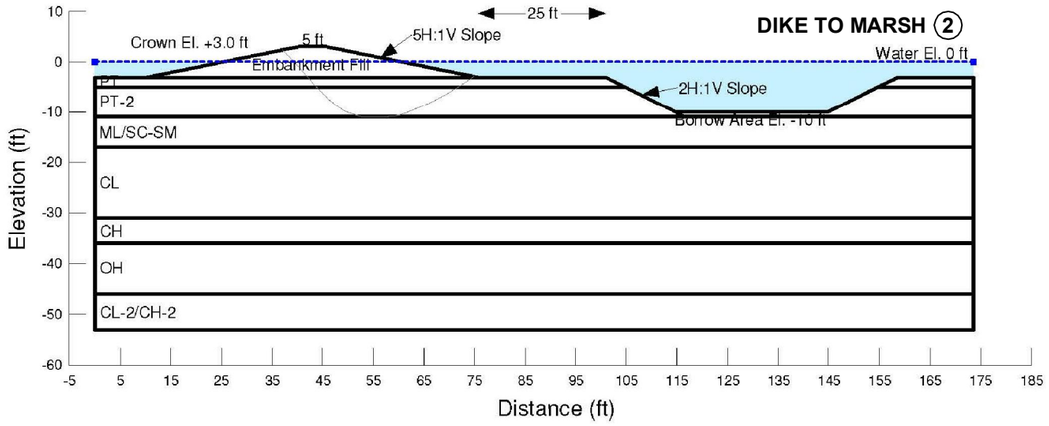
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 63 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2 Model: Mohr-Coulomb Unit Weight: 68 pcf Cohesion': 60 psf Phi': 0 °
Name: ML/SC-SM Model: Mohr-Coulomb Unit Weight: 114 pcf Cohesion': 200 psf Phi': 10 °
Name: CL Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 160 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 200 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 74 pcf Cohesion': 225 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 99 pcf Cohesion': 260 psf Phi': 0 °

F of S: 1.533



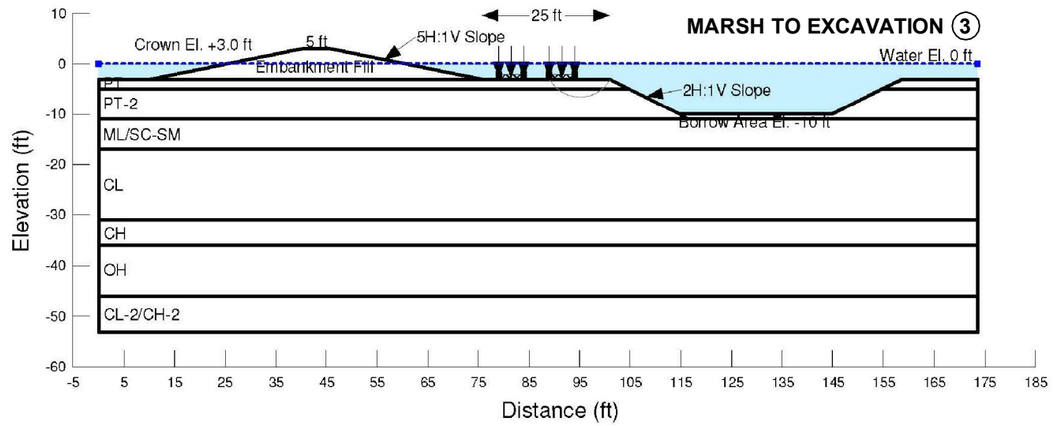
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 63 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2 Model: Mohr-Coulomb Unit Weight: 68 pcf Cohesion': 60 psf Phi': 0 °
Name: ML/SC-SM Model: Mohr-Coulomb Unit Weight: 114 pcf Cohesion': 200 psf Phi': 10 °
Name: CL Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 160 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 200 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 74 pcf Cohesion': 225 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 99 pcf Cohesion': 260 psf Phi': 0 °

F of S: 1.208



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 63 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2 Model: Mohr-Coulomb Unit Weight: 68 pcf Cohesion': 60 psf Phi': 0 °
Name: ML/SC-SM Model: Mohr-Coulomb Unit Weight: 114 pcf Cohesion': 200 psf Phi': 10 °
Name: CL Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 160 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 200 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 74 pcf Cohesion': 225 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 99 pcf Cohesion': 260 psf Phi': 0 °

F of S: 1.254



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL B - B2/C4 @ ELEV. +3.0 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure B-4b

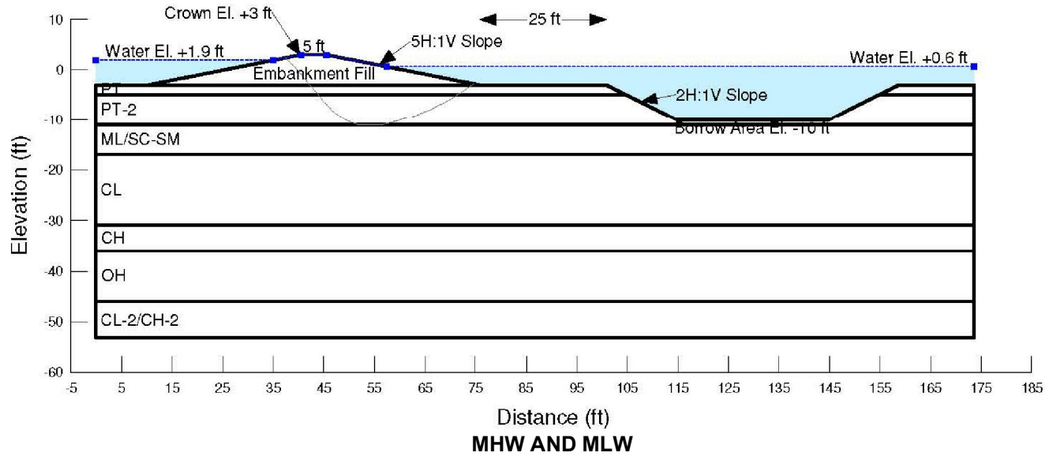
DPS : KMC

P:\16\16715040\00\CAD\Slope Stability.dwg\TAB:B2C4 3ft modified on Jun 29, 2015 - 1:00pm

DPS : KMC

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 63 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2 Model: Mohr-Coulomb Unit Weight: 68 pcf Cohesion': 60 psf Phi': 0 °
Name: ML/SC-SM Model: Mohr-Coulomb Unit Weight: 114 pcf Cohesion': 200 psf Phi': 10 °
Name: CL Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 160 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 200 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 74 pcf Cohesion': 225 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 99 pcf Cohesion': 260 psf Phi': 0 °

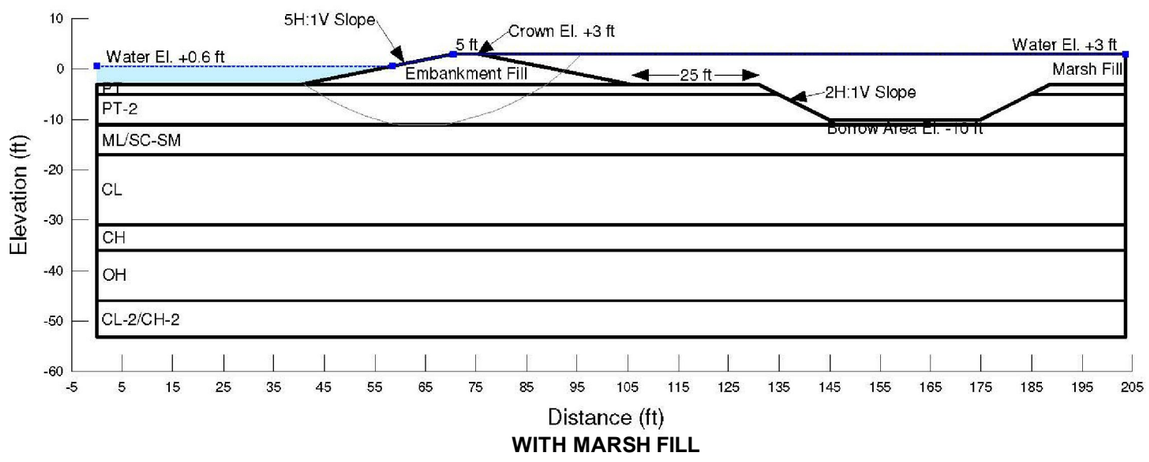
F of S: 1.400



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 63 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2 Model: Mohr-Coulomb Unit Weight: 68 pcf Cohesion': 60 psf Phi': 0 °
Name: ML/SC-SM Model: Mohr-Coulomb Unit Weight: 114 pcf Cohesion': 200 psf Phi': 10 °
Name: CL Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 160 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 200 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 74 pcf Cohesion': 225 psf Phi': 0 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 99 pcf Cohesion': 260 psf Phi': 0 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.286



WITH MARSH FILL

Notes:
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SLOPE STABILITY - CELL B - B2/C4 @ ELEV. +3 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

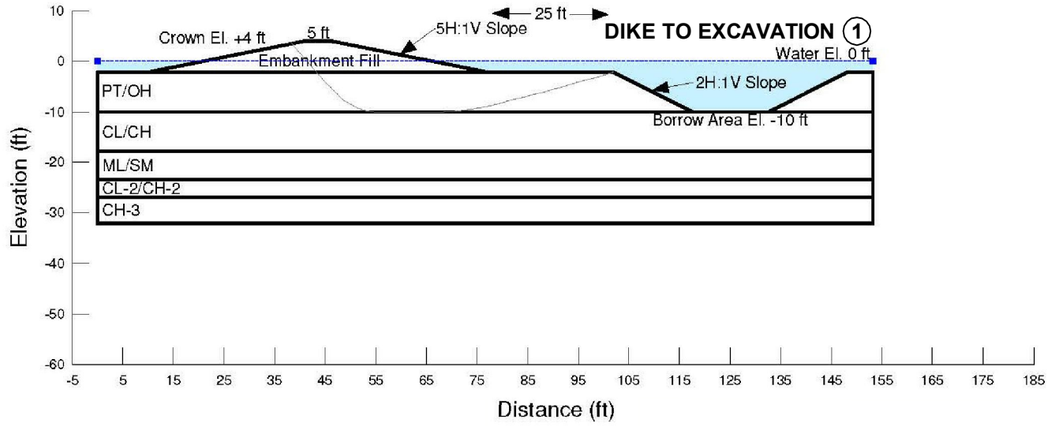
GeoEngineers

Figure B-4c

P:\16\16715040\00\CAD\Drawing3_1_1_4964_recover_1_1_7171.sv$.dwg\TAB:B-4c modified on Jun 30, 2015 - 2:59pm

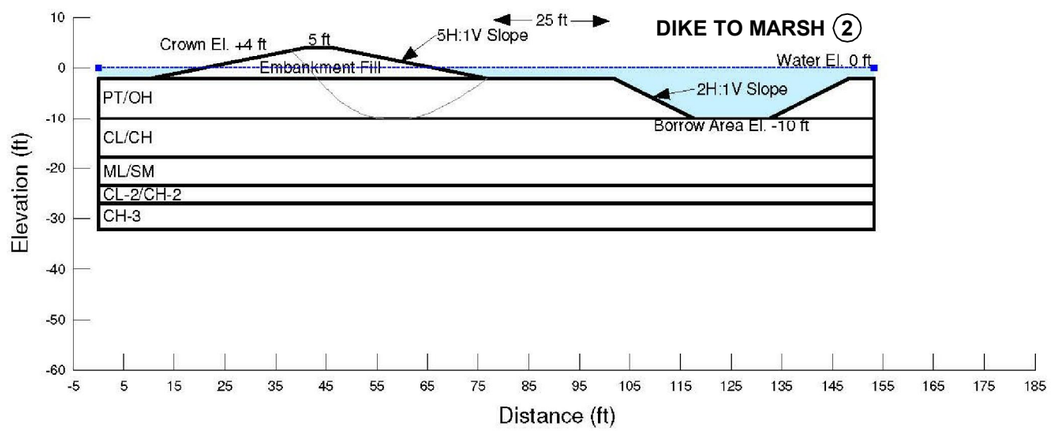
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 100 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 170 psf Phi': 0 °
Name: CH-3 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.306



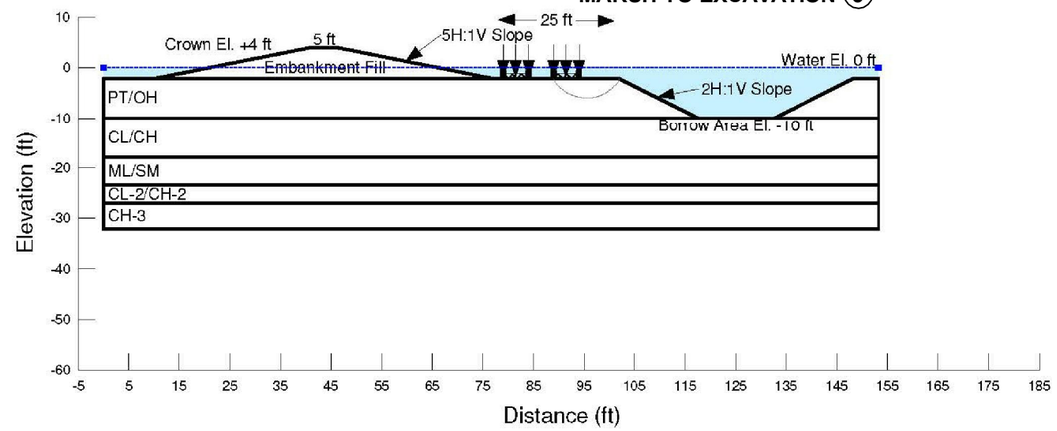
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 100 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 170 psf Phi': 0 °
Name: CH-3 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.028



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 100 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 170 psf Phi': 0 °
Name: CH-3 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.356



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL C - C5 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

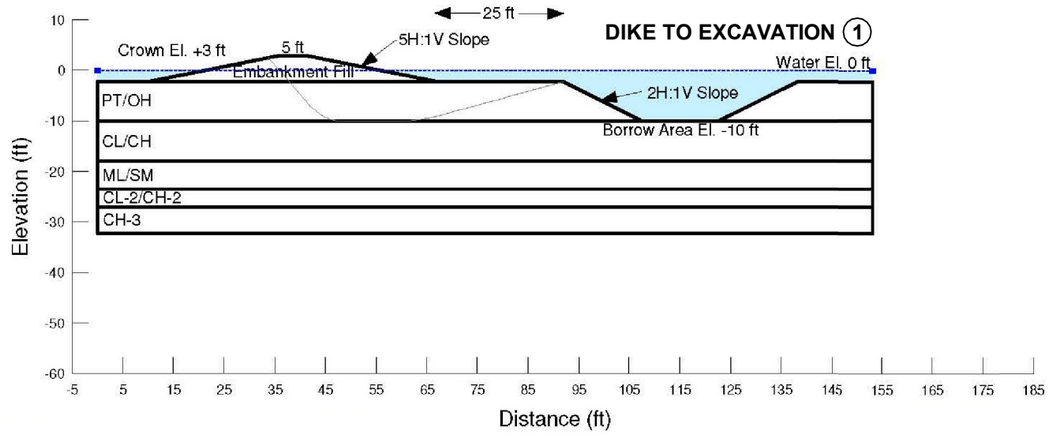
Figure B-5a

DPS : KMC

P:\161671504000\CAD\Slope Stability.dwg\TAB:C5 4.25 modified on Jun 29, 2015 - 1:05pm

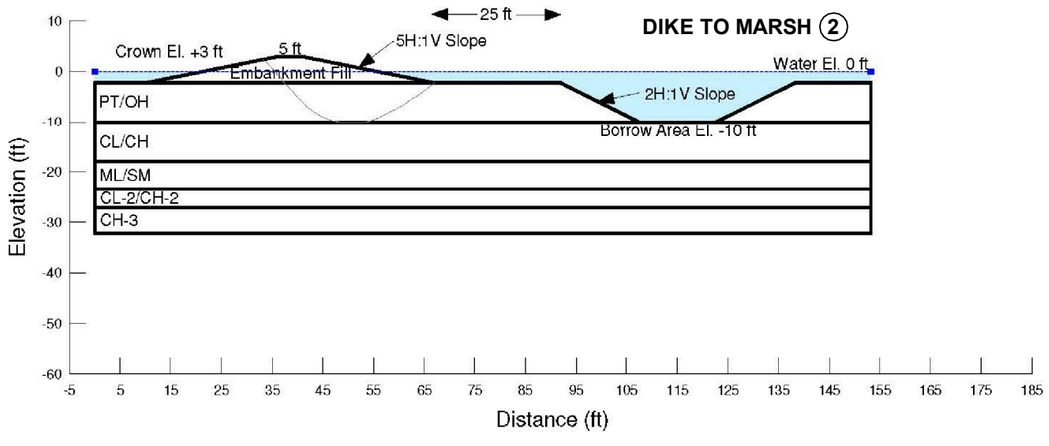
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 100 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 170 psf Phi': 0 °
Name: CH-3 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.625



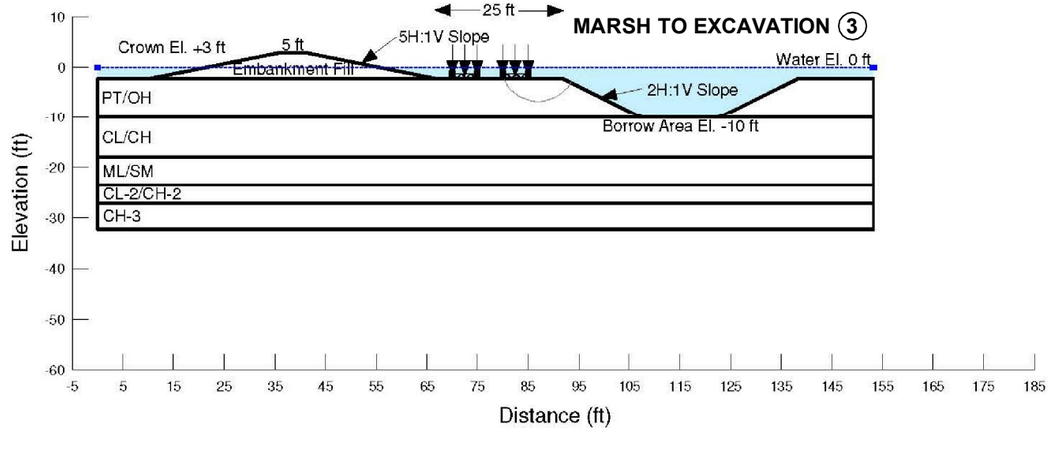
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 100 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 170 psf Phi': 0 °
Name: CH-3 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.259



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 100 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 170 psf Phi': 0 °
Name: CH-3 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.316



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL C - C5 @ ELEV. +3 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

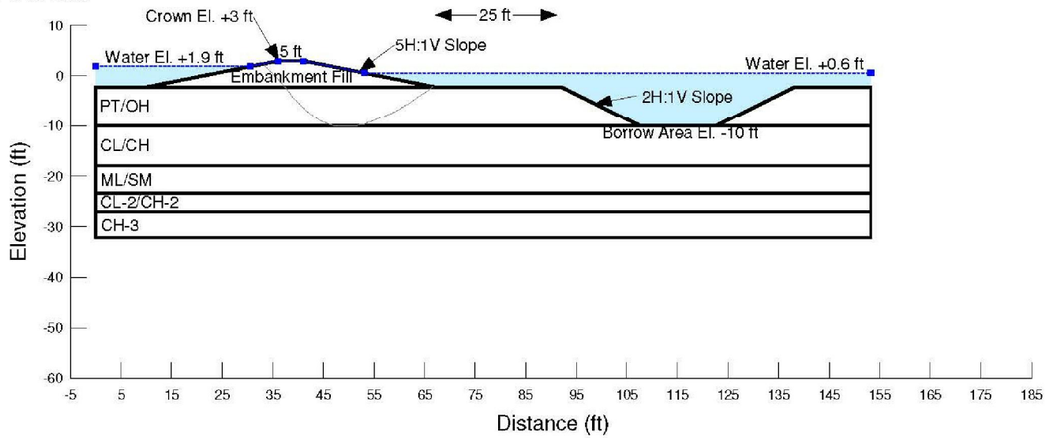
Figure B-5b

DPS : KMC

P:\16\16715040\00\CAD\Slope Stability.dwg\TAB:C5 3 modified on Jun 29, 2015 - 1:14pm

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 100 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 170 psf Phi': 0 °
Name: CH-3 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °

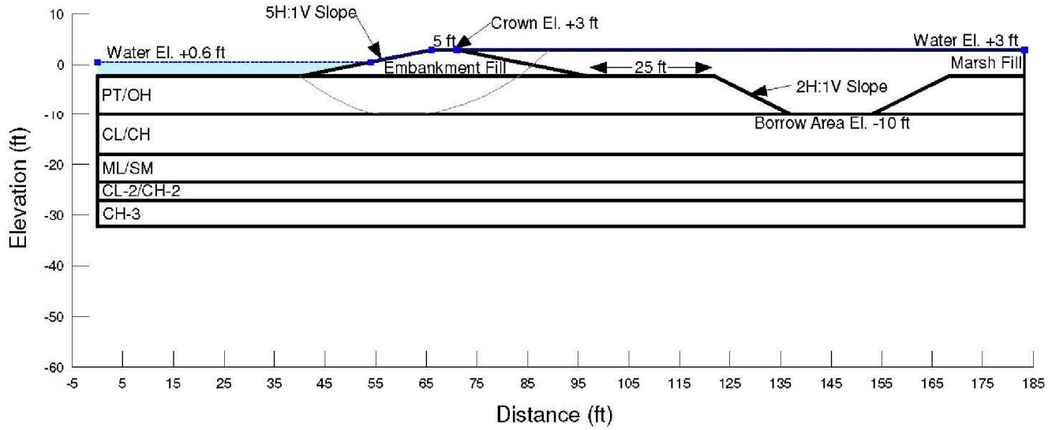
F of S: 1.459



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 60 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 100 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 170 psf Phi': 0 °
Name: CH-3 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.362



WITH MARSH FILL

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SLOPE STABILITY - CELL C - C5 @ ELEV. +3 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

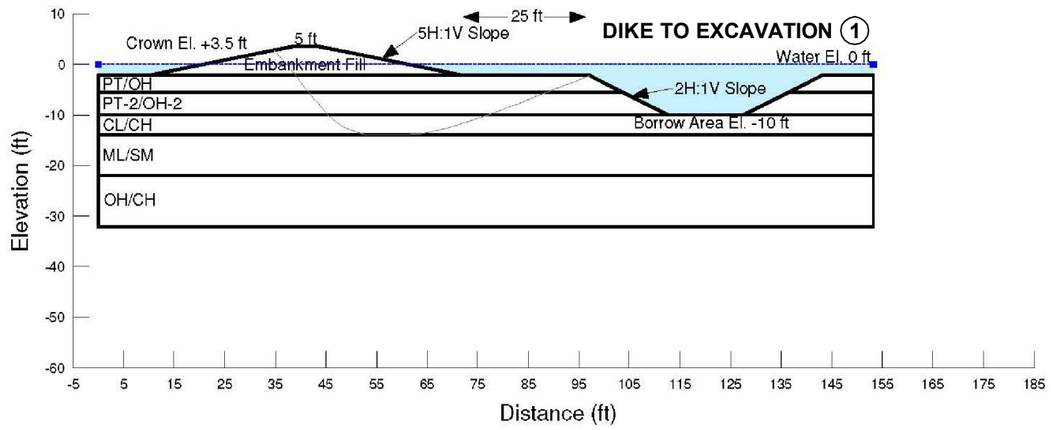
Figure B-5c

DPS : KMC

P:\16\16715040\000\CAD\Drawing3_1_1_4964.dwg\TAB:B-5c modified on Jun 30, 2015 - 9:12am

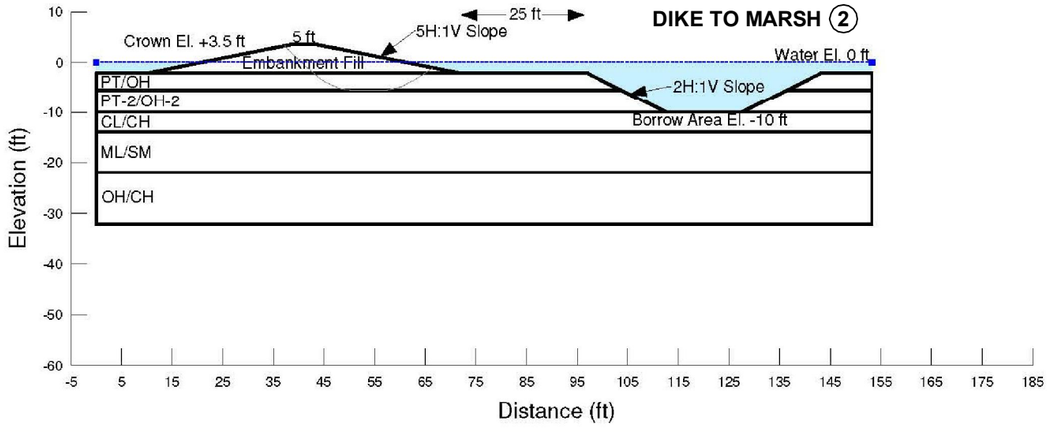
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2/OH-2 Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 70 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.356



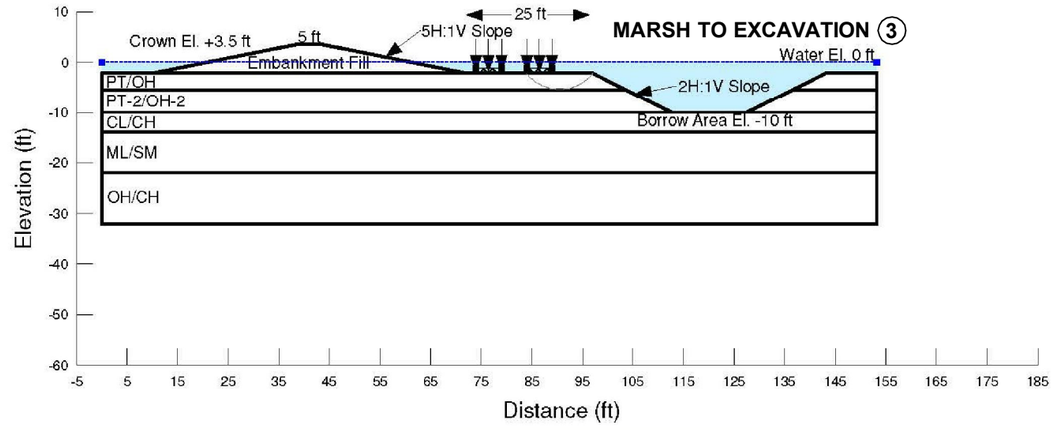
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2/OH-2 Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 70 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.158



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2/OH-2 Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 70 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.181



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL C - C6 @ ELEV. +3.5 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

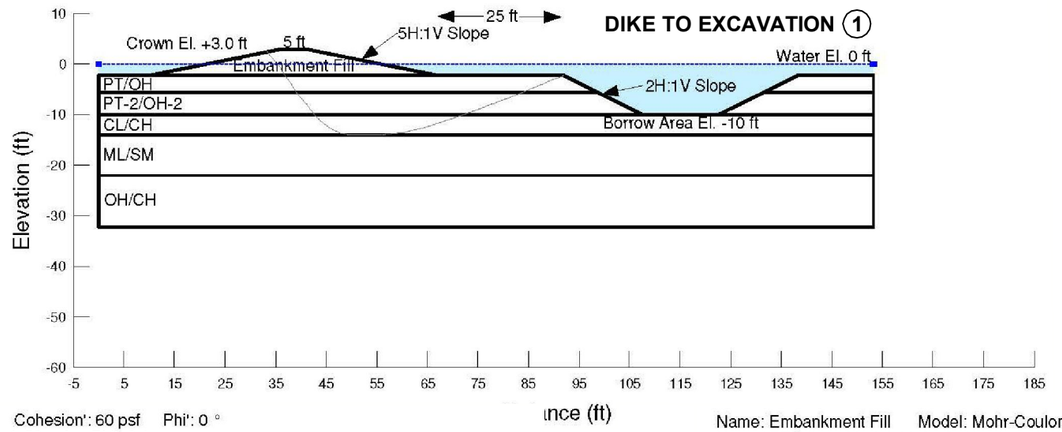
Figure B-6a

DPS : KMC

P:\161671504000\CAD\Slope Stability.dwg\TAB:C6 3.5 modified on Jun 29, 2015 - 1:18pm

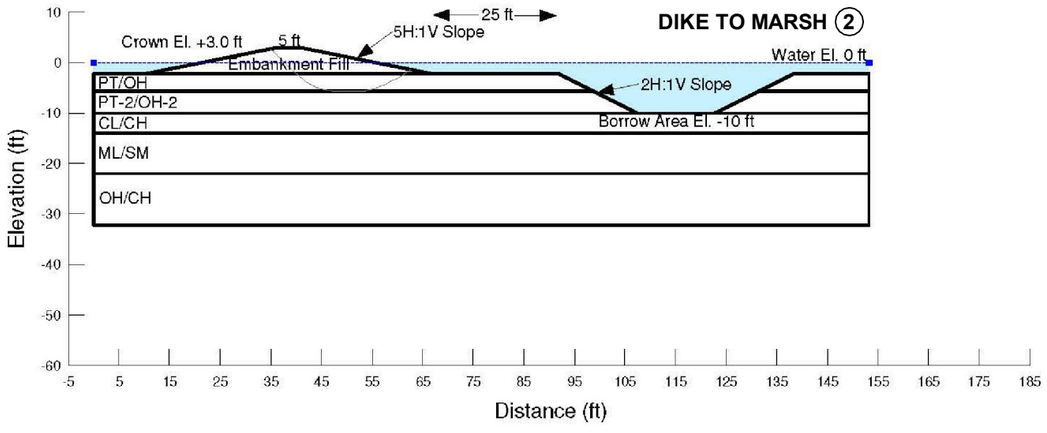
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2/OH-2 Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 70 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.543



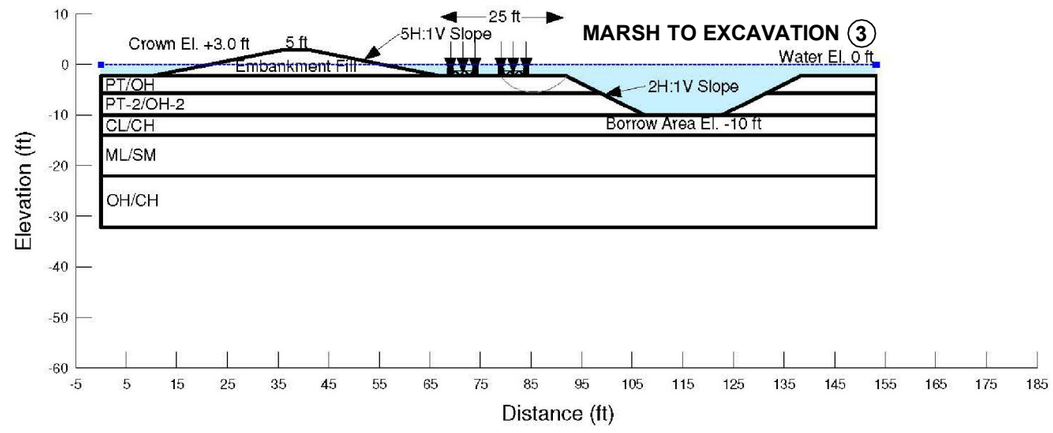
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2/OH-2 Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 70 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.287



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2/OH-2 Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 70 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.177



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL C - C6 @ ELEV. +3 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

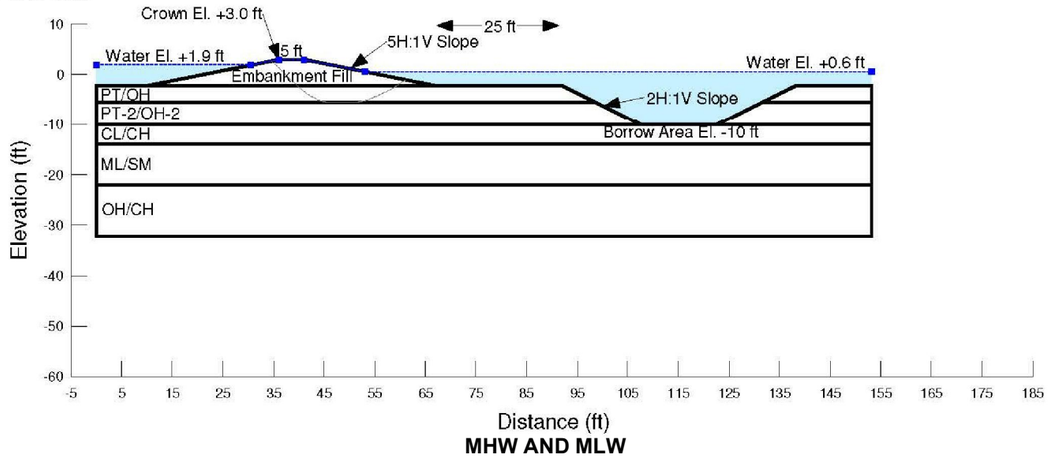
Figure B-6b

DPS : KMC

P:\16\16715040\00\CAD\Slope Stability.dwg\TAB:C6 3 modified on Jun 29, 2015 - 1:22pm

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2/OH-2 Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 70 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 200 psf Phi': 0 °

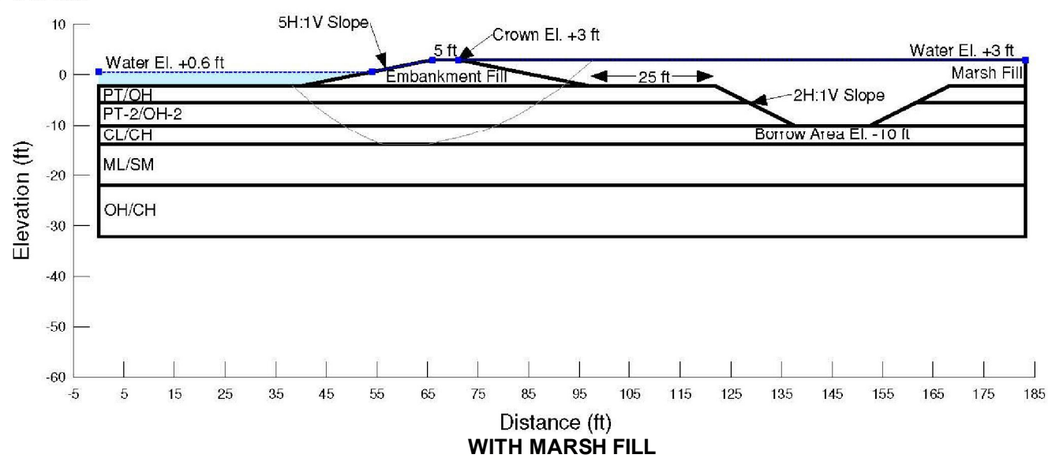
F of S: 1.469



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 50 psf Phi': 0 °
Name: PT-2/OH-2 Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CH Model: Mohr-Coulomb Unit Weight: 113 pcf Cohesion': 70 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 104 pcf Cohesion': 200 psf Phi': 0 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.337



WITH MARSH FILL

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SLOPE STABILITY - CELL C - C6 @ ELEV. +3 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GEOENGINEERS

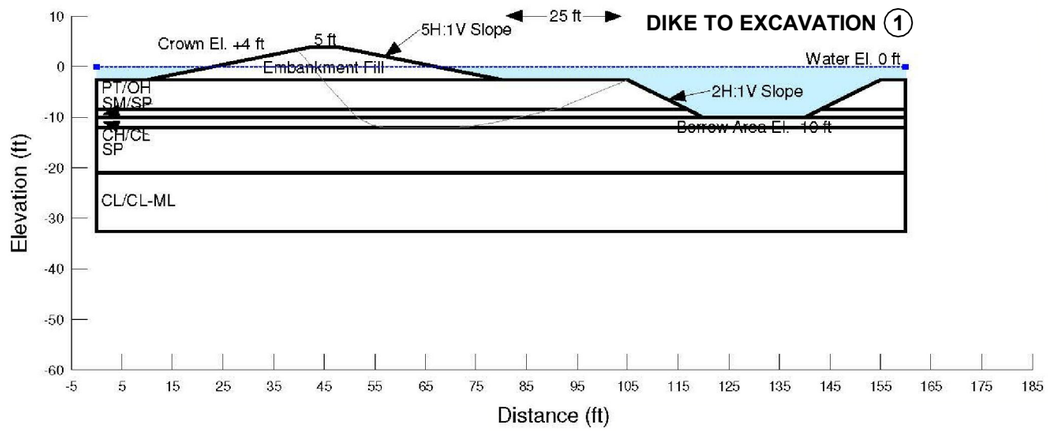
Figure B-6c

DPS : KMC

P:\16\16715040\00\CADDrawing3_1_1_4964_recover.dwg\TAB:B-6c modified on Jun 30, 2015 - 9:16am

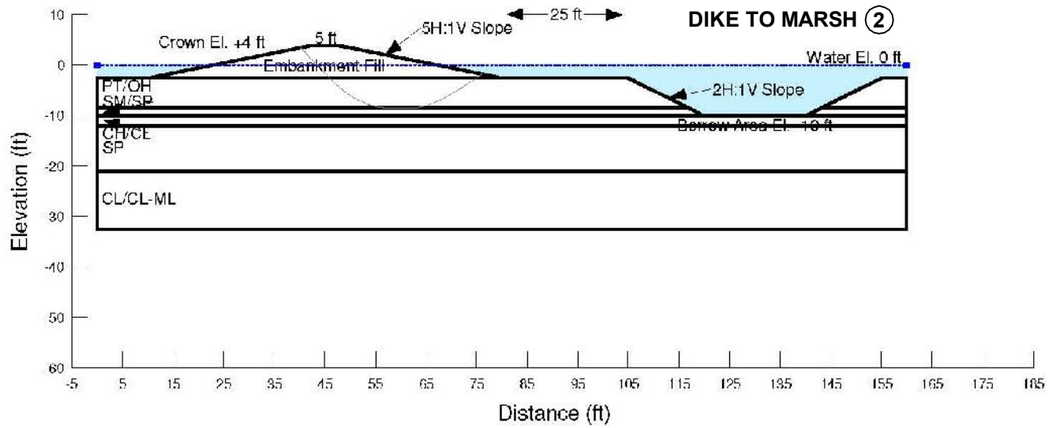
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 90 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 114 pcf Cohesion': 90 psf Phi': 0 °
Name: SP Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 0 psf Phi': 30 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 300 psf Phi': 0 °

F of S: 1.783



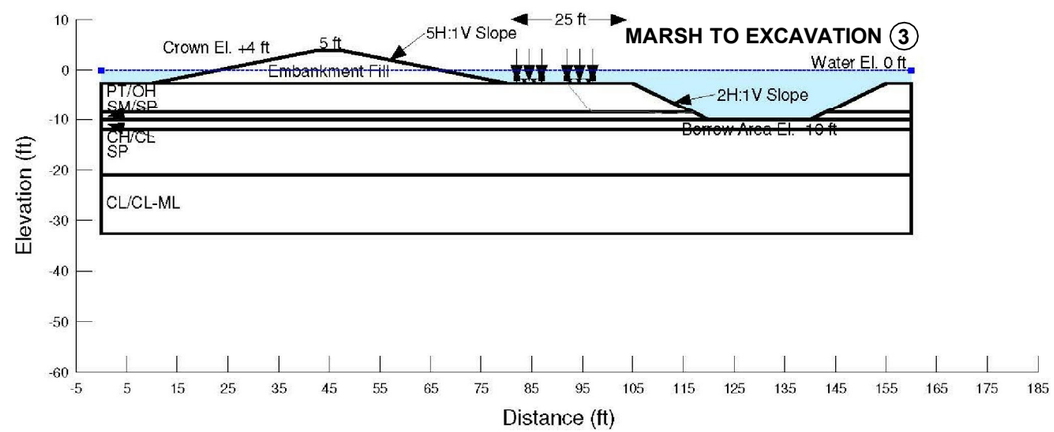
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 90 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 114 pcf Cohesion': 90 psf Phi': 0 °
Name: SP Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 0 psf Phi': 30 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 300 psf Phi': 0 °

F of S: 1.494



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 90 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 114 pcf Cohesion': 90 psf Phi': 0 °
Name: SP Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 0 psf Phi': 30 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 300 psf Phi': 0 °

F of S: 1.059



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL D - C7 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

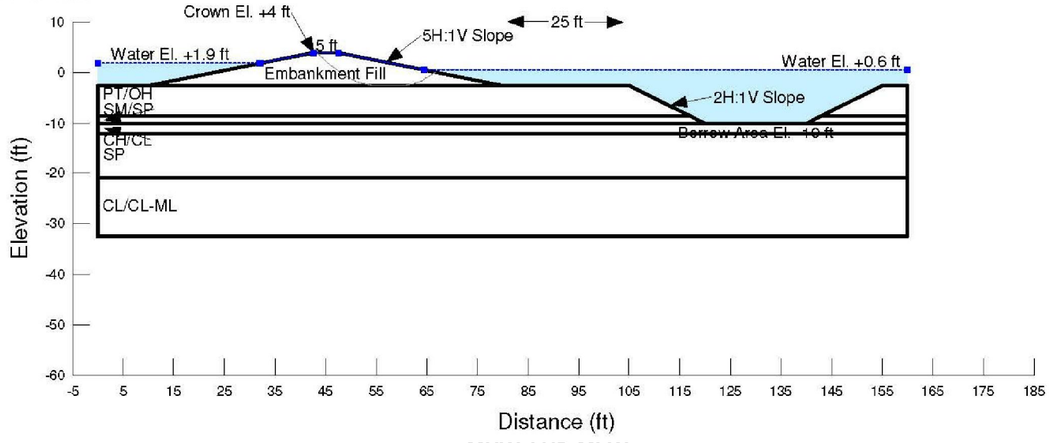
Figure B-7a

DPS : KMC

P:\161671504000\CAD\Slope Stability_1_1_1784.sv$_1_1_5077.sv$.dwg\TAB:C7 modified on Jun 30, 2015 - 9:17am

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 90 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 114 pcf Cohesion': 90 psf Phi': 0 °
Name: SP Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 0 psf Phi': 30 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 300 psf Phi': 0 °

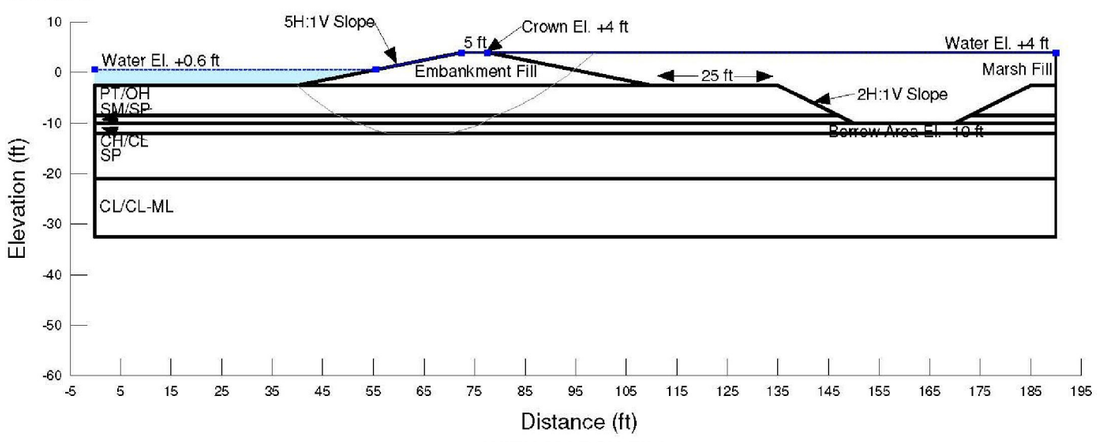
F of S: 1.619



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 90 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 114 pcf Cohesion': 90 psf Phi': 0 °
Name: SP Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 0 psf Phi': 30 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 300 psf Phi': 0 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.476



WITH MARSH FILL

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SLOPE STABILITY - CELL D - C7 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

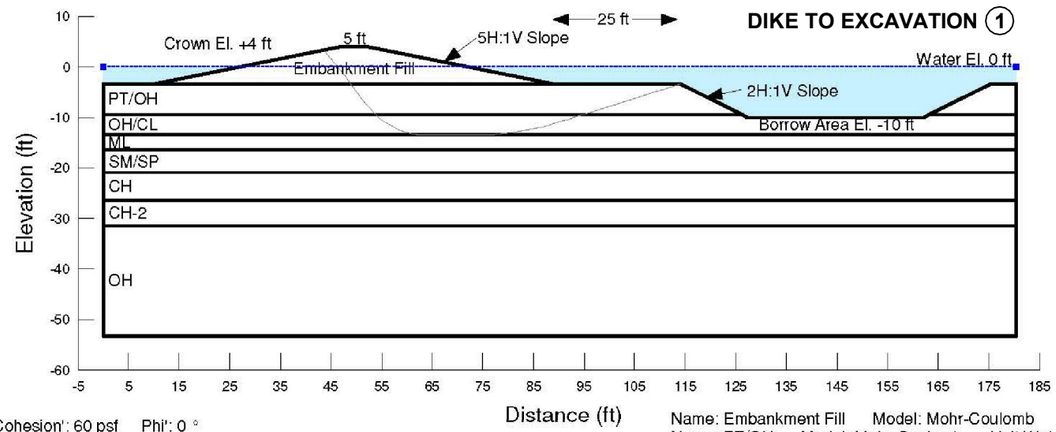
Figure B-7b

DPS : KMC

P:\16\16715040\00\CAD\Drawing3_1_1_4964_recover.dwg\TAB:B-7b modified on Jun 30, 2015 - 9:18am

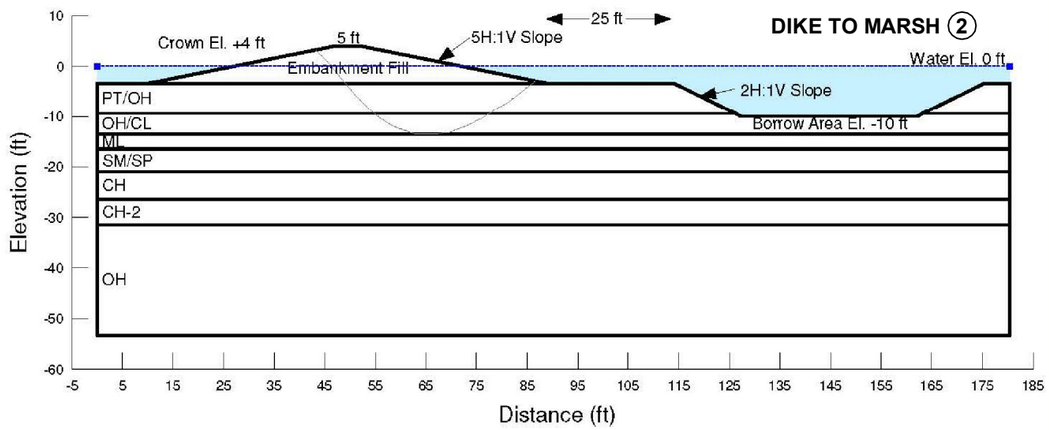
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 79 pcf Cohesion': 80 psf Phi': 0 °
Name: OH/CL Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 80 psf Phi': 0 °
Name: ML Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 28 °
Name: CH Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 0 °
Name: CH-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 200 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 270 psf Phi': 0 °

F of S: 1.492



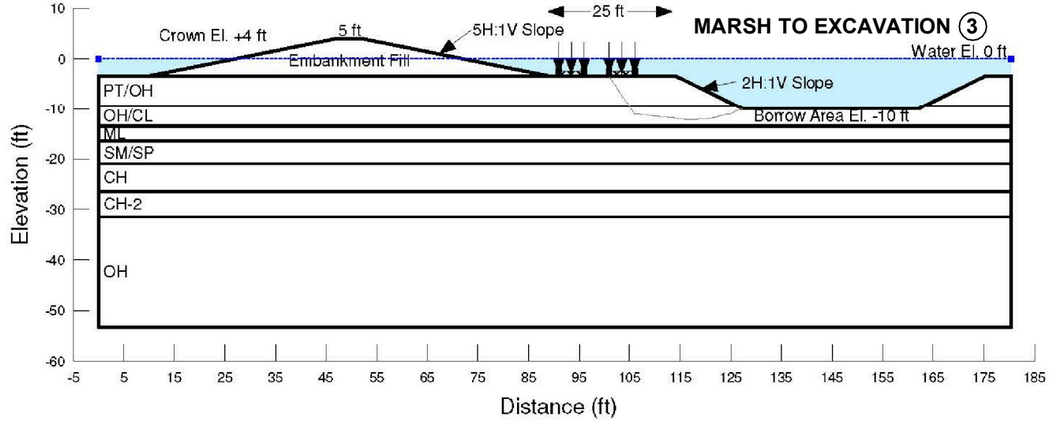
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 79 pcf Cohesion': 80 psf Phi': 0 °
Name: OH/CL Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 80 psf Phi': 0 °
Name: ML Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 28 °
Name: CH Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 0 °
Name: CH-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 200 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 270 psf Phi': 0 °

F of S: 1.233



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 79 pcf Cohesion': 80 psf Phi': 0 °
Name: OH/CL Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 80 psf Phi': 0 °
Name: ML Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 28 °
Name: CH Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 0 °
Name: CH-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 200 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 270 psf Phi': 0 °

F of S: 1.450



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL D - B3/C8 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

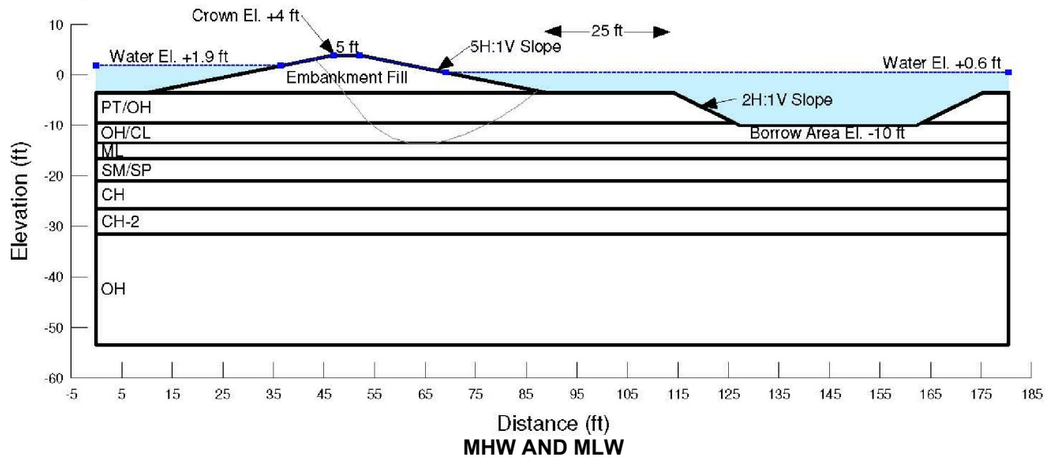
Figure B-8a

DPS : KMC

P:\16\16715040\00\CAD\Slope Stability_1_1_1784.sv$_1_1_5077.sv$.dwg\TAB:B3C8 25 modified on Jun 30, 2015 - 9:19am

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 79 pcf Cohesion': 80 psf Phi': 0 °
Name: OH/CL Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 80 psf Phi': 0 °
Name: ML Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 28 °
Name: CH Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 0 °
Name: CH-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 200 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 270 psf Phi': 0 °

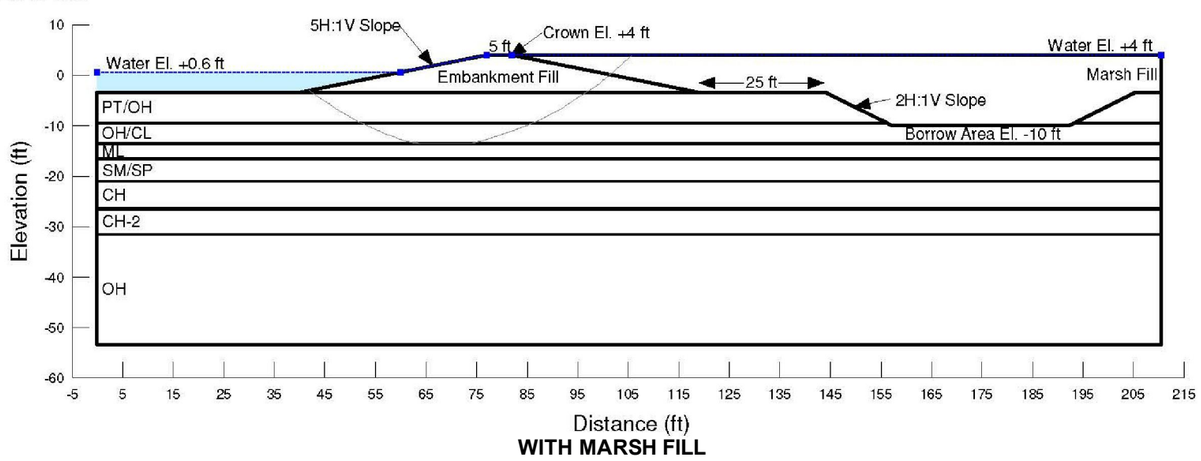
F of S: 1.372



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 79 pcf Cohesion': 80 psf Phi': 0 °
Name: OH/CL Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 80 psf Phi': 0 °
Name: ML Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 28 °
Name: CH Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 0 °
Name: CH-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 200 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 90 pcf Cohesion': 270 psf Phi': 0 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.237



WITH MARSH FILL

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SLOPE STABILITY - CELL D - B3/C8 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

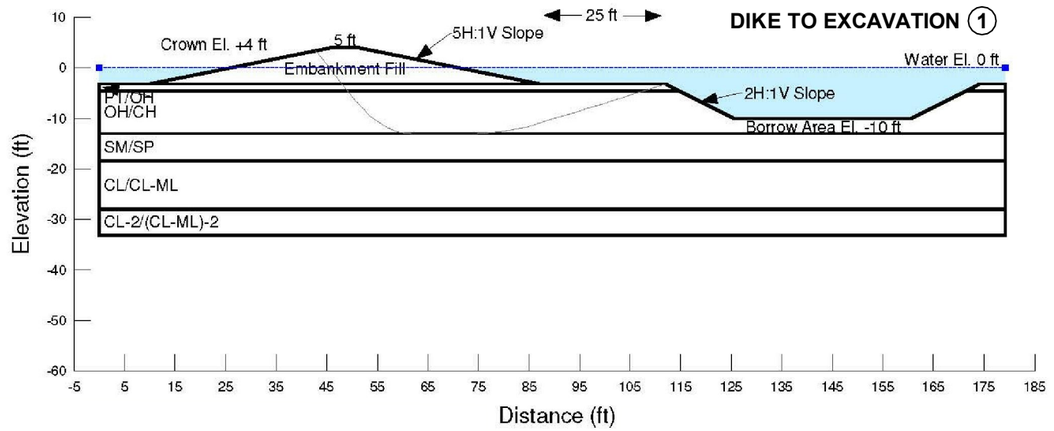
Figure B-8b

DPS : KMC

P:\16\16715040\00\CAD\Drawing3_1_1_4964_recover.dwg\TAB:B-8b modified on Jun 30, 2015 - 9:19am

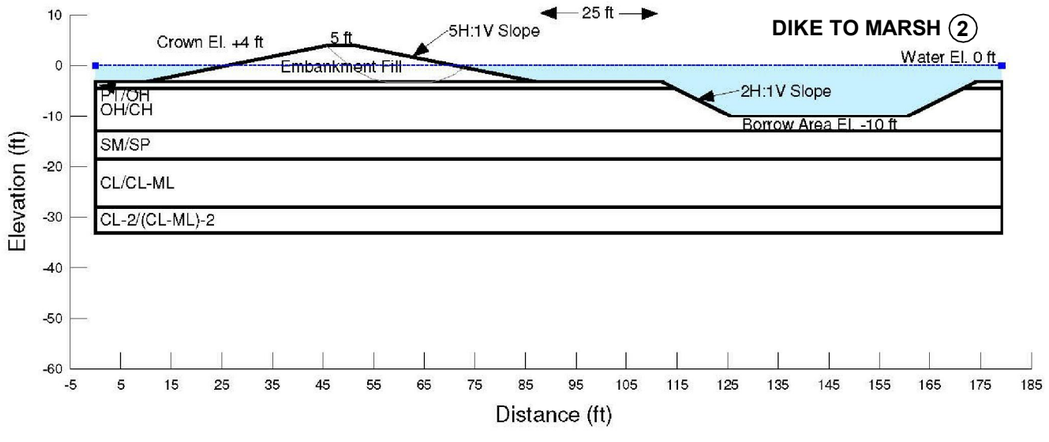
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 110 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 110 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 260 psf Phi': 0 °
Name: CL-2/(CL-ML)-2 Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 260 psf Phi': 0 °

F of S: 2.030



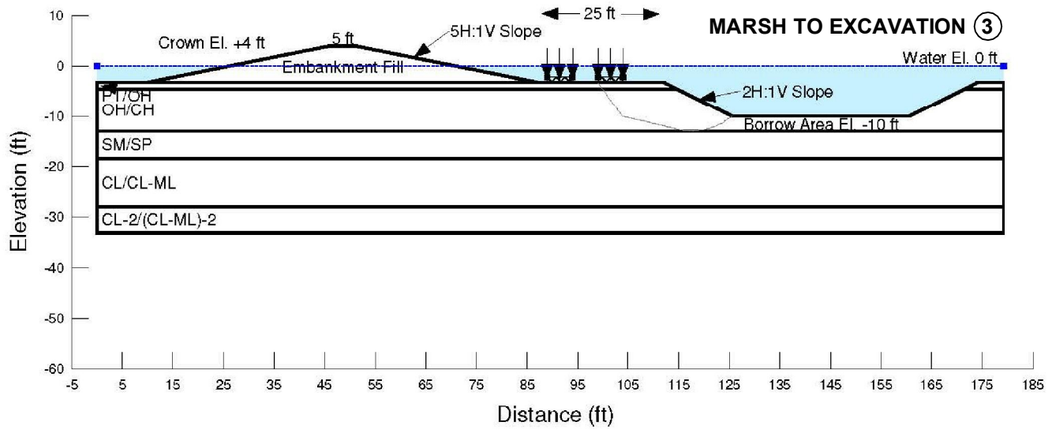
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 110 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 110 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 260 psf Phi': 0 °
Name: CL-2/(CL-ML)-2 Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 260 psf Phi': 0 °

F of S: 1.422



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 110 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 110 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 260 psf Phi': 0 °
Name: CL-2/(CL-ML)-2 Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 260 psf Phi': 0 °

F of S: 1.562



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL D - C9 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure B-9a

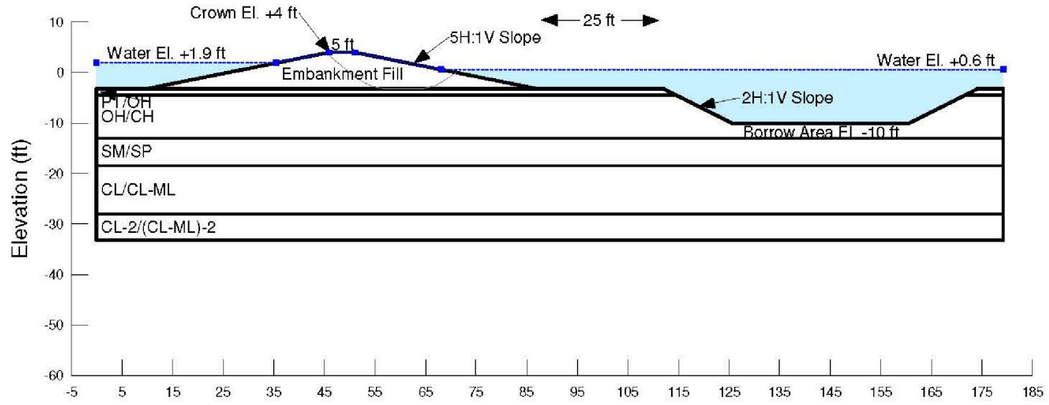
DPS : KMC

P:\16\16715040\00\CAD\Slope Stability_1_1_1784.sv$_1_1_5077.sv$.dwgTAB:C9 4.25 modified on Jun 30, 2015 - 9:19am

DPS : KMC

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 110 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 110 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 260 psf Phi': 0 °
Name: CL-2/(CL-ML)-2 Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 260 psf Phi': 0 °

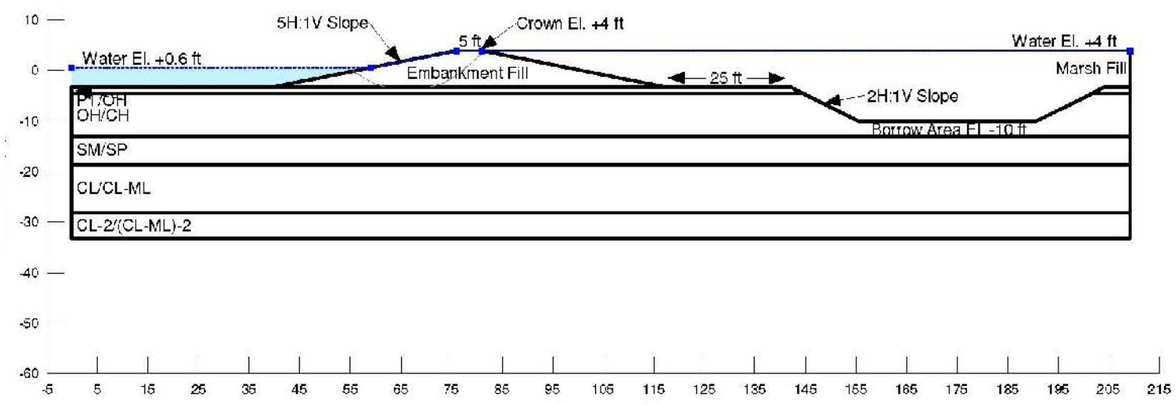
F of S: 1.502



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 110 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 110 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 260 psf Phi': 0 °
Name: CL-2/(CL-ML)-2 Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 260 psf Phi': 0 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

S: 1.508



WITH MARSH FILL

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SLOPE STABILITY - CELL D - C9 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

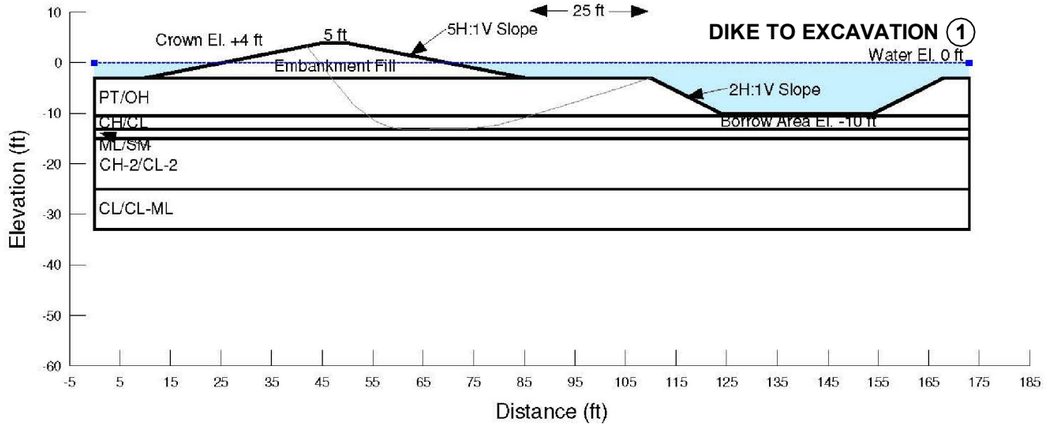
GeoEngineers

Figure B-9b

P:\16\16715040\00\CAD\Drawing3_1_1_4964_recover.dwg\TAB:B-9c modified on Jun 30, 2015 - 9:20am

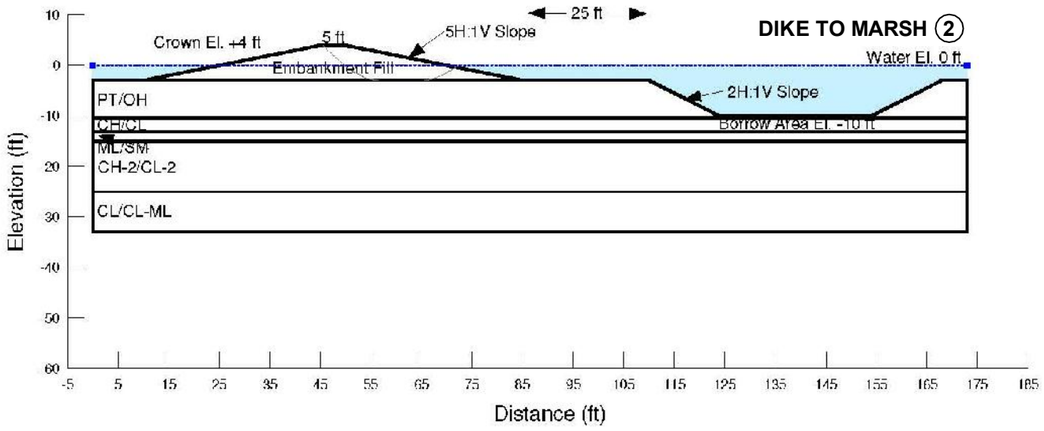
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 100 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 106 pcf Cohesion': 100 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 200 psf Phi': 10 °
Name: CH-2/CL-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 210 psf Phi': 0 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 210 psf Phi': 0 °

F of S: 1.857



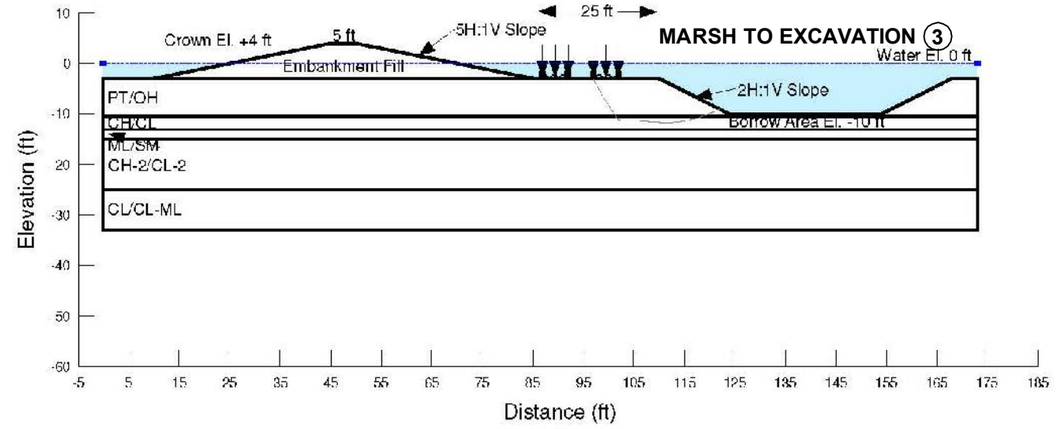
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 100 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 106 pcf Cohesion': 100 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 200 psf Phi': 10 °
Name: CH-2/CL-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 210 psf Phi': 0 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 210 psf Phi': 0 °

F of S: 1.456



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 100 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 106 pcf Cohesion': 100 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 200 psf Phi': 10 °
Name: CH-2/CL-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 210 psf Phi': 0 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 210 psf Phi': 0 °

F of S: 1.839



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL D - C10 - @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure B-10a

DPS : KMC

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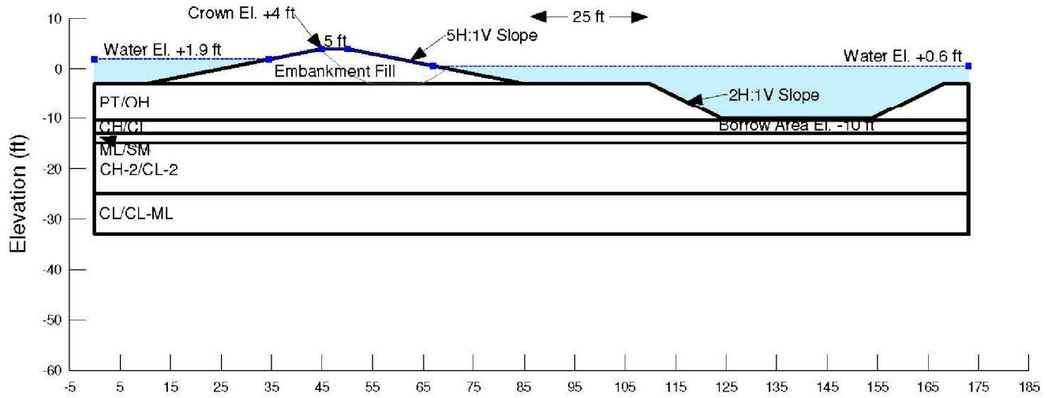
DPS : KMC

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 100 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 106 pcf Cohesion': 100 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 200 psf Phi': 10 °
Name: CH-2/CL-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 210 psf Phi': 0 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 210 psf Phi': 0 °

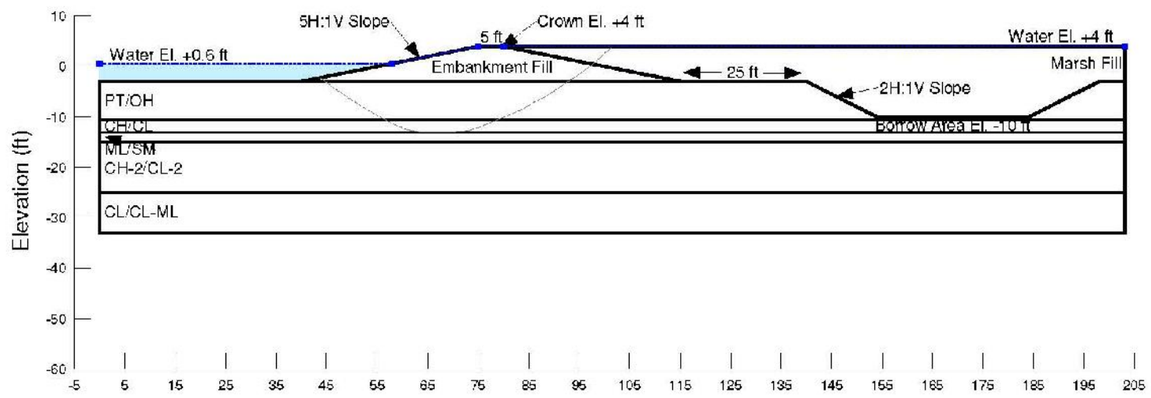
F of S: 1.533



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 100 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 106 pcf Cohesion': 100 psf Phi': 0 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 200 psf Phi': 10 °
Name: CH-2/CL-2 Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 210 psf Phi': 0 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 210 psf Phi': 0 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.559



WITH MARSH FILL

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SLOPE STABILITY - CELL D - C10 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

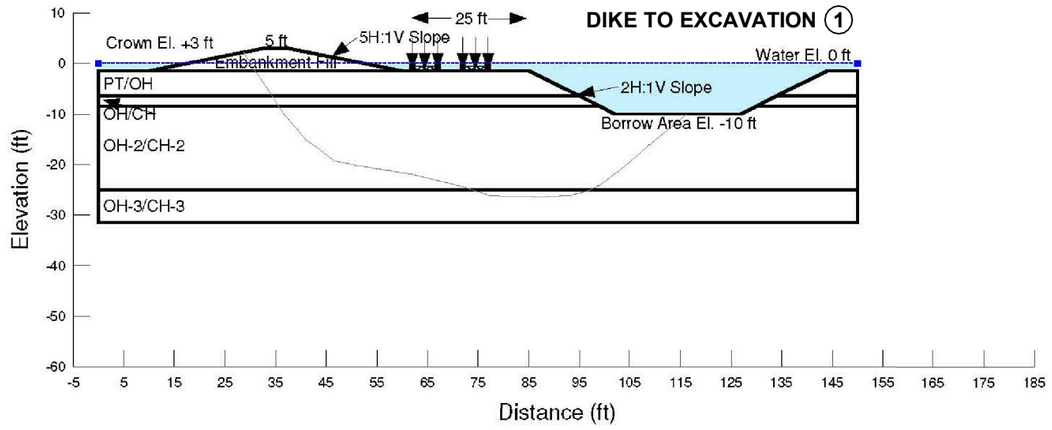
GeoEngineers

Figure B-10b

P:\16\16715040\00\CAD\Drawing3_1_1_4964_recover.dwg\TAB:B-10c modified on Jun 30, 2015 - 9:20am

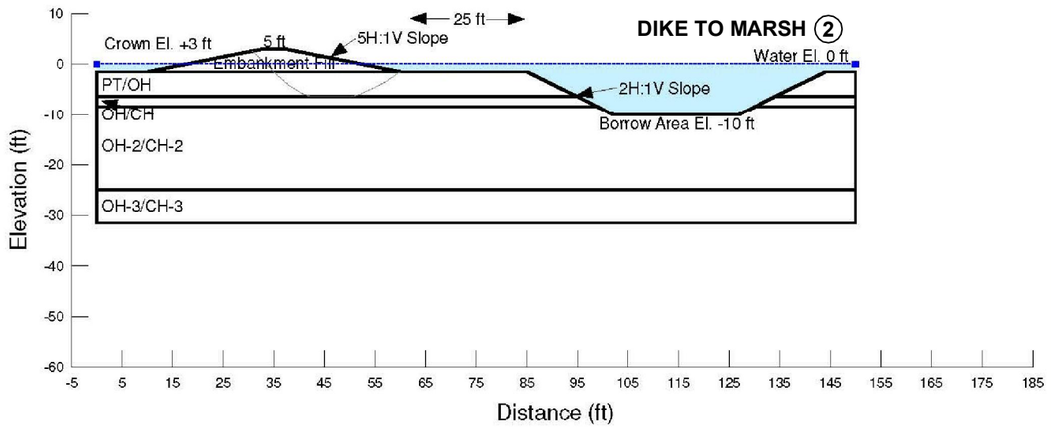
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 70 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °
Name: OH-3/CH-3 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °

F of S: 1.983



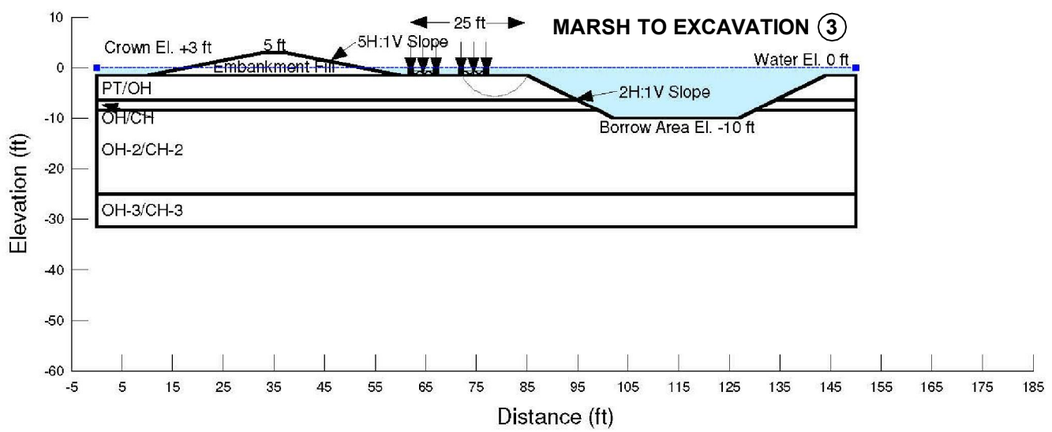
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 70 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °
Name: OH-3/CH-3 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °

F of S: 1.200



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 70 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °
Name: OH-3/CH-3 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °

F of S: 1.132



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL E - C11 @ ELEV. +3 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

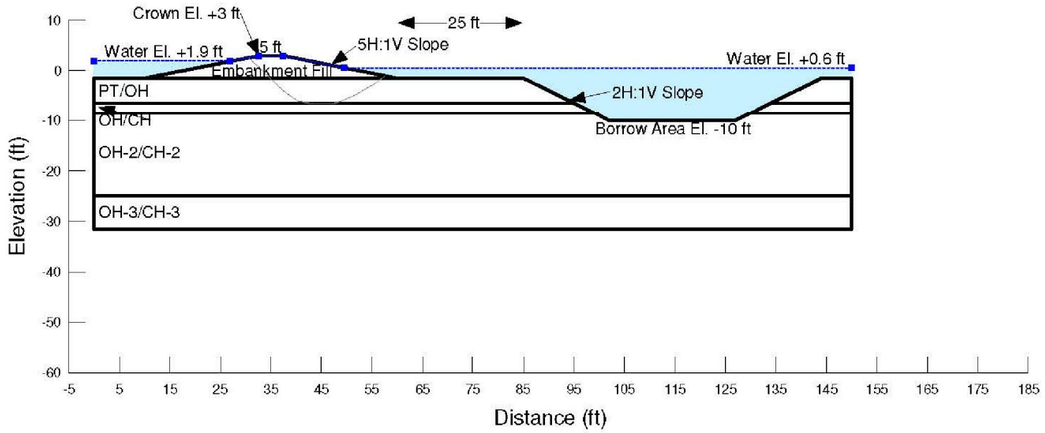
Figure B-11a

DPS : KMC

P:\16\16715040\00\CAD\Slope Stability_1_1_1784.sv$_1_1_5077.sv$.dwg\TAB:C11 3 modified on Jun 30, 2015 - 9:23am

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 70 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °
Name: OH-3/CH-3 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °

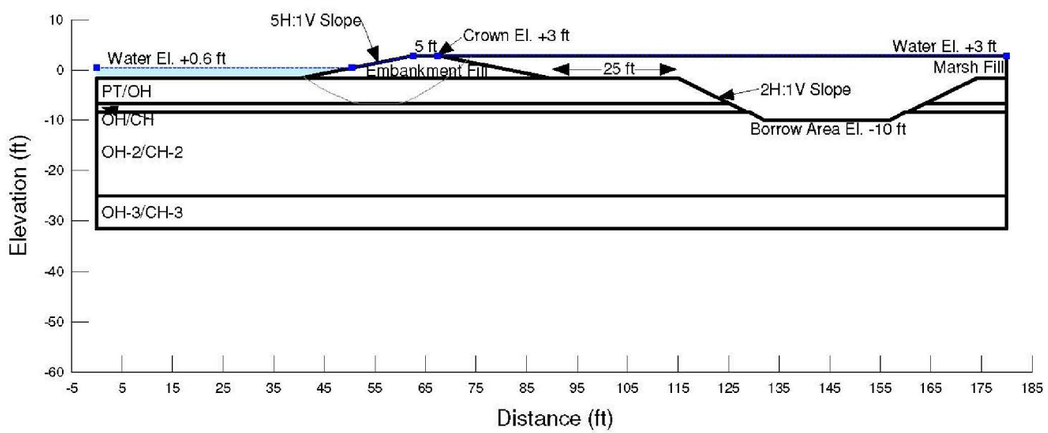
F of S: 1.391



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 70 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °
Name: OH-3/CH-3 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 150 psf Phi': 0 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.360



WITH MARSH FILL

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SLOPE STABILITY - CELL E - C11 @ ELEV. +3 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

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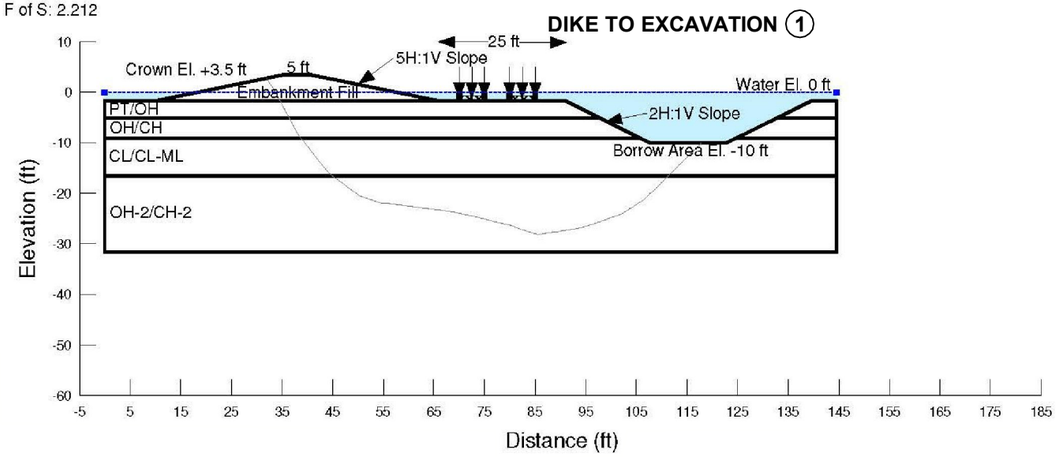
Figure B-11b

DPS : KMC

P:\16\16715040\00\CAD\Drawing3_1_1_4964_recover.dwg\TAB:B-11b modified on Jun 30, 2015 - 9:22am

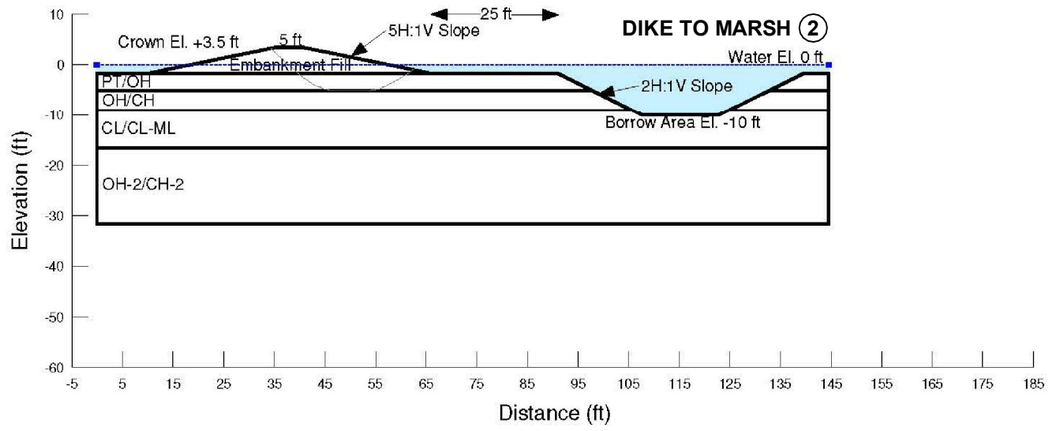
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 160 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °

F of S: 2.212



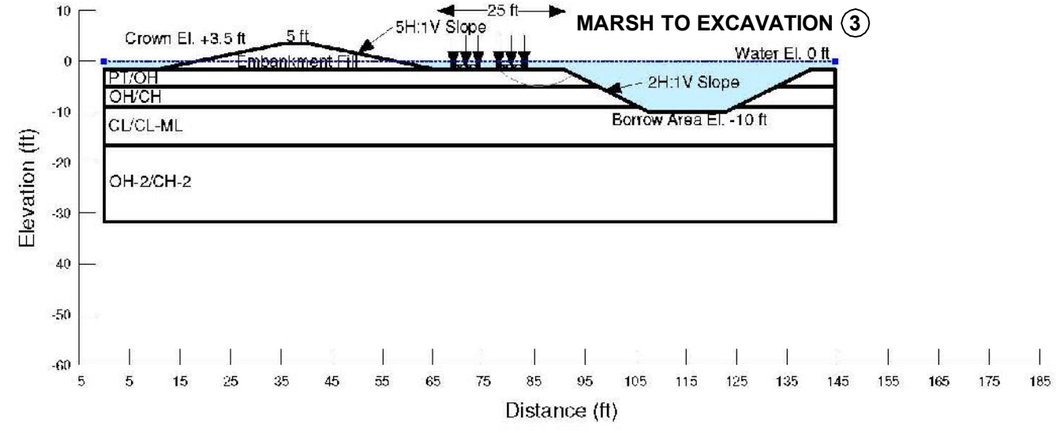
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 160 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.188



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 160 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.273



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL E - C12 @ ELEV. +3.5 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

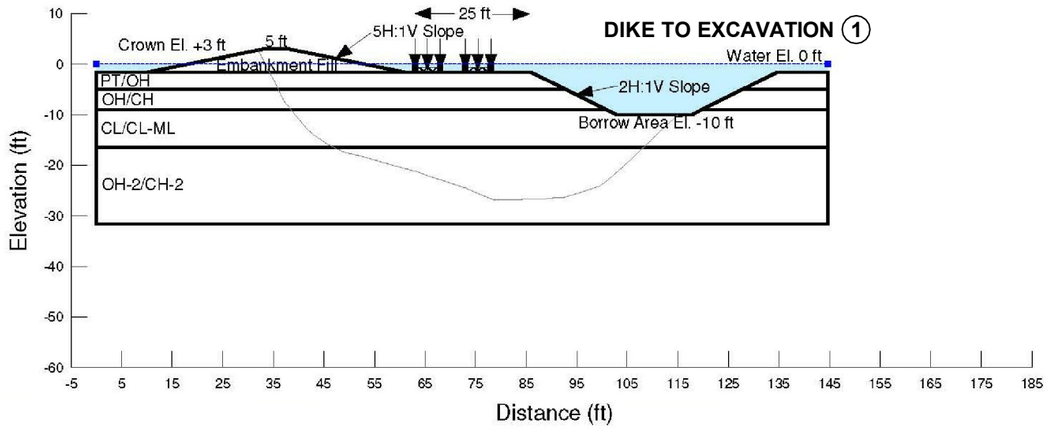
Figure B-12a

DPS : KMC

P:\16\16715040\00\CAD\Slope Stability.dwg\TAB:C12 3.5 modified on Jun 29, 2015 - 1:55pm

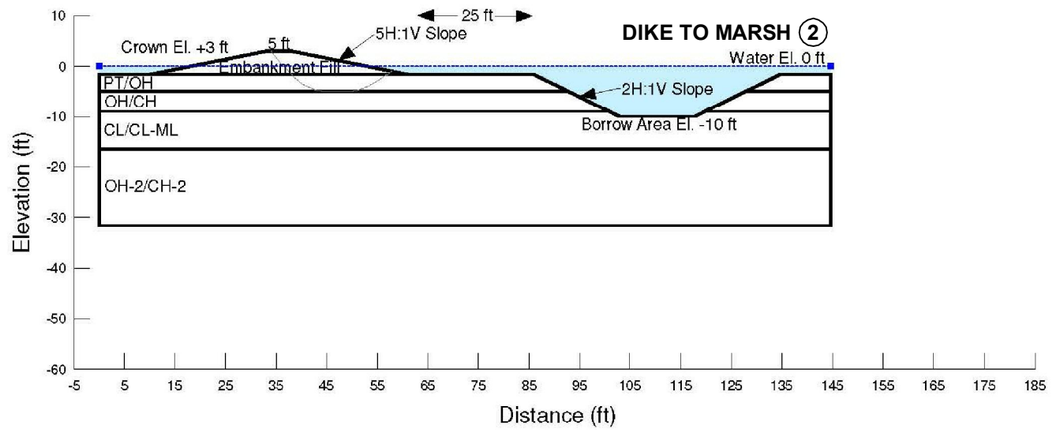
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 160 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °

F of S: 2.296



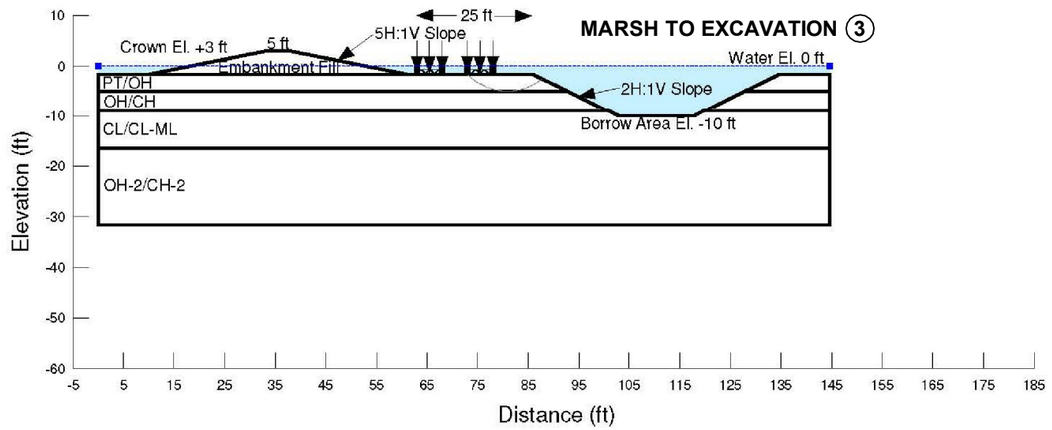
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 160 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.341



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 160 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °

F of S: 1.256



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL E - C12 @ ELEV. +3 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

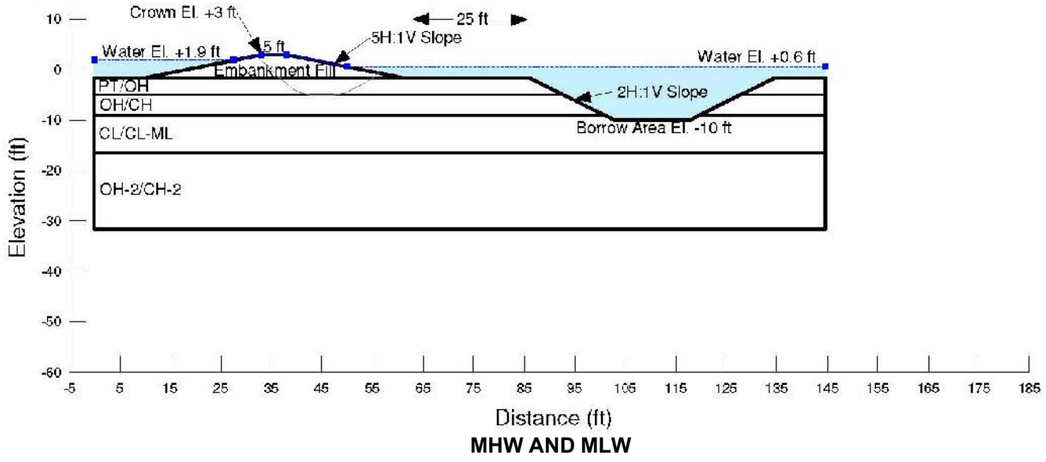
Figure B-12b

DPS : KMC

P:\16\16715040\00\CAD\Slope Stability.dwg\TAB:C12 3 modified on Jun 29, 2015 - 1:49pm

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 160 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °

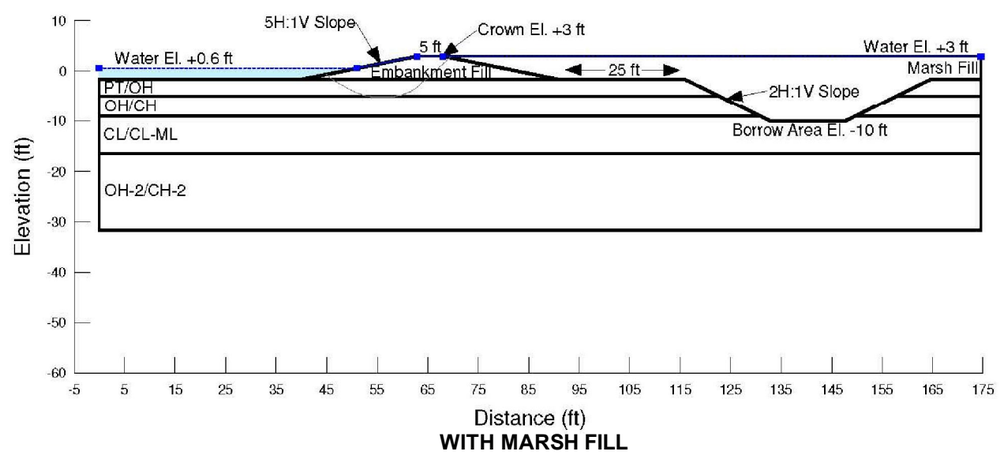
F of S: 1.497



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 70 psf Phi': 0 °
Name: CL/CL-ML Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 160 psf Phi': 0 °
Name: OH-2/CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 200 psf Phi': 0 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.497



WITH MARSH FILL

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SLOPE STABILITY - CELL E - C12 @ ELEV. +3 FT.

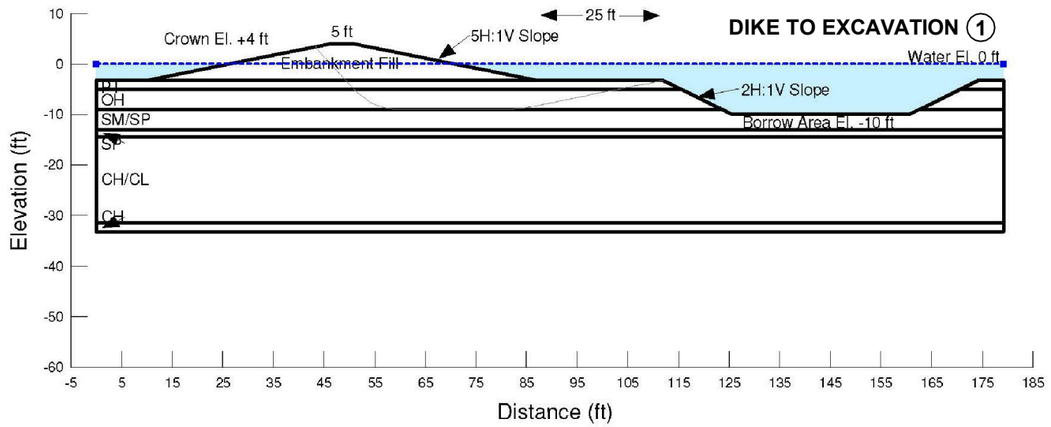
Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure B-12c

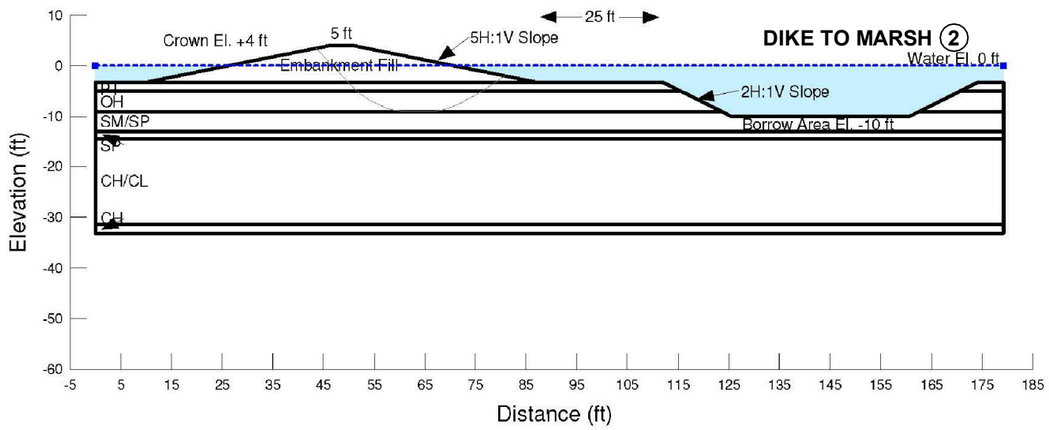
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 80 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 80 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 28 °
Name: SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 30 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 220 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 101 pcf Cohesion': 220 psf Phi': 0 °

F of S: 1.814



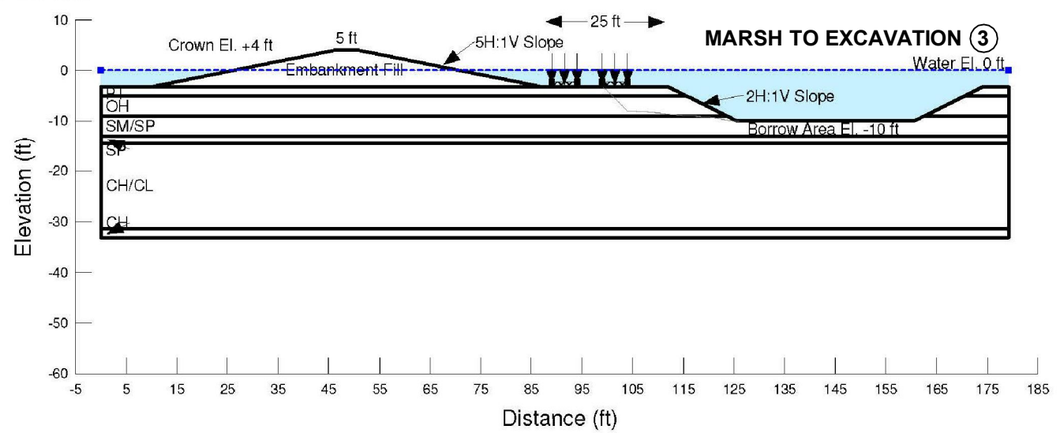
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 80 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 80 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 28 °
Name: SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 30 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 220 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 101 pcf Cohesion': 220 psf Phi': 0 °

F of S: 1.322



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 80 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 80 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 28 °
Name: SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 30 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 220 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 101 pcf Cohesion': 220 psf Phi': 0 °

F of S: 1.307



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL E - B4/C13 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

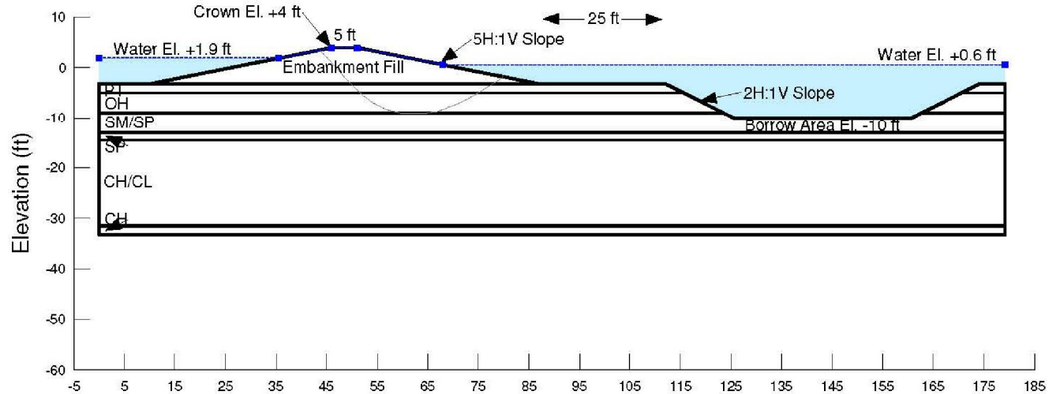
Figure B-13a

DPS : KMC

P:\16\16715040\00\CAD\Slope Stability_1_1_1784.sv$_1_1_5077.sv$.dwg\TAB:B4C13 modified on Jun 30, 2015 - 9:24am

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 80 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 80 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 28 °
Name: SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 30 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 220 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 101 pcf Cohesion': 220 psf Phi': 0 °

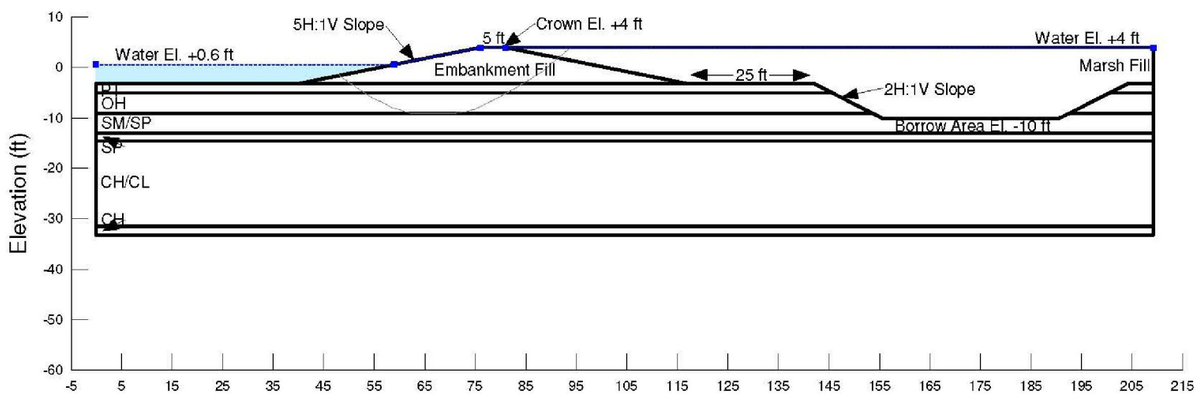
F of S: 1.461



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 80 psf Phi': 0 °
Name: OH Model: Mohr-Coulomb Unit Weight: 103 pcf Cohesion': 80 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 28 °
Name: SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 30 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 220 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 101 pcf Cohesion': 220 psf Phi': 0 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.385



WITH MARSH FILL

Notes:
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SLOPE STABILITY - CELL E - B4/C13 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

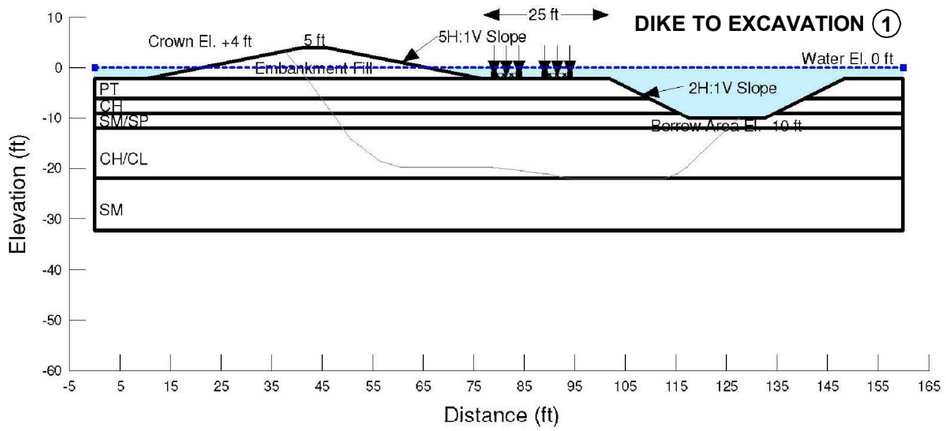
Figure B-13b

DPS : KMC

P:\16\16715040\00\CAD\Drawing3_1_1_4964_recover.dwg\TAB:B-13b modified on Jun 30, 2015 - 9:25am

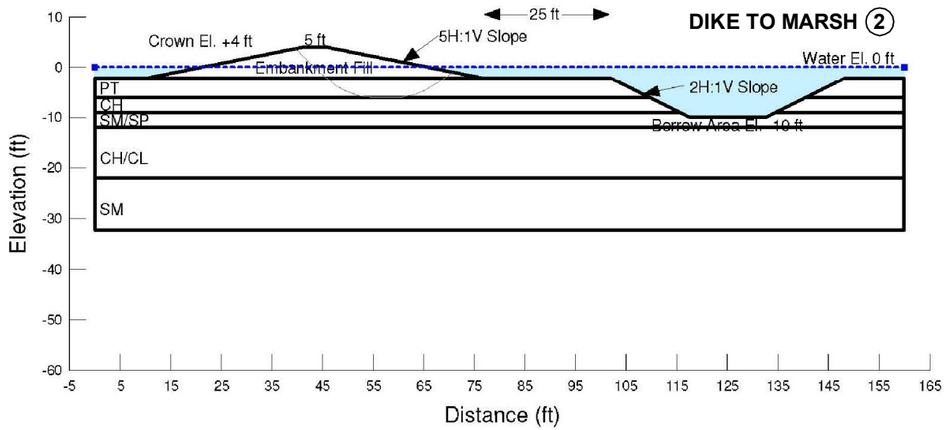
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 79 pcf Cohesion': 70 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 110 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 28 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 110 psf Phi': 0 °
Name: SM Model: Mohr-Coulomb Unit Weight: 128 pcf Cohesion': 0 psf Phi': 30 °

F of S: 1.357



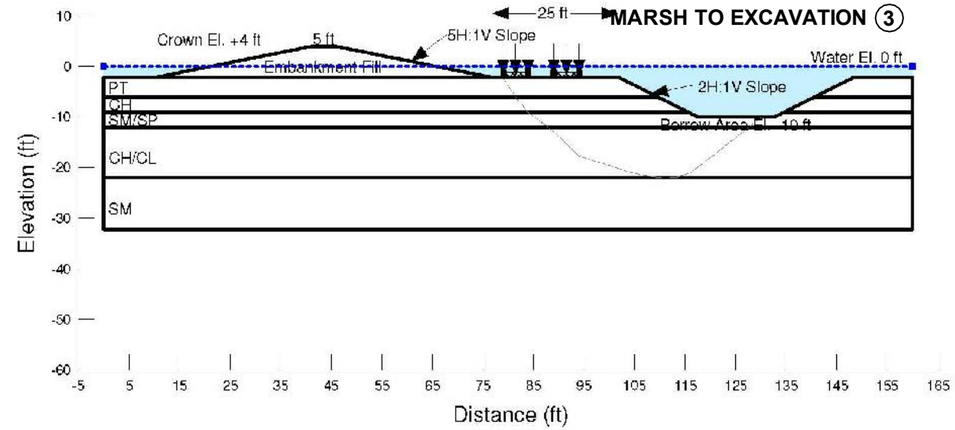
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 79 pcf Cohesion': 70 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 110 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 28 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 110 psf Phi': 0 °
Name: SM Model: Mohr-Coulomb Unit Weight: 128 pcf Cohesion': 0 psf Phi': 30 °

F of S: 1.320



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 79 pcf Cohesion': 70 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 110 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 28 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 110 psf Phi': 0 °
Name: SM Model: Mohr-Coulomb Unit Weight: 128 pcf Cohesion': 0 psf Phi': 30 °

F of S: 1.284



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL E - B5/C14 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

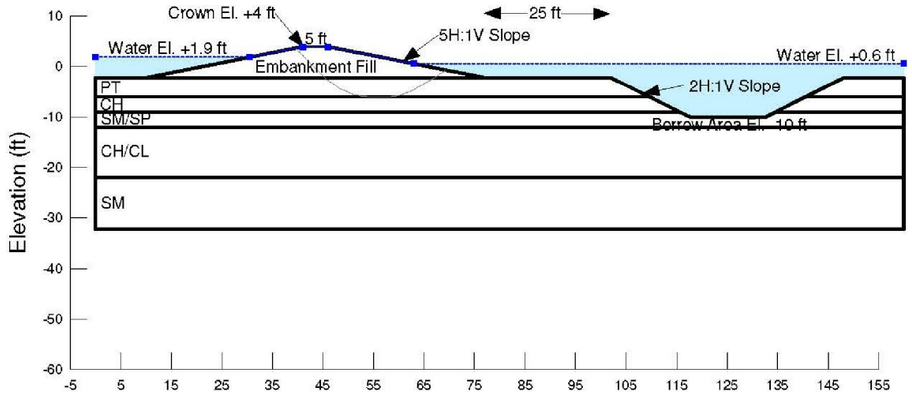
Figure B-14a

DPS : KMC

P:\16\16715040\00\CAD\Slope Stability_1_1_1784.sv$_1_1_5077.sv$.dwg\TAB:B5C14 25 modified on Jun 30, 2015 - 9:26am

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 79 pcf Cohesion': 70 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 110 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 28 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 110 psf Phi': 0 °
Name: SM Model: Mohr-Coulomb Unit Weight: 128 pcf Cohesion': 0 psf Phi': 30 °

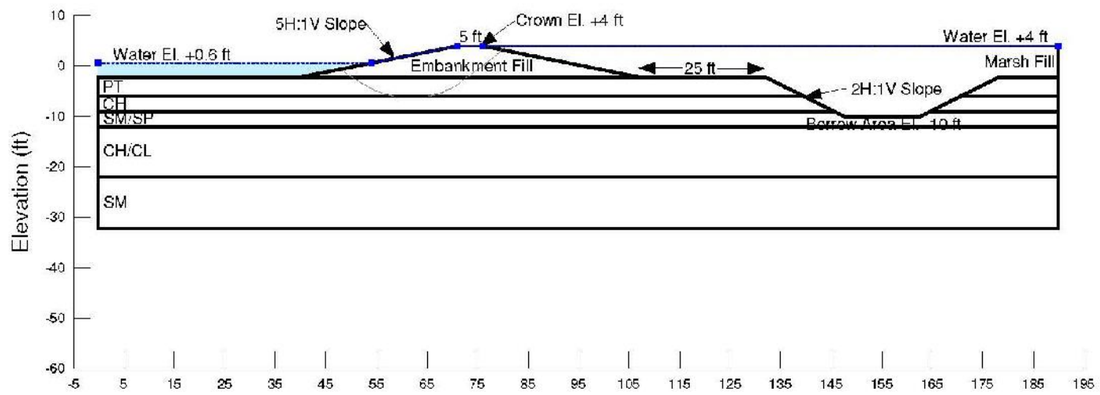
F of S: 1.433



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 79 pcf Cohesion': 70 psf Phi': 0 °
Name: CH Model: Mohr-Coulomb Unit Weight: 118 pcf Cohesion': 110 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 28 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 102 pcf Cohesion': 110 psf Phi': 0 °
Name: SM Model: Mohr-Coulomb Unit Weight: 128 pcf Cohesion': 0 psf Phi': 30 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.419



WITH MARSH FILL

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SLOPE STABILITY - CELL E - B5/C14 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

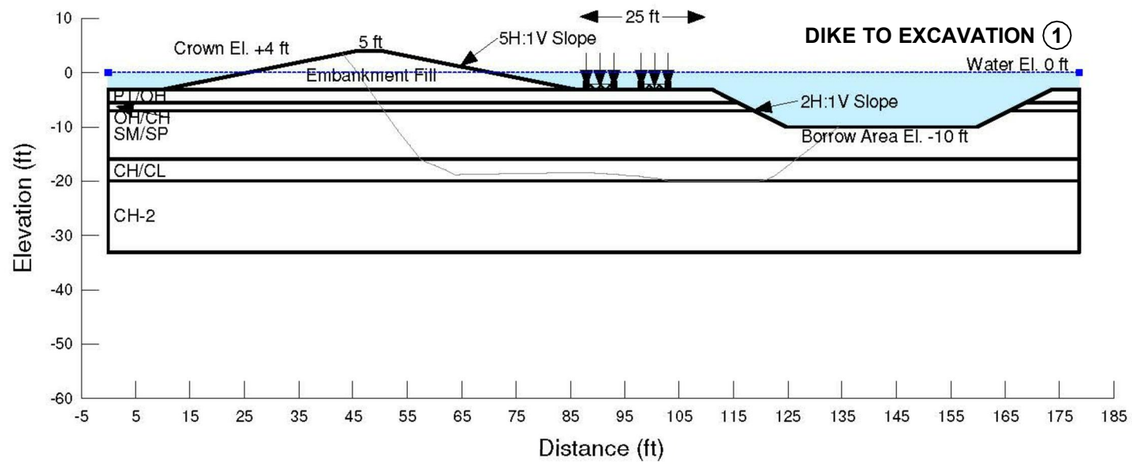
Figure B-14b

DPS : KMC

P:\16\16715040\00\CAD\Drawing3_1_1_4964_recover.dwg\TAB:B-14b modified on Jun 30, 2015 - 9:25am

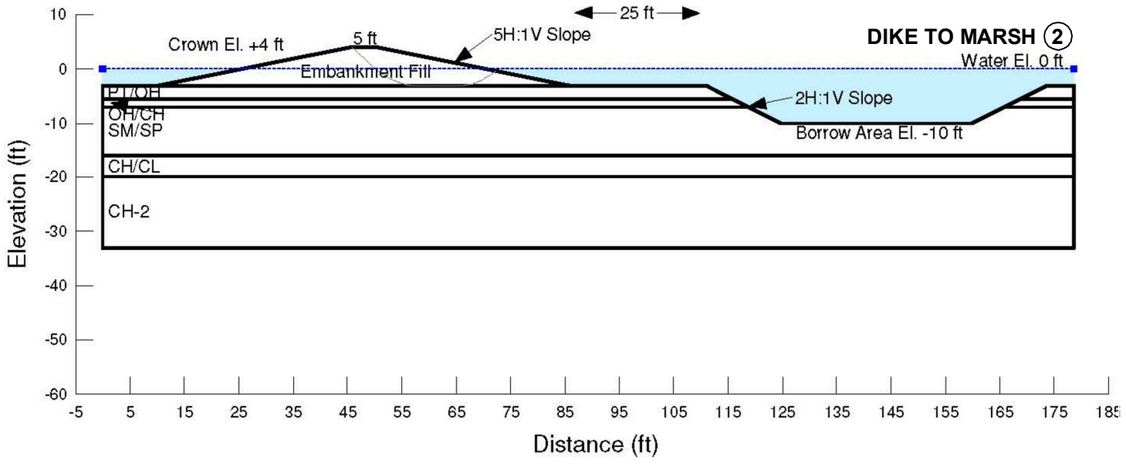
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 100 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 100 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 150 psf Phi': 0 °
Name: CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 350 psf Phi': 0 °

F of S: 2.091



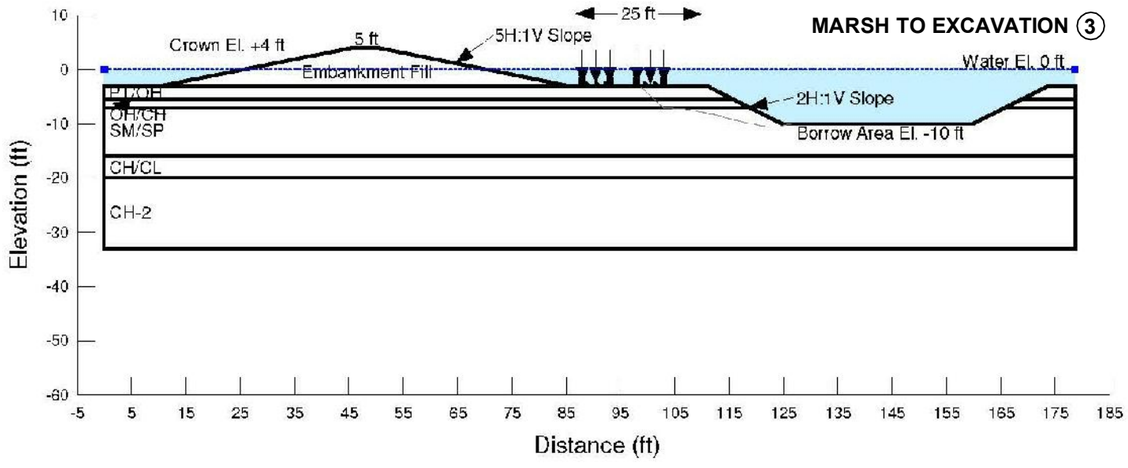
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 100 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 100 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 150 psf Phi': 0 °
Name: CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 350 psf Phi': 0 °

F of S: 1.440



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 100 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 100 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 150 psf Phi': 0 °
Name: CH-2 Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 350 psf Phi': 0 °

F of S: 1.455



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL E - C15 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure B-15a

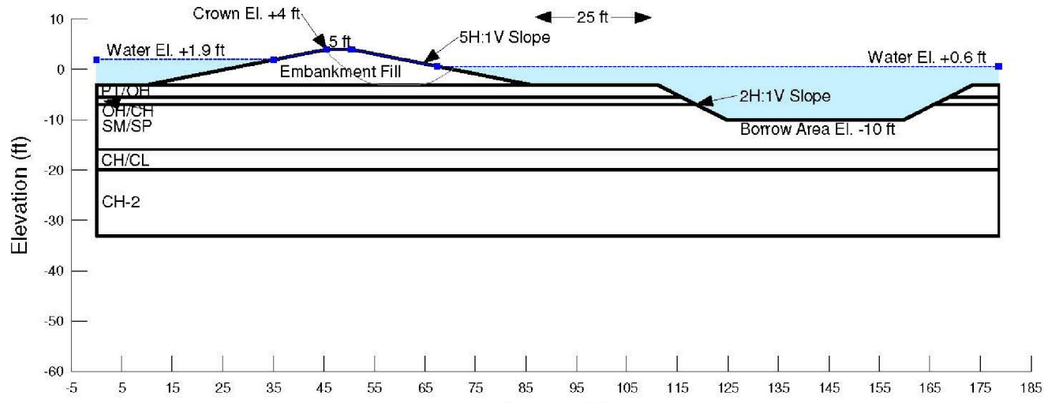
DPS : KMC

P:\161671504000\CAD\Slope Stability_1_1_1784.sv$_1_1_5077.sv$.dwg\TAB:C15 modified on Jun 30, 2015 - 9:34am

DPS : KMC

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 100 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 100 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 150 psf Phi': 0 °
Name: CH-2 Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 350 psf Phi': 0 °

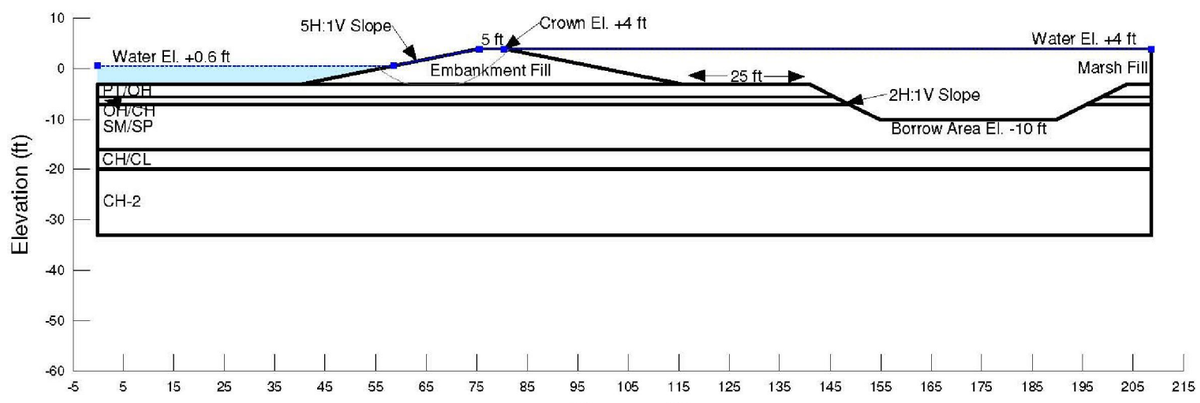
F of S: 1.516



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 100 psf Phi': 0 °
Name: OH/CH Model: Mohr-Coulomb Unit Weight: 105 pcf Cohesion': 100 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 117 pcf Cohesion': 0 psf Phi': 28 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 150 psf Phi': 0 °
Name: CH-2 Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 350 psf Phi': 0 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.520



WITH MARSH FILL

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SLOPE STABILITY - CELL E - C15 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

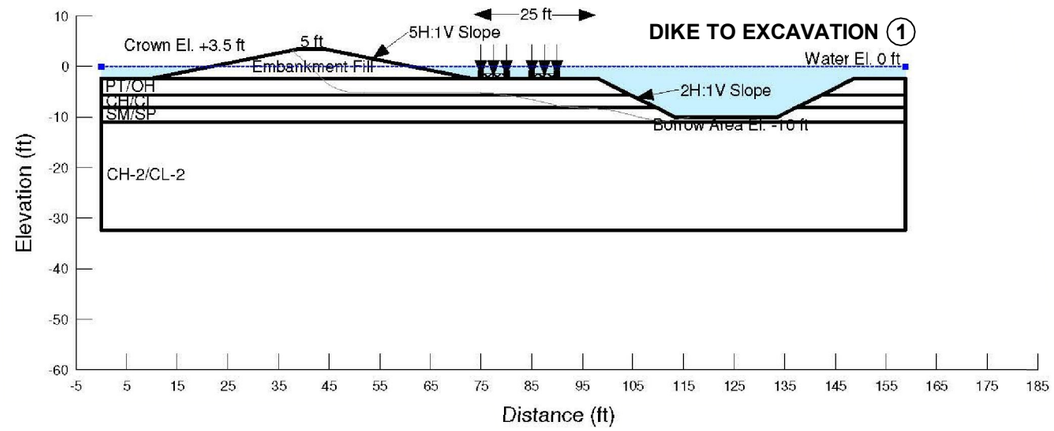
GeoEngineers

Figure B-15b

P:\16\16715040\00\CAD\Drawing3_1_1_4964_recover_1_1_7171.sv$.dwg\TAB:B-15b modified on Jun 30, 2015 - 9:28am

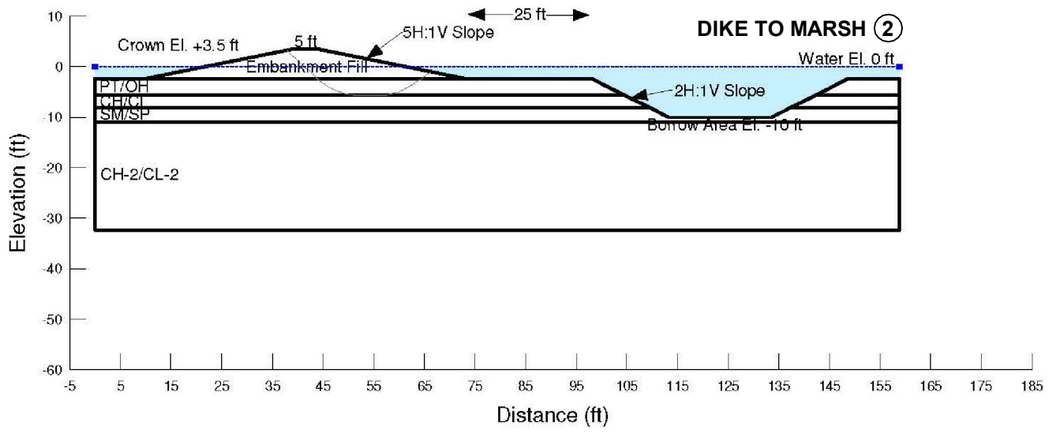
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 100 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 116 pcf Cohesion': 0 psf Phi': 28 °
Name: CH-2/CL-2 Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 400 psf Phi': 0 °

F of S: 1.837



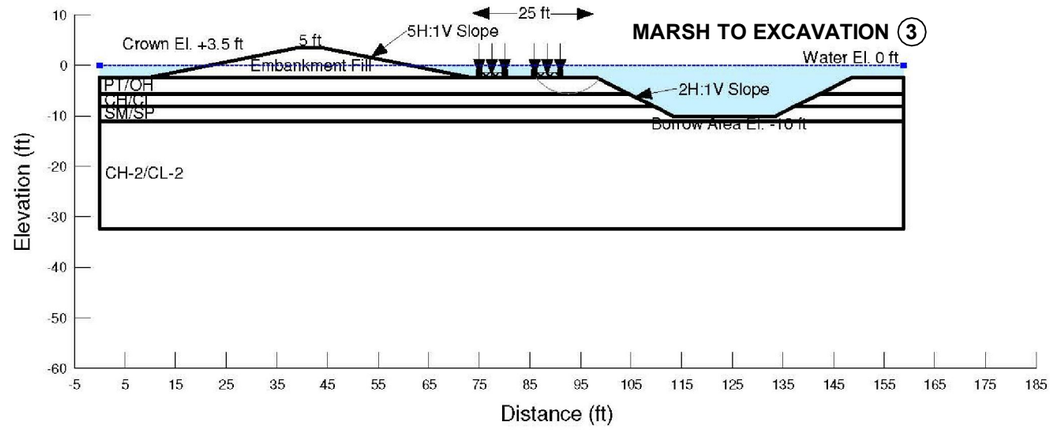
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 100 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 116 pcf Cohesion': 0 psf Phi': 28 °
Name: CH-2/CL-2 Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 400 psf Phi': 0 °

F of S: 1.167



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 100 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 116 pcf Cohesion': 0 psf Phi': 28 °
Name: CH-2/CL-2 Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 400 psf Phi': 0 °

F of S: 1.146



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL E - C17 @ ELEV. +3.5 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

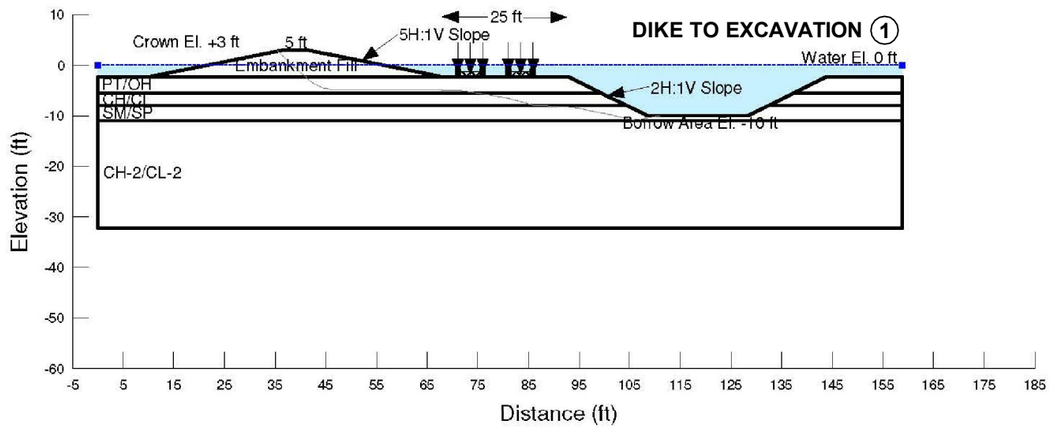
Figure B-16a

DPS : KMC

P:\16\16715040\00\CAD\Slope Stability.dwg\TAB:C17 modified on Jul 01, 2015 - 10:22am

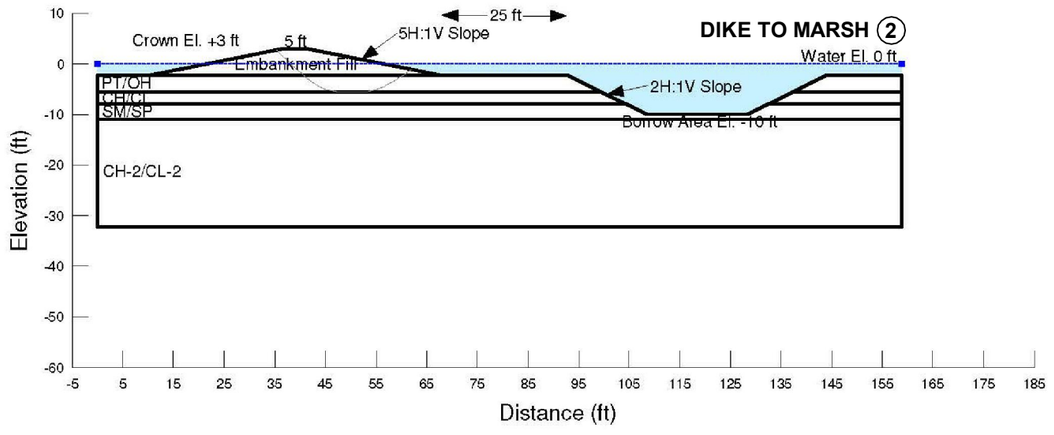
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 100 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 116 pcf Cohesion': 0 psf Phi': 28 °
Name: CH-2/CL-2 Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 400 psf Phi': 0 °

F of S: 1.940



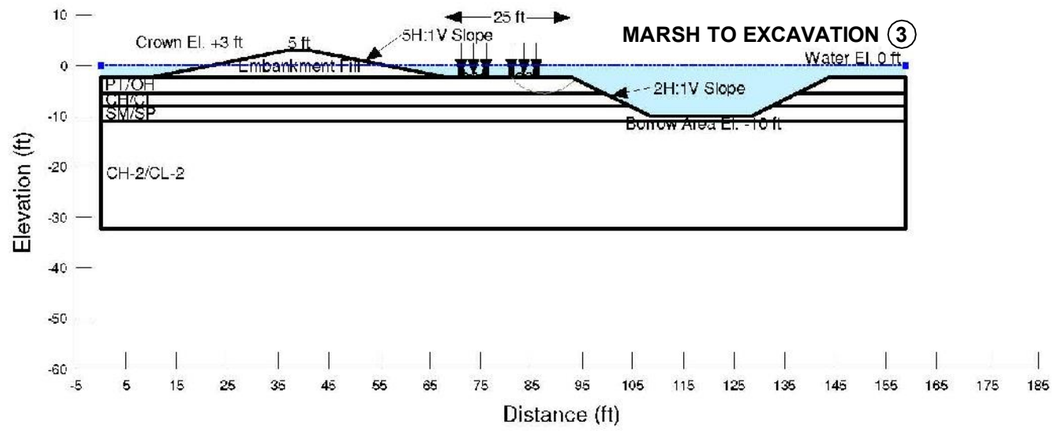
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 100 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 116 pcf Cohesion': 0 psf Phi': 28 °
Name: CH-2/CL-2 Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 400 psf Phi': 0 °

F of S: 1.294



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 100 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 116 pcf Cohesion': 0 psf Phi': 28 °
Name: CH-2/CL-2 Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 400 psf Phi': 0 °

F of S: 1.142



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CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL E - C17 @ ELEV. +3 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

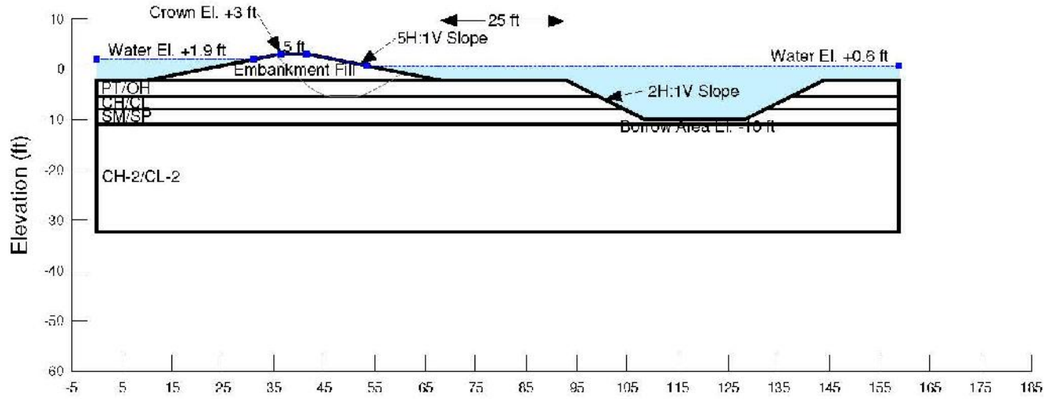
Figure B-16b

DPS : KMC

P:\161671504000\CAD\Slope Stability.dwg\TAB:c17 3 modified on Jun 29, 2015 - 2:12pm

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 100 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 116 pcf Cohesion': 0 psf Phi': 28 °
Name: CH-2/CL-2 Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 400 psf Phi': 0 °

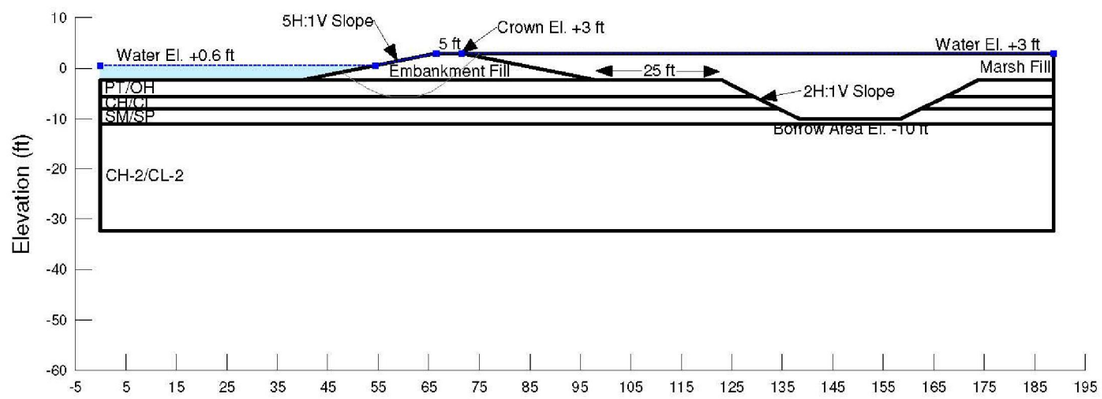
F of S: 1.477



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT/OH Model: Mohr-Coulomb Unit Weight: 78 pcf Cohesion': 50 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 100 psf Phi': 0 °
Name: SM/SP Model: Mohr-Coulomb Unit Weight: 116 pcf Cohesion': 0 psf Phi': 28 °
Name: CH-2/CL-2 Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 400 psf Phi': 0 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.470



WITH MARSH FILL

Notes:
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SLOPE STABILITY - CELL E - C17 @ ELEV. +3 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

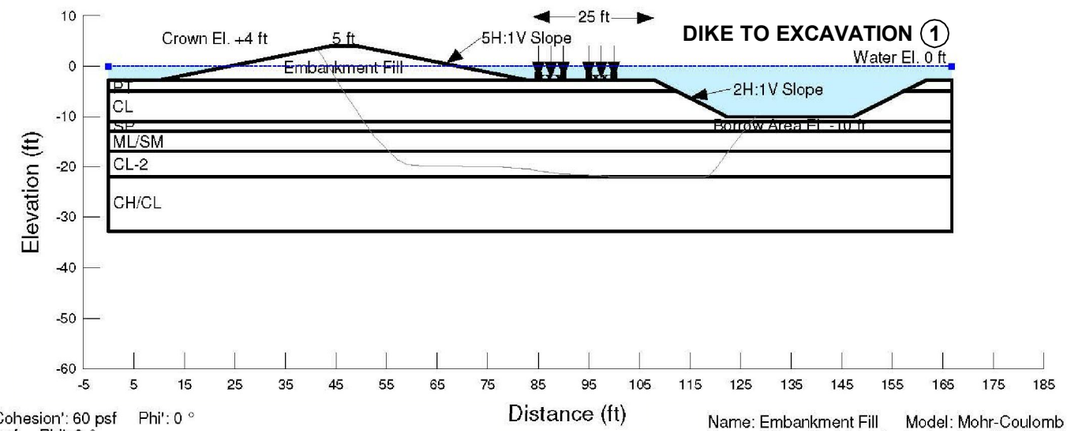
Figure B-16c

DPS : KMC

P:\16\16715040\00\CAD\Drawing3_1_1_4964_recover_1_1_7171.sv$.dwg\TAB:B-16c modified on Jun 30, 2015 - 9:29am

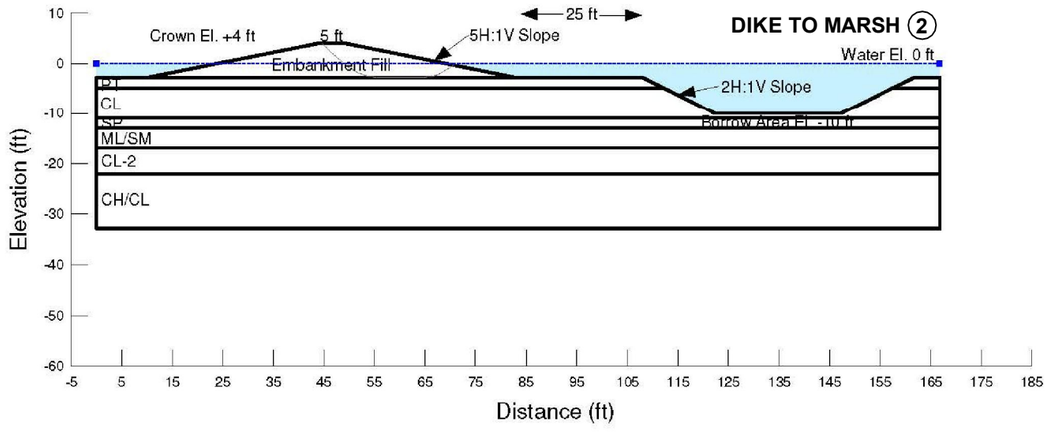
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 90 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 120 psf Phi': 0 °
Name: SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 30 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2 Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 180 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 280 psf Phi': 0 °

F of S: 2.302



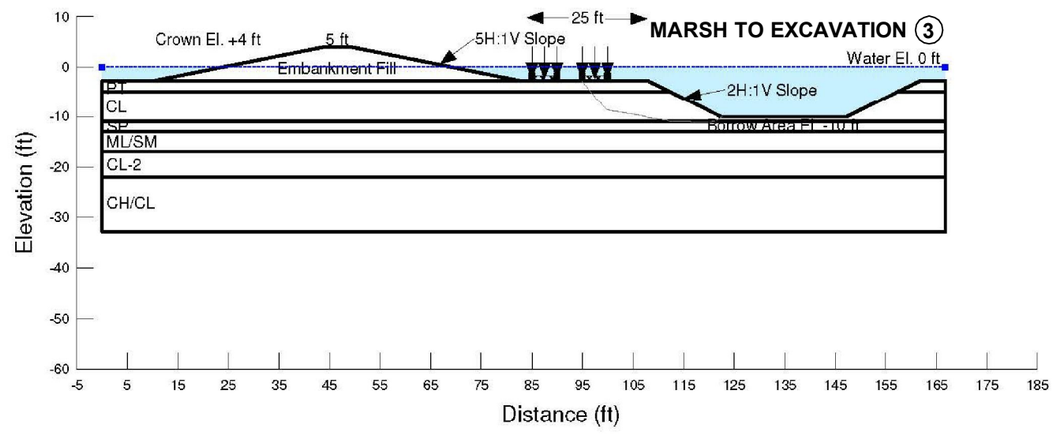
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 90 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 120 psf Phi': 0 °
Name: SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 30 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2 Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 180 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 280 psf Phi': 0 °

F of S: 1.486



Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 90 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 120 psf Phi': 0 °
Name: SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 30 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2 Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 180 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 280 psf Phi': 0 °

F of S: 1.743



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

CONDITION (1) DIKE TO EXCAVATION
CONDITION (2) DIKE TO MARSH
CONDITION (3) MARSH TO EXCAVATION

SLOPE STABILITY - CELL E - B6/C18 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure B-17a

DPS : KMC

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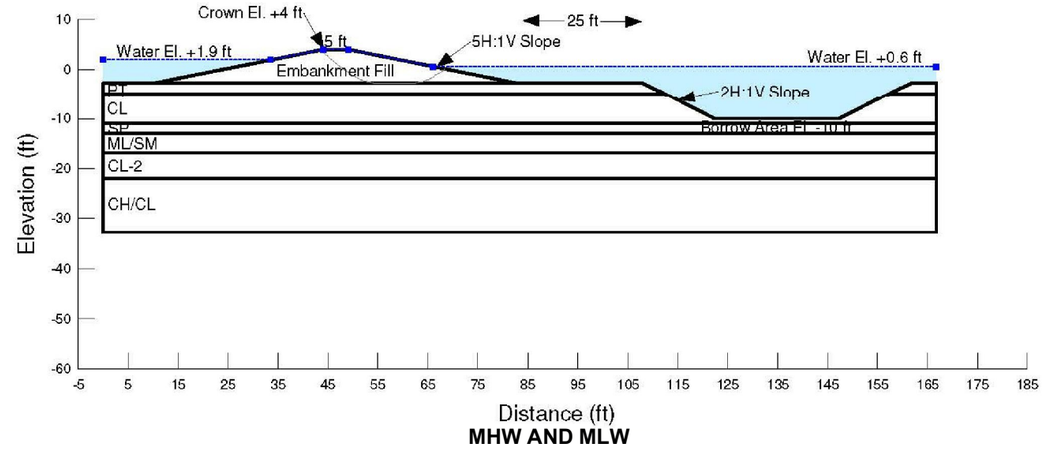
Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 90 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 120 psf Phi': 0 °
Name: SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 30 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2 Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 180 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 280 psf Phi': 0 °

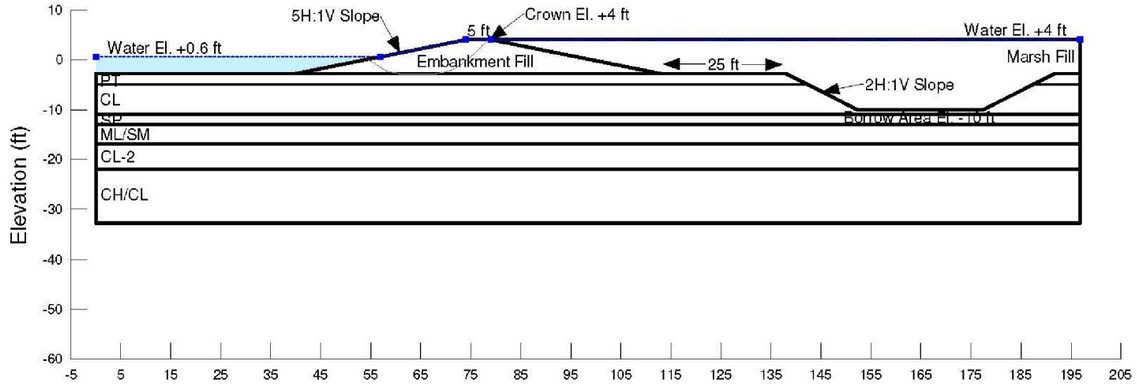
F of S: 1.559



MHW AND MLW

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 80 pcf Cohesion': 60 psf Phi': 0 °
Name: PT Model: Mohr-Coulomb Unit Weight: 76 pcf Cohesion': 90 psf Phi': 0 °
Name: CL Model: Mohr-Coulomb Unit Weight: 110 pcf Cohesion': 120 psf Phi': 0 °
Name: SP Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 30 °
Name: ML/SM Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 200 psf Phi': 10 °
Name: CL-2 Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 180 psf Phi': 0 °
Name: CH/CL Model: Mohr-Coulomb Unit Weight: 109 pcf Cohesion': 280 psf Phi': 0 °
Name: Marsh Fill Model: Mohr-Coulomb Unit Weight: 100 pcf Cohesion': 60 psf Phi': 0 °

F of S: 1.561



WITH MARSH FILL

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

SLOPE STABILITY - CELL E - B6/C18 @ ELEV. +4 FT.

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure B-17b

DPS : KMC

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Calculation Checksheet

Project No. 16715-040-00 Project Title: Island Road Marsh Creation and Nourishment (TE-117)

Deliverable Title: Earthen Containment Dike Bearing Capacity

Calculations Description: Computed bearing capacity and factor of safety against global bearing failure using the method for bearing contained in Figure 11-5 of NAVFAC DM-7 to compute bearing capacity of two-layered soil (soft layer overlying a stiffer soil) for dikes with no geotextile reinforcement.

Originator: VT/ECK Checked by: ECK/VT Date: 05/20/2015

Checking method (describe): Verified method, parameters, and spreadsheet inputs.

Comments: Water was set at elevation +0.0 ft NAVD 88 and mudline was based on survey data at the field exploration.

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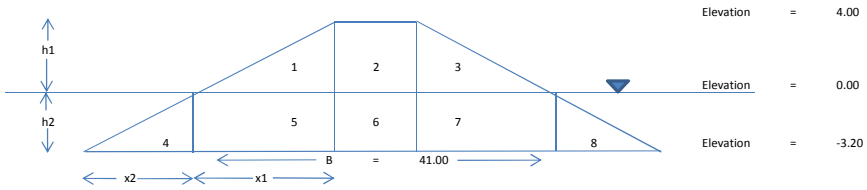
FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-B-7/C-1 El +4 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-3.20	4.00	7.20	5.00	1.00	5.00	0.00	77.00	4.00	3.20	20.00	16.00



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-3.20	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	41.00	279

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	40	20	40	26	64	16	64	26	295
Applied Load (lb./ft.)	3200	1600	3200	451	1126	282	1126	451	11436

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-3.20	-	-5.00		0.10	100.00	1.80
		-5.00	-	-11.00		0.10	100.00	6.00
		-11.00	-	-15.00		0.10	100.00	4.00
		-15.00	-	-23.00		0.10	100.00	8.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
1.80	41.00	0.04	100.00	100.00	1.00

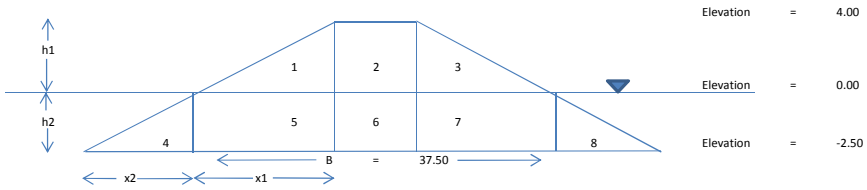
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	41.00	5.53	100	553	279	1.98

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-B-1/C-2 El +4 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-2.50	4.00	6.50	5.00	1.00	5.00	0.00	70.00	4.00	2.50	20.00	12.50



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-2.50	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	37.50	281

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	40	20	40	16	50	13	50	16	244
Applied Load (lb./ft.)	3200	1600	3200	275	880	220	880	275	10530

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-2.50	-	-4.00		0.05	50.00	1.50
		-4.00	-	-11.00		0.07	70.00	7.00
		-11.00	-	-15.00		0.14	140.00	4.00
		-15.00	-	-17.00		0.20	200.00	2.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
1.50	37.50	0.04	50.00	70.00	1.40

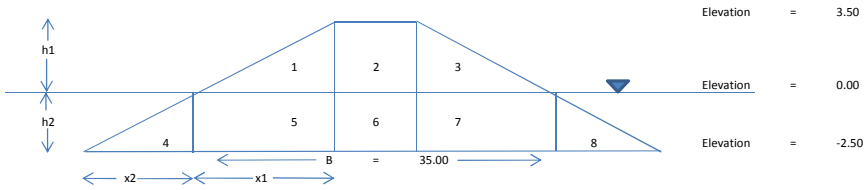
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	37.50	7.50	50	375	281	1.34

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-B-1/C-2 El +3.5 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-2.50	3.50	6.00	5.00	1.00	5.00	0.00	65.00	3.50	2.50	17.50	12.50



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-2.50	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	35.00	246

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	31	18	31	16	44	13	44	16	210
Applied Load (lb./ft.)	2450	1400	2450	275	770	220	770	275	8610

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-2.50	-	-4.00		0.05	50.00	1.50
		-4.00	-	-11.00		0.07	70.00	7.00
		-11.00	-	-15.00		0.14	140.00	4.00
		-15.00	-	-17.00		0.20	200.00	2.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
1.50	35.00	0.04	50.00	70.00	1.40

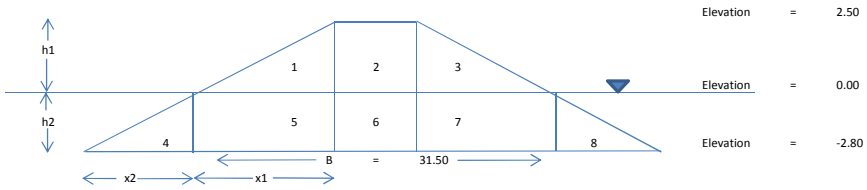
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	35.00	7.50	50	375	246	1.52

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-C-3 El +2.5 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-2.80	2.50	5.30	5.00	1.00	5.00	0.00	58.00	2.50	2.80	12.50	14.00



Assumptions:

1. Unit weight of dike 80.00 pcf
2. Water at EL. 0.00 feet
3. Mud line at EL. -2.80 feet
4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	31.50	180

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	16	13	16	20	35	14	35	20	167
Applied Load (lb./ft.)	1250	1000	1250	345	616	246	616	345	5668

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-2.80	-	-11.00		0.06	60.00	8.20
		-11.00	-	-14.50		0.06	60.00	3.50
		-14.50	-	-17.00		0.08	80.00	2.50
		-17.00	-	-22.50		0.10	100.00	5.50
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
11.70	31.50	0.37	60.00	80.00	1.33

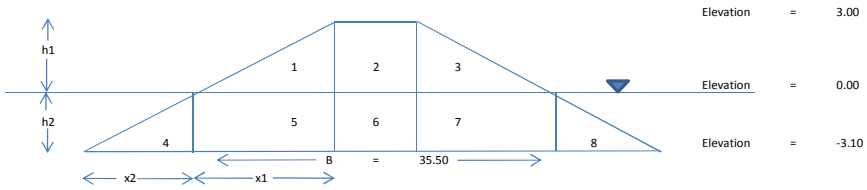
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	31.50	5.53	60	332	180	1.84

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-B-2/C-4 El +3 ft

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-3.10	3.00	6.10	5.00	1.00	5.00	0.00	66.00	3.00	3.10	15.00	15.50



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-3.10	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	35.50	213

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	23	15	23	24	47	16	47	24	217
Applied Load (lb./ft.)	1800	1200	1800	423	818	273	818	423	7555

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-3.10	-	-5.00		0.05	50.00	1.90
		-5.00	-	-11.00		0.06	60.00	6.00
		-11.00	-	-17.00		0.20	200.00	6.00
		-17.00	-	-26.00		0.16	160.00	9.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
1.90	35.50	0.05	50.00	60.00	1.20

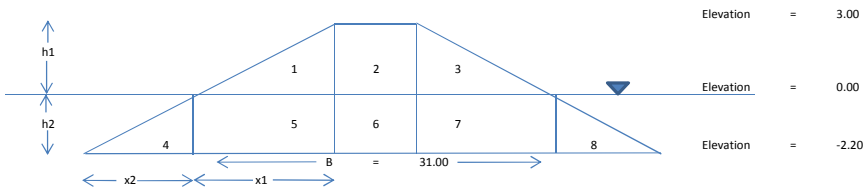
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	35.50	6.60	50	330	213	1.55

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-C-5 El +3 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-2.20	3.00	5.20	5.00	1.00	5.00	0.00	57.00	3.00	2.20	15.00	11.00



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-2.20	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	31.00	212

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	23	15	23	12	33	11	33	12	161
Applied Load (lb./ft.)	1800	1200	1800	213	581	194	581	213	6581

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-2.20	-	-10.00		0.06	60.00	7.80
		-10.00	-	-18.00		0.10	100.00	8.00
		-18.00	-	-23.50		0.20	200.00	5.50
		-23.50	-	-32.50		0.17	170.00	9.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
7.80	31.00	0.25	60.00	100.00	1.67

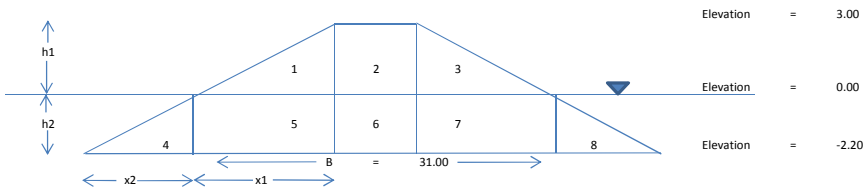
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	31.00	7.50	60	450	212	2.12

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-C-6 El +3 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-2.20	3.00	5.20	5.00	1.00	5.00	0.00	57.00	3.00	2.20	15.00	11.00



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-2.20	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	31.00	212

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	23	15	23	12	33	11	33	12	161
Applied Load (lb./ft.)	1800	1200	1800	213	581	194	581	213	6581

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-2.20	-	-5.50		0.05	50.00	3.30
		-5.50	-	-14.00		0.07	70.00	8.50
		-14.00	-	-22.00		0.20	200.00	8.00
			-				0.00	0.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
3.30	31.00	0.11	50.00	70.00	1.40

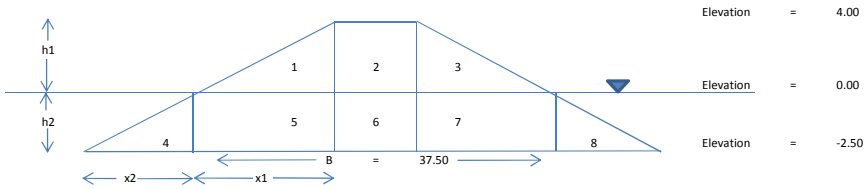
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	31.00	7.40	50	370	212	1.74

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-C-7 El +4 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-2.50	4.00	6.50	5.00	1.00	5.00	0.00	70.00	4.00	2.50	20.00	12.50



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-2.50	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	37.50	281

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	40	20	40	16	50	13	50	16	244
Applied Load (lb./ft.)	3200	1600	3200	275	880	220	880	275	10530

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-2.20	-	-8.50		0.09	90.00	6.30
		-8.50	-	-12.00		0.09	90.00	3.50
			-				0.00	0.00
			-				0.00	0.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
6.30	37.50	0.17	90.00	90.00	1.00

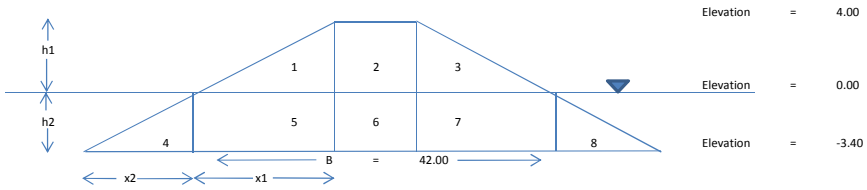
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	37.50	5.53	90	498	281	1.77

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-B-3/C-8 El +4 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-3.40	4.00	7.40	5.00	1.00	5.00	0.00	79.00	4.00	3.40	20.00	17.00



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-3.40	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	42.00	279

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	40	20	40	29	68	17	68	29	311
Applied Load (lb./ft.)	3200	1600	3200	509	1197	299	1197	509	11710

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-3.40	-	-7.00		0.08	80.00	3.60
		-7.00	-	-10.00		0.08	80.00	3.00
		-10.00	-	-12.00		0.08	80.00	2.00
		-12.00	-	-14.00		0.08	80.00	2.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
3.60	42.00	0.09	80.00	80.00	1.00

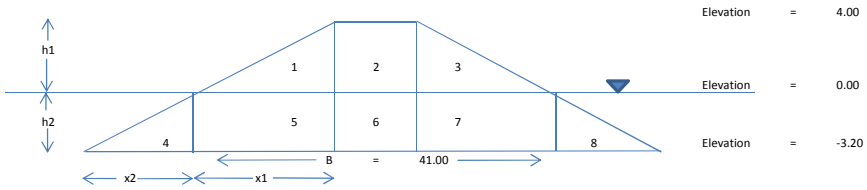
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	42.00	5.53	80	442	279	1.59

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-C-9 El +4 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-3.20	4.00	7.20	5.00	1.00	5.00	0.00	77.00	4.00	3.20	20.00	16.00



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-3.20	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	41.00	279

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	40	20	40	26	64	16	64	26	295
Applied Load (lb./ft.)	3200	1600	3200	451	1126	282	1126	451	11436

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-3.20	-	-13.00		0.11	110.00	9.80
		-13.00	-	-18.50		0.11	110.00	5.50
			-				0.00	0.00
			-				0.00	0.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
9.80	41.00	0.24	110.00	110.00	1.00

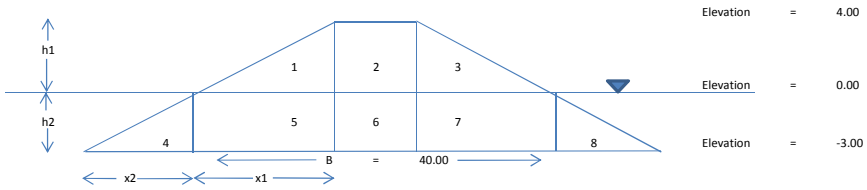
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	41.00	5.53	110	608	279	2.18

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-C-10 El +4 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-3.00	4.00	7.00	5.00	1.00	5.00	0.00	75.00	4.00	3.00	20.00	15.00



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-3.00	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	40.00	279

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	40	20	40	23	60	15	60	23	280
Applied Load (lb./ft.)	3200	1600	3200	396	1056	264	1056	396	11168

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-3.20	-	-10.50		0.10	100.00	7.30
		-10.50	-	-12.50		0.10	100.00	2.00
			-				0.00	0.00
			-				0.00	0.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
7.30	40.00	0.18	100.00	100.00	1.00

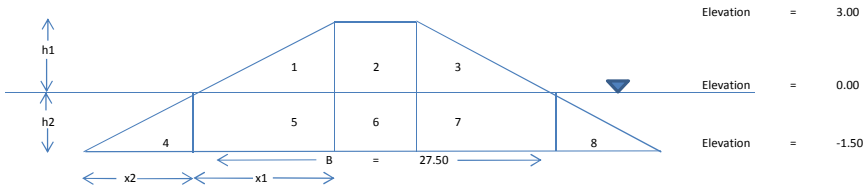
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	40.00	5.53	100	553	279	1.98

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-C-11 El +3 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-1.50	3.00	4.50	5.00	1.00	5.00	0.00	50.00	3.00	1.50	15.00	7.50



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-1.50	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	27.50	215

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	23	15	23	6	23	8	23	6	124
Applied Load (lb./ft.)	1800	1200	1800	99	396	132	396	99	5922

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-1.50	-	-6.50		0.05	50.00	5.00
		-6.50	-	-8.50		0.07	70.00	2.00
			-				0.00	0.00
			-				0.00	0.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
5.00	27.50	0.18	50.00	70.00	1.40

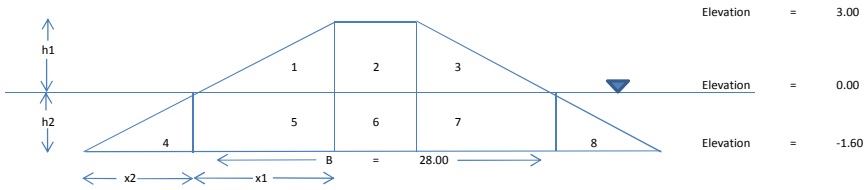
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	27.50	7.30	50	365	215	1.69

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-C-12 El +3 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-1.60	3.00	4.60	5.00	1.00	5.00	0.00	51.00	3.00	1.60	15.00	8.00



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-1.60	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	28.00	215

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	23	15	23	6	24	8	24	6	129
Applied Load (lb./ft.)	1800	1200	1800	113	422	141	422	113	6011

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-1.60	-	-5.00		0.05	50.00	3.40
		-5.00	-	-9.00		0.07	70.00	4.00
			-				0.00	0.00
			-				0.00	0.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
3.40	28.00	0.12	50.00	70.00	1.40

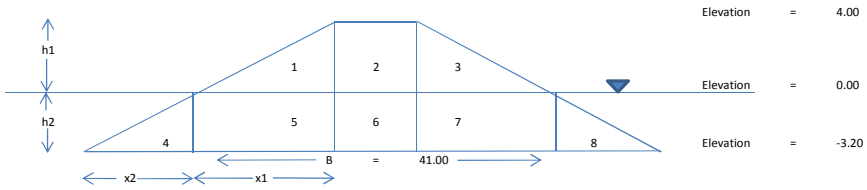
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	28.00	7.30	50	365	215	1.70

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-B-4/C-13 El +4 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-3.20	4.00	7.20	5.00	1.00	5.00	0.00	77.00	4.00	3.20	20.00	16.00



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-3.20	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	41.00	279

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	40	20	40	26	64	16	64	26	295
Applied Load (lb./ft.)	3200	1600	3200	451	1126	282	1126	451	11436

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-3.20	-	-5.00		0.08	80.00	1.80
		-5.00	-	-7.00		0.08	80.00	2.00
		-7.00	-	-9.00		0.08	80.00	2.00
		-9.00	-	-13.00		0.20	200.00	4.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
1.80	41.00	0.04	80.00	80.00	1.00

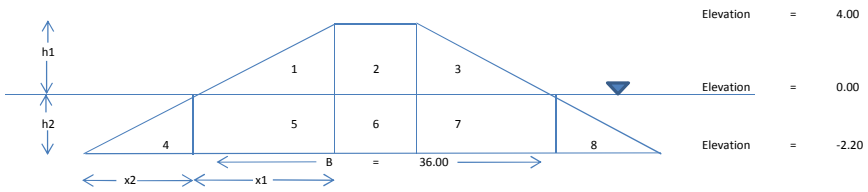
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	41.00	5.53	80	442	279	1.59

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-B-5/C-14 El +4 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-2.20	4.00	6.20	5.00	1.00	5.00	0.00	67.00	4.00	2.20	20.00	11.00



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-2.20	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	36.00	282

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	40	20	40	12	44	11	44	12	223
Applied Load (lb./ft.)	3200	1600	3200	213	774	194	774	213	10168

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-2.20	-	-6.00		0.07	70.00	3.80
		-6.00	-	-9.00		0.11	110.00	3.00
		-9.00	-	-12.00		0.20	200.00	3.00
		-12.00	-	-18.00		0.11	110.00	6.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
3.80	36.00	0.11	70.00	110.00	1.57

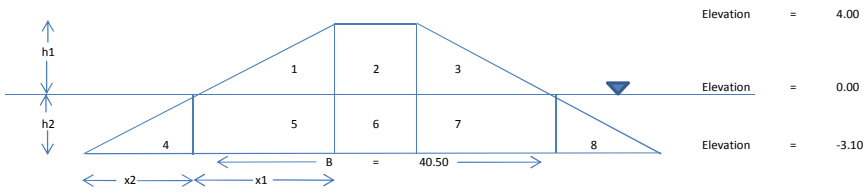
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	36.00	7.50	70	525	282	1.86

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-C-15 El +4 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-3.10	4.00	7.10	5.00	1.00	5.00	0.00	76.00	4.00	3.10	20.00	15.50



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-3.10	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	40.50	279

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	40	20	40	24	62	16	62	24	288
Applied Load (lb./ft.)	3200	1600	3200	423	1091	273	1091	423	11301

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-3.10	-	-5.50		0.10	100.00	2.40
		-5.50	-	-16.00		0.10	100.00	10.50
			-				0.00	0.00
			-				0.00	0.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
2.40	40.50	0.06	100.00	100.00	1.00

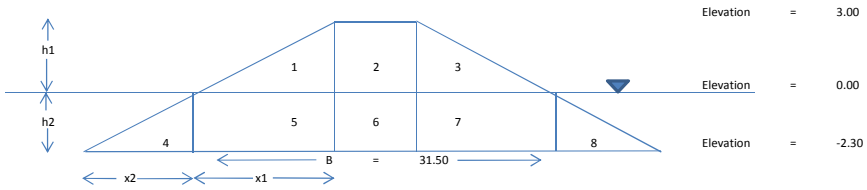
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	40.50	5.53	100	553	279	1.98

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-C-17 El +3 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-2.30	3.00	5.30	5.00	1.00	5.00	0.00	58.00	3.00	2.30	15.00	11.50



Assumptions:

1. Unit weight of dike 80.00 pcf
2. Water at EL. 0.00 feet
3. Mud line at EL. -2.30 feet
4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	31.50	212

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	23	15	23	13	35	12	35	13	167
Applied Load (lb./ft.)	1800	1200	1800	233	607	202	607	233	6682

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-1.50	-	-5.50		0.05	50.00	4.00
		-5.50	-	-8.00		0.07	70.00	2.50
			-				0.00	0.00
			-				0.00	0.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
4.00	31.50	0.13	50.00	70.00	1.40

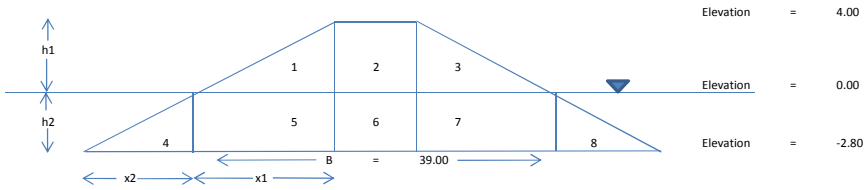
BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	31.50	7.30	50	365	212	1.72

FACTOR OF SAFETY AGAINST BEARING CAPACITY
FOR UNREINFORCED DIKES USING NAVFAC DM 7; FIGURE 11-5, PAGE 7-11-6

GEOMETRY-B-6/C-18 El +4 feet

Elevation at Bottom of Dike (ft.)	Elevation at Top of Dike (ft.)	Height of Dike (ft.)	Slope Inclination (H:V)		Width at Top of Dike (ft.)	Elevation of Water (ft.)	Full Width at Bottom of Dike (ft.)	h1 (ft.)	h2 (ft.)	x1 (ft.)	x2 (ft.)
-2.80	4.00	6.80	5.00	1.00	5.00	0.00	73.00	4.00	2.80	20.00	14.00



Assumptions:

1. Unit weight of dike	80.00	pcf
2. Water at EL.	0.00	feet
3. Mud line at EL.	-2.80	feet

4. No reinforcement is used between the dike and the subsurface.
5. The effective width of the dike is equal to the width of the crown plus the width of one sloped side.
6. The factor of safety for bearing capacity must be greater or equal to 1.3.

APPLIED STRESS

Total Unit Weight of Dike (pcf)	Buoyant Unit Weight of Dike (pcf)	Effective Width of Dike (B) (ft.)	Applied Stress (psf)
80.00	17.60	39.00	280

Zone	1	2	3	4	5	6	7	8	Total
Area (ft^2)	40	20	40	20	56	14	56	20	265
Applied Load (lb./ft.)	3200	1600	3200	345	986	246	986	345	10908

SUBSURFACE CONDITIONS

Soil Description		Elevation (ft.)				Cohesion (ksf)	Cohesion (psf)	Thickness (ft.)
		-2.80	-	-5.00		0.09	90.00	2.20
		-5.00	-	-11.00		0.12	120.00	6.00
		-11.00	-	-13.00		0.00	0.00	2.00
		-13.00	-	-17.00		0.20	200.00	4.00
			-				0.00	0.00
			-				0.00	0.00
							0.00	0.00

T	B	T/B	C1	C2	C2/C1
2.20	39.00	0.06	90.00	120.00	1.33

BEARING CAPACITY RESULTS

Depth of Soft Soil (ft.)	Effective Width of Dike (B) (ft.)	Nc Factor From NAVFAC DM-7 Figure 11-5	C1	Ultimate Bearing Capacity (psf)	Applied Stress (psf)	Factor of Safety
30.00	39.00	7.40	90	666	280	2.38

APPENDIX C
Settlement Analyses for Earthen Containment Dikes

Calculation Checksheet

Project No. 16715-040-00 Project Title: Island Road Marsh Creation and Nourishment (TE-117)

Deliverable Title: Earthen Containment Dike Settlement

Calculations Description: The settlement calculations for earthen containment dike were calculated using the Westergaard stress distribution method in Settle3D. The model assumes that the first soil layer begins at mudline, and depths are positive into the soil. The water level at each design cross-section was adjusted so the appropriate depth of water influenced the soil behavior. The soil properties varied between layers but were assumed constant within each layer. Inputs for the soil profile were assigned from the design soil profile at each boring location. Settlement within the fill was estimated as 10% of the fill height due to the peat and organic soil in the upper soil profile.

Originator: ECK/VT Checked by: PH/ECK/VT Date: 5/18/2015

Checking method (describe): Checked the input parameters for every run and re-ran a few to check the program output.

Comments:

GeoEngineers

Settlement Calculation Approach for Earthen Containment Dike
Island Road Marsh Creation and Nourishment (TE-117)

1. Settlement parameters were developed for each soil boring as shown in the attached spreadsheets. The following description explains how the parameters were developed.
    a. A total of six consolidation tests were completed at various soil borings to represent various soil layers across the site.
    b. Graphs for each consolidation test were reconstructed to determine compression (C_c), recompression (C_r), and vertical consolidation (C_v) coefficients, initial void ratios (e_0), and maximum past pressures (P_c).
    c. Correlations presented in equations 1 through 4 (shown in the attached spreadsheets) were used to calculate specific gravity, e_0, C_c, and C_r for all soil layers.
    d. GeoEngineers developed different correlations based on the analyses of the consolidation test results as follows:
        i. C_v values were determined based on moisture content using a graphical correlation developed by GeoEngineers based on this and other coastal projects.
        ii. w vs. C_c: C_c=0.0054*((w*S.G.)-35) was found to provide sufficient accuracy based on the test data for this and other projects for all compressible soil types. C_c for each of the soil layers was determined based on the moisture contents estimated during soil profile development.
        iii. C_r=0.3094C_c-0.0744 for C_c>0.5; $C_c \leq 0.5$, 0.16*C_c was used.
    e. For soil layers without a representative consolidation test, the above mentioned correlations/calculation methods were used to estimate C_c, C_r, and C_v.
    f. Maximum past pressure (P_c) was obtained from the consolidation test curves for the soil layers with a representative consolidation test. The soil typically was over consolidated in the upper 11 to 25 feet and normally consolidated below.
2. In this area, clay shear strength for a normally consolidated soil profile will be approximately 22% of the effective overburden pressure. This relationship is shown as the C/P line on the shear strength profiles.

The settlement calculations for the earthen containment dike were calculated using the Westergaard stress distribution method in Settle3D. The model assumes the first soil layer begins at mudline, and depths are positive into the soil. The water level at each design cross-section was adjusted so the appropriate depth of water influenced the soil behavior. The soil properties varied between layers but were assumed constant within each layer. Inputs for the soil profile were assigned from the design soil profile at each boring location.

The water elevation was set at EL +0.0 ft NAVD88 Geoid 12A at all boring locations. The settlement was evaluated for crown elevations of +4 and +2 feet. The settlement values for crown elevation in between El. +4 feet and El. +2 feet were interpolated. The fill used in the earthen containment dikes was given a unit weight of 80 pcf and a cohesion of 60 psf, matching the values imputed in the slope stability and bearing capacity analyses.

Figures C-1 through C-8 show in graphical and tabular format the earthen containment dike crown elevation based on settlement of the foundation soils under the dike. Foundation settlement was calculated by the program for 30 days, 60 days, 6 months, 1, 3, 5 and 10 years after construction. Long term settlement (20 years) was also calculated.

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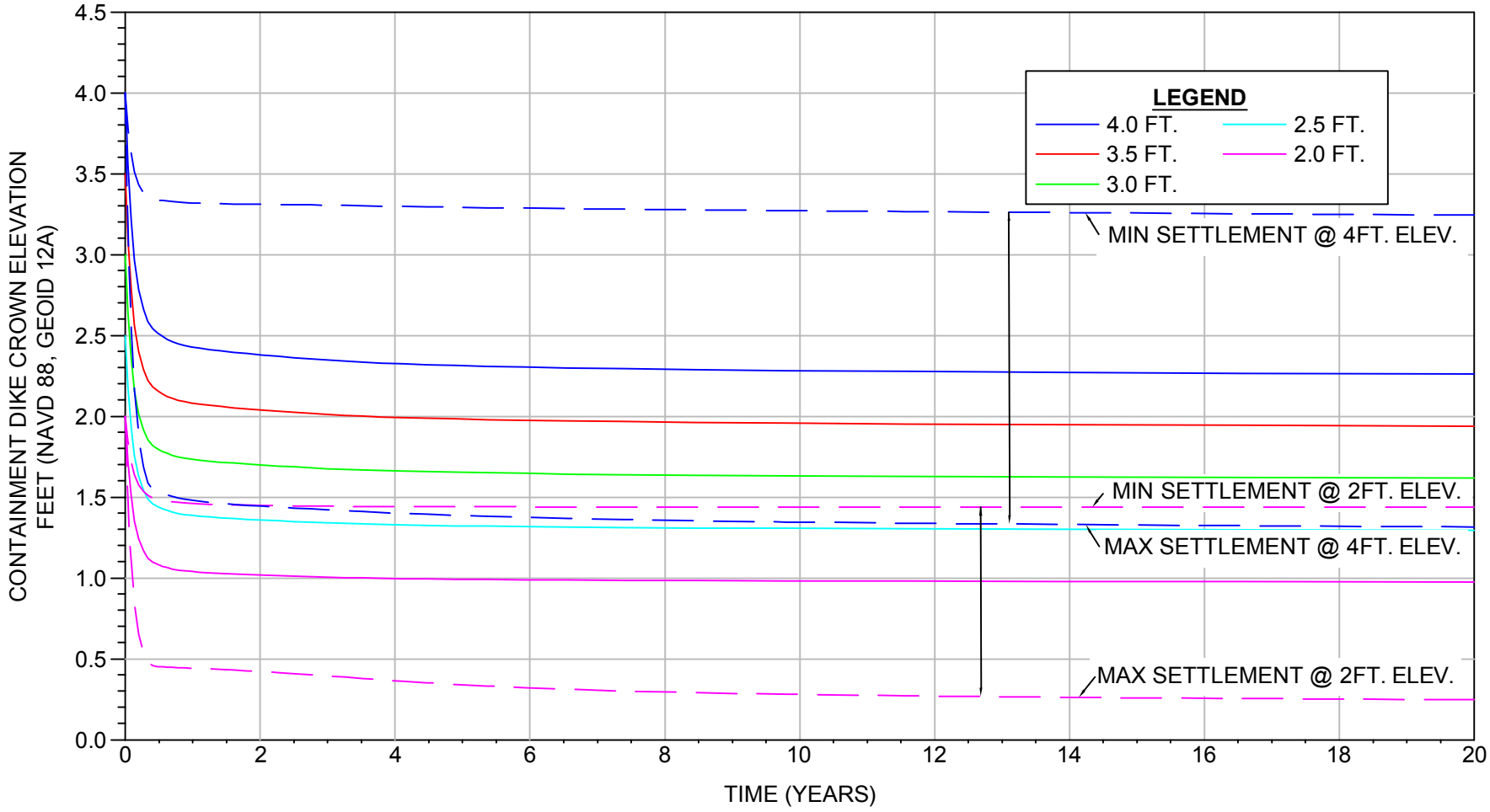

CONTAINMENT DIKE CROWN ELEVATION (FEET, NAVD88, GEOID 12A)							
END OF CONSTRUCTION	60 DAYS (0.16 YEARS)	180 DAYS (0.5 YEARS)	1 YEAR	3 YEARS	5 YEARS	10 YEARS	20 YEARS
4.0	2.7	2.5	2.4	2.3	2.3	2.3	2.3
3.5	2.3	2.1	2.1	2.0	2.0	2.0	1.9
3.0	1.9	1.8	1.7	1.7	1.6	1.6	1.6
2.5	1.5	1.4	1.4	1.3	1.3	1.3	1.3
2.0	1.1	1.1	1.0	1.0	1.0	1.0	1.0

CONTAINMENT DIKE - SETTLEMENT VS. TIME
AVERAGE OF ALL BORINGS

Island Road Marsh Creation and
Nourishment (TE-117)
Terrebonne Parish, Louisiana

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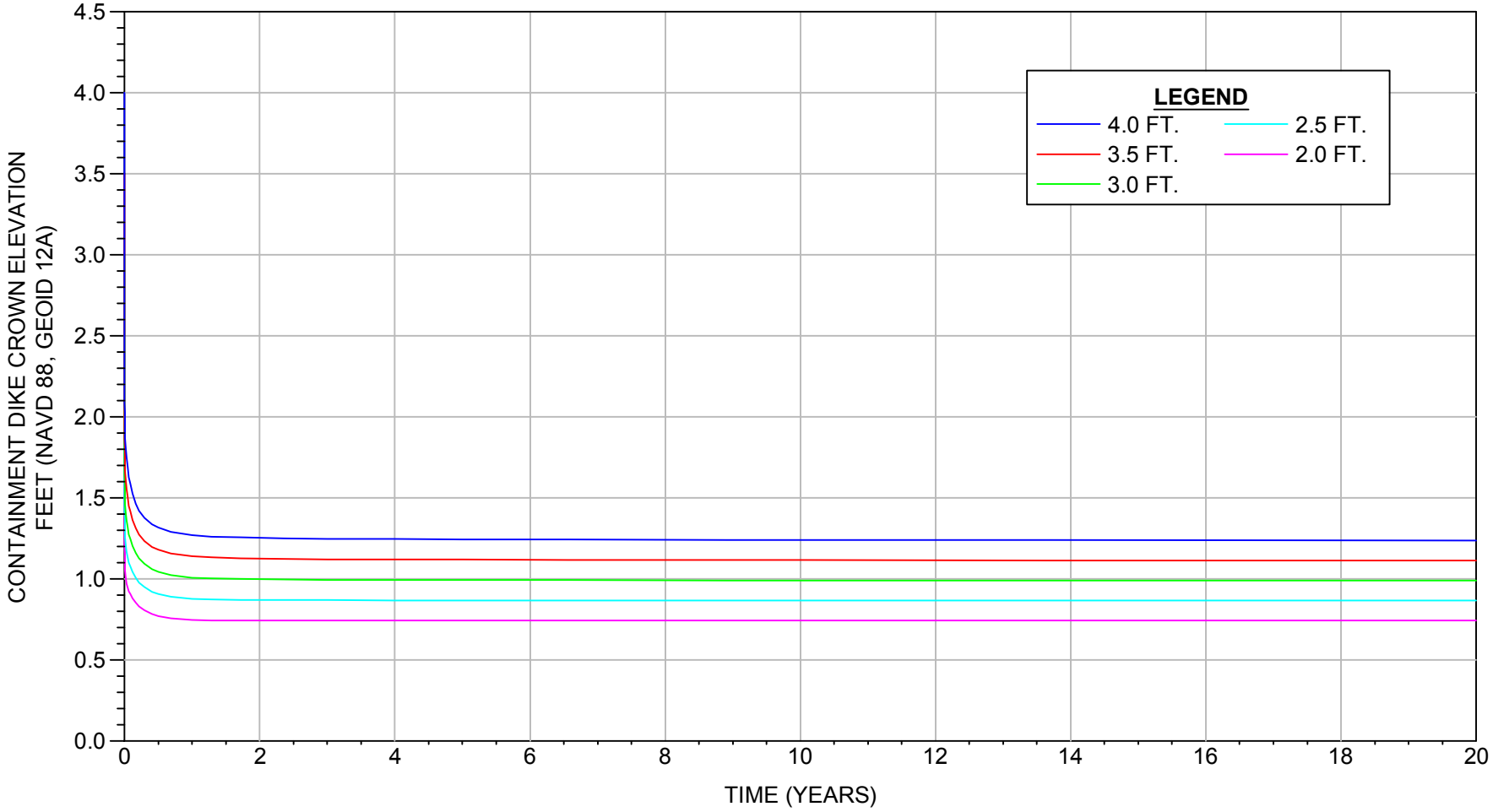
Figure C-1

P:\16\16715040\00\CAD\Settlement1.dwg\TAB:B-1 modified on May 22, 2015 - 5:50pm VT : KMC



CONTAINMENT DIKE CROWN ELEVATION (FEET, NAVD88, GEOID 12A)							
END OF CONSTRUCTION	60 DAYS (0.16 YEARS)	180 DAYS (0.5 YEARS)	1 YEAR	3 YEARS	5 YEARS	10 YEARS	20 YEARS
4.0	1.6	1.3	1.3	1.2	1.2	1.2	1.2
3.5	1.4	1.2	1.1	1.1	1.1	1.1	1.1
3.0	1.2	1.0	1.0	1.0	1.0	1.0	1.0
2.5	1.1	0.9	0.9	0.9	0.9	0.9	0.9
2.0	0.9	0.8	0.7	0.7	0.7	0.7	0.7

CONTAINMENT DIKE - SETTLEMENT VS. TIME (B-1)

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

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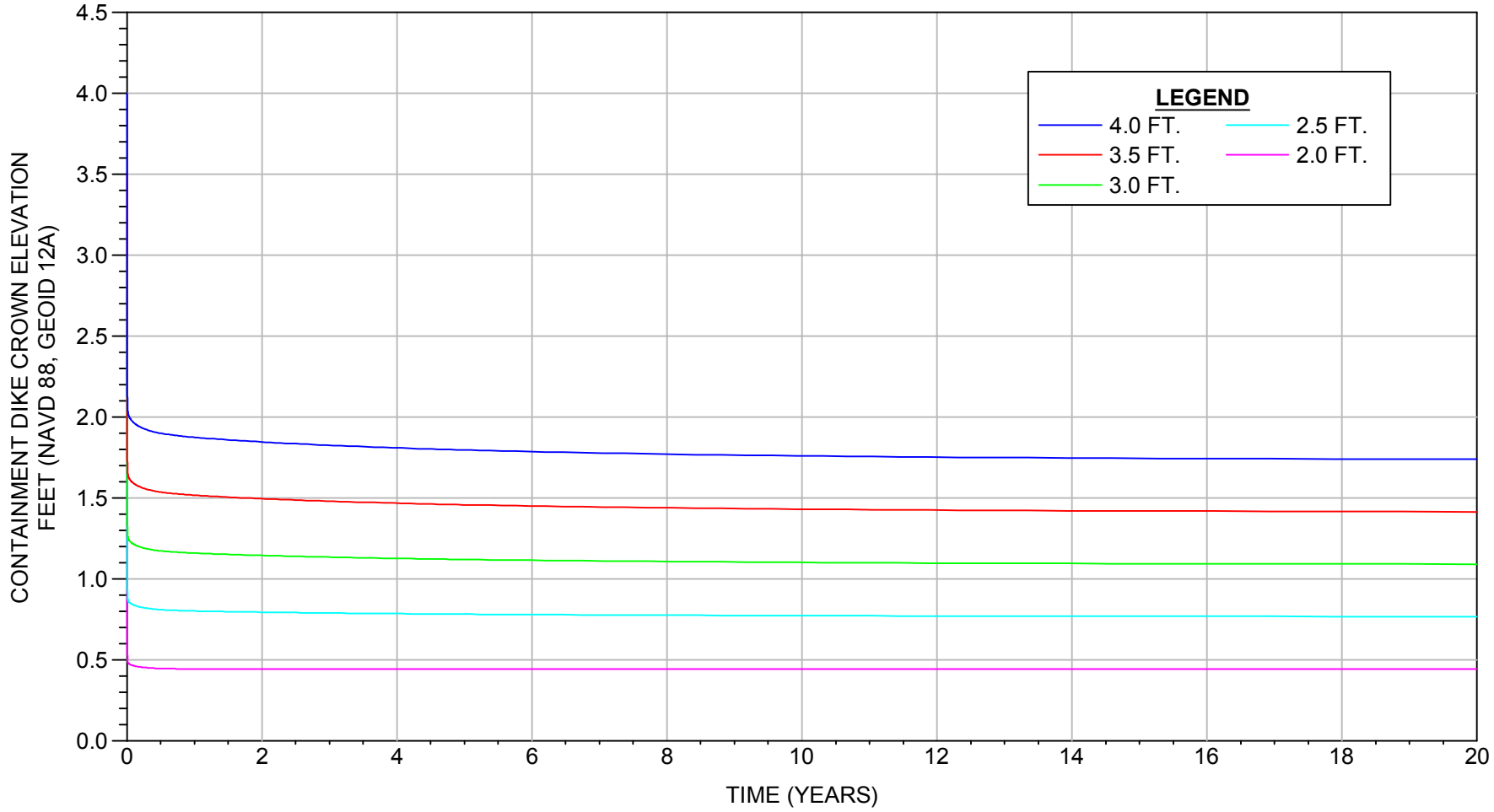
Figure C-2

P:\16\16715040\00\CAD\Settlement1.dwg\TAB:B-2 modified on May 22, 2015 - 5:51pm VT : KMC



CONTAINMENT DIKE CROWN ELEVATION (FEET, NAVD88, GEOID 12A)							
END OF CONSTRUCTION	60 DAYS (0.16 YEARS)	180 DAYS (0.5 YEARS)	1 YEAR	3 YEARS	5 YEARS	10 YEARS	20 YEARS
4.0	2.0	1.9	1.9	1.8	1.8	1.8	1.7
3.5	1.6	1.6	1.5	1.5	1.5	1.4	1.4
3.0	1.2	1.2	1.2	1.2	1.1	1.1	1.1
2.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8
2.0	0.5	0.4	0.4	0.4	0.4	0.4	0.4

CONTAINMENT DIKE - SETTLEMENT VS. TIME (B-2)

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

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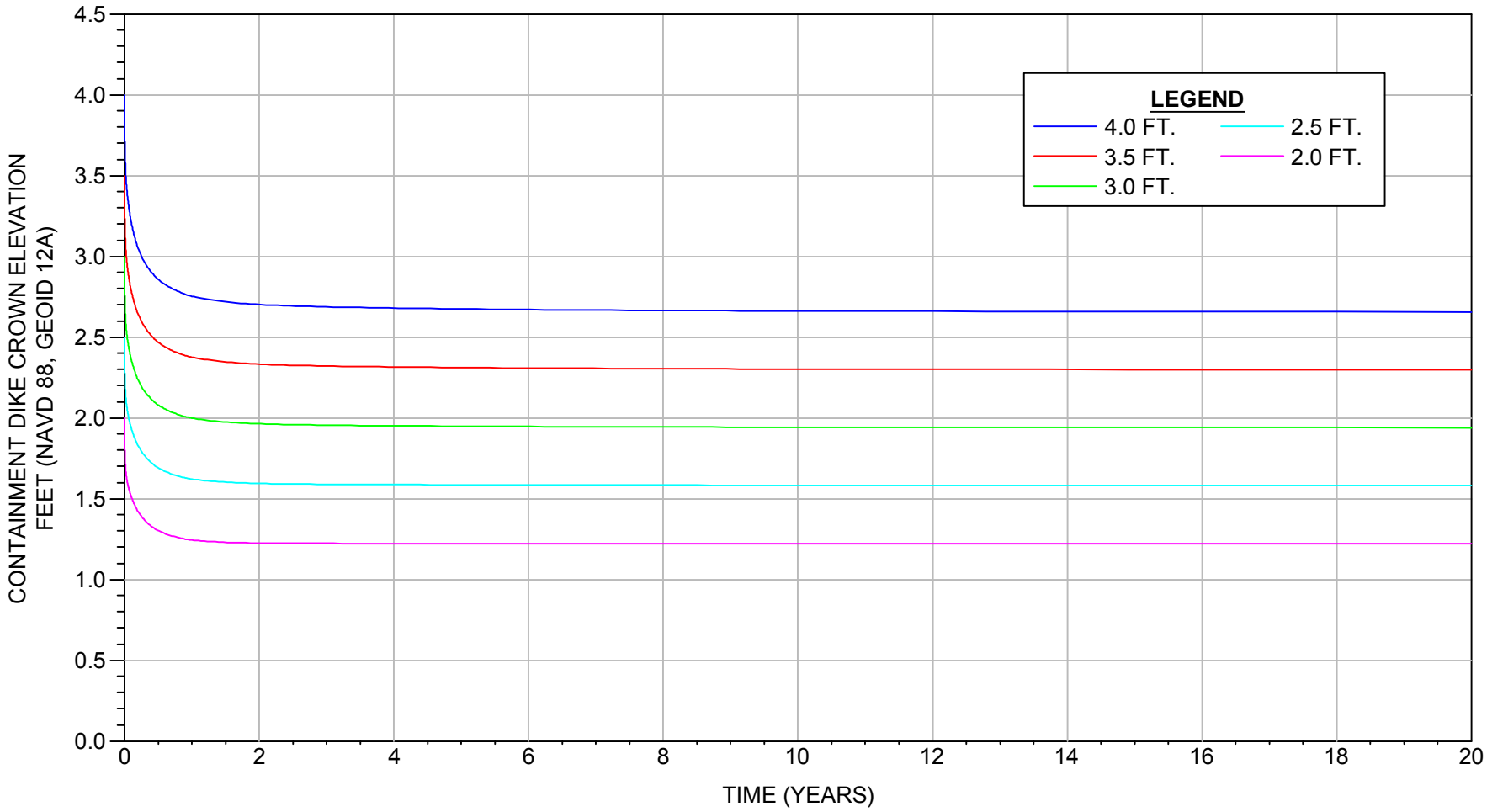
Figure C-3



CONTAINMENT DIKE CROWN ELEVATION (FEET, NAVD88, GEOID 12A)							
END OF CONSTRUCTION	60 DAYS (0.16 YEARS)	180 DAYS (0.5 YEARS)	1 YEAR	3 YEARS	5 YEARS	10 YEARS	20 YEARS
4.0	3.3	2.9	2.8	2.7	2.7	2.7	2.7
3.5	2.8	2.5	2.4	2.3	2.3	2.3	2.3
3.0	2.4	2.1	2.0	1.9	1.9	1.9	1.9
2.5	2.0	1.7	1.6	1.6	1.6	1.6	1.6
2.0	1.5	1.3	1.2	1.2	1.2	1.2	1.2

CONTAINMENT DIKE - SETTLEMENT VS. TIME (B-3)

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

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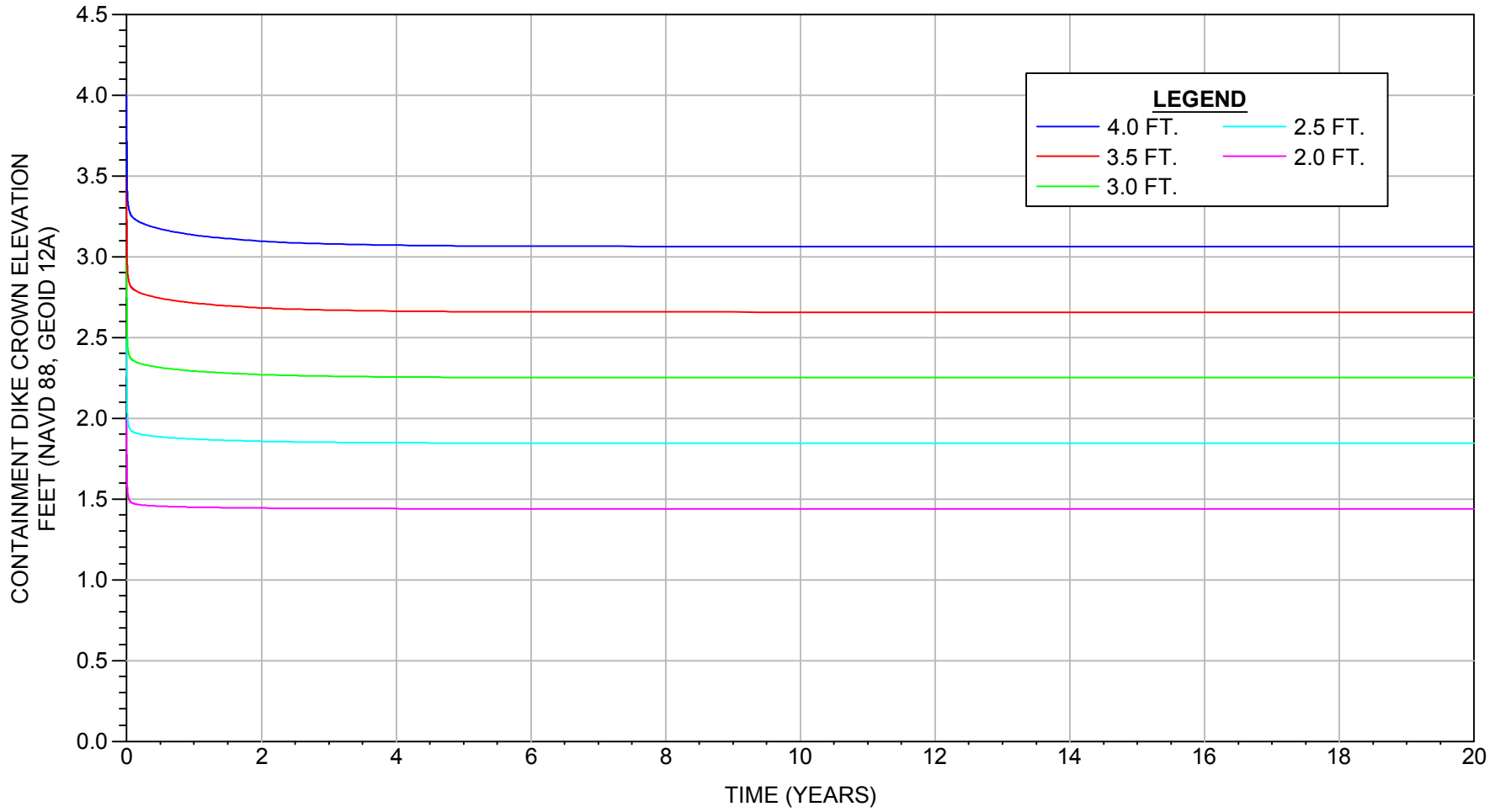
Figure C-4

P:\16\16715040\00\CAD\Settlement1.dwg\TAB:B-4 modified on May 22, 2015 - 5:52pm VT : KMC



CONTAINMENT DIKE CROWN ELEVATION (FEET, NAVD88, GEOID 12A)							
END OF CONSTRUCTION	60 DAYS (0.16 YEARS)	180 DAYS (0.5 YEARS)	1 YEAR	3 YEARS	5 YEARS	10 YEARS	20 YEARS
4.0	3.2	3.2	3.1	3.1	3.1	3.1	3.1
3.5	2.8	2.7	2.7	2.7	2.7	2.7	2.7
3.0	2.4	2.3	2.3	2.3	2.3	2.3	2.3
2.5	1.9	1.9	1.9	1.9	1.8	1.8	1.8
2.0	1.5	1.5	1.4	1.4	1.4	1.4	1.4

CONTAINMENT DIKE - SETTLEMENT VS. TIME (B-4)

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

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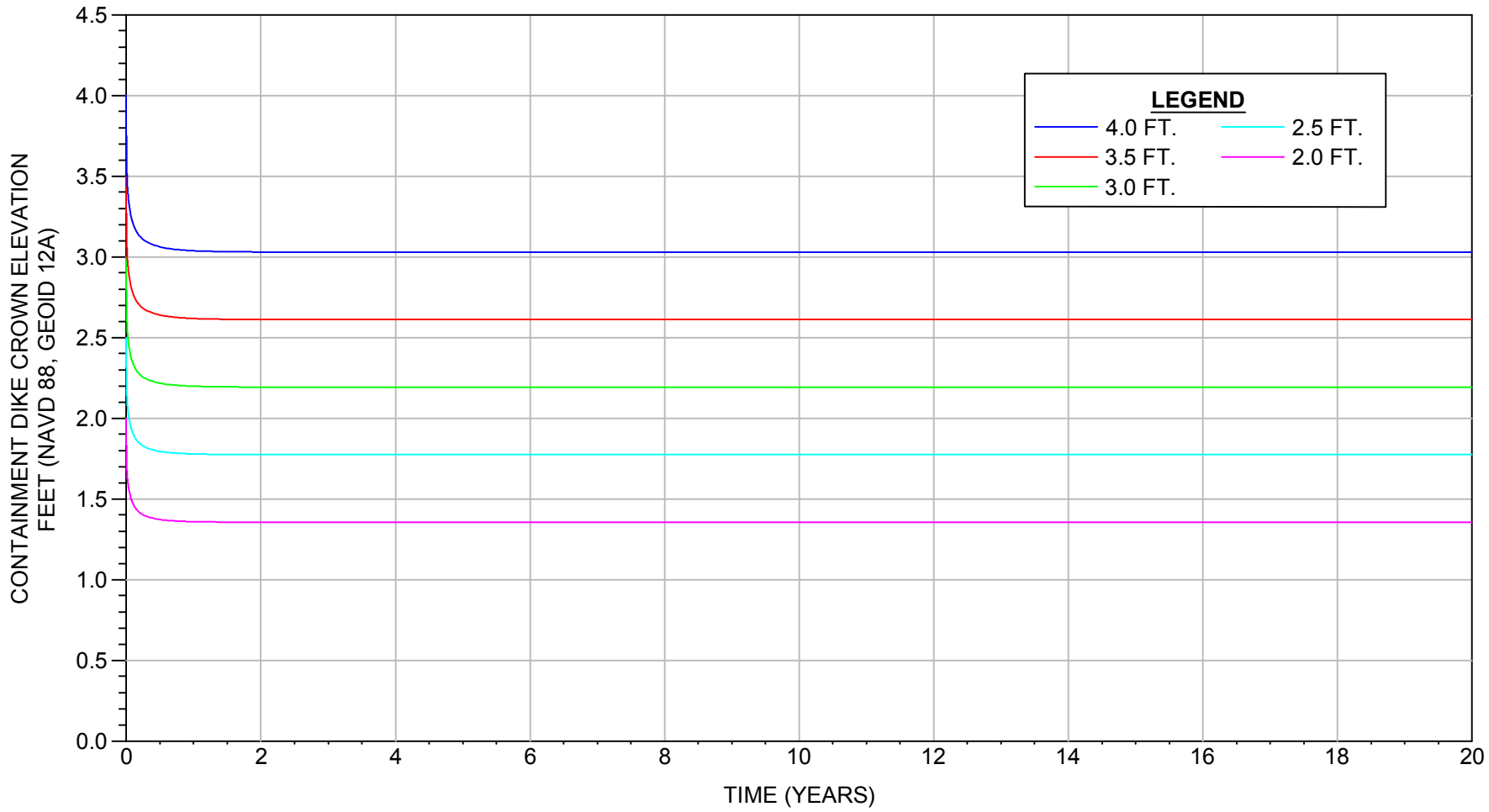
Figure C-5

P:\16\16715040\00\CAD\Settlement1.dwg\TAB:B-5 modified on May 22, 2015 - 5:52pm VT : KMC



CONTAINMENT DIKE CROWN ELEVATION (FEET, NAVD88, GEOID 12A)							
END OF CONSTRUCTION	60 DAYS (0.16 YEARS)	180 DAYS (0.5 YEARS)	1 YEAR	3 YEARS	5 YEARS	10 YEARS	20 YEARS
4.0	3.2	3.1	3.0	3.0	3.0	3.0	3.0
3.5	2.8	2.6	2.6	2.6	2.6	2.6	2.6
3.0	2.4	2.2	2.2	2.2	2.2	2.2	2.2
2.5	1.9	1.8	1.8	1.8	1.8	1.8	1.8
2.0	1.5	1.4	1.4	1.4	1.4	1.4	1.4

CONTAINMENT DIKE - SETTLEMENT VS. TIME (B-5)

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

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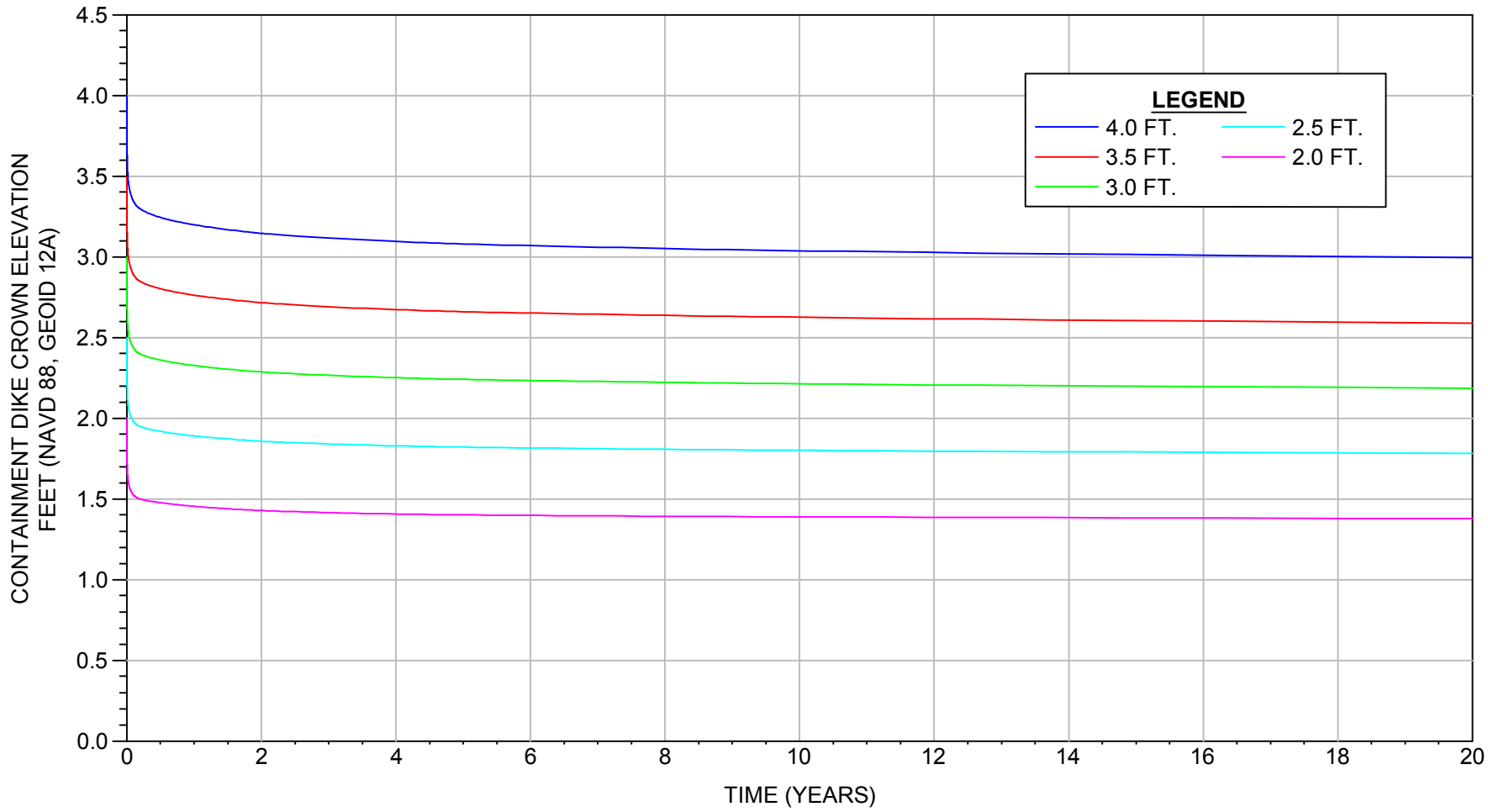
Figure C-6

P:\16\16715040\00\CAD\Settlement1.dwg\TAB:B-6 modified on May 22, 2015 - 5:53pm VT : KMC



CONTAINMENT DIKE CROWN ELEVATION (FEET, NAVD88, GEOID 12A)							
END OF CONSTRUCTION	60 DAYS (0.16 YEARS)	180 DAYS (0.5 YEARS)	1 YEAR	3 YEARS	5 YEARS	10 YEARS	20 YEARS
4.0	3.4	3.2	3.2	3.1	3.1	3.0	3.0
3.5	2.9	2.8	2.8	2.7	2.7	2.6	2.6
3.0	2.4	2.4	2.3	2.3	2.2	2.2	2.2
2.5	2.0	1.9	1.9	1.8	1.8	1.8	1.8
2.0	1.5	1.5	1.5	1.4	1.4	1.4	1.4

CONTAINMENT DIKE - SETTLEMENT VS. TIME (B-6)

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

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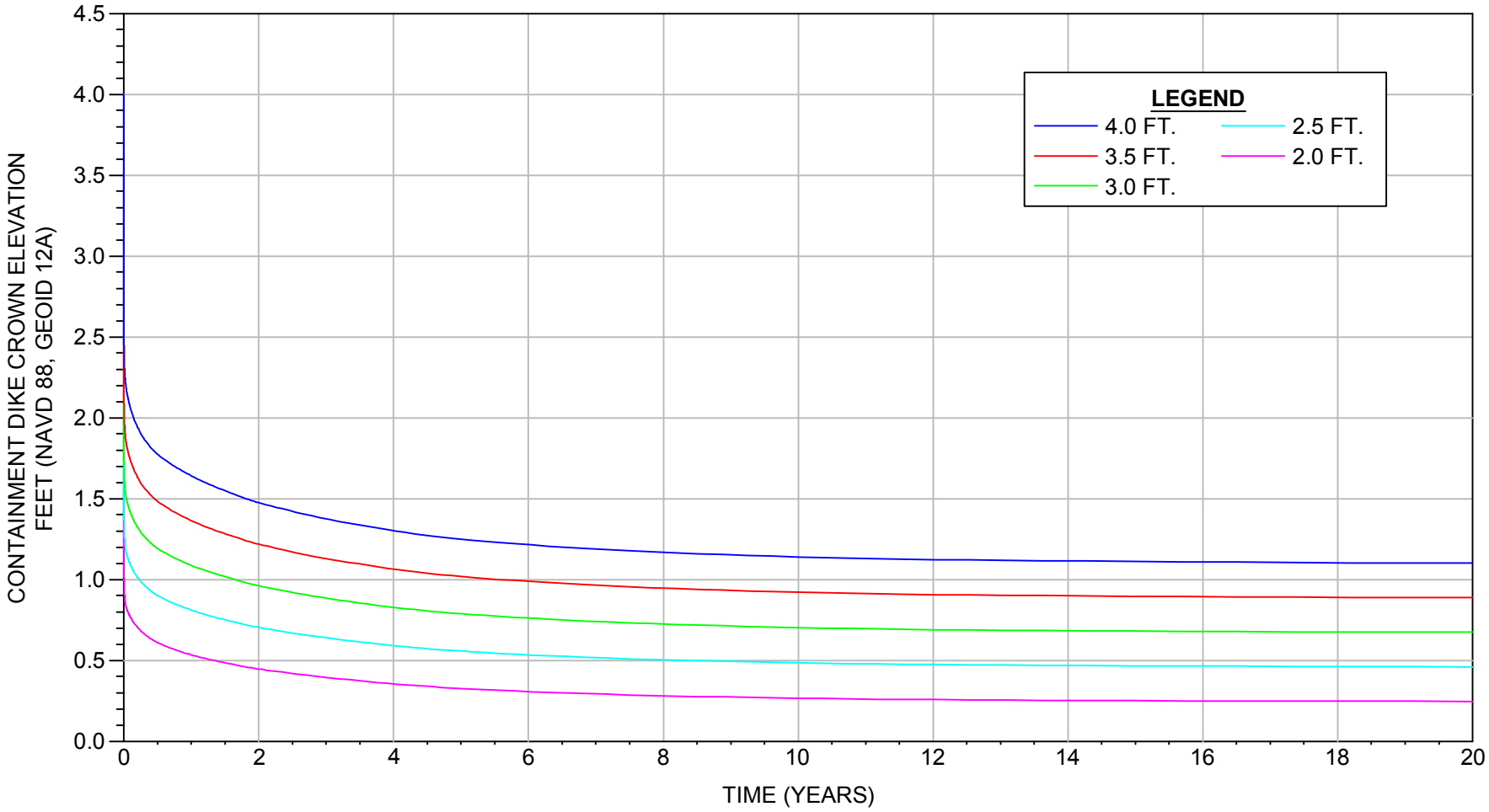
Figure C-7

P:\16\16715040\00\CAD\Settlement1.dwg\TAB:B-7 modified on May 22, 2015 - 6:13pm VT : KMC



CONTAINMENT DIKE CROWN ELEVATION (FEET, NAVD88, GEOID 12A)							
END OF CONSTRUCTION	60 DAYS (0.16 YEARS)	180 DAYS (0.5 YEARS)	1 YEAR	3 YEARS	5 YEARS	10 YEARS	20 YEARS
4.0	2.1	1.8	1.6	1.4	1.2	1.1	1.1
3.5	1.8	1.5	1.4	1.1	1.0	0.9	0.9
3.0	1.4	1.2	1.1	0.9	0.8	0.7	0.7
2.5	1.1	0.9	0.8	0.6	0.6	0.5	0.5
2.0	0.8	0.6	0.5	0.4	0.3	0.3	0.2

CONTAINMENT DIKE - SETTLEMENT VS. TIME (B-7)

Island Road Marsh Creation and Nourishment (TE-117)
Terrebonne Parish, Louisiana

GeoEngineers

Figure C-8

Island Road Marsh Creation and Nourishment (TE-117)

Terrebonne Parish, Louisiana

SETTLEMENT PARAMETERS FOR B-1

				EQ. 1	UNIT WEIGHT		EQ. 2		EQ. 3		EQ. 4	DESIGN PARAMETERS						Pc						
ELEV		COHESION	M.C		WET	DRY		Consol.	Use MC	Consol.		Adopted	Adopted	Adopted	Adopted	C_v[1]	C_v	Consol	P_{avg}	P_t	Po	OCR[2]	OCR	Adopted[3]
FEET		KSF	%	S.G	PCF	PCF	e_o	C_c	C_c	C_r	C_r	C_c	Cc Σ	Cr	Cr Σ	ft^2/day	$\times 10^{-5} in^2$/sec	tsf	tsf	tsf	tsf		Consol	OCR
-2.5	-4.5	0.050	829	2.03	63	7	16.840		8.905		2.681	8.905	0.499	2.681	0.150	4.330	721.7		0.0003	0	0.0003	1671.1		20.0
-4.5	-10.5	0.070	205	2.19	86	28	4.485	3.170	2.233	1.090	0.616	2.233	0.407	0.616	0.112	0.052	8.7	0.085	0.0354	0.0006	0.036	6.4	2.4	6.4
-10.5	-14.5	0.140	55	2.75	108	70	1.515		0.629		0.120	0.629	0.250	0.120	0.048	0.053	8.8		0.0456	0.0714	0.117	3.5		3.5
-14.5	-16.5	0.200	30	2.90	115	88	1.020		0.281		0.045	0.281	0.139	0.045	0.022	1.200	200.0		0.0263	0.1626	0.1889	3.0		3.0
-16.5	-27.0	0.170	30	2.90	108	83	1.020		0.281		0.045	0.281	0.139	0.045	0.022	1.200	200.0		0.1197	0.2152	0.3349	1.2		1.2
-27.0	-29.0	0.000	30	2.90	120	92	1.020		0.281		0.045	0.281	0.139	0.045	0.022	1.200	200.0		0.0288	0.4546	0.4834	0.0		1.0
-29.0	-60.0	0.290	50	2.83	111	74	1.416		0.576		0.104	0.576	0.238	0.104	0.043	0.079	13.2		0.37665	0.5122	0.88885	0.7		1.0

Equations:

EQ. 1 S.G. = e0/M.C. (assumes 100% saturation)

EQ. 2 e0 = 0.0198*M.C. + 0.4261

EQ. 3 C_c = 0.0054*((S.G.*M.C.)-35) (NAVFAC)

EQ. 4 C_r= 0.3094C_c -0.0744(For Cc<0.5, use 0.16*C_c)

Note:

[1] Cv values for materials were determined using the Cv vs MC curve developed by GeoEngineers based on data from coastal projects

[2] OCR = (c/(p' * 0.22))^(1/0.8) (Recommended practice for soft ground site characterization: Arthur Casagrande Lecture Figure 7.1)

[3] From Note 2, reviewing c/p line and consolidation test result; Assumed OCR =1 if OCR<1 from calculations

Consolidation test results from Boring B-1

References:

"Foundation Design: Principles and Practices" Donald Coduto 1994

"NAVFAC DM-7.1 Soil Mechanics" 1982

"GeoEngineers" based on our experience with coastal soils

"Soil Mechanics" Lambe and Whitman 1969

Island Road Marsh Creation and Nourishment (TE-117)

Terrebonne Parish, Louisiana

SETTLEMENT PARAMETERS FOR B-2

				EQ. 1	UNIT WEIGHT		EQ. 2		EQ. 3		EQ. 4	DESIGN PARAMETERS						Pc					
ELEV		COHESION	M.C		WET	DRY		Consol.	Use MC	Consol.		Adopted	Adopted	Adopted	Adopted	C_v[1]	C_v	Consol	P_{avg}	P_t	Po	OCR[2]	OCR	Adopted[3]
FEET		KSF	%	S.G	PCF	PCF	e_o	C_c	C_c	C_r	C_r	C_c	Cc∑	Cr	Cr∑	ft^2/day	$\times 10^{-5} in^2$/sec	tsf	tsf	tsf	tsf		Consol	OCR
-3.1	-5.0	0.050	1633	2.01	63	4	32.760		17.501		5.340	17.501	0.518	5.340	0.158	5.000	833.3		0.000285	0	0.000285	1781.7		20.0
-5.0	-11.0	0.060	700	2.04	68	9	14.286		7.525		2.254	7.525	0.492	2.254	0.147	1.780	296.7		0.0084	0.00057	0.00897	30.0		20.0
-11.0	-17.0	0.200	30	2.90	114	88	1.020		0.281		0.045	0.281	0.139	0.045	0.022	1.200	200.0		0.0774	0.01737	0.09477	7.1		7.1
-17.0	-26.0	0.160	30	2.90	103	79	1.020		0.281		0.045	0.281	0.139	0.045	0.022	1.200	200.0		0.09135	0.17217	0.26352	1.5		1.5
-26.0	-31.0	0.160	66	2.63	103	62	1.733		0.747		0.157	0.747	0.273	0.157	0.057	0.033	5.5		0.05075	0.35487	0.40562	0.9		1.0
-31.0	-36.0	0.225	111	2.36	103	49	2.624	1.410	1.228	0.210	0.306	1.228	0.339	0.306	0.084	0.027	4.5	0.430	0.05075	0.45637	0.50712	1.0	0.9	1.0
-36.0	-46.0	0.225	140	2.28	74	31	3.198		1.538		0.401	1.538	0.366	0.401	0.096	0.033	5.5		0.029	0.55787	0.58687	0.8		1.0
-46.0	-53.1	0.260	75	2.55	99	57	1.911		0.843		0.186	0.843	0.290	0.186	0.064	0.026	4.3		0.064965	0.61587	0.680835	0.8		1.0

Equations:

EQ. 1 S.G. = e0/M.C. (assumes 100% saturation)

EQ. 2 e0 = 0.0198*M.C. + 0.4261

EQ. 3 C_c = 0.0054*((S.G.*M.C.)-35) (NAVFAC)

EQ. 4 C_r= 0.3094C_c -0.0744(For Cc<0.5, use 0.16*C_c)

Note:

[1] Cv values for materials were determined using the Cv vs MC curve developed by GeoEngineers based on data from coastal projects

[2] OCR = (c/(p' * 0.22))^(1/0.8) (Recommended practice for soft ground site characterization: Arthur Casagrande Lecture Figure 7.1)

[3] From Note 2, reviewing c/p line and consolidation test result; Assumed OCR =1 if OCR<1 from calculations

Consolidation test results from Boring B-2

References:

"Foundation Design: Principles and Practices" Donald Coduto 1994

"NAVFAC DM-7.1 Soil Mechanics" 1982

"GeoEngineers" based on our experience with coastal soils

"Soil Mechanics" Lambe and Whitman 1969

Island Road Marsh Creation and Nourishment (TE-117)

Terrebonne Parish, Louisiana

SETTLEMENT PARAMETERS FOR B-3

ELEV		COHESION	M.C	EQ. 1	UNIT WEIGHT		EQ. 2		EQ. 3		EQ. 4	DESIGN PARAMETERS						Pc						
FEET		KSF	%	S.G	WET PCF	DRY PCF	e_o	Consol. C_c	Use MC C_c	Consol. C_r	C_r	Adopted C_c	Adopted Cc*	Adopted Cr	Adopted Cr*	C_v[1] ft^2/day	C_v $\times 10^{-5} in^2/sec$	Consol tsf	P_{avg} tsf	P_t tsf	Po tsf	OCR[2]	OCR Consol	Adopted[3] OCR
-3.4	-7.5	0.080	198	2.20	79	27	4.347		2.158		0.593	2.158	0.404	0.593	0.111	0.049	8.2		0.017015	0	0.017015	19.3		19.3
-7.5	-9.5	0.080	498	2.07	79	13	10.287		5.366		1.586	5.366	0.475	1.586	0.140	0.417	69.5		0.0083	0.03403	0.04233	6.2		6.2
-9.5	-11.5	0.080	141	2.28	102	42	3.218		1.549		0.405	1.549	0.367	0.405	0.096	0.034	5.7		0.0198	0.05063	0.07043	3.3		3.3
-11.5	-13.5	0.080	43	2.90	102	71	1.278		0.484		0.078	0.484	0.213	0.078	0.034	0.144	24.0		0.0198	0.09023	0.11003	1.9		1.9
-13.5	-16.5	0.200	43	2.64	115	80	1.014	0.230	0.423	0.030	0.068	0.230	0.114	0.030	0.015	0.042	7.0	0.740	0.03945	0.12983	0.16928	3.4	3.5	3.5
-16.5	-21.0	0.000	43	2.90	122	85	1.278		0.484		0.078	0.484	0.213	0.078	0.034	10.000	1666.7		0.06705	0.20873	0.27578	0.0		1.0
-21.0	-26.5	0.200	43	2.90	115	80	1.278		0.484		0.078	0.484	0.213	0.078	0.034	0.144	24.0		0.072325	0.34283	0.415155	1.1		1.0
-26.5	-31.5	0.200	71	2.58	102	60	1.832		0.800		0.173	0.800	0.283	0.173	0.061	0.028	4.7		0.0495	0.48748	0.53698	0.8		1.0
-31.5	-60.0	0.270	202	2.19	90	30	4.426		2.201		0.607	2.201	0.406	0.607	0.112	0.051	8.5		0.19665	0.58648	0.78313	0.7		1.0

Equations:

EQ. 1 S.G. = e0/M.C. (assumes 100% saturation)

EQ. 2 e0 = 0.0198*M.C. + 0.4261

EQ. 3 C_c = 0.0054*((S.G.*M.C.)-35) (NAVFAC)

EQ. 4 C_r= 0.3094C_c -0.0744(For Cc<0.5, use 0.16*C_c)

Note:

1 Cv values for materials were determined using the Cv vs MC curve developed by GeoEngineers based on data from coastal projects

2 OCR = (c/(p' * 0.22))^(1/0.8) (Recommended practice for soft ground site characterization: Arthur Casagrande Lecture Figure 7.1)

3 From Note 2, reviewing c/p line and consolidation test result; Assumed OCR =1 if OCR<1 from calculations

Consolidation test results from Boring B-3

References:

"Foundation Design: Principles and Practices" Donald Coduto 1994

"NAVFAC DM-7.1 Soil Mechanics" 1982

"GeoEngineers" based on our experience with coastal soils

"Soil Mechanics" Lambe and Whitman 1969

Island Road Marsh Creation and Nourishment (TE-117)

Terrebonne Parish, Louisiana

SETTLEMENT PARAMETERS FOR B-4

ELEV		COHESION	M.C	EQ. 1	UNIT WEIGHT		EQ. 2		EQ. 3		EQ. 4	DESIGN PARAMETERS						Pc						
FEET		KSF	%	S.G	WET PCF	DRY PCF	e_o	Consol. C_c	Use MC C_c	Consol. C_r	C_r	Adopted C_c	Adopted Cc*	Adopted Cr	Adopted Cr*	C_v[1] ft²/day	C_v ×10⁻⁵in²/sec	Consol tsf	P_{avg} tsf	P_t tsf	Po tsf	OCR[2]	OCR Consol	Adopted[3] OCR
-3.2	-5.5	0.080	318	2.11	78	19	6.723	4.310	3.441	1.171	0.990	3.441	0.446	0.990	0.128	0.123	20.5	0.160	0.00897	0	0.00897	43.0	20.5	20.0
-5.5	-7.5	0.080	61	2.68	103	64	1.634		0.693		0.140	0.693	0.263	0.140	0.053	0.041	6.8		0.0203	0.01794	0.03824	7.0		7.0
-7.5	-9.0	0.080	31	2.90	103	79	1.040		0.296		0.047	0.296	0.145	0.047	0.023	0.950	158.3		0.015225	0.05854	0.073765	3.1		3.1
-9.0	-13.0	0.000	31	2.90	122	93	1.040		0.296		0.047	0.296	0.145	0.047	0.023	10.000	1666.7		0.0596	0.08899	0.14859	0.0		1.0
-13.0	-14.5	0.000	31	2.90	122	93	1.040		0.296		0.047	0.296	0.145	0.047	0.023	10.000	1666.7		0.02235	0.20819	0.23054	0.0		1.0
-14.5	-20.5	0.220	31	2.90	118	90	1.040		0.296		0.047	0.296	0.145	0.047	0.023	0.950	158.3		0.0834	0.25289	0.33629	1.6		1.6
-20.5	-31.5	0.220	72	2.57	118	69	1.852		0.811		0.176	0.811	0.284	0.176	0.062	0.027	4.5		0.1529	0.41969	0.57259	0.8		1.0
-31.5	-60.0	0.220	72	2.57	101	59	1.852		0.811		0.176	0.811	0.284	0.176	0.062	0.027	4.5		0.275025	0.72549	1.000515	0.4		1.0

Equations:

EQ. 1 S.G. = e0/M.C. (assumes 100% saturation)

EQ. 2 e0 = 0.0198*M.C. + 0.4261

EQ. 3 C_c = 0.0054*((S.G.*M.C.)-35) (NAVFAC)

EQ. 4 C_r= 0.3094C_c -0.0744(For Cc<0.5, use 0.16*C_c)

Note:

1 Cv values for materials were determined using the Cv vs MC curve developed by GeoEngineers based on data from coastal projects

2 OCR = (c/(p' * 0.22))^(1/0.8) (Recommended practice for soft ground site characterization: Arthur Casagrande Lecture Figure 7.1)

3 From Note 2, reviewing c/p line and consolidation test result; Assumed OCR =1 if OCR<1 from calculations

Consolidation test results from Boring B-4

References:

"Foundation Design: Principles and Practices" Donald Coduto 1994

"NAVFAC DM-7.1 Soil Mechanics" 1982

"GeoEngineers" based on our experience with coastal soils

"Soil Mechanics" Lambe and Whitman 1969

Island Road Marsh Creation and Nourishment (TE-117)

Terrebonne Parish, Louisiana

SETTLEMENT PARAMETERS FOR B-5

ELEV FEET			COHESION KSF	M.C %	EQ. 1 S.G	UNIT WEIGHT WET PCF	UNIT WEIGHT DRY PCF	EQ. 2 e_o	Consol. C_c	EQ. 3 Use MC C_c	Consol. C_r	EQ. 4 C_r	DESIGN PARAMETERS Adopted C_c	Adopted C_c ±	Adopted Cr	Adopted Cr ±	C_v[1] ft^2/day	C_v $\times 10^{-5} in^2$/sec	Pc Consol tsf	P_{avg} tsf	P_t tsf	Po tsf	OCR^2	OCR Consol	Adopted[3] OCR
-2.2	-	-6.0	0.070	244	2.15	79	23	5.257		2.650		0.745	2.650	0.423	0.745	0.119	0.068	11.3		0.01577	0	0.01577	18.0		18.0
-6.0	-	-8.0	0.110	69	2.60	118	70	1.792		0.779		0.167	0.779	0.279	0.167	0.060	0.029	4.8		0.0278	0.03154	0.05934	6.0		6.0
-8.0	-	-9.0	0.110	24	2.90	118	95	0.901		0.187		0.030	0.187	0.098	0.030	0.016	5.000	833.3		0.0139	0.08714	0.10104	3.1		3.1
-9.0	-	-12.0	0.000	24	2.90	122	98	0.901		0.187		0.030	0.187	0.098	0.030	0.016	10.000	1666.7		0.0447	0.11494	0.15964	0.0		1.0
-12.0	-	-18.0	0.110	24	2.90	102	82	0.901		0.187		0.030	0.187	0.098	0.030	0.016	5.000	833.3		0.0594	0.20434	0.26374	0.9		1.0
-18.0	-	-22.0	0.110	73	2.56	102	59	1.872		0.822		0.180	0.822	0.286	0.180	0.063	0.027	4.5		0.0396	0.32314	0.36274	0.6		1.0
-22.0	-	-32.2	0.000	24	2.90	128	103	0.901		0.187		0.030	0.187	0.098	0.030	0.016	10.000	1666.7		0.16728	0.40234	0.56962	0.0		1.0
-32.2		-60.0	0.110	73	2.56	102	59	1.872		0.822		0.180	0.822	0.286	0.180	0.063	0.027	4.5		0.27522	0.7369	1.01212	0.2		1.0

Equations:

EQ. 1 S.G. = e0/M.C. (assumes 100% saturation)

EQ. 2 e0 = 0.0198*M.C. + 0.4261

EQ. 3 C_c = 0.0054*((S.G.*M.C.)-35) (NAVFAC)

EQ. 4 C_r= 0.3094C_c -0.0744(For Cc<0.5, use 0.16*C_c)

Note:

1 Cv values for materials were determined using the Cv vs MC curve developed by GeoEngineers based on data from coastal projects

2 OCR = (c/(p' * 0.22))^(1/0.8) (Recommended practice for soft ground site characterization: Arthur Casagrande Lecture Figure 7.1)

3 From Note 2, reviewing c/p line and consolidation test result; Assumed OCR =1 if OCR<1 from calculations

Consolidation test results from Boring B-5

References:

"Foundation Design: Principles and Practices" Donald Coduto 1994

"NAVFAC DM-7.1 Soil Mechanics" 1982

"GeoEngineers" based on our experience with coastal soils

"Soil Mechanics" Lambe and Whitman 1969

Island Road Marsh Creation and Nourishment (TE-117)

Terrebonne Parish, Louisiana

SETTLEMENT PARAMETERS FOR B-6

				EQ. 1	UNIT WEIGHT		EQ. 2		EQ. 3		EQ. 4	DESIGN PARAMETERS						Pc						
ELEV		COHESION	M.C		WET	DRY		Consol.	Use MC	Consol.		Adopted	Adopted	Adopted	Adopted	C_v[1]	C_v	Consol	P_{avg}	P_t	Po	OCR[2]	OCR	Adopted[3]
FEET		KSF	%	S.G	PCF	PCF	e_o	C_c	C_c	C_r	C_r	C_c	Cc Σ	Cr	Cr Σ	ft^2/day	$\times 10^{-5} in^2$/sec	tsf	tsf	tsf	tsf		Consol	OCR
-2.8	-5.0	0.090	286	2.13	76	20	6.089		3.099		0.884	3.099	0.437	0.884	0.125	0.092	15.3		0.00748	0	0.00748	62.5		20.0
-5.0	-11.0	0.120	48	2.87	110	74	1.377		0.554		0.097	0.554	0.233	0.097	0.041	0.091	15.2		0.0714	0.01496	0.08636	4.2		4.2
-11.0	-13.0	0.000	48	2.87	122	82	1.377	0.453	0.554	0.066	0.097	0.554	0.233	0.097	0.041	10.000	1666.7	0.28	0.0298	0.15776	0.18756	0.0	1.556	1.0
-13.0	-17.0	0.200	25	2.90	115	92	0.921		0.203		0.032	0.203	0.105	0.032	0.017	5.000	833.3		0.0526	0.21736	0.26996	1.9		1.9
-17.0	-22.5	0.180	50	2.83	109	73	1.416		0.576		0.104	0.576	0.238	0.104	0.043	0.078	13.0		0.064075	0.32256	0.386635	1.1		1.1
-22.5	-26.0	0.280	64	2.65	109	66	1.693		0.725		0.150	0.725	0.269	0.150	0.056	0.035	5.8		0.040775	0.45071	0.491485	1.4		1.4
-26.0	-60.0	0.280	35	2.90	109	81	1.119		0.359		0.057	0.359	0.169	0.057	0.027	0.400	66.7		0.3961	0.53226	0.92836	0.6		1.0

Equations:

EQ. 1	S.G. = e0/M.C. (assumes 100% saturation)
EQ. 2	e0 = 0.0198*M.C. + 0.4261
EQ. 3	C_c = 0.0054*((S.G.*M.C.)-35) (NAVFAC)
EQ. 4	C_r= 0.3094C_c -0.0744(For Cc<0.5, use 0.16*C_c)

Note:

1	Cv values for materials were determined using the Cv vs MC curve developed by GeoEngineers based on data from coastal projects
2	OCR = (c/(p' * 0.22))^(1/0.8) (Recommended practice for soft ground site characterization: Arthur Casagrande Lecture Figure 7.1)
3	From Note 2, reviewing c/p line and consolidation test result; Assumed OCR =1 if OCR<1 from calculations
	Consolidation test results from Boring B-6

References:

"Foundation Design: Principles and Practices" Donald Coduto 1994

"NAVFAC DM-7.1 Soil Mechanics" 1982

"GeoEngineers" based on our experience with coastal soils

"Soil Mechanics" Lambe and Whitman 1969

Island Road Marsh Creation and Nourishment (TE-117)

Terrebonne Parish, Louisiana

SETTLEMENT PARAMETERS FOR B-7

ELEV			COHESION	M.C	EQ. 1	UNIT WEIGHT		EQ. 2		EQ. 3		EQ. 4	DESIGN PARAMETERS						Pc						
FEET			KSF	%	S.G	WET PCF	DRY PCF	e_o	Consol. C_c	Use MC C_c	Consol. C_r	C_r	Adopted C_c	Adopted Cc Σ	Adopted Cr	Adopted Cr Σ	C_v[1] ft^2/day	C_v $\times 10^{-5} in^2/sec$	Consol tsf	P_{avg} tsf	P_t tsf	Po tsf	OCR[2]	OCR Consol	Adopted[3] OCR
-3.2	-	-5.0	0.100	1000	2.02	64	6	20.226		10.733		3.246	10.733	0.506	3.246	0.153	5.000	833.3		0.00072	0	0.00072	1330.5		20.0
-5.0	-	-11.5	0.100	210	2.18	82	26	4.584		2.286		0.633	2.286	0.409	0.633	0.113	0.054	9.0		0.03185	0.00144	0.03329	11.0		11.0
-11.5	-	-15.0	0.100	125	2.32	86	38	2.901		1.378		0.352	1.378	0.353	0.352	0.090	0.029	4.8		0.02065	0.06514	0.08579	3.4		3.4
-15.0	-	-27.0	0.100	65	2.64	104	63	1.713	0.230	0.736	0.020	0.153	0.736	0.271	0.153	0.057	0.034	5.7	0.82	0.1248	0.10644	0.23124	1.0	3.905	1.0
-27.0	-	-29.0	0.000	30	2.90	120	92	1.020		0.281		0.045	0.281	0.139	0.045	0.022	1.200	200.0		0.0288	0.35604	0.38484	0.0		1.0
-29.0	-	-60.0	0.290	50	2.83	111	74	1.416		0.576		0.104	0.576	0.238	0.104	0.043	0.079	13.2		0.37665	0.41364	0.79029	0.8		1.0

Equations:

EQ. 1 S.G. = e0/M.C. (assumes 100% saturation)

EQ. 2 e0 = 0.0198*M.C. + 0.4261

EQ. 3 C_c = 0.0054*((S.G.*M.C.)-35) (NAVFAC)

EQ. 4 C_r= 0.3094C_c -0.0744(For Cc<0.5, use 0.16*C_c)

Note:

[1] Cv values for materials were determined using the Cv vs MC curve developed by GeoEngineers based on data from coastal projects

[2] OCR = (c/(p' * 0.22))^(1/0.8) (Recommended practice for soft ground site characterization: Arthur Casagrande Lecture Figure 7.1)

[3] From Note 2, reviewing c/p line and consolidation test result; Assumed OCR =1 if OCR<1 from calculations

Consolidation test results from Boring B-7

Assumed properties from soil boring B-1

References:

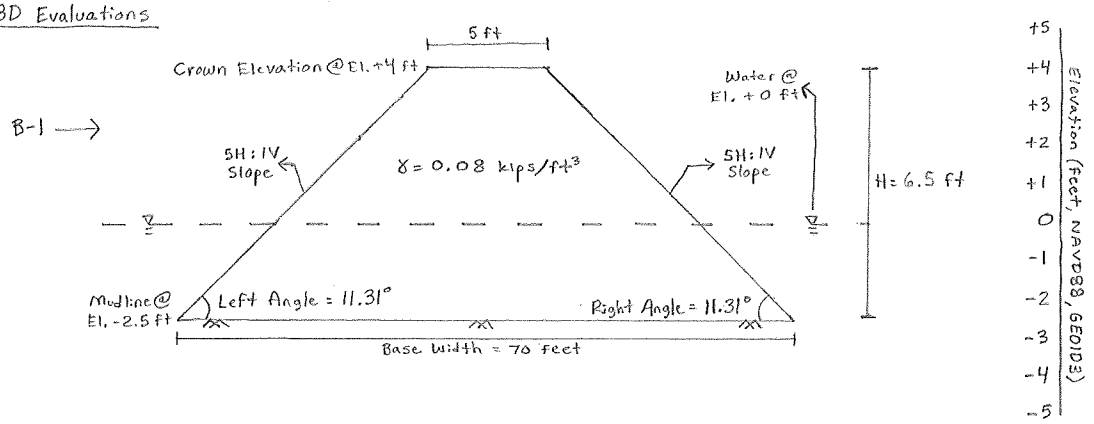
"Foundation Design: Principles and Practices" Donald Coduto 1994

"NAVFAC DM-7.1 Soil Mechanics" 1982

"GeoEngineers" based on our experience with coastal soils

"Soil Mechanics" Lambe and Whitman 1969

Settle3D Evaluations

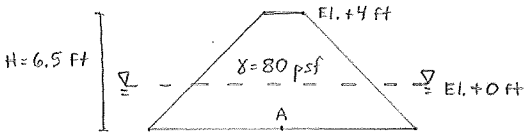


Notes: Page 6 of the attached Settle3D output file shows tables with containment dike properties. Soil properties are shown on page 7.

Left and right angle values come from the following calculation:

Side slopes are 5H:1V $\longrightarrow \tan\theta = \frac{1}{5} \longrightarrow \theta = \tan^{-1}\left(\frac{1}{5}\right) \longrightarrow \theta = 11.31°$

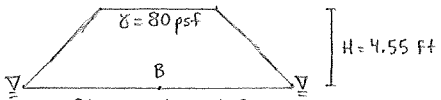
Input for height = H came from an equivalent height calculation:



Stress at point A

= (80 psf × 4 ft) + (80 − 62.4 psf)(2.5 ft)

= 364 psf



Stress at point B = 364 psf

80H = 364

H = 4.55

Similarly for locations B-2, B-3, B-4, B-5, B-6, and B-7, the following containment dike configurations have been used to compute settlement

Location	Base Width (ft)	Height (ft)	Unit Weight (kips/ft³)	Left Angle (degrees)	Right Angle (degrees)	Crown Elevation (ft)
B-2	76.0	4.682	0.08	11.31	11.31	+4
B-3	79.0	4.748	0.08	11.31	11.31	+4
B-4	77.0	4.704	0.08	11.31	11.31	+4
B-5	67.0	4.484	0.08	11.31	11.31	+4
B-6	73.0	4.616	0.08	11.31	11.31	+4
B-7	77.0	4.704	0.08	11.31	11.31	+4

Settle3D Analysis Information
Island Road Marsh Creation and Nourishment (TE-117)

Project Settings

Document Name	B-01 El +2.s3z
Project Title	Island Road Marsh Creation and Nourishment (TE-117)
Analysis	B-01
Author	IAH
Company	GeoEngineers, Inc.
Date Created	5/11/2015
Comments	
Groundwater at Elevation -0.5 ft NAVD88	
Westergaard Method	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/day
Include buoyancy effect when material settles below water table	
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Use average properties to calculate layered stresses	

Stage Settings

Stage #	Name	Time [years]
1	0 days	0
2	30 days	0.082
3	60 days	0.164
4	180 days	0.5
5	365 days	1
6	730 days	3
7	1825 days	5
8	3650 days	10
9	7300 days	20

Results

Time taken to compute: 0 seconds

Stage: 0 days = 0 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.0560775	0.019949
Consolidation Settlement [in]	-0.0760266	3.71671e-005
Immediate Settlement [in]	0	0.019949
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.204084
Effective Stress [ksf]	-0.0054319	2.53104
Total Stress [ksf]	0	6.15233
Total Strain	-0.00467759	0.000859306
Pore Water Pressure [ksf]	0	3.62128
Excess Pore Water Pressure [ksf]	0	0.204084
Degree of Consolidation [%]	0	0.0198038
Pre-consolidation Stress [ksf]	0.0012	2.52954
Over-consolidation Ratio	1	21.5149
Void Ratio	0	16.9234
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 30 days = 0.082 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	15.0147
Consolidation Settlement [in]	0	15.0062
Immediate Settlement [in]	0	0.019949
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.204084
Effective Stress [ksf]	0	2.60817
Total Stress [ksf]	-2.1684e-019	6.15233
Total Strain	-0.0198892	0.668442
Pore Water Pressure [ksf]	-0.00163337	3.61968
Excess Pore Water Pressure [ksf]	0	0.152895
Degree of Consolidation [%]	0	99.4572
Pre-consolidation Stress [ksf]	0.0012	2.60668
Over-consolidation Ratio	1	19.9479
Void Ratio	0	17.1948
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 60 days = 0.164 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	15.1695
Consolidation Settlement [in]	0	15.1609
Immediate Settlement [in]	0	0.019949
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.204084
Effective Stress [ksf]	0	2.60858
Total Stress [ksf]	-2.1684e-019	6.15233
Total Strain	-0.0216241	0.666859
Pore Water Pressure [ksf]	-0.00164305	3.62021
Excess Pore Water Pressure [ksf]	0	0.135431
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0012	2.60709
Over-consolidation Ratio	1	19.9479
Void Ratio	0	17.2258
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 180 days = 0.5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	15.4712
Consolidation Settlement [in]	0	15.4626
Immediate Settlement [in]	0	0.019949
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.204084
Effective Stress [ksf]	0	2.60909
Total Stress [ksf]	-2.1684e-019	6.15233
Total Strain	-0.0242732	0.664428
Pore Water Pressure [ksf]	-0.00166326	3.62169
Excess Pore Water Pressure [ksf]	0	0.0511305
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0012	2.6076
Over-consolidation Ratio	1	19.9479
Void Ratio	0	17.273
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 365 days = 1 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	15.6122
Consolidation Settlement [in]	0	15.6036
Immediate Settlement [in]	0	0.019949
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.204084
Effective Stress [ksf]	0	2.60876
Total Stress [ksf]	-2.1684e-019	6.15233
Total Strain	-0.0250812	0.663687
Pore Water Pressure [ksf]	-0.00167497	3.62333
Excess Pore Water Pressure [ksf]	-2.1684e-019	0.0424539
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0012	2.6076
Over-consolidation Ratio	1	19.9479
Void Ratio	0	17.2874
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 730 days = 3 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	15.6751
Consolidation Settlement [in]	0	15.6665
Immediate Settlement [in]	0	0.019949
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.204084
Effective Stress [ksf]	0	2.60908
Total Stress [ksf]	-2.1684e-019	6.15233
Total Strain	-0.0252635	0.663524
Pore Water Pressure [ksf]	-0.00169493	3.62503
Excess Pore Water Pressure [ksf]	-1.0842e-019	0.0370298
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0012	2.6076
Over-consolidation Ratio	1	19.9479
Void Ratio	0	17.2907
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 1825 days = 5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	15.6878
Consolidation Settlement [in]	0	15.6792
Immediate Settlement [in]	0	0.019949
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.204084
Effective Stress [ksf]	0	2.61372
Total Stress [ksf]	-2.1684e-019	6.15233
Total Strain	-0.0252637	0.663524
Pore Water Pressure [ksf]	-0.00170542	3.62091
Excess Pore Water Pressure [ksf]	-8.13152e-020	0.0329088
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0012	2.61223
Over-consolidation Ratio	1	19.9479
Void Ratio	0	17.2907
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 3650 days = 10 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	15.7046
Consolidation Settlement [in]	0	15.696
Immediate Settlement [in]	0	0.019949
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.204084
Effective Stress [ksf]	0	2.62606
Total Stress [ksf]	-2.1684e-019	6.15233
Total Strain	-0.0252637	0.663524
Pore Water Pressure [ksf]	-0.00172209	3.6085
Excess Pore Water Pressure [ksf]	-5.42101e-019	0.0205043
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0012	2.62457
Over-consolidation Ratio	1	19.9479
Void Ratio	0	17.2907
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 7300 days = 20 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	15.7155
Consolidation Settlement [in]	0	15.7069
Immediate Settlement [in]	0	0.019949
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.204084
Effective Stress [ksf]	0	2.63885
Total Stress [ksf]	-4.33681e-019	6.15233
Total Strain	-0.0252637	0.663524
Pore Water Pressure [ksf]	-0.00173424	3.59541
Excess Pore Water Pressure [ksf]	-8.09763e-019	0.00740741
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0012	2.63736
Over-consolidation Ratio	1	19.9479
Void Ratio	0	17.2907
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Embankments

1. Embankment

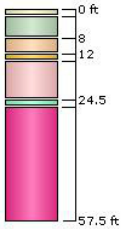
Center Line	(0, 0) to (0, 350)
Number of Layers	1
Near End Angle	11.31 degrees
Far End Angle	11.31 degrees
Base Width	50

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft^3)	Right Angle (deg)	Right Bench Width (ft)
1	0 days = 0 y	0	11.31	2.55	0.08	11.31	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	-2.5 to -4.5	2	0	No
2	-4.5 to -10.5	6	2	No
3	-10.5 to -14.5	4	8	Yes
4	-14.5 to -16.5	2	12	Yes
5	-16.5 to -27	10.5	14	Yes
6	-27 to -29	2	24.5	Yes
7	-29 to -60	31	26.5	No



Soil Properties

Property	-2.5 to -4.5	-4.5 to -10.5	-10.5 to -14.5	-14.5 to -16.5	-16.5 to -27	-27 to -29	-29 to -60
Color							
Unit Weight [kips/ft^3]	0.063	0.086	0.108	0.115	0.108	0.12	0.111
Saturated Unit Weight [kips/ft^3]	0.063	0.086	0.108	0.115	0.108	0.12	0.111
Immediate Settlement	Disabled	Disabled	Disabled	Enabled	Disabled	Enabled	Disabled
Es [ksf]				146		208.9	
Esur [ksf]				146		208.9	
Primary Consolidation	Enabled	Enabled	Enabled	Disabled	Enabled	Disabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear		Non-Linear		Non-Linear
Cc	8.905	2.233	0.629		0.281		0.576
Cr	2.681	0.616	0.12		0.045		0.104
e0	16.84	4.485	1.515		1.02		1.416
OCR	20	6.4	3.5	1	1.2	1	1
Cv [ft^2/d]	4.33	0.052	0.053		1.2		0.079
B-bar	1	1	1		1		1
Undrained Su A [kips/ft2]	0	0	0	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Piezo Line ID	0	0	0	0	0	0	0

Groundwater

Groundwater method	Piezometric Lines
Water Unit Weight	0.0624 kips/ft^3

Query Points

Point #	(X,Y) Location	Number of Divisions
1	0, 168.804	Auto: 63
2	0, 350	Auto: 63

Field Point Grid

Number of points	608
Expansion Factor	2

Grid Coordinates

X [ft]	Y [ft]
242.5	590
242.5	-240
-242.5	-240
-242.5	590

Settle3D Analysis Information
Island Road Marsh Creation and Nourishment (TE-117)

Project Settings

Document Name	B-01 El +4.s3z
Project Title	Island Road Marsh Creation and Nourishment (TE-117)
Analysis	B-01
Author	IAH
Company	GeoEngineers, Inc.
Date Created	5/11/2015
Comments	
Groundwater at Elevation -0.5 ft NAVD88	
Westergaard Method	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/day
Include buoyancy effect when material settles below water table	
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Use average properties to calculate layered stresses	

Stage Settings

Stage #	Name	Time [years]
1	0 days	0
2	30 days	0.082
3	60 days	0.164
4	180 days	0.5
5	365 days	1
6	730 days	3
7	1825 days	5
8	3650 days	10
9	7300 days	20

Results

Time taken to compute: 0 seconds

Stage: 0 days = 0 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.039072	0.210459
Consolidation Settlement [in]	-0.0662218	0.168609
Immediate Settlement [in]	0	0.0576504
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.364116
Effective Stress [ksf]	-0.0175477	2.53104
Total Stress [ksf]	0	6.19149
Total Strain	-0.00545847	0.0450487
Pore Water Pressure [ksf]	0	3.66049
Excess Pore Water Pressure [ksf]	0	0.364116
Degree of Consolidation [%]	0	0.556893
Pre-consolidation Stress [ksf]	0.0012	2.52953
Over-consolidation Ratio	1	21.752
Void Ratio	0	16.9374
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 30 days = 0.082 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	28.963
Consolidation Settlement [in]	0	28.9054
Immediate Settlement [in]	0	0.0576504
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.364116
Effective Stress [ksf]	0	2.60489
Total Stress [ksf]	-2.1684e-019	6.19149
Total Strain	-0.0309625	0.987963
Pore Water Pressure [ksf]	-0.00163853	3.66234
Excess Pore Water Pressure [ksf]	0	0.286447
Degree of Consolidation [%]	0	99.8332
Pre-consolidation Stress [ksf]	0.0012	2.6034
Over-consolidation Ratio	1	19.8279
Void Ratio	-0.785252	17.3924
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 60 days = 0.164 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	30.418
Consolidation Settlement [in]	0	30.3603
Immediate Settlement [in]	0	0.0576504
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.364116
Effective Stress [ksf]	0	2.60527
Total Stress [ksf]	-2.1684e-019	6.19149
Total Strain	-0.0336783	0.986187
Pore Water Pressure [ksf]	-0.00165213	3.66325
Excess Pore Water Pressure [ksf]	0	0.253375
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0012	2.60377
Over-consolidation Ratio	1	19.8279
Void Ratio	-0.75358	17.4408
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 180 days = 0.5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	32.2079
Consolidation Settlement [in]	0	32.1502
Immediate Settlement [in]	0	0.0576504
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.364116
Effective Stress [ksf]	0	2.60576
Total Stress [ksf]	-2.1684e-019	6.19149
Total Strain	-0.0385836	0.983953
Pore Water Pressure [ksf]	-0.00167114	3.66653
Excess Pore Water Pressure [ksf]	0	0.107167
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0012	2.60427
Over-consolidation Ratio	1	19.8278
Void Ratio	-0.71372	17.5283
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 365 days = 1 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	32.76
Consolidation Settlement [in]	0	32.7024
Immediate Settlement [in]	0	0.0576504
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.364116
Effective Stress [ksf]	0	2.6055
Total Stress [ksf]	-2.1684e-019	6.19149
Total Strain	-0.0406287	0.983344
Pore Water Pressure [ksf]	-0.00168201	3.67011
Excess Pore Water Pressure [ksf]	-2.1684e-019	0.0968606
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0012	2.60427
Over-consolidation Ratio	1	19.8278
Void Ratio	-0.702854	17.5648
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 730 days = 3 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	33.0167
Consolidation Settlement [in]	0	32.9591
Immediate Settlement [in]	0	0.0576504
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.364116
Effective Stress [ksf]	0	2.60608
Total Stress [ksf]	-2.1684e-019	6.19149
Total Strain	-0.0413423	0.98321
Pore Water Pressure [ksf]	-0.00170252	3.67332
Excess Pore Water Pressure [ksf]	-5.42101e-020	0.0853159
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0012	2.60459
Over-consolidation Ratio	1	19.8278
Void Ratio	-0.700461	17.5775
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 1825 days = 5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	33.0667
Consolidation Settlement [in]	0	33.0091
Immediate Settlement [in]	0	0.0576504
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.364116
Effective Stress [ksf]	0	2.61072
Total Stress [ksf]	-2.1684e-019	6.19149
Total Strain	-0.0413828	0.98321
Pore Water Pressure [ksf]	-0.00171421	3.66361
Excess Pore Water Pressure [ksf]	-8.13152e-020	0.0756088
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0012	2.60923
Over-consolidation Ratio	1	19.8278
Void Ratio	-0.700459	17.5783
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 3650 days = 10 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	33.115
Consolidation Settlement [in]	0	33.0573
Immediate Settlement [in]	0	0.0576504
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.364116
Effective Stress [ksf]	0	2.62819
Total Stress [ksf]	-2.1684e-019	6.19149
Total Strain	-0.0414193	0.98321
Pore Water Pressure [ksf]	-0.00172914	3.63505
Excess Pore Water Pressure [ksf]	-8.13152e-019	0.0470546
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0012	2.62669
Over-consolidation Ratio	1	19.8278
Void Ratio	-0.700459	17.5789
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 7300 days = 20 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	33.153
Consolidation Settlement [in]	0	33.0953
Immediate Settlement [in]	0	0.0576504
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.364116
Effective Stress [ksf]	0	2.64638
Total Stress [ksf]	-2.1684e-019	6.19149
Total Strain	-0.0414482	0.98321
Pore Water Pressure [ksf]	-0.00174217	3.605
Excess Pore Water Pressure [ksf]	-8.43645e-019	0.0169979
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0012	2.64488
Over-consolidation Ratio	1	19.8278
Void Ratio	-0.700459	17.5794
Permeability [ft/d]	0	977.31
Coefficient of Consolidation [ft^2/d]	0	4.33
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Embankments

1. Embankment

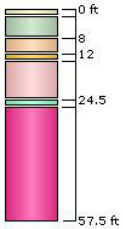
Center Line	(0, 0) to (0, 350)
Number of Layers	1
Near End Angle	11.31 degrees
Far End Angle	11.31 degrees
Base Width	70

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft^3)	Right Angle (deg)	Right Bench Width (ft)
1	0 days = 0 y	0	11.31	4.55	0.08	11.31	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	-2.5 to -4.5	2	0	No
2	-4.5 to -10.5	6	2	No
3	-10.5 to -14.5	4	8	Yes
4	-14.5 to -16.5	2	12	Yes
5	-16.5 to -27	10.5	14	Yes
6	-27 to -29	2	24.5	Yes
7	-29 to -60	31	26.5	No



Soil Properties

Property	-2.5 to -4.5	-4.5 to -10.5	-10.5 to -14.5	-14.5 to -16.5	-16.5 to -27	-27 to -29	-29 to -60
Color							
Unit Weight [kips/ft^3]	0.063	0.086	0.108	0.115	0.108	0.12	0.111
Saturated Unit Weight [kips/ft^3]	0.063	0.086	0.108	0.115	0.108	0.12	0.111
Immediate Settlement	Disabled	Disabled	Disabled	Enabled	Disabled	Enabled	Disabled
Es [ksf]				146		208.9	
Esur [ksf]				146		208.9	
Primary Consolidation	Enabled	Enabled	Enabled	Disabled	Enabled	Disabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear		Non-Linear		Non-Linear
Cc	8.905	2.233	0.629		0.281		0.576
Cr	2.681	0.616	0.12		0.045		0.104
e0	16.84	4.485	1.515		1.02		1.416
OCR	20	6.4	3.5	1	1.2	1	1
Cv [ft^2/d]	4.33	0.052	0.053		1.2		0.079
B-bar	1	1	1		1		1
Undrained Su A [kips/ft2]	0	0	0	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Piezo Line ID	0	0	0	0	0	0	0

Groundwater

Groundwater method	Piezometric Lines
Water Unit Weight	0.0624 kips/ft^3

Query Points

Point #	(X,Y) Location	Number of Divisions
1	0, 162.5	Auto: 63
2	0, 350	Auto: 63

Field Point Grid

Number of points	608
Expansion Factor	2

Grid Coordinates

X [ft]	Y [ft]
242.5	590
242.5	-240
-242.5	-240
-242.5	590

Settle3D Analysis Information
Island Road Marsh Creation and Nourishment (TE-117)

Project Settings

Document Name	B-02 El +2.s3z
Project Title	Island Road Marsh Creation and Nourishment (TE-117)
Analysis	B-02
Author	IAH
Company	GeoEngineers, Inc.
Date Created	5/12/2015
Comments	
Groundwater at Elevation -0.8 ft NAVD88	
Boussinesq Method	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/day
Include buoyancy effect when material settles below water table	
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Use average properties to calculate layered stresses	

Stage Settings

Stage #	Name	Time [years]
1	0 days	0
2	30 days	0.082
3	60 days	0.164
4	180 days	0.5
5	365 days	1
6	730 days	2
7	1825 days	5
8	3650 days	10
9	7300 days	20
10	18250 days	50

Results

Time taken to compute: 0 seconds

Stage: 0 days = 0 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.408466	0.213219
Consolidation Settlement [in]	-0.621685	0
Immediate Settlement [in]	0	0.213219
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0249882	0.214431
Effective Stress [ksf]	-0.0176156	1.4916
Total Stress [ksf]	0.2144	4.65567
Total Strain	-0.0931433	0.00327842
Pore Water Pressure [ksf]	0.226011	3.16407
Excess Pore Water Pressure [ksf]	0.0249882	0.214431
Degree of Consolidation [%]	0	0
Pre-consolidation Stress [ksf]	0.00114	1.489
Over-consolidation Ratio	1	66.728
Void Ratio	0	35.9045
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 30 days = 0.082 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	18.2314
Consolidation Settlement [in]	0	18.0182
Immediate Settlement [in]	0	0.213219
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0249882	0.214431
Effective Stress [ksf]	0.101208	1.53567
Total Stress [ksf]	0.2144	4.65567
Total Strain	-0.0579165	0.709724
Pore Water Pressure [ksf]	0.0977389	3.12
Excess Pore Water Pressure [ksf]	0	0.0738896
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.118084	1.53072
Over-consolidation Ratio	1	4.41698
Void Ratio	0	34.7153
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 60 days = 0.164 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	18.3262
Consolidation Settlement [in]	0	18.113
Immediate Settlement [in]	0	0.213219
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0249882	0.214431
Effective Stress [ksf]	0.101202	1.53567
Total Stress [ksf]	0.2144	4.65567
Total Strain	-0.058354	0.709324
Pore Water Pressure [ksf]	0.0977449	3.12
Excess Pore Water Pressure [ksf]	-3.25261e-019	0.0685544
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.118084	1.5316
Over-consolidation Ratio	1	4.41716
Void Ratio	0	34.73
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 180 days = 0.5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	18.467
Consolidation Settlement [in]	0	18.2538
Immediate Settlement [in]	0	0.213219
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0249882	0.214431
Effective Stress [ksf]	0.101041	1.53567
Total Stress [ksf]	0.2144	4.65567
Total Strain	-0.0590277	0.708715
Pore Water Pressure [ksf]	0.097745	3.12
Excess Pore Water Pressure [ksf]	-1.35525e-019	0.0627275
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.118084	1.53224
Over-consolidation Ratio	1	4.41716
Void Ratio	0	34.7528
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 365 days = 1 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	18.4972
Consolidation Settlement [in]	0	18.284
Immediate Settlement [in]	0	0.213219
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0249882	0.214431
Effective Stress [ksf]	0.100877	1.53567
Total Stress [ksf]	0.2144	4.65567
Total Strain	-0.0591835	0.708578
Pore Water Pressure [ksf]	0.097745	3.12
Excess Pore Water Pressure [ksf]	-1.76183e-019	0.0578805
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.118084	1.53244
Over-consolidation Ratio	1	4.41716
Void Ratio	0	34.758
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 730 days = 2 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	18.5
Consolidation Settlement [in]	0	18.2868
Immediate Settlement [in]	0	0.213219
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0249882	0.214431
Effective Stress [ksf]	0.100858	1.53567
Total Stress [ksf]	0.2144	4.65567
Total Strain	-0.0592023	0.708562
Pore Water Pressure [ksf]	0.097745	3.12
Excess Pore Water Pressure [ksf]	-1.64936e-019	0.0496919
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.118084	1.53258
Over-consolidation Ratio	1	4.41716
Void Ratio	0	34.7587
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 1825 days = 5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	18.5001
Consolidation Settlement [in]	0	18.2868
Immediate Settlement [in]	0	0.213219
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0249882	0.214431
Effective Stress [ksf]	0.100858	1.53567
Total Stress [ksf]	0.2144	4.65567
Total Strain	-0.0592024	0.708562
Pore Water Pressure [ksf]	0.097745	3.12
Excess Pore Water Pressure [ksf]	-1.05952e-019	0.0289225
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.118084	1.5328
Over-consolidation Ratio	1	4.41716
Void Ratio	0	34.7587
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 3650 days = 10 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	18.5001
Consolidation Settlement [in]	0	18.2868
Immediate Settlement [in]	0	0.213219
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0249882	0.214431
Effective Stress [ksf]	0.100858	1.53567
Total Stress [ksf]	0.2144	4.65567
Total Strain	-0.0592024	0.708562
Pore Water Pressure [ksf]	0.097745	3.12
Excess Pore Water Pressure [ksf]	-1.54225e-019	0.0114365
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.118084	1.53301
Over-consolidation Ratio	1	4.41716
Void Ratio	0	34.7587
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 7300 days = 20 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	18.5001
Consolidation Settlement [in]	0	18.2868
Immediate Settlement [in]	0	0.213219
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0249882	0.214431
Effective Stress [ksf]	0.100858	1.53567
Total Stress [ksf]	0.2144	4.65567
Total Strain	-0.0592024	0.708562
Pore Water Pressure [ksf]	0.097745	3.12
Excess Pore Water Pressure [ksf]	-1.03467e-019	0.00178484
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.118084	1.53312
Over-consolidation Ratio	1	4.41716
Void Ratio	0	34.7587
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 18250 days = 50 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	18.5001
Consolidation Settlement [in]	0	18.2868
Immediate Settlement [in]	0	0.213219
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0249882	0.214431
Effective Stress [ksf]	0.100858	1.53567
Total Stress [ksf]	0.2144	4.65567
Total Strain	-0.0592024	0.708562
Pore Water Pressure [ksf]	0.097745	3.12
Excess Pore Water Pressure [ksf]	-1.0303e-019	6.74773e-006
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.118084	1.53314
Over-consolidation Ratio	1	4.41716
Void Ratio	0	34.7587
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Embankments

1. Embankment

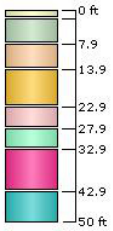
Center Line	(0, 0) to (0, 380)
Number of Layers	1
Near End Angle	11.31 degrees
Far End Angle	11.31 degrees
Base Width	56

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft^3)	Right Angle (deg)	Right Bench Width (ft)
1	0 days = 0 y	0	11.31	2.68	0.08	11.31	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	-3.1 to -5	1.9	0	No
2	-5 to -11	6	1.9	Yes
3	-11 to -17	6	7.9	Yes
4	-17 to -26	9	13.9	Yes
5	-26 to -31	5	22.9	Yes
6	-31 to -36	5	27.9	No
7	-36 to -46	10	32.9	No
8	-46 to -53	7.1	42.9	Yes



Soil Properties

Property	-3.1 to -5	-5 to -11	-11 to -17	-17 to -26	-26 to -31	-31 to -36	-36 to -46	-46 to -53
Color								
Unit Weight [kips/ft^3]	0.063	0.068	0.114	0.103	0.103	0.103	0.074	0.099
Saturated Unit Weight [kips/ft^3]	0.063	0.068	0.114	0.103	0.103	0.103	0.074	0.099
Immediate Settlement	Disabled	Disabled	Enabled	Disabled	Disabled	Disabled	Disabled	Disabled
Es [ksf]			50					
Esur [ksf]			50					
Primary Consolidation	Enabled	Enabled	Disabled	Enabled	Enabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear		Non-Linear	Non-Linear	Non-Linear	Non-Linear	Non-Linear
Cc	17.501	7.525		0.281	0.747	1.228	1.538	0.843
Cr	7.525	2.254		0.045	0.157	0.306	0.401	0.186
e0	32.76	14.286		1.02	1.733	2.624	3.198	1.911
OCR	20	20	3.1	1.5	1	1	1	1
Cv [ft^2/d]	5	1.78		1.2	0.033	0.027	0.033	0.026
B-bar	1	1		1	1	1	1	1
Undrained Su A [kips/ft2]	0	0	0	0	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Piezo Line ID	0	0	0	0	0	0	0	0

Groundwater

Groundwater method Piezometric Lines
Water Unit Weight 0.0624 kips/ft^3

Query Points

Point #	(X,Y) Location	Number of Divisions
1	0, 165	Auto: 69
2	0, 380	Auto: 69

Settle3D Analysis Information
Island Road Marsh Creation and Nourishment (TE-117)

Project Settings

Document Name	B-02 El +4.s3z
Project Title	Island Road Marsh Creation and Nourishment (TE-117)
Analysis	B-02
Author	IAH
Company	GeoEngineers, Inc.
Date Created	5/12/2015
Comments	
Groundwater at Elevation -0.8 ft NAVD88	
Boussinesq Method	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/day
Include buoyancy effect when material settles below water table	
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Use average properties to calculate layered stresses	

Stage Settings

Stage #	Name	Time [years]
1	0 days	0
2	30 days	0.082
3	60 days	0.164
4	180 days	0.5
5	365 days	1
6	730 days	2
7	1825 days	5
8	3650 days	10
9	7300 days	20
10	18250 days	50

Results

Time taken to compute: 0 seconds

Stage: 0 days = 0 y

Data Type	Minimum	Maximum
Total Settlement [in]	-1.6133	0.396967
Consolidation Settlement [in]	-1.92086	0.000374087
Immediate Settlement [in]	0	0.396967
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.374602
Effective Stress [ksf]	-0.0217126	1.49191
Total Stress [ksf]	0	4.70837
Total Strain	-0.358614	0.00599546
Pore Water Pressure [ksf]	0	3.21677
Excess Pore Water Pressure [ksf]	0	0.374602
Degree of Consolidation [%]	0	0.211878
Pre-consolidation Stress [ksf]	0.00114	1.48931
Over-consolidation Ratio	1	10735.7
Void Ratio	0	44.8668
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 30 days = 0.082 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.000512807	24.274
Consolidation Settlement [in]	-0.000512807	24.1398
Immediate Settlement [in]	0	0.396967
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.374602
Effective Stress [ksf]	0	1.67126
Total Stress [ksf]	-1.0842e-019	4.70837
Total Strain	-0.097379	0.954818
Pore Water Pressure [ksf]	-0.0166664	3.12563
Excess Pore Water Pressure [ksf]	0	0.15028
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.00114	1.6654
Over-consolidation Ratio	1	19.942
Void Ratio	0	36.0475
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 60 days = 0.164 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.000869345	24.6036
Consolidation Settlement [in]	-0.000869345	24.2066
Immediate Settlement [in]	0	0.396967
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.374602
Effective Stress [ksf]	0	1.67137
Total Stress [ksf]	-1.0842e-019	4.70837
Total Strain	-0.0996012	0.954819
Pore Water Pressure [ksf]	-0.0166665	3.12
Excess Pore Water Pressure [ksf]	-8.67362e-019	0.143946
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.00114	1.66674
Over-consolidation Ratio	1	19.942
Void Ratio	0	36.1225
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 180 days = 0.5 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.00136959	25.1746
Consolidation Settlement [in]	-0.00136959	24.7776
Immediate Settlement [in]	0	0.396967
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.374602
Effective Stress [ksf]	0	1.67149
Total Stress [ksf]	-1.0842e-019	4.70837
Total Strain	-0.103444	0.954819
Pore Water Pressure [ksf]	-0.0166665	3.12
Excess Pore Water Pressure [ksf]	-4.33681e-019	0.132474
Degree of Consolidation [%]	0	99.9192
Pre-consolidation Stress [ksf]	0.00114	1.66777
Over-consolidation Ratio	1	19.942
Void Ratio	0	36.2523
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 365 days = 1 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	25.4727
Consolidation Settlement [in]	0	25.0758
Immediate Settlement [in]	0	0.396967
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.374602
Effective Stress [ksf]	0	1.6716
Total Stress [ksf]	-1.0842e-019	4.70837
Total Strain	-0.105063	0.954819
Pore Water Pressure [ksf]	-0.0166665	3.12
Excess Pore Water Pressure [ksf]	-3.79471e-019	0.123522
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.00114	1.66817
Over-consolidation Ratio	1	19.942
Void Ratio	0	36.3069
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 730 days = 2 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	25.8174
Consolidation Settlement [in]	0	25.4205
Immediate Settlement [in]	0	0.396967
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.374602
Effective Stress [ksf]	0	1.6717
Total Stress [ksf]	-1.0842e-019	4.70837
Total Strain	-0.106182	0.954819
Pore Water Pressure [ksf]	-0.0166665	3.12
Excess Pore Water Pressure [ksf]	-3.52366e-019	0.106249
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.00114	1.66849
Over-consolidation Ratio	1	19.942
Void Ratio	0	36.3447
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 1825 days = 5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	26.4248
Consolidation Settlement [in]	0	26.0278
Immediate Settlement [in]	0	0.396967
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.374602
Effective Stress [ksf]	0	1.67183
Total Stress [ksf]	-1.0842e-019	4.70837
Total Strain	-0.107539	0.954819
Pore Water Pressure [ksf]	-0.0166665	3.12
Excess Pore Water Pressure [ksf]	-3.5246e-019	0.0618059
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.00114	1.66889
Over-consolidation Ratio	1	19.942
Void Ratio	0	36.3905
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 3650 days = 10 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	26.8764
Consolidation Settlement [in]	0	26.4794
Immediate Settlement [in]	0	0.396967
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.374602
Effective Stress [ksf]	0	1.67192
Total Stress [ksf]	-1.0842e-019	4.70837
Total Strain	-0.108502	0.954819
Pore Water Pressure [ksf]	-0.0166665	3.12
Excess Pore Water Pressure [ksf]	-3.25261e-019	0.0244379
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.00114	1.66918
Over-consolidation Ratio	1	19.942
Void Ratio	0	36.423
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 7300 days = 20 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	27.1198
Consolidation Settlement [in]	0	26.7228
Immediate Settlement [in]	0	0.396967
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.374602
Effective Stress [ksf]	0	1.67203
Total Stress [ksf]	-1.0842e-019	4.70837
Total Strain	-0.108929	0.954819
Pore Water Pressure [ksf]	-0.0166665	3.12
Excess Pore Water Pressure [ksf]	-3.44744e-019	0.00381392
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.00114	1.66941
Over-consolidation Ratio	1	19.942
Void Ratio	0	36.4374
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 18250 days = 50 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	27.164
Consolidation Settlement [in]	0	26.767
Immediate Settlement [in]	0	0.396967
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.374602
Effective Stress [ksf]	0	1.67213
Total Stress [ksf]	-1.0842e-019	4.70837
Total Strain	-0.109081	0.954819
Pore Water Pressure [ksf]	-0.0166665	3.12
Excess Pore Water Pressure [ksf]	-3.43383e-019	1.44188e-005
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.00114	1.66953
Over-consolidation Ratio	1	19.942
Void Ratio	0	36.4426
Permeability [ft/d]	0	1233.71
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Embankments

1. Embankment

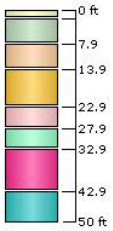
Center Line	(0, 0) to (0, 380)
Number of Layers	1
Near End Angle	11.31 degrees
Far End Angle	11.31 degrees
Base Width	76

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft^3)	Right Angle (deg)	Right Bench Width (ft)
1	0 days = 0 y	0	11.31	4.682	0.08	11.31	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	-3.1 to -5	1.9	0	No
2	-5 to -11	6	1.9	Yes
3	-11 to -17	6	7.9	Yes
4	-17 to -26	9	13.9	Yes
5	-26 to -31	5	22.9	Yes
6	-31 to -36	5	27.9	No
7	-36 to -46	10	32.9	No
8	-46 to -53	7.1	42.9	Yes



Soil Properties

Property	-3.1 to -5	-5 to -11	-11 to -17	-17 to -26	-26 to -31	-31 to -36	-36 to -46	-46 to -53
Color								
Unit Weight [kips/ft^3]	0.063	0.068	0.114	0.103	0.103	0.103	0.074	0.099
Saturated Unit Weight [kips/ft^3]	0.063	0.068	0.114	0.103	0.103	0.103	0.074	0.099
Immediate Settlement	Disabled	Disabled	Enabled	Disabled	Disabled	Disabled	Disabled	Disabled
Es [ksf]			50					
Esur [ksf]			50					
Primary Consolidation	Enabled	Enabled	Disabled	Enabled	Enabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear		Non-Linear	Non-Linear	Non-Linear	Non-Linear	Non-Linear
Cc	17.501	7.525		0.281	0.747	1.228	1.538	0.843
Cr	7.525	2.254		0.045	0.157	0.306	0.401	0.186
e0	32.76	14.286		1.02	1.733	2.624	3.198	1.911
OCR	20	20	3.1	1.5	1	1	1	1
Cv [ft^2/d]	5	1.78		1.2	0.033	0.027	0.033	0.026
B-bar	1	1		1	1	1	1	1
Undrained Su A [kips/ft2]	0	0	0	0	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Piezo Line ID	0	0	0	0	0	0	0	0

Groundwater

Groundwater method Piezometric Lines
Water Unit Weight 0.0624 kips/ft^3

Query Points

Point #	(X,Y) Location	Number of Divisions
1	0, 165	Auto: 69
2	0, 380	Auto: 69

Field Point Grid

Number of points 608
Expansion Factor 2

Grid Coordinates

X [ft]	Y [ft]
263.5	641
263.5	-261
-263.5	-261
-263.5	641

Settle3D Analysis Information
Island Road Marsh Creation and Nourishment (TE-117)

Project Settings

Document Name	B-03 El 2.s3z
Project Title	Island Road Marsh Creation and Nourishment (TE-117)
Analysis	B-03
Author	IAH
Company	GeoEngineers, Inc.
Date Created	5/12/2015
Comments	
Groundwater at Elevation -0.1 ft NAVD88	
Boussinesq Method	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/day
Include buoyancy effect when material settles below water table	
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Use average properties to calculate layered stresses	

Stage Settings

Stage #	Name	Time [years]
1	0 days	0
2	30 days	0.082
3	60 days	0.164
4	180 days	0.5
5	365 days	1
6	730 days	2
7	1825 days	5
8	3650 days	10
9	7300 days	20
10	18250 days	50

Results

Time taken to compute: 0 seconds

Stage: 0 days = 0 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.0344702
Consolidation Settlement [in]	-0.0206495	0
Immediate Settlement [in]	0	0.0344702
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.21984
Effective Stress [ksf]	-7.18697e-005	1.95964
Total Stress [ksf]	0	5.53429
Total Strain	-0.0012621	0.000678487
Pore Water Pressure [ksf]	0	3.57466
Excess Pore Water Pressure [ksf]	0	0.21984
Degree of Consolidation [%]	0	0
Pre-consolidation Stress [ksf]	0.0656779	1.95885
Over-consolidation Ratio	1	19.8124
Void Ratio	0	10.2885
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 30 days = 0.082 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	5.57464
Consolidation Settlement [in]	0	5.54017
Immediate Settlement [in]	0	0.0344702
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.21984
Effective Stress [ksf]	0	2.00797
Total Stress [ksf]	0	5.53429
Total Strain	-0.00648231	0.33655
Pore Water Pressure [ksf]	-2.54411e-006	3.53184
Excess Pore Water Pressure [ksf]	0	0.184929
Degree of Consolidation [%]	0	96.8416
Pre-consolidation Stress [ksf]	0.0656779	2.0066
Over-consolidation Ratio	1	19.3048
Void Ratio	0	10.3602
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 60 days = 0.164 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	6.61658
Consolidation Settlement [in]	0	6.58211
Immediate Settlement [in]	0	0.0344702
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.21984
Effective Stress [ksf]	0	2.00972
Total Stress [ksf]	0	5.53429
Total Strain	0	0.33555
Pore Water Pressure [ksf]	-2.81099e-006	3.53184
Excess Pore Water Pressure [ksf]	0	0.160092
Degree of Consolidation [%]	0	98.642
Pre-consolidation Stress [ksf]	0.0656779	2.00853
Over-consolidation Ratio	1	19.3029
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 180 days = 0.5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	8.38386
Consolidation Settlement [in]	0	8.34939
Immediate Settlement [in]	0	0.0344702
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.21984
Effective Stress [ksf]	0	2.01322
Total Stress [ksf]	0	5.53429
Total Strain	0	0.333543
Pore Water Pressure [ksf]	-5.2987e-006	3.53184
Excess Pore Water Pressure [ksf]	0	0.0704795
Degree of Consolidation [%]	0	99.9895
Pre-consolidation Stress [ksf]	0.0656779	2.01219
Over-consolidation Ratio	1	19.3001
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 365 days = 1 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	9.07512
Consolidation Settlement [in]	0	9.04065
Immediate Settlement [in]	0	0.0344702
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.21984
Effective Stress [ksf]	0	2.01492
Total Stress [ksf]	0	5.53429
Total Strain	0	0.332701
Pore Water Pressure [ksf]	-7.55897e-006	3.53184
Excess Pore Water Pressure [ksf]	0	0.0564666
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0656779	2.01396
Over-consolidation Ratio	1	19.2988
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 730 days = 2 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	9.29846
Consolidation Settlement [in]	0	9.26399
Immediate Settlement [in]	0	0.0344702
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.21984
Effective Stress [ksf]	0	2.01554
Total Stress [ksf]	0	5.53429
Total Strain	0	0.332426
Pore Water Pressure [ksf]	-9.54643e-006	3.53184
Excess Pore Water Pressure [ksf]	0	0.0477922
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0656779	2.01463
Over-consolidation Ratio	1	19.2983
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 1825 days = 5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	9.31724
Consolidation Settlement [in]	0	9.28277
Immediate Settlement [in]	0	0.0344702
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.21984
Effective Stress [ksf]	0	2.0156
Total Stress [ksf]	0	5.53429
Total Strain	0	0.332403
Pore Water Pressure [ksf]	-1.21941e-005	3.53184
Excess Pore Water Pressure [ksf]	-2.11523e-034	0.0243277
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0656779	2.01476
Over-consolidation Ratio	1	19.2983
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 3650 days = 10 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	9.31724
Consolidation Settlement [in]	0	9.28277
Immediate Settlement [in]	0	0.0344702
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.21984
Effective Stress [ksf]	0	2.0156
Total Stress [ksf]	0	5.53429
Total Strain	0	0.332403
Pore Water Pressure [ksf]	-1.2809e-005	3.53184
Excess Pore Water Pressure [ksf]	-5.01476e-037	0.00762514
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0656779	2.01481
Over-consolidation Ratio	1	19.2983
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 7300 days = 20 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	9.31724
Consolidation Settlement [in]	0	9.28277
Immediate Settlement [in]	0	0.0344702
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.21984
Effective Stress [ksf]	0	2.0156
Total Stress [ksf]	0	5.53429
Total Strain	0	0.332403
Pore Water Pressure [ksf]	-1.28499e-005	3.53184
Excess Pore Water Pressure [ksf]	-5.91402e-018	0.000748559
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0656779	2.01483
Over-consolidation Ratio	1	19.2983
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 18250 days = 50 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	9.31724
Consolidation Settlement [in]	0	9.28277
Immediate Settlement [in]	0	0.0344702
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.21984
Effective Stress [ksf]	0	2.0156
Total Stress [ksf]	0	5.53429
Total Strain	0	0.332403
Pore Water Pressure [ksf]	-1.2856e-005	3.53184
Excess Pore Water Pressure [ksf]	-7.88971e-018	7.02276e-007
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0656779	2.01483
Over-consolidation Ratio	1	19.2983
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Embankments

1. Embankment

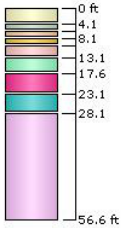
Center Line	(0, 0) to (0, 395)
Number of Layers	1
Near End Angle	11.31 degrees
Far End Angle	11.31 degrees
Base Width	59

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft^3)	Right Angle (deg)	Right Bench Width (ft)
1	0 days = 0 y	0	11.31	2.748	0.08	11.31	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	-3.4 to -7.5	4.1	0	No
2	-7.5 to -9.5	2	4.1	No
3	-9.5 to -11.5	2	6.1	No
4	-11.5 to -13.5	2	8.1	Yes
5	-13.5 to -16.5	3	10.1	Yes
6	-16.5 to -21	4.5	13.1	Yes
7	-21 to -26.5	5.5	17.6	Yes
8	-26.5 to -31.5	5	23.1	Yes
9	-31.5 to -60	28.5	28.1	Yes



Soil Properties

Property	-3.4 to -7.5	-7.5 to -9.5	-9.5 to -11.5	-11.5 to -13.5	-13.5 to -16.5	-16.5 to -21	-21 to -26.5	-26.5 to -31.5	-31.5 to -60
Color									
Unit Weight [kips/ft^3]	0.079	0.079	0.102	0.102	0.115	0.122	0.115	0.102	0.09
Saturated Unit Weight [kips/ft^3]	0.079	0.079	0.102	0.102	0.115	0.122	0.115	0.102	0.09
Immediate Settlement	Disabled	Disabled	Disabled	Disabled	Disabled	Enabled	Disabled	Disabled	Disabled
Es [ksf]						208.9			
Esur [ksf]						208.9			
Primary Consolidation	Enabled	Enabled	Enabled	Enabled	Enabled	Disabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear	Non-Linear	Non-Linear		Non-Linear	Non-Linear	Non-Linear
Cc	2.158	5.366	1.549	0.484	0.23		0.484	0.8	2.201
Cr	0.593	1.586	0.405	0.078	0.03		0.078	0.173	0.607
e0	4.347	10.287	3.218	1.278	1.014		1.278	1.832	4.426
OCR	19.3	6.2	3.3	1.9	3.5	1	1	1	1
Cv [ft^2/d]	0.049	0.417	0.034	0.144	0.042		0.144	0.028	0.051
B-bar	1	1	1	1	1		1	1	1
Undrained Su A [kips/ft2]	0	0	0	0	0	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Piezo Line ID	0	0	0	0	0	0	0	0	0

Groundwater

Groundwater method Piezometric Lines
Water Unit Weight 0.0624 kips/ft^3

Query Points

Point #	(X,Y) Location	Number of Divisions
1	0, 197.5	Auto: 67

Field Point Grid

Number of points 608
Expansion Factor 2

Grid Coordinates

X [ft]	Y [ft]
274	666.5
274	-271.5
-274	-271.5
-274	666.5

Settle3D Analysis Information
Island Road Marsh Creation and Nourishment (TE-117)

Project Settings

Document Name	B-03 El 4.s3z
Project Title	Island Road Marsh Creation and Nourishment (TE-117)
Analysis	B-03
Author	IAH
Company	GeoEngineers, Inc.
Date Created	5/12/2015
Comments	
Groundwater at Elevation -0.1 ft NAVD88	
Boussinesq Method	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/day
Include buoyancy effect when material settles below water table	
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Use average properties to calculate layered stresses	

Stage Settings

Stage #	Name	Time [years]
1	0 days	0
2	30 days	0.082
3	60 days	0.164
4	180 days	0.5
5	365 days	1
6	730 days	2
7	1825 days	5
8	3650 days	10
9	7300 days	20
10	18250 days	50

Results

Time taken to compute: 0 seconds

Stage: 0 days = 0 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.0647215
Consolidation Settlement [in]	-0.0389184	0
Immediate Settlement [in]	0	0.0647215
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.37984
Effective Stress [ksf]	-0.00013418	1.95957
Total Stress [ksf]	0	5.58193
Total Strain	-0.00239019	0.001261
Pore Water Pressure [ksf]	0	3.62237
Excess Pore Water Pressure [ksf]	0	0.37984
Degree of Consolidation [%]	0	0
Pre-consolidation Stress [ksf]	0.0656779	1.95879
Over-consolidation Ratio	1	20.2819
Void Ratio	0	10.2899
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 30 days = 0.082 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	8.9713
Consolidation Settlement [in]	0	8.90658
Immediate Settlement [in]	0	0.0647215
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.37984
Effective Stress [ksf]	0	2.05009
Total Stress [ksf]	0	5.58193
Total Strain	-0.00917433	0.432847
Pore Water Pressure [ksf]	-1.14135e-006	3.53184
Excess Pore Water Pressure [ksf]	0	0.321743
Degree of Consolidation [%]	0	96.8663
Pre-consolidation Stress [ksf]	0.0656779	2.04808
Over-consolidation Ratio	1	19.3075
Void Ratio	0	10.3906
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 60 days = 0.164 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	10.8403
Consolidation Settlement [in]	0	10.7756
Immediate Settlement [in]	0	0.0647215
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.37984
Effective Stress [ksf]	0	2.05009
Total Stress [ksf]	0	5.58193
Total Strain	0	0.431781
Pore Water Pressure [ksf]	-1.40919e-006	3.53184
Excess Pore Water Pressure [ksf]	0	0.281621
Degree of Consolidation [%]	0	98.5906
Pre-consolidation Stress [ksf]	0.0656779	2.04844
Over-consolidation Ratio	1	19.3041
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 180 days = 0.5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	13.7417
Consolidation Settlement [in]	0	13.677
Immediate Settlement [in]	0	0.0647215
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.37984
Effective Stress [ksf]	0	2.05009
Total Stress [ksf]	0	5.58193
Total Strain	0	0.430025
Pore Water Pressure [ksf]	-1.74465e-006	3.53184
Excess Pore Water Pressure [ksf]	0	0.134611
Degree of Consolidation [%]	0	99.9869
Pre-consolidation Stress [ksf]	0.0656779	2.04878
Over-consolidation Ratio	1	19.2986
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 365 days = 1 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	14.9748
Consolidation Settlement [in]	0	14.9101
Immediate Settlement [in]	0	0.0647215
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.37984
Effective Stress [ksf]	0	2.05009
Total Stress [ksf]	0	5.58193
Total Strain	0	0.429388
Pore Water Pressure [ksf]	-2.9991e-006	3.53184
Excess Pore Water Pressure [ksf]	0	0.118445
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0656779	2.04892
Over-consolidation Ratio	1	19.2959
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 730 days = 2 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	15.5915
Consolidation Settlement [in]	0	15.5267
Immediate Settlement [in]	0	0.0647215
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.37984
Effective Stress [ksf]	0	2.05009
Total Stress [ksf]	0	5.58193
Total Strain	0	0.429186
Pore Water Pressure [ksf]	-3.51757e-006	3.53184
Excess Pore Water Pressure [ksf]	0	0.100134
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0656779	2.04903
Over-consolidation Ratio	1	19.2948
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 1825 days = 5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	15.9036
Consolidation Settlement [in]	0	15.8389
Immediate Settlement [in]	0	0.0647215
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.37984
Effective Stress [ksf]	0	2.05009
Total Stress [ksf]	-4.23516e-022	5.58193
Total Strain	0	0.429168
Pore Water Pressure [ksf]	-4.25168e-006	3.53184
Excess Pore Water Pressure [ksf]	-7.79885e-034	0.0509565
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0656779	2.04918
Over-consolidation Ratio	1	19.2947
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 3650 days = 10 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	16.0551
Consolidation Settlement [in]	0	15.9904
Immediate Settlement [in]	0	0.0647215
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.37984
Effective Stress [ksf]	0	2.05009
Total Stress [ksf]	-4.23516e-022	5.58193
Total Strain	0	0.429168
Pore Water Pressure [ksf]	-4.51507e-006	3.53184
Excess Pore Water Pressure [ksf]	-2.85278e-036	0.0159718
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0656779	2.04929
Over-consolidation Ratio	1	19.2947
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 7300 days = 20 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	16.1155
Consolidation Settlement [in]	0	16.0508
Immediate Settlement [in]	0	0.0647215
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.37984
Effective Stress [ksf]	0	2.05009
Total Stress [ksf]	-4.23516e-022	5.58193
Total Strain	0	0.429168
Pore Water Pressure [ksf]	-4.56385e-006	3.53184
Excess Pore Water Pressure [ksf]	-7.11846e-018	0.00156795
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0656779	2.04934
Over-consolidation Ratio	1	19.2947
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 18250 days = 50 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	16.122
Consolidation Settlement [in]	0	16.0573
Immediate Settlement [in]	0	0.0647215
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.37984
Effective Stress [ksf]	0	2.05009
Total Stress [ksf]	-4.23516e-022	5.58193
Total Strain	0	0.429168
Pore Water Pressure [ksf]	-4.5811e-006	3.53184
Excess Pore Water Pressure [ksf]	-7.37165e-018	1.471e-006
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.0656779	2.04935
Over-consolidation Ratio	1	19.2947
Void Ratio	0	10.287
Permeability [ft/d]	0	0.157664
Coefficient of Consolidation [ft^2/d]	0	0.417
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Embankments

1. Embankment

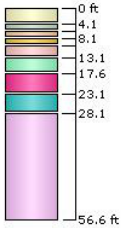
Center Line	(0, 0) to (0, 395)
Number of Layers	1
Near End Angle	11.31 degrees
Far End Angle	11.31 degrees
Base Width	79

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft^3)	Right Angle (deg)	Right Bench Width (ft)
1	0 days = 0 y	0	11.31	4.748	0.08	11.31	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	-3.4 to -7.5	4.1	0	No
2	-7.5 to -9.5	2	4.1	No
3	-9.5 to -11.5	2	6.1	No
4	-11.5 to -13.5	2	8.1	Yes
5	-13.5 to -16.5	3	10.1	Yes
6	-16.5 to -21	4.5	13.1	Yes
7	-21 to -26.5	5.5	17.6	Yes
8	-26.5 to -31.5	5	23.1	Yes
9	-31.5 to -60	28.5	28.1	Yes



Soil Properties

Property	-3.4 to -7.5	-7.5 to -9.5	-9.5 to -11.5	-11.5 to -13.5	-13.5 to -16.5	-16.5 to -21	-21 to -26.5	-26.5 to -31.5	-31.5 to -60
Color									
Unit Weight [kips/ft^3]	0.079	0.079	0.102	0.102	0.115	0.122	0.115	0.102	0.09
Saturated Unit Weight [kips/ft^3]	0.079	0.079	0.102	0.102	0.115	0.122	0.115	0.102	0.09
Immediate Settlement	Disabled	Disabled	Disabled	Disabled	Disabled	Enabled	Disabled	Disabled	Disabled
Es [ksf]						208.9			
Esur [ksf]						208.9			
Primary Consolidation	Enabled	Enabled	Enabled	Enabled	Enabled	Disabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear	Non-Linear	Non-Linear		Non-Linear	Non-Linear	Non-Linear
Cc	2.158	5.366	1.549	0.484	0.23		0.484	0.8	2.201
Cr	0.593	1.586	0.405	0.078	0.03		0.078	0.173	0.607
e0	4.347	10.287	3.218	1.278	1.014		1.278	1.832	4.426
OCR	19.3	6.2	3.3	1.9	3.5	1	1	1	1
Cv [ft^2/d]	0.049	0.417	0.034	0.144	0.042		0.144	0.028	0.051
B-bar	1	1	1	1	1		1	1	1
Undrained Su A [kips/ft2]	0	0	0	0	0	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Piezo Line ID	0	0	0	0	0	0	0	0	0

Groundwater

Groundwater method Piezometric Lines
Water Unit Weight 0.0624 kips/ft^3

Query Points

Point #	(X,Y) Location	Number of Divisions
1	0, 197.5	Auto: 67

Field Point Grid

Number of points 608
Expansion Factor 2

Grid Coordinates

X [ft]	Y [ft]
274	666.5
274	-271.5
-274	-271.5
-274	666.5

Settle3D Analysis Information
Island Road Marsh Creation and Nourishment (TE-117)

Project Settings

Document Name	B-04 El 2.s3z
Project Title	Island Road Marsh Creation and Nourishment (TE-117)
Analysis	B-04
Author	IAH
Company	GeoEngineers, Inc.
Date Created	5/12/2015
Comments	
Groundwater at Elevation -0.9 ft NAVD88	
Boussinesq Method	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/day
Include buoyancy effect when material settles below water table	
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Use average properties to calculate layered stresses	

Stage Settings

Stage #	Name	Time [years]
1	0 days	0
2	30 days	0.082
3	60 days	0.164
4	180 days	0.5
5	365 days	1
6	730 days	2
7	1825 days	5
8	3650 days	10
9	7300 days	20
10	18250 days	50

Results

Time taken to compute: 0 seconds

Stage: 0 days = 0 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.0516903
Consolidation Settlement [in]	-0.0329752	3.51041e-005
Immediate Settlement [in]	0	0.0516903
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.216385
Effective Stress [ksf]	-9.73328e-005	2.55116
Total Stress [ksf]	0	6.13605
Total Strain	-0.00407249	0.000848613
Pore Water Pressure [ksf]	0	3.5849
Excess Pore Water Pressure [ksf]	0	0.216385
Degree of Consolidation [%]	0	0.139028
Pre-consolidation Stress [ksf]	0.03588	2.55006
Over-consolidation Ratio	1	21.5179
Void Ratio	0	6.75445
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 30 days = 0.082 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	6.30015
Consolidation Settlement [in]	0	6.24846
Immediate Settlement [in]	0	0.0516903
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.216385
Effective Stress [ksf]	0	2.59729
Total Stress [ksf]	0	6.13605
Total Strain	0	0.494027
Pore Water Pressure [ksf]	-4.98894e-006	3.54432
Excess Pore Water Pressure [ksf]	-5.17237e-034	0.102723
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.59544
Over-consolidation Ratio	1	19.9983
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 60 days = 0.164 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	6.40323
Consolidation Settlement [in]	0	6.35154
Immediate Settlement [in]	0	0.0516903
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.216385
Effective Stress [ksf]	0	2.59734
Total Stress [ksf]	0	6.13605
Total Strain	0	0.49389
Pore Water Pressure [ksf]	-5.58002e-006	3.54432
Excess Pore Water Pressure [ksf]	-1.35645e-035	0.0976577
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.59571
Over-consolidation Ratio	1	19.9982
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 180 days = 0.5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	6.53484
Consolidation Settlement [in]	0	6.48315
Immediate Settlement [in]	0	0.0516903
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.216385
Effective Stress [ksf]	0	2.59735
Total Stress [ksf]	0	6.13605
Total Strain	0	0.493888
Pore Water Pressure [ksf]	-6.15749e-006	3.54432
Excess Pore Water Pressure [ksf]	-2.80647e-022	0.0811271
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.59594
Over-consolidation Ratio	1	19.9982
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 365 days = 1 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	6.6054
Consolidation Settlement [in]	0	6.55371
Immediate Settlement [in]	0	0.0516903
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.216385
Effective Stress [ksf]	0	2.59735
Total Stress [ksf]	0	6.13605
Total Strain	0	0.493888
Pore Water Pressure [ksf]	-6.22563e-006	3.54432
Excess Pore Water Pressure [ksf]	-8.47033e-022	0.0599209
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.59602
Over-consolidation Ratio	1	19.9982
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 730 days = 2 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	6.67269
Consolidation Settlement [in]	0	6.621
Immediate Settlement [in]	0	0.0516903
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.216385
Effective Stress [ksf]	0	2.59735
Total Stress [ksf]	0	6.13605
Total Strain	0	0.493888
Pore Water Pressure [ksf]	-6.23113e-006	3.54432
Excess Pore Water Pressure [ksf]	-8.47033e-022	0.0526035
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.59608
Over-consolidation Ratio	1	19.9982
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 1825 days = 5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	6.72143
Consolidation Settlement [in]	0	6.66973
Immediate Settlement [in]	0	0.0516903
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.216385
Effective Stress [ksf]	0	2.59735
Total Stress [ksf]	0	6.13605
Total Strain	0	0.493888
Pore Water Pressure [ksf]	-6.2321e-006	3.54432
Excess Pore Water Pressure [ksf]	-8.47033e-022	0.0390486
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.59615
Over-consolidation Ratio	1	19.9982
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 3650 days = 10 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	6.72627
Consolidation Settlement [in]	0	6.67458
Immediate Settlement [in]	0	0.0516903
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.216385
Effective Stress [ksf]	0	2.59735
Total Stress [ksf]	0	6.13605
Total Strain	0	0.493888
Pore Water Pressure [ksf]	-6.2321e-006	3.54432
Excess Pore Water Pressure [ksf]	-8.07015e-022	0.0212495
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.5962
Over-consolidation Ratio	1	19.9982
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 7300 days = 20 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	6.72637
Consolidation Settlement [in]	0	6.67468
Immediate Settlement [in]	0	0.0516903
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.216385
Effective Stress [ksf]	0	2.59735
Total Stress [ksf]	0	6.13605
Total Strain	0	0.493888
Pore Water Pressure [ksf]	-6.2321e-006	3.54432
Excess Pore Water Pressure [ksf]	-1.08141e-022	0.00619302
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.59624
Over-consolidation Ratio	1	19.9982
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 18250 days = 50 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	6.72637
Consolidation Settlement [in]	0	6.67468
Immediate Settlement [in]	0	0.0516903
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.216385
Effective Stress [ksf]	0	2.59735
Total Stress [ksf]	0	6.13605
Total Strain	0	0.493888
Pore Water Pressure [ksf]	-6.2321e-006	3.54432
Excess Pore Water Pressure [ksf]	-7.71782e-022	0.000152991
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.59626
Over-consolidation Ratio	1	19.9982
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Embankments

1. Embankment

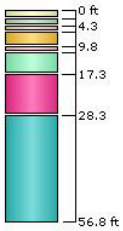
Center Line	(0, 0) to (0, 385)
Number of Layers	1
Near End Angle	11.31 degrees
Far End Angle	11.31 degrees
Base Width	57

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft^3)	Right Angle (deg)	Right Bench Width (ft)
1	0 days = 0 y	0	11.31	2.704	0.08	11.31	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	-3.2 to -5.5	2.3	0	No
2	-5.5 to -7.5	2	2.3	Yes
3	-7.5 to -9	1.5	4.3	Yes
4	-9 to -13	4	5.8	Yes
5	-13 to -14.5	1.5	9.8	Yes
6	-14.5 to -20.5	6	11.3	Yes
7	-20.5 to -31.5	11	17.3	Yes
8	-31.5 to -60	28.5	28.3	Yes



Soil Properties

Property	-3.2 to -5.5	-5.5 to -7.5	-7.5 to -9	-9 to -13	-13 to -14.5	-14.5 to -20.5	-20.5 to -31.5	-31.5 to -60
Color								
Unit Weight [kips/ft^3]	0.078	0.103	0.103	0.122	0.122	0.118	0.118	0.101
Saturated Unit Weight [kips/ft^3]	0.078	0.103	0.103	0.122	0.122	0.118	0.118	0.101
Immediate Settlement	Disabled	Disabled	Disabled	Enabled	Enabled	Disabled	Disabled	Disabled
Es [ksf]				208.9	208.9			
Esur [ksf]				208.9	208.9			
Primary Consolidation	Enabled	Enabled	Enabled	Disabled	Disabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear			Non-Linear	Non-Linear	Non-Linear
Cc	3.441	0.693	0.296			0.296	0.811	0.811
Cr	0.99	0.14	0.047			0.047	0.176	0.176
e0	6.723	1.634	1.04			1.04	1.852	1.852
OCR	20	7	3.1	1.8	3.3	1.6	1	1
Cv [ft^2/d]	0.274	0.041	0.95			0.95	0.027	0.027
B-bar	1	1	1			1	1	1
Undrained Su A [kips/ft2]	0	0	0	0	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Piezo Line ID	0	0	0	0	0	0	0	0

Groundwater

Groundwater method Piezometric Lines
Water Unit Weight 0.0624 kips/ft^3

Query Points

Point #	(X,Y) Location	Number of Divisions
1	0, 192.5	Auto: 69
2	0, 385	Auto: 69

Field Point Grid

Number of points 608
Expansion Factor 2

Grid Coordinates

X [ft]	Y [ft]
274	666.5
274	-271.5
-274	-271.5
-274	666.5

Settle3D Analysis Information
Island Road Marsh Creation and Nourishment (TE-117)

Project Settings

Document Name	B-04 El 4.s3z
Project Title	Island Road Marsh Creation and Nourishment (TE-117)
Analysis	B-04
Author	IAH
Company	GeoEngineers, Inc.
Date Created	5/12/2015
Comments	
Groundwater at Elevation -0.9 ft NAVD88	
Boussinesq Method	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/day
Include buoyancy effect when material settles below water table	
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Use average properties to calculate layered stresses	

Stage Settings

Stage #	Name	Time [years]
1	0 days	0
2	30 days	0.082
3	60 days	0.164
4	180 days	0.5
5	365 days	1
6	730 days	2
7	1825 days	5
8	3650 days	10
9	7300 days	20
10	18250 days	50

Results

Time taken to compute: 0 seconds

Stage: 0 days = 0 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.0942312
Consolidation Settlement [in]	-0.0607689	7.86141e-005
Immediate Settlement [in]	0	0.0942312
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.376326
Effective Stress [ksf]	-0.000174044	2.55118
Total Stress [ksf]	0	6.18156
Total Strain	-0.00758258	0.0015258
Pore Water Pressure [ksf]	0	3.63048
Excess Pore Water Pressure [ksf]	0	0.376326
Degree of Consolidation [%]	0	0.141415
Pre-consolidation Stress [ksf]	0.03588	2.55008
Over-consolidation Ratio	1	22.9183
Void Ratio	0	6.78156
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 30 days = 0.082 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	9.04443
Consolidation Settlement [in]	0	8.95019
Immediate Settlement [in]	0	0.0942312
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.376326
Effective Stress [ksf]	0	2.63724
Total Stress [ksf]	0	6.18156
Total Strain	-9.75523e-006	0.603383
Pore Water Pressure [ksf]	-4.21805e-006	3.54432
Excess Pore Water Pressure [ksf]	-2.50836e-034	0.202389
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.63455
Over-consolidation Ratio	1	19.9945
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 60 days = 0.164 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	9.35553
Consolidation Settlement [in]	0	9.2613
Immediate Settlement [in]	0	0.0942312
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.376326
Effective Stress [ksf]	0	2.63724
Total Stress [ksf]	0	6.18156
Total Strain	0	0.603226
Pore Water Pressure [ksf]	-4.90234e-006	3.54432
Excess Pore Water Pressure [ksf]	-1.2344e-035	0.19339
Degree of Consolidation [%]	0	99.9963
Pre-consolidation Stress [ksf]	0.03588	2.63502
Over-consolidation Ratio	1	19.9944
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 180 days = 0.5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	9.94844
Consolidation Settlement [in]	0	9.85421
Immediate Settlement [in]	0	0.0942312
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.376326
Effective Stress [ksf]	0	2.63724
Total Stress [ksf]	0	6.18156
Total Strain	0	0.60292
Pore Water Pressure [ksf]	-5.51091e-006	3.54432
Excess Pore Water Pressure [ksf]	-3.02637e-022	0.16107
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.63549
Over-consolidation Ratio	1	19.9944
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 365 days = 1 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	10.3948
Consolidation Settlement [in]	0	10.3005
Immediate Settlement [in]	0	0.0942312
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.376326
Effective Stress [ksf]	0	2.63724
Total Stress [ksf]	0	6.18156
Total Strain	0	0.602671
Pore Water Pressure [ksf]	-5.55205e-006	3.54432
Excess Pore Water Pressure [ksf]	-1.32349e-022	0.126347
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.63566
Over-consolidation Ratio	1	19.9944
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 730 days = 2 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	10.8593
Consolidation Settlement [in]	0	10.765
Immediate Settlement [in]	0	0.0942312
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.376326
Effective Stress [ksf]	0	2.63724
Total Stress [ksf]	0	6.18156
Total Strain	0	0.602405
Pore Water Pressure [ksf]	-5.55373e-006	3.54432
Excess Pore Water Pressure [ksf]	-1.07667e-022	0.112317
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.63579
Over-consolidation Ratio	1	19.9944
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 1825 days = 5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	11.2023
Consolidation Settlement [in]	0	11.1081
Immediate Settlement [in]	0	0.0942312
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.376326
Effective Stress [ksf]	0	2.63724
Total Stress [ksf]	0	6.18156
Total Strain	0	0.602208
Pore Water Pressure [ksf]	-5.55382e-006	3.54432
Excess Pore Water Pressure [ksf]	-9.06826e-023	0.0832701
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.63592
Over-consolidation Ratio	1	19.9944
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 3650 days = 10 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	11.2474
Consolidation Settlement [in]	0	11.1531
Immediate Settlement [in]	0	0.0942312
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.376326
Effective Stress [ksf]	0	2.63724
Total Stress [ksf]	0	6.18156
Total Strain	0	0.602187
Pore Water Pressure [ksf]	-5.55382e-006	3.54432
Excess Pore Water Pressure [ksf]	-8.80683e-023	0.0453102
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.63604
Over-consolidation Ratio	1	19.9944
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 7300 days = 20 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	11.2579
Consolidation Settlement [in]	0	11.1637
Immediate Settlement [in]	0	0.0942312
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.376326
Effective Stress [ksf]	0	2.63724
Total Stress [ksf]	0	6.18156
Total Strain	0	0.602187
Pore Water Pressure [ksf]	-5.55382e-006	3.54432
Excess Pore Water Pressure [ksf]	-1.17386e-022	0.0132055
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.63615
Over-consolidation Ratio	1	19.9944
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 18250 days = 50 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	11.2619
Consolidation Settlement [in]	0	11.1677
Immediate Settlement [in]	0	0.0942312
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.376326
Effective Stress [ksf]	0	2.63724
Total Stress [ksf]	0	6.18156
Total Strain	0	0.602187
Pore Water Pressure [ksf]	-5.55382e-006	3.54432
Excess Pore Water Pressure [ksf]	-8.54489e-023	0.000326227
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.03588	2.63619
Over-consolidation Ratio	1	19.9944
Void Ratio	0	6.723
Permeability [ft/d]	0	1.84622
Coefficient of Consolidation [ft^2/d]	0	0.95
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Embankments

1. Embankment

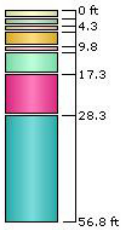
Center Line	(0, 0) to (0, 385)
Number of Layers	1
Near End Angle	11.31 degrees
Far End Angle	11.31 degrees
Base Width	77

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft^3)	Right Angle (deg)	Right Bench Width (ft)
1	0 days = 0 y	0	11.31	4.704	0.08	11.31	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	-3.2 to -5.5	2.3	0	No
2	-5.5 to -7.5	2	2.3	Yes
3	-7.5 to -9	1.5	4.3	Yes
4	-9 to -13	4	5.8	Yes
5	-13 to -14.5	1.5	9.8	Yes
6	-14.5 to -20.5	6	11.3	Yes
7	-20.5 to -31.5	11	17.3	Yes
8	-31.5 to -60	28.5	28.3	Yes



Soil Properties

Property	-3.2 to -5.5	-5.5 to -7.5	-7.5 to -9	-9 to -13	-13 to -14.5	-14.5 to -20.5	-20.5 to -31.5	-31.5 to -60
Color								
Unit Weight [kips/ft^3]	0.078	0.103	0.103	0.122	0.122	0.118	0.118	0.101
Saturated Unit Weight [kips/ft^3]	0.078	0.103	0.103	0.122	0.122	0.118	0.118	0.101
Immediate Settlement	Disabled	Disabled	Disabled	Enabled	Enabled	Disabled	Disabled	Disabled
Es [ksf]				208.9	208.9			
Esur [ksf]				208.9	208.9			
Primary Consolidation	Enabled	Enabled	Enabled	Disabled	Disabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear			Non-Linear	Non-Linear	Non-Linear
Cc	3.441	0.693	0.296			0.296	0.811	0.811
Cr	0.99	0.14	0.047			0.047	0.176	0.176
e0	6.723	1.634	1.04			1.04	1.852	1.852
OCR	20	7	3.1	1.8	3.3	1.6	1	1
Cv [ft^2/d]	0.274	0.041	0.95			0.95	0.027	0.027
B-bar	1	1	1			1	1	1
Undrained Su A [kips/ft2]	0	0	0	0	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Piezo Line ID	0	0	0	0	0	0	0	0

Groundwater

Groundwater method Piezometric Lines
Water Unit Weight 0.0624 kips/ft^3

Query Points

Point #	(X,Y) Location	Number of Divisions
1	0, 192.5	Auto: 69

Field Point Grid

Number of points 608
Expansion Factor 2

Grid Coordinates

X [ft]	Y [ft]
274	666.5
274	-271.5
-274	-271.5
-274	666.5

Settle3D Analysis Information
Island Road Marsh Creation and Nourishment (TE-117)

Project Settings

Document Name	B-05 El 2.s3z
Project Title	Island Road Marsh Creation and Nourishment (TE-117)
Analysis	B-05
Author	IAH
Company	GeoEngineers, Inc.
Date Created	5/12/2015
Comments	
Groundwater at Elevation -0.9 ft NAVD88	
Boussinesq Method	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/day
Include buoyancy effect when material settles below water table	
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Use average properties to calculate layered stresses	

Stage Settings

Stage #	Name	Time [years]
1	0 days	0
2	30 days	0.082
3	60 days	0.164
4	180 days	0.5
5	365 days	1
6	730 days	2
7	1825 days	5
8	3650 days	10
9	7300 days	20
10	18250 days	50

Results

Time taken to compute: 0 seconds

Stage: 0 days = 0 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.0241352
Consolidation Settlement [in]	-0.0139292	0
Immediate Settlement [in]	0	0.0241352
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.199051
Effective Stress [ksf]	-5.30725e-005	2.52268
Total Stress [ksf]	0	6.15953
Total Strain	-0.00109433	0.000706992
Pore Water Pressure [ksf]	0	3.63685
Excess Pore Water Pressure [ksf]	0	0.199051
Degree of Consolidation [%]	0	0
Pre-consolidation Stress [ksf]	0.056772	2.52158
Over-consolidation Ratio	1	18.385
Void Ratio	0	5.26385
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 30 days = 0.082 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	6.15122
Consolidation Settlement [in]	0	6.12708
Immediate Settlement [in]	0	0.0241352
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.199051
Effective Stress [ksf]	0	2.55509
Total Stress [ksf]	0	6.15953
Total Strain	0	0.357984
Pore Water Pressure [ksf]	-1.48814e-006	3.60672
Excess Pore Water Pressure [ksf]	-5.97177e-036	0.12589
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.55344
Over-consolidation Ratio	1	18.0015
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 60 days = 0.164 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	6.86475
Consolidation Settlement [in]	0	6.84062
Immediate Settlement [in]	0	0.0241352
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.199051
Effective Stress [ksf]	0	2.55572
Total Stress [ksf]	0	6.15953
Total Strain	0	0.357163
Pore Water Pressure [ksf]	-1.61557e-006	3.60672
Excess Pore Water Pressure [ksf]	-3.38813e-021	0.0695342
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.55424
Over-consolidation Ratio	1	18
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 180 days = 0.5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	7.53718
Consolidation Settlement [in]	0	7.51305
Immediate Settlement [in]	0	0.0241352
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.199051
Effective Stress [ksf]	0	2.55632
Total Stress [ksf]	0	6.15953
Total Strain	0	0.356558
Pore Water Pressure [ksf]	-2.04478e-006	3.60672
Excess Pore Water Pressure [ksf]	-5.9557e-023	0.0434346
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.555
Over-consolidation Ratio	1	17.9989
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 365 days = 1 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	7.68024
Consolidation Settlement [in]	0	7.65611
Immediate Settlement [in]	0	0.0241352
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.199051
Effective Stress [ksf]	0	2.55636
Total Stress [ksf]	0	6.15953
Total Strain	0	0.356526
Pore Water Pressure [ksf]	-2.94791e-006	3.60672
Excess Pore Water Pressure [ksf]	-5.37667e-023	0.0409691
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.5551
Over-consolidation Ratio	1	17.9988
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 730 days = 2 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	7.72113
Consolidation Settlement [in]	0	7.697
Immediate Settlement [in]	0	0.0241352
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.199051
Effective Stress [ksf]	0	2.55637
Total Stress [ksf]	0	6.15953
Total Strain	0	0.356525
Pore Water Pressure [ksf]	-3.53416e-006	3.60672
Excess Pore Water Pressure [ksf]	-5.12064e-023	0.0359879
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.55515
Over-consolidation Ratio	1	17.9988
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 1825 days = 5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	7.72424
Consolidation Settlement [in]	0	7.70011
Immediate Settlement [in]	0	0.0241352
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.199051
Effective Stress [ksf]	0	2.55637
Total Stress [ksf]	0	6.15953
Total Strain	0	0.356525
Pore Water Pressure [ksf]	-3.6758e-006	3.60672
Excess Pore Water Pressure [ksf]	-1.51334e-022	0.0261067
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.55519
Over-consolidation Ratio	1	17.9988
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 3650 days = 10 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	7.72424
Consolidation Settlement [in]	0	7.70011
Immediate Settlement [in]	0	0.0241352
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.199051
Effective Stress [ksf]	0	2.55637
Total Stress [ksf]	0	6.15953
Total Strain	0	0.356525
Pore Water Pressure [ksf]	-3.70064e-006	3.60672
Excess Pore Water Pressure [ksf]	-1.97023e-022	0.0137414
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.55523
Over-consolidation Ratio	1	17.9988
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 7300 days = 20 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	7.72424
Consolidation Settlement [in]	0	7.70011
Immediate Settlement [in]	0	0.0241352
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.199051
Effective Stress [ksf]	0	2.55637
Total Stress [ksf]	0	6.15953
Total Strain	0	0.356525
Pore Water Pressure [ksf]	-3.70913e-006	3.60672
Excess Pore Water Pressure [ksf]	-5.62871e-021	0.00375751
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.55526
Over-consolidation Ratio	1	17.9988
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 18250 days = 50 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	7.72424
Consolidation Settlement [in]	0	7.70011
Immediate Settlement [in]	0	0.0241352
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.199051
Effective Stress [ksf]	0	2.55637
Total Stress [ksf]	0	6.15953
Total Strain	0	0.356525
Pore Water Pressure [ksf]	-3.71082e-006	3.60672
Excess Pore Water Pressure [ksf]	-5.60663e-021	7.67151e-005
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.55528
Over-consolidation Ratio	1	17.9988
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Embankments

1. Embankment

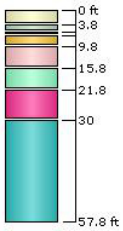
Center Line	(0, 0) to (0, 385)
Number of Layers	1
Near End Angle	11.31 degrees
Far End Angle	11.31 degrees
Base Width	47

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft^3)	Right Angle (deg)	Right Bench Width (ft)
1	0 days = 0 y	0	11.31	2.484	0.08	11.31	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	-2.2 to -6	3.8	0	No
2	-6 to -8	2	3.8	Yes
3	-8 to -9	1	5.8	Yes
4	-9 to -12	3	6.8	Yes
5	-12 to -18	6	9.8	Yes
6	-18 to -22	6	15.8	Yes
7	-22 to -32.2	8.2	21.8	Yes
8	-32.2 to -60	27.8	30	Yes



Soil Properties

Property	-2.2 to -6	-6 to -8	-8 to -9	-9 to -12	-12 to -18	-18 to -22	-22 to -32.2	-32.2 to -60
Color								
Unit Weight [kips/ft^3]	0.079	0.118	0.118	0.122	0.102	0.102	0.128	0.102
Saturated Unit Weight [kips/ft^3]	0.079	0.118	0.118	0.122	0.102	0.102	0.128	0.102
Immediate Settlement	Disabled	Disabled	Disabled	Enabled	Disabled	Disabled	Enabled	Disabled
Es [ksf]				208.9			208.9	
Esur [ksf]				208.9			208.9	
Primary Consolidation	Enabled	Enabled	Enabled	Disabled	Enabled	Enabled	Disabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear		Non-Linear	Non-Linear		Non-Linear
Cc	2.65	0.779	0.187		0.187	0.822		0.822
Cr	0.745	0.167	0.03		0.03	0.18		0.18
e0	5.257	1.792	0.901		0.901	1.872		1.872
OCR	18	6	3.1	1.8	1	1	1	1
Cv [ft^2/d]	0.068	0.029	5		5	0.027		0.027
B-bar	1	1	1		1	1		1
Undrained Su A [kips/ft2]	0	0	0	0	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Piezo Line ID	0	0	0	0	0	0	0	0

Groundwater

Groundwater method Piezometric Lines
Water Unit Weight 0.0624 kips/ft^3

Query Points

Point #	(X,Y) Location	Number of Divisions
1	0, 167.5	Auto: 73

Field Point Grid

Number of points 608
Expansion Factor 2

Grid Coordinates

X [ft]	Y [ft]
274	666.5
274	-271.5
-274	-271.5
-274	666.5

Settle3D Analysis Information
Island Road Marsh Creation and Nourishment (TE-117)

Project Settings

Document Name	B-05 El 4.s3z
Project Title	Island Road Marsh Creation and Nourishment (TE-117)
Analysis	B-05
Author	IAH
Company	GeoEngineers, Inc.
Date Created	5/12/2015
Comments	
Groundwater at Elevation -0.9 ft NAVD88	
Boussinesq Method	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/day
Include buoyancy effect when material settles below water table	
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Use average properties to calculate layered stresses	

Stage Settings

Stage #	Name	Time [years]
1	0 days	0
2	30 days	0.082
3	60 days	0.164
4	180 days	0.5
5	365 days	1
6	730 days	2
7	1825 days	5
8	3650 days	10
9	7300 days	20
10	18250 days	50

Results

Time taken to compute: 0 seconds

Stage: 0 days = 0 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.109281
Consolidation Settlement [in]	-0.0651489	8.37988e-005
Immediate Settlement [in]	0	0.110441
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.359182
Effective Stress [ksf]	-0.00023553	2.52271
Total Stress [ksf]	0	6.19676
Total Strain	-0.00509465	0.001354
Pore Water Pressure [ksf]	0	3.67408
Excess Pore Water Pressure [ksf]	0	0.359182
Degree of Consolidation [%]	0	0.0731682
Pre-consolidation Stress [ksf]	0.056772	2.52161
Over-consolidation Ratio	1	19.8637
Void Ratio	0	5.28888
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 30 days = 0.082 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	9.25402
Consolidation Settlement [in]	0	9.14358
Immediate Settlement [in]	0	0.110441
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.359182
Effective Stress [ksf]	0	2.59004
Total Stress [ksf]	0	6.19676
Total Strain	0	0.468631
Pore Water Pressure [ksf]	-3.41437e-006	3.60672
Excess Pore Water Pressure [ksf]	-1.29233e-035	0.232441
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.58772
Over-consolidation Ratio	1	18.0019
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 60 days = 0.164 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	10.2522
Consolidation Settlement [in]	0	10.1417
Immediate Settlement [in]	0	0.110441
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.359182
Effective Stress [ksf]	0	2.59004
Total Stress [ksf]	0	6.19676
Total Strain	0	0.467918
Pore Water Pressure [ksf]	-4.03404e-006	3.60672
Excess Pore Water Pressure [ksf]	-6.77626e-021	0.147894
Degree of Consolidation [%]	0	99.7548
Pre-consolidation Stress [ksf]	0.056772	2.58808
Over-consolidation Ratio	1	17.9988
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 180 days = 0.5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	11.2709
Consolidation Settlement [in]	0	11.1605
Immediate Settlement [in]	0	0.110441
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.359182
Effective Stress [ksf]	0	2.59004
Total Stress [ksf]	0	6.19676
Total Strain	0	0.467211
Pore Water Pressure [ksf]	-5.16357e-006	3.60672
Excess Pore Water Pressure [ksf]	-8.47033e-022	0.102112
Degree of Consolidation [%]	0	99.8378
Pre-consolidation Stress [ksf]	0.056772	2.58844
Over-consolidation Ratio	1	17.9961
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 365 days = 1 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	11.5445
Consolidation Settlement [in]	0	11.434
Immediate Settlement [in]	0	0.110441
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.359182
Effective Stress [ksf]	0	2.59004
Total Stress [ksf]	0	6.19676
Total Strain	0	0.467032
Pore Water Pressure [ksf]	-6.23425e-006	3.60672
Excess Pore Water Pressure [ksf]	-8.47033e-022	0.0963045
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.58857
Over-consolidation Ratio	1	17.9959
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 730 days = 2 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	11.6271
Consolidation Settlement [in]	0	11.5166
Immediate Settlement [in]	0	0.110441
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.359182
Effective Stress [ksf]	0	2.59004
Total Stress [ksf]	0	6.19676
Total Strain	0	0.466977
Pore Water Pressure [ksf]	-6.8722e-006	3.60672
Excess Pore Water Pressure [ksf]	-7.41154e-022	0.0854297
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.58867
Over-consolidation Ratio	1	17.9959
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 1825 days = 5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	11.6334
Consolidation Settlement [in]	0	11.5229
Immediate Settlement [in]	0	0.110441
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.359182
Effective Stress [ksf]	0	2.59004
Total Stress [ksf]	0	6.19676
Total Strain	0	0.466972
Pore Water Pressure [ksf]	-6.9814e-006	3.60672
Excess Pore Water Pressure [ksf]	-7.14684e-022	0.0619048
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.58878
Over-consolidation Ratio	1	17.9959
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 3650 days = 10 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	11.6334
Consolidation Settlement [in]	0	11.5229
Immediate Settlement [in]	0	0.110441
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.359182
Effective Stress [ksf]	0	2.59004
Total Stress [ksf]	0	6.19676
Total Strain	0	0.466972
Pore Water Pressure [ksf]	-6.99433e-006	3.60672
Excess Pore Water Pressure [ksf]	-7.06116e-022	0.0325819
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.58886
Over-consolidation Ratio	1	17.9959
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 7300 days = 20 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	11.6334
Consolidation Settlement [in]	0	11.5229
Immediate Settlement [in]	0	0.110441
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.359182
Effective Stress [ksf]	0	2.59004
Total Stress [ksf]	0	6.19676
Total Strain	0	0.466972
Pore Water Pressure [ksf]	-6.99746e-006	3.60672
Excess Pore Water Pressure [ksf]	-1.12574e-020	0.00890942
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.58893
Over-consolidation Ratio	1	17.9959
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 18250 days = 50 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	11.6334
Consolidation Settlement [in]	0	11.5229
Immediate Settlement [in]	0	0.110441
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.359182
Effective Stress [ksf]	0	2.59004
Total Stress [ksf]	0	6.19676
Total Strain	0	0.466972
Pore Water Pressure [ksf]	-6.99784e-006	3.60672
Excess Pore Water Pressure [ksf]	-1.12133e-020	0.000181899
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.056772	2.58896
Over-consolidation Ratio	1	17.9959
Void Ratio	0	5.257
Permeability [ft/d]	0	0.247733
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Embankments

1. Embankment

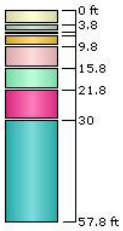
Center Line	(0, 0) to (0, 385)
Number of Layers	1
Near End Angle	11.31 degrees
Far End Angle	11.31 degrees
Base Width	67

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft^3)	Right Angle (deg)	Right Bench Width (ft)
1	0 days = 0 y	0	11.31	4.484	0.08	11.31	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	-2.2 to -6	3.8	0	No
2	-6 to -8	2	3.8	Yes
3	-8 to -9	1	5.8	Yes
4	-9 to -12	3	6.8	Yes
5	-12 to -18	6	9.8	Yes
6	-18 to -22	6	15.8	Yes
7	-22 to -32.2	8.2	21.8	Yes
8	-32.2 to -60	27.8	30	Yes



Soil Properties

Property	-2.2 to -6	-6 to -8	-8 to -9	-9 to -12	-12 to -18	-18 to -22	-22 to -32.2	-32.2 to -60
Color								
Unit Weight [kips/ft^3]	0.079	0.118	0.118	0.122	0.102	0.102	0.128	0.102
Saturated Unit Weight [kips/ft^3]	0.079	0.118	0.118	0.122	0.102	0.102	0.128	0.102
Immediate Settlement	Disabled	Disabled	Disabled	Enabled	Disabled	Disabled	Enabled	Disabled
Es [ksf]				208.9			208.9	
Esur [ksf]				208.9			208.9	
Primary Consolidation	Enabled	Enabled	Enabled	Disabled	Enabled	Enabled	Disabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear		Non-Linear	Non-Linear		Non-Linear
Cc	2.65	0.779	0.187		0.187	0.822		0.822
Cr	0.745	0.167	0.03		0.03	0.18		0.18
e0	5.257	1.792	0.901		0.901	1.872		1.872
OCR	18	6	3.1	1.8	1	1	1	1
Cv [ft^2/d]	0.068	0.029	5		5	0.027		0.027
B-bar	1	1	1		1	1		1
Undrained Su A [kips/ft2]	0	0	0	0	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Piezo Line ID	0	0	0	0	0	0	0	0

Groundwater

Groundwater method Piezometric Lines
Water Unit Weight 0.0624 kips/ft^3

Query Points

Point #	(X,Y) Location	Number of Divisions
1	0, 167.5	Auto: 73

Field Point Grid

Number of points 608
Expansion Factor 2

Grid Coordinates

X [ft]	Y [ft]
274	666.5
274	-271.5
-274	-271.5
-274	666.5

Settle3D Analysis Information
Island Road Marsh Creation and Nourishment (TE-117)

Project Settings

Document Name	B-06 El 2.s3z
Project Title	Island Road Marsh Creation and Nourishment (TE-117)
Analysis	B-06
Author	IAH
Company	GeoEngineers, Inc.
Date Created	5/12/2015
Comments	
Groundwater at Elevation -0.8 ft NAVD88	
Boussinesq Method	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/day
Include buoyancy effect when material settles below water table	
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Use average properties to calculate layered stresses	

Stage Settings

Stage #	Name	Time [years]
1	0 days	0
2	30 days	0.082
3	60 days	0.164
4	180 days	0.5
5	365 days	1
6	730 days	2
7	1825 days	5
8	3650 days	10
9	7300 days	20
10	18250 days	50

Results

Time taken to compute: 0 seconds

Stage: 0 days = 0 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.0719818
Consolidation Settlement [in]	-0.0492049	6.66763e-005
Immediate Settlement [in]	0	0.0719818
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.209313
Effective Stress [ksf]	-0.000118504	2.64904
Total Stress [ksf]	0	6.25468
Total Strain	-0.00615513	0.00309275
Pore Water Pressure [ksf]	0	3.60564
Excess Pore Water Pressure [ksf]	0	0.209313
Degree of Consolidation [%]	0	0.22093
Pre-consolidation Stress [ksf]	0.02992	2.64746
Over-consolidation Ratio	1	22.4073
Void Ratio	0	6.13263
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 30 days = 0.082 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.0082223	5.5945
Consolidation Settlement [in]	-0.0082223	5.52252
Immediate Settlement [in]	0	0.0719818
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.209313
Effective Stress [ksf]	0	2.65214
Total Stress [ksf]	0	6.25468
Total Strain	-0.000267551	0.512224
Pore Water Pressure [ksf]	-6.62129e-006	3.60659
Excess Pore Water Pressure [ksf]	0	0.153838
Degree of Consolidation [%]	0	85.1776
Pre-consolidation Stress [ksf]	0.02992	2.65057
Over-consolidation Ratio	1	19.9987
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 60 days = 0.164 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.00921026	5.93994
Consolidation Settlement [in]	-0.00921026	5.86796
Immediate Settlement [in]	0	0.0719818
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.209313
Effective Stress [ksf]	0	2.65183
Total Stress [ksf]	0	6.25468
Total Strain	-0.000260066	0.511691
Pore Water Pressure [ksf]	-7.79781e-006	3.60822
Excess Pore Water Pressure [ksf]	0	0.127453
Degree of Consolidation [%]	0	90.6777
Pre-consolidation Stress [ksf]	0.02992	2.65057
Over-consolidation Ratio	1	19.9981
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 180 days = 0.5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	6.26934
Consolidation Settlement [in]	0	6.19735
Immediate Settlement [in]	0	0.0719818
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.209313
Effective Stress [ksf]	0	2.65059
Total Stress [ksf]	0	6.25468
Total Strain	0	0.511253
Pore Water Pressure [ksf]	-8.55331e-006	3.61377
Excess Pore Water Pressure [ksf]	0	0.105887
Degree of Consolidation [%]	0	94.7211
Pre-consolidation Stress [ksf]	0.02992	2.65057
Over-consolidation Ratio	1	19.998
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 365 days = 1 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	6.54077
Consolidation Settlement [in]	0	6.46878
Immediate Settlement [in]	0	0.0719818
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.209313
Effective Stress [ksf]	0	2.65158
Total Stress [ksf]	0	6.25468
Total Strain	0	0.511056
Pore Water Pressure [ksf]	-9.84367e-006	3.62069
Excess Pore Water Pressure [ksf]	0	0.0891838
Degree of Consolidation [%]	0	96.0974
Pre-consolidation Stress [ksf]	0.02992	2.65057
Over-consolidation Ratio	1	19.9979
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 730 days = 2 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	6.85505
Consolidation Settlement [in]	0	6.78306
Immediate Settlement [in]	0	0.0719818
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.209313
Effective Stress [ksf]	0	2.65288
Total Stress [ksf]	-1.69407e-021	6.25468
Total Strain	0	0.510892
Pore Water Pressure [ksf]	-1.10596e-005	3.63011
Excess Pore Water Pressure [ksf]	0	0.0718091
Degree of Consolidation [%]	0	97.3144
Pre-consolidation Stress [ksf]	0.02992	2.65129
Over-consolidation Ratio	1	19.9979
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 1825 days = 5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	7.17688
Consolidation Settlement [in]	0	7.10489
Immediate Settlement [in]	0	0.0719818
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.209313
Effective Stress [ksf]	0	2.65644
Total Stress [ksf]	-1.69407e-021	6.25468
Total Strain	0	0.510757
Pore Water Pressure [ksf]	-1.21514e-005	3.63284
Excess Pore Water Pressure [ksf]	0	0.0635615
Degree of Consolidation [%]	0	98.7431
Pre-consolidation Stress [ksf]	0.02992	2.65485
Over-consolidation Ratio	1	19.9979
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 3650 days = 10 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	7.32425
Consolidation Settlement [in]	0	7.25227
Immediate Settlement [in]	0	0.0719818
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.209313
Effective Stress [ksf]	0	2.66208
Total Stress [ksf]	-1.69407e-021	6.25468
Total Strain	0	0.510711
Pore Water Pressure [ksf]	-1.30686e-005	3.61604
Excess Pore Water Pressure [ksf]	0	0.0467631
Degree of Consolidation [%]	0	99.2378
Pre-consolidation Stress [ksf]	0.02992	2.6605
Over-consolidation Ratio	1	19.9978
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 7300 days = 20 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	7.45912
Consolidation Settlement [in]	0	7.38714
Immediate Settlement [in]	0	0.0719818
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.209313
Effective Stress [ksf]	0	2.67606
Total Stress [ksf]	-1.69407e-021	6.25468
Total Strain	0	0.510672
Pore Water Pressure [ksf]	-1.41131e-005	3.59225
Excess Pore Water Pressure [ksf]	0	0.0229731
Degree of Consolidation [%]	0	99.6301
Pre-consolidation Stress [ksf]	0.02992	2.67449
Over-consolidation Ratio	1	19.9978
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 18250 days = 50 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	7.57112
Consolidation Settlement [in]	0	7.49914
Immediate Settlement [in]	0	0.0719818
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.209313
Effective Stress [ksf]	0	2.69
Total Stress [ksf]	-1.69407e-021	6.25468
Total Strain	0	0.510639
Pore Water Pressure [ksf]	-1.52472e-005	3.57198
Excess Pore Water Pressure [ksf]	0	0.00270037
Degree of Consolidation [%]	0	99.9559
Pre-consolidation Stress [ksf]	0.02992	2.68843
Over-consolidation Ratio	1	19.9978
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Embankments

1. Embankment

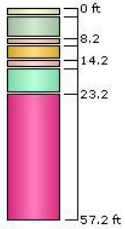
Center Line	(0, 0) to (0, 365)
Number of Layers	1
Near End Angle	11.31 degrees
Far End Angle	11.31 degrees
Base Width	53

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft^3)	Right Angle (deg)	Right Bench Width (ft)
1	0 days = 0 y	0	11.31	2.616	0.08	11.31	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	-2.8 to -5	2.2	0	No
2	-5 to -11	6	2.2	No
3	-11 to -13	2	8.2	No
4	-13 to -17	4	10.2	No
5	-17 to -22.5	2	14.2	No
6	-22.5 to -26	7	16.2	No
7	-26 to -60	34	23.2	No



Soil Properties

Property	-2.8 to -5	-5 to -11	-11 to -13	-13 to -17	-17 to -22.5	-22.5 to -26	-26 to -60
Color							
Unit Weight [kips/ft^3]	0.076	0.11	0.122	0.115	0.109	0.109	0.109
Saturated Unit Weight [kips/ft^3]	0.076	0.11	0.122	0.115	0.109	0.109	0.109
Immediate Settlement	Disabled	Disabled	Enabled	Disabled	Disabled	Disabled	Disabled
Es [ksf]			50				
Esur [ksf]			50				
Primary Consolidation	Enabled	Enabled	Disabled	Enabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear		Non-Linear	Non-Linear	Non-Linear	Non-Linear
Cc	3.099	0.554		0.203	0.576	0.725	0.359
Cr	0.884	0.097		0.032	0.104	0.15	0.057
e0	6.089	1.377		0.921	1.416	1.693	1.119
OCR	20	4.2	3	1.9	1	1	1
Cv [ft^2/d]	0.092	0.091		5	0.078	0.035	0.4
B-bar	1	1		1	1	1	1
Undrained Su A [kips/ft2]	0	0	0	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Piezo Line ID	0	0	0	0	0	0	0

Groundwater

Groundwater method Piezometric Lines
Water Unit Weight 0.0624 kips/ft^3

Query Points

Point #	(X,Y) Location	Number of Divisions
1	0, 182	Auto: 63

Field Point Grid

Number of points 608
Expansion Factor 2

Grid Coordinates

X [ft]	Y [ft]
253	615.5
253	-250.5
-253	-250.5
-253	615.5

Settle3D Analysis Information
Island Road Marsh Creation and Nourishment (TE-117)

Project Settings

Document Name	B-06 El 4.s3z
Project Title	Island Road Marsh Creation and Nourishment (TE-117)
Analysis	B-06
Author	IAH
Company	GeoEngineers, Inc.
Date Created	5/12/2015
Comments	
Groundwater at Elevation -0.8 ft NAVD88	
Boussinesq Method	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/day
Include buoyancy effect when material settles below water table	
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Use average properties to calculate layered stresses	

Stage Settings

Stage #	Name	Time [years]
1	0 days	0
2	30 days	0.082
3	60 days	0.164
4	180 days	0.5
5	365 days	1
6	730 days	2
7	1825 days	5
8	3650 days	10
9	7300 days	20
10	18250 days	50

Results

Time taken to compute: 0 seconds

Stage: 0 days = 0 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.134889
Consolidation Settlement [in]	-0.093798	0
Immediate Settlement [in]	0	0.134889
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.369325
Effective Stress [ksf]	-0.000213912	2.649
Total Stress [ksf]	0	6.29588
Total Strain	-0.0119237	0.00576244
Pore Water Pressure [ksf]	0	3.64696
Excess Pore Water Pressure [ksf]	0	0.369325
Degree of Consolidation [%]	0	0
Pre-consolidation Stress [ksf]	0.02992	2.64741
Over-consolidation Ratio	1	24.9258
Void Ratio	0	6.17353
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 30 days = 0.082 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.0019767	7.69685
Consolidation Settlement [in]	-0.0019767	7.56196
Immediate Settlement [in]	0	0.134889
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.369325
Effective Stress [ksf]	0	2.65059
Total Stress [ksf]	0	6.29588
Total Strain	-0.000443309	0.622695
Pore Water Pressure [ksf]	-1.73902e-006	3.65372
Excess Pore Water Pressure [ksf]	0	0.285868
Degree of Consolidation [%]	0	92.4412
Pre-consolidation Stress [ksf]	0.02992	2.6491
Over-consolidation Ratio	1	19.995
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 60 days = 0.164 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.00158271	8.306
Consolidation Settlement [in]	-0.00158271	8.17111
Immediate Settlement [in]	0	0.134889
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.369325
Effective Stress [ksf]	0	2.6506
Total Stress [ksf]	0	6.29588
Total Strain	-0.000439739	0.622204
Pore Water Pressure [ksf]	-2.32522e-006	3.65715
Excess Pore Water Pressure [ksf]	0	0.244142
Degree of Consolidation [%]	0	96.7485
Pre-consolidation Stress [ksf]	0.02992	2.6491
Over-consolidation Ratio	1	19.9935
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 180 days = 0.5 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.00198579	9.07267
Consolidation Settlement [in]	-0.00198579	8.93778
Immediate Settlement [in]	0	0.134889
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.369325
Effective Stress [ksf]	0	2.65248
Total Stress [ksf]	0	6.29588
Total Strain	-4.61576e-005	0.621561
Pore Water Pressure [ksf]	-3.39811e-006	3.66842
Excess Pore Water Pressure [ksf]	0	0.206214
Degree of Consolidation [%]	0	98.1886
Pre-consolidation Stress [ksf]	0.02992	2.65089
Over-consolidation Ratio	1	19.9932
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 365 days = 1 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.00262913	9.61047
Consolidation Settlement [in]	-0.00262913	9.47559
Immediate Settlement [in]	0	0.134889
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.369325
Effective Stress [ksf]	0	2.65464
Total Stress [ksf]	0	6.29588
Total Strain	-2.14798e-005	0.6211
Pore Water Pressure [ksf]	-4.19773e-006	3.68186
Excess Pore Water Pressure [ksf]	0	0.176807
Degree of Consolidation [%]	0	98.5162
Pre-consolidation Stress [ksf]	0.02992	2.65304
Over-consolidation Ratio	1	19.9931
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 730 days = 2 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.000752181	10.2461
Consolidation Settlement [in]	-0.000752181	10.1112
Immediate Settlement [in]	0	0.134889
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.369325
Effective Stress [ksf]	0	2.65752
Total Stress [ksf]	0	6.29588
Total Strain	-6.14527e-006	0.620664
Pore Water Pressure [ksf]	-4.71065e-006	3.69932
Excess Pore Water Pressure [ksf]	0	0.147324
Degree of Consolidation [%]	0	98.8059
Pre-consolidation Stress [ksf]	0.02992	2.65593
Over-consolidation Ratio	1	19.9931
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 1825 days = 5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	11.0388
Consolidation Settlement [in]	0	10.9039
Immediate Settlement [in]	0	0.134889
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.369325
Effective Stress [ksf]	0	2.6652
Total Stress [ksf]	0	6.29588
Total Strain	0	0.620208
Pore Water Pressure [ksf]	-5.27591e-006	3.70055
Excess Pore Water Pressure [ksf]	0	0.13127
Degree of Consolidation [%]	0	99.1487
Pre-consolidation Stress [ksf]	0.02992	2.66362
Over-consolidation Ratio	1	19.993
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 3650 days = 10 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	11.5459
Consolidation Settlement [in]	0	11.411
Immediate Settlement [in]	0	0.134889
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.369325
Effective Stress [ksf]	0	2.6783
Total Stress [ksf]	0	6.29588
Total Strain	0	0.619972
Pore Water Pressure [ksf]	-5.87466e-006	3.66385
Excess Pore Water Pressure [ksf]	0	0.0945675
Degree of Consolidation [%]	0	99.4196
Pre-consolidation Stress [ksf]	0.02992	2.67672
Over-consolidation Ratio	1	19.9929
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 7300 days = 20 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	12.0595
Consolidation Settlement [in]	0	11.9246
Immediate Settlement [in]	0	0.134889
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.369325
Effective Stress [ksf]	0	2.69431
Total Stress [ksf]	0	6.29588
Total Strain	0	0.619746
Pore Water Pressure [ksf]	-6.70203e-006	3.61452
Excess Pore Water Pressure [ksf]	0	0.0452409
Degree of Consolidation [%]	0	99.7031
Pre-consolidation Stress [ksf]	0.02992	2.69273
Over-consolidation Ratio	1	19.9928
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Stage: 18250 days = 50 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	12.4671
Consolidation Settlement [in]	0	12.3322
Immediate Settlement [in]	0	0.134889
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0	0.369325
Effective Stress [ksf]	0	2.72218
Total Stress [ksf]	0	6.29588
Total Strain	0	0.619565
Pore Water Pressure [ksf]	-7.55229e-006	3.5742
Excess Pore Water Pressure [ksf]	0	0.00492154
Degree of Consolidation [%]	0	99.9576
Pre-consolidation Stress [ksf]	0.02992	2.72063
Over-consolidation Ratio	1	19.9927
Void Ratio	0	6.089
Permeability [ft/d]	0	0.729373
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0

Embankments

1. Embankment

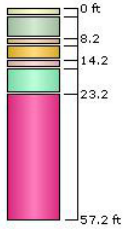
Center Line	(0, 0) to (0, 365)
Number of Layers	1
Near End Angle	11.31 degrees
Far End Angle	11.31 degrees
Base Width	73

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft^3)	Right Angle (deg)	Right Bench Width (ft)
1	0 days = 0 y	0	11.31	4.616	0.08	11.31	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	-2.8 to -5	2.2	0	No
2	-5 to -11	6	2.2	No
3	-11 to -13	2	8.2	No
4	-13 to -17	4	10.2	No
5	-17 to -22.5	2	14.2	No
6	-22.5 to -26	7	16.2	No
7	-26 to -60	34	23.2	No



Soil Properties

Property	-2.8 to -5	-5 to -11	-11 to -13	-13 to -17	-17 to -22.5	-22.5 to -26	-26 to -60
Color							
Unit Weight [kips/ft^3]	0.076	0.11	0.122	0.115	0.109	0.109	0.109
Saturated Unit Weight [kips/ft^3]	0.076	0.11	0.122	0.115	0.109	0.109	0.109
Immediate Settlement	Disabled	Disabled	Enabled	Disabled	Disabled	Disabled	Disabled
Es [ksf]			50				
Esur [ksf]			50				
Primary Consolidation	Enabled	Enabled	Disabled	Enabled	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear		Non-Linear	Non-Linear	Non-Linear	Non-Linear
Cc	3.099	0.554		0.203	0.576	0.725	0.359
Cr	0.884	0.097		0.032	0.104	0.15	0.057
e0	6.089	1.377		0.921	1.416	1.693	1.119
OCR	20	4.2	3	1.9	1	1	1
Cv [ft^2/d]	0.092	0.091		5	0.078	0.035	0.4
B-bar	1	1		1	1	1	1
Undrained Su A [kips/ft2]	0	0	0	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Piezo Line ID	0	0	0	0	0	0	0

Groundwater

Groundwater method Piezometric Lines
Water Unit Weight 0.0624 kips/ft^3

Query Points

Point #	(X,Y) Location	Number of Divisions
1	0, 182	Auto: 63

Field Point Grid

Number of points 608
Expansion Factor 2

Grid Coordinates

X [ft]	Y [ft]
253	615.5
253	-250.5
-253	-250.5
-253	615.5

Settle3D Analysis Information
Island Road Marsh Creation and Nourishment (TE-117)

Project Settings

Document Name	B-07 El 2.s3z
Project Title	Island Road Marsh Creation and Nourishment (TE-117)
Analysis	B-07
Author	IAH
Company	GeoEngineers, Inc.
Date Created	5/12/2015
Comments	
Groundwater at Elevation -0.8 ft NAVD88	
Boussinesq Method	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/day
Include buoyancy effect when material settles below water table	
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Use average properties to calculate layered stresses	

Stage Settings

Stage #	Name	Time [years]
1	0 days	0
2	30 days	0.082
3	60 days	0.164
4	180 days	0.5
5	365 days	1
6	730 days	2
7	1825 days	5
8	3650 days	10
9	7300 days	20
10	18250 days	50

Results

Time taken to compute: 0 seconds

Stage: 0 days = 0 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.460115	0.0105917
Consolidation Settlement [in]	-0.470707	0
Immediate Settlement [in]	0	0.0105917
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0392497	0.21632
Effective Stress [ksf]	-0.0038641	2.33388
Total Stress [ksf]	0.21632	5.91745
Total Strain	-0.035736	0.000453215
Pore Water Pressure [ksf]	0.220184	3.58357
Excess Pore Water Pressure [ksf]	0.0392497	0.21632
Degree of Consolidation [%]	0	0
Pre-consolidation Stress [ksf]	0.00288	2.33237
Over-consolidation Ratio	1	39.2026
Void Ratio	0	20.9845
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.468336

Stage: 30 days = 0.082 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	14.2446
Consolidation Settlement [in]	0	14.234
Immediate Settlement [in]	0	0.0105917
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0392497	0.21632
Effective Stress [ksf]	0.0963808	2.33243
Total Stress [ksf]	0.21632	5.91745
Total Strain	-0.0168899	0.596403
Pore Water Pressure [ksf]	0.0776364	3.58502
Excess Pore Water Pressure [ksf]	0	0.169034
Degree of Consolidation [%]	0	79.6447
Pre-consolidation Stress [ksf]	0.163546	2.33237
Over-consolidation Ratio	1	11.3596
Void Ratio	0	20.5845
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.468336

Stage: 60 days = 0.164 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	14.9218
Consolidation Settlement [in]	0	14.9112
Immediate Settlement [in]	0	0.0105917
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0392497	0.21632
Effective Stress [ksf]	0.126138	2.33175
Total Stress [ksf]	0.21632	5.91745
Total Strain	-0.0185982	0.594877
Pore Water Pressure [ksf]	0.0811227	3.5857
Excess Pore Water Pressure [ksf]	0	0.161368
Degree of Consolidation [%]	0	86.1439
Pre-consolidation Stress [ksf]	0.163546	2.33237
Over-consolidation Ratio	1	10.702
Void Ratio	0	20.6208
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.468336

Stage: 180 days = 0.5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	16.305
Consolidation Settlement [in]	0	16.2944
Immediate Settlement [in]	0	0.0105917
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0392497	0.21632
Effective Stress [ksf]	0.125981	2.32985
Total Stress [ksf]	0.21632	5.91745
Total Strain	-0.0222224	0.59165
Pore Water Pressure [ksf]	0.0882271	3.5876
Excess Pore Water Pressure [ksf]	0	0.138407
Degree of Consolidation [%]	0	92.7211
Pre-consolidation Stress [ksf]	0.163546	2.33237
Over-consolidation Ratio	1	7.40028
Void Ratio	0	20.6977
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.468336

Stage: 365 days = 1 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	17.2325
Consolidation Settlement [in]	0	17.222
Immediate Settlement [in]	0	0.0105917
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0392497	0.21632
Effective Stress [ksf]	0.121178	2.32775
Total Stress [ksf]	0.21632	5.91745
Total Strain	-0.0247745	0.589388
Pore Water Pressure [ksf]	0.0930021	3.5897
Excess Pore Water Pressure [ksf]	0	0.124879
Degree of Consolidation [%]	0	95.4979
Pre-consolidation Stress [ksf]	0.163546	2.33237
Over-consolidation Ratio	1	6.00929
Void Ratio	0	20.7519
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.468336

Stage: 730 days = 2 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	18.2782
Consolidation Settlement [in]	0	18.2676
Immediate Settlement [in]	0	0.0105917
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0392497	0.21632
Effective Stress [ksf]	0.11576	2.32538
Total Stress [ksf]	0.21632	5.91745
Total Strain	-0.0277761	0.586738
Pore Water Pressure [ksf]	0.0983877	3.59207
Excess Pore Water Pressure [ksf]	0	0.0946401
Degree of Consolidation [%]	0	97.3377
Pre-consolidation Stress [ksf]	0.163546	2.33237
Over-consolidation Ratio	1	5.50983
Void Ratio	0	20.8156
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.468336

Stage: 1825 days = 5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	19.7601
Consolidation Settlement [in]	0	19.7495
Immediate Settlement [in]	0	0.0105917
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0392497	0.21632
Effective Stress [ksf]	0.108059	2.33137
Total Stress [ksf]	0.21632	5.91745
Total Strain	-0.032276	0.582786
Pore Water Pressure [ksf]	0.106018	3.58608
Excess Pore Water Pressure [ksf]	0	0.0417647
Degree of Consolidation [%]	0	98.7481
Pre-consolidation Stress [ksf]	0.163546	2.33237
Over-consolidation Ratio	1	5.34698
Void Ratio	0	20.9111
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.468336

Stage: 3650 days = 10 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	20.5035
Consolidation Settlement [in]	0	20.4929
Immediate Settlement [in]	0	0.0105917
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0392497	0.21632
Effective Stress [ksf]	0.104183	2.34765
Total Stress [ksf]	0.21632	5.91745
Total Strain	-0.0346521	0.580709
Pore Water Pressure [ksf]	0.109843	3.5698
Excess Pore Water Pressure [ksf]	0	0.0254766
Degree of Consolidation [%]	0	99.3792
Pre-consolidation Stress [ksf]	0.163546	2.34617
Over-consolidation Ratio	1	5.28592
Void Ratio	0	20.9615
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.468336

Stage: 7300 days = 20 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	20.7076
Consolidation Settlement [in]	0	20.697
Immediate Settlement [in]	0	0.0105917
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0392497	0.21632
Effective Stress [ksf]	0.103113	2.36431
Total Stress [ksf]	0.21632	5.91745
Total Strain	-0.0353227	0.580123
Pore Water Pressure [ksf]	0.110897	3.55314
Excess Pore Water Pressure [ksf]	0	0.00881915
Degree of Consolidation [%]	0	99.8923
Pre-consolidation Stress [ksf]	0.163546	2.36283
Over-consolidation Ratio	1	5.26836
Void Ratio	0	20.9758
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.468336

Stage: 18250 days = 50 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	20.7188
Consolidation Settlement [in]	0	20.7082
Immediate Settlement [in]	0	0.0105917
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0392497	0.21632
Effective Stress [ksf]	0.103037	2.37277
Total Stress [ksf]	0.21632	5.91745
Total Strain	-0.035371	0.580082
Pore Water Pressure [ksf]	0.110973	3.54468
Excess Pore Water Pressure [ksf]	0	0.00036306
Degree of Consolidation [%]	0	99.9987
Pre-consolidation Stress [ksf]	0.163546	2.37129
Over-consolidation Ratio	1	5.26753
Void Ratio	0	20.9768
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.468336

Embankments

1. Embankment

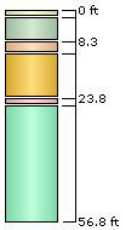
Center Line	(0, 0) to (0, 365)
Number of Layers	1
Near End Angle	11.31 degrees
Far End Angle	11.31 degrees
Base Width	57

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft^3)	Right Angle (deg)	Right Bench Width (ft)
1	0 days = 0 y	0	11.31	2.704	0.08	11.31	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	-3.2 to -5	1.8	0	No
2	-5 to -11.5	6.5	1.8	No
3	-11.5 to -15	3.5	8.3	No
4	-15 to -27	12	11.8	Yes
5	-27 to -29	2	23.8	Yes
6	-29 to -60	31	25.8	No



Soil Properties

Property	-3.2 to -5	-5 to -11.5	-11.5 to -15	-15 to -27	-27 to -29	-29 to -60
Color						
Unit Weight [kips/ft^3]	0.064	0.082	0.086	0.104	0.12	0.111
Saturated Unit Weight [kips/ft^3]	0.064	0.082	0.086	0.104	0.12	0.111
Immediate Settlement	Disabled	Disabled	Disabled	Disabled	Enabled	Disabled
Es [ksf]					208.9	
Esur [ksf]					208.9	
Primary Consolidation	Enabled	Enabled	Enabled	Enabled	Disabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear	Non-Linear		Non-Linear
Cc	10.733	2.286	1.378	0.736		0.576
Cr	3.246	0.633	0.352	0.153		0.104
e0	20.226	4.584	2.901	1.713		1.416
OCR	20	11	3.4	1	1	1
Cv [ft^2/d]	5	0.054	0.029	0.034		0.079
B-bar	1	1	1	1		1
Undrained Su A [kips/ft2]	0	0	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1	1	1

Groundwater

Groundwater method	Piezometric Lines
Water Unit Weight	0.0624 kips/ft^3

Piezometric Line Entities

ID	Depth (ft)
1	0 ft

Query Points

Point #	(X,Y) Location	Number of Divisions
1	0, 182	Auto: 65

Settle3D Analysis Information
Island Road Marsh Creation and Nourishment (TE-117)

Project Settings

Document Name	B-07 El 4.s3z
Project Title	Island Road Marsh Creation and Nourishment (TE-117)
Analysis	B-07
Author	IAH
Company	GeoEngineers, Inc.
Date Created	5/12/2015
Comments	
Groundwater at Elevation -0.8 ft NAVD88	
Boussinesq Method	
Stress Computation Method	Westergaard
Time-dependent Consolidation Analysis	
Time Units	years
Permeability Units	feet/day
Include buoyancy effect when material settles below water table	
Use settlement cutoff	
Load/Insitu vertical stress ratio	0.1
Use average properties to calculate layered stresses	

Stage Settings

Stage #	Name	Time [years]
1	0 days	0
2	30 days	0.082
3	60 days	0.164
4	180 days	0.5
5	365 days	1
6	730 days	2
7	1825 days	5
8	3650 days	10
9	7300 days	20
10	18250 days	50

Results

Time taken to compute: 0 seconds

Stage: 0 days = 0 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.159639	0.0212851
Consolidation Settlement [in]	-0.180924	0
Immediate Settlement [in]	0	0.0212851
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0860316	0.37632
Effective Stress [ksf]	-9.91824e-005	2.33388
Total Stress [ksf]	0.37632	5.96423
Total Strain	-0.0577068	0.000907098
Pore Water Pressure [ksf]	0.376419	3.63035
Excess Pore Water Pressure [ksf]	0.0860316	0.37632
Degree of Consolidation [%]	0	0
Pre-consolidation Stress [ksf]	0.00288	2.33237
Over-consolidation Ratio	1	47.685
Void Ratio	0	21.4509
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.470168

Stage: 30 days = 0.082 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.000459801	22.8319
Consolidation Settlement [in]	-0.000459801	22.8106
Immediate Settlement [in]	0	0.0212851
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0860316	0.37632
Effective Stress [ksf]	0.105389	2.33087
Total Stress [ksf]	0.37632	5.96423
Total Strain	-0.00281346	0.988416
Pore Water Pressure [ksf]	0.118694	3.63337
Excess Pore Water Pressure [ksf]	0	0.305656
Degree of Consolidation [%]	0	62.6178
Pre-consolidation Stress [ksf]	0.214003	2.33237
Over-consolidation Ratio	1	11.647
Void Ratio	-0.75411	7.27549
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.470168

Stage: 60 days = 0.164 y

Data Type	Minimum	Maximum
Total Settlement [in]	-0.000384024	24.1141
Consolidation Settlement [in]	-0.000384024	24.0928
Immediate Settlement [in]	0	0.0212851
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0860316	0.37632
Effective Stress [ksf]	0.135845	2.32946
Total Stress [ksf]	0.37632	5.96423
Total Strain	-0.00125996	0.986702
Pore Water Pressure [ksf]	0.125367	3.63477
Excess Pore Water Pressure [ksf]	0	0.292806
Degree of Consolidation [%]	0	66.0518
Pre-consolidation Stress [ksf]	0.214003	2.33237
Over-consolidation Ratio	1	10.2916
Void Ratio	-0.717745	7.30543
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.470168

Stage: 180 days = 0.5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	26.5529
Consolidation Settlement [in]	0	26.5316
Immediate Settlement [in]	0	0.0212851
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0860316	0.37632
Effective Stress [ksf]	0.212396	2.32559
Total Stress [ksf]	0.37632	5.96423
Total Strain	-0.000591449	0.983321
Pore Water Pressure [ksf]	0.13804	3.63865
Excess Pore Water Pressure [ksf]	0	0.257587
Degree of Consolidation [%]	0	73.422
Pre-consolidation Stress [ksf]	0.218193	2.33237
Over-consolidation Ratio	1	5.46293
Void Ratio	-0.645978	7.36437
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.470168

Stage: 365 days = 1 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	28.1575
Consolidation Settlement [in]	0	28.1362
Immediate Settlement [in]	0	0.0212851
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0860316	0.37632
Effective Stress [ksf]	0.229919	2.32139
Total Stress [ksf]	0.37632	5.96423
Total Strain	0	0.980992
Pore Water Pressure [ksf]	0.146401	3.64285
Excess Pore Water Pressure [ksf]	0	0.231982
Degree of Consolidation [%]	0	78.3914
Pre-consolidation Stress [ksf]	0.248566	2.33237
Over-consolidation Ratio	1	4.23217
Void Ratio	-0.596545	7.40472
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.470168

Stage: 730 days = 2 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	30.1354
Consolidation Settlement [in]	0	30.1141
Immediate Settlement [in]	0	0.0212851
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0860316	0.37632
Effective Stress [ksf]	0.219611	2.31687
Total Stress [ksf]	0.37632	5.96423
Total Strain	0	0.978004
Pore Water Pressure [ksf]	0.156709	3.64736
Excess Pore Water Pressure [ksf]	0	0.174863
Degree of Consolidation [%]	0	84.6753
Pre-consolidation Stress [ksf]	0.30165	2.33237
Over-consolidation Ratio	1	3.90692
Void Ratio	-0.53311	7.45617
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.470168

Stage: 1825 days = 5 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	32.875
Consolidation Settlement [in]	0	32.8538
Immediate Settlement [in]	0	0.0212851
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0860316	0.37632
Effective Stress [ksf]	0.205339	2.33041
Total Stress [ksf]	0.37632	5.96423
Total Strain	0	0.973631
Pore Water Pressure [ksf]	0.170981	3.63382
Excess Pore Water Pressure [ksf]	0	0.0894999
Degree of Consolidation [%]	0	93.6491
Pre-consolidation Stress [ksf]	0.305378	2.33237
Over-consolidation Ratio	1	3.80055
Void Ratio	-0.440281	7.53077
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.470168

Stage: 3650 days = 10 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	34.1963
Consolidation Settlement [in]	0	34.175
Immediate Settlement [in]	0	0.0212851
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0860316	0.37632
Effective Stress [ksf]	0.198458	2.36539
Total Stress [ksf]	0.37632	5.96423
Total Strain	0	0.971414
Pore Water Pressure [ksf]	0.177862	3.59884
Excess Pore Water Pressure [ksf]	0	0.0545249
Degree of Consolidation [%]	0	98.1801
Pre-consolidation Stress [ksf]	0.305378	2.36393
Over-consolidation Ratio	1	3.75269
Void Ratio	-0.393234	7.56824
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.470168

Stage: 7300 days = 20 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	34.6144
Consolidation Settlement [in]	0	34.5931
Immediate Settlement [in]	0	0.0212851
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0860316	0.37632
Effective Stress [ksf]	0.196251	2.40104
Total Stress [ksf]	0.37632	5.96423
Total Strain	0	0.970687
Pore Water Pressure [ksf]	0.180069	3.56319
Excess Pore Water Pressure [ksf]	0	0.0188733
Degree of Consolidation [%]	0	99.6924
Pre-consolidation Stress [ksf]	0.305378	2.39958
Over-consolidation Ratio	1	3.74318
Void Ratio	-0.377804	7.58048
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.470168

Stage: 18250 days = 50 y

Data Type	Minimum	Maximum
Total Settlement [in]	0	34.6854
Consolidation Settlement [in]	0	34.6641
Immediate Settlement [in]	0	0.0212851
Secondary Settlement [in]	0	0
Loading Stress [ksf]	0.0860316	0.37632
Effective Stress [ksf]	0.19585	2.41913
Total Stress [ksf]	0.37632	5.96423
Total Strain	0	0.970554
Pore Water Pressure [ksf]	0.18047	3.5451
Excess Pore Water Pressure [ksf]	0	0.000776964
Degree of Consolidation [%]	0	99.9824
Pre-consolidation Stress [ksf]	0.305378	2.41768
Over-consolidation Ratio	1	3.74567
Void Ratio	-0.374985	7.5827
Permeability [ft/d]	0	476.34
Coefficient of Consolidation [ft^2/d]	0	5
Hydroconsolidation Settlement [in]	0	0
Average Degree of Consolidation [%]	0	0
Undrained Shear Strength	0	0.470168

Embankments

1. Embankment

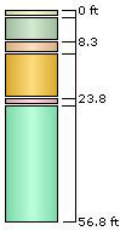
Center Line	(0, 0) to (0, 365)
Number of Layers	1
Near End Angle	11.31 degrees
Far End Angle	11.31 degrees
Base Width	77

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft^3)	Right Angle (deg)	Right Bench Width (ft)
1	0 days = 0 y	0	11.31	4.704	0.08	11.31	0

Soil Layers

Ground Surface Drained: Yes

Layer #	Type	Thickness [ft]	Depth [ft]	Drained at Bottom
1	-3.2 to -5	1.8	0	No
2	-5 to -11.5	6.5	1.8	No
3	-11.5 to -15	3.5	8.3	No
4	-15 to -27	12	11.8	Yes
5	-27 to -29	2	23.8	Yes
6	-29 to -60	31	25.8	No



Soil Properties

Property	-3.2 to -5	-5 to -11.5	-11.5 to -15	-15 to -27	-27 to -29	-29 to -60
Color						
Unit Weight [kips/ft^3]	0.064	0.082	0.086	0.104	0.12	0.111
Saturated Unit Weight [kips/ft^3]	0.064	0.082	0.086	0.104	0.12	0.111
Immediate Settlement	Disabled	Disabled	Disabled	Disabled	Enabled	Disabled
Es [ksf]					208.9	
Esur [ksf]					208.9	
Primary Consolidation	Enabled	Enabled	Enabled	Enabled	Disabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear	Non-Linear		Non-Linear
Cc	10.733	2.286	1.378	0.736		0.576
Cr	3.246	0.633	0.352	0.153		0.104
e0	20.226	4.584	2.901	1.713		1.416
OCR	20	11	3.4	1	1	1
Cv [ft^2/d]	5	0.054	0.029	0.034		0.079
B-bar	1	1	1	1		1
Undrained Su A [kips/ft2]	0	0	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8	0.8	0.8
Piezo Line ID	1	1	1	1	1	1

Groundwater

Groundwater method	Piezometric Lines
Water Unit Weight	0.0624 kips/ft^3

Piezometric Line Entities

ID	Depth (ft)
1	0 ft

Query Points

Point #	(X,Y) Location	Number of Divisions
1	0, 182	Auto: 65

APPENDIX D
Report Limitations and Guidelines for Use

APPENDIX D
REPORT LIMITATIONS AND GUIDELINES FOR USE

This appendix provides information to help you manage your risks with respect to the use of this report.

Geotechnical Services Are Performed for Specific Purposes, Persons and Projects

This report has been prepared for Louisiana Coastal Protection and Restoration Authority and their authorized agents and regulatory agencies. The information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. No party other than Louisiana Coastal Protection and Restoration Authority may rely on the product of our services unless we agree to such reliance in advance and in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted geotechnical practices in this area at the time this report was prepared. Use of this report is not recommended for any purpose or project except the one originally contemplated.

A Geotechnical Engineering or Geologic Report Is Based on a Unique Set of Project-Specific Factors

This report has been prepared for the Island Road Marsh Creation and Nourishment (TE-117) project in Terrebonne Parish, Louisiana. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- the function of the proposed structure;
- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or
- project ownership.

If important changes are made after the date of this report, we recommend that GeoEngineers be given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Most Geotechnical and Geologic Findings Are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an informed opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Geotechnical Engineering Report Recommendations Are Not Final

The construction recommendations included in this report are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers is unable to assume responsibility for the recommendations in this report without performing construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. The logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the report can create a risk of misinterpretation.

Give Contractors a Complete Report and Guidance

To help prevent costly problems associated with unanticipated subsurface conditions, we recommend giving contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report's accuracy is limited. In addition, encourage them to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer.

Contractors Are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

Read These Provisions Closely

It is important to recognize that the geoscience practices (geotechnical engineering, geology and environmental science) are less exact than other engineering and natural science disciplines. Without this understanding, there may be expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you need to know more how these "Report Limitations and Guidelines for Use" apply to your project or site.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field.

Have we delivered World Class Client Service?

Please let us know by visiting **www.geoengineers.com/feedback**.

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