

CLECO POWER LLC

DOLET HILLS POWER STATION



5-YEAR PERIODIC REVIEW

SAFETY FACTOR ASSESSMENT

ASH BASIN No. 1

OCTOBER 2021

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Providence Project No: 002-293



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1.0 INTRODUCTION

Providence was contracted by Cleco Power LLC (Cleco) to conduct the 5-year periodic review of the safety factor assessment of Ash Basin No. 1 at Cleco's Dolet Hills Power Station.

The Coal Combustion Residual (CCR) regulations at 40 CFR 257.73(e)(1) established requirements for owners and operators to conduct safety factor assessments to document whether the calculated factors of safety for the Ash Basin No. 1 achieve the minimum safety factors specified below:

- The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.
- The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.
- The calculated seismic factor of safety must equal or exceed 1.00.
- For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

This safety factor assessment pertains to Ash Basin No. 1 that is utilized for the Unit 1 coal-fired generation unit. The Cleco Dolet Hills Power Station is located approximately 8 miles southeast of Mansfield, DeSoto Parish, LA. A site location map showing the Dolet Hills Power Station is included as **Figure 1**. A site map for Ash Basin No. 1 is included as **Figure 2**.

2.0 FACTORS OF SAFETY

Providence performed a review of their 2016 structural stability analysis (slope stability analysis) for the western levee for Ash Basin No. 1. Ash Basin No. 1 was initially constructed by erecting a levee on the downstream side of an existing natural drainage area. The only levee that exists around Ash Basin No. 1 is on the north and west sides. Ash Basin No. 1 shares a perimeter levee with the Secondary Ash Pond to the north. The location of Ash Basin No. 1 is shown in **Figure 2**. This analysis required a review of the original permit and construction drawings for Ash Basin No. 1, a review of the topographic survey of the perimeter levees of Ash Basin No. 1, a review of borings in the perimeter levees for the structural properties of these levees and a review of the safety factor models and calculations.

Providence mobilized to the Dolet Hills Power Station in March of 2016 to install a geotechnical boring in the perimeter levee of Ash Basin No. 1. Geotechnical testing Laboratory, Inc. installed 1 boring in 2016 for Ash Basin No. 1. A soil profile was generated for the section along the Ash Basin that shows the results of the geotechnical boring and the laboratory analysis. Based on the geotechnical results, **Table 1** shows the soil profile for this section and the characteristics used for the slope stability modeling.

Table 1 Subsurface Soil Classification and Parameters

Ash Basin No. 1 Section 1 B-1	Soil	Depth (ft)	Unit Wt. (lb/ft ³)	Cohesion (lb/ft ²)
	CL-CH	22.0	109	1,000
	CH	11.0	109	730
	CH	5.0	111	1,000
	CL-CH	22.0	115	1,200

The slope stability analysis uses the strength of the soil material of which the levee is made of and subgrade to assess levee stability in accordance with existing conditions. The Spencer Method for slope stability was used since it is the most conservative approach. The Spencer Method is a general method of slices developed on the basis of limit equilibrium. It requires satisfying equilibrium of forces and moments acting on individual blocks. The blocks are created by dividing the soil above the slip surface by dividing planes. Deep failure analysis evaluates the potential of the levees to fail through the bottom of the levees into the existing native soils. The analysis was based upon the following assumptions and input parameters.

- The subgrade stratigraphy was modeled using soil profile from the completed soil boring at the site with the soil profile condition at this section for this pond through the levee system. (**Table 1**)
- The height and exterior slope of the levee was determined based on actual field surveys and previously permitted design data.
- The bottom elevation and the interior slope of the levee below the water line was determined based on the previous permitting and design information provided by Cleco.
- The input parameters used in our analyses were based upon results from geotechnical investigations conducted for this slope stability analysis. **Appendix A** includes a copy of the geotechnical results as provided by the geotechnical contractor.
- The fill material in the pond was assumed to be water for Ash Basin No. 1. Maximum water elevation in Ash Basin No. 1 is 251.5 feet NAVD 88.

The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50

In 2016, Providence modeled Ash Basin No. 1 under the long-term, maximum storage to the freeboard level for the surface impoundment. The current operational status of the Bottom Ash Pond has not changed since 2016. After a review of the results of the slope stability analysis, Providence has determined that the following minimum factor of safety will remain the same:

Table 2 Long-Term Factor of Safety

Surface Impoundment	Section Number	Soil Boring No.	Maximum Water Elevation (feet NAVD 88)	Analysis	Factor of Safety
Ash Basin No. 1	Section 2	B-5 and B-6	251.5	Spencer Method Circular Failure	1.59

The calculated long-term static factor of safety under maximum storage pool loading conditions is greater than 1.50, therefore this safety factor is adequate.

Results of the long-term slope stability analysis and model input parameters can be found in **Appendix A**.

The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40

In 2016, Providence modeled the pond using a scenario where the facility allows the pond to fill to the freeboard level for Ash Basin No. 1. This scenario represents the flood/heavy rainfall conditions. The flood/heavy rainfall freeboard elevation was determined using 2.5 feet of freeboard from the lowest levee crown elevation for this pond.

The current operational status of Ash Basin No.1 has not changed since 2016. After a review of the 2016 results of the short-term slope stability analysis, Providence has determined that the following minimum factor of safety will remain the same:

Table 3 Short-Term Factor of Safety

Surface Impoundment	Section Number	Soil Boring No.	Maximum Water Elevation (feet NAVD 88)	Analysis	Factor of Safety
Ash Basin No. 1	Section 1	B-1	251.5	Spencer Method Circular Failure	2.78

The calculated short-term static factor of safety under maximum surcharge pool loading conditions is greater than 1.40, therefore this safety factor is adequate.

Results of the short-term slope stability analysis and model input parameters can be found in **Appendix A**.

The calculated seismic factor of safety must equal or exceed 1.00

The Dolet Hills Power Station is not located in a seismic area. The Louisiana Geological Survey and the United States Geological Survey classifies the entire state of Louisiana as a low seismic risk area. This low seismic risk classification denotes that the levels of horizontal shaking that have a 2 in 100 chance of being exceed in a 50-year period range from 0-8% g, where g is the acceleration of a falling object due to gravity. The nearest published fault system to the Dolet Hills Power Station is approximately 26 miles away. Therefore, the calculated seismic factor of safety is not applicable to Ash Basin No. 1.

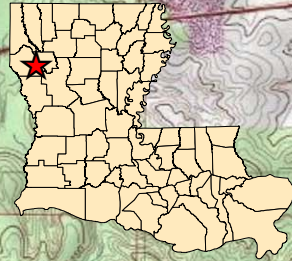
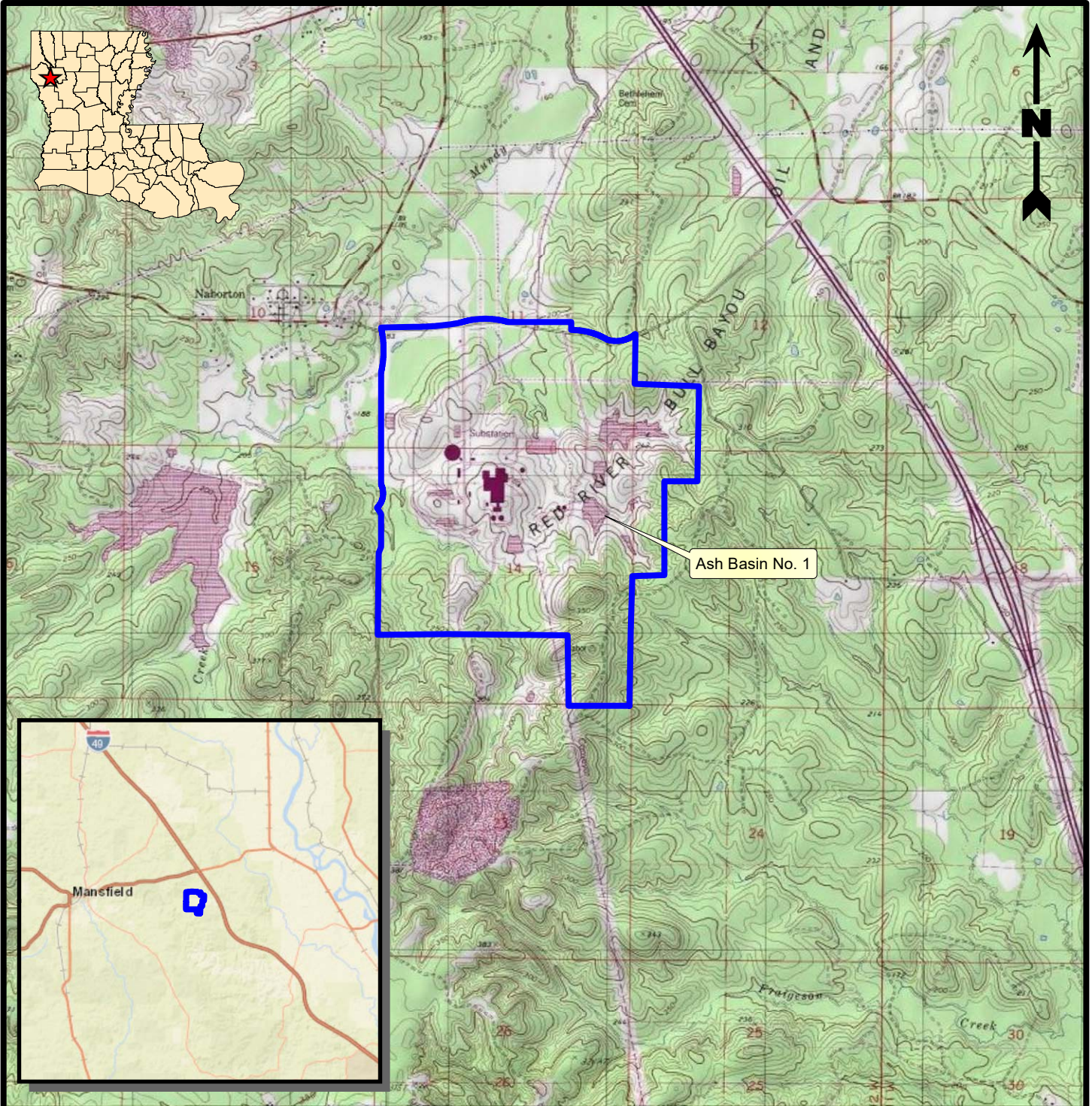
For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.2

The clay soils found in the Ash Basin No. 1 levees are not subject to liquefaction. Therefore, the calculated liquefaction factor of safety is not applicable to Ash Basin No. 1.

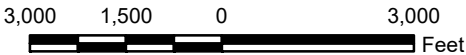
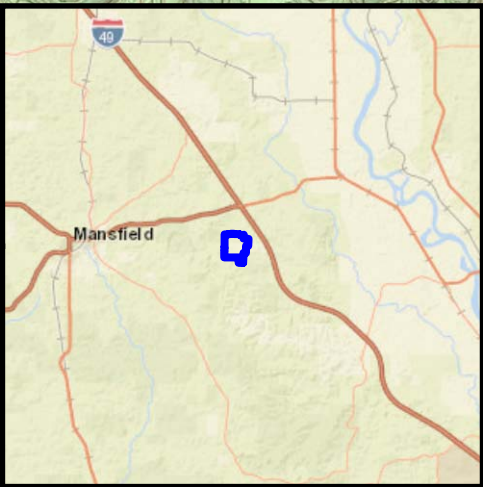
3.0 CONCLUSIONS

After a review of the 2016 results from the safety factor analysis, the existing levee design for Ash Basin No. 1 achieves the minimum safety factor requirements of the 40 CFR 257.73(e)(1) CCR regulations. Results of the safety factor analysis and model input parameters can be found in **Appendix A**. **Appendix B** contains a P.E. Certification that attests to the 5-year periodic review of the safety factor assessment for Ash Basin No. 1.


FIGURE 1
SITE LOCATION MAP



Ash Basin No. 1



Legend

 Facility Boundary

Reference

Base map comprised of U.S.G.S. 7.5 minute topographic maps, "Lena, LA", "Boyce, LA", "Jericho, LA", and "Gardner, LA".

Site Location Map

**5-Year Periodic Review
Safety Factor Assessment - Ash Basin No. 1
Mansfield, DeSoto Parish, Louisiana**

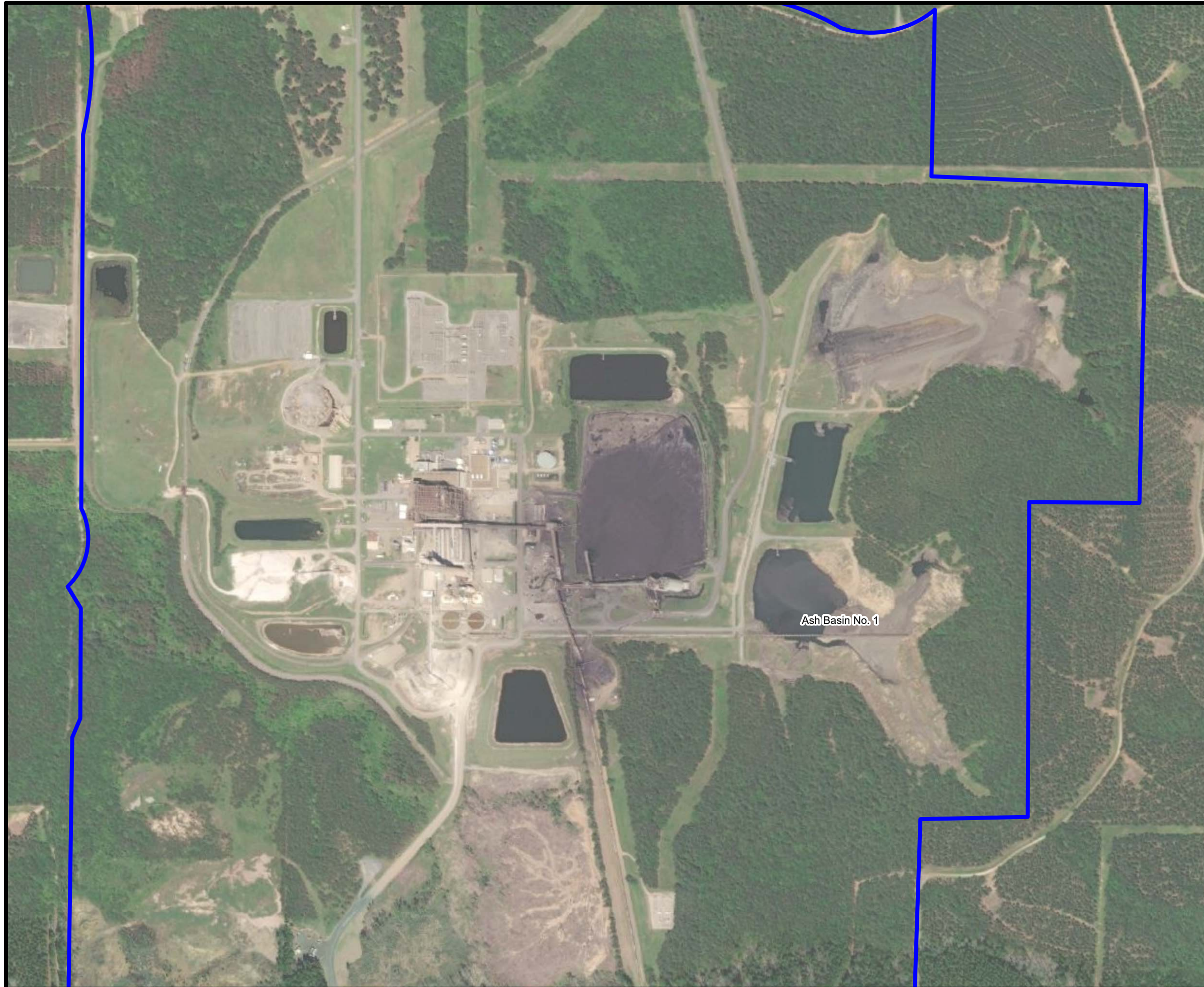
Cleco Power LLC
Dolet Hills Power Station




Drawn By	LMH	09/21/21
Checked By	LMH	09/21/21
Approved By	CVH	09/21/21

Project Number	002-293	1 Figure
Drawing Number	002-293-A007	

FIGURE 2
SITE MAP

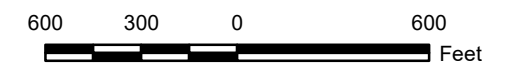


Legend

 Facility Boundary

Reference

Base map comprised of Bing Maps aerial imagery from (c) 2021 Microsoft Corporation and its data suppliers.



Site Map

**5-Year Periodic Review
Safety Factor Assessment - Ash Basin No. 1**
Mansfield, DeSoto Parish, Louisiana

Cleco Power LLC
Dolet Hills Power Station



Drawn By	LMH	09/21/21
Checked By	LMH	09/21/21
Approved By	CVH	09/21/21
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Drawing Number		
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APPENDIX A
SLOPE STABILITY ANALYSIS

PROVIDENCE

1201 Main Street
Baton Rouge, LA 70802

Attn: Mr. Gary Leonards, P.E.

**Re: Slope Stability Analysis of Ash Basin 1
Cleco Dolet Hills Power Station
Mansfield, Louisiana**

Dear Mr. Leonards:

APS Engineering and Testing, LLC has completed slope stability analysis of Ash Basin 1 located at Cleco Dolet Hills Power Station in Mansfield, Louisiana. Authorization to proceed with this work was received from **Mr. Gary Leonards** via email on July 18, 2016. Our analysis was performed based on the soil boring log data provided by the client. Our scope of services included performing landside stability of the existing levee with maximum ash slurry elevation, as requested by the client. This report provides the stability analysis results of Ash Basin 1.

Background

Ash Basin 1 at the Dolet Hills Power Station was constructed in 1984. The facility went into operation in 1985 when the coal fired boiler system (Unit #1) came on line. The bottom ash is sluiced to Ash Basin 1. The Ash Basin 1 is an existing unit that is essential component for the management of solid residuals generated at the Dolet Hills Power Station.

TABLE 1.0

Levee at	Soil boring data used*	Boring Depth (Feet)	Average Top of Levee Elevation (feet, NAVD88)	Max Ash Slurry Elevation (feet, NAVD88)
Ash Basin -1	B-1	60	254.0	251.5

*This data was obtained from Report No.: 03-16-039 prepared by Geotechnical Testing Laboratory (GTL), Inc.,

Ash Slurry Properties

Cohesion (psf)	20 (assumed)
Unit Weight (pcf)	75.0 (provided by client)

Assumptions and Observations:

- Soil layers are horizontal with uniform thickness.
- Soil layers encountered in Levee Centerline boring were used for the analysis.
- Cross section profiles were extended horizontally on the land side, whenever the failure plane passes the limits.

Slope Stability Analysis Results

Slope stability analysis was performed using Spencer method for both short term and long term conditions as requested by the client. Changes in slopes, structural loadings, and other conditions may affect the results of slope stability analysis. Factors of safety (FoS) obtained from slope stability analysis results do meet 1.50 according to HSDRRS guidelines for steady water level conditions.

TABLE 2.0

Soil Type	Phi	Cohesion (psf)
Silt (ML)	28°	0
Clay (CL/CH)	28°	0
Sand (SP / SM)	37°	0

TABLE 3.0

Stability Check	Flood Side Slurry Elevation	Condition	Factor of Safety	Recommended FoS
Ash Basin-1	251.5	Short Term	2.68	1.50
Ash Basin-1	251.5	Long Term	1.59	1.50

Based on the results presented in the above table, Ash Basin 1 meets minimum required factor of safety for both short term and long term conditions with the projected maximum Ash Slurry Elevations. This is based on the soil boring data provided by the client.

Liquefaction

The clay soils present at the project site are not susceptible to liquefaction.

If you have any questions pertaining to this report, or if we may be of further service, please contact our office.

Respectfully submitted,
APS ENGINEERING AND TESTING, LLC



Sairam Eddanapudi, P.E.
Project Manager



Sergio Aviles, P.E.
President

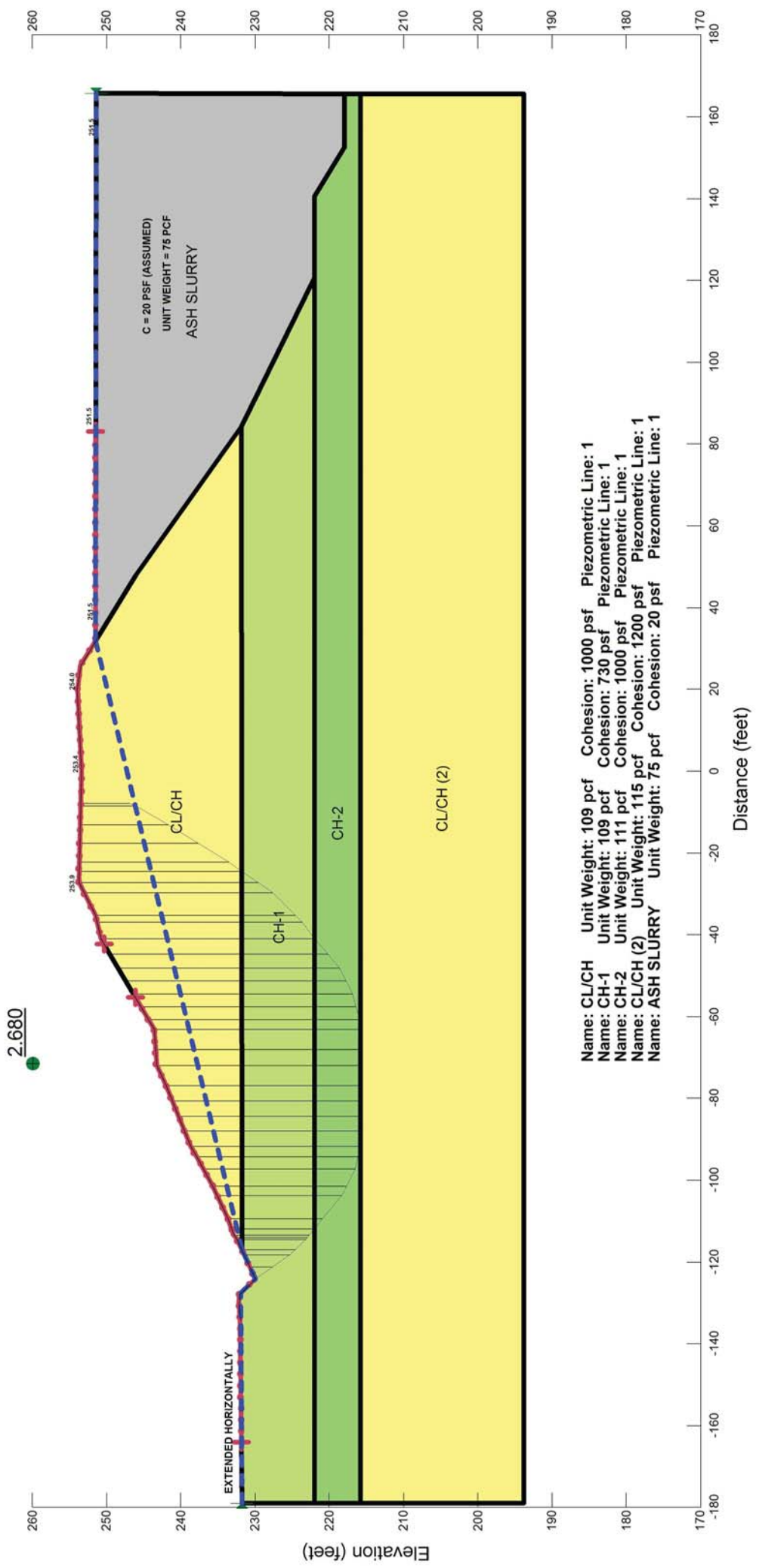
Attachments

Boring Location Plan
Slope Stability Analysis Results

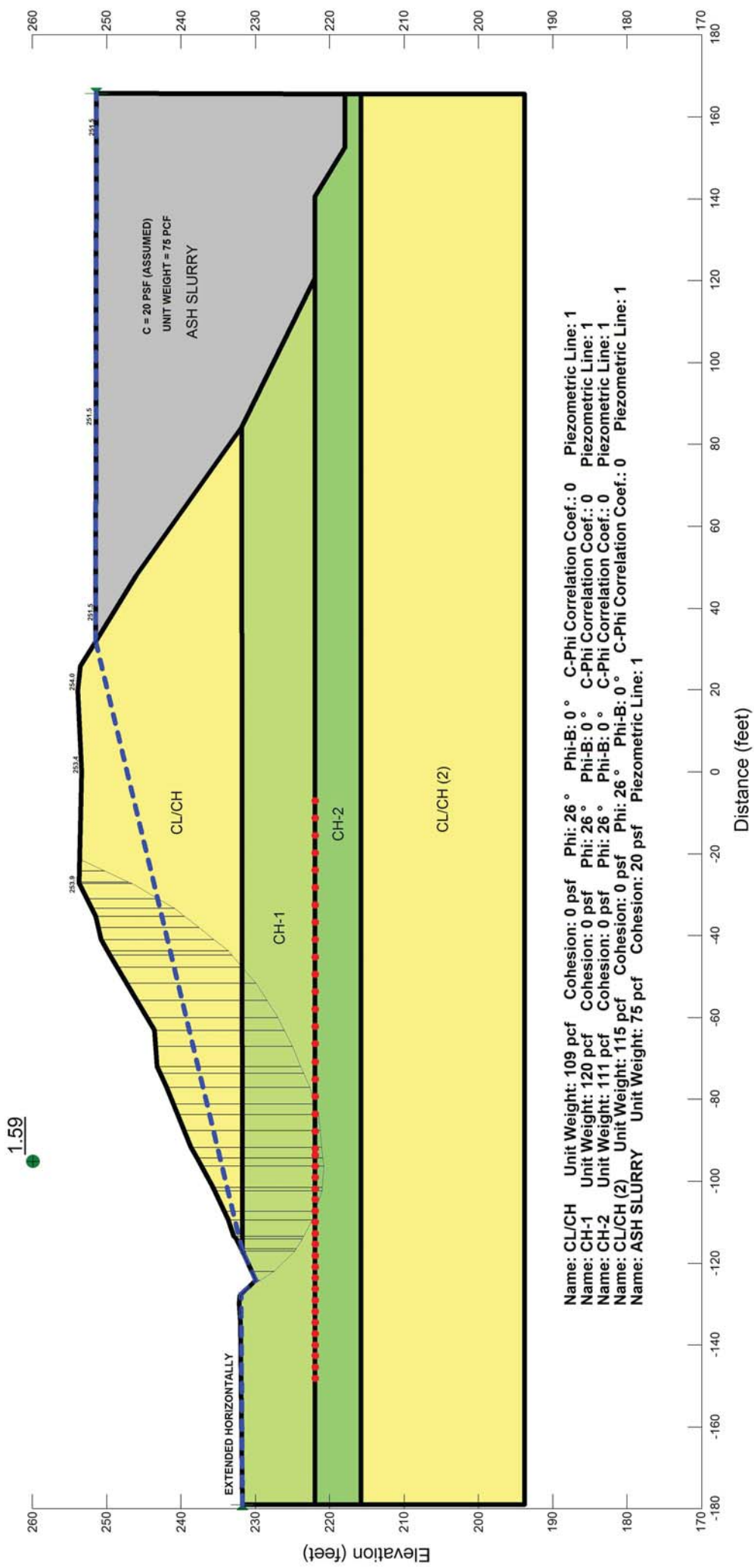


ASH BASIN 1

**CLECO DOLET HILLS POWER STATION
ASH BASIN 1
SHORT TERM SLOPE STABILITY ANALYSIS
SOIL BORING B-1 DATA (FROM GTL REPORT NO.: 03-16-039)**



**CLECO DOLET HILLS POWER STATION
ASH BASIN 1
LONG TERM SLOPE STABILITY ANALYSIS (S-CASE)
SOIL BORING B-1 DATA (FROM GTL REPORT NO.: 03-16-039)**



Name: CL/CH	Unit Weight: 109 pcf	Cohesion: 0 psf	Phi: 26 °	Phi-B: 0 °	C-Phi Correlation Coef.: 0	Piezometric Line: 1
Name: CH-1	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 26 °	Phi-B: 0 °	C-Phi Correlation Coef.: 0	Piezometric Line: 1
Name: CH-2	Unit Weight: 111 pcf	Cohesion: 0 psf	Phi: 26 °	Phi-B: 0 °	C-Phi Correlation Coef.: 0	Piezometric Line: 1
Name: CL/CH (2)	Unit Weight: 115 pcf	Cohesion: 0 psf	Phi: 26 °	Phi-B: 0 °	C-Phi Correlation Coef.: 0	Piezometric Line: 1
Name: ASH SLURRY	Unit Weight: 75 pcf	Cohesion: 20 psf	Phi: 26 °	Phi-B: 0 °	C-Phi Correlation Coef.: 0	Piezometric Line: 1

APPENDIX B
P.E. CERTIFICATION

**CLECO BRAME ENERGY CENTER
ASH BASIN NO. 1
5-YEAR PERIODIC REVIEW - CCR SAFETY FACTOR ASSESSMENT**

PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I have performed the 5-year periodic review of the safety factor assessment for Cleco's Dolet Hills Power Station Ash Basin No. 1 in accordance with the 40 CFR 257.73(e)(1) CCR requirements. This 5-year periodic review of the safety factor assessment has determined that Ash Basin No. 1 continues to meet the following requirements:

- The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.
- The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.

And that these requirements were not applicable based on the findings:

- The calculated seismic factor of safety must equal or exceed 1.00.
- For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

James C. Van Hoof

Name

24630

Registration No.

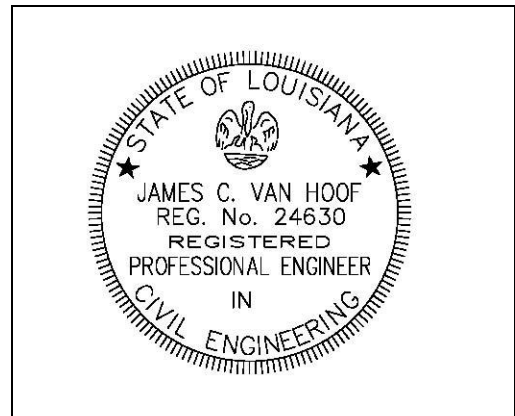
LA

State

Signature

10/14/2021

Date



(Seal)