PERIODIC SAFETY FACTOR ASSESSMENT
PLANT GASTON GYPSUM POND
ALABAMA POWER COMPANY

EPA's "Disposal of Coal Combustion Residuals from Electric Utilities" Final Rule (40 C.F.R. Part 257 and Part 261) and the State of Alabama's ADEM Admin. Code Chapter 335-13-15 , require the owner or operator of an existing CCR surface impoundment to conduct periodic safety factor assessments. Per §257.73(e) and ADEM Admin. Code r. 335-13-15-.04(4)(e), the owner or operator must document that the minimum safety factors outlined in §257.73(e)(1)(i) through (iv) and ADEM Admin. Code r. 335-13-15-.04(4)(e)(1)(i) through (iv) for the critical embankment section are achieved. In addition, §257.73(f)(3) and ADEM Admin. Code r. 335-13-15-.04(4)(f)3. require a subsequent assessment be performed within 5 years of the previous assessment.

The CCR surface impoundment located at Alabama Power Company's Plant Gaston also referred to as the Plant Gaston Gypsum Pond is located on Plant Gaston property, east of Wilsonville, Alabama. The CCR surface impoundment is formed by an engineered perimeter embankment. The critical section of this CCR unit had previously been determined to be, and remains, on the west embankment.

The analyses used to determine the minimum safety factor for the critical section resulted in the following minimum safety factors:

Loading Condition	Minimum Calculated Safety Factor	Minimum Required Safety Factor
Long-term Maximum Storage Pool (Static)	2.5	1.5
Maximum Surcharge Pool (Static)	2.6	1.4
Seismic	2.1	1.0

The embankments are constructed of clays that are not susceptible to liquefaction. Therefore, a minimum liquefaction safety factor determination was not required.

I hereby certify that the safety factor assessment was conducted in accordance with 40 C.F.R. §257.73 (e)(1) and ADEM Admin. Code r. 335-13-15-.04(4)(e)(1).

12/15/2021

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Technical and Project Solutions Calculation

Calculation Number: TV-GS-APC767400-002

Project/Plant: Plant Gaston Gypsum Pond	**Unit(s):** n/a	**Discipline/Area:** Env. Solutions
Title/Subject: Periodic Factor of Safety Assessment for CCR Rule		
Purpose/Objective: Determine the Factor of Safety of the Gypsum Pond Dike		
System or Equipment Tag Numbers: n/a	**Originator:** Jacob A. Jordan, P.E.	

Contents

Revision Record

Rev. No.	Description	Originator Initial / Date	Reviewer Initial / Date	Approver Initial / Date
0	Issued for Information	JAJ/06-24-21	JCP/06-24-21	JCP/06-24-21

Notes:

Purpose of Calculation

The purpose of this calculation is to update the 2016 stability analysis of the Gypsum Pond Dike.

Summary of Conclusions

The following table lists the factors of safety for various slope stability failure conditions. All conditions are steady state except where noted. Construction cases were not considered. The analyses indicate that in all cases the factor of safety is at or above the require minimum.

Load Conditions	Computed Factor of Safety	Required Minimum Factor of Safety
Long-term Maximum Storage (Static)	2.5	1.5
Maximum Surcharge Pool (Static)	2.6	1.4
Seismic	2.1	1.0

Methodology

The calculation was performed using the following methods and software:

- GeoStudio 2021 R2 version 11.1.1.22085 Copyright 1991-2021, GEO-SLOPE International, Ltd.
- Strata (Version 0.8.0),University of Texas, Austin
- Morgenstern-Price analytical method

Criteria and Assumptions

The slope stability models were run using the following assumptions and design criteria:

- Seismic site response was determined using a one-dimensional equivalent linear site response analysis. The analysis was performed using Strata and utilizing random vibration theory. The input motion consisted of the USGS published 2014 Uniform Hazard Response Spectrum (UHRS) for Site Class B/C at a 2% Probability of Exceedance in 50 years. The UHRS was converted to a Fourier Amplitude Spectrum, and propagated through a representative one-dimensional soil column using linear wave propagation with strain-dependent dynamic soil properties. The input soil properties and layer thickness were randomized based on defined statistical distributions to perform Monte Carlo simulations for 100 realizations, which were used to generate a median estimate of the surface ground motions.
- The median surface ground motions were then used to calculate a pseudostatic seismic coefficient for utilization in the stability analysis using the approach suggested by Bray and Tavasarou (2009). The procedure calculates the seismic coefficient for an allowable seismic displacement and a probability exceedance of the displacement. For this analysis, an allowable displacement of 0.5 ft, and a probability of exceedance of 16% were conservatively selected, providing a seismic coefficient of 0.092g for use as a horizontal acceleration in the stability analysis.

- The current required minimum criteria (factors of safety) were taken from the Structural Integrity Criteria for existing CCR surface impoundment from 40 CFR 257.73, published April 17, 2015.
- The COE EM 1110-2-1902, October 2003, allows the use of the phreatic surface established for the maximum storage condition (normal pool) in the analysis for the maximum surcharge loading condition. This is based on the short-term duration of the surcharge loading relative to the permeability of the embankment and the foundation materials. This method is used in the analysis for the impoundments at this facility with surcharge loading.

Design Inputs/References

- SCS Calculation TV-GS-APC390793-002
- USGS Earthquake Hazards website, *earthquake.usgs.gov/hazards/interactive*
- US Corps of Engineers Manual EM 1110-2-1902, October 2003
- Bray, J. D. and Travasarou, T., *Pseudostatic Coefficient for Use in Simplified Seismic Slope Stability Evaluation*, Journal of Geotechnical and Environmental Engineering, American Society of Civil Engineers, September 2009
- The design parameters for the materials comprising the gypsum pond dike were obtained from construction documents and laboratory test results.
- Dike geometry was determined by reviewing section drawings from the design phase of the pond construction, and from recent LiDAR and bathymetric surveys.

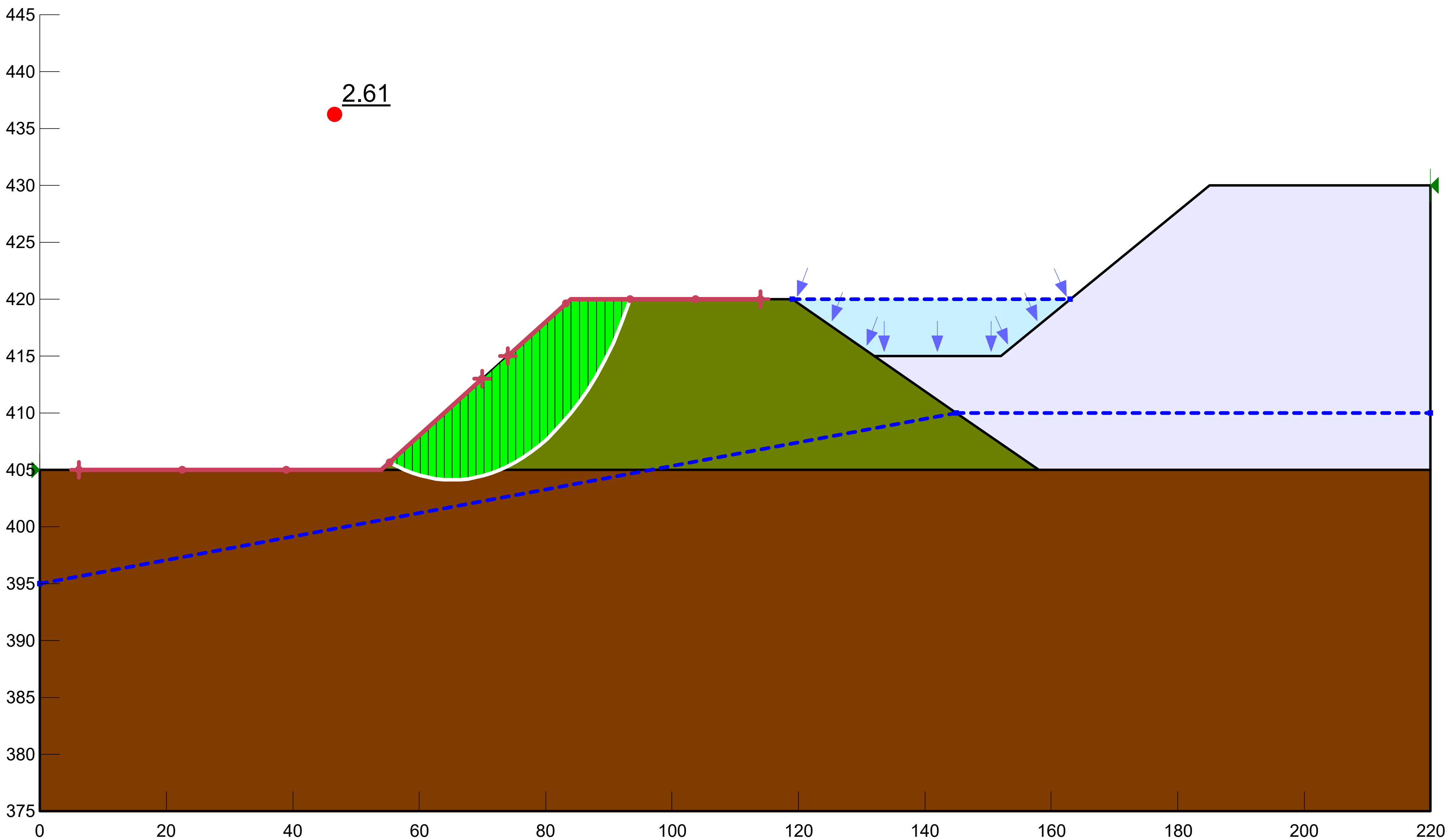
Body of Calculation

SLOPE/W modeling attached.

Plant Gaston Gypsum Pond
Factor of Safety Analysis

Maximum Surcharge Pool

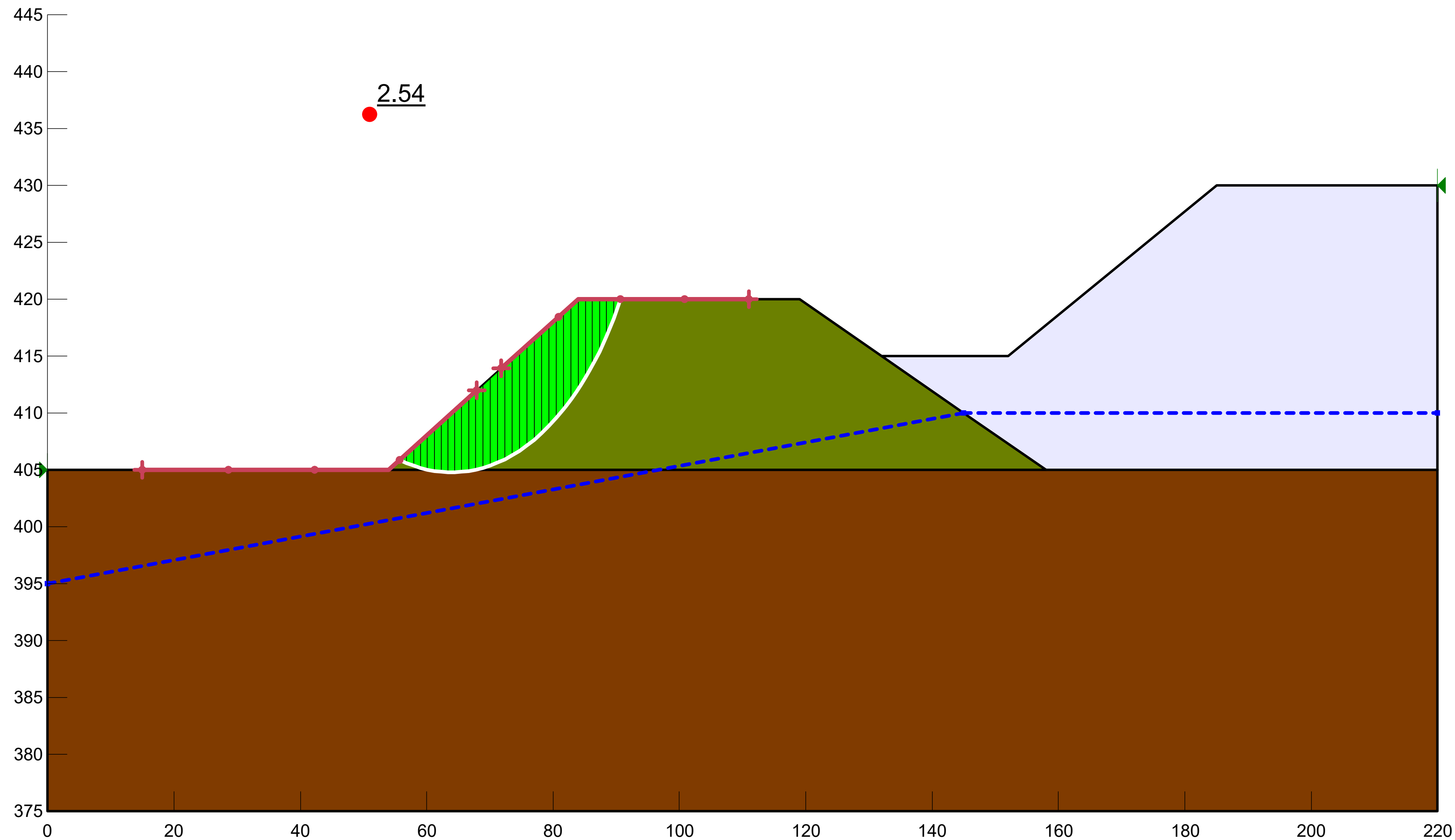
Color	Name	Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Dike Fill	Mohr-Coulomb	120	200	30
	Gypsum	Mohr-Coulomb	80	0	20
	Residuum	Mohr-Coulomb	120	200	30



Plant Gaston Gypsum Pond
Factor of Safety Analysis

Maximum Storage

Color	Name	Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Dike Fill	Mohr-Coulomb	120	200	30
	Gypsum	Mohr-Coulomb	80	0	20
	Residuum	Mohr-Coulomb	120	200	30



Plant Gaston Gypsum Pond
Factor of Safety Analysis

Seismic Loading
Kh = 0.092g

Color	Name	Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Dike Fill	Mohr-Coulomb	120	200	30
	Gypsum	Mohr-Coulomb	80	0	20
	Residuum	Mohr-Coulomb	120	200	30