STRUCTURAL STABILITY ASSESSMENT REPORT

Economizer Ash System, Big Bend Power Plant
Apollo Beach, Florida

PREPARED FOR:
Tamp Electric Company

AREHNA | Engineering, Inc.

TABLE OF CONTENTS

CERTIFICATION

Professional Engineer Certification Statement [40 CFR 257.73(b)]

I hereby certify that, having reviewed the attached documentation and being familiar with the provisions of Title 40 of the Code of Federal Regulations 40 CFR Part 257.73(d)), I attest that this Structural Stability Assessment is accurate and has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of 40 CFR Part 257.73(d).

AREHNA Engineering, Inc.
Florida Board of Professional Engineers Certificate of Authorization No. 28410

Jessica A McRory

Digitally signed by Jessica A McRory
DN: c=US, o=IdenTrust ACES Business Representative, ou=AREHNA ENGINEERING INC., cn=Jessica A McRory, 0.9.2342.19200300.100.1.1=A01097C0000015472088EB70000F980
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Name

68440
Florida Professional Registration Number

1.0 INTRODUCTION

On April 17, 2015, the United States Environmental Protection Agency (EPA) issued the Coal Combustion Residual (CCR) Resource Conservation and Recovery Act (RCRA) Rule (40 CFR 257 Subpart D) ("CCR RCRA Rule") to regulate the beneficial use and disposal of CCR materials generated at coal-fired electrical power generating complexes. In accordance with the CCR RCRA Rule, any CCR surface impoundment or CCR landfill that was actively receiving CCRs on the effective date of the CCR RCRA Rule was deemed to be an "Existing CCR Unit" on that date and subject to self-implementing compliance standards and schedules. Tampa Electric Company has identified the Economizer Ash Pond System as a CCR surface impoundment at the Big Bend Power Station located in Apollo Beach, Florida. This system is comprised of the following ponds:

- North Economizer Ash Pond
- South Economizer Ash Pond
- Economizer Ash Suction Pond

The CCR RCRA Rule requires that existing CCR surface impoundments meeting the requirements of Section 257.73(b) have initial and periodic structural stability assessments conducted in accordance with Section 257.73(d), and safety factor assessments in accordance with Section 257.73(e). This report provides the initial structural stability and factor of safety assessments for the Economizer Ash Pond System.

2.0 SITE DESCRIPTION AND BACKGROUND

The Big Bend Power Plant is a coal-fired power generation facility located in Apollo Beach, FL as presented on Figure 1, Site Location Map and a Plan of the Economizer Ash Pond System is presented on Figure 2

North Economizer Ash Pond – This is an active CCR storage area approximately 330 x 710 feet in plan. Approximately the eastern half of the pond currently has exposed CCR materials / vegetation that extend above the water level in the pond.

Economizer Ash Suction Pond – This pond is located west of the north economizer ash pond and is approximately 230 x 340 feet in plan. The plant instrumentation for the water level in the economizer ash pond system is located in this pond.

South Economizer Ash Pond – This CCR facility no longer actively receives CCR materials; it is approximately 330 x 960 feet in plan. The 2012 survey shows the top of the impounded materials range from elevation +35 feet NAVD88 (west side) to +45 feet (east side) NAVD88. This pond area is also used to convey water from the North Economizer Ash Pond to the Long Term Fly Ash pond, by routing along the north, west, and south sides of the impoundment.

AREHNA has been provided and reviewed the following background documents and incorporated the findings in this structural and factor of safety assessment.

SUMMARY OF BACKGROUND DOCUMENTS			
No	DOCUMENT	DATE	AUTHOR
1	Monthly Instrumentation Inspection Reports	11/15 - 12/16	Tampa Electric Company
2	Annual & Quarterly Impoundment Inspection Reports	2013 - 2016	AREHNA Engineering, Inc.
3	Report of Geotechnical Engineering Services Coal Combustion Residue Impoundment	8/12	S&ME
4	Report of Geotechnical Engineering Services & Additional Engineering Services – Big Bend Fly Ash Relocation	12/09, 1/10	MACTEC Engineering & Consulting, Inc.
5	Topographic Survey Bottom Ash & Economizer Ponds	4/09	George F. Young
6	South Economizer Fly Ash Pond Survey	8/10	George F. Young
7	Final CCR Impoundment Dam Assessment Report	12/11	Dewberry & Davis
8	Ash Pond Dike Stability Analysis	2/81	Stone & Webster
9	Specification of Earthwork on Byproducts Storage Disposal Area, Unit 4 – Big Bend Station	8/82	Stone & Webster

3.0 STRUCTURAL STABILITY ASSESSMENT

The following sections provide documentation on the initial structural stability assessment and rely mainly on the current and historic annual inspections performed at the site as well as the weekly field inspections performed by Tampa Electric Company. A summary of the 2016 inspection is provided under a separate report. Field inspection observations focus on structural failure mechanisms including erosion, beaching, seepage, slides/sloughing, settlement, structural movement, and cracks.

A Periodic Structural Stability Assessment is required to be completed once every five years to meet the requirements of the CCR rule. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained properly. This assessment addresses the sections of the CCR rule listed:

- §257.73(d)(i) Stable foundations and abutments
- §257.73(d)(ii) Adequate slope protection
- §257.73(d)(iii) Dikes (Embankment)
- §257.73(d)(iv) Vegetated Slopes
- §257.73(d)(v) Spillways
- §257.73(d)(vi) Hydraulic Structures
- §257.73(d)(vii) Downstream erosion protection (if applicable)

3.1 Foundations and Abutments

The construction specification documents and slope stability calculations for the original design and construction have been reviewed. As-built documents were not available on the original construction of the embankments or the conditions of the foundations and abutments.

The stability of the foundations was evaluated using soil data from field investigations and reviewing design drawings, operational and maintenance procedures, and conditions observed in the field by AREHNA. Geotechnical investigations revealed that the foundation soils generally consist of granular fill soils (SP, SP-SM) at the surface underlain by natural granular soils (SP-SM, SP-SC), underlain by clay (CL) and the limestone formation. The general relative density of the granular fill soils was found to have a medium dense to very dense relative density. There has been no indication of instability in recent inspections and stability evaluations indicated that the foundations are stable. Therefore, the foundation soils and abutments are considered stable and meet the requirements presented in §257.73(d)(1)(i).

3.2 Slope Protection

No evidence of significant areas of erosion or wave action was observed. The interior slopes are protected with a geomembrane liner, and the exterior slopes are protected with vegetation. The geomembrane liner on the interior slopes isolates the embankment soils from surface erosion or wave action. Operational and maintenance procedures to repair the vegetation (exterior slopes) and liner (interior slopes) as needed are appropriate to protect against surface erosion or wave action. Additionally, the slopes are inspected weekly for erosion, signs of seepage, animal burrows, sloughing, and vegetation condition that could negatively impact the embankment. The 2016 Annual Inspection Report did not identify items relating to slope protection that required further investigation or repair. The existing slope protection measures are considered adequate to provide protection against surface erosion, wave action and adverse effects of sudden drawdown. The Economizer Ash Pond System meets the requirements in §257.73(d)(1)(ii).

3.3 Dikes (Embankment)

No certified as-built documents were available on the original construction of the embankments or the conditions of the foundations and abutments. The specification indicates that the perimeter dike was constructed with standard earthwork equipment and compacted and/or proof rolled before subsequent lifts were placed based on the compact relative density of the CCR material generally observed from Standard Penetration Test (SPT) sampling during recent subsurface investigations. Results of the stability analysis as well as inspections indicated that the existing dikes have adequate factor of safety and do not exhibit signs of instability. Based on the relative density of the material encountered during the investigations, historic inspections, recent observations, and results of the stability analysis; the embankment dikes are considered stable.

3.4 Vegetated Slopes

Visual observations in 2016 indicate that the exterior embankment slopes are covered with grass vegetation, which appears to be generally well maintained and mowed at less than 6-inches in height. Based on this evaluation, the vegetation on the exterior slopes is adequate as no substantial bare or overgrown areas were observed. Exposed geomembrane liners on the interior slopes are used as an alternate form of slope protection, which is adequate as significant tears or defects were not observed.

3.5 Spillways

There are no spillways on the CCR surface impoundments. Therefore, the spillway requirements in §257.73(d)(1)(v)(A) and (B) are not applicable to the Economizer Ash Pond System.

3.6 Hydraulic Structures

Flow is conveyed between ponds via interconnected surface and subsurface pipes. The North and South Economizer Ash Ponds are connected through pipes that pass through concrete channels. The Economizer Ash Pond System has been designed, constructed, operated, and maintained with the hydraulic structures passing through the dike. Based on our review of the periodic inspections and the annual inspection, the hydraulic structures that were inspected are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure.

3.7 Downstream Slopes Adjacent to Water Body

Bodies of water adjacent to the downstream slopes are not present. The Economizer System is bounded to the South by the Long Term Fly Ash Pond, which is a lined pond. Based on this evaluation, the requirements listed in §257.73(d)(1)(vii) are not applicable to the Economizer Ash System ponds, as inundation of the downstream slopes is not expected to occur.

4.0 FACTOR OF SAFETY ASSESSMENT

A Factor of Safety assessment was performed to evaluate the design, performance and condition of the earthen dikes of the Economizer Ash Pond System. Previous geotechnical explorations consisted of Standard Penetration Test borings, piezometer installation and monitoring and laboratory programs including strength and index testing. Data collected from the geotechnical investigations, available design drawings, construction records, inspection reports, previous engineering investigations, and other pertinent historic documents were utilized to perform the safety factor assessment. ReSSA, a slope stability software, was utilized for the analysis.

The factor of safety assessments include:

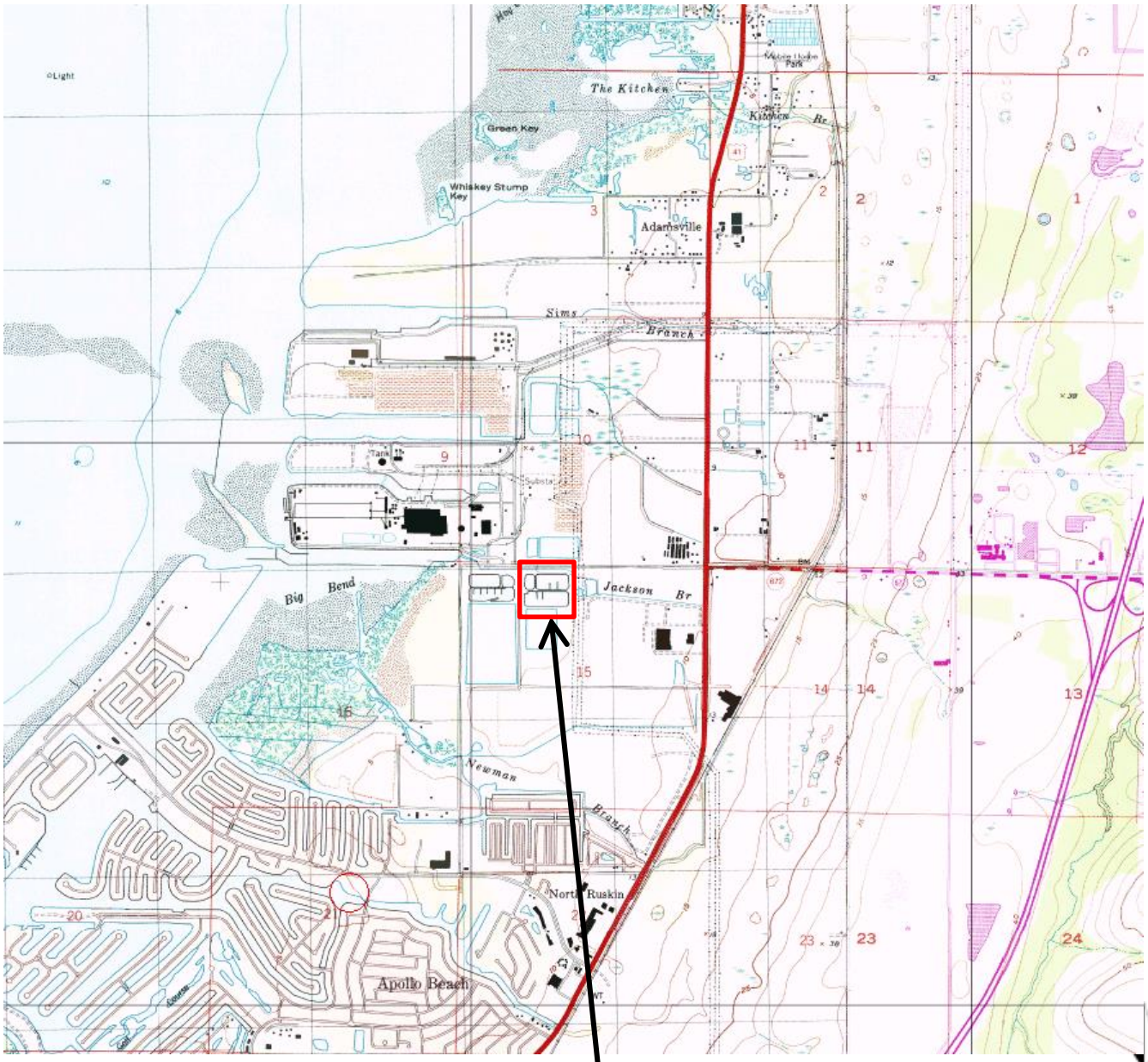
1. Long-term, maximum storage pool loading (Required FS ≥ 1.5)
2. Maximum (flood) surcharge pool loading (Required FS ≥ 1.4)
3. Calculated seismic factor of safety (Required FS ≥ 1.0) *
4. Calculated liquefaction factor of safety (Required FS ≥ 1.2) *

* *Since the plant is in a non-seismic zone, only static loading analyses are necessary.*

Results of the Initial Safety Factor Assessments, for the critical cross-section for each loading condition are listed in the table below and a plan of the cross-section locations is attached to this report.

Location ID	Location	Required Factor of Safety		Calculated Factor of Safety	
		Maximum Pool Storage	Maximum Pool Surcharge	Maximum Pool Storage	Maximum Pool Surcharge
EAP-3	North Slope North Economizer Ash Pond	≥ 1.5	≥ 1.4	1.79	1.41
EAP-7	East Slope North Economizer Ash Pond			1.76	1.4
EAP-8	East Slope South Economizer Ash Pond			1.53	1.41
EAP-11	South Slope South Economizer Ash Pond			1.76	1.41
EAP-15	West Slope Economizer Suction Ash Pond			1.79	1.41

Based on the 2016 site inspection, structural stability assessment contained herein and the safety factor assessment, no structural stability deficiencies were identified.



Economizer Ash Pond System Apollo Beach, Florida	AREHNA | Engineering, Inc. 5012 West Lemon Street, Tampa, FL 33609 Phone 813.944.3464 ▪ Fax 813.944.4959	Site Location Topographic Map
Client: Tampa Electric Company Project: B-15-073 Date: January 15, 2017	Designed By: KSL Checked By: JAM Drawn By: KCA	FIGURE 3

Earthen Berm Inspected

Cross-section Location

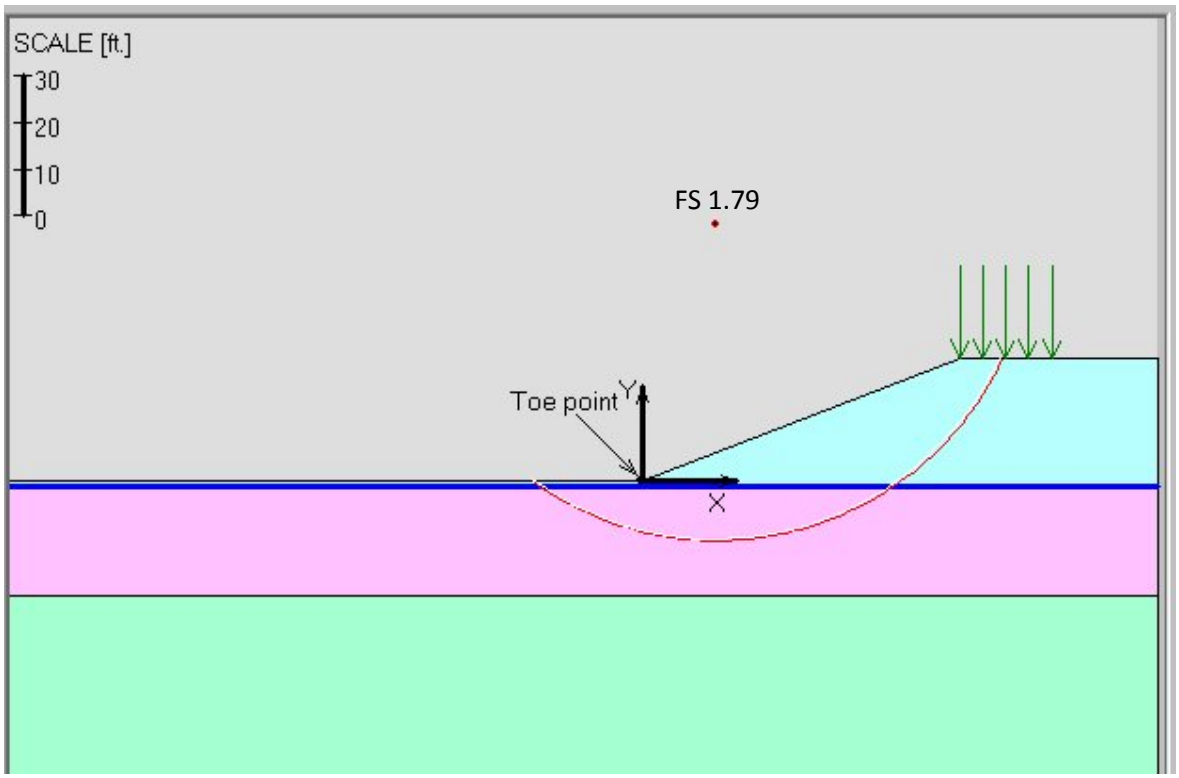
Boring Data Location

AREHNA | Engineering, Inc.
5012 W. Lemon Street, Tampa, FL 33609
Phone 813.944.3464 ▪ Fax 813.944.4959

Economizer System Earthen Berm Inspection
TECO Big Bend, FL
AREHNA Project No. B-15-073

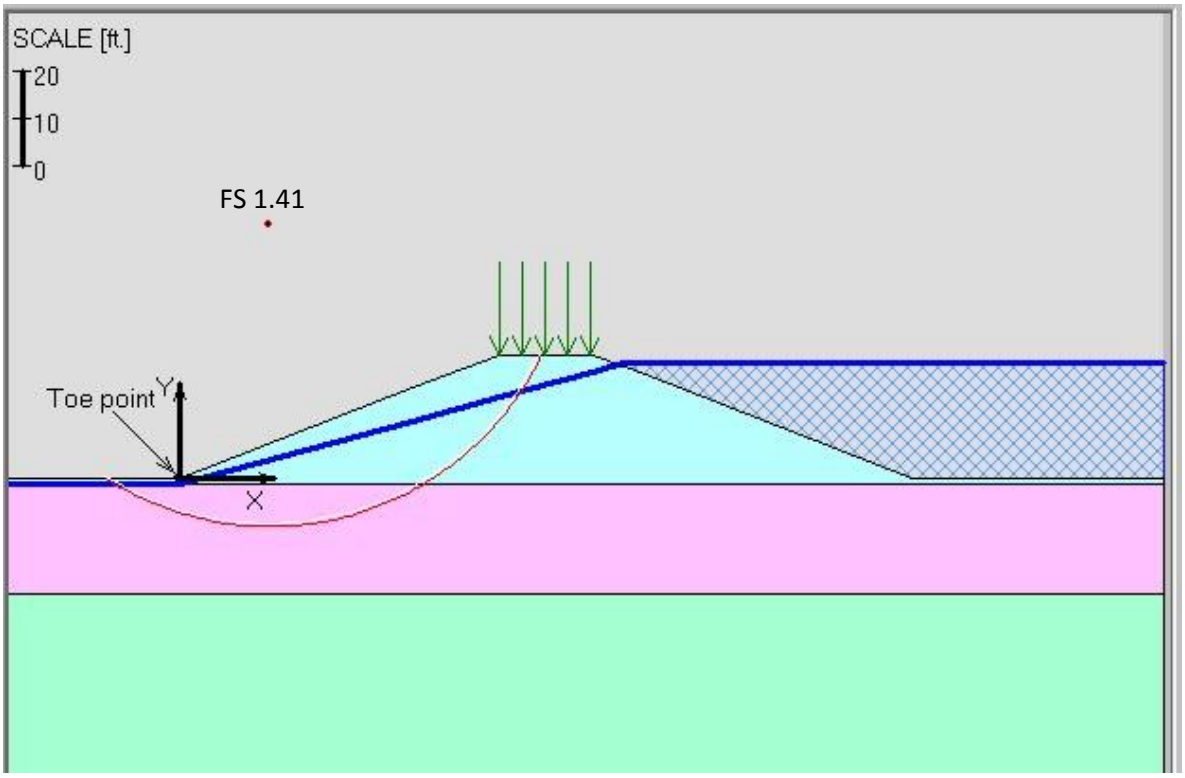
Location: **EAP – 3**

Condition: Maximum Pool Storage



Location: **EAP – 3**

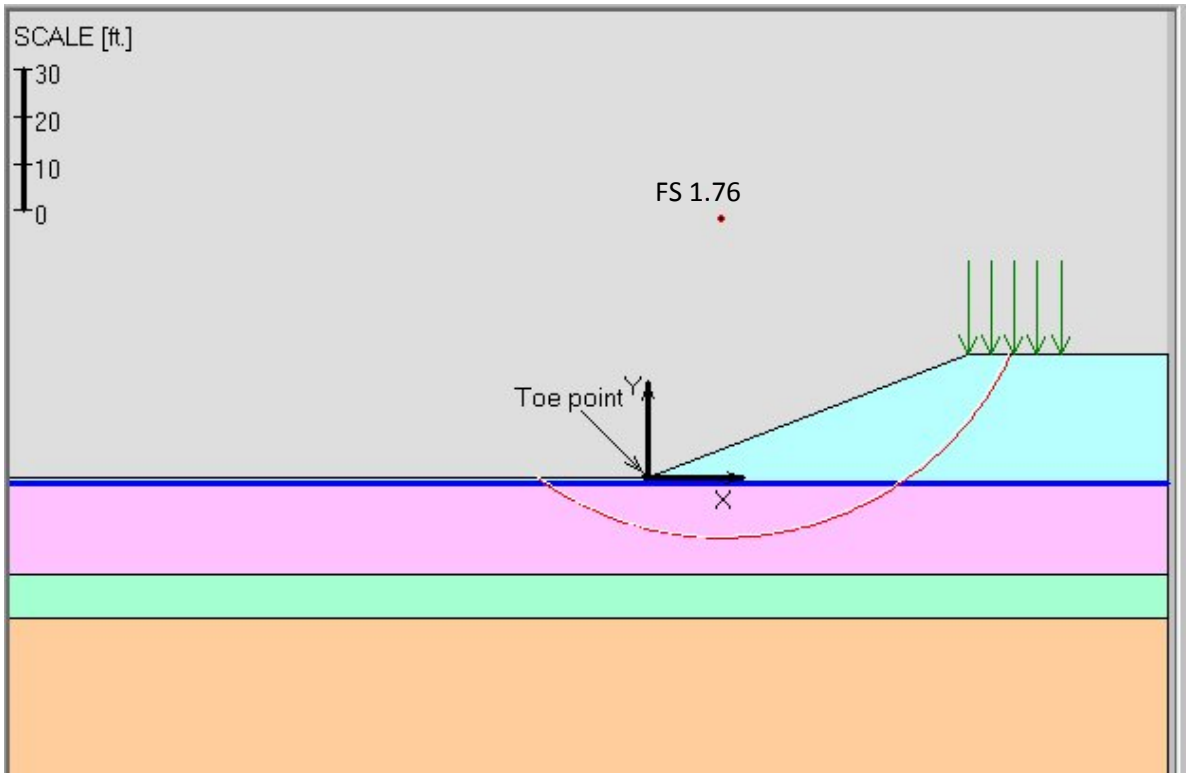
Condition: Maximum Pool Surcharge



FACTOR OF SAFETY – Rotational Failure Mode – CCR Economizer Ash Pond System

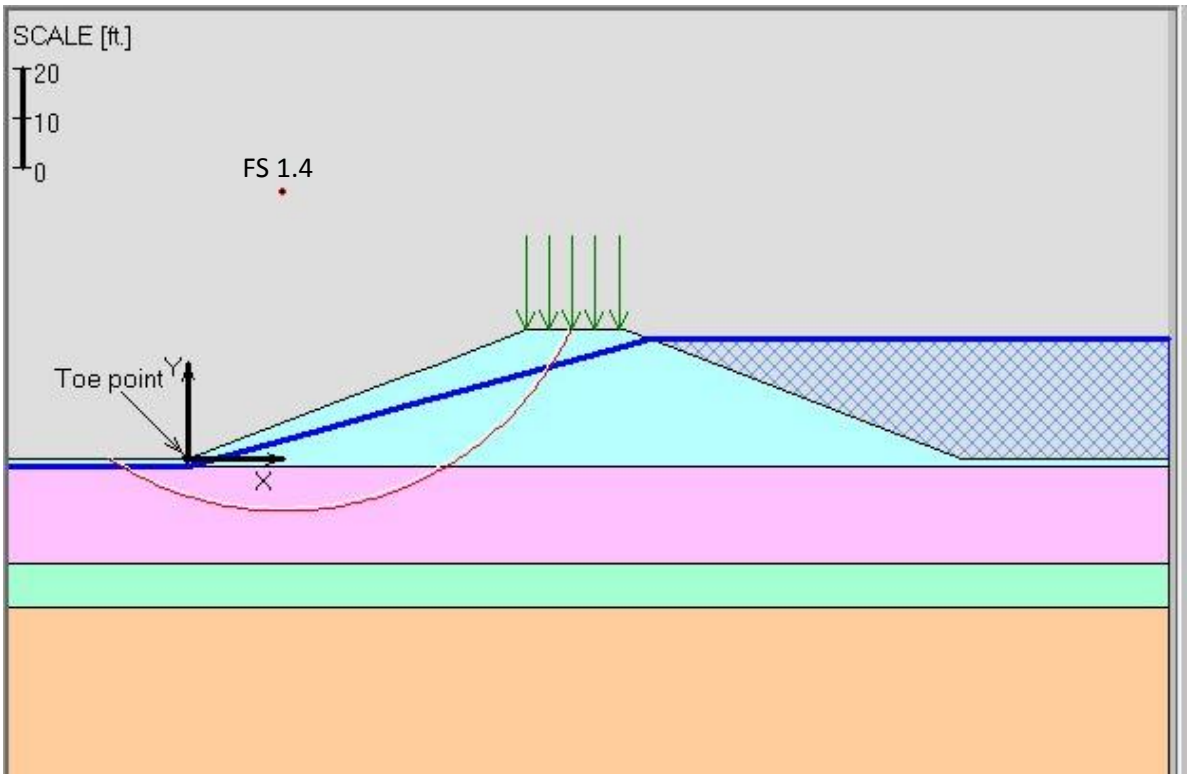
Location: **EAP – 7**

Condition: Maximum Pool Storage



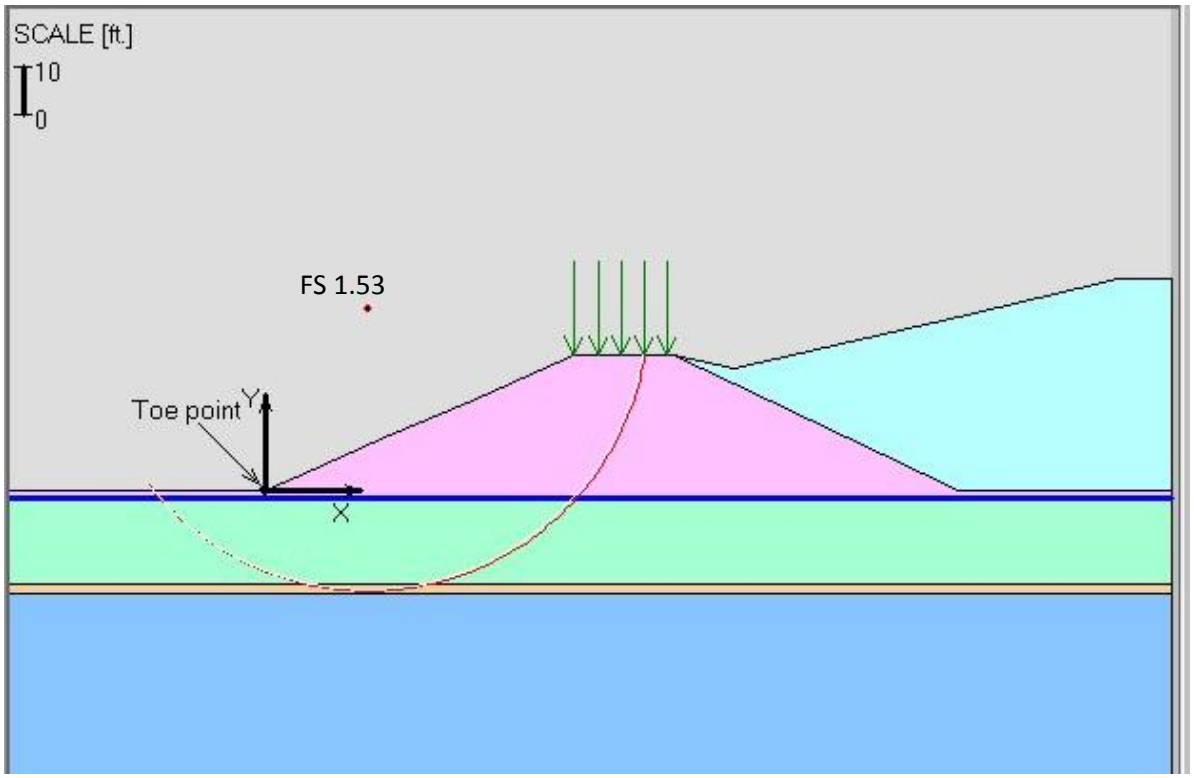
Location: **EAP – 7**

Condition: Maximum Pool Surcharge



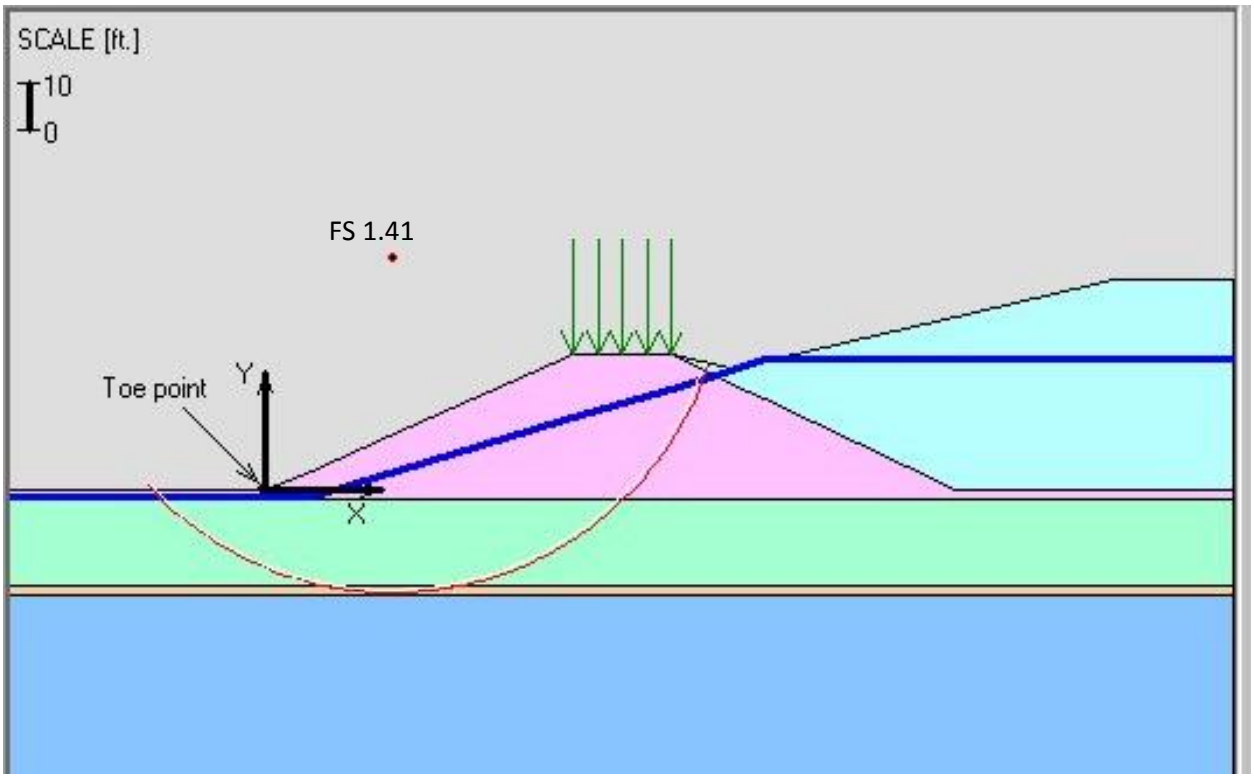
Location: **EAP – 8**

Condition: Maximum Pool Storage



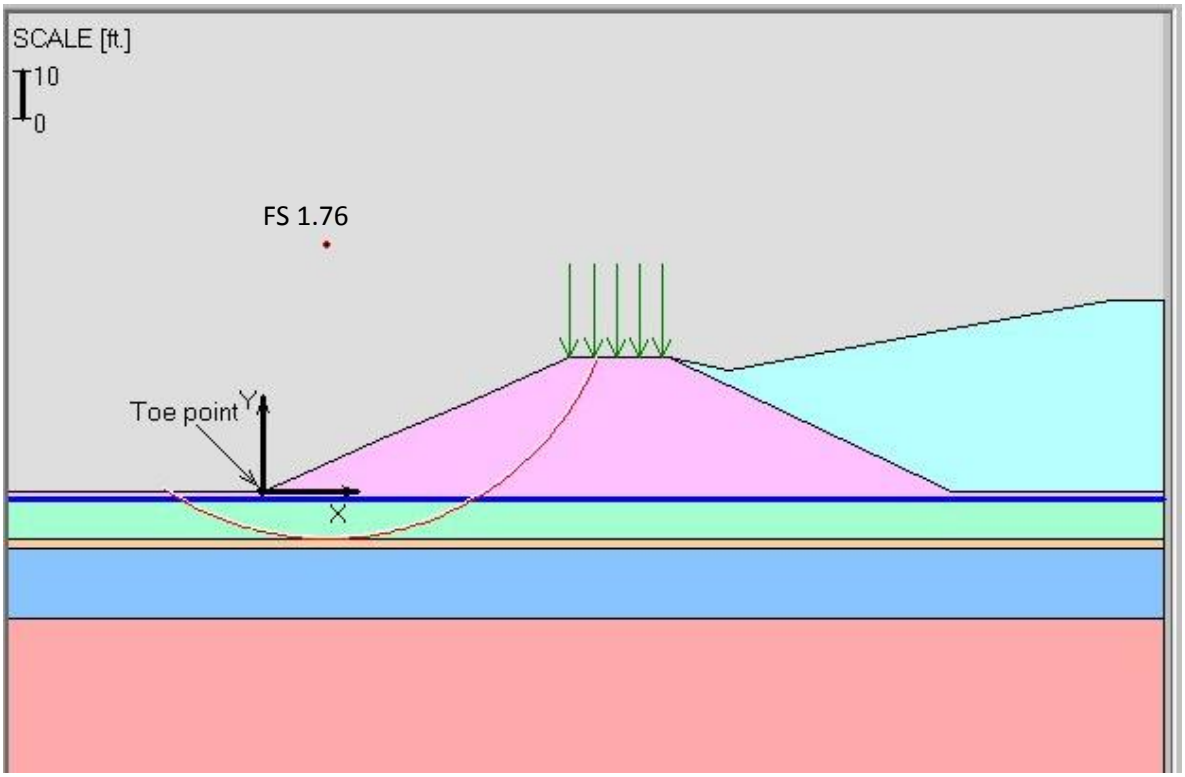
Location: **EAP – 8**

Condition: Maximum Pool Surcharge



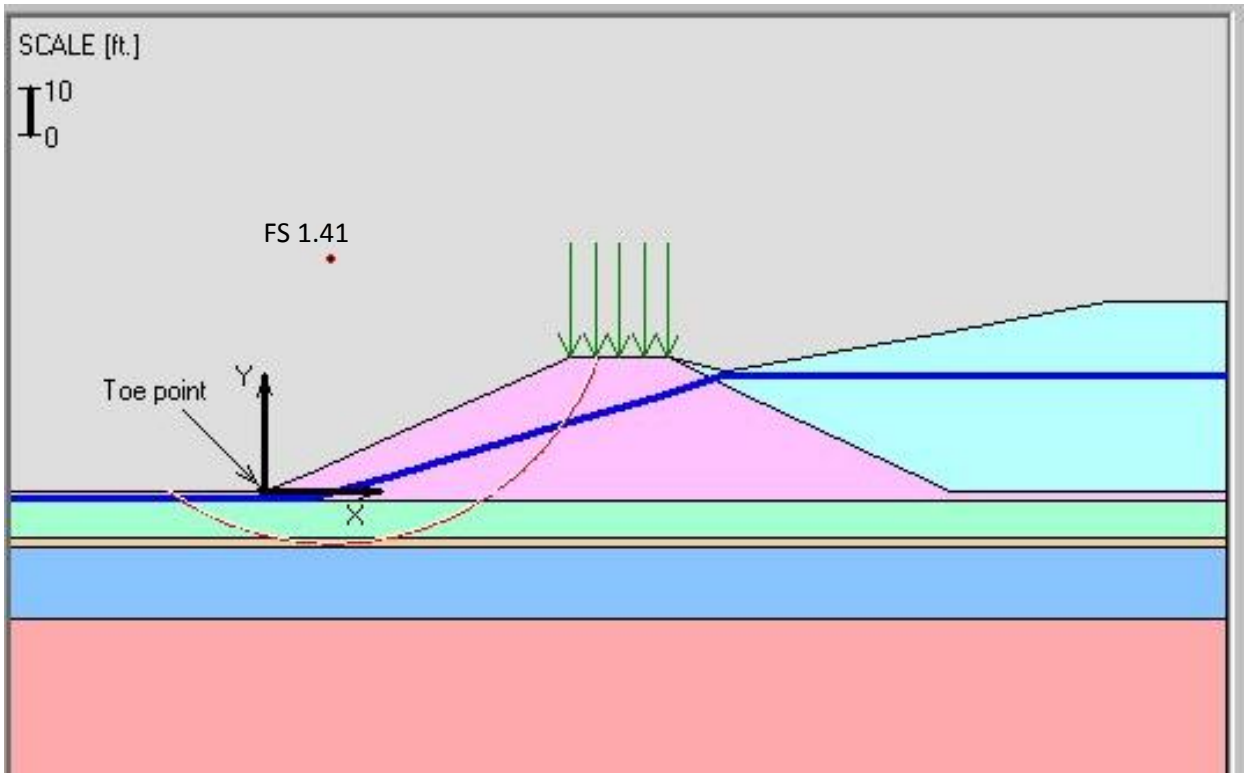
Location: **EAP – 11**

Condition: Maximum Pool Storage



Location: **EAP – 11**

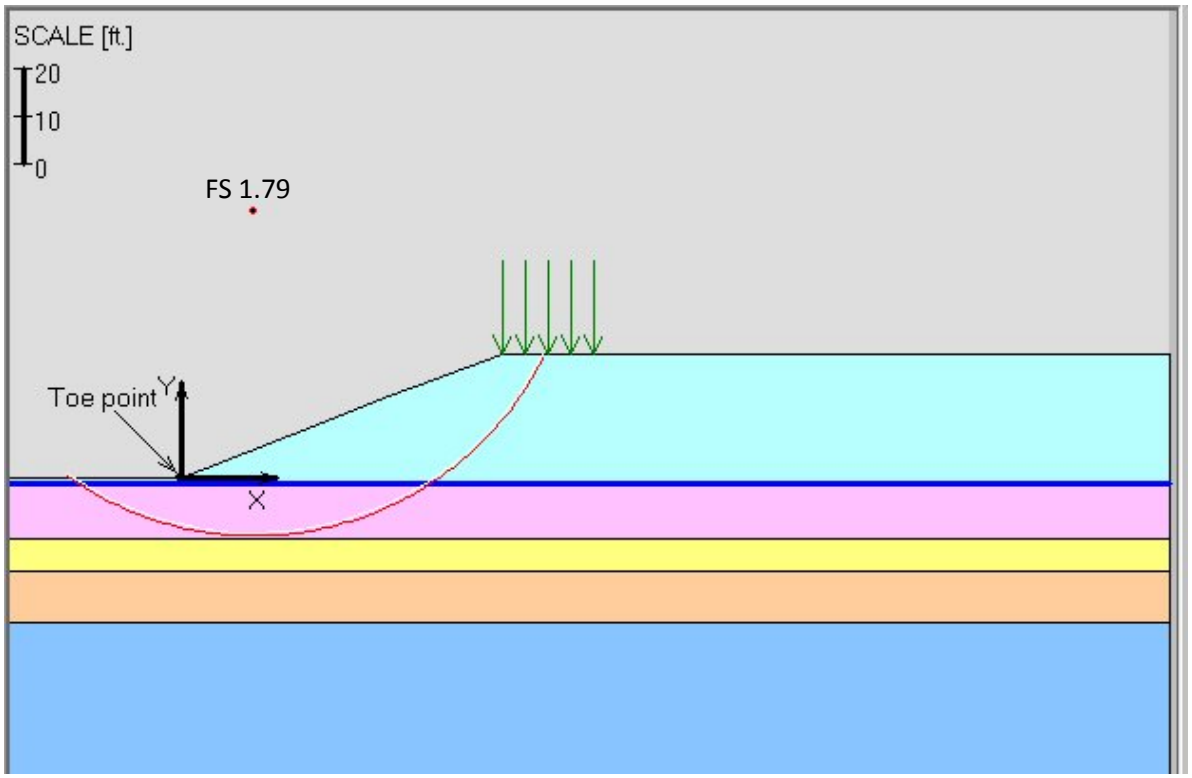
Condition: Maximum Pool Surcharge



FACTOR OF SAFETY – Rotational Failure Mode – CCR Economizer Ash Pond System

Location: **EAP – 15**

Condition: Maximum Pool Storage



Location: **EAP – 15**

Condition: Maximum Pool Surcharge