solutions and action

Wisconsin Power and Light Company

Rock River Generating Station

CCR Surface Impoundment Safety Factor Assessment

154.018.028.007.001

Report issued: May 6, 2026

Hard Hat Services

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Glen Ellyn, IL 60137

Executive Summary

This Safety Factor Assessment (Report) for the former Rock River Generating Station (ROR) has been prepared in accordance with the requirements of the United States Environmental Protection Agency rules for Hazardous and Solid Waste Management System – Disposal of CCR from Electric Utilities (40 CFR Parts 257 and 261, also known as CCR Rule).

On May 8, 2024, the EPA issued the Final Legacy Coal Combustion Residual (CCR) Surface Impoundment Rule ("Legacy Surface Impoundment Rule") that established regulations for CCR surface impoundments at inactive facilities (40 C.F.R. § 257.100). The Legacy Surface Impoundment Rule requires that legacy surface impoundments that no longer receive CCR but contain both CCR and liquid on or after October 19, 2015 and that are located at an inactive electric utility, generally comply with the EPA requirements for inactive CCR surface impoundments in accordance with Title 40 of the Code of Federal Regulations, Part 257 Subpart D Hazardous and Solid Waste Management System; Disposal of CCR from Electric Utilities.

This Report serves as the initial safety factors assessment for the ROR Final WPDES Settling Pond in Beloit, Wisconsin in accordance with §257.73(b) and §257.73(e) of the CCR Rule. Primarily, this Report is focused on assessing if each CCR surface impoundment achieves the minimum safety factors, which include:

- Static factor of safety under long-term, maximum storage pool loading condition,
- Static factor of safety under the maximum surcharge pool loading condition,
- Seismic factor of safety; and,
- Post-Liquefaction factor of safety for embankments constructed of soils that have susceptibility to liquefaction.

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1. INTRODUCTION

The owner or operator of the Coal Combustion Residual (CCR) unit must conduct an initial and periodic safety factor assessment to determine if each CCR surface impoundment achieves the minimum safety factors, which include:

- Static factor of safety under long-term, maximum storage pool loading condition,
- Static factor of safety under the maximum surcharge pool loading condition,
- Seismic factor of safety; and,
- Post-Liquefaction factor of safety for embankments constructed of soils that have susceptibility to liquefaction.

This Report serves as the initial analysis and has been prepared in accordance with the requirements of §257.73(b) and §257.73(e) of the CCR Rule.

1.1 CCR Rule Requirements

The CCR Rule requires a periodic safety factor assessment by a qualified professional engineer (PE) for existing and legacy CCR surface impoundments with a height of 5 feet or more and a storage volume of 20 acre-feet or more; or the existing CCR surface impoundment has a height of 20 feet or more (40 CFR §§ 257.73(b), 257.73(d) and 257.83(b)).

1.2 Safety Factor Assessment Applicability

The Wisconsin Power and Light Company (WPL), Rock River Generating Station (ROR) in Beloit, Wisconsin (Figure 1) has one legacy CCR surface impoundment, identified as the Final WPDES Settling Pond. The Final WPDES Settling Pond meets the requirements of §257.73(b)(1) and/or §257.73(b)(2), and is subject to the initial and periodic safety factor assessment requirements of the CCR Rule.

2. FACILITY DESCRIPTION

ROR was located north of town on the western shore of the Rock River in Rock County at 827 W. B. R. Townline Road in Beloit, Wisconsin (Figure 1). ROR was bounded on the north by Townline Road, on the west by property owned by WPL known as Riverside Energy Center (REC), and on the south and east by the Rock River, which is a navigable body of water.

ROR was commissioned in 1954 as a coal-fired power plant. The facility consisted of two units. ROR ended coal combustion when the coal-fired boilers were converted to natural gas in 2000. The facility terminated generation of all electricity in 2012 and was demolished in 2017.

General Facility Information:

Date of Initial Facility Operations:		1954
Historical WPDES Wastewater Permit Number:		WI-0002402-05-0
Historical WPDES General Storm water Permit Number:		WI-S067857-3
Latitude / Longitude:	42°34’54.66”N	89°1’38.80”W
Unit Nameplate Ratings:	Unit 1 (1954) 75 MW - Coal	
	Unit 2 (1955) 75 MW - Coal	
Impoundment WDNR State ID	None	

2.1 ROR Final WPDES Settling Pond Location

The Final WPDES Settling Pond is located south of the Closed Ash Landfill and storm water retention pond. The eastern and southern embankments of the Final WPDES Settling Pond are bordered by the Rock River, while the western boundary is bordered by a set of railroad tracks. Figure 1 shows the location of the Final WPDES Settling Pond. As of 2012, the estimated volume of CCR in the surface impoundment was 2,000 cubic yards as identified within the December

2012 Settling Basin Abandonment Plan and Landfill Closure Plan Modification. The CCR has been removed from the Final WPDES Settling Pond as of October 2025 (Appendix A).

The adjacent areas of the site comprise several components, including an Ash Disposal Facility (Landfill) Area, a former coal yard, and a Storm Water Management Pond. Storm water from the former coal yard is conveyed through a 36-inch concrete pipe into the Storm Water Management Pond. Similarly, runoff from the Landfill Area is directed into the Storm Water Management Pond through open channel swales. The Storm Water Management Pond is constructed with an embankment height of 8 feet and serves as the primary collection point for site runoff. From there, storm water is discharged via a 24-inch concrete pipe located at elevation 745.8 feet into the Final WPDES Settling Pond. Additionally, surface runoff from the area surrounding the Final WPDES Settling Pond is also directed into the pond.

The Final WPDES Settling Pond is approximately 5.0 acres with embankments approximately 9 feet high relative to pond side and estimated at 20 feet high on the Rock River side based on stream bed information from available Federal Emergency Management Agency (FEMA) Flood Zone Profiles for Rock County, Wisconsin. Storm water exfiltrates into underlying and adjacent soils under normal conditions. However, during high-intensity storm events, excess water could be discharged through an approximate 10-foot wide, 1-foot deep emergency spillway installed on top of the southern embankment during closure construction set at elevation 753 feet.

3. SAFETY FACTOR ASSESSMENT- §257.73(e)

This Report documents whether the former ROR Final WPDES Settling Pond achieves the minimum safety factors, which are identified on the table below.

Safety Factor Assessment	Minimum Safety Factor
Static Safety Factor Under Maximum Storage Pool Loading	1.50
Static Safety Factor Under Maximum Surcharge Pool Loading	1.40
Seismic Safety Factor	1.00
Liquefaction Safety Factor	1.20

3.1 Safety Factor Assessment Methods

The safety factor assessment was completed with the two-dimensional limit-equilibrium slope stability analyses program GeoStudio Slope/W. The program analyzes many potential failure surfaces using the toe and crest search boundaries set for each analysis. The solution occurs by balancing the resisting forces along the failure plane due to the Mohr-Columb failure strength parameters of friction angle and cohesion. The gravity driving forces are divided by the resisting forces to produce a safety factor for the slope. The minimum safety factor slip surface identified through iterations is presented as the applicable safety factor.

There are both total stress and effective stress friction angle and cohesion values for soil. In the case of cohesionless soil (gravel, sand and silt) the friction angle value is the same for total stress and effective stress analysis and there is no cohesion.

3.1.1 Soil Conditions

A review of regional geology indicates the site is within the ancestral Rock River valley, which is filled with glacial outwash. The site is near the western edge of the ancestral river valley. The uppermost bedrock is Prairie du Chien dolomite, which overlies St. Croix sandstone. The depth to bedrock in the area is approximately 250 to 350 feet. The bedrock is overlain by thick deposits of glacial outwash and alluvium material deposited within the ancestral Rock River valley. These deposits consist primarily of sand and gravel. These soils are consistent with the results of the site borings performed in 2025. The soils encountered in the borings are medium dense.

The results of soil borings taken in 2025 identified that the medium dense sand dense sand foundation material is overlain with medium stiff silt with sand material that is overlain with medium dense sand and silt to create the embankment. The medium dense embankment sand was well compacted to a density that is greater than the native sands below the embankment (Appendix B).

The density observations from the soil borings were used to assign soil properties to the embankment and foundation soils using UFC DM 7.1 and experience. The internal friction angles selected based on the Standard Penetration Test Split Spoon (SPT) results reported on the borings used in the analysis are presented in the attached Embankment Slope Stability Analysis in Appendix D.

The very dense sand found below the loose sand was not included in the modeled soil profile, since its exact depth in the foundation of the embankments is unknown. Ignoring the very dense sand will produce a conservative slope safety factor.

3.1.2 Design water surface for maximum normal pool and maximum pool under design inflow storm

The ROR Final WPDES Settling Pond has not been used for process water handling since the facility retired in 2012 and the CCR has been removed from the pond as of October 2025. The pond is generally dry and storm water exfiltrates into underlying and adjacent soils under normal conditions. However, during high-intensity storm events, excess water could be discharged through an approximate 10-footwide, 1 -foot-deep emergency spillway installed on top of the southern embankment during closure construction set at elevation 753 feet.

The ROR Final WPDES Settling Pond will store 16.9 acre-feet of water during the maximum storm event analyzed in the Inflow Flood Control Plan and the maximum water elevation will reach 750 feet. The minimum crest elevation of the embankment is elevation 753 with a resultant freeboard of approximately 3 feet at the peak of the storm flow.

3.1.3 Selection of Seismic Design Parameters and Description of Method

The design earthquake ground acceleration is selected from the United States Geologic Survey (USGS) detailed seismic design maps based on the latitude and longitude of the SSS. The peak ground acceleration value is selected for a 2% probability of exceedance in 50 years (2,500-year return period) as required by §257.53. Peak ground acceleration seismic factors were selected based on the 2014 USGS Seismic Impact Zones map of horizontal and vertical coefficient of 0.05 g for the seismic and liquefaction assessment.

3.1.4 Liquefaction Assessment Method and Parameters

Certain soils may have zero effective stress (liquefaction) during an earthquake of from static shear of a saturated embankment slope. Soils that will liquefy include loose or very loose uniform fine sand or silt, and low plasticity clay (plastic index of less than 12). The liquefaction resistance of a soil is based on its strength and effective confining stress. The strength of the saturated embankment and foundation sand is measured by the SPT results shown on the borings in Appendix B.

Liquefaction potential of the site soils was evaluated based on the simplified procedure summarized by Seed and Harder (1990) and described in RCRA Subtitle D for solid waste facilities. The procedure uses the Standard Penetration Test N values to calculate a Standardized Penetration Resistance. A Cyclic Stress Ratio is also calculated based on the maximum horizontal acceleration for the design earthquake and the effective overburden stress within the soil being evaluated for liquefaction potential.

The results for the soil profile typical of the former ROR Final WPDES Settling Pond is shown in Appendix C. The results indicate that the medium dense sands within and below the embankment will not liquefy during the site design earthquake with an acceleration factor of 0.05 g.

3.2 ROR Final WPDES Settling Pond (Inactive)

The Final WPDES Settling Pond is incised on the north side. The south and west sides have embankment crests that are approximately 10 feet wide. The north slope separates the Final WPDES Settling Pond from the Closed Ash Disposal Facility Landfill and the Storm Water Management Pond. The slopes are approximately three feet horizontal to one foot vertical. The south and west embankments are approximately 1.5 horizontal to 1.0 vertical slopes. The south embankment is approximately 9 feet high relative to pond side and estimated at 20 feet high on the Rock River side based on stream bed information from available Federal Emergency

Management Agency (FEMA) Flood Zone Profiles for Rock County, Wisconsin and was identified as the critical section for analysis.

3.2.1 Static Safety Factor Assessment Under Maximum Storage Pool Loading - §257.73(e)(1)(i)

The critical cross-section was analyzed under normal operations where the Final WPDES Settling Pond is dry. Water levels in the soil under the embankment and in the Rock River were assumed to be at the same elevation of approximately 744 feet elevation based on the average water level measurements from November 2025 through February 2026 in the monitoring wells around the Final WPDES Settling Pond. Analysis for circular failure surface was conducted and shows a minimum factor of safety factor of 1.45 (Appendix D).

3.2.2 Static Safety Factor Assessment Under Maximum Surcharge Pool Loading - §257.73(e)(1)(ii)

The ROR Final WPDES Settling Pond storm water elevation at the end of the design 1,000-year storm is elevation 750 feet. The increase in water elevation is considered without exfiltration loss through the permeable impoundment bottom. Analysis for circular failure surface was conducted and show a minimum factor of safety factor of 1.42 (Appendix D).

3.2.3 Seismic Safety Factor Assessment - §257.73(e)(1)(iii)

The ROR Final WPDES Settling Pond was assigned a pseudo-static earthquake coefficient equal to 0.05g for both horizontal and vertical components. Analysis for circular failure surface was conducted and shows a minimum factor of safety factor of 1.27 (Appendix D).

3.2.4 Liquefaction Safety Factor Assessment - §257.73(e)(1)(iv)

The embankment and foundation soils of the ROR Final WPDES Settling Pond are not susceptible to liquefaction. See discussion in Section 3.1.4.

4. Results Summary

The results of the safety factor assessment show that the geometry and material properties of the Final WPDES Settling Pond embankment have a calculated safety factor value that meets the minimum recommended safety factor under 40 CFR 257.73(e) for the following conditions:

- The calculated seismic factor of safety equals or exceeds 1.00.
- The calculated static factor of safety under the maximum surcharge pool loading condition equals or exceeds 1.40.

The results show that the geometry and material properties of the Final WPDES Settling Pond embankment has a calculated safety factor value that does not meet the minimum recommended safety factor for the following condition:

- The calculated static factor of safety under the long-term, maximum storage pool loading condition does not equal or exceed 1.50.

The results are summarized as:

	Long-Term, Maximum Storage Pool Loading (Static)	Maximum Surcharge Pool Loading (Static)	Pseudo Static Earthquake with Normal Water Elevation	Liquefaction Potential	Post Earthquake Static Stability Normal Water Elevation
Required Safety Factor	1.5 ≥	1.4 ≥	1.0 ≥	Yes/No	1.2 ≥
ROR Final WPDES Settling Pond	1.45	1.42	1.27	No	Not Applicable

5. QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

To meet the requirements of 40 CFR 257.73(e)(2), I Mark W. Loerop hereby certify that I am a licensed professional engineer in the State of Wisconsin; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in 40 CFR 257.73(b) and 40 CFR 257.73(e).

By: [signature]

Name: MARK LOEROP

Date: MAY 6, 2026

WISCONSIN
MARK W.
LOEROP
E-43783-6
NAPERVILLE
IL
PROFESSIONAL ENGINEER

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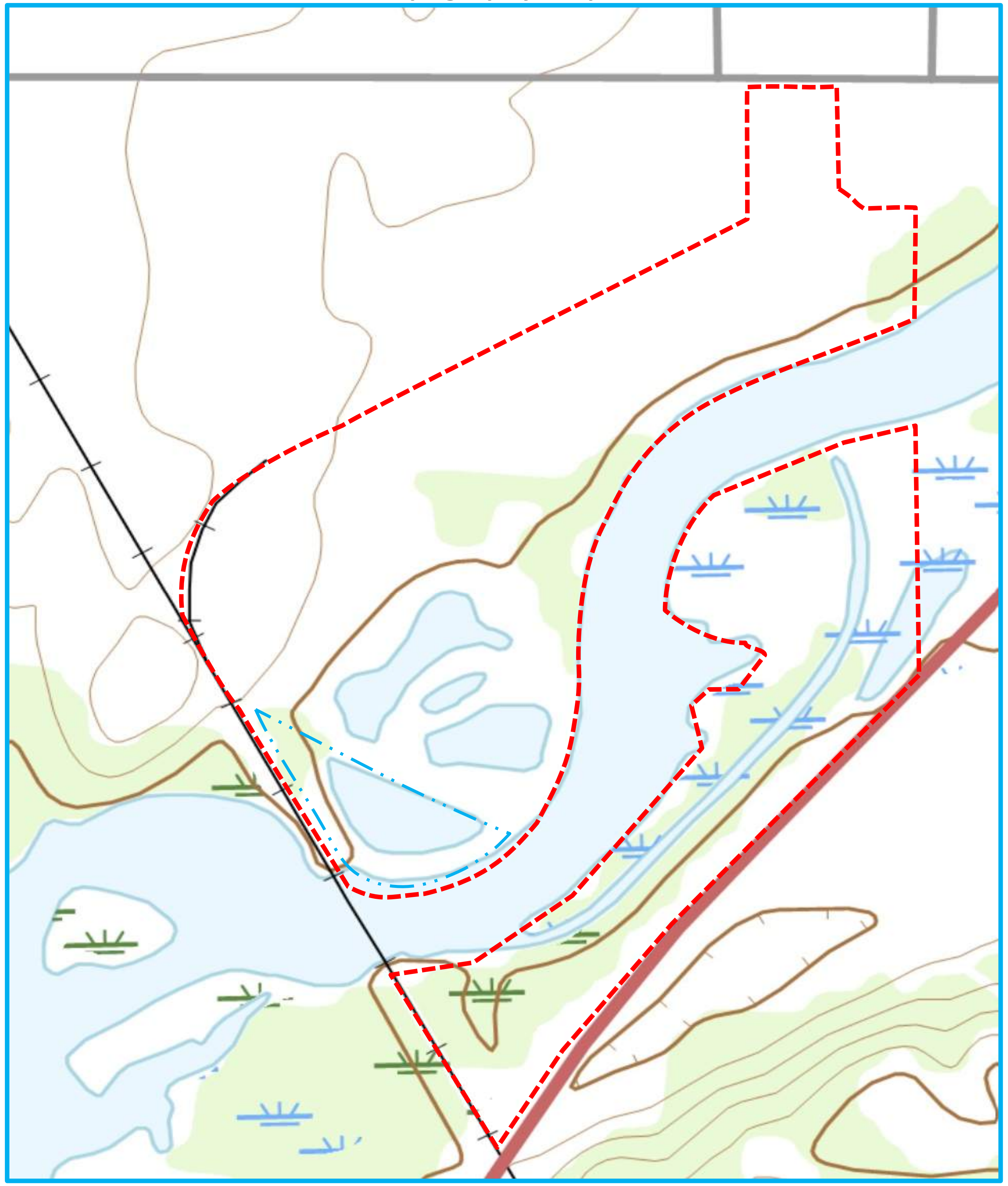
FIGURES

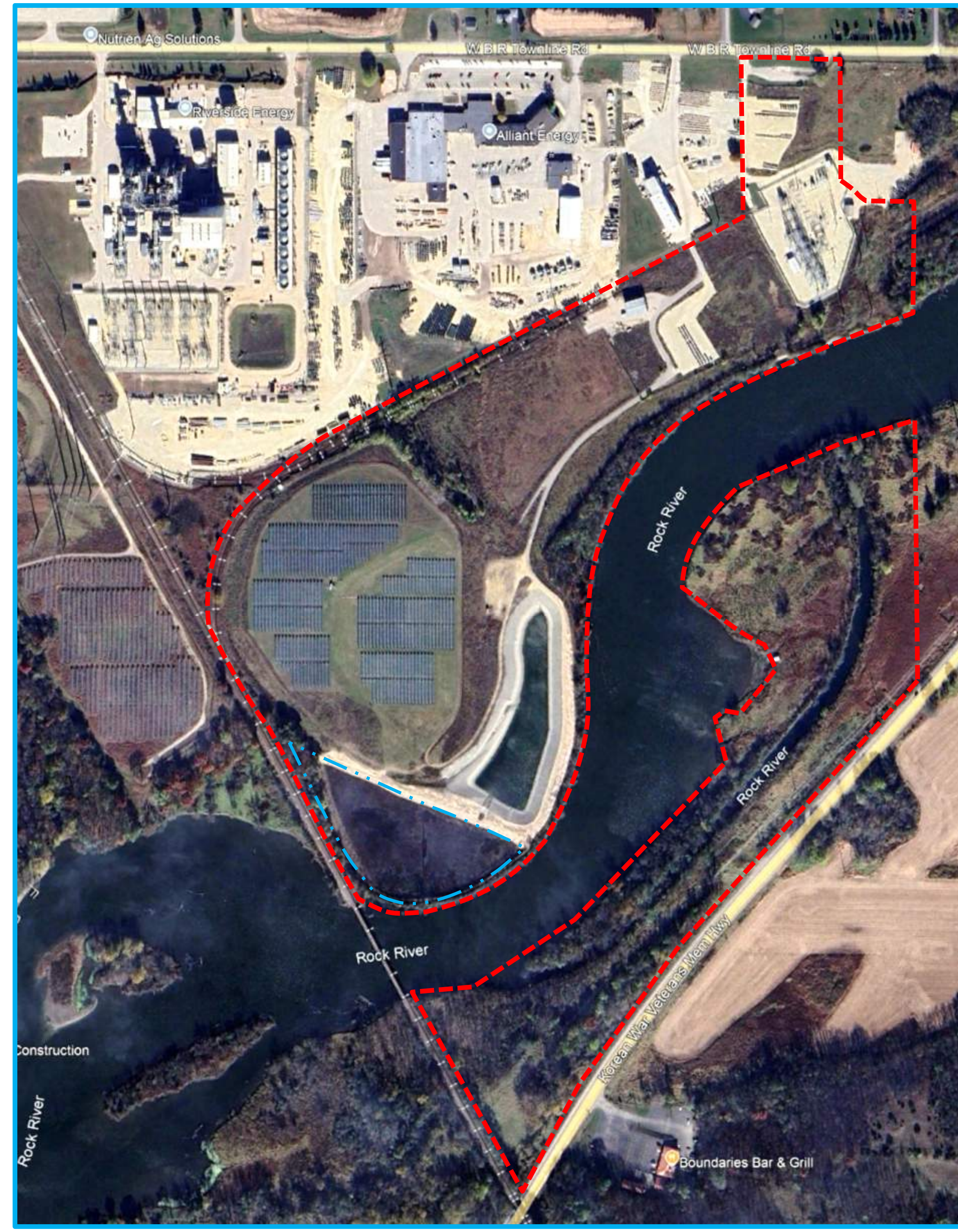
Alliant Energy
Wisconsin Power and Light Company
Rock River Generating Station
Beloit, Wisconsin

Safety Factor Assessment

Topography Map



Aerial Photo



Approximate Property Boundary

Final WPDES Settling Pond

hard hat™ SERVICES

Site Location
Rock River Generating Station
Wisconsin Power and Light Company

Drawing	Date
Figure 1	4/28/2026

APPENDIX A – WPDES Final Settling Pond Cross Section Location

Alliant Energy
Wisconsin Power and Light Company
Rock River Generating Station
Beloit, Wisconsin

Safety Factor Assessment

LEGEND

—746—	EXISTING GRADE (1' CONTOUR)
—745—	EXISTING GRADE (5' CONTOUR)
	RAILROAD TRACKS
—x—x—x—	FENCE
	PAVED ROAD
	UNPAVED ROAD
	CULVERT
	ASH MANAGEMENT AREA
	APPROXIMATE LIMITS OF EXISTING FINAL COVER
	MONITORING WELL
	PIEZOMETER
	STAFF GAUGE
	GEOTECHNICAL SOIL BORING

NOTES:

1. HORIZONTAL DATUM BASED ON WISCONSIN COUNTY COORDINATE SYSTEM, ROCK COUNTY. VERTICAL SITE DATUM REFERENCED TO NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).
2. TOPOGRAPHIC SURVEY AND AERIAL IMAGERY FROM SCS ENGINEERS DRONE FLIGHT ON SEPTEMBER 30, 2025.
3. GT-101 AND GT-102 AND MW-301 TO MW-305 INSTALLED BY HORIZON CONSTRUCTION AND EXPLORATION, LLC AND OVERSEEN BY SCS ENGINEERS ON NOVEMBER 10-13, 2025. LOCATIONS SURVEYED BY BIRRENKOTT SURVEYING ON JANUARY 15, 2026.
4. OTHER MONITORING WELL AND SITE FEATURES BASED ON FINAL SETTLING POND CCR REMOVAL CONSTRUCTION DOCUMENTATION DRAWINGS BY SCS ENGINEERS DATED NOVEMBER 2025.

N

100 0 100

SCALE: 1" = 100'

CROSS SECTION LOCATION

FIGURE 1

SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

ENGINEER

WISCONSIN POWER AND LIGHT
ROCK RIVER ASH DISPOSAL LANDFILL
827 WBR TOWNLINE ROAD
BELOIT, WISCONSIN

SITE

Wisconsin Power and Light Company

CLIENT

PROJECT NO.	25225169.01	DRAWN BY:	AR
DRAWN:	12/10/2025	CHECKED BY:	BSS
REVISED:	03/06/2026	APPROVED BY:	

I:\25225169.01\Drawings\Slope Stability\1_Section A-A' Location Map.dwg, 3/9/2026 8:47:20 AM

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APPENDIX B – Boring Logs and Lab Data

Alliant Energy
Wisconsin Power and Light Company
Rock River Generating Station
Beloit, Wisconsin

Safety Factor Assessment

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Rock River Generating Station SCS#: 25225169.01		GT-101

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Sweet Horizon	11/12/2025	11/13/2025	solid stem auger

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			744.4 Feet	755.75 Feet	1.75/3.5 in.

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐
State Plane 230,282 N, 491,215 E S / C / N
SE 1/4 of SE 1/4 of Section 2, T 1 N, R 12 E
Lat 42° 20' 36.49"
Long 89° 0' 54.04"
Local Grid Location: Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Rock	54	Beloit

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S1	16	18		SILTY SAND with gravel (SM), dark brown (10YR 3/3), medium dense, very fine to coarse angular sand, fine to coarse angular gravel	SM					M				Samples from (ft): 0-2, 2.5-4.5, 5-7, 8.5-10.5 (Shelby Tube), 10.5-12.5, 13-15, 15-17 (failed shelby attempt),17-19, 19.5-21.5, 22-24, 24.5-26.5, 27-29, 29.5-31.5, 32-34, 34.5-36.5, 37-39
			1.5	SILT with fine to coarse subround sand and gravel, black (10YR 2/1), stiff, with roots	ML									
S2	6.5	94	3.0	CLAYEY SAND (SC) with gravel, dark brown and dark yellowish brown (10YR 3/3 and 4/4), very dense, sand is fine to medium round sand, fine to coarse angular and round gravel, tree root in bottom of run, potential gray ash	SC				1.25	M				
			4.5											
S3	21.5	94	6.0	SANDY SILT with gravel (ML), black (10YR 2/1), hard, fine to coarse angular and round gravel, fine to coarse subangular sand, small 2 inch seam of yellowish brown sand at ~6.75ft	ML				~1.5, brittle	M				
			7.5											
ST			9.0	Shelby tube, Clayey sand, black (10YR 2/1) with some yellow brown, stiff, fine to medium (SC)	SC				1.0	M	22	8	28.6	water content =14.37%
S4	3	11	10.5	SILTY SAND with gravel (SM), grayish brown (10YR 5/2), medium dense, fine to coarse subangular sand and gravel	SM					M				Started mud drilling, until this point dry drilling
			12.0											
S5	8	4	13.5	SILT (ML), olive (5Y 4/3), very loose to loose, fine to coarse angular sand and gravel	ML					W				
ST fail			15.0	SHELBY TUBE ATTEMPT, No sample all fell out, assumed very soft silt	NO CORE									
			16.5											
S6	14	40		SILT (ML), same as above, with sand and gravel, same color, hard	ML					W				
			18.0	POORLY GRADED (SP), light olive brown (2.5Y 5/3), dense, very fine to coarse round to subround sand, fine to coarse subangular to subround gravel	SP									
			19.5		SM									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	
Bridget Jarosinski	SCS Engineers	Tel: Fax:

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A

Boring Number GT-101 Use only as an attachment to Form 4400-122.

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S7	10.5	150	21.0	SILTY SAND with gravel (SM), light olive brown (2.5Y 5/3), dense, fine to coarse subround sand and gravel (outwash)	SM					W				Samples from (ft): 19.5-21.5, 22-24, 24.5-26.5, 27-29, 29.5-31.5, 32-34, 34.5-36.5, 37-39
S8	~20	200	22.5 – 24.0	SILT (ML), light olive brown (2.5Y 5/4), very dense, some fine to medium round sand	ML					W				Recovery from 22-24ft is estimated. Little actual material, mostly liquified and goo-like
S9	24	20	25.5	SILTY SAND with gravel (SM) transition, last 3 inches, same color as above, medium dense	SM					W				
			27.0	POORLY GRADED GRAVELLY SAND (SP), light olive brown (2.5Y 5/4), medium dense, both fine to coarse round, with silt (outwash)	SP									
S10	11.5	21	28.5	SILTY SAND with gravel (SM), same color, medium dense, very fine to coarse angular sand, fine to coarse subangular gravel (outwash)	SM					W				sluff in first foot, silty goo
S11	9.5	19	30.0 – 31.5	POORLY GRADED SAND with silt (SP-SM), light yellowish brown (2.5Y 6/4), medium dense, similar to above in grain size/shape, but more sand than silt	SP-SM					W				still some silt sluff
S12	10	10	33.0	fine to coarse round sand and gravel, otherwise same as above						W				still some silt sluff
S13	3	9	34.5 – 36.0	POORLY GRADED SAND (SP), light yellowish brown (2.5Y 6/4), loose, with very fine to coarse round sand and fine to coarse round gravel (outwash)	SP					W				no more sluff
S14	10	13	37.5 – 39.0	more coarse sand grains, but medium dense, still very fine to coarse round sand and fine to coarse round gravel same color						W				
S15	8.5	19	40.5	same as above						W				
S16	11	19	42.0 – 43.5	POORLY GRADED GRAVELLY SAND (SP), pale brown (10YR 7/3 and 8/3) with silt, medium dense, fine to coarse subangular to subround gravel, very fine to coarse subround and subangular sand	SP-SM					W				Samples from (ft): 39.5-41.5, 42-44, 44.5-46.5, 47-49, 49.5-51.5, 54.5-56.5
S17	9	16	45.0 – 46.5							W				
S18	6.5	13	48.0							W				
S19	3.5	24	49.5 – 51.0	same as above						W				
			52.5											

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION SUPPLEMENT
Form 4400-122A

Boring Number GT-101 Use only as an attachment to Form 4400-122.

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			54.0											
S20	11	16	55.5	light gray (10YR 7/3), otherwise same as above						W				
			57.0											
			58.5		SP-SM									
S21	11	NM NM NM NM	60.0	same as above, but subround to round										missed blow counts on accident
			61.5											
			63.0											
			64.5											
S22	13	27	66.0	POORLY GRADED SAND (SP), light yellowish brown (10YR 6/4), medium dense, with some fine to coarse subround sand and gravel						W				Samples from (ft): 64.5-66.5, 68.5-70
			67.5		SP									
S23	11	28	69.0							W				
				End of boring at 70ft, grouting for abandonment										

State of Wisconsin
Department of Natural Resources

SOIL BORING LOG INFORMATION

Form 4400-122 Rev. 7-98

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Redevelopment ☐ Other ☐

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Rock River Generating Station SCS#: 25225169.01		GT-102

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Sweet Horizon	11/12/2025	11/12/2025	solid stem auger

WI Unique Well No.	DNR Well ID No.	Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
			744.1 Feet	756.29 Feet	1.75/3.5 in.

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☐
State Plane 230,507 N, 490,461 E S / C / N
NW 1/4 of SW 1/4 of Section 2, T 1 N, R 12 E

Lat 42 ° 20 ' 37.32 "
Long 89 ° 1 ' 12.07 "

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	County Code	Civil Town/City/ or Village
	Rock	54	Beloit

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S1	19	19	1.5	SILTY SAND with gravel (SM), pale brown and yellow (10YR 6/3 and 8/6), medium dense, fine to coarse subangular	SM					M				Samples taken from (ft): 0-2, 2.5-4.5, 5-7, 7.5-9.5, 10-12, 12.5-14.5, 15-17, 17.5-19.5 Dry drilling no water use
S2	22	19	3.0 4.5	SILT, very dark brown (10YR 2/2) brittle, very stiff SANDY SILT (ML), silt is very dark brown (10YR 2/2), sand is yellowish brown (10YR 5/4), very stiff, sand and gravel are fine to coarse, round	ML ML					M				
S3	24	13	6.0	POORLY GRADED SAND (SP-SM), dark yellowish brown (10YR 4/6), medium dense, with silt and gravel SILT (ML), very dark brown (10YR 2/2) 4 inches, stiff	SP-SM ML SP					M				
S4	24	22	7.5 9.0	POORLY GRADED SAND (SP) dark yellowish brown (10YR 4/6), stiff, with gravel fine to coarse SILT (ML), very dark brown (10YR 2/2), very stiff, with sand and gravel POORLY GRADED SAND, dark yellowish brown and yellowish brown (10YR 3/4 and 5/6), medium dense, fine to coarse round	ML SP					M				DTW at about 11.75-12ft
S5	20	3	10.5 12.0	LEAN CLAY (CL), black (5Y 2.5/1), soft, trace silt and sand, fine to medium grained	CL			1.5 1.0		M/W W				Redrilled hole next to this to obtain Shelby Tube Sample from 10.5-12.83ft, collapsed in at bottom
S6	10	6	13.5	SILTY SAND with gravel (SM), dark olive gray (5Y 3/2), loose, very fine to coarse angular sand and fine to coarse angular gravel	SM					W				
S7	12	16	15.0 16.5	same as above, but color change to olive (5Y 4/3 and 5/4), very soft						W				
S8	14	27	18.0 19.5	POORLY GRADED SAND with gravel, olive yellow (2.5Y 6/6), medium dense, fine to coarse angular sand, fine to coarse angular and round gravel, large round cobbles and trace silt (Outwash)	SP					W				

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	
Bridget Jarosinski	SCS Engineers	Tel: Fax:

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

SOIL BORING LOG INFORMATION SUPPLEMENT

Form 4400-122A

Boring Number GT-102 Use only as an attachment to Form 4400-122.

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID/FID	Soil Properties: Standard Penetration	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
S9	13	34	21.0	same as above, but light yellowish brown (2.5Y 6/3), dense						W				
			22.5											
S10	13	24	24.0	POORLY GRADED SAND, pale brown (10YR 6/3), medium dense, with very fine to coarse round to subround grains, and fine to coarse round and angular gravel, no more silt	SP					W				
S11	1.5	10	25.5	same as above but no angular, just rounded, loose to medium dense						W				
			27.0											
S12	1	3	28.5	same as above but fine to medium round sand, no gravel and trace silt						W				
				End of boring at 29.5ft drilling second hole, step out to take Shelby tube 10.5ft to 12.83ft. Abandoned holes with Bentonite chips										

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Milwaukee, WI 53207
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GESTRA

Report On: **Test Report Attachment**

Lab No: **25-06466**
Report No: 25-06466

Project No: 25369-40 **Cust No:** 0410

Client: SCS Engineers
Debra Nelson
SCS Engineers
2830 Dairy Drive
Madison, WI 53718

Project: WPL Rock River Ash Disposal Facility

Report Date: 12/19/2025

Location:

Sample Date: 12/18/2025
Sampled By: Client

Orig: SCS Engineers Attn: Debra Nelson
(1-ec copy)
1-cc Laboratory

Respectfully Submitted,

GESTRA Engineering, Inc
191 W. Edgerton Ave
Milwaukee, WI 53207
Phone: (414) 933-7444; Fax: (414) 933-7844

Laboratory Test Results of Atterberg Limits of Soil

Project Name:	Rock River Ash Disposal Facility	Date:	December 17, 2025
Project Number:	25369-40	Client:	SCS
Project Location:	Beloit, WI	SCS #:	25225169.01
ASTM Designation:	**D4318 (Method A)**		

Sample Information

Type of Sample	Shelby Tube
Boring Number	GT-101
Sample Number	--
Depth of Sample	8.5' - 10.5'

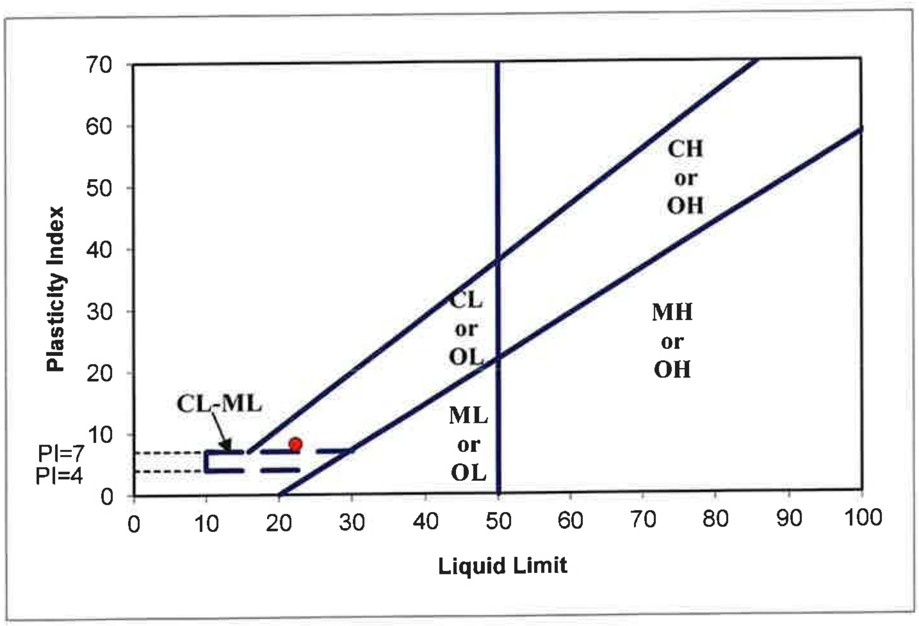
Determination of Liquid Limit

Cup Number			
Weight of Cup (g)	10.91	10.85	10.91
Weight of Wet Soil and Cup (g)	36.70	34.80	32.82
Weight of Dry Soil and Cup (g)	32.04	30.25	28.54
Moisture Content (%)	22.1	23.5	24.3
Blow Counts	26	19	15

Determination of Plastic Limit

Cup Number		
Weight of Cup (g)	7.19	7.24
Weight of Wet Soil and Cup (g)	16.78	17.55
Weight of Dry Soil and Cup (g)	15.62	16.30
Moisture Content (%)	13.8	13.8

Compilation of Test Results



Liquid Limit	22
Plastic Limit	14
Plasticity Index	8
USCS Symbol	**CL**

Performed by: C. Schneider

Reviewed By: Nicole Merkes
GESTRA Engineering, Inc.

Geotechnical-Structural-Pavement-Construction Material

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Milwaukee, WI 53207
Phone: (414) 933-7444; Fax: (414) 933-7844

Laboratory Test Results of Mechanical Analysis of Soil or Aggregate

Project Name:	Rock River Ash Disposal Facility	Date:	December 11, 2025
Project Number:	25369-40	Reported To:	SCS
Project Location:	Beloit, WI	SCS #:	25225169.01
ASTM Designation:	**D6913**	**Method**	**A**

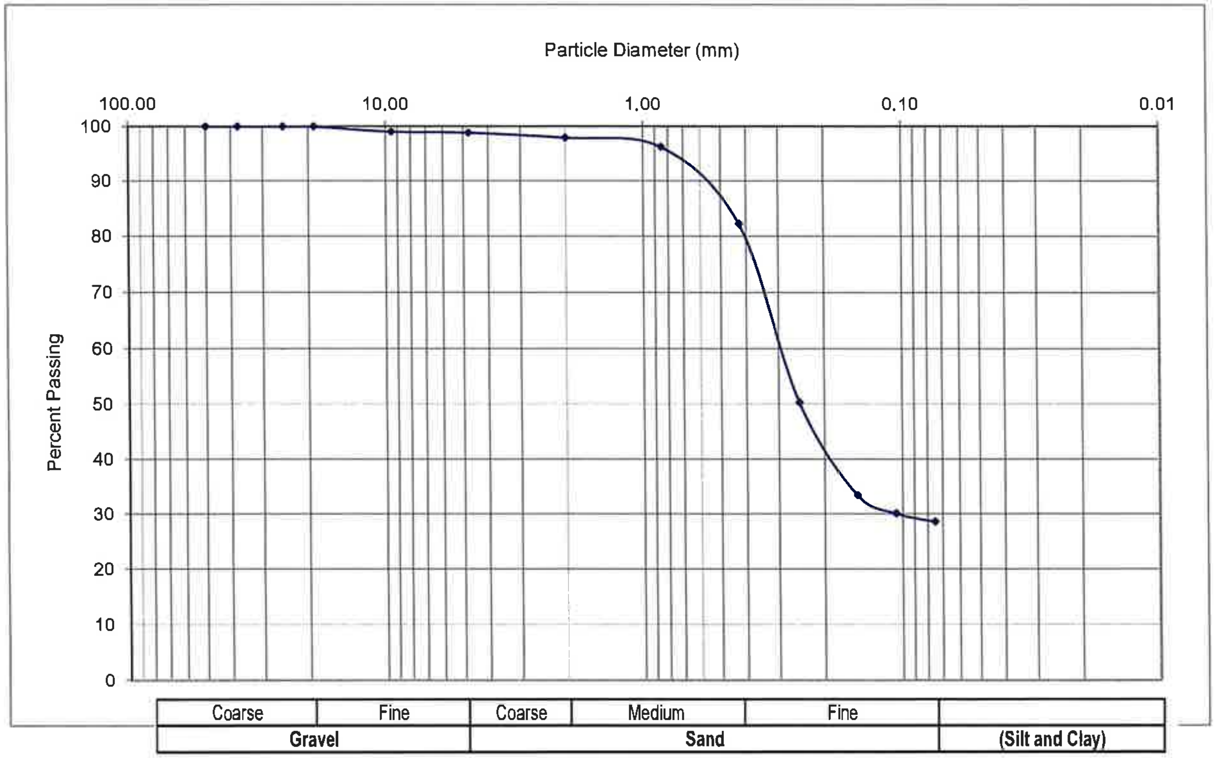
Sample Information

Type of Sample: Shelby Tube

Boring Number: GT-101 Depth of Sample: 6.5'-10.5'

Mechanical Analysis Data

Sieve	Sieve Opening (mm)	Percent Passing (%)
2	50	100.0
1 1/2	37.5	100.0
1	25.0	100.0
3/4	19.0	100.0
3/8	9.5	99.1
#4	4.75	98.8
#10	2.000	97.9
#20	0.850	96.2
#40	0.425	82.2
#60	0.250	50.3
#100	0.150	33.5
#140	0.106	30.1
#200	0.075	28.6
Pan		27.5



Moisture Content 14.8 %

Remarks: Gravel 1.2 % Sand 70.2 %

Passing #200 Sieve (Silt & Clay) 28.6 %

Performed by: C. Schneider

Reviewed by: Nicole Merkes
GESTRA Engineering, Inc.

Geotechnical-Structural-Pavement-Construction Material

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Shelby Tube Extraction Form

Project Name:	Rock River Ash Disposal Facility	Date:	December 5, 2025
Project Number:	25369-40	Client:	SCS
Projection Location:	Beloit, WI	SCS #:	25225169.01
ASTM Designation:	**D2488**		

Sample Information

Boring Number	GT-101		
Sample Number	--	qp:	1.0
Depth of Sample	8.5' - 10.5'		

Recovery: 23" (bottom 3" remained in damaged portion of tube)

Soil Description: Top 4" - Slough
Bottom 13" - Dark brown, sandy lean clay, moist, medium stiff to to stiff, trace gravel.
6" - to 10" - Silty sand, light brown, moist, trace gravel.

Performed By: S. McLafferty

Reviewed By: Nicole Merkes

Geotechnical-Structural-Pavement-Construction Material

GESTRA Engineering, Inc
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Milwaukee, WI 53207
Phone: (414) 933-7444; Fax: (414) 933-7844

Laboratory Test Results of Atterberg Limits of Soil

Project Name:	Rock River Ash Disposal Facility	Date:	December 17, 2025
Project Number:	25369-40	Client:	SCS
Project Location:	Beloit, WI	SCS #:	25225169.01
ASTM Designation:	**D4318 (Method A)**		

Sample Information

Type of Sample	Shelby Tube
Boring Number	GT-102
Sample Number	--
Depth of Sample	10.5' - 12.3'

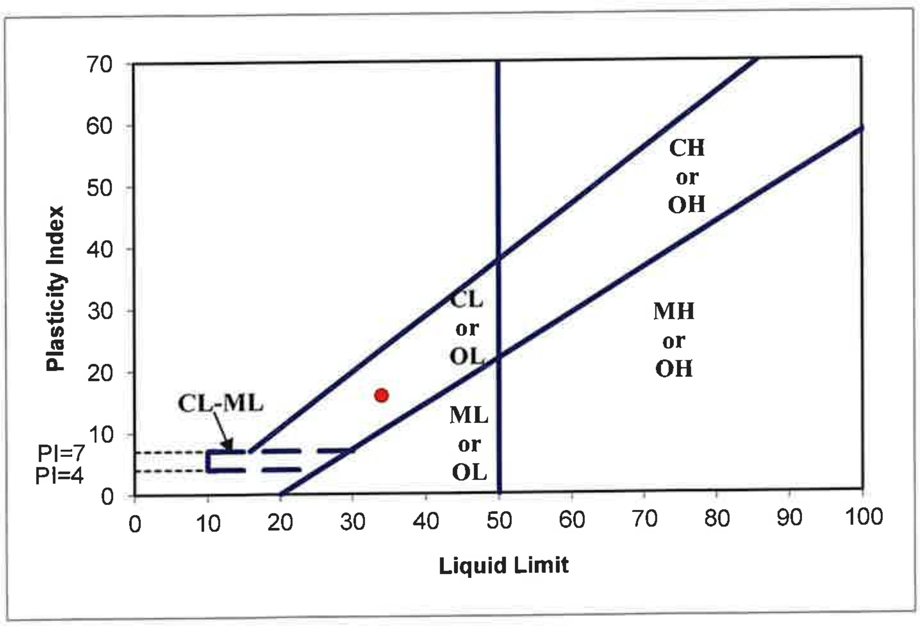
Determination of Liquid Limit

Cup Number			
Weight of Cup (g)	18.91	18.93	18.86
Weight of Wet Soil and Cup (g)	40.16	41.71	42.03
Weight of Dry Soil and Cup (g)	34.88	35.92	35.98
Moisture Content (%)	33.1	34.1	35.3
Blow Counts	28	25	20

Determination of Plastic Limit

Cup Number		
Weight of Cup (g)	7.30	7.45
Weight of Wet Soil and Cup (g)	14.66	14.91
Weight of Dry Soil and Cup (g)	13.57	13.77
Moisture Content (%)	17.4	18.0

Compilation of Test Results



Liquid Limit	34
Plastic Limit	18
Plasticity Index	16
USCS Symbol	**CL**

Performed by: M. Biddick

Reviewed By: Nicole Merkes
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Laboratory Test Results of
Mechanical Analysis of Soil or Aggregate

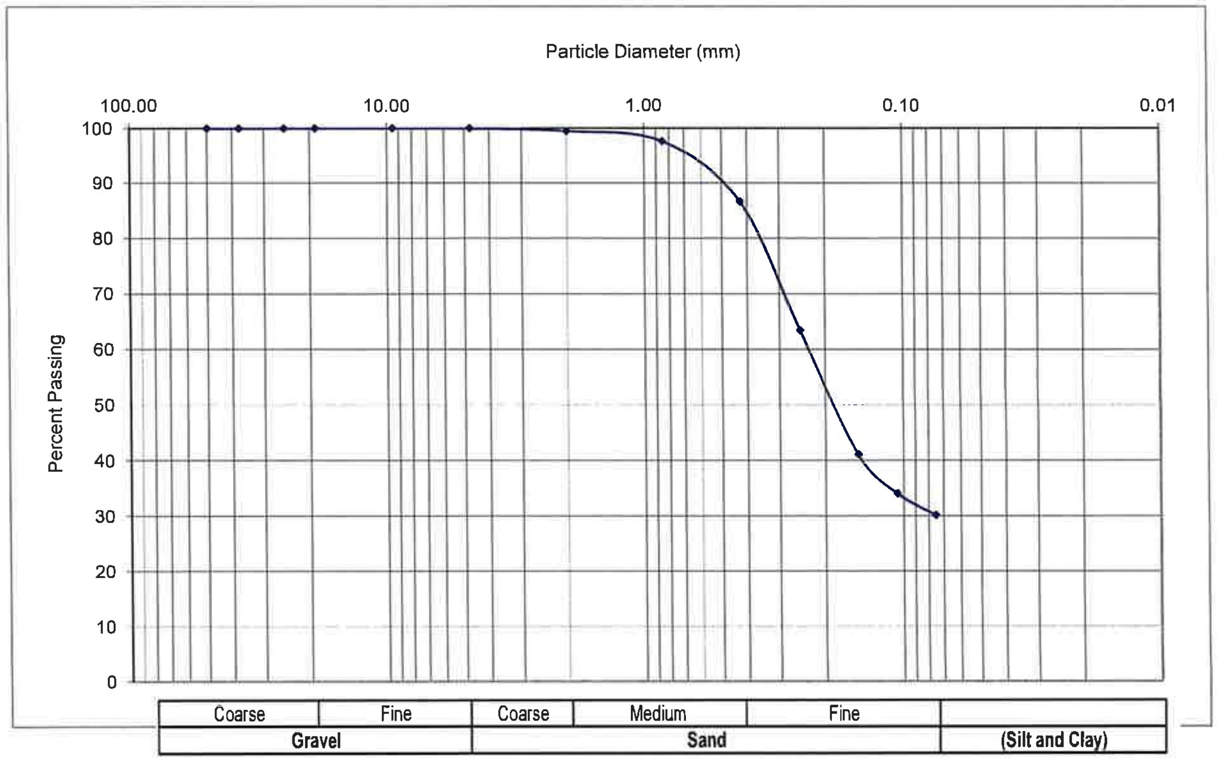
Project Name: Rock River Ash Disposal Facility
Project Number: 25369-40
Project Location: Beloit, WI
ASTM Designation: **D6913** **Method B**

Date: December 11, 2025
Reported To: SCS
SCS #: 25225169.01

Sample Information
Type of Sample: Shelby Tube
Boring Number: GT-102
Depth of Sample: 10.5'-12.3'

Mechanical Analysis Data

Sieve	Sieve Opening (mm)	Percent Passing (%)
2	50	100.0
1 1/2	37.5	100.0
1	25.0	100.0
3/4	19.0	100.0
3/8	9.5	100.0
#4	4.75	100.0
#10	2.000	99.5
#20	0.850	97.7
#40	0.425	86.7
#60	0.250	63.4
#100	0.150	41.1
#140	0.106	34.1
#200	0.075	30.2
Pan		28.2



Moisture Content 25.5 %

Remarks: Gravel 0.0 % Sand 69.8 %
Passing #200 Sieve (Silt & Clay) 30.2 %

Performed by: C. Schneider

Reviewed by: Nicole Merkes
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Geotechnical-Structural-Pavement-Construction Material

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Shelby Tube Extraction Form

Project Name:	Rock River Ash Disposal Facility	Date:	December 5, 2025
Project Number:	25369-40	Client:	SCS
Projection Location:	Beloit, WI	SCS #:	25225169.01
ASTM Designation:	D2488		

Sample Information

Boring Number	GT-102	
Sample Number	--	qp: N/A
Depth of Sample	10.5' - 12.3'	

Recovery: 13" (bottom 2" remained in damaged portion of tube).

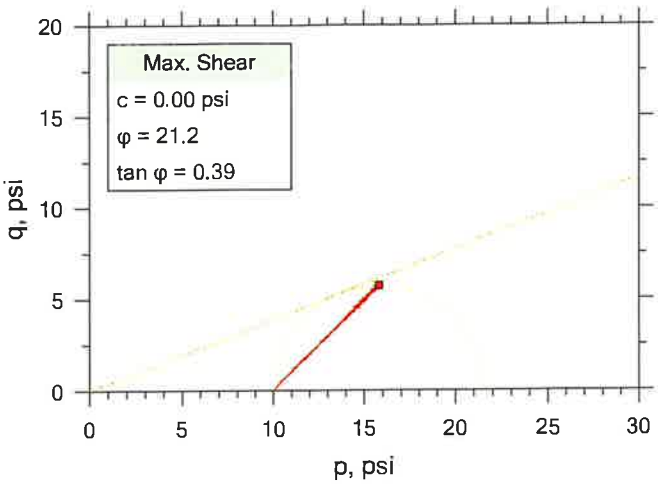
Soil Description:
Top 6" - Silty sand with gravel, gray, moist.
Bottom 7" - Sand with silt, light brown, most, trace gravel.
Dark brown sandy lean clay, sand lense in bottom 4" (qp: 1.00)

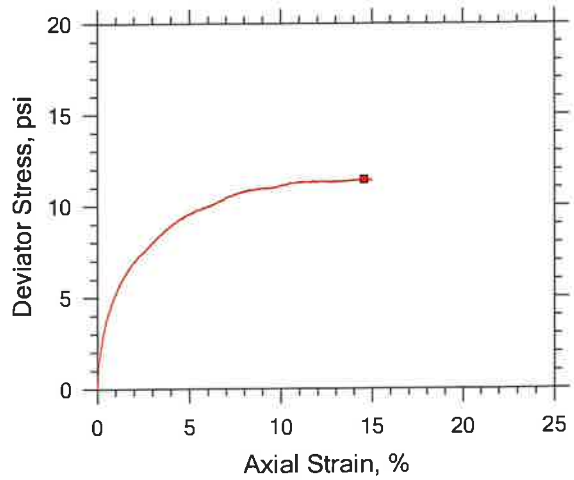
Performed By: S. McLafferty

Reviewed By: Nicole Merkes

Geotechnical-Structural-Pavement-Construction Material

Unconsolidated Undrained by ASTM D2850





Symbol		■
Sample ID		N/A
Depth		8.5' - 10.5'
Test Number		1
Initial	Height, in	5.765
	Diameter, in	2.839
	Moisture Content (from Cuttings), %	14.3
	Dry Density, pcf	117.
	Saturation (Wet Method), %	88.8
	Void Ratio	0.432
Final	Moisture Content, %	16.0
	Dry Density, pcf	117.
	Cross-Sectional Area (Method A), in²	6.322
	Saturation, %	100.0
	Void Ratio	0.429
	Back Pressure, psi	0.000
Vertical Effective Consolidation Stress, psi		9.986
Horizontal Effective Consolidation Stress, psi		9.992
Vertical Strain after Consolidation, %		0.000
Volumetric Strain after Consolidation, %		0.000
Time to 50% Consolidation, min		0.000
Shear Strength, psi		5.727
Strain at Failure, %		14.6
Strain Rate, %/min		1.000
Deviator Stress at Failure, psi		11.45
Effective Minor Principal Stress at Failure, psi		10.21
Effective Major Principal Stress at Failure, psi		21.66
B-Value		---

Notes:
- Before Shear Saturation set to 100% for phase calculation.
- Moisture Content determined by ASTM D2216.
- Atterberg Limits determined by ASTM D4318.
- Deviator Stress includes membrane correction.
- Values for c and φ determined from best-fit straight line for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site conditions.

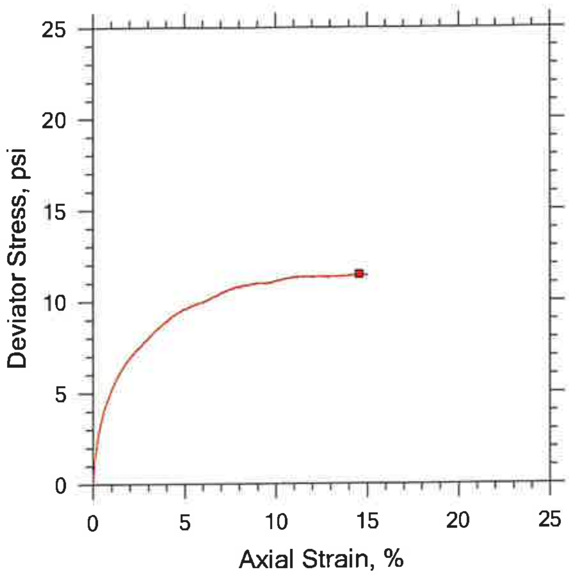
GESTRA

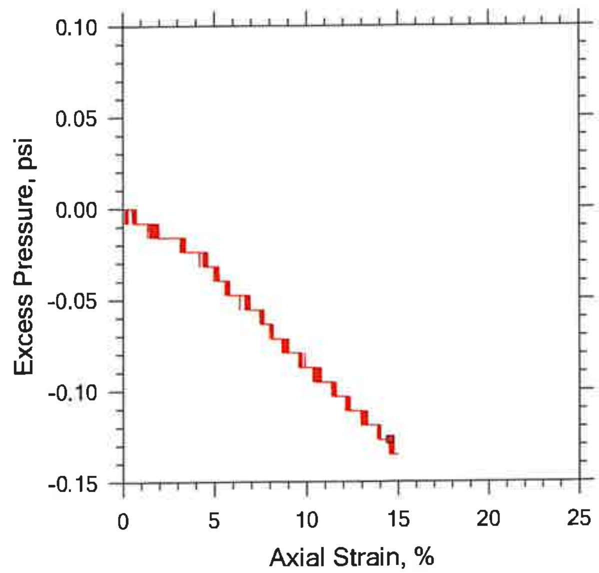
Project Name: Rock River Ash Disposal	Location: Beloit, WI	Project Number: 25369-40
Boring Number: GT-101	Tester: N. Merkes	Checker: N. Merkes
Sample Number: N/A	Test Date: 12/09/2025	Depth: 8.5' - 10.5'
Test Number: 1	Preparation: Shelby Tube	Elevation:
Client: SCS	Classification:	Group Symbol:

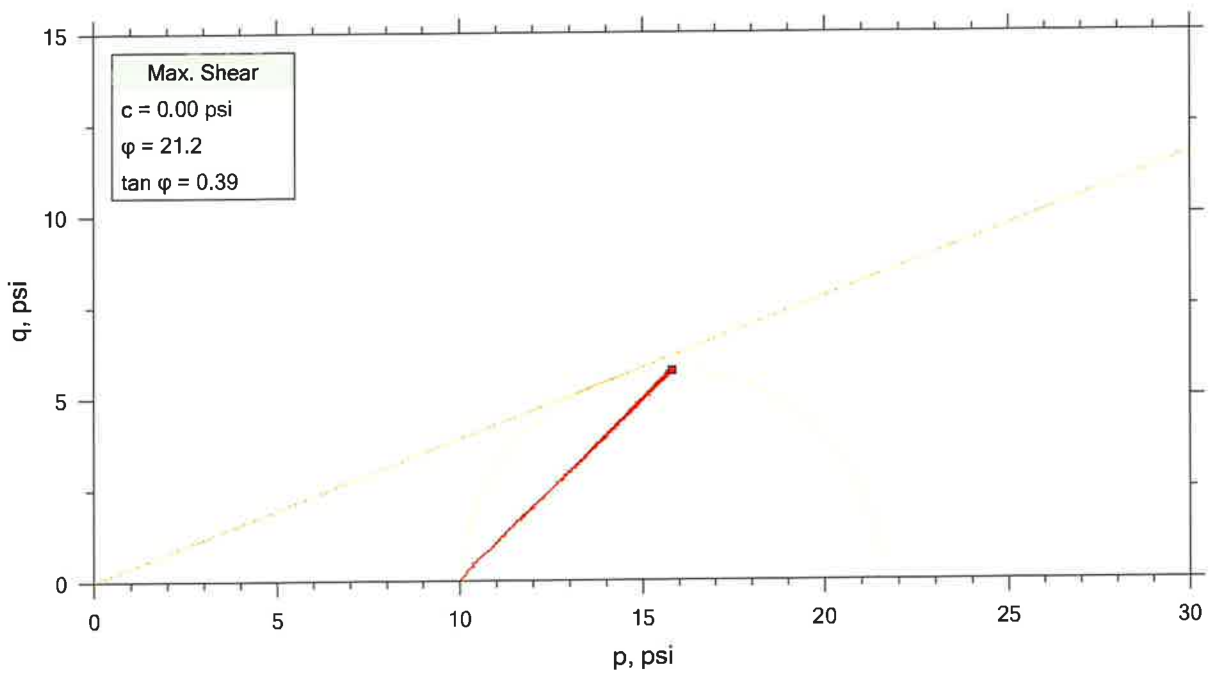
Description: Dark brown sandy lean clay. (Silt lense present in bottom 4")

Remarks:

Unconsolidated Undrained by ASTM D2850







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■	N/A	1	8.5' - 10.5'	N. Merkes	12/09/2025	N. Merkes	12/18/2025	GT-102, UU 10psi.dat

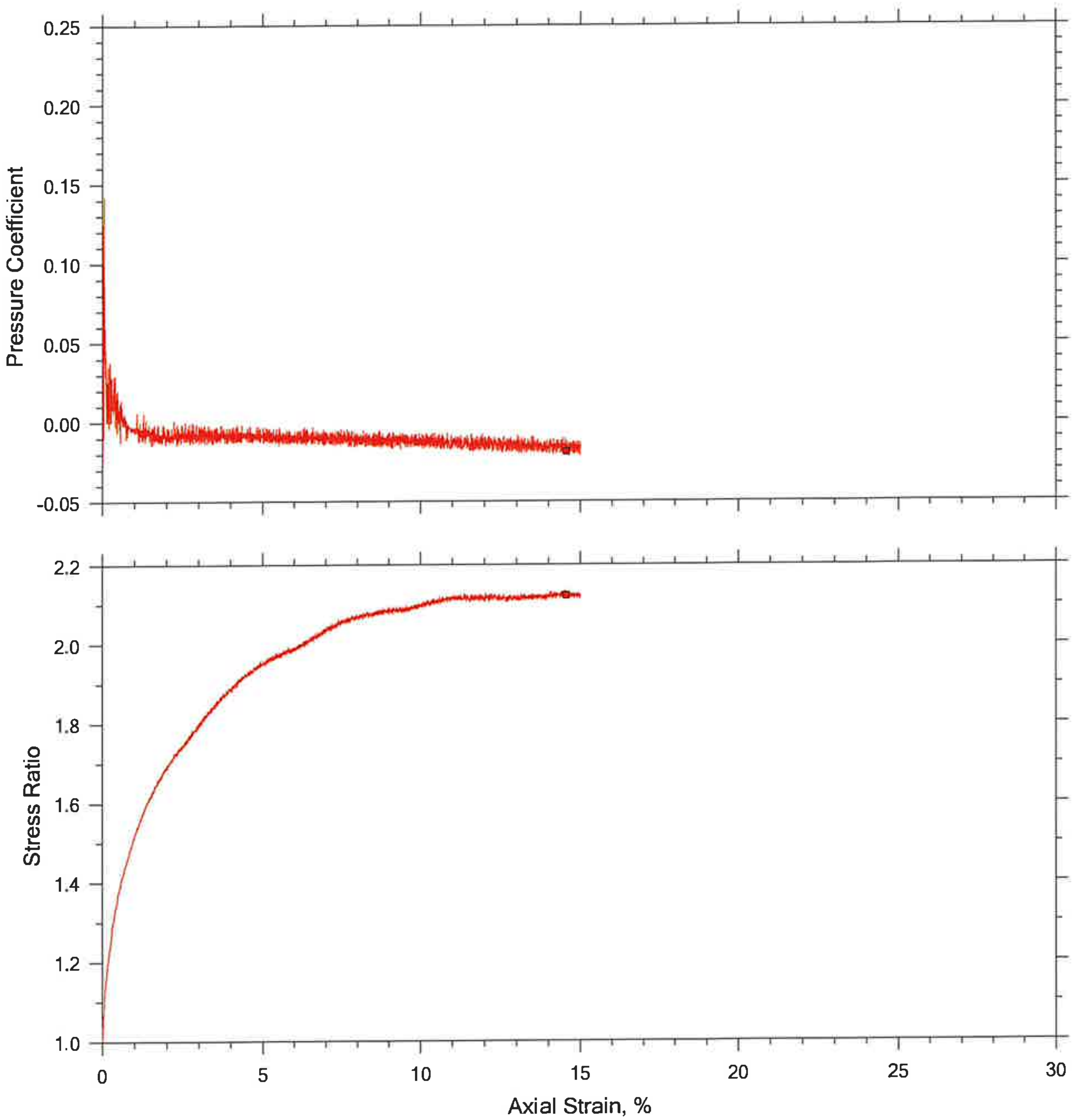
GESTRA

Project Name: Rock River Ash Disposal	Location: Beloit, WI	Project Number: 25369-40
Boring Number: GT-101	Tester: N. Merkes	Checker: N. Merkes
Sample Number: N/A	Test Date: 12/09/2025	Depth: 8.5' - 10.5'
Test Number: 1	Preparation: Shelby Tube	Elevation:
Client: SCS	Classification:	Group Symbol:

Description: Dark brown sandy lean clay. (Silt lense present in bottom 4")

Remarks:

Unconsolidated Undrained by ASTM D2850



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
■	N/A	1	8.5' - 10.5'	N. Merkes	12/09/2025	N. Merkes	12/18/2025	GT-102, UU 10psi.dat

GESTRA

Project Name: Rock River Ash Disposal	Location: Beloit, WI	Project Number: 25369-40
Boring Number: GT-101	Tester: N. Merkes	Checker: N. Merkes
Sample Number: N/A	Test Date: 12/09/2025	Depth: 8.5' - 10.5'
Test Number: 1	Preparation: Shelby Tube	Elevation:
Client: SCS	Classification:	Group Symbol:

Description: Dark brown sandy lean clay. (Silt lense present in bottom 4")

Remarks:

GESTRA

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191 W. Edgerton Ave
Milwaukee, WI 53207
Phone (414) 933-7444; Fax (414) 933-7844

Laboratory Test Results of
Moisture Content, Organic Content, and Density of Soil

Project Name:	Rock River Ash Disposal Facility	Date:	December 5, 2025
Project Number:	25369-40	Report To:	SCS
Project Location:	Beloit, WI	GZA#:	25225169.01
ASTM Designation:	**D2216, D2974 (Method A), D7263**		

Boring Number	GT-101		GT-102								
Sample Number	8.5' - 10.5'		10.5' - 12.3'								
Cup Number											
Weight of Cup (g)	72.53		52.30								
Weight of Wet Soil and Cup (g)	153.14		117.31								
Weight of Dry Soil and Cup (g)	143.04		103.38								
Weight of Soil and Cup After Burn (g)	141.30		100.86								
Weight of Sample for Density (lbs)											
Diameter (in)											
Length(in)											
Moisture Content (%)	14.3		27.3								
Organic Content (%)	2.5		4.9								
Wet Density (pcf)											
Dry Density (pcf)											

Boring Number											
Sample Number											
Cup Number											
Weight of Cup (g)											
Weight of Wet Soil and Cup (g)											
Weight of Dry Soil and Cup (g)											
Weight of Soil and Cup After Burn (g)											
Weight of Sample for Density (lbs)											
Diameter (in)											
Length(in)											
Moisture Content (%)											
Organic Content (%)											
Wet Density (pcf)											
Dry Density (pcf)											

Performed by C. Schneider/ N. Merkes

Reviewed by Nicole Merkes

hard hat SERVICES

solutions and action

APPENDIX C – Liquefaction Analysis

Alliant Energy
Wisconsin Power and Light Company
Rock River Generating Station
Beloit, Wisconsin

Safety Factor Assessment

Problem Statement:

Evaluate the liquefaction potential of the sand layers within and below the impoundment perimeter berm induced by an earthquake in accordance with 40 CFR Section 257.73. Liquefaction is most likely to occur in saturated, loose sand layers. Because the saturated soils above the sand layers are primarily silt, the silt layers are not prone to liquefaction and are not included in the liquefaction evaluation.

Given:

- Boring log GT-101.
- Laboratory soil test results for boring GT-101.
- RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities. (refer to attached pages).
- Seed and Harder, *Cyclic Pore Pressure* (refer to attached pages).
- Liao and Whitman, Overburden Correction Factors for SPT in Sand (refer to attached pages).

Assumptions:

- Boring GT101 is located on the berm of the CCR surface impoundment and was advanced to 70 ft below ground surface (bgs). The sand deposits extend from a depth of approximately 17 feet bgs to the end of boring. Groundwater was near 13 ft bgs during drilling. Based on the recorded blow counts in this boring, the calculated average blow count for the saturated sand deposit is 38.
- The effective (F'_F) and total (F_F) overburden stresses were calculated below the top surface of the perimeter berm. To be conservative, these stresses were calculated by assuming the saturated medium dense sands are 1 foot thick. The effective (F'_F) and total (F_F) overburden stresses, are 1907.1 psf and 2187.5 psf (see attached table).
- From the 2014 USGS seismic hazard map, the maximum horizontal acceleration is approximately 0.0500 g.
- From Seed and Harder, the Standardized Penetration Resistance $(N_1)_{60}$ is calculated by the following equation (for stress in tsf):

$$(N_1)_{60} = N \times C_N$$

$$C_N = \sqrt{\frac{1}{\sigma'_F}}$$

- From RCRA, the Cyclic Stress Ratio (CSR), is calculated by the following equation:

$$CSR = \frac{(\tau_H)_{ave}}{\sigma'_F} = (0.65)\frac{(a_{max})(\sigma_F)}{(g)(\sigma'_F)}(r_d)$$

$$r_d = 1 - 0.015D$$

Where,

CSR = Cyclic Stress Ratio
a_{max} = Horizontal acceleration, 0.0500 g
$(\tau_H)_{ave}$ = Static driving shear stress (psf)
g = Acceleration due to gravity, 32.2 ft/sec^2
σ_F = Final total overburden stress (psf)
σ'_F = Final effective overburden stress (psf)
r_d = Stress reduction factor at depth (m)

- The depth (D) is the depth in meters measured from the surface of the saturated medium dense sand layer. To be conservative, we are assuming the saturated medium dense sands are 1 foot thick at this location (when they are estimated to be approximately 250 to 350 feet thick).

Calculations:

See attached tables for calculations.

The calculated CSR of 0.0012 and the average $(N_1)_{60}$ of 38.8 is plotted on Figure 5.5 from Seed and Harder. The point is well below the line of liquefaction potential.

Results:

Results of the liquefaction evaluation indicate that the saturated medium dense sands within and below the impoundment perimeter berm will not liquefy during an earthquake with a horizontal acceleration of 0.0500g.

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ROR CCR Surface Impoundment Stresses by Geologic Layer								
Location / Point	**Layer Description**	**Unit Thickness (ft)**	**Unit Weights (pcf)**		**Bottom-Layer Stresses (psf)**		**Mid-Layer Stresses (psf)**	
			λ_{sat} soil	$\lambda_{bouyant}$ soil	σ' (effective)	σ (total)	σ' (effective)	σ (total)
GT101	Medium Dense Sand & Silt	8.5	125.00	125.00	1,062.50	1,062.50	531.25	531.25
	Medium Stiff Silt with Sand Above Groundwater	4.5	125.00	125.00	1,625.00	1,625.00	1,343.75	1,343.75
	Medium Stiff Silt with Sand Below Groundwater	4.0	125.00	62.70	1,875.80	2,125.00	1,750.40	1,875.00
	Medium Dense Sand	1.0	125.00	62.60			1,907.10	2,187.50

Calculations (Medium Dense Sand)				
N	**C_N (tsf)**	**$(N_1)_{60}$**	**r_d (meters)**	**CSR**
38	1.024	38.8	0.995	0.0012

Prepared by: LAC, 01/26/2026
Reviewed by: DLN, 01/26/2026

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RCRA SUBTITLE D (258)
SEISMIC DESIGN GUIDANCE
FOR
MUNICIPAL SOLID WASTE LANDFILL FACILITIES

Prepared By:

Gregory N. Richardson
G.N. Richardson & Associates
Raleigh, North Carolina 27603

and

Edward Kavazanjian, Jr.
and
Neven Matasović
GeoSyntec Consultants
Huntington Beach, California 92647

PROJECT MANAGER

Robert Landreth
Waste Minimization, Destruction and
Disposal Research Division
Risk Reduction Engineering Laboratory
Cincinnati, Ohio 45268

Risk Reduction Engineering Laboratory
Office of Research and Development
U.S. Environmental Protection Agency
Cincinnati, Ohio 45268

Procedure for evaluating liquefaction potential at the site of a MSWLF can be carried out using the following steps:

Step 1: From in-situ testing and laboratory index tests, develop a detailed understanding of site conditions: stratigraphy, layer geometry, material properties and their variability, and the areal extent of potential problem zones. Establish the most critical zones to be analyzed and develop simplified sections amenable to analysis. The data should include location of the water table, either SPT blowcount, N, or tip resistance of a standard CPT cone, q_c, and mean grain size, D_{50}, the unit weight of the soil, and the percentage of fines (percent by weight passing the No. 200 sieve) for the materials involved in the liquefaction potential assessment.

Step 2: Evaluate the total vertical stress, σ_o, and vertical effective stress, σ_o', in the deposit at the time of exploration and for design. Design values should include the overburden stress due to the landfill. Outside of the waste footprint, the exploration and design values may be the same if the design ground water level is at the same elevation as the ground water was during sampling, or they may be different due to temporal fluctuations in the water table.

Step 3: Evaluate the stress reduction factor, r_d. The stress reduction factor is a soil flexibility factor defined as the ratio of the peak shear stress for the soil column, $(\tau_{max})_d$, to that of a rigid body, $(\tau_{max})_r$. There are several ways to determine r_d. For depths less than 40 ft (12 m), the average value from Figure 5.3 (Seed and Idriss, 1982) can be used. Alternatively, the following equation proposed by Iwasaki et al. (1978) can be used:

$$r_d = 1 - 0.015\,D \qquad (5.1)$$

where D is depth in meters.

If results of a site response analyses (e.g., a SHAKE analysis) are available, r_d can be determined directly from results of such analysis, as:

$$r_d = \frac{(\tau_{max})_{@depth=D}}{(\sigma_o)_{@depth=D} \cdot (a_{max}/g)_{@surface}} \qquad (5.2)$$

where a_{max} is the peak ground surface acceleration and g is the acceleration of gravity.

Use of the results of a site response analysis to evaluate r_d is considered to be generally more reliable than either of the two simplified approaches and is strongly recommended for sites that are marginal with respect to liquefaction potential (sites where the factor of safety for liquefaction is close to 1.0).

Step 4: Calculate the critical stress ratio induced by the design earthquake, CSR_{EQ}, as:

$$CSR_{EQ} = 0.65\ (a_{max}/g)\ r_d\ (\sigma_o/\sigma_o') \quad (5.3)$$

Step 5: Evaluate the *standardized* SPT blowcount, N_{60}. N_{60} is the standard penetration test blowcount for a hammer with an efficiency of 60 percent (60 percent of the nominal SPT energy is delivered to the rods). The "standardized" equipment corresponding to an efficiency of 60 percent is specified in Table 5.4. If nonstandard equipment is used, N_{60} is determined as:

$$N_{60} = N \cdot C_{60} \quad (5.4)$$

where C_{60} is the product of various correction factors. Correction factors recommended by various investigators for some common non-standard SPT configurations are provided in Table 5.3. Alternatively, if CPT data are used, N_{60} can be obtained from the chart relating N_{60} to q_c and D_{50} shown in Figure 5.2 (Seed and De Alba, 1986).

Step 6: Calculate the normalized standardized SPT blowcount, $(N_1)_{60}$. $(N_1)_{60}$ is the standardized blow count normalized to an effective overburden pressure of 1 tsf (2000 psf or 950 kPa) in order to eliminate the influence of confining pressure. The most commonly used way to normalize blowcount is via the correction factor, C_N, shown in Figure 5.4 (Seed et al., 1983). However, the closed-form expression proposed by Liao and Whitman (1986) may also be used:

$$C_N = (1/\sigma_o')^{½} \quad (5.5)$$

where σ_o' equals the vertical effective stress at the sampling point in tons/ft^2.

As illustrated in Figure 5.4, Equation 5.5, and the correction factor curves are valid only for depths greater than 3 m (10 ft). For depths of less than 3 m (10 ft),

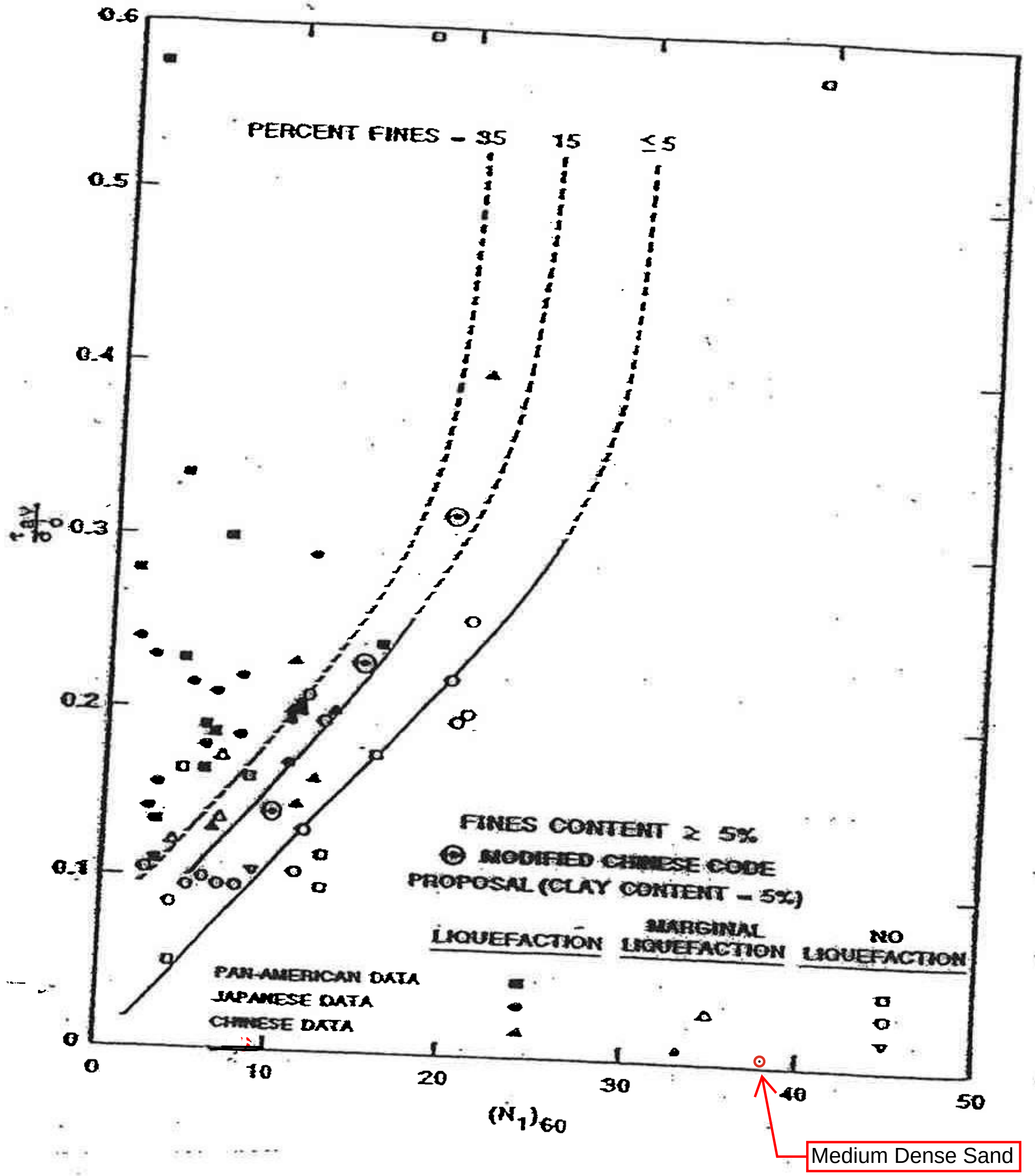

Figure 5.5 Relationships Between Stress Ratio Causing Liquefaction and $(N_1)_{60}$ Values for Sands for M 7.5 Earthquakes (Seed et al., 1985).

Soils below the water table were modelled using effective or "bouyant" unit weights to account for bouyancy in evaluating effective stresses. The effects of seepage forces were evaluated based on an initial flownet analysis from which seepage forces were derived; these were then applied as equivalent nodal forces. The final calculated effective stresses within each element provided the key static stresses (σ'_o and τ_{hv}) necessary for subsequent stages of the overall analytical process.

Seed et al. [1, 4] presented dynamic response analyses of the Lower San Fernando Dam performed in 1972 using the program QUAD4 [14]. Similar analyses were performed more recently using the code FLUSH [15], and the mesh illustrated in Figure 2. Both analyses used static stresses, calculated as described above, as a basis for modelling dynamic shear moduli of cohesionless zones, though slightly different relationships were used to model the nonlinear relationships between shear strain and dynamic shear modulus and damping: [16] for the earlier analyses, and [17] for the more recent analyses. Similarly, the relationships proposed in [16] were used to model strain-dependent moduli and damping in the cohesive zones in the earlier analyses, and [18] in the more recent analyses.

The earlier analyses used the input motions described by Seed et al. [1, 4]: (a) an interpretation of the abutment record by Scott [19], and (b) a modified version of the time history recorded at the Pacoima station during the 1971 San Fernando earthquake. The modifications consisted of trimming of acceleration pulses of greater than 0.9 g, then scaling the record to a maximum horizontal acceleration of 0.6 g, providing a motion in good agreement with Scott's [20] interpretation of the 1971 seismoscope record from the abutment of the Lower San Fernando Dam, but without the unusual low frequency components of the interpreted abutment record. The more recent analyses employed the modified Pacoima input motion scaled to 0.55 g.

The results of the 1973 and 1987 analyses were in close agreement: both produced maximum horizontal crest accelerations on the order of 0.5 to 0.55 g, in good agreement with the actual recorded peak crest accelerations. Both analyses also calculated similar peak cyclic horizontal shear stresses ($\tau_{hv,cyclic}$) within the hydraulic fill zones of the embankment.

It is interesting to note that Jong [20] performed one-dimensional, columnar analyses of individual vertical soil columns through the embankment using the program SHAKE [21]. These analyses, modelling vertical propagation of shear waves and using the same nonlinear soil models and soil parameters as the 2-D FLUSH analyses, significantly underestimated both accelerations and cyclic shear stresses near the crest and upper faces of the embankment. These analyses also, however, provided relatively good agreement with the 2-D dynamic response analyses with regard to cyclic shear stresses ($\tau_{hv,cyclic}$) within the hydraulic fill zones near the base of the embankment, typically calculating peak cyclic shear stresses only 5% to 15% lower than those calculated by the 2-D analyses in these zones.

EVALUATION OF LIQUEFACTION RESISTANCE

Having calculated the cyclic shear stresses resulting from the earthquake loading at each point within the hydraulic fill, the next step is to evaluate the resistance of this material to cyclic pore pressure generation or accumulation of cyclic shear strain. This constitutes evaluation of the resistance to "triggering" or initiation of potential liquefaction failure, defined as sufficient pore pressure or strain accumulation to bring the material to a condition at which undrained residual (or "steady state") strength will control further behavior.

Figure 3 shows a recommended relationship between "corrected" SPT penetration resistance and the equivalent uniform cyclic stress ratio required to "trigger" liquefaction during an earthquake with a duration (or number of loading cycles) representative of a typical earthquake with a magnitude of $M \approx 7\frac{1}{2}$, as suggested by Seed et al. [22, 23]. In this relationship, cyclic stress ratio (CSR) is defined as the ratio of the cyclic shear stress acting on a horizontal plane ($\tau_{hv,c}$) to the initial (pre-earthquake) effective vertical or overburden stress (σ'_o), as $CSR = (\tau_{hv,c})/\sigma'_o$. The relationships presented in Figure 3 represent a significant improvement over earlier, similar relationships developed by Dr. Seed and his colleagues, as (a) they directly account for the influence of fines content on the relationship between penetration resistance and liquefaction resistance, and (b) they are based on a "corrected" or "standardized" SPT penetration resistance.

The standardized penetration resistance $(N_1)_{60}$ is a new "standard" SPT blowcount, based on standardized equipment and procedures as presented (in part) in Table 1 [22, 23]. The use of other types of hammer (e.g. donut hammers), or other types of mechanisms to raise and drop the hammer (e.g. automatic mechanical "trip" hammers, "free fall" hammers, rope and cathead with <u>three</u> turns of the rope about the cathead, etc.), can impart different levels of energy to the top of the drill stem. These non-standard procedures and equipment require correction of the blowcounts in order to develop the standardized blowcount. The $(N_1)_{60}$ "standardized" system and procedures, combined with a "typical" rope and cathead system (with two turns of the rope about the cathead) typically deliver approximately 60% of the theoretical "free fall" hammer energy to the drill stem. For other systems, the measured penetration resistances (N, blows/ft) should be corrected as

$$N_{60} = N \times \frac{ER}{60\%}$$

where ER or energy ratio is the "efficiency" or percent of theoretical free fall energy delivered by the hammer system actually used to the top of the drill stem. This can be measured directly, using a pile analyzer, or can be estimated (for the most common alternate systems in widespread use) based on correlations and data summarized by Seed et al. [22, 23].

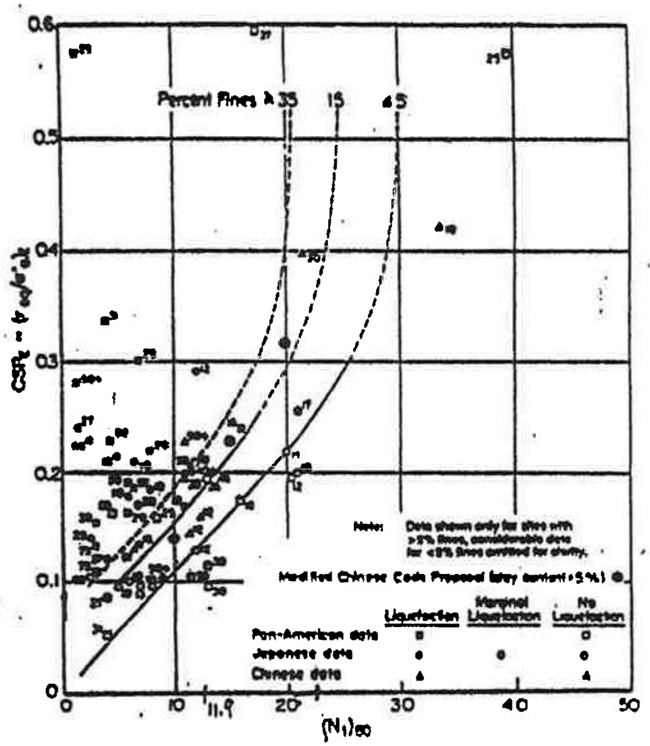

Fig. 3: Relationship Between Cyclic Stress Ratio Causing Liquefaction and N_1-Values for M = 7½ Earthquakes (After Seed, et al., 1984)

Table 1: Recommended "Standardized" SPT Equipment and Procedures (After Seed, et al., 1984)

Sampler:	Std. Sampler with: (a) O.D. = 2.00 inches, and (b) I.D. = 1.375 inches (constant - i.e. no room for liners in the barrel.)
Drill Rods:	A or AW for depths less than 50 feet N or NW for greater depths
Energy Delivered to Sampler:	2520 in.-lbs. (60% of theoretical free fall maximum.)
Blowcount Rate:	30 to 40 blows per minute
Penetration Resistance Count:	Measured over range of 6 to 18 inches of penetration into the ground

An additional correction, increasing the measured N-value by between 10% to 30%, can be necessitated by the use of an ASTM standard sampler configured to accommodate an internal sample liner (tube), but with the liner ommitted. This is fairly common practice in the U.S., and causes a reduction in frictional drag inside the sampler, lowering the blowcounts by about 10% to 30% (increasing percent change with increased blowcount), as summarized by Seed et al. [22, 23] relative to the blowcounts obtained using a standard sampler with a constant inside diameter of 1.375 inches.

Having made any appropriate corrections necessary to develop the standardized blowcount $(N)_{60}$, this penetration resistance must be further corrected to account for effective overburden stress to develop the final, standardized and corrected penetration resistance $(N_1)_{60}$ representative of the "equivalent" penetration resistance at a hypothetical overburden stress of σ'_o = 1 ton/ft^2 (1 kg/cm^2)as:

$$(N_1)_{60} = N_{60} \times c_N$$

Dr. Seed and his colleagues have long recommended a pair of relationships between σ'_o and c_N; one for sandy soils at $D_R \approx$ 40 to 60% and one for $D_R \approx$ 60 to 80%, as shown in Figure 4. An alternate relationship, proposed by Liao and Whitman [24] is $c_N = 1/\sqrt{\sigma'_o}$ where σ'_o is expressed in units of [tons/ft^2]. This provides a relationship intermediate between the two suggested relationships shown in Figure 4, and so eliminates the need to estimate D_R. If D_R must be estimated, for in situ, clean sandy soils not placed recently, the approximate relationship presented in Figure 5 can be used as a guide [25]. This relationship should not be used for freshly-placed soils, or for coarser materials than fine to medium sands.

The relationships between $(N_1)_{60}$ and the equivalent uniform cyclic stress ratio necessary to cause liquefaction (CSR_ℓ) in Figure 3 can be extended to earthquakes of magnitude other than M ≈ 7½ by noting that earthquakes of larger magnitude tend to produce a longer duration of shaking and thus more cycles of loading. Seed et al. [26, 27] present procedures for converting a typical, irregular earthquake-induced cyclic load history to an "equivalent" number of uniform loading cycles with an amplitude equal to 65% of the peak or maximum amplitude of the irregular load history. Processing a large number of recorded earthquake time histories using these techniques, Seed et al. [26, 27] developed the "typical" or average numbers of equivalent uniform loading cycles for different magnitude events shown in Table 2.

For earthquakes of magnitude not equal to 7½, the value of CSR_ℓ determined from Figure 3 can be corrected to develop an estimate of the CSR necessary to cause liquefaction as

$$CSR_{\ell(M=M)} = CSR_{\ell(M=7\frac{1}{2})} \cdot C_M$$

where C_M values are a function of magnitude, as suggested by the first and third columns of Table 2. These values are based on review of a considerable body of laboratory test data [26]. An alternate procedure would be to develop an estimate of the number of equivalent, uniform

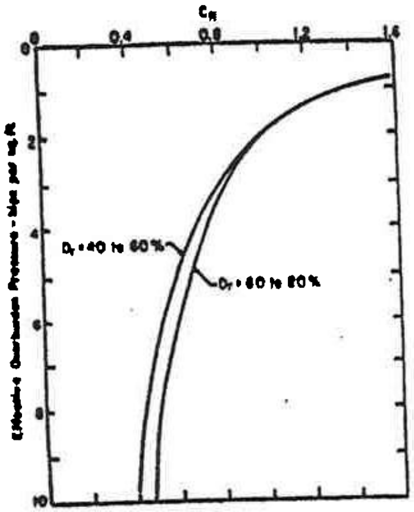

Fig. 4: Chart for Values of C_N

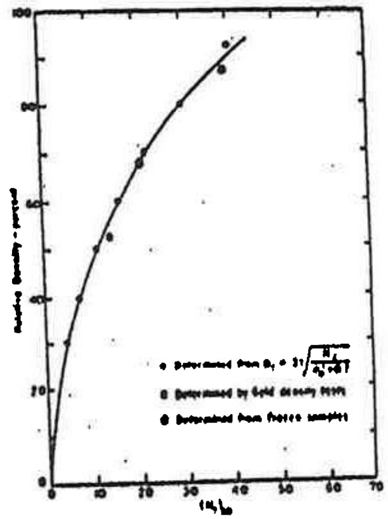

Fig. 5: Approximate Relationship Between D_R and $(N_1)_{60}$. [25]

Table 2: Relationship Between Magnitude, Number of Equivalent Uniform Load Cycles, and Liquefaction Resistance Factor C_M

Earthquake Magnitude, M	No. of representative cycles at 0.65 $\tau_{cyclic, max}$	Magnitude or Duration Correction Factor: C_M
8 1/2	26	0.89
7 1/2	15	1.0
6 3/4	10	1.13
6	5-6	1.32
5 1/4	2-3	1.5

loading cycles representing the earthquake in question (after Seed et al., [27]), and then use the second and third columns of Table 2 to select an appropriate value of C_M. Either of these procedures result in relationships between $(N_1)_{60}$ and CSR_ℓ for earthquakes of other magnitudes than M ≈ 7½ that are in good agreement with available field data [22, 23], though the field (case history) data base is less extensive for events of other ranges of magnitude.

Virtually all of the field (case history) data reflected in Figure 3 (and in similar collections of data for other magnitude ranges) are for level ground conditions and relatively shallow soils with relatively small initial effective

overburden stresses. At higher effective overburden stresses, a given CSR and number of loading cycles will be more damaging. This is because while soils generally develop higher cyclic load resistance with increasing confinement, the <u>normalized</u> resistance as expressed in terms of cyclic stress ratio usually decreases with increasing confinement. Accordingly, values of CSR_ℓ from Figure 3 can be used for in situ conditions where $\sigma'_o \leq$ 1 ton/ft² (1 kg/cm²), but must be corrected for conditions with initial effective overburden stresses greater than 1 ton/ft² as

$$CSR_{\ell(\sigma'_o = \sigma'_o)} = CSR_{\ell(\sigma'_o = 1\,tsf)} \cdot K_\sigma$$

A recommended relationship between K_σ and σ'_o is presented in Figure 6, based on data summarized by Harder [28].

Finally, all of the above has been based on "level ground conditions", or conditions in which there is no static "driving" shear stress acting on a horizontal plane in the soil. Generation of pore pressures and accumulation of shear strains under cyclic loading can be significantly affected by the presence of a static (non-cyclic) driving shear stress, and this too must be accounted for in analysis of liquefaction resistance within dams and embankments.

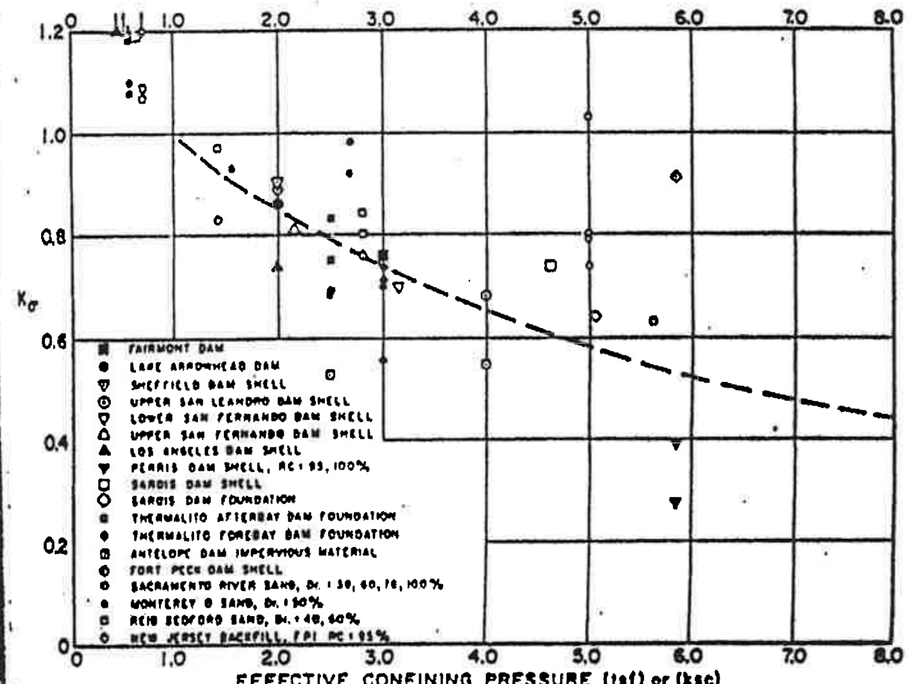

Fig. 6: Relationship Between Effective Vertical Stress (σ'_o) and K_σ

portion of the test data for which grain size characteristics were determined. It is noted that although the fines content varied considerably for the two sands, the mean grain diameter was nearly always about 0.2 mm, with a standard deviation of only 0.04 mm.

The generated plot indicates that if the presence of fines were to increase from 6% to 30%, by dry weight and for the same mean grain diameter, the ratio q_c/N could drop by half. Finally, if the entire data bank were to be examined, realizing that the natural sand has, typically, about double the amount of fines as the fill sand, a similar conclusion can be drawn regarding the significant effect of the fines content on the q_c/N ratio.

Conclusions

The relationship between q_c/N and the mean soil grain diameter presented by Robertson and Campanella (3) represents a good average for sands with low fines content (less than 10%). Such correlations should take into account conditions that would cause variability in either the cone, the SPT results, or both.

Data from a site in Alameda, CA indicates that the ratio q_c/N is significantly less for sands with higher fine contents than for mostly clean sands. It appears that this difference is primarily related to the dominant effects of the fines fraction of the permeability and, hence, pore pressure distribution and the modification of the compressibility and ductility characteristics of these sands.

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The data do not indicate that the q_c/N ratio is a function of the numerical value of the cone tip resistance.

It is suggested that variations in the q_c/N ratio from established generalized correlations of this type be considered when conducting analyses that are correlation based, such as the proposed empirical procedure by Robertson and Campanella (3) for liquefaction analyses, and also for those cases where conversion of cone penetration test data to standard penetration test blow count is being made for studies of settlement, seismically induced pore pressures, and others, where the current field experience is heavily weighted in favor of the standard penetration test.

Acknowledgment

The cooperation of Harbor Bay Isle Associates and Doric Development, Inc. is greatly appreciated.

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Overburden Correction Factors for SPT in Sand

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Introduction

The need for normalizing or correcting the results of the standard penetration test in sands to account for overburden was first clearly demonstrated by the data published by Gibbs and Holtz (1957). Since then, the correction for overburden has become a standard aspect of calculations of settlements on sand and liquefaction potential. Several formulae and charts for making the correction have been published. However, depending on *which* published correction factor is used, very different interpretations may result. The purpose of this technical note is to try to clarify and resolve some of these differences, and to propose a simple formula for the correction factor.

The experimental basis for the correction factors rests for the most part on data for normally consolidated, uncemented, unaged, primarily quartz, clean sands. Further research is required for the range of soils in general.

Published Correction Factors

The SPT correction factor C_N is defined as the ratio of the SPT resistance measured at a given effective vertical stress level σ_v to the resistance measured at a standard stress level $(\bar{\sigma}_v)_{ref}$, usually 1 ton/sq ft or equivalently 1 kg/cm². In practice, the SPT resistance N is measured and then normalized or corrected to N_1 using the equation

$$N_1 = C_N N \quad (1)$$

The commonly used overburden correction factors that have been published in the literature are summarized in Table 1 and plotted in Fig. 1.

Inconsistent Correction Factors.—Fig. 1(*a*) shows the wide range of correction factors that are available in the literature. The Teng (1962) equation plots to the right of all the other correction factors simply because its reference stress level $(\sigma_v)_{ref}$ is at approximately 2.9 tsf (40 psi), whereas the other curves are standardized at 1.0 tsf. The use of different stress levels for standardization of the SPT N-value does not present a conflict, as long as empirical correlations associated with each are consistently applied. For example, if liquefaction criteria are established from data using a correction based on a certain $(\bar{\sigma}_v)_{ref}$, then future evaluations

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Note.—Discussion open until August 1, 1986. To extend the closing date one month, a written request must be filed with the ASCE Manager of Journals. The manuscript for this paper was submitted for review and possible publication on September 5, 1985. This paper is part of the *Journal of Geotechnical Engineering*, Vol. 112, No. 3, March, 1986. ©ASCE, ISSN 0733-9410/86/0003-0373/$01.00. Paper No. 20479.

TABLE 1.—Summary of Published Correction Factors

Reference (1)	Correction factor C_N (2)	Units of $\bar{\sigma}_v$ (3)
Teng (1962)	$C_N = \dfrac{50}{10 + \bar{\sigma}_v}$	psi
Bazaraa (1967)	$C_N = \begin{cases} \dfrac{4}{1 + 2\bar{\sigma}_v} & \sigma_v \le 1.5 \\ \dfrac{4}{3.25 + 0.5\bar{\sigma}_v} & \bar{\sigma}_v > 1.5 \end{cases}$	ksf
Peck, Hansen, and Thornburn (1974)	$C_N = 0.77 \log_{10} \dfrac{20}{\bar{\sigma}_v}$	tsf
Seed (1976)	$C_N = 1 - 1.25 \log_{10} \bar{\sigma}_v$	tsf
Seed (1979)	See Fig. 1(*b*)	tsf
Tokimatsu and Yoshimi (1983)	$C_N = \dfrac{1.7}{0.7 + \bar{\sigma}_v}$	kg/cm²

should use the same correction factor.

The Teng (1962) correction is also frequently referred to as the Gibbs and Holtz correction factor. Although the interpretation of Terzaghi and Peck's (1948) classifications of SPT resistance as a function of relative density, which led to this particular correction, originated with Gibbs and Holtz (1957), the actual equation for the correction factor can be attributed to Teng (1962).

The leftmost curve in Fig. 1(*a*) is that presented by Seed (1976). This correction factor is very conservative especially at high overburden pressures, and in fact, becomes negative for $\bar{\sigma}_v > 6.3$ tsf. Seed (1979) has since revised his recommendations for C_N, based particularly on the data from Marcuson and Bieganousky (1977a, 1977b). Even so, the earlier Seed

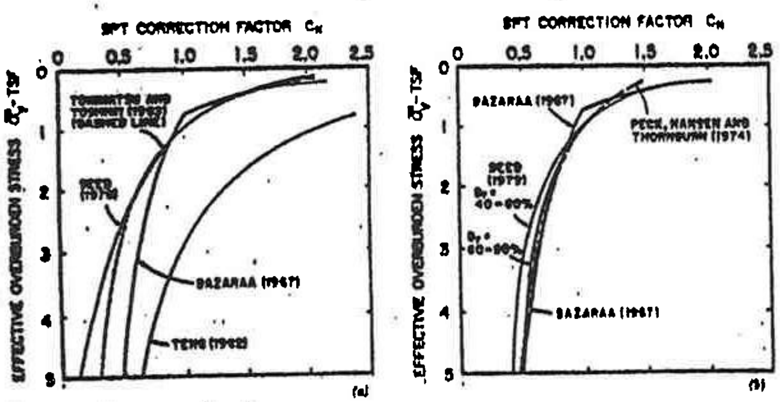

FIG. 1.—Comparison of Published Corrections Factors: (*a*) Inconsistent Correction Factors; (*b*) Consistent Correction Factors

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(1976) correction factor may still be in use, though this practice ld be discouraged.

The correction factor presented by Tokimatsu and Yoshimi (1983) is based on Meyerhoff (1957) and is also somewhat conservative for $\bar{\sigma}_v >$ 1.5 tsf. Tokimatsu and Yoshimi propose that this is justified because of a reduction in the energy reaching the SPT sampler for the longer rod lengths and depths corresponding to higher values of $\bar{\sigma}_v$. However, this constitutes a mixing of the different effects of overburden and energy transmission, which would be better taken care of, in the writers' opinion, by accounting *separately* for these effects using a formulation similar to that proposed by Kovacs, et al. (1984), or Seed, et al. (1985). Based on the available data, it appears that the correction factor C_N is independent of hammer energy, even though relative density correlations may be affected.

Consistent Correction Factors.—Fig. 1(*b*) shows the Bazaraa (1967), Peck, Hansen, and Thornburn (1973) and the Seed (1979) correction factors. The Bazaraa (1967) correction factor has a slope discontinuity and does not equal 1 at $\bar{\sigma}_v = 1$ tsf. It is shown in both Figs. 1(*a–b*) as a reference for comparison. The Seed (1979) correction curves are based on the data presented by Marcuson and Bieganousky (1977b), which show a dependence not only on $\bar{\sigma}_v$, but also on the relative density D_r. The curves in Fig. 1(*b*) all fall within a fairly narrow band of values. Thus for engineering applications, and considering the statistical errors associated with the SPT, these correction factors may be considered to be practically equivalent.

Proposed Correction Factor

Standardization.—In view of the recent efforts at promoting stricter standardization of the SPT (e.g., Kovacs and Salamone 1982; Kovacs, et al. 1984; and Seed et al. 1984), it is proposed that standards of common interpretation of overburden correction factors should also be desirable. Thus it is recommended that the Teng (1962) correction factor should be phased out of usage, because its standard stress level is set too high at $(\bar{\sigma}_v)_{ref} = 2.9$ tsf. It is also recommended that the Seed (1976) and Tokimatsu and Yoshimi (1983) correction factors should not be used, or at least be restricted for use to $\sigma_v \le 1.5$ tsf, because of their conservative values for $\sigma_v > 1.5$ tsf. *Use of any of the correction factors shown in Fig. 1(b) is acceptable and would lead to at least a temporary standard of interpretation and fairly consistent results.* However, a simple correction factor, which is comparable to any of those in Fig. 1(*b*) is proposed as:

$$C_N = \sqrt{\frac{1}{\bar{\sigma}_v}} \quad (\bar{\sigma}_v \text{ in tsf or kg/cm}^2) \qquad (2)$$

Comparison of this correction factor with the Bazaraa (1967) and the Seed (1979) correction factors is shown in Fig. 2.

Other Rationale.—The mathematical form of the proposed correction factor is not new. More generally, the form can be written as

$$C_N = \left[\frac{(\bar{\sigma}_v)_{ref}}{\bar{\sigma}_v}\right]^k \qquad (3)$$

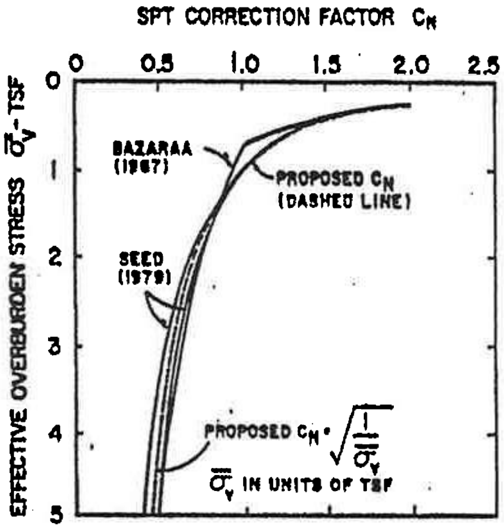

FIG. 2.—Comparison of Proposed C_N with Bazaraa (1967) and Seed (1969) Correction Factors

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where k is a parameter to be obtained by fitting to test data. Al-Akwati (1975), Fardis and Veneziano (1981), and Baldi, et al. (1985) have fitted data from static and dynamic penetration tests to Eq. 3 or to a similar form. Their results indicate k to vary between 0.4 to 0.6 depending on the data used and the method of regression. Baldi, et al. (1985) indicate slightly higher values of k for cone penetration data with a mean k = 0.72.

It is probable that the coefficient k is a function of relative density, as suggested by Marcuson and Bieganousky (1977b) and Seed (1979), and possibly other factors as well. However, as a practical matter, considering the relative crudeness and the accuracy (or lack thereof) with which the penetration resistance can be measured, k = 0.5 or Eq. 2 is considered to be appropriate as a tentative recommendation.

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APPENDIX D – Slope Stability Analysis

Alliant Energy
Wisconsin Power and Light Company
Rock River Generating Station
Beloit, Wisconsin

Safety Factor Assessment

March 9, 2026
File No. 25220100.00

TECHNICAL MEMORANDUM

ANALYSIS PREPARED BY:	Lukas Charmelo Brandon Suchomel
ANALYSIS REVIEWED BY:	Deb Nelson
SUBJECT:	Embankment Slope Stability Analysis ROR Final WPDES Settling Pond Rock River Generation Station, Beloit, Wisconsin

PURPOSE

The purpose of this memorandum is to summarize the analyses performed for the safety factor assessment of the existing embankments of the Final Wisconsin Pollutant Discharge Elimination System (WPDES) Settling Pond at the Rock River Generating Station. The Final WPDES Settling Pond is a legacy Coal Combustion Residual (CCR) surface impoundment and is subject to the requirements under 40 CFR 257.73(e) which requires evaluation of the following:

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

CONCLUSION

The attached results confirm that geometry and material properties of the Final WPDES Settling Pond embankment have a calculated Factor of Safety (FS) that meet the minimum recommended FS under 40 CFR 257.73(e) for the following condition:

- The calculated seismic factor of safety equals or exceeds 1.00.
- The calculated static factor of safety under the maximum surcharge pool loading condition equals or exceeds 1.40.

The attached results show that the geometry and material properties of the Final WPDES Settling Pond embankment has a calculated FS values that does not meet the minimum recommended FS for the following conditions:

- The calculated static factor of safety under the long-term, maximum storage pool loading condition does not equal or exceed 1.50.

A separate analysis shows that the embankment and foundation soils are not susceptible to liquefaction.

APPROACH

The Final WPDES Settling Pond embankment was evaluated at the post-CCR excavation conditions which were completed as of October 2025. Analysis was performed at the most critical/highest embankment height location through the southern embankment adjacent to the Rock River.

- (i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.
  - Under normal operations the Final WPDES Settling Pond is dry. Water levels in the soil under the embankment and in the Rock River were assumed to be at the same elevation. The average water level measurements from November 2025 through February 2026 in the monitoring wells around the Final WPDES Settling Pond of approximately 744 feet elevation were used in the analysis.
- (ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.
  - Maximum surcharge storage pool is 750 ft elevation (see Reference 11). Water levels in the soil under the embankment and in the Rock River were assumed to be at the same elevation. The average water level measurements from November 2025 through February 2026 in the monitoring wells around the Final WPDES Settling Pond of approximately 744 feet elevation were used in the analysis.
- (iii) The calculated seismic factor of safety must equal or exceed 1.00.
  - Evaluated psuedostatic analysis utilizing earthquake horizontal coefficient of 0.05 g and vertical coefficient of 0.05 g (see Reference 10). Water levels in the soil under the embankment and in the Rock River were assumed to be at the same elevation. The average water level measurements from November 2025 through February 2026 in the monitoring wells around the Final WPDES Settling Pond of approximately 744 feet elevation were used in the analysis.
- (iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.
  - The embankment and foundation soils are not susceptible to liquefaction (see Reference 12).

Section Setup

The south embankment consists of medium dense sand and silt fill overlying medium stiff silt with sand fill overlying medium dense sand native alluvial and glacial outwash material (see Reference 4 and 5). A drill rig could not safely be positioned on the embankment to perform a geotechnical boring with standard penetration test/split spoon sampling. Borings were conducted at the west and east ends of the embankment and the findings were consistent with each other. The south embankment and underlying soils were identified to be consistent such that properties used to analyze the critical section through the south embankment near the center of the berm were appropriate (see Figure 1).

The geometry of the analyzed section was generalized based on 2025 survey data of the site (see Reference 2). Embankment slopes are approximately 1.5H:1V on the interior side and approximately 1.5H:1V on the exterior/Rock River side. The exterior/Rock River slope was assumed to continue at the same upper embankment slope down to the estimated Rock River bottom grades (see Reference 8 and 9)

Average water level measurements from November 2025 through February 2026 in the monitoring wells around the Final WPDES Settling Pond were used to represent the piezometric conditions in the soils underlying the embankment under normal conditions and long-term conditions. The water level pool for the exterior Rock River side of the embankment was assumed to match the elevation in the soils underlying the embankment as groundwater in the soils under the Final WPDES Settling Pond are hydraulically connected to the Rock River. The surcharge pool water level is 750 feet elevation (see Reference 11) on the interior of the embankment. Analysis during different pool and flood loading conditions assumed the piezometric conditions followed a linear gradient through the embankment.

ASSUMPTIONS

The analyses were performed with the following assumptions:

- Water level and piezometric conditions are appropriate for the current site condition understanding.

- Circular slip surface failure stability analyses are appropriate to evaluate the slope stability.

- Material properties shown in the attached *Material Properties and Factor of Safety Results Summary* tables are based on the indicated references, laboratory soil test results for boring GT-101, and assumed values based on experience. Friction angles for soils are conservative assumed values based on soil type, published typical values (UFC DM 7.1), and SCS experience.

RESULTS

The calculated safety factors for each slope section and failure type are shown in the attached *Material Properties and Factor of Safety Results Summary* table.

REFERENCES

1. Geo-Slope International, Ltd., GeoStudio 2024.2.1, Slope/W slope stability software.
2. SCS Engineers, Rock River Ash Disposal Landfill Final Settling Pond CCR Removal Construction Documentation Drawings, November 2025.
3. SCS Engineers, Rock River Generating Station Settling Pond Abandonment and Landfill Closure Construction Documentation Drawings, October 2015.
4. SCS Engineers, GT101 and GT102 Geotechnical Borings, drilled November 2025.
5. GESTRA Engineering, Inc., Laboratory Test Report for Borings GT101 and GT102, December 19, 2025.
6. Unified Facilities Criteria, Soil Mechanics (DM 7.1) UFC 3-220-10, 1 February 2022, US Department of Defense, Chapter 8 Correlations for Soil and Rock (Correlations with Standard Penetration Test).
7. SCS Engineers, Rock River Generating Station Liquefaction Analysis, December 2025.
8. FEMA, Rock County, Wisconsin Flood Insurance Study, September 16, 2015.
9. FEMA, National Flood Insurance Flood Insurance Rate Map for Rock County, Wisconsin and Incorporated Areas, Maps 55105C0308E and 55105C0309E, September 18, 2020.
10. USGS Seismic Impact Zones Map, Two-Percent probability of exceedance in 50 years, 2014.
11. Hard Hat Services, CCR Surface Impoundment, Inflow Design Flood Control Plan.
12. Hard Hat Services, CCR Surface Impoundment, Safety Factor and Structural Stability Assessment.

Attachments: Calculations organized as follows:

- Analysis Section Location Figure
- Material Properties and Factor of Safety Summary Results Table
- Slope/W Outputs

BSS/LAC/AJR/DLN/EJN

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LEGEND

- 746 — EXISTING GRADE (1' CONTOUR)
- 745 — EXISTING GRADE (5' CONTOUR)
- RAILROAD TRACKS
- —x—x—x— FENCE
- PAVED ROAD
- UNPAVED ROAD
- CULVERT
- ASH MANAGEMENT AREA
- APPROXIMATE LIMITS OF EXISTING FINAL COVER
- MONITORING WELL
- PIEZOMETER
- STAFF GAUGE
- GEOTECHNICAL SOIL BORING

NOTES:

1. HORIZONTAL DATUM BASED ON WISCONSIN COUNTY COORDINATE SYSTEM, ROCK COUNTY. VERTICAL SITE DATUM REFERENCED TO NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).
2. TOPOGRAPHIC SURVEY AND AERIAL IMAGERY FROM SCS ENGINEERS DRONE FLIGHT ON SEPTEMBER 30, 2025.
3. GT-101 AND GT-102 AND MW-301 TO MW-305 INSTALLED BY HORIZON CONSTRUCTION AND EXPLORATION, LLC AND OVERSEEN BY SCS ENGINEERS ON NOVEMBER 10-13, 2025. LOCATIONS SURVEYED BY BIRRENKOTT SURVEYING ON JANUARY 15, 2026.
4. OTHER MONITORING WELL AND SITE FEATURES BASED ON FINAL SETTLING POND CCR REMOVAL CONSTRUCTION DOCUMENTATION DRAWINGS BY SCS ENGINEERS DATED NOVEMBER 2025.

N

100 0 100

SCALE: 1" = 100'

CROSS SECTION LOCATION

FIGURE 1

SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

ENGINEER

WISCONSIN POWER AND LIGHT
ROCK RIVER ASH DISPOSAL LANDFILL
827 WBR TOWNLINE ROAD
BELOIT, WISCONSIN

SITE

Wisconsin Power and Light Company

CLIENT

PROJECT NO.	25225169.01	DRAWN BY:	AR
DRAWN:	12/10/2025	CHECKED BY:	BSS
REVISED:	03/06/2026	APPROVED BY:	BSS 05/06/2026

I:\25225169.01\Drawings\Slope Stability\1_Section A-A' Location Map.dwg, 3/6/2026 8:53:44 AM

Slope Stability - CCR Surface Impoundment - Section A-A'
Material Properties and Factors of Safety Results Summary
Rock River Generating Station

Material	Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)
Medium Dense Sand & Silt	125	32	0
Medium Dense Sand	125	32	0
Medium Stiff Silt with Sand	125	0	825

Required Minimum Safety Factor (CFR 257.73(e))

FS = 1.5 for normal operating condition

FS = 1.4 for maximum surcharge pool loading condition

FS = 1.0 for seismic factor of safety

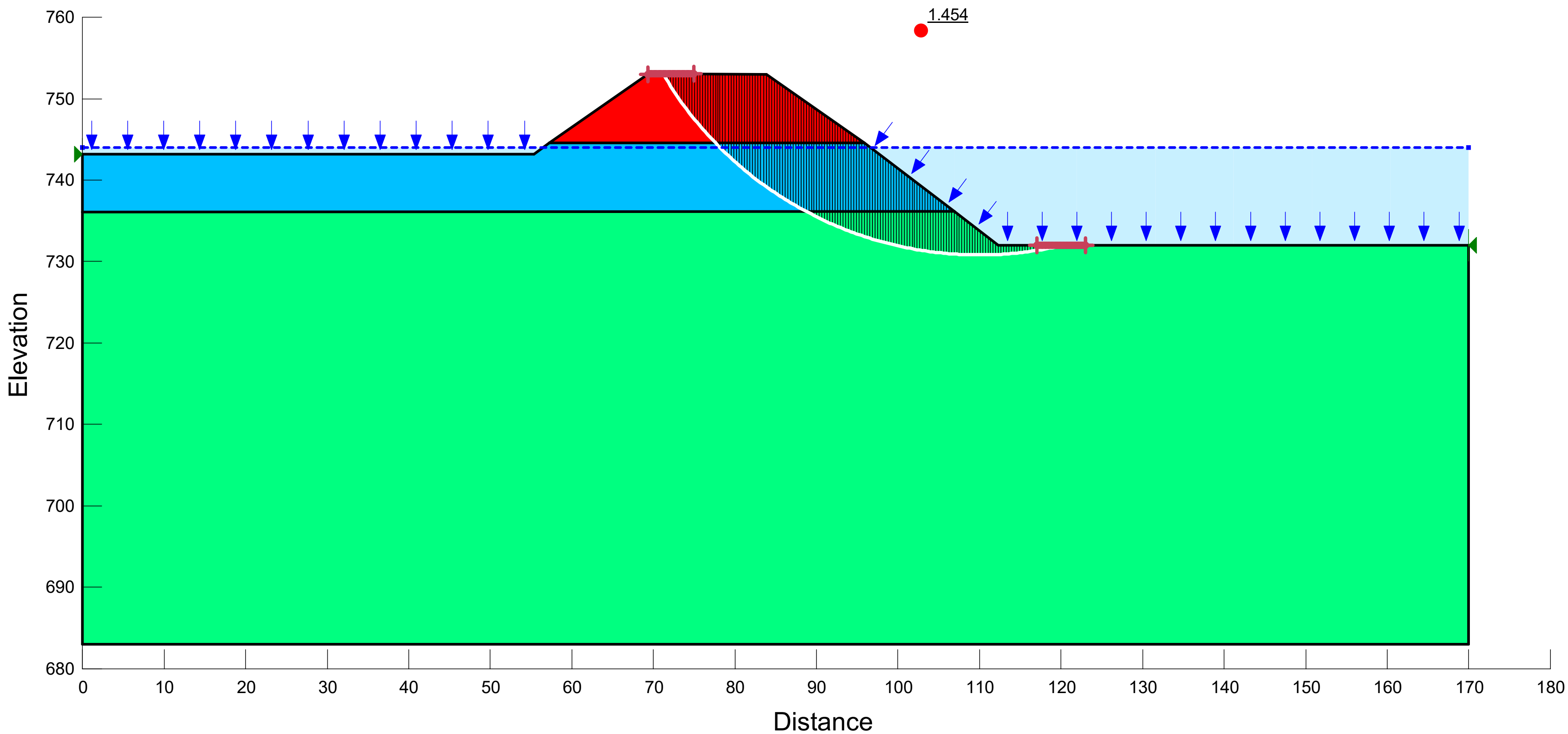
FS = 1.2 for normal operating condition for dikes constructed of soils susceptible to liquefaction

Scenario Analyzed	Failure Type	Calculated Safety Factor	Required Safety Factor	Comments
Section A				
01_ROR A-A' Base Condition	Circular	1.454	1.5	Evaluating Section A-A'. Piezo WL set at normal operation water level of 744 ft.
02_ROR A-A' Base Condition Seismic	Circular	1.266	1.0	Evaluating Section A-A'. Piezo WL set at normal pond water elevation of 744 ft. Seismic horizontal and vertical coefficients: 0.05g
03_ROR A-A' Surcharge Flow Condition	Circular	1.423	1.4	Evaluating Section A-A'. Piezo WL set at surcharge water elevation in pond of 750.0 ft. Piezo WL linear gradient through embankment to exterior normal water elevation of 744 ft.

Notes:
1. Seismic coefficient based on USGS 2014 Seismic Hazard Maps which show the site mapped in the zone of 0.04g-0.06g zone for peak acceleration.
2. Under normal operations the Final WPDES Settling Pond is generally dry. Water level in the soil in the embankment is connected to the river stage of the Rock River and assumed to be at the same elevation. Water levels used in the base condition were based on the average water level measurements from November 2025 through February 2026 in monitoring wells around the Final WPDES Settling Pond which was approximately 744 ft elevation.
3. Maximum surcharge storage pool is 750 ft elevation based on analysis performed for the Inflow Design Flood Control Plan by Hard Hat Services.
4. Liquefaction analysis scenario not conducted as Final WPDES Settling Pond embankments and underlying soils are not susceptible to liquefaction.

Created by: LAC 01/13/2026
Updated by: LAC 03/04/2026
Checked by: BSS 03/06/2026

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
	Medium Dense Sand	Mohr-Coulomb	125	0	32	1
	Medium Dense Sand & Silt	Mohr-Coulomb	125	0	32	
	Medium Stiff Silt with Sand	Mohr-Coulomb	125	825	0	1



Title: ROR Final WPDES Settling Pond Embankment Analysis
Name: 01_ROR A-A'_Base Condition
Directory: I:\25225169.01\Data and Calculations\Geotechnical\Slope Stability\SlopeW\Rock River A Updated.gsz

SCS ENGINEERS

01_ROR A-A'_Base Condition

File Information

- File Version: 11.07
- Product Version: 24.2.1.28
- Title: ROR Final WPDES Settling Pond Embankment Analysis
- Comments: Slope stability for Rock River.
- Created By: Charmelo, Lukas
- Last Edited By: Charmelo, Lukas
- Revision Number: 73
- Date: 03/04/2026
- Time: 11:33:04 AM
- File Name: Rock River A Updated.gsz
- Directory: I:\25225169.01\Data and Calculations\Geotechnical\Slope Stability\SlopeW\
- Last Solved Date: 03/04/2026
- Last Solved Time: 11:33:12 AM

Project Settings

- Unit System: U.S. Customary Units

Analysis Settings

01_ROR A-A'_Base Condition

- Kind: SLOPE/W
- Analysis Type: Bishop
- Settings
  - PWP Conditions from: Piezometric Surfaces
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
  - Unit Weight of Water: 62.430189 pcf
- Slip Surface
  - Direction of movement: Left to Right
  - Use Passive Mode: No
  - Slip Surface Option: Entry and Exit
  - Critical slip surfaces saved: 10
  - Optimize Critical Slip Surface Location: No
  - Tension Crack Option: (none)
- Distribution
  - F of S Calculation Option: Constant
- Convergence
  - Geometry Settings
    - Minimum Slip Surface Depth: 0.1 ft
    - Minimum Slip Surface Volume: 35.314667 ft³
    - Number of Columns: 150
  - Factor of Safety Convergence Settings
    - Maximum Number of Iterations: 100
    - Tolerable difference in F of S: 0.001

Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50

Materials

Medium Dense Sand

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Medium Dense Sand & Silt

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °

Medium Stiff Silt with Sand

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 825 psf
Effective Friction Angle: 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (69.28973, 753) ft
Left-Zone Right Coordinate: (75, 753.06369) ft
Left-Zone Increment: 30
Right Type: Range
Right-Zone Left Coordinate: (117, 732.0006) ft
Right-Zone Right Coordinate: (123, 732.0006) ft
Right-Zone Increment: 30
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 743.21591) ft
Right Coordinate: (170, 732.0006) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	0 ft	744 ft
Coordinate 2	170 ft	744 ft

Geometry

Name: 2D Geometry

Settings

View: 2D
Element Thickness: 1 ft

Points

	X	Y
Point 1	69.40809 ft	753.08311 ft
Point 2	83.83636 ft	753.03301 ft
Point 3	95.83659 ft	744.5572 ft
Point 4	57.26586 ft	744.5572 ft
Point 5	0 ft	736.0572 ft
Point 6	106.87166 ft	736.1612 ft
Point 7	55.35562 ft	743.21591 ft
Point 8	0 ft	743.21591 ft
Point 9	112.31182 ft	732.0006 ft
Point 10	170 ft	732.0006 ft
Point 11	170 ft	683 ft
Point 12	0 ft	683 ft

Regions

	Material	Points	Area
Region 1	Medium Dense Sand & Silt	1,2,3,4	225.27 ft²
Region 2	Medium Stiff Silt with Sand	5,6,3,4,7,8	781 ft²
Region 3	Medium Dense Sand	5,6,9,10,11,12	8,780.5 ft²

Slip Results

Slip Surfaces Analysed: 2883 of 4805 converged

Current Slip Surface

Slip Surface: 1,633
Factor of Safety: 1.454
Volume: 374.25163 ft³
Weight: 46,781.453 lbf
Resisting Moment: 1,002,807 lbf·ft

Activating Moment: 689,812.74 lbf·ft
Resisting Force: 18,586.166 lbf
Activating Force: 13,423.637 lbf
Slip Rank: 1 of 4,805 slip surfaces
Exit: (120.2, 732.0006) ft
Entry: (71.175644, 753.07697) ft
Radius: 44.906492 ft
Center: (109.95409, 775.72261) ft

Slip Columns

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Column Base Material
Column 1	71.33682 ft	752.80537 ft	0 psf	19.653425 psf	12.280823 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 2	71.65918 ft	752.27058 ft	0 psf	59.119128 psf	36.941731 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 3	71.98154 ft	751.75206 ft	0 psf	98.341598 psf	61.450651 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 4	72.30390 ft	751.24877 ft	0 psf	137.29949 psf	85.794243 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 5	72.62626 ft	750.75980 ft	0 psf	175.97593 psf	109.96197 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 6	72.94862 ft	750.28431 ft	0 psf	214.35765 psf	133.94553 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 7	73.27098 ft	749.82156 ft	0 psf	252.43428 psf	157.73844 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 8	73.59334 ft	749.37089 ft	0 psf	290.19779 psf	181.33571 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 9	73.91570 ft	748.93167 ft	0 psf	327.64212 psf	204.73352 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 10	74.23806 ft	748.50337 ft	0 psf	364.76275 psf	227.92906 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 11	74.56042 ft	748.08546 ft	0 psf	401.55645 psf	250.92032 psf	0 psf	0 psf	Medium Dense

								Sand & Silt
Column 12	74.88278 ft	747.67748 ft	0 psf	438.02106 psf	273.70594 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 13	75.20514 ft	747.27901 ft	0 psf	474.15532 psf	296.28513 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 14	75.52750 ft	746.88965 ft	0 psf	509.95865 psf	318.65753 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 15	75.84986 ft	746.50904 ft	0 psf	545.4311 psf	340.82318 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 16	76.17222 ft	746.13684 ft	0 psf	580.57318 psf	362.78239 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 17	76.49458 ft	745.77273 ft	0 psf	615.38583 psf	384.53574 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 18	76.81694 ft	745.41643 ft	0 psf	649.8703 psf	406.08403 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 19	77.13930 ft	745.06765 ft	0 psf	684.02812 psf	427.42821 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 20	77.46166 ft	744.72616 ft	0 psf	717.86104 psf	448.56936 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 21	77.75947 ft	744.41669 ft	-26.013987 psf	496.41273 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 22	78.03273 ft	744.13809 ft	-8.6209369 psf	541.17099 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 23	78.33604 ft	743.83473 ft	10.317585 psf	589.80653 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 24	78.66939 ft	743.50761 ft	30.740309 psf	642.1324 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand

Column 25	79.00275 ft	743.18718 ft	50.744453 psf	693.27621 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 26	79.33610 ft	742.87327 ft	70.34227 psf	743.28259 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 27	79.66945 ft	742.56567 ft	89.545303 psf	792.19317 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 28	80.00280 ft	742.26423 ft	108.36445 psf	840.04684 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 29	80.33616 ft	741.96877 ft	126.80998 psf	886.87998 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 30	80.66951 ft	741.67914 ft	144.89165 psf	932.72672 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 31	81.00286 ft	741.39519 ft	162.61865 psf	977.61905 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 32	81.33622 ft	741.11678 ft	179.99972 psf	1,021.5871 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 33	81.66957 ft	740.84378 ft	197.04315 psf	1,064.6591 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 34	82.00292 ft	740.57607 ft	213.7568 psf	1,106.8619 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 35	82.33627 ft	740.31351 ft	230.14816 psf	1,148.2205 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 36	82.66963 ft	740.05601 ft	246.22435 psf	1,188.7589 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 37	83.00298 ft	739.80344 ft	261.99214 psf	1,228.4995 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 38	83.33633 ft	739.55571 ft	277.458 psf	1,267.4636 psf	0 psf	825 psf	0 psf	Medium Stiff Silt

								with Sand
Column 39	83.66968 ft	739.31271 ft	292.6281 psf	1,305.6715 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 40	83.99977 ft	739.07665 ft	307.36539 psf	1,328.4256 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 41	84.32660 ft	738.84735 ft	321.6809 psf	1,335.7585 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 42	84.65342 ft	738.62234 ft	335.7282 psf	1,342.4166 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 43	84.98025 ft	738.40155 ft	349.51212 psf	1,348.4154 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 44	85.30707 ft	738.18491 ft	363.03733 psf	1,353.7698 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 45	85.63390 ft	737.97233 ft	376.30827 psf	1,358.4939 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 46	85.96072 ft	737.76377 ft	389.32922 psf	1,362.6011 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 47	86.28755 ft	737.55914 ft	402.10427 psf	1,366.1043 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 48	86.61438 ft	737.35838 ft	414.63736 psf	1,369.016 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 49	86.94120 ft	737.16145 ft	426.93227 psf	1,371.3477 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 50	87.26803 ft	736.96826 ft	438.99264 psf	1,373.111 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 51	87.59485 ft	736.77878 ft	450.82194 psf	1,374.3164 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand

Column 52	87.92168 ft	736.59295 ft	462.42355 psf	1,374.9745 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 53	88.24850 ft	736.41071 ft	473.80069 psf	1,375.0951 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 54	88.57533 ft	736.23202 ft	484.95646 psf	1,374.6877 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 55	88.90005 ft	736.05793 ft	495.82503 psf	1,455.9033 psf	599.92349 psf	0 psf	0 psf	Medium Dense Sand
Column 56	89.22268 ft	735.88835 ft	506.412 psf	1,455.3742 psf	592.9774 psf	0 psf	0 psf	Medium Dense Sand
Column 57	89.54531 ft	735.72209 ft	516.79163 psf	1,454.3432 psf	585.84722 psf	0 psf	0 psf	Medium Dense Sand
Column 58	89.86794 ft	735.55911 ft	526.96649 psf	1,452.8148 psf	578.53421 psf	0 psf	0 psf	Medium Dense Sand
Column 59	90.19057 ft	735.39937 ft	536.93908 psf	1,450.7934 psf	571.03958 psf	0 psf	0 psf	Medium Dense Sand
Column 60	90.51320 ft	735.24283 ft	546.71178 psf	1,448.2834 psf	563.36446 psf	0 psf	0 psf	Medium Dense Sand
Column 61	90.83583 ft	735.08946 ft	556.28691 psf	1,445.2886 psf	555.50993 psf	0 psf	0 psf	Medium Dense Sand
Column 62	91.15846 ft	734.93921 ft	565.66669 psf	1,441.813 psf	547.47699 psf	0 psf	0 psf	Medium Dense Sand
Column 63	91.48109 ft	734.79206 ft	574.85328 psf	1,437.8602 psf	539.26659 psf	0 psf	0 psf	Medium Dense Sand
Column 64	91.80372 ft	734.64797 ft	583.84875 psf	1,433.4337 psf	530.87962 psf	0 psf	0 psf	Medium Dense Sand
Column 65	92.12635 ft	734.50691 ft	592.6551 psf	1,428.5369 psf	522.31692 psf	0 psf	0 psf	Medium Dense Sand
Column 66	92.44898 ft	734.36885 ft	601.27428 psf	1,423.1729 psf	513.57926 psf	0 psf	0 psf	Medium Dense Sand
Column 67	92.77161 ft	734.23376 ft	609.70816 psf	1,417.3448 psf	504.66737 psf	0 psf	0 psf	Medium Dense Sand
Column 68	93.09424 ft	734.10161 ft	617.95852 psf	1,411.0554 psf	495.58192 psf	0 psf	0 psf	Medium Dense Sand

Column 69	93.41687 ft	733.97237 ft	626.02713 psf	1,404.3075 psf	486.32353 psf	0 psf	0 psf	Medium Dense Sand
Column 70	93.73950 ft	733.84601 ft	633.91565 psf	1,397.1036 psf	476.89276 psf	0 psf	0 psf	Medium Dense Sand
Column 71	94.06213 ft	733.72251 ft	641.62573 psf	1,389.4463 psf	467.29013 psf	0 psf	0 psf	Medium Dense Sand
Column 72	94.38476 ft	733.60184 ft	649.15892 psf	1,381.3378 psf	457.51611 psf	0 psf	0 psf	Medium Dense Sand
Column 73	94.70739 ft	733.48399 ft	656.51674 psf	1,372.7803 psf	447.57114 psf	0 psf	0 psf	Medium Dense Sand
Column 74	95.03002 ft	733.36891 ft	663.70066 psf	1,363.7759 psf	437.45557 psf	0 psf	0 psf	Medium Dense Sand
Column 75	95.35265 ft	733.25661 ft	670.71209 psf	1,354.3266 psf	427.16973 psf	0 psf	0 psf	Medium Dense Sand
Column 76	95.67528 ft	733.14704 ft	677.5524 psf	1,344.4341 psf	416.71392 psf	0 psf	0 psf	Medium Dense Sand
Column 77	96.01968 ft	733.03318 ft	684.66087 psf	1,332.2806 psf	404.67774 psf	0 psf	0 psf	Medium Dense Sand
Column 78	96.38585 ft	732.91538 ft	692.01468 psf	1,317.7844 psf	391.02435 psf	0 psf	0 psf	Medium Dense Sand
Column 79	96.72991 ft	732.80775 ft	698.73448 psf	1,310.399 psf	382.21044 psf	0 psf	0 psf	Medium Dense Sand
Column 80	97.05187 ft	732.70985 ft	704.84601 psf	1,310.2645 psf	378.30744 psf	0 psf	0 psf	Medium Dense Sand
Column 81	97.37383 ft	732.61459 ft	710.79355 psf	1,309.7682 psf	374.28093 psf	0 psf	0 psf	Medium Dense Sand
Column 82	97.69579 ft	732.52193 ft	716.57818 psf	1,308.9114 psf	370.13089 psf	0 psf	0 psf	Medium Dense Sand
Column 83	98.01775 ft	732.43186 ft	722.20094 psf	1,307.695 psf	365.85727 psf	0 psf	0 psf	Medium Dense Sand
Column 84	98.33971 ft	732.34438 ft	727.66284 psf	1,306.1198 psf	361.46002 psf	0 psf	0 psf	Medium Dense Sand
Column 85	98.66167 ft	732.25945 ft	732.96485 psf	1,304.1867 psf	356.93902 psf	0 psf	0 psf	Medium Dense Sand
Column 86	98.98363 ft	732.17707 ft	738.10791 psf	1,301.8964 psf	352.29417 psf	0 psf	0 psf	Medium Dense Sand

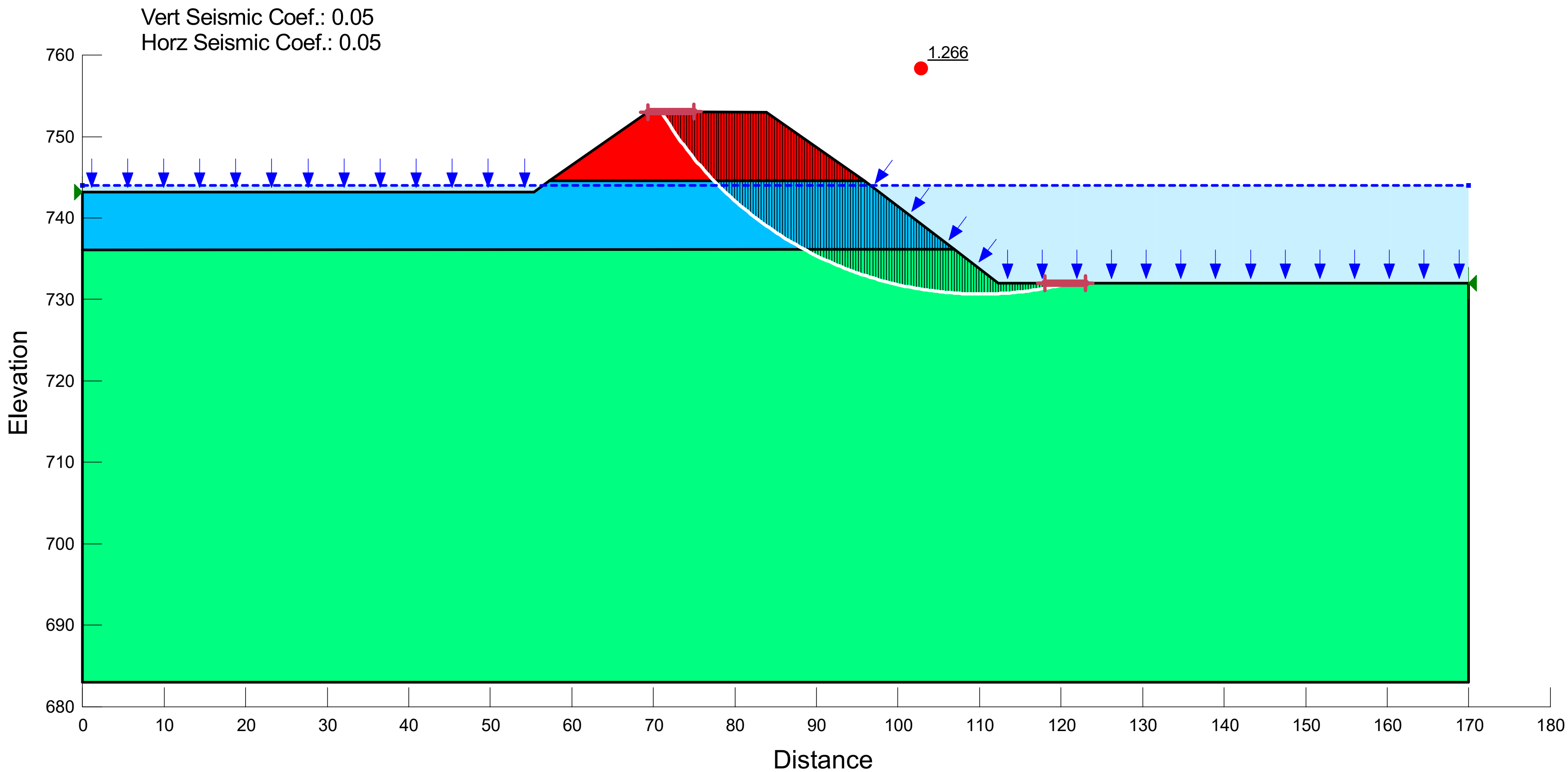
Column 87	99.30559 ft	732.09722 ft	743.09292 psf	1,299.2497 psf	347.52531 psf	0 psf	0 psf	Medium Dense Sand
Column 88	99.62755 ft	732.01989 ft	747.92075 psf	1,296.247 psf	342.63227 psf	0 psf	0 psf	Medium Dense Sand
Column 89	99.94951 ft	731.94506 ft	752.59223 psf	1,292.8889 psf	337.61483 psf	0 psf	0 psf	Medium Dense Sand
Column 90	100.27147 ft	731.87272 ft	757.10815 psf	1,289.1758 psf	332.47279 psf	0 psf	0 psf	Medium Dense Sand
Column 91	100.59343 ft	731.80287 ft	761.4693 psf	1,285.1081 psf	327.20587 psf	0 psf	0 psf	Medium Dense Sand
Column 92	100.91540 ft	731.73548 ft	765.67639 psf	1,280.6861 psf	321.81379 psf	0 psf	0 psf	Medium Dense Sand
Column 93	101.23736 ft	731.67055 ft	769.73016 psf	1,275.91 psf	316.29626 psf	0 psf	0 psf	Medium Dense Sand
Column 94	101.55932 ft	731.60806 ft	773.63126 psf	1,270.7798 psf	310.65291 psf	0 psf	0 psf	Medium Dense Sand
Column 95	101.88128 ft	731.54801 ft	777.38034 psf	1,265.2958 psf	304.8834 psf	0 psf	0 psf	Medium Dense Sand
Column 96	102.20324 ft	731.49038 ft	780.97804 psf	1,259.4578 psf	298.98732 psf	0 psf	0 psf	Medium Dense Sand
Column 97	102.52520 ft	731.43517 ft	784.42493 psf	1,253.2658 psf	292.96426 psf	0 psf	0 psf	Medium Dense Sand
Column 98	102.84716 ft	731.38236 ft	787.72158 psf	1,246.7196 psf	286.81377 psf	0 psf	0 psf	Medium Dense Sand
Column 99	103.16912 ft	731.33195 ft	790.86853 psf	1,239.8189 psf	280.53535 psf	0 psf	0 psf	Medium Dense Sand
Column 100	103.49108 ft	731.28394 ft	793.86629 psf	1,232.5636 psf	274.12851 psf	0 psf	0 psf	Medium Dense Sand
Column 101	103.81304 ft	731.23830 ft	796.71533 psf	1,224.9532 psf	267.59271 psf	0 psf	0 psf	Medium Dense Sand
Column 102	104.13500 ft	731.19504 ft	799.41613 psf	1,216.9872 psf	260.92738 psf	0 psf	0 psf	Medium Dense Sand
Column 103	104.45696 ft	731.15415 ft	801.9691 psf	1,208.6652 psf	254.13191 psf	0 psf	0 psf	Medium Dense Sand
Column 104	104.77892 ft	731.11561 ft	804.37465 psf	1,199.9864 psf	247.20568 psf	0 psf	0 psf	Medium Dense Sand

Column 105	105.10088 ft	731.07944 ft	806.63318 psf	1,190.9504 psf	240.14803 psf	0 psf	0 psf	Medium Dense Sand
Column 106	105.42284 ft	731.04561 ft	808.74503 psf	1,181.5562 psf	232.95825 psf	0 psf	0 psf	Medium Dense Sand
Column 107	105.74480 ft	731.01413 ft	810.71053 psf	1,171.803 psf	225.63562 psf	0 psf	0 psf	Medium Dense Sand
Column 108	106.06676 ft	730.98498 ft	812.53 psf	1,161.69 psf	218.17939 psf	0 psf	0 psf	Medium Dense Sand
Column 109	106.38872 ft	730.95817 ft	814.20372 psf	1,151.2162 psf	210.58875 psf	0 psf	0 psf	Medium Dense Sand
Column 110	106.71068 ft	730.93369 ft	815.73196 psf	1,140.3804 psf	202.86287 psf	0 psf	0 psf	Medium Dense Sand
Column 111	107.03166 ft	730.91160 ft	817.11119 psf	1,129.1781 psf	195.00103 psf	0 psf	0 psf	Medium Dense Sand
Column 112	107.35167 ft	730.89188 ft	818.34252 psf	1,117.61 psf	187.00309 psf	0 psf	0 psf	Medium Dense Sand
Column 113	107.67168 ft	730.87445 ft	819.43075 psf	1,105.6803 psf	178.86859 psf	0 psf	0 psf	Medium Dense Sand
Column 114	107.99169 ft	730.85931 ft	820.37606 psf	1,093.3876 psf	170.59657 psf	0 psf	0 psf	Medium Dense Sand
Column 115	108.31170 ft	730.84645 ft	821.17859 psf	1,080.7305 psf	162.18602 psf	0 psf	0 psf	Medium Dense Sand
Column 116	108.63171 ft	730.83588 ft	821.83845 psf	1,067.7073 psf	153.63591 psf	0 psf	0 psf	Medium Dense Sand
Column 117	108.95172 ft	730.82759 ft	822.35576 psf	1,054.3165 psf	144.94516 psf	0 psf	0 psf	Medium Dense Sand
Column 118	109.27173 ft	730.82159 ft	822.7306 psf	1,040.5564 psf	136.11264 psf	0 psf	0 psf	Medium Dense Sand
Column 119	109.59174 ft	730.81787 ft	822.96301 psf	1,026.425 psf	127.13719 psf	0 psf	0 psf	Medium Dense Sand
Column 120	109.91175 ft	730.81643 ft	823.05303 psf	1,011.9207 psf	118.01759 psf	0 psf	0 psf	Medium Dense Sand
Column 121	110.23176 ft	730.81726 ft	823.00068 psf	997.04124 psf	108.75261 psf	0 psf	0 psf	Medium Dense Sand
Column 122	110.55177 ft	730.82038 ft	822.80596 psf	981.78468 psf	99.340932 psf	0 psf	0 psf	Medium Dense Sand

Column 123	110.87178 ft	730.82578 ft	822.46882 psf	966.1488 psf	89.781215 psf	0 psf	0 psf	Medium Dense Sand
Column 124	111.19179 ft	730.83347 ft	821.98922 psf	950.1313 psf	80.072061 psf	0 psf	0 psf	Medium Dense Sand
Column 125	111.51180 ft	730.84343 ft	821.36708 psf	933.72981 psf	70.212023 psf	0 psf	0 psf	Medium Dense Sand
Column 126	111.83181 ft	730.85568 ft	820.60232 psf	916.94182 psf	60.199603 psf	0 psf	0 psf	Medium Dense Sand
Column 127	112.15182 ft	730.87022 ft	819.69481 psf	899.76474 psf	50.033247 psf	0 psf	0 psf	Medium Dense Sand
Column 128	112.47616 ft	730.88730 ft	818.62823 psf	890.01207 psf	44.605572 psf	0 psf	0 psf	Medium Dense Sand
Column 129	112.80483 ft	730.90700 ft	817.3985 psf	887.74721 psf	43.958758 psf	0 psf	0 psf	Medium Dense Sand
Column 130	113.13351 ft	730.92912 ft	816.01766 psf	885.16863 psf	43.210318 psf	0 psf	0 psf	Medium Dense Sand
Column 131	113.46218 ft	730.95366 ft	814.4855 psf	882.27427 psf	42.359123 psf	0 psf	0 psf	Medium Dense Sand
Column 132	113.79085 ft	730.98063 ft	812.80177 psf	879.06203 psf	41.404005 psf	0 psf	0 psf	Medium Dense Sand
Column 133	114.11953 ft	731.01003 ft	810.96619 psf	875.5297 psf	40.34376 psf	0 psf	0 psf	Medium Dense Sand
Column 134	114.44820 ft	731.04187 ft	808.97847 psf	871.675 psf	39.177144 psf	0 psf	0 psf	Medium Dense Sand
Column 135	114.77688 ft	731.07615 ft	806.83827 psf	867.49555 psf	37.902874 psf	0 psf	0 psf	Medium Dense Sand
Column 136	115.10555 ft	731.11288 ft	804.54525 psf	862.98887 psf	36.519625 psf	0 psf	0 psf	Medium Dense Sand
Column 137	115.43422 ft	731.15206 ft	802.09903 psf	858.15239 psf	35.026029 psf	0 psf	0 psf	Medium Dense Sand
Column 138	115.76290 ft	731.19371 ft	799.4992 psf	852.98346 psf	33.420672 psf	0 psf	0 psf	Medium Dense Sand
Column 139	116.09157 ft	731.23782 ft	796.74534 psf	847.4793 psf	31.702094 psf	0 psf	0 psf	Medium Dense Sand
Column 140	116.42025 ft	731.28441 ft	793.83698 psf	841.63703 psf	29.868785 psf	0 psf	0 psf	Medium Dense Sand

Column 141	116.74892 ft	731.33347 ft	790.77364 psf	835.45367 psf	27.919184 psf	0 psf	0 psf	Medium Dense Sand
Column 142	117.07760 ft	731.38503 ft	787.5548 psf	828.92614 psf	25.85168 psf	0 psf	0 psf	Medium Dense Sand
Column 143	117.40627 ft	731.43909 ft	784.17992 psf	822.0512 psf	23.664602 psf	0 psf	0 psf	Medium Dense Sand
Column 144	117.73494 ft	731.49566 ft	780.64843 psf	814.82554 psf	21.356224 psf	0 psf	0 psf	Medium Dense Sand
Column 145	118.06362 ft	731.55474 ft	776.95973 psf	807.24568 psf	18.924761 psf	0 psf	0 psf	Medium Dense Sand
Column 146	118.39229 ft	731.61636 ft	773.11318 psf	799.30804 psf	16.368363 psf	0 psf	0 psf	Medium Dense Sand
Column 147	118.72097 ft	731.68051 ft	769.10812 psf	791.00888 psf	13.685115 psf	0 psf	0 psf	Medium Dense Sand
Column 148	119.04964 ft	731.74721 ft	764.94386 psf	782.34435 psf	10.873034 psf	0 psf	0 psf	Medium Dense Sand
Column 149	119.37831 ft	731.81648 ft	760.61967 psf	773.31043 psf	7.9300648 psf	0 psf	0 psf	Medium Dense Sand
Column 150	119.70699 ft	731.88831 ft	756.1348 psf	763.90295 psf	4.8540778 psf	0 psf	0 psf	Medium Dense Sand
Column 151	120.03566 ft	731.96274 ft	751.48845 psf	754.11758 psf	1.6428646 psf	0 psf	0 psf	Medium Dense Sand

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
	Medium Dense Sand	Mohr-Coulomb	125	0	32	1
	Medium Dense Sand & Silt	Mohr-Coulomb	125	0	32	
	Medium Stiff Silt with Sand	Mohr-Coulomb	125	825	0	1



Title: ROR Final WPDES Settling Pond Embankment Analysis
Name: 02_ROR A-A'_Base Condition_Seismic
Directory: I:\25225169.01\Data and Calculations\Geotechnical\Slope Stability\SlopeW\Rock River A Updated.gsz

SCS ENGINEERS

02_ROR A-A'_Base Condition_Seismic

File Information

File Version: 11.07
Product Version: 24.2.1.28
Title: ROR Final WPDES Settling Pond Embankment Analysis
Comments: Slope stability for Rock River.
Created By: Charmelo, Lukas
Last Edited By: Charmelo, Lukas
Revision Number: 72
Date: 03/04/2026
Time: 11:31:53 AM
File Name: Rock River A Updated.gsz
Directory: I:\25225169.01\Data and Calculations\Geotechnical\Slope Stability\SlopeW\
Last Solved Date: 03/04/2026
Last Solved Time: 11:32:02 AM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

02_ROR A-A'_Base Condition_Seismic

- Kind: SLOPE/W
- Analysis Type: Bishop
- Settings
  - PWP Conditions from: Piezometric Surfaces
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
  - Unit Weight of Water: 62.430189 pcf
- Slip Surface
  - Direction of movement: Left to Right
  - Use Passive Mode: No
  - Slip Surface Option: Entry and Exit
  - Critical slip surfaces saved: 10
  - Optimize Critical Slip Surface Location: No
  - Tension Crack Option: (none)
- Distribution
  - F of S Calculation Option: Constant
- Convergence
  - Geometry Settings
    - Minimum Slip Surface Depth: 0.1 ft
    - Minimum Slip Surface Volume: 35.314667 ft^3
    - Number of Columns: 150
  - Factor of Safety Convergence Settings
    - Maximum Number of Iterations: 100
    - Tolerable difference in F of S: 0.001

Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50

Materials

Medium Dense Sand

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Medium Dense Sand & Silt

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °

Medium Stiff Silt with Sand

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 825 psf
Effective Friction Angle: 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (69.28973, 753) ft
Left-Zone Right Coordinate: (75, 753.06369) ft
Left-Zone Increment: 30
Right Type: Range
Right-Zone Left Coordinate: (118, 732.0006) ft
Right-Zone Right Coordinate: (123, 732.0006) ft
Right-Zone Increment: 30
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 743.21591) ft
Right Coordinate: (170, 732.0006) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	0 ft	744 ft
Coordinate 2	170 ft	744 ft

Seismic Coefficients

Horz Seismic Coef.: 0.05
Vert Seismic Coef.: 0.05

Geometry

Name: 2D Geometry

Settings

View: 2D
Element Thickness: 1 ft

Points

	X	Y
Point 1	69.40809 ft	753.08311 ft
Point 2	83.83636 ft	753.03301 ft
Point 3	95.83659 ft	744.5572 ft
Point 4	57.26586 ft	744.5572 ft
Point 5	0 ft	736.0572 ft
Point 6	106.87166 ft	736.1612 ft
Point 7	55.35562 ft	743.21591 ft
Point 8	0 ft	743.21591 ft
Point 9	112.31182 ft	732.0006 ft
Point 10	170 ft	732.0006 ft
Point 11	170 ft	683 ft
Point 12	0 ft	683 ft

Regions

	Material	Points	Area
Region 1	Medium Dense Sand & Silt	1,2,3,4	225.27 ft^2
Region 2	Medium Stiff Silt with Sand	5,6,3,4,7,8	781 ft^2
Region 3	Medium Dense Sand	5,6,9,10,11,12	8,780.5 ft^2

Slip Results

Slip Surfaces Analysed: 2883 of 4805 converged

Current Slip Surface

Slip Surface: 1,488
Factor of Safety: 1.266
Volume: 381.53069 ft³
Weight: 47,691.336 lbf
Resisting Moment: 1,055,253.7 lbf·ft
Activating Moment: 833,429.3 lbf·ft
Resisting Force: 19,427.21 lbf
Activating Force: 16,224.394 lbf
Slip Rank: 1 of 4,805 slip surfaces
Exit: (121, 732.0006) ft
Entry: (70.984426, 753.07764) ft
Radius: 45.388057 ft
Center: (110.12054, 776.06547) ft

Slip Columns

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Column Base Material
Column 1	71.15460 ft	752.79272 ft	0 psf	20.440477 psf	12.772628 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 2	71.49494 ft	752.23201 ft	0 psf	61.557265 psf	38.465248 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 3	71.83528 ft	751.68896 ft	0 psf	102.4921 psf	64.044171 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 4	72.17562 ft	751.16240 ft	0 psf	143.21597 psf	89.491272 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 5	72.51596 ft	750.65132 ft	0 psf	183.70548 psf	114.79193 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 6	72.85630 ft	750.15478 ft	0 psf	223.94173 psf	139.93432 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 7	73.19664 ft	749.67198 ft	0 psf	263.90946 psf	164.90893 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 8	73.53699 ft	749.20217 ft	0 psf	303.59642 psf	189.7081 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 9	73.87733 ft	748.74468 ft	0 psf	342.9928 psf	214.32569 psf	0 psf	0 psf	Medium Dense

								Sand & Silt
Column 10	74.21767 ft	748.29890 ft	0 psf	382.09077 psf	238.75681 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 11	74.55801 ft	747.86428 ft	0 psf	420.88422 psf	262.99765 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 12	74.89835 ft	747.44030 ft	0 psf	459.36836 psf	287.04521 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 13	75.23869 ft	747.02650 ft	0 psf	497.5396 psf	310.89724 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 14	75.57903 ft	746.62245 ft	0 psf	535.39527 psf	334.55209 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 15	75.91937 ft	746.22776 ft	0 psf	572.93352 psf	358.0086 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 16	76.25972 ft	745.84205 ft	0 psf	610.15317 psf	381.26602 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 17	76.60006 ft	745.46499 ft	0 psf	647.05359 psf	404.32396 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 18	76.94040 ft	745.09626 ft	0 psf	683.63463 psf	427.18233 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 19	77.28074 ft	744.73557 ft	0 psf	719.8965 psf	449.84126 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 20	77.58759 ft	744.41670 ft	-26.014777 psf	464.44816 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 21	77.86095 ft	744.13810 ft	-8.6217266 psf	512.30475 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 22	78.15982 ft	743.83915 ft	10.041913 psf	563.54719 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand

Column 23	78.48419 ft	743.52064 ft	29.926542 psf	618.01295 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 24	78.80856 ft	743.20842 ft	49.418483 psf	671.2861 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 25	79.13294 ft	742.90231 ft	68.528832 psf	723.41066 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 26	79.45731 ft	742.60215 ft	87.268062 psf	774.42778 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 27	79.78169 ft	742.30777 ft	105.64608 psf	824.37597 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 28	80.10606 ft	742.01903 ft	123.67225 psf	873.29134 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 29	80.43043 ft	741.73578 ft	141.35545 psf	921.20778 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 30	80.75481 ft	741.45789 ft	158.70412 psf	968.15717 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 31	81.07918 ft	741.18524 ft	175.72624 psf	1,014.1695 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 32	81.40356 ft	740.91769 ft	192.42942 psf	1,059.2731 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 33	81.72793 ft	740.65513 ft	208.82088 psf	1,103.4946 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 34	82.05230 ft	740.39746 ft	224.90752 psf	1,146.8592 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 35	82.37668 ft	740.14456 ft	240.6959 psf	1,189.3909 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 36	82.70105 ft	739.89634 ft	256.19226 psf	1,231.1123 psf	0 psf	825 psf	0 psf	Medium Stiff Silt

								with Sand
Column 37	83.02543 ft	739.65270 ft	271.40259 psf	1,272.0446 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 38	83.34980 ft	739.41356 ft	286.33259 psf	1,312.2084 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 39	83.67417 ft	739.17881 ft	300.98772 psf	1,351.6228 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 40	84.00387 ft	738.94468 ft	315.6047 psf	1,375.4778 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 41	84.33888 ft	738.71121 ft	330.17988 psf	1,383.7657 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 42	84.67390 ft	738.48219 ft	344.47808 psf	1,391.3112 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 43	85.00891 ft	738.25752 ft	358.50434 psf	1,398.1317 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 44	85.34393 ft	738.03712 ft	372.26348 psf	1,404.2438 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 45	85.67894 ft	737.82094 ft	385.76013 psf	1,409.6633 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 46	86.01395 ft	737.60888 ft	398.99869 psf	1,414.4052 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 47	86.34897 ft	737.40089 ft	411.98344 psf	1,418.4841 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 48	86.68398 ft	737.19691 ft	424.71843 psf	1,421.9137 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 49	87.01900 ft	736.99686 ft	437.20758 psf	1,424.707 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand

Column 50	87.35401 ft	736.80068 ft	449.45465 psf	1,426.8768 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 51	87.68903 ft	736.60833 ft	461.46326 psf	1,428.4351 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 52	88.02404 ft	736.41974 ft	473.23686 psf	1,429.3933 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 53	88.35906 ft	736.23487 ft	484.77881 psf	1,429.7627 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 54	88.69270 ft	736.05437 ft	496.04695 psf	1,510.3631 psf	633.81505 psf	0 psf	0 psf	Medium Dense Sand
Column 55	89.02497 ft	735.87819 ft	507.0462 psf	1,510.7438 psf	627.17989 psf	0 psf	0 psf	Medium Dense Sand
Column 56	89.35725 ft	735.70551 ft	517.82665 psf	1,510.5711 psf	620.33558 psf	0 psf	0 psf	Medium Dense Sand
Column 57	89.68952 ft	735.53629 ft	528.3911 psf	1,509.8497 psf	613.28339 psf	0 psf	0 psf	Medium Dense Sand
Column 58	90.02180 ft	735.37048 ft	538.74226 psf	1,508.5842 psf	606.02453 psf	0 psf	0 psf	Medium Dense Sand
Column 59	90.35407 ft	735.20806 ft	548.88271 psf	1,506.7791 psf	598.56013 psf	0 psf	0 psf	Medium Dense Sand
Column 60	90.68634 ft	735.04896 ft	558.81495 psf	1,504.4386 psf	590.89122 psf	0 psf	0 psf	Medium Dense Sand
Column 61	91.01862 ft	734.89317 ft	568.54141 psf	1,501.5665 psf	583.01881 psf	0 psf	0 psf	Medium Dense Sand
Column 62	91.35089 ft	734.74063 ft	578.06441 psf	1,498.1668 psf	574.94379 psf	0 psf	0 psf	Medium Dense Sand
Column 63	91.68317 ft	734.59131 ft	587.3862 psf	1,494.243 psf	566.66701 psf	0 psf	0 psf	Medium Dense Sand
Column 64	92.01544 ft	734.44518 ft	596.50893 psf	1,489.7985 psf	558.18925 psf	0 psf	0 psf	Medium Dense Sand
Column 65	92.34771 ft	734.30221 ft	605.43471 psf	1,484.8365 psf	549.51123 psf	0 psf	0 psf	Medium Dense Sand
Column 66	92.67999 ft	734.16236 ft	614.16554 psf	1,479.3601 psf	540.63359 psf	0 psf	0 psf	Medium Dense Sand

Column 67	93.01226 ft	734.02560 ft	622.70338 psf	1,473.3723 psf	531.55692 psf	0 psf	0 psf	Medium Dense Sand
Column 68	93.34454 ft	733.89191 ft	631.0501 psf	1,466.8756 psf	522.28176 psf	0 psf	0 psf	Medium Dense Sand
Column 69	93.67681 ft	733.76124 ft	639.2075 psf	1,459.8728 psf	512.80857 psf	0 psf	0 psf	Medium Dense Sand
Column 70	94.00908 ft	733.63358 ft	647.17735 psf	1,452.3661 psf	503.13777 psf	0 psf	0 psf	Medium Dense Sand
Column 71	94.34136 ft	733.50890 ft	654.96133 psf	1,444.3579 psf	493.2697 psf	0 psf	0 psf	Medium Dense Sand
Column 72	94.67363 ft	733.38717 ft	662.56107 psf	1,435.8502 psf	483.20467 psf	0 psf	0 psf	Medium Dense Sand
Column 73	95.00591 ft	733.26836 ft	669.97814 psf	1,426.845 psf	472.94292 psf	0 psf	0 psf	Medium Dense Sand
Column 74	95.33818 ft	733.15246 ft	677.21406 psf	1,417.3442 psf	462.48463 psf	0 psf	0 psf	Medium Dense Sand
Column 75	95.67045 ft	733.03943 ft	684.27029 psf	1,407.3493 psf	451.82994 psf	0 psf	0 psf	Medium Dense Sand
Column 76	96.01968 ft	732.92379 ft	691.48958 psf	1,395.1758 psf	439.71194 psf	0 psf	0 psf	Medium Dense Sand
Column 77	96.38585 ft	732.80582 ft	698.85447 psf	1,380.7514 psf	426.09652 psf	0 psf	0 psf	Medium Dense Sand
Column 78	96.73510 ft	732.69641 ft	705.68535 psf	1,373.2822 psf	417.16083 psf	0 psf	0 psf	Medium Dense Sand
Column 79	97.06745 ft	732.59522 ft	712.00237 psf	1,372.9055 psf	412.97814 psf	0 psf	0 psf	Medium Dense Sand
Column 80	97.39980 ft	732.49681 ft	718.14646 psf	1,372.1248 psf	408.65104 psf	0 psf	0 psf	Medium Dense Sand
Column 81	97.73214 ft	732.40114 ft	724.11878 psf	1,370.941 psf	404.17936 psf	0 psf	0 psf	Medium Dense Sand
Column 82	98.06449 ft	732.30821 ft	729.92046 psf	1,369.3548 psf	399.56293 psf	0 psf	0 psf	Medium Dense Sand
Column 83	98.39684 ft	732.21800 ft	735.55257 psf	1,367.367 psf	394.80149 psf	0 psf	0 psf	Medium Dense Sand
Column 84	98.72918 ft	732.13048 ft	741.01617 psf	1,364.9783 psf	389.89479 psf	0 psf	0 psf	Medium Dense Sand

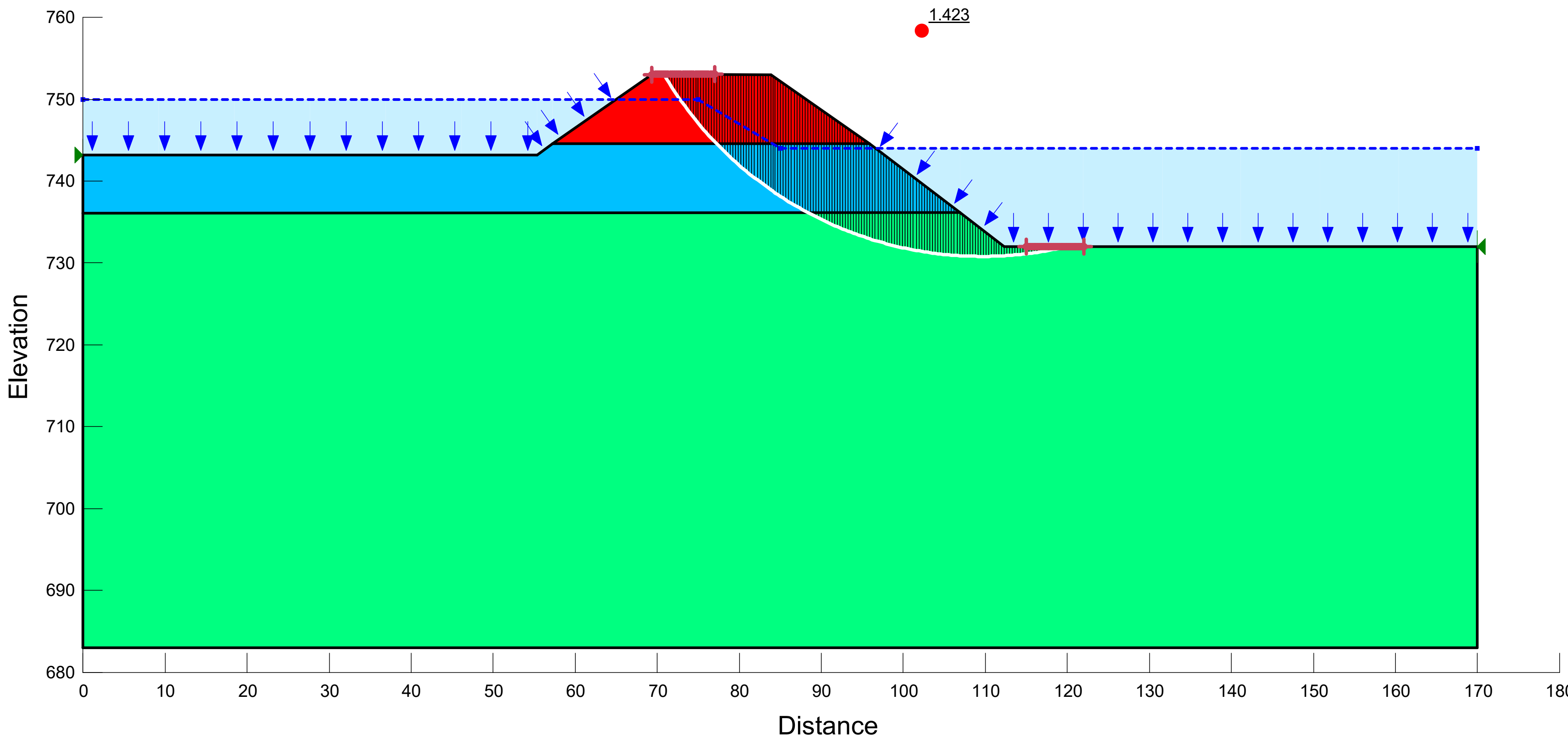
Column 85	99.06153 ft	732.04565 ft	746.31227 psf	1,362.1891 psf	384.84254 psf	0 psf	0 psf	Medium Dense Sand
Column 86	99.39387 ft	731.96349 ft	751.44182 psf	1,358.9999 psf	379.6444 psf	0 psf	0 psf	Medium Dense Sand
Column 87	99.72622 ft	731.88397 ft	756.40576 psf	1,355.411 psf	374.30001 psf	0 psf	0 psf	Medium Dense Sand
Column 88	100.05857 ft	731.80710 ft	761.20497 psf	1,351.4227 psf	368.80897 psf	0 psf	0 psf	Medium Dense Sand
Column 89	100.39091 ft	731.73285 ft	765.84033 psf	1,347.0352 psf	363.17085 psf	0 psf	0 psf	Medium Dense Sand
Column 90	100.72326 ft	731.66122 ft	770.31264 psf	1,342.2485 psf	357.38518 psf	0 psf	0 psf	Medium Dense Sand
Column 91	101.05560 ft	731.59218 ft	774.6227 psf	1,337.0626 psf	351.45145 psf	0 psf	0 psf	Medium Dense Sand
Column 92	101.38795 ft	731.52573 ft	778.77126 psf	1,331.4774 psf	345.36912 psf	0 psf	0 psf	Medium Dense Sand
Column 93	101.72030 ft	731.46185 ft	782.75904 psf	1,325.4927 psf	339.13762 psf	0 psf	0 psf	Medium Dense Sand
Column 94	102.05264 ft	731.40054 ft	786.58673 psf	1,319.1082 psf	332.75634 psf	0 psf	0 psf	Medium Dense Sand
Column 95	102.38499 ft	731.34178 ft	790.255 psf	1,312.3235 psf	326.22462 psf	0 psf	0 psf	Medium Dense Sand
Column 96	102.71733 ft	731.28557 ft	793.76446 psf	1,305.1382 psf	319.54179 psf	0 psf	0 psf	Medium Dense Sand
Column 97	103.04968 ft	731.23189 ft	797.11572 psf	1,297.5517 psf	312.70711 psf	0 psf	0 psf	Medium Dense Sand
Column 98	103.38203 ft	731.18073 ft	800.30935 psf	1,289.5633 psf	305.71982 psf	0 psf	0 psf	Medium Dense Sand
Column 99	103.71437 ft	731.13209 ft	803.34588 psf	1,281.1723 psf	298.57911 psf	0 psf	0 psf	Medium Dense Sand
Column 100	104.04672 ft	731.08596 ft	806.22582 psf	1,272.3779 psf	291.28415 psf	0 psf	0 psf	Medium Dense Sand
Column 101	104.37906 ft	731.04233 ft	808.94965 psf	1,263.1791 psf	283.83404 psf	0 psf	0 psf	Medium Dense Sand
Column 102	104.71141 ft	731.00120 ft	811.51783 psf	1,253.5748 psf	276.22787 psf	0 psf	0 psf	Medium Dense Sand

Column 103	105.04376 ft	730.96254 ft	813.93078 psf	1,243.564 psf	268.46465 psf	0 psf	0 psf	Medium Dense Sand
Column 104	105.37610 ft	730.92637 ft	816.1889 psf	1,233.1455 psf	260.54338 psf	0 psf	0 psf	Medium Dense Sand
Column 105	105.70845 ft	730.89268 ft	818.29256 psf	1,222.3178 psf	252.463 psf	0 psf	0 psf	Medium Dense Sand
Column 106	106.04079 ft	730.86145 ft	820.24212 psf	1,211.0797 psf	244.22241 psf	0 psf	0 psf	Medium Dense Sand
Column 107	106.37314 ft	730.83269 ft	822.03788 psf	1,199.4295 psf	235.82045 psf	0 psf	0 psf	Medium Dense Sand
Column 108	106.70549 ft	730.80638 ft	823.68014 psf	1,187.3657 psf	227.25593 psf	0 psf	0 psf	Medium Dense Sand
Column 109	107.04166 ft	730.78228 ft	825.18456 psf	1,174.6936 psf	218.39748 psf	0 psf	0 psf	Medium Dense Sand
Column 110	107.38168 ft	730.76045 ft	826.54781 psf	1,161.4001 psf	209.23891 psf	0 psf	0 psf	Medium Dense Sand
Column 111	107.72168 ft	730.74117 ft	827.75116 psf	1,147.6671 psf	199.90565 psf	0 psf	0 psf	Medium Dense Sand
Column 112	108.06170 ft	730.72445 ft	828.79483 psf	1,133.4925 psf	190.39621 psf	0 psf	0 psf	Medium Dense Sand
Column 113	108.40171 ft	730.71029 ft	829.67898 psf	1,118.8738 psf	180.70901 psf	0 psf	0 psf	Medium Dense Sand
Column 114	108.74171 ft	730.69868 ft	830.40377 psf	1,103.8088 psf	170.84242 psf	0 psf	0 psf	Medium Dense Sand
Column 115	109.08173 ft	730.68962 ft	830.96932 psf	1,088.2947 psf	160.79476 psf	0 psf	0 psf	Medium Dense Sand
Column 116	109.42173 ft	730.68311 ft	831.37573 psf	1,072.3289 psf	150.56425 psf	0 psf	0 psf	Medium Dense Sand
Column 117	109.76175 ft	730.67915 ft	831.62305 psf	1,055.9085 psf	140.14908 psf	0 psf	0 psf	Medium Dense Sand
Column 118	110.10175 ft	730.67774 ft	831.71135 psf	1,039.0304 psf	129.54734 psf	0 psf	0 psf	Medium Dense Sand
Column 119	110.44177 ft	730.67887 ft	831.64062 psf	1,021.6917 psf	118.75707 psf	0 psf	0 psf	Medium Dense Sand
Column 120	110.78177 ft	730.68255 ft	831.41086 psf	1,003.8889 psf	107.77622 psf	0 psf	0 psf	Medium Dense Sand

Column 121	111.12179 ft	730.68878 ft	831.02204 psf	985.61862 psf	96.602671 psf	0 psf	0 psf	Medium Dense Sand
Column 122	111.46179 ft	730.69756 ft	830.47407 psf	966.87733 psf	85.234219 psf	0 psf	0 psf	Medium Dense Sand
Column 123	111.80181 ft	730.70888 ft	829.76688 psf	947.66125 psf	73.668582 psf	0 psf	0 psf	Medium Dense Sand
Column 124	112.14181 ft	730.72276 ft	828.90034 psf	927.96647 psf	61.90339 psf	0 psf	0 psf	Medium Dense Sand
Column 125	112.47890 ft	730.73904 ft	827.88449 psf	916.9915 psf	55.680241 psf	0 psf	0 psf	Medium Dense Sand
Column 126	112.81306 ft	730.75766 ft	826.72188 psf	914.84346 psf	55.064473 psf	0 psf	0 psf	Medium Dense Sand
Column 127	113.14722 ft	730.77875 ft	825.40487 psf	912.358 psf	54.334343 psf	0 psf	0 psf	Medium Dense Sand
Column 128	113.48138 ft	730.80233 ft	823.93323 psf	909.5326 psf	53.488419 psf	0 psf	0 psf	Medium Dense Sand
Column 129	113.81554 ft	730.82838 ft	822.30672 psf	906.36465 psf	52.525223 psf	0 psf	0 psf	Medium Dense Sand
Column 130	114.14970 ft	730.85692 ft	820.52508 psf	902.85146 psf	51.443229 psf	0 psf	0 psf	Medium Dense Sand
Column 131	114.48387 ft	730.88795 ft	818.58801 psf	898.99019 psf	50.240861 psf	0 psf	0 psf	Medium Dense Sand
Column 132	114.81803 ft	730.92147 ft	816.49519 psf	894.77794 psf	48.91649 psf	0 psf	0 psf	Medium Dense Sand
Column 133	115.15219 ft	730.95749 ft	814.24627 psf	890.21164 psf	47.468435 psf	0 psf	0 psf	Medium Dense Sand
Column 134	115.48635 ft	730.99602 ft	811.84088 psf	885.28816 psf	45.894958 psf	0 psf	0 psf	Medium Dense Sand
Column 135	115.82051 ft	731.03706 ft	809.27861 psf	880.00422 psf	44.194262 psf	0 psf	0 psf	Medium Dense Sand
Column 136	116.15467 ft	731.08062 ft	806.55905 psf	874.3564 psf	42.364489 psf	0 psf	0 psf	Medium Dense Sand
Column 137	116.48883 ft	731.12671 ft	803.68172 psf	868.34118 psf	40.403716 psf	0 psf	0 psf	Medium Dense Sand
Column 138	116.82299 ft	731.17534 ft	800.64615 psf	861.95489 psf	38.309956 psf	0 psf	0 psf	Medium Dense Sand

Column 139	117.15715 ft	731.22650 ft	797.45182 psf	855.19373 psf	36.08115 psf	0 psf	0 psf	Medium Dense Sand
Column 140	117.49131 ft	731.28022 ft	794.09818 psf	848.05372 psf	33.715167 psf	0 psf	0 psf	Medium Dense Sand
Column 141	117.82547 ft	731.33650 ft	790.58466 psf	840.53078 psf	31.2098 psf	0 psf	0 psf	Medium Dense Sand
Column 142	118.15963 ft	731.39535 ft	786.91066 psf	832.62063 psf	28.562764 psf	0 psf	0 psf	Medium Dense Sand
Column 143	118.49379 ft	731.45678 ft	783.07554 psf	824.31886 psf	25.771687 psf	0 psf	0 psf	Medium Dense Sand
Column 144	118.82796 ft	731.52080 ft	779.07863 psf	815.62085 psf	22.834114 psf	0 psf	0 psf	Medium Dense Sand
Column 145	119.16212 ft	731.58743 ft	774.91924 psf	806.52184 psf	19.747495 psf	0 psf	0 psf	Medium Dense Sand
Column 146	119.49628 ft	731.65667 ft	770.59664 psf	797.01686 psf	16.509188 psf	0 psf	0 psf	Medium Dense Sand
Column 147	119.83044 ft	731.72853 ft	766.11006 psf	787.10076 psf	13.116448 psf	0 psf	0 psf	Medium Dense Sand
Column 148	120.16460 ft	731.80304 ft	761.45869 psf	776.76818 psf	9.5664253 psf	0 psf	0 psf	Medium Dense Sand
Column 149	120.49876 ft	731.88019 ft	756.64172 psf	766.01354 psf	5.85616 psf	0 psf	0 psf	Medium Dense Sand
Column 150	120.83292 ft	731.96002 ft	751.65826 psf	754.83105 psf	1.9825757 psf	0 psf	0 psf	Medium Dense Sand

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
	Medium Dense Sand	Mohr-Coulomb	125	0	32	1
	Medium Dense Sand & Silt	Mohr-Coulomb	125	0	32	1
	Medium Stiff Silt with Sand	Mohr-Coulomb	125	825	0	1



Title: ROR Final WPDES Settling Pond Embankment Analysis
Name: 03_ROR A-A'_Surcharge Flow Condition
Directory: I:\25225169.01\Data and Calculations\Geotechnical\Slope Stability\SlopeW\Rock River A Updated.gsz

SCS ENGINEERS

03_ROR A-A'_Surcharge Flow Condition

File Information

File Version: 11.07
Product Version: 24.2.1.28
Title: ROR Final WPDES Settling Pond Embankment Analysis
Comments: Slope stability for Rock River.
Created By: Charmelo, Lukas
Last Edited By: Charmelo, Lukas
Revision Number: 72
Date: 03/04/2026
Time: 11:31:53 AM
File Name: Rock River A Updated.gsz
Directory: I:\25225169.01\Data and Calculations\Geotechnical\Slope Stability\SlopeW\
Last Solved Date: 03/04/2026
Last Solved Time: 11:32:02 AM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

03_ROR A-A'_Surcharge Flow Condition

- Kind: SLOPE/W
- Analysis Type: Bishop
- Settings
  - PWP Conditions from: Piezometric Surfaces
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
  - Unit Weight of Water: 62.430189 pcf
- Slip Surface
  - Direction of movement: Left to Right
  - Use Passive Mode: No
  - Slip Surface Option: Entry and Exit
  - Critical slip surfaces saved: 10
  - Optimize Critical Slip Surface Location: No
  - Tension Crack Option: (none)
- Distribution
  - F of S Calculation Option: Constant
- Convergence
  - Geometry Settings
    - Minimum Slip Surface Depth: 0.1 ft
    - Minimum Slip Surface Volume: 35.314667 ft³
    - Number of Columns: 150
  - Factor of Safety Convergence Settings
    - Maximum Number of Iterations: 100
    - Tolerable difference in F of S: 0.001

Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50

Materials

Medium Dense Sand

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Medium Dense Sand & Silt

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 32 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Medium Stiff Silt with Sand

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 825 psf
Effective Friction Angle: 0 °
Phi-B: 0 °
Pore Water Pressure
Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (69.28973, 753) ft
Left-Zone Right Coordinate: (77, 753.05675) ft
Left-Zone Increment: 30
Right Type: Range
Right-Zone Left Coordinate: (115, 732.0006) ft
Right-Zone Right Coordinate: (122, 732.0006) ft
Right-Zone Increment: 30
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 743.21591) ft
Right Coordinate: (170, 732.0006) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	0 ft	750 ft
Coordinate 2	75 ft	750 ft
Coordinate 3	85 ft	744 ft
Coordinate 4	170 ft	744 ft

Geometry

Name: 2D Geometry

Settings

View: 2D
Element Thickness: 1 ft

Points

	X	Y
Point 1	69.40809 ft	753.08311 ft
Point 2	83.83636 ft	753.03301 ft
Point 3	95.83659 ft	744.5572 ft
Point 4	57.26586 ft	744.5572 ft
Point 5	0 ft	736.0572 ft
Point 6	106.87166 ft	736.1612 ft
Point 7	55.35562 ft	743.21591 ft
Point 8	0 ft	743.21591 ft
Point 9	112.31182 ft	732.0006 ft
Point 10	170 ft	732.0006 ft
Point 11	170 ft	683 ft
Point 12	0 ft	683 ft

Regions

	Material	Points	Area
Region 1	Medium Dense Sand & Silt	1,2,3,4	225.27 ft²
Region 2	Medium Stiff Silt with Sand	5,6,3,4,7,8	781 ft²
Region 3	Medium Dense Sand	5,6,9,10,11,12	8,780.5 ft²

Slip Results

Slip Surfaces Analysed: 2883 of 4805 converged

Current Slip Surface

Slip Surface: 1,038
Factor of Safety: 1.423
Volume: 382.11265 ft³

Weight: 47,764.081 lbf
Resisting Moment: 996,140.75 lbf·ft
Activating Moment: 700,093.32 lbf·ft
Resisting Force: 18,563.936 lbf
Activating Force: 13,775.575 lbf
Slip Rank: 1 of 4,805 slip surfaces
Exit: (119.9, 732.0006) ft
Entry: (70.810773, 753.07824) ft
Radius: 44.939058 ft
Center: (109.61368, 775.74658) ft

Slip Columns

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Column Base Material
Column 1	70.97497 ft	752.80173 ft	-174.91243 psf	19.833447 psf	12.393313 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 2	71.30338 ft	752.25741 ft	-140.9305 psf	59.673024 psf	37.287844 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 3	71.63178 ft	751.72992 ft	-107.9993 psf	99.274482 psf	62.033581 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 4	71.96018 ft	751.21818 ft	-76.05098 psf	138.61484 psf	86.616166 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 5	72.28858 ft	750.72121 ft	-45.025163 psf	177.67592 psf	111.02424 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 6	72.61698 ft	750.23815 ft	-14.867884 psf	216.44337 psf	135.24883 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 7	72.93967 ft	749.77619 ft	13.972312 psf	259.5944 psf	153.48172 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 8	73.25664 ft	749.33423 ft	41.564391 psf	306.73399 psf	165.69636 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 9	73.57362 ft	748.90328 ft	68.468434 psf	353.00081 psf	177.79556 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 10	73.89059 ft	748.48283 ft	94.717091 psf	398.42766 psf	189.77943 psf	0 psf	0 psf	Medium Dense Sand & Silt

Column 11	74.20757 ft	748.07240 ft	120.34025 psf	443.04498 psf	201.64829 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 12	74.52454 ft	747.67155 ft	145.36536 psf	486.88102 psf	213.40267 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 13	74.84151 ft	747.27988 ft	169.8177 psf	529.96212 psf	225.04321 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 14	75.16145 ft	746.89351 ft	187.8914 psf	570.62141 psf	239.15625 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 15	75.48435 ft	746.51224 ft	199.59849 psf	608.96288 psf	255.79926 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 16	75.80725 ft	746.13941 ft	210.77919 psf	646.71229 psf	272.40123 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 17	76.13014 ft	745.77470 ft	221.45316 psf	683.88696 psf	288.96071 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 18	76.45304 ft	745.41781 ft	231.63867 psf	720.50325 psf	305.47649 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 19	76.77594 ft	745.06847 ft	241.3528 psf	756.5766 psf	321.94756 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 20	77.09884 ft	744.72643 ft	250.61146 psf	792.12159 psf	338.37309 psf	0 psf	0 psf	Medium Dense Sand & Silt
Column 21	77.42469 ft	744.38844 ft	259.50624 psf	488.52014 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 22	77.75349 ft	744.05441 ft	268.0435 psf	542.41283 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 23	78.08230 ft	743.72724 ft	276.15241 psf	595.0694 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 24	78.41110 ft	743.40672 ft	283.84597 psf	646.53857 psf	0 psf	825 psf	0 psf	Medium Stiff Silt

								with Sand
Column 25	78.73991 ft	743.09267 ft	291.13641 psf	696.86564 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 26	79.06871 ft	742.78488 ft	298.03527 psf	746.09287 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 27	79.39751 ft	742.48319 ft	304.55341 psf	794.25973 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 28	79.72632 ft	742.18743 ft	310.70111 psf	841.4031 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 29	80.05512 ft	741.89746 ft	316.48808 psf	887.5576 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 30	80.38392 ft	741.61311 ft	321.92351 psf	932.75565 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 31	80.71273 ft	741.33426 ft	327.01612 psf	977.02777 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 32	81.04153 ft	741.06076 ft	331.77418 psf	1,020.4026 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 33	81.37033 ft	740.79250 ft	336.20555 psf	1,062.9073 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 34	81.69914 ft	740.52935 ft	340.31769 psf	1,104.5673 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 35	82.02794 ft	740.27120 ft	344.11771 psf	1,145.4067 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 36	82.35674 ft	740.01794 ft	347.61237 psf	1,185.4483 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 37	82.68555 ft	739.76946 ft	350.80812 psf	1,224.7137 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand

Column 38	83.01435 ft	739.52568 ft	353.71113 psf	1,263.2233 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 39	83.34315 ft	739.28650 ft	356.32725 psf	1,300.9965 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 40	83.67196 ft	739.05181 ft	358.6621 psf	1,338.0517 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 41	83.95385 ft	738.85387 ft	360.46055 psf	1,358.9759 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 42	84.22611 ft	738.66619 ft	361.97929 psf	1,364.6938 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 43	84.53567 ft	738.45613 ft	363.49797 psf	1,370.6665 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 44	84.84522 ft	738.24980 ft	364.78365 psf	1,376.0556 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 45	85.16874 ft	738.03818 ft	372.19775 psf	1,381.066 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 46	85.50621 ft	737.82153 ft	385.72305 psf	1,385.6542 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 47	85.84369 ft	737.60910 ft	398.98508 psf	1,389.5923 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 48	86.18117 ft	737.40082 ft	411.98823 psf	1,392.8943 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 49	86.51864 ft	737.19661 ft	424.73667 psf	1,395.5733 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 50	86.85612 ft	736.99643 ft	437.23445 psf	1,397.6419 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 51	87.19360 ft	736.80019 ft	449.48543 psf	1,399.1122 psf	0 psf	825 psf	0 psf	Medium Stiff Silt

								with Sand
Column 52	87.53107 ft	736.60785 ft	461.49332 psf	1,399.9957 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 53	87.86855 ft	736.41935 ft	473.26169 psf	1,400.3034 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 54	88.20603 ft	736.23462 ft	484.79396 psf	1,400.046 psf	0 psf	825 psf	0 psf	Medium Stiff Silt with Sand
Column 55	88.53698 ft	736.05706 ft	495.87935 psf	1,478.0613 psf	613.73539 psf	0 psf	0 psf	Medium Dense Sand
Column 56	88.86140 ft	735.88646 ft	506.52961 psf	1,477.7385 psf	606.87865 psf	0 psf	0 psf	Medium Dense Sand
Column 57	89.18583 ft	735.71923 ft	516.97032 psf	1,476.9073 psf	599.8352 psf	0 psf	0 psf	Medium Dense Sand
Column 58	89.51026 ft	735.55530 ft	527.20409 psf	1,475.5724 psf	592.6063 psf	0 psf	0 psf	Medium Dense Sand
Column 59	89.83469 ft	735.39465 ft	537.23345 psf	1,473.7383 psf	585.19318 psf	0 psf	0 psf	Medium Dense Sand
Column 60	90.15911 ft	735.23724 ft	547.06083 psf	1,471.4092 psf	577.59698 psf	0 psf	0 psf	Medium Dense Sand
Column 61	90.48354 ft	735.08302 ft	556.68858 psf	1,468.5892 psf	569.81877 psf	0 psf	0 psf	Medium Dense Sand
Column 62	90.80797 ft	734.93197 ft	566.11895 psf	1,465.2822 psf	561.85958 psf	0 psf	0 psf	Medium Dense Sand
Column 63	91.13239 ft	734.78404 ft	575.35414 psf	1,461.4919 psf	553.72036 psf	0 psf	0 psf	Medium Dense Sand
Column 64	91.45682 ft	734.63920 ft	584.39624 psf	1,457.2219 psf	545.40199 psf	0 psf	0 psf	Medium Dense Sand
Column 65	91.78125 ft	734.49743 ft	593.2473 psf	1,452.4754 psf	536.90532 psf	0 psf	0 psf	Medium Dense Sand
Column 66	92.10568 ft	734.35868 ft	601.90928 psf	1,447.2558 psf	528.23112 psf	0 psf	0 psf	Medium Dense Sand
Column 67	92.43010 ft	734.22293 ft	610.38407 psf	1,441.566 psf	519.38012 psf	0 psf	0 psf	Medium Dense Sand
Column 68	92.75453 ft	734.09015 ft	618.6735 psf	1,435.409 psf	510.35298 psf	0 psf	0 psf	Medium Dense

								Sand
Column 69	93.07896 ft	733.96032 ft	626.77934 psf	1,428.7875 psf	501.15032 psf	0 psf	0 psf	Medium Dense Sand
Column 70	93.40339 ft	733.83339 ft	634.70329 psf	1,421.7041 psf	491.77271 psf	0 psf	0 psf	Medium Dense Sand
Column 71	93.72781 ft	733.70935 ft	642.44701 psf	1,414.1614 psf	482.22064 psf	0 psf	0 psf	Medium Dense Sand
Column 72	94.05224 ft	733.58818 ft	650.01209 psf	1,406.1615 psf	472.49459 psf	0 psf	0 psf	Medium Dense Sand
Column 73	94.37667 ft	733.46984 ft	657.40005 psf	1,397.7068 psf	462.59497 psf	0 psf	0 psf	Medium Dense Sand
Column 74	94.70109 ft	733.35431 ft	664.61239 psf	1,388.7992 psf	452.52214 psf	0 psf	0 psf	Medium Dense Sand
Column 75	95.02552 ft	733.24157 ft	671.65054 psf	1,379.4408 psf	442.27642 psf	0 psf	0 psf	Medium Dense Sand
Column 76	95.34995 ft	733.13161 ft	678.51587 psf	1,369.6333 psf	431.85808 psf	0 psf	0 psf	Medium Dense Sand
Column 77	95.67438 ft	733.02438 ft	685.20973 psf	1,359.3784 psf	421.26734 psf	0 psf	0 psf	Medium Dense Sand
Column 78	96.01968 ft	732.91335 ft	692.14152 psf	1,346.8674 psf	409.11815 psf	0 psf	0 psf	Medium Dense Sand
Column 79	96.38585 ft	732.79886 ft	699.28952 psf	1,332.0209 psf	395.37445 psf	0 psf	0 psf	Medium Dense Sand
Column 80	96.73510 ft	732.69276 ft	705.91317 psf	1,324.3058 psf	386.41461 psf	0 psf	0 psf	Medium Dense Sand
Column 81	97.06745 ft	732.59474 ft	712.03264 psf	1,323.8506 psf	382.30628 psf	0 psf	0 psf	Medium Dense Sand
Column 82	97.39980 ft	732.49949 ft	717.9788 psf	1,323.0112 psf	378.0662 psf	0 psf	0 psf	Medium Dense Sand
Column 83	97.73214 ft	732.40701 ft	723.75278 psf	1,321.7887 psf	373.6943 psf	0 psf	0 psf	Medium Dense Sand
Column 84	98.06449 ft	732.31726 ft	729.35569 psf	1,320.184 psf	369.19049 psf	0 psf	0 psf	Medium Dense Sand
Column 85	98.39684 ft	732.23024 ft	734.78859 psf	1,318.198 psf	364.55464 psf	0 psf	0 psf	Medium Dense Sand
Column 86	98.72918 ft	732.14592 ft	740.05249 psf	1,315.8314 psf	359.7866 psf	0 psf	0 psf	Medium Dense

								Sand
Column 87	99.06153 ft	732.06429 ft	745.14837 psf	1,313.085 psf	354.88617 psf	0 psf	0 psf	Medium Dense Sand
Column 88	99.39387 ft	731.98535 ft	750.07717 psf	1,309.9592 psf	349.85314 psf	0 psf	0 psf	Medium Dense Sand
Column 89	99.72622 ft	731.90906 ft	754.8398 psf	1,306.4547 psf	344.68727 psf	0 psf	0 psf	Medium Dense Sand
Column 90	100.05857 ft	731.83542 ft	759.43713 psf	1,302.5719 psf	339.38827 psf	0 psf	0 psf	Medium Dense Sand
Column 91	100.39091 ft	731.76441 ft	763.86997 psf	1,298.311 psf	333.95584 psf	0 psf	0 psf	Medium Dense Sand
Column 92	100.72326 ft	731.69603 ft	768.13913 psf	1,293.6724 psf	328.38963 psf	0 psf	0 psf	Medium Dense Sand
Column 93	101.05560 ft	731.63026 ft	772.24537 psf	1,288.6562 psf	322.68928 psf	0 psf	0 psf	Medium Dense Sand
Column 94	101.38795 ft	731.56708 ft	776.18941 psf	1,283.2624 psf	316.85437 psf	0 psf	0 psf	Medium Dense Sand
Column 95	101.72030 ft	731.50649 ft	779.97196 psf	1,277.4911 psf	310.88447 psf	0 psf	0 psf	Medium Dense Sand
Column 96	102.05264 ft	731.44848 ft	783.59366 psf	1,271.3422 psf	304.77912 psf	0 psf	0 psf	Medium Dense Sand
Column 97	102.38499 ft	731.39304 ft	787.05517 psf	1,264.8155 psf	298.53782 psf	0 psf	0 psf	Medium Dense Sand
Column 98	102.71733 ft	731.34015 ft	790.35707 psf	1,257.9108 psf	292.16002 psf	0 psf	0 psf	Medium Dense Sand
Column 99	103.04968 ft	731.28980 ft	793.49993 psf	1,250.6278 psf	285.64517 psf	0 psf	0 psf	Medium Dense Sand
Column 100	103.38203 ft	731.24200 ft	796.4843 psf	1,242.9659 psf	278.99266 psf	0 psf	0 psf	Medium Dense Sand
Column 101	103.71437 ft	731.19673 ft	799.31068 psf	1,234.9247 psf	272.20186 psf	0 psf	0 psf	Medium Dense Sand
Column 102	104.04672 ft	731.15398 ft	801.97956 psf	1,226.5036 psf	265.27209 psf	0 psf	0 psf	Medium Dense Sand
Column 103	104.37906 ft	731.11374 ft	804.49138 psf	1,217.702 psf	258.20265 psf	0 psf	0 psf	Medium Dense Sand
Column 104	104.71141 ft	731.07602 ft	806.84658 psf	1,208.519 psf	250.99279 psf	0 psf	0 psf	Medium Dense

								Sand
Column 105	105.04376 ft	731.04080 ft	809.04555 psf	1,198.9539 psf	243.64175 psf	0 psf	0 psf	Medium Dense Sand
Column 106	105.37610 ft	731.00807 ft	811.08866 psf	1,189.0056 psf	236.14869 psf	0 psf	0 psf	Medium Dense Sand
Column 107	105.70845 ft	730.97783 ft	812.97625 psf	1,178.6731 psf	228.51276 psf	0 psf	0 psf	Medium Dense Sand
Column 108	106.04079 ft	730.95009 ft	814.70863 psf	1,167.9554 psf	220.73306 psf	0 psf	0 psf	Medium Dense Sand
Column 109	106.37314 ft	730.92482 ft	816.28609 psf	1,156.8512 psf	212.80867 psf	0 psf	0 psf	Medium Dense Sand
Column 110	106.70549 ft	730.90203 ft	817.7089 psf	1,145.3591 psf	204.73859 psf	0 psf	0 psf	Medium Dense Sand
Column 111	107.03166 ft	730.88204 ft	818.95656 psf	1,133.6663 psf	196.65245 psf	0 psf	0 psf	Medium Dense Sand
Column 112	107.35167 ft	730.86477 ft	820.03489 psf	1,121.7865 psf	188.55533 psf	0 psf	0 psf	Medium Dense Sand
Column 113	107.67168 ft	730.84978 ft	820.97041 psf	1,109.5426 psf	180.31994 psf	0 psf	0 psf	Medium Dense Sand
Column 114	107.99169 ft	730.83709 ft	821.76326 psf	1,096.9332 psf	171.94527 psf	0 psf	0 psf	Medium Dense Sand
Column 115	108.31170 ft	730.82667 ft	822.41357 psf	1,083.9566 psf	163.43025 psf	0 psf	0 psf	Medium Dense Sand
Column 116	108.63171 ft	730.81853 ft	822.92142 psf	1,070.6112 psf	154.77376 psf	0 psf	0 psf	Medium Dense Sand
Column 117	108.95172 ft	730.81268 ft	823.2869 psf	1,056.8952 psf	145.97465 psf	0 psf	0 psf	Medium Dense Sand
Column 118	109.27173 ft	730.80910 ft	823.51007 psf	1,042.8067 psf	137.03173 psf	0 psf	0 psf	Medium Dense Sand
Column 119	109.59174 ft	730.80781 ft	823.59096 psf	1,028.3438 psf	127.94375 psf	0 psf	0 psf	Medium Dense Sand
Column 120	109.91175 ft	730.80879 ft	823.52958 psf	1,013.5044 psf	118.70944 psf	0 psf	0 psf	Medium Dense Sand
Column 121	110.23176 ft	730.81205 ft	823.32592 psf	998.28642 psf	109.32746 psf	0 psf	0 psf	Medium Dense Sand
Column 122	110.55177 ft	730.81760 ft	822.97995 psf	982.68761 psf	99.79642 psf	0 psf	0 psf	Medium Dense

								Sand
Column 123	110.87178 ft	730.82542 ft	822.49162 psf	966.7056 psf	90.114897 psf	0 psf	0 psf	Medium Dense Sand
Column 124	111.19179 ft	730.83552 ft	821.86085 psf	950.33796 psf	80.281404 psf	0 psf	0 psf	Medium Dense Sand
Column 125	111.51180 ft	730.84791 ft	821.08755 psf	933.58212 psf	70.294405 psf	0 psf	0 psf	Medium Dense Sand
Column 126	111.83181 ft	730.86258 ft	820.1716 psf	916.43541 psf	60.152306 psf	0 psf	0 psf	Medium Dense Sand
Column 127	112.15182 ft	730.87954 ft	819.11286 psf	898.89507 psf	49.853458 psf	0 psf	0 psf	Medium Dense Sand
Column 128	112.47678 ft	730.89912 ft	817.89031 psf	888.79641 psf	44.307053 psf	0 psf	0 psf	Medium Dense Sand
Column 129	112.80670 ft	730.92140 ft	816.49925 psf	886.20366 psf	43.556151 psf	0 psf	0 psf	Medium Dense Sand
Column 130	113.13662 ft	730.94613 ft	814.95582 psf	883.29265 psf	42.701592 psf	0 psf	0 psf	Medium Dense Sand
Column 131	113.46654 ft	730.97329 ft	813.25977 psf	880.06121 psf	41.742173 psf	0 psf	0 psf	Medium Dense Sand
Column 132	113.79646 ft	731.00291 ft	811.41081 psf	876.50706 psf	40.676649 psf	0 psf	0 psf	Medium Dense Sand
Column 133	114.12638 ft	731.03498 ft	809.40865 psf	872.62785 psf	39.503739 psf	0 psf	0 psf	Medium Dense Sand
Column 134	114.45631 ft	731.06951 ft	807.25296 psf	868.42113 psf	38.222117 psf	0 psf	0 psf	Medium Dense Sand
Column 135	114.78623 ft	731.10650 ft	804.94337 psf	863.88435 psf	36.830414 psf	0 psf	0 psf	Medium Dense Sand
Column 136	115.11615 ft	731.14597 ft	802.47951 psf	859.01488 psf	35.327218 psf	0 psf	0 psf	Medium Dense Sand
Column 137	115.44607 ft	731.18791 ft	799.86096 psf	853.80995 psf	33.711067 psf	0 psf	0 psf	Medium Dense Sand
Column 138	115.77599 ft	731.23234 ft	797.0873 psf	848.26672 psf	31.980454 psf	0 psf	0 psf	Medium Dense Sand
Column 139	116.10591 ft	731.27926 ft	794.15804 psf	842.38223 psf	30.133819 psf	0 psf	0 psf	Medium Dense Sand
Column 140	116.43583 ft	731.32868 ft	791.07271 psf	836.15341 psf	28.169547 psf	0 psf	0 psf	Medium Dense

								Sand
Column 141	116.76575 ft	731.38061 ft	787.83077 psf	829.57705 psf	26.085972 psf	0 psf	0 psf	Medium Dense Sand
Column 142	117.09567 ft	731.43506 ft	784.43168 psf	822.64986 psf	23.881368 psf	0 psf	0 psf	Medium Dense Sand
Column 143	117.42559 ft	731.49203 ft	780.87486 psf	815.36839 psf	21.553948 psf	0 psf	0 psf	Medium Dense Sand
Column 144	117.75551 ft	731.55154 ft	777.1597 psf	807.72908 psf	19.101865 psf	0 psf	0 psf	Medium Dense Sand
Column 145	118.08544 ft	731.61360 ft	773.28556 psf	799.72821 psf	16.523204 psf	0 psf	0 psf	Medium Dense Sand
Column 146	118.41536 ft	731.67821 ft	769.25176 psf	791.36195 psf	13.815984 psf	0 psf	0 psf	Medium Dense Sand
Column 147	118.74528 ft	731.74539 ft	765.0576 psf	782.62631 psf	10.978149 psf	0 psf	0 psf	Medium Dense Sand
Column 148	119.07520 ft	731.81515 ft	760.70235 psf	773.51715 psf	8.007572 psf	0 psf	0 psf	Medium Dense Sand
Column 149	119.40512 ft	731.88751 ft	756.18524 psf	764.03015 psf	4.9020445 psf	0 psf	0 psf	Medium Dense Sand
Column 150	119.73504 ft	731.96247 ft	751.50546 psf	754.16086 psf	1.6592776 psf	0 psf	0 psf	Medium Dense Sand