

TERRA ASSOCIATES, Inc.

Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

November 21, 2022
No. T-8816

Dr. Saurabh Khandelwal and Dr. Veena Shankaran
8460 Southeast 83rd Street
Mercer Island, Washington 98040

Subject: Geologic Hazard Evaluation
Khandelwal Remodel
8460 Southeast 83rd Street
Mercer Island, Washington

Dear Dr. Khandelwal and Dr. Shankaran:

As requested by Ms. Marlo Brown of Marlo Brown Architects, Terra Associates, Inc. conducted a geologic evaluation of the subject property. The purpose of our work was to determine if site conditions meet Mercer Island City Code (MICC) criteria defining a seismic hazard area, to evaluate potential adverse impacts to the subject property resulting from the seismic hazard, and to evaluate any potential adverse impacts to the geologically hazardous area or adjacent properties resulting from the proposed project.

Information provided to us shows the project consisting of a second story addition above a main floor office remodel and potentially a new covered indoor/outdoor dining space, and a kitchen/family room remodel. The proposed project areas are within the footprint of the existing residence.

Surface Conditions

The subject site is a 0.3-acre residential parcel located at the southeastern terminus of Southeast 83rd Street, approximately 350 feet southeast of the intersection with 84th Avenue Southeast, in Mercer Island, Washington. The site location is shown on Figure 1. A single family residence occupies the central portion of the parcel. Existing surface grades are relatively flat except on the northern side of the house, which slopes down about 4 to 5 feet to the Southeast 83rd Street cul-de-sac. Site vegetation generally consists of grass lawn, landscape trees and shrubs, and scattered mature coniferous trees.

Surface gradients drop steeply down to the east approximately 23 feet east of the eastern property margin and about 47 feet east of the existing residence. LiDAR-derived elevation contours obtained from the City of Mercer Island Information & Geographic Services (IGS) map portal website indicates the slope is about 110 feet high with inclinations ranging between about 70 and 85 percent. This geometry is generally consistent with our field observations. We did not observe any indications of recent deep-seated instability or significant active erosion on the steep slope. Slope vegetation generally consists of mature coniferous and deciduous trees with brush undergrowth.

Soils

We explored subsurface conditions at the site in a 46.5-foot deep test boring drilled with a limited access, track-mounted drill rig using hollow-stem auger drilling methods. The soils observed in the test boring consist of glacial outwash sand with varying minor proportions of silt and gravel. The sand deposits were observed to be in a dense to very dense and moist condition. The approximate test boring location is shown on Figure 2. The Test Boring Log is attached as Figure 4.

The *Geologic Map of Mercer Island, Washington* by K.G. Troost and A.P. Wisher, dated October 2006, shows surficial geology at the site mapped as Vashon advance outwash deposits (Qva). The soils observed in the test boring are consistent with this geologic map unit. Surficial geology beyond the toe of the steep slope is mapped as Lawton clay (Qvlc).

Groundwater

Groundwater was not encountered in the test boring. The IGS map portal website shows mapped springs near the toe of the steep slope at approximately Elev. 170, about 100 feet in elevation below ground surface at the subject site.

Geologic Hazards

MICC Section 19.07.160.A defines geologically hazardous areas as "...lands that are susceptible to erosion, landslides, seismic events, or other factors as identified by WAC 365-190-120." The IGS map portal website shows the steep slope mapped as a potential landslide hazard area, steep slope hazard area, seismic hazard area, and erosion hazard area. With the exception of the seismic hazard, all of these potential hazard areas are confined to the steep slope more than 20 feet east of the subject property. The mapped potential seismic hazard extends about 58 to 66 feet into the subject property from the steep slope crest and overlies about one half of the existing residence footprint. The mapped seismic hazard area is shown on Figure 5.

Per WAC 365-190-120(7), seismic hazard areas include areas subject to severe risk of damage as a result of earthquake-induced ground shaking, slope failure, settlement or subsidence, soil liquefaction, surface faulting, or tsunamis. Our evaluation of site susceptibility to these earthquake-induced conditions are discussed below:

Surface Faulting

The Washington State Department of Natural Resources (DNR) Geologic Information Portal website (<https://www.dnr.wa.gov/geologyportal>) shows the nearest fault suspected of Quaternary activity (designated "Class B") as the southern strand of the Seattle Fault Zone. The inferred trace of this feature trends northwest to southeast about 2,000 feet north of the subject site. Accordingly, the risk of ground rupture (surface faulting) along a fault at the site is low.

Soil Liquefaction

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in water pressure induced by vibrations. Liquefaction mainly affects geologically recent deposits of fine-grained sands underlying the groundwater table. Soils of this nature derive their strength from intergranular friction. The generated water pressure or pore pressure essentially separates the soil grains and eliminates this intergranular friction; thus, eliminating the soil's strength.

The soils observed in our subsurface explorations consist predominantly of medium dense to very dense advance outwash sand. Groundwater was not observed in the test boring. Mapped seepage zones shown on the IGS map portal website indicate perched groundwater exists about 100 feet in elevation below the subject site. Based on these subsurface conditions, it is our opinion that the risk of soil liquefaction occurring at the site during a severe seismic event would be negligible.

Settlement or Subsidence

Settlement and subsidence during a severe seismic event is typically a result of soil liquefaction. As discussed above, the risk of liquefaction occurring at the site is negligible. The site location is not susceptible to regional settlement resulting from large subduction zone earthquakes.

Tsunamis

The site location is not susceptible to tsunami inundation.

Ground Shaking

Based on the subsurface conditions observed at the site, it is our opinion that design in accordance with local building codes for determining seismic forces would adequately mitigate impacts associated with ground shaking. Based on the site soil conditions and our knowledge of the area geology, per the current International Building Code (IBC), site class “D” should be used in structural design.

Slope Failure

We performed stability analyses to evaluate the relative stability of the steep slope located east of the subject site. Our analyses were performed for both static and pseudostatic (seismic) loading conditions on a slope section identified as Section A-A’ on Figure 5 using the computer program Slide2 v.9.009, published by RocScience, Inc. Soil parameters used for our analyses are estimates based on field data obtained from the onsite test boring, our experience with similar soil and slope conditions, and published data. The soil parameters are shown on the attached Slide 2 graphical output.

Development of the slope model used in the analysis included topography, geologic contacts, and mapped seepage zones obtained from the IGS map portal website. The slope model is conservative as it does not account for drainage and structural support improvements made through existing residential development along the toe of the steep slope. Our interpretation of the geologic conditions through Section A-A’ is shown on Figure 6.

The pseudostatic analysis used a horizontal earthquake coefficient value of 0.345g to model ground motions expected from a severe earthquake. This seismic acceleration is one-half of the site-modified peak ground acceleration (PGA_M) value for the ASCE 7-16 maximum considered earthquake (MCE) determined for the site (Latitude 47.52804767 and Longitude -122.22736627) using the Structural Engineers Association of California (SEAOC) U.S. Seismic Design Maps website (<https://seismicmaps.org/>) accessed on October 19, 2022.

The lowest factors of safety determined by our analyses are presented on the following table:

Section Analyzed	Min. Safety Factors		Max. Failure Surface Development	
	Static ²	Pseudostatic	Static ³	Pseudostatic ⁴
A-A'	1.30	0.81	44 feet	101 feet
<i>Minimum Acceptable Values¹</i>	<i>1.5</i>	<i>1.1</i>		

1. Min. safety factor values considered acceptable for stable slopes by local geotechnical engineering practice.
2. Cohesion not included in long-term static analysis
3. Max. lateral extent of failure surface development beyond existing steep slope crest for F.S. <1.5
4. Max. lateral extent of failure surface development beyond existing steep slope crest for F.S. <1.1

The results of the stability analyses indicate the slope model along Section A-A' is stable under long-term static conditions and unstable under pseudostatic conditions. Although the static safety factor of 1.3 indicates a stable slope condition, it is lower than the minimum safety factor value of 1.5 considered acceptable for a stable slope by local geotechnical engineering practice. Analysis of the data determined that the maximum upgradient extent of potential failure surface development related to safety factors less than the acceptable minimum values of 1.5 static and 1.1 pseudostatic would be about 44 feet beyond the crest of the steep slope, and outside of the existing building footprint, for the static condition and about 104 feet beyond the crest of the steep slope, and inside the existing building footprint, for the pseudostatic condition.

Based on the results of the pseudostatic analysis, we evaluated the magnitude of potential lateral displacement that may occur during a design level seismic event by performing a Newmark analysis along Section A-A' using the Slide2 program. The ground motion used in the analysis was the RIO-270 record for the 1992 Cape Mendocino earthquake, which has a similar magnitude (7.1) as the MCE and a PGA (0.385g) that is approximately one-half of the PGA_M .

The Newmark analysis results indicate that a maximum lateral displacement of about 0.70 inches could occur about 15 feet beyond the crest of the steep slope, outside of the subject property. Potential lateral displacements decrease moving away from the slope crest with maximum lateral displacements of less than 0.14 inches beneath the existing building footprint. In our opinion, lateral displacements of this magnitude would not result in significant adverse impacts to the subject property or existing residence. The locations of the maximum lateral displacements determined by the Newmark analysis are shown on Figure 6. Graphical output of the Slide2 Newmark analysis is attached.

Discussion

The results of our study indicate that the site conditions are not subject to a severe risk of damage resulting from earthquake-induced ground shaking, settlement or subsidence, soil liquefaction, surface faulting, or tsunamis, and the results of the stability analysis and Newmark analysis demonstrate that the site would not be subject to severe risk of damage as a result of earthquake-induced slope failure. Accordingly, the site conditions do not meet the criteria defining a seismic hazard area given in WAC 365-190-120(7) as referenced in MICC 19.07.160.A, and the proposed project area is not located in a seismic hazard area.

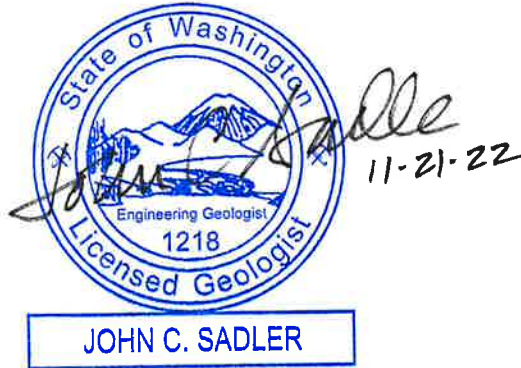
Dr. Saurabh Khandelwal and Dr. Veena Shankaran
November 21, 2022

We trust the information presented in this report is sufficient for your current needs. Please contact us if you have questions or require additional information.

Sincerely yours,
TERRA ASSOCIATES, INC.

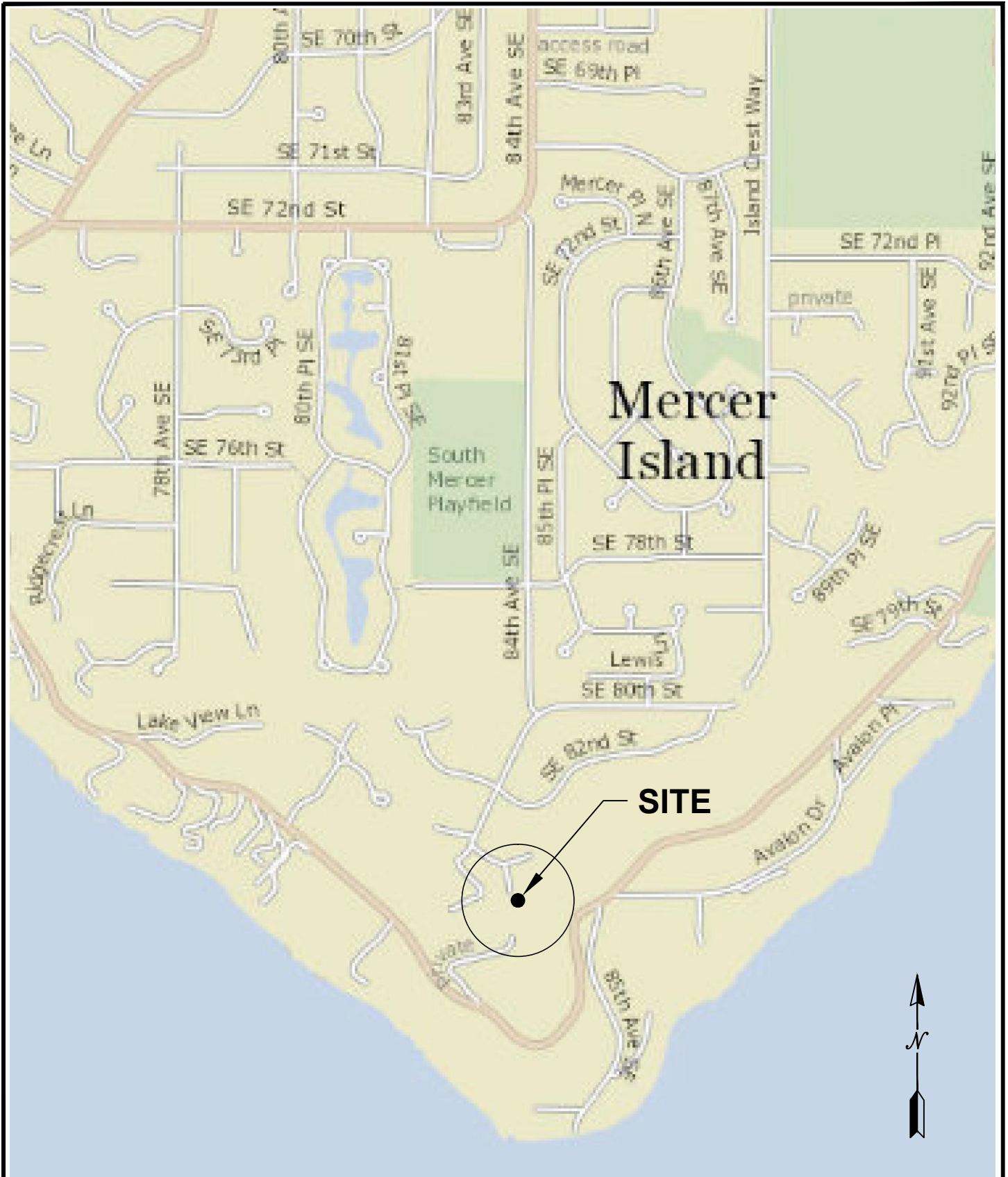
John C. Sadler

John C. Sadler, L.E.G., L.H.G.
Senior Engineering Geologist



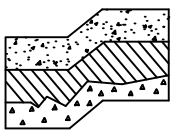
11-21-2022

- Encl: Figure 1 – Vicinity Map
Figure 2 – Exploration Location Plan
Figure 3 – Unified Soils Classification System
Figure 4 – Boring Log
Figure 5 – Potential Seismic Hazard Area Map
Figure 6 – Geologic Section A-A'
Figure 7 – Grain Size Analysis
Slide2 Output



REFERENCE: KING COUNTY IMAP

NOT TO SCALE



Terra Associates, Inc.

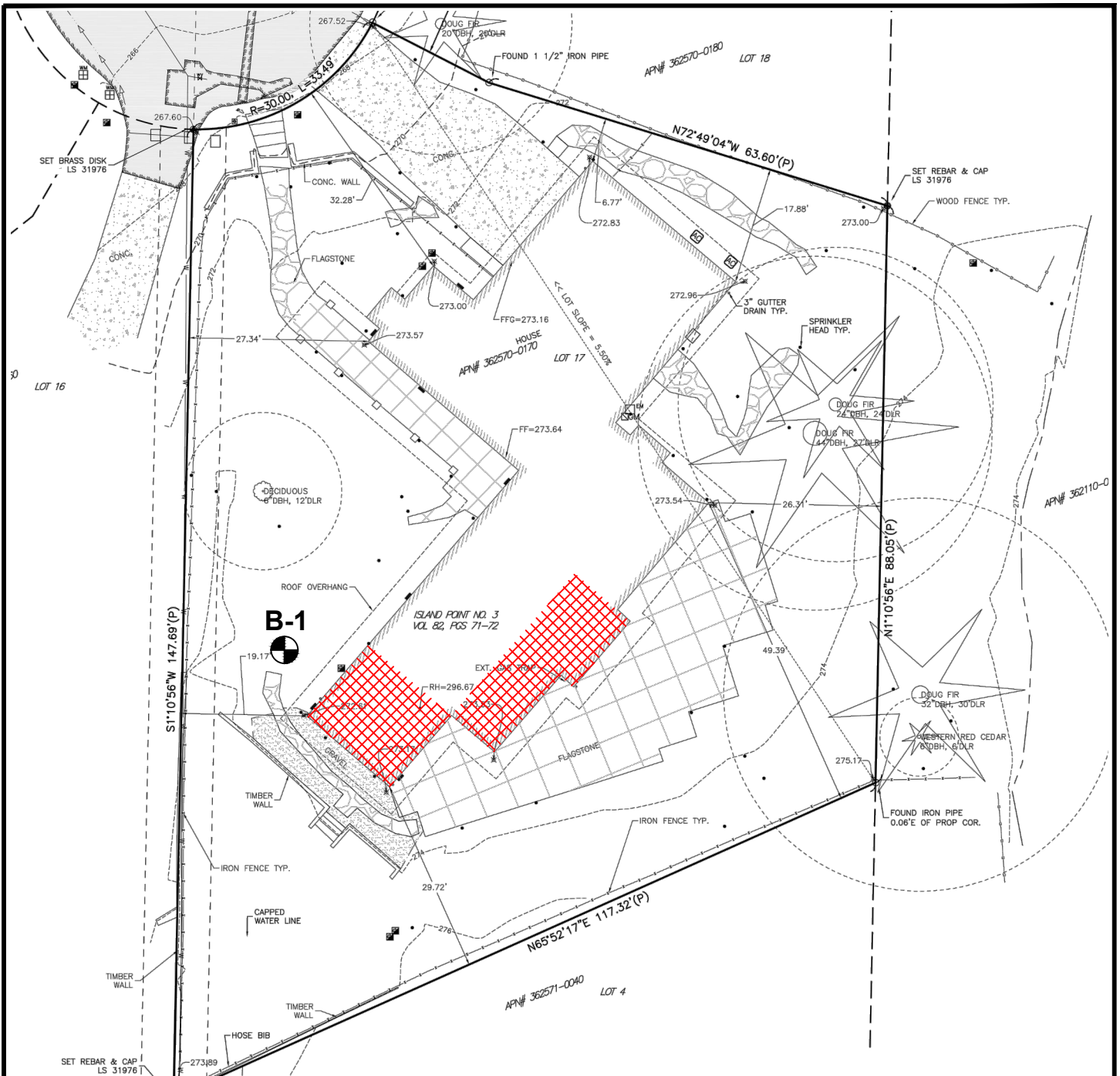
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VICINITY MAP
KHANDELWAL REMODEL
MERCER ISLAND, WASHINGTON



Proj. No. T-8816

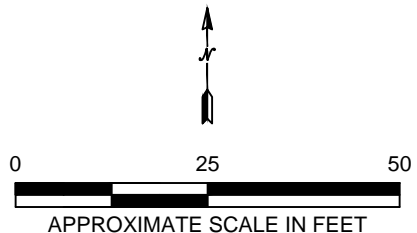
Date NOV 2022

Figure 1



LEGEND:

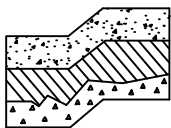
-  APPROXIMATE BORING LOCATION
-  PROPOSED SECOND STORY ADDITION / MAIN FLOOR REMODEL



REFERENCE: PLOG ENGINEERING

NOTE:

THIS SITE PLAN IS SCHEMATIC. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. IT IS INTENDED FOR REFERENCE ONLY AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES.



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EXPLORATION LOCATION PLAN
KHADELWAL REMODEL
MERCER ISLAND, WASHINGTON




Proj. No. T-8816

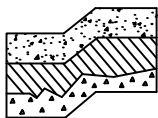
Date NOV 2022

Figure 2

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTION	
COARSE GRAINED SOILS	More than 50% material larger than No. 200 sieve size	GRAVELS More than 50% of coarse fraction is larger than No. 4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
				GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
			Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
				GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	More than 50% material smaller than No. 200 sieve size	SANDS More than 50% of coarse fraction is smaller than No. 4 sieve	Clean Sands (less than 5% fines)	SW	Well-graded sands, sands with gravel, little or no fines.
				SP	Poorly-graded sands, sands with gravel, little or no fines.
			Sands with fines	SM	Silty sands, sand-silt mixtures, non-plastic fines.
				SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS	SILTS AND CLAYS Liquid Limit is less than 50%		ML	Inorganic silts, rock flour, clayey silts with slight plasticity.	
			CL	Inorganic clays of low to medium plasticity. (Lean clay)	
			OL	Organic silts and organic clays of low plasticity.	
	SILTS AND CLAYS Liquid Limit is greater than 50%		MH	Inorganic silts, elastic.	
			CH	Inorganic clays of high plasticity. (Fat clay)	
			OH	Organic clays of high plasticity.	
HIGHLY ORGANIC SOILS			PT	Peat.	

DEFINITION OF TERMS AND SYMBOLS

COHESIONLESS	<u>Density</u>	<u>Standard Penetration Resistance in Blows/Foot</u>	 2" OUTSIDE DIAMETER SPILT SPOON SAMPLER
	Very Loose Loose Medium Dense Dense Very Dense	0-4 4-10 10-30 30-50 >50	 2.4" INSIDE DIAMETER RING SAMPLER OR SHELBY TUBE SAMPLER
COHESIVE	<u>Consistency</u>	<u>Standard Penetration Resistance in Blows/Foot</u>	 WATER LEVEL (Date)
	Very Soft Soft Medium Stiff Stiff Very Stiff Hard	0-2 2-4 4-8 8-16 16-32 >32	Tr TORVANE READINGS, tsf Pp PENETROMETER READING, tsf DD DRY DENSITY, pounds per cubic foot LL LIQUID LIMIT, percent PI PLASTIC INDEX N STANDARD PENETRATION, blows per foot



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**UNIFIED SOIL CLASSIFICATION SYSTEM
 KHANDELWAL REMODEL
 MERCER ISLAND, WASHINGTON**

Proj. No.T-8816

Date NOV 2022

Figure 3

LOG OF BORING NO. 1

Figure No. 4

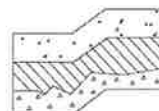
Project: Khandelwal Remodel Project No: T-8816 Date Drilled: October 19, 2022

Client: Veena and Saurabh Khandelwal Driller: Boretect Logged By: JCS

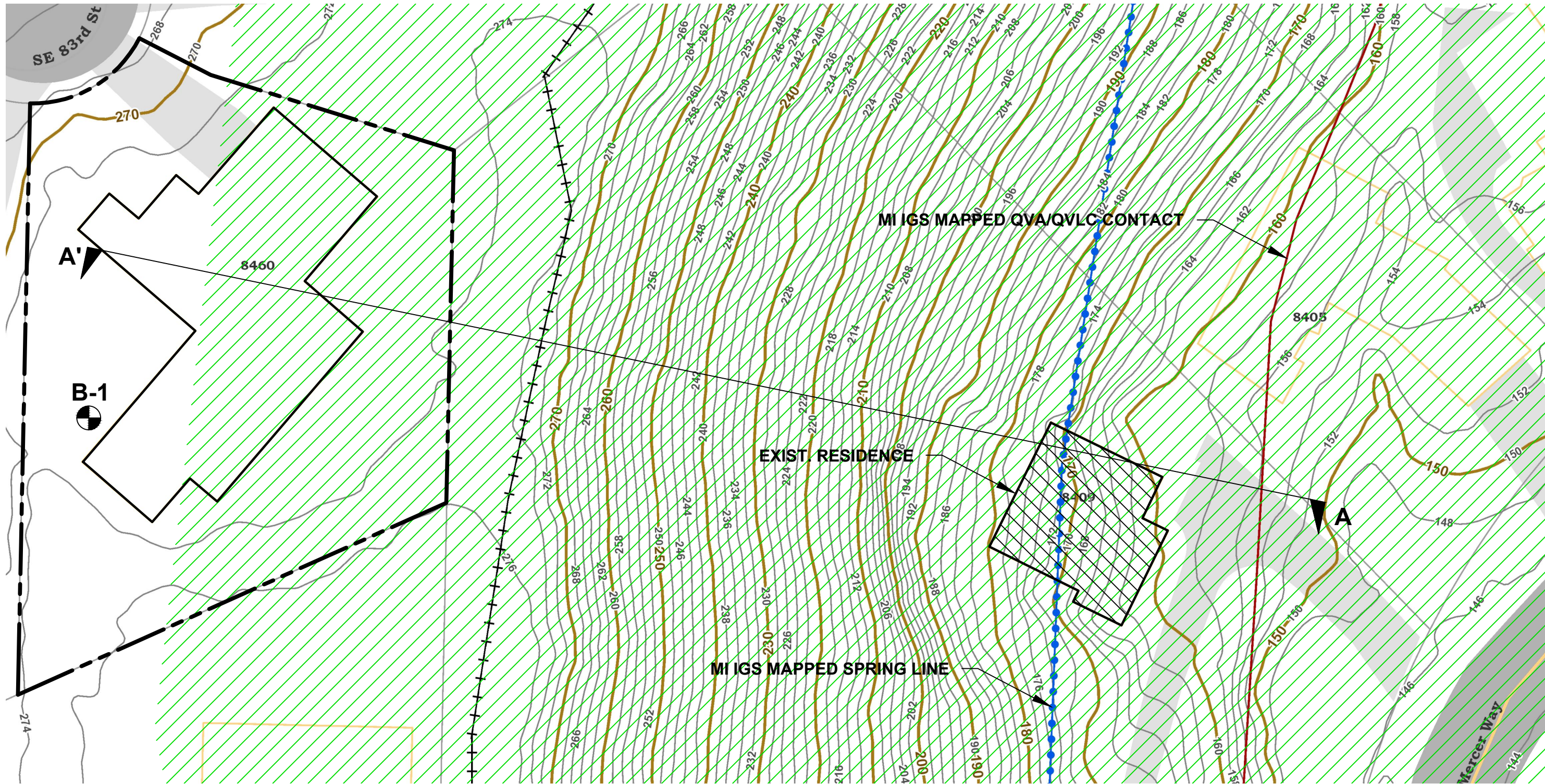
Location: Mercer Island, Washington Depth to Groundwater: NA Approx. Elev: NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot			Moisture Content (%)		
				10	30	50			
0									
5		Gray-brown SAND to SAND with silt, fine grained, trace of fine to coarse gravel, moist. (SP/SP-SM) (Vashon advance outwash)	Medium Dense		•		24	8.3	
10		Gray-brown SAND with silt to silty SAND, fine grained, moist. (SP-SM/SM) (Vashon advance outwash)			•		31	7.1	
15		- Trace of fine to coarse gravel between 15 and 21.5 feet.			•		31	6.5	
20							•	48	6.5
25			Dense		•		34	7.7	
30		Gray SAND with silt, fine grained, moist. (SP-SM) (Vashon advance outwash)					•	43	8.2
35							•	49	7.7
40							•	73	6.5
45			Very Dense				•	68	6.6
50		Boring terminated at 46.5 feet. No groundwater.							

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpreted as being indicative of other areas of the site



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REFERENCE:

MERCER ISLAND IGS

NOTE:

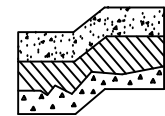
THIS SITE PLAN IS SCHEMATIC. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. IT IS INTENDED FOR REFERENCE ONLY AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES.

LEGEND:

-  APPROXIMATE BORING LOCATION
-  SEISMIC HAZARD AREA PER MERCER ISLAND IGS MAPPING
-  GEOLOGIC SECTION A-A'

0 25 50

APPROXIMATE SCALE IN FEET



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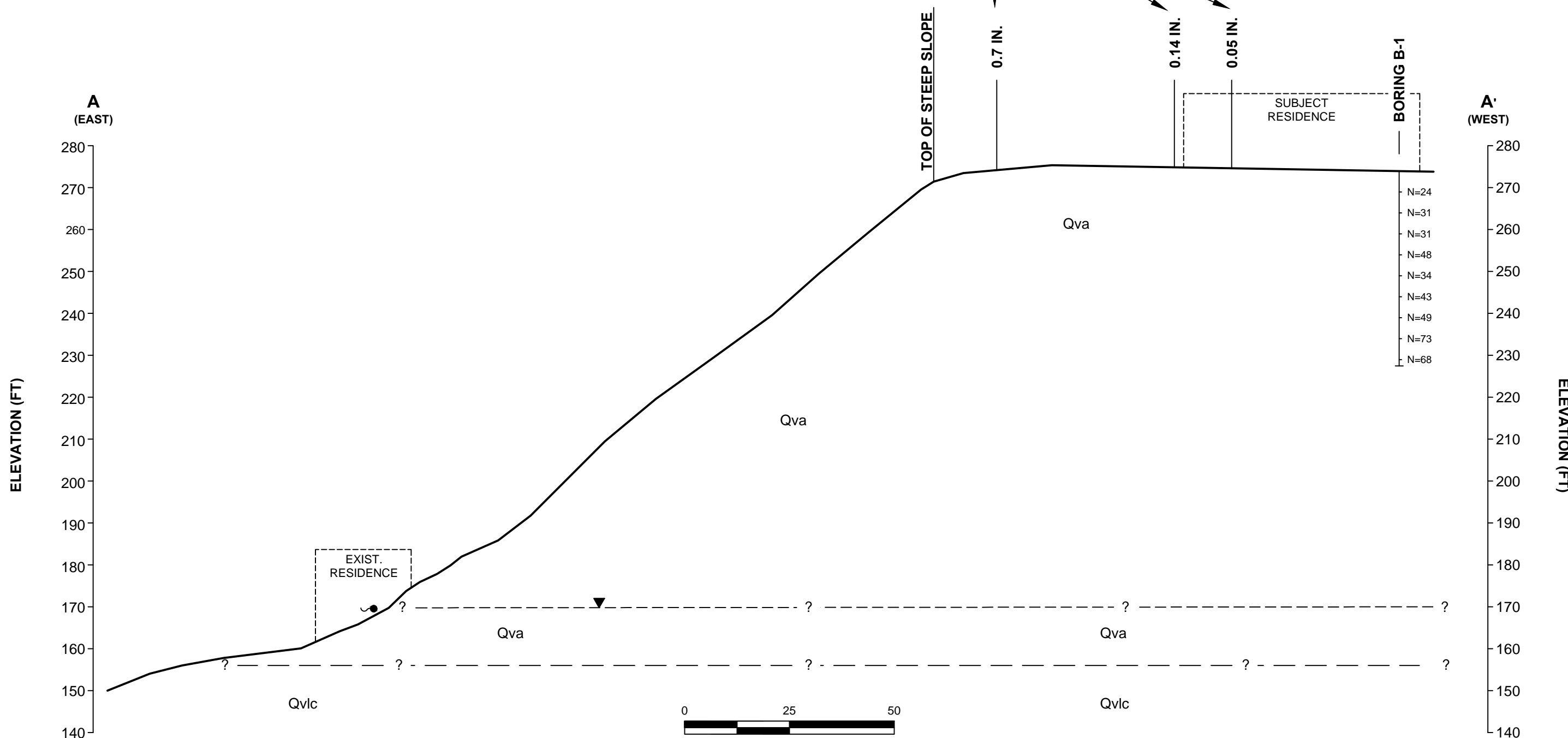
POTENTIAL SEISMIC HAZARD AREA MAP
KHANDELWAL REMODEL
MERCER ISLAND, WASHINGTON

Proj. No.T-8816

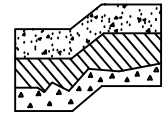
Date NOV 2022

Figure 5

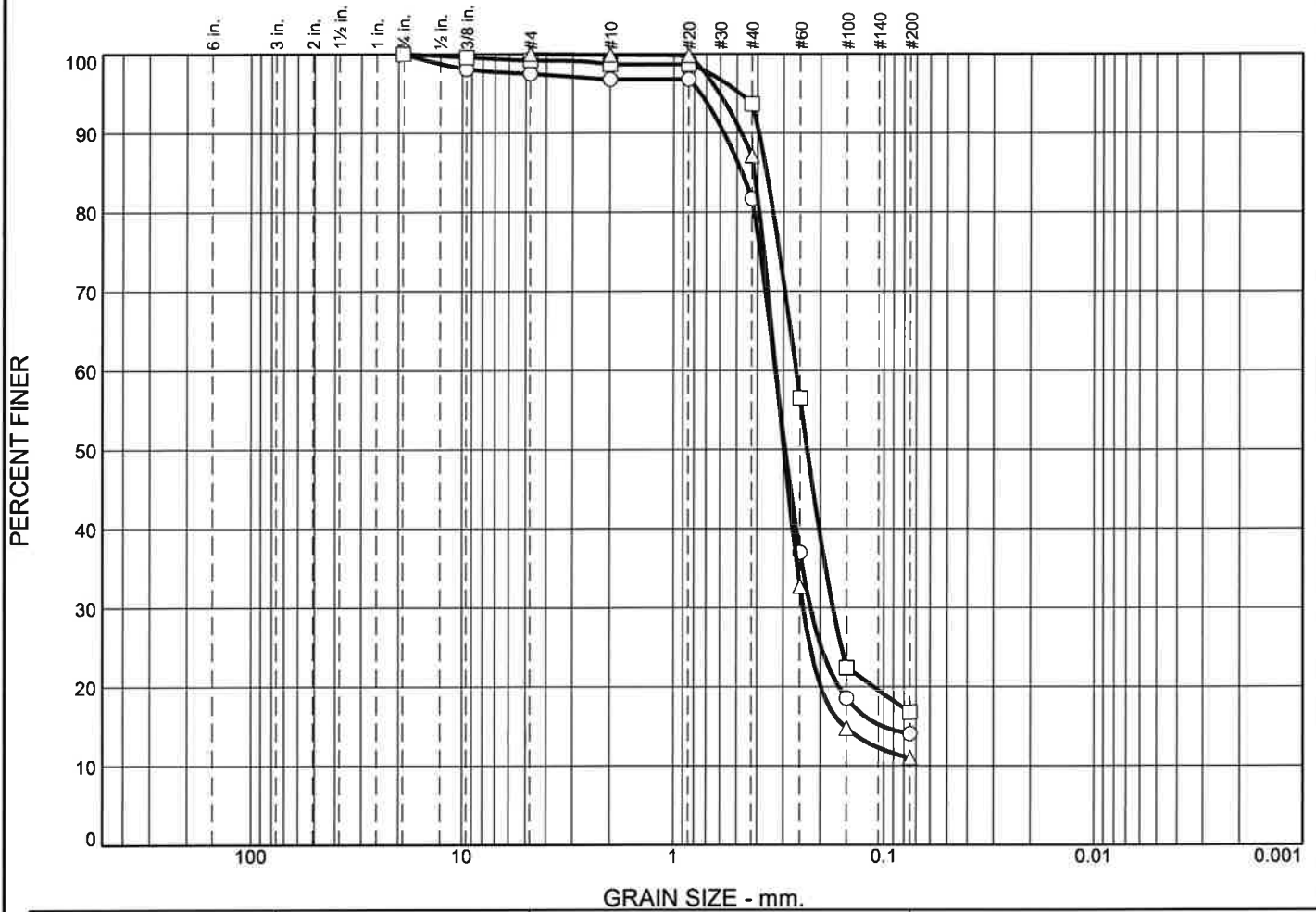
MAX. LATERAL DISPLACEMENT DUE TO SEISMICALLY-INDUCED SLOPE FAILURE DETERMINED BY NEWMARK ANALYSIS



- LEGEND:**
- Qva VASHON ADVANCE OUTWASH
 - Qvlc LAWTON CLAY
 - ▼ ESTIMATED GROUNDWATER LEVEL
 - APPROXIMATE SPRING LOCATION PER MERCER ISLAND IGS MAPPING

 <p>Terra Associates, Inc. Consultants in Geotechnical Engineering Geology and Environmental Earth Sciences</p>	<p>GEOLOGIC SECTION A-A' KHANDELWAL REMODEL MERCER ISLAND, WASHINGTON</p>		
	<p>Proj. No.T-8816</p>	<p>Date NOV 2022</p>	<p>Figure 6</p>

Particle Size Distribution Report



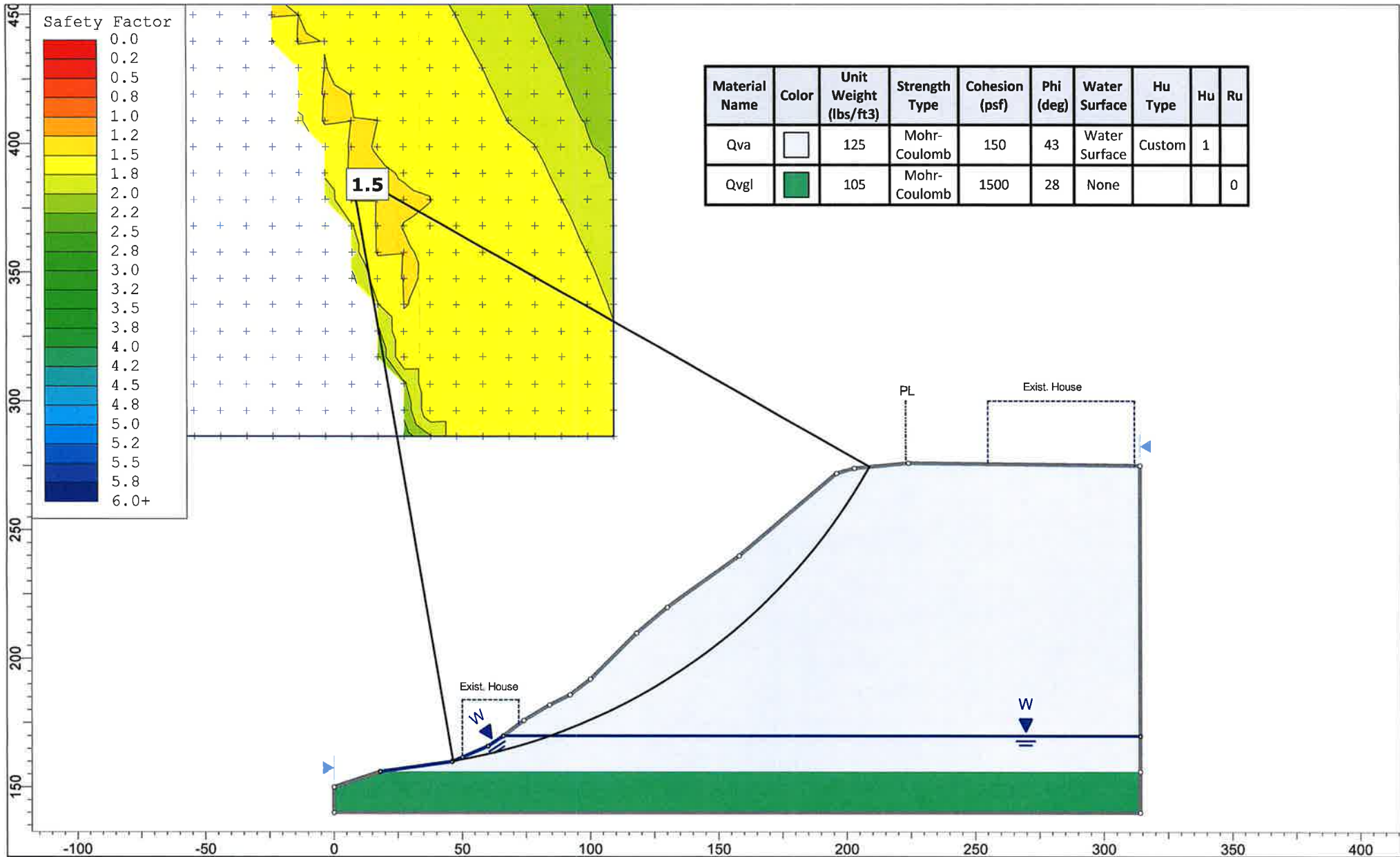
	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	2.5	0.7	15.1	67.6	14.1			
□	0.0	0.0	0.8	0.5	5.0	76.9	16.8			
△	0.0	0.0	0.0	0.1	12.8	76.1	11.0			
⊗	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○			0.4744	0.3275	0.2936	0.2223	0.1002			
□			0.3620	0.2609	0.2307	0.1742				
△			0.4141	0.3257	0.2981	0.2413	0.1530			



Material Description	USCS	AASHTO
○ SAND with silt	SP-SM	
□ silty SAND	SM	
△ SAND with silt	SP-SM	


<p>Project No. T-8816 Client: Veena and Saurabh Khandelwal</p> <p>Project: Khandelwal Remodel</p> <p>○ Location: B-1 Depth: 5'</p> <p>□ Location: B-1 Depth: 25'</p> <p>△ Location: B-1 Depth: 45'</p> <p style="text-align: center;">Terra Associates, Inc.</p> <p style="text-align: center;">Kirkland, WA</p>	<p>Remarks:</p> <p>○ Tested October 28, 2022</p> <p>□ Tested October 28, 2022</p> <p>△ Tested October 28, 2022</p>
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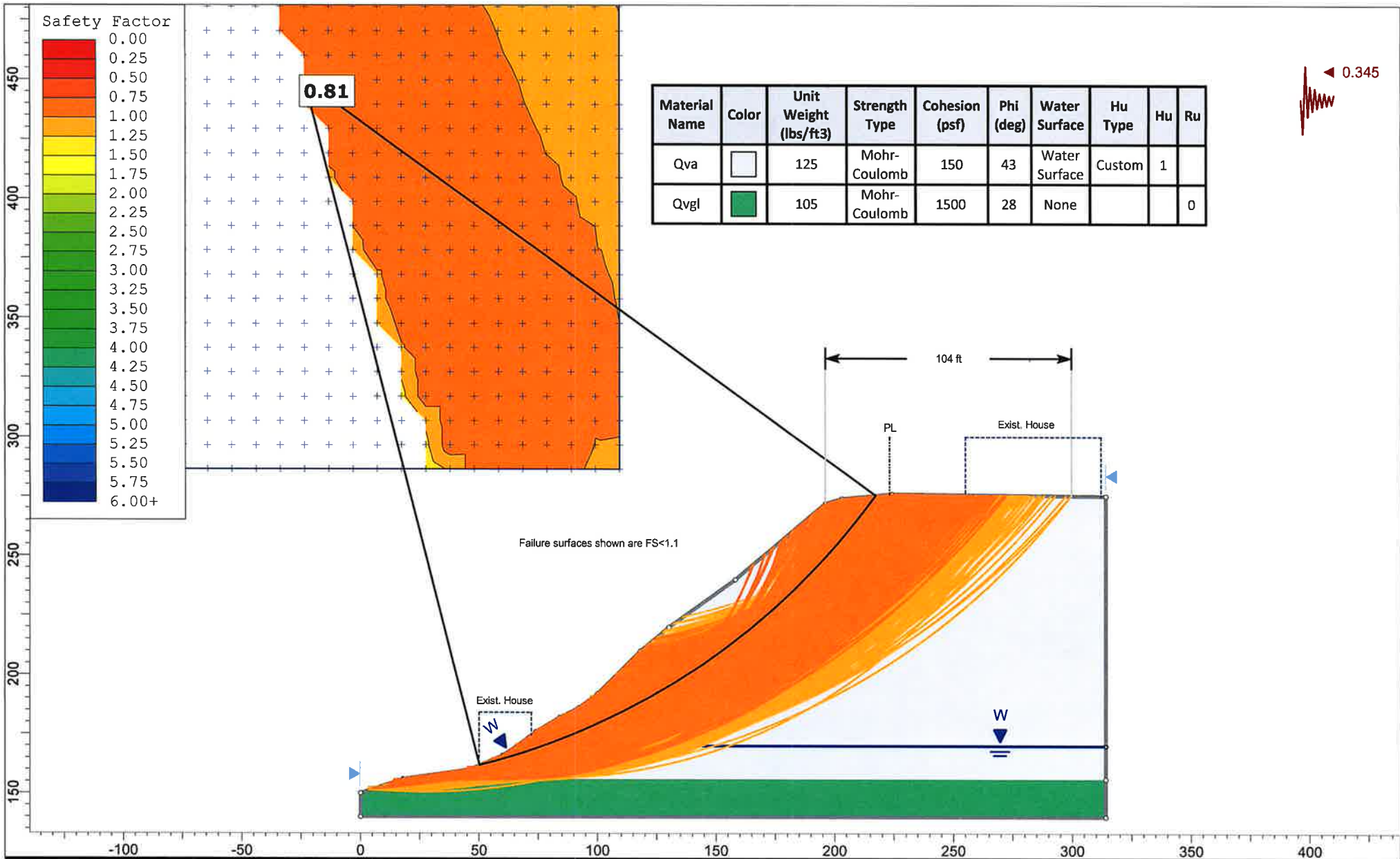
Figure 7

**SLIDE2 OUTPUT
KHANDELWAL REMODEL**

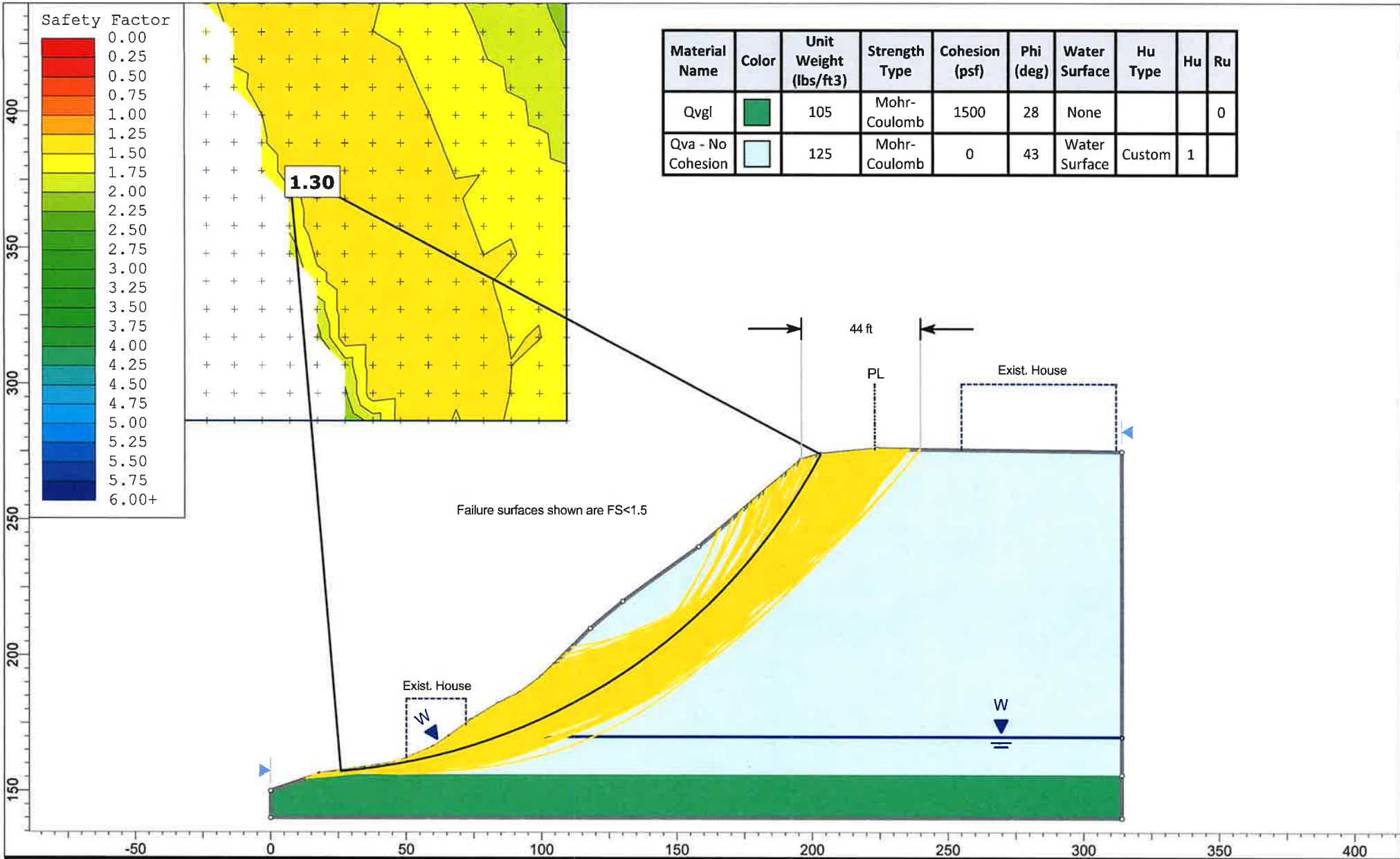


Material Name	Color	Unit Weight (lbs/ft ³)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Qva		125	Mohr-Coulomb	150	43	Water Surface	Custom	1	
QvgI		105	Mohr-Coulomb	1500	28	None			0

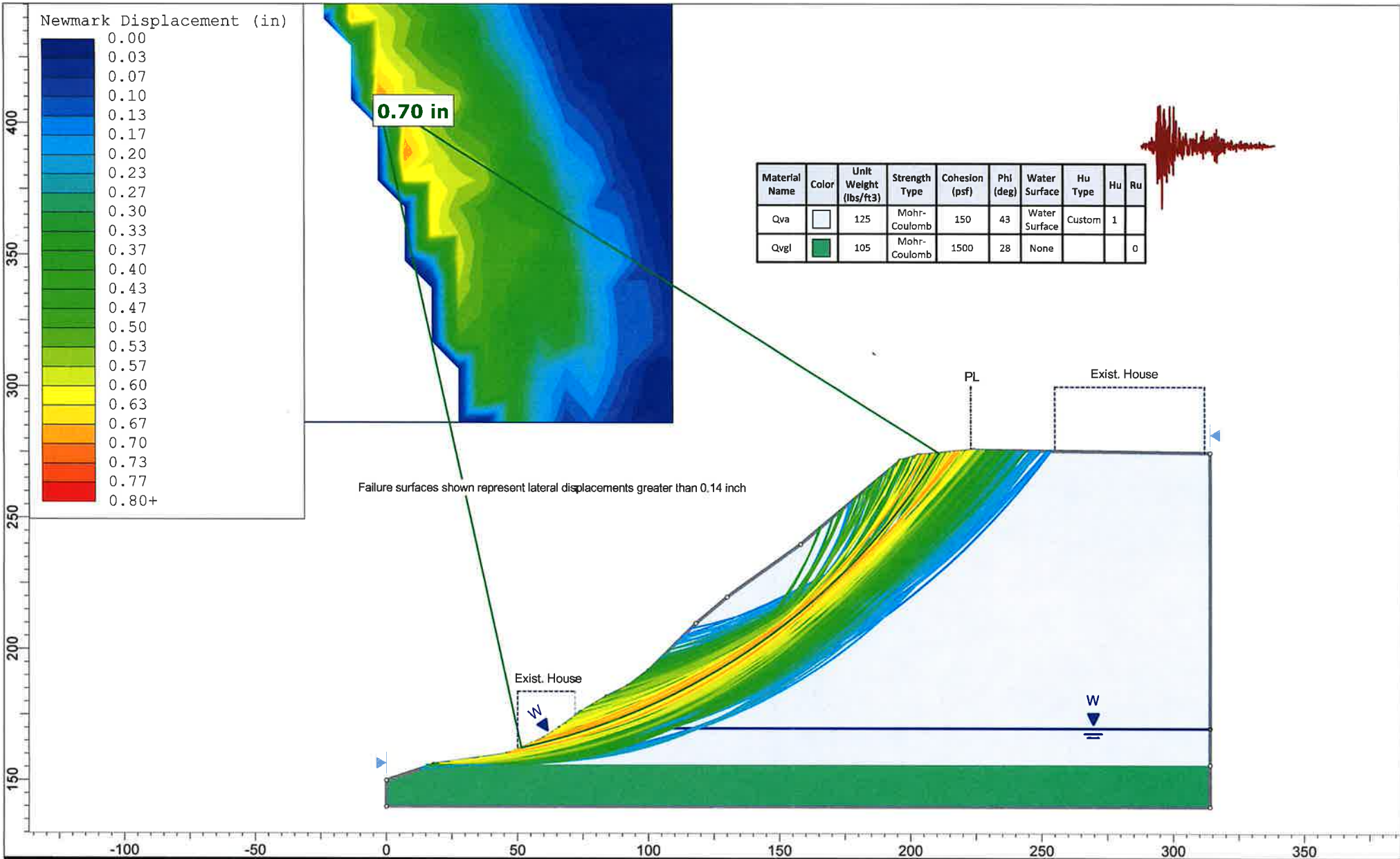
	Project	Khandelwal.slmd		
	Analysis Description	A-A' Static		
	Drawn By	JCS	Company	Terra Associates, Inc.
	Date	11/11/2022	File Name	Khandelwal.slmd



<i>Project</i>	Khandelwal.slmd		
<i>Analysis Description</i>	A-A' Pseudostatic		
<i>Drawn By</i>	JCS	<i>Company</i>	Terra Associates, Inc.
<i>Date</i>	11/11/2022	<i>File Name</i>	Khandelwal.slmd



	Project	Khandelwal.slmd		
	Analysis Description	A-A' No Cohesion		
	Drawn By	JCS	Company	Terra Associates, Inc.
	Date	11/11/2022	File Name	Khandelwal.slmd



	Project	Khandelwal.slm		
	Analysis Description	A-A' Newmark Displacement		
	Drawn By	JCS	Company	Terra Associates, Inc.
	Date	11/11/2022	File Name	Khandelwal.slm



Khandelwal

SLIDE - An Interactive Slope Stability Program

Date Created: 10/31/2022, 2:14:51 PM

Software Version: 9.009

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Slide Analysis Information

Khandelwal

Project Summary

File Name: Khandelwal.slmd
Slide Modeler Version: 9.009
Project Title: SLIDE - An Interactive Slope Stability Program
Date Created: 10/31/2022, 2:14:51 PM

Currently Open Scenarios

Group Name	Scenario Name	Global Minimum	Compute Time
A-A' 	Static	Bishop Simplified: 1.468950	00h:00m:00.180s
	Pseudostatic	Bishop Simplified: 0.810024	00h:00m:00.104s
	No Cohesion	Bishop Simplified: 1.304560	00h:00m:00.102s
	Newmark Displacement	Bishop Simplified: 0.700800	00h:00m:00.277s

Analysis Options

All Open Scenarios

Slices Type:	Vertical
Analysis Methods Used	
	Bishop simplified
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Groundwater Analysis

All Open Scenarios

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft ³]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

All Open Scenarios

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

All Open Scenarios

Surface Type:	Circular
Search Method:	Grid Search
Radius Increment:	10
Composite Surfaces:	Disabled
Reverse Curvature:	Invalid Surfaces
Minimum Elevation [ft]:	140.5
Minimum Depth [ft]:	25
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

◆ A-A' - Static

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

◆ A-A' - Pseudostatic

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.345


◆ A-A' - No Cohesion


Advanced seismic analysis:	No
Staged pseudostatic analysis:	No


◆ A-A' - Newmark Displacement

Advanced seismic analysis:	Yes
Locate surface with minimum critical horizontal seismic acceleration (K_y):	No
Using Newmark analysis:	Yes
Seismic record used:	Cape Mendocino 1992: RIO-270
Scaling records:	No Scaling
Displacement computed using:	Maximum positive/negative
Analysis type	Rigid
Displacement direction:	Downslope only
Staged pseudostatic analysis:	No




Materials

Qva	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft ³]	125
Cohesion [psf]	150
Friction Angle [deg]	43
Water Surface	Assigned per scenario
Hu Value	1

Qvgl	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft ³]	105
Cohesion [psf]	1500
Friction Angle [deg]	28
Water Surface	Assigned per scenario
Ru Value	0

Qva - No Cohesion	
Color	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft ³]	125
Cohesion [psf]	0
Friction Angle [deg]	43
Water Surface	Assigned per scenario
Hu Value	1

Materials In Use

Material	Static	Pseudostatic	No Cohesion	Newmark Displacement
Qva 	✓	✓	✗	✓
Qvgl 	✓	✓	✓	✓
Qva - No Cohesion 	✗	✗	✓	✗

Global Minimums

◆ A-A' - Static

Method: bishop simplified

	FS	1.468950
Center:	7.162, 388.461	
Radius:	231.651	
Left Slip Surface Endpoint:	46.347, 160.149	
Right Slip Surface Endpoint:	208.876, 274.560	
Resisting Moment:	7.24184e+07 lb-ft	
Driving Moment:	4.92996e+07 lb-ft	
Total Slice Area:	2951.52 ft ²	
Surface Horizontal Width:	162.529 ft	
Surface Average Height:	18.1599 ft	

◆ A-A' - Pseudostatic

Method: bishop simplified

	FS	0.810024
Center:	-23.485, 449.756	
Radius:	297.244	
Left Slip Surface Endpoint:	50.140, 161.774	
Right Slip Surface Endpoint:	217.218, 275.354	
Resisting Moment:	7.19989e+07 lb-ft	
Driving Moment:	8.8885e+07 lb-ft	
Total Slice Area:	2843.19 ft ²	
Surface Horizontal Width:	167.078 ft	
Surface Average Height:	17.0171 ft	

◆ A-A' - No Cohesion

Method: bishop simplified

	FS	1.304560
Center:	7.162, 378.245	
Radius:	221.910	
Left Slip Surface Endpoint:	25.879, 157.126	
Right Slip Surface Endpoint:	203.067, 274.006	
Resisting Moment:	5.48132e+07 lb-ft	
Driving Moment:	4.20167e+07 lb-ft	
Total Slice Area:	2609.76 ft ²	
Surface Horizontal Width:	177.188 ft	
Surface Average Height:	14.7288 ft	

◆ A-A' - Newmark Displacement

Method: bishop simplified

Newmark Displacement (in)	0.700800
Center:	-3.054, 408.893
Radius:	252.501
Left Slip Surface Endpoint:	51.489, 162.353
Right Slip Surface Endpoint:	210.868, 274.749
Resisting Moment:	6.41857e+07 lb-ft
Driving Moment:	6.41857e+07 lb-ft
Total Slice Area:	2732.81 ft ²
Surface Horizontal Width:	159.379 ft
Surface Average Height:	17.1466 ft

Valid and Invalid Surfaces

◆ A-A' - Pseudostatic

Method: bishop simplified

Number of Valid Surfaces:	3137
Number of Invalid Surfaces:	6124

Error Codes

Error Code -106 reported for 19 surfaces
 Error Code -115 reported for 4740 surfaces
 Error Code -1000 reported for 1365 surfaces

All other Scenarios

Method: bishop simplified

Number of Valid Surfaces:	3137
Number of Invalid Surfaces:	6124

Error Codes

Error Code -106 reported for 19 surfaces
 Error Code -115 reported for 4740 surfaces
 Error Code -1000 reported for 1365 surfaces

Error Code Descriptions

The following errors were encountered during the computation:

- 106 = Average slice width is less than $0.0001 * (\text{maximum horizontal extent of soil region})$. This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
- 115 = Surface too shallow, below the minimum depth.
- 1000 = No valid slip surface is generated

Slice Data

◆ A-A' - Static

Global Minimum Query (bishop simplified) - Safety Factor: 1.46895

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	3.1555	155.465	10.135	Qva	150	43	105.776	155.379	30.3603	24.5917	5.76863	49.2685	24.6768
2	3.1555	457.475	10.9289	Qva	150	43	132.023	193.936	119.485	72.3696	47.1155	144.978	72.6082
3	3.1555	741.571	11.7249	Qva	150	43	156.244	229.515	202.583	117.314	85.2685	235.01	117.696
4	3.1555	1007.6	12.5232	Qva	150	43	178.468	262.16	279.676	159.4	120.276	319.317	159.917
5	3.1555	1322.55	13.324	Qva	150	43	205.985	302.581	370.345	206.721	163.624	419.128	212.407
6	3.1555	1832.47	14.1274	Qva	150	43	247.236	363.177	518.498	289.894	228.604	580.725	290.831
7	3.1555	2370.51	14.9337	Qva	150	43	313.597	460.658	667.596	334.455	333.141	751.235	416.78
8	3.1555	2959.89	15.743	Qva	150	43	440.687	647.347	813.782	280.444	533.338	938.01	657.566
9	3.1555	3527.72	16.5556	Qva	150	43	563.622	827.932	950.417	223.424	726.993	1117.96	894.541
10	3.1555	3949.25	17.3716	Qva	150	43	661.539	971.767	1044.59	163.358	881.236	1251.55	1088.19
11	3.1555	4296.85	18.1913	Qva	150	43	747.086	1097.43	1116.2	100.206	1016	1361.71	1261.5
12	3.1555	4624.38	19.0148	Qva	150	43	829.45	1218.42	1179.66	33.9251	1145.74	1465.51	1431.58
13	3.28062	5057.91	19.8589	Qva	150	43	879.254	1291.58	1224.19	0	1224.19	1541.77	1541.77
14	3.28062	5233.12	20.7241	Qva	150	43	898.867	1320.39	1255.09	0	1255.09	1595.17	1595.17
15	3.28062	5450.99	21.5942	Qva	150	43	924.599	1358.19	1295.62	0	1295.62	1661.59	1661.59
16	3.28062	5892.03	22.4696	Qva	150	43	983.927	1445.34	1389.08	0	1389.08	1796.02	1796.02
17	3.28062	6338.34	23.3505	Qva	150	43	1042.83	1531.86	1481.87	0	1481.87	1932.07	1932.07
18	3.28062	6979.47	24.2374	Qva	150	43	1129.79	1659.61	1618.86	0	1618.86	2127.5	2127.5
19	3.28062	7706.41	25.1304	Qva	150	43	1227.75	1803.51	1773.17	0	1773.17	2349.09	2349.09
20	3.28062	8407.68	26.0301	Qva	150	43	1319.85	1938.8	1918.26	0	1918.26	2562.85	2562.85
21	3.28062	9082.67	26.9367	Qva	150	43	1406.11	2065.5	2054.12	0	2054.12	2768.61	2768.61
22	3.28062	9730.77	27.8506	Qva	150	43	1486.49	2183.58	2180.75	0	2180.75	2966.16	2966.16
23	3.28062	10296.2	28.7723	Qva	150	43	1553.1	2281.43	2285.68	0	2285.68	3138.53	3138.53
24	3.28062	10674.2	29.7023	Qva	150	43	1591.37	2337.65	2345.97	0	2345.97	3253.76	3253.76
25	3.28062	11013.2	30.6409	Qva	150	43	1622.94	2384.02	2395.7	0	2395.7	3357.07	3357.07
26	3.28062	11322	31.5888	Qva	150	43	1649.21	2422.6	2437.06	0	2437.06	3451.22	3451.22
27	3.28062	11513.3	32.5463	Qva	150	43	1658.21	2435.83	2451.25	0	2451.25	3509.54	3509.54
28	3.28062	11599.5	33.5143	Qva	150	43	1652.14	2426.91	2441.69	0	2441.69	3535.81	3535.81
29	3.28062	11652.8	34.4931	Qva	150	43	1641.17	2410.79	2424.4	0	2424.4	3552.05	3552.05
30	3.28062	11672.1	35.4836	Qva	150	43	1625.26	2387.42	2399.34	0	2399.34	3557.92	3557.92
31	3.28062	11656	36.4865	Qva	150	43	1604.37	2356.74	2366.44	0	2366.44	3553.02	3553.02
32	3.28062	11603.2	37.5025	Qva	150	43	1578.47	2318.69	2325.63	0	2325.63	3536.94	3536.94
33	3.28062	11512.3	38.5326	Qva	150	43	1547.5	2273.2	2276.85	0	2276.85	3509.22	3509.22
34	3.28062	11381.5	39.5776	Qva	150	43	1511.41	2220.19	2220.01	0	2220.01	3469.36	3469.36
35	3.28062	11231.3	40.6387	Qva	150	43	1472.94	2163.67	2159.39	0	2159.39	3423.58	3423.58
36	3.28062	11166.4	41.7168	Qva	150	43	1445.08	2122.75	2115.51	0	2115.51	3403.79	3403.79
37	3.28062	11076.5	42.8134	Qva	150	43	1413.93	2076.99	2066.44	0	2066.44	3376.37	3376.37
38	3.28062	10938.2	43.9299	Qva	150	43	1376.79	2022.43	2007.93	0	2007.93	3334.23	3334.23
39	3.28062	10748.9	45.0676	Qva	150	43	1333.54	1958.91	1939.82	0	1939.82	3276.51	3276.51
40	3.28062	10505.4	46.2286	Qva	150	43	1284.09	1886.26	1861.92	0	1861.92	3202.29	3202.29
41	3.28062	10204.2	47.4146	Qva	150	43	1228.31	1804.32	1774.04	0	1774.04	3110.5	3110.5
42	3.28062	9841.52	48.628	Qva	150	43	1166.06	1712.89	1675.99	0	1675.99	2999.94	2999.94
43	3.28062	9412.69	49.8714	Qva	150	43	1097.22	1611.76	1567.55	0	1567.55	2869.22	2869.22
44	3.28062	8912.54	51.1476	Qva	150	43	1021.63	1500.73	1448.48	0	1448.48	2716.76	2716.76
45	3.28062	8335.02	52.4602	Qva	150	43	939.154	1379.57	1318.55	0	1318.55	2540.72	2540.72
46	3.28062	7673.04	53.8133	Qva	150	43	849.62	1248.05	1177.51	0	1177.51	2338.94	2338.94
47	3.28062	6598.03	55.2115	Qva	150	43	720.506	1058.39	974.126	0	974.126	2011.24	2011.24
48	3.28062	4993.78	56.6609	Qva	150	43	543.748	798.738	695.687	0	695.687	1522.23	1522.23
49	3.28062	3191.93	58.1683	Qva	150	43	355.87	522.755	399.73	0	399.73	972.981	972.981
50	3.28062	1089.02	59.7428	Qva	150	43	149.816	220.072	75.1433	0	75.1433	331.963	331.963

A-A' - Pseudostatic

Global Minimum Query (bishop simplified) - Safety Factor: 0.810024

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	3.35335	117.151	14.6752	Qva	150	43	157.909	127.91	-6.25172	17.4369	-23.6886	35.1018	17.6649
2	3.35335	342.654	15.3444	Qva	150	43	185.676	150.402	51.4375	51.0065	0.430957	102.387	51.3808
3	3.35335	551.071	16.0158	Qva	150	43	210.687	170.662	104.101	81.9437	22.1573	164.577	82.6338
4	3.35335	927.771	16.6894	Qva	150	43	256.512	207.781	200.073	138.111	61.9622	276.979	138.868
5	3.35335	1438.64	17.3655	Qva	150	43	318.91	258.325	329.689	213.524	116.165	429.418	215.894
6	3.35335	2012.96	18.044	Qva	150	43	488.14	395.405	441.901	178.736	263.165	600.922	422.186
7	3.35335	2599.99	18.7252	Qva	150	43	685.601	555.353	543.876	109.187	434.689	776.275	667.088
8	3.35335	3085.81	19.4091	Qva	150	43	856.218	693.557	619.755	36.8599	582.895	921.429	884.569
9	3.33931	3410.8	20.0945	Qva	150	43	958.843	776.686	672.04	0	672.04	1022.82	1022.82
10	3.33931	3727.68	20.7814	Qva	150	43	1024.5	829.873	729.075	0	729.075	1117.87	1117.87
11	3.33931	3969.7	21.4715	Qva	150	43	1070.8	867.373	769.289	0	769.289	1190.47	1190.47
12	3.33931	4109.37	22.1648	Qva	150	43	1091.87	884.441	787.591	0	787.591	1232.39	1232.39
13	3.33931	4271.8	22.8616	Qva	150	43	1117.59	905.275	809.934	0	809.934	1281.14	1281.14
14	3.33931	4675.55	23.562	Qva	150	43	1198.02	970.426	879.799	0	879.799	1402.26	1402.26
15	3.33931	5104.67	24.2662	Qva	150	43	1282.23	1038.64	952.947	0	952.947	1530.98	1530.98
16	3.33931	5719.41	24.9742	Qva	150	43	1406.05	1138.94	1060.5	0	1060.5	1715.39	1715.39
17	3.33931	6453.47	25.6864	Qva	150	43	1553.35	1258.25	1188.46	0	1188.46	1935.58	1935.58
18	3.33931	7166.13	26.4028	Qva	150	43	1692.33	1370.83	1309.18	0	1309.18	2149.37	2149.37
19	3.33931	7856.99	27.1238	Qva	150	43	1823.08	1476.74	1422.76	0	1422.76	2356.63	2356.63
20	3.33931	8525.64	27.8494	Qva	150	43	1945.7	1576.06	1529.26	0	1529.26	2557.25	2557.25
21	3.33931	9112.71	28.5799	Qva	150	43	2047.72	1658.7	1617.89	0	1617.89	2733.41	2733.41
22	3.33931	9512.88	29.3155	Qva	150	43	2107.7	1707.29	1669.98	0	1669.98	2853.52	2853.52
23	3.33931	9879.8	30.0564	Qva	150	43	2158.85	1748.72	1714.41	0	1714.41	2963.66	2963.66
24	3.33931	10221.4	30.8029	Qva	150	43	2203.02	1784.5	1752.79	0	1752.79	3066.21	3066.21
25	3.33931	10438	31.5553	Qva	150	43	2220.24	1798.45	1767.75	0	1767.75	3131.27	3131.27
26	3.33931	10564.7	32.3138	Qva	150	43	2218.45	1797	1766.2	0	1766.2	3169.39	3169.39
27	3.33931	10665.6	33.0787	Qva	150	43	2210.91	1790.89	1759.64	0	1759.64	3199.74	3199.74
28	3.33931	10739.8	33.8504	Qva	150	43	2197.64	1780.14	1748.11	0	1748.11	3222.1	3222.1
29	3.33931	10786.7	34.629	Qva	150	43	2178.69	1764.79	1731.65	0	1731.65	3236.26	3236.26
30	3.33931	10805.4	35.415	Qva	150	43	2154.11	1744.88	1710.3	0	1710.3	3241.99	3241.99
31	3.33931	10795.3	36.2088	Qva	150	43	2123.91	1720.42	1684.07	0	1684.07	3239.04	3239.04
32	3.33931	10755.2	37.0107	Qva	150	43	2088.14	1691.44	1652.99	0	1652.99	3227.13	3227.13
33	3.33931	10732.4	37.8212	Qva	150	43	2055.57	1665.06	1624.7	0	1624.7	3220.38	3220.38
34	3.33931	10801.7	38.6407	Qva	150	43	2039.52	1652.06	1610.77	0	1610.77	3241.27	3241.27
35	3.33931	10844.4	39.4696	Qva	150	43	2018.24	1634.82	1592.28	0	1592.28	3254.19	3254.19
36	3.33931	10853.1	40.3086	Qva	150	43	1990.58	1612.42	1568.25	0	1568.25	3256.9	3256.9
37	3.33931	10826.5	41.1581	Qva	150	43	1956.55	1584.85	1538.69	0	1538.69	3249	3249
38	3.33931	10763.1	42.0188	Qva	150	43	1916.18	1552.15	1503.62	0	1503.62	3230.09	3230.09
39	3.33931	10661.5	42.8913	Qva	150	43	1869.45	1514.3	1463.03	0	1463.03	3199.71	3199.71
40	3.33931	10520.1	43.7763	Qva	150	43	1816.4	1471.33	1416.95	0	1416.95	3157.37	3157.37
41	3.33931	10337	44.6746	Qva	150	43	1757.01	1423.22	1365.36	0	1365.36	3102.53	3102.53
42	3.33931	10110.4	45.5871	Qva	150	43	1691.31	1370	1308.29	0	1308.29	3034.62	3034.62
43	3.33931	9837.98	46.5147	Qva	150	43	1619.29	1311.66	1245.73	0	1245.73	2952.98	2952.98
44	3.33931	9468.9	47.4583	Qva	150	43	1533.51	1242.18	1171.22	0	1171.22	2842.31	2842.31
45	3.33931	8483.97	48.4193	Qva	150	43	1356.71	1098.97	1017.65	0	1017.65	2546.79	2546.79
46	3.33931	7274.79	49.3988	Qva	150	43	1152.05	933.192	839.871	0	839.871	2183.94	2183.94
47	3.33931	5825.18	50.3982	Qva	150	43	919.316	744.668	637.704	0	637.704	1748.9	1748.9
48	3.33931	4241.9	51.4192	Qva	150	43	675.981	547.561	426.331	0	426.331	1273.7	1273.7
49	3.33931	2593.94	52.4635	Qva	150	43	433.109	350.829	215.362	0	215.362	779.057	779.057
50	3.33931	876.624	53.5332	Qva	150	43	191.029	154.738	5.08125	0	5.08125	263.556	263.556

◆ A-A' - No Cohesion

Global Minimum Query (bishop simplified) - Safety Factor: 1.30456

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	3.62205	40.9588	5.3078	Qva - No Cohesion	0	43	3.79853	4.95541	10.9561	5.64211	5.31402	11.309	5.66692
2	3.62205	109.286	6.2478	Qva - No Cohesion	0	43	10.0208	13.0728	29.078	15.0591	14.0189	30.175	15.1159
3	3.62205	150.359	7.1895	Qva - No Cohesion	0	43	13.6359	17.7889	39.7962	20.7199	19.0763	41.5163	20.7964
4	3.62205	164.019	8.13316	Qva - No Cohesion	0	43	14.7132	19.1942	43.186	22.6026	20.5834	45.2887	22.6861
5	3.62205	150.083	9.07904	Qva - No Cohesion	0	43	13.3177	17.3737	39.313	20.6819	18.6311	41.4411	20.7592
6	3.62205	154.685	10.0274	Qva - No Cohesion	0	43	17.6323	23.0024	39.5962	14.9292	24.667	42.7139	27.7847
7	3.62205	481.228	10.9786	Qva - No Cohesion	0	43	41.7832	54.5087	124.775	66.3211	58.4536	132.88	66.5592
8	3.62205	851.697	11.9328	Qva - No Cohesion	0	43	73.1536	95.4333	219.72	117.38	102.34	235.18	117.8
9	3.62205	1193.58	12.8905	Qva - No Cohesion	0	43	101.417	132.304	306.379	164.499	141.88	329.589	165.09
10	3.62205	1572.13	13.8517	Qva - No Cohesion	0	43	135.036	176.163	400.827	211.916	188.911	434.125	222.209
11	3.62205	2211.8	14.817	Qva - No Cohesion	0	43	183.91	239.921	562.116	304.833	257.283	610.765	305.932
12	3.62205	2914.56	15.7867	Qva - No Cohesion	0	43	282.417	368.43	725.02	329.927	395.093	804.865	474.938
13	3.62205	3665.32	16.7609	Qva - No Cohesion	0	43	440.153	574.206	879.704	263.943	615.761	1012.27	748.323
14	3.62205	4323.23	17.7402	Qva - No Cohesion	0	43	581.936	759.17	1007.86	193.755	814.11	1194.03	1000.28
15	3.62205	4776.96	18.7249	Qva - No Cohesion	0	43	690.545	900.858	1085.35	119.296	966.051	1319.42	1200.12
16	3.62205	5189.13	19.7153	Qva - No Cohesion	0	43	792.589	1033.98	1149.31	40.4939	1108.81	1433.33	1392.84
17	3.50692	5317.18	20.696	Qva - No Cohesion	0	43	853.79	1113.82	1194.42	0	1194.42	1516.97	1516.97
18	3.50692	5490.25	21.6672	Qva - No Cohesion	0	43	872.026	1137.61	1219.94	0	1219.94	1566.38	1566.38
19	3.50692	5719.31	22.6449	Qva - No Cohesion	0	43	898.479	1172.12	1256.94	0	1256.94	1631.77	1631.77
20	3.50692	6194.5	23.6296	Qva - No Cohesion	0	43	962.378	1255.48	1346.33	0	1346.33	1767.38	1767.38
21	3.50692	6688.07	24.6218	Qva - No Cohesion	0	43	1027.45	1340.37	1437.37	0	1437.37	1908.24	1908.24
22	3.50692	7432.85	25.6219	Qva - No Cohesion	0	43	1128.94	1472.77	1579.36	0	1579.36	2120.79	2120.79
23	3.50692	8216.1	26.6305	Qva - No Cohesion	0	43	1233.59	1609.29	1725.76	0	1725.76	2344.31	2344.31
24	3.50692	8965.31	27.648	Qva - No Cohesion	0	43	1330.41	1735.6	1861.2	0	1861.2	2558.14	2558.14
25	3.50692	9679.57	28.6752	Qva - No Cohesion	0	43	1419.41	1851.7	1985.7	0	1985.7	2762.01	2762.01
26	3.50692	10349.4	29.7125	Qva - No Cohesion	0	43	1499.35	1955.99	2097.55	0	2097.55	2953.19	2953.19
27	3.50692	10805.1	30.7606	Qva - No Cohesion	0	43	1546.16	2017.06	2163.03	0	2163.03	3083.29	3083.29
28	3.50692	11151.7	31.8203	Qva - No Cohesion	0	43	1575.78	2055.7	2204.47	0	2204.47	3182.27	3182.27
29	3.50692	11458.7	32.8923	Qva - No Cohesion	0	43	1598.45	2085.27	2236.18	0	2236.18	3269.95	3269.95
30	3.50692	11660.9	33.9774	Qva - No Cohesion	0	43	1605.34	2094.26	2245.82	0	2245.82	3327.71	3327.71
31	3.50692	11703.7	35.0766	Qva - No Cohesion	0	43	1589.59	2073.71	2223.79	0	2223.79	3340	3340
32	3.50692	11699.6	36.1907	Qva - No Cohesion	0	43	1567.12	2044.4	2192.35	0	2192.35	3338.92	3338.92

33	3.50692	11649.3	37.321	Qva - No Cohesion	0	43	1538.23	2006.71	2151.93	0	2151.93	3324.64	3324.64
34	3.50692	11550.7	38.4686	Qva - No Cohesion	0	43	1502.87	1960.58	2102.47	0	2102.47	3296.55	3296.55
35	3.50692	11401.3	39.6347	Qva - No Cohesion	0	43	1460.99	1905.95	2043.88	0	2043.88	3254.01	3254.01
36	3.50692	11198.8	40.8208	Qva - No Cohesion	0	43	1412.55	1842.75	1976.11	0	1976.11	3196.28	3196.28
37	3.50692	10940.1	42.0286	Qva - No Cohesion	0	43	1357.45	1770.88	1899.04	0	1899.04	3122.52	3122.52
38	3.50692	10693.2	43.2598	Qva - No Cohesion	0	43	1304.32	1701.57	1824.71	0	1824.71	3052.12	3052.12
39	3.50692	10506.4	44.5164	Qva - No Cohesion	0	43	1258.86	1642.26	1761.11	0	1761.11	2998.9	2998.9
40	3.50692	10254.8	45.8007	Qva - No Cohesion	0	43	1205.92	1573.19	1687.04	0	1687.04	2927.14	2927.14
41	3.50692	9931.3	47.1154	Qva - No Cohesion	0	43	1145.09	1493.84	1601.95	0	1601.95	2834.88	2834.88
42	3.50692	9530.57	48.4635	Qva - No Cohesion	0	43	1076.26	1404.04	1505.65	0	1505.65	2720.57	2720.57
43	3.50692	9046.31	49.8484	Qva - No Cohesion	0	43	999.256	1303.59	1397.93	0	1397.93	2582.41	2582.41
44	3.50692	8471.2	51.2742	Qva - No Cohesion	0	43	913.94	1192.29	1278.58	0	1278.58	2418.31	2418.31
45	3.50692	7796.54	52.7458	Qva - No Cohesion	0	43	820.162	1069.95	1147.38	0	1147.38	2225.78	2225.78
46	3.50692	7011.97	54.269	Qva - No Cohesion	0	43	717.765	936.368	1004.13	0	1004.13	2001.87	2001.87
47	3.50692	6104.87	55.8508	Qva - No Cohesion	0	43	606.62	791.372	848.642	0	848.642	1742.96	1742.96
48	3.50692	5059.61	57.5	Qva - No Cohesion	0	43	486.614	634.817	680.758	0	680.758	1444.59	1444.59
49	3.50692	3416.37	59.2275	Qva - No Cohesion	0	43	316.882	413.391	443.307	0	443.307	975.461	975.461
50	3.50692	1175.3	61.0477	Qva - No Cohesion	0	43	104.658	136.533	146.414	0	146.414	335.593	335.593

◆ A-A' - Newmark Displacement

Global Minimum Query (bishop simplified) - Newmark Displacement (in): 0.7008

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	3.02584	114.952	12.8269	Qva	150	43	138.366	138.366	6.48572	18.9617	-12.476	37.99	19.0283
2	3.02584	337.426	13.5321	Qva	150	43	165.041	165.041	71.7943	55.6652	16.1291	111.515	55.8496
3	3.02584	549.757	14.2394	Qva	150	43	190.505	190.505	133.343	89.9064	43.4364	181.687	91.781
4	3.02584	924.76	14.9489	Qva	150	43	234.375	234.375	243.044	152.563	90.4814	305.621	153.058
5	3.02584	1376.52	15.6608	Qva	150	43	287.578	287.578	374.301	226.766	147.535	454.923	228.157
6	3.02584	1876.12	16.3751	Qva	150	43	418.035	418.035	497.196	209.762	287.434	620.033	410.271
7	3.02584	2390.36	17.0921	Qva	150	43	578.209	578.209	612.189	152.992	459.197	789.982	636.99
8	3.02584	2861.93	17.8119	Qva	150	43	726.901	726.901	712.282	93.6314	618.65	945.83	852.199
9	3.02584	3189.48	18.5345	Qva	150	43	840.622	840.622	772.249	31.6482	740.601	1054.08	1022.43
10	3.22308	3721.14	19.284	Qva	150	43	924.862	924.862	830.939	0	830.939	1154.53	1154.53
11	3.22308	4027.48	20.0608	Qva	150	43	981.141	981.141	891.289	0	891.289	1249.57	1249.57
12	3.22308	4218.87	20.8413	Qva	150	43	1011.53	1011.53	923.878	0	923.878	1308.96	1308.96
13	3.22308	4363.56	21.626	Qva	150	43	1031.24	1031.24	945.011	0	945.011	1353.85	1353.85
14	3.22308	4613.41	22.4149	Qva	150	43	1072.32	1072.32	989.065	0	989.065	1431.37	1431.37
15	3.22308	5038.79	23.2084	Qva	150	43	1148.59	1148.59	1070.86	0	1070.86	1563.35	1563.35
16	3.22308	5470.88	24.0066	Qva	150	43	1224.37	1224.37	1152.12	0	1152.12	1697.41	1697.41
17	3.22308	6121.33	24.8097	Qva	150	43	1342.38	1342.38	1278.67	0	1278.67	1899.22	1899.22
18	3.22308	6808.4	25.6182	Qva	150	43	1464.83	1464.83	1409.99	0	1409.99	2112.39	2112.39
19	3.22308	7472.85	26.4321	Qva	150	43	1579.77	1579.77	1533.24	0	1533.24	2318.54	2318.54
20	3.22308	8114.21	27.2518	Qva	150	43	1687.24	1687.24	1648.48	0	1648.48	2517.53	2517.53
21	3.22308	8731.97	28.0776	Qva	150	43	1787.29	1787.29	1755.78	0	1755.78	2709.2	2709.2
22	3.22308	9253.98	28.9098	Qva	150	43	1866.29	1866.29	1840.5	0	1840.5	2871.16	2871.16
23	3.22308	9610.23	29.7487	Qva	150	43	1911.66	1911.66	1889.15	0	1889.15	2981.69	2981.69
24	3.22308	9937.38	30.5947	Qva	150	43	1949.97	1949.97	1930.23	0	1930.23	3083.2	3083.2
25	3.22308	10237.9	31.4482	Qva	150	43	1981.85	1981.85	1964.42	0	1964.42	3176.43	3176.43
26	3.22308	10421.7	32.3095	Qva	150	43	1991.07	1991.07	1974.3	0	1974.3	3233.47	3233.47
27	3.22308	10514.1	33.1791	Qva	150	43	1982.93	1982.93	1965.57	0	1965.57	3262.13	3262.13
28	3.22308	10578.2	34.0574	Qva	150	43	1969.23	1969.23	1950.89	0	1950.89	3282.02	3282.02
29	3.22308	10613.2	34.9449	Qva	150	43	1949.99	1949.99	1930.26	0	1930.26	3292.86	3292.86
30	3.22308	10618	35.8421	Qva	150	43	1925.23	1925.23	1903.7	0	1903.7	3294.37	3294.37
31	3.22308	10591.7	36.7496	Qva	150	43	1894.93	1894.93	1871.21	0	1871.21	3286.2	3286.2
32	3.22308	10533.2	37.668	Qva	150	43	1859.13	1859.13	1832.81	0	1832.81	3268.05	3268.05
33	3.22308	10441.2	38.5979	Qva	150	43	1817.8	1817.8	1788.5	0	1788.5	3239.52	3239.52
34	3.22308	10328	39.5399	Qva	150	43	1773.16	1773.16	1740.62	0	1740.62	3204.38	3204.38
35	3.22308	10301.5	40.495	Qva	150	43	1742.73	1742.73	1708	0	1708	3196.16	3196.16
36	3.22308	10266.9	41.4639	Qva	150	43	1710.8	1710.8	1673.76	0	1673.76	3185.42	3185.42
37	3.22308	10192.8	42.4474	Qva	150	43	1672.52	1672.52	1632.7	0	1632.7	3162.46	3162.46
38	3.22308	10077.5	43.4467	Qva	150	43	1627.84	1627.84	1584.79	0	1584.79	3126.67	3126.67
39	3.22308	9918.83	44.4627	Qva	150	43	1576.74	1576.74	1529.99	0	1529.99	3077.44	3077.44
40	3.22308	9714.5	45.4968	Qva	150	43	1519.19	1519.19	1468.28	0	1468.28	3014.04	3014.04
41	3.22308	9461.99	46.5502	Qva	150	43	1455.15	1455.15	1399.6	0	1399.6	2935.7	2935.7
42	3.22308	9158.46	47.6246	Qva	150	43	1384.57	1384.57	1323.92	0	1323.92	2841.52	2841.52
43	3.22308	8800.71	48.7214	Qva	150	43	1307.43	1307.43	1241.19	0	1241.19	2730.53	2730.53
44	3.22308	8385.14	49.8428	Qva	150	43	1223.67	1223.67	1151.37	0	1151.37	2601.59	2601.59
45	3.22308	7907.66	50.9908	Qva	150	43	1133.27	1133.27	1054.43	0	1054.43	2453.45	2453.45
46	3.22308	7227.82	52.168	Qva	150	43	1018.35	1018.35	931.188	0	931.188	2242.52	2242.52
47	3.22308	5943.35	53.3772	Qva	150	43	829.222	829.222	728.377	0	728.377	1844	1844
48	3.22308	4502.43	54.6218	Qva	150	43	627.979	627.979	512.57	0	512.57	1396.93	1396.93
49	3.22308	2791.21	55.9058	Qva	150	43	402.74	402.74	271.03	0	271.03	866.004	866.004
50	3.22308	946.935	57.2338	Qva	150	43	173.13	173.13	24.8041	0	24.8041	293.798	293.798

Interslice Data

◆ A-A' - Static

Global Minimum Query (bishop simplified) - Safety Factor: 1.46895

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	46.3467	160.149	0	0	0
2	49.5022	160.713	316.642	0	0
3	52.6577	161.322	660.428	0	0
4	55.8132	161.977	1020.77	0	0
5	58.9687	162.678	1387.89	0	0
6	62.1242	163.425	1761.09	0	0
7	65.2797	164.219	2129.42	0	0
8	68.4352	165.061	2557.1	0	0
9	71.5907	165.95	3223.77	0	0
10	74.7462	166.888	4110.7	0	0
11	77.9017	167.876	5166.96	0	0
12	81.0572	168.913	6366.89	0	0
13	84.2127	170	7701.33	0	0
14	87.4933	171.185	9135.19	0	0
15	90.774	172.426	10526.1	0	0
16	94.0546	173.725	11876.9	0	0
17	97.3352	175.081	13219.9	0	0
18	100.616	176.498	14542.2	0	0
19	103.896	177.975	15857.6	0	0
20	107.177	179.514	17156.6	0	0
21	110.458	181.116	18413	0	0
22	113.738	182.783	19601.6	0	0
23	117.019	184.516	20698	0	0
24	120.299	186.318	21675.4	0	0
25	123.58	188.189	22505.7	0	0
26	126.861	190.132	23174.2	0	0
27	130.141	192.15	23668	0	0
28	133.422	194.243	23975.6	0	0
29	136.703	196.416	24090.8	0	0
30	139.983	198.67	24009.7	0	0
31	143.264	201.009	23730.3	0	0
32	146.544	203.435	23251.7	0	0
33	149.825	205.953	22575	0	0
34	153.106	208.565	21703.2	0	0
35	156.386	211.277	20641.2	0	0
36	159.667	214.093	19393.1	0	0
37	162.947	217.017	17946.6	0	0
38	166.228	220.057	16304.5	0	0
39	169.509	223.217	14475.4	0	0
40	172.789	226.505	12471.3	0	0
41	176.07	229.93	10307.8	0	0
42	179.351	233.499	8004.89	0	0
43	182.631	237.224	5587.46	0	0
44	185.912	241.116	3086.17	0	0
45	189.192	245.188	538.538	0	0
46	192.473	249.458	-2009.76	0	0
47	195.754	253.942	-4503.2	0	0
48	199.034	258.664	-6739.59	0	0
49	202.315	263.651	-8425.09	0	0
50	205.595	268.936	-9370.05	0	0
51	208.876	274.56	0	0	0

◆ A-A' - Pseudostatic

Global Minimum Query (bishop simplified) - Safety Factor: 0.810024

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	50.1404	161.774	0	0	0
2	53.4937	162.653	492.468	0	0
3	56.8471	163.573	947.054	0	0
4	60.2004	164.535	1360.4	0	0
5	63.5538	165.541	1695.89	0	0
6	66.9071	166.589	1918.94	0	0
7	70.2605	167.682	2372.05	0	0
8	73.6138	168.818	3146.66	0	0
9	76.9672	170	4209.47	0	0
10	80.3065	171.222	5400.75	0	0
11	83.6458	172.489	6598.16	0	0
12	86.9851	173.802	7779.53	0	0
13	90.3244	175.163	8921.82	0	0
14	93.6637	176.571	10024.7	0	0
15	97.003	178.027	11114.9	0	0
16	100.342	179.532	12183.8	0	0
17	103.682	181.088	13237.5	0	0
18	107.021	182.694	14268.5	0	0
19	110.36	184.352	15254.3	0	0
20	113.7	186.062	16173.3	0	0
21	117.039	187.826	17005	0	0
22	120.378	189.646	17728.4	0	0
23	123.718	191.521	18325	0	0
24	127.057	193.453	18783.7	0	0
25	130.396	195.444	19094.8	0	0
26	133.735	197.495	19252.7	0	0
27	137.075	199.607	19255.7	0	0
28	140.414	201.782	19101.9	0	0
29	143.753	204.022	18790.5	0	0
30	147.093	206.328	18321.7	0	0
31	150.432	208.702	17697.2	0	0
32	153.771	211.147	16919.5	0	0
33	157.111	213.664	15992.7	0	0
34	160.45	216.257	14915	0	0
35	163.789	218.926	13671.5	0	0
36	167.129	221.676	12264.2	0	0
37	170.468	224.509	10697.8	0	0
38	173.807	227.428	8978.41	0	0
39	177.146	230.436	7114.16	0	0
40	180.486	233.539	5114.99	0	0
41	183.825	236.738	2992.98	0	0
42	187.164	240.04	762.452	0	0
43	190.504	243.448	-1559.78	0	0
44	193.843	246.969	-3954.16	0	0
45	197.182	250.608	-6382.62	0	0
46	200.522	254.372	-8627.44	0	0
47	203.861	258.267	-10577.7	0	0
48	207.2	262.304	-12103.8	0	0
49	210.54	266.49	-13103.6	0	0
50	213.879	270.836	-13494	0	0
51	217.218	275.354	0	0	0

A-A' - No Cohesion

Global Minimum Query (bishop simplified) - Safety Factor: 1.30456

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	25.8787	157.126	0	0	0
2	29.5007	157.462	10.0386	0	0
3	33.1228	157.859	34.7167	0	0
4	36.7448	158.315	65.8053	0	0
5	40.3668	158.833	96.6145	0	0
6	43.9889	159.412	121.982	0	0
7	47.6109	160.052	160.333	0	0
8	51.233	160.755	223.637	0	0
9	54.855	161.52	319.781	0	0
10	58.4771	162.349	432.268	0	0
11	62.0991	163.243	562.21	0	0
12	65.7212	164.201	688.15	0	0
13	69.3432	165.225	966.18	0	0
14	72.9653	166.316	1596.96	0	0
15	76.5873	167.474	2531.83	0	0
16	80.2094	168.702	3694.47	0	0
17	83.8314	170	5066.6	0	0
18	87.3383	171.325	6471.1	0	0
19	90.8452	172.718	7822.2	0	0
20	94.3521	174.181	9126.58	0	0
21	97.8591	175.715	10427.8	0	0
22	101.366	177.323	11712.1	0	0
23	104.873	179.005	13005.4	0	0
24	108.38	180.763	14286.4	0	0
25	111.887	182.6	15521.6	0	0
26	115.394	184.518	16678.8	0	0
27	118.901	186.519	17726.4	0	0
28	122.407	188.607	18620.7	0	0
29	125.914	190.783	19336.4	0	0
30	129.421	193.051	19856.8	0	0
31	132.928	195.414	20165.2	0	0
32	136.435	197.877	20250.1	0	0
33	139.942	200.443	20107.5	0	0
34	143.449	203.116	19735.6	0	0
35	146.956	205.903	19135.1	0	0
36	150.463	208.807	18309.4	0	0
37	153.97	211.837	17264.9	0	0
38	157.477	214.997	16011.4	0	0
39	160.984	218.298	14552.8	0	0
40	164.49	221.746	12884.3	0	0
41	167.997	225.352	11019.1	0	0
42	171.504	229.128	8976.37	0	0
43	175.011	233.087	6781.13	0	0
44	178.518	237.244	4465.84	0	0
45	182.025	241.617	2071.63	0	0
46	185.532	246.228	-349.765	0	0
47	189.039	251.103	-2733.64	0	0
48	192.546	256.273	-4998.97	0	0
49	196.053	261.778	-7043.96	0	0
50	199.56	267.667	-8546.14	0	0
51	203.067	274.006	0	0	0

◆ A-A' - Newmark Displacement

Global Minimum Query (bishop simplified) - Newmark Displacement (in): 0.7008

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	51.4894	162.353	0	0	0
2	54.5152	163.042	389.354	0	0
3	57.5411	163.77	763.51	0	0
4	60.5669	164.538	1118.71	0	0
5	63.5928	165.346	1431.62	0	0
6	66.6186	166.194	1686.68	0	0
7	69.6444	167.083	2103.93	0	0
8	72.6703	168.013	2767.15	0	0
9	75.6961	168.986	3655.45	0	0
10	78.722	170	4726.1	0	0
11	81.945	171.128	5965.5	0	0
12	85.1681	172.305	7208.08	0	0
13	88.3912	173.532	8422.67	0	0
14	91.6143	174.809	9595.55	0	0
15	94.8374	176.139	10739.5	0	0
16	98.0604	177.521	11872.2	0	0
17	101.284	178.956	12981.9	0	0
18	104.507	180.446	14080.1	0	0
19	107.73	181.992	15150.3	0	0
20	110.953	183.594	16170	0	0
21	114.176	185.254	17117.2	0	0
22	117.399	186.973	17971.2	0	0
23	120.622	188.753	18709.9	0	0
24	123.845	190.595	19313.8	0	0
25	127.068	192.501	19771.9	0	0
26	130.291	194.472	20074.2	0	0
27	133.514	196.511	20214.3	0	0
28	136.737	198.618	20190.1	0	0
29	139.96	200.797	19999.8	0	0
30	143.184	203.049	19643.1	0	0
31	146.407	205.377	19120.6	0	0
32	149.63	207.784	18434.8	0	0
33	152.853	210.272	17589.4	0	0
34	156.076	212.845	16589.7	0	0
35	159.299	215.505	15440.7	0	0
36	162.522	218.258	14129.7	0	0
37	165.745	221.106	12657.5	0	0
38	168.968	224.054	11031.5	0	0
39	172.191	227.107	9261.31	0	0
40	175.414	230.27	7359.3	0	0
41	178.637	233.549	5340.46	0	0
42	181.86	236.952	3222.99	0	0
43	185.084	240.484	1028.56	0	0
44	188.307	244.156	-1217.14	0	0
45	191.53	247.976	-3483.89	0	0
46	194.753	251.954	-5736.23	0	0
47	197.976	256.105	-7881.36	0	0
48	201.199	260.441	-9652.02	0	0
49	204.422	264.98	-10927.9	0	0
50	207.645	269.742	-11523.8	0	0
51	210.868	274.749	0	0	0

Entity Information

◆ A-A'

Shared Entities

Type	Coordinates (x,y)
External Boundary	314, 140
	314, 156
	314, 170
	314, 275
	224, 276
	203, 274
	196, 272
	158, 240
	130, 220
	118, 210
	100, 192
	92, 186
	84, 182
	74, 176
	66, 170
	60, 166
	46, 160
18, 156	
0, 150	
0, 140	
Material Boundary	18, 156 314, 156

Scenario-based Entities

Type	Coordinates (x,y)	Static	Pseudostatic	No Cohesion	Newmark Displacement
Water Table	18, 156	Assigned to:	Assigned to:	Assigned to:	Assigned to:
	46, 160	<input type="checkbox"/> Qva	<input type="checkbox"/> Qva	<input checked="" type="checkbox"/> Qva - No Cohesion	<input type="checkbox"/> Qva
	50, 161.714				
	60, 166				
	66, 170				
	314, 170				