GEOTECH
CONSULTANTS, INC.

2401 10th Ave E
Seattle, Washington 98102
(425) 747-5618

June 6, 2023

JN 22007

Dorothy Strand
6950 Southeast Maker Street
Mercer Island, Washington 98040
via email: kcra2005@yahoo.com

Subject: **Review of Revised Plans**
Proposed New Residence
6950 Southeast Maker Street
Mercer Island, Washington

Dear Ms. Strand:

As required by the City of Mercer Island, we have completed a review of the geotechnical aspects of the revised plans for your proposed new residence. This revision to the plans addresses not only stabilization of the filled rockery on the west side of the site, but also providing protection for your residence in the event of future movement of the filled modular wall located on your eastern neighbor's lot.

Following discussions with you and your project team, partial removal of the western rockery combined with the installation of closely-spaced soldier piles behind the remaining portion of the rockery was chosen as the method to stabilize the fill located on the western portion of your property. This method substantially reduces the amount of site disturbance and earthwork, while providing stability for the filled rockery in the event of the Maximum Considered Earthquake (MCE). The design recommendations for this stabilization system are presented in our May 8, 2023 *Slope Stability Update*, which is attached for reference.

During this process, we were informed that it would not be possible to obtain permission to place fill against the eastern neighbor's filled modular block wall. We had previously recommended placing this fill buttress against the wall, as the wall was obviously not reinforced with geogrids, and would be inadequate to withstand a large earthquake. After discussing alternatives with your project team, it was decided to build a sloping fill up to the eastern property line, with a wall constructed at the property line to retain the fill within the site boundaries. This bermed fill will serve to absorb the impact from a potential future failure of the eastern neighbor's modular block wall.

Review of Plans:

We have been provided with the revised plans, which include the architectural plans (Jeffrey Almeter; June 2, 2023), shoring plans (Jeffrey Almeter and Buker Engineering; June 2, 2023), civil plans (Goldsmith Land Development Services; June 2, 2023), and the structural drawings (DS Engineering; February 2, 2023).

The shoring (SH) drawings correctly depict the partial removal of the existing western rockery, combined with the installation of closely-spaced soldier piles immediately behind the remaining lower portion of the rockery. The remaining lower approximately 5 feet of the rockery will no longer have to resist any lateral soil load, as this will be accomplished by the stabilization piles. This

system incorporates our recommendations to provide stability for the existing fill located on the west side of the lot.

The Site Plan and sections on SH1, as well as sheets C-2 and C-3, properly illustrate the fill berm and modular block wall to be constructed as protection against a potential failure of the eastern neighbor's modular block wall.

Where the new storm outfall pipe will extend to S.E. Maker Street, the existing rockery will be removed, and the ground will be lowered and regraded to a sloping condition between the end of the stabilization wall and the new driveway.

The plans that we reviewed have incorporated our recommendations for shoring, foundations, and permanent stability.

Statement of Risk: In order to satisfy the City of Mercer Island's requirements, a statement of risk is needed. As such, we make the following statement:

The landslide hazard area or seismic hazard area will be modified or the development has been designed so that the risk to the site and adjacent property is eliminated or mitigated such that the site is determined to be safe;

Please contact us if you have any questions regarding this letter.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

6/6/2023
Marc R. McGinnis, P.E.
Principal

Attachment: May 8, 2023 Slope Stability Update

cc: **Jeffrey Almeter**
via email: jeffrey.almeter@gmail.com

MRM:kg

GEOTECH
CONSULTANTS, INC.

2401 10th Ave E
Seattle, Washington 98102
(425) 747-5618

May 8, 2023

JN 22007

Dorothy Strand
6950 Southeast Maker Street
Mercer Island, Washington 98040
via email: kcra2005@yahoo.com

Subject: **Slope Stability Update**
Proposed New Residence
6950 S.E. Maker Street
Mercer Island, Washington

Dear Ms. Strand:

As a part of the 2207-019-SUB1-PLANS REVIEW by City of Mercer Island, their geotechnical third-party reviewer made the following comment:

> The geotechnical engineering report indicates "...due to the loose nature of the upper fill soils behind the rockery, it would only be considered moderately stable, and likely has a current factor of safety of 1.0 or slightly higher with regards to slope stability." Indicate how this hazard is being mitigated (MICC 19.07.160).

As we discussed in our previous response to this comment, the rockery in question existed before development of the adjacent western property. The planned redevelopment of your lot with a new home would not adversely impact the stability of this filled rockery, and may actually improve its stability slightly by collecting all runoff from impervious surfaces and discharging it to the storm sewer.

No mitigation of this potential hazard was included in the neighboring construction. It is likely that excavation for that house would have extended into the influence zone of that rockery, and the front entry and entry walk were placed close to the base of the rockery.

Following our meeting with City of Mercer Island staff, we understand that they are interpreting Mercer Island Code to require that the risk of potential future failure of the old filled rockery located along the western side of your lot is to be mitigated for the planned redevelopment of your property. The most likely cause of any potential future movement of the filled rockery would be a moderate to large earthquake.

With you and your design team, we have discussed several different methods to provide stability of the fill behind the western rockery under both static and seismic (Maximum Considered Earthquake with a 2% chance of occurring in 50 years) conditions. Based on these discussions, and our review of the site conditions for equipment and truck access, it appears most practical to install a line of closely-spaced stabilization piles immediately behind the western rockery. These piles would retain the loose fill soils behind the rockery and provide stability for the fill in the event of an earthquake. In conjunction with the construction of this stabilization wall, the uppermost 4 to 5 feet of the existing rockery would be removed. This will create a level bench for the installation of the drilled piles. The upper 4 to 5 feet of the stabilization piles would then be lagged and backfilled to restore the ground surface elevation in the western yard area.

Based on our previous stability assessments, a theoretical failure could have extended through the toe of the existing rockery in the event of the low probability Maximum Considered Earthquake. The stabilization piles should be designed to resist active and seismic earth pressures to that depth, with passive soil pressure in the competent glacial till resisting the lateral earth loads below that depth.

The following section has design recommendations for the stabilization wall consisting of closely-spaced soldier piles.

STABILIZATION WALL

The stabilization wall should consist of closely spaced, drilled soldier piles spaced no further apart than 3 feet edge-to-edge. The soil within the stabilization zone will arch between the piles if a failure does in fact occur on the eastern slope. The piles could be installed by drilling them to depth. It is likely that a debris barrier, potentially consisting of plywood spanning between metal posts, with need to be installed along the western side of the work area to prevent drill spoils from falling onto the neighboring property.

There will be no need for a subsurface drain behind the stabilization wall. Any small amounts of groundwater that currently travel laterally below the ground surface will pass between the piles.

The stabilization wall should be designed for an active soil pressure equal to that pressure exerted by an equivalent fluid with a unit weight of 40 pounds per cubic foot (pcf) if it retains level soil. A seismic surcharge of 8H pounds per square foot (psf) should be applied also. In this case H is the effective design retention height, which extends to the base of the existing rockery. An ultimate (no safety factor included) passive soil pressure equal to that pressure exerted by a fluid with a density of 450 pcf will resist the lateral movement of the piles below the stabilization depth. This passive resistance can be assumed to act over twice the width of the wide-flange beams. Typically, a safety factor of 1.5 is applied to the ultimate passive resistance for static conditions, and 1.1 to 1.2 for seismic loading conditions.

Please contact us if you have any questions regarding this letter.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

5/8/2023

Marc R. McGinnis, P.E.
Principal

Attachments:

- Slope Stability Analyses

cc: **Jeffrey Almeter -** *via email: jeffrey.almeter@gmail.com*

22007 - Strand

Cross Section

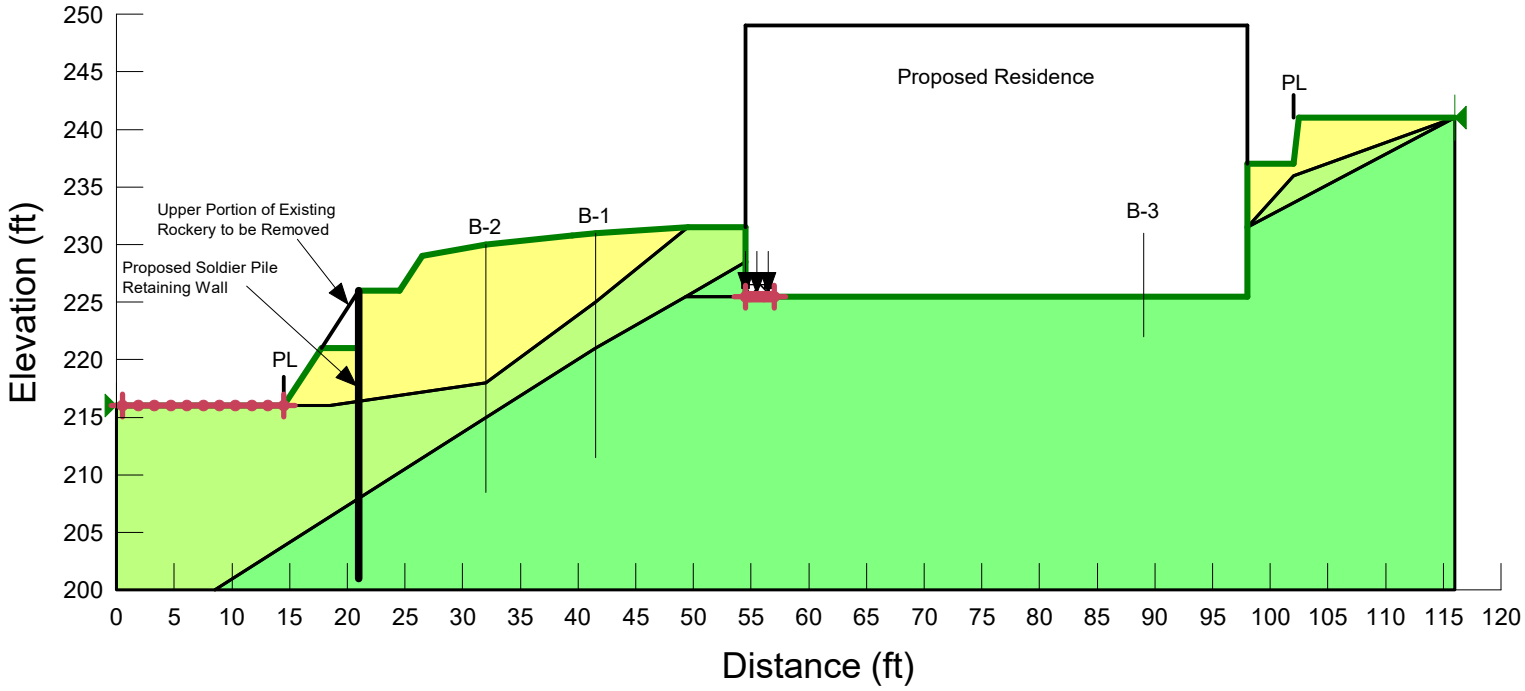
Materials

- Loose FILL
- Medium-Dense Silty SAND
- Dense GLACIAL TILL

Name: Loose FILL
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 30 °

Name: Medium-Dense Silty SAND
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Dense GLACIAL TILL
Unit Weight: 140 pcf
Cohesion': 100 psf
Phi': 40 °



22007 - Strand

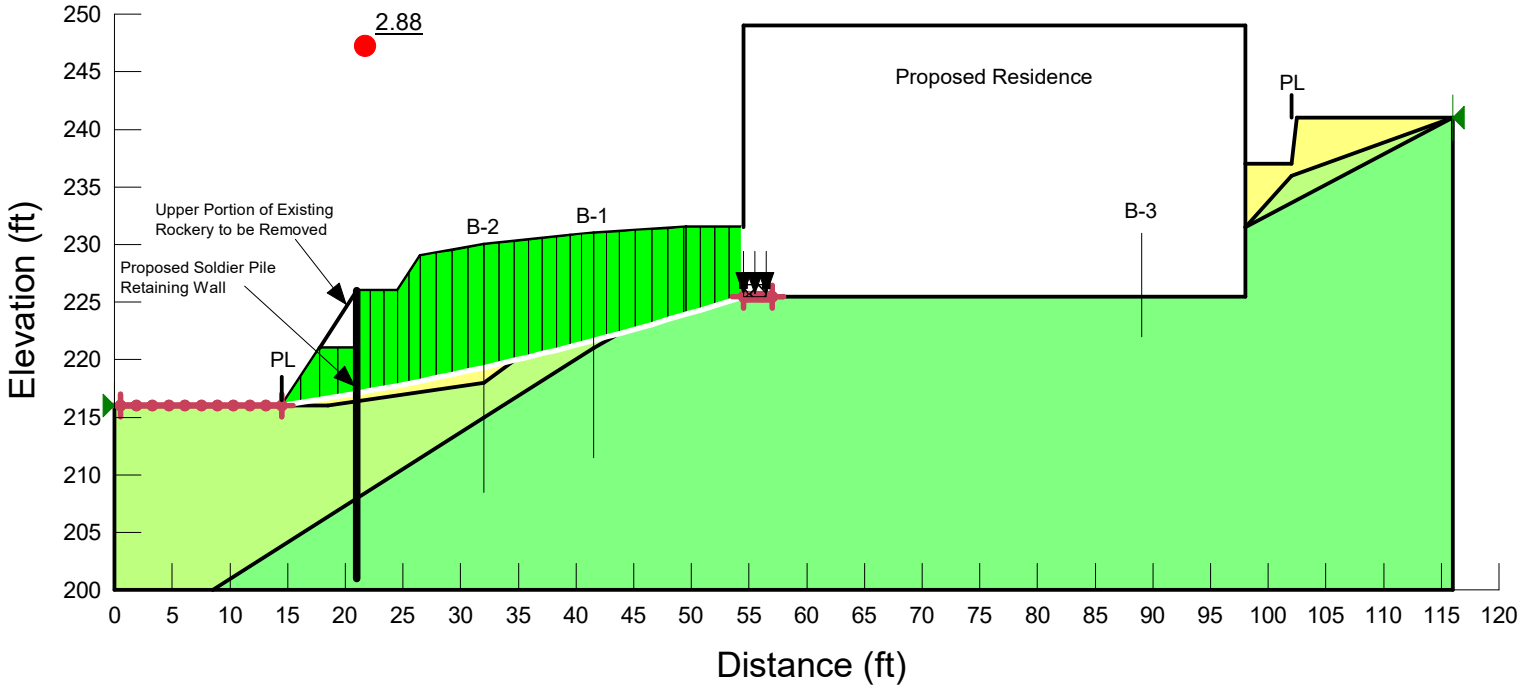
Static

Materials
- Loose FILL
- Medium-Dense Silty SAND
- Dense GLACIAL TILL

Name: Loose FILL
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 30 °

Name: Medium-Dense Silty SAND
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Dense GLACIAL TILL
Unit Weight: 140 pcf
Cohesion': 100 psf
Phi': 40 °



Static

File Information

File Version: 8.15
Title: 22007 Slope Stability Analysis
Created By: Adam Moyer
Last Edited By: Adam Moyer
Revision Number: 64
Date: 5/3/2023
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Tool Version: 8.15.6.13446
File Name: 22007 Slope Stability Analysis - Strand (Soldier Piles).gsz
Directory: C:\Users\AdamM\Geotech Consultants\Shared Documents - Documents\2022 Jobs\22007 Strand (MRM)\
Last Solved Date: 5/3/2023
Last Solved Time: 6:17:05 PM

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

Static

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
Side Function
Interslice force function option: Half-Sine
PWP Conditions Source: (none)
Slip Surface
Direction of movement: Right to Left
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 1
Resisting Side Maximum Convex Angle: 1 °
Driving Side Maximum Convex Angle: 5 °

Optimize Critical Slip Surface Location: No
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 30
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 0.1 ft
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Loose FILL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Medium-Dense Silty SAND

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 34 °
Phi-B: 0 °

Dense GLACIAL TILL

Model: Mohr-Coulomb
Unit Weight: 140 pcf
Cohesion': 100 psf
Phi': 40 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (0.5, 216) ft
Left-Zone Right Coordinate: (14.5, 216) ft
Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (54.5, 225.5) ft
Right-Zone Right Coordinate: (57, 225.5) ft
Right-Zone Increment: 10

Radius Increments: 10

Slip Surface Limits

Left Coordinate: (0, 216) ft
Right Coordinate: (116, 241) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 3,000 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	54.5	226.5
	56.5	226.5

Points

	X (ft)	Y (ft)
Point 1	0	216
Point 2	14.5	216
Point 3	18.5	216
Point 4	21	226
Point 5	24.5	226
Point 6	26.5	229
Point 7	32	230
Point 8	41.5	231
Point 9	54.5	231.5
Point 10	89	231.5
Point 11	98	231.5
Point 12	98	237
Point 13	102	237
Point 14	102.5	241
Point 15	116	241
Point 16	0	200
Point 17	116	200
Point 18	41.5	225
Point 19	41.5	221
Point 20	41.5	211.5
Point 21	32	218
Point 22	32	215
Point 23	32	208.5
Point 24	89	228
Point 25	89	222

Point 26	8.5	200
Point 27	102	236
Point 28	54.5	225.5
Point 29	49.35714	225.5
Point 30	98	225.5
Point 31	49.5	231.5
Point 32	54.5	228.5
Point 33	39.5	230.78947
Point 34	39.5	226
Point 35	24.5	221
Point 36	17.75	221
Point 37	21	221

Regions

	Material	Points	Area (ft²)
Region 1	Dense GLACIAL TILL	26,22,19,29,28,30,11,15,17	2,422.8
Region 2	Loose FILL	11,12,13,14,15,27	47
Region 3	Medium-Dense Silty SAND	11,27,15	21.5
Region 4	Medium-Dense Silty SAND	1,16,26,22,19,29,32,9,31,18,21,3,2	444.46
Region 5	Dense GLACIAL TILL	29,28,32	7.7143
Region 6	Loose FILL	2,36,37,4,5,6,7,33,8,31,18,21,3	252.62

Current Slip Surface

Slip Surface: 1,211
F of S: 2.88
Volume: 326.12155 ft³
Weight: 39,826.943 lbs
Resisting Moment: 7,039,834.2 lbs-ft
Activating Moment: 2,442,671.4 lbs-ft
Resisting Force: 26,195.096 lbs
Activating Force: 9,086.373 lbs
F of S Rank (Analysis): 1 of 1,331 slip surfaces
F of S Rank (Query): 1 of 1,331 slip surfaces
Exit: (14.5, 216) ft
Entry: (54.5, 225.5) ft
Radius: 260.50867 ft
Center: (-25.508672, 473.41809) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	15.3125	216.12891	0	130.3198	75.24017	0
Slice 2	16.9375	216.392	0	389.65597	224.96798	0
Slice 3	18.5625	216.66564	0	502.09014	289.88188	0
Slice 4	20.1875	216.94987	0	468.40576	270.43419	0
Slice 5	21.583333	217.20186	0	1,016.9121	587.11447	0

Slice 6	22.75	217.41904	0	990.97995	572.14254	0
Slice 7	23.916667	217.64172	0	964.57018	556.89485	0
Slice 8	25	217.85326	0	1,026.1775	592.46385	0
Slice 9	26	218.05293	0	1,175.7195	678.80196	0
Slice 10	27.1875	218.29579	0	1,248.0613	720.56852	0
Slice 11	28.5625	218.58367	0	1,243.1162	717.71349	0
Slice 12	29.9375	218.8793	0	1,237.3377	714.37727	0
Slice 13	31.3125	219.18272	0	1,230.6767	710.53152	0
Slice 14	32.66155	219.48792	0	1,217.4169	702.87598	0
Slice 15	33.984649	219.79465	0	1,197.5562	691.4094	0
Slice 16	35.252924	220.09536	0	1,166.3245	786.69579	0
Slice 17	36.466374	220.38949	0	1,149.4162	775.29099	0
Slice 18	37.679825	220.6898	0	1,131.7434	763.37059	0
Slice 19	38.893275	220.99629	0	1,113.2802	750.91698	0
Slice 20	40	221.281	0	1,095.7635	739.10185	0
Slice 21	41	221.54293	0	1,079.3145	728.00684	0
Slice 22	42.059146	221.82512	0	1,058.7441	714.13192	0
Slice 23	43.177438	222.12812	0	1,033.9776	697.4267	0
Slice 24	44.439154	222.47679	0	978.55527	821.10536	100
Slice 25	45.844293	222.87271	0	952.63834	799.35848	100
Slice 26	47.249432	223.27715	0	925.64169	776.7056	100
Slice 27	48.654571	223.69015	0	897.53754	753.12342	100
Slice 28	49.42857	223.92025	0	881.7284	739.85797	100
Slice 29	50.125	224.13133	0	860.41948	721.97767	100
Slice 30	51.375	224.51401	0	820.33679	688.3443	100
Slice 31	52.625	224.90357	0	779.3911	653.98678	100
Slice 32	53.875	225.30004	0	737.58834	618.9101	100

22007 - Strand

Seismic

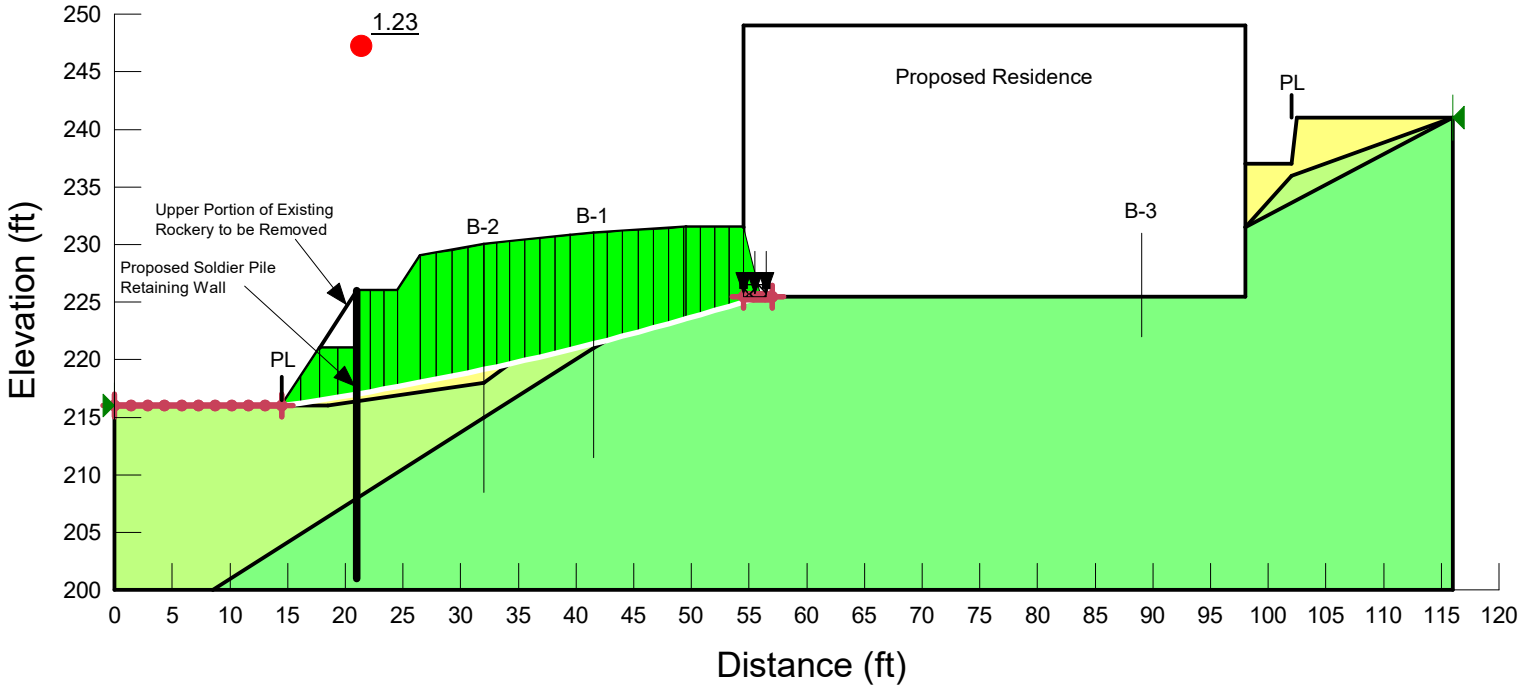
Materials

- Loose FILL
- Medium-Dense Silty SAND
- Dense GLACIAL TILL

Name: Loose FILL
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 30 °

Name: Medium-Dense Silty SAND
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 34 °

Name: Dense GLACIAL TILL
Unit Weight: 140 pcf
Cohesion': 100 psf
Phi': 40 °



Seismic

File Information

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Directory: C:\Users\AdamM\Geotech Consultants\Shared Documents - Documents\2022 Jobs\22007 Strand (MRM)\
Last Solved Date: 5/3/2023
Last Solved Time: 6:17:07 PM

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

Seismic

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
Side Function
Interslice force function option: Half-Sine
PWP Conditions Source: (none)
Slip Surface
Direction of movement: Right to Left
Use Passive Mode: No
Slip Surface Option: Entry and Exit
Critical slip surfaces saved: 1
Resisting Side Maximum Convex Angle: 1 °
Driving Side Maximum Convex Angle: 5 °

Optimize Critical Slip Surface Location: No
Tension Crack
Tension Crack Option: (none)
F of S Distribution
F of S Calculation Option: Constant
Advanced
Number of Slices: 30
F of S Tolerance: 0.001
Minimum Slip Surface Depth: 0.1 ft
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Loose FILL

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 0 psf
Phi': 30 °
Phi-B: 0 °

Medium-Dense Silty SAND

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 0 psf
Phi': 34 °
Phi-B: 0 °

Dense GLACIAL TILL

Model: Mohr-Coulomb
Unit Weight: 140 pcf
Cohesion': 100 psf
Phi': 40 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (0, 216) ft
Left-Zone Right Coordinate: (14.5, 216) ft
Left-Zone Increment: 10
Right Projection: Range
Right-Zone Left Coordinate: (54.53697, 225.5) ft
Right-Zone Right Coordinate: (57, 225.5) ft
Right-Zone Increment: 10

Radius Increments: 20

Slip Surface Limits

Left Coordinate: (0, 216) ft
Right Coordinate: (116, 241) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 3,000 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	54.5	226.5
	56.5	226.5

Seismic Coefficients

Horz Seismic Coef.: 0.333

Points

	X (ft)	Y (ft)
Point 1	0	216
Point 2	14.5	216
Point 3	18.5	216
Point 4	21	226
Point 5	24.5	226
Point 6	26.5	229
Point 7	32	230
Point 8	41.5	231
Point 9	54.5	231.5
Point 10	89	231.5
Point 11	98	231.5
Point 12	98	237
Point 13	102	237
Point 14	102.5	241
Point 15	116	241
Point 16	0	200
Point 17	116	200
Point 18	41.5	225
Point 19	41.5	221
Point 20	41.5	211.5
Point 21	32	218

Point 22	32	215
Point 23	32	208.5
Point 24	89	228
Point 25	89	222
Point 26	8.5	200
Point 27	102	236
Point 28	54.5	225.5
Point 29	49.35714	225.5
Point 30	98	225.5
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Point 32	54.5	228.5
Point 33	39.5	230.78947
Point 34	39.5	226
Point 35	24.5	221
Point 36	17.75	221
Point 37	21	221

Regions

	Material	Points	Area (ft²)
Region 1	Dense GLACIAL TILL	26,22,19,29,28,30,11,15,17	2,422.8
Region 2	Loose FILL	11,12,13,14,15,27	47
Region 3	Medium-Dense Silty SAND	11,27,15	21.5
Region 4	Medium-Dense Silty SAND	1,16,26,22,19,29,32,9,31,18,21,3,2	444.46
Region 5	Dense GLACIAL TILL	29,28,32	7.7143
Region 6	Loose FILL	2,36,37,4,5,6,7,33,8,31,18,21,3	252.62

Current Slip Surface

Slip Surface: 2,437
F of S: 1.23
Volume: 335.14206 ft³
Weight: 41,016.233 lbs
Resisting Moment: 7,816,151.8 lbs-ft
Activating Moment: 6,329,166.7 lbs-ft
Resisting Force: 28,364.767 lbs
Activating Force: 22,978.623 lbs
F of S Rank (Analysis): 1 of 2,541 slip surfaces
F of S Rank (Query): 1 of 2,541 slip surfaces
Exit: (14.5, 216) ft
Entry: (56.014788, 225.5) ft
Radius: 267.59565 ft
Center: (-24.245383, 480.77581) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	15.3125	216.12144	0	127.61968	73.681258	0

Slice 2	16.9375	216.36944	0	385.93709	222.82088	0
Slice 3	18.5625	216.62767	0	506.05186	292.16918	0
Slice 4	20.1875	216.89615	0	483.92787	279.39589	0
Slice 5	21.583333	217.13436	0	1,048.034	605.08273	0
Slice 6	22.75	217.33983	0	1,038.0148	599.29813	0
Slice 7	23.916667	217.55062	0	1,026.7199	592.77699	0
Slice 8	25.5	217.84655	0	1,187.6527	685.69161	0
Slice 9	27.1875	218.1704	0	1,361.8933	786.28945	0
Slice 10	28.5625	218.44344	0	1,370.9793	791.5353	0
Slice 11	29.9375	218.72399	0	1,375.1612	793.94967	0
Slice 12	31.3125	219.01206	0	1,374.473	793.55233	0
Slice 13	32.559552	219.27953	0	1,364.6292	787.86903	0
Slice 14	33.678655	219.52514	0	1,346.7008	777.51808	0
Slice 15	34.89593	219.79825	0	1,186.7347	800.46263	0
Slice 16	36.211379	220.09985	0	1,162.6433	784.21278	0
Slice 17	37.526827	220.40843	0	1,138.5167	767.93922	0
Slice 18	38.842276	220.72404	0	1,113.5438	751.09476	0
Slice 19	40.5	221.13296	0	1,078.7191	727.60522	0
Slice 20	42.103438	221.53677	0	1,037.3242	699.68404	0
Slice 21	43.371903	221.86489	0	775.7868	650.96242	100
Slice 22	44.701956	222.2159	0	759.75205	637.50767	100
Slice 23	46.032008	222.57425	0	741.24307	621.97679	100
Slice 24	47.362061	222.93995	0	719.99806	604.15011	100
Slice 25	48.692114	223.31304	0	696.15487	584.14329	100
Slice 26	49.42857	223.52189	0	682.11062	572.35877	100
Slice 27	50.125	223.72318	0	661.96447	555.45414	100
Slice 28	51.375	224.08813	0	623.49376	523.17339	100
Slice 29	52.625	224.45969	0	583.53148	489.64105	100
Slice 30	53.875	224.8379	0	542.25987	455.01006	100
Slice 31	55.257394	225.26434	0	2,310.0591	1,938.3698	100