GEOTECHNICAL ENGINEERING REPORT ADDENDUM

Buttenwieser/Wiley Residence
6838 96th Avenue SE
Mercer Island, Washington

Prepared for: Janet Buttenwieser

Project No. 200631 • April 26, 2022 (Revised August 16, 2022)

Aspect CONSULTING

earth + water

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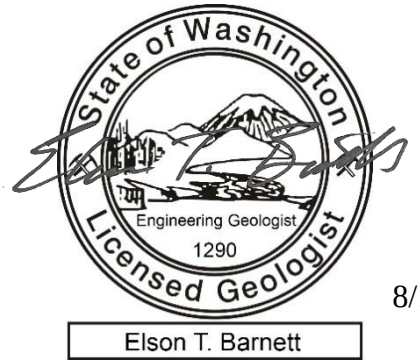
8/16/2022



8/16/2022

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Contents

List of Tables

List of Photographs

List of Figures

List of Appendices

1 Introduction

Aspect Consulting, LLC (Aspect) prepared this revised addendum to our original Geotechnical Engineering Report[1] supporting design and construction of the proposed new residence (Project) at 6838 96th Avenue SE on Mercer Island, Washington (King County Parcel No. 302405-9010; Site) in response to comments[2,3] from the City of Mercer Island (City).

This addendum is intended to provide additional information requested by the City and the Project design team and should be used in conjunction with our original Geotechnical Engineering Report. In the case of conflicts between this addendum and the original report, the content of this addendum shall govern.

1.1 Narrative Responses to City Comments

We have included narrative responses to the first round of City comments in a letter format as Appendix A to this addendum. We similarly included responses to the second round of City comments as Appendix B to this addendum.

1.2 Statement of Risk

The verbatim statement of risk from Mercer Island City Code (MICC) 19.07.160.B.3 is provided below, based on our assumption that the final design will comply with our recommendations:

> *"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."*

[1] Aspect Consulting, LLC (Aspect), 2021, Geotechnical Engineering Report, Buttenwieser/Wiley Residence, 6838 96th Avenue SE, Mercer Island, Washington, Prepared for Janet Buttenwieser, September 2, 2021.

[2] City of Mercer Island (City), 2022, Letter re: Notice of Completeness - File Nos. CAO21-007/SHL21-042/SEP21-027 – Buttenwieser/Wiley Residence, 6838 96th Ave SE, Mercer Island, WA 98040; King County APN 302405-9010, February 25, 2022.

[3] City of Mercer Island (City), 2022, Letter re: Mercer Island House: Cascade, 6838 96th Avenue SE, Mercer Island, Washington, CAP 21-007, SUB 2. From: Elizabeth Thompson, Planner, Community Planning and Development, City of Mercer Island, Signed Michele Lorilla, P.E., Geotechnical Peer Reviewer. June 1, 2022.

2 Site Conditions

2.1 Steep Slopes and Retaining Walls

Our original geotechnical engineering report describes locations where existing retaining walls have yielded and where a tree trunk exhibits curvature. Refer to the Site Plan (Figure 1), which identifies these walls and trees and the extents of observed yielding.

Please refer to the Photographs 1 and 2 for representative examples of the extent and magnitude of observed yielding and the conditions of the aforementioned tree.

Photograph 1. Looking northeast at the existing yielding wall northwest of the existing residence.

Photograph 2. Looking upslope at a conifer with slightly curved trunk northwest of the existing residence.

We did not observe tension cracks or noticeable, well-delineated ground subsidence associated with the yielding condition of the wall, nor did the topographic survey performed for the Project capture any localized subsidence at this location. In our opinion, the cause of the yielding is localized surficial slope movement that reflects the age and decay of the railroad tie timbers and/or that the wall was not designed/engineered for the earth pressures it has been exposed to. In our opinion, the slope movement likely extends upslope a distance on the order of inches to a few feet.

2.2 Previous Nearby Exploration by Others

We have included logs from a previous nearby exploration completed by others[4] on the property to the north of the Site, which aided in our interpretation of the stratigraphy at the top of the slope (Appendix C). The location of this additional exploration is shown on Figure 1.

2.3 Supplemental Explorations by Aspect

On July 8, 2022, Aspect advanced a series of hand augers (AHA-01 through AHA-06) on the Site slope northwest of the residence to better quantify the thickness of colluvium on the slope. These logs are included as Appendix D and the results are incorporated into our analyses, conclusions, and recommendations.

[4] Cascade Group LLC, 2016, Geotechnical Engineering Report, Proposed Residence. 6828 – 96th Avenue SE, Mercer Island, Washington, Prepared for Ms. Xinmin Luo, June 14, 2016.

3 Geotechnical Conclusions and Recommendations

3.1 Retaining Wall Construction Sequencing and Temporary Slope Stability Considerations

The Project includes replacement of existing timber retaining walls with new cast-in-place cantilevered concrete walls and/or cantilevered soldier pile and lagging walls. In some cases, the existing retaining walls are supporting slopes that may become unstable if the existing walls are removed without maintaining continuous lateral support throughout construction.

It is important to note the Contractor is fully responsible for Site safety, including the stability of temporary excavations and slopes. The Contractor is solely responsible for the means, methods, techniques, sequences, and operations of construction operations. Slope heights, inclinations, and excavation depths should in no case exceed those specified in local, state, or federal safety regulations. Under no circumstances should Aspect's provision of the following information be construed to mean that we are assuming responsibility for construction site safety or the Contractor's activities.

We make the following recommendations to reduce the potential for slope instability during construction:

- Proposed soldier pile wall alignments should be located, to the maximum extent practical, immediately upslope of the existing timber wall alignments to allow for drilling of shafts and placement of steel prior to demolition of the existing timber walls. Excavation in front of the proposed soldier pile walls and lagging installation should take place from the top down, concurrent with piece-wise demolition of the existing timber wall elements such that lateral support of the slope is maintained at all times.

  Alternatively, soldier pile walls can be located directly in front of the existing walls, and the existing walls can be left in-place during backfill placement.

- Wall demolition and construction should take place during the dry season (April through September) when precipitation and groundwater are typically at a minimum and there is a reduced risk of saturation of the Site soils and associated slope instability.

- It may become necessary for the Contractor to utilize temporary shoring systems to provide temporary support of slopes. The Contractor is responsible for the design and successful installation of temporary shoring systems. Temporary shoring systems should be designed and constructed to support lateral loads exerted by the retained soil mass and any pressures applied during construction, such as heavy equipment and stockpiles next to the excavation.

3.2 Retaining Wall Design and Construction Considerations

Based on discussions with the design team and our review of preliminary design documents, we identified three primary retaining walls at the Site:

1. **Wall 1:** cantilevered soldier pile wall located along the southern property line south of the garage.
2. **Wall 2:** cast-in-place concrete wall located along the south side of the driveway west of the garage.
3. **Wall 3:** cantilevered soldier pile wall located at the bottom of the Environmentally Critical Area (ECA) steep slope north of the main residence.

These walls, as well as preliminary grading information provided by the design team, are shown on Figure E-1 in Appendix E. The following sections contain design and construction recommendations for the proposed retaining walls.

All proposed retaining walls should be designed by the Project structural engineer.

3.2.1 Lateral Earth Pressures

Lateral earth pressures acting on earth retaining systems with assumed geometries for active, at-rest, and seismic conditions are shown below in Table 1. These values assume that new walls will primarily retain existing fill deposits at an approximately vertical interface. These values also assume that existing fill deposits will provide passive support in front of the structures. To invoke active earth pressure conditions, a wall must be capable of yielding laterally at least 0.001 to 0.002H, where H is the exposed height of the wall; otherwise, at-rest conditions should be assumed.

We included an earth pressure diagram for clarity as Figure 2 with this addendum.

Table 1. Lateral Earth Pressure Parameters

Earth Pressure Condition	Foreslope Condition	Backslope Condition	Earth Pressure Coefficient	Equivalent Fluid Density[2] (pcf)[1]	Uniform Lateral Surcharge Pressure[3] (psf)[1]
Active	-	Level	0.33	40	0.33S
Active[4]	-	2H:1V	0.52	63	0.52S
Active	-	Steeper than 2H:1V[6]	0.80	100	0.80S
Passive[5]	Level	-	3.20	350	-
Passive[4,5]	2H:1V	-	0.90	110	-
At-Rest	-	Level	0.50	60	0.50S
Seismic	-	Level	-	-	18.0H

Notes:

1. psf = pounds per square foot; pcf = pounds per cubic foot.
2. The equivalent fluid densities provided above are distributed triangularly along the exposed height of the wall. The uniform lateral surcharge pressures are distributed uniformly (rectangularly) along the exposed height of the wall.
3. S is the vertical surcharge pressure at the ground surface immediately above/behind the wall. H is the height of the wall. The resultant uniform rectangular lateral pressure should be applied to the full height of the wall.
4. These values assume a maximum backslope/foreslope of 2H:1V. Linear interpolation can be used for shallower backslope/foreslope conditions.
5. The passive value includes a factor of safety of 1.5. Passive resistance within a depth of 2 feet of the ground surface in front of the walls should be ignored.
6. Up to 1H:1V max.

3.2.2 Wall Global Stability

The purpose of our global stability analyses was to calculate factors of safety against global failure and determine minimum recommended embedment for the soldier piles (for the soldier pile walls) and/or wall footings (for the precast concrete wall) to ensure global stability. We performed global stability analyses for the proposed walls using topographic survey data and proposed grading information provided by the design team, as well as the results of our subsurface exploration program. We selected critical cross section locations for our analyses as shown in Appendix E-1.

We conducted two-dimensional limit equilibrium slope stability analyses (SSA) using the Slide computer software program (Rocscience, 2018[5]). We assessed stability under both static and seismic conditions. The Slide program performs slope stability computations based on the modeled slope conditions and calculates a factor of safety against slope

[5] Rocscience, 2018, Slide 8.08 Analysis Program, Build date October 16, 2017.

failure, which is defined as the ratio of resisting forces to driving forces. A factor of safety of 1.0 indicates a "just-stable" condition, and a factor of safety less than 1.0 would indicate unstable conditions. Minimum factors of safety of 1.5 and 1.1 for static and seismic loading conditions, respectively, are generally considered acceptable.

We made the following specific assumptions regarding wall geometry at each wall location (refer to Appendix E-1 for wall locations):

Wall 1 – located along the southern property line south of the garage:

- Wall Type: Cantilevered soldier piles with lagging
- Maximum Exposed Height: 5.5 feet
- Soldier Pile Spacing: 8 feet
- Ultimate Pile Shear Strength: 25 kips
- Minimum Pile Embedment: 10.5 feet[6]

Wall 2 – located along the south side of the driveway west of the garage:

- Wall Type: Cast-in-place concrete
- Maximum Exposed Height: 5.5 feet
- Minimum Footing Embedment: 4 feet

Wall 3 – located at the bottom of the ECA steep slope north of the main residence:

- Wall Type: Cantilevered soldier piles with lagging
- Maximum Exposed Height: 6 feet
- Soldier Pile Spacing: 8 feet
- Ultimate Pile Shear Strength: 180 kips
- Minimum Pile Embedment: 8 feet[5]

The model inputs, geometry, and results are presented graphically in Appendix E-2 through E-11. The calculated factors of safety for global stability are summarized in Table 2 below, which meet or exceed the recommended minimums in each case.

[6] We recommend that the soldier piles penetrate the minimum embedment recommended above, or a minimum of 1 foot into the fine-grained Pre-Olympia nonglacial deposits, whichever is deeper. The minimum embedment depth should be established in the field based on observations during construction.

Table 2. Summary of Factor of Safety Values for Global Stability

Wall ID	Analysis Cross Section	Seismic Factor of Safety for Global Stability(1)	Static Factor of Safety for Global Stability(2)
1	A-A'	1.2	2.9
2	B-B'	1.1	1.9
3	C-C'	1.2	2.2
3	D-D'	1.2	2.3
3	E-E'	1.1	2.1

Notes:
1. Limit equilibrium minimum factor of safety found using Spencer's method in SLIDE
2. Pseudostatic seismic analysis with a horizontal seismic coefficient of 0.341g

3.2.3 Wall 3 Catchment Considerations for Shallow Landslides

We performed stability analyses of the shallow landslide hazard to identify whether a catchment feature should be provided on the proposed soldier pile wall located at the base of the ECA steep slope north of the main residence (Wall 3). We analyzed sections C-C,' D-D,' and E-E' (refer to Appendices E and F) and found that section E-E' governed our catchment recommendations.

Based on our interpretation of the failure surfaces and ranges in calculated factors of safety, it is our opinion that a unit volume of slide debris expected to mobilize during a characteristic shallow slide is approximately 90 cubic feet per foot of slope width. Assuming the slide debris will come to rest at the base of the slope with a residual backslope of approximately 20 degrees, we recommend a minimum extra stick-up height for debris catchment of 2.0 feet above existing grade at the top back of the wall. These calculations are represented graphically in Appendix F.

We recommend the wall be designed to resist lateral forces exerted by the shallow landslide debris. The impact load exerted on a barrier in the path of a landslide can be estimated via several rational methods:

- Assuming continuum-like behavior based on either hydrostatic force equilibrium or hydrodynamic momentum conservation;
- Explicitly evaluating the discrete impulse loads from large particles; or
- Via some combination of the two[7]

These methods have been modified with semi-empirical coefficients to better match observations in the field and laboratory. These coefficients require the application of professional judgement and can have a material effect on the results. In general, the magnitude of the impact load is a function of the composition of the flow material, the velocity of the flow, and the geometry and stiffness of the barrier structure. The

[7] Poudyal, S., Choi, C.E., Song, D., Zhou, G.G.D., Yune, C.Y., Cui, Y., Leonardi, A., Busslinger, M., Wendeler, C., Piton, G., Moase, E., Strouth, A, 2019. Review of the mechanisms of debris-flow impact against barriers. 7th International Conference on Debris-Flow Hazards Mitigation.

properties and velocities of the debris material are challenging to estimate rigorously. In our experience, these methods are not often applied in practice.

Hungr et al. (1984)[8] examined the characteristics of debris flows in British Columbia and the Northwest United States and provided an observational database to estimate regional debris flow discharge volumes, velocities, and flow depths. These debris flows are much larger than what can reasonably be anticipated at the Site but provide a series of empirical charts than can provide insight on the magnitude of volumes, velocities, and flow depths that might be expected more generally.

In our experience, local professional practice has considered the various approaches used in the literature in combination with observational approaches. Practicing geotechnical engineers in the Puget Sound area have typically specified lateral debris loads on the order of 30*H to 60*H (in pounds per square foot), where H is the height of the wall. Based on our review of the literature and our local experience, it is our opinion that a uniform lateral load of 75 pounds per square foot, distributed uniformly over the stick-up height, is appropriate for use in design. This is presented graphically in the earth pressure diagram on Figure 2.

It is important to note that actual loads and debris depths from potential future landslides may exceed our estimates, and damage may occur during future landslides. Our recommendations are intended to result in a structure designed to local standards of care. Our recommendations are presented for a single landslide event; therefore:

- Landslide debris accumulation should be removed as soon as possible once equipment and manpower can safely operate on the Site.
- The wall should be inspected for damage following a landslide event and repaired promptly.
- We recommend annual inspection of the wall each fall prior to the wet winter season.

3.2.4 Temporary Shoring

Temporary shoring may be required for excavations, especially to prevent encroachment across property lines. We anticipate the Contractor will be responsible for the design and successful installation of temporary shoring systems. The Contractor should verify the provided information herein is appropriate for their operation or use. Temporary shoring systems used should be designed and constructed to support lateral loads exerted by the retained soil mass and any pressures applied during construction, such as heavy equipment and stockpiles next to the excavation.

A variety of shoring systems are feasible for the Project, including (but not limited to):

- Trench boxes

[8] Hungr, O., Morgan G.C., Kellerhals, R. 1984, Quantitatve Analysis of Debris Torrent Hazards for Design of Remedial Measures, Canadian Geotechnical Journal, V 21, 663-677, DOI 10.1139/t84-073.

- A slide rail shoring system
- Internally braced sheet piling
- A cantilevered or anchored soldier pile wall
- Gravity walls comprised of gabions or concrete ecology blocks

If engineered shoring systems are used, they can be designed utilizing the soil engineering parameters in Table 2 of the original geotechnical report.

4 Limitations

Work for this project was performed for Janet Buttenwieser (Client), and this report was prepared consistent with recognized standards of professionals in the same locality and involving similar conditions, at the time the work was performed. No other warranty, expressed or implied, is made by Aspect Consulting, LLC (Aspect).

Recommendations presented herein are based on our interpretation of site conditions, geotechnical engineering calculations, and judgment in accordance with our mutually agreed-upon scope of work. Our recommendations are unique and specific to the project, site, and Client. Application of this report for any purpose other than the project should be done only after consultation with Aspect.

Variations may exist between the soil and groundwater conditions reported and those actually underlying the site. The nature and extent of such soil variations may change over time and may not be evident before construction begins. If any soil conditions are encountered at the site that are different from those described in this report, Aspect should be notified immediately to review the applicability of our recommendations.

Risks are inherent with any site involving slopes and no recommendations, geologic analysis, or engineering design can assure slope stability. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the Client.

It is the Client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, and agents, are made aware of this report in its entirety. At the time of this report, design plans and construction methods have not been finalized, and the recommendations presented herein are based on preliminary project information. If project developments result in changes from the preliminary project information, Aspect should be contacted to determine if our recommendations contained in this report should be revised and/or expanded upon.

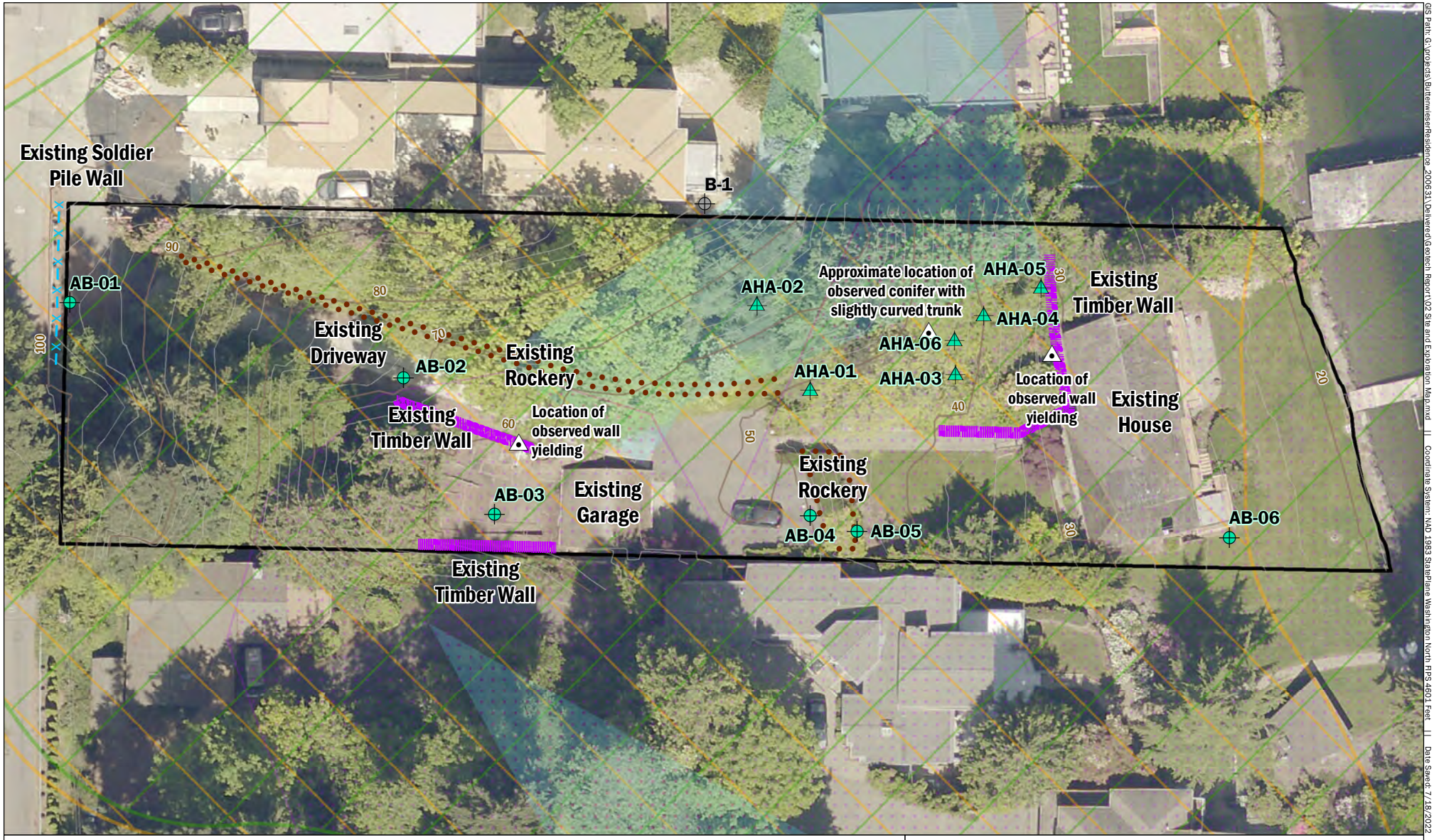
The scope of work does not include services related to construction safety precautions. Site safety is typically the responsibility of the contractor, and our recommendations are not intended to direct the contractor’s site safety methods, techniques, sequences, or procedures. The scope of our work also does not include the assessment of environmental characteristics, particularly those involving potentially hazardous substances in soil or groundwater.

All reports prepared by Aspect for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect. Aspect’s original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

Please refer to Appendix E titled “Report Limitations and Guidelines for Use” for additional information governing the use of this report.

We appreciate the opportunity to perform these services. If you have any questions please call Chip Barnett, Senior Engineering Geologist, at 425.765.2183.

FIGURES



Explorations

- Hand Auger *(Aspect)*
- Boring *(Aspect)*
- Boring *(Cascade Group LLC)*

Mercer Island Geologic Hazard Area

- Seismic
- Steep Slope
- Potential Slide
- Erosion

- Contour - 10' Interval
- Contour - 2' Interval
- Site Parcel

N

0 40 80
Feet

Note: Topographic Contours were obtained using survey data completed by Terrane Land Surveying and reference the North American Vertical Datum of 1988.

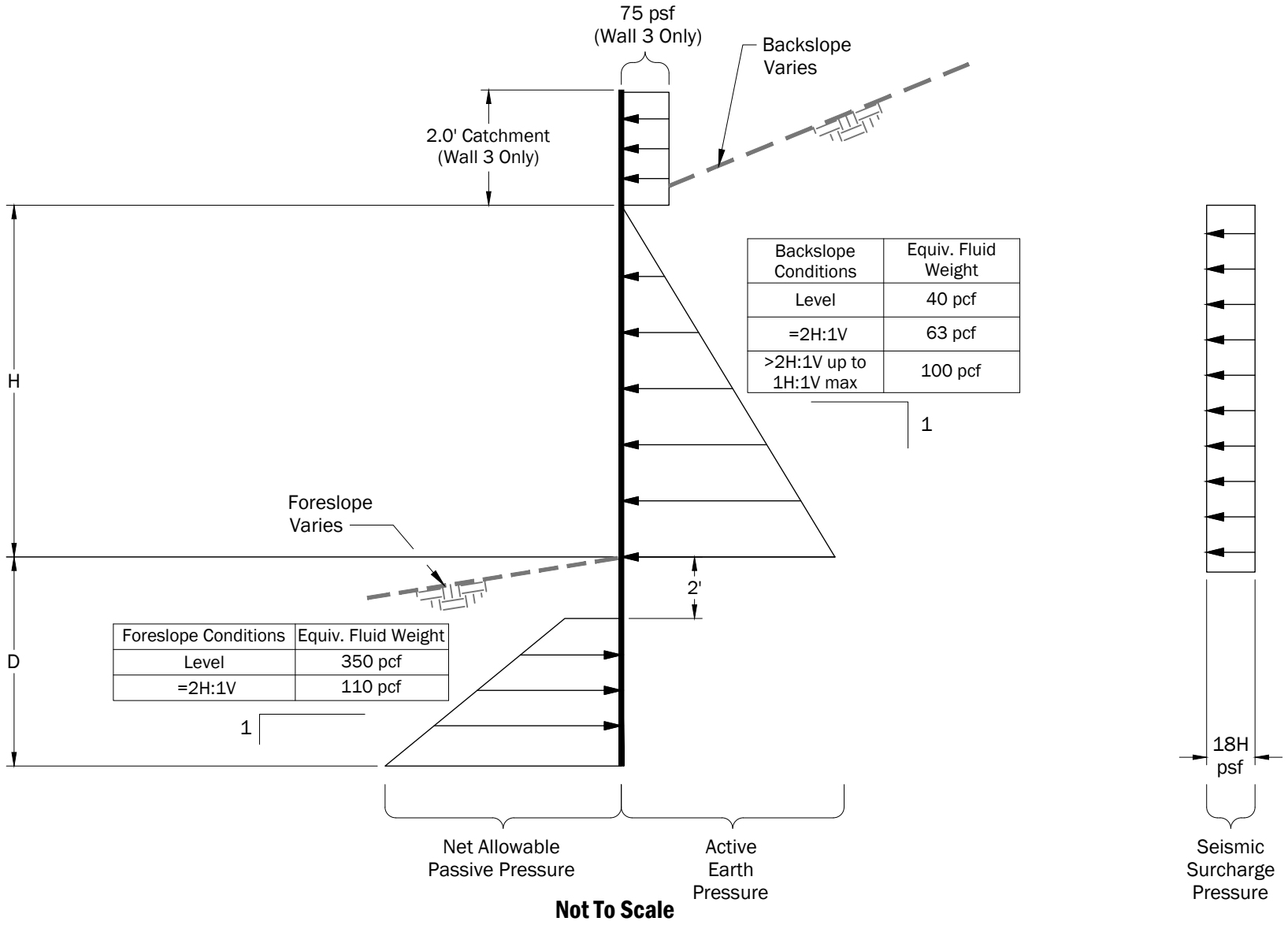
Basemap Layer Credits || EagleView Technologies, Inc.

Site and Exploration Map

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
6838 96th Avenue SE
Mercer Island, Washington

Aspect Consulting	JUL-2022	BY: MR / SBM	FIGURE NO. 1
	PROJECT NO. 200631	REVISED BY: ETB / WEG / NLK	

GIS Path: G:\projects\ButterwieserResidence_200631\Delivered\Geotech Report\02 Site and Exploration Map.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 7/18/2022 || User: nkochie || Print Date: 7/18/2022



Not To Scale

Legend

H = Exposed Height of Wall, Feet
D = Soldier Pile Embedment Depth, Feet
pcf = Pounds per Cubic Foot
psf = Pounds per Square Foot

Notes

1. Linear interpolation can be used for backslope/foreslope conditions between level and 2H:1V.
2. Active/apparent earth pressure and surcharge act over the pile center-to-center spacing above the base of the excavation.
3. Passive earth pressure acts over 3 times the soldier pile shaft diameter, or the soldier pile center-to-center spacing, whichever is less.
4. Passive earth pressure includes a factor of safety of 1.5.

Earth Pressure Diagram

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
6839 96th Avenue NE
Mercer Island, Washington

Aspect Consulting	Jul-2022	BY: MBR/CMV	FIGURE NO. 2
	PROJECT NO. 200631	REVISED BY: -	

APPENDIX A

City Comment Response
Letter No. 2 (July 20, 2022)

July 20, 2022

Janet Buttenwieser & Matt Wiley
6838 96th Avenue SE,
Mercer Island, WA 98040

Re: Geotechnical Comment Responses
File No. CAO21-007, SUB 2
Mercer Island House: Cascade
Buttenwieser/Wiley Residence
6838 96th Ave SE, Mercer Island, WA 98040; King County APN 302405-9010
Aspect Project No. 200631

Dear Ms. Buttenwieser and Mr. Wiley:

Aspect Consulting, LLC (Aspect) prepared this letter to document our responses to a second round of geotechnical engineering peer review comments[1] from the City of Mercer Island (City) on our Geotechnical Engineering Report Addendum[2] supporting design and construction of the proposed new residence (Project) at 6838 96th Avenue SE on Mercer Island, Washington (King County Parcel No. 302405-9010; Site).

Geotechnical Engineering Peer Review:

1. *"The geotechnical addendum addressed many of our review comments from the SUB1 review phase. The outstanding item remains the issue of catchment capacity and design of Aspect designated Wall 3. According to the geotechnical report addendum… … the stratigraphy used in the slope stability cross-sections was not determined by specific borings or information at those specific cross-section locations… … We recommend that the geotechnical engineer resolve the lack of subsurface information, revise cross-sections using the results from explorations located on the slope, revise slope stability analyses and catchment calculations.*

Aspect Response: Aspect advanced a series of supplemental hand auger explorations on the slope to provide additional information regarding the thickness of the colluvium layer in cross-sections C-C', D-D', and E-E'. The supplemental exploration logs are included as an appendix to the revised geotechnical addendum. We revised the slope stability analyses and catchment calculations appropriately and included updated output results as appendices to the revised geotechnical addendum.

[1] City of Mercer Island (City), 2022, Letter re: Mercer Island House: Cascade, 6838 96th Avenue SE, Mercer Island, Washington, CAP 21-007, SUB 2. From: Elizabeth Thompson, Planner, Community Planning and Development, City of Mercer Island, Signed Michele Lorilla, P.E., Geotechnical Peer Reviewer. June 1, 2022.

[2] Aspect Consulting, LLC (Aspect), 2022, Geotechnical Engineering Report Addendum. Buttenwieser/Wiley Residence. 6838 96th Avenue SE, Mercer Island, Washington, Prepared for Janet Buttenwieser, April 26, 2022.

2. *"We also request documentation of assumptions and calculations to support the debris flow loading value and configuration."*

   Aspect Response: Aspect has included a discussion of the assumptions and calculations supporting the debris flow loading value and configuration in the revised geotechnical addendum.

We appreciate the opportunity to perform these services.

Sincerely,

Aspect consulting, LLC

7/20/2022

Elson T. Barnett

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7/20/2022

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cc: April Ng, The Miller Hull Partnership, LLP

APPENDIX B

City Comment Response
Letter No. 1 (April 15, 2021)

April 15, 2022

Janet Buttenwieser & Matt Wiley
6838 96th Avenue SE,
Mercer Island, WA 98040

Re: Geotechnical Comment Responses
File Nos. CAO21-007/SHL21-042/SEP21-027 – Buttenwieser/Wiley Residence
6838 96th Ave SE, Mercer Island, WA 98040; King County APN 302405-9010
Aspect Project No. 200631

Dear Ms. Buttenwieser and Mr. Wiley:

Aspect Consulting, LLC (Aspect) prepared this letter to document our responses to comments[1] from the City of Mercer Island (City) on our Geotechnical Engineering Report[2] supporting design and construction of the proposed new residence (Project) at 6838 96th Avenue SE on Mercer Island, Washington (King County Parcel No. 302405-9010; Site).

Planning:

1a. Please address the landslide hazard area standards in MICC 19.07.160(D).

Aspect Response: Mercer Island City Code (MICC) 19.07.160(D) – Development Standards – Seismic Hazard Areas prescribes development standards for seismic hazard areas and does not include landslide hazard area standards. The seismic hazard area development standards include (1) a requirement for a critical area study that evaluates the magnitude of expected seismic settlement and demonstrates that risks of seismic settlement are suitably mitigated, (2) a requirement that seismic hazard areas be identified by a qualified professional via appropriate methods, (3) prescriptive buffers (minimum 50 feet) and mitigation sequencing requirements for sites with an active fault.

Our report addresses the Site seismic hazards in detail in Section 3.3. The Project will utilize deep foundations which bear on deposits that are not susceptible to liquefaction or other seismically-induced settlement. The seismic hazard area encumbering the east portion of the Site is described in the report narrative and shown in Figure 1 of the report, as well as a description of nearby mapped faults (Section 3.3.3). In our opinion, there is no active fault on the Site, so the prescriptive buffer does not apply.

[1] City of Mercer Island (City), 2022, Letter re: Notice of Completeness - File Nos. CAO21-007/SHL21-042/SEP21-027 – Buttenwieser/Wiley Residence, 6838 96th Ave SE, Mercer Island, WA 98040; King County APN 302405-9010, February 25, 2022.

[2] Aspect Consulting, LLC (Aspect), 2021, Geotechnical Engineering Report. Buttenwieser/Wiley Residence. 6838 96th Avenue SE, Mercer Island, Washington, Prepared for Janet Buttenwieser, September 2, 2021.

MICC 19.07.160(C) – Development Standards – Landslide Hazard Areas includes development standards for landslide hazard areas, which include (1) a requirement for a critical areas study for any alteration of a landslide hazard area or associated buffer, and (2) prescriptive buffers for steep slopes (the height of the slope up to 75 feet maximum), shallow landslide hazard areas (minimum 25 feet), and deep-seated landslide hazard areas (minimum 75 feet).

Our report addresses the Site landslide hazards in detail in Section 3.1. The entire Site is encumbered by a potential slide hazard area mapped by the City, so it is not possible to establish and maintain a buffer. The recommendations in our report are intended to ensure impacts to the geologically hazardous areas are suitably mitigated.

From a global stability perspective, the proposed redevelopment of the residence will improve drainage within the landslide hazard area and will also increase the load at the toe of the slope where the residential improvements are proposed thereby reducing the landslide hazard from the current condition.

1b. Please address the criteria in MICC 19.07.160(B).

Aspect Response: MICC 19.07.160(B) – General Review Requirements lists standards for alterations within geologically hazardous areas or associated buffers including (1) a requirement for a critical area study concluding the hazard risk(s) can be effectively mitigated; (2) requirements for the critical area study to conclude that the proposed alteration will not adversely impact other critical areas, not adversely impact the Site or nearby areas, mitigate impacts to the hazard(s) with best available science to the maximum extent reasonably possible, and include landscaping of disturbed areas; and (3) that the geotechnical professional provide a statement of risk concluding that the risk to the site is suitably mitigated.

The purpose and intent of our report is to fulfil the requirements of MICC 19.07.160(B) and demonstrate that the Project can effectively mitigate risks of the identified hazards. Our report includes detailed geotechnical engineering conclusions and recommendations to mitigate impacts associated with the seismic hazard, landslide hazard, and erosion hazard.

We have included a statement of risk in our addendum.

1c. Please provide a statement of risk as required by MICC 19.07.160(C).

Aspect Response: We have included a statement of risk in our addendum.

1d. As required by MICC 19.07.160(D)(1), Please provide:

i. *A determination of the magnitude of seismic settling that could occur during a seismic event; and,*
ii. *A demonstration that the risk associated with the proposed alteration is within acceptable limits or that appropriate construction methods are provided to mitigate the risk of seismic settlement such that there will be no significant impact to life, health, safety, and property.*

Aspect Response: The Project will utilize deep foundations which bear on deposits that are not susceptible to liquefaction- or other seismically-induced settlement.

Geotechnical Engineering Peer Review:

Site Information:

1. *Identify the locations, extents, and magnitudes of yielding conditions of existing retaining walls on a site plan. Include the location of the tree exhibiting response to slope creep discussed in geotechnical report section 2.1.3 on the site plan.*

Aspect Response: We have included the requested information in our addendum.

2. *Specifically for the yielding retaining wall located northwest of the existing residential structure, indicate on a site plan, the location and extent of tension cracking in the soil or ground subsidence that is associated with this yielding condition. Indicate the cause of the yielding and whether the cause extends upslope.*

Aspect Response: We have included the requested information in our addendum.

Stability Analyses:

3. *Include construction sequencing recommendations to reduce the potential for slope instability during demolition of the existing site retaining walls. Include specific recommendations for the soldier pile wall installation where the localized yielding of the existing wall has been noted. What mitigation measures will be used to prevent slope movement once the yielding wall is removed?*

   Aspect Response: We have included the requested information in our addendum. We have included recommendations that will facilitate continuous support of the slopes at all times during construction. In our opinion, this can be accomplished by locating proposed soldier pile walls behind or in front of existing timber walls, by using a soldier pile wall system for the proposed wall along the southern property line southeast of the garage, and/or by implementing engineered shoring systems.

4. *The stability analyses provided in the geotechnical report includes stratigraphy that does not seem to be reflected in the boring logs. Indicate what boring log or detailed geologic reconnaissance information is associated with each wall cross section presented in Appendix C of the geotechnical report.*

   Aspect Response: The stratigraphy in the slope stability model represents our generalized interpretation of the subsurface conditions, based on the totality of our subsurface exploration program and our local geologic experience. The relative location of each cross section and nearby borings can be seen in Appendix C-1 of the addendum. It should be noted that the explorations are at locations and elevations that do not directly project to the modeled stratigraphy in all cases. Our modeled assumptions are reasonable and appropriate based on the variable topography and our interpretation of the subsurface and the proposed Site grading. For your information, we also included logs from a previous nearby

exploration completed by others[3] on the northerly property, which aided in our interpretation of the stratigraphy at the top of the slope.

5. *Provide stability analyses of temporary open cuts that will be required to install the new retaining walls. Provide stability results along with any mitigation recommendations, as appropriate.*

   Aspect Response: Please refer to the addendum for our recommendations on construction staging and temporary support during construction. We have included recommendations that will facilitate continuous support of the slopes at all times during construction. In our opinion, this can be accomplished by locating proposed soldier pile walls behind or in front of existing timber walls, by using a soldier pile wall system for the proposed wall along the southern property line southeast of the garage, and/or by implementing engineered shoring systems. In our opinion, it will not be necessary to make significant open cuts to install the new walls supporting steep slopes.

6. *Based on existing topography, backslopes steeper than 2H:1V will be supported by some of the proposed site retaining walls. Geotechnical engineer to provide lateral earth pressures to be used in the design of these walls with steeper than 2H:1V backslopes.*

   Aspect Response: We have included the requested information in our addendum.

7. *The geotechnical engineer identified a moderate risk for shallow landslides at this site. Given the proximity of the proposed structures to the steep slopes, the geotechnical engineer shall provide a discussion as to whether the proposed site retaining walls should include a catchment feature and if so, provide design recommendations so that the structural engineer can incorporate a catchment feature to the top of the wall.*

   If no catchment feature is recommended, indicate whether a surficial landslide from the steep slope area could physically impact the proposed residential structures. Indicate how this would not pose a threat to public health and safety.

   Aspect Response: We have included the requested information in our addendum.

8. *Geotechnical engineer to provide statement of risk matching one given in MICC 19.07.160.B.3. based on their review of current project development plan set.*

   Note: Each revision to the plan set that has a revised geotechnical component, will require an updated statement of risk.

   Aspect Response: We have included a statement of risk in our addendum.

[3] Cascade Group LLC, 2016, Geotechnical Engineering Report. Proposed Residence, 6828 – 96th Avenue SE, Mercer Island, Washington, Prepared for Ms. Xinmin Luo, June 14, 2016.

We appreciate the opportunity to perform these services.

Sincerely,

Aspect consulting, LLC

4/15/2022

Elson T. Barnett

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4/15/2022

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cc: April Ng, The Miller Hull Partnership, LLP

V:\200631 Buttenwieser Residence Mercer Island\Deliverables\Geotech Addendum_April 2022\Attach\App A - City Comment Response Letter.docx

APPENDIX C

Previous Nearby Explorations by Others

Date Started:	6/13/2016	Drill Rig:	Acker Portable Rig
Date Completed:	6/13/2016	Drilling Method:	4" Hollow Stem Auger
Logged by:	MX	Driving Energy:	140 lb. wt., 30 in. drop
total Depth:	16.5 feet		

Depth, ft	Field: Sample	Field: Blows / inch	Laboratory: Dry Density, pcf	Laboratory: Moisture Content, %	Laboratory: Compression Strength, psf	Other Data	Pocket Pen, tsf	Symbol	Approx. Surface Elevation (ft): **DESCRIPTION**
		5 8 9							Brown-light brown, silty fine **SAND (SM)**, medium dense, damp (Topsoil/Fill)
		4 5 8							Brown-gray, slightly silty fine **SAND (SM)**, trace gravel medium dense, moist
5									
		3 5 7							
		6 8 11							Gray, fine **SAND (SP-SM)**, some silt, medium dense moist
10									
		5 8 11							Gray, fine **SAND (SP-SM)**, trace silt, medium dense moist
15									
		9 14 16							Gray, fine **SAND (SP-SM)**, trace silt, medium dense moist
									Boring terminated at about 16.5 feet. No groundwater encountered during drilling.
20									

CASCADE GROUP LLC	**LOG OF BORING B-1** **6827 96TH AVENUE SE** **MERCER ISLAND, WASHINGTON**	**FIGURE** **A-1**
PROJECT # 201618 **Jun-16**		

APPENDIX D

Aspect Supplemental Exploration Logs

Coarse-Grained Soils - More than 50%[1] Retained on No. 200 Sieve	Gravels - More than 50%[1] of Coarse Fraction Retained on No. 4 Sieve	≤5% Fines	GW	Well-graded GRAVEL Well-graded GRAVEL WITH SAND
			GP	Poorly-graded GRAVEL Poorly-graded GRAVEL WITH SAND
		≥15% Fines	GM	SILTY GRAVEL SILTY GRAVEL WITH SAND
			GC	CLAYEY GRAVEL CLAYEY GRAVEL WITH SAND
	Sands - 50%[1] or More of Coarse Fraction Passes No. 4 Sieve	≤5% Fines	SW	Well-graded SAND Well-graded SAND WITH GRAVEL
			SP	Poorly-graded SAND Poorly-graded SAND WITH GRAVEL
		≥15% Fines	SM	SILTY SAND SILTY SAND WITH GRAVEL
			SC	CLAYEY SAND CLAYEY SAND WITH GRAVEL
Fine-Grained Soils - 50%[1] or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less than 50%		ML	SILT SANDY or GRAVELLY SILT SILT WITH SAND SILT WITH GRAVEL
			CL	LEAN CLAY SANDY or GRAVELLY LEAN CLAY LEAN CLAY WITH SAND LEAN CLAY WITH GRAVEL
			OL	ORGANIC SILT SANDY or GRAVELLY ORGANIC SILT ORGANIC SILT WITH SAND ORGANIC SILT WITH GRAVEL
	Silts and Clays Liquid Limit 50% or More		MH	ELASTIC SILT SANDY or GRAVELLY ELASTIC SILT ELASTIC SILT WITH SAND ELASTIC SILT WITH GRAVEL
			CH	FAT CLAY SANDY or GRAVELLY FAT CLAY FAT CLAY WITH SAND FAT CLAY WITH GRAVEL
			OH	ORGANIC CLAY SANDY or GRAVELLY ORGANIC CLAY ORGANIC CLAY WITH SAND ORGANIC CLAY WITH GRAVEL
Highly Organic Soils			PT	PEAT and other mostly organic soils

"WITH SILT" or "WITH CLAY" means 5 to 15% silt and clay, denoted by a "-" in the group name; e.g., SP-SM • "SILTY" or "CLAYEY" means >15% silt and clay • "WITH SAND" or "WITH GRAVEL" means 15 to 30% sand and gravel. • "SANDY" or "GRAVELLY" means >30% sand and gravel. • "Well-graded" means approximately equal amounts of fine to coarse grain sizes • "Poorly graded" means unequal amounts of grain sizes • Group names separated by "/" means soil contains layers of the two soil types; e.g., SM/ML.

Soils were described and identified in the field in general accordance with the methods described in ASTM D2488. Where indicated in the log, soils were classified using ASTM D2487 or other laboratory tests as appropriate. Refer to the report accompanying these exploration logs for details.

1. Estimated or measured percentage by dry weight
2. (SPT) Standard Penetration Test (ASTM D1586)
3. Determined by SPT, DCPT (ASTM STP399) or other field methods. See report text for details.

GEOTECHNICAL LAB TESTS

MC	=	Natural Moisture Content
PS	=	Particle Size Distribution
FC	=	Fines Content (% < 0.075 mm)
GH	=	Hydrometer Test
AL	=	Atterberg Limits
C	=	Consolidation Test
Str	=	Strength Test
OC	=	Organic Content (% Loss by Ignition)
Comp	=	Proctor Test
K	=	Hydraulic Conductivity Test
SG	=	Specific Gravity Test

CHEMICAL LAB TESTS

Organic Chemicals

BTEX	=	Benzene, Toluene, Ethylbenzene, Xylenes
TPH-Dx	=	Diesel and Oil-Range Petroleum Hydrocarbons
TPH-G	=	Gasoline-Range Petroleum Hydrocarbons
VOCs	=	Volatile Organic Compounds
SVOCs	=	Semi-Volatile Organic Compounds
PAHs	=	Polycyclic Aromatic Hydrocarbon Compounds
PCBs	=	Polychlorinated Biphenyls

Metals

RCRA8	=	As, Ba, Cd, Cr, Pb, Hg, Se, Ag, (d = dissolved, t = total)
MTCA5	=	As, Cd, Cr, Hg, Pb (d = dissolved, t = total)
PP-13	=	Ag, As, Be, Cd, Cr, Cu, Hg, Ni, Pb, Sb, Se, Tl, Zn (d=dissolved, t=total)

FIELD TESTS

PID	=	Photoionization Detector
Sheen	=	Oil Sheen Test
SPT[2]	=	Standard Penetration Test
NSPT	=	Non-Standard Penetration Test
DCPT	=	Dynamic Cone Penetration Test

COMPONENT DEFINITIONS

Descriptive Term		*Size Range and Sieve Number*
Boulders	=	Larger than 12 inches
Cobbles	=	3 inches to 12 inches
Coarse Gravel	=	3 inches to 3/4 inches
Fine Gravel	=	3/4 inches to No. 4 (4.75 mm)
Coarse Sand	=	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	=	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	=	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	=	Smaller than No. 200 (0.075 mm)

ESTIMATED[1] PERCENTAGE

% by Weight		*Modifier*	*% by Weight*		*Modifier*
<1	=	Subtrace	15 to 25	=	Little
1 to <5	=	Trace	30 to 45	=	Some
5 to 10	=	Few	>50	=	Mostly

MOISTURE CONTENT

Dry	=	Absence of moisture, dusty, dry to the touch
Slightly Moist	=	Perceptible moisture
Moist	=	Damp but no visible water
Very Moist	=	Water visible but not free draining
Wet	=	Visible free water, usually from below water table

RELATIVE DENSITY

Non-Cohesive or Coarse-Grained Soils

Density[3]		*SPT*[2] *Blows/Foot*	*Penetration with 1/2" Diameter Rod*
Very Loose	=	0 to 4	≥ 2'
Loose	=	5 to 10	1' to 2'
Medium Dense	=	11 to 30	3" to 1'
Dense	=	31 to 50	1" to 3"
Very Dense	=	> 50	< 1"

CONSISTENCY

Cohesive or Fine-Grained Soils

Consistency[3]		*SPT*[2] *Blows/Foot*	*Manual Test*
Very Soft	=	0 to 1	Penetrated >1" easily by thumb. Extrudes between thumb & fingers.
Soft	=	2 to 4	Penetrated 1/4" to 1" easily by thumb. Easily molded.
Medium Stiff	=	5 to 8	Penetrated >1/4" with effort by thumb. Molded with strong pressure.
Stiff	=	9 to 15	Indented ~1/4" with effort by thumb.
Very Stiff	=	16 to 30	Indented easily by thumbnail.
Hard	=	> 30	Indented with difficulty by thumbnail.

GEOLOGIC CONTACTS

Observed and Distinct — Observed and Gradual — Inferred

Aspect CONSULTING

Exploration Log Key

Aspect CONSULTING	Buttenwieser/Wiley Residence - 200631		Geotechnical Exploration Log	
	Project Address & Site Specific Location 6838 96th Ave SE, Mercer Island, Washington, 5ft Behind Existing Wall		*Coordinates (Lat,Lon WGS84)* 47.5411, -122.2101	*Exploration Number* **AHA-01**
Contractor Aspect Consulting	*Equipment* Hand	*Sampling Method* Grab	*Ground Surface Elev. (NAVD88)* 46'	
Operator CAL	*Exploration Method(s)* Hand tools	*Work Start/Completion Dates* 7/8/2022	*Top of Casing Elev. (NAVD88)* NA	*Depth to Water (Below GS)* 3.6' (ATD)

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot ▲ Water Content (%)● 0 10 20 30 40 50	Blows/6"	Tests	Material Type	Description	Depth (ft)
						T-probe = 1.8 ft		**Topsoil** SILTY SAND (SM); loose, slightly moist, brown; fine sand; some to mostly roots.	
1	45	Backfilled with excavated soil.				T-probe = greater than 1 ft		**Colluvium** SILTY SAND (SM); loose, slightly moist, light brown with orange mottling; fine sand; some decomposed organics, roots, and charcoal; iron-oxide staining. Becomes with trace fine, rounded gravel.	1
2	44							Becomes moist, gray, with few to little decomposed organics.	2
3	43	▽ 7/2/2022 11:27 AM						Becomes very moist and fine to medium sand.	3
4	42							**Weathered Pre-Olympia Nonglacial Deposits** SILTY SAND (SM); medium dense, wet, gray with orange mottling; fine to medium sand; iron-oxide staining; trace decomposed organics.	4
5	41							Bottom of exploration at 5.5 ft. bgs.	5
6	40								6

Legend

Sample Type

Plastic Limit ⊢⊣ Liquid Limit

Water Level ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: ETB

Exploration Log AHA-01
Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\200631 BUTTENWIESER RESIDENCE.GPJ August 16, 2022

Aspect CONSULTING	Buttenwieser/Wiley Residence - 200631		Geotechnical Exploration Log	
	Project Address & Site Specific Location 6838 96th Ave SE, Mercer Island, Washington, Near Hilltop		*Coordinates (Lat,Lon WGS84)* 47.5412, -122.2102	*Exploration Number* **AHA-02**
Contractor Aspect Consulting	*Equipment* Hand	*Sampling Method* Grab	*Ground Surface Elev. (NAVD88)* 64'	
Operator CAL	*Exploration Method(s)* Hand tools	*Work Start/Completion Dates* 7/8/2022	*Top of Casing Elev. (NAVD88)* NA	*Depth to Water (Below GS)* No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot ▲ Water Content (%)● 0 10 20 30 40 50	Blows/6"	Tests	Material Type	Description	Depth (ft)
						T-probe = 3.0 ft		**Topsoil** SANDY SILT (ML); soft, dry to slightly moist, dark brown; non-plastic; fine sand; little fine roots.	
1	63	Backfilled with excavated soil.						**Colluvium** SILT WITH SAND (ML); very loose, dry to slightly moist, light brown; non-plastic; fine sand; trace fine subangular to subrounded gravel; few to little fine roots.	1
2	62							SILTY SAND (SM); loose, slightly moist, light brown; fine to coarse sand; trace fine to coarse subrounded to rounded gravel; few to little fine roots.	2
3	61								3
4	60							**Weathered Pre-Olympia Nonglacial Deposits** SAND WITH SILT (SP-SM); medium dense, moist, light brown; fine to medium sand.	4
5	59							Becomes light gray-brown with mottling.	5
6	58							Bottom of exploration at 6 ft. bgs.	6

Legend

Sample Type

Water Level

Plastic Limit ⊢⊣ Liquid Limit

No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: CAL/ABM
Approved by: ETB

Exploration Log AHA-02
Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\200631 BUTTENWIESER RESIDENCE.GPJ August 16, 2022

Buttenwieser/Wiley Residence - 200631

Geotechnical Exploration Log

Project Address & Site Specific Location	Coordinates (Lat,Lon WGS84)	Exploration Number
6838 96th Ave SE, Mercer Island, Washington, Ivy Patch Above Existing Wall	47.5411, -122.2099	AHA-03

Contractor	Equipment	Sampling Method	Ground Surface Elev. (NAVD88)	
Aspect Consulting	Hand	Grab	43'	
Operator	**Exploration Method(s)**	**Work Start/Completion Dates**	**Top of Casing Elev. (NAVD88)**	**Depth to Water (Below GS)**
ABM	Hand tools	7/8/2022	NA	No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot ▲ Water Content (%)● 0 10 20 30 40 50	Blows/6"	Tests	Material Type	Description	Depth (ft)
0	43					T-probe = 2 ft		**Topsoil** SILTY SAND (SM); loose, slightly moist, dark brown.	0
1	42	Backfilled with excavated soil.				T-probe = greater than 1 ft		**Colluvium** SILTY SAND (SM); loose, slightly moist, light brown; fine to medium sand; trace fine, subrounded gravel; few roots.	1
2	41							Becomes light gray-brown with orange mottling and trace fine, subrounded gravel.	2
2.5	40.5							Bottom of exploration at 2.5 ft. bgs.	2.5
3	40								3
4	39								4
5	38								5
6	37								6

Legend

Sample Type

Plastic Limit ⊢⊣ Liquid Limit

Water Level — No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: ABM
Approved by: ETB

Exploration Log AHA-03
Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\200631 BUTTENWIESER RESIDENCE.GPJ August 16, 2022

Buttenwieser/Wiley Residence - 200631

Geotechnical Exploration Log

Aspect CONSULTING

Project Address & Site Specific Location	Coordinates (Lat,Lon WGS84)	Exploration Number
6838 96th Ave SE, Mercer Island, Washington, Edge of Ivy Patch	47.5412, -122.2099	**AHA-04**

Contractor	Equipment	Sampling Method	Ground Surface Elev. (NAVD88)	
Aspect Consulting	Hand	Grab	38'	
Operator	**Exploration Method(s)**	**Work Start/Completion Dates**	**Top of Casing Elev. (NAVD88)**	**Depth to Water (Below GS)**
ABM	Hand tools	7/8/2022	NA	4' (ATD)

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot ▲ Water Content (%)● 0 10 20 30 40 50	Blows/6"	Tests	Material Type	Description	Depth (ft)
						T-probe = 2 ft		**Topsoil** SILTY SAND (SM); very loose, slightly moist, dark brown; fine sand; mostly roots and rootlets.	
1	37	Backfilled with excavated soil.				T-probe = greater than 1 ft		**Colluvium** SILTY SAND (SM); loose, moist, brown; fine to medium sand; orange staining; trace to few roots and decomposed organics.	1
2	36								2
3	35							Becomes very moist.	3
4	34	▽ 7/8/2022						**Weathered Pre-Olympia Nonglacial Deposits** SAND WITH SILT (SP-SM); medium dense, wet, light gray-brown; fine to medium sand; iron-oxide staining.	4
5	33								5
								Bottom of exploration at 5.5 ft. bgs.	
6	32								6

Legend

Sample Type

Plastic Limit ⊢⊣ Liquid Limit

Water Level ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: ABM
Approved by: ETB

Exploration Log AHA-04

Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\200631 BUTTENWIESER RESIDENCE.GPJ August 16, 2022

Aspect CONSULTING	Buttenwieser/Wiley Residence - 200631		Geotechnical Exploration Log	
	Project Address & Site Specific Location 6838 96th Ave SE, Mercer Island, Washington, N.W. House Corner		*Coordinates (Lat,Lon WGS84)* 47.5412, -122.2098	*Exploration Number* **AHA-05**
Contractor Aspect Consulting	*Equipment* Hand	*Sampling Method* Grab	*Ground Surface Elev. (NAVD88)* 33'	
Operator CAL	*Exploration Method(s)* Hand tools	*Work Start/Completion Dates* 7/8/2022	*Top of Casing Elev. (NAVD88)* NA	*Depth to Water (Below GS)* 0.7' (ATD)

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot ▲ Water Content (%)● 0 10 20 30 40 50	Blows/6"	Tests	Material Type	Description	Depth (ft)
						T-probe = 2.5 ft		**Fill** ORGANIC SILT (OL); very loose, very moist, dark brown; few fine sand; mostly organics	
								GRAVEL WITH SILT (GP-GM); loose, moist, dark brown; fine to coarse, rounded to angular gravel.	
		▽ 7/8/2022						Becomes wet.	
1	32	Backfilled with excavated soil.						PEAT (PT); loose, wet, black; fine to medium sand; organic odor; mostly decomposed organics and woody debris.	1
								SILTY SAND (SM); loose, very moist, dark gray; fine to medium sand; organic odor; few to little decomposed organics, rootlets, needles and woody debris.	
						T-probe = 4 in		SAND WITH SILT (SP-SM); medium dense, very moist, gray; fine to medium sand; few decomposed organics.	
2	31					T-probe = 2 in		**Weathered Pre-Olympia Nonglacial Deposits** SILTY SAND (SM); dense, very moist, gray; fine to medium sand; trace fine to coarse, rounded to angular gravel; few to little decomposed organics	2
								Bottom of exploration at 2.16 ft. bgs.	
3	30								3
4	29								4
5	28								5
6	27								6

Legend

Sample Type

Plastic Limit ⊢⊣ Liquid Limit

Water Level ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: ETB

Exploration Log AHA-05
Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\200631 BUTTENWIESER RESIDENCE.GPJ August 16, 2022

Aspect CONSULTING	Buttenwieser/Wiley Residence - 200631		Geotechnical Exploration Log	
	Project Address & Site Specific Location 6838 96th Ave SE, Mercer Island, Washington, 5ft N. of AHA-03		*Coordinates (Lat,Lon WGS84)* 47.5412, -122.2099	*Exploration Number* **AHA-06**
Contractor Aspect Consulting	*Equipment* Hand	*Sampling Method* Grab	*Ground Surface Elev. (NAVD88)* 48'	
Operator ABM	*Exploration Method(s)* Hand tools	*Work Start/Completion Dates* 7/8/2022	*Top of Casing Elev. (NAVD88)* NA	*Depth to Water (Below GS)* No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot ▲ Water Content (%)● 0 10 20 30 40 50	Blows/6"	Tests	Material Type	Description	Depth (ft)
						T-probe = 2.0 ft		**Topsoil** SILTY SAND (SM); very loose, moist, gray brown; fine to medium sand; some roots and rootlets.	
1	47	Backfilled with excavated soil.						**Colluvium** SILTY SAND (SM); loose, moist, light brown with orange mottling; fine to coarse sand; trace fine, rounded to subrounded gravel; iron-oxide staining; little roots, woody debris, and decomposed organics.	1
								Weathered Pre-Olympia Nonglacial Deposits SILTY SAND (SM); very dense, very moist, gray with orange mottling; fine to coarse sand; trace coarse, rounded gravel; iron-oxide staining.	
2	46					T-probe = 0.5 in			2
								Bottom of exploration at 2.3 ft. bgs.	
3	45								3
4	44								4
5	43								5
6	42								6

Legend

Sample Type

Water Level

Plastic Limit ⊢⊣ Liquid Limit

No Water Encountered

See Exploration Log Key for explanation of symbols

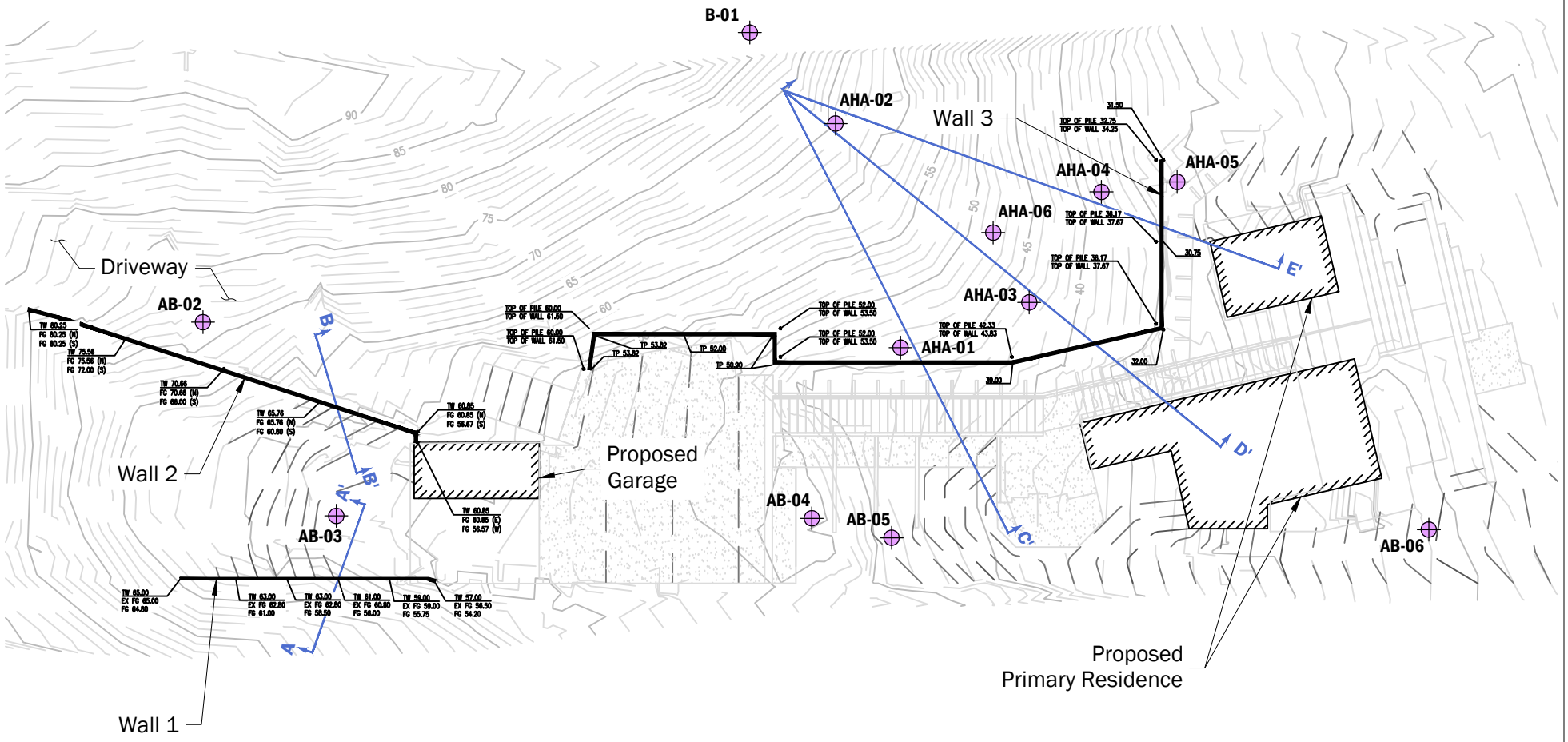
Logged by: CAL/ABM
Approved by: ETB

Exploration Log AHA-06
Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\200631 BUTTENWIESER RESIDENCE.GPJ August 16, 2022

APPENDIX E

Retaining Wall Global Stability Analyses



Legend

- **AB-XX** Exploration Location
- Existing 1' & 5' Topographic Contours
- Proposed 1' & 5' Topographic Contours
- Proposed Retaining Wall
- A A' Cross Section for Global Stability Analysis

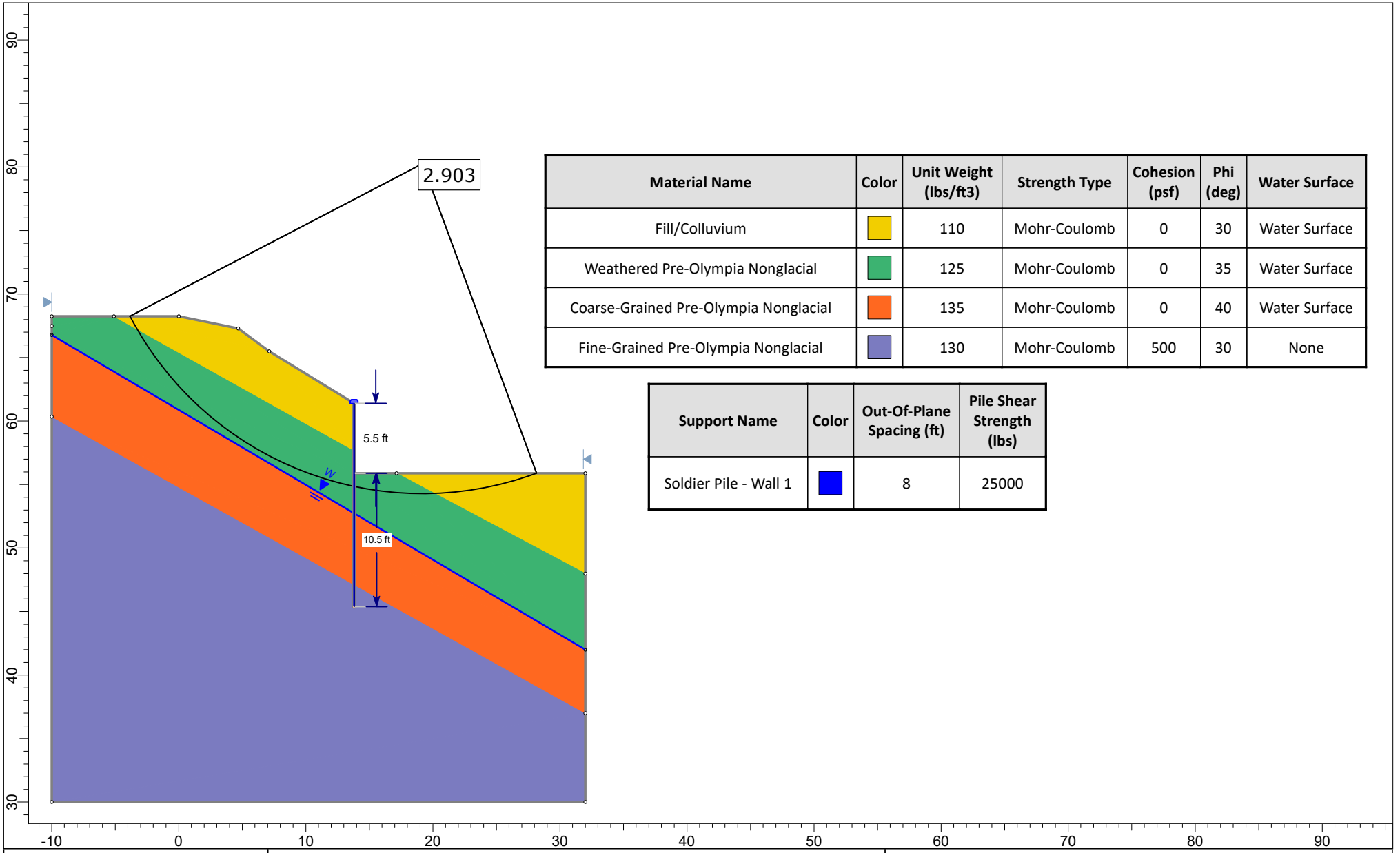
0 30 60 Feet

Global Stability Analysis Plan

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
6838 96th Avenue SE
Mercer Island, Washington

Aspect Consulting	Jul-2022	BY: MBR	FIGURE NO. E-1
	PROJECT NO. 200631	REVISED BY: -	

CAD Path: Q:_GeoTech\200631 Buttenwieser\ButtenwieserGlobalStability.dwg 8.5x11 Landscape || Date Saved: Jul 13, 2022 7:41am || User: mreiter



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Fill/Colluvium		110	Mohr-Coulomb	0	30	Water Surface
Weathered Pre-Olympia Nonglacial		125	Mohr-Coulomb	0	35	Water Surface
Coarse-Grained Pre-Olympia Nonglacial		135	Mohr-Coulomb	0	40	Water Surface
Fine-Grained Pre-Olympia Nonglacial		130	Mohr-Coulomb	500	30	None

Support Name	Color	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
Soldier Pile - Wall 1		8	25000

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

Section A-A' SP Wall Static

Global Stability Analysis

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
Mercer Island, WA

SLIDEINTERPRET 8.032

SCALE: 1:125

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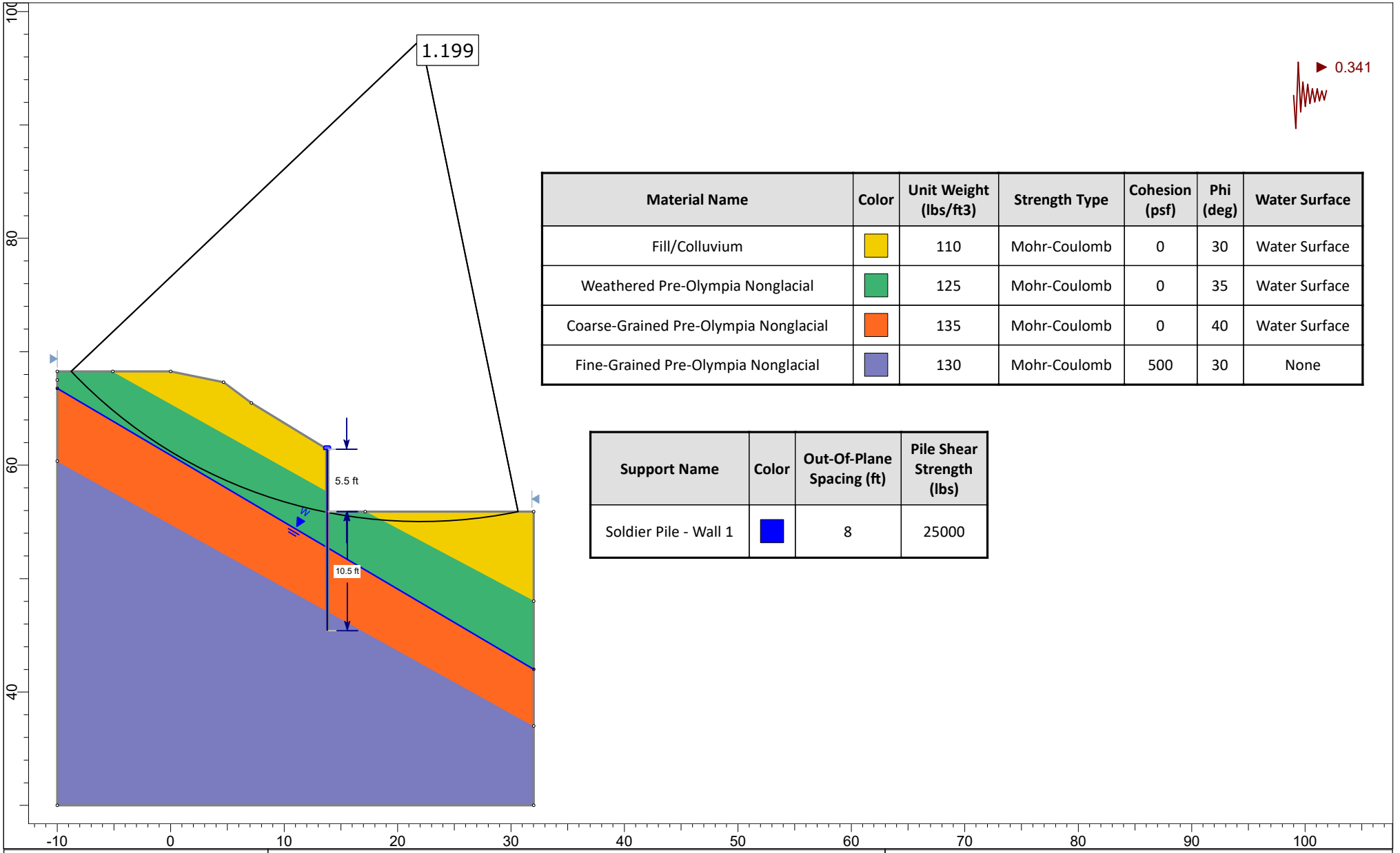
4/12/2022

PROJECT NO. 200631

BY: MBR

REVIEWED BY: HHH

APPENDIX: **E-2**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Fill/Colluvium		110	Mohr-Coulomb	0	30	Water Surface
Weathered Pre-Olympia Nonglacial		125	Mohr-Coulomb	0	35	Water Surface
Coarse-Grained Pre-Olympia Nonglacial		135	Mohr-Coulomb	0	40	Water Surface
Fine-Grained Pre-Olympia Nonglacial		130	Mohr-Coulomb	500	30	None

Support Name	Color	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
Soldier Pile - Wall 1		8	25000

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

Section A-A' SP Wall Seismic

Global Stability Analysis

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
Mercer Island, WA

SLIDEINTERPRET 8.032

SCALE: 1:140

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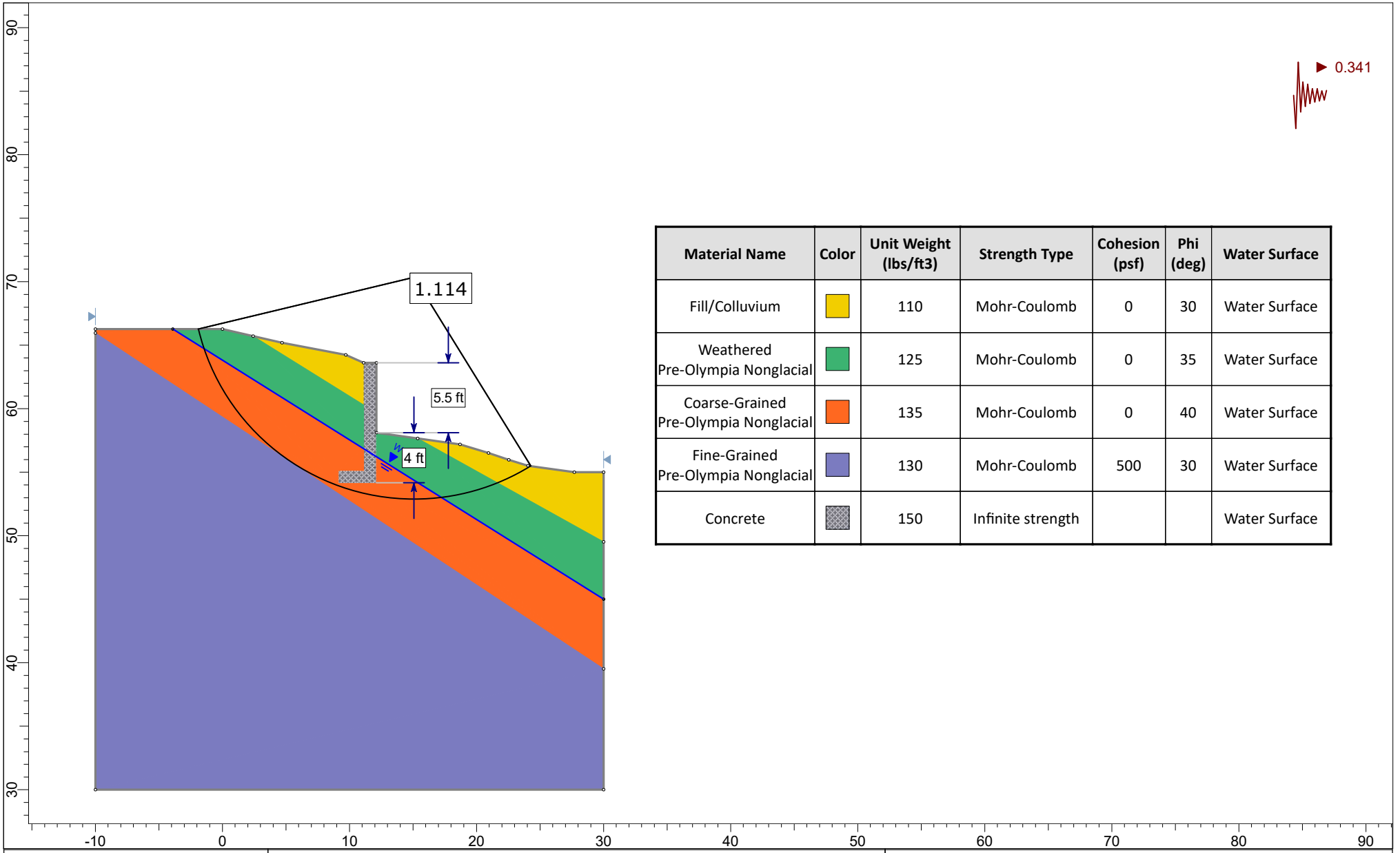
PROJECT NO. 200631

BY: MBR

REVIEWED BY: HHH

APPENDIX: **E-3**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Fill/Colluvium		110	Mohr-Coulomb	0	30	Water Surface
Weathered Pre-Olympia Nonglacial		125	Mohr-Coulomb	0	35	Water Surface
Coarse-Grained Pre-Olympia Nonglacial		135	Mohr-Coulomb	0	40	Water Surface
Fine-Grained Pre-Olympia Nonglacial		130	Mohr-Coulomb	500	30	Water Surface
Concrete		150	Infinite strength			Water Surface

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

Section B-B'
Seismic

Global Stability Analysis

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
Mercer Island, WA

SLIDEINTERPRET 8.032

SCALE: 1:125

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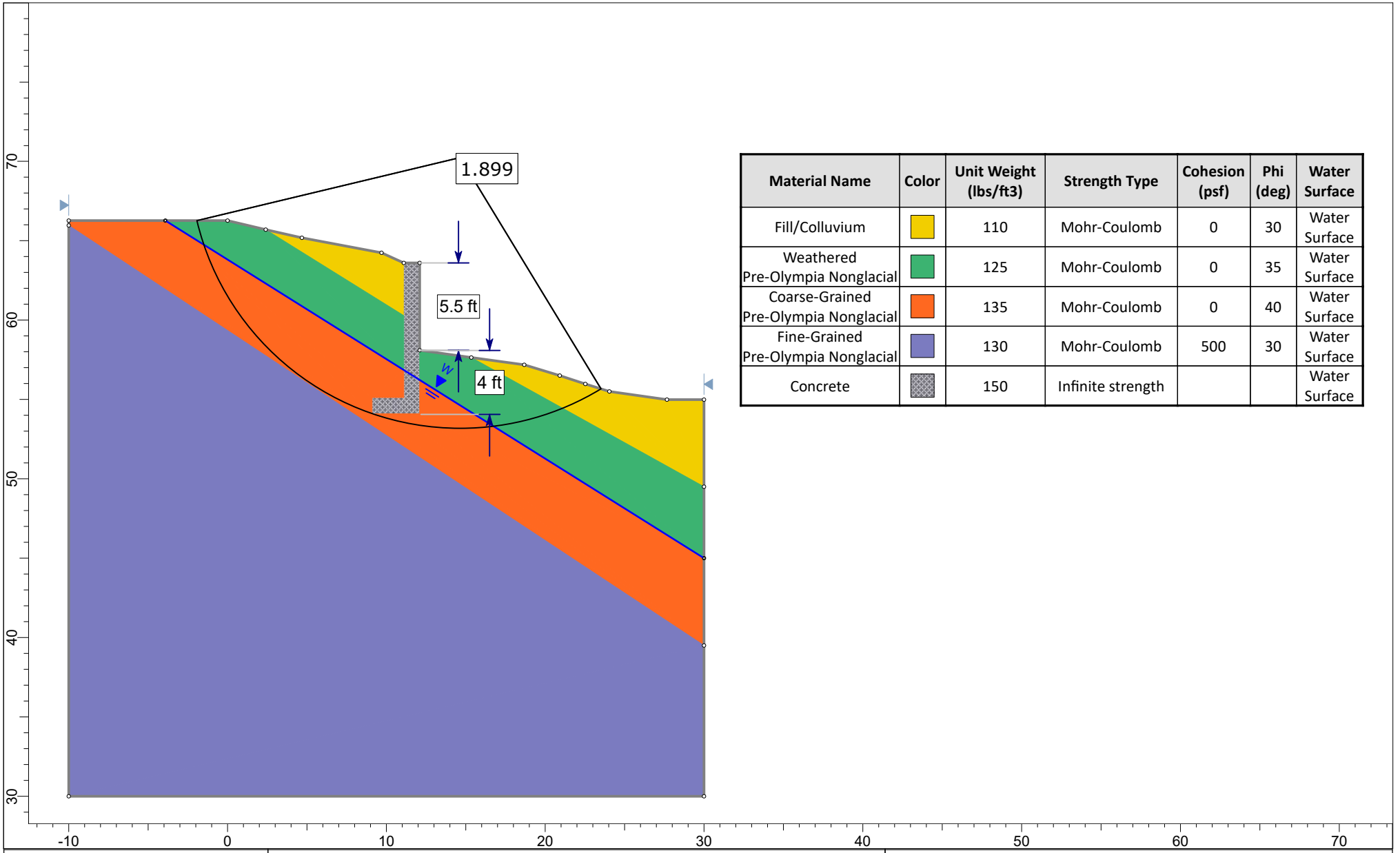
PROJECT NO. 200631

BY: MBR

REVIEWED BY: HHH

APPENDIX: **E-4**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Fill/Colluvium		110	Mohr-Coulomb	0	30	Water Surface
Weathered Pre-Olympia Nonglacial		125	Mohr-Coulomb	0	35	Water Surface
Coarse-Grained Pre-Olympia Nonglacial		135	Mohr-Coulomb	0	40	Water Surface
Fine-Grained Pre-Olympia Nonglacial		130	Mohr-Coulomb	500	30	Water Surface
Concrete		150	Infinite strength			Water Surface

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- B-2 Boring Location and Depth

Section B-B'
Static

Global Stability Analysis

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
Mercer Island, WA

SLIDEINTERPRET 8.032

SCALE: 1:100

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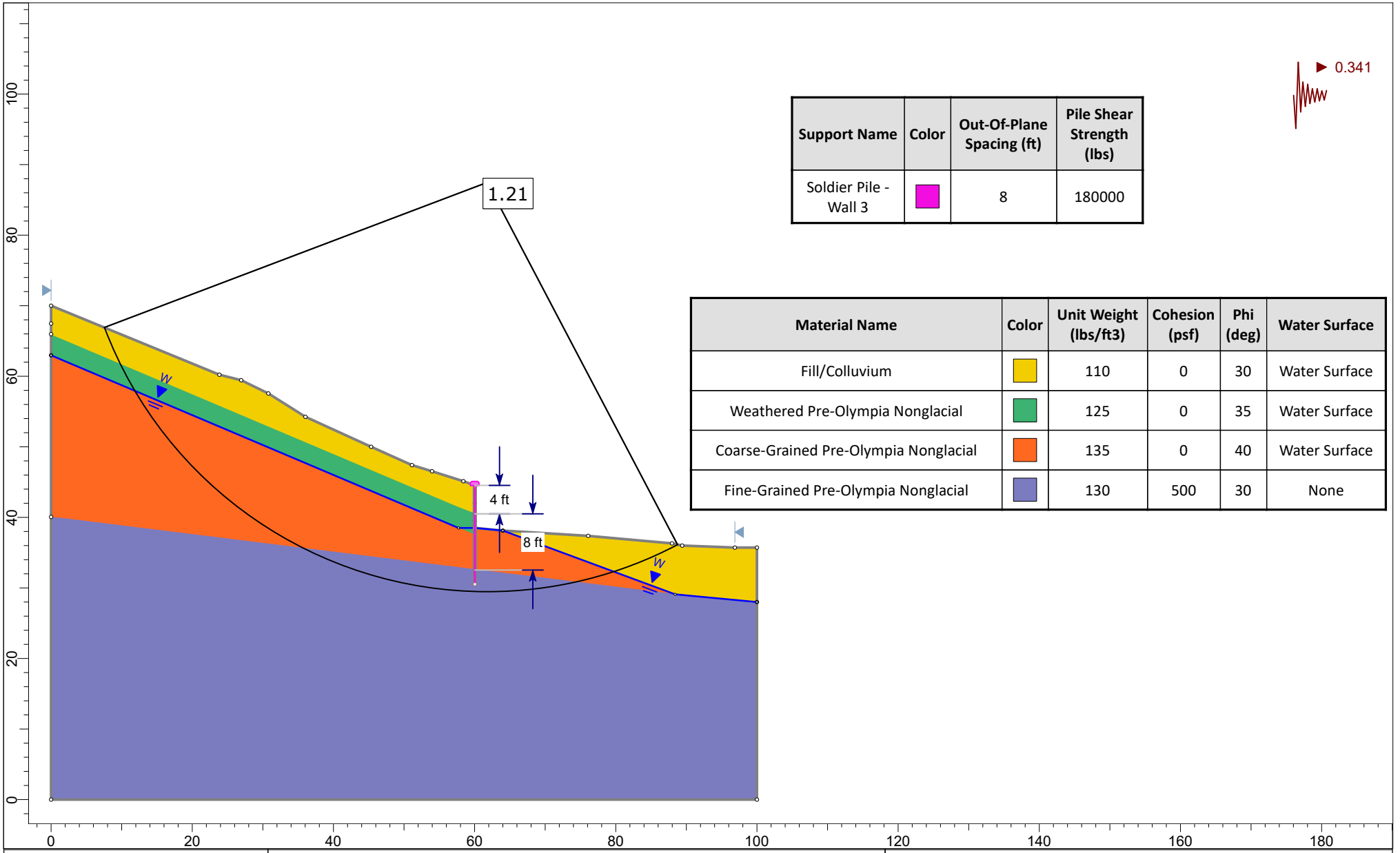
PROJECT NO. 200631

BY: MBR

REVIEWED BY: HHH

APPENDIX: **E-5**



Support Name	Color	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
Soldier Pile - Wall 3		8	180000

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
Fill/Colluvium		110	0	30	Water Surface
Weathered Pre-Olympia Nonglacial		125	0	35	Water Surface
Coarse-Grained Pre-Olympia Nonglacial		135	0	40	Water Surface
Fine-Grained Pre-Olympia Nonglacial		130	500	30	None

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

Section C-C'
Seismic

Global Stability Analysis

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
Mercer Island, WA

SLIDEINTERPRET 8.032

SCALE: 1:225

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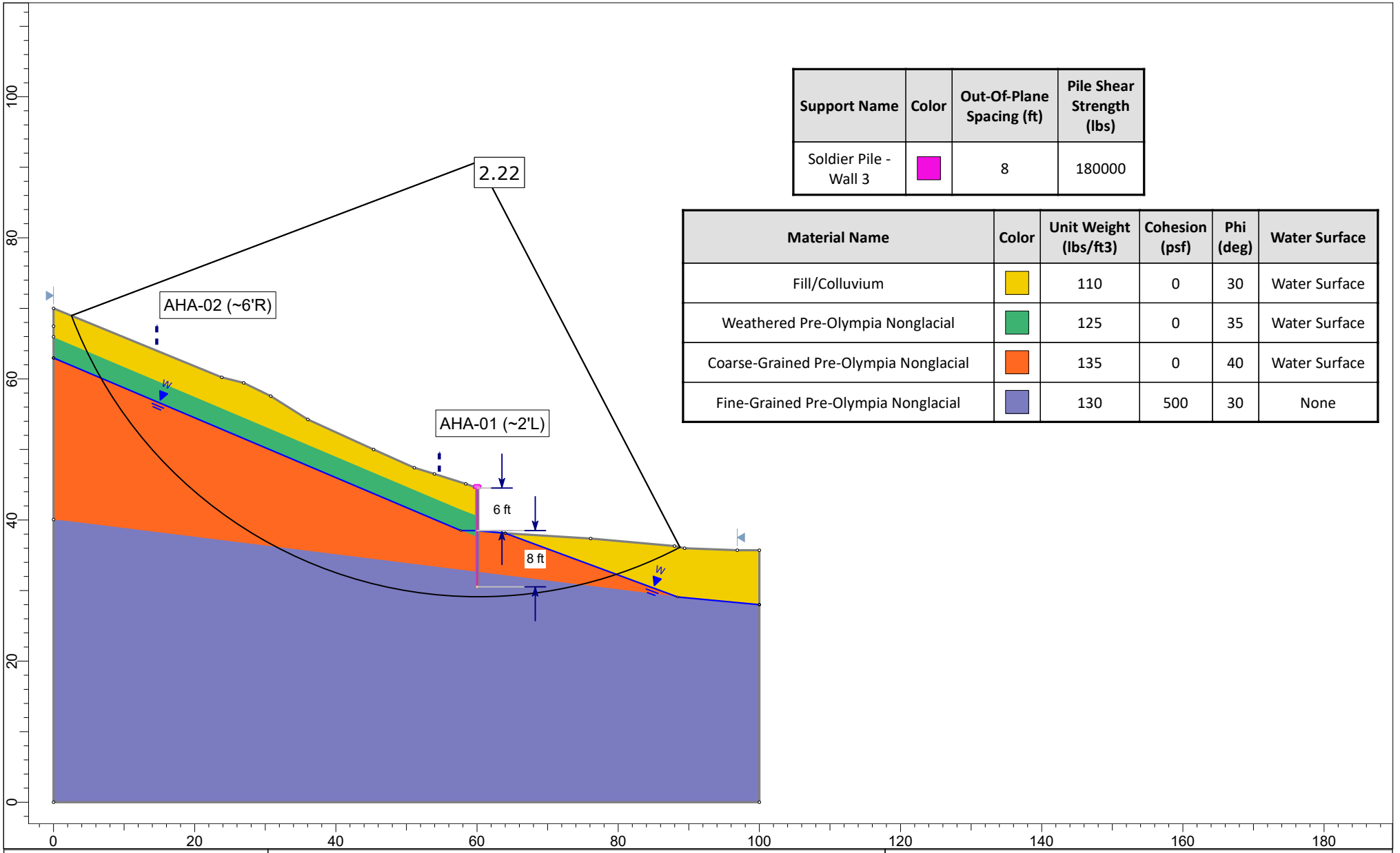
PROJECT NO. 200631

BY: MBR

REVIEWED BY: HHH

APPENDIX: **E-6**



Support Name	Color	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
Soldier Pile - Wall 3		8	180000

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
Fill/Colluvium		110	0	30	Water Surface
Weathered Pre-Olympia Nonglacial		125	0	35	Water Surface
Coarse-Grained Pre-Olympia Nonglacial		135	0	40	Water Surface
Fine-Grained Pre-Olympia Nonglacial		130	500	30	None

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

Section C-C'
Static

Global Stability Analysis

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
Mercer Island, WA

SLIDEINTERPRET 8.032

SCALE: 1:225

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PROJECT NO. 200631

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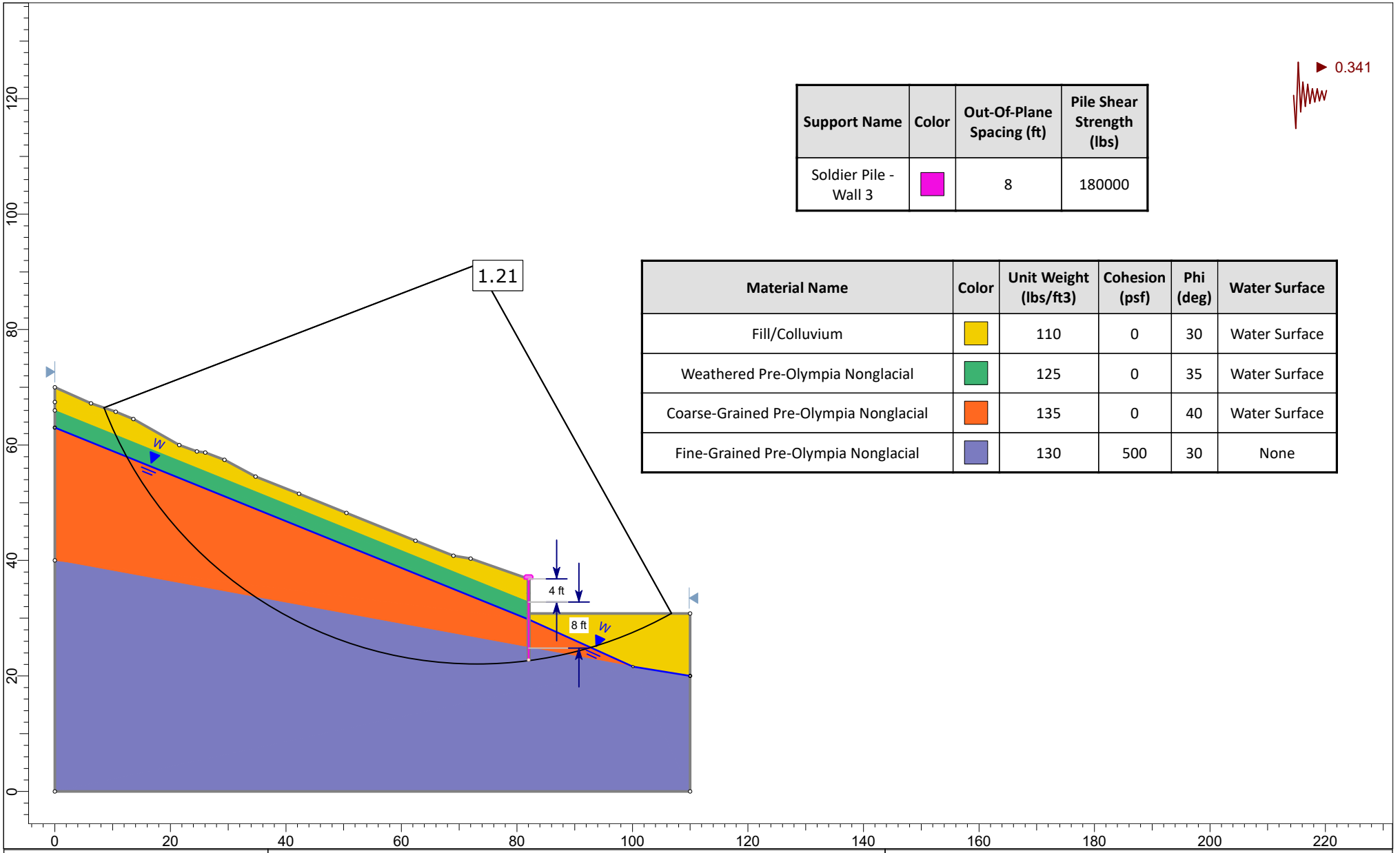
APPENDIX: **E-7**



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Support Name	Color	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
Soldier Pile - Wall 3		8	180000

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
Fill/Colluvium		110	0	30	Water Surface
Weathered Pre-Olympia Nonglacial		125	0	35	Water Surface
Coarse-Grained Pre-Olympia Nonglacial		135	0	40	Water Surface
Fine-Grained Pre-Olympia Nonglacial		130	500	30	None

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

Section D-D'
Seismic

Global Stability Analysis

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
Mercer Island, WA

SLIDEINTERPRET 8.032

SCALE: 1:275

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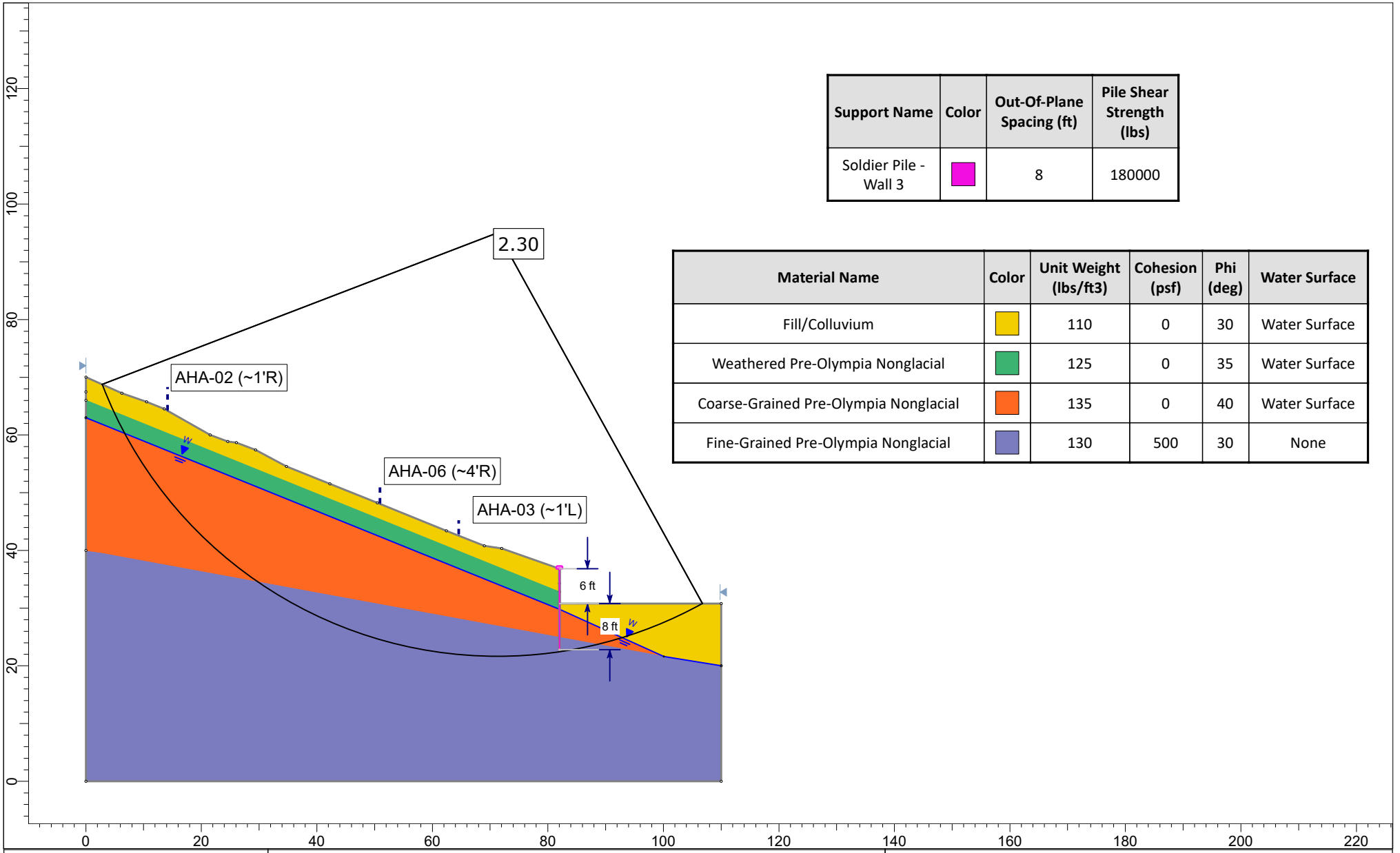
APPENDIX: **E-8**

Support Name	Color	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
Soldier Pile - Wall 3		8	180000

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
Fill/Colluvium		110	0	30	Water Surface
Weathered Pre-Olympia Nonglacial		125	0	35	Water Surface
Coarse-Grained Pre-Olympia Nonglacial		135	0	40	Water Surface
Fine-Grained Pre-Olympia Nonglacial		130	500	30	None



Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

Section D-D'
Static

Global Stability Analysis

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
Mercer Island, WA

SLIDEINTERPRET 8.032

SCALE: 1:275

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PROJECT NO. 200631

BY: MBR

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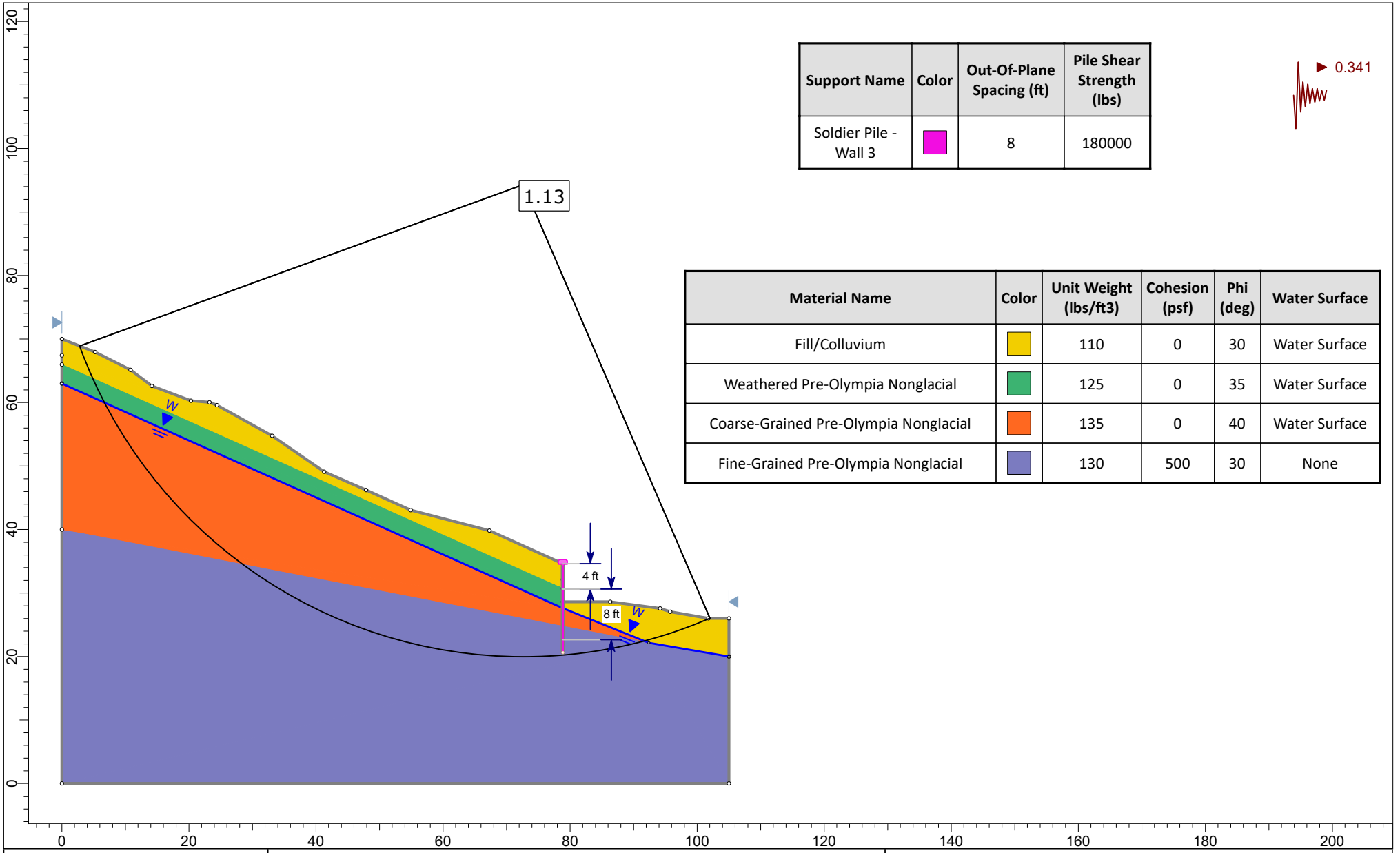
APPENDIX: **E-9**

Support Name	Color	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
Soldier Pile - Wall 3		8	180000

▶ 0.341



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
Fill/Colluvium		110	0	30	Water Surface
Weathered Pre-Olympia Nonglacial		125	0	35	Water Surface
Coarse-Grained Pre-Olympia Nonglacial		135	0	40	Water Surface
Fine-Grained Pre-Olympia Nonglacial		130	500	30	None

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

Section E-E'
Seismic

Global Stability Analysis

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
Mercer Island, WA

SLIDEINTERPRET 8.032

SCALE: 1:250

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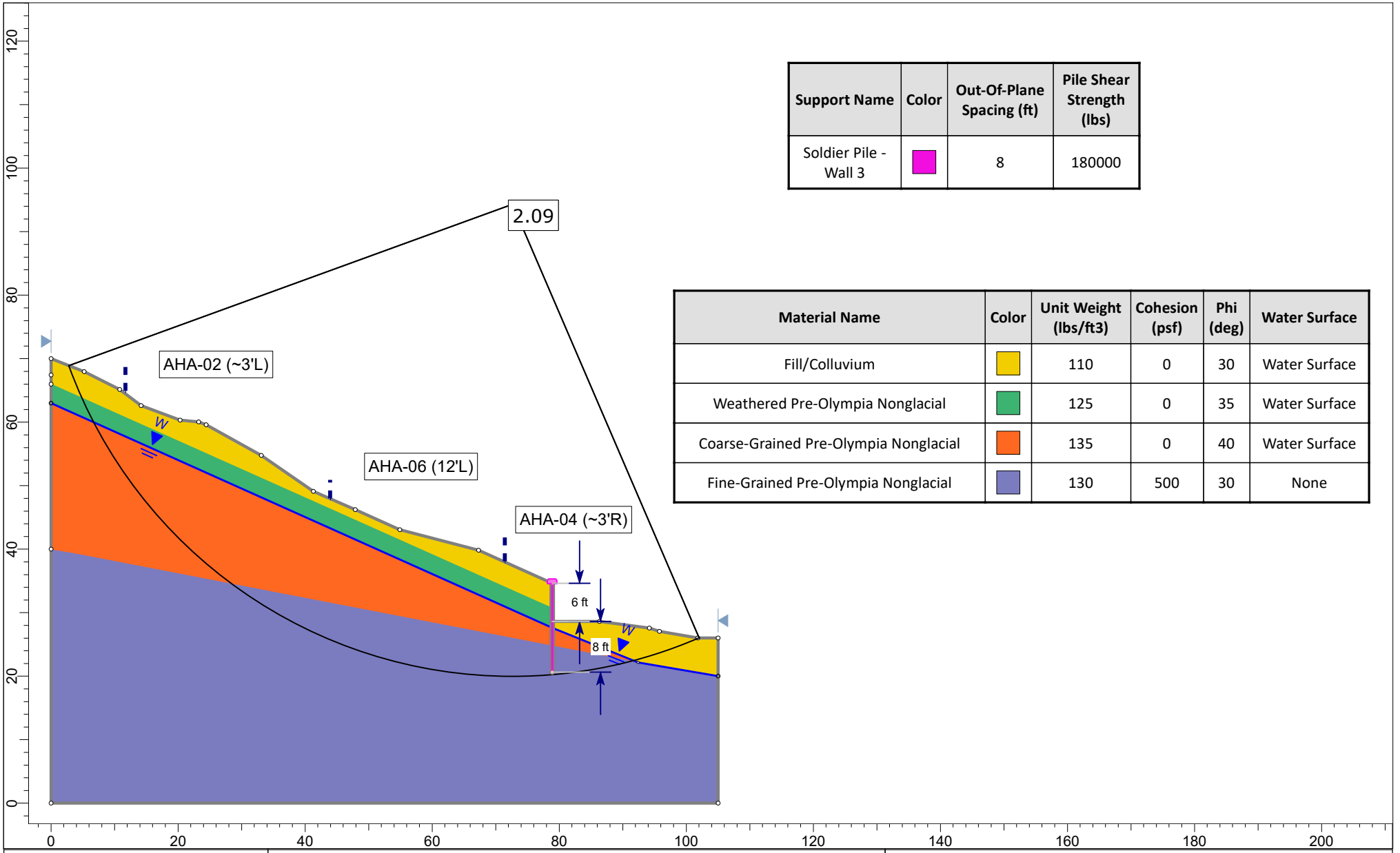
PROJECT NO. 200631

BY: MBR

REVIEWED BY: HHH

APPENDIX: **E-10**

Support Name	Color	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
Soldier Pile - Wall 3		8	180000



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
Fill/Colluvium		110	0	30	Water Surface
Weathered Pre-Olympia Nonglacial		125	0	35	Water Surface
Coarse-Grained Pre-Olympia Nonglacial		135	0	40	Water Surface
Fine-Grained Pre-Olympia Nonglacial		130	500	30	None

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

Section E-E'
Static

Global Stability Analysis

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
Mercer Island, WA

SLIDEINTERPRET 8.032

SCALE: 1:250

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PROJECT NO. 200631

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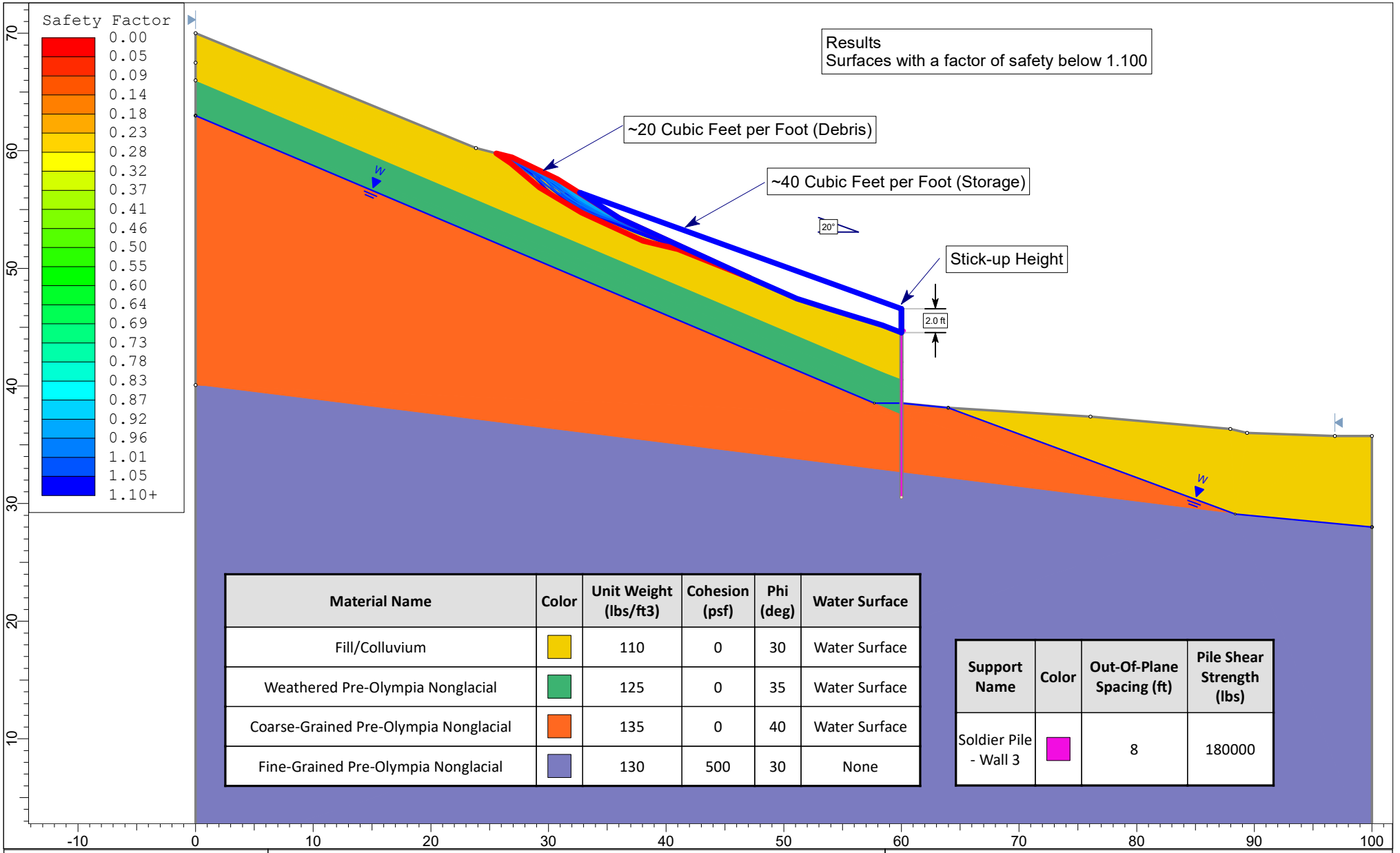
REVIEWED BY: HHH

APPENDIX: **E-11**

APPENDIX F

Retaining Wall Catchment Calculations



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
Fill/Colluvium		110	0	30	Water Surface
Weathered Pre-Olympia Nonglacial		125	0	35	Water Surface
Coarse-Grained Pre-Olympia Nonglacial		135	0	40	Water Surface
Fine-Grained Pre-Olympia Nonglacial		130	500	30	None

Support Name	Color	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
Soldier Pile - Wall 3		8	180000

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

Section C-C'
Catchment Calculations

Global Stability Analysis

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
Mercer Island, WA

SLIDEINTERPRET 8.032

SCALE: 1:135

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PROJECT NO. 200631

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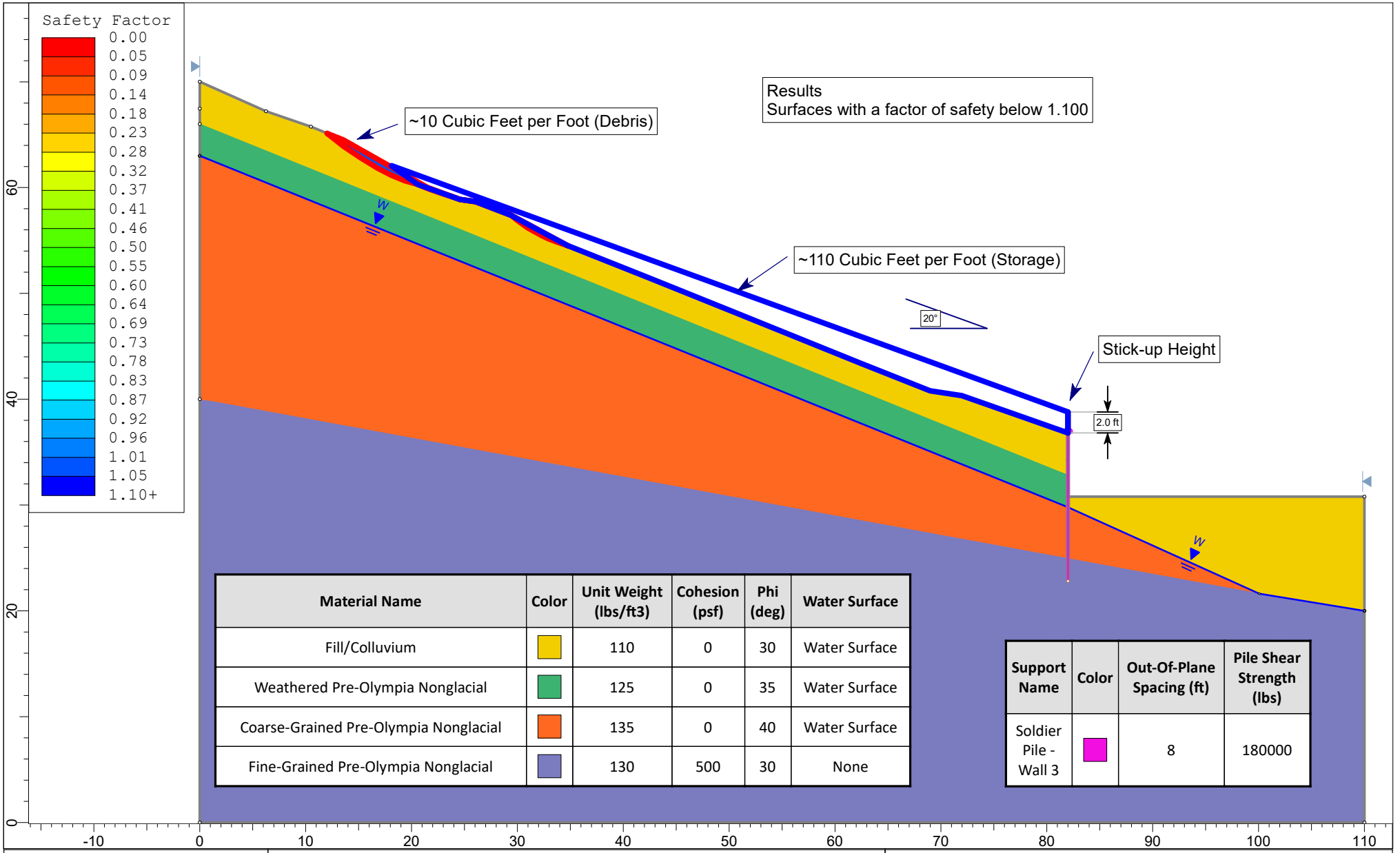
REVIEWED BY: HHH

APPENDIX: F-1



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
Fill/Colluvium		110	0	30	Water Surface
Weathered Pre-Olympia Nonglacial		125	0	35	Water Surface
Coarse-Grained Pre-Olympia Nonglacial		135	0	40	Water Surface
Fine-Grained Pre-Olympia Nonglacial		130	500	30	None

Support Name	Color	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
Soldier Pile - Wall 3		8	180000

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

Section D-D'
Catchment Calculations

Global Stability Analysis

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
Mercer Island, WA

SLIDEINTERPRET 8.032

SCALE: 1:150

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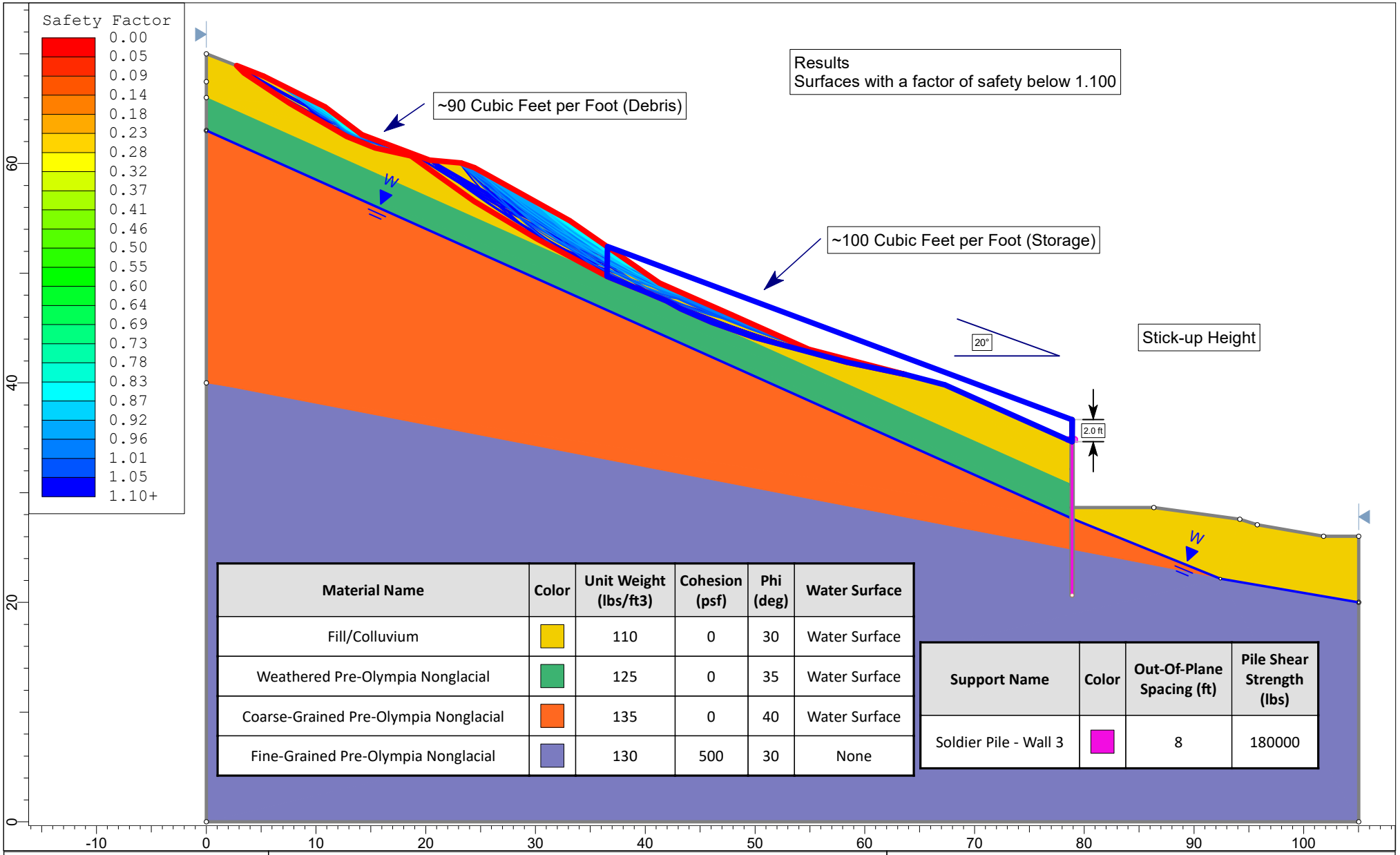
PROJECT NO. 200631

BY: MBR

REVIEWED BY: HHH

APPENDIX: F-2



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Water Surface
Fill/Colluvium		110	0	30	Water Surface
Weathered Pre-Olympia Nonglacial		125	0	35	Water Surface
Coarse-Grained Pre-Olympia Nonglacial		135	0	40	Water Surface
Fine-Grained Pre-Olympia Nonglacial		130	500	30	None

Support Name	Color	Out-Of-Plane Spacing (ft)	Pile Shear Strength (lbs)
Soldier Pile - Wall 3		8	180000

Legend

- Search Grid
- Search Limits
- Modeled Groundwater Level
- Boring Location and Depth

Section E-E'
Catchment Calculations

Global Stability Analysis

Geotechnical Engineering Report
Buttenwieser/Wiley Residence
Mercer Island, WA

SLIDEINTERPRET 8.032

SCALE: 1:145

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PROJECT NO. 200631

BY: MBR

REVIEWED BY: HHH

APPENDIX: F-3

APPENDIX G

Report Limitations and Guidelines for Use

REPORT LIMITATIONS AND GUIDELINES FOR USE

Geoscience is Not Exact

The geoscience practices (geotechnical engineering, geology, and environmental science) are far less exact than other engineering and natural science disciplines. It is important to recognize this limitation in evaluating the content of the report. If you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or property, you should contact Aspect Consulting, LLC (Aspect).

This Report and Project-Specific Factors

Aspect's services are designed to meet the specific needs of our clients. Aspect has performed the services in general accordance with our agreement (the Agreement) with the Client (defined under the Limitations section of this project's work product). This report has been prepared for the exclusive use of the Client. This report should not be applied for any purpose or project except the purpose described in the Agreement.

Aspect considered many unique, project-specific factors when establishing the Scope of Work for this project and report. You should not rely on this report if it was:

- Not prepared for you;
- Not prepared for the specific purpose identified in the Agreement;
- Not prepared for the specific subject property assessed; or
- Completed before important changes occurred concerning the subject property, project, or governmental regulatory actions.

If changes are made to the project or subject property after the date of this report, Aspect should be retained to assess the impact of the changes with respect to the conclusions contained in the report.

Reliance Conditions for Third Parties

This report was prepared for the exclusive use of the Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against liability claims by third parties with whom there would otherwise be no contractual limitations. Within the limitations of scope, schedule, and budget, our services have been executed in accordance with our Agreement with the Client and recognized geoscience practices in the same locality and involving similar conditions at the time this report was prepared.

Property Conditions Change Over Time

This report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by events such as a change in property use or occupancy, or by natural events, such as floods,

earthquakes, slope instability, or groundwater fluctuations. If any of the described events may have occurred following the issuance of the report, you should contact Aspect so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Geotechnical, Geologic, and Environmental Reports Are Not Interchangeable

The equipment, techniques, and personnel used to perform a geotechnical or geologic study differ significantly from those used to perform an environmental study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually address any environmental findings, conclusions, or recommendations (e.g., about the likelihood of encountering underground storage tanks or regulated contaminants). Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding the subject property.

We appreciate the opportunity to perform these services. If you have any questions please contact the Aspect Project Manager for this project.