associated earth sciences incorporated

February 29, 2024
Project No. 20220141E001

Brad and Judy Chase
4467 Forest Avenue SE
Mercer Island, Washington 98040

Subject: Response to City Comments
Chase (Fused Elements) Residence
4525 Forest Avenue SE
Mercer Island, Washington

Geotechnical Report: Subsurface Exploration, Geologic Hazard, and Geotechnical Engineering Report
Chase Residence
Mercer Island, Washington
Dated August 16, 2022

Plans Reviewed: Fused Elements
Civil Sheets C1.00, C2.00, C2.50, C3.00, C4.00, C4.50, C5.00 and C5.01, kpff, dated February 23, 2024
Architectural Sheets G0.00, A0.02, A0.03, A0.20, A0.24, A0.30, A0.50, A0.53, A2.40, A3.00, A3.01, A3.10, A4.00, A4.01, A7.00, A7.01, A8.00 and A8.01, dated September 8, 2023, and Sheets A0.21, A0.51, A0.52, A1.00, A2.10, A2.20 and A2.30, dated February 23, 2024, Olson Kundig
Structural Sheets S0.01, S0.02, S1.01, S2.02, S2.03, S4.01, S4.02, S5.01, S6.01, S6.02 and S6.03, dated September 8, 2023, and Sheets S2.00, S2.01, SH0.01, SH2.01 and SH4.01, dated February 23, 2024, kpff
Boundary and Topographic Survey, PLOG Engineering, dated 2022
Topographic and Boundary Survey, Terrane, dated July 7, 2021
Landscaping Sheets L1.00, L1.01 and L1.02, Spring Greenworks, dated February 23, 2024

Dear Mr. and Ms. Chase:

This letter addresses selected geotechnical comments made by the City of Mercer Island's reviewer regarding the proposed residence. Associated Earth Sciences, Inc. (AESI) has prepared a geotechnical report, dated August 16, 2022, for the proposed residence, to be located at 4525 Forest Avenue SE in Mercer Island, Washington. The following provides our responses to selected City comments.

Geotechnical engineer to review final approved plan set and provide PE stamped letter indicating whether proposed development conforms to their geotechnical design and construction recommendations. Please also provide an updated statement of risk in accordance with MICC 19.07.160.B.3.

We have reviewed the project plans referenced above. In our opinion, these plans conform to our geotechnical engineering recommendations. In our opinion, provided the project is constructed in accordance with these plans, the development practices proposed for the alteration would render the development as safe as if it were not located in a geologic hazard area, per MICC 19.07.160(B)(3)(c).

The geotechnical report provided dated August 16, 2022, indicates that it presents preliminary design recommendations. The memo dated October 5, 2023 indicated that AES also provided design-phase geotechnical consultation. Please provide for review all final design geotechnical recommendations for any geotechnical related elements presented in the project plan set (e.g. recommendations for use of dispersion trenches at the site, helical anchors, surcharge loading on shoring wall, etc.).

Our comments related to the above-listed items include:

a) Our review of the above-referenced plans indicates that dispersion trenches are no longer proposed.
b) We understand that the project team has deemed the design of helical anchors to be completed by the contractor ("bidder design"). We are available to review proposed designs, as needed.
c) The pressure diagram presented in our August 16, 2022 report provides for various surcharges. We understand that the previously-submitted structural plans included a different pressure diagram than that presented in our August 16, 2022 report, and that the current plans now reflect our recommendations.

In the geotechnical report dated August 16, 2022, liquefiable soils were noted in boring EB-1. Please provide an assessment of the liquefaction potential of the site soils and potential resultant ground movements such as post-liquefaction settlement, lateral spreading or flow failure. Please provide mitigation recommendations, if appropriate. Please include calculations and relevant slope stability cross sections, analyses and results for review.

Saturated portions of the lake deposits encountered in our explorations have the potential to liquefy during a seismic event. However, the underlying dense to very dense pre-Olympia sediments are not likely to liquefy due to their dense condition. The results of a liquefaction analysis (attached) using the computer program LiquefyPro (copyright Civiltech Software), with an assumed peak horizontal ground acceleration of 0.676g, indicated a range of approximately 2.0 to 4.2 inches of potential settlement within the lake deposits encountered at EB-1, during a design level (2,475-year return period) seismic event. This range is based on values calculated using various analysis methods (Tokimatsu/Seed, Tokimatsu. M Correlation and Ishihara/

Yoshimine) and fines corrections (None, Idriss/Seed, Stark/Olson et al., and Modify Stark/Olson). The analyses predicting the lowest and highest settlement values are included in the Appendix.

Per our September 20, 2018 report, the placement of the residence on a deep foundation (piles) "*will mitigate the potential for building settlement caused by loose or liquefiable sediments under both static and seismic conditions. It is our opinion that the risk of damage to the proposed home and site improvements by liquefaction is low, provided the recommendations in this report are incorporated into the project plans and adhered to during construction.*"

Lateral spreading is a hazard for liquefaction-prone sites adjacent to waterways. The liquefied soils may spread horizontally toward the water due to the reduction of soil strength and lack of confinement on the water side. We performed a lateral spread analysis based on methods presented by Youd and others (2002). In summary, due to the fine-grained nature of the lake deposits and the density of the underlying pre-Olympia-age sediments encountered below the water table, we consider the risk of lateral spreading during a seismic event posed to the residence to be low, with the potential magnitude of lateral spread below the mudline near the shoreline on the order of one foot or less. Given the small scale of the project relative to the broad area of the surrounding shoreline, it is our opinion that mitigation measures beyond the pile-supported foundation that is currently proposed are not practical or feasible. The owners should therefore understand and accept the inherent, albeit low, risk of lateral spreading damage to the structure in the event of a strong earthquake.

In the geotechnical report dated August 16, 2022, the following opinions was presented: "Given the broad nature of the delineated hazard area upslope of the subject site and neighboring parcels, the ability to mitigate risks associated with landslides occurring along these slopes, based on the relative size of the slope complex as compared to the subject site, is limited. ... Local slope stability mitigation for the planned structure is feasible using the recommendations presented in this report." Please quantify the potential landslide hazard risks for the subject site. Please provide static and seismic slope stability cross sections, analyses and results and mitigation measures to document that the proposed development meets the requirements of MICC 19.07.160. Mitigation measures could include slope stabilization walls, catchment walls, landslide debris diversion systems, etc.

An analysis of the stability of the site was completed using the computer program SLOPE/W, Version 8.16 by GeoSlope International. The program used the Morgenstern–Price method for evaluating a rotational failure. Input parameters for the analysis included slope geometry, geology, and soil strength parameters. The profile used for our analysis was located along section line A-A' as depicted on the site plan presented in the attached Appendix. The geology of the slope was based on the subsurface conditions encountered in our explorations. Soil strength parameters used for our analysis were assumed based on typical published values for similar materials and our prior experience. The values assumed for our analysis were selected to be conservatively low and are shown on the SLOPE/W attached profiles. For evaluation of

slope stability under seismic conditions, a horizontal ground acceleration of 0.338g was used for our analysis. This value is equivalent to ½ of the peak horizontal ground acceleration based on a seismic event with a 2-percent probability of exceedance in 50 years in accordance with the 2018 *International Building Code* (IBC).

The factor of safety of a slope is the ratio between the forces that resist sliding to the forces that drive sliding. For example, a factor of safety of 1.0 would indicate a slope where the driving forces and the resisting forces are exactly equal. Increasing factor of safety values greater than 1.0 indicate increased stability.

Minimum factors of safety calculated for the proposed development were 2.2 for static conditions and 1.3 for seismic conditions. These values are greater than or equal to typical standards of 1.5 for static conditions and 1.15 for seismic conditions for a permanent slope. Copies of the results of the slope stability analysis are included in the attached Appendix.

Provided that the current plans do not substantially change, it is our opinion that the proposed project will not result in adverse impacts to the stability of the slope on the subject site or on the adjacent properties and the risk of the damage to the proposed improvements by landsliding is low.

It must be understood that no recommendations or engineering design can yield a guarantee of stable slopes. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the owner. Should the current plans change significantly, AESI should be allowed to review the final project plans once they have been developed to update our recommendations, as necessary.

Please have geotechnical engineer review all the locations of the proposed helical anchors and provide recommendations for minimum distance between pipe piles and anchors. Please revise structural design if necessary.

We understand that the helical anchors will be a bidder design item. For practical purposes, we consider a design using a minimum clearance of six inches between the outer edges of the planned pipe piles and helical anchors. This clearance recommendation assumes that the helical anchors will be installed prior to pipe pile installation, mitigating the clearance needs of the helical anchor flights.

Please revise design lateral soil pressures to reflect current design.

The pressure diagram presented in our August 16, 2022 report provides for various surcharges. We understand that the previously-submitted structural plans included a different pressure diagram than that presented in our August 16, 2022 report, and that the current plans now reflect our recommendations.

Closure

We appreciate the opportunity to be of continued service. If you have any questions, please call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

Bruce Blyton
Digitally signed by Bruce Blyton
Date: 2024.02.29 14:16:15 -08'00'

Jeffrey P. Laub, P.E., L.G., L.E.G.
Associate Engineer/Geologist

Bruce L. Blyton, P.E.
Senior Principal Engineer

Appendix: Liquefaction Analysis
Slope stability Analysis (site plan and cross-section)

JPL/ld – 20220141E001-005

APPENDIX

Liquefaction Analysis

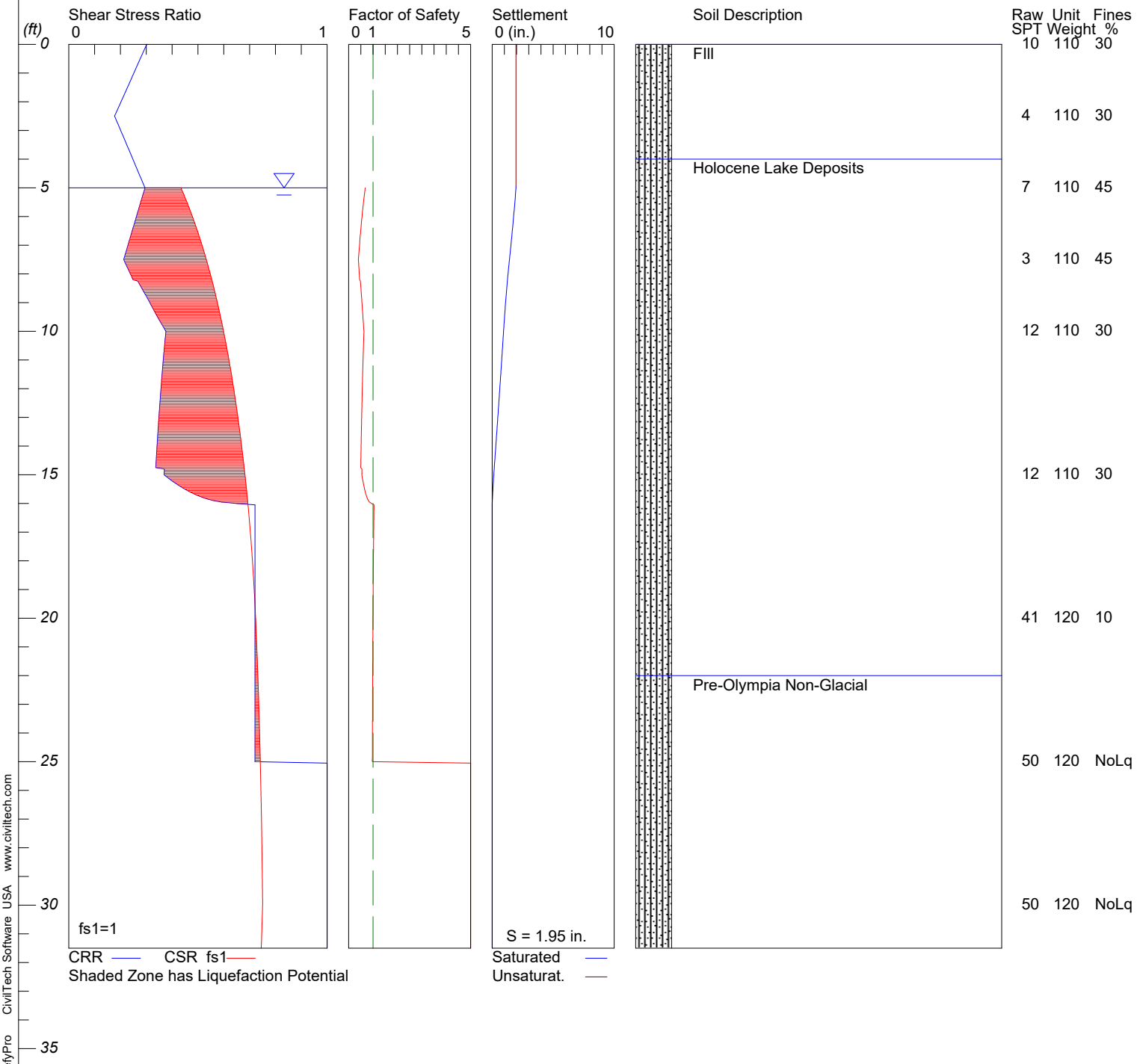
Slope stability Analysis (site plan and cross-section)

LIQUEFACTION ANALYSIS

Chase Residence - 20220141E001

Hole No.=EB-1 Water Depth=5 ft Surface Elev.=23 NA

Magnitude=6.5
Acceleration=0.676g



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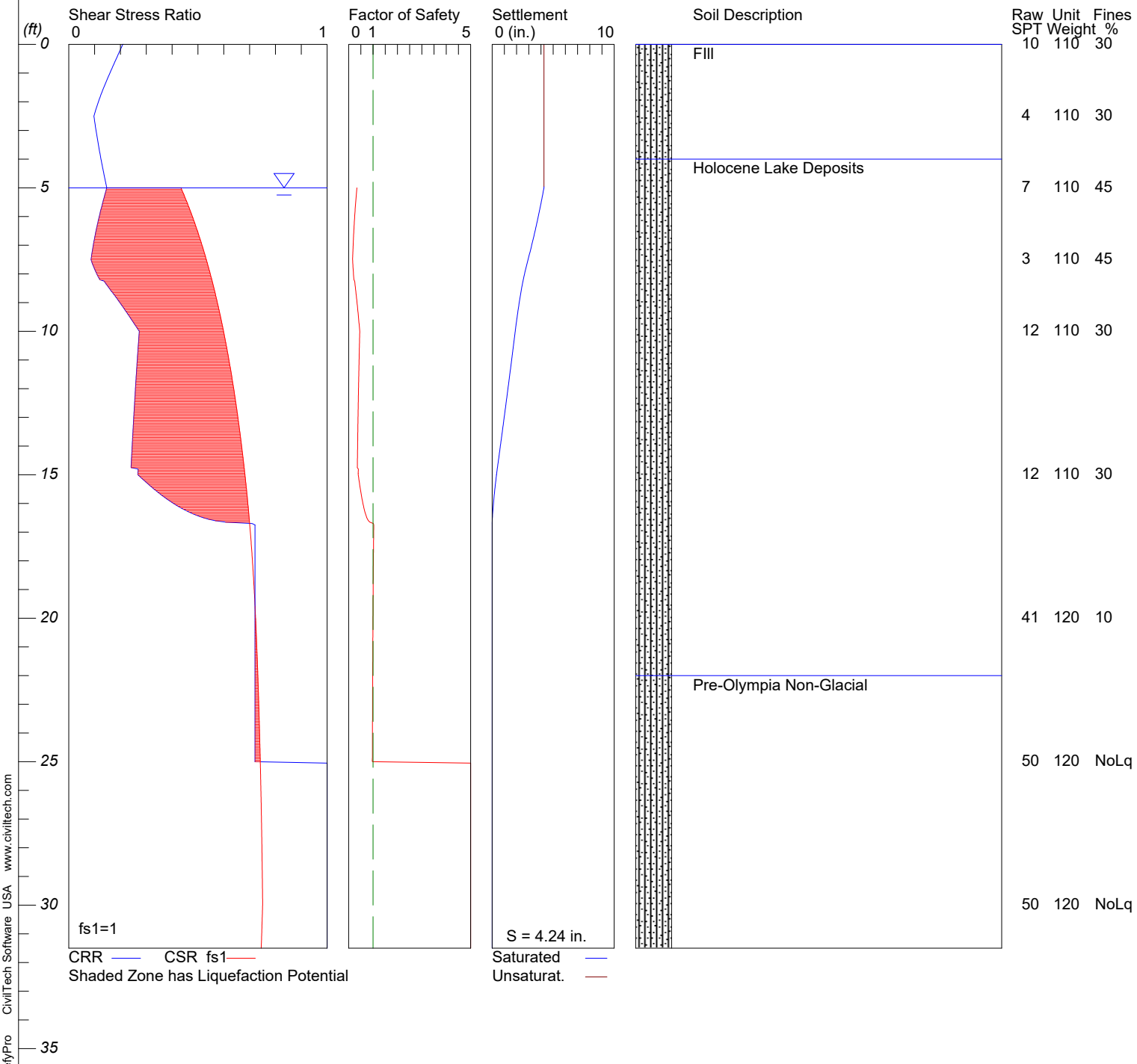
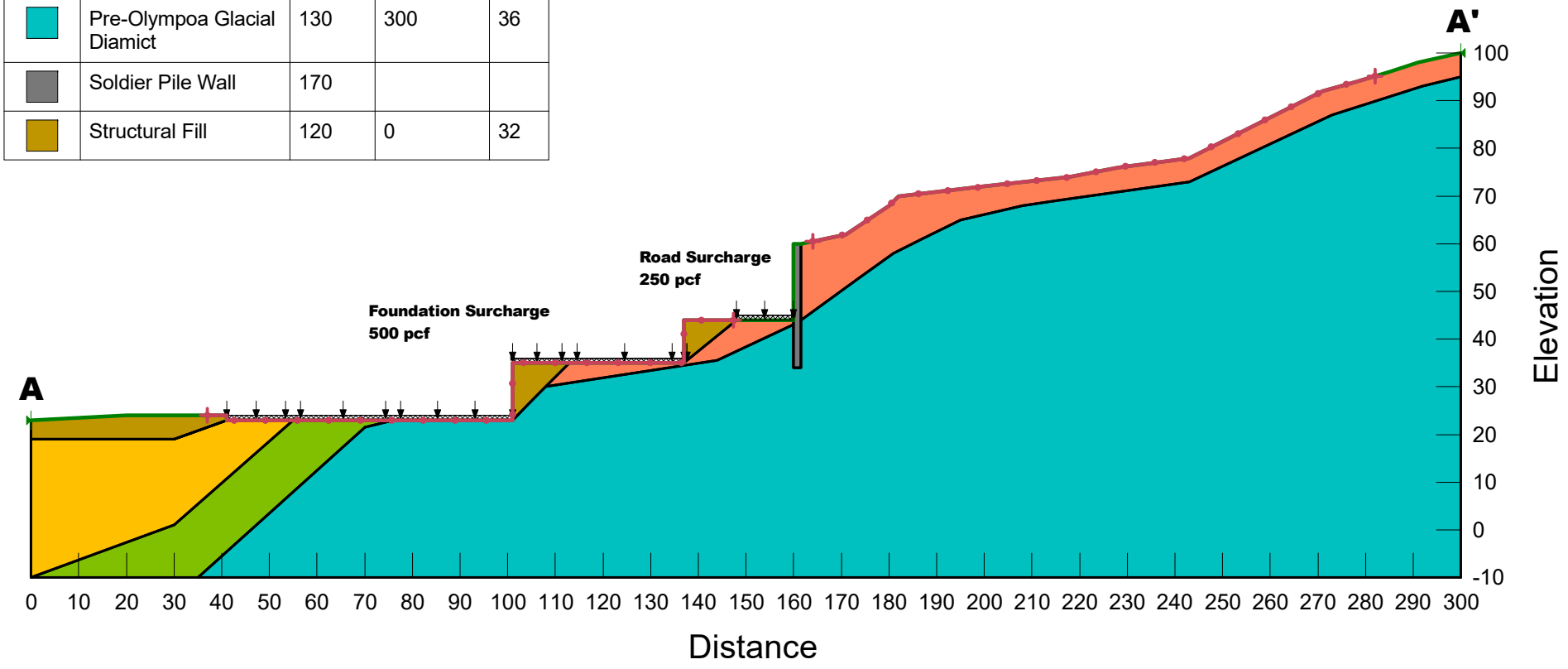
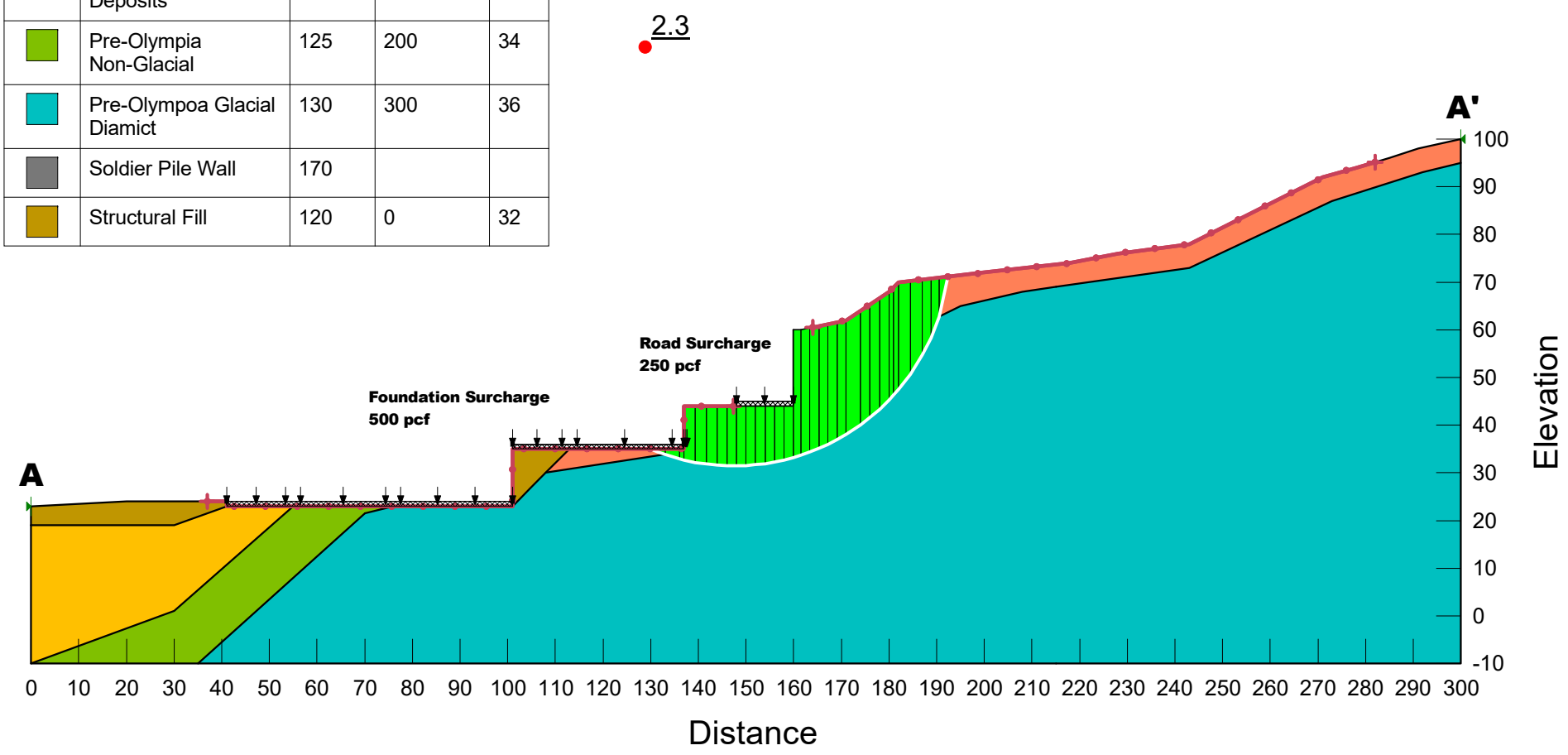


Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Beach Deposits	110	50	32
	Holocene Mass-Wastage Deposits	120	0	30
	Pre-Olympia Non-Glacial	125	200	34
	Pre-Olympoa Glacial Diamict	130	300	36
	Soldier Pile Wall	170		
	Structural Fill	120	0	32



Proposed Conditions - Static
20220141E001 Chase Residence - A.gsz
02/16/2024 1:400

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Beach Deposits	110	50	32
	Holocene Mass-Wastage Deposits	120	0	30
	Pre-Olympia Non-Glacial	125	200	34
	Pre-Olympoa Glacial Diamict	130	300	36
	Soldier Pile Wall	170		
	Structural Fill	120	0	32



Proposed Conditions - Static	
20220141E001 Chase Residence - A.gsz	
02/16/2024	1:400

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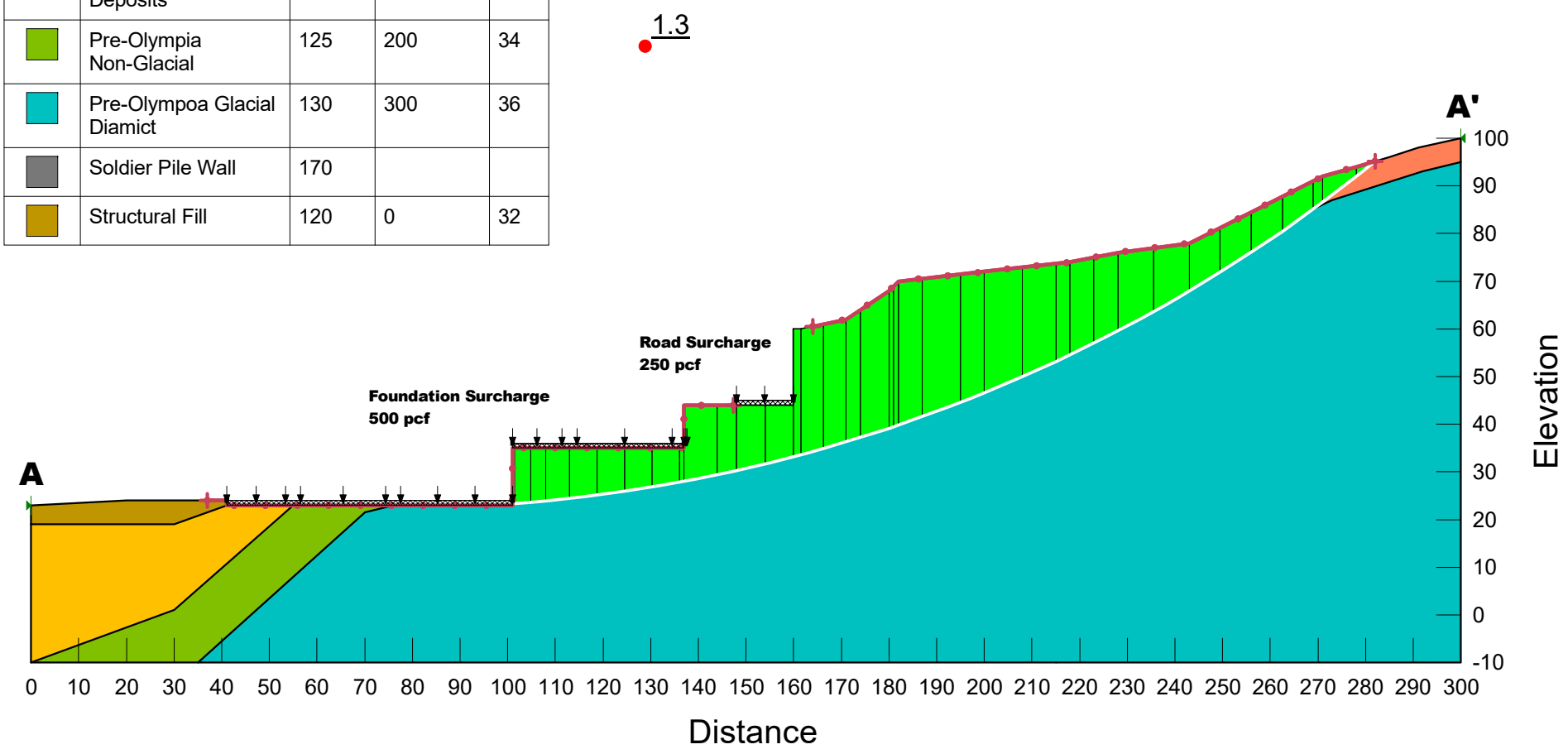
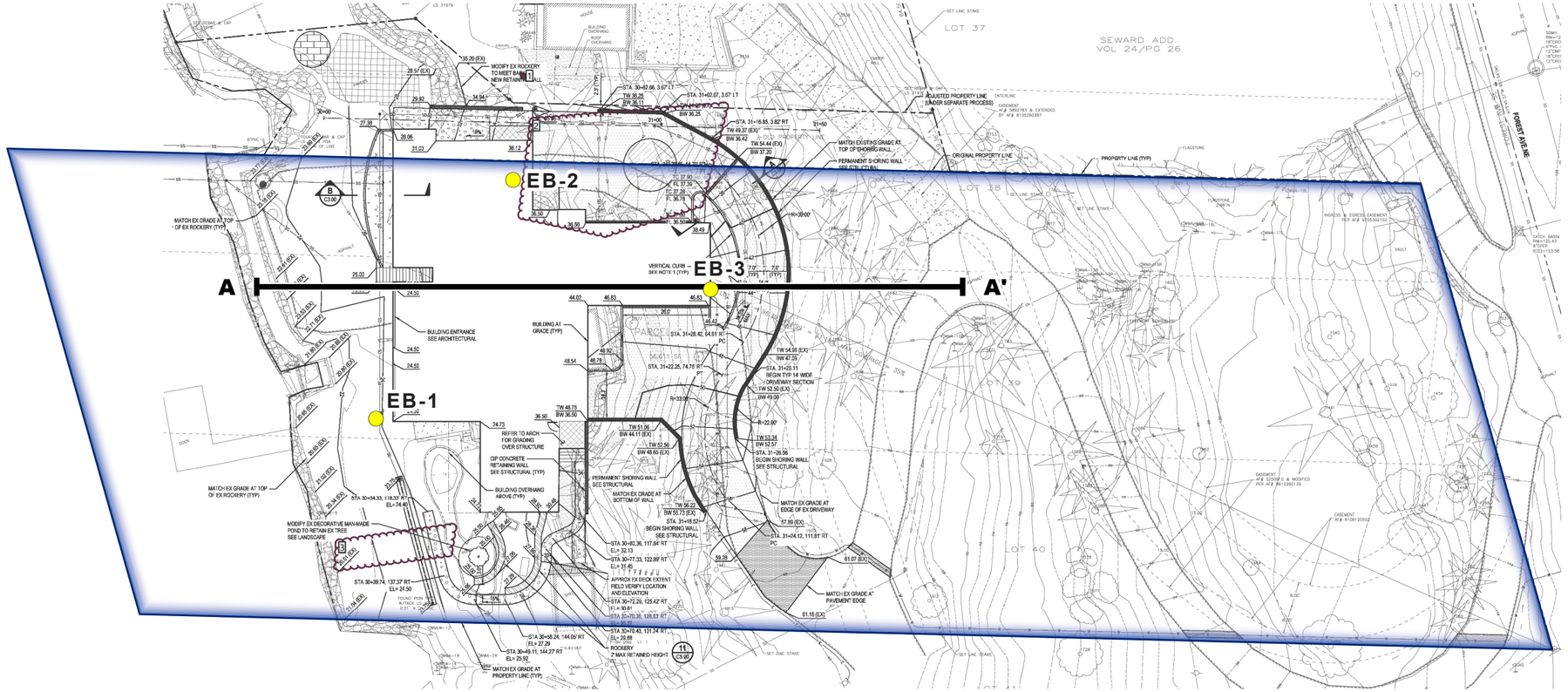


Proposed Conditions - Seismic (0.338 Horizontal Acceleration)	
20220141E001 Chase Residence - A.gsz	
02/16/2024	1:400



LEGEND

- SITE
- EXPLORATION BORING
- CROSS-SECTION

DATA SOURCES/REFERENCES:
FUSED ELEMENTS 4525 FOREST AVE SE MERCER ISLAND, GRADING PLAN, SHEET C3, 9/8/23.

BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION. LOCATION AND DISTANCES SHOWN ARE APPROXIMATE.

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SITE AND EXPLORATION PLAN

CHASE RESIDENCE
MERCER ISLAND, WASHINGTON

PROJECT NO.	DATE	FIGURE
20220141E001	2/24	2

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