

January 24, 2022

JN 22013

Weaver Construction
23631 – 140th Avenue S.E.
Kent, Washington 98042

Attention: Cameron Weaver
via email: cam@weaverconstruction.com

Subject: **Foundation Considerations and Critical Area Report**
Proposed Addition to Existing Wai Residence
7235 East Mercer Way
Mercer Island, Washington

Greetings:

This report presents our geotechnical engineering report related to the planned work associated with the existing Wai residence. The scope of our services consisted of assessing the site surface and subsurface conditions, and then developing this summary report.

Based on the provided architectural drawings, and our discussions with you, we expect that the family room and the garage located on the lower floor will be expanded approximately 4 feet-2 inches to the east. Above this addition will be an expansion of the upper floor deck and the bathroom for the northeastern bedroom. This expansion will occur in the western edge of the existing deck that currently extends eastward from the lower level of the house. This deck will not be expanded eastward. We anticipate that most or all of the construction will be accomplished using hand-carried tools and equipment. Excavation will be limited to that necessary for the new foundations. No significant retaining walls are expected. The lower level addition will be constructed using a framed floor. No development is planned to the west, upslope, of the house.

We visited the subject property on December 9, 2022 to observe the existing site conditions, and to assess the subsurface conditions exposed in two test holes excavated in the footprint of the addition. The existing residence has one story overlying an east-facing basement. The garage is located in the northern end of the basement level, and is accessed via a paved driveway sloping upward from East Mercer Way. We did note signs of settlement in the eastern foundation wall of the house, which has resulted in tilting of the foundation that supports the east side of the garage door. The house sits on the western, upslope, portion of the lot. The ground slopes moderately up to the house from East Mercer Way, with two residential driveways, including the one serving the Wai's residence, crossing this sloping ground. Outside of the paved driveways, the ground on this portion of the lot is covered primarily with ivy. There were no indications of slope instability. We did note seepage exiting the lower portion of the slope, alongside the lower of the two driveways. To the west of the house is a steep slope that rises to the adjacent western residence. This slope is approximately 60 feet in height, and is covered with trees and brush. The toe of the steep slope is approximately 40 feet to the west of the planned addition, on the opposite side of the house. We saw no indications of recent instability on this slope.

The City of Mercer Island GIS maps your entire lot as a Potential Landslide Hazard, Erosion Hazard, and Seismic Hazard. The area west of the house, opposite the planned development area, is mapped as a Steep Slope.

Published geologic maps indicate that the near-surface geology consists of glacial drift or glacial till. These are glacially-compressed soils typically comprised of gravel, silt, and fine-grained sand. Glacial drift and glacial till soils have high internal strength. In 1997 our firm completed a geotechnical engineering study for a lot located immediately west of the Wai's property, at the top of the steep slope. The test pits conducted for that study found several feet of loose soils overlying dense silt and sands consistent with glacial drift soils. During our December 9, 2022 site visit, we completed test holes in the north and south halves of the proposed eastern addition, approximately 5 feet from the east wall of the residence. These test holes encountered loose silt fill extending to a depth of more than 5 feet at these locations. We did not observe any groundwater seepage in the test holes. The seepage observed near the base of the eastern sloping ground appears to be perched on top of the glacially compressed soils.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

THIS SECTION CONTAINS A SUMMARY OF OUR STUDY AND FINDINGS FOR THE PURPOSES OF A GENERAL OVERVIEW ONLY. MORE SPECIFIC RECOMMENDATIONS AND CONCLUSIONS ARE CONTAINED IN THE REMAINDER OF THIS REPORT. ANY PARTY RELYING ON THIS REPORT SHOULD READ THE ENTIRE DOCUMENT.

The Wai property is underlain by competent, glacially-compressed soils. However, the near-surface fill soils in the area of the addition are not suitable to support the new addition without excessive post-construction settlement. Considering the limited access, and the desire to minimize site disturbance, we recommend that the loads from the new additions be supported on 2-inch-diameter pipe piles driven to refusal in the dense, native silty sand. The 2-inch piles can be installed using hand-held jackhammers. The floors of the addition should be supported on the piles also.

Unfortunately, it appears that the eastern perimeter footing of the existing house was constructed on loose soils, possibly fill, which has caused settlement. If the new additions are to be supported on the existing house foundation, that footing should be underpinned with 2-inch-diameter pipe piles that are connected to the footing. Alternatively, the additions should be entirely self-supporting on pipe piles, independent of the existing house foundations. This approach may result in some noticeable distress in finishes at the transition between the new and existing construction, as the existing footing would likely undergo slow, long-term settlement.

Seismic Hazard: The underlying glacially-compressed soils beneath the site are not susceptible to seismic liquefaction. The pipe piles for the new foundations will be driven through the fill and any loose upper soils and will be embedded into this dense, non-liquefiable native soil layer. This will mitigate the Seismic Hazard.

Potential Landslide Hazard: The glacially-compressed soils underlying the site are not susceptible to instability on the gentle to moderate slopes, even under the ground motions of the design earthquake (probability of once in 500 years). The planned development is on the opposite side of the house from the steep, western slope, which could undergo future

movement. The planned development will not adversely affect the stability of the steep slope.

No additional buffer or other mitigation measures should be required to address the Potential Landslide Hazard mapping of the site.

Steep Slope Hazard: Considerations for the steep western slope relative to the planned development are discussed above in the Potential Landslide Hazard section.

Erosion Hazard: The site disturbance for the proposed development will be limited. The mapped Erosion Hazard can be mitigated by implementing proper temporary erosion control measures that will depend heavily on the weather conditions that are encountered. We anticipate that a silt fence will be needed around the downslope sides of any work areas. Existing ground cover and landscaping should be left in place wherever possible to minimize the amount of exposed soil. Small soil stockpiles should be covered with plastic during wet weather. Soil and mud should not be tracked onto the adjoining streets, and silty water must be prevented from traveling off the site. It should be possible to complete the planned addition during the wet season without adverse impacts to the site and neighboring lots. On most construction projects, it is necessary to periodically maintain or modify temporary erosion control measures to address specific site and weather conditions.

We provide the following “statement of risk” to satisfy City of Mercer Island conditions:

“It is our professional opinion that the development practices proposed in this report for the new development would render the development as safe as if it were not located in a geologic hazard area.”

We recommend including this report, in its entirety, in the project contract documents. This report should also be provided to any future property owners so they will be aware of our findings and recommendations.

SEISMIC CONSIDERATIONS

In accordance with the International Building Code (IBC), the site class within 100 feet of the ground surface is best represented by Site Class Type D (Stiff Soil).

The IBC and ASCE 7 require that the potential for liquefaction (soil strength loss) during an earthquake be evaluated for the peak ground acceleration of the Maximum Considered Earthquake (MCE), which has a probability of occurring once in 2,475 years (2 percent probability of occurring in a 50-year period). The dense soils that will support the foundations are not susceptible to seismic liquefaction under the ground motions of the MCE.

PIPE PILES

A 2-inch-diameter pipe pile driven with a minimum 90-pound jackhammer or a 140-pound Rhino hammer to a final penetration rate of 1-inch or less for one minute of continuous driving may be assigned an allowable compressive load of 3 tons. Extra-strong steel pipe should be used.

The site soils are not highly organic, and are not located near salt water. As a result, they do not have an elevated corrosion potential. Considering this, it is our opinion that standard "black" pipe can be used, and corrosion protection, such as galvanizing, is not necessary for the pipe piles. Subsequent pipe sections should be connected together using threaded or slip couplers, or by welding. If slip couplers are used, they must fit snugly into the ends of the pipes. This can require that shims or beads of welding flux be applied to the couplers.

Pile caps and grade beams should be used to transmit loads to the piles. In general, a minimum of two piles should be used in isolated pile caps, in order to prevent eccentric loading on individual piles.

Lateral loads may be resisted by passive earth pressure acting on the vertical, embedded portions of the foundation. For this condition, the foundation must be either poured directly against relatively level, undisturbed soil or surrounded by level structural fill. We recommend using an ultimate (no safety factor included) passive earth pressure of 200 pounds per cubic foot (pcf) for this resistance. If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate. Due to their small diameter, the lateral capacity of vertical pipe piles is negligible.

LIMITATIONS

This report has been prepared for the exclusive use of Weaver Construction, and their representatives, for specific application to this project and site. Our conclusions and recommendations are professional opinions derived in accordance with our understanding of current local standards of practice, and within the scope of our services. No warranty is expressed or implied. The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. Our services also do not include assessing or minimizing the potential for biological hazards, such as mold, bacteria, mildew and fungi in either the existing or proposed site development.

ADDITIONAL SERVICES

In addition to reviewing the final plans, Geotech Consultants, Inc. should be retained to provide geotechnical consultation, testing, and observation services during construction. This is to confirm that subsurface conditions are consistent with those indicated by our exploration, to evaluate whether earthwork and foundation construction activities comply with the general intent of the recommendations presented in this report, and to provide suggestions for design changes in the event subsurface conditions differ from those anticipated prior to the start of construction. However, our work would not include the supervision or direction of the actual work of the contractor and its employees or agents. Also, job and site safety, and dimensional measurements, will be the responsibility of the contractor.

During the construction phase, we will provide geotechnical observation and testing services when requested by you or your representatives. Please be aware that we can only document site work we actually observe. It is still the responsibility of your contractor or on-site construction team to verify that our recommendations are being followed, whether we are present at the site or not.

We appreciate the opportunity to be of service on this project. Please contact us if you have any questions, or if we can be of further assistance.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.



1/24/2022

Marc R. McGinnis, P.E.
Principal

MRM:kg