PERRONE CONSULTING, INC., P.S.

Geotechnical & Underground Engineering

11220 Fieldstone Lane NE
Bainbridge Island, Washington 98110
Tel: 206-778-8074 Fax: 206-780-5669
www.perroneconsulting.com

March 4, 2016

Mr. Travis Saunders
City of Mercer Island Development Services
9611 SE 36th St.
Mercer Island, Washington 98040-3732

Subject: Geotechnical Third Party Review
Response to February 4, 2016 Geo Group NW Letter
5637 E. Mercer Way
Mercer Island, Washington
Perrone Consulting Project #15124

Dear Mr. Saunders:

We have reviewed the February 4, 2016 Geo Group NW (Geo Group NW, 2016) letter for the proposed residential project at 5637 East Mercer Way, Mercer Island, Washington. During this review process, we previously identified five items requiring further information and clarification. Two of those items have already been adequately addressed (Geo Group NW, 2015). Geo Group NW current letter addresses the three remaining item numbers 3, 4 and 5. The item numbers listed here correspond to the item numbers previously used in our correspondences.

Request 3

Provide the results of slope stability analyses of the critical slope section for static and seismic conditions, including the effect of liquefaction on soil strength properties.

Revised slope stability computations were provided for long term static and seismic conditions and for temporary excavation slopes. We understand that the temporary slopes will be dewatered prior to excavating to a 1H:1V configuration. The computed factor of safety for temporary slopes was 1.15 which is less than generally accepted minimum value of 1.3. Similarly, the long term static factor of safety is 1.22 which is less than the minimum acceptable value of 1.5. Accordingly, the engineer should provide recommendations to increase the stability of the temporary excavation to acceptable levels. In addition, recommendations should be provided to either increase the long term stability of the slope or provide a catchment wall with sufficient capacity to restrain potential slope failures with factors of safety less than 1.5 (see Request 4).

The results of the seismic stability analyses are uncertain since Geo Group NW indicates that the input horizontal seismic coefficient, k_h = 0.09g in Attachment 1 whereas the report text indicates they used k_h = 0.15 which is the same value used in the previously reported analyses (Geo Group NW, 2015). The computed factor of safety for k_h = 0.09g is 1.01.

As stated in our previous review, the horizontal seismic coefficient, k_h = 0.15g is not in accordance with the standard of practice and IBC 2012 which is incorporated as part of the City of Mercer Island's Building Code. Geo Group NW references published research (Melo & Sharma, 2004) as a basis for using k_h = 0.15g. However, the researchers concluded:

> *"….the mean of the ratio of the weighted average of k_h to PHA (peak horizontal acceleration) was 0.459 and the best linear fit for the ratio of the weighted average of k_h to PHA was 0.422. These results suggest that perhaps k_h values ranging from 40 to 45% of the PHA should be used in slope stability design…."*

Based on this research and a peak ground acceleration of 0.6g, the recommended design k_h = 0.24g to 0.27g. Revised seismic slope stability computations with the larger ground accelerations

should be provided and the output results should show the limits of the slide mass with factors of safety less than or equal to 1.0. Recommendation should be provided to increase the seismic stability of the slope or provide a catchment wall that can restrain potential seismic slope failures with factors of safety of 1.0 (see Request 4).

Request 4

Based on the results of the stability analyses, provide design parameters for the foundation/catchment wall including impact forces and an estimate of the wall height based on the volume of future landslide debris.

Recommendations have been provided for foundation/catchment wall lateral earth pressures. Geo Group NW has recommended an 8 ft high catchment wall based on the results of their static and seismic slope stability analyses. The seismic slope stability analyses should be revised based on higher k_h values consistent with IBC 2012 (see Request 3). These seismic and static slope stability results, and the distance of the house foundation wall from the slope failure should be used as a basis for determining the catchment wall height needed to contain the unstable volume of landslide material defined by the slope stability analyses.

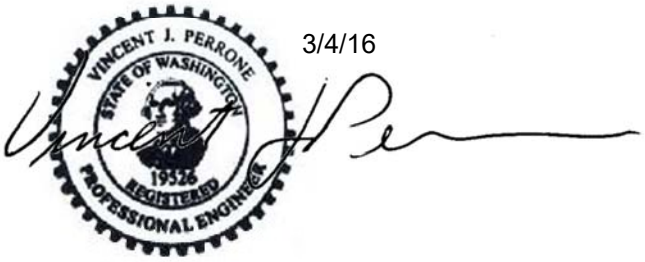
Request 5

Provide an estimate of downdrag loads on the pin pile foundations due to liquefaction and settlement of 15 to 20 ft of loose soil around the pin piles.

The recommended down drag loads included in the current letter adequately addresses our request 5.

We trust that this information suits your current needs. If you have questions or need additional information, please contact us.

Very Truly Yours,
PERRONE CONSULTING, INC., P.S.



3/4/16

Vincent J. Perrone, Ph.D., P.E.
Principal Engineer

References:

Geo Group NW, 2015. "Response to September 3, 2015, Geotechnical Third Party Review Letter, Proposed Residence, 5637 East Mercer Way, Mercer Island, Washington," October 28, 2015.

----------, 2016. "Response to November 18, 2015, Geotechnical Third Party Review Letter, Proposed Residence, 5637 East Mercer Way, Mercer Island, Washington," October 28, 2015.

Melo, C., Sharma, S., 2004. "Seismic Coefficients for Pseudo-static Slope Analysis," 13th World Conference on Earthquake Engineering, Vancouver, B.C., Canada, August 1-6, 2004, Paper No. 369.

Perrone Consulting, Inc. P.S., 2015. "Geotechnical Third Party Review Letter, Proposed Residence, 5637 East Mercer Way, Mercer Island, Washington," November 18, 2015.