

April 1, 2024

Mr. Luke Sasse  
Timberland, Inc.  
9321 NE 72<sup>nd</sup> Avenue, Building C #7  
Vancouver, Washington 98665

Dear Mr. Sasse

**Re: Response to Engineering Review, Proposed Riverfront Village Apartments Project,  
Lewis River Road, Woodland (Cowlitz County), Washington**

In accordance with your request, we are providing you with the following response to the recent engineering review letter by Nelson & McClure, PLLC dated March 25, 2024.

As you are aware, we previously performed a Geotechnical Investigation for the proposed Riverfront Village Apartments project the results of which were presented in our formal report dated October 31, 2022. During the course of our investigation, we performed two (2) drilled test borings (B-#1 and B-#2) and two (2) cone penetration tests (CPT-#1 and CPT-#2) as well as seven (7) test hole excavations (TH-#1 through TH-#7) across the site. We also performed engineering analysis and provided appropriate recommendations with regard to the design and construction of the proposed site improvements. However, at the time of our fieldwork and engineering analysis, a detailed site development and/or grading plan was not available.

In general, the results of our work found that the subject property was suitable for the proposed development. However, our report pointed out that surface water may temporarily perch at and/or near the ground surface during periods of heavy and/or prolonged rainfall. Additionally, our engineering analysis indicated that there was a potential for liquefaction at and/or beneath the site during a magnitude M8.5 earthquake.

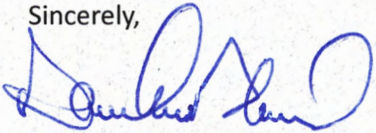
In regard to the potential for temporary perched surface water during periods of heavy and/or prolonged rainfall, the potential for temporary perched surface water was not an indication of near surface "groundwater" but rather perched surface water due to the restrictive infiltration rate and/or property of the near surface silty subgrade soils as compared to that of the more favorable infiltration rate (property) of the underlying sandy subgrade soils. In this regard, our monitoring of the seasonal high groundwater level and/or elevation beneath the subject property during the recent wet season (i.e., October 1, 2023 through March 31, 2024) found that the seasonal high groundwater level and/or elevation beneath the subject site was approximately Elevation 11' (feet). This is approximately thirteen (13) to fourteen (14) feet beneath the existing site and/or surface grades which Elevation 24' (feet) and Elevation 25' (feet).

With regard to the potential for liquefaction at and/or beneath the site, our earlier engineering analysis was based on the site and/or subsurface conditions as well as the surface grades present at the time of our fieldwork. Additionally, we point out that our earlier engineering analysis regarding the potential for liquefaction was performed using "trigger analyses" which is one (1) of several computer methods used to evaluate the potential for and/or estimating the factor of safety against liquefaction. However, the "trigger analyses" computer program was written by others. We are only the user and only have the ability to change those input parameters and/or variables which the programmer wants us to be able to change. The rest of the program and/or the resulting output file is then beyond our control and we are left to offer "our professional opinion" with regard to the results. As such, it was our professional opinion that a magnitude M8.5 earthquake would produce a factor of safety (FS) less than 1.0. We did not, however, report the actual (FS) value as that would suggest that we, as engineers, have a relatively high degree of certainty with regard to the computer generated results.

In this regard, we do not know if a magnitude M8.5 earthquake is the design standard for the project. Additionally, as the proposed site development is not considered and/or classified as a critical and/or essential structure and/or site, it is our understanding that a site specific seismic analyses is not required. However, we point out that since the completion of our previous Geotechnical Investigation, a detailed site grading plan has been prepared. Specifically, development of the subject property will require the placement of some ten (10) to fifteen (15) feet of structural fill soil across the site bringing the finish site grade(s) to approximately Elevation 39' (feet). As such, the apparent depth of groundwater will likely be approximately twenty-eight (28) feet below the finish site grade. Additionally, the weight of the 10- to 15-feet of structural fill (i.e., 1,000 to 1,500 pounds per square foot) will in effect act as a surcharge resulting in the compression and/or consolidation of the underlying native subgrade soils. Further, the additional 10- to 15-feet of structural fill and corresponding unit weight will significantly increase the effective stress in the underlying native sandy subgrade soils located at and/or below the groundwater level beneath the site. As such, it is unclear as to what the reviewers Geotechnical background is. However, under the current site grading plan, it is our professional opinion that a magnitude M8.5 earthquake will produce a factor of safety (FS) in the underlying saturated sandy soils greater than 1.0 and seismic induced settlements less than 1.0 inches.

We appreciate this opportunity to be of service to you at this time and trust that the above information is suitable to your present needs. Should you have any questions regarding the above or if you require any additional information, please do not hesitate to call.

Sincerely,



Daniel M. Redmond, P.E., G.E.  
President/Principal Engineer

