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April 14, 2023

Catherine and Edward Moran
Via Email: catherine.b.moran@gmail.com
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cc: William Gottlieb
Plan One Fine Home Design
Via Email: wmgottlieb@planone.biz

Response to City Review Comments and Geotechnical Plan Review Letter
Moran Residence Development
5028 West Mercer Way
Mercer Island, Washington
NGA File No. 1211520

Dear Catherine and Edward:

This letter documents our geotechnical plan review and response to geotechnical city review comments regarding your planned residence at **5028 West Mercer Way in Mercer Island, Washington.**

INTRODUCTION

We prepared a revised geotechnical report titled ***"Geotechnical Engineering Evaluation (REV2) – Moran Residence Development – 5000 West Mercer Way – Mercer Island," dated September 27, 2021.*** We also prepared a plan review memorandum dated August 6, 2021, and a critical areas study dated December 17, 2021.

For our use in preparing this letter, we were provided with the following documents:

- ***Sheets 1 through 16 prepared by Plan One Fine Home Design dated December 8, 2022***
- ***Sheets S-1 through S-8 and SH-1 through SH-3 prepared by Kia Co dated March 31, 2023***
- ***Sheets SH-1 through SH-3 prepared by Kia Co dated December 8, 2022***
- ***Sheets C-01 through C-06 prepared by JMJ Team dated December 16, 2022***

MERCER ISLAND REVIEW COMMENTS

We have been provided with geotechnical review comments from the City of Mercer Island for the proposed residence development. In the following sections we summarize the review comments followed by our responses.

COMMENT 1: Structural Plans – Sheet S-2

Is the slope-facing eastern residence foundation wall supposed to be designed to resist potential debris loading and if so, has it been designed with a design pressure of 90 pcf, per the geotechnical engineer recommendations? The geotechnical engineer should also confirm the extents of the debris protection portions of the residence foundation wall.

RESPONSE 1:

We discussed this issue with the project architect and structural engineer. We recommended that the eastern foundation wall be designed with a surcharge of 90 pcf to account for potential debris impact and should apply to all east-facing exterior foundation walls located within 12 feet from the proposed shoring wall. The debris protection foundation wall should extend a minimum of 4-feet above the finished ground surface.

We received an updated copy of Sheet S-2 (foundation plan) and supporting calculations dated March 31, 2023. Based on a review of the provided plans and calculations, it appears the easterly wall has been designed with the recommended values and extents.

COMMENT 2:

"The geotechnical report dated September 27, 2021 recommended 1-1/2 feet of debris protection. This seems marginal with respect to providing protection to the residential structure. Provide supporting assumptions and calculations for the proposed catchment capacity for the wall."

RESPONSE 2:

Per the current structural plans, Sheet SH-2, the shoring wall along piles P9 through P15 contain a minimum 18-inch extension above the finished slope surface, designed to withstand a pressure of 90 pcf to account for potential slide debris impact. Based on the current pile layout and elevations (SH-1, -2), the vertical distance between existing slope surface and top of pile ranges from approximately 2- to 3.5-feet. Additional pile extending above the slope surface should be adjusted in the field to maintain the 18-inch stickup design recommendation.

Above the proposed shoring wall, existing slope gradients range from approximately 18 to 33 degrees (32.5 to 64.9 percent) for an overall vertical relief of 30- to 35-feet. As previously documented, the upper eastern site slopes are well vegetated and signs of excessive erosion, groundwater seeps or springs, or indications of slope failure/instability were not observed. Based on the slope geometry and competent glacially consolidated soils interpreted to form the core of the site slopes, the potential for deep-seated slope failures is low. Surficial topsoil and/or undocumented fill soils mantling the steep slopes have a potential to be mobilized in a shallow slide event, particularly during prolonged precipitation events or seismic activity.

We analyzed a potential shallow slide failure impacting the debris catchment systems by modeling a potential wedge-shaped failure with maximum depth of 2.0-feet and 10-foot slide length, extending from the upper portions of the eastern steep slopes towards the residence. Our analysis is only evaluating a 1-foot-wide section of the slide to formulate design parameters for the debris catchment wall. With the above slide dimensions, a total volume of 10 cubic feet (0.37 cubic yards) per linear foot (laterally) of material will be generated at the landslide initiation point. To account for irregularities in the slope surface, existing vegetation, and other factors contributing to arresting mobilized forces, we approximated a 25 percent reduction in volume of slide debris actually reaching the shoring catchment wall, resulting in approximately 7.5 cubic feet of material per linear foot of affected slope surface to accumulate within the catchment portion of the shoring wall. A design storage volume of 3.5 cubic feet is considered in the debris runout analysis for the 18-inch extension of the shoring wall above the slope surface. Considering an average unit weight of 120 pounds per cubic foot (pcf) for the mobilized debris mass and an average slide velocity of 10 miles per hour (14.67 feet per second), the impact momentum experienced at the back of the catchment wall results in 6,161.4 foot-pounds per second. We estimate the debris accumulation along the back of the wall will take approximately 60 seconds, which equates to a resultant force of 102 pounds. Utilizing the resulting force at the 1.5-foot-tall catchment wall extension as a result of the debris impact, a triangular earth pressure distribution equivalent to that exerted by a fluid with a density of approximately 90 PCF will be experienced by the catchment wall.

With the above assumptions and in this runout scenario, the shoring wall catchment could be overtopped with approximately 6 cubic feet of material. We estimate the overtopped material will take an additional 15 seconds to develop full impact force on the foundation retaining wall, which has also been designed with additional reinforcement to provide debris impact protection. The overall weight of debris impacting the residence wall is estimated to be approximately 720 pounds, resulting in a momentum of approximately 10,562.4-foot pounds per second. Accounting for the 15 seconds of impact time, we estimate a resulting force of 704 pounds experienced by the foundation wall. This equates to approximately 88 pounds per cubic foot of equivalent fluid density based on a 4-foot high stem wall.

Two proposed debris protection measures include the 1.5-foot debris catchment extension to the shoring wall and the structural house foundation wall along portions of the east side of the residence, extending a minimum of 4-feet above the finished ground surface. Through the above shallow slide scenario, we anticipate the two-tier protection of the residence is sufficient to mitigate hazards and potential life-safety issues.

COMMMENT 3:

"Indicate what earthquake ground motion was used to determine the seismic loading for the permanent shoring wall. Provide calculations supporting the 8H seismic loading recommendation."

RESPONSE 3:

The Mononobe-Okabe analysis was utilized to determine the dynamic earth pressures and seismic design values for the site, as described in the AASHTO LRFD Bridge Design Specifications Manual. The analysis requires input values of wall geometry, a horizontal seismic coefficient, soil unit weight, and internal friction angle of the soil. The yield is a dynamic active earth pressure coefficient to be utilized in determining resultant activated forces on a retaining structure. For the calculations, we utilized a soil unit weight of 125 pcf and an internal friction angle of 36 degrees. A horizontal seismic coefficient of 0.2g was utilized in the calculation. The above parameters assume drained quality structural fill or competent native soils, in the case of the soldier pile wall. Comparing the active earth pressures under static and seismic conditions for a 10-foot high wall, we calculated a seismic loading of 2291 lbs., compared to a static load of 1475 lbs. Converting the difference between the two values to a uniform surcharge we calculated approximately 80 psf. As such, we anticipate the provided active pressure of 40 pcf, plus an additional uniform load of 8H, maintain retaining wall stability during normal and seismic conditions.

PLAN REVIEW

We have reviewed the geotechnical aspects of the provided plans and found the plans to be in general compliance with our recommendations as presented in our previous geotechnical report and supplemental recommendations provided to the design team. The soil parameters used in the foundation and retaining wall designs are consistent with the recommendations provided in our previous report and supplemental documentation. All other recommendations provided in our previous report should be strictly followed.

Adjustments to the previous versions of the plans include clarification to the 18-inch extension to the shoring wall, to be utilized as a debris catchment measure and addition of a structural foundation wall along the eastern side of the residence to serve as secondary protection to the house in the event of slide activity.

MINIMUM RISK STATEMENT

In accordance with MICC 19.07.160 (B) (2), it is our opinion that the alteration of the landslide hazard buffers will not adversely impact other critical areas, will not adversely impact the subject property or adjacent properties, will mitigate impacts to the geologically hazardous area consistent with the best available science to the maximum extent reasonably possible such that the site is determined to be safe; and will include the landscaping of all disturbed areas outside of building footprints and installation of hardscape prior to final inspection.

It is further our professional opinion that 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. (MIMC 19.07.160(B)(3)(c))

CLOSURE

We recommend that NGA be retained to provide construction monitoring and consultation during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities comply with project plans and specifications.

Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering practices in effect in this area at the time this letter was prepared. No other warranty, expressed or implied, is made. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the owner.

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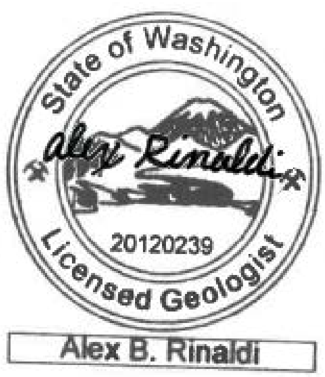
We appreciate the opportunity to provide service to you on this project. If you have any questions or require further information, please call.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.



Alex Rinaldi, LG, EIT
Project Geologist

4.14.2023

Khaled M. Shawish, PE
Principal

ABR:KMS:dy