



April 20, 2018

Nelson Rutherford
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**Subject: Supplemental Geotechnical Review
Potential Impacts from Proposed Development of New Single Family
Residence at 1923 Mapleleaf Court
Lake Oswego, Clackamas County, Oregon
EEI Report No. 18-061-2**

Dear Mr. Rutherford:

Per your request, **Earth Engineers, Inc. (EEI)** is issuing this report so that you may submit it to be considered by the City of Lake Oswego Development Review Commission (DRC) and City of Lake Oswego engineering staff for LU 17-0065 (a request for a minor partition creating 2 parcels). EEI previously issued report no. 18-061-1 dated March 30, 2018. You submitted that report to DRC and City staff for their consideration at a public hearing held on April 2 (note that EEI Principal Geotechnical Engineer Troy Hull attended the hearing). In part, our previous report identified concerns related to the lack of a complete geotechnical analysis to evaluate the impact of the applicant's stormwater disposal system would have on the safety and security of the adjacent, neighboring lots.

Based on the concerns raised in our report, as well as other public testimony from the neighbors, DRC requested that the applicant, Ottbone Investments, ask their geotechnical consultant, Rapid Soil Solutions (RSS), to more thoroughly evaluate the impact of the proposed stormwater disposal system on the neighboring lots, especially as it pertains to slope stability and water intrusion in basements.

The following are our comments related to the follow-up work requested by DRC to be completed by RSS.

1. There was some discussion by City staff, the applicant, and their Civil Engineering consultant (Theta) as to whether an overflow drywell was even necessary because the primary stormwater disposal system (i.e. a rain garden with a drywell system) has been designed by Theta to handle all the the stormwater. We would like to point out that the Lake Oswego Stormwater Management Manual (SWMM) requires that rain gardens

systems (the primary rain garden area and the overflow drywell) are installed. Unfortunately, RSS only addressed the stability of the slopes on the applicant's property. While not having performed our own engineering analysis, based on the topography of the lot, we expect that we would concur with RSS's opinion that the applicant's property slopes will be stable.

However, RSS did not evaluate the stability of the slopes on the neighboring properties (17080 and 17090 Fernwood Drive), which will be directly impacted by the drywell systems at the rain garden and overflow drywell. It is our understanding from attending the April 2 public hearing that DRC and City staff gave the applicant direction to perform a geotechnical engineering analysis to evaluate slope stability at 17080 and 17090 Fernwood Drive, given the fact that stormwater will be infiltrated into the slopes via drywells. **This request from the City to evaluate the neighboring property slopes is consistent with City of Lake Oswego Municipal Code Section 50.06.006.2.d.vi(3), which states that "design and construction of the project will not cause erosion or land slippage."**

Section 50.06.006.2.d.iii(1) and (2) of the code also support DRC's recommendation that the applicant retain RSS to further investigate the impact on the neighboring property slopes. This code section requires a registered civil engineer experienced in soils engineering (i.e. a geotechnical engineer) to certify the contemplated project will be safe where it is known to be in an existing landslide hazard area. The applicant acknowledges the project is located in a known landslide hazard area in their application paperwork and RSS acknowledges in their August 31, 2017 report that the neighboring slopes are mapped as a slide area.

3. There was some discussion in the April 2 hearing as to whether this project warranted a detailed geotechnical evaluation of impact on the neighboring steep slopes by the applicant's stormwater disposal system. The concern seemed to center around whether the applicant should have to evaluate someone else's property. Our point would be that the steep slopes don't stop at property lines. Steep slopes commonly include more than one property. And if one of those properties plans to construct something like a drywell that could impact the remainder of the slope that is not on their property, then the applicant and their geotechnical engineer have a duty to evaluate it. While we agree that the overflow drywell is located on relatively flat ground, that is just a small level bench on a slope. The impact on the overall slope still needs to be evaluated by RSS.
4. The standard of practice for evaluating slope stability when it comes to protecting personal property and life-safety is to perform a quantitative slope stability analysis and determine the Factor of Safety (FOS) for both static and seismic conditions. The typical minimum FOS for safe static slope conditions is 1.5¹ and the typical minimum FOS for safe seismic conditions (i.e. during an earthquake) is 1.1. A quantitative evaluation means that the engineer collects actual, verified data for the subsurface soil and

¹ Duncan, J.M. 1992. "State-of-the-Art: Static Stability and Deformation Analysis," *Proceedings of Stability and Performance of Slopes and Embankments II, A 25 Year Perspective*, ASCE Geotechnical Special Publication No. 31, R.B. Seed and R.W. Boulanger, editors, ASCE, New York.

groundwater conditions and enters that data into commercially available and industry accepted computer software (i.e. SLIDE, SLOPE/W, GEOSLOPE, etc.) so they can accurately evaluate the stability and calculate the Factors of Safety.

We have some concern that the applicant's geotechnical consultant may try to convince the City staff that slope stability for this project can be evaluated qualitatively—like they did for evaluating the applicant's slopes. A qualitative evaluation means that the engineer looks at the slope with their eyes and somehow determines that the slope is stable based on what they assume (and haven't verified) is going on below the ground surface. It is not clear to us how a visual reconnaissance would allow RSS to determine what the static and seismic FOS values are for the slopes on the 2 adjoining properties.

Because of the guesswork, qualitative evaluation entails great risk. Based on my past experience, both the City and the applicant's team would have greater than normal future risk exposure to the affected neighboring properties should they assure those neighbors that the slopes will be stable in the future based on guesswork rather than field verified data—especially when that data is readily available to be obtained. Given that the slopes on the neighboring property could affect life-safety if a landslide occurs, it seems that asking the applicant to perform a quantitative slope stability analysis—which is currently the standard of practice—makes sense in mitigating future unnecessary risk. To properly model the slope and subsurface conditions in a quantitative, we expect that RSS would need to investigate the 2 neighboring properties and we understand those 2 neighbors have been and are willing to grant access to their properties so that RSS can collect the necessary data. As of the date of this report, we understand that no neighbors have been contacted by the applicant concerning conducting evaluations.

The standard of practice for collecting subsurface data would be to drill borings and collect Standard Penetration Test samples as well as Shelby tube samples. Groundwater levels in the slope stability model should reflect the fact that the drywells could saturate the slope and raise groundwater levels. The soil samples would be brought back to their lab where the soil parameters used in the slope stability calculations (i.e. unit weight, cohesion, and shear strength) are verified by lab testing.

This request for the applicant's geotechnical consultant to perform a quantitative slope stability study is both consistent with the current standard of practice and City of Lake Oswego Municipal Code Section 50.06.006.2.d.vi(3), which states that "design and construction of the project will not cause erosion or land slippage."

5. We still have concerns about the infiltration rates used in the stormwater disposal system design. We believe the test data presented in the consultant reports was both confusing and not in accordance with City requirements. During the April 2 meeting, the DRC commissioners mentioned multiple times that the data was confusing and because of that, made it difficult to interpret whether it met City requirements or not. As geotechnical consultants who deal with infiltration reports like these all the time, we would concur with the commissioners that the data presented to them was not clear. **There is a simple solution to that—the applicant's consultant should be requested**

to submit the data in a clear and concise report so that it can be properly understood and interpreted. Unlike what has been presented to date, the test report should clearly show:

- a. the test locations in relation to the proposed stormwater system development on a scaled site plan
- b. the test depths below grade
- c. the test depth in relation to the bottom of the proposed drywell systems
- d. detailed description of the test procedure and a reference to the City code (SWMM Appendix B) the test is following
- e. any deviations in the testing from the City code requirements
- f. all of the test data for each test trial

City staff appeared to indicate during the April 2 meeting that the applicant's stormwater infiltration testing would not need to meet City requirements (i.e. the City would not require the tests be performed by PIT test method as outlined in Appendix B of SWMM). Instead, the City would accept the test results performed in hand auger borings, which is not in accordance with the City requirements for PIT testing. It would set a dangerous precedent to indicate that this project will be evaluated strictly by City code requirements outlined in the Notice of Public Hearing and then have the City staff ignore those requirements. **Having performed hundreds of infiltration tests over the years, the PIT test is far superior to the hand auger boring test, and we request that the City require this project be designed from PIT test results as is required in City code. It is not clear why the City staff would agree with the applicant to do something less than required by their code in this case, especially when it will have a direct impact on the evaluation of slope stability.**

We also still contend that the performance of the tests to date is not in accordance with the test procedure outlined in Appendix B of the SWMM. The procedure requires that test trials be performed until achieving a constant flow rate. There was some discussion in the April 2 hearing that the testing was stopped after a constant flow rate was achieved. Based on our experience, this is just not accurate. For example, one of the tests performed by the RSS on 5/4/17 had 3 test trials. The test rates were 5 inches/hour for the 1st trial, 4 inches/hour for the 2nd trial, and 3.5 inches/hour for the 3rd trial. Per the test procedure, they should have continued with trials until the infiltration rate stabilized. While the City's code doesn't state what "stabilized" means, the EPA's test procedure for which most jurisdictions model their programs after, states that when the readings are within 1/16 inch of each other they shall be considered stabilized. In other words, if they had conducted 1 or 2 more test trials with a result of about 3.5 inches/hour, then they would have demonstrated that they tested until the rate stabilized. In this case, it is abundantly clear that the testing was stopped well before it should have been. **We recommend that the applicant's geotechnical consultant be required to perform the infiltration testing for both the rain garden and overflow drywell in accordance with City requirements.** It is possible that the actual final test rates are at the rain garden and overflow drywell are much less than what has been reported to date,

and the project Civil Engineer may need to redesign their system for a much slower infiltration rate.

6. We still have concerns that the applicant's geotechnical consultant has not established the depth to the seasonal groundwater level. The City of Lake Oswego SWMM requires that the "bottom of drywells must be at least 5 feet above seasonal groundwater or impermeable layer." It is not clear that RSS met this requirement by extending their soil borings at least 5 feet below the bottom of the planned infiltration system. **We recommend RSS perform additional soil explorations to confirm this, so that they comply with City requirements.**

7. We still have concerns related to the top elevation of the overflow drywell. The City of Lake Oswego SWMM requires that "the top of drywell must be lower than the floor elevation of basements in immediately adjacent buildings." This requirement by the City is warranted in order to ensure drywells do not flood the basement of adjacent homes. In this case, the proposed drywell will be just upslope from the basement on the 17080 property. The current drywell plan does not appear to comply with City requirements. We recommend the applicant propose a solution that complies with this City requirement. Our understanding is that this requirement was put in place to prevent neighboring buildings from being flooded out due to drywells and it would be a shame if the basement on the 17080 property flooded because this requirement was not followed. **At a minimum, we recommend that the City require the applicant's geotechnical consultant to address this concern so that the City requirements are met.**

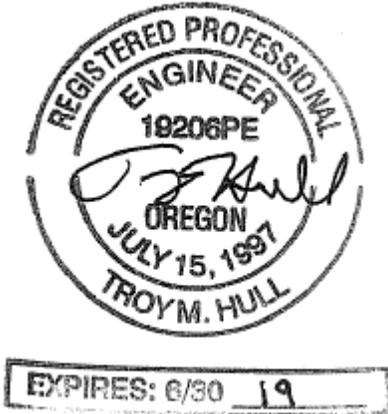
As a final comment, there was some discussion by City staff and the commissioners in the April 2 meeting about the fact that opposing geotechnical experts can present professional opinions that are in total disagreement with each other and that it is difficult for staff and the commissioners to know which one to believe. If you re-read this report, we believe you will find that we are not presenting opposing professional opinions to those of the applicant's geotechnical professional. All we are saying is that the methods the applicant's geotechnical consultant used to develop their professional opinions are either not in accordance with the current standard of practice or are not in accordance with City code requirements. We request that the City require the applicant's geotechnical consultant to perform their work in accordance with the current standard of practice and City code requirements. If they come up with results that are not in agreement with the neighbor's concerns about slope instability and flooding basements, that would be acceptable because they will have at least followed the appropriate path to get there.

We believe we have presented a good outline to DRC for what items the applicant's geotechnical consultant needs to follow through on and address in order to comply with City code requirements and the standard of geotechnical engineering practice.

If you have any questions pertaining to this report, or if we may be of further service, please contact Troy Hull at 360-567-1806 (office) or 360-903-2784 (cell).

Sincerely,
Earth Engineers, Inc.

Reviewed by:



A handwritten signature in cursive script that reads "Travis Willis".

Troy Hull, P.E., G.E.
Principal Geotechnical Engineer

Travis Willis, P.E.
Principal Geotechnical Engineer

Report Distribution (electronic copy only):

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