

EARTHWORKS



ENGINEERING CONSULTANTS

May 23, 2016
Project No. EWKS15-0180

Cascade Springs LLC
Mr. David Sweet
2005 70th Avenue West
Tacoma, Washington 98466-5540

Subject: Landslide Hazard Geotechnical Letter
Lots 5, 9, 10, 11, 16, and Large Lot 5, Cascade Springs Development, Pierce County, WA

Reference: Geotechnical Engineering Study, Cascade Springs Development, Pierce County, WA
Report Dated: April 5, 2001 [Revised May 6, 2005] by Creative Engineering Options, Inc.]

Dear Mr. Sweet:

As requested, this letter provides the results of our review of the referenced report and our site reconnaissance conducted on December 17, 2015. Our report review and site reconnaissance were conducted to determine conformance of existing site conditions to those anticipated in the referenced report and allow determination of applicability of recommendations presented in the referenced report to currently proposed development on Lots 5, 9, 10, 11, 16 and Large Lot 5. This letter has been prepared for the exclusive use of Cascade Springs, LLC and their agents for specific application to the proposed development on the subject lots, and in accordance with current local standards of practice in the field of geotechnical engineering. No other warranty, express or implied, is made. Our work to date has been completed in general accordance with our Contract Agreement Dated January 12, 2016.

This letter provides a brief summarization of our assessment of soil conditions on the subject lots, our opinion regarding the stability of the slopes on the subject lots, and provides our concurrence with the original geotechnical design and construction recommendations presented in the above referenced report.

For ease of review, the format of this letter follows the prescriptive formula item by item as outlined in Pierce County Title 18E.

- 1. The letter shall be labeled identifying the submittal as a "Landslide Hazard Geotechnical Letter."** See "Subject", above.
- 2. The dates when the geological assessment was performed. The date when the letter was prepared.**

Geological assessment performed on December 14, 2015. Letter prepared May 23, 2016

3. The parcel number(s) of the site.

Lot Number	Pierce County Parcel Number	Lot Number	Pierce County Parcel Number
5	7000680050	11	7000680110
9	7000680090	16	7000680160
10	7000680100	Lg Lot 5	0519231044

4. The address of the site.

Lot Number	Pierce County Address	Lot Number	Pierce County Address
5	XXX 146TH ST E	11	XXX 146TH ST E
9	XXX 228TH AV E	16	22607 146TH ST E
10	XXX 228TH AV E	Lg Lot 5	22706 146TH ST E

5. A brief description of the project and a description of the area to be developed.

Project Description

The residences are anticipated to be single family residential on conventional foundation systems extending into suitable native strata or structural fill supported on suitable strata. Some of the structures may incorporate daylight basements into construction. Grading may be necessary for driveway access and establishment of building pad grade. The anticipated structure locations are depicted on Figure 1.

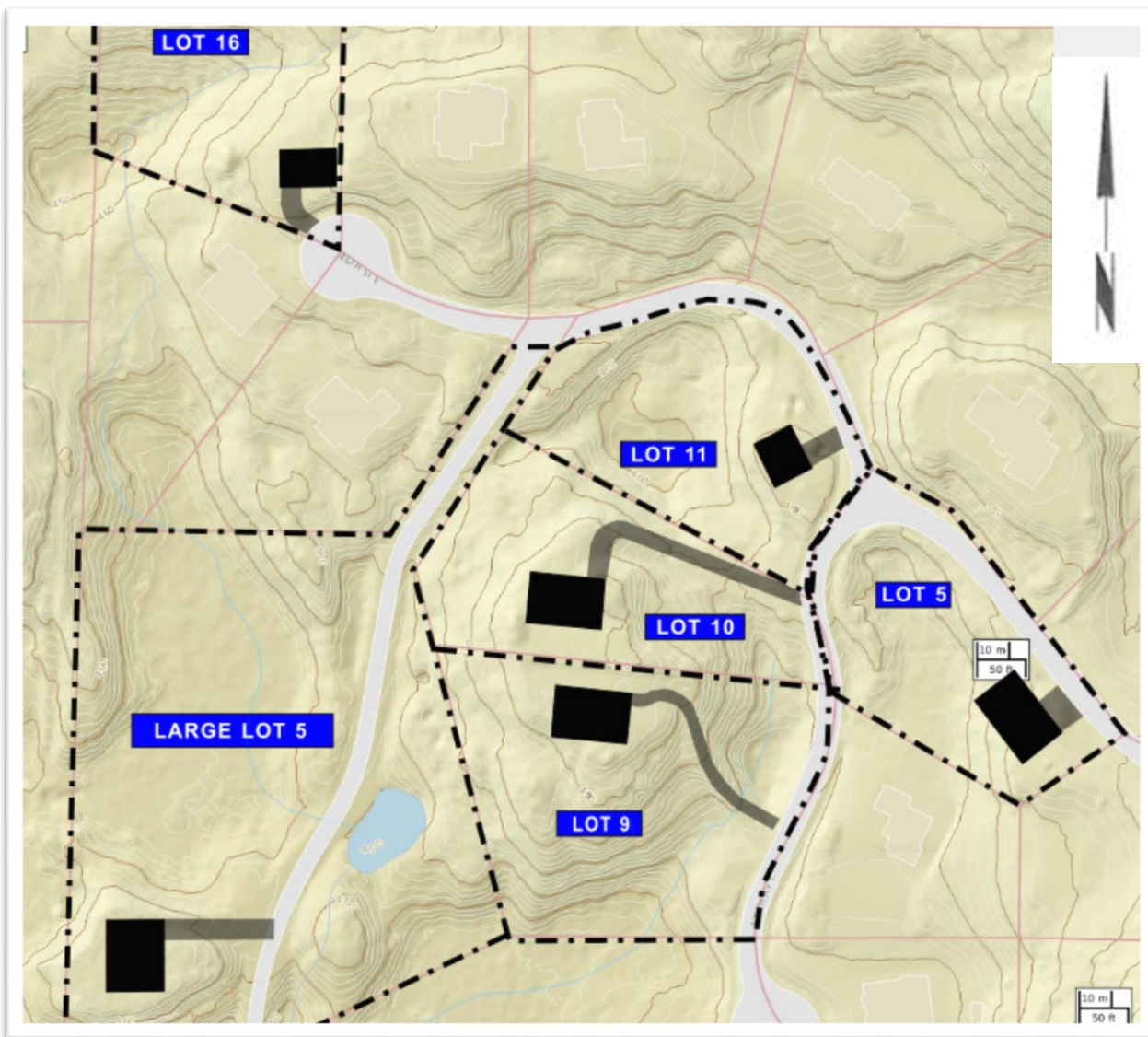


Figure 1

Area to be Developed (Site Description)

General site location and lot layout relative to the Cascade Springs development including approximate locations of the exploratory test pits documented during original site exploration is presented on Plates 1 and 2, respectively in the referenced CEO, Inc. report.

Lot 5 is located at the southeast corner of the "T" intersection of 146th Street East and 228th Avenue East within the Cascade Springs Development. Based on available site topography the eastern and western perimeters of the site descend toward the central portion of the site forming a ravine, the base of which slopes gently toward the southeast and south. Slope height ranges from less than 10 feet adjacent to 228th to a maximum of 35 feet adjacent to 146th Street East.

Lots 9 and 10 are located on the west side of 228th Avenue East, south of Lot 11 and east of Large Lot 5. Available site topography indicates a relatively level "mesa" within the central portion of these two lots, sloping down in all directions from the perimeter of the "mesa". Percent slope ranges to a maximum of 38 percent on lot 9 and 33 percent on lot 10. Slope height ranges to approximately 50 feet toward the south and 40 feet toward the east and west on lot 9 and to approximately 30 feet toward the west and 20 feet toward the east on lot 10. Runoff from adjacent areas flows south along the toe of the slope within the eastern portion of the lots. The southern portion of lot 9 is dedicated as a wetland buffer Tract A.

Lot 11 is bounded to the north by 146th Street, 228th Avenue East on the east and a private access drive onto Large Lot 5 on the west. Topographic information indicates a relatively level "mesa" within the southwesterly portion of the lot with slopes to approximately 20 feet in height descending toward the west and south. A 10 foot high "mound" is located within the eastern portion of the lot adjacent to the intersection of 228th Avenue East and 146th Street East. The western portion of Lot 11 is reserved as a Storm Drainage Easement.

Lot 16 is located off the northwest radius of the 146th Street East cul-de-sac within the northwest corner of the Cascade Springs development. The southeastern portion of the lot comprises the western end of a "mesa" which extends east onto lot 15. The north and west portions of Lot 16 is comprised of a southwesterly flowing ravine through which runoff from adjacent areas flows. The side slopes of the ravine descend a vertical distance up to approximately 50 feet at a slope of approximately 45 percent.

Large Lot 5 is located within the western portion of the Cascade Springs development, with an access road between Lot 18 to the west and Lots 10 and 11 to the east and extending approximately 300 feet southwest from the south side of 146th Street East. From the end of the access road, a driveway extends south-southwest through the lot to the southerly adjacent parcel. The majority of the northern portion of the lot is relatively level with a depression identified as Wetland "B" Buffer occupying the central and northern portion of the lot west of the driveway. The northern portion of the lot east of the driveway is relatively level with a small pond into the west side of which overflow from Wetland "B" flows, exiting from the southern perimeter of the pond, and following the driveway alignment offsite to the south. South and southeast descending slopes along the southeast perimeter of the site range in height to approximately 50 feet at slopes up to 76 percent with the drainage from Lots 9 and 10 described above flowing offsite along the toe of the southeasterly descending Large Lot 5 slopes.

No sign of erosion or instability was noted on any of the subject lots during our site reconnaissance. No sign of cracking, settlement or distress was noted within roadways adjacent to the subject lots.

Subsurface Site Conditions

Subsurface conditions anticipated are based on our review of the referenced report, review of select geologic literature and the results of our observations during site reconnaissance. It should be noted that Test Pit 5, 9, 10, 11, 16 and 19 were excavated in preparation of the referenced report by CEO, Inc. within the general vicinity of the proposed structures on lots discussed herein and therefore considered to be representative of conditions to be encountered during proposed development. Based on information presented the lots are underlain by a surficial layer of topsoil under which a generally medium dense silty fine to coarse sand in a moist condition with localized gravel and cobble (small boulders in TP-16) is anticipated. Review of the regional geologic map indicates that the site and surrounding areas are underlain by recessional outwash soils consisting of stratified sand and gravel deposited during the retreat of the Vashon glaciation. This strata is generally considered suitable for support of light to medium structural loading such as the typical residential structure without detrimental settlement. Based on the relatively granular nature of these soils they are considered to be relatively free draining and moderately permeable.

No groundwater or seepage was reported in the log of Test Pits excavated on the subject lots. No seepage or evidence of seepage was noted during our site reconnaissance. Groundwater seepage should be expected to change with changes in seasons and future development within nearby areas.

6. A paragraph that states the following specific language:

"The services described in this letter were prepared under the responsible charge of Maire Thornton, P.E. Ms. Thornton meets the qualifications contained in Title 18E, Section 18E.80.030 to prepare a landslide hazard geological assessment. Ms. Thornton understands the requirements of the current Landslide Hazard Area Chapter 18E.80 and the definitions of the applicable terms contained within Chapter 18.25. Ms. Thornton or someone under his/her responsible charge has performed a landslide hazard geological assessment, conducted a field investigation, and researched historic records on or in the vicinity of the above referenced site. In my opinion, the scope of services completed for this project is adequate to meet the requirements of the Department and it does not appear that an active landslide hazard area exists within 300 feet of the site."

7. The name, mailing address, and telephone number of geotechnical professional who performed the geological assessment and prepared the letter.

Maire Thornton, P.E.
Earthworks
30841 50th Avenue SW
Federal Way, WA 98023
206-910-1938

8. The name, mailing address, and telephone number of the property owner.

Mr. David Sweet
2005 70th Ave W
Federal Way, WA 98023
253-565-7355

Discussion and Recommendations

Based on the results of our review of the information and recommendations presented in the referenced report and on the results of our observations during our site reconnaissance, it is Earthworks opinion that the subject lots can be developed as anticipated. The lots are considered to be stable under usual conditions. The proposed residential structures may be supported by conventional spread footings bearing on undisturbed, medium dense to dense native soil (encountered at a depth within 1 foot of the ground surface on lots 5, 9, 10 and large lot 5, approximately 5 feet on lot 10 and approximately 3.5 feet on lot 16), re-densified in-place soils, or on at least two feet of compacted structural fill (described in the attached report). Where properly prepared, the subsurface soils are considered to be suitable for firm and unyielding support for the proposed residential structures.

Where a daylight basement level is included in design, the walls should be designed as reinforced concrete retaining walls capable of supporting the applied lateral loads, and will need suitable drainage to reduce the potential for buildup of hydrostatic pressure. Where the basement walls are to support sloping rather than horizontal ground as anticipated in the referenced report, additional analysis and recommendations will be required to prepare geotechnical recommendations to be used in wall design.

The recommendations presented in the referenced report should be closely followed in the design and construction of the project.

Conclusions

Based on the results of our review and observations during our December 17, 2015 site reconnaissance, it is Earthworks opinion that the geotechnical recommendations for design and construction presented in the referenced report are suitable and applicable for development currently anticipated on the subject lots.

Closure

In order to reduce the potential for misinterpretation of geotechnical recommendations, Earthworks should be given the opportunity to review the final design plans and specifications for conformance to the original geotechnical recommendations. Earthworks anticipates involvement during the construction phase of the project to document compliance with geotechnical design recommendations/specifications and to allow preparation of additional recommendations as necessary where changed conditions are encountered.

We appreciate the opportunity to provide geotechnical services for you on this project. Please do not hesitate to call if we can answer any questions regarding this letter or other geotechnical engineering aspects of the project.

Sincerely,
EARTHWORKS



Maire Thornton, P.E.
Principal Engineer

Distribution: sweetpoetry@mindspring.com

