[redacted]

5 August 2022

[redacted]

Subject: **GEOTECHNICAL INVESTIGATION**
Proposed Accessory Dwelling Unit
[redacted]

[redacted]

In accordance with your authorization, [redacted] has completed a geotechnical investigation for the proposed accessory dwelling unit at the subject site. The purpose of this study was to investigate the subsurface conditions and obtain geotechnical data for use in the design and construction of the proposed accessory dwelling unit. The scope of this investigation included the following:

a. A site and area reconnaissance by the Project Engineer.
b. An excavation, logging, and sampling of two exploratory borings.
c. Laboratory testing of selected soil samples.
d. An engineering analysis of the data and information obtained.
e. Preparation and writing of this report which presents our findings, conclusions, and recommendations.

SITE LOCATION AND DESCRIPTION

The subject site is located at [redacted] The property is located to the south of [redacted] is adjacent to other single-family homes. The ground is sloping downward from south to north in the backyard of the property with an inclination of 2.5:1(Horizontal:Vertical). An existing residential structure and swimming pool were present on the property at the time of our investigation. A retaining wall was present at the southern end of the property.

PROPOSED PROJECT

The proposed project consists of constructing accessory dwelling unit at the southwestern corner of the property. We anticipate that the proposed structure will utilize wood-framed construction. It is our understanding the proposed structure will not be connected to the existing retaining wall. Light to moderate building loads are typically associated with this type of construction.

FIELD INVESTIGATION

[redacted] conducted the field investigation on July 6, 2022. The field investigation consisted of a site reconnaissance by the Project Engineer and an excavation of two exploratory borings. The borings were excavated using a minutemen drill-rig. The approximate locations of the borings are shown on the Site Plan, Figure 1.

Soils encountered during the excavation operation were continuously logged in the field. Relatively undisturbed samples were obtained by dynamically driving 18 inches using a 3.0-inch outside diameter Modified California Sampler with a 140-pound hammer free falling 30 inches. Blow counts were recorded for every 6-inch penetration interval, and reported corresponding to the last 12 inches of penetration. A correction factor of 0.6 was used to convert the blows for the last 12 inches of penetration for Modified California samples to corrected SPT values presented in the boring log. The classifications, descriptions, natural moisture contents, dry densities, and depths of the obtained samples are shown in the Boring Logs, Figures 2 and 3 of Appendix A.

LABORATORY TESTING

CLASSIFICATION

The field classifications of the samples were visually verified in the laboratory in accordance with the Unified Soil Classification System. These classifications are presented in the Boring Logs, Figures 2 and 3.

MOISTURE-DENSITY

The natural moisture contents and/or dry weights were determined for selected soil samples obtained during our field investigation. The data is presented in the aforementioned Boring Log.

ATTERBERG LIMITS

The Atterberg Limits Test was determined for the selected soil sample to classify, as well as to obtain an indication of the expansion and shrinkage potential with respect to moisture content variations. The liquid limit and plasticity index of the soil were found to be:

Sample	*Liquid Limit*	*Plasticity Index*
Brown sandy clay	32%	15

The Atterberg Limits tests indicate that a representative sample of the soil is of medium plasticity. The expansion potential for these soils is thus moderate.

SUBSURFACE SOIL CONDITIONS

The following soil descriptions were derived from our site reconnaissance and information obtained from our exploratory boring samples. Detailed descriptions of the materials encountered in the exploratory borings and results of the laboratory testing are presented in the Boring Logs, Figures 2 and 3.

Boring 1 soils encountered at the site consisted of 6.0 feet of brown sandy clay, very stiff, and moist, followed by brown silty sand, very dense, and moist to the maximum refusal depth explored of 7.5 feet below the ground surface.

Boring 2 soils encountered at the site consisted of 6.0 feet of brown sandy clay, very stiff, and moist, followed by brown silty sand, very dense, and moist to the maximum refusal depth explored of 8.0 feet below the ground surface.

No groundwater is encountered in the exploratory boring at the time of our investigation. Fluctuations in the groundwater table are anticipated to vary with respect to seasonal rainfall.

SEISMIC CONSIDERATIONS

According to the published maps by the International Conference of Building Officials (I.C.B.O.), in February 1998, the distances from active faults to the subject site are listed in the following table.

Fault Name	Distance (kilometers)	Direction From Site
Northern Calaveras	0.1	Northeast
Hayward	10.5	Southwest

Damage resulting from earthquakes is not necessarily related directly to the distance from the fault. More important than distance, are the foundation materials upon which structures are to be built. If structures are not located across the trace of the fault, are located on structurally competent materials, and are designed with state-of-the-art seismic considerations, the probability of continued usefulness after an earthquake is relatively good.

CALIFORNIA BUILDING CODE SITE CHARACTERIZATION

The following design values are base on the geologic information, longitude and latitude of the site, and the USGS computer program. Furthermore, in accordance with California Building Code 2019 (ASCE 7-16), the site seismic design values are provided as follow:

CBC Category/Coefficient ASCE 7-16	Design Value
Short-Period MCE at 0.2s, Ss	2.006
1.0s Period MCE, S1	0.738
Soil Profile Type, Site Class	D
Site Coefficient, Fa:	1.0
Site Coefficient, Fv:	null or See section 11.4.8 or 1.7
S_{MS} = Spectral Response Accelerations	2.006
S_{M1} = Spectral Response Accelerations	null or See section 11.4.8
S_{DS} = Design Spectral Response Accelerations	1.337
S_{D1} = Design Spectral Response Accelerations	null or See section 11.4.8
** Latitude: 37.6687363 Longitude: -121.918666	

It is noted that final values should be determined by the project structural engineer according to site class, risk categories of the proposed structure, and ASCE 7-16 Table 11.4-1 and 11.4-2.

SITE GEOLOGY

Slope Instability

The site is located in a potential landslide zone according to the Required Zones of Investigation map from the California Geologic Survey. The site also appears to be located near a dormant deep rock slide. Based on our review, the site is not located within the dormant deep rock slide, as shown in our Landslide Location map, Figure 4 in Appendix A. Based on our review of this data and the boring logs, it is the opinion of [redacted] that the probability of landslide potential of the soil within our boring depth underlying this site is low.

Soil Liquefaction

Soil liquefaction is a phenomenon in which saturated (submerged) cohesionless soils can be subjected to a temporary loss of strength due to the buildup pore water pressures, especially as a result of cyclic loadings such as induced by earthquakes. In the process, the soil acquires a mobility sufficient to permit both horizontal and vertical deformations, if not confined. Soils that are most susceptible to liquefaction are clean, loose, saturated, uniformly graded, fine sands.

Based on our review of this data, the boring logs, and the absence of ground water, it is the opinion of WTAI that the probability of liquefaction of the soil within our boring depth underlying this site is low.

Total and Differential Settlement

During moderate and large earthquakes, soft or loose, natural or fill soils can become densified and consolidate, often unevenly across a site. This earthquake-induced consolidation can result in differential settlement of structures supported in these soils. Based on our subsurface exploration, the majority of the subsurface materials encountered in our boring at the site appear to be very dense. Therefore, in our opinion, differential compaction should not constitute a significant hazard to the proposed structure provided that they are supported on foundations designed in accordance with the recommendations presented in this report.

Surface Displacement due to Seismically Induced Lateral Spreading or Lateral Flow

From the above discussion of liquefaction, there is low to no potential liquefaction at the subject site. Therefore, potential lateral spreading or lateral flows occur at the site is low.

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

1. Based on the results of our investigation, [redacted] concludes that the subject site is geotechnically suitable for the proposed accessory dwelling unit provided the recommendations presented in this report are incorporated into the project plans and specifications.

2. [redacted] should review the grading and foundation plans and specifications so that comments can be made regarding the interpretation and implementation of our geotechnical recommendations in the design and specifications.

3. It is recommended that [redacted] be retained for observation during foundation construction phases to help determine that the design requirements are fulfilled. Our firm should be notified at least two working days prior to grading and/or foundation operations on the property.

4. Any work related to the grading and foundation operations performed without the direct observation of [redacted] will invalidate the recommendations of this report.

5. The recommendations given in this report are applicable only for the design of the previously described accessory dwelling unit and only at the location indicated on the site plan. They should not be used for any other purpose.

SITE PREPARATION AND GRADING

6. Prior to grading, the proposed structure areas should be cleared of all obstructions and deleterious materials. After clearing, these areas should be stripped of all organic topsoil. The predominantly organic materials generated from the stripping should be removed from the site.

7. After the organic topsoil has been stripped, the proposed pad areas can be excavated. The top 10 inches of the subgrade soil should be scarified, watered or aerated as necessary to bring the soil to about 3 percent above the optimum moisture content. The subgrade should then be uniformly recompacted to at least 90 percent relative compaction. Relative compaction is based on the maximum dry density as determined by ASTM D1557 Latest Version Laboratory Test Procedure.

FOUNDATION

8. Due to presence of moderately expansive clay, the proposed accessory dwelling unit can be satisfactorily supported on a spread footing or mat slab foundation.

Footing Foundation

9. The footing foundation should be designed for an allowable bearing pressure of 2,400 p.s.f. due to dead loads plus design live loads, and 3,200 p.s.f. due to all loads that include wind or seismic forces. The bottom of the foundation should be founded at least 30 inches below the lowest adjacent pad grade (trench depth). Footing reinforcement will be determined by the Structural Engineer.

10. Resistance to lateral force may be provided by sliding resistance between the base of the footings and the underlying soils. Sliding resistance may be taken as a friction value of 0.30.

Mat Slab Foundation

11. A modulus of subgrade reaction of 75 k.c.f. may be used in the mat slab foundation design. The slabs should be designed based on the allowable bearing capacity of 2,400 p.s.f. due to dead loads plus design live loads, and 3,200 p.s.f. due to all loads which include wind or seismic forces. The bottom of the edges of slab should be founded at least 12 inches below the bottom of the slab.

12. The available resistance to lateral loads when utilizing a mat slab is limited to the sliding resistance along the base of the slab. Sliding resistance between the bottom of the slab and the underlying soil should be based on a friction value of 0.30.

13. Movements under the anticipated building loads are expected to be within tolerable limits for the proposed structure. We estimate that the total movement will be less than 1.50-inches, and post-construction differential settlements across the structure should not exceed approximately 0.75-inches during the life of the structure following construction.

CONCRETE SLABS ON GRADE

14. To reduce the potential cracking of the concrete slabs, the following recommendations are made:

a. Any concrete slab-on-grade should be underlain by at least 4 inches of clean crushed, 3/4-inch size rock, to act as a cushion and capillary break between the subsoil and the slab. In addition, an additional 12 inches of soil below the crushed rock should be overexcavated and replaced with class II baserock and compacted to a minimum relative compaction of 95 percent.

b. In areas where moisture transmission through slabs is undesirable, a waterproofing membrane of such as, Bituthene, Paraseal or equal should be placed according to the instruction of the manufacture and the specification of foundation plans. Design waterproofing for the concrete slab is not within the purview of WTAI. Waterproofing should be designed by a professional waterproofing designer.

GENERAL CONSTRUCTION REQUIREMENTS

15. All finished grading must be adjusted to provide positive drainage away from the structure to prevent ponding of water toward the building.

16. All roof drains should be collected by a system of gutters and downspouts and discharged to a closed pipe system to carry storm water away from the building structure.

17. Backfill of utility trenches under the building areas should be compacted to at least 90 percent compaction to ensure against water migration underneath the building structure.

18. Flowerbeds and planting are not recommended along the building perimeter. Only drip systems can be installed where they may cause saturation of the foundation soils. Landscape mounds or concrete flatwork should not block or obstruct the surface drainage measures.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

19. Our client should recognize that this report is prepared for the exclusive use of the proposed accessory dwelling unit. Our professional services, findings, and recommendations were prepared in accordance with generally accepted engineering principles and practices. No other warranty, expressed or implied, is made.

20. The conclusions and recommendations contained in this report will not be considered valid after a period of two years unless the changes are reviewed, and the conclusions of this report are modified or verified in writing.

21. This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure the information and recommendations contained in this report are brought to the attention of the Architect, Engineer, and Contractor. In all cases, the contractor shall retain responsibility for the quality of the work and for repairing defects regardless of when they are found. It is also the responsibility of the contractor for conforming to the project plans and specifications.

Should you have any questions relating to the contents of this report, please contact our office at your convenience.

Very truly yours,

[redacted]