Wallace Kuhl & Associates

*Geotechnical Engineering Report*

**19-ACRE OGG PROPERTY**

Placer County, California

WKA No. 10218.02

September 15, 2014

*Prepared For:*

Meritage Homes

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## INTRODUCTION

We have completed a geotechnical engineering investigation for the planned 19-acre Ogg Property single-family residential development, located on the west side of Antelope Road, south of PFE Road, in Placer County, California. The purposes of our study have been to explore the existing soil and groundwater conditions at the site, and to provide geotechnical engineering conclusions and recommendations for the design and construction of the single-family home structures and associated residential subdivision improvements. This report presents the results of our work.

### Work Scope

Our scope of services for this project has included the following tasks:

1. site reconnaissance;
2. review of historic USGS topographic maps and geologic maps of the property;
3. review of previous geotechnical reports prepared for projects in the vicinity of the project site;
4. subsurface exploration, including the drilling and sampling of nine borings to depths of approximately 9½ to 16 feet below the existing grades;
5. bulk sampling of the near-surface soils;
6. laboratory testing of selected soil samples;
7. engineering analyses; and,
8. preparation of this report.

### Related Experience

Supplemental information used in the preparation of this report included review of the following reports prepared by our firm:

- *Geotechnical Engineering Report* (WKA No. 10215.02, dated September 12, 2014) prepared for the 25-acre Pruett Property residential development, which is located adjacent to and west of the project site; and,

- *Geotechnical Engineering Report* (WKA No. 10216.02, dated September 12, 2014) prepared for the six-acre Pruett Property residential development, which is located adjacent to and south of the project site; and,
- *Phase 1 Environmental Site Assessment (ESA)* (WKA No, 10218.01, dated August 25, 2014) prepared for the subject property.

Figures and Attachments

This report contains a Vicinity Map as Figure 1; a Site Plan with approximate boring locations as Figure 2; Logs of Soil Borings as Figures 3 through 11; and, an explanation of the symbols and classification system used on the logs as Figure 12. Appendix A contains information of a general nature regarding exploratory methods used during the field investigation phase of our study and results of laboratory testing. Appendix B contains *Earthwork Specifications* that may be used in the preparation of contract documents.

Proposed Development

We understand the subject site is proposed for development with a residential subdivision. Specific lot information was not available at the time this report was completed. We anticipate the houses will consist of one- and two-story, wood-framed structures with interior slab-on-grade lower floors. Structural loads for the structures are anticipated to be relatively light based on this type of construction. Associated development is anticipated to include construction of underground utilities, exterior flatwork, retaining walls, interior paved residential streets, and typical residential landscaping.

## FINDINGS

Site Description

The approximately 19-acre, rectangular-shaped parcel is located west of Antelope Road, south of PFE Road, in Placer County, California. The site is bounded to the north by an rural residence and associated outbuildings; to the east by Antelope Road, beyond which is vacant land and an existing storage facility; and, to the south and west by vacant land and an existing nursery.

On the day of our field investigation, August 5, 2014, the major portion of the site was undeveloped and covered with a moderate to dense growth grass and weeds. Several mature trees and numerous orchard trees were observed scattered throughout the site. Portions of the

property had been had been disced for weed abatement. A rural residence with several barn structures was observed on the southeastern portion of the property.

The surface of the site is gently rolling terrain with surface elevations of approximately +140 to +155 feet mean sea level (msl) based on review of the USGS *Topographic Map of the Citrus Heights Quadrangle*, dated 1992.

Site History

Review of aerial photographs taken between 1937 and 2012 indicate the site has supported an orchard since 1937. Structures, similar in size and location to those observed during our site visit, have been visible on the site since 1957.

Based on review of historical topographic maps and recent conversations with Mr. Henry Ogg, the site owner, the primary residence and associated well house and outbuildings were constructed in 1956. The orchard has not been maintained since 1986. Mr. Ogg indicated a septic system is located to the west of the primary residence. The mobile home was placed in the southeaster portion of the site in 1986.

Site Geology

The site is mapped as being underlain by the Turlock Lake formation as identified by the Department of Interior United States Geologic Survey publication, "Geologic Map of the Late Cenozoic Deposits of the Sacramento Valley and Northern Sierra Foothills, California." The Turlock Lake Formation consists of sands, silts, and gravels deposited as alluvial fans over 600,000 years ago.

Subsurface Soil Conditions

The surface and near-surface soil conditions encountered by our borings generally consist of alternating layers of variably cemented, sandy and clayey silts and silty sands to the maximum depth explored of approximately 16 feet below existing site grades. Near-surface silty clays were encountered in seven of the borings at depths of approximately 0 to 5 feet below existing site grades. A discontinuous layer of very dense, clean sand was encountered in Borings D2 and D4 at depths of approximately 8½ and 15 feet below existing site grades.

Please refer to the Logs of Soil Borings (Figures 3 through 11) for more information regarding the soils at a particular location.

Groundwater

Permanent groundwater was not encountered within the borings performed on August 5, 2014, to the maximum depth explored of approximately 16 feet below existing site grades.

To supplement the groundwater information obtained from the field exploration, we reviewed available California Department of Water Resources (DWR) records for wells in the vicinity of the project site. DWR monitored well identified as #387285N1213396W001 located approximately ½-mile northwesterly of the project site and was monitored by the DWR from December 13, 1948 to October 2, 1981. The ground elevation at the well is indicated to be approximately +142 feet msl. Groundwater measurements obtained from the well indicate a "high" groundwater elevation of +62 feet msl (about 80 feet below existing grades at the well) occurred on March 24, 1949, and a "low" groundwater elevation of -1 feet msl (about 143 feet below existing grades at the well) occurred on October 2, 1981.

## CONCLUSIONS

Seismic Site Class

The soil conditions encountered at the boring locations indicates the site is underlain by the Quaternary-aged Turlock Lake Formation. The Turlock Lake Formation has been identified as a material meeting Site Classification C (Wills, et al., 2001). Based on the geology of the site and the soil conditions encountered at the boring locations, the soils at this site can be designated as site Class C for determining seismic design forces for this project in accordance with Section 1613.3.2 of the 2013 California Building Code (CBC).

2013 CBC/ASCE 7-10 Seismic Design Criteria

Section 1613 of the 2013 edition of the CBC references ASCE Standard 7-10 for seismic design. The following seismic parameters were determined based on the site latitude and longitude using the public domain computer program developed by the USGS. The following parameters summarized in the table below may be used for seismic design of the proposed residential structures.

**Table 1 –2013 CBC/ASCE 7-10 Seismic Design Parameters**

| Latitude: 38.7264° N<br>Longitude: -121.3299° W | ASCE 7-10 Table/Figure | 2013 CBC Table/Figure | Factor/ Coefficient | Value |
|---|---|---|---|---|
| Short-Period MCE at 0.2s | Figure 22-1 | Figure 1613.3.1(1) | $S_S$ | 0.529 g |
| 1.0s Period MCE | Figure 22-2 | Figure 1613.3.1(2) | $S_1$ | 0.257 g |
| Soil Class | Table 20.3-1 | Section 1613.3.2 | Site Class | C |
| Site Coefficient | Table 11.4-1 | Table 1613.3.3(1) | $F_a$ | 1.189 |
| Site Coefficient | Table 11.4-2 | Table 1613.3.3(2) | $F_v$ | 1.543 |
| Adjusted MCE Spectral Response Parameters | Equation 11.4-1 | Equation 16-37 | $S_{MS}$ | 0.628 g |
| | Equation 11.4-2 | Equation 16-38 | $S_{M1}$ | 0.397 g |
| Design Spectral Acceleration Parameters | Equation 11.4-3 | Equation 16-39 | $S_{DS}$ | 0.419 g |
| | Equation 11.4-4 | Equation 16-40 | $S_{D1}$ | 0.265 g |
| Seismic Design Category | Table 11.6-1 | Section 1613.3.5(1) | Risk Category I to III | C |
| | | | Risk Category IV | D |
| | Table 11.6-2 | Section 1613.3.5(2) | Risk Category I to IV | D |

MCE – Maximum Considered Earthquake
g – acceleration due to gravity

Based upon the results of our subsurface exploration, the known site geologic, seismologic, groundwater and soil conditions, it is our opinion that the potential for liquefaction occurring at this site is very low.

The site is not underlain by any active faults and is not located within an Alquist-Priolo Fault Study Zone.

Bearing Capacity

Based on our field investigation and laboratory test results, it is our opinion the undisturbed native soils and engineered fill, properly placed and compacted in accordance with the recommendations of this report, are capable of supporting the proposed structures and pavements provided the following recommendations regarding site preparation and engineered fill placement are carefully followed.

Specific recommendations to scarify, moisture condition, and recompact the surface soils have been provided in the Site Preparation section of this report.

Excavation Conditions

The on-site surface and near-surface soils should be readily excavatable with conventional construction equipment. The underlying variably cemented soils will be slower to excavate, but special excavation equipment is not anticipated. We anticipate soil sidewalls for the planned foundation excavations and shallow utility excavations will remain stable at near-vertical inclinations without significant caving, unless saturated or disturbed soils are encountered.

Excavations deeper than five feet that will be entered by workers should be sloped, braced or shored in accordance with current OSHA regulations. The contractor must provide an adequately constructed and braced shoring system in accordance with federal, state and local safety regulations for individuals working in an excavation that may expose them to the danger of moving ground.

Excavated materials should not be stockpiled directly adjacent to an open trench to prevent surcharge loading of the trench sidewalls. Excessive truck and equipment traffic should be avoided near open trenches. If material is stored or heavy equipment is operated near an excavation, stronger shoring would be needed to resist the extra pressure due to the superimposed loads.

Soil Suitability for Use in Fill Construction

On-site soils are considered suitable for use in engineered fill construction, if free of significant concentrations of organic materials, rubble, rubbish or deleterious material and are at a suitable moisture content to achieve the desired degree of compaction.

Soil Expansion Potential

Laboratory expansion testing of the near-surface clayey subgrade soils indicate a medium expansion potential when tested in accordance with the UBC 29-2 (ASTM D4829) test method (see Figures A1 and A2). These clayey soils are capable of exerting significant expansion pressures on building foundations, interior floor slabs and exterior flatwork with variations in soil moisture content, which must be considered in design and construction. Specific recommendations to reduce the effects of expansive soils, including moisture conditioning and presaturation of the slab subgrade, are presented in this report.

Pavement Subgrade Qualities

Based on our experience of adjacent projects and the results of previous laboratory testing, the surface and near-surface soils are variable with respect to their support qualities. Laboratory testing of the near-surface soils indicate these materials possess a Resistance ("R") value of 5 (See Figure A3). Based on the previous laboratory testing, our experience on adjacent projects, and the anticipated mixing of soils during earthwork construction, we have selected an R-value of 5 for the calculation of alternative pavement sections.

Soil Corrosion Potential

Three soil samples collected from the site were submitted to Sunland Analytical to determine soil pH, minimum resistivity, and chloride and sulfate concentrations to help evaluate potential for corrosive attack upon reinforced concrete and exposed buried metal. The results of the corrosivity testing are summarized in Table 2. Copies of the test reports are presented on Figures A4 through A6.

**TABLE 2**
**SOIL CORROSIVITY TESTING**

| Analyte | Test Method | Sample Identification | | |
|---|---|---|---|---|
| | | D1 (0'-3') | D5 (0'–3') | D6 (0' -3½') |
| Soil pH | CA DOT 643 Modified* | 6.58 | 6.65 | 7.76 |
| Minimum Resistivity | CA DOT 643 Modified* | 2680 Ω-cm | 3480 Ω-cm | 1740 Ω-cm |
| Chloride | CA DOT 417 | 16.5 ppm | 7.1 ppm | 8.1 ppm |
| Sulfate | CA DOT 422 | 7.9 ppm | 5.2 ppm | 4.0 ppm |

* = Small cell method
Ω-cm = Ohm-centimeters
ppm = Parts per million

Published literature[1] defines a corrosive area as an area where the soil and/or water contains more than 500 ppm of chlorides, more than 2000 ppm of sulfates, or has a pH of less than 5.5. The corrosivity test results suggest that the native soils are corrosive to steel reinforcement properly embedded within Portland cement concrete for the samples tested.

[1] California Department of Transportation, Division of Engineering Services, Materials Engineering and Testing Services, Corrosion Technology Branch, *Corrosion Guidelines,* version 2.0, November 2012.

Table 4.2.1 – *Exposure Categories and Classes*, American Concrete Institute (ACI) 318, Section 4.2, as referenced in Section 1904.1 of the 2013 CBC, indicates the severity of sulfate exposure for the samples tested is *Not Applicable*. Ordinary Type I-II Portland cement is considered suitable for use on this project, assuming a minimum concrete cover is maintained over the reinforcement.

Wallace-Kuhl & Associates are not corrosion engineers. Therefore, to further define the soil corrosion potential at the site a corrosion engineer should be consulted.

Groundwater

A permanent groundwater table is indicated to be at least 100 feet below the existing ground surface. Therefore, we conclude that groundwater should not be a significant factor in design, construction or performance of structures at this site. However, it is possible that perched water could be encountered within excavations, especially when construction takes place in the winter or early spring months.

Seasonal Water

During the wet season, infiltrating surface water will create saturated soil conditions within the building pads. Grading operations attempted following the on-set of winter rains and prior to prolonged drying periods will be hampered by high soil moisture contents. Such soils, intended for use as engineered fill, will require considerable aeration to reach a moisture content that will permit the specified degree of compaction to be achieved.

## RECOMMENDATIONS

General

The recommendations presented below are appropriate for typical construction in the late spring through fall months. The on-site soils likely will be saturated by rainfall in the winter and early spring months, and will not be compactable without drying by aeration or the addition of lime (or a similar product) to dry the soils. Should the construction schedule require work to continue during the wet months, additional recommendations can be provided, as conditions dictate.

Site Preparation

Initially, the site should be cleared of all existing structures, trees, septic tanks, utilities to be relocated or abandoned including backfill, debris, rubbish, rubble, and other unsuitable