Wallace Kuhl
& ASSOCIATES

*Geotechnical Engineering Report*
**19-ACRE OGG PROPERTY**
Placer County, California
WKA No. 10218.02
September 15, 2014

*Prepared For:*
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*Geotechnical Engineering Report*

**19-ACRE OGG PROPERTY**

Placer County, California

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*Geotechnical Engineering Report*
**19-ACRE OGG PROPERTY**
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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

materials. Demolition debris should be removed from the site. Trees and shrubs designated to be removed should include the entire rootball and all roots larger than one-half inch (½") in diameter. Adequate removal of debris and tree roots may require laborers and handpicking to clear the subgrade soils to the satisfaction of our on-site representative, prior to further site preparation. We recommend construction bid documents contain a unit price (price per cubic yard) for additional excavation of unsuitable materials and replacement with engineered fill. Existing water wells and septic systems should be abandoned in accordance with Placer County Environmental Health requirements.

Remaining areas should be stripped of surface vegetation and organically contaminated topsoil; strippings may be stockpiled for later use or disposed of off-site. *If used, on-site strippings may be placed in backyard areas, provided they are kept at least five feet from the building pads, flatwork, and pavements, are less than 18" thick, and are moisture conditioned and compacted. Strippings should not be used as fill in areas that will support either retaining walls or sound walls.* Discing of the organics into the surface soils may be a suitable alternate to stripping, depending on the condition and quantity of the organics at the time of grading. The decision to utilize discing in lieu of stripping should be made by our representative at the time of earthwork construction. Discing operations, if approved, should be observed by our representative and must be continuous until the organics are adequately mixed into the surface soils to provide a compactable mixture of soil containing minor amounts of organics. Pockets or concentrations of organics will not be allowed.

Following site clearing, the entire site should be thoroughly ripped and cross-ripped to a depth of at least 12 inches to help uncover and remove remaining structure remnants, tree roots, buried debris and rubble.

Areas to receive fill, remain at-grade, or achieved by excavation, should be scarified to a depth of 12 inches, brought to at least the optimum moisture content and compacted in-place to at least 90 percent of the ASTM D1557 maximum dry density. Loose, soft or saturated soils, as identified by our representative during the recompaction operations, should be removed and replaced with engineered fill.

Difficulty in achieving subgrade compaction or unusual soil instability may be indications of loose fill associated with past subsurface items such as underground tanks, cisterns, burn pits, excavations or utility lines. Should these conditions exist, the materials should be excavated to check for subsurface structures and the excavations restored to grade with engineered fill placed and compacted in accordance with the recommendations contained within this report. We recommend that construction bid documents include a unit price (per cubic yard) for all excess excavation due to unsuitable materials and replacement with engineered fill. *We consider it essential that our representative be present during site clearing and demolition*

*activities to observe the behavior of the compaction equipment and verify the compaction of the subgrade.*

Engineered Fill Construction

Engineered fill should be placed in horizontal lifts not exceeding six inches in compacted thickness. Each layer should be uniformly moisture conditioned to at least the optimum moisture content and compacted to at least 90 percent of the maximum dry density, as defined above. Clay soils should be moisture conditioned to at least two percent above the optimum moisture content. Compactive effort should be applied uniformly across the full width of the fill.

On-site soils are considered suitable for use in engineered fill construction, if free of rubble, rubbish, or concentrations of organics. Imported fill materials, if required, should be compactable, granular soils with a Plasticity Index of 15 or less; an Expansion Index of 20 or less; be free of particles greater than three inches in maximum dimension; and, have a minimum Resistance ("R") value of 20. Imported soils should be approved by our office prior to being transported to the site. Also, if import fills are required (other than aggregate base) the contractor must provide appropriate documentation that the import is clean of known contamination.

The upper 12 inches of final pavement subgrades should be uniformly moisture conditioned to at least the optimum moisture content, and uniformly compacted to at least 95 percent of the maximum dry density, regardless of whether final grade is completed by excavation, filling, or left at existing grade. Final subgrade preparation and compaction should be performed just prior to placement of aggregate base, after underground construction is complete.

Subgrades for support of the building slabs, exterior flatwork and pavements should be protected from disturbance or desiccation until covered by capillary break material or aggregate base. Disturbed subgrade soils may require moisture conditioning, scarification and recompaction, depending on the level of disturbance.

Permanent excavation and fill slopes should be constructed no steeper than two horizontal to one vertical (2:1) and should be vegetated as soon as practical following grading to minimize erosion. As a minimum, erosion control measures should include placement of straw bale sediment barriers or construction of silt filter fences in areas where surface run-off may be concentrated. Slopes should be over-built and cutback to design grades and inclinations.

Site preparation should be accomplished in accordance with the recommendations of this section and the appended *Earthwork Specifications.* Our representative should be regularly present throughout grading operations to determine compliance with the job specifications.

Residential Utility Trench Construction

We recommend only native soils (in lieu of select gravel or sand backfill) be used as backfill for utility trenches located within the building footprints and extending at least five feet beyond the perimeter foundations to minimize water transmission beneath the structures. All utility trench backfill should be thoroughly moisture conditioned to at least the optimum moisture content and mechanically compacted in lifts to at least 90 percent of the ASTM D1557 maximum dry density.

We recommend that underground utility trenches, which are aligned nearly parallel with foundations, be at least three feet from the outer edge of foundations. Trenches should not encroach into the zone extending outward at a 1:1 inclination below the bottom of the foundations. Additionally, trenches near foundations should not remain open longer than 72 hours to prevent drying and formation of desiccation and shrinkage cracks. The intent of these recommendations is to prevent loss of both lateral and vertical support of foundations, resulting in possible settlement.

Trench backfill materials and compaction within street right-of-ways should conform to the applicable portions of the current Placer County Standards, latest edition.

Foundations

The proposed one- and two-story single-family structures may be supported upon a continuous perimeter foundation with continuous and/or isolated interior spread foundations that extend at least 18 inches into the compacted building pad, as measured from lowest adjacent soil grade. For this project, the building pad subgrade is defined as the soil surface on which capillary break gravel is placed. Continuous foundations should be at least 12 inches wide; isolated spread foundations should maintain a minimum 18-inch dimension.

Foundations so established may be sized based upon an allowable bearing capacity of 2000 psf for dead load plus live loads, with a 1/3 increase to include the short-term effects of seismic or wind forces. The weight of foundation concrete extending below lowest adjacent soil grade may be disregarded in sizing computations.

To impede moisture migration to or from beneath the structures, the perimeter foundation should be continuous around the entire structure. Continuous foundations should be reinforced with a minimum of four No. 4 reinforcement bars, placed two each near the top and bottom of the foundation to minimize the effects of potentially expansive soils, and to allow the foundations the ability to span isolated soil irregularities. The project structural engineer should evaluate the need for additional reinforcement.

Resistance to lateral displacement of shallow foundations may be computed using an allowable friction factor of 0.30 multiplied by the effective vertical load on each foundation. Additional lateral resistance may be achieved using an allowable passive earth pressure against the vertical projection of the foundation equal to an equivalent fluid pressure of 300 psf per foot of depth. These two modes of resistance should not be added unless the frictional component is reduced by 50 percent since mobilization of the passive resistance requires some horizontal movement, effectively reducing the frictional resistance.

Interior Floor Slab Support

Interior concrete slab-on-grade floors can be supported upon the soil subgrade prepared in accordance with the recommendations in this report and maintained in that condition (at least the optimum moisture content). Interior concrete slab-on-grade floors should be at least four inches thick and, as a minimum for crack control, contain chaired No. 3 reinforcing bars placed no wider than 18-inch center-to-center each way throughout the slab, and located at mid-slab depth. This slab reinforcement is suggested as a guide only; final reinforcement and joint spacing should be determined by the structural engineer or architect. Proper and consistent location of the reinforcement near mid-slab is essential to its performance. The risk of uncontrolled shrinkage cracking is increased if the reinforcement is not properly located within the slab.

Floor slabs should be underlain by a layer of free-draining crushed rock, serving as a deterrent to migration of capillary moisture. The crushed rock layer should be at least four inches thick and graded such that 100 percent passes a one-inch sieve and none passes a No. 4 sieve. Additional moisture protection may be provided by placing a vapor retarder membrane (at least 10-mils thick) directly over the crushed rock. The membrane should meet or exceed the minimum specifications as outlined in ASTM E1745 and be installed in strict conformance with the manufacturer's recommendations.

Floor slab construction over the past 25 years or more has included placement of a thin layer of sand over the vapor retarder membrane. The intent of the sand is to aid in the proper curing of the slab concrete. However, recent debate over excessive moisture vapor emissions from floor slabs includes concern for water trapped within the sand. As a consequence, we consider the use of the sand layer as optional. The concrete curing benefits should be weighed against efforts to reduce slab moisture vapor transmission.

Due to the presence of expansive soils, moisture conditioning of subgrade soils prior to placement of floor slab concrete is considered essential. Immediately prior to slab concrete placement the subgrade soils, to a depth of least 12 inches, should be brought to a uniform, near-saturated moisture condition by liberal watering or sprinkling. Slab subgrade moisture

condition should be field checked by our representative for each building pad prior to and within 48 hours of slab placement.

The recommendations presented above are intended to mitigate any significant soils-related cracking of the slab-on-grade floors. More important to the performance and appearance of a Portland cement concrete slab is the quality of the concrete, the workmanship of the concrete contractor, the curing techniques utilized, and the spacing of control joints.

Floor Slab Moisture Penetration Resistance

Presaturation of the subgrade soils prior to slab placement will result in wet subgrade soils below the slab. For this reason, it should be assumed that all slabs in living areas, as well as those intended for moisture-sensitive floor coverings or materials, require protection against moisture or moisture vapor penetration. Standard practice includes the gravel and vapor retarder membrane as suggested above. However, the gravel and membrane offer only a limited, first-line of defense against soil-related moisture. Recommendations contained in this report concerning foundation and floor slab design are presented as *minimum* requirements, only from the geotechnical engineering standpoint.

It is emphasized that the use of a membrane below the slab will not "moisture proof" the slab, nor does it assure that slab moisture transmission levels will be low enough to prevent damage to floor coverings or other building components. If increased protection against moisture vapor penetration of slabs is desired, a concrete moisture protection specialist should be consulted. It is commonly accepted that maintaining the lowest practical water-cement ratio in the slab concrete is one of the most effective ways to reduce future moisture vapor penetration of the completed slabs.

Exterior Flatwork Construction

Soil subgrades supporting exterior concrete flatwork (i.e., driveways, sidewalks, patios, etc.) should be brought to at least two percent above the optimum moisture condition and uniformly compacted prior to the placement of the concrete. *Proper moisture conditioning and compaction of the subgrade soils is considered essential to the performance of exterior flatwork.* Expansion joints should be provided to allow for minor vertical movement of the flatwork. Exterior flatwork should be constructed independent of the perimeter building foundation and isolated column foundations by the placement of a layer of felt material between the flatwork and the foundation. Consideration also should be given to reinforcing the slabs with rebar for crack control. Irrigated landscaping adjacent to concrete flatwork will help maintain a more uniform moisture in the soils and reduce the potential for differential movement.

Pavement Design

Representative samples of the anticipated subgrade soils were obtained during the field exploration for the performance of Resistance value (R-value) testing. The results of the R-value tests are presented as Figure A4. Based on the test results and our local experience, we have selected a design R-value of 5. The following pavement design sections provided in Table 3 are based on assumed traffic indices, the design R-value, and the methods contained in the "California Department of Transportation Highway Design Manual," Sixth Edition. The project civil engineer should select the appropriate pavement sections based upon Placer County requirements.

**TABLE 3**
**PAVEMENT DESIGN ALTERNATIVES**

| Traffic Index (TI) | Type B Asphalt Concrete (inches) | Class 2 Aggregate Base (inches) |
|---|---|---|
| 5.0 | 3* | 11 |
| 5.5 | 3* | 12 |
| 6.0 | 3 | 14 |
| | 3½* | 13 |
| 6.5 | 3½ | 17 |
| | 4* | 16 |

* = Asphalt thickness includes Caltrans Factor of Safety

We emphasize that the performance of a pavement is critically dependent upon uniform compaction of the subgrade soils, as well as all engineered fill and utility trench backfill within the limits of the pavements. The upper 12 inches of pavement subgrades should be compacted to at least 95 percent of the ASTM D1557 maximum dry density at no less than the optimum moisture content, and must be stable under construction traffic prior to placement of aggregate base. *We recommend that pavement subgrade preparation, i.e. scarification, moisture conditioning and compaction, be performed just prior to aggregate base placement.* Class 2 aggregate base should be compacted to at least 95 percent of the ASTM D1557 maximum dry density.

Efficient drainage of all surface water to avoid infiltration and saturation of the supporting aggregate base and subgrade soils is important to the performance of pavements. Drop inlets should be provided with weep holes at the base/subgrade level to allow free drainage of water that may collect in the aggregate base course.

Materials quality and construction within the structural section of the pavement should conform to the applicable provisions of the latest editions of the *Caltrans Standard Specifications* and *Placer County Standards.*

Site Drainage

Performance of building foundations, slabs-on-grade floors and pavement areas is dependent upon proper control of surface water on the site. The ground adjacent to buildings should be sloped away from foundations at a gradient no less than two percent for a distance of at least five feet, where possible. We recommend that roof drain downspouts either discharge onto paved surfaces leading away from structures or that roof drains be connected to solid PVC piping directed to an appropriate drainage point away from the structures. Ponding of surface water should not be allowed adjacent to the structures or exterior flatwork.

Future Engineering/Testing Services

Representatives of Wallace-Kuhl & Associates should be present during site preparation and lot grading operations to observe and test the fill to verify compliance with our recommendations and the job specifications. These services are beyond the scope of work authorized for this investigation.

We also should be retained to review the foundation plans, when completed, to verify that the intent of our recommendations has been implemented in those documents. These services also are beyond the scope of work authorized for this investigation.

## LIMITATIONS

Our recommendations are based upon the information provided regarding the proposed construction, combined with our analysis of site conditions revealed by the field exploration and laboratory testing programs. We have used prudent engineering judgment based upon the information provided and the data generated from our investigation. This report has been prepared in substantial compliance with generally accepted geotechnical engineering practices that exist in the area of the project at the time the report was prepared. No warranty, either express or implied, is provided.

If the proposed construction is modified or relocated or, if it is found during construction that subsurface conditions differ from those we encountered at the boring locations, we should be afforded the opportunity to review the new information or changed conditions to determine if our conclusions and recommendations must be modified.

We emphasize that this report is applicable only to the proposed construction and the investigated site. This report should not be utilized for construction on any other site. This report is considered valid for the proposed construction for a period of two years following the date of this report. If construction has not started within two years, we must re-evaluate the recommendations of this report and update the report, if necessary.

Wallace-Kuhl & Associates

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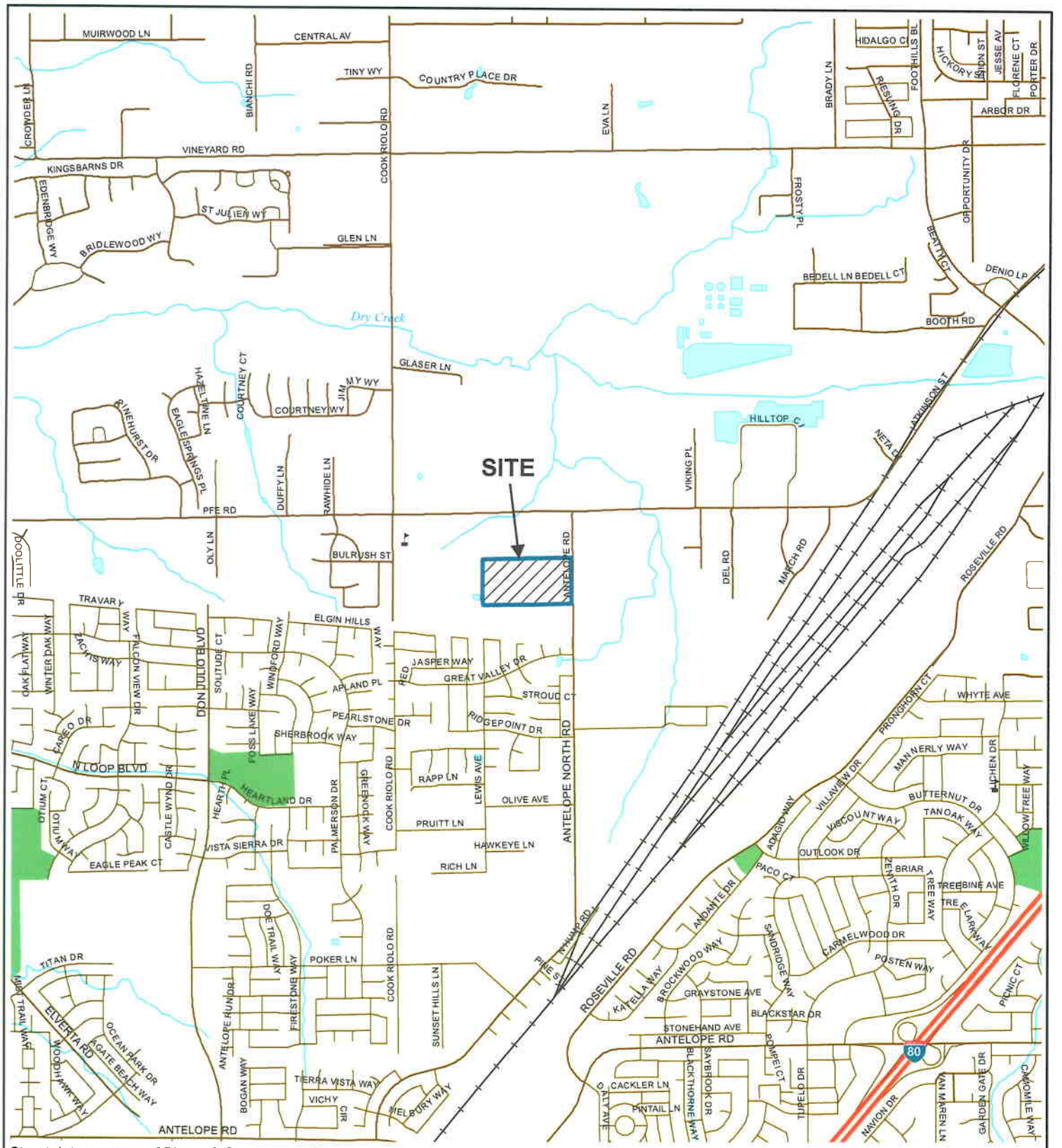
Exp. 6/30/16
CIVIL
STATE OF CALIFORNIA

Dominic J. Potestio
Project Engineer




Street data courtesy of Placer & Sacramento Counties.
Hydrography courtesy of the U.S. Geological Survey
acquired from the GIS Data Depot, December, 2007.
Projection: NAD 83, California State Plane, Zone II

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**VICINITY MAP**

19 ACRE OGG PROPERTY

Placer County, California

| FIGURE | 1 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 8/14 |
| WKA NO. 10218.02 | |

Adapted from a Google Earth aerial photograph, dated August 14, 2013.
Projection: NAD 83, California State Plane, Zone II

Legend

Approximate boring location

N

0 100 200
Feet

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**SITE PLAN**

19 ACRE OGG PROPERTY

Placer County, California

| FIGURE | 2 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 8/14 |
| WKA NO. 10218.02 | |

**Project: 19 Acre Ogg Property**
**Project Location: Placer County, California**
**WKA Number: 10218.02**

# LOG OF SOIL BORING D1

Sheet 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 8/5/14 | Logged By | JDW | Checked By | DJP |
| Drilling Method | Solid Flight Augers | Drilling Contractor | V&W Drilling, Inc. | Total Depth of Drill Hole | 11.0 feet |
| Drill Rig Type | CME-75 | Diameter(s) of Hole, inches | 6" | Approx. Surface Elevation, ft MSL | |
| Groundwater Depth [Elevation], feet | Groundwater was not encountered | Sampling Method(s) | California Modified | Drill Hole Backfill | Soil Cuttings |
| Remarks | | | | Driving Method and Drop | 140-lb automatic hammer; 30-inch drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE | SAMPLE NUMBER | NUMBER OF BLOWS | MOISTURE CONTENT, % | DRY UNIT WEIGHT, pcf | ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|
| | | | Light brown, slightly moist, sandy silt (ML) | | | | | | |
| | | | Dark brown, slightly moist, hard, silty clay (CL) | ■ | D1-1I | 35 | 9.9 | 116 | |
| | 5 | | Red brown, slightly moist, dense, partially cemented, sandy silt (ML) | ■ | D1-2I | 50 | 11.0 | 115 | |
| | 10 | | | ■ | D1-3I | 50/6" | | | |

BORING LOG 10218.02 - 19 ACRE OGG PROPERTY.GPJ WKA.GDT 9/15/14 2:11 PM

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**FIGURE 3**

**Project: 19 Acre Ogg Property**
**Project Location: Placer County, California**
**WKA Number: 10218.02**

# LOG OF SOIL BORING D2

Sheet 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 8/5/14 | Logged By | JDW | Checked By | DJP |
| Drilling Method | Solid Flight Augers | Drilling Contractor | V&W Drilling, Inc. | Total Depth of Drill Hole | 9.5 feet |
| Drill Rig Type | CME-75 | Diameter(s) of Hole, inches | 6" | Approx. Surface Elevation, ft MSL | |
| Groundwater Depth [Elevation], feet | Groundwater was not encountered | Sampling Method(s) | California Modified | Drill Hole Backfill | Soil Cuttings |
| Remarks | | | | Driving Method and Drop | 140-lb automatic hammer; 30-inch drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE | SAMPLE NUMBER | NUMBER OF BLOWS | MOISTURE CONTENT, % | DRY UNIT WEIGHT, pcf | ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|
| | | | Light brown, slightly moist, sandy silt (ML) | | | | | | |
| | | | Dark red brown, slightly moist, very stiff, silty clay (CL) | ■ | D2-1I | 32 | 11.9 | 93 | |
| | | | Brown, slightly moist, variably cemented, very dense, sandy silt (ML) | ■ | D2-2I | 50/6" | | | |
| | 5 | | | | | | | | |
| | | | Yellow brown, slightly moist, very dense, well graded sand (SW) | ■ | D2-3I | 50/6" | 6.6 | 109 | |

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**FIGURE 4**

**Project: 19 Acre Ogg Property**
**Project Location: Placer County, California**
**WKA Number: 10218.02**

# LOG OF SOIL BORING D3

Sheet 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 8/5/14 | Logged By | JDW | Checked By | DJP |
| Drilling Method | Solid Flight Augers | Drilling Contractor | V&W Drilling, Inc. | Total Depth of Drill Hole | 9.5 feet |
| Drill Rig Type | CME-75 | Diameter(s) of Hole, inches | 6" | Approx. Surface Elevation, ft MSL | |
| Groundwater Depth [Elevation], feet | Groundwater was not encountered | Sampling Method(s) | California Modified | Drill Hole Backfill | Soil Cuttings |
| Remarks | | | | Driving Method and Drop | 140-lb automatic hammer; 30-inch drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE | SAMPLE NUMBER | NUMBER OF BLOWS | MOISTURE CONTENT, % | DRY UNIT WEIGHT, pcf | ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|
| | | | Light brown, slightly moist, sandy silt (ML) | | | | | | |
| | | | Dark brown, moist, very hard, silty clay (CL) | | | | | | |
| | | | Light brown with orange mottling, slightly moist, very dense, variably cemented, sandy silt (ML) | ■ | D3-1I | 50/6" | 30.6 | 80 | |
| | | | | ■ | D3-2I | 50/6" | 21.0 | 88 | |
| | 5 | | | | | | | | |
| | | | | ■ | D3-3I | 50/6" | | | |

SAMPLE DATA | TEST DATA

BORING LOG 10218.02 - 19 ACRE OGG PROPERTY.GPJ WKA.GDT 9/15/14 2:11 PM

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**FIGURE 5**

**Project: 19 Acre Ogg Property**
**Project Location: Placer County, California**
**WKA Number: 10218.02**

# LOG OF SOIL BORING D4

Sheet 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 8/5/14 | Logged By | JDW | Checked By | DJP |
| Drilling Method | Solid Flight Augers | Drilling Contractor | V&W Drilling, Inc. | Total Depth of Drill Hole | 16.0 feet |
| Drill Rig Type | CME-75 | Diameter(s) of Hole, inches | 6" | Approx. Surface Elevation, ft MSL | |
| Groundwater Depth [Elevation], feet | Groundwater was not encountered | Sampling Method(s) | California Modified | Drill Hole Backfill | Soil Cuttings |
| Remarks | | | | Driving Method and Drop | 140-lb automatic hammer; 30-inch drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE | SAMPLE NUMBER | NUMBER OF BLOWS | MOISTURE CONTENT, % | DRY UNIT WEIGHT, pcf | ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|
| | | | Light brown, slightly moist, clayey silt (ML) | | | | | | |
| | | | Dark brown, slightly moist, very hard, silty clay (CL) | ■ | D4-1I | 50/6" | 12.4 | 112 | |
| | | | Light brown to brown, slightly moist, very dense, variably cemented, sandy silt (ML) | | | | | | |
| | 5 | | light gray with orange mottling | ■ | D4-2I | 50/6" | | | |
| | 10 | | very hard, variably cemented, clayey silt | ■ | D4-3I | 50/6" | | | |
| | 15 | | Yellow brown, slightly moist, very dense, well graded sand (SW) | ■ | D4-4I | 50/6" | 7.5 | 104 | |

BORING LOG 10218.02 - 19 ACRE OGG PROPERTY.GPJ WKA.GDT 9/15/14 2:11 PM

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**FIGURE 6**

**Project:** 19 Acre Ogg Property
**Project Location:** Placer County, California
**WKA Number:** 10218.02

# LOG OF SOIL BORING D5

Sheet 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 8/5/14 | Logged By | JDW | Checked By | DJP |
| Drilling Method | Solid Flight Augers | Drilling Contractor | V&W Drilling, Inc. | Total Depth of Drill Hole | 16.0 feet |
| Drill Rig Type | CME-75 | Diameter(s) of Hole, inches | 6" | Approx. Surface Elevation, ft MSL | |
| Groundwater Depth [Elevation], feet | Groundwater was not encountered | Sampling Method(s) | California Modified | Drill Hole Backfill | Soil Cuttings |
| Remarks | | | | Driving Method and Drop | 140-lb automatic hammer; 30-inch drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE | SAMPLE NUMBER | NUMBER OF BLOWS | MOISTURE CONTENT, % | DRY UNIT WEIGHT, pcf | ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|
| | | | Dark red brown, slightly moist, loose, slightly clayey, sandy silt (ML) | | | | | | |
| | | | | ■ | D5-1I | 10 | 11.4 | 109 | |
| | 5 | | hard, clayey silt | ■ | D5-2I | 39 | 24.8 | 97 | |
| | 10 | | Light gray, slightly moist, medium dense, silty fine sand (SM) | ■ | D5-3I | 28 | | | |
| | 15 | | partially cemented | ■ | D5-4I | 50/6" | | | |

BORING LOG 10218.02 - 19 ACRE OGG PROPERTY.GPJ WKA.GDT 9/15/14 2:11 PM

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**FIGURE 7**

**Project: 19 Acre Ogg Property**
**Project Location: Placer County, California**
**WKA Number: 10218.02**

# LOG OF SOIL BORING D6

Sheet 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 8/5/14 | Logged By | JDW | Checked By | DJP |
| Drilling Method | Solid Flight Augers | Drilling Contractor | V&W Drilling, Inc. | Total Depth of Drill Hole | 15.5 feet |
| Drill Rig Type | CME-75 | Diameter(s) of Hole, inches | 6" | Approx. Surface Elevation, ft MSL | |
| Groundwater Depth [Elevation], feet | Groundwater was not encountered | Sampling Method(s) | California Modified | Drill Hole Backfill | Soil Cuttings |
| Remarks | | | | Driving Method and Drop | 140-lb automatic hammer; 30-inch drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE | SAMPLE NUMBER | NUMBER OF BLOWS | MOISTURE CONTENT, % | DRY UNIT WEIGHT, pcf | ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|
| | | | Dark brown, moist, very hard, silty clay (CL) | | | | | | |
| | | | | ■ | D6-1I | 50/6" | 12.0 | 113 | |
| | | | Red brown, slightly moist, very hard, variably cemented, clayey silt (ML) | | | | | | |
| | 5 | | dense, sandy silt | ■ | D6-2I | 42 | | | |
| | 10 | | Light brown, moist, very dense, silty fine sand (SM) | ■ | D6-3I | 50/6" | 16.3 | 108 | |
| | 15 | | Light brown, moist, very dense, variably cemented, clayey sand (SC) | ■ | D6-4I | 50/9" | | | |

BORING LOG 10218.02 - 19 ACRE OGG PROPERTY.GPJ WKA.GDT 9/15/14 2:11 PM

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**FIGURE 8**

**Project: 19 Acre Ogg Property**
**Project Location: Placer County, California**
**WKA Number: 10218.02**

# LOG OF SOIL BORING D7

Sheet 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 8/5/14 | Logged By | JDW | Checked By | DJP |
| Drilling Method | Solid Flight Augers | Drilling Contractor | V&W Drilling, Inc. | Total Depth of Drill Hole | 11.5 feet |
| Drill Rig Type | CME-75 | Diameter(s) of Hole, inches | 6" | Approx. Surface Elevation, ft MSL | |
| Groundwater Depth [Elevation], feet | Groundwater was not encountered | Sampling Method(s) | California Modified | Drill Hole Backfill | Soil Cuttings |
| Remarks | | | | Driving Method and Drop | 140-lb automatic hammer; 30-inch drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE | SAMPLE NUMBER | NUMBER OF BLOWS | MOISTURE CONTENT, % | DRY UNIT WEIGHT, pcf | ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|
| | | | Brown, slightly moist, medium dense, silty sand (SM) | | | | | | |
| | | | | ■ | D7-1I | 20 | 8.0 | 107 | |
| | 5 | | | ■ | | | | | |
| | | | Light gray brown, slightly moist, medium dense, sandy silt (ML) | ■ | D7-2I | 30 | 22.1 | 94 | |
| | 10 | | | ■ | D7-3I | 27 | | | |
| | | | variably cemented | | | | | | |

BORING LOG 10218.02 - 19 ACRE OGG PROPERTY.GPJ WKA.GDT 9/15/14 2:11 PM

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**FIGURE 9**

**Project: 19 Acre Ogg Property**
**Project Location: Placer County, California**
**WKA Number: 10218.02**

# LOG OF SOIL BORING D8

Sheet 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | **8/5/14** | Logged By | **JDW** | Checked By | **DJP** |
| Drilling Method | **Solid Flight Augers** | Drilling Contractor | **V&W Drilling, Inc.** | Total Depth of Drill Hole | **14.5 feet** |
| Drill Rig Type | **CME-75** | Diameter(s) of Hole, inches | **6"** | Approx. Surface Elevation, ft MSL | |
| Groundwater Depth [Elevation], feet | **Groundwater was not encountered** | Sampling Method(s) | **California Modified** | Drill Hole Backfill | **Soil Cuttings** |
| Remarks | | | | Driving Method and Drop | **140-lb automatic hammer; 30-inch drop** |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE | SAMPLE NUMBER | NUMBER OF BLOWS | MOISTURE CONTENT, % | DRY UNIT WEIGHT, pcf | ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|
| | | | Light red brown, slightly moist, sandy silt (ML) | | | | | | |
| | | | Dark red brown, slightly moist, hard, silty clay (CL) | ■ | D8-1I | 37 | 12.9 | 112 | |
| | | | Light brown, slightly moist, very dense, sandy silt (ML) | ■ | D8-2I | 50/6" | | | |
| | 5 | | slightly clayey | | | | | | |
| | | | Light gray, slightly moist, very dense, partially cemented, silty fine sand (SM) | ■ | D8-3I | 50/6" | | | |
| | 10 | | | | | | | | |
| | | | | ■ | D8-4I | 50/6" | | | |

BORING LOG 10218.02 - 19 ACRE OGG PROPERTY.GPJ WKA.GDT 9/15/14 2:11 PM

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**FIGURE 10**

| | |
|---|---|
| **Project: 19 Acre Ogg Property**<br>**Project Location: Placer County, California**<br>**WKA Number: 10218.02** | **LOG OF SOIL BORING D9**<br>Sheet 1 of 1 |

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | **8/5/14** | Logged By | **JDW** | Checked By | **DJP** |
| Drilling Method | **Solid Flight Augers** | Drilling Contractor | **V&W Drilling, Inc.** | Total Depth of Drill Hole | **11.5 feet** |
| Drill Rig Type | **CME-75** | Diameter(s) of Hole, inches | **6"** | Approx. Surface Elevation, ft MSL | |
| Groundwater Depth [Elevation], feet | **Groundwater was not encountered** | Sampling Method(s) | **California Modified** | Drill Hole Backfill | **Soil Cuttings** |
| Remarks | | | | Driving Method and Drop | **140-lb automatic hammer; 30-inch drop** |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | SAMPLE DATA: SAMPLE NUMBER | SAMPLE DATA: NUMBER OF BLOWS | TEST DATA: MOISTURE CONTENT, % | TEST DATA: DRY UNIT WEIGHT, pcf | TEST DATA: ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|
| | | | Light brown, slightly moist, sandy silt (ML) | | | | | | |
| | | | Dark red brown, moist, stiff, silty clay (CL) | ■ | D9-1I | 12 | 14.1 | 111 | |
| | 5 | | Gray, red brown, slightly moist, medium dense, slightly clayey, sandy silt (ML) | ■ | D9-2I | 38 | 21.2 | 103 | |
| | 10 | | Light gray brown, moist, dense, slightly clayey, silty fine sand (SM) | ■ | D9-3I | 45 | | | |

BORING LOG 10218.02 - 19 ACRE OGG PROPERTY.GPJ WKA.GDT 9/15/14 2:11 PM

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**FIGURE 11**

# UNIFIED SOIL CLASSIFICATION SYSTEM

| MAJOR DIVISIONS | | SYMBOL | CODE | TYPICAL NAMES |
|---|---|---|---|---|
| COARSE GRAINED SOILS (More than 50% of soil > no. 200 sieve size) | GRAVELS (More than 50% of coarse fraction > no. 4 sieve size) | GW | | Well graded gravels or gravel - sand mixtures, little or no fines |
| | | GP | | Poorly graded gravels or gravel - sand mixtures, little or no fines |
| | | GM | | Silty gravels, gravel - sand - silt mixtures |
| | | GC | | Clayey gravels, gravel - sand - clay mixtures |
| | SANDS (50% or more of coarse fraction < no. 4 sieve size) | SW | | Well graded sands or gravelly sands, little or no fines |
| | | SP | | Poorly graded sands or gravelly sands, little or no fines |
| | | SM | | Silty sands, sand - silt mixtures |
| | | SC | | Clayey sands, sand - clay mixtures |
| FINE GRAINED SOILS (50% or more of soil < no. 200 sieve size) | SILTS & CLAYS LL < 50 | ML | | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity |
| | | CL | | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays |
| | | OL | | Organic silts and organic silty clays of low plasticity |
| | SILTS & CLAYS LL ≥ 50 | MH | | Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts |
| | | CH | | Inorganic clays of high plasticity, fat clays |
| | | OH | | Organic clays of medium to high plasticity, organic silty clays, organic silts |
| HIGHLY ORGANIC SOILS | | Pt | | Peat and other highly organic soils |
| ROCK | | RX | | Rocks, weathered to fresh |
| FILL | | FILL | | Artificially placed fill material |

## OTHER SYMBOLS

= Drive Sample: 2-1/2" O.D. Modified California sampler

= Drive Sampler: no recovery

= SPT Sampler

= Initial Water Level

= Final Water Level

= Estimated or gradational material change line

= Observed material change line

Laboratory Tests

PI = Plasticity Index

EI = Expansion Index

UCC = Unconfined Compression Test

TR = Triaxial Compression Test

GR = Gradational Analysis (Sieve)

K = Permeability Test

## GRAIN SIZE CLASSIFICATION

| CLASSIFICATION | RANGE OF GRAIN SIZES | |
|---|---|---|
| | U.S. Standard Sieve Size | Grain Size in Millimeters |
| BOULDERS | Above 12" | Above 305 |
| COBBLES | 12" to 3" | 305 to 76.2 |
| GRAVEL | 3" to No. 4 | 76.2 to 4.76 |
| coarse (c) | 3" to 3/4" | 76.2 to 19.1 |
| fine (f) | 3/4" to No. 4 | 19.1 to 4.76 |
| SAND | No. 4 to No. 200 | 4.76 to 0.074 |
| coarse (c) | No. 4 to No. 10 | 4.76 to 2.00 |
| medium (m) | No. 10 to No. 40 | 2.00 to 0.420 |
| fine (f) | No. 40 to No. 200 | 0.420 to 0.074 |
| SILT & CLAY | Below No. 200 | Below 0.074 |

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**UNIFIED SOIL CLASSIFICATION SYSTEM**

19 ACRE OGG PROPERTY

Placer County, California

| FIGURE | 12 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 8/14 |
| WKA NO. | 10218.02 |

# APPENDIX A

Field and Laboratory Testing

# APPENDIX A

## A. GENERAL INFORMATION

The performance of a geotechnical engineering investigation for the 19-acre Ogg Property residential development located west of Antelope Road, south of PFE Road, in Placer County, California, was authorized by Mr. Rob Wilson on July 28, 2014. Authorization was for an investigation as described in our proposal letter dated July 22, 2014, sent to our client, Meritage Homes, whose mailing address is 1671 Monte Vista Avenue, Suite 214, Vacaville, California 95688; telephone (707) 359-2000; facsimile (707) 359-2054.

## B. FIELD EXPLORATION

A total of nine borings were drilled on August 5, 2014, at the approximate locations indicated on Figure 2 to maximum depths of approximately 9½ to 16 feet below existing grades, utilizing a CME-75 truck-mounted drill rig equipped with six-inch diameter solid helical augers. At various intervals, relatively undisturbed soil samples were recovered with a 2½-inch O.D., 2-inch I.D., modified California sampler (ASTM D3550) driven by an automatic 140-pound hammer freely falling 30 inches. The number of blows of the hammer required to drive the 18-inch long sampler each 6-inch interval was recorded. The sum of the blows required to drive the sampler the lower 12-inch interval is designated the penetration resistance or "blow count" for that particular drive. The actual blow counts recorded with the sampler are presented on the boring logs.

The samples obtained with the modified California sampler were retained in 2-inch diameter by 6-inch long, thin-walled brass tubes contained within the sampler. Immediately after recovery, the field engineer visually classified the soil in the tubes and the ends of the tubes were sealed to preserve the natural moisture contents. Bulk samples of the surface and near-surface materials also were obtained at various locations and depths. The soil samples were submitted to our laboratory for additional classification (ASTM D2488) and selection of samples for testing.

The Logs of Soil Borings, Figures 3 through 11, contain descriptions of the soils encountered in each boring. A Legend explaining the Unified Soil Classification System and the symbols used on the logs is contained on Figure 12.

## C. LABORATORY TESTING

Selected undisturbed samples of the soils were tested to determine dry unit weight (ASTM D2937) and natural moisture content (ASTM D2216). The results of these tests are included on the boring logs at the depth each sample was obtained.

Two bulk sample of the near-surface soil were subjected to Expansion Index testing (ASTM D4829); the results of these tests are presented on Figures A1 and A2.

One representative bulk sample of anticipated pavement subgrade materials was subjected to Resistance-value ("R") testing in accordance with California Test 301. Results of the R-value test are contained on Figure A3.

Three representative samples of near-surface soils were submitted to Sunland Analytical to determine the soil pH and minimum resistivity (California Test 643), Sulfate concentration (California Test 417) and Chloride concentration (California Test 422). Results of these tests are included as Figure A4 through A6.

# EXPANSION INDEX TEST RESULTS

ASTM D4829

MATERIAL DESCRIPTION: Dark brown, silty clay

LOCATION: D1

| Sample Depth | Pre-Test Moisture (%) | Post-Test Moisture (%) | Dry Density (pcf) | Expansion Index |
|---|---|---|---|---|
| 1'-3' | 8.7 | 21.7 | 110.7 | **52** |

CLASSIFICATION OF EXPANSIVE SOIL *

| EXPANSION INDEX | POTENTIAL EXPANSION |
|---|---|
| 0 - 20 | Very Low |
| 21 - 50 | Low |
| **51 - 90** | **Medium** |
| 91 - 130 | High |
| Above 130 | Very High |

* From ASTM D4829, Table 1

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**EXPANSION INDEX TEST RESULTS**

19 ACRE OGG PROPERTY

Placer County, California

| FIGURE | A1 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 8/14 |
| WKA NO. | 10218.02 |

# EXPANSION INDEX TEST RESULTS

ASTM D4829

MATERIAL DESCRIPTION: Dark brown, silty clay

LOCATION: D6

| Sample Depth | Pre-Test Moisture (%) | Post-Test Moisture (%) | Dry Density (pcf) | Expansion Index |
|---|---|---|---|---|
| 0'-3' | 12.4 | 23.0 | 104.5 | **59** |

CLASSIFICATION OF EXPANSIVE SOIL *

| EXPANSION INDEX | POTENTIAL EXPANSION |
|---|---|
| 0 - 20 | Very Low |
| 21 - 50 | Low |
| **51 - 90** | **Medium** |
| 91 - 130 | High |
| Above 130 | Very High |

* From ASTM D4829, Table 1

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**EXPANSION INDEX TEST RESULTS**

19 ACRE OGG PROPERTY

Placer County, California

| FIGURE | A2 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 8/14 |
| WKA NO. | 10218.02 |

# RESISTANCE VALUE TEST RESULTS

(California Test 301)

MATERIAL DESCRIPTION: Dark reddish brown, silty clay

LOCATION: D8 (1'-3')

| Specimen No. | Dry Unit Weight (pcf) | Moisture @ Compaction (%) | Exudation Pressure (psi) | Expansion Pressure (dial) | Expansion Pressure (psf) | R Value |
|---|---|---|---|---|---|---|
| 1 | 116 | 15.1 | 361 | 47 | 204 | |
| 2 | 112 | 16.1 | 553 | 42 | 182 | |
| 3 | | | | | | |

Sample extruded, therefore R-Value = 5

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**RESISTANCE VALUE TEST RESULTS**

19 ACRE OGG PROPERTY

Placer County, California

| FIGURE | A3 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 8/14 |
| WKA NO. | 10218.02 |

# Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 08/15/2014
Date Submitted 08/12/2014

To: Dominic Potestio
Wallace-Kuhl & Assoc.
3050 Industrial Blvd.
West Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager \

The reported analysis was requested for the following location:
Location : 10218.02-19 AC OGG Site ID : D1 @ 0-3 FT.
Your purchase order number is 3595.
Thank you for your business.

* For future reference to this analysis please use SUN # 67708-140537.

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EVALUATION FOR SOIL CORROSION

| | | | |
|---|---|---|---|
| Soil pH | 6.58 | | |
| Minimum Resistivity | 2.68 ohm-cm (x1000) | | |
| Chloride | 16.5 ppm | 00.00165 | % |
| Sulfate | 7.9 ppm | 00.00079 | % |

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

WallaceKuhl & ASSOCIATES

**CORROSION TEST RESULTS**

19 ACRE OGG PROPERTY

Placer County, California

| FIGURE | A4 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 8/14 |

WKA NO. 10218.02

# Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 08/15/2014
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To: Dominic Potestio
Wallace-Kuhl & Assoc.
3050 Industrial Blvd.
West Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 10218.02-19 AC OGG Site ID : D5 @ 0-3 FT.
Your purchase order number is 3595.
Thank you for your business.

* For future reference to this analysis please use SUN # 67708-140538.

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EVALUATION FOR SOIL CORROSION

| | | | |
|---|---|---|---|
| Soil pH | 6.65 | | |
| Minimum Resistivity | 3.48 ohm-cm (x1000) | | |
| Chloride | 7.1 ppm | 00.00071 | % |
| Sulfate | 5.2 ppm | 00.00052 | % |

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

WallaceKuhl & ASSOCIATES

**CORROSION TEST RESULTS**

19 ACRE OGG PROPERTY

Placer County, California

| FIGURE | A5 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 8/14 |
| WKA NO. 10218.02 | |

# Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 08/15/2014
Date Submitted 08/12/2014

To: Dominic Potestio
Wallace-Kuhl & Assoc.
3050 Industrial Blvd.
West Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 10218.02-19 AC OGG Site ID : D6 @ 0-3.5 FT.
Your purchase order number is 3595.
Thank you for your business.

* For future reference to this analysis please use SUN # 67708-140539.

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EVALUATION FOR SOIL CORROSION

| | | | |
|---|---|---|---|
| Soil pH | 7.76 | | |
| Minimum Resistivity | 1.74 ohm-cm (x1000) | | |
| Chloride | 8.1 ppm | 00.00081 | % |
| Sulfate | 4.0 ppm | 00.00040 | % |

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

WallaceKuhl & ASSOCIATES

**CORROSION TEST RESULTS**

19 ACRE OGG PROPERTY

Placer County, California

| FIGURE | A6 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 8/14 |
| WKA NO. 10218.02 | |

# APPENDIX B

Earthwork Specifications

APPENDIX B

*EARTHWORK SPECIFICATIONS*

**19-ACRE OGG PROPERTY**

Placer County, California

WKA No. 10218.02

## GEOTECHNICAL ENGINEERING REPORT

A Geotechnical Engineering Report (WKA No. 10218.02, dated September 15, 2014) has been prepared for this site by Wallace - Kuhl & Associates, Geotechnical Engineers of West Sacramento, California; (916) 372-1434. A copy is available for review at the office of Wallace - Kuhl & Associates. The information contained in the Geotechnical Engineering Report was obtained for design purposes only.

## GENERAL DESCRIPTION

This item shall include all clearing and grubbing, site demolition, preparation of land to be filled, spreading, compaction, observation and testing of the fill, and all subsidiary work necessary to complete the grading of the site to conform with the lines, grades and slopes as shown on the accepted plans.

## CLEARING, GRUBBING AND PREPARING BUILDING AND PAVEMENT AREAS

All vegetation; loose and/or saturated materials; existing structures; septic tanks; rubble and rubbish; and, underground utilities or irrigation pipes to be relocated or abandoned shall be removed and disposed of so as to leave the areas that have been disturbed with a neat and finished appearance, free from unsightly debris. Tree removal shall include the rootball and all surface roots larger than one-half inch (½") in diameter. Excavations and depressions resulting from the removal of such items, as well as any existing excavations or loose soil deposits, as determined by the Geotechnical Engineer, shall be widened to allow access to construction equipment, cleaned out to firm, undisturbed soil, and backfilled with suitable materials in accordance with these specifications. Water wells shall be abandoned in accordance with Placer County Department of Environmental Health requirements.

Areas of removed trees and structures shall be thoroughly cross-ripped to a depth of twelve inches (12") to expose any remaining roots, structures and rubble. Cross-ripping operations shall be performed in the presence of the Geotechnical Engineer. Resulting excavations and

depressions shall be widened to allow access to construction equipment, cleaned out to firm, undisturbed soil and backfilled with suitable materials in accordance with these specifications.

Exposed soil subgrades to receive fill, left at-grade or achieved by excavation, shall be scarified to a depth of eight inches (12"), uniformly moisture conditioned to at least the optimum moisture content and compacted to at least ninety percent (90%) of the maximum dry density as determined by the ASTM D1557 Test Method. Recompaction operations shall be performed in the presence of the Geotechnical Engineer who will evaluate the performance of the materials under compactive load. Unstable soil deposits, as determined by the Geotechnical Engineer, shall be excavated to expose a firm base and grades restored with engineered fill in accordance with these specifications

## MATERIALS

Proposed fill material shall be free from organic matter and other unsuitable substances and shall be approved by the Geotechnical Engineer. Clods, rocks, hard lumps or cobbles exceeding six inches (6") shall be removed from any fill supporting the buildings. Imported fill material shall be granular soils with a Plasticity Index of 15 or less; an Expansion Index of 20 or less; and, be free of particles greater than three inches in maximum dimension. All imported fill sources shall be sampled, tested and approved by the Geotechnical Engineer prior to being transported to the site.

## PLACING, SPREADING AND COMPACTING FILL MATERIAL

The selected fill material shall be placed in layers which when compacted shall not exceed six inches (6") in compacted thickness. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to promote uniformity of material in each layer.

When the moisture content of the fill material is less than the recommended moisture, water shall be added until the proper moisture content is achieved.

When the moisture content of the fill material is too high to permit the specified compaction to be attained, the fill material shall be aerated by blading or other methods until the moisture content is satisfactory.

After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to not less than ninety percent (90%) of the maximum dry density as determined by the ASTM

D1557 Test Method. Compaction shall be undertaken with a heavy, self-propelled, sheepsfoot compactor, (Caterpillar 815 or equivalent) capable of achieving the specified density and shall be accomplished while the fill material is at the required moisture content. Each layer shall be compacted over its entire area until the desired density has been obtained.

## SEASONAL LIMITS

Fill materials shall not be placed, spread or rolled during unfavorable weather conditions. When heavy rains interrupt the work, fill operations shall not be resumed until field tests indicate that the moisture content and density of the fill are satisfactory.

## FIELD DENSITY TESTS

The Geotechnical Engineer or his representative shall make field density tests after compaction of each layer of fill. Additional layers of fill shall not be spread until field density tests indicate the specified density has been obtained.

## FINAL SUBGRADE PREPARATION

The upper twelve inches (12") of all final building pad subgrades shall be uniformly compacted to at least ninety percent (90%) of the maximum dry density as determined by the ASTM D1557 Test Method, regardless of whether final subgrade elevation is attained by filling, excavation or is left at existing grade. The upper 12 inches of the building pad subgrades should be brought to a uniform, near saturated moisture condition by liberal watering or sprinkling, immediately prior to slab concrete placement. Site conditions should be field checked by our representative within 48 hours prior to slab construction.

The upper twelve inches (12") of all final pavement subgrades shall be uniformly compacted to at least ninety-five percent (95%) of the maximum dry density as determined by the ASTM D1557 Test Method.

## TESTING

Observation and testing by the Geotechnical Engineer or his representative shall be provided during all filling and compaction operations. The grading contractor shall give at least twenty-four (24) hours notice prior to beginning such operations to allow proper scheduling of the work.

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