Wallace Kuhl & Associates

*Geotechnical Engineering Report*

**PLACER GREENS PROPERTY**

Placer County, California

WKA No. 10281.02

September 17, 2014

*Prepared For:*

Meritage Homes

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*Geotechnical Engineering Report*

**PLACER GREENS PROPERTY**

Placer County, California

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## INTRODUCTION

We have completed a geotechnical engineering investigation for the planned Placer Greens Property single-family residential development, located southeasterly of PFE Road and Antelope 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. a site reconnaissance;
2. review of historic USGS topographic maps and geologic maps of the property;
3. review of previous geotechnical reports prepared for the project site and in the vicinity of the project site;
4. subsurface exploration, including the drilling and sampling of six borings to depths of approximately 10 to 15 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:

- *Geotechnical Engineering Report* (WKA No. 10218.02, dated September 15, 2014) prepared for the 19-acre Ogg Property residential development, which is located adjacent to and west of the project site; and,

- *Geotechnical Engineering Report* (WKA No. 10215.02, dated September 12, 2014) prepared for the 25-acre Pruett Property residential development, which is located approximately ¼-mile west of the project site; and,
- *Preliminary Geotechnical Engineering Report* (WKA No. 5567.02, dated July 9, 2003) prepared by Wallace-Kuhl & Associates, Inc., for a proposed commercial development on the Placer Greens property, which included the project site.

Logs of Borings (Figures 3 through 8) and associated laboratory testing (Figures A1 and A2) from the previous report (WKA No. 5567.02) also were utilized in the preparation of this report and are included in this report.

Figures and Attachments

This report contains a Vicinity Map as Figure 1; a Site Plan with approximate boring locations as Figure 2; Logs of Borings as Figures 3 through 8; and, an explanation of the symbols and classification system used on the logs as Figure 9. Appendix A contains information of a general nature regarding exploratory methods used during the previous field investigation and results of previous 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, sounds walls, interior paved residential streets, and typical residential landscaping.

## FINDINGS

Site Description

The approximate 45 acre, square-shaped parcel is located southerly of PFE Road and easterly of Antelope Road in Placer County, California. The site is bounded to the north by PFE Road, beyond which is vacant land and a rural residence; to the east by an existing industrial complex;

to the south by an existing storage facility; and, to the west by Antelope Road, beyond which are rural residences and vacant land.

On the day of our recent site visit, September 12, 2014, the site was undeveloped and covered with a moderate to dense growth of grass and weeds. A low lying drainage, or tributary, associated with Dry Creek was observed meandering through the eastern portion of the property in a relatively, north-south direction. The drainage area supported mature trees and a dense growth of weeds but did not contain water on the day of our field investigation. Off-road vehicle trails also were observed in the area of the tributary. These observations are generally consistent with the observations during the initial field investigation on June 11, 2003.

The surface of the site is gently rolling terrain with surface elevations of approximately +110 to +140 feet mean sea level (msl) based on review of the USGS *Topographic Map of the Citrus Heights Quadrangle*, dated 1992.

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 dense and partially cemented, sandy and clayey silts and silty sands to the maximum depth explored of approximately 15 feet below existing site grades. Near-surface sandy and silty clays were encountered in three of the borings at depths of approximately 1½ to 2 feet below existing site grades.

Please refer to the Logs of Borings (Figures 3 through 8) for more information regarding the soils at a particular location.

Groundwater

Permanent groundwater was not encountered within the borings performed on June 11, 2003, to the maximum depth explored of approximately 15 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 ¾-mile westerly 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

### 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.

### 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: 38.7272° N<br>Longitude: -121.3251° 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) | $S_S$ | 0.526 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) | $F_a$ | 1.190 |
| 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 | $S_{MS}$ | 0.626 g |
| | Equation 11.4-2 | Equation 16-38 | $S_{M1}$ | 0.396 g |
| Design Spectral Acceleration Parameters | Equation 11.4-3 | Equation 16-39 | $S_{DS}$ | 0.417 g |
| | Equation 11.4-4 | Equation 16-40 | $S_{D1}$ | 0.264 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.

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 soils indicates a medium expansion potential when tested in accordance with the UBC 29-2 (ASTM D4829) test method (see Figure A1). 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

The surface and near-surface soils exhibit poor subgrade qualities for support of asphalt concrete pavements. Laboratory testing of the near-surface soils indicate that these materials possess a Resistance ("R") value of 6 as presented on Figure A2. Therefore, based on the results of the laboratory testing and our experience on nearby projects with similar soil types, we have selected an R-value of 5 for the calculation of alternative pavement sections.

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 fencing, 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. We recommend construction bid documents contain a unit price (price per cubic yard) for additional excavation of unsuitable materials and replacement with engineered fill.

Subgrades within areas of removed trees and shrubs should be ripped and cross-ripped to a depth of at least 12 inches to expose any remaining roots or debris. All exposed debris and roots should be cleared from the site. Adequate removal of debris and tree roots may require laborers and handpicking to clean the subgrade soils to the satisfaction of our on-site representative. All depressions resulting from the removal of such items, as well as all loose, disturbed or saturated soils in areas of clearing operations or tree removal, as identified by our representative in the field, should be cleaned out to firm, undisturbed soil, as determined by our representative, and restored to grade with engineered fill compacted in accordance with the recommendations of this report.

The existing drainages associated with Dry Creek should be fully drained of water and cleaned of organics. Saturated and unstable soils exposed within ponds and ditches should be removed to expose firm, native materials as determined by our representative. The exposed surface should be scarified to a depth of 12 inches and compacted to at least 90 percent of the ASTM D1557 maximum dry density. These soils will likely be saturated and will require aeration and a period of drying to allow proper compaction. Organically contaminated soils will not be allowed for use in engineered fill construction. Our representative will provide alternative recommendations for stabilizing the bottom of the excavations, as conditions dictate.

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, 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.

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.

The emergence of unstable soil conditions during site grading operations could indicate the presence of subsurface structures, rubble, debris or other unsuitable materials. Areas exhibiting instability, as determined by our field representative, should be excavated to expose dense, stable soils. It will be crucial that our representative be involved during site grading operations to observe the equipment in operation.

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; and, be free of particles greater than three inches in maximum dimension. 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 "minimum" only; final reinforcement and joint spacing should be determined by the structural engineer. 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.

Retaining Wall Design

Retaining walls capable of slight rotation about their base (unrestrained at the top or sides) should be capable of resisting "active" lateral earth pressures equal to an equivalent fluid pressure of 40 psf per foot of wall backfill for horizontal backfill conditions. If the walls are fixed at the top, they should be capable of resisting "at-rest" lateral earth pressures equal to an equivalent fluid pressure of 60 psf per foot for horizontal backfill conditions. For retaining walls with backfill sloped at a maximum gradient of two horizontal to one vertical (2:1), 20 psf per foot of depth should be added to the values for horizontal backfill. Retaining wall foundations should extend at least 12 inches below soil grade and may be designed in accordance with the appropriate recommendations contained in the Foundation section of this report.

Backfill behind retaining walls should be fully drained to prevent the build-up of hydrostatic pressure behind the wall. Retaining walls should be provided with a drainage blanket (Class 2 permeable material, Caltrans Specification Section 68-2.02F(3)) at least one-foot wide extending from the base of wall to within one foot of the top of the wall. The top foot above the drainage layer should consist of compacted on-site materials, unless covered by concrete flatwork or pavements. Weep holes or perforated PVC pipe should be provided near the base of the wall to allow drainage of accumulated water. Drainpipes, if used, should slope to discharge at no less than a one percent fall to suitable drainage facilities. Open-graded ½-inch to ¾-inch crushed rock may be used in lieu of the Class 2 permeable material, if the rock and drain pipe are completely enveloped in an approved nonwoven geotextile filter fabric.

Structural backfill materials for retaining walls (other than the drainage layer) should consist of on-site or imported soils free of significant quantities of rubbish, rubble, organics and rock over six inches in size; clays are not allowed for use as wall backfill. Structural backfill should be placed in lifts not exceeding 12 inches in compacted thickness, and should be mechanically compacted to at least 90 percent relative compaction. The lateral pressures recommended above assume that clay soils, if exposed during site excavations, will not be used as fill or backfill behind retaining walls.

## Sound Wall Foundation Systems

### *Shallow Foundations*

The proposed sound walls may be supported upon a shallow spread and/or continuous foundation embedded at least 18 inches below the lowest adjacent soil grade into firm undisturbed native soil or properly placed and compacted engineered fill, as confirmed by our representative. Continuous foundations should maintain a minimum width of 12 inches and isolated spread foundations should be at least 12 inches in plan dimension. Foundations so established may be sized for maximum net allowable soil bearing pressures of 2250 pounds per square foot (psf) for dead plus live loads, with a one-third increase for total loads including the short-term effects of wind or seismic forces. The weight of the foundation concrete extending below lowest adjacent soil grade may be disregarded in sizing computations. The project structural engineer should determine the final dimensions and structural reinforcement of the sound wall foundations.

Resistance to lateral foundation displacement for conventional foundations may be computed using an allowable friction factor of 0.30, which may be multiplied by the effective vertical load on the foundation. Additional lateral resistance may be computed using an allowable passive earth pressure of 300 psf per foot of depth. These two modes of resistance should not be added unless the frictional value is reduced by 50 percent since full mobilization of these resistances typically occurs at different degrees of horizontal movement. Where foundations extend within five feet of slopes steeper than three horizontal to one vertical (3:1) or steeper, six inches of embedment should be disregarded.

We recommend that all foundation excavations be observed by our representative prior to placement of reinforcement and concrete to verify firm bearing materials are exposed. If unsuitable materials are encountered at the proposed bottom of foundation elevation, the unsuitable materials should be removed and replaced with suitable material compacted to 90 percent of the maximum dry density as determined by ASTM D1557. Alternatively, the foundation may be extended deeper to bear directly on suitable soils.

*Cast-in-Place Concrete Drilled Piers*

Sound walls could also be supported on cast-in-place concrete drilled piers. The piers should extend at least three feet below the lowest adjacent soil grade and have a minimum shaft diameter of 18 inches to help facilitate proper cleaning of the bottom of the pier. Drilled piers founded within undisturbed native soils may be sized utilizing a maximum allowable vertical bearing capacity of 3000 psf and an allowable skin friction of 250 psf for dead plus live loads, which may be applied over the surface of the pier extending deeper than 12 inches below the lowest adjacent soil grade. Those values may be increased by one-third to include short-term wind or seismic forces. The weight of foundation concrete below grade may be disregarded in sizing computations.

Uplift resistance of pier foundations may be computed using the following resisting forces, where applicable: 1) weight of the pier concrete (150 pounds per cubic foot) and, 2) the allowable skin friction of 250 psf applied over the shaft area of the pier. Increased uplift resistance can be achieved by increasing the diameter of the pier or increasing the depth.

The bottom of the pier excavations should be free of loose or disturbed soils prior to placement of the concrete. Cleaning of the bearing surface should be verified by the geotechnical engineer prior to concrete placement. Reinforcement and concrete should be placed in the pier excavations as soon as possible after excavation is completed to minimize the chances of sidewall caving into the excavations.

## 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.

## 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.

## 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 2**
**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*.

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.

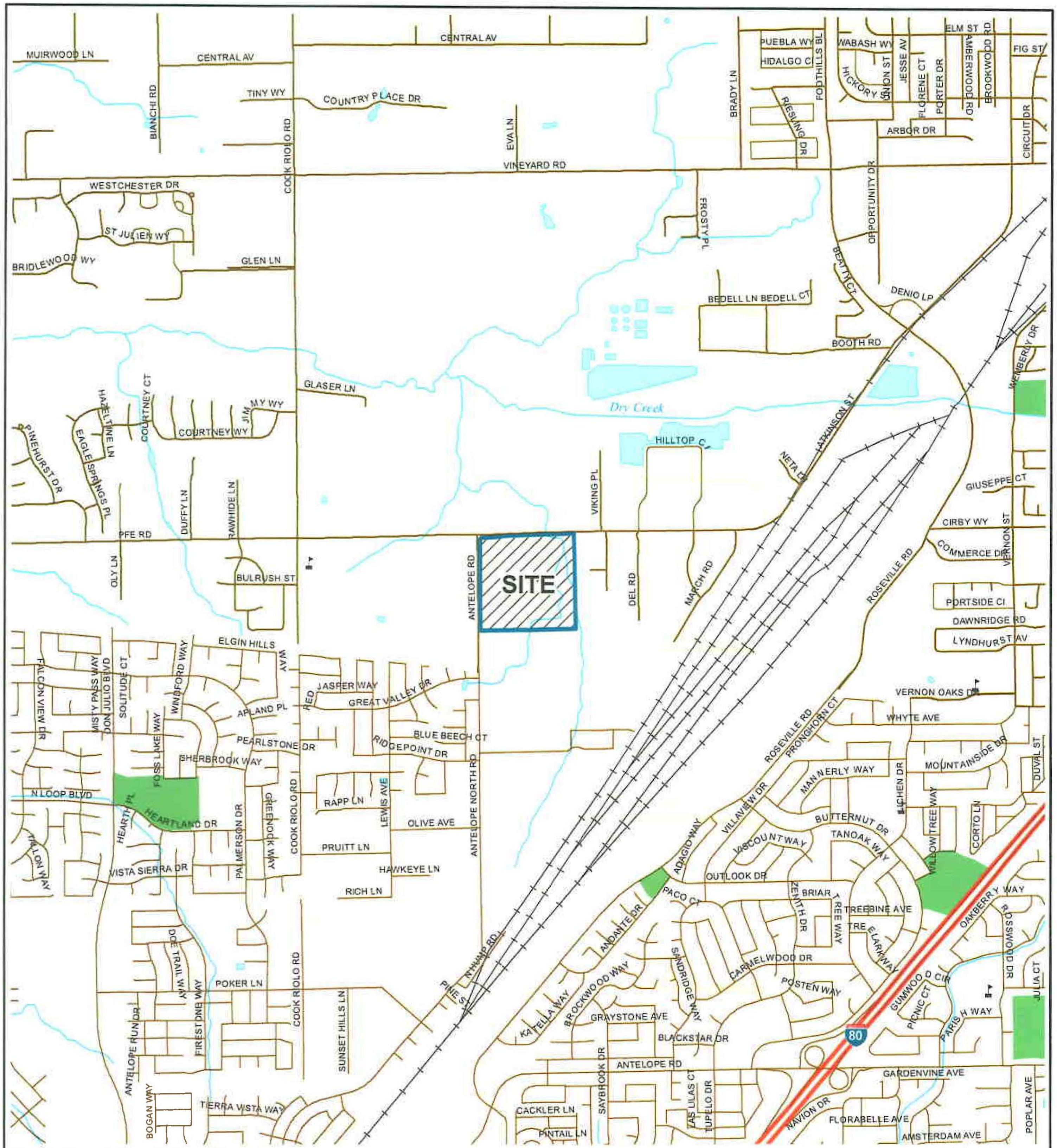
If the proposed construction is modified or relocated or, if it is found during construction that subsurface conditions differ from those we encountered at the boring locations, we should be afforded the opportunity to review the new information or changed conditions to determine if our conclusions and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

REGISTERED PROFESSIONAL ENGINEER
DOMINIC J. POTESTIO
NO. 69299
Exp. 6/30/16
CIVIL
STATE OF CALIFORNIA

Dominic J. Potestio
Project Engineer




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

N

0 1,000 2,000
Feet

WallaceKuhl
& ASSOCIATES

**VICINITY MAP**

PLACER GREENS PROPERTY

Placer County, California

| FIGURE | 1 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 9/14 |
| WKA NO. 10281.02 | |


Adapted from a Google Earth aerial photograph, dated April 19, 2014.
Projection: NAD 83, California State Plane, Zone II

Legend

Approximate boring location

Site boundary

N

0 150 300
Feet

WallaceKuhl & ASSOCIATES

**SITE PLAN**

PLACER GREENS PROPERTY

Placer County, California

| FIGURE | 2 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 9/14 |
| WKA NO. 10281.02 | |

BORING NUMBER: D1
DATE DRILLED: 6/11/03
LOGGED BY: GJF

DRILL RIG/METHOD:
CME-55/6-INCH
SOLID FLIGHT AUGERS

| DEPTH (feet) | SAMPLER | SAMPLE NUMBER | BLOWS/FT. | DRY UNIT WT. (PCF) | MOISTURE CONTENT (%) | OTHER TESTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | ML | | Brown, fine, sandy silt |
| | | | | | | | CL | | Brown, sandy clay |
| | | D1-1I | 10 | 110 | 16.0 | | | | |
| 5 | | | | | | | SM | | Brown, silty fine sand |
| | | D1-2I | 30 | | | | | | |
| 10 | | | | | | | ML | | Brown, clayey silt |
| | | D1-3I | 39 | | | | | | |
| 15 | | | | | | | | | |
| 20 | | | | | | | | | |

Notes:
1. This log depicts conditions only at the boring location, see Figure 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Figure 9.

Wallace Kuhl & Associates

**LOG OF BORING D1**

PLACER GREENS PROPERTY

Placer County, California

| FIGURE | 3 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 9/14 |

WKA NO. 10281.02

BORING NUMBER: D2
DATE DRILLED: 6/11/03
LOGGED BY: GJF

DRILL RIG/METHOD:
CME-55/6-INCH
SOLID FLIGHT AUGERS

| DEPTH (feet) | SAMPLER | SAMPLE NUMBER | BLOWS/FT. | DRY UNIT WT. (PCF) | MOISTURE CONTENT (%) | OTHER TESTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | ML | | Brown, clayey silt |
| | | D2-1I | 46 | | | | | | |
| 5 | | D2-2I | 37 | 100 | 19.2 | | | | |
| | | | | | | | SM/ ML | | Brown, silty fine sand/sandy silt |
| 10 | | D2-3I | 44 | | | | | | |
| | | | | | | | ML | | Brown, clayey silt |
| | | D2-4I | 50/4" | | | | ML | | Brown, partially cemented, sandy silt |
| 15 | | | | | | | | | |
| 20 | | | | | | | | | |

Notes:
1. This log depicts conditions only at the boring location, see Figure 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Figure 9.

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**LOG OF BORING D2**

PLACER GREENS PROPERTY

Placer County, California

| FIGURE | 4 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 9/14 |

WKA NO. 10281.02

| DEPTH (feet) | SAMPLER | SAMPLE NUMBER | BLOWS/FT. | DRY UNIT WT. (PCF) | MOISTURE CONTENT (%) | OTHER TESTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | ML | | Brown, partially cemented, clayey silt |
| | | D3-1I | 35 | 80 | 28.8 | | | | |
| | | | | | | | | | slightly sandy |
| 5 | | | | | | | | | |
| | | D3-2I | 45 | | | | | | |
| 10 | | | | | | | | | |
| | | D3-3I | 24 | | | | | | |
| 15 | | | | | | | | | |
| 20 | | | | | | | | | |

BORING NUMBER: D3
DATE DRILLED: 6/11/03
LOGGED BY: GJF

DRILL RIG/METHOD:
CME-55/6-INCH
SOLID FLIGHT AUGERS

Notes:
1. This log depicts conditions only at the boring location, see Figure 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Figure 9.

Wallace Kuhl & Associates

**LOG OF BORING D3**

PLACER GREENS PROPERTY

Placer County, California

| FIGURE | 5 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 9/14 |

WKA NO. 10281.02

| BORING NUMBER: | D4 | DRILL RIG/METHOD: |
|---|---|---|
| DATE DRILLED: | 6/11/03 | CME-55/6-INCH |
| LOGGED BY: | GJF | SOLID FLIGHT AUGERS |

| DEPTH (feet) | SAMPLER | SAMPLE NUMBER | BLOWS/FT. | DRY UNIT WT. (PCF) | MOISTURE CONTENT (%) | OTHER TESTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | ML | | Brown, partially cemented, slightly sandy, clayey silt |
| | | D4-1I | 61 | | | | | | |
| 5 | | D4-2I | 56 | 93 | 26.4 | | | | |
| | | | | | | | SM | | Brown, silty fine to coarse sand |
| | | | | | | | ML | | Brown, clayey silt |
| 10 | | D4-3I | 37 | | | | | | |
| 15 | | | | | | | | | |
| 20 | | | | | | | | | |

Notes:

1. This log depicts conditions only at the boring location, see Figure 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Figure 9.

Wallace Kuhl & Associates

**LOG OF BORING D4**

PLACER GREENS PROPERTY

Placer County, California

| FIGURE | 6 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 9/14 |
| WKA NO. 10281.02 | |

BORING NUMBER: D5
DATE DRILLED: 6/11/03
LOGGED BY: GJF

DRILL RIG/METHOD:
CME-55/6-INCH
SOLID FLIGHT AUGERS

| DEPTH (feet) | SAMPLER | SAMPLE NUMBER | BLOWS/FT. | DRY UNIT WT. (PCF) | MOISTURE CONTENT (%) | OTHER TESTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | ML | | Brown, well cemented, clayey silt |
| | | | | | | | CL | | Brown, silty clay |
| | | | | | | | ML | | Brown, clayey silt |
| | | D5-1I | 39 | 81 | 29.6 | | | | |
| 5 | | | | | | | ML | | Brown, slightly clayey, sandy silt |
| | | D5-2I | 31 | | | | | | |
| 10 | | | | | | | ML | | Brown, slightly sandy, clayey silt |
| | | D5-3I | 65 | | | | | | |
| 15 | | | | | | | | | |
| 20 | | | | | | | | | |

Notes:
1. This log depicts conditions only at the boring location, see Figure 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Figure 9.

Wallace Kuhl & Associates

**LOG OF BORING D5**

PLACER GREENS PROPERTY

Placer County, California

| FIGURE | 7 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 9/14 |
| WKA NO. 10281.02 | |

| DEPTH (feet) | SAMPLER | SAMPLE NUMBER | BLOWS/FT. | DRY UNIT WT. (PCF) | MOISTURE CONTENT (%) | OTHER TESTS | USCS | GRAPHIC LOG | SOIL DESCRIPTION AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | ML | | Brown, well cemented, clayey silt |
| | | D6-1I | 19 | 107 | 10.2 | | CL | | Brown, silty clay |
| | | | | | | | ML | | Brown, partially cemented, sandy silt |
| 5 | | D6-2I | 59 | | | | SM | | Brown, silty sand |
| | | | | | | | ML | | Brown, sandy silt |
| 10 | | D6-3I | 48 | | | | | | |
| 15 | | | | | | | | | |
| 20 | | | | | | | | | |

BORING NUMBER: D6
DATE DRILLED: 6/11/03
LOGGED BY: GJF

DRILL RIG/METHOD:
CME-55/6-INCH
SOLID FLIGHT AUGERS

Notes:

1. This log depicts conditions only at the boring location, see Figure 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Figure 9.

Wallace Kuhl & Associates

## LOG OF BORING D6

PLACER GREENS PROPERTY

Placer County, California

| FIGURE | 8 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 9/14 |

WKA NO. 10281.02

# 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**

PLACER GREENS PROPERTY

Placer County, California

| FIGURE | 9 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 9/14 |
| WKA NO. 10281.02 | |

# APPENDIX A

Field and Laboratory Testing

## APPENDIX A

## A. GENERAL INFORMATION

The performance of a geotechnical engineering investigation for the planned Placer Greens Property residential development located southeasterly of PFE Road and Antelope Road in Placer County, California, was authorized by Mr. Rob Wilson on September 15, 2014. Authorization was for an investigation as described in our proposal letter dated September 12, 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 six borings were drilled on June 11, 2003, at the approximate locations indicated on Figure 2 to maximum depths of approximately 10 to 15 feet below existing grades, utilizing a CME-55 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 Borings, Figures 3 through 8, 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 9.

## 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.

One bulk sample of the near-surface soil was subjected to Expansion Index testing (ASTM D4829); the results of these tests are presented on Figure A1.

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 tests are contained on Figure A2.

/

# EXPANSION INDEX TEST RESULTS

## ASTM D4829

MATERIAL DESCRIPTION: Brown, sandy silt/sandy clay

LOCATION: D1

| Sample Depth | Pre-Test Moisture (%) | Post-Test Moisture (%) | Dry Density (pcf) | Expansion Index |
|---|---|---|---|---|
| 0'-3' | 10.5 | 22.2 | 107 | **63** |

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

WallaceKuhl & ASSOCIATES

**EXPANSION INDEX TEST RESULTS**

PLACER GREENS PROPERTY

Placer County, California

| FIGURE | A1 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 9/14 |
| WKA NO. 10281.02 | |

# RESISTANCE VALUE TEST RESULTS

(California Test 301)

MATERIAL DESCRIPTION: Brown, sandy silt/sandy clay

LOCATION: D1 (0'-3')

| Specimen No. | Dry Unit Weight (pcf) | Moisture @ Compaction (%) | Exudation Pressure (psi) | Expansion Pressure (dial) | Expansion Pressure (psf) | R Value |
|---|---|---|---|---|---|---|
| 1 | 109 | 18.7 | 287 | 0 | 0 | 6 |
| 2 | 113 | 16.9 | 494 | 2 | 9 | 10 |
| 3 | 118 | 15.1 | 685 | 4 | 17 | 15 |

R-Value at 300 psi exudation pressure = 6

WallaceKuhl & ASSOCIATES

**RESISTANCE VALUE TEST RESULTS**

PLACER GREENS PROPERTY

Placer County, California

| FIGURE | A2 |
|---|---|
| DRAWN BY | TJC |
| CHECKED BY | DJP |
| PROJECT MGR | DJP |
| DATE | 9/14 |

WKA NO. 10281.02

**APPENDIX B**

Earthwork Specifications

APPENDIX B

*EARTHWORK SPECIFICATIONS*

**PLACER GREENS PROPERTY**

Placer County, California

WKA No. 10281.02

## GEOTECHNICAL ENGINEERING REPORT

A Geotechnical Engineering Report (WKA No. 10281.02, dated September 17, 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

The site shall be cleared of all fencing, debris, rubbish, rubble, and all other unsuitable materials designated for removal should be removed to expose firm native undisturbed soils. Trees and shrubs designated to be removed shall 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 clean the subgrade soils to the satisfaction of our on-site representative. All depressions resulting from the removal of such items, as well as all loose, disturbed or saturated soils in areas of clearing operations or tree removal, as identified by our representative in the field, should be cleaned out to firm, undisturbed soil, as determined by our representative, and restored to grade with engineered fill compacted in accordance with the recommendations of this report.

All significant vegetation shall be removed from construction areas by stripping. Discing, if approved by the Geotechnical Engineer prior to grading, shall be allowed only if minor quantities of organics will be incorporated into the upper soils and provided a uniform, compactable mixture can be achieved that is free of clumps, layers or pockets of organics.

Subgrades within areas of removed trees and shrubs should be ripped and cross-ripped to a depth of at least 12 inches to expose any remaining roots or debris. All exposed debris and roots should be cleared from the site.

Areas designated to receive fill, remain at-grade or achieved by excavation, including areas which have been subexcavated as described above, shall be scarified to a depth of at least twelve inches (12") until the surface is free from ruts or the uneven features that would tend to prevent uniform compaction by the equipment to be used.

After the foundation for fill within building pad and pavement areas has been cleared and scarified, and is free from large clods, it shall be brought to at least the optimum moisture content for granular soils, and at least two percent (2%) above optimum for clay soils and compacted to not less than ninety percent (90%) of the maximum dry density as determined by the ASTM D1557 Test Method.

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.

/