GEOTECHNICAL EXPLORATION REPORT for PROPOSED OLD SONOMA HOUSING PROJECT at 2344 Old Sonoma Road, Napa, California for NAPA COMMUNITY REAL ESTATE FUND

By KC ENGINEERING COMPANY

Project No. VV5305

29 November 2022
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29 November 2022

Mr. Charles Loveman
Napa Community Real Estate Fund
608 N. Fair Oaks Ave., Unit 126
Pasadena, CA 91103

Subject: Proposed Old Sonoma Housing Project
2344 Old Sonoma Road
Napa, California
GEOTECHNICAL EXPLORATION REPORT

Dear Mr. Loveman:

In accordance with your authorization, KC ENGINEERING COMPANY has explored the geotechnical conditions of the surface and subsurface soils for the proposed multi-family and single-family residential project to be constructed at the subject site.

The accompanying report presents our conclusions and recommendations based on our exploration. Our findings indicate that the proposed multi-family and single-family residential project is geotechnically feasible for construction on the subject site provided the recommendations of this report are carefully followed and are incorporated into the project plans and specifications.

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

Respectfully Submitted,

KC ENGINEERING COMPANY

David V. Cymanski, G.E.
Principal Engineer

Reviewed by,

Andrew L. King, P.E.
Principal Engineer

Copies: 3 mail, 1 email
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GEOTECHNICAL EXPLORATION

Purpose and Scope

The purpose of the geotechnical exploration for the proposed multi-family and single-family residential project to be constructed at 2344 Old Sonoma Road in Napa, California, was to determine the surface and subsurface soil conditions at the subject site. Based on the results of the exploration, geotechnical criteria were established for the grading of the site, design of foundations, slabs-on-grade, retaining walls, pavement sections and the construction of other related facilities on the property.

In accordance with your authorization, our exploration services included the following tasks:

a. A review of available geotechnical and geologic literature concerning the site and vicinity;
b. Site reconnaissance by the Geotechnical Engineer to observe and map surface conditions;
c. Drilling of fifteen exploratory borings and sampling of the surface and subsurface soils;
d. Construction of six monitoring well piezometers;
e. Laboratory testing of the samples obtained to determine their classification and engineering characteristics;
f. Analysis of the data and formulation of conclusions and recommendations; and
g. Preparation of this written report.

Site Location and Description

The subject site is located at 2344 Old Sonoma Road in the City of Napa, California as shown on Figure 1 “Aerial Vicinity Map” included in the Appendix of this report. The 8.59-acre property contains numerous buildings and related surface and subsurface infrastructure related to the former Napa County Health and Human Services facility. The property is bounded on the north by single-family residences and the track and field of Napa Christian Campus, on the east by single-family residences, on the south by Old Sonoma Road, and on the west by Walnut Street. It is noted that Napa County Juvenile Hall is located immediately southwest of the subject property. The property is relatively flat to gently sloping with a broad ridge in the central portion at the historic buildings. Elevations range across the site from about elevation 34 feet above mean sea level at the central broad ridge area to about elevation 25 feet on the east and elevation 28 feet on the west. Vegetation on the site consists of landscaped grass lawn areas, weeds, various bushes and numerous mature trees.
The above description is based on a reconnaissance of the site by the Geotechnical Engineer and a review of Google Earth images. A Google Earth image was used as the basis for our “Aerial Vicinity Map” included as Figure 1.

**Proposed Construction**

Based on our review of the Draft Updated Site Plan by Moule & Polyzoides Architects dated 11/23/22, we understand the majority of the old County buildings and infrastructure will be demolished followed by construction of a large 101-unit 2 to 4 story Courtyard multi-family structure with subterranean parking on the north central portion of the site, construction of a 40-unit 3 to 4 story Redwood multi-family housing structure on the northwest, renovation of the east and west historic buildings into six residential units, renovation of the central historic building into mixed-use commercial use, construction of eight 2 story single-family residence on the east, and construction of two 2 story townhome structures on the southeast and central portion of the site as shown on Figure 2.0, “Proposed Site Plan”.

We expect the new residential structures to be constructed of conventional wood and/or steel framing. Concrete or steel reinforced podium decking and supporting walls and columns are planned for the subterranean parking garage at the north central Courtyard multi-family structure. The multi-family structures may have column loads ranging up to about 275 to 350 kips with wall loads ranging up to about 10 kips per linear foot. Due to the soil conditions, the Courtyard and Redwood multi-family structures are expected to be supported by a thickened conventionally reinforced mat slab foundations as recommended herein. The 1 to 2 story structures are expected to be relatively light to moderately heavy and similar to typical residential structures. The single-family and townhome structures are planned to be supported by either conventional spread-footing foundations in conjunction with building pad lime treatment, or drilled pier and grade-beam foundations, or uniformly thickened post-tensioned or mild-steel reinforced mat slabs.

The eastern and western historic buildings are planned to be renovated and converted into residential units, while the central building will be renovated into mixed-use commercial with event space, a café and an art studio. Due to existing foundation and wall distress cracking, the existing foundations of these historic buildings will require structural strengthening enhancements along with construction of new footings for new bearing and shear walls. Underpinning of old foundation elements may be required depending on structural analysis and loading conditions.

Additional site improvements will consist of underground utilities, driveways, parking areas, storm water bio-retention swales or basins and landscaping. Earthwork grading is anticipated to
consist of various cuts and/or fills of about 5 vertical feet or less for the building pads and new parking lots. The subterranean parking garage is expected to range in depth up to about 6 feet below existing grades with additional excavation depth to facilitate construction of the mat slab. Temporary dewatering and construction of subdrainage under the mat slab will also be performed as recommended herein. Lime treatment of the building pads and pavement subgrade areas may also be required depending on the time of year and weather conditions, and where spread footing foundations are used.

**Field Exploration**

Our field exploration was performed in January 2022 and included a reconnaissance of the site and the drilling of 15 exploratory test borings at the approximate locations shown on Figure 2.1, “Aerial Site Plan” included in the Appendix. Bulk samples of the near surface soils and proposed pavement subgrade were also obtained. Two borings were previously drilled by RGH Consultants in March 2021. The RGH boring logs and data are included in the Appendix of this report.

The borings were drilled to a maximum depth of 50 feet below the existing ground surface. The drilling was performed with a CME 55 drill rig using power-driven, four-inch diameter flight augers. Visual classifications were made from auger cuttings and the samples in the field. As the drilling proceeded, relatively undisturbed tube samples were obtained by driving a 3-inch O.D., California split-tube sampler, containing thin brass liners, into the boring bottom in accordance with ASTM D3550. The samplers were driven into the in-situ soils at various depths under the impact of a 140-pound hammer having a free fall of 30 inches. The number of blows required to advance the sampler 12 inches into the soil, after seating the sampler 6 inches, were adjusted to the standard penetration resistance (N-Value). The raw blow counts obtained using the California sampler were corrected to equivalent N-Values using an 80% energy correction for the automatic trip hammer utilized. When the sampler was withdrawn from the boring bottom, the samples were removed, examined for identification purposes, labeled and sealed to preserve the in-situ moisture content, and transported to our laboratory for testing.

Classifications made in the field were verified in the laboratory after further examination and testing. The stratification of the soils, descriptions, location of disturbed soil samples and standard penetration resistance are shown on the respective “Log of Test Boring” contained within the Appendix.

On 8/24/22, six monitoring well piezometers were constructed in the location of Borings 1, 4, 9, 10, 13 and 15. The depth of the piezometers ranged from 8 to 12.5 feet. Details of monitoring well construction are presented on the respective Log of Test Boring in the Appendix.
Subsequent groundwater level readings were then obtained as presented in the “Groundwater Conditions” section below.

**Laboratory Testing**

The laboratory testing program was directed towards providing sufficient information for the estimation of the engineering characteristics of the site soils so that the recommendations outlined in this report could be formulated. The laboratory test results are presented on the respective Boring Logs and data sheets in the Appendix.

Moisture content and dry density tests (ASTM D2937) were performed on representative relatively undisturbed soil samples in order to determine the consistency of the soil and the moisture variation throughout the explored soil profile as well as estimate the compressibility of the underlying soils.

The strength parameters of the foundation soils were determined from direct shear tests (ASTM D3080) and unconfined compression tests (ATSTM D2166) performed on selected relatively undisturbed soil samples. Standard field penetration resistance (N-Values) and pocket penetrometer readings also assisted in the determination of strength and bearing capacity. The corrected standard penetration resistances and pocket penetrometer readings are recorded on the respective boring logs in the Appendix.

In order to assist in the identification and classification of the subsurface soils, sieve analysis tests (ASTM D6913) and Atterberg Limits tests (ASTM D4318) were performed on selected soil samples. The Atterberg Limits test results were used to estimate the expansion potential of the near surface soils. Expansion Index (ASTM D4829) tests were also performed on collected bulk samples to aid in evaluating the expansion potential. The sieve analysis results aided in our soil identification and liquefaction analysis.

Laboratory consolidation tests (ASTM D2435) were performed on samples of the underlying firm to stiff soil deposits to determine its compressibility/consolidation characteristics. The results were used to estimate the potential settlement due to the anticipated structure loads.

An R-Value test (Cal Test 301) was performed on a composite bulk sample representative of the proposed subgrade to assist in pavement section design. The bulk sample was obtained from the upper 3 feet across the site pavement areas.

Representative bulk samples of the near surface soils were obtained to evaluate the presence and concentration of water soluble sulfates in accordance with ASTM C1580. These test results were
used to identify the corrosion potential of the soils to at or below grade concrete. Additional soil corrosion potential tests (pH, Resistivity & Chlorides) were also performed. A discussion is presented in the “Soil Corrosivity” section of this report.

**Subsurface Soil Conditions**

Based on our field exploration, laboratory testing, and review of the RGH data, the surface and subsurface soil conditions consist of poorly stratified native alluvium and alluvial deposits of variable thickness across the property. The near surface deposits principally consist of highly expansive, firm to very stiff silty clays, sandy clays and gravelly clay soils. Isolated layers of loose to medium dense clayey sands and gravels were encountered at variable depths. In Boring 1, a loose to medium dense clayey gravel with sand layer was encountered at 38 to 47 feet below grade. In Boring 4, loose to medium dense sandy and clayey gravel layers were encountered at 7 to 22 feet below grade. In Boring 9, dense clayey sand was found below 20 feet. In Boring 10, medium dense clayey sand was encountered at 19 to 25 feet below grade. Firm to very stiff cohesive clays are located above and below the identified sand and gravel layers. Loose to medium dense clayey sand with gravel was found in the RGH Boring B-1. Stiff to very stiff sandy clay with gravel undocumented fill was encountered in the upper 4.5 feet of Boring 11. Firm to stiff and medium dense clay and gravel undocumented fill was found in the upper 7 feet of Boring 13.

A more thorough description and stratification of the soils encountered along with the results of the laboratory tests are presented on the respective boring logs in the Appendix. The approximate locations of the borings are shown on Figure 2.1, “Aerial Site Plan”.

**Groundwater Conditions**

Groundwater was initially encountered in our drill hole borings in January at variable depths ranging from 7 to 15 feet below surface grade. Most of the drill holes were left open for 24 to 48 hours to measure any change in hydrostatic water levels before grouting with neat cement. In all of our drill holes, the initial water level rose to depths ranging from 2 to 10 feet below grade. The following table summarizes the groundwater levels encountered at that time. Fluctuations in the groundwater conditions can occur with variations in seasonal rainfall, site irrigation and variations in subsurface stratification. We should note that Napa received approximately 20 inches of rain in October through December of 2021 which likely resulted in elevated groundwater levels.
<table>
<thead>
<tr>
<th>Boring Number</th>
<th>Initial Water Depth</th>
<th>Final Water Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>7’</td>
<td>2’</td>
</tr>
<tr>
<td>B-2</td>
<td>11’</td>
<td>6’</td>
</tr>
<tr>
<td>B-3</td>
<td>9’&lt;br&gt;Hole Grouted</td>
<td></td>
</tr>
<tr>
<td>B-4</td>
<td>9’</td>
<td>5’</td>
</tr>
<tr>
<td>B-5</td>
<td>10’</td>
<td>Hole Grouted</td>
</tr>
<tr>
<td>B-6</td>
<td>13’</td>
<td>8.5’</td>
</tr>
<tr>
<td>B-7</td>
<td>11’</td>
<td>4’</td>
</tr>
<tr>
<td>B-8</td>
<td>Dry to 13.5’</td>
<td>10’</td>
</tr>
<tr>
<td>B-9</td>
<td>14’</td>
<td>6.5’</td>
</tr>
<tr>
<td>B-10</td>
<td>14’</td>
<td>6’</td>
</tr>
<tr>
<td>B-11</td>
<td>9’</td>
<td>7’</td>
</tr>
<tr>
<td>B-12</td>
<td>15’</td>
<td>6.5’</td>
</tr>
<tr>
<td>B-13</td>
<td>8’</td>
<td>5’</td>
</tr>
<tr>
<td>B-14</td>
<td>10’</td>
<td>4’</td>
</tr>
<tr>
<td>B-15</td>
<td>12’</td>
<td>6’</td>
</tr>
<tr>
<td>RGH B-1</td>
<td>17’</td>
<td>13’</td>
</tr>
<tr>
<td>RGH B-2</td>
<td>18.5’</td>
<td>16.5’</td>
</tr>
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We should note that we reviewed groundwater levels in nearby wells as reported on the California Department of Water Resources Water Data Library website. An irrigation well located about 0.35 miles southeast at the corner of S. Jefferson Street and Belgium Court, indicated groundwater depths ranging from 7.5 to 24 feet between 1951 to 1978. An irrigation well located about 0.5 miles northeast at the corner of Jefferson Street and 2nd Street, indicated groundwater depths ranging from 1.7 to 6.4 feet between 1962 to 1975.

Due to the above noted shallow groundwater depths on site and in the vicinity, we were retained to install six monitoring well piezometers on 8/24/22 followed by subsequent monitoring. These were constructed in the same location as Borings 1, 4, 9, 10, 13 and 15. The total depth of the piezometers ranged from 8 to 12.5 feet below ground surface. Details of monitoring well construction and materials used are presented on the respective Log of Test Boring in the Appendix. The depth to groundwater in each monitoring well piezometer are presented in the following table.
Soil Corrosivity

Representative bulk samples of the near surface building pad soil (upper 5 feet) were collected and transported to Sunland Analytical in Rancho Cordova for testing of water soluble sulfates, pH, minimum resistivity and chlorides per ASTM and California Test Methods.

The testing indicates sulfate contents of 26.7 and 27.5 ppm (mg/kg), chloride contents of 7.0 and 20.3 ppm, minimum resistivity values of 1,260 and 1,880 ohm-cm, and soil pH values of 5.73 and 6.13 for the samples collected. It is noted that the sulfate test results indicate low or “S0” sulfate exposure to concrete as identified in the Durability Requirements, Section 1904 of the 2019 and 2022 California Building Code, and Tables 19.3.1.1 of ACI 318-14 and ACI 318-19 Building Code Requirements for Structural Concrete. No cement type restriction is required in concrete mixes.

The Caltrans Corrosion Guidelines¹ defines a corrosive site as one where the soil and/or water has a sulfate concentration of 1,500 ppm or more, a chloride concentration of 500 ppm or more, a pH of 5.5 or less, and a minimum resistivity less than 1,100 ohm-cm. Based on these criteria, the soils at the site are not considered to have a severe corrosion potential to buried metal.

KC Engineering Company is not a corrosion engineering firm. Therefore, to further define the soil corrosion potential and interpret the above test results, or to design cathodic protection or grounding systems, a licensed Corrosion Engineer should be consulted.

Site Geology

According to the Geologic Map of the Napa 7.5’ Quadrangle², a portion of which is included as Figure 3, “Geologic Map” in the Appendix, the geologic deposits underlying the majority of the site are

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mapped as early to late Pleistocene-aged alluvium. The alluvium is composed of consolidated sand, silt, clay and gravel. The northwest and northeast corners of the site are mapped as Holocene-aged alluvial fan deposits composed of moderately to poorly sorted sand, gravel, silt and clay. The subsurface deposits encountered during our exploration generally correlate with State geologic mapping.

**Geo-Hazards**

**Seismicity & Ground Motion Analysis**

The site is not located within an Alquist-Priolo Earthquake Fault Zone. There are no known active faults crossing the site as mapped and/or recognized by the State of California. However, Napa is located in a seismically-active region and earthquake related ground shaking should be expected during the design life of structures constructed on the site. The California Geological Survey has defined an active Holocene fault as one that has had surface displacement in the last 11,700 years, or has experienced earthquakes in recorded history.

Based on our review of the Fault Activity Map of California and the USGS National Seismic Hazard Maps-Source Parameters, the nearest major active faults are the West Napa Fault, the Green Valley Fault, the Hunting Creek-Berryessa Fault, and the Hayward-Rodgers Creek Fault, located approximately 0.8 miles west, 7.6 miles east, 12.5 miles northeast, and 13.4 miles west of the site, respectively. Numerous other active faults in the Bay Area may also produce significant seismic shaking at the site.

The 2019 and 2022 CBC specifies that the potential for liquefaction and soil strength loss should be evaluated, where applicable, for the Maximum Considered Earthquake Geometric Mean (MCEG) peak ground acceleration with an adjustment for site class effects in accordance with American Society of Civil Engineer (ASCE 7-16 & 7-22). The MCEG peak ground acceleration is based on the geometric mean peak ground acceleration with a 2 percent probability of exceedance in 50 years. Based on ASCE 7-16, the MCEG peak ground acceleration with adjustment for site class effects (PGAω) was calculated to be 0.946g using the ATC Hazards by Location seismic design maps web-based tool with a site coefficient (FPGA) of 1.1 for Site Class D. Based on ASCE 7-22, the MCEG peak ground acceleration with adjustment for site class effects

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6 American Society of Civil Engineer (ASCE), 2016, Minimum Design Loads for Buildings and Other Structures, Standard 7-16 and Supplement 1, dated 12/12/18. ASCE/SEI 7-22 dated 12/1/21
(PGA<sub>M</sub>) was calculated to be 0.82 g using the ASCE 7 Hazard Tool web-based seismic design tool for Site Class D.

Structures at the site should be designed to withstand the anticipated ground accelerations. Based on the ATC<sup>7</sup> website and ASCE 7-16, the 2019 CBC earthquake design values are as follows. The ATC seismic design summary report is included in the Appendix.

<table>
<thead>
<tr>
<th>Site Class:</th>
<th>F*, D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapped Acceleration Parameters:</td>
<td>S&lt;sub&gt;S&lt;/sub&gt; = 2.066 g; S&lt;sub&gt;1&lt;/sub&gt; = 0.748 g</td>
</tr>
<tr>
<td>Design Spectral Response Accelerations:</td>
<td>S&lt;sub&gt;D5&lt;/sub&gt; = 1.377 g; S&lt;sub&gt;D1&lt;/sub&gt; = 0.848 g</td>
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Based on the ASCE 7 Hazards Tool<sup>8</sup> website and ASCE 7-22, the 2022 CBC earthquake design values are as follows. The seismic design report is included in the Appendix.

<table>
<thead>
<tr>
<th>Site Class:</th>
<th>F*, D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapped Acceleration Parameters:</td>
<td>S&lt;sub&gt;S&lt;/sub&gt; = 2.29 g; S&lt;sub&gt;1&lt;/sub&gt; = 0.83 g</td>
</tr>
<tr>
<td>Design Spectral Response Accelerations:</td>
<td>S&lt;sub&gt;D5&lt;/sub&gt; = 1.5 g; S&lt;sub&gt;D1&lt;/sub&gt; = 1.19 g</td>
</tr>
</tbody>
</table>

* A Site Class F is noted because liquefiable layers are present (ASCE 7-16, Section 20.3.1 & ASCE 7-22, Section 20.2.1). However, based on the average standard penetration resistance N value and correlated shear wave velocity for the upper 100 feet, it is our opinion that a Site Class D represents the project subsurface conditions. The provided values are based on a stiff clay soil profile or Site Class D for the upper 100 feet. In our opinion, a ground motion hazard analysis is not necessary per ASCE 7-16, Section 11.4.8, Exception 2. The seismic response coefficient Cs should be determined by Eq. (12.8-2) for values of T<sub>L</sub> &lt; 1.5T<sub>S</sub> and taken as equal to 1.5 times the value computed in accordance with either Eq. (12.8-3) for T<sub>L</sub> &gt; T <sub>S</sub> or Eq. (12.8-4) for T <sub>L</sub>. This must be evaluated and verified by the Structural Engineer.

**Fault Rupture**

The site is not located within an Alquist-Priolo Earthquake Fault Zone. Based on our review of geologic maps, no known active or inactive faults cross or project toward the subject site. In addition, no evidence of active faulting was visible on the site during our site reconnaissance. Therefore, it is our opinion that there is no potential for fault-related surface rupture at the subject site.

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<sup>7</sup> https://hazards.atcouncil.org/, accessed 2/7/22

<sup>8</sup> https://asce7hazardtool.online/, accessed 11/28/22
Landsliding

The subject site and immediate vicinity is relatively flat and therefore, not subject to seismically-induced landslide hazards.

Liquefaction

Soil liquefaction is a phenomenon in which loose and saturated cohesionless soils are subject to a temporary, but essentially total loss of shear strength, due to pore water pressure build-up under the reversing cyclic shear stresses associated with earthquakes. Soils typically found most susceptible to liquefaction are saturated and loose, fine to medium grained sand having a uniform particle range and less than 35% fines passing the No. 200 sieve, and a corrected standard penetration blow count \( (N_1)_{60} \) less than 30. According to Special Publication 117A by the California Geological Survey, the assessment of hazards associated with potential liquefaction of soil deposits at a site must consider translational site instability (i.e. lateral spreading, etc.) and more localized hazards such as bearing failure and settlement. The acceptable factor of safety against liquefaction is recommended in SP117 to be 1.3 or greater.

Based on our site exploration and laboratory test data, the soil profile within the upper 50 feet was found to principally consist of fine-grained firm to very stiff cohesive sandy clays, silty clays, gravelly clays, and clayey gravels. The liquefaction potential of these cohesive materials are considered to be very low. However, potentially liquefiable loose to medium dense clayey gravel with sand having 21% fines passing the No. 200 sieve was identified in Boring 1 between 38 to 47 feet below grade, and in Boring 4 between 16 to 22 feet below grade with 16% fines. The sieve analysis results of these clayey gravel layers revealed a non-uniform or relatively well-graded particle range indicating a low to moderate potential for liquefaction. Due to the shallow nature of the layer in Boring 4, this layer was analyzed for potential liquefaction as noted below. A clayey sand layer was identified in Boring 9 between 20 to 25 feet, however the sand was found to be dense. A clayey sand layer was identified in Boring 10 between 19 to 25 feet, however 37% fines passing the No. 200 sieve was determined. In our opinion, the sand layers in Borings 9 and 10 have a low potential for liquefaction due to the dense condition in Boring 9 and the high fines content in Boring 10.

A liquefaction analysis was performed for the layer in Boring 4 using the data from our field and lab exploration per the recommended analysis methods of the NCEER report\(^9\). The high groundwater modeled in the analysis was 5 feet below the ground surface. Per CGS Special

Publication 117, a probabilistically derived peak ground acceleration with a 10 percent probability of exceedance in 50 years (475-year return period) of 0.46g was used as obtained from the USGS Unified Hazard Tool. A maximum magnitude of 6.7 was also used from the nearby West Napa Fault. Based on our analysis, the layer in Boring 4 was found to have a factor of safety of less than 1.3 and is therefore considered to be susceptible to liquefaction.

Utilizing the volumetric strain relationship developed by Tokimatsu and Seed\textsuperscript{10}, total settlement of 1.4 inches was determined. Since the adjacent borings did not reveal liquefiable soil deposits, differential settlement can be assumed to be equal to the total settlement of 1.4 inches at the northeast corner of the site. According to Ishihara\textsuperscript{11}, the potential for surface manifestation (i.e. sand boils/ejecta, ground fissures, etc...) is unlikely considering the depth of the potentially liquefiable soil layer. Due to the lack of open slope faces, the potential for lateral spreading at the site is considered nil.

We should note that RGH Boring B-1 medium dense clayey sand layers between 20 to 30 feet below grade. Their analysis indicated that potentially 1.5 inches of total settlement may be possible. We should note that RGH Boring B-1 is located outside of the proposed development.

**Settlement Considerations**

Our investigation of the site also included an evaluation of consolidation settlement of the firm to stiff subsurface silty clay layers encountered in Boring 1 between 10 to 20 feet below grade and in Boring 14 between 12 to 20 feet. These two borings are located on the northwest portion of the site. In order to determine the compressibility and potential settlement of these soils, laboratory consolidation tests (ASTM D2435) were performed on a relatively undisturbed soil samples. The results are presented in the Appendix. The sample in Boring 1 was found to be over-consolidated while the sample in Boring 14 was found to be under-consolidated indicating potential settlement under current conditions and new structure loading. Therefore, we performed a settlement analysis utilizing estimated structure loads. Once actual structure loads are determined, additional analysis may be required.

Estimated column loads ranging from 275 to 350 kips and wall loads up to 10 kplf were used for this analysis. We analyzed the case where 5 feet of existing grades would be removed followed by foundation construction. Utilizing a 350 kip column load and a bearing capacity of 2,000 psf, we determined total consolidation settlement of up to 3 inches in Boring 1 and 2.8 inches in


Boring 14. Differential settlements across the northern multi-family building footprints are expected to range from about 0.5 to 1.5 inches.

In our opinion, the amount of anticipated total and differential settlement and/or angular distortion that may occur over the proposed building footprint is excessive for a conventional shallow spread footing and slab floor foundation. To mitigate these concerns and to minimize the anticipated differential settlement, we recommend that the northern Redwood and Courtyard multi-family structures be supported on conventionally reinforced, thickened mat slab foundation systems as recommended herein.
DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

General

From a geotechnical point of view, the proposed Old Sonoma Road multi-family and single-family housing project and improvements are considered to be feasible for construction on the subject site provided the recommendations presented in this report are incorporated into the project plans and specifications.

All grading and foundation plans for the development must be reviewed by the Geotechnical Engineer prior to contract bidding or submittal to governmental agencies to ensure that the geotechnical recommendations contained herein are properly incorporated and utilized in design.

 KC ENGINEERING CO. should be notified at least two working days prior to site clearing, grading, and/or foundation operations on the property. This will give the Soil Engineer ample time to discuss the problems that may be encountered in the field and coordinate the work with the contractor.

Field observation and testing during the grading and/or foundation operations must be provided by representatives of KC ENGINEERING CO. to enable them to form an opinion regarding the adequacy of the site preparation, the acceptability of fill materials, and the extent to which the earthwork construction and the degree of compaction comply with the specification requirements. Any work related to the grading and/or foundation operations performed without the full knowledge and under the direct observation of the Soil Engineer will render the recommendations of this report invalid.

Geotechnical Considerations

The primary geotechnical considerations for the proposed project are the presence of highly expansive near surface clay soils, the potential for total and differential settlements due to seismically induced liquefaction and consolidation settlement, the presence of shallow groundwater, and the expected site disturbance from demolition operations.

Laboratory testing of samples obtained show that the surficial clay soils are highly expansive. This clay soil is prone to excessive heave and shrink movements with changes in moisture content and, consequently, must be carefully considered in the design of foundations and drainage. Considering the presence of highly expansive soils, it is our opinion that the proposed 1 to 2 story single-family homes and townhouse structures be supported by either conventional spread-
footing foundations in conjunction with building pad lime treatment, or drilled pier and grade-beam foundations, or uniformly thickened post-tensioned or mild-steel reinforced mat slabs.

As discussed in the “Liquefaction” and “Settlement Considerations” sections above, up to 1.5 inches of total and differential settlement may occur from seismically induced liquefaction, and up to 1.5 to 3 inches of consolidation settlement is expected from the multi-family structure loading. In our opinion, the amount of anticipated total and differential settlement and/or angular distortion that may occur over the proposed multi-family building footprints are excessive for a conventional shallow spread footing and slab floor foundation. To mitigate these concerns and to minimize the anticipated differential settlement, we recommend that the northern Redwood and Courtyard multi-family structures be supported on conventionally reinforced, thickened mat slab foundation systems as recommended in the “Foundation” section herein.

The eastern and western historic buildings are planned to be renovated and converted into residential units, while the central building will be renovated into mixed-use commercial with event space, a café and an art studio. Due to existing foundation and wall distress cracking, the existing foundations of these historic buildings will require structural strengthening enhancements along with construction of new deepened and well-reinforced footings for new bearing and shear walls. Underpinning of old foundation elements with mini-piles may be required depending on structural analysis, loading conditions, and findings of floor level surveys. We recommend that floor level surveys be performed for each of the historic buildings to evaluate the relative elevations and magnitude of structure settlement that has likely occurred.

Relatively shallow groundwater was encountered during our site exploration as noted in the “Groundwater Conditions” section above and as shown on our boring logs. Deeper groundwater levels were encountered in the borings by RGH. The shallow groundwater levels found during our exploration are likely a result of rainfall and the nearby location to the Napa River. Shallow groundwater should be accounted for by the General Contractor during construction. Temporary dewatering and groundwater control during construction of the subterranean parking garages, under floor subdrainage and underground utility construction is the responsibility of the Contractor. Temporary dewatering wells and sump pump systems may be required. With respect to long-term performance considerations, we recommend that underfloor subdrains and basement waterproofing measures be incorporated in the design of the parking garages by the project Architect, Civil Engineer and Structural Engineer. A waterproofing consultant should also be retained to aid in the design of the subterranean garage.

After demolition of the existing structures and removal of foundations, underground utilities and trees, etc., we expect that the upper 2 feet or more across the site will be disturbed and loosened.
To mitigate this concern, processing and compacting of the disturbed areas under proposed foundations and new surface improvements will be required as recommended in the “Grading” section below.

**Demolition**

Prior to building pad grading, demolition of the existing buildings, foundation, asphalt pavements, underground utilities and other improvements should be performed under the proposed pavements and building footprints, plus a 5 foot lateral over-build. Demolition should include the complete removal of all surface and subsurface structures. Recycling of the concrete and asphalt pavements may be possible. Where any of the following are encountered: concrete, foundations, asphalt, buried pipelines, tanks, tree roots, etc.; these should be removed with the exception of items specified by the owner for salvage. In addition, all underground structures must be located on the grading plans so that proper removal may be carried out. It is vital that **KC ENGINEERING CO.**, intermittently observe the demolition operations and be notified in ample time to ensure that subsurface structures are not covered.

Excavations made by the removal of any structure should be left open by the demolition contractor for backfill in accordance with the requirements for engineered fill. The removal of any underground structures or utility pipelines should be done under the observation of the Soil Engineer to assure adequacy of the removal and that subsoils are left in proper condition for placement of engineered fills. Any soil exposed by the demolition operations, which are deemed soft or unsuitable by the Soil Engineer, shall be excavated as uncompacted fill soil and be removed as required by the Soil Engineer during grading. The demolition operation should be approved by the Soil Engineer prior to commencing building pad grading operations. Any resulting excavations should be properly backfilled with engineered fill under the observation of the Soil Engineer. Should the location of any localized excavation be found to underlie any structure, backfill should be compacted to a minimum relative compaction of 92% or the excavation widened to extend 5 feet beyond the footprint of the structure and backfilled to the specifications for engineered fill as recommended in the “Grading” section below.

**Groundwater Control & Dewatering**

Relatively shallow groundwater was encountered during our site exploration as noted in the “Groundwater Conditions” section above and as shown on our boring logs. The shallow groundwater levels found during our exploration are likely a result of rainfall and the nearby location to the Napa River. Shallow groundwater should be accounted for by the General Contractor during construction. Temporary dewatering and groundwater control during construction of the subterranean parking garages, under floor subdrainage and underground
utility construction is the responsibility of the Contractor. Temporary dewatering wells and sump pump systems may be required. Temporary dewatering well points and/or sump pits should be installed to facilitate pumping of collected seepage water. The system should be designed to prevent migration and pumping of soil fines with discharge water.

Should groundwater be encountered during underground utility construction, the utility excavation should begin at its lowest point and proceed uphill. The utility trench should be over-excavated 6 to 12 inches below the Napa required pipe bedding material. Open-graded 1.5-inch crushed aggregate should be placed in the bottom of the trench followed by the City of Napa standard bedding material. A sump pit should be excavated at the lowest point of the open excavation/trench to facilitate pumping of collected water. The collected water should be pumped to a City approved discharge facility or dispersed on-site.

With respect to long-term performance considerations, we recommend that underfloor subdrains and basement waterproofing measures be incorporated in the design of the parking garages by the project Architect, Civil Engineer and Structural Engineer. We recommend that underfloor subdrains be incorporated in the design by the Architect and Civil Engineer. Subdrains should be placed at approximate 50 feet horizontal intervals and consist of a 2 feet deep trench by 18 inches wide filled with Caltrans Class 2 Permeable drainrock with a 6 inch diameter SDR 35 perforated pipe placed 3 to 4 inches above the bottom of trench. Subdrain trenches and pipes should slope a minimum of 1% to a sump ejector pit and/or storm drain catch basin as designed by the Civil Engineer. Basement waterproofing measures should also be incorporated in the design of the parking garages by the project Architect and a waterproofing consultant.

**Temporary Excavations**

Applicable safety standards require that excavations in excess of 4 feet must be properly shored or that the walls of the excavation be sloped back to provide safety for installation of parking garages and pipeline trenches. We expect that the basement excavations will be open cut with no shoring. All temporary excavations should be designed, planned, constructed and maintained by the Contractor and should conform to all state and federal safety regulations and requirements.

Based on the subsurface soils encountered during our field exploration, it is our opinion that the soils may be considered to be Type B above the groundwater and Type C below per OSHA Standards. Based on our findings, it is our opinion that the proposed temporary excavations will perform adequately at a maximum 1H:1V slope with a 3 feet vertical at the toe. This is provided that the following comments and recommendations are included in the Contractor work plan:
1) The excavations must be monitored by competent personnel for stability and safety. Should any tension cracking or displacement be observed, the excavation must be backfilled immediately, or the upper slope laid back and flattened and our office notified for further recommendations.

2) The cut slope and adjacent surface should be covered with visqueen during rain events and to minimize rainfall infiltration.

3) Dewatering must be provided to maintain the level at 2 feet below the base of the excavation. Our Geotechnical Engineer should be contacted to evaluate the excavations and provide supplemental recommendations as necessary.

4) Stockpiling of spoils and equipment should be setback 10 feet minimum from the top of cuts.

5) Excavation stability and dewatering is the responsibility of the Contractor.

**Grading**

Grading activities may be performed during the rainy season, however, achieving proper compaction may be difficult due to excessive moisture and delays will occur. Use of lime treatment or geogrids and geotextiles to stabilize soft areas and street subgrades may be required depending on actual moisture conditions at the time of grading. Grading performed during the dry months will minimize the occurrence of the above problems.

The surface of the site in areas to be graded should be stripped to remove all existing vegetation and/or other deleterious materials. It is estimated that stripping depths of 1 to 2 inches will be necessary. Disking of vegetation into the soils is not recommended. Any material that is deemed to be topsoil and requiring stripping may not be used as engineered fill but may be stockpiled and used later for landscaping purposes.

As noted above, we expect the upper 2 feet or more of the surface to be disturbed and loosened from demolition operations. To mitigate this concern, we recommend that surface building pads and other improvement areas be over-excavated a minimum of 12 inches and the exposed surface scarified to a depth of 12 inches, uniformly mixed and moisture conditioned to a minimum relative compaction of 90% at a minimum of 4 percent above optimum moisture content as determined by ASTM D1557 Laboratory Test Procedure. After processing and compacting the lower 12 inches in place, the site may be brought to the desired finished grades by placing engineered fill in lifts of 8 to 12 inches in uncompacted thickness, moisture conditioned and compacted to a minimum relative compaction of 90% at 4% or more above optimum moisture content in accordance with the aforementioned test procedure. The above over-excavation and compaction is recommended to occur for a minimum of 5 feet horizontally past the proposed building footprints. It is noted that deeper processing may be required depending
on actual conditions observed after demolition. All soils encountered during our investigation are suitable for use as engineered fill when placed and compacted at the recommended moisture content.

At the subterranean garages, we anticipate the garage levels to be excavated 4 to 8 feet below existing grades. Dewatering may be required and is the responsibility of the Contractor. In these areas, we recommend that the upper 12 inches of the subgrade soils be processed and compacted in place to a minimum relative compaction of 90% at a minimum of 4 percent above optimum moisture content prior to subdrain installation and placement of aggregate base and foundations.

As discussed in the “Geotechnical Considerations” section above, the proposed single-family homes and townhome structures may be supported by conventional spread footing foundations provided the building pads are lime treated. As mitigation to minimize differential heave and shrink movements from the highly expansive clays, we recommend that the upper 3 feet of the building pads be processed and compacted as engineered fill by lime treatment. We recommend that the structural fill pad be a minimum of 3 feet thick, extend 5 feet beyond the building footprint, and consist of the existing on-site materials treated with high-calcium quicklime meeting ASTM C977. The building and equipment pad areas to be treated should be graded to a depth of 1.5 feet below design pad grade elevation. The exposed bottom 1.5 feet can then be processed and compacted in-place with lime, followed by placing the upper 1.5 feet and treating the upper lift. Alternatively, select import may be used to construct the fill pads.

The lime treatment should consist of a 4% mixture by dry weight. Based on a unit weight of 120 p.c.f., a spread rate of 7.2 p.s.f. should be applied for the 18-inch mixing depths. The lime treated soils should be compacted to at least 95% relative compaction of the maximum wet density per ASTM D1557 at a moisture content at least 4% above optimum. The lime treatment must be performed by a qualified soil stabilization contractor in general conformance with Caltrans Standard Specification Section 24. The product specification and quality control test results must be provided to us by the contractor for review and acceptance prior to the treatment operations. The lime should be spread and mixed with equipment capable of providing relatively uniform conditions. After mellowing overnight, the lime treated sections must be mixed the following day prior to compaction. After compaction, it is important to moist cure the lime treated soils until placement of the subsequent slab subbase materials (i.e. do not let pad dry out and desiccate).

Where select import material is to be used to meet design grades or be required for general fill, the import material should be approved by the Soil Engineer before it is brought to the site. Where select import soil is used for the pad areas, it should meet the following requirements:
a. Have a Plasticity Index not higher than 15;
b. No rocks larger than 3 inches in maximum size;
c. Caltrans Class 2 aggregate base may be used.

The site is relatively level, however, shallow cut and fill slopes of about 5 vertical feet or less may be performed. Maximum cut and fill slopes of 2H:1V (horizontal to vertical) may be utilized within the project. Slopes should be rounded at the upper extremities. Graded slopes should not be left exposed through a winter season without the completion of erosion control measures.

Retaining wall backfill utilizing on-site soils or select import should be placed and compacted as recommended above. Utility trench backfill materials and compaction requirements should conform to the City of Napa Standards.

The fill materials shall be placed in uniform lifts of not more than 8 to 12 inches in uncompacted thickness depending on size and weight of equipment used. Each layer shall be spread evenly and shall be thoroughly blade mixed during the spreading to obtain uniformity of material in each layer. Before compaction begins, the fill shall be brought to a water content that will permit proper compaction by either (a) aerating the material if it is too wet, or (b) spraying the material with water if it is too dry.

Compaction shall be by footed rollers or other types of acceptable compacting rollers. Rollers shall be of such design that they will be able to compact the fill to the specified density. Rolling shall be accomplished while the fill material is within the specified moisture content range. Rolling of each layer shall be continuous over its entire area and the roller shall make sufficient trips to ensure that the required density has been obtained. No ponding or jetting shall be permitted.

The standard test used to define maximum densities and optimum moisture content of all compaction work shall be the Laboratory Test procedure ASTM D1557 and field tests shall be expressed as a relative compaction in terms of the maximum dry density and optimum moisture content obtained in the laboratory by the foregoing standard procedure. Field density and moisture tests shall be made in each compacted layer by the Soil Engineer in accordance with ASTM D6938, respectively. When footed rollers are used for compaction, the density and moisture tests shall be taken in the compacted material below the surface disturbed by the roller. When these tests indicate that the compaction requirements for any layer of fill, or portion thereof, have not been met, the particular layer, or portion thereof, shall be reworked until the compaction requirements have been met.
Surface & Subsurface Drainage

A very important factor affecting the performance of structures and pavements is the proper design, implementation, and maintenance of surface drainage, as well as maintaining uniform moisture conditions around the structures. Ponded water will cause swelling and/or loss of soil strength and may also seep under structures. Should surface water be allowed to seep under the structures, differential foundation movement resulting in structural damage and/or standing water under the slab will occur. This may cause dampness to the floor which may result in mildew, staining, and/or warping of floor coverings. To minimize the potential for the above problems, dampproofing and waterproofing should be provided as required by Section 1805 of the 2019 and 2022 CBC. In addition, the following surface drainage measures are recommended and must be maintained by the property owner in perpetuity:

a) Positive building pad slopes and surface drainage must be provided by the project Civil Engineer to remove all storm water from the pad and to prevent storm and/or irrigation water from ponding adjacent to the structure foundations. The finished pad grade around the structures should be compacted and sloped 5% away from the exterior foundations and as required in Section 1804.4 of the 2019 and 2022 CBC and directed to appropriate drainage inlets. Earth swales should slope a minimum of 2% to a suitable outlet.

b) Enclosed or trapped planter areas adjacent to the structure foundations should be avoided if possible. Where enclosed planter areas are constructed, these areas must be provided with adequate measures to drain surface water (irrigation and rainfall) away from the foundation. Positive surface gradients and/or controlled drainage area inlets should be provided. Care should be taken to adequately slope surface grades away from the structure foundations and into area inlets. Drainage area inlets should be piped to a suitable discharge facility.

c) Adequate measures for storm water discharge from the roof gutter downspouts must be provided by the project Civil Engineer and maintained by the property owners at all times, such that no water is allowed to pond next to the structure. Closed pipe discharge lines should be connected to downspouts and discharged into a suitable drainage facility. It is important not to allow concentrated discharge on the surface of any slope so as to prevent erosion.

d) Site drainage should be designed by the project Civil Engineer. Civil engineering, hydraulic engineering, and surveying expertise is necessary to design proper surface drainage to assure that the flow of water is directed away from the foundations.
e) Over-irrigation of plants is a common source of water migrating beneath a structure. Consequently, the amount of irrigation should not be any more than the amount necessary to support growth of the plants. Foliage requiring little irrigation (drip system) is recommended for the areas immediately adjacent to the structures.

f) Landscape mounds or concrete flatwork should not be constructed to block or obstruct the surface drainage paths. The Landscape Architect or other landscaper should be made aware of these landscaping recommendations and should implement them as designed. The surface drainage facilities should be constructed by the contractor as designed by the Civil Engineer.

With respect to any proposed bio-retention swales or basins, we anticipate that bio-swales will be located relatively close to the proposed structures. We recommend a minimum separation of 10 horizontal feet where possible. The bottom of bio-swales or basins should be sloped away from the structure foundations. In addition, we recommend that a subsurface drain be provided below the select treatment soils at the low side of the swale/basin. The subdrain should be connected to the nearest storm drain catch basin. A 4 inch SDR35 perforated pipe surrounded by Caltrans Class 2 Permeable Material should be provided to discharge collected water into the nearest catch basin. An impermeable liner may also be required in the bottom of the swales. Additional details can be provided when Civil plans are available.

With respect to long-term performance considerations, we recommend that underfloor subdrains be incorporated in the design of the subterranean parking garages as designed by the Architect and Civil Engineer. Subdrains should be placed at approximate 50 feet horizontal intervals and consist of a 2 feet deep trench by 18 inches wide filled with Caltrans Class 2 Permeable drainrock with a 6 inch diameter SDR 35 perforated pipe placed 3 to 4 inches above the bottom of trench. Subdrain trenches and pipes should slope a minimum of 1% to a sump ejector pit or storm drain catch basin.

**Foundations**

After processing and compacting the building pad areas as recommended in the “Grading” section above, we recommend that the Redwood and Courtyard multi-family structures be supported on conventionally reinforced, thickened mat slab foundation systems as recommended below. Considering the presence of highly expansive soils, it is our opinion that the proposed 1 to 2 story single-family homes and townhouse structures be supported by either conventional spread-footing foundations in conjunction with building pad lime treatment, or drilled pier and grade-beam foundations, or uniformly thickened post-tensioned or mild-steel reinforced mat slabs. Recommendations for these foundation systems are presented below.
Additional and/or revised foundation design parameters may be required depending on actual foundation layout and design loading conditions. Our office should be contacted for supplemental criteria if required.

The eastern and western historic buildings are planned to be renovated and converted into residential units, while the central building will be renovated into mixed-use commercial with event space, a café and an art studio. Due to existing foundation and wall distress cracking, the existing foundations of these historic buildings will require structural strengthening enhancements along with construction of new deepened and well-reinforced footings for new bearing and shear walls. Underpinning of old foundation elements with mini-piles may be required depending on structural analysis, loading conditions, and findings of floor level surveys. We recommend that floor level surveys be performed for each of the historic buildings to evaluate the relative elevations and magnitude of structure settlement that has likely occurred.

**Mat Slab Foundation**

Conventionally reinforced structural mat slabs for the proposed northern Redwood and Courtyard multi-family structures should be a minimum of 16 inches in thickness and designed per the method presented in the WRI Design of Slab-On-Ground Foundations\textsuperscript{12} or other appropriate structural methods based on finite element analysis. Based on the WRI document, the slabs should be designed with a minimum edge cantilever length ($l_c$) of 6 feet and an interior clear span of 12 feet. A modulus of subgrade reaction ($k$) of 75 psi/in may be utilized for the mat slab design. The recommended design allowable bearing pressure for mat slabs is 1,500 p.s.f. due to dead plus live loads. The allowable bearing pressures may be increased by 1/3 due to all transient loads which include wind and seismic. Foundations designed in accordance with the above criteria are expected to experience a total settlement of less than 3 inches with less than 3/4 of an inch of differential settlement across a span of 50 feet.

The subgrade soils under mat slabs should be prepared as recommended in the “Grading” section above. Mat slabs should be underlain by a minimum of 6 inches of Caltrans Class 2 Aggregate Base compacted to a minimum relative compaction of 95%. A waterproofing membrane should be placed between the compacted aggregate base and concrete mat slab as designed by a waterproofing consultant.

We recommend that appropriate provisions be provided by the Structural Engineer and Contractor to minimize mat slab cracking, such as curing measures and/or admixtures to

minimize concrete shrinkage and curling. American Concrete Institute methods and guidelines of curing, such as wet curing or membrane curing, are recommended to minimize drying shrinkage cracking.

**Spread-Footings**

Conventional spread footing foundations may be utilized to support the single-family residences and townhome structures provided the building pads are lime treated as recommended in the “Grading” section above. In addition, the existing foundations of the three historic buildings will require structural strengthening enhancements to the existing foundations along with construction of new deepened and well-reinforced footings for new bearing and shear walls.

Continuous strip spread footings should be placed around the perimeter of the structures and be a minimum of 16 inches wide. Continuous spread footings should be utilized around the perimeter of the structures and for all interior bearing and shear walls. All interior and exterior column footings for new and historic structures should be interconnected to the perimeter with reinforced concrete tie-beams. Isolated footings should not be utilized unless connected with reinforced tie-beams. The continuous and pad/column footings should extend a minimum depth of 24 inches below the interior slab subgrade soil elevation. The tie beams should extend to a minimum depth of 18 inches below the interior soil pad grade. The recommended design allowable bearing pressure for footings is 2,000 p.s.f. due to dead plus live loads. This value may be increased by one-third for transient wind and seismic loads.

All foundations must be adequately reinforced to provide structural continuity and resist the anticipated loads as determined by the project Structural Engineer. The final footing design and reinforcement should be determined by the project Structural Engineer. However, continuous footings are recommended to be reinforced with a minimum of four No. 5 bars, two at the top and two near the bottom of the footing. Additional reinforcement will be as required by the Structural Engineer and in accordance with structural building code requirements. Foundations designed in accordance with the above criteria are expected to experience a total settlement of approximately 1 inch with less than 0.5 inches of differential settlement across the footprint.

To accommodate lateral building loads, the passive resistance of the foundation soil can be utilized. The passive soil pressures can be assumed to act against the front face of the footing below a depth of 1 foot below the ground surface. It is recommended that an ultimate passive pressure equivalent to that of a fluid weighing 250 p.c.f. be used. For design purposes, an allowable friction coefficient of 0.32 can be assumed at the base of the spread footings. These two modes of resistance should not be added unless the frictional component is reduced by 50
percent since the mobilization of the passive resistance requires some horizontal movement, effectively reducing the frictional resistance.

**Post-Tensioned Slabs**

Post-tensioned slabs may be used for the 1 to 2 story single-family and townhome structures without lime treatment. Post-tensioned slabs should be a minimum 12 inches in thickness (for uniform thickness slabs) and designed using the following criteria which is based on the design method of the “Standard Requirements for Design of Shallow Post-Tensioned Concrete Foundations on Expansive Soils”, dated May 2008, Third Edition, prepared by the Post Tensioning Institute:

- **Edge Moisture Variation Distance:**
  - $e_m$ (Edge Lift) = 4.3 feet
  - $e_m$ (Center Lift) = 8.0 feet

- **Differential Movement:**
  - $y_m$ (Edge Lift) = 1.9 inches
  - $y_m$ (Center Lift) = -1.3 inches

- **Estimated Differential Settlement:** = 0.5 inches

In addition to the recommendations and guidelines in the Third Edition by the PTI, the following recommendations should also be incorporated into the design and construction for the above structural mat and post-tension foundation system:

- a) An allowable bearing capacity of 1,500 p.s.f. may be utilized and may be increased by one-third to resist short-term wind and seismic loading.

- b) To resist lateral loading, a coefficient of friction between the perimeter concrete thickened edge and the soil of 0.32 may be used.

- c) All areas to receive slabs should be thoroughly moistened in the upper 8 inches prior to placing the underslab components. This work should be performed under the observation of the Soil Engineer and approved prior to vapor barrier and concrete placement.

- d) The reinforcement and/or cables shall be placed in the center of the slab unless otherwise designated by the Structural Engineer.
e) A vapor retarder membrane should be installed between the prepared building pad and the interior slab to minimize moisture condensation under the floor coverings and/or upward vapor transmission. The vapor barrier membrane should be a minimum 15-mil extruded polyolefin plastic that complies with ASTM E1745 Class A and have a permeance of less than 0.01 perms per ASTM E96 or ASTM F1249. It is noted that polyethylene films (visqueen) do not meet these specifications. The vapor barrier must be adequately lapped and taped/sealed at penetrations and seems in accordance with ASTM E1643 and the manufacturer’s specifications. The vapor retarder must be placed continuously across the slab area.

f) The slabs should be thickened at the perimeter to extend below pad grade at least 6 inches for a width of 12 inches to create frictional resistance for lateral loading, to provide additional edge rigidity, and to minimize moisture infiltration under the slab.

g) Water vapor migrating to the surface of the concrete can adversely affect floor covering adhesives. Provisions should be provided in the concrete mix design to minimize moisture emissions. This should include the selection of a water-cement ratio which inhibits water permeation (0.45 max). Additional suitable admixtures to limit water transmission may also be utilized. The slabs should not be subjected to rainfall or cleaning water prior to placement of the floor coverings. In addition, we recommend that a Type II cement be utilized in the concrete mix to provide an additional protection against sulfate attack.

h) Exterior porches, garages and attached covered patios areas should also be designed as part of the same post-tension foundation system.

i) We recommend that appropriate provisions be provided by the Structural Engineer and Contractor to minimize slab cracking, such as curing measures and/or admixtures to minimize concrete shrinkage and curling. American Concrete Institute methods and guidelines of curing, such as wet curing or membrane curing, are recommended to minimize drying shrinkage cracking.

j) The foundation plans, specifications, calculations and concrete mix designs should be provided to the Structural Engineer and us for review prior to construction to ensure conformance with the above recommendations.
Pier & Grade Beam

Pier and grade beam foundations may be used for the 1 to 2 story single-family and townhome structures without lime treatment. The piers should have a minimum diameter of 16 inches and extend a minimum depth of 10 feet below pad grade. The piers should be designed on the basis of skin friction acting between the soil and that portion of the pier that extends below a depth of 2 feet below finished grade. For the soil at the site, an allowable skin friction value of 500 p.s.f. can be used for combined dead and live loads. This value can be increased by one-third for transient loads which include wind or seismic forces. Reinforced concrete grade beams should be used to support bearing walls and to tie all piers together. Isolated piers should not be used. Reinforcing steel should be provided as necessary for structural support and continuity of pier and grade beam. Piers should be reinforced with a minimum of four No. 6 reinforcing bars for the full depth of the piers. The grade beams should be reinforced with a minimum of four No. 5 bars, two located near the top and two near the bottom of the grade beams. Spacing of the piers should be determined, as required, by the load distribution but minimum spacing should not be less than three pier diameters, center to center. It is noted that the above recommendations are minimums only. The final design of the foundation must be performed by a qualified Structural Engineer or Architect in accordance with current standard of practice and for the anticipated loading conditions.

In order to mitigate against the effects of soil expansion on the foundations, it is recommended that the grade beams be designed to resist uplift loads. The grade beams should be designed for an uplift pressure of 2,000 p.s.f. acting against the bottom of the grade beam. Resistance to uplift is to be provided by the pier foundations and the dead load of the structure. An adhesion value of 400 psf may be applied to the portion of the pier below its upper 2 feet.

To resist lateral loads, the passive resistance of the soil can be used. The soil passive pressures can be assumed to act against the lateral projected area of the pier described by the vertical dimension of twice the pier diameter. It is recommended that a passive pressure equivalent of that of a fluid weighing 250 p.c.f. be used below the upper 2 feet.

Even though the piers will be designed to develop their capacity through friction, their bottoms should be cleaned and/or tamped prior to placing reinforcing steel and pouring concrete. Also, it is important that care be exercised to ensure that any concrete spills during the concrete pour must be removed, and no "mushrooming" effects are allowed to remain around the top of the pier or bottom of the grade beam. It is the responsibility of the contractor to ensure that this condition does not occur.
**Slab-on-Grade Construction**

Interior floor slabs where spread footings are used and garage slabs, along with exterior concrete slabs/flatwork, including pedestrian sidewalks, driveways and non-structural detached patios and general flatwork may experience some cracking due to finishing and curing methods as well as from heaving or shrinking from moisture variations within the underlying clay soils. We should note that City maintained curbs, gutters, sidewalks and driveway aprons should be designed and constructed per the City of Napa Standards, Specifications and Plans. To reduce the potential cracking of the slabs-on-grade, the following recommendations are made:

a) All areas to receive slabs should be thoroughly wetted and soaked to seal any desiccation or shrinkage cracks prior to placing concrete. This work should be done under the observation of the Soil Engineer.

b) Slabs should be underlain by a minimum of 4 inches of angular gravel or clean crushed rock material placed between the finished subgrade and the slabs to serve as a capillary break between the subsoil and the slab. The gravel should not have more that 10% passing the No. 4 sieve per CBC Section 1805.4.1.

c) All slabs should be a minimum of 5 inches thick and reinforced with a minimum of No. 4 rebar spaced 18 inches center to center, each way. Additional concrete pavement recommendations are provided in the “Pavement Areas” section of this report. The actual slab thickness and reinforcement should be determined by the project Structural Engineer in accordance with the structural requirements and the anticipated loading conditions. The reinforcement shall be placed in the center of the slab unless otherwise designated by the design engineer.

d) Slabs for driveways, and exterior flatwork should be placed structurally independent of the foundations. A 30-pound felt strip, expansion joint material, or other positive separator should be provided around the edge of all floating slabs to prevent bonding to the foundation.

e) Slabs should be provided with crack control saw cut joints, tool joints or other methods to allow for expansion and contraction of the concrete. In general, contraction joints should be spaced no more than 20 times the slab thickness in each direction. The layout of the joints should be determined by the project Structural Engineer and/or Architect.
f) To minimize moisture infiltration under slabs and to add edge rigidity, we recommend that slabs be thickened at the edges to extend below the aggregate base layer to the soil subgrade for a minimum width of 6 inches.

g) Curing of slabs should follow the guidelines provided by the American Concrete Institute and the CBC to minimize shrinkage cracking.

**Retaining Walls**

Any retaining walls that are to be incorporated into the project should be designed to resist lateral pressures exerted from a media having an equivalent fluid weight as follows:

<table>
<thead>
<tr>
<th>Gradient of Back Slope</th>
<th>Equivalent Fluid Weight (p.c.f.)</th>
<th>Coefficient of Friction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unrestrained Condition (Active)</td>
<td>Restrained Condition (At Rest)</td>
</tr>
<tr>
<td>Horizontal</td>
<td>60</td>
<td>75</td>
</tr>
</tbody>
</table>

It should be noted that the effects of any surcharge or compaction loads behind the walls must be accounted for in the design of the walls. We recommend that the project Structural Engineer use the formula \( P = QH K_a \) where \( Q \) = uniform surcharge load in psf, \( K_a = 0.5 \), and \( H \) = wall height. Because the surcharge pressure acting on the retaining wall is considered relatively uniform, the resultant force \( P \) should be applied at mid-height of the wall.

Per Section 1803.5.12 of the 2019 and 2022 California Building Code, dynamic lateral earth pressures on retaining walls supporting more than 6 feet of backfill in height are required. Based on the Mononobe-Okabe & Seed-Whitman equations, a total unit weight of 120 pcf and a \( K_h \) of \( \frac{1}{2} PG_A m \), an earthquake load of \( 21H^2 \) should be applied at \( 1/3H \) where \( H \) = wall height, from the bottom of the wall is applicable.

We recommend that the subterranean garage walls be supported by the mat slab foundation. Other low height retaining walls (less than 5 feet) may be founded on continuous spread footings that extend to a minimum depth of 24 inches below lowest adjacent pad grade (i.e., trenching depth). At this depth, the recommended design bearing pressure for continuous and isolated footings should not exceed 2,000 p.s.f. due to dead plus live loads. The above allowable pressures may be increased by 1/3 due to all loads which include wind and seismic. All foundations must be adequately reinforced to provide structural continuity and resist the anticipated loads as determined by the project Structural Engineer. To accommodate lateral building loads, the passive resistance of the foundation soil can be utilized. The passive soil
pressures can be assumed to act against the front face of the footing below a depth of 1 foot below the ground surface. It is recommended that a passive pressure equivalent to that of a fluid weighing 250 p.c.f. be used. For design purposes, an allowable friction coefficient of 0.32 can be assumed at the base of the spread footings. These two modes of resistance should not be added unless the frictional component is reduced by 50 percent since the mobilization of the passive resistance requires some horizontal movement, effectively reducing the frictional resistance.

The above criteria are based on fully drained conditions. In order to achieve fully-drained conditions, a gravel drainage filter blanket should be placed behind the wall. Walls should also be waterproofed as designed by a waterproofing consultant. The gravel blanket should be a minimum of 12 inches thick and should extend to the bottom of the mat slab and to within 12 inches of the surface and be capped with compacted soil. If the excavated area behind the wall exceeds 12 inches, the entire excavated space behind the 12-inch blanket should consist of compacted engineered fill or gravel blanket material. The drainage blanket material may consist of either granular crushed rock and drain pipe fully encapsulated in geotextile filter fabric (Mirafi 140N or equivalent) or Class II permeable material that meets CalTrans Specification, Section 68. A 4-inch diameter SDR35 perforated drain pipe should be installed in the bottom of the drainage blanket and should be underlain by 3 to 4 inches of gravel material. Piping with a minimum gradient of 1% shall be provided to discharge water that collects behind the walls to an adequately controlled discharge system away from the structure foundations.

If mechanically stabilized earth, segmental retaining walls such as Keystone walls are utilized, the design and construction of these proposed flexible modular retaining wall systems should conform to the recommendations of the manufacturer and/or Keystone Retaining Wall Systems or the National Concrete Masonry Association (NCMA). The following soil parameters would be applicable for design using on-site soil materials within the reinforced, retained and bearing zones: $\phi = 25$ degrees, $c = 100$ p.s.f., $\gamma = 120$ p.c.f. The wall backfill within the reinforced zone may consist of the on-site soil materials provided it has a maximum Liquid Limit of 40 and a maximum Plasticity Index of 20. The wall embedment should conform to the recommendations by Keystone or NCMA.

**Pavement Areas**

The driveways and parking areas will be paved with either asphalt concrete (AC) or Portland cement concrete (PCC) surfaces. Recommendations for these pavement surfaces are presented below. We emphasize that the performance of the pavement is critically dependent upon adequate and uniform compaction of the subgrade soils, as well as engineered fill and utility trench backfill within the limits of pavements. Pavements will typically have poor performance and shorter life where water is allowed to migrate into the aggregate base and subgrade soils. The main sources of water
into pavement materials are landscape planters constructed within or adjacent to pavement areas. Where this is planned, it is suggested to extend the curbs into the soil subgrade at least 2 inches. The construction of all pavements should conform to the requirements set forth by the latest Standard Specifications of the Department of Transportation of the State of California (Caltrans) and/or the City of Napa.

R-Value: A composite bulk sample was obtained of the near surface soils within the planned parking lot and driveways that is relatively representative of the anticipated subgrade soils. The sample was tested in accordance with the California Test Method 301 to determine the R-Value for the site soils. An R-Value of 12 was determined for the sample as shown in the Appendix. Due to variations in the clay materials on site, we recommend a maximum R-value of 10 for design. However, we understand that new pavement areas may be constructed during the winter months and will be lime treated. Therefore, an alternate 5% lime treated R-value of 25 is also considered herein.

Preparation of Subgrade: After underground utilities have been placed in the areas to receive pavement and removal of excess material has been completed, the upper 12 inches of the subgrade soil shall be scarified, moisture conditioned and compacted to a minimum relative compaction of 95% at a moisture content at 3% or more above optimum in accordance with the grading recommendations specified in this report. Prior to placement of aggregate baserock, it is recommended that the subgrade be proof rolled and observed for deflection by the Soils Engineer. Should deflection and/or pumping conditions be encountered, stabilization recommendations will be provided based on field conditions.

Aggregate Base: All aggregate base material placed subsequently should also be compacted to a minimum relative compaction of 95% based on the ASTM Test Procedure D1557. Aggregate base should meet the minimum requirements of Caltrans ¾” Class 2 per Section 26 and be crushed and angular. The recommended aggregate base thicknesses for asphalt concrete pavements are noted in the table below. The minimum aggregate base thickness for Portland cement concrete PCC roadway pavements is 6 compacted inches.

Asphalt Concrete: Asphalt concrete shall conform with Section 39 of Caltrans Standard Specifications and shall be per the City of Napa Standards. Based on an R-Value of 10, and traffic indices typical for similar developments, the recommended pavement sections for asphalt concrete surfaces are summarized in the table below. Should the parking lot soils be lime treated, we are providing an alternate section based on a minimum R-value of 25. The appropriate traffic index (TI) and any minimum pavement sections should be determined by the Civil Engineer in conformance with the City of Napa.
<table>
<thead>
<tr>
<th>Traffic Condition</th>
<th>Traffic Index (TI)</th>
<th>Asphalt Concrete (inches)</th>
<th>Class II Aggregate Base (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto Parking Stalls</td>
<td>4.5</td>
<td>3.0</td>
<td>5.0*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Drive Aisles</td>
<td>6.5</td>
<td>3.5</td>
<td>10.5*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>City Streets</td>
<td>8.0</td>
<td>4.5</td>
<td>17.0</td>
</tr>
</tbody>
</table>

NOTES:
1. Minimum R-Value = 78
2. All layers in compacted thickness to CalTrans Standard Specifications.
   * Lime Treated Subgrade (R-Value = 25 min)

Portland Cement Concrete: Where PCC pavement areas are utilized, such as for drive isles and truck areas or at trash enclosures, the concrete should be poured on the compacted aggregate base layer described above of 6 inches. The concrete section should be designed by the project Civil or Structural Engineer per Chapter 620 of the Highway Design Manual or City Standards. We recommend a minimum of 6 inches thick PCC reinforced with a minimum of No. 4 rebar spaced at 16 inches on center, each way, underlain by 6 inches of compacted Class 2 aggregate base. Additional reinforcement may be required by the Structural Engineer. Pavement joints shall be per the HDM and City Standards.

**Underground Utility and Excavations**

Groundwater was encountered at depths as shallow as 2 feet at the time of our exploration. Depending on the time of year of underground construction, groundwater may be encountered especially in deeper utilities. Temporary dewatering and shoring are the responsibility of the Contractor.

Should groundwater be encountered, the utility construction should begin at its lowest point and proceed uphill. The utility trench should be over-excavated 6 to 12 inches below the City of Napa required pipe bedding material. Open-graded 1.5-inch crushed aggregate should be placed in the bottom of the trench followed by the City standard bedding material. A sump pit should be excavated at the lowest point of the open excavation/trench to facilitate pumping of collected water. The collected water should be pumped to a City approved discharge facility.

Utility trench backfill shall conform to the City of Napa Standards.
Applicable safety standards require that excavations in excess of 5 feet must be properly shored or that the walls of the excavation slope back to provide safety for installation of lines. If excavation wall sloping is performed, the inclination should vary with the soil type. The soils at the site are considered to be OSHA Type B. However, should groundwater be encountered, a Type C soil should be used. During excavation operations, the underground contractor should consult with the Soil Engineer for additional recommendations as deemed necessary.

With respect to state-of-the-art construction or local requirements, utility lines are generally bedded with granular materials. These materials can convey surface or subsurface water beneath the structures. It is, therefore, recommended that all utility trenches which possess the potential to transport water be sealed with a compacted impervious cohesive soil material or lean concrete where the trench enters/exits the building perimeter. This impervious seal should extend a minimum of 2 feet away from the building perimeter.
LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. It should be noted that it is the responsibility of the owner or his representative to notify KC ENGINEERING CO., in writing, a minimum of two working days before any clearing, grading, or foundation excavation operations can commence at the site.

2. The recommendations of this report are based upon the assumption that the soil conditions do not deviate from those disclosed in the borings and from a reconnaissance of the site. Should any variations or undesirable conditions be encountered during the development of the site, KC ENGINEERING CO., will provide supplemental recommendations as dictated by the field conditions.

3. This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure that the information and recommendations contained herein are brought to the attention of the Architect and Engineer for the project and incorporated into the plans and that the necessary steps are taken to see that the Contractor and Subcontractors carry out such recommendations in the field.

4. At the present date, the findings of this report are valid for the property investigated. With the passage of time, significant changes in the conditions of a property can occur due to natural processes or works of man on this or adjacent properties. In addition, legislation or the broadening of knowledge may result in changes in applicable standards. Changes outside of our control may render this report invalid, wholly or partially. Therefore, this report should not be considered valid after a period of two (2) years without our review, nor should it be used, or is it applicable, for any properties other than those investigated.

5. Not withstanding, all the foregoing applicable codes must be adhered to at all times.
APPENDIX

Aerial Vicinity Map

Proposed Site Plan

Aerial Site Plan

Geologic Map

Log of Test Borings

Subsurface Exploration Legend

Laboratory Test Results

RGH Borings & Data

ATC Seismic Design Report

ASCE 7 Hazard Report
SITE
Lat. 38.2887 deg.
Long. -122.2986 deg.

Figure 1 – AERIAL VICINITY MAP
Project No. VV5305
Proposed Old Sonoma Road Housing Project
2344 Old Sonoma Road, Napa, CA

Figure 2.0 – PROPOSED SITE PLAN
Figure 2.1 – AERIAL SITE PLAN

LEGEND
- Approximate Boring Locations, KCE 2022
- Approximate Boring Locations, RGH 2021

Proposed Old Sonoma Road Housing Project
2344 Old Sonoma Road, Napa

KC ENGINEERING COMPANY
865 Cotting Lane, Suite A
Vacaville, CA 95688
707-447-4025
Figure 3 – GEOLOGIC MAP

GEOLOGIC MAP OF THE
NAPA 7.5' QUADRANGLE
NAPA COUNTY, CALIFORNIA: A DIGITAL DATABASE

Qoa

Alluvium (early to late Pleistocene) - Composed of consolidated sand, silt, clay, and gravel. Topography is moderately rolling with little or no original alluvial surfaces preserved, deeply dissected.

Qhf

Alluvial fan deposits (Holocene) - Alluvial fan sediment deposited by streams emanating from mountain drainages onto alluvial valleys, composed of moderately to poorly sorted sand, gravel, silt and clay.

Qhf1

Qhf2

Fault - Solid where accurately located, dashed where approximately located, dotted where concealed, queried where uncertain.
# LOG OF TEST BORING

**BORING NO.: 1**

**PROJECT:** Old Sonoma Housing Project  
**CLIENT:** Napa Community Real Estate Fund  
**LOCATION:** 2344 Old Sonoma Road, Napa  
**DRILLER:** Cal-Nev & Geo-Ex  
**DRILL RIG:** CME-55  
**DEPTH TO WATER:** INITIAL $\varphi_0$: 7'  
**DATE:** 01/12/22 & 08/24/22  
**ELEVATION:** n/a  
**LOGGED BY:** DVC  
**PROJECT NO.:** VV5305  
**BORING DIAMETER:** 4'' & 6''

## Geotechnical Description and Classification

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Soil Classification</th>
<th>Converted SPT Blow Count (Blows/ft)</th>
<th>Dry Density (PCF)</th>
<th>Moisture Content (Percent)</th>
<th>Additional Tests and Remarks (LL, PI, UCC, ø&amp;c, Gradation)</th>
</tr>
</thead>
</table>
| 0-1        | CH                  | 13                                   | 81.7              | 32.7                      | LL=52  
|            |                     |                                      |                   |                           | PI=32                                                  |
| 1-1        | CH                  | 4                                    |                   |                           | No. 3 Sand  
|            |                     |                                      |                   |                           | from 2' to 8'                                         |
| 1-2        | CL                  | 20                                   | 93.8              | 28.2                      | Bottom 5'  
|            |                     |                                      |                   |                           | Slotted Pipe.                                          |
| 1-3        | CL                  | 8                                    | 91.0              | 32.9                      | Dry at time of  
|            |                     |                                      |                   |                           | installation,  
|            |                     |                                      |                   |                           | on 08/24/22                                             |
| 1-4        | CL                  | 9                                    | 84.7              | 35.3                      | Pc=1,613 psf  
|            |                     |                                      |                   |                           |                                                         |
| 1-5        | CL                  | 10                                   | 94.6              | 28.6                      | %<200=66%                                             |

This information pertains only to this boring and is not necessarily indicative of the whole site.

---

**KC ENGINEERING CO.**  
Figure 4
Brown Gravelly CLAY; very moist, very stiff.

Brown Clayey GRAVEL w/ Sand; wet, loose to medium dense.

Olive CLAY w/ Gravels to 1"; moist, hard.

Boring Terminated @ 50'. Groundwater Encountered @ 7' then rose to 2' after 48 hours.
### LOG OF TEST BORING
**BORING NO.: 2**

**PROJECT:** Old Sonoma Housing Project  
**CLIENT:** Napa Community Real Estate Fund  
**LOCATION:** 2344 Old Sonoma Road, Napa  
**DRILLER:** Cal-Nev  
**DRILL RIG:** CME-55  
**DEPTH TO WATER:** INITIAL \(\varnothing\) : 11'  
**GROUNDWATER ENCOUNTERED:** @ 11' then rose to 6'.

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>SAMPLE NO.</th>
<th>GRAPHIC LOG</th>
<th>GEOTECHNICAL DESCRIPTION AND CLASSIFICATION</th>
<th>SOIL CLASSIFICATION</th>
<th>CONVERTED SPT BLOW COUNT (BLOWS/FT.)</th>
<th>DRY DENSITY (PCF)</th>
<th>MOISTURE CONTENT (PERCENT)</th>
<th>Qp (t.s.f.)</th>
<th>PENETROMETER</th>
<th>ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&amp;c, Gradation)</th>
</tr>
</thead>
</table>
| 0     | 2-1        | 3" Asphalt Concrete  
8" Aggregate Base  
Brown Silty CLAY; moist, stiff to very stiff. |
| 5     | 2-2        | Mottled Gray & Brown Silty CLAY; moist, stiff. |
| 10    | 2-3        | As Above, very stiff. |
| 15    | 2-4        | As Above, stiff.  
Boring Terminated @ 16.5'.  
Groundwater Encountered @ 11' then rose to 6'. |

**UCC=2,769 psf**

---

This information pertains only to this boring and is not necessarily indicative of the whole site.

**KC ENGINEERING CO.**

Figure 5
LOG OF TEST BORING
BORING NO.: 3

PROJECT: Old Sonoma Housing Project
CLIENT: Napa Community Real Estate Fund
LOCATION: 2344 Old Sonoma Road, Napa
DRILLER: Cal-Nev
DRILL RIG: CME-55

DEPTH TO WATER: INITIAL : 9'

This information pertains only to this boring and is not necessarily indicative of the whole site.

KC ENGINEERING CO.
**LOG OF TEST BORING**

**BORING NO.: 4**

**PROJECT:** Old Sonoma Housing Project  
**CLIENT:** Napa Community Real Estate Fund  
**LOCATION:** 2344 Old Sonoma Road, Napa  
**DRILLER:** Cal-Nev & Geo-Ex  
**DRILL RIG:** CME-55  
**DEPTH TO WATER:** INITIAL \( \varnothing : 9' \)  
**DATE:** 01/12/22 & 08/24/22  
**ELEVATION:** n/a  
**LOGGED BY:** DVC  
**BORING DIAMETER:** 4" & 6"  
**FINAL \( \varnothing : 5' \) AFTER:** hrs.

### GEOTECHNICAL DESCRIPTION AND CLASSIFICATION

<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SOIL CLASSIFICATION</th>
<th>CONVERTED SPT BLOW COUNT (BLOWS/FT.)</th>
<th>DRY DENSITY (PCF)</th>
<th>MOISTURE CONTENT (PERCENT)</th>
<th>ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&amp;c, Gradation)</th>
<th>MONITORING WELL NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>CL</td>
<td></td>
<td></td>
<td></td>
<td>Bentonite to 3'</td>
<td>MW-B4</td>
</tr>
<tr>
<td>4-1</td>
<td>GP</td>
<td>12</td>
<td>93.7</td>
<td>26.5</td>
<td>LL=45 Pl=25</td>
<td></td>
</tr>
<tr>
<td>4-2</td>
<td>GP</td>
<td>14</td>
<td>117.4</td>
<td>16.4</td>
<td>No. 3 Sand from 3' to 12.5'</td>
<td></td>
</tr>
<tr>
<td>4-3</td>
<td>GP</td>
<td>19</td>
<td></td>
<td></td>
<td>Bottom 5' Slotted Pipe.</td>
<td></td>
</tr>
<tr>
<td>4-4</td>
<td>GC</td>
<td>10</td>
<td>98.6</td>
<td>29.5</td>
<td>Water @ 8.5' at time of installation, on 08/24/22.</td>
<td></td>
</tr>
</tbody>
</table>

This information pertains only to this boring and is not necessarily indicative of the whole site.
**LOG OF TEST BORING**

**BORING NO.: 5**

**PROJECT:** Old Sonoma Housing Project  
**CLIENT:** Napa Community Real Estate Fund  
**LOCATION:** 2344 Old Sonoma Road, Napa  
**DRILLER:** Cal-Nev  
**DRILL RIG:** CME-55  
**ELEVATION:** n/a  
**DATE:** 01/12/22  
**LOGGED BY:** DVC  
**BORING DIAMETER:** 4"  
**DEPTH TO WATER: INITIAL:** 10'  

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>SAMPLE NO.</th>
<th>SAMPLER</th>
<th>GRAPHIC LOG</th>
<th>SOIL CLASSIFICATION</th>
<th>CONVERTED SPT BLOW COUNT (BLOWS/FT.)</th>
<th>DRY DENSITY (PCF)</th>
<th>MOISTURE CONTENT (PERCENT)</th>
<th>Qp (t.s.f.)</th>
<th>Penetrometer</th>
<th>ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&amp;c, Gradation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5-1</td>
<td>CH</td>
<td></td>
<td>Dark Brown CLAY w/ Few Gravels; moist, stiff to very stiff.</td>
<td>17</td>
<td>3.5</td>
<td>98.0</td>
<td>27.0</td>
<td>2.5</td>
<td>UCC=2,540 psf</td>
</tr>
<tr>
<td>5</td>
<td>5-2</td>
<td>CL</td>
<td></td>
<td>Gray &amp; Brown Silty CLAY; moist, stiff.</td>
<td>13</td>
<td>98.0</td>
<td>27.0</td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>5-3</td>
<td></td>
<td></td>
<td>As Above.</td>
<td>13</td>
<td>98.0</td>
<td>27.0</td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>5-4</td>
<td></td>
<td></td>
<td>As Above, very stiff.</td>
<td>19</td>
<td>95.1</td>
<td>29.1</td>
<td>2.75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 20    |             |         |             | Boring Terminated @ 16.5'.  
Groundwater Encountered @ 10'. |                        |                  |                                    |             |             |                                                          |
| 25    |             |         |             |                                                                |                        |                  |                                    |             |             |                                                          |

This information pertains only to this boring and is not necessarily indicative of the whole site.
### LOG OF TEST BORING

**BORING NO.: 6**

**PROJECT:** Old Sonoma Housing Project  
**CLIENT:** Napa Community Real Estate Fund  
**LOCATION:** 2344 Old Sonoma Road, Napa  
**DRILLER:** Cal-Nev  
**DRILL RIG:** CME-55  
**DEPTH TO WATER:** INITIAL: 13'  
**ELEVATION:** n/a  
**DATE:** 01/12/22  
**PROJECT NO.:** VV5305  
**LOGGED BY:** DVC  
**BORING DIAMETER:** 4"  
**BORING DURATION:** AFTER: 48 HRS

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>SAMPLE NO.</th>
<th>SAMPLER</th>
<th>GRAPHIC LOG</th>
<th>GEOTECHNICAL DESCRIPTION AND CLASSIFICATION</th>
<th>SOIL CLASSIFICATION</th>
<th>CONVERTED SPT BLOW COUNT (BLOWS/FT.)</th>
<th>DRY DENSITY (PCF)</th>
<th>MOISTURE CONTENT (PERCENT)</th>
<th>Qp (t.s.f.)</th>
<th>PENETROMETER</th>
<th>ADDITIONAL TESTS AND REMARKS (LL, PL, UCC, ø&amp;c, Gradation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6-0</td>
<td></td>
<td></td>
<td>2½&quot; Asphalt Concrete</td>
<td>CH</td>
<td>22</td>
<td>103.5</td>
<td>21.0</td>
<td>4.0</td>
<td></td>
<td>El=105</td>
</tr>
<tr>
<td>6</td>
<td>6-1</td>
<td></td>
<td></td>
<td>6&quot; Aggregate Base</td>
<td>CL</td>
<td>17</td>
<td>123.5</td>
<td>2.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>6-2</td>
<td></td>
<td></td>
<td>Mottled Brown &amp; Gray CLAY; very moist, very stiff.</td>
<td>CL</td>
<td>14</td>
<td>95.5</td>
<td>1.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>6-3</td>
<td></td>
<td></td>
<td>Brown Silty CLAY; wet, stiff.</td>
<td></td>
<td>15</td>
<td>90.5</td>
<td>31.9</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>6-4</td>
<td></td>
<td></td>
<td>As Above.</td>
<td></td>
<td>15</td>
<td>90.5</td>
<td>31.9</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td>Brown CLAY w/ Sand; very moist, stiff.</td>
<td></td>
<td>15</td>
<td>90.5</td>
<td>31.9</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This information pertains only to this boring and is not necessarily indicative of the whole site.

KC ENGINEERING CO.  
Figure 9
LOG OF TEST BORING
BORING NO.: 6

PROJECT: Old Sonoma Housing Project
CLIENT: Napa Community Real Estate Fund
LOCATION: 2344 Old Sonoma Road, Napa
DRILLER: Cal-Nev
DRILL RIG: CME-55

DEPTH TO WATER: INITIAL: 13'

This information pertains only to this boring and is not necessarily indicative of the whole site.
### LOG OF TEST BORING

**BORING NO.: 7**

**PROJECT:** Old Sonoma Housing Project  
**CLIENT:** Napa Community Real Estate Fund  
**LOCATION:** 2344 Old Sonoma Road, Napa  
**DRILLER:** Cal-Nev  
**DRILL RIG:** CME-55  
**DEPTH TO WATER:** INITIAL : 11'  
**DATE:** 01/13/22  
**ELEVATION:** n/a  
**LOGGED BY:** DVC  
**PROJECT NO.:** VV5305  
**CLIENT:** Napa Community Real Estate Fund  
**DATE:** 01/13/22  
**ELEVATION:** n/a  
**LOGGED BY:** DVC  
**LOCATION:** 2344 Old Sonoma Road, Napa  
**DRILLER:** Cal-Nev  
**DRILL RIG:** CME-55  
**DEPTH TO WATER:** INITIAL : 11'  
**DATE:** 01/13/22  
**ELEVATION:** n/a  
**LOGGED BY:** DVC  
**LOCATION:** 2344 Old Sonoma Road, Napa  

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>SAMPLER</th>
<th>GRAPHIC LOG</th>
<th>SOIL CLASSIFICATION</th>
<th>CONVERTED SPT BLOW COUNT (B/FT.)</th>
<th>DRY DENSITY (PCF)</th>
<th>MOISTURE CONTENT (PERCENT)</th>
<th>Qp (t.s.f.)</th>
<th>Penetrometer</th>
<th>ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&amp;c, Gradation)</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
| 7-1   | 2½” Asphalt Concrete  
6” Aggregate Base  
Dark Brown Silty CLAY; moist, very stiff.  
Mottled Brown CLAY; moist, very stiff.  
Mottled Gray & Brown CLAY w/ Fine Sand; very moist to wet, very stiff.  
As Above, very stiff.  
Olive Brown CLAY; moist, very stiff. | CH | 22 | 104.1 | 22.4 | 3.75 |
| 7-2   | 3½” | 17 | 92.2 | 29.8 | 2.75 | CL |
| 7-3   | 3½” | 21 | 98.1 | 26.4 | 2.25 | CH |

This information pertains only to this boring and is not necessarily indicative of the whole site.
As Above.

Boring Terminated @ 30.5'. Groundwater Encountered @ 11' then rose to 4' in 24 hours.
## LOG OF TEST BORING

**BORING NO.: 8**

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>SAMPLER</th>
<th>SAMPLE NO.</th>
<th>GRAPHIC LOG</th>
<th>GEOTECHNICAL DESCRIPTION AND CLASSIFICATION</th>
<th>SOIL CLASSIFICATION</th>
<th>CONVERTED SPT BLOW COUNT (BLOWS/FT.)</th>
<th>DRY DENSITY (PCF)</th>
<th>MOISTURE CONTENT (PERCENT)</th>
<th>Qp (t.s.f.)</th>
<th>Penetrometer</th>
<th>ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&amp;c, Gradation)</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>8-0</td>
<td></td>
<td>Mottled Brown Sandy CLAY; moist, firm to stiff.</td>
<td>CL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ei=24</td>
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<tr>
<td>5</td>
<td></td>
<td>8-1</td>
<td></td>
<td>Mottled Olive Brown Sandy CLAY; moist, very stiff to hard.</td>
<td>CL</td>
<td>15</td>
<td>100.9</td>
<td>25.3</td>
<td>3.0</td>
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<td>UCC=2,547 psf</td>
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<td>8-2</td>
<td></td>
<td>Mottled Light Olive Brown CLAY; moist, very stiff.</td>
<td>CL</td>
<td>32</td>
<td>89.2</td>
<td>33.5</td>
<td>1.75</td>
<td></td>
<td></td>
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<tr>
<td>15</td>
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<td>8-3</td>
<td></td>
<td>Boring Terminated @ 13.5’. No Groundwater Encountered at time of drilling, then rose to 10’ after 24 hours.</td>
<td>CL</td>
<td>19</td>
<td>89.2</td>
<td>33.5</td>
<td>1.75</td>
<td></td>
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</tbody>
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This information pertains only to this boring and is not necessarily indicative of the whole site.
**LOG OF TEST BORING**

**BORING NO.: 9**

**PROJECT:** Old Sonoma Housing Project  
**CLIENT:** Napa Community Real Estate Fund  
**LOCATION:** 2344 Old Sonoma Road, Napa  
**DRILLER:** Cal-Nev & Geo-Ex  
**PROJECT NO.:** VV5305  
**DATE:** 01/12/22 & 08/24/22  
**ELEVATION:** n/a  
**LOGGED BY:** DVC  
**BORING DIAMETER:** 4" & 6"  
**DEPTH TO WATER:** INITIAL $\varphi$ : 14'  
**FINAL $\varphi$ : 6.5' AFTER: 24 hrs.**

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<th>DEPTH</th>
<th>MONITORING WELL</th>
<th>SAMPLER</th>
<th>GRAPHIC LOG</th>
<th>SOIL CLASSIFICATION</th>
<th>CONVERTED SPT BLOW COUNT (BLOWS/FT.)</th>
<th>DRY DENSITY (PCF)</th>
<th>MOISTURE CONTENT (PERCENT)</th>
<th>ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&amp;c, Gradation)</th>
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</tbody>
</table>

Brown CLAY & Gray Angular GRAVELS; moist, medium dense. (FILL)

Mottled Olive Brown CLAY; moist, firm to stiff. (NATIVE)

As Above, very stiff.

Mottled Olive Brown CLAY; very moist, stiff.

Brown Clayey SAND w/ Some Gravels; wet, dense.

Boring Terminated @ 25'. Groundwater Encountered @ 14', then rose to 6.5' after 24 hours.

**GC**

Bentonite to 3'  
No. 3 Sand from 3' to 12'

Bottom 5' Slotted Pipe.

Dry at time of installation, on 08/24/22.

%<200=92%  
%<200=26%

This information pertains only to this boring and is not necessarily indicative of the whole site.

KC ENGINEERING CO.  
Figure 12
**LOG OF TEST BORING**
**BORING NO.: 10**

**PROJECT:** Old Sonoma Housing Project  
**CLIENT:** Napa Community Real Estate Fund  
**LOCATION:** 2344 Old Sonoma Road, Napa  
**DRILLER:** Cal-Nev & Geo-Ex  
**DRILL RIG:** CME-55  
**DEPTH TO WATER:** INITIAL \( \varnothing \): 14'  
**DATE:** 01/13/22 & 08/24/22  
**ELEVATION:** n/a  
**PROJECT NO.:** VV5305  
**LOGGED BY:** DVC  
**BORING DIAMETER:** 4" & 6"  
**FINAL \( \varnothing \): 6' AFTER: 24 hrs.

### Geotechnical Description and Classification

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<th>Depth (ft)</th>
<th>Monitoring Well Sample No.</th>
<th>Sampler</th>
<th>Graphic Log</th>
<th>Soil Classification</th>
<th>Converted SPT Blow Count (Blows/ft.)</th>
<th>Dry Density (PCF)</th>
<th>Moisture Content (Percent)</th>
<th>Additional Tests and Remarks (LL, PI, UCC, ø &amp; c, Gradation)</th>
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<td>SM</td>
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<td>SM</td>
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<td></td>
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<td>MW-B10 Bentonite to 3'</td>
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<td>CL</td>
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<td>CL</td>
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</tr>
<tr>
<td>10</td>
<td></td>
<td>CL</td>
<td></td>
<td>CL</td>
<td>13</td>
<td>95.5</td>
<td>25.1</td>
<td>4 = 26.8° c = 464 psf</td>
</tr>
<tr>
<td>10-1</td>
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<td>CL</td>
<td></td>
<td>CL</td>
<td></td>
<td></td>
<td></td>
<td>4 = 26.8° c = 464 psf</td>
</tr>
<tr>
<td>10-2</td>
<td></td>
<td>CH</td>
<td></td>
<td>CH</td>
<td>25</td>
<td></td>
<td></td>
<td>Bottom 5' Slotted Pipe.</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>CL</td>
<td></td>
<td>CL</td>
<td>14</td>
<td>89.8</td>
<td>31.1</td>
<td>Dry at time of installation, on 08/24/22.</td>
</tr>
<tr>
<td>15-3</td>
<td></td>
<td>SC</td>
<td></td>
<td>SC</td>
<td></td>
<td>11</td>
<td>91.8</td>
<td>% &lt; 200 = 37%</td>
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<td>CL</td>
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</tr>
<tr>
<td>20-4</td>
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<td>CL</td>
<td></td>
<td>CL</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>25</td>
<td></td>
<td>CL</td>
<td></td>
<td>CL</td>
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</tbody>
</table>

**Figure 13**

This information pertains only to this boring and is not necessarily indicative of the whole site.
LOG OF TEST BORING
BORING NO.: 10

PROJECT: Old Sonoma Housing Project
CLIENT: Napa Community Real Estate Fund
LOCATION: 2344 Old Sonoma Road, Napa
DRILLER: Cal-Nev & Geo-Ex
DRILL RIG: CME-55
DEPT TO WATER: INITIAL $\text{\textfrac{\textdiameter}{\textlength}}$ : 14'

This information pertains only to this boring and is not necessarily indicative of the whole site.
## LOG OF TEST BORING

### BORING NO.: 11

**PROJECT:** Old Sonoma Housing Project  
**CLIENT:** Napa Community Real Estate Fund  
**LOCATION:** 2344 Old Sonoma Road, Napa  
**DRILLER:** Cal-Nev  
**DRILL RIG:** CME-55  
**DATE:** 01/13/22  
**ELEVATION:** n/a  
**LOGGED BY:** DVC  
**PROJECT NO.:** VV5305  
**CLIENT:** Napa Community Real Estate Fund  
**DATE:** 01/13/22  
**LOCATION:** 2344 Old Sonoma Road, Napa  

#### LOG OF TEST BORING

**DEPTH TO WATER: INITIAL **9'**  
**FINAL:** 7'  
**AFTER:** 24 HRS

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>SAMPLE NO.</th>
<th>SAMPLER</th>
<th>GRAPHIC LOG</th>
<th>GEOTECHNICAL DESCRIPTION AND CLASSIFICATION</th>
<th>SOIL CLASSIFICATION</th>
<th>CONVERTED SPT BLOW COUNT (BLOWS/FT.)</th>
<th>DRY DENSITY (PCF)</th>
<th>MOISTURE CONTENT (PERCENT)</th>
<th>Qp (t.s.f.)</th>
<th>PENETROMETER</th>
<th>ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&amp;c, Gradation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>Brown Sandy CLAY w/ Gravels; moist, stiff to very stiff. (FILL)</td>
<td>CL</td>
<td>21</td>
<td>104.5</td>
<td>19.0</td>
<td>2.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>11-1</td>
<td></td>
<td></td>
<td>Brown Gravelly CLAY; very moist, very stiff. (NATIVE)</td>
<td>CL</td>
<td>17</td>
<td>104.5</td>
<td>19.0</td>
<td>2.25</td>
<td></td>
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</tr>
<tr>
<td>10</td>
<td>11-2</td>
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<td></td>
<td>Mottled Gray &amp; Olive CLAY; wet, stiff.</td>
<td>CL</td>
<td>13</td>
<td>90.6</td>
<td>32.6</td>
<td></td>
<td></td>
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<tr>
<td>15</td>
<td>11-3</td>
<td></td>
<td></td>
<td>Mottled Gray &amp; Olive CLAY; wet, stiff to very stiff.</td>
<td>CL</td>
<td>18</td>
<td></td>
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<td></td>
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<tr>
<td>20</td>
<td>11-4</td>
<td></td>
<td></td>
<td>Boring Terminated @ 21.5'. Groundwater Encountered @ 9' then rose to 7' after 24 hours.</td>
<td>CL</td>
<td>18</td>
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This information pertains only to this boring and is not necessarily indicative of the whole site.
# LOG OF TEST BORING

## BORING NO.: 12

### PROJECT: Old Sonoma Housing Project

### CLIENT: Napa Community Real Estate Fund

### LOCATION: 2344 Old Sonoma Road, Napa

### DRILLER: Cal-Nev

### DRILL RIG: CME-55

### DEPTH TO WATER: INITIAL $\varnothing$: 15'

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<th>GEOTECHNICAL DESCRIPTION AND CLASSIFICATION</th>
<th>SOIL CLASSIFICATION</th>
<th>CONVERTED SPT BLOW COUNT (BLOWS/FT.)</th>
<th>DRY DENSITY (PCF)</th>
<th>MOISTURE CONTENT (PERCENT)</th>
<th>Qp (t.s.f.)</th>
<th>PENETROMETER</th>
<th>ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&amp;c, Gradation)</th>
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</tr>
<tr>
<td>5</td>
<td>12-1</td>
<td></td>
<td></td>
<td>Brown CLAY; moist, firm to stiff.</td>
<td>CL/CH</td>
<td></td>
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</tr>
<tr>
<td>5</td>
<td>12-2</td>
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<td>Mottled Brown Sandy CLAY w/ Gravels; moist, very stiff.</td>
<td>CL</td>
<td>18</td>
<td>77.7</td>
<td>23.3</td>
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<td>LL=42, PI=26</td>
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<tr>
<td>10</td>
<td>12-3</td>
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<td>As Above, hard.</td>
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<tr>
<td>15</td>
<td>12-4</td>
<td></td>
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<td>Mottled Gray &amp; Olive Silty CLAY; very moist, very stiff.</td>
<td>CL</td>
<td>28</td>
<td>2.25</td>
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<td>15</td>
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<td>As Above, stiff.</td>
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<td>Boring Terminated @ 16.5'. Groundwater Encountered @ 15', then rose to 6.5' after 24 hours.</td>
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This information pertains only to this boring and is not necessarily indicative of the whole site.
**LOG OF TEST BORING**

**BORING NO.: 13**

**PROJECT:** Old Sonoma Housing Project

**CLIENT:** Napa Community Real Estate Fund

**LOCATION:** 2344 Old Sonoma Road, Napa

**DRILLER:** Cal-Nev & Geo-Ex

**DRILL RIG:** CME-55

**DEPTH TO WATER:** INITIAL $\frac{\pi}{2} : 8'$

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<td>13-50</td>
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</tbody>
</table>

**GEOTECHNICAL DESCRIPTION AND CLASSIFICATION**

- **Brown CLAY & Gray Angular GRAVELS; moist, firm to stiff & medium dense. (FILL)**
  - **SOIL CLASSIFICATION:** GC
  - **CONVERTED SPT BLOW COUNT (BLOWS/FT.):** 12
  - **DRY DENSITY (PCF):** 102.4
  - **MOISTURE CONTENT (PERCENT):** 4.7

- **Brown Gravelly CLAY; wet, very stiff. (NATIVE)**
  - **SOIL CLASSIFICATION:** CL
  - **CONVERTED SPT BLOW COUNT (BLOWS/FT.):** 27
  - **DRY DENSITY (PCF):** 91.0
  - **MOISTURE CONTENT (PERCENT):** 32.9

- **Mottled Gray & Olive CLAY; very moist, very stiff.**
  - **SOIL CLASSIFICATION:** CL/CH
  - **CONVERTED SPT BLOW COUNT (BLOWS/FT.):** 17

- **As Above, very stiff.**

**Boring Terminated @ 20.5'. Groundwater Encountered @ 8', then rose to 5' after 24 hours.**

**ADDITIONAL TESTS AND REMARKS**

- **MW-B13**
  - Bentonite to 3'
  - No. 3 Sand from 3' to 12'
  - Bottom 5' Slotted Pipe.
  - Water @ 11'3" at time of installation, on 08/24/22.

---

This information pertains only to this boring and is not necessarily indicative of the whole site.

**KC ENGINEERING CO.**

Figure 16
Brown Sandy CLAY; moist, firm to stiff, w/ some roots.

Mottled Brown CLAY; moist, very stiff.

Mottled Gray & Brown Silty CLAY; wet, firm to stiff.

Mottled Gray & Olive CLAY; wet, stiff.

Boring Terminated @ 21.5’. Groundwater Encountered @ 10’, then rose to 4’ in 1 hour.

This information pertains only to this boring and is not necessarily indicative of the whole site.
**LOG OF TEST BORING**

**BORING NO.: 15**

**PROJECT:** Old Sonoma Housing Project  
**CLIENT:** Napa Community Real Estate Fund  
**LOCATION:** 2344 Old Sonoma Road, Napa  
**DRILLER:** Cal-Nev & Geo-Ex  
**DRILL RIG:** CME-55  
**DEPTH TO WATER:** INITIAL $\varnothing : 12'$  
**FINAL $\varnothing : 6'$**  
**AFTER: hrs.**

## Monitoring Well Notes
- **MW-B15**
- Bentonite to 3'
- No. 3 Sand from 3' to 12.5'
- Bottom 5' Slotted Pipe.
- Water @ 9' at time of installation, on 08/24/22.

### Additional Tests and Remarks
- LL = 51  
- PI = 31

### Monitoring Well Notes

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>MONITORING WELL</th>
<th>SAMPLE NO.</th>
<th>SAMPLER</th>
<th>GRAPHIC LOG</th>
<th>GEOTECHNICAL DESCRIPTION AND CLASSIFICATION</th>
<th>SOIL CLASSIFICATION</th>
<th>CONVERTED SPT BLOW COUNT (BLOWS/FT.)</th>
<th>DRY DENSITY (PCF)</th>
<th>MOISTURE CONTENT (PERCENT)</th>
<th>ADDITIONAL TESTS AND REMARKS (LL, PI, UCC, ø&amp;c, Gradation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>15-0</td>
<td></td>
<td></td>
<td>3&quot; Asphalt Concrete</td>
<td>CH</td>
<td>14</td>
<td></td>
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<tr>
<td>3</td>
<td></td>
<td>15-1</td>
<td></td>
<td></td>
<td>6&quot; Aggregate Base</td>
<td>CH</td>
<td>14</td>
<td></td>
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<tr>
<td>6</td>
<td></td>
<td>15-2</td>
<td></td>
<td></td>
<td>Brown CLAY; moist, stiff.</td>
<td>CL/CH</td>
<td>18</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>9</td>
<td></td>
<td>15-3</td>
<td></td>
<td></td>
<td>Mottled Gray &amp; Brown CLAY; moist, stiff to very stiff.</td>
<td>CL/CH</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>15-4</td>
<td></td>
<td></td>
<td>As Above, stiff.</td>
<td>CH</td>
<td>17</td>
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<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>As Above, very stiff.</td>
<td>CH</td>
<td>17</td>
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</tr>
</tbody>
</table>

*This information pertains only to this boring and is not necessarily indicative of the whole site.*
### Unified Soil Classification System

<table>
<thead>
<tr>
<th>MAJOR DIVISIONS</th>
<th>SYMBOLS</th>
<th>TYPICAL NAMES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GRAVEL</strong></td>
<td>GW</td>
<td>Clean gravels (&lt;5% fines)</td>
</tr>
<tr>
<td>More than half of coarse fraction is larger than No. 4 sieve</td>
<td>GP</td>
<td>Silty gravels and gravel-sand-silt mixtures (PI ≤ 4 or below &quot;A&quot; line)</td>
</tr>
<tr>
<td></td>
<td>GM</td>
<td>Clayey gravels and gravel-sand-clay mixtures (PI ≥ 7 &amp; on or above &quot;A&quot; line)</td>
</tr>
<tr>
<td></td>
<td>GC</td>
<td>Clean sands (&lt;5% fines)</td>
</tr>
<tr>
<td></td>
<td>SW</td>
<td>Silty sands and gravel-sand-silt mixtures (PI = 4 or below &quot;A&quot; line)</td>
</tr>
<tr>
<td></td>
<td>SP</td>
<td>Poorly graded sands, sandy gravel, sand, or sand (Cu ≤ 4 and/or 1 &lt; Cc &lt; 3)</td>
</tr>
<tr>
<td></td>
<td>SM</td>
<td>Silty sands and gravel-sand-silt mixtures (PI = 4 or below &quot;A&quot; line)</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>Clayey sands and gravel-sand-clay mixtures (PI = 4 or below &quot;A&quot; line)</td>
</tr>
<tr>
<td><strong>SAND</strong></td>
<td>ML</td>
<td>Inorganic silts with sand and gravel having slight plasticity (PI &lt; 4 or below &quot;A&quot; line)</td>
</tr>
<tr>
<td>Half or more of the coarse fraction is smaller than No. 4 sieve</td>
<td>CL</td>
<td>Inorganic clays of low to medium plasticity with sand and gravel (PI ≤ 7 &amp; on or above &quot;A&quot; line)</td>
</tr>
<tr>
<td></td>
<td>OL</td>
<td>Organic silts and clays of low plasticity (PI ≤ 7 &amp; on or above &quot;A&quot; line)</td>
</tr>
<tr>
<td><strong>SILTS AND CLAYS</strong></td>
<td>MH</td>
<td>Inorganic elastic silts (PI below &quot;A&quot; line)</td>
</tr>
<tr>
<td>Liquid Limit is less than 50%</td>
<td>CH</td>
<td>Inorganic clays of high plasticity, fat clays (PI on or above &quot;A&quot; line)</td>
</tr>
<tr>
<td></td>
<td>OH</td>
<td>Organic silts and clays of medium to high plasticity (PI on or above &quot;A&quot; line)</td>
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<tr>
<td></td>
<td>Pt</td>
<td>Peat and other highly organic soils</td>
</tr>
<tr>
<td><strong>SANDS &amp; GRAVELS BLOWS/Foot</strong></td>
<td><strong>SILTS &amp; CLAYS CONSISTENCY (Fine-grained soils)</strong></td>
<td><strong>SILTS &amp; CLAYS STRENGTH</strong></td>
</tr>
<tr>
<td>Very Loose</td>
<td>0 – 4</td>
<td>Very Soft</td>
</tr>
<tr>
<td>Loose</td>
<td>4 – 10</td>
<td>Soft</td>
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<tr>
<td>Medium Dense</td>
<td>10 – 30</td>
<td>Firm</td>
</tr>
<tr>
<td>Dense</td>
<td>30 – 50</td>
<td>Stiff</td>
</tr>
<tr>
<td>Very Dense</td>
<td>&gt; 50</td>
<td>Very Stiff</td>
</tr>
</tbody>
</table>

1 – Number of blows of 140 pound hammer falling 30 inches to drive 2-inch O.D. split spoon sampler (ASTM D1586)

2 – Unconfined compressive strength in lb/ft² as determined by lab testing or approximated by the standard penetration test (ASTM D1586) or pocket penetrometer.

### Weathering (Bedrock)

- **Fresh**: No visible sign of decomposition or discoloration; rings under hammer impact
- **Slightly weathered**: Slight discoloration inwards from open fractures; little or no effect on normal cementation; otherwise similar to Fresh
- **Moderately weathered**: Discoloration throughout; weaker minerals decomposed; strength somewhat less than fresh rock but cores can not be broken by hand or scraped with knife; texture preserved; cementation little to not affected; fractures may contain filling
- **Highly weathered**: Most minerals somewhat decomposed; specimens can be broken by hand with effort or shaved with knife; texture becoming indistinct but fabric preserved; faint fractures
- **Completely weathered**: Minerals decomposed to soil but fabric and structure preserved; specimens can be easily crumbled or penetrated

### Bedding (Bedrock) and Spacing (inches)

- **Very thickly bedded**: > 48
- **Thickly bedded**: 24 to 48
- **Thin bedded**: 2.5 to 24
- **Very thin bedded**: 5/8 to 2.5
- **Laminated**: 1/8 to 5/8
- **Thinly laminated**: < 1/8

### Fracturing (Bedrock) and Spacing (inches)

- **Very little fractured**: > 48
- **Occasionally fractured**: 12 to 48
- **Moderately fractured**: 6 to 12
- **Closely fractured**: 1 to 6
- **Intensely fractured**: 5/8 to 1
- **Crushed**: < 5/8

### Soil Grain Size

**U.S. Standard Sieve Openings**

<table>
<thead>
<tr>
<th>U.S. STANDARD SIEVE OPENINGS</th>
<th>#200</th>
<th>#40</th>
<th>#10</th>
<th>#4</th>
<th>3”</th>
<th>12”</th>
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<tbody>
<tr>
<td>0.002</td>
<td>FINE</td>
<td>MEDIUM</td>
<td>COARSE</td>
<td>FINE</td>
<td>COARSE</td>
<td>COBBLES</td>
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<td>0.075</td>
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<td></td>
<td></td>
<td>75</td>
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<tr>
<td>0.425</td>
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<td>2.00</td>
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<td>19.0</td>
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### SOIL GRAIN SIZE IN MILLIMETERS

<table>
<thead>
<tr>
<th>RELATIVE DENSITY (Coarse-grained soils)</th>
<th>CONSISTENCY (Fine-grained soils)</th>
<th>STRENGTH (Bedrock)</th>
<th>WEATHERING (Bedrock)</th>
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<tbody>
<tr>
<td>Very Loose</td>
<td>Very Soft</td>
<td>Plastic</td>
<td>Fresh</td>
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<tr>
<td>Loose</td>
<td>Soft</td>
<td>Friable</td>
<td>Slightly weathered</td>
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<tr>
<td>Medium Dense</td>
<td>Firm</td>
<td>Weak</td>
<td>Moderately weathered</td>
</tr>
<tr>
<td>Dense</td>
<td>Stiff</td>
<td>Moderately strong</td>
<td>Highly weathered</td>
</tr>
<tr>
<td>Very Dense</td>
<td>Very Stiff</td>
<td>Strong</td>
<td>Completely weathered</td>
</tr>
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</table>

### Sampling and Lab Testing Legend

- **Auger**: Bulk Sample, taken from auger cuttings
- **California Sampler**: Bulk/Grab Sample
- **Pitcher**: Standard Penetration Test
- **Shelby Tube**: No Recovery

**LL**: Liquid Limit (%)

**PI**: Plasticity Index

**C**: Cohesion

**Cu**: Unconfined Compressivity

**Cc**: Unconfined Cylindrical Compressivity

**Consol**: Consolidation Test
## Density of Soil in Place by the Drive-Cylinder Method (ASTM D2937) and Liquid Limit, Plastic Limit & Plasticity Index of Soils (ASTM D4318)

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Description</th>
<th>Dry Density p.c.f.</th>
<th>Moisture Content %</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plastic Index</th>
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</thead>
<tbody>
<tr>
<td>Subgrade</td>
<td>Mottled Brown Sandy Clay (visual)</td>
<td>---</td>
<td>---</td>
<td>52</td>
<td>20</td>
<td>32</td>
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<tr>
<td>1-1 @ 3.0’</td>
<td>Brown Clay (visual)</td>
<td>81.7</td>
<td>32.7</td>
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<tr>
<td>1-2 @ 8.0’</td>
<td>Mottled Gray and Brown Clay (visual)</td>
<td>93.8</td>
<td>28.2</td>
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</tr>
<tr>
<td>1-3 @ 13.0’</td>
<td>Mottled Brown Clay (visual)</td>
<td>91.0</td>
<td>32.9</td>
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</tr>
<tr>
<td>1-4 @ 18.0’</td>
<td>Mottled Brown Clay (visual)</td>
<td>84.7</td>
<td>35.3</td>
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<tr>
<td>1-5 @ 26.0’</td>
<td>Mottled Gray and Brown Sandy Clay (visual)</td>
<td>94.6</td>
<td>28.6</td>
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</tr>
<tr>
<td>1-6 @ 33.0’</td>
<td>Brown Gravelly Clay (visual)</td>
<td>101.6</td>
<td>22.1</td>
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<td>1-7 @ 41.0’</td>
<td>Brown Clayey Gravel with Sand (visual)</td>
<td>110.9</td>
<td>23.1</td>
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<td>2-1 @ 2.5’</td>
<td>Brown Silty Clay (visual)</td>
<td>86.4</td>
<td>18.8</td>
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<td>2-2 @ 6.0’</td>
<td>Mottled Gray and Brown Clay (visual)</td>
<td>95.3</td>
<td>25.6</td>
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<tr>
<td>2-4 @ 16.0’</td>
<td>Mottled Gray and Brown Clay (visual)</td>
<td>89.3</td>
<td>33.6</td>
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<td>3-1 @ 4.0’</td>
<td>Brown Clay (visual)</td>
<td>92.8</td>
<td>28.2</td>
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<tr>
<td>3-3 @ 14.0’</td>
<td>Brown Clay (visual)</td>
<td>85.5</td>
<td>35.9</td>
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<td>4-1 @ 4.0’</td>
<td>Brown Sandy Clay (visual)</td>
<td>93.7</td>
<td>26.5</td>
<td>45</td>
<td>20</td>
<td>25</td>
</tr>
</tbody>
</table>

Tested by John Hubbard.
The samples were tested according to the referenced standard test procedures and relate only to the items inspected or tested. Results are not transferable and shall not be reproduced, except in full, without written permission from MTI.
# Density of Soil in Place by the Drive-Cylinder Method (ASTM D2937) and Liquid Limit, Plastic Limit & Plasticity Index of Soils (ASTM D4318)

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Description</th>
<th>Dry Density p.c.f.</th>
<th>Moisture Content %</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plastic Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-2 @ 9.0’</td>
<td>Brown Gravel with Sand and Clay (visual)</td>
<td>117.4</td>
<td>16.3</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>4-4 @ 19.5’</td>
<td>Brown Clayey Gravel with Sand (visual)</td>
<td>98.6</td>
<td>29.5</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>5-2 @ 6.0’</td>
<td>Gray and Brown Clay (visual)</td>
<td>98.0</td>
<td>27.0</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>5-4 @ 16.0’</td>
<td>Gray and Brown Clay (visual)</td>
<td>95.1</td>
<td>29.1</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>6-1 @ 3.0’</td>
<td>Brown Clay (visual)</td>
<td>103.5</td>
<td>21.0</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>6-4 @ 21.0’</td>
<td>Brown Clay (visual)</td>
<td>90.5</td>
<td>31.9</td>
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<td>---</td>
<td>---</td>
</tr>
<tr>
<td>6-5 @ 27.0’</td>
<td>Brown Clay with Sand (visual)</td>
<td>92.7</td>
<td>30.0</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>7-1 @ 5.0’</td>
<td>Mottled Brown Clay (visual)</td>
<td>104.1</td>
<td>22.4</td>
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<td>---</td>
<td>---</td>
</tr>
<tr>
<td>7-2 @ 10.0’</td>
<td>Mottled Gray and Brown Clay (visual)</td>
<td>92.2</td>
<td>29.8</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>7-3 @ 20.0’</td>
<td>Mottled Gray and Brown Clay (visual)</td>
<td>98.1</td>
<td>26.4</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>8-1 @ 3.0’</td>
<td>Dark Brown Clay (visual)</td>
<td>100.9</td>
<td>25.3</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>8-3 @ 13.0’</td>
<td>Mottled Light Olive Brown Clay (visual)</td>
<td>89.2</td>
<td>33.5</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>9-1 @ 4.0’</td>
<td>Brown and Gray Clayey Gravel (visual)</td>
<td>100.0</td>
<td>17.3</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>9-3 @ 16.0’</td>
<td>Mottled Olive Brown Clay (visual)</td>
<td>87.5</td>
<td>33.6</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Tested by John Hubbard.

The samples were tested according to the referenced standard test procedures and relate only to the items inspected or tested. Results are not transferable and shall not be reproduced, except in full, without written permission from MTI.
Density of Soil in Place by the Drive-Cylinder Method (ASTM D2937) and Liquid Limit, Plastic Limit & Plasticity Index of Soils (ASTM D4318)

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Description</th>
<th>Dry Density p.c.f.</th>
<th>Moisture Content %</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plastic Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-4 @ 24.5’</td>
<td>Brown Clayey Sand with Gravel (visual)</td>
<td>108.1</td>
<td>21.4</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>10-1 @ 5.0’</td>
<td>Brown Clay (visual)</td>
<td>95.5</td>
<td>25.1</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>10-3 @ 15.0’</td>
<td>Brown Clay (visual)</td>
<td>89.8</td>
<td>31.1</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>10-4 @ 21.0’</td>
<td>Mottled Olive and Brown Clayey Sand (visual)</td>
<td>91.8</td>
<td>32.1</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>11-1 @ 3.0’</td>
<td>Brown Clay with Gravel (visual)</td>
<td>104.5</td>
<td>19.0</td>
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<tr>
<td>11-3 @ 15.0’</td>
<td>Mottled Gray and Olive Clay (visual)</td>
<td>90.6</td>
<td>32.6</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>12-1 @ 2.0’</td>
<td>Black Sandy Clay with Gravel (visual)</td>
<td>77.7</td>
<td>23.3</td>
<td>42</td>
<td>16</td>
<td>26</td>
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<tr>
<td>12-4 @ 16.0’</td>
<td>Mottled Gray and Olive Clay (visual)</td>
<td>89.5</td>
<td>32.9</td>
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<tr>
<td>13-1 @ 5.0’</td>
<td>Brown Gravel (visual)</td>
<td>102.4</td>
<td>4.7</td>
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<td>---</td>
</tr>
<tr>
<td>13-3 @ 15.0’</td>
<td>Mottled Gray and Brown Clay (visual)</td>
<td>91.0</td>
<td>32.9</td>
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<td>---</td>
<td>---</td>
</tr>
<tr>
<td>14-1 @ 4.0’</td>
<td>Brown Sandy Clay (visual)</td>
<td>95.0</td>
<td>28.4</td>
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<td>---</td>
<td>---</td>
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<tr>
<td>14-3 @ 15.0’</td>
<td>Mottled Gray and Brown Clay (visual)</td>
<td>86.7</td>
<td>36.5</td>
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<tr>
<td>14-4 @ 21.0’</td>
<td>Mottled Gray and Olive Clay (visual)</td>
<td>84.2</td>
<td>38.8</td>
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<tr>
<td>15-0 @ 1.0’-3.0’</td>
<td>Brown Sandy Clay (visual)</td>
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<td>---</td>
<td>51</td>
<td>20</td>
<td>31</td>
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<tr>
<td>15-3 @ 13.0’</td>
<td>Mottled Gray and Brown Clay (visual)</td>
<td>86.3</td>
<td>35.0</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Tested by John Hubbard.

The samples were tested according to the referenced standard test procedures and relate only to the items inspected or tested. Results are not transferable and shall not be reproduced, except in full, without written permission from MTI.
### Particle Size Distribution Report

#### Material Description
Mottled Gray and Brown Sandy Clay (visual)

#### Atterberg Limits

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D90=</td>
<td>0.1835</td>
</tr>
<tr>
<td>D50=</td>
<td>0.1436</td>
</tr>
<tr>
<td>D10=</td>
<td>0.66</td>
</tr>
<tr>
<td>Cc=</td>
<td>0.1835</td>
</tr>
<tr>
<td>Cu=</td>
<td>0.1436</td>
</tr>
</tbody>
</table>

#### Classification

<table>
<thead>
<tr>
<th>USCS</th>
<th>AASHTO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL</td>
<td></td>
</tr>
</tbody>
</table>

#### Remarks
Material Tested in Accordance with ASTM D6913.

### Particle Size Distribution Report

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>PERCENT FINER</th>
<th>SPEC.(^*) PERCENT</th>
<th>PASS? (X=NO)</th>
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<tbody>
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<tr>
<td>#8</td>
<td>100</td>
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</tr>
<tr>
<td>#16</td>
<td>100</td>
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<td></td>
</tr>
<tr>
<td>#30</td>
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<td></td>
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<tr>
<td>#50</td>
<td>96</td>
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<td></td>
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<tr>
<td>#100</td>
<td>86</td>
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<tr>
<td>#200</td>
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</tbody>
</table>

\(^*\) (no specification provided)

---

**Location:** 1-5  
**Sample Number:** 8  
**Depth:** 26.0'  
**Date:** 01/28/2022

---

**Client:** Napa Community Real Estate Fund  
**Project:** Proposed Multi & Single Family Housing  
2344 Old Sonoma Road, Napa, California  
**Project No:** VV5305  
**Figure:** 0300-002

**Tested By:** John Hubbard
**Material Description**
Brown Clayey Gravel with Sand (visual)

**Atterberg Limits**

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>D90</td>
<td>41.6959</td>
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<tr>
<td>D85</td>
<td>31.4711</td>
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<tr>
<td>D60</td>
<td>9.5250</td>
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</tbody>
</table>

**Classification**

- USCS: GC
- AASHTO:

**Remarks**
Material Tested in Accordance with ASTM D6913.
### Material Description

Brown Clayey Gravel with Sand (visual)

### Atterberg Limits

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D_90</td>
<td>29.2748</td>
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<td>D_60</td>
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<td>D_50</td>
<td>4.2582</td>
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<td>D_10</td>
<td>3.6500</td>
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<tr>
<td>C_u</td>
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<tr>
<td>C_c</td>
<td>0.5006</td>
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</table>

### Classification

USCS = GC

AASHTO =

### Remarks

Material Tested in Accordance with ASTM D6913.

### Location Information

- Location: 4-4
- Sample Number: 20
- Depth: 19.5'
- Date: 01/28/2022

### Client Information

- Client: Napa Community Real Estate Fund
- Project: Proposed Multi & Single Family Housing
- Project No: VV5305
- Figure: 0300-004

### Tested By

John Hubbard
Particle Size Distribution Report

Material Description
Mottled Brown Sandy Clay (visual)

Atterberg Limits
- PL=
- LL=
- PI=

Coefficients
- D90= 4.7500
- D85= 0.6000
- D60=
- D50= 
- D40= 
- D30= 
- D20= 
- D10= 
- CU= 
- CC=

Classification
USCS= CL
AASHTO=

Remarks
Material Tested in Accordance with ASTM D6913.

Location: 4-5
Sample Number: 21
Depth: 26.0'
Date: 01/28/2022

Client: Napa Community Real Estate Fund
Project: Proposed Multi & Single Family Housing
2344 Old Sonoma Road, Napa, California
Project No: VV5305
Figure 0300-005

Tested By: John Hubbard
**Material Description**

Brown Clay with Sand (visual)

**Atterberg Limits**

<table>
<thead>
<tr>
<th>CL</th>
<th>USCS</th>
<th>AASHTO</th>
</tr>
</thead>
</table>

**Coefficients**

- PL = 0.1141
- LL = 0.0802
- D85 = 0.84
- D60 = 0.7
- C_u = 12
- C_c = 8

**Classification**

CL

**Remarks**

Material Tested in Accordance with ASTM D6913.

---

**Location:** 6-5  
**Sample Number:** 29  
**Depth:** 27.0'  
**Date:** 01/28/2022

---

**Client:** Napa Community Real Estate Fund  
**Project:** Proposed Multi & Single Family Housing  
2344 Old Sonoma Road, Napa, California  
**Project No:** VV5305  
**Figure:** 0300-006

---

**Tested By:** John Hubbard
Material Description

Mottled Olive Brown Clay (visual)

Atterberg Limits

<table>
<thead>
<tr>
<th>PL=</th>
<th>LL=</th>
<th>Pl=</th>
</tr>
</thead>
<tbody>
<tr>
<td>D90=</td>
<td>D85=</td>
<td>D60=</td>
</tr>
<tr>
<td>D50=</td>
<td>D30=</td>
<td>D15=</td>
</tr>
<tr>
<td>D10=</td>
<td>C_u=</td>
<td>C_c=</td>
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</table>

Coefficients

Classification

USCS= CL

AASHTO=

Remarks

Material Tested in Accordance with ASTM D6913.

# SIEVE SIZE | % FINER | SPEC.* PERCENT |
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>#4</td>
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<tr>
<td>#8</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>#16</td>
<td>100</td>
<td></td>
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<tr>
<td>#30</td>
<td>100</td>
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<tr>
<td>#50</td>
<td>99</td>
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<td>#100</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td>#200</td>
<td>92</td>
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</table>

* (no specification provided)
### Material Description
Brown Clayey Sand with Gravel (visual)

### Atterberg Limits

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>PL</td>
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<tr>
<td>LL</td>
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</tr>
<tr>
<td>D90</td>
<td>10.7112</td>
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<tr>
<td>D50</td>
<td>6.7749</td>
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<tr>
<td>D30</td>
<td>2.4517</td>
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<tr>
<td>D15</td>
<td>2.1136</td>
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</table>

### Coefficients

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>C_u</td>
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</tr>
<tr>
<td>C_c</td>
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</table>

### Classification

USCS: SC  
AASHTO:  

**Remarks**
Material Tested in Accordance with ASTM D6913.

---

**Location:** 9-4  
**Sample Number:** 39  
**Depth:** 24.5'  
**Date:** 01/28/2022
**Material Description**
Mottled Olive and Brown Clayey Sand (visual)

**Atterberg Limits**

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL</td>
<td>0.6428</td>
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<tr>
<td>LL</td>
<td>0.1335</td>
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<tr>
<td>D90</td>
<td>0.0100</td>
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<tr>
<td>D85</td>
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<tr>
<td>D30</td>
<td>0.1926</td>
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<tr>
<td>D10</td>
<td>0.1926</td>
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**Classification**
- USCS: SC
- AASHTO:

**Remarks**
Material Tested in Accordance with ASTM D6913.

**Location:** 10-4  
**Sample Number:** 43  
**Depth:** 21.0'  
**Date:** 01/28/2022

**Client:** Napa Community Real Estate Fund  
**Project:** Proposed Multi & Single Family Housing  
2344 Old Sonoma Road, Napa, California  
**Project No:** VV5305  
**Figure:** 0300-009

**Tested By:** John Hubbard
Material Description
Brown Sandy Clay (visual)

Atterberg Limits
PL = LL = PL =

Coefficients
D_90 = 3.3674  D_85 = 1.5799  D_60 =
D_50 =  D_30 = D_15 =
D_10 =  C_u =  C_c =

Classification
USCS = CL  AASHTO =

Remarks
Material Tested in Accordance with ASTM D6913.

Location: 10-5
Sample Number: 44  Depth: 30.0'-31.5'

Client:  Napa Community Real Estate Fund
Project:  Proposed Multi & Single Family Housing
2344 Old Sonoma Road, Napa, California
Project No:  VV5305  Figure: 0300-010

Tested By:  John Hubbard
Material Description

Mottled Gray and Olive Clay (visual)

Atterberg Limits

<table>
<thead>
<tr>
<th>PL=</th>
<th>LL=</th>
<th>PI=</th>
</tr>
</thead>
<tbody>
<tr>
<td>D90=</td>
<td>D85=</td>
<td>D60=</td>
</tr>
<tr>
<td>D50=</td>
<td>D30=</td>
<td>D15=</td>
</tr>
<tr>
<td>D10=</td>
<td>C_u=</td>
<td>C_c=</td>
</tr>
</tbody>
</table>

Coefficients

Classification

USCS= CL

AASHTO=

Remarks

Material Tested in Accordance with ASTM D6913.

Location: 11-4
Sample Number: 48
Depth: 21.0'

Client: Napa Community Real Estate Fund
Project: Proposed Multi & Single Family Housing
2344 Old Sonoma Road, Napa, California
Project No: VV5305
Figure 0300-011

Date: 01/28/2022

Tested By: Allante Blocker
**UNCONFINED COMPRESSION TEST**

### Test Details

**Sample No.:** 1  
**Unconfined strength, psf:** 2769  
**Undrained shear strength, psf:** 1384  
**Failure strain, %:** 21.3  
**Strain rate, in./min.:** 0.070  
**Water content, %:** 25.6  
**Wet density, pcf:** 119.7  
**Dry density, pcf:** 95.3  
**Saturation, %:** 91.4  
**Void ratio:** 0.7491  
**Specimen diameter, in.:** 2.41  
**Specimen height, in.:** 5.60  
**Height/diameter ratio:** 2.32

### Description
Mottled Gray and Brown Clay (visual)

### Remarks
Material Tested in Accordance with ASTM D2166, Type of Failure - Bulge & Shear

### Project Information
**Client:** Napa Community Real Estate Fund  
**Project:** Proposed Multi & Single Family Housing  
**Location:** 2-2  
**Sample Number:** 12  
**Depth:** 6.0'

---

**Tested By:** Cindy Gooden
### UNCONFINED COMPRESSION TEST

**Sample No.** | 1  
**Unconfined strength, psf** | 1037  
**Undrained shear strength, psf** | 518  
**Failure strain, %** | 10.8  
**Strain rate, in./min.** | 0.080  
**Water content, %** | 28.7  
**Wet density, pcf** | 119.5  
**Dry density, pcf** | 92.8  
**Saturation, %** | 93.7  
**Void ratio** | 0.8359  
**Specimen diameter, in.** | 2.41  
**Specimen height, in.** | 5.65  
**Height/diameter ratio** | 2.34

**Description:** Mottled Gray and Brown Clay (visual)

<table>
<thead>
<tr>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>GS</th>
<th>Type</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.73</td>
<td>Tube</td>
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</table>

**Project No.:** VV5305  
**Date Sampled:** 01/28/2022  
**Remarks:**  
Material Tested in Accordance with ASTM D2166.  
Type of Failure - Bulge

| Client: | Napa Community Real Estate Fund  
| Project: | Proposed Multi & Single Family Housing  
| Location: | 2344 Old Sonoma Road, Napa, California  
| Sample Number: | 14  
| Depth: | 4.0′

**Figure 0300-013**

**Tested By:** Cindy Gooden
**UNCONFINED COMPRESSION TEST**

![Graph showing compressive stress vs. axial strain.]

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>1</th>
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<tbody>
<tr>
<td>Unconfined strength, psf</td>
<td>2540</td>
</tr>
<tr>
<td>Undrained shear strength, psf</td>
<td>1270</td>
</tr>
<tr>
<td>Failure strain, %</td>
<td>6.4</td>
</tr>
<tr>
<td>Strain rate, in./min.</td>
<td>0.080</td>
</tr>
<tr>
<td>Water content, %</td>
<td>27.0</td>
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<tr>
<td>Wet density, pcf</td>
<td>124.6</td>
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<tr>
<td>Dry density, pcf</td>
<td>98.0</td>
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<tr>
<td>Saturation, %</td>
<td>96.7</td>
</tr>
<tr>
<td>Void ratio</td>
<td>0.7829</td>
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<tr>
<td>Specimen diameter, in.</td>
<td>2.41</td>
</tr>
<tr>
<td>Specimen height, in.</td>
<td>6.00</td>
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<tr>
<td>Height/diameter ratio</td>
<td>2.49</td>
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</table>

**Description:** Gray and Brown Clay (visual)

<table>
<thead>
<tr>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>GS</th>
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<tbody>
<tr>
<td></td>
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<td>2.80</td>
<td>Tube</td>
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</table>

**Project No.:** VV5305  
**Date Sampled:** 01/28/2022  
**Remarks:**
Material Tested in Accordance with ASTM D2166,  
Type of Failure - Bulge

**Client:** Napa Community Real Estate Fund  
**Project:** Proposed Multi & Single Family Housing  
2344 Old Sonoma Road, Napa, California  
**Location:** 5-2  
**Sample Number:** 23  
**Depth:** 6.0'

**Figure:** 0300-014  

**Tested By:** John Hubbard
UNCONFINED COMPRESSION TEST

Sample No. 1
Unconfined strength, psf 2547
Undrained shear strength, psf 1273
Failure strain, % 5.1
Strain rate, in./min. 0.065
Water content, % 25.3
Wet density, pcf 120.4
Dry density, pcf 96.1
Saturation, % 83.2
Void ratio 0.8769
Specimen diameter, in. 2.41
Specimen height, in. 5.60
Height/diameter ratio 2.32

Description: Dark Brown Clay (visual)

LL = PL = PI = GS = 2.89 Type: Tube

Project No.: VV5305
Date Sampled: 01/28/2022
Remarks:
Material Tested in Accordance with ASTM D2166,
Type of Failure - Bulge & Shear

Client: Napa Community Real Estate Fund
Project: Proposed Multi & Single Family Housing
2344 Old Sonoma Road, Napa, California
Location: 8-1
Sample Number: 34 Depth: 3.0'

Tested By: John Hubbard
UNCONFINED COMPRESSION TEST

Sample No. | 1
---|---
Unconfined strength, psf | 926
Undrained shear strength, psf | 463
Failure strain, % | 12.5
Strain rate, in./min. | 0.066
Water content, % | 28.4
Wet density, pcf | 118.1
Dry density, pcf | 92.0
Saturation, % | 86.0
Void ratio | 0.9485
Specimen diameter, in. | 2.41
Specimen height, in. | 5.30
Height/diameter ratio | 2.20

Description: Brown Sandy Clay (visual)

LL = PL = PI = GS= 2.87 Type: Tube

Project No.: VV5305
Date Sampled: 01/28/2022
Remarks:
Material Tested in Accordance with ASTM D2166,
Type of Failure - Bulge & Shear

Client: Napa Community Real Estate Fund
Project: Proposed Multi & Single Family Housing
2344 Old Sonoma Road, Napa, California
Location: 14-1
Sample Number: 54 Depth: 4.0'

Figure 0300-016

Tested By: John Hubbard
Sample Type: Tube
Description: Mottled Brown Clay (visual)

Specific Gravity = 2.76
Remarks: Material Tested in Accordance with ASTM D3080.

Sample No. | 1 | 2 | 3
---|---|---|---
Water Content, % | 25.1 | 25.1 | 25.1
Dry Density, pcf | 98.7 | 93.0 | 102.7
Saturation, % | 92.9 | 81.1 | 102.0
Void Ratio | 0.7451 | 0.8531 | 0.6782
Diameter, in. | 2.41 | 2.41 | 2.41
Height, in. | 1.00 | 1.00 | 1.00

Water Content, % | 34.9 | 33.6 | 31.5
Dry Density, pcf | 72.7 | 88.4 | 100.8
Saturation, % | 70.2 | 97.7 | 122.6
Void Ratio | 1.3716 | 0.9487 | 0.7094
Diameter, in. | 2.41 | 2.41 | 2.41
Height, in. | 1.36 | 1.05 | 1.02

Normal Stress, psf | 1000 | 2000 | 3000
Fail. Stress, psf | 862 | 1326 | 1818
Displacement, in. | 0.32 | 0.22 | 0.42
Ult. Stress, psf | | | |
Displacement, in. | | | |
Strain rate, in./min. | 0.002 | 0.002 | 0.002

Figure 0300-017

Client: Napa Community Real Estate Fund
Project: Proposed Multi & Single Family Housing
2344 Old Sonoma Road, Napa, California
Location: 1-3
Sample Number: 6
Depth: 13.0'
Proj. No.: VV5305
Date Sampled: 01/28/2022

Tested By: Brayden Burnham
Sample Type: Tube
Description: Brown Clay (visual)

Specific Gravity: 2.96
Remarks: Material Tested in Accordance with ASTM D3080.

Client: Napa Community Real Estate Fund
Project: Proposed Multi & Single Family Housing
2344 Old Sonoma Road, Napa, California
Location: 10-1
Sample Number: 40
Depth: 5.0'
Proj. No.: VV5305
Date Sampled: 01/28/2022

Sample No. | 1 | 2 | 3
---|---|---|---
Water Content, % | 32.9 | 32.9 | 32.9
Dry Density,pcf | 89.8 | 89.8 | 94.6
Saturation, % | 92.0 | 92.0 | 102.2
Void Ratio | 1.0581 | 1.0581 | 0.9527
Diameter, in. | 2.41 | 2.41 | 2.41
Height, in. | 1.00 | 1.00 | 1.00

At Test

Water Content, % | 27.9 | 26.8 | 25.9
Dry Density,pcf | 65.3 | 83.3 | 93.6
Saturation, % | 45.2 | 65.2 | 78.7
Void Ratio | 1.8278 | 1.2172 | 0.9750
Diameter, in. | 2.41 | 2.41 | 2.41
Height, in. | 1.37 | 1.08 | 1.01

Normal Stress, psf | 1000 | 2000 | 3000
Fail. Stress, psf | 953 | 1506 | 1963
Displacement, in. | 0.11 | 0.14 | 0.17
Ult. Stress, psf | \( C \), psf | 464 | \( \phi \), deg | 26.8 | \( \tan(\phi) \) | 0.51

Tested By: Brayden Burnham
# CONSOLIDATION TEST REPORT

## Coefficients of Consolidation and Secondary Consolidation

<table>
<thead>
<tr>
<th>No.</th>
<th>Load (psf)</th>
<th>$C_v$ (ft.²/day)</th>
<th>$\alpha$</th>
<th>No.</th>
<th>Load (psf)</th>
<th>$C_v$ (ft.²/day)</th>
<th>$\alpha$</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>250</td>
<td>0.053</td>
<td>0.001</td>
<td>4</td>
<td>500</td>
<td>0.161</td>
<td>0.004</td>
</tr>
<tr>
<td>5</td>
<td>1000</td>
<td>0.381</td>
<td></td>
<td>6</td>
<td>2000</td>
<td>0.030</td>
<td>0.007</td>
</tr>
<tr>
<td>7</td>
<td>4000</td>
<td>0.054</td>
<td>0.005</td>
<td>8</td>
<td>8000</td>
<td>0.052</td>
<td>0.006</td>
</tr>
<tr>
<td>12</td>
<td>250</td>
<td>0.004</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Natural Moisture and Void Ratio

<table>
<thead>
<tr>
<th>Natural Saturation</th>
<th>Moisture %</th>
<th>Void Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>100.4 %</td>
<td>35.3 %</td>
<td>0.64</td>
</tr>
</tbody>
</table>

## Material Description

Mottled Brown Clay (visual)

## Project Details

**Project No.:** VV5305  
**Client:** Napa Community Real Estate Fund  
**Project:** Proposed Multi & Single Family Housing  
2344 Old Sonoma Road, Napa, California  

**Location:** 1-4  
**Depth:** 18.0'  
**Sample Number:** 7

**Remarks:** Material Tested in Accordance with ASTM D2435.

**Figure:** 0300-019

**Tested By:** Cindy Gooden
## CONSOLIDATION TEST REPORT

### Coefficients of Consolidation and Secondary Consolidation

<table>
<thead>
<tr>
<th>No.</th>
<th>Load (psf)</th>
<th>$C_v$ (ft.²/day)</th>
<th>$C_\alpha$</th>
<th>No.</th>
<th>Load (psf)</th>
<th>$C_v$ (ft.²/day)</th>
<th>$C_\alpha$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>0.907</td>
<td></td>
<td>9</td>
<td>16000</td>
<td>0.020</td>
<td>0.007</td>
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<tr>
<td>2</td>
<td>100</td>
<td>0.001</td>
<td></td>
<td>10</td>
<td>4000</td>
<td>0.048</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>250</td>
<td>0.009</td>
<td>0.005</td>
<td>12</td>
<td>250</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>500</td>
<td>0.007</td>
<td>0.009</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1000</td>
<td>0.021</td>
<td>0.007</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>2000</td>
<td>0.023</td>
<td>0.006</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>4000</td>
<td>0.030</td>
<td>0.005</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### MATERIAL DESCRIPTION

**USCS**

- Project No.: VV5305
- Client: Napa Community Real Estate Fund
- Project: Proposed Multi & Single Family Housing
- Location: 14-3
- Depth: 15.0'
- Sample Number: 55

**AASHTO**

- Remarks: Material Tested in Accordance with ASTM D2435.

**Tested By:** Cindy Gooden
EXPANSION INDEX
(ASTM D4829)

<table>
<thead>
<tr>
<th>Sample #:</th>
<th>Bulk 6-0 @ 1.0’-3.0’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Description:</td>
<td>Mottled Brown Clay</td>
</tr>
<tr>
<td>Initial Moisture Content (%):</td>
<td>13.5</td>
</tr>
<tr>
<td>Moisture Content after Test (%):</td>
<td>29.5</td>
</tr>
<tr>
<td>Initial Dry Density (lb/ft³):</td>
<td>96.6</td>
</tr>
<tr>
<td>After Test Wet Density (lb/ft³):</td>
<td>125.1</td>
</tr>
<tr>
<td>Degree of Saturation (%):</td>
<td>49.4</td>
</tr>
<tr>
<td>Expansion Index:</td>
<td>105</td>
</tr>
</tbody>
</table>

Table 1 Classification of Potential Expansion of Soils Using EI (ASTM D4829-11)

<table>
<thead>
<tr>
<th>Expansion Index, EI</th>
<th>Potential Expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 20</td>
<td>Very Low</td>
</tr>
<tr>
<td>21 – 50</td>
<td>Low</td>
</tr>
<tr>
<td>51 – 90</td>
<td>Medium</td>
</tr>
<tr>
<td>91 – 130</td>
<td>High</td>
</tr>
<tr>
<td>&gt;130</td>
<td>Very High</td>
</tr>
</tbody>
</table>

Tested by John Hubbard.
The samples were tested according to the referenced standard test procedures and relate only to the items inspected or tested.
Results are not transferable and shall not be reproduced, except in full, without written permission from MTI.
**Client:** Napa Community Real Estate Fund  

608 N Fair Oaks Avenue, Unit 126  

Pasadena, CA 91103  

**Client No.:** VV5305  

**Figure No.:** 0300-022  

**Date:** 01/28/2022  

**Page No.:** 1 of 1  

**Subject:** Proposed Multi & Single Family Housing  

**Submitted by:** KC Engineering  

**Location:** 2344 Old Sonoma Road, Napa, California  

**Date Sampled:** 01/14/2022

### EXPANSION INDEX  
*(ASTM D4829)*

<table>
<thead>
<tr>
<th>Sample #:</th>
<th>Bulk 8-0 @ 0.0'-2.0' &amp; 10-0'@ 1-4'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Description:</td>
<td>Mottled Brown Sandy Clay</td>
</tr>
<tr>
<td>Initial Moisture Content (%):</td>
<td>51.1</td>
</tr>
<tr>
<td>Moisture Content after Test (%):</td>
<td>24.1</td>
</tr>
<tr>
<td>Initial Dry Density (lb/ft³):</td>
<td>102.7</td>
</tr>
<tr>
<td>After Test Wet Density (lb/ft³):</td>
<td>127.5</td>
</tr>
<tr>
<td>Degree of Saturation (%):</td>
<td>51.1</td>
</tr>
<tr>
<td>Expansion Index:</td>
<td>24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expansion Index, EI</th>
<th>Potential Expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 20</td>
<td>Very Low</td>
</tr>
<tr>
<td>21 – 50</td>
<td>Low</td>
</tr>
<tr>
<td>51 – 90</td>
<td>Medium</td>
</tr>
<tr>
<td>91 – 130</td>
<td>High</td>
</tr>
<tr>
<td>&gt;130</td>
<td>Very High</td>
</tr>
</tbody>
</table>

**Table 1 Classification of Potential Expansion of Soils Using EI (ASTM D4829-11)**

 Tested by John Hubbard.  
The samples were tested according to the referenced standard test procedures and relate only to the items inspected or tested. Results are not transferable and shall not be reproduced, except in full, without written permission from MTI.
**Materials Testing, Inc.**

8798 Airport Road
Redding, California 96002
(530) 222-1116, fax 222-1611

865 Cotting Lane, Suite A
Vacaville, California 95688
(707) 447-4025, fax 447-4143

---

Client: Napa Community Real Estate Fund  
608 N Fair Oaks Avenue, Unit 126  
Pasadena, CA 91103  
Client No.: VV5305

Figure No.: 0300-023  
Date: 01/28/2022  
Page No.: 1 of 1

Project: Proposed Multi & Single Family Housing  
2344 Old Sonoma Road, Napa, California  
Submitted by: KC Engineering  
Date Sampled: 01/14/2022

---

**“R” VALUE TEST REPORT**  
(CTM 301)

Sample: 1  
Description: Mottled Brown Sandy Clay (visual)  
Location: Subgrade

---

### SIEVE ANALYSIS

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>1-1/2”</th>
<th>1”</th>
<th>3/4”</th>
<th>1/2”</th>
<th>3/8”</th>
<th>#4</th>
</tr>
</thead>
<tbody>
<tr>
<td>As Received (% Pass)</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>100</td>
</tr>
<tr>
<td>As Used (% Pass)</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>100</td>
</tr>
</tbody>
</table>

---

### RESISTANCE VALUE

<table>
<thead>
<tr>
<th>Specimen Number</th>
<th>Dry Unit Weight, PCF</th>
<th>Moisture (%)</th>
<th>Exudation Pressure (PSI)</th>
<th>Expansion Pressure Dial Reading &amp; PSF</th>
<th>R-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>111.4</td>
<td>18.3</td>
<td>796</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>104.2</td>
<td>20.9</td>
<td>532</td>
<td>10</td>
<td>43</td>
</tr>
<tr>
<td>3</td>
<td>97.5</td>
<td>24.4</td>
<td>270</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

R-Value @ 300 PSI Exudation Pressure = 12

Notes:

---

Tested by John Hubbard  
The samples were tested according to the referenced standard test procedures and relate only to the items inspected or tested.  
Results are not transferable and shall not be reproduced, except in full, without written permission from MTI.
<table>
<thead>
<tr>
<th>KEY SYMBOL</th>
<th>SAMPLE NUMBER</th>
<th>DEPTH</th>
<th>NATURAL MOISTURE CONTENT, %</th>
<th>LIQUID LIMIT, LL</th>
<th>PLASTIC LIMIT, PL</th>
<th>PLASTICITY INDEX, PI</th>
<th>LIQUIDITY INDEX</th>
<th>UNIFIED SOIL CLASSIFICATION SYMBOL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>Subgrade</td>
<td>N/A</td>
<td>52</td>
<td>20</td>
<td>32</td>
<td>N/A</td>
<td>CH</td>
</tr>
<tr>
<td>▲</td>
<td>4-1</td>
<td>4.0'</td>
<td>N/A</td>
<td>45</td>
<td>20</td>
<td>25</td>
<td>N/A</td>
<td>CL</td>
</tr>
<tr>
<td>□</td>
<td>12-1</td>
<td>2.0'</td>
<td>N/A</td>
<td>42</td>
<td>16</td>
<td>26</td>
<td>N/A</td>
<td>SC</td>
</tr>
<tr>
<td>■</td>
<td>15-0</td>
<td>1.0'-3.0'</td>
<td>N/A</td>
<td>51</td>
<td>20</td>
<td>31</td>
<td>N/A</td>
<td>CH</td>
</tr>
</tbody>
</table>

Note: Atterberg Limits tested in accordance with ASTM D4318.
To: David Cymanski  
K.C. Engineering  
865 Cotting Lane Suite A  
Vacaville, CA 95688

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

The reported analysis was requested for the following location:  
Location: VV5305  Site ID: B2 @ 0-5.  
Thank you for your business.

* For future reference to this analysis please use SUN # 86465-180085.

EVALUATION FOR SOIL CORROSION

Soil pH  
6.13

Minimum Resistivity  
1.88 ohm-cm (x1000)

Chloride  
7.0 ppm  0.00070 %

Sulfate-SO4  
27.5ppm  0.00275 %

METHODS  
ph and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)  
Sulfate-SO4 ASTM C1580, Chloride CA DOT Test #422m
To:  David Cymanski  
K.C. Engineering  
865 Cotting Lane Suite A  
Vacaville, CA  95688

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

The reported analysis was requested for the following location:
Location: VV3305  Site ID: B7 @ 0-5.
Thank you for your business.

* For future reference to this analysis please use SUN # 86466-180086.

---------------------------------------------------------------------

EVALUATION FOR SOIL CORROSION

Soil pH  5.73
Minimum Resistivity  1.26 ohm-cm (x1000)
Chloride  20.3 ppm  0.00203 %
Sulfate-SO4  26.7 ppm  0.00267 %

METHODS
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate-SO4 ASTM C1580,  Chloride CA DOT Test #422m
<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Material Description</th>
<th>Density (pcf)</th>
<th>Water Content (%), %&lt;200 Sieve</th>
<th>PI, %</th>
<th>LL, %</th>
<th>Expansion Index (EI)</th>
<th>UC, ksi</th>
<th>Remarks and Other Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3' ASPHALT OVER 11' AGGREGATE BASE</td>
<td>88.2</td>
<td>30.2</td>
<td>50.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BROWN CLAY (CH), medium stiff to stiff, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PL = 19.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>ORANGE BROWN SANDY CLAY (CH), stiff, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>SAND WITH CLAY, loose, moist, coarse rounded sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>BROWN CLAY WITH SAND (CH), medium stiff, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**LOG OF BORING B-1**
2344 Old Sonoma Road
Napa, California

**RGH CONSULTANTS**
Job No: 6381.06.04.2 Date: MAR 2021

PLATE 3
LOG OF BORING B-1 CONTINUED

MATERIAL DESCRIPTION

BROWN CLAYEY SAND WITH GRAVEL (SC), loose to medium dense, wet, primarily coarse sands

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Sample Type</th>
<th>Sampling Resistance (blowcnt)</th>
<th>Graphic Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>15</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>12</td>
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<td>10</td>
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<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dry Density (pcf) 22.9
Water Content (%) 14.4
% <#200 Sieve 28.9
PL % 36.9
LL % 41.5
Expansion Index (EI) PL = 22.1
UC, ksf

REMARDS AND OTHER TESTS

Boring terminated at 30 feet
Groundwater first encountered at 17 feet
Groundwater measured at 13 feet after augers were pulled

RGH CONSULTANTS
2344 Old Sonoma Road
Napa, California

Job No: 6381.06.04.2 Date: MAR 2021
**LOG OF BORING B-2**

**Date Drilled:** 3/4/2021  
**Logged By:** NSM  
**Checked By:** JJP

<table>
<thead>
<tr>
<th>Date Drilled</th>
<th>Drilled Method</th>
<th>Drilling Rig Type</th>
<th>Groundwater Level</th>
<th>Logged By</th>
<th>Checked By</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4/2021</td>
<td>Hollow Stem Auger</td>
<td>Mobile B-53</td>
<td>16 1/2 feet</td>
<td>NSM</td>
<td>JJP</td>
</tr>
</tbody>
</table>

- **Drill Bit Size/Type:** 8 inch
- **Total Depth of Borehole:** 28 feet
- **Sampling Method(s):** Modified California, SPT
- **Hammer Data:** 140 lb 30" drop

**MATERIAL DESCRIPTION**

- **3" ASPHALT OVER 16" AGGREGATE BASE**
- **DARK OLIVE BROWN CALY (CH), medium stiff to stiff, moist, some gravels (with serpentinite)**
- **ORANGE BROWN SANDY CLAY (CL), stiff, moist, large root in sample**
- **ORANGE-BROWN SILTY CLAY (CL-ML), stiff, moist, root at 12 feet**
- **ORANGE-BROWN CLAY WITH SAND (CH), stiff, moist**
- **ORANGE-BROWN SANDY CLAY (CL), stiff, moist, mostly coarse rounded sand**

**Graph Log**

- Depth (feet): 0, 5, 8, 10, 15, 20
- Sampling Resistance, blow/sift

**Remarks and Other Tests**

- **Hammer Data:** 140 lb 30" drop
- **Expansion Index (EI):** 71
- **Expansion Index (EI):**

---

**RGH CONSULTANTS**

2344 Old Sonoma Road  
Napa, California

Job No: 6381.06.04.2  Date: MAR 2021
**MATERIAL DESCRIPTION**

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Sampling Resistance, blowen</th>
<th>Graph Log</th>
<th>Dry Density (pcf)</th>
<th>Water Content (%)</th>
<th>PL</th>
<th>LL</th>
<th>Expansion Index (EI)</th>
<th>Uc, ksf</th>
<th>Remarks and Other Tests</th>
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<tr>
<td></td>
<td>ORANGE-BROWN SANDY CLAY (CL), stiff, moist, mostly coarse rounded sand</td>
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<td></td>
<td>PL = 20.9</td>
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<td></td>
<td>SANDY CLAY (SC) and CLAY WITH SAND (CH)</td>
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<td>ORANGE-BROWN SANDY CLAY (CL), stiff, moist, mostly coarse rounded sand</td>
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<td>LIGHT BROWN CLAY (CL), medium stiff, moist</td>
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<td></td>
<td>Boring terminated at 28 feet</td>
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<tr>
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<td>Groundwater first encountered at 18 1/2 feet</td>
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<tr>
<td></td>
<td>Groundwater measured at 16 1/2 feet after augers were pulled</td>
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<tr>
<td>Depth (feet)</td>
<td>Sample Type</td>
<td>Sampling Resistance, blows/ft</td>
<td>Graphic Log</td>
<td>MATERIAL DESCRIPTION</td>
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</tbody>
</table>

**COLUMN DESCRIPTIONS**

1. Depth (feet): Depth in feet below the ground surface.
2. Sample Type: Type of soil sample collected at the depth interval shown.
3. Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
4. Graphic Log: Graphic depiction of the subsurface material encountered.
5. MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
7. Water Content (%): Water content, percent.
8. % <#200 Sieve: % <#200 Sieve
9. PI, %: Plasticity Index, expressed as a water content.
10. LL, %: Liquid Limit, expressed as a water content.
11. Expansion Index (EI): Expansion Index (EI)
12. UC, ksf: Unconfined compressive strength, in kips per square foot.
13. REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel. Su, psf: Undrained Shear Strength, in pounds per square foot (psf)

**FIELD AND LABORATORY TEST ABBREVIATIONS**

LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
Su: Undrained Shear Strength, in pounds per square foot (psf)

**MATERIAL GRAPHIC SYMBOLS**

- Asphaltic Concrete (AC)
- Fat CLAY, CLAY w/SAND, SANDY CLAY (CH)
- Lean CLAY, CLAY w/SAND, SANDY CLAY (CL)
- SILTY CLAY (CL-ML)
- Clayey SAND (SC)

**TYPICAL SAMPLER GRAPHIC SYMBOLS**

- 2.5-inch-ID Modified California w/ brass liners
- 2-inch-OD unlined split spoon (SPT)

**OTHER GRAPHIC SYMBOLS**

- Water level (at time of drilling, ATD)
- Water level (after waiting)
- Minor change in material properties within a stratum
- Inferred/gradational contact between strata
- Queried contact between strata

**GENERAL NOTES**

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.
LIQUID AND PLASTIC LIMITS TEST REPORT

MATERIAL DESCRIPTION
- Gray/Brown Clay (CH) 50.1 19.9 30.2 88.2 CH
- Brown Clayey Sand W/ Gravel (SC) 36.9 22.1 14.8 22.9 SC
- Brown Clayey Sand W/ Gravel (SC) 41.3 26.0 15.3 18.2 SC
- Brown Sandy Clay (CL) 38.0 20.9 17.1 56.4 CL

PLASTICITY INDEX
- ML or OL
- MH or OH

Dashed line indicates the approximate upper limit boundary for natural soils.

Remarks:
- Source of Sample: B-1
  - Depth: 2.0'-2.3'
  - Project: 2344 Old Sonoma Road
- Source of Sample: B-2
  - Depth: 21.0'-22.0'
  - Project: 2344 Old Sonoma Road
- Source of Sample: B-1
  - Depth: 22.0'-23.0'
  - Project: 2344 Old Sonoma Road

Job No: 6381.06.04.2
2344 Old Sonoma Road
2344 Old Sonoma Road
Napa, California

Date: MAR 2021
Hazard by Location

Search Information

Coordinates: 38.2887, -122.2986
Elevation: 30 ft
Timestamp: 2022-02-08T00:35:24.495Z
Hazard Type: Seismic
Reference Document: ASCE7-16
Risk Category: II
Site Class: D

Basic Parameters

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<th>Description</th>
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<td>MCE$_R$ ground motion (period=0.2s)</td>
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<tr>
<td>$S_1$</td>
<td>0.748</td>
<td>MCE$_R$ ground motion (period=1.0s)</td>
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<td>Site-modified spectral acceleration value</td>
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<td>$S_{M1}$</td>
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<td>Site-modified spectral acceleration value</td>
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* See Section 11.4.8

Additional Information

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<td>Coefficient of risk (0.2s)</td>
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<td>CR$_T$</td>
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<td>PGA</td>
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<td>MCE$_R$ peak ground acceleration</td>
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<td>$F_{PGA}$</td>
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<td>Site amplification factor at PGA</td>
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<td>$PGA_M$</td>
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<td>Site modified peak ground acceleration</td>
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<td>$T_L$</td>
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<td>Long-period transition period (s)</td>
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<td>Probabilistic risk-targeted ground motion (0.2s)</td>
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<td>Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)</td>
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* See Section 11.4.8

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard layers are provided by the US Geological Survey Seismic Hazard Web Services.
https://hazards.atcouncil.org/#/seismic?lat=38.2887&lng=-122.2986&address=
ASCE 7 Hazards Report

Address: No Address at This Location

Standard: ASCE/SEI 7-22
Risk Category: II
Soil Class: D - Stiff Soil
Latitude: 38.2887
Longitude: -122.2986
Elevation: 27.52 ft (NAVD 88)
Seismic Design Category: E

Seismic Site Soil Class:
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Seismic Design Category: E

Vertical ground motion data has not yet been made available by USGS.

https://asce7hazardtool.online/
Date Source:
USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.
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https://asce7hazardtool.online/