Appendix G – Geotechnical and Geologic Investigation

Via E-Mail

March 24, 2020
BGG Project No. G147.01

Troy Bourne
Spieker Senior Development Partners
3000 Sand Hill Road, Suite 3-190
Menlo Park, California 94025

Subject: Due Diligence Geotechnical and Geologic Investigation
Seven Hills Ranch Senior Living Center (Proposed)
Seven Hills Ranch Road
Walnut Creek, California

Dear Mr. Bourne:

Baez Geotechnical Group (BGG) has completed a due diligence level geotechnical and geologic investigation for the subject project. The site is located within the City of Walnut Creek, between Treat Boulevard and Ygnacio Valley Boulevard, east of Highway 680, as shown on Plate 1, Vicinity Map. We have reviewed preliminary development plans and performed a geologic reconnaissance with a limited field investigation. It is our understanding that the approximately 30-acre site will be developed into a senior living facility. The project may require up to 25-feet of cuts and fills due to the presently hilly terrain. Retaining walls are anticipated to be predominantly up to about 6-feet tall, with some walls potentially up to 10-feet tall for the Health Center and ILU buildings. Some of the proposed structures include:

- A one and two-story Health Center
- 54 to 66 Villa Duet single-family residences
- A 3-Story building with 315 Individual Living Units (ILU)
- A basement parking garage below the ILU building
- A Commons building
- Central Plant

PURPOSE AND SCOPE OF SERVICES

The purpose of our investigation was to evaluate the subject site with respect to soil, bedrock, and groundwater conditions, and to provide preliminary geological and geotechnical conclusions and recommendations for the design and construction of the proposed improvements. The scope of our services included a review of available geologic literature covering the site, field reconnaissance, limited field investigation, laboratory testing, geological and geotechnical evaluation, and preparation of this report. We have reviewed the following project documents pertaining to this project:

- BKF, Existing Topography, 8/31/19.
- Engeo, Preliminary Geotechnical Reconnaissance, Seven Hills Ranch, Walnut Creek, California, Job No. N90-3169-E1, November 1, 1990.

- KTGY, Conceptual Site Plan, several iterations.

FIELD INVESTIGATION AND LABORATORY TESTING

SITE DESCRIPTION

The site is nestled within a residential neighborhood at the north end of the City of Walnut Creek. Access to the site is off of Homestead Avenue at the southwest corner of the property. The Seven Hills School abuts the northern property corner. The north-flowing Walnut Creek, hardscaped and channelized with concrete retaining walls in the late 1960s or early 1970s, defines the west and northwest property boundaries. Homes and condominiums overlook the site along the east and southeast sides.

The property can be generally characterized as hilly terrain with bold rock outcrops along the ridgetops and steep rock exposures along Walnut Creek. Elevations within the site range from about 100-feet above mean sea level along Walnut Creek on the north and west sides to about 155-feet above mean sea level for the high knobs in the interior of the property (see Plate 2, Geologic Map for existing site topography). A perennial stream flowing from the southeast to the northwest bisects the site and drains into the channelized portion of Walnut Creek. The stream runs along the northern edge of a large level area created by the placement of artificial fill from the channelization of the adjacent Walnut Creek. There is a concentration of structures consisting of two residences and several sheds along the prominent ridge at the south end of the site where the caretaker of the property lives. A single-lane paved roadway leads through the property from south to north. The site is covered in weeds and grasses with sparse trees.

GEOLOGIC RECONNAISSANCE AND FIELD INVESTIGATION

A geologic reconnaissance and limited field investigation were performed on January 23, 2020, and additional geologic mapping of the site was performed on January 27, 2020. The field investigation consisted of excavating and geologic logging 10 exploratory test pits using a backhoe with a 24-inch wide bucket in the approximate locations shown on Plate 2, Geologic Map. The test pits were excavated to depths between 3-feet to 17-feet below the existing ground surface (bgs) and were loosely backfilled and wheel-rolled upon completion. Graphic representations of the test pits are included in Appendix A. The surficial geology observed during our reconnaissance and aerial photographic analysis, including approximate areal limits of colluvium, alluvium, artificial fill, and bedrock outcrops, is shown on Plate 2, Geologic Map. Three bulk soil samples and two boulder samples obtained from the test pits were collected for laboratory testing.

LABORATORY TESTING

Several soil and bedrock (boulders) samples were transported to ENGEO for Atterberg Limits and unconfined compression testing. The results of the tests are shown below, summarized in the test pit logs in Appendix A, and contained in Appendix B. Three soil samples were transported to CERCO Analytical for corrosion testing, for which the results are summarized below. The corrosion testing report with a brief evaluation is contained in Appendix C.

Test Pit	Liquid Limit	Plasticity Index	Avg. Bedrock Unconfined Compressive Strength	Corrosivity	Sulfates
TP1, 0-2 ft.	59	44	---	Mod. Corrosive	ND
TP8, 2-3 ft.	54	30	---	Mod. Corrosive	ND
TP9, 0-3 ft.	---	---	2,910 psi	---	---
TP10, 0-5 ft.	66	49	---	Mod. Corrosive	ND

ND – Not Detected

GEOLOGICAL AND GEOTECHNICAL FINDINGS

GEOLOGY AND SUBSURFACE CONDITIONS

The property is located within the San Francisco Bay portion of the Coast Ranges geomorphic province of California, a region characterized by northwest-southeast trending ridges and intervening valleys influenced by the strike of the San Andreas and related major faults. The site is at the northwest end of a series of prominent subparallel ridges collectively known as Shell Ridge. Shell Ridge, formed by a layered sequence of Miocene age sedimentary beds that have been tilted nearly vertical, passes along the southwest flank of Mt. Diablo (Dibblee, 1980 and 2005; Ellen and Wentworth, 1995; and Graymer and others, 1994). The geologic structure of the site area is severely complicated by Quaternary tectonics involving deep folding and uplift of Mt. Diablo to the east (Unruh, 2000). Based on our review of historic aerial photographs, the landscape within the site vicinity was initially modified by agricultural practices and more recently by residential development.

SUBSURFACE CONDITIONS

Surface Soils

The USDA Natural Resources Conservation Services Web Soil Survey shows that the majority of site to be mantled by the Lodo soil series. These native soils are reported to be low expansive clays with bedrock near the ground surface. The clays have 100 percent passing the No. 4 sieve (sand size particles), approximately 80 percent passing the No. 200 sieve (silt and clay sized particles), with Liquid Limits (LL) between 30 and 40, and Plasticity Indices (PI) between 15 and 20.

The laboratory tests for the three surface samples collected from the exploratory test pits indicate that the soils are very likely expansive, with LLs of 54 to 66 and PIs of 30 to 49. These test results are different than those of published reports for the native soils and suggests that some of the bedrock is more clay-rich than others. These expansive soils will shrink upon drying and swell upon wetting. Expansive clays on hillsides have a tendency to creep down slope seasonally, expanding when wetted perpendicular to the slope face and shrinking when drying vertically downward with a net downslope movement.

<u>Artificial Fill</u>

Our research indicates that there are three main areas underlain by artificial fill with the site and minor fill areas along the channelized portion of Walnut Creek that borders the west portion of the property. The smallest fill consists of a stream crossing near the center of the site for the narrow paved roadway that runs the length of the site. The second largest fill area is located at the south end of the site along Seven Hills Ranch Road. The main fill area is located along the southwest side of the perennial creek. The approximate areal limits of these fill areas are shown Plate 2, Geologic Map.

Our review of historic aerial photographs suggests that the large fill along the west side of the perennial stream was placed sometime between 1968 and 1974. This is approximately the same time frame for the channelization of the segment of Walnut Creek that passes along the west side of the property. The maximum depth of the fill is not known. We explored the larger fill area with two test pits and discovered the fill materials generally consisted of blue gray silty to clayey sands with cobbles and boulders. Test Pit TP-6 was excavated approximately 17 feet below the top of the fill surface and did not reach the bottom of the fill at this location. Standing water was encountered in the bottom of the test pit.

<u>Colluvium</u>

Accumulations of native soils or colluvial soils were mapped along the base of slopes and in the swales and hollows along the slopes during our geologic reconnaissance. Most of the colluvial soils as explored in our test pits consisted of silty to clayey sands of low plasticity. However, samples of clayey soil tested from Test Pit TP-1, TP-8 and TP-10 were found to be highly expansive.

Our review of historic aerial photographs suggests that the area now overlain by the large artificial fill near the center of the property was once a broad nearly level area along the perennial stream that may have be underlain by relatively thick colluvial soils. We did not know whether or not the colluvial materials, if present, were removed prior to placement of the fill.

<u>Alluvium</u>

Alluvial materials have been mapped at the far northeast end of the site and as remnants of alluvial terraces along portions of Walnut Creek on the west side of the property. The presence and areal limits of the alluvial deposits were determined from our geologic reconnaissance and review of historic aerial photographs. We did not explore the alluvial materials during our recent field investigation program. We anticipate that these materials would generally consist of sands and gravels with variable amounts of silt and clay.

<u>Bedrock</u>

According to published geologic maps, the site and surrounding slopes are underlain by sedimentary bedrock of Miocene age. The sedimentary rocks have been assigned to various formations including the Briones Formation, the Monterey Formation, and the Neroly Formation (Crane, 1995; Dibblee, 1980 and 2005; Ellen and Wentworth, 1995; and Graymer and others, 1994). The bedrock encountered in the majority of the exploratory test pits and mapped in bedrock exposures within the site consisted of well cemented, fine to coarse grained sandstone with variable amounts of silt and gravel. In Test Pit TP-8, we also encountered minor sandy claystone beds. The rocks were generally moderately fractured creating sizeable blocks of intact rock.

Bedding observed within the sedimentary rocks ranged from thin distinctive beds to massive units lacking any obvious bedding structure. All of the bedding attitudes measured in the test pits and during our geologic mapping were northwest-striking and generally southwest-dipping. This is consistent with the bedrock structure shown on published geologic maps for the site area. The fracturing of bedrock appears to favor a prominent joint plane that is east-west striking and north-dipping at moderate angles. Our bedding and joint attitudes are plotted on Plate 2, Geologic Map.

The bedding inclinations were very steep and near vertical. The steep bedding structure and well cemented nature of the sandstone beds created bold linear rock outcrop that characterized the ridgetops within the site as shown on Plate 2, Geologic Map. Similar linear rock outcrops due to near vertical bedding was observed on the aerial photographs extending offsite to the southeast.

Two sandstone boulders from TP-9 were cut into 3 cubes and then tested for unconfined compressive strength. The results indicate the rock cores had an average compressive strength of 2,910 psi. The test results are contained in Appendix B.

Groundwater

Groundwater levels within the site are likely similar to the elevation of the bottom of Walnut Creek adjacent to the west side of the property. We observed standing water in Test Pit TP-6 within the large artificial fill area at approximately 17 feet below the ground surface. Seepage, not groundwater, was observed at the top of bedrock contact with colluvial soils in Test Pit TP-4.

GEOLOGIC HAZARDS

Faults

The San Francisco Bay Area is dominated by northwest-southeast trending San Andreas Fault and associated major faults such as the Hayward, Calaveras, Concord, and Greenville Faults (Jennings and Bryant, 2010). The State of California has identified and mapped seismically active faults or those that have the potential for ground rupture during an earthquake and in doing so have established Earthquake Fault Zones (Hart and Bryant, 1997). The closest seismically active fault to the site is the Concord Fault located approximately 2.3 miles to the east of the site (State Geologist, 1993). The property is not included within or adjacent to a State of California Earthquake Fault Zone for seismically active faults (Hart and Bryant, 1997).

There are other prominent faults mapped in the vicinity of the site. The closest of these, the northwest projection of the Calaveras Fault, has been suggested approximately 1 mile to the west of the site (Dibblee, 1980 and 2005). However, the presence of the Calaveras Fault at this location has not been confirmed. No faults have been mapped as passing through the site (Crane, 1995; Dibblee, 1980 and 2005; and Graymer and others, 1994).

The Bay Area is on of the most seismically active regions in the country where small earthquakes (Magnitude <4) are frequent, moderate earthquakes are sometimes felt (Magnitude 4 – 6), and large earthquakes (Magnitude >6) occur, but are rare. The last major earthquakes to occur in historic times include the October 21, 1968 Hayward Earthquake (Magnitude 6.8) and the April 18, 1906 San Francisco Earthquake (Magnitude 8.25) located approximately 15 miles to the south and 30 miles to the west, respectively. The last major earthquake to occur in modern times was the Loma October 18, 1989 Prieta Earthquake (Magnitude 7.0) locate approximately 53 miles to the south. The most recent earthquake to shake the Bay Area was the August 24, 2014 Napa Earthquake (Magnitude 5.9) located approximately 24 miles to the northwest (Jennings and Bryant, 2010; and Stover and Coffman, 1993).

Liquefaction

The majority of the site consists of bedrock ridges and slopes where bedrock is at or near the ground surface. Thicker unconsolidated deposits such as alluvial materials can be prone to liquefaction during earthquake shaking. These liquefaction prone deposits are associated with the Walnut Creek channel along the west boundary of the property. We should point out that native sediments, possibly alluvial deposits, may be present along the perennial stream that bisects the property. This area is now overlain by a significant amount of artificial fill. A future design level investigation should evaluate the possibility of liquefiable deposits under this fill area.

Landslides and Stability of Existing and Proposed Slopes

No landslides have been mapped within or adjacent to the property as shown on published geologic maps (Dibblee, 1980 and 2005; and Nilsen, 1975). We did not identify any landslides within the property during our geologic reconnaissance, limited site exploration with test pits, or from our review of historic aerial photographs dating back to 1952.

We observed several rock blocks along the fencing that surrounds the channelized Walnut Creek near the north corner of the site. These blocks have spawn from the near vertical rock slope that exists in this area. Whether the rock slope was part of a natural stream bank along Walnut Creek or excavated as part of the channelization construction is not known. Failure of the blocks appears to have been facilitated along the prominent north-dipping joint planes measured during our geologic reconnaissance mapping.

Other less prominent near vertical areas exist adjacent to the channelized Walnut Creek, but these are not as high as the rock slope near the north corner of the property. We observed that both bedrock and thick soils are exposed along these cut slopes. The future design level investigation should provide proposed cut and fill slope recommendations.

Artificial Fill

The low-lying central portion of the site was backfilled and elevated more than 17 feet as determined from our limited field exploration. The quality and depth of the fill materials is not known. It is not known whether or not the native soils and/or alluvial deposits were stripped away prior to placement of the fill materials. These issues will be investigated in the future design level study.

PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

GENERAL SUMMARY

The project can generally be constructed as planned; however, the geotechnical and geologic investigation constraints shown on Plate 3, Geologic Constraints Map, will need to be addressed as part of a design-level geotechnical investigation. Geotechnical considerations pertaining to this site and the geologic constraints are summarized below.

1. The 2019 CBC classification of the site as being located in Site Class B or C should be determined. Building foundations, retaining walls, and structural framing requirements will be impacted by the Site Classification.
2. The central portion of the site (blue hachure area on Plate 3) is underlain by artificial fill and colluvial soils that are more than 17 feet deep. The liquefaction potential of these underlying soils should be evaluated.
3. More detailed evaluation of the excavation characteristics of the sandstone and claystone bedrock underlying the site should be performed. The locations of the rock outcrops where hard sandstone is present are shown in red shading on Plate 3. The excavation characteristics of the bedrock will impact cut grading and excavations for underground utilities and foundations.
4. Final recommendations for grading should be provided, including permanent and temporary slope inclinations, differential fill thickness for building pads, fill construction, and the extent of colluvial and artificial soil removal.
5. The impacts from the onsite expansive soils on proposed structures, pavements, and flatwork should be addressed.
6. The design and construction of valley drains and subdrains in fill keyways and benches should be addressed.
7. Potential water seepage through rock fractures, daylighting from cut slopes and into utility trenches should be assessed.
8. Pseudostatic seismic loads will need to be incorporated into the design of retaining walls which will be more than 6 feet tall, as specified in the CBC.

GRADING

The following are our preliminary grading recommendations for the design and construction of the project.

1. Cuts into bedrock will be difficult and will require rock grading and excavation methods and equipment. Compressive strengths of approximately 3,000 psi were obtained from near surface sandstone boulder samples in TP-9. We anticipate the hardness of the rock will increase with depth. Blasting is not recommended.
2. Grading operations will need to consider potential accidental rockfall hazards along the western and northern property boundaries. Grading equipment operating on hillsides may dislodge boulders that could roll downhill.
3. Overexcavation in street areas to accommodate future utility trench excavations should be considered for cut areas.
4. Cut slopes into hard bedrock will likely be limited to about 0.25H:1V for temporary cuts and approximately 0.5H:1V for permanent cut slopes.
5. Cut slopes in soils will likely need to be laid back to 1H:1V for temporary cut slopes and 2.5H:1V for permanent cut slopes.
6. Permanent fill slopes will likely need to be limited to 2H:1V for slopes less than 10-feet high, and limited to 2.5H:1V for slopes more than 10-feet high.
7. Overexcavation of bedrock may also be needed to limit the amount of differential fill under the building pads to reduce potential differential settlement.
8. Utilizing existing soil and rock material generate from cut areas or from overexcavation operations is acceptable.
9. Oversized rock particles greater than about 4 to 6-inches diameter in size should be buried at least 5-feet deep in fill areas.
10. Expansive colluvial clay soils should be buried at least 5-feet deep in fill areas. If the expansive soils are utilized as engineered fill in the upper 5-feet of final design grades, building foundations, retaining walls, pavement sections, and flatwork designs will need to be fortified.
11. Expansive soils will likely need to be placed at higher moisture contents and compacted to a lower relative density than nonexpansive soils.
12. During earthwork observation, compaction testing of the rocky soils derived from bedrock cuts may not be feasible with conventional nuclear density gauges. These soils may require that performance criteria be specified rather than a percent compaction requirement to verify appropriate compaction of the rocky soils.

CONTROLLING GROUNDWATER

Perched groundwater likely flows northerly in the underlying bedrock fractures and sandy soil lenses. Typically, landscape irrigation from the new development and existing uphill developments can contribute to an increase in the amount of groundwater seepage. Controlling groundwater seepage will be required.

Keyway and Bench Subdrains

Keyway and intermediate bench subdrains will be needed for fill slopes. The water collected in the subdrains will need to be routed to drain to an appropriate outfall structure. Keyway and bench subdrains will likely consist of 6-inch diameter perforated pipes surrounded by Caltrans Class 2 Permeable Material.

Valley Subdrains

Groundwater has a tendency to continue seeping in lower lying swales and valleys, even after development and fill placement. Valley subdrains are recommended in fill areas in the locations shown on Plate 3. The valley subdrains should be at least 5-feet deep in soil areas or at least 2-feet into bedrock (whichever is less). The water should be routed to an appropriate outfall structure. Valley subdrains will likely be installed in a 3-feet wide trench and will have a 6-inch diameter perforated piped surrounded by Caltrans Class 2 Permeable Material.

Trench Subdrains at the Base of Bedrock Cut Slopes

Cut slopes and cut pads will likely be susceptible to water seeping through rock fractures and emanating out of cut slopes. A trench subdrain is recommended along the base of cut slopes in bedrock to control water seepage from entering the building pad. The trench subdrain will likely consist of a 6-inch diameter perforated pipe surrounded by Caltrans Class 2 Permeable Material. The trench drains will likely be at least 2-feet wide and at least 3-feet deep.

Utility Trenches

Underground utilities in bedrock areas will likely need a subdrain installed in the shading material next to the utility lines. This is discussed in more detail below.

CALIFORNIA BUILDING CODE (CBC) SEISMIC DESIGN PARAMETERS

The design level geotechnical investigation should determine if the project is designated as Site Class B or C according to the 2019 CBC. We are providing CBC seismic design parameters for the site for both Site Class designations. The Structural Engineer should determine if there is an economic advantage for designing the structures for Site Class B versus Site Class C. However, the effort and cost for performing an evaluation to distinguish the Site Class should also be considered.

The approximate center of the subject site is located at roughly 37.9199 degrees north latitude and -122.0499 degrees west longitude. The following are ASCE7-16 (2019 CBC) seismic design criteria, according to the Structural Engineers Association of California (SEAOC) website, https://seismicmaps.org.

CBC SEISMIC DESIGN CRITERIA

Seismic Design Parameter	ASCE7-16 - C site	ASCE7-16 - B site
Site Modified Peak Ground Acceleration	1.01 g	0.79 g
Mapped Spectral Acceleration for Short Periods, $S_{s,}$ for Site Class B with 5% damping	2.153 g	2.153 g
Mapped Spectral Acceleration for 1-Second Period, $S_{1,}$ for Site Class B with 5% damping	0.694 g	0.694 g
Site Class	C – Soft Rock	B – Rock
Site Coefficient F_a (for Site Class)	1.2	0.9
Site Coefficient F_v (for Site Class)	1.4	0.8
Acceleration Parameter S_{MS} (adjusted for Site Class)	2.583 g	1.937 g
Acceleration Parameter, S_{M1} (adjusted for Site Class)	0.972 g	0.555 g
Acceleration Parameter, S_{DS} (adjusted for Site Class)	1.722 g	1.292 g
Acceleration Parameter, S_{D1} (adjusted for Site Class)	0..648 g	0.370 g

UNDERGROUND UTILITIES

The following are design and construction considerations for underground utilities. The design-level geotechnical investigation should consider the following:

1. Underground utilities located in bedrock cut areas will be difficult. Overexcavating the street sections to accommodate the deepest underground utilities during grading should be considered. Otherwise, rock trenching equipment may be required for excavating utility trenches.
2. Temporary trench excavations in bedrock can likely be cut nearly vertical. The soil overlying the bedrock will likely need to be laid back at a 1H:1V inclination.
3. Subsurface water in rock fractures and on top of the bedrock will likely seep into utility trenches during construction and into the shading materials after installation. Considerations for the impact of groundwater entering utility trenches should be addressed. Water stops are not advisable; a subdrain system in the utility trenches may be needed.

BUILDING FOUNDATIONS

The Villas will likely be supported on Post Tensioned (PT) slab foundations and the remaining structures (ILU building, Health Center and Central Plant) will likely be supported on shallow foundations with concrete floor slabs. The final design for the foundations will be determined by the final grading plans and the characteristics of the supporting soil or bedrock materials. Building pads will likely need to be overexcavated in cut areas to accommodate underground utilities and to provide a uniform building pad. The design-level geotechnical investigation should address the following:

1. Building pad construction.
2. Foundation types.
3. Foundation excavation characteristics.
4. Foundation setback from top of cut and fill slopes.

EXTERIOR CONCRETE FLATWORK

The geotechnical investigation should address exterior flatwork conditions, including driveways, sidewalks, patios, and door stoops, as needed. The investigation should also consider exterior flatwork that may be constructed on expansive soils, fills, and bedrock.

LANDSCAPING

The landscape architect will need to consider that the underlying materials in some planting areas could be hard bedrock or shallow soils overlying hard bedrock. Caution is advised for irrigating planter areas at the tops of slopes and covering the slopes. The irrigation water could seep into the underlying bedrock and flow through the rock fractures and daylight somewhere downhill of the irrigation water source.

RETAINING WALLS

Retaining wall foundations will likely encounter hard bedrock conditions as discussed in the Foundations section above. If the expansive soils overlying the bedrock are utilized as retaining wall backfill, the retaining walls will need to be designed for higher active and at-rest lateral pressures than for nonexpansive backfill soils. Retaining walls that are more than 6-feet tall will need to be designed for pseudostatic lateral loads, which will be substantial (possibly two times the active pressure) due to the high peak ground accelerations from the proximal faults. The pseudostatic loads would be less for a Site Class B than a Site Class C.

STREETS

The following are potential impacts of the site conditions on the design and construction for streets:

1. Streets underlain by soil should consider utilizing either lime or cement additives to the onsite soils. The treated subgrade soil could then be considered as a subbase material and be utilized as part of the structural pavement section. This would reduce the requirement for exporting subgrade soils and importing Class 2 aggregate base (AB).
2. If a conventional structural pavement section with Class 2 AB is utilized, then a pavement edgedrain along the uphill side of the new streets will likely be needed. If soil treated subgrade soils are utilized as part of the structural pavement section, then a pavement edgedrain may not be needed since the treated soil is essentially not permeable.
3. Streets in cut areas may be underlain by bedrock, and may require overexcavating into the existing bedrock at the site. Overexcavation may be needed to reduce the potential for longitudinal crack development in the AC pavement at the bedrock and soil contacts.

LIMITATIONS

The preliminary conclusions and recommendations contained in this report are based upon the information provided to us regarding the proposed improvements, subsurface conditions encountered during our limited field investigation, laboratory testing, and professional judgment. This due diligence study has been conducted in accordance with current professional geotechnical engineering and engineering geology standards; no other warranty is expressed or implied.

If you have any questions, please contact us. We appreciate the opportunity of providing professional services to Trumark Homes.

Respectfully Submitted,

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Attachments:
- Plate 1 – Vicinity Map
- Plate 2 – Geologic Map
- Plate 3 - Geologic Constraints Map
- Appendix A – Test Pit Logs
- Appendix B - Geotechnical Laboratory Test Results
- Appendix C – Corrosion Test Results

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Lee Cooper

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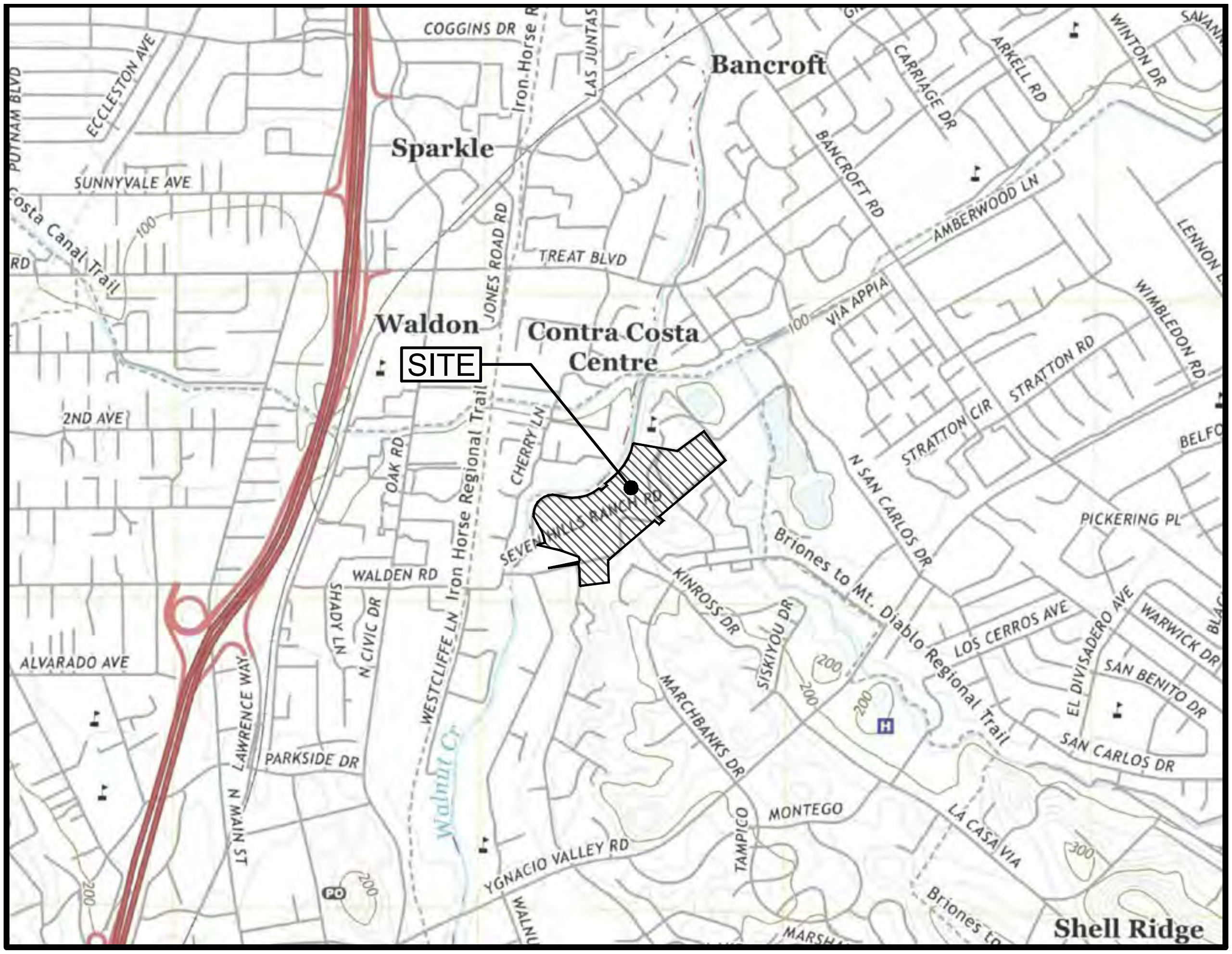
AERIAL PHOTOGRAPHS REVIEWED

Date	Flight Line	Frames	Scale	Type
10-08-52	AV-104	03-10 & 11	1:20,000	B & W Stereo
05-04-57	AV-253	18-15 & 16	1:12,000	B & W Stereo
03-02-58	S.F. AREA	2-194 & 195	1:36,000	B & W Stereo
07-02-59	AV-334	12-12 & 13	1:9,600	B & W Stereo
07-26-63	AV-550	11-17 & 18	1:36,000	B & W Stereo
04-20-68	AV-845	04-12 $ 13	1:9,600	B & W Stereo
03-08-74	AV-1102	08-13, 14 & 15	1:12,000	B & W Stereo
03-08-74	AV-1102	09-07 & 08	1:12,000	B & W Stereo
05-07-84	AV-2460	08-01 & 02	1:12,000	B & W Stereo
05-17-84	AV-2480	08-14 & 15	1:12,000	B & W Stereo
07-07-92	AV-4230	20-15 & 16	1:12,000	B & W Stereo
06-27-02	AV-8202	19-13, 14 & 15	1:12,000	B & W Stereo

Photographs available for review at Pacific Aerial Surveys in Novato, California

BGG NUMBER: G147.01 DATE: 2-2-20 BY: KR



BASE: PORTION OF U.S.G.S. 7.5 MINUTE TOPOGRAPHIC QUADRANGLE, WALNUT CREEK, CALIFORNIA, PHOTOREVISED 2018, AT A SCALE OF 1:24,000.

N

0 2000

1 INCH = 2000 FEET

VICINITY MAP

SEVEN HILLS RANCH
SENIOR LIVING CENTER

WALNUT CREEK, CALIFORNIA

FOR

SPIEKER SENIOR DEVELOPMENT PARTNERS

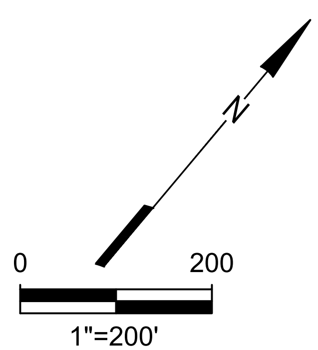
BAEZ GEOTECHNICAL GROUP

PLATE 1

BGG NUMBER: G147.01

DATE: 2-1-20

DRAWN BY: KR



EXPLANATION

	PROMINENT BEDROCK OUTCROPS
	GEOLOGIC CONTACT
TP-10	TEST PIT LOCATIONS
81	STRIKE AND DIP OF BEDDING
66	STRIKE AND DIP OF OVERTURNED BEDDING
75	STRIKE AND DIP OF JOINTS
af	ARTIFICIAL FILL

Qcol	NATIVE COLLUVIAL SOILS WITHIN HOLLOWS ALONG SLOPES
Qa	ALLUVIAL GRAVEL, SAND AND CLAY OF VALLEY AREAS
Qt	ALLUVIAL TERRACE AREAS ALONG WALNUT CREEK, MAY UNDERLIE SOME ARTIFICIAL FILL AREAS
Tms	SANDSTONE, LIGHT GRAY TO TAN, MEDIUM GRAINED, ARKOSIC, BASAL UNIT LOCALLY CALLED SOBRANTE, AGE MIDDLE TO LOWER MIOCENE
Tmc	CLAY SHALE/SILTSTONE, GRAY, VAGUELY BEDDED, ARGILLACEOUS TO SANDY, INCLUDES FINE GRAINED SANDSTONE

BAEZ GEOTECHNICAL GROUP

GEOLOGIC MAP

SEVEN HILLS RANCH SENIOR LIVING CENTER

WALNUT CREEK, CALIFORNIA

FOR

SPIEKER SENIOR DEVELOPMENT PARTNERS

BASE: EXISTING TOPO FILE PROVIDED BY BKF, EMAIL DATED: 1-24-20

PLATE 2

DRAWN BY: KR

DATE: 2-1-20

BGG NUMBER: G147.01

GEOLOGIC CONSTRAINTS MAP

SEVEN HILLS RANCH SENIOR LIVING CENTER

WALNUT CREEK, CALIFORNIA

FOR

SPIEKER SENIOR DEVELOPMENT PARTNERS

NOTE: FILL SLOPES WILL REQUIRE KEYING AND BENCHING WITH KEYWAY SUBDRAINS AND SOME BENCH SUBDRAINS

N

0 200

1"=200'

BAEZ GEOTECHNICAL GROUP

EXPLANATION

PROMINENT BEDROCK OUTCROPS - SURROUNDING AREAS WILL BE DIFFICULT TO EXCAVATE

GEOLOGIC CONTACT

TP-10 TEST PIT LOCATIONS

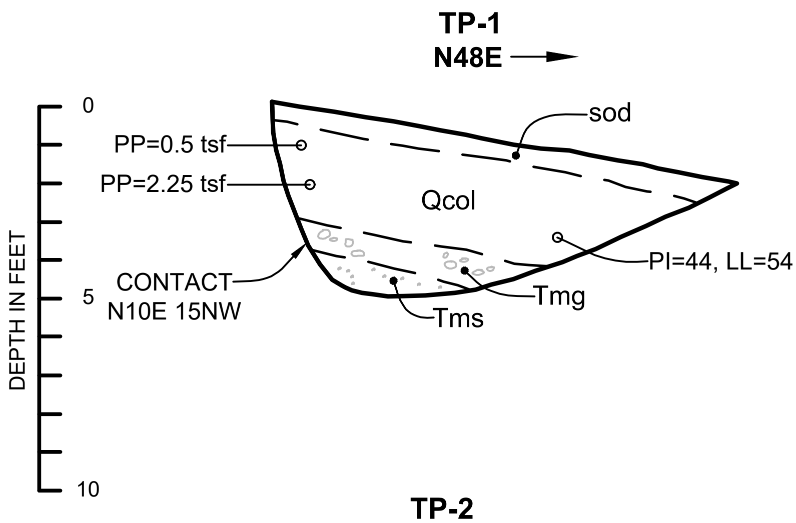
Qcol, af, Qt TO BE REMOVED AND REPLACED

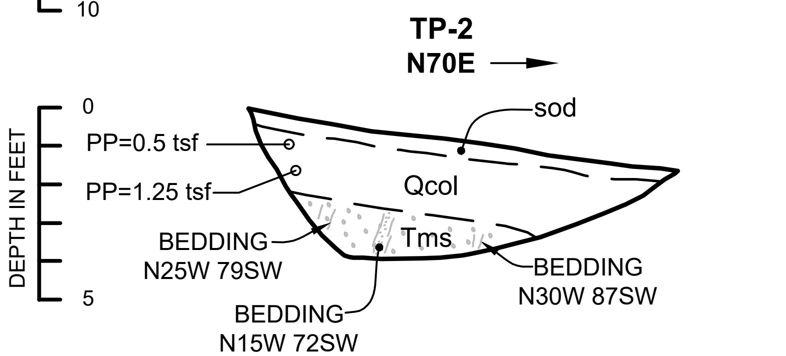
POTENTIAL LIQUEFACTION

VALLEY DRAIN IN FILL AREAS: MINIMUM 5 FEET DEEP BELOW EXISTING GROUND OR 2-FOOT INTO BEDROCK

af	ARTIFICIAL FILL
Qcol	NATIVE COLLUVIAL SOILS WITHIN HOLLOWS ALONG SLOPES
Qa	ALLUVIAL GRAVEL, SAND AND CLAY OF VALLEY AREAS
Qt	ALLUVIAL TERRACE AREAS ALONG WALNUT CREEK, MAY UNDERLIE SOME ARTIFICIAL FILL AREAS
Tms	SANDSTONE, LIGHT GRAY TO TAN, MEDIUM GRAINED, ARKOSIC, BASAL UNIT LOCALLY CALLED SOBRANTE, AGE MIDDLE TO LOWER MIOCENE
Tmc	CLAY SHALE/SILTSTONE, GRAY, VAGUELY BEDDED, ARGILLACEOUS TO SANDY, INCLUDES FINE GRAINED SANDSTONE

BASE: AERIAL DATED: 8-31-19, EXISTING TOPO FILE PROVIDED BY BKF, EMAIL DATED: 1-24-20





TP-1 EXPLANATION

Qcol	SILTY SAND WITH FINE GRAVEL (SM), VERY DARK GRAYISH BROWN (10YR 3/2), MOIST TO WET, LOOSE TO MODERATELY DENSE (COLLUVIUM)
Tmg	PEBBLE CONGLOMERATE, MOTTLED PALE YELLOWISH ORANGE (10YR 8/6), SLIGHTLY MOIST, DENSE, MODERATELY CEMENTED, ROUNDED PEBBLES UP TO 1-1/2 INCHES, MODERATELY WEATHERED (BEDROCK)
Tms	SILTY SANDSTONE, PALE YELLOWISH BROWN (10YR 6/2), SLIGHTLY MOIST, DENSE, MODERATELY CEMENTED, THINLY BEDDED, MODERATELY WEATHERED, FINE-GRAINED (BEDROCK)

TP-2 EXPLANATION

Qcol	SILTY SAND WITH FINE GRAVEL (SM), DARK BROWN (10YR 3/3), MOIST TO WET, LOOSE TO MODERATELY DENSE (COLLUVIUM)
Tms	SILTY SANDSTONE, PREDOMINATELY PALE YELLOWISH BROWN (10YR 6/2), SLIGHTLY MOIST, DENSE TO HARD, WELL CEMENTED, THIN TO THICK BEDDED, SLIGHTLY WEATHERED, FINE-GRAINED, SLIGHTLY TO MODERATELY FRACTURED, SOME IRON STAINING ALONG FRACTURES, VERY DIFFICULT TO EXCAVATE (BEDROCK)

PP=POCKET PENETROMETER

0 5

1"=5'

BAEZ GEOTECHNICAL GROUP

TEST PIT LOGS
TP-1 AND TP-2
SEVEN HILLS RANCH
SENIOR LIVING CENTER

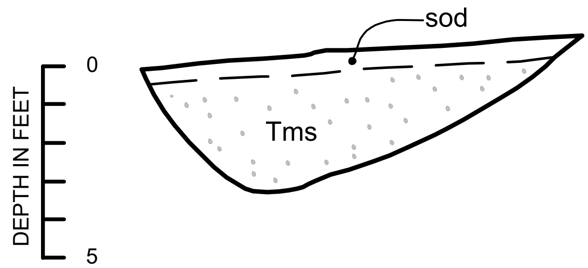
WALNUT CREEK, CALIFORNIA

FOR

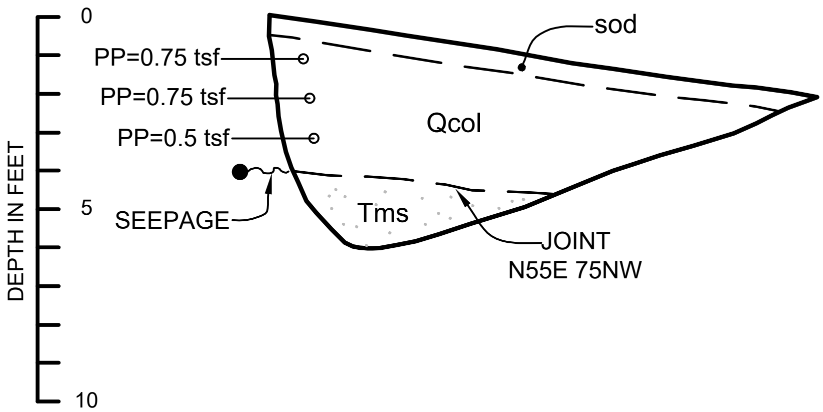
SPIEKER SENIOR DEVELOPMENT PARTNERS

BGG NUMBER: G147.01 DATE: 1-28-20 DRAWN BY: KR

TP-3
N35W



TP-4
N73E



TP-3 EXPLANATION

Tms	MEDIUM TO COARSE GRAINED SANDSTONE, DARK YELLOWISH ORANGE (10YR 6/6), SLIGHTLY MOIST TO MOIST, DENSE, MODERATELY CEMENTED, MASSIVE, MODERATELY WEATHERED (BEDROCK)

TP-4 EXPLANATION

Qcol	SILTY SAND WITH FINE GRAVEL (SM), DARK BROWN (10YR 3/3), MOIST TO WET, LOOSE TO MODERATELY DENSE, SEEPAGE FLOWING INTO TEST PIT NEAR BASE OF UNIT (COLLUVIUM)
Tms	SILTY SANDSTONE, PALE YELLOWISH BROWN (10YR 6/2), SLIGHTLY MOIST, DENSE, MODERATELY CEMENTED, MODERATELY WEATHERED, MODERATELY FRACTURED WITH IRON STAINING ALONG FRACTURE SURFACES (BEDROCK)

PP=POCKET PENETROMETER

0 5

1"=5'

BAEZ GEOTECHNICAL GROUP

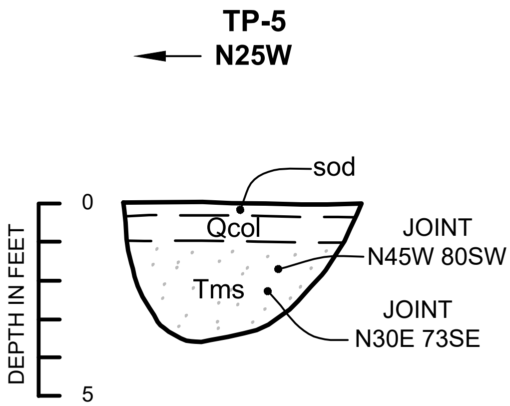
TEST PIT LOGS
TP-3 AND TP-4
SEVEN HILLS RANCH
SENIOR LIVING CENTER

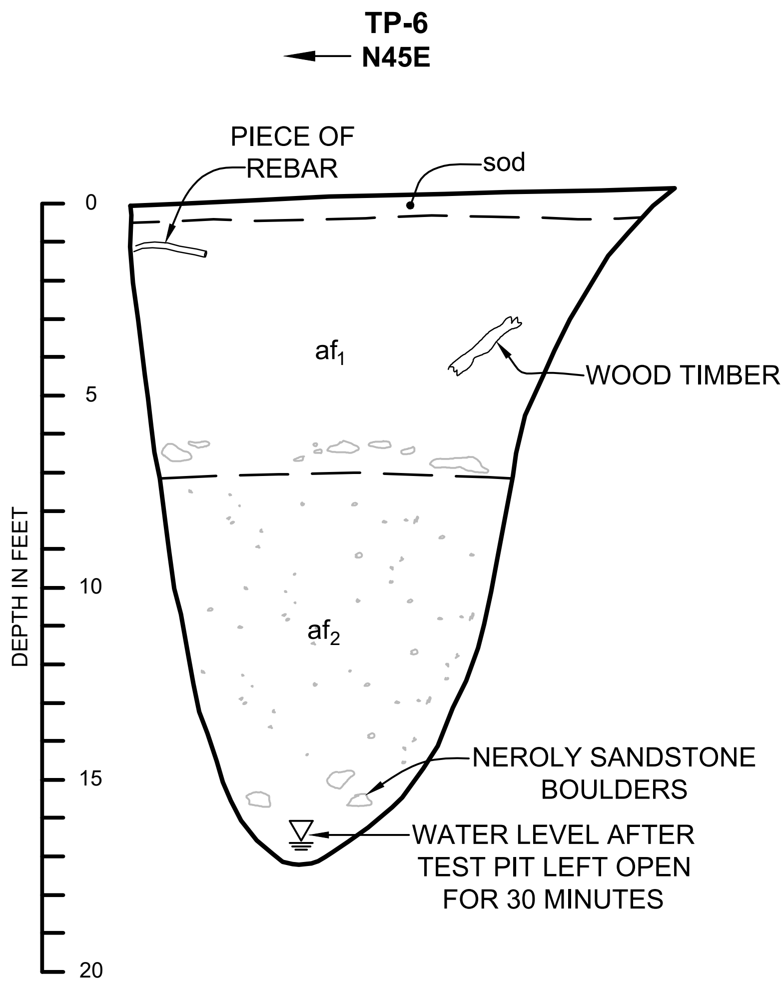
WALNUT CREEK, CALIFORNIA

FOR

SPIEKER SENIOR DEVELOPMENT PARTNERS

BGG NUMBER: G147.01 DATE: 1-28-20 DRAWN BY: KR





TP-5 EXPLANATION

Qcol	SILTY SAND, WITH FINE GRAVEL (SM), DARK BROWN (10YR 3/3), MOIST, LOOSE (COLLUVIUM
Tms	SILTY SANDSTONE, PALE YELLOWISH BROWN (10YR 6/2), SLIGHTLY MOIST, DENSE TO HARD, WELL CEMENTED, SLIGHTLY WEATHERED, MODERATELY FRACTURED, MASSIVE, DIFFICULT TO EXCAVATE (BEDROCK)

TP-6 EXPLANATION

af_1	SILTY TO CLAYEY SAND WITH ROCK FRAGMENTS (SM/SC), MOTTLED BROWN AND LIGHT BROWN, SLIGHTLY MOIST, MODERATELY DENSE, SOME CONSTRUCTION DEBRIS (ARTIFICIAL FILL)
af_2	SILTY SAND WITH SCATTERED BOULDERS (SM), MOTTLED LIGHT BLUE-GRAY, SLIGHTLY MOIST, MODERATELY DENSE, SCATTERED ROOTS, LIKELY FROM NEROLY SANDSTONE FORMATION SOURCE AREA (ARTIFICIAL FILL)

0 5

1"=5'

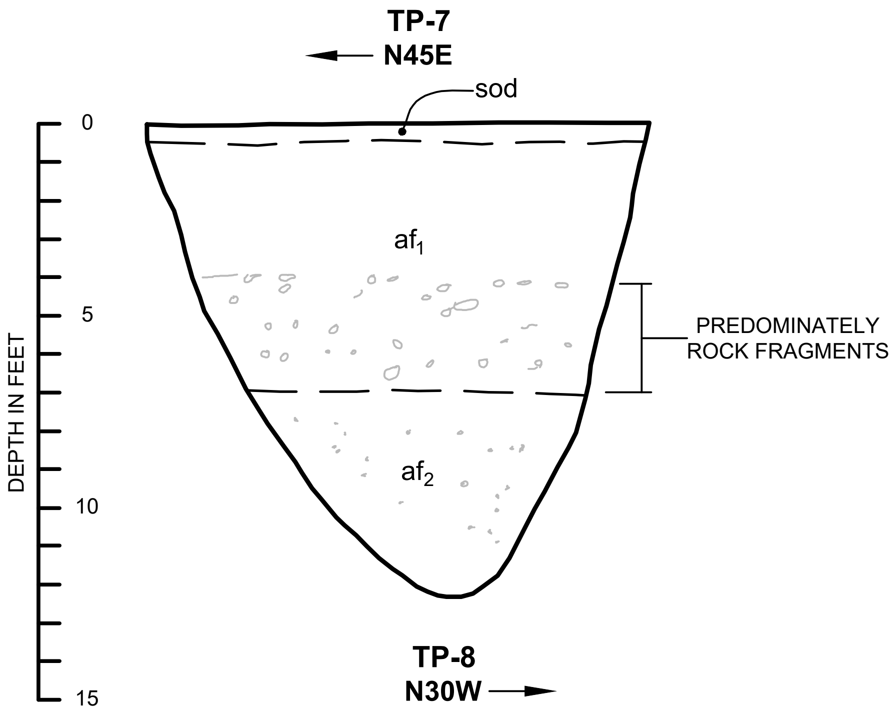
BAEZ GEOTECHNICAL GROUP

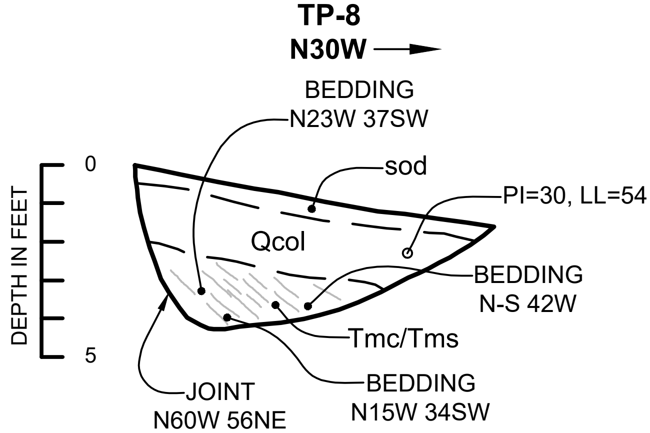
TEST PIT LOGS
TP-5 AND TP-6
SEVEN HILLS RANCH SENIOR LIVING CENTER

WALNUT CREEK, CALIFORNIA

FOR

SPIEKER SENIOR DEVELOPMENT PARTNERS





BGG NUMBER: G147.01 DATE: 1-28-20 DRAWN BY: KR

TP-7 EXPLANATION

af_1	SILTY TO CLAYEY SAND WITH ROCK FRAGMENTS (SM/SC), MOTTLED BROWN AND LIGHT BROWN, SLIGHTLY MOIST, MODERATELY DENSE, LOWER 3 FEET ROCKY (ARTIFICIAL FILL)
af_2	SILTY TO CLAYEY SAND WITH ROCK FRAGMENTS (SM/SC), MOTTLED LIGHT BLUE GRAY AND BROWN, SLIGHTLY MOIST, MODERATELY DENSE; LIGHT BLUE GRAY SAND IS LIKELY FROM NEROLY SANDSTONE FORMATION SOURCE AREA (ARTIFICIAL FILL)

TP-8 EXPLANATION

Qcol	SANDY CLAY (CL), DARK BROWN (10YR 3/3), MOIST, SOFT (COLLUVIUM)
Tmc/Tms	INTERBEDDED SANDY CLAYSTONE AND CLAYEY SANDSTONE, PALE YELLOWISH BROWN (10YR 6/2), SLIGHTLY MOIST, DENSE, WELL CEMENTED, MODERATELY WEATHERED, MODERATELY FRACTURED, THIN BEDDED, SOME SCATTERED SHELL MOLDS (BEDROCK)

0 5

1"=5'

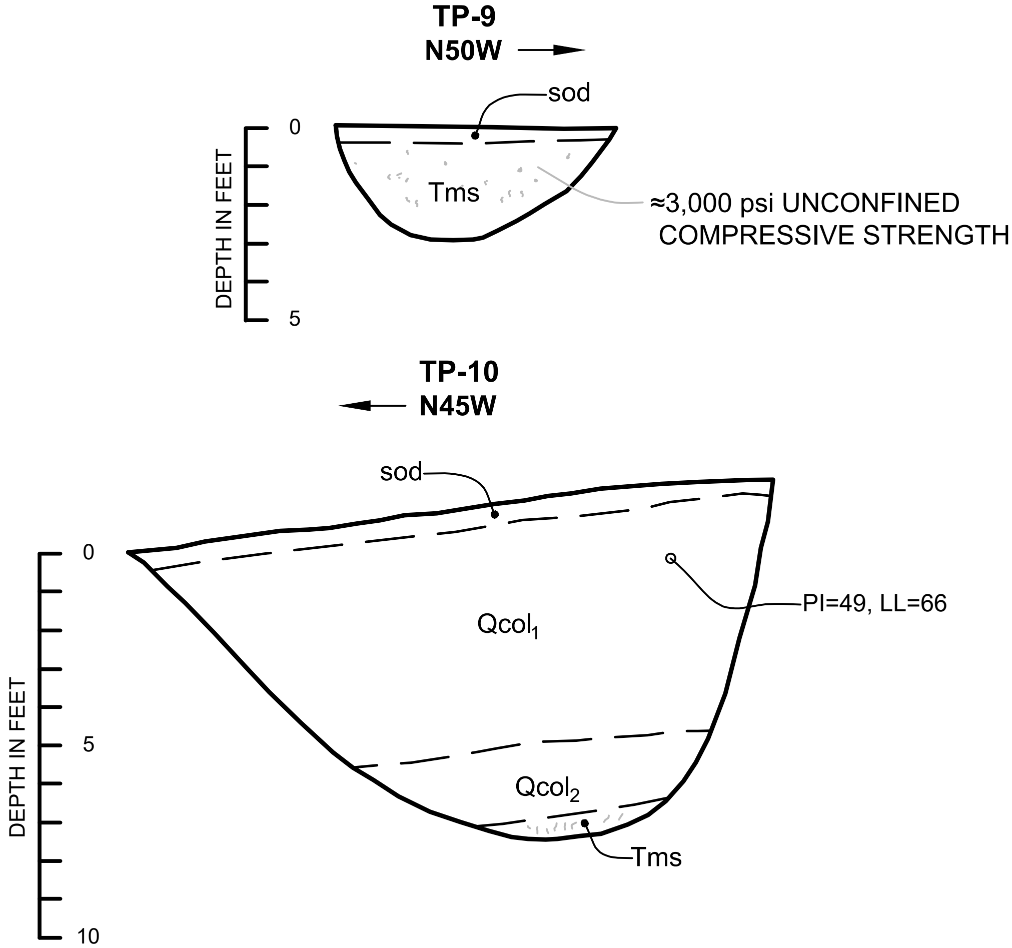
BAEZ GEOTECHNICAL GROUP

TEST PIT LOGS
TP-7 AND TP-8
SEVEN HILLS RANCH
SENIOR LIVING CENTER

WALNUT CREEK, CALIFORNIA

FOR

SPIEKER SENIOR DEVELOPMENT PARTNERS



TP-9 EXPLANATION

Tms	MEDIUM TO COARSE SANDSTONE, PALE YELLOWISH BROWN (10YR 6/2), SLIGHTLY MOIST, DENSE TO HARD, WELL CEMENTED, SLIGHTLY WEATHERED, MODERATELY FRACTURED, MASSIVE (BEDROCK)

TP-10 EXPLANATION

$Qcol_1$	SANDY CLAY (CL/CH), VERY DARK GRAY (10YR 3/1), SLIGHTLY MOIST, FIRM, SCATTERED PEBBLES, SCATTERED ROOTLETS, SOME CALCIUM CARBONATE FILAMENTS (COLLUVIUM)
$Qcol_2$	CLAYEY SAND (SC), DARK GRAYISH BROWN (10YR 4/2), SLIGHTLY MOIST, SCATTERED SHALE GRAVEL (COLLUVIUM)
Tms	MEDIUM TO COARSE SANDSTONE, PALE YELLOWISH BROWN (10YR 6/2), SLIGHTLY MOIST, DENSE TO HARD, WELL CEMENTED, SLIGHTLY WEATHERED, MASSIVE, DIFFICULT TO EXCAVATE (BEDROCK)

0 5
1"=5'

BAEZ GEOTECHNICAL GROUP

TEST PIT LOGS

TP-9 AND TP-10

SEVEN HILLS RANCH SENIOR LIVING CENTER

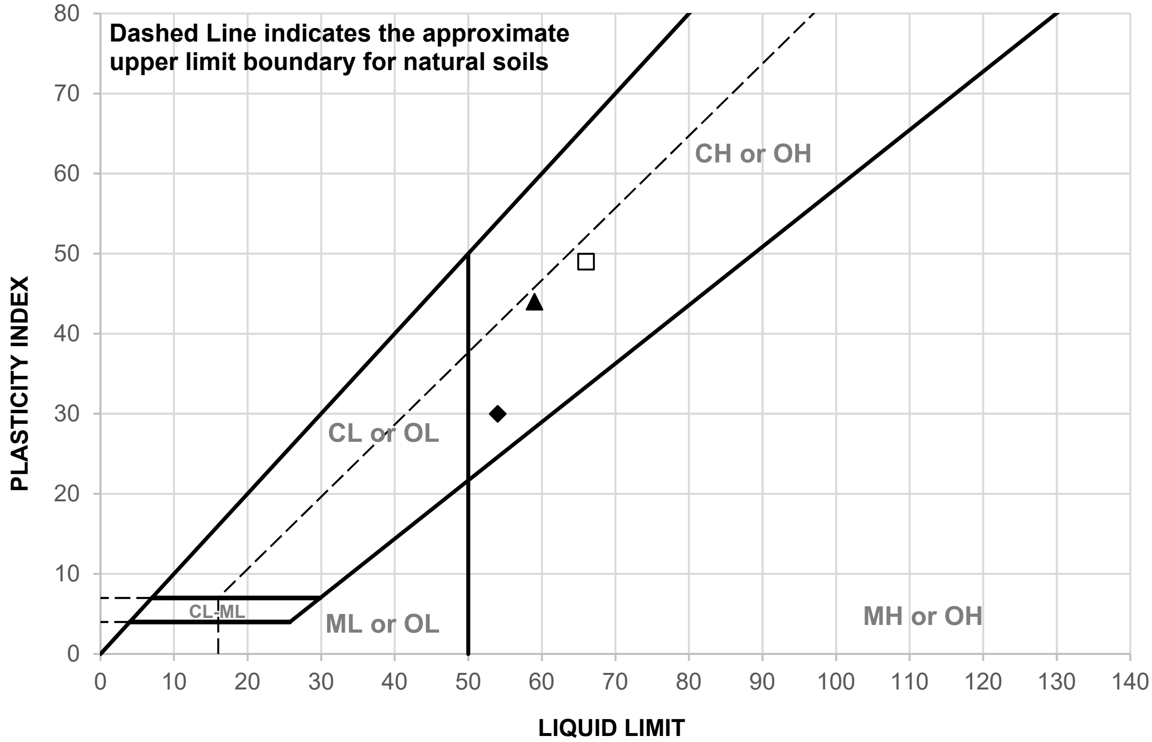
WALNUT CREEK, CALIFORNIA

FOR

SPIEKER SENIOR DEVELOPMENT PARTNERS

BGG NUMBER: G147.01 DATE: 1-28-20 DRAWN BY: KR

LIQUID AND PLASTIC LIMITS TEST REPORT
ASTM D4318



	SAMPLE ID	DEPTH	MATERIAL DESCRIPTION	LL	PL	PI
▲	TP-1	0-2 feet	See exploration logs	59	15	44
◆	TP-8	2-3 feet	See exploration logs	54	24	30
□	TP-10	0-5 feet	See exploration logs	66	17	49

	SAMPLE ID	TEST METHOD	REMARKS
▲	TP-1	PI: ASTM D4318, Wet Method	
◆	TP-8	PI: ASTM D4318, Wet Method	
□	TP-10	PI: ASTM D4318, Wet Method	

ENGEO
Expect Excellence

CLIENT: Baez Geotechnical Group
PROJECT NAME: 7 Hills, Job No. G147.01
PROJECT NO: 14368.000.051
PROJECT LOCATION: N/A
REPORT DATE: 1/28/2020
TESTED BY: M. Quasem
REVIEWED BY: M. Tong

Compressive Strength of Rock Cube

Test Method: ASTM C39

Report Date: 1/31/2020
Sample: 17972

San Ramon
2010 Crow Canyon Place
Suite 250
San Ramon, CA 94583
Phone: (925) 866-9000
Fax: (888) 279-2698

Client:
Baez Geotechnical Group. Inc.

Turlock, CA 94551

Project:
14368.000.051 -P:LAB
7 Hills
2060 Colorado Ave., Ste. B
Turlock, CA 94551

Sample Details

Set #:	1	**Technician:**	Bryant Jr., Donald	**Batched:**	
Specimen Size:	Rock Cube	**Cast By:**	Bryant Jr., Donald	**Sampled:**	
Specimens In Set:	2	**Date Cast:**	01/31/20	**Cast:**	
Truck / Ticket #:		**Sampled From:**		**Truck Empty:**	
Contractor:	N/A	**Placement Method:**		**Placement Time:**	

Location

Placement Location: Not Specified
Location Details: Sample #1
Sample Location / Notes: Sample #1

Batch Log

On-Site Admixtures: None

Specifications

Strength: N/A

Field Measurements

Weather:	**Consistency:**	**Air Content:**
Air Temperature (F):		**Load Volume:**

Lab Test Results

Testing Lab: San Ramon Lab, 3420 Fostoria Way, Suite E, Danville, CA, 94526

Specimen Number	Test Age Days	Test Date	Field / Lab Cure Days	Avg. Width 1 & 3 (in)	Avg. Width 2 & 4 (in)	Area (in²)	Avg Height	Max Load (lbs)	Strength (psi)	Break Remark	Fracture Type	Capping Method
1-1	0	01/31/20		3.06	3.06	9.30	6.00	23,100	2,480		G3	S
1-2	0	01/31/20		2.16	2.16	4.67	4.18	14,225	3,050		G3	S

Test Age Average Strengths (psi): 0 Day - **2770**
Test Age Strength Standard Deviation: 0 Day - **281**

Break Remarks

Tested By: Donald Bryant Jr. (1,2)
Checked In : 01/31/2020 (1,2)

Capping Methods

S: Sulfur Caps (ASTM C617)

Fracture Types

G3: Columnar

Compressive Strength of Rock Cube

Test Method: ASTM C39

Report Date: 1/31/2020
Sample: 17973

San Ramon
2010 Crow Canyon Place
Suite 250
San Ramon, CA 94583
Phone: (925) 866-9000
Fax: (888) 279-2698

Client:
Baez Geotechnical Group. Inc.

Turlock, CA 94551

Project:
14368.000.051 -P:LAB
7 Hills
2060 Colorado Ave., Ste. B
Turlock, CA 94551

Sample Details

Set #:	2	**Technician:**	Bryant Jr., Donald	**Batched:**	
Specimen Size:	Rock Cube	**Cast By:**	Bryant Jr., Donald	**Sampled:**	
Specimens In Set:	1	**Date Cast:**	01/31/2020	**Cast:**	
Contractor:	N/A	**Sampled From:**	Other (ASTM C172)		

Location

Placement Location: Not Specified
Location Details: Sample #2
Sample Location / Notes: Sample #2

Batch Log

On-Site Admixtures: None

Specifications

Strength: N/A

Field Measurements

Weather:
Consistency:
Air Content:
Air Temperature (F):

Lab Test Results

Testing Lab: San Ramon Lab, 3420 Fostoria Way, Suite E, Danville, CA, 94526

Specimen Number	Test Age Days	Test Date	Field / Lab Cure Days	Avg. Width 1 & 3 (in)	Avg. Width 2 & 4 (in)	Area (in²)	Avg Height	Max Load (lbs)	Strength (psi)	Break Remark	Fracture Type	Capping Method
2-1	0	01/31/20		3.00	3.00	9.00	6.26	28,775	3,200		G3	S

Test Age Average Strengths (psi): 0 Day - **3200**
Test Age Strength Standard Deviation: 0 Day - **0**

Break Remarks

Tested By: Donald Bryant Jr. (1)
Checked In : 01/31/2020 (1)

Capping Methods

S: Sulfur Caps (ASTM C617)

Fracture Types

G3: Columnar

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 **462 2771** Fax. 925 **462 2775**
www.cercoanalytical.com

6 February, 2020

Job No. 2001162
Cust. No. 13042

Mr. Bill Stevens
Baez Geotechnical Group
P.O. Box 3808
Turlock, CA 95381

Subject: Project No.: G147.01
Project Name: 7 Hills
Corrosivity Analysis – ASTM Methods

Dear Mr. Stevens:

Pursuant to your request, CERCO Analytical has analyzed the soil sample submitted on January 24, 2020. Based on the analytical results, this brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurement, all samples are classified as "moderately corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentrations were none detected at 15 mg/kg.

The sulfate ion concentrations were none detected at 15 mg/kg.

The sulfide ion concentrations reflect none detected with a detection limit of 50 mg/kg.

The pH of the soils ranged from 6.59 to 6.92, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potentials ranged from 330 to 390-mV which is indicative of potentially "slightly corrosive" soils resulting from anaerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific design recommendations or consultation, please call *JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
CERCO ANALYTICAL, INC.

J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

California State Certified Laboratory No. 2153

CERCO analytical

1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 **462 2771** Fax. 925 **462 2775**
www.cercoanalytical.com

Client: Baez Geotechnical Group
Client's Project No.: G147.01
Client's Project Name: 7 Hills
Date Sampled: Not Indicated
Date Received: 24-Jan-20
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 7-Feb-2020

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
2001162-001	TP-1 @ 0-2	330	6.59	-	5,100	N.D.	N.D.	N.D.
2001162-002	TP-8 @ 2-3'	390	6.92	-	2,000	N.D.	N.D.	N.D.
2001162-003	TP-10 @ 0-5'	381	6.63	-	2,400	N.D.	N.D.	N.D.

Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	10	-	50	15	15
Date Analyzed:	4-Feb-2020	4-Feb-2020	-	5-Feb-2020	31-Jan-2020	5-Feb-2020	5-Feb-2020

* Results Reported on "As Received" Basis
N.D. - None Detected

Cheryl McMillen
Laboratory Director

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

Chain of Custody

1100 Willow Pass Court
Concord, CA 94520-1006
925 462 2771
Fax: 925 462 2775
CERCO analytical

Job No.	CU#	Client Project I.D.
G147.01	1304	

Schedule
Analyte

Date Sampled	Date Due

Full Name Bill Stevens, wrs@baezgeotechnicalgroup.com **Phone** Office (209) 632-3779
Stefanie Parman, smp@baezdgeotechnicalgroup.com

Company and/or Mailing Address **Cell** BS (925) 766-1616
Baez Geotechnical Group, Inc., PO Box 3808, Turlock, CA 95381-3808 SP (209) 602-6569

Sample Source 7 Hills

ANALYSIS — ASTM

Lab No.	Sample I.D.	Date	Time	Matrix	Contain.	Size	Preserv.	Qty.	Redox Potential	pH	Sulfate	Chloride	Resistivity-100% Saturated	Sulfides		Brief Evaluation						
001	TP1 0-2'								X	X	X	X	X	X		X						
002	TP8 2'-3'								X	X	X	X	X	X		X						
003	TP10 0-5'								X	X	X	X	X	X		X						

MATRIX
DW - Drinking Water
GW - Ground Water
SW - Surface Water
WW - Waste Water
Water
SL - Sludge
S - Soil
Product

ABBREVIATIONS
HB - Hosebib
PV - Petcock Valve
PT - Pressure Tank
PH - Pump House
RR - Restroom
GL - Glass
PL - Plastic
ST - Sterile

SAMPLE RECEIPT
Total No. of Containers
Rec'd Good Cond/Cold
Conforms to Record
Temp. a t Lab -°C
Sampler

		Date	Time
Relinquished By:	[signature]		
Received By:	[signature]	1/24	11:00
Relinquished By:			
Received By:			
Relinquished By:			
Received By:			

Comments:

THERE IS AN ADDITIONAL CHARGE FOR EXTRUDING SOIL FROM METAL TUBES

Email Address