Geological Characterization Report

For

Proposed Agricultural Plot

Portion of APN: 046-131-046, Santa Rita Road

Cayucos, San Luis Obispo County, California

March 15, 2020

Prepared For

Mr. Bob Blanchard

By

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Project: Proposed Agricultural Plot
Portion of APN: 046-131-046; Santa Rita Road
Cayucos, San Luis Obispo County, California

Subject: Geological Characterization Report

As authorized, a Geological Characterization Study was performed for the above referenced project. This report presents the results of a literature, map, and aerial photography review, site reconnaissance, and conclusions and recommendations for the engineering geology aspects of the project design. These services were performed using the standard of care ordinarily exercised in this locality at the time this report was prepared.

Based on this study, it is my opinion that the site is suitable for the proposed agricultural use from an engineering geology standpoint provided the recommendations of this report are successfully implemented.

I have appreciated this opportunity to be of service to you on this project. Please call if you have any questions, or if I can be of further service.

Respectfully submitted,

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Contents

1. INTRODUCTION

This report presents results of a Geological Characterization Study performed for the proposed agricultural plot and associated access roadway alignments to be located in San Luis Obispo County, California.

1.1 Description

1.1.1 It should be noted that the as-built plans were reviewed as part of this report. These plans show the current conditions of the proposed agricultural plot and position of the access roads. Prior to any additional construction or grading, a certified engineering geologist should review changes made to the grading plan in order to verify that the final plans follow the recommendations offered herein. The proposed agricultural plot site and bisecting access roads have been developed by cutting and filling to create a gently sloping plot with raised planter beds and bisecting access roads. A majority of access road alignments are located along an existing access roads. Localized areas were minimally cut or filled across the agricultural plot and along the driveway alignments.

1.1.2 The proposed agricultural plot consists of several raised beds with sprinkler irrigation.

1.1.3 The proposed access roads are assumed to remain as-built and consists of roughly graded gently sloping dirt pathways that lie in between each of the raised beds within the agricultural plot.

1.1.4 The site was farmed continually with dry land hay until 1971. After 1971, an Avocado tree orchard was planted and the site was disked annually for weed control. The trees in the proposed agricultural plot area were removed in 2016.

2 SCOPE OF WORK

2.1 The purpose of this geological investigation that led to this report was to evaluate the slope conditions of the site with respect to the proposed agricultural use. These conditions include surface and subsurface geology. The scope of our work included:

- Reconnaissance of the site.
- Review of published literature and geologic mapping for the project site vicinity.
- Review of aerial photography.
- Geological analysis of the data obtained.
- Preparation of this report.

2.2 Contained in the report are:

- Site geologic maps and cross sections of the project site.
- Conclusions and recommendations pertaining to site use.

3 SITE SETTING

3.1 The site of the proposed development is located in the County of San Luis Obispo, California, with the approximate geographical coordinates. 35°29'01.83"N and 120°50'07.90"W. See the Vicinity Map (Figure 1).

3.2 The proposed agricultural plot is atop a low-lying spur ridge and eroded bedrock surface in the central portion of the parcel. Surrounding areas have been cleared and plowed for orchards with localized oak trees surrounded by native shrubs, and grasses.

3.2.1 The proposed agricultural plot site is gently sloping and is located atop an southeast trending spur ridge or eroded bedrock surface. The site is bound to the north and west by moderately steep to steeply ascending and descending slopes. The site is bound to the south and east by south flowing tributary seasonal drainages and hummocky topography.

4 SURFACE INVESTIGATION

4.1 The property is geologically described on the project Geologic Site Map (Appendix). A generalized geologic map of the project site area was created on the 'as-built' topographic map that shows the current site conditions, as well as the locations of access roads. Two cross sections have also been constructed on the detailed site geologic maps in order to assess the sub surface conditions across the project site area.

5 REGIONAL GEOLOGIC SETTING

5.1 The Site lies within the Coast Ranges Geomorphic Province of California, specifically the western flank of the Santa Lucia Mountain Range, which is a series of mountain ranges and valleys that trend northwest, sub-parallel to the San Andreas Fault (CGS, 2002). This portion of Central California between Monterey Bay and Los Angeles is part of the distributed North American-Pacific plate boundary, a complex interplate setting shaped by Late Cenozoic subduction, transtention and transpression. The setting is distinguished by moderate to high rates of seismicity, right-lateral shear deformation parallel to the San Andreas Fault and contractional strain both oblique and normal to the San Andreas Fault. The site lies within the Coastal Franciscan seismo-tectonic domain. The Coastal Franciscan domain consists of a northwest trending sliver of largely Franciscan Complex basement bounded by the San Gregorio-Hosgri fault on the west and the Nacimiento fault and the southern portion of the Rinconada fault on the east. The Coastal Franciscan domain includes the southern Santa Lucia Mountain ranges that were uplifted in the Pliocene and Quaternary Coast Range orogeny (Clark and others, 1994).

5.2 The Site is located on the Geologic Map of the Morro Bay North Quadrangle mapped by Thomas W. Dibblee, Jr. (2006) (Figure 2). The region is dominated by Jurassic to Cretaceous aged, Franciscan Complex basement rocks consisting of a mélange of pervasively sheared sedimentary marine and volcanic rocks. Overlying the Franciscan Complex is a series of Cretaceous to Tertiary aged sedimentary and volcanic rock units generally striking to the northwest. The site is located along the Oceanic Fault Zone. The Oceanic Fault and related folding in this region is associated with regional uplift and compression.

5.3 The proposed agricultural plot site is located in the central portion of the property across a low-lying spur ridge or eroded bedrock surface within the Cretaceous aged Toro Formation (Kjt member). The Kjt member of the Toro Formation underlies the entire area proposed for the agricultural plot and is described by Dibblee (2006) as a light colored (grayish where weathered), siliceous, and thinly bedded shale and sandstone. An outcrop along a tributary canyon incision in this area within this material shows bedding striking N 60 W and dipping 47 northeast. The CGS (2016) maps the material to the west of this area as being orientated N 80 W and dipping 76 northeast.

5.4 A thin and poorly developed residual soil occupies portions of the hill tops and valley bottoms in this area. Where located on hillslopes, the residual soils are prone to erosion and localized shallow soil slips.

6 REGIONAL SEISMICITY AND FAULTING

San Andreas Fault

The San Andreas Fault system is an active major dextral strike-slip fault zone extending for about 1100 km along the western side of California, which is located approximately 49 km east of the project site. The San Andreas Fault Zone is a major seismic hazard in California. The fault marks the boundary between the Pacific Plate to the west and the North American Plate to the east. Fault activity is caused by the Pacific Plate slipping along the boundary, in a northwest direction, between the two plates. Many smaller faults branch from and join the San Andreas Fault Zone. The San Andreas is broken up into segments with the Parkfield Segment being the closest to the site. The fault has a slip rate between 20-35 mm/year and a Maximum magnitude of 8.0 (SCEDC, online).

Rinconada Fault

The Rinconada Fault is a right-lateral strike-slip fault associated with the San Andreas Fault System and is located approximately 8 km east of the project site. The Rinconada Fault is believed to have accommodated about 60 km of Neogene right-lateral displacement and 18 km of post-Miocene offset (Dibblee, 1976). The fault has a slip rate of 1 mm/year, a maximum earthquake magnitude of 7.3 and a recurrence interval of 1764 years (Petersen and others, 1996). In the vicinity of the project site, the Rinconada Fault lies within the Salinian Block and generally divides this region into two distinct areas, the Santa Lucia Range on the west and the Salinas Valley to the east (Rosenberg and Clark, 2009). The nearby San Antonio Thrust Fault and mirror image Los Lobos Thrust Fault, appear to be a result of transpression across the Rinconada Fault Zone (Dibblee, 1976).

Hosgri Fault Zone

Located over 30 kilometers to the southeast, the Hosgri fault zone is the southernmost component of a complex system of right-slip faults that includes the San Gregorio, Sur, and San Simeon Faults. The modern Hosgri Zone is a convergent right-slip (transpressional) fault having a late Quaternary slip rate of 1 to 3 mm/year (Hanson and others, 1995). The fault zone has a Maximum magnitude of 7.3 (NSHMP, 2008) and is considered to be active (SLO County Safety Element, 1999).

West Huasna - Oceanic Fault Zone

The active Oceanic Fault Zone crosses directly south and west of the site. The West Huasna – Oceanic Fault Zone trends north-northwest for approximately 100 kilometers through the central portion of the Coastal Franciscan domain and is considered active. The fault extends from approximately the Santa Maria River on the south to San Simeon to the north. The Magnitude 6.5 San Simeon Earthquake, which shook the region December 22, 2003 most likely occurred on the Oceanic section of the fault zone. A study of elastic waves radiated from the source indicates that the San Simeon Earthquake was caused by reverse faulting (USGS, 2004).

Cambria Fault

The potentially active Cambria fault is located a few kilometers west of the site, approximately 0.4 km and trends to the northwest. At approximately 64 km long, the Cambria Fault projects southeast across a portion of Morro Bay and eventually intersects with the Oceanic Fault just east of San Luis Obispo. San Luis Obispo County lists the Cambria Fault as having a Maximum Magnitude of 6.25 (SLO County Safety Element, 1999).

7 HISTORIC REGIONAL EARTHQUAKES

1857 Fort Tejon, California, Magnitude 7.9: The earthquake occurred along the San Andreas Fault and ruptured from Parkfield to Wrightwood, a distance of approximately 300 km. Up to 9 meters of horizontal displacement was observed on the Carrizo Plain. Instances of seiching, fissuring, sandboils and hydrologic changes were reported from Sacramento to the Colorado River delta. Ground fissures were observed in the beds of the Los Angeles, Santa Ana, and Santa Clara Rivers and at Santa Barbara. Sandboils occurred at Santa Barbara and in the flood plain of the Santa Clara River. One report describes sunken trees, possibly associated with liquefaction, in the area between Stockton and Sacramento (USGS, online).

1865 Santa Cruz Mountains, California, Magnitude 6.5: This earthquake caused damage from the San Juan Bautista on the south to Napa on the north (USGS, online).

1901 Parkfield, California: This earthquake was felt from San Francisco to the north, San Luis Obispo to the south and Porterville to the east. Chimneys were toppled at Bradley, Echo Valley, Parkfield, Slacks Canyon, Stone Canyon, and Warthan Canyon. At Parkfield, three houses were twisted out of shape and one was almost wrecked (USGS, online).

1906 San Francisco, California, Magnitude 7.8: This earthquake caused the most lengthly rupture of a fault that has been observed in the contiguous United States. The displacement of the San Andreas Fault was observed over a distance of 300 kilometers from San Juan Bautista to Point Arena, where is passes out to sea. The largest horizontal displacement, 6.4 meters, occurred near Point Reyes Station in Marin County. Damage in San Francisco resulting only from the earthquake was estimated at $20 million; outside the city, it was estimated at $4 million. The duration of the shaking in San Francisco was about 1 minute (USGS, online).

1926 Monterey Bay, California, Magnitude 6.1 and 6.1: Two large earthquakes caused considerable damage in the Monterey Bay region. The quakes were felt as far away as San Francisco, approximately 120 km from the epicenter (USGS, online).

1983 Coalinga, California, Magnitude 6.4: This damaging earthquake was caused by a 0.5-meter uplift of Anticline Ridge northeast of Coalinga, but surface faulting was not observed. Ground and aerial searches immediately after the earthquake revealed ground cracks and fissures within about 10 kilometers of the instrumental epicenter, none of which appeared to represent movement on deeply rooted fault structures. This earthquake triggered thousands of rockfalls and rockslides as far as 34 kilometers northwest, 15 kilometers south, and 26 kilometers southwest of the epicenter. This earthquake caused an estimated $10 million in property damage (according to the American Red Cross) and injured 94 people. Damage was most severe in Coalinga, where the 8-block downtown commercial district was almost completely destroyed (USGS, online).

1989 Loma Prieta (Santa Cruz Mountains), California, Magnitude 6.9: The largest earthquake to occur on the San Andreas Fault since the great San Francisco earthquake in April 1906, caused 63 deaths, 3,757 injuries, and an estimated $6 billion in property damage. The most severe property damage occurred in Oakland and San Francisco, about 100 kilometer north of the fault segment that slipped on the San Andreas. Six feet of right-lateral strike-slip and 4 feet of reverse-slip was inferred from geodetic data. This earthquake was felt over most of central California and in part of western Nevada. Liquefaction caused severe damage to buildings in San Francisco's Marina district as well as along the coastal areas of Oakland and Alameda in the east San Francisco Bay shore area and also contributed significantly to the property damage in the Santa Cruz and Monterey Bay areas, which lie near the epicentral zone (USGS, online).

2003 San Simeon, California, Magnitude 6.5: The epicenter was located 11 km northeast of San Simeon and 39 km northwest of Paso Robles. The rupture propagated unilaterally to the southeast. The earthquake occurred on a previously unknown blind thrust fault. No surface rupture associated with the earthquake has been identified. The worst damage occurred in Paso Robles where 2 people died in the collapse of an unreinforced masonry building (Hardebeck and others, 2004).

2004 Central Coast, California, Magnitude 6.0: This earthquake ruptured along roughly the same segment of the San Andreas Fault that broke in 1966. This earthquake is the seventh in a series of repeating earthquakes on this stretch of the fault. The previous events were in 1857, 1881, 1901, 1922, 1934, and 1966 (USGS, online).

8 SITE CONDITIONS

8.1 Site Geology

8.1.1 The proposed agricultural plot site is flanked by descending slopes to the south and east and is proposed to be placed in raised beds across the central portion of a low-lying north south trending spur ridge or eroded bedrock surface. The descending hillslope west of the proposed agricultural plot site contains road cuts with localized bedrock outcroppings and the majority of this area is covered by a thin residual bedrock soil over natural hill slope topography. The descending hillslope south and east of the proposed development site contains localized bedrock outcroppings beneath a plowed natural hill slope topography. No springs or areas indicative of shallow ground water were observed in this area of the agricultural plot site. Runoff from the proposed agricultural plot site area is by sheet flow to the east and south. The eastern and southern flanks of the spur ridge are bound by well incised seasonal tributary drainages. The proposed agricultural plot site is not prone to head ward erosion related to these features. Shallow soil slips are possible along the margins of these tributary incisions. It is recommended that surface runoff in the vicinity of the proposed agricultural plot site be controlled and directed away from the hillslopes in order to discourage any hillside erosion. One distinct rock unit is observed in this portion of project site area. The Kjt or shale member of the Toro Formation underlies the area proposed for the agricultural plot site and is a light colored, fine grained, thinly bedded, highly fractured, and moderately well weathered shale. A majority of the observed fracturing on site are closely spaced, randomly orientated, discontinuous, and stepped.

8.1.2 The proposed access road alignment exits from the proposed agricultural plot site to the west and both descends along the south facing hillside toward the valley to the south. The proposed access roads across the proposed agricultural plot site are entirely underlain by the Kjt or shale member of the Toro Formation underlies all of the access roads and is a light colored, fine grained, thinly bedded, highly fractured, and moderately well weathered shale and sandstone. A majority of the observed fracturing on site are closely spaced, randomly orientated, discontinuous, and stepped. Across the entire agricultural plot site area, the access roads are not cut or filled. The alignments in this area in not prone to head ward erosion related to the incised tributary drainages. It is recommended that surface runoff along the access roads be controlled and directed away from the adjacent slopes in order to discourage any erosion.

9 MAPS, AERIAL PHOTOGRAPHS AND LITERATURE REVIEW

9.1.1 Geologic maps by the USGS (1975), Dibblee (2006), and the CGS (2016) were reviewed across the project site vicinity. The most up to date map by Dibblee and the CGS seem to be the most accurate and incorporates most of the features from the older map. Descriptions and structural analysis of the regional geology were compiled mostly from Durham (1968), Dibblee (2006), Clark and others (1994) and Rosenberg and Clark (2009).

9.2.1 Aerial photographs were reviewed to aid in the location of any geologic hazards not easily observed from on-site reconnaissance (USDA and NAPP Imagery). No surficial slope failures were observed, nor were any deeper landslides or other geologic hazards recognized within the project area.

10 GROUNDWATER CONDITIONS

10.1 Neither seeps, springs or areas indicative of shallow ground water were observed in the vicinity of the agricultural plot site. It should be noted that groundwater elevations can fluctuate depending on seasonal rainfall and groundwater withdrawal.

11 GEOLOGIC HAZARDS

11.1 Seismic Hazards -The State of California considers surface fault rupture and seismic groundshaking primary seismic hazards. Surface fault rupture is disruption along the surface trace of an active fault as a result of seismic activity or fault creep. Unlike surface fault rupture, groundshaking is not confined to the trace of a fault, but instead propagates into surrounding areas during an earthquake. The project site is located in a seismically active region of the coastal California. The project site is located within an earthquake fault zone identified by maps produced by the Alquist-Priolo Earthquake Fault Zoning Act. Potentially active and active nearby faults could produce strong ground shaking in the assumed lifetime of the proposed structure. No evidence of any surface fault rupture was observed during aerial photograph review or on-site investigations.

11.2 Liquefaction – Earthquake induced vibrations can be the cause of several significant phenomena, including liquefaction of saturated fine sands and silty sands. Loose soils can transform from a solid to a liquid state as a result of increased pore pressure during seismic loading. Liquefaction results in a complete loss of strength and can cause structures to settle or even overturn if it occurs in the bearing zone. If liquefaction occurs beneath sloping ground, a phenomena known as lateral spreading can occur. Due to the dense conditions of shallow bedrock encountered during the field analysis and the absence of a shallow groundwater table, the potential for liquefaction is low within the proposed project site.

11.3 Landslide and Slope Stability Hazards - According to the Geologic Map produced by Dibblee (2004), adverse bedrock bedding conditions potentially exist regionally, but were not observed locally in the area of the proposed agricultural plot site. Stringent erosion control measures are recommended to minimize the potential for any surficial slope sliding. Due to the lack of evidence for prior landslide or slumping features observed during site exploration, aerial photograph interpretation and geologic map review, the potential for landslides is low at the agricultural plot site.

11.4 Regional orientation of bedding within the geologic formation, along with the slope direction of the agricultural plot site shows that into slope bedding conditions persist across the site (Appendix).

11.5 All surface and potential subsurface water should be diverted away from the agricultural plot site and access roads by subsurface drains, lined drainage swales or other means.

11.6 Subsidence -Subsidence is often caused by human activities, such as overpumping groundwater from an aquifer. Due the dense subsurface bedrock observed and absence of observation of fissures in the near vicinity during site reconnaissance and aerial photograph review, the potential for subsidence is low at the site.

11.7 Ridgetop Shattering -Ridgetop shattering is an earthquake related shattering of exposed bedrock material along a ridgeline or other topographic high point. The presence of highly fractured bedrock in the near vicinity of the proposed development or near the edge of slopes make the potential for ridgetop shattering moderately high at the project site. The potential threat for shattering should not affect the agricultural plot site. There are no related structures.

11.8 Earthquake Induced Flooding, Tsunamis and Seiches - The agricultural plot site is well elevated above any near any large bodies of water to warrant the potential for earthquake induced flooding, including tsunamis and seiches.

11.9 Volcanic Hazards - The site is not located in the near vicinity of any known active or potentially active volcanoes.

11.10 Erosion - Erosion problems are widespread in San Luis Obispo County due to the sandy nature of native soils. On-site surface soils are of a fairly loose silty clayey sand. High rates of rainfall in winter months and moderately inclined slopes make the project site moderately susceptible to erosion and sedimentation problems. Care should be taken during agricultural processes to minimize the effects it will have on the surrounding environment. Proper erosion control measures and drainage design should be implemented into all plans for the proposed agricultural plot site.

11.11 Naturally Occurring Asbestos (NOA) and Radon Potential
Ultramafic rocks are dark, heavy, and rich in iron and magnesium minerals. They begin as igneous rocks formed in high temperature environments well below the surface of the earth. Ultramafic rocks may be partially to completely altered to serpentinite (a type of metamorphic rock) by the time they are exposed at the surface by uplift and erosion. Naturally occurring asbestos fibers, including chrysotile asbestos and tremolite-actinolite asbestos, are more likely to be encountered in, and immediately adjacent to, areas of ultramafic rock due to the metamorphic processes of formation. Historically, asbestos has been used in manufactured goods for its fibrous and heat-resistant characteristics. Serpentine rock, often containing asbestos, has also been used extensively as base material in the construction of new roads. Exposure and disturbance of rock and soil that contains asbestos can result in the release of fibers to the air and consequent exposure to the public. All types of asbestos are now considered hazardous and pose public health risks. The California Air Resource Board (CARB) regulates the use of asbestos containing materials. The agricultural plot site is not located near a unit containing ultramafic rocks, therefore the potential for NOA is low. The presence of ultramafic rocks, although not anticipated, should be monitored during grading.

Radon is a radioactive gas formed by the decay of small amounts of uranium and thorium naturally present in rock and soil. Sometimes radon gas can move from underlying soil and rock into houses and become concentrated in the indoor air, posing a significant lung cancer risk for the residents. Four picocuries per liter is the U.S. EPA recommended action level above which remedial action should be considered. The only way to identify specific buildings with indoor-radon levels exceeding 4 pCi/L is through testing. In the study completed by Churchhill (2008), Monterey Formation units, especially Tml, Tm, Tmu, and Tmw are the most likely geologic units to have areas with elevated radon potentials. The project site does not lie within or near the Monterey Formation (Tm) and is located in an area identified as "Low" potential for indoor radon levels exceeding 4 pCi/L on the map by Churchill (2007).

12 SEISMIC DESIGN CONDITIONS

12.1 Deaggregation and seismic parameter analysis made available by the California Geological Survey was used to determine the site specific peak ground acceleration. The acceleration value is based off the 2008 NSHMP/PSHA Interactive Deaggregation-Earthquake Hazards Program (revised August 3, 2009) for earthquakes having a 10% probability of being exceeded in 50 years.

12.2 The following estimated ground motion parameters have been established using the methods outlined in the 2010 California Building Code with reference to the acceleration contour maps provided by the U.S. Geological Survey (USGS) and the National Seismic Hazard Mapping Project (NSHMP). These ground motion parameters represent the Maximum Considered Earthquake (MCE) spectral response of seismic events experiencing 5 percent damped acceleration and having a 2 percent probability of exceedance within a 50 year period.

2016 California Building Code Seismic Parameters	
Parameter	**Value**
Seismic Design Category	D
Site Class	D
Short Period Spectral Acceleration, S_s	1.185
1-second period spectral acceleration, S_1	0.440
Short period site coefficient, F_a	1.026
1-second period site coefficient, F_v	1.560
Adjusted short period spectral acceleration, S_{ms}	1.216
Adjusted 1-second period spectral acceleration, S_{m1}	0.687
Short period design spectral acceleration, S_{DS}	0.811
1-second period design spectral acceleration, S_{D1}	0.458

13 Conclusions

13.1 The potential for active fault rupture at the site is low.

13.2 The potential from the effects of groundshaking associated with a substantial earthquake in the vicinity is moderate.

13.3 The potential for earthquake-induced landslides within the proposed development area is moderate.

13.4 The potential for ridgetop shattering is moderate.

13.5 The potential for earthquake-induced liquefaction is low.

13.6 The potential for subsidence is low.

13.7 Creep or landslides were not observed within the proposed agricultural plot site areas of influence.

13.8 Potential for earthquake-induced flooding, including tsunamis and seiches is low.

13.9 The potential for volcanic hazards is low.

14 Recommendations

The site is suitable for the proposed agricultural plot site from a geological standpoint provided the recommendations contained herein are properly implemented into the project.

14.1 Ground shaking from a large magnitude earthquake along any faults in the vicinity could result in structural damage and potentially cause injuries to people if the proposed agricultural plot site area is not properly designed to sustain seismic activity. All structural elements should be designed according to current code minimums.

14.2 All recommendations Site Development should be followed to provide stable bearing conditions for the proposed agricultural plot site.

14.3 Proper erosion control measures and drainage design should be implemented into all agricultural plot site plans.

14.4 All recommendations in the project Geotechnical Engineering Report should be properly implemented into the project plans.

15 References

Beacon Geotechnical Inc., 2017, Geotechnical Engineering Report for Proposed Single-Family Residence and Access Road, Santa Rita Road, APN: 039-261-052, San Luis Obispo County, California, Unpublished.

CGS, 2002, California Geomorphic Provinces, Note 36, California Geological Survey.

Churchill, R.K., 2008, Radon Potential in San Luis Obispo County, California Geological Survey, Special Report 208.

Clark, D.G., Slemmons, D.B., and Caskey, S.J., and dePolo, D.M., 1994, Seismotectonic Framework of Coastal Central California, *in* Alterman, I.B., McMullen, R.B., Cluff, L.S., and Slemmons, D.B., eds., Seismotectonics of the Central Coast California Coast Ranges, Geological Society of America Special Paper 292.

Dibblee, T.W., 1976, The Rinconda and Related Faults in Southern Coast Ranges, California, and Their Tectonic Significance, U.S. Geological Survey Professional Paper 981.

Dibblee, T.W. Jr., 2004, edited by Minch, J.A., Geologic Map of the Templeton Quadrangle, San Luis Obispo County, California, 1:24000, Santa Barbara Museum of Natural History, Map # DF-135.

Dibblee, T.W., Jr., (2006), Geologic Map of the Atascadero Quadrangle, San Luis Obispo County, California, Dibblee Geology Map Center Map, Published by the Santa Barbara Museum of Natural History, Scale 1:24,000.

Groundwater Bulletin, 2004, California's Groundwater Bulletin 118, Salinas Valley Groundwater Basin, State of California, The Resources Agency Department of Water Resources.

Hall, C.A., 1974, Geologic Map of the Cambria Region, San Luis Obispo County, California, 1:24000, USGS Miscellaneous Field Studies Map MF-599.

Hanson, K.L., Lettis, W.R., McLaren, M.K., Savage, W.U., and Hall, N.T., 1995, edited by Keller, M.A., Style and Rate of Quaternary Deformation of the Hosgri Fault Zone, Offshore South-Central California, USGS Bulletin 1995-BB.

Hardebeck, J.L., Boatwright, J., Dreger, D., Goel, R., Graizer, V., Hudnut, K., Ji, C., Jones, L., Langbein, J., Lin, J., Roeloffs, E., Simpson. R., Stark, K., Stein, R., and Tinsley, J.C., 2004, Preliminary Report on the 22 December 2003 M6.5 San Simeon, California Earthquake, Seismological Research Letters.

National Seismic Hazard Mapping Project (NSHMP), 2008, USGS, Online, U.S. Geological Survey, http://earthquake.usgs.gov/hazards/designmaps/javacalc.php

Petersen, M.D., Bryant, W.A., Cramer, C.H., Cao, T., and Reichle, M., 1996, Probalistic Seismic Hazard Assessment for the State of California, California Department of Conservation, Division of Mines and Geology, S.S. Geologic Survey, Open File Report 96-706

Rosenberg, L.I., and Clark, J.C., 2009, Map of the Rinconada and Reliz Fault Zones, Salinas River Valley, California, Scientific Investigations Map 3059, U.S. Geological Survey.

San Luis Obispo County, 1999, Safety Element San Luis Obispo County General Plan, San Luis Obispo County Planning and Building Department.

USGS, 2004, Poster of the San Simeon, California Earthquake of 22 December 2003- Magnitude 6.5, USGS National Earthquake Information Center, in Cooperation with CISN and ANSS.

Southern California Earthquake Data Center (SCEDC), online, http://www.data.scec.org/

USGS, online, Earthquake Hazards Program, http://earthquake.usgs.gov/regional/states/historical_state_mag.php

USGS, 2008, online, 2008 Interactive Deaggragations, U.S. Geological Survey, http://eqint.cr.usgs.gov/deaggint/2008/index.php

USGS/CGS, 2002-Revised 2003, Seismic Shaking Hazards in California, California Geological Survey, http://redirect.conservation.ca.gov/cgs/rghm/pshamap/pshamain.html

USGS, 2002, Stereographic Pair Aerial Photographs, 9"x9", color infrared, Original Scale 1:31680, Optical Scan Resolution 2400 dpi, 6/7/2002, USGS

PROJECT LIMITATIONS AND UNIFORMITY OF CONDITIONS

The analysis and recommendations submitted in this report are based in part upon the site observations. The nature and extent of variations between and beyond the observations may not become evident until use of the plot. If variations then appear evident, it may be necessary to re-evaluate the recommendations of this report.

The scope of our services did not include environmental assessment. The scope of services did not include investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, surface water, groundwater or air. Any statements in this report or on the soil boring logs regarding odors, unusual or suspicious items or conditions observed are strictly for the information of the client.

Findings of this report are valid as of this date, however, changes in a condition of a property can occur with passage of time whether they be due to natural processes or works of man on this or adjacent properties. In addition, changes in applicable or appropriate standard may occur whether they result from legislation or broadening knowledge. Accordingly, findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of one (1) year.

In the event that any changes in the nature, design, or location of the agricultural plot site and other improvements are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.
This report is issued with the understanding that it is the responsibility of the owner or his representatives to insure the information and recommendations offered herein are called to the attention of the project manager. It is also the responsibility of the owner or his representatives to insure the information and recommendations offered herein are incorporated into the project plans and specifications and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

John Helms, CEG has prepared this report for the exclusive use of the client and authorized agents. This report has been prepared in accordance with generally accepted geological practices. No other warranties, either expressed or implied, are made as to the professional advice provided under the terms of this agreement.

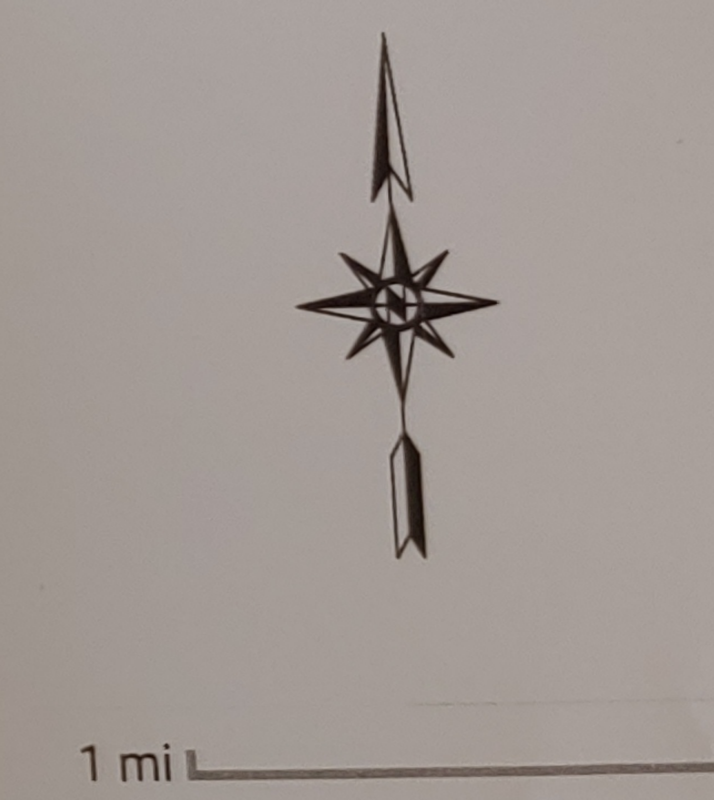
It is recommended that John Helms, CEG be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications. If John Helms, CEG is not accorded the privilege of making this recommended review, we can assume no responsibility for misinterpretation of recommendations.

Google Maps 12520 Santa Rita Rd

Title
Site Location Map

Project 12520 Santa Rita Rd
San Louis Obispo, California

John Helms, CEG | FIGURE 1



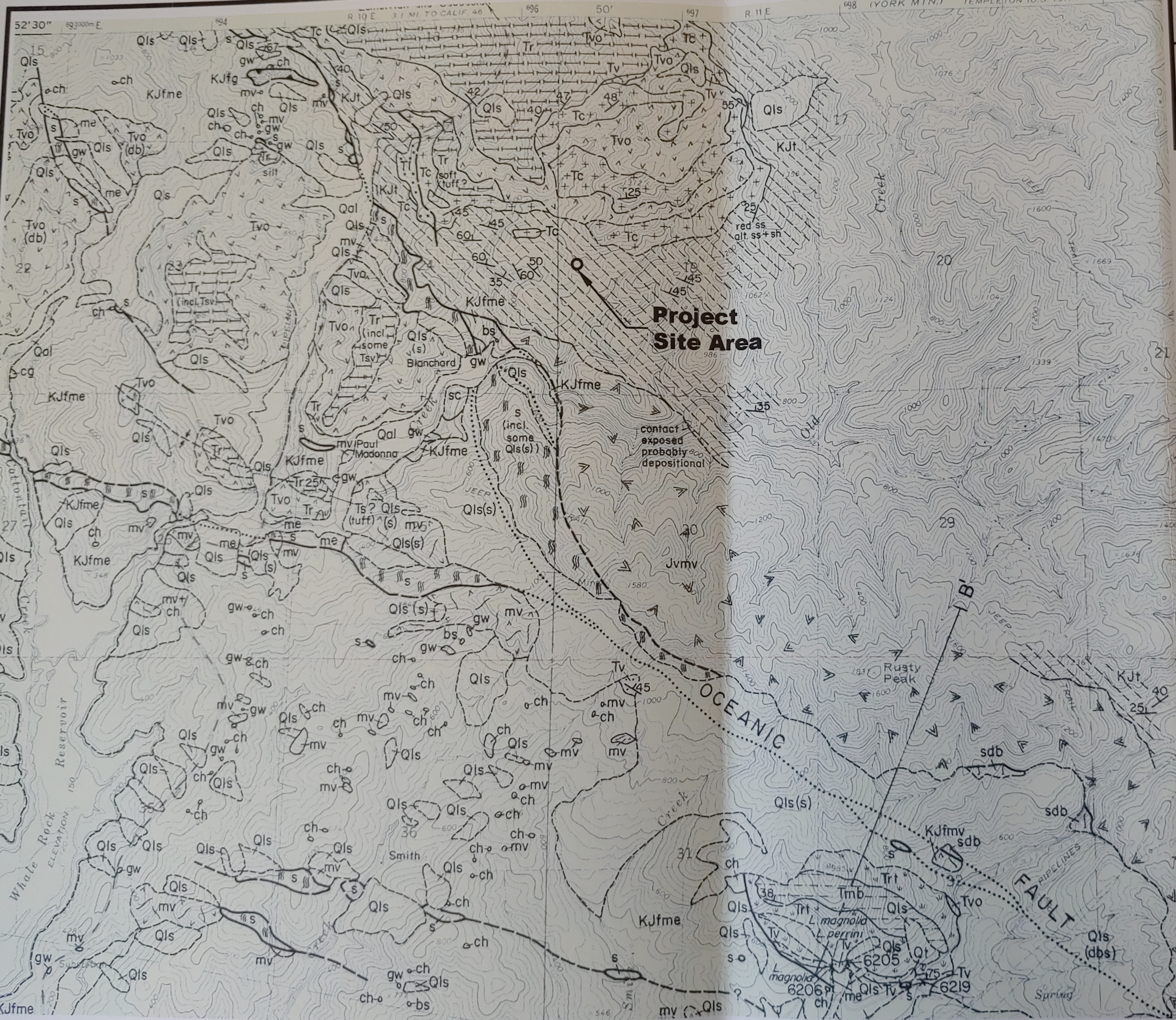
Title

USGS MAP

Project

12520 Santa Rita Rd
San Luis Obispo, California

John Helms, CEG | FIGURE 4



0 2000' 4000'

Explanation

Holocene

Qya - Alluvium

Qls - Landslide

Jurassic

Jbd - Obispo Formation

Jsd - Meta Volcanic

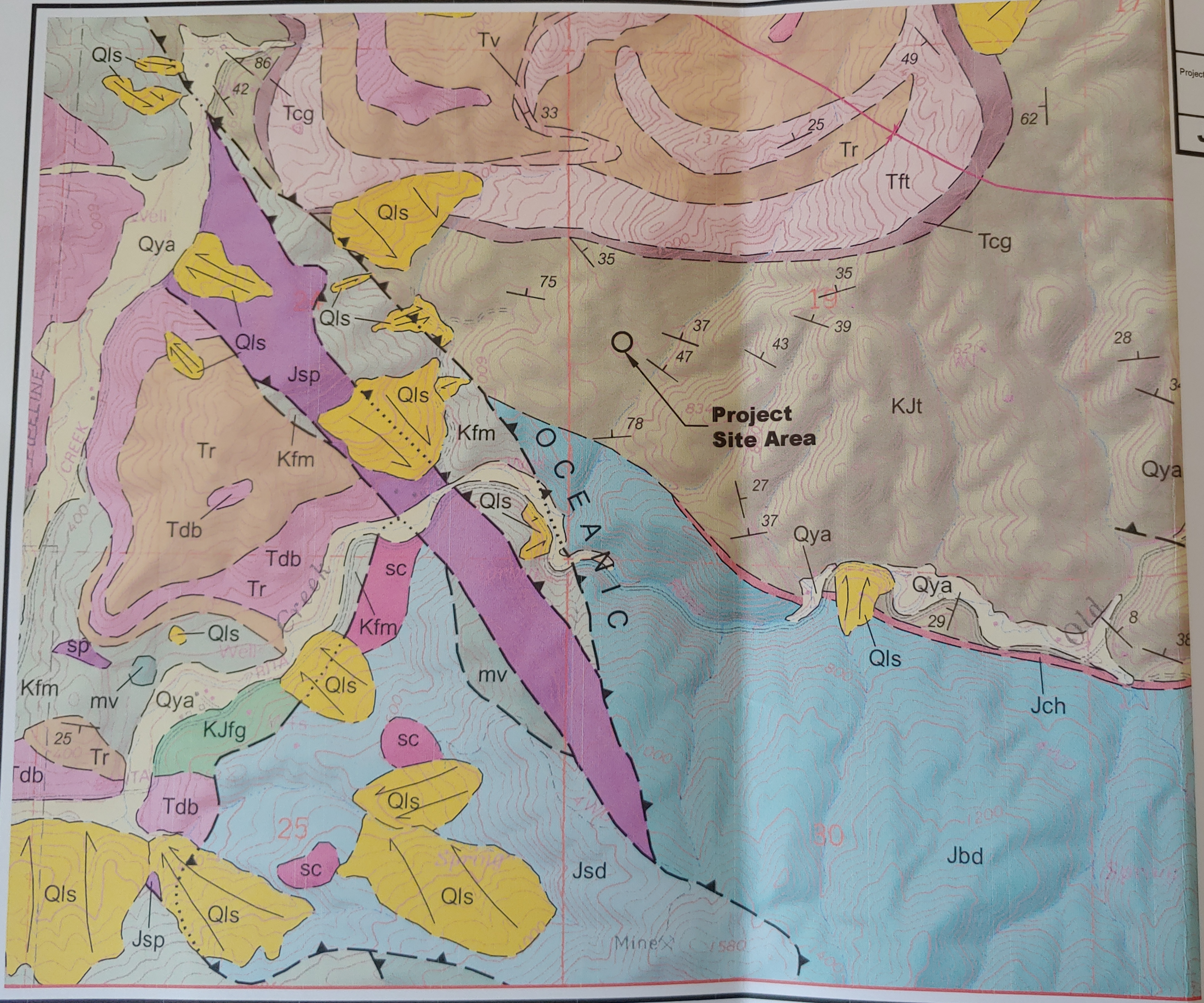
Cretaceous

Kst - Toro Formation Shale and Sandstone

Kfm - Franscian Melange

Fault Zone

(USGS MF-686, Hall and Prior 1975)



Title

Regional Geologic Map

Project

12520 Santa Rita Rd
San Louis Obispo, California

John Helms, CEG | FIGURE 3

0 1000' 2000'

Explanation

Holocene

Qya - Alluvium

Qls - Landslide

Jurassic

Jbd - Obispo Formation

Jsd - Meta Volcanic

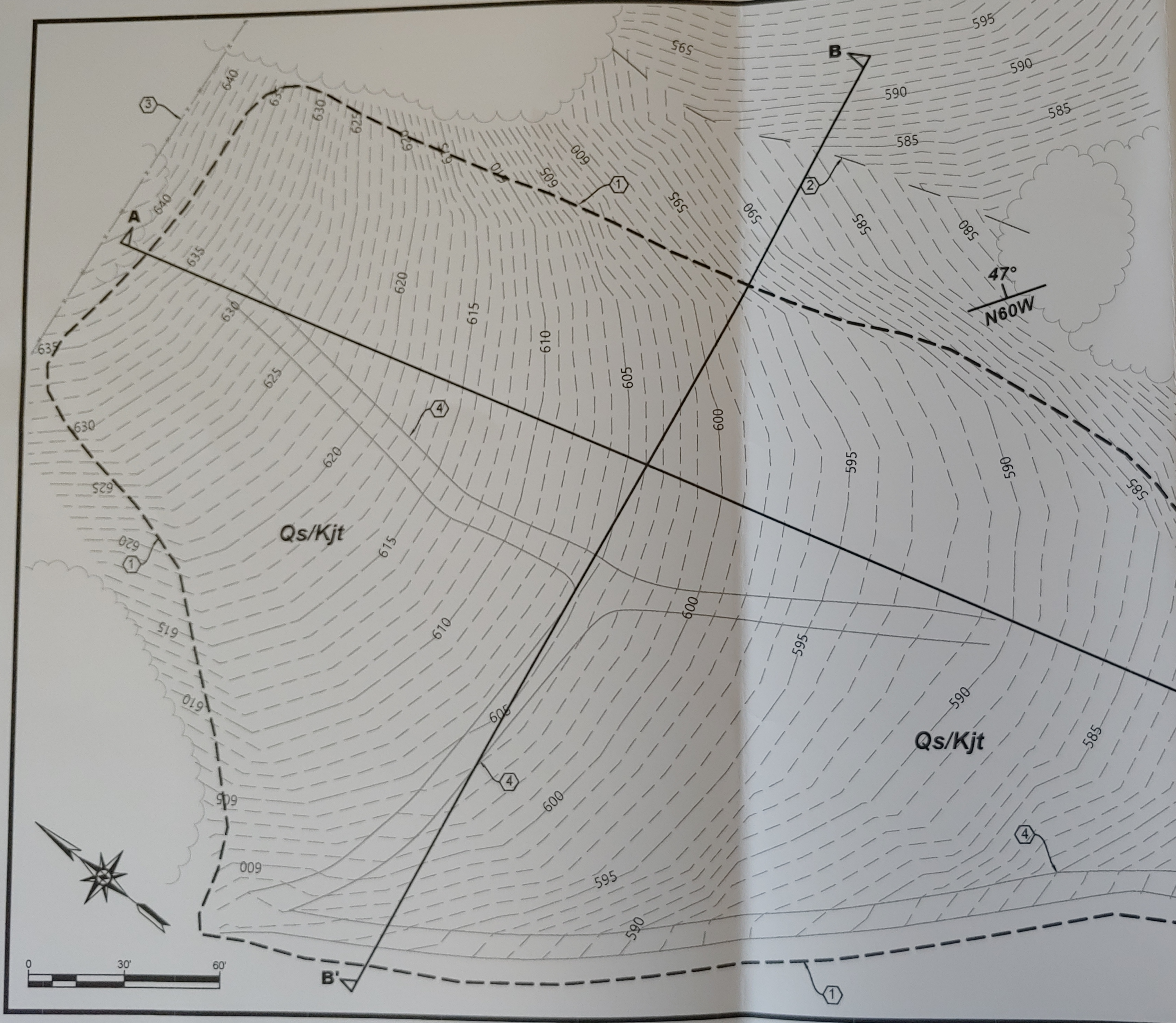
Cretaceous

Kst - Toro Formation Shale and Sandstone

Kfm - Franscian Melange

Fault Zone

(CGS Digital Map, 2016)



Title

Site Geologic Map

Project

12520 Santa Rita Rd
San Louis Obispo, California

John Helms, CEG | FIGURE 5

CONSTRUCTION NOTES

1. Approximate limits of disturbance, typ. Site is currently naturally vegetated and stabilized.
2. Existing seasonal swale.
3. Existing fence.
4. Existing ag road to remain.
5. Not used.

Explanation

Qs Hill Slope Soils

Kjt Cretaceous Toro Formation Shale and Sandstone