ROCKRIDGE GEOTECHNICAL

Prepared for **SummerHill Apartment Communities**

PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL BUILDING
11 EL CAMINO REAL
SAN CARLOS, CALIFORNIA

UNAUTHORIZED USE OR COPYING OF THIS DOCUMENT IS STRICTLY PROHIBITED BY ANYONE OTHER THAN THE CLIENT FOR THE SPECIFIC PROJECT

January 5, 2023
Project No. 21-2014

June 17, 2021
Project No. 21-2014

Ms. Elaine Breeze
Vice President of Development
SummerHill Apartment Communities
777 S. California Avenue
Palo Alto, California 94304

Subject: Preliminary Geotechnical Investigation
Proposed Residential Development
11 El Camino Real
San Carlos, California

Dear Ms. Breeze,

We are pleased to present our preliminary geotechnical investigation report, dated June 17, 2021, to support your due diligence evaluation of the property located at 11 El Camino Real in San Carlos, California. Our services were provided in accordance with our proposal dated March 2, 2021.

This subject property consists of two contiguous parcels (APNs 045-320-170 & 045-320-220) encompassing 2.2 acres on the northeastern side of El Camino Real just southeast of its intersection with F Street in San Carlos. It is bordered by a vacant lot to the northwest, the Caltrain right-of-way to the northeast, and a shopping center to the southeast. The site is trapezoidal shaped with a length of about 400 feet and a width ranging from about 215 to 250 feet. The ground surface across the site slopes up from the southwest to the northeast with a total grade change of approximately 10 feet across the site. The northwestern approximately one-third of the site is presently occupied by a one-story CVS store and the southeastern two-thirds consists of an asphalt-paved parking lot.

We understand the development currently envisioned for the site consists of demolishing the existing building and constructing a residential building. The proposed building configuration has not yet been finalized but will likely consist of five stories of Type IIIA construction over two stories of Type IA podium construction. The building will likely have below-grade parking with an entry from El Camino Real. Plans are for the lower parking level of the building to daylight approximately halfway from El Camino Real to the back property line. The rear portion of the building will be at grade. Preliminary plans call for the finished floor elevation for the below-grade parking to be at Elevation 26.1 feet (NAVD88 – North American Vertical Datum of 1988).

Based on the results of our preliminary geotechnical investigation, we conclude there are no major geotechnical issues that would preclude development of the site as proposed. The primary geotechnical issues affecting the proposed development include: 1) the potential for up to 1-1/2 inches of seismically induced settlement and reduction in bearing capacity due to liquefaction beneath shallow foundations in the eastern portion of the site, 2) the presence of relatively weak soil layers above a depth of 10 feet in the southern portion of the site, and 3) protecting the adjacent improvements while excavating the below-grade level.

The proposed building foundation, which we assume will range from about 2 to 18 feet below existing site grades, will be underlain by soft to hard clay with interbedded layers of medium dense to very dense sand with varying fines content. We conclude a shallow foundation system, such as footings or a mat, supported on improved soil would be an appropriate foundation system for the proposed new building.

The conclusions and recommendations presented in this report are intended to assist the due diligence evaluation for the property and preliminary design of the currently proposed project. The report is not intended for final design. Our conclusions and recommendations are based on review of existing data and a limited subsurface exploration program. Consequently, variations between expected and actual soil conditions may be found in localized areas. Prior to final design of any new improvements, we should be retained to provide a final geotechnical report based on the proposed project scope and a supplemental field investigation, if needed. At that time, we can prepare final foundation and grading recommendations specific to the proposed project.

We appreciate the opportunity to provide our services to you on this project. If you have any questions, please call.

Sincerely yours,
ROCKRIDGE GEOTECHNICAL, INC.

REGISTERED PROFESSIONAL ENGINEER
CRAIG S. SHIELDS
GE2116
3/31/23
GEOTECHNICAL
STATE OF CALIFORNIA

Craig S. Shields, P.E., G.E.
Principal Geotechnical Engineer

Enclosure

ROCKRIDGE GEOTECHNICAL

TABLE OF CONTENTS

ROCKRIDGE GEOTECHNICAL

LIST OF FIGURES

APPENDIX A

PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL BUILDING
11 EL CAMINO REAL
San Carlos, California

1.0 INTRODUCTION

This report presents the results of the preliminary geotechnical investigation performed by Rockridge Geotechnical, Inc. to support the due diligence evaluation of the property located at 11 El Camino Real in San Carlos, California. The site is located on the northeastern side of El Camino Real, south of its intersection with F Street, as shown on the Site Location Map, Figure 1.

This subject property consists of two contiguous parcels (APNs 045-320-170 & 045-320-220) encompassing 2.2 acres on the northeastern side of El Camino Real just southeast of its intersection with F Street in San Carlos. It is bordered by a vacant lot to the northwest, the Caltrain right-of-way to the northeast, and a shopping center to the southeast. The site is trapezoidal shaped with a length of about 400 feet and a width ranging from about 215 to 250 feet. The ground surface across the site slopes up from the southwest to the northeast with a total grade change of approximately 10 feet across the site. The northwestern approximately one-third of the site is presently occupied by a one-story CVS store and the southeastern two-thirds consists of an asphalt-paved parking lot.

We understand the development currently envisioned for the site consists of demolishing the existing building and constructing a residential building. The proposed building will consist of five stories of Type III construction over two stories of Type I (concrete) construction. The building will have two levels of parking with an entrance to the upper level (referred to as Level 1) on El Camino Real. The finished floor for the lower (basement) parking level will be close to the existing grade along the rear property line and will be one level below grade on El Camino Real. Level 1 will also include a leasing lounge/lobby, a fitness room, utility rooms, and residential units on the southern and western sides of the building. Level 2 will include two courtyard areas with a pool in the south courtyard. The upper five stories will be occupied by residential units.

2.0 SCOPE OF SERVICES

Our investigation was performed in accordance with our proposal dated March 2, 2021. Our scope of work consisted of exploring subsurface conditions at the site by performing six cone penetration tests (CPTs) and performing engineering analyses to develop conclusions and recommendations regarding:

- the most appropriate foundation type(s) for the proposed building
- preliminary design criteria for the recommended foundation type(s)
- estimates of foundation settlement
- design groundwater level
- site seismicity and seismic hazards, including the potential for liquefaction and liquefaction-induced ground failure
- 2019 California Building Code (CBC) site class and design spectral response acceleration parameters
- construction considerations.

3.0 FIELD INVESTIGATION

Our field investigation consisted of performing six CPTs, designated as CPT-1 through CPT-6, at the approximate locations shown on the Site Plan, Figure 2. Prior to performing our field investigation, we submitted a drilling notification form to San Mateo County Environmental Health Services Division (SMCEH). We also contacted Underground Service Alert (USA) to notify them of our work and retained a private utility locator, Precision Locating, LLC, to verify the CPT locations were clear of existing underground utilities.

The CPTs were performed by Middle Earth Geo Testing, Inc. of Hayward, California on May 3, 2021. All CPTs reached early refusal depths of approximately 16 to 36 feet below the existing ground surface (bgs). The CPTs were performed by hydraulically pushing a 1.7-inch-diameter cone-tipped probe with a projected area of 15 square centimeters into the ground with a 30-ton truck. The cone-tipped probe measured tip resistance and the friction sleeve behind the cone tip measured frictional resistance. Electrical strain gauges within the cone continuously measured soil parameters for the entire depth advanced. Soil data, including tip resistance, frictional resistance, and pore water pressure, were recorded by a computer while the test was conducted. Accumulated data were processed by computer to provide engineering information such as the soil behavior types, approximate strength characteristics, and the liquefaction potential of the soil encountered. The CPT logs showing tip resistance, friction ratio, and pore pressure, as well as correlated soil behavior type, are presented in Appendix A on Figures A-1 through A-6.

Upon completion, the CPT holes were backfilled with cement grout in accordance with SMCEH requirements.

4.0 SUBSURFACE CONDITIONS

The Regional Geologic Map (Figure 3) for the site vicinity indicates the site is primarily underlain by Pleistocene-age alluvium (Qpa). The northern portion along the railroad line is mapped in a zone of artificial fill (af). The results of our field investigation indicate the alluvium generally consists of clay and silty clay interbedded with layers of sand and silty sand to the maximum depth explored of 36 feet bgs. The thickest sand layer was encountered at CPT-1 from 6 to 14 feet. Material descriptions are based on the methodology by Robertson (2010) to describe Soil Behavior Type (SBT). Logs of the soil behavior type for each CPT are presented on Figures A-1 through A-6 in Appendix A. The CPT data indicate the clay layers are generally stiff to hard except between depths of about 5 and 8 feet at the CPT-5 location and between depths of 8 and 10 feet at the CPT-6 location, where a soft to medium stiff clay layer was encountered. The sand and silty sand layers are generally medium dense to very dense.

4.1 Groundwater

Approximately 10 minutes after the completion of each CPT, a tape was dropped in the CPT hole to measure the depth to groundwater. Groundwater was measured at approximately 11 feet bgs at CPT-1, CPT-3, and CPT-6. No groundwater was present in CPT-1 or CPT-2 when the measurements were taken. At CPT-5, groundwater was measured at 2 feet bgs; however, we believe this could be perched water. A summary of groundwater measurements taken during our investigations are presented below in Table 1.

TABLE 1
Groundwater Level Measurements

Boring/CPT No.	Boring/CPT Elevation (feet)[1]	Date	Depth to Groundwater (feet)	Groundwater Elevation (feet)
CPT-1	29	5/3/21	11	18
CPT-3	25	5/3/21	11	14
CPT-5	25	5/3/21	2	23
CPT-6	30	5/3/21	11	19

Note 1. Ground surface elevations at CPT locations estimated by interpolating between ground surface elevations shown on Topographic Base Map prepared by CBG Civil Engineers, dated March 9, 2021.

The groundwater depths measured may not represent stabilized levels due to the cohesive nature of the soils encountered and the fact that the holes were only left open for approximately 10 minutes. The groundwater level at the site is expected to fluctuate several feet seasonally with potentially larger fluctuations annually, depending on the amount of rainfall. If a precise groundwater level is needed for design of below-grade walls and determine if dewatering will be required during construction, a monitoring well should be installed onsite during the final geotechnical investigation.

In the California Geologic Survey (CGS) report *Seismic Hazard Zone Report for the San Mateo 7.5-Minute Quadrangle, San Mateo County, California*, Plate 1.2 shows the historic high groundwater at the site is approximately 9 feet bgs; it appears this depth is based on two relatively close measurements. To further evaluate depth to groundwater at the site, we reviewed groundwater data on the State of California Water Resources Control Board GeoTracker website (geotracker.waterboards.ca.gov). At a site approximately 400 feet south of the site, located at 90 El Camino Real, 10 monitoring wells were monitored from 1987 to 2012. The groundwater readings showed that the groundwater generally fluctuated from 0.04 to 4.95 feet bgs with one reading at 10.50 feet bgs. The elevation of the ground surface elevations at 11 El Camino Real is approximately 3 to 13 feet higher than the ground surface elevation at 90 El Camino Real.

Based on the available historic groundwater information for the site and near vicinity, we preliminarily conclude the depth to historic high groundwater at the site is approximately eight feet bgs. For preliminary planning, we recommend using a design groundwater table sloping from Elevation 25 feet along the southwestern edge of the site to Elevation 17 feet along the northeastern edge of the site.

5.0 SEISMIC CONSIDERATIONS

The San Francisco Bay Area is considered to be one of the most seismically active regions in the world. The results of our evaluation regarding seismic considerations for the project site are presented in the following sections.

5.1 Regional Seismicity and Faulting

The site is in the Coast Ranges geomorphic province of California that is characterized by northwest-trending valleys and ridges. These topographic features are controlled by folds and faults that resulted from the collision of the Farallon plate and North American plate and subsequent strike-slip faulting along the San Andreas fault system. The San Andreas fault is more than 600 miles long from Point Arena in the north to the Gulf of California in the south. The Coast Ranges province is bounded on the east by the Great Valley and on the west by the Pacific Ocean.

The major active faults in the area are the San Andreas, Monte Vista-Shannon, and Hayward faults. These and other faults in the region are shown on the Regional Fault Map, Figure 4. For these and other active faults within a 50-kilometer radius of the site, the distance from the site and estimated characteristic moment magnitude[1] [Peterson et al. (2014) & Thompson et al.

1 Moment magnitude is an energy-based scale and provides a physically meaningful measure of the size of a faulting event. Moment magnitude is directly related to average slip and fault rupture area.

(2016)] are summarized in Table 1. These references are based on the Third Uniform California Earthquake Rupture Forecast (UCERF3), prepared by Field et al. (2013).

TABLE 1
Regional Faults and Seismicity

Fault Segment	Approximate Distance from Site (km)	Direction from Site	Characteristic Moment Magnitude
Monte Vista - Shannon	5.8	Southwest	7.14
Total North San Andreas (SAO+SAN+SAP+SAS)	6.1	Southwest	8.04
North San Andreas (Peninsula, SAP)	6.1	Southwest	7.38
San Gregorio (North)	18	West	7.44
Total Hayward + Rodgers Creek (RC+HN+HS+HE)	24	Northeast	7.58
Hayward (South, HS)	24	Northeast	7.00
Butano	25	Southwest	6.93
Hayward (North, HN)	31	Northeast	6.90
Total Calaveras (CN+CC+CS+CE)	35	East	7.43
Calaveras (North, CN)	35	East	6.86
Zayante-Vergeles (2011 CFM)	37	South	7.48
Calaveras (Central, CC)	40	East	6.85
Las Positas	41	East	6.50
Mount Diablo Thrust North CFM	42	Northeast	6.72
Mount Diablo Thrust South	43	Northeast	6.50
Hayward (Extension, HE)	43	East	6.18
Mount Diablo Thrust	44	Northeast	6.67
North San Andreas (Santa Cruz Mts, SAS)	44	Southeast	7.15
Concord	49	Northeast	6.45

Since 1800, four major earthquakes have been recorded on the North San Andreas Fault. In 1836, an earthquake with an estimated maximum intensity of VII on the Modified Mercalli (MM) scale occurred east of Monterey Bay on the San Andreas Fault (Toppozada and Borchardt

1998). The estimated Moment magnitude, M_w, for this earthquake is about 6.25. In 1838, an earthquake occurred with an estimated intensity of about VIII-IX (MM), corresponding to an M_w of about 7.5. The San Francisco Earthquake of 1906 caused the most significant damage in the history of the Bay Area in terms of loss of lives and property damage. This earthquake created a surface rupture along the San Andreas Fault from Shelter Cove to San Juan Bautista approximately 470 kilometers in length. It had a maximum intensity of XI (MM), an M_w of about 7.9, and was felt 560 kilometers away in Oregon, Nevada, and Los Angeles. The Loma Prieta Earthquake of October 17, 1989 had an M_w of 6.9 and occurred about 63 kilometers south of the site. On August 24, 2014, an earthquake with an estimated maximum intensity of VIII (severe) on the MM scale occurred on the West Napa fault. This earthquake was the largest earthquake event in the San Francisco Bay Area since the Loma Prieta Earthquake. The M_w of the 2014 South Napa Earthquake was 6.0.

In 1868, an earthquake with an estimated maximum intensity of X on the MM scale occurred on the southern segment (between San Leandro and Fremont) of the Hayward Fault. The estimated M_w for the earthquake is 7.0. In 1861, an earthquake of unknown magnitude (probably an M_w of about 6.5) was reported on the Calaveras Fault. The most recent significant earthquake on this fault was the 1984 Morgan Hill earthquake ($M_w = 6.2$).

As part of the UCERF3 project, researchers estimated that the probability of at least one $M_W \geq 6.7$ earthquake occurring the greater San Francisco Bay Area during a 30-year period (starting in 2014) is 72 percent. The highest probabilities are assigned to the sections of the Hayward (South), Calaveras (Central), and the North San Andreas (Santa Cruz Mountains) faults. The respective probabilities are approximately 25, 21, and 17 percent.

5.2 Geologic Hazards

Because the project site in in a seismically active region, we evaluated the potential for earthquake-induced geologic hazards, including ground shaking, ground surface rupture, liquefaction[2], lateral spreading[3] and cyclic densification.[4] We used the results of our field investigation to evaluate the potential of these phenomena occurring at the project site.

5.2.1 Ground Shaking

The seismicity of the site is governed by the activity of the Monte Vista and San Andrea Faults, although ground shaking from future earthquakes on other faults will also be felt at the site. The intensity of earthquake ground motion at the site will depend upon the characteristics of the generating fault, distance to the earthquake epicenter, and magnitude and duration of the earthquake. We judge that strong to very strong ground shaking could occur at the site during a large earthquake on one of the nearby faults.

5.2.2 Ground Surface Rupture

Historically, ground surface displacements closely follow the trace of geologically young faults. The site is not within an Earthquake Fault Zone, as defined by the Alquist-Priolo Earthquake Fault Zoning Act, and no known active or potentially active faults exist on the site. We therefore conclude the risk of fault offset at the site from a known active fault is very low. In a seismically active area, the remote possibility exists for future faulting in areas where no faults previously existed; however, we conclude the risk of surface faulting and consequent secondary ground failure from previously unknown faults is also very low.

---

2 Liquefaction is a phenomenon where loose, saturated, cohesionless soil experiences temporary reduction in strength during cyclic loading such as that produced by earthquakes.

3 Lateral spreading is a phenomenon in which surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. Upon reaching mobilization, the surficial blocks are transported downslope or in the direction of a free face by earthquake and gravitational forces.

4 Cyclic densification is a phenomenon in which non-saturated, cohesionless soil is compacted by earthquake vibrations, causing ground-surface settlement.

5.2.3 Liquefaction and Associated Hazards

When a saturated, cohesionless soil liquefies, it experiences a temporary loss of shear strength created by a transient rise in excess pore pressure generated by strong ground motion. Soil susceptible to liquefaction includes loose to medium dense sand and gravel, low-plasticity silt, and some low-plasticity clay deposits. Flow failure, lateral spreading, differential settlement, loss of bearing strength, ground fissures and sand boils are evidence of excess pore pressure generation and liquefaction.

As presented on Figure 5, the site is bordered to the north by a zone of liquefaction potential on the map titled *Earthquake Zones of Required Investigation, San Mateo Quadrangle,* prepared by the California Geological Survey (CGS), dated January 11, 2018. The mapped liquefaction zone corresponds to the area mapped as artificial fill to the north of the site.

Liquefaction susceptibility was assessed using the software CLiq v3.3 (GeoLogismiki, 2021). CLiq uses measured field CPT data and assesses liquefaction potential, including post-earthquake vertical settlement, given a user-defined earthquake magnitude and peak ground acceleration (PGA). We performed a liquefaction triggering analysis using the CPTs in accordance with the methodology by Boulanger and Idriss (2014). We also used the relationship proposed by Zhang, Robertson, and Brachman (2002) to estimate post-liquefaction volumetric strains and corresponding ground surface settlement; a relationship that is an extension of the work by Ishihara and Yoshimine (1992).

Our analyses were performed using a high groundwater depth of eight feet bgs. In accordance with the 2019 CBC, we used a peak ground acceleration of 0.86 times gravity (g) in our liquefaction evaluation; this peak ground acceleration is consistent with the Maximum Considered Earthquake Geometric Mean (MCE_G) peak ground acceleration adjusted for site effects (PGA_M). We also used a moment magnitude 8.04 earthquake, which is consistent with the characteristic moment magnitude for the Total North San Andreas Fault, as presented in Table 1.

The results of our analysis indicate there are several discontinuous layers of potentially liquifiable soil between depths of about 9 and 20 feet bgs. The thickness of the layers varies from a few inches to about four feet. Based on the results of our analysis, we estimate total “free-field” ground settlement associated with liquefaction after an MCE event generating a PGA_M of 0.86g will range from less than 1/4 inch at the CPT-2, CPT-3, CPT-4, and CPT-6 locations to between 3/4 and 1-1/2 inches at the CPT-1 and CPT-5 locations. Based on the data available, it appears liquefiable soil is only present in the eastern portion of the property; however, the lateral extent of the potentially liquefaction layers should be further evaluated during the final geotechnical investigation based on exploratory borings, laboratory testing, and additional CPTs.

Considering the relatively flat grades in the site vicinity, as well as the depth, relative thickness, and discontinuous nature of the potentially liquefiable layers beneath the site, we conclude the risk of lateral spreading and other types of ground failure associated with liquefaction occurring at the site is low.

5.2.4 Cyclic Densification

Cyclic densification (also referred to as differential compaction) of non-saturated sand (sand above groundwater table) can occur during an earthquake, resulting in settlement of the ground surface and overlying improvements. The results of our investigation indicate the soil encountered above the groundwater table has sufficient cohesion and/or density, such that the potential for cyclic densification to occur at the site in those locations is low.

6.0 PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our engineering analyses using the data from the CPTs, we conclude there are no major geotechnical issues that would preclude development of the site as proposed. The primary geotechnical issues affecting the proposed construction are: 1) the potential for up to 1-1/2 inches of seismically induced settlement and a reduction in bearing capacity due to liquefaction of soil beneath shallow foundations in the eastern portion of the site, 2) the presence of relatively weak soil layers above a depth of 10 feet in the southern portion of the site, and 3) protecting the adjacent improvements while excavating the below-grade level. These and other geotechnical issues as they pertain to the proposed development are discussed below.

6.1 Preliminary Design Groundwater Elevation

Based on the groundwater levels measured during our investigation and review of available historic groundwater information from wells in the site vicinity, we conclude a groundwater table sloping from Elevation 25 feet along the southwestern edge of the site to Elevation 17 feet along the northeastern edge should be used for preliminary design. Basement walls and foundations that will extend below the design groundwater table, if any, should be designed for hydrostatic pressures and waterproofed. Groundwater monitoring wells should be installed during the final geotechnical investigation to further evaluate the groundwater levels beneath the site. To provide useful data, the wells should be installed prior to December and be monitored through April.

6.2 Foundation and Settlement

The proposed building foundation, which we assume will range from about 2 to 18 feet below existing site grades, will be underlain by soft to hard clay with interbedded layers of medium dense to very dense sand with varying fines content. Shallow foundations, such as spread footings or a reinforced concrete mat, bearing on these soil deposits will experience: 1) erratic and excessive settlement in the southern portion of the site (i.e., CPT-5 and CPT-6 locations) where there is soft to medium stiff clay layer above a depth of 10 feet bgs, as well as post-liquefaction reconsolidation in the eastern portion of the site (i.e., CPT-1 and CPT-5 locations) following a major earthquake; and 2) reduction of bearing capacity due to liquefaction of the supporting soil during a major earthquake at the CPT-1 location. Therefore, we conclude the proposed building should not be supported on a shallow foundation system bearing on the unimproved soil.

We conclude a shallow foundation system, such as footings or a mat, supported on improved soil would be an appropriate foundation system for the proposed new building, provided: 1) the soil improvement is implemented to mitigate liquefaction in the eastern portion of the site, and 2) the soil improvement extends to a depth that would reduce differential settlement of the structure under both static and seismic conditions to a tolerable amount. Based on our experience, we believe the most appropriate ground improvement method for the site conditions consists of drilled displacement columns (DDCs); however, considering the shallow depth to competent bearing soil beneath the site, we suggest contacting ground improvement contractors to determine whether other ground improvement methods may be more economical.

Drilled displacement columns are installed by advancing a continuous flight, hollow-stem auger that mostly displaces the soil and then pumping a sand-cement mixture into the hole under pressure as the auger is withdrawn. This system results in low vibration during installation and generates a relatively small amount of drilling spoils for off-haul. DDCs are installed under design-build contracts by specialty contractors. The required size, spacing, length, and strength of columns should be determined by the contractor, based on the desired level of improvement. The replacement ratio for ground improvement should be selected to mitigate liquefaction in the eastern portion of the site, as well as to limit differential settlement from a combination of static and seismic loading to an amount that can be tolerated by the superstructure. We recommend a preliminary design, including calculations of static and seismic settlement, be prepared by the ground improvement contractor, and submitted for our review.

For preliminary design of spread footings or a mat foundation bearing on DDCs, we preliminary conclude ground improvement elements should extend into the very stiff to hard clay at a depth of about 20 feet below existing grade, resulting in DDC lengths ranging from about 8 to 18 feet below foundation level. We anticipate the ground improvement system should be capable of increasing the allowable bearing pressures for footings and a mat foundation to 6,000 and 4,000 pounds per square foot (psf), respectively, for dead-plus-live-loads, while limiting combined static and seismic differential settlements to less than one inch. The actual design allowable bearing pressures and estimated settlements should be evaluated by the design-build ground improvement contractor, as they will be based on the diameter, depth, and spacing of the ground improvement elements.

Based on the CPT data, we estimate up to 1-1/2 inches of seismically induced free-field settlement may occur in the eastern portion of the site following a major earthquake due to post-liquefaction reconsolidation. Therefore, for planning purposes, it should be assumed the DDC spacing should not exceed six feet on center in the eastern half of the site, including beneath the floor slab for the footing option. The available CPT data indicates liquefaction mitigation is not required in the western approximately half of the site.

For either the mat or footing option, if any portion of the foundation is beneath the design groundwater level, it will need to be waterproofed and designed for hydrostatic pressure.

6.3 Excavation Support

Assuming foundations extend 2-1/2 feet below the finished floor elevation, the bottom of foundations would extend up to about 10 feet bgs along the southwestern edge of the site and approximately ½ to 2 feet bgs along the northeastern edge of the site. Based on the current building layout, it appears there is room to slope the sides of the excavation except for possibly along El Camino Real where shoring may be required in some areas.

The site is generally underlain by stiff clay and silty clay, which can be assumed to be Cal-OSHA Type B material above the groundwater, which requires limiting temporary slope cuts to a maximum inclination of 1:1, provided the slope is not surcharged by adjacent structures, construction equipment, or stockpiled soil. Where granular material or seepage is observed in the cut slope during construction, the material should be downgraded to OSHA Type C soil and a corresponding maximum inclination of 1.5:1 (horizontal:vertical) should be used. Where there is insufficient space to slope cut the planned excavation, shoring will be required.

There are several key considerations in selecting a suitable shoring system. Those we consider of primary concern are:

- protection of surrounding improvements, including underground utilities, pavements, and sidewalks,
- the potential presence of groundwater above the proposed excavation depth in the western portion of the site
- proper construction of the shoring system to reduce potential for shoring-induced ground movement, and
- cost.

Considering El Camino Real is under State of California, Department of Transportation jurisdiction (Caltrans), we anticipate it will be necessary to de-tension or remove tiebacks beneath the roadway, which significantly increases the cost of that system. Therefore, we preliminarily conclude a cantilevered shoring system would be the most appropriate shoring system for the currently proposed design.

6.4 Excavation Dewatering

Based on the available information, it appears the finished floor elevation of the proposed building will be about one foot above the preliminary design groundwater elevation along the aouthwestern portion of the site and approximately nine feet above the preliminary design groundwater table in the northeastern portion of the site. Assuming the below-grade level for the building is constructed during a rainy season with well-above-average rainfall, like that which occurred in the 2016-2017 rainy season, localized dewatering may be required until foundations are constructed. The need for temporary dewatering should be further evaluated by installation of 2 or 3 monitoring wells as discussed above in Section 6.1. These wells could also be used to obtain groundwater samples that may be needed for disposal of groundwater during the dewatering operation.

6.5 Seismic Design

The latitude and longitude of the site are 37.5134° and -122.2673°, respectively. For design in accordance with 2019 CBC, we preliminarily recommend the following:

- Site Class D
- $S_S = 1.82$, $S_1 = 0.745g$

The 2019 CBC is based on the guidelines contained within ASCE 7-16 which stipulate that where S_1 is greater than 0.2 times gravity (g) for Site Class D, a ground motion hazard analysis is needed unless the seismic response coefficient (C_s) value will be calculated as outlined in Section 11.4.8, Exception 2. Assuming the C_s value will be calculated as outlined in Section 11.4.8, Exception 2, we recommend the following seismic design parameters:

- $F_a = 1.0$, $F_v = 1.7$

- S_{MS} = 1.82g, S_{M1} = 1.267g
- S_{DS} = 1.214g, S_{D1} = 0.844g
- Seismic Design Category D for Risk Factors I, II, and III

Depending on the structural design methodology and fundamental period of the proposed building, it may be advantageous to perform a site-specific ground motion hazard analysis (the project structural engineer should confirm). We can perform a ground motion hazard analysis upon request.

7.0 ADDITIONAL GEOTECHNICAL SERVICES

Prior to construction, Rockridge Geotechnical should review the project plans and specifications to verify that they conform to the intent of our recommendations. During construction, our field engineer should provide on-site observation and testing during site preparation, placement and compaction of fill, and installation of new foundations. These observations will allow us to compare actual with anticipated subsurface conditions and to verify that the contractor's work conforms to the geotechnical aspects of the plans and specifications.

8.0 LIMITATIONS

This geotechnical investigation has been conducted in accordance with the standard of care commonly used as state-of-practice in the profession. No other warranties are either expressed or implied. The recommendations made in this report are based on the assumption that the subsurface conditions do not deviate appreciably from those disclosed in the CPTs. If any variations or undesirable conditions are encountered during construction, we should be notified so that additional recommendations can be made. The foundation recommendations presented in this report are developed exclusively for the proposed development described in this report and are not valid for other locations and construction in the project vicinity.

REFERENCES

Boulanger, R.W and Idriss, I.M. (2014). "CPT and SPT Based Liquefaction Triggering Procedures", Center for Geotechnical Modeling, Department of Civil and Environmental Engineering, University of California, Davis, Report No. UCD/CGM-14/01, April.

Cao, T., Bryant, W. A., Rowshandel, B., Branum D. and Wills, C. J. (2003). "The Revised 2002 California Probabilistic Seismic Hazard Maps"

California Building Code (2019).

California Division of Mines and Geology (1996), Probabilistic seismic hazard assessment for the State of California, DMG Open-File Report 96-08.

California Geological Survey (2018). State of California Seismic Hazard Zone Report, San Mateo 7.5-Minute Quadrangle, San Mateo County, California, Seismic Hazard Zone Report.

California Geologic Survey (2008), Fault Rupture Hazard Zones in California, Special Publication 42.

Field, E.H., Biasi, G.P., Bird, P., Dawson, T.E., Felzer, K.R., Jackson, D.D., Johnson, K.M., Jordan, T.H., Madden, C., Michael, A.J., Milner, K.R., Page, M.T., Parsons, T., Powers, P.M., Shaw, B.E., Thatcher, W.R., Weldon, R.J., II, and Zeng, Y., (2013). Uniform California earthquake rupture forecast, version 3 (UCERF3)—The time-independent model: U.S. Geological Survey Open-File Report 2013–1165, 97 p.

GeoLogismiki (2021). CLiq, Version 3.3.

GeoTracker website, State of California Water Resources Control Board, (https://geotracker.waterboards.ca.gov/), accessed May 7, 2021.

Graymer, R.W. (2000), Geologic Map and map database of the Oakland metropolitan area, Alameda, Contra Costa, and San Francisco Counties, California, U.S. Geological Survey.

Idriss, I.M., Boulanger, R.W. (2008). "Soil Liquefaction During Earthquakes," Earthquake Engineering Research Institute (EERI), MNO-12.

Jennings, C.W., 1994, Fault activity map of California and adjacent areas with locations and ages of recent volcanic eruptions: California Division of Mines and Geology Geologic Data Map No. 6, scale 1: 750,000.

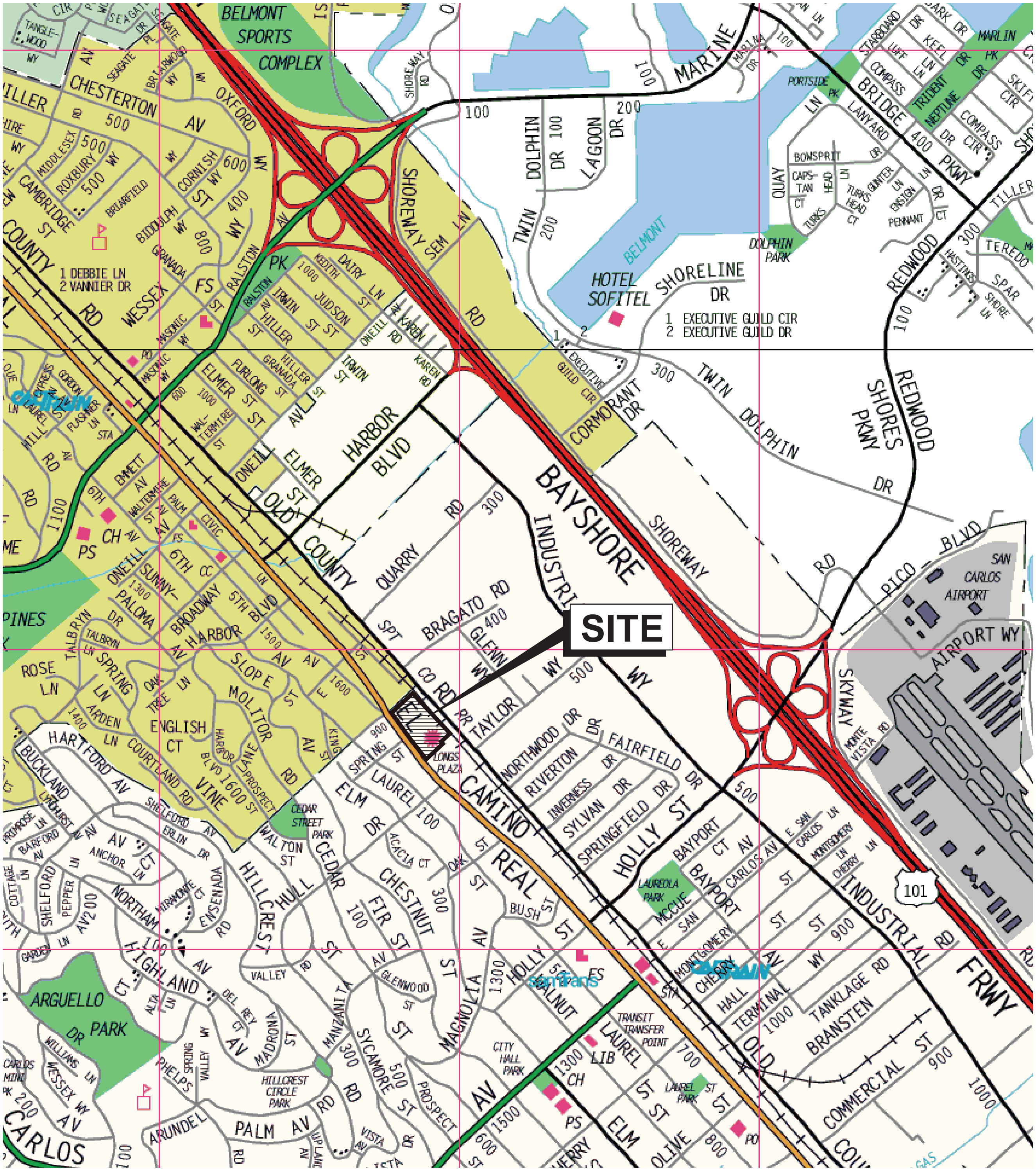
U.S. Geological Survey (USGS), 2008, The Uniform California Earthquake Rupture Forecast, Version 2 (UCERF 2): prepared by the 2007 Working Group on California Earthquake Probabilities, U.S. Geological Survey Open File Report 2007-1437.

Youd, T.L., and Idriss, I.M. (2001). "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils," Journal of Geotechnical and Geoenvironmental Engineering, Vol. 127, No. 4.

Zhang G., Robertson. P.K., Brachman R. (2002), Estimating Liquefaction Induced Ground Settlements from the CPT, Canadian Geotechnical Journal, 39: pp 1169-1180.

ROCKRIDGE GEOTECHNICAL

FIGURES



Base map: The Thomas Guide
San Mateo County
2002

0 1/4 1/2 Mile

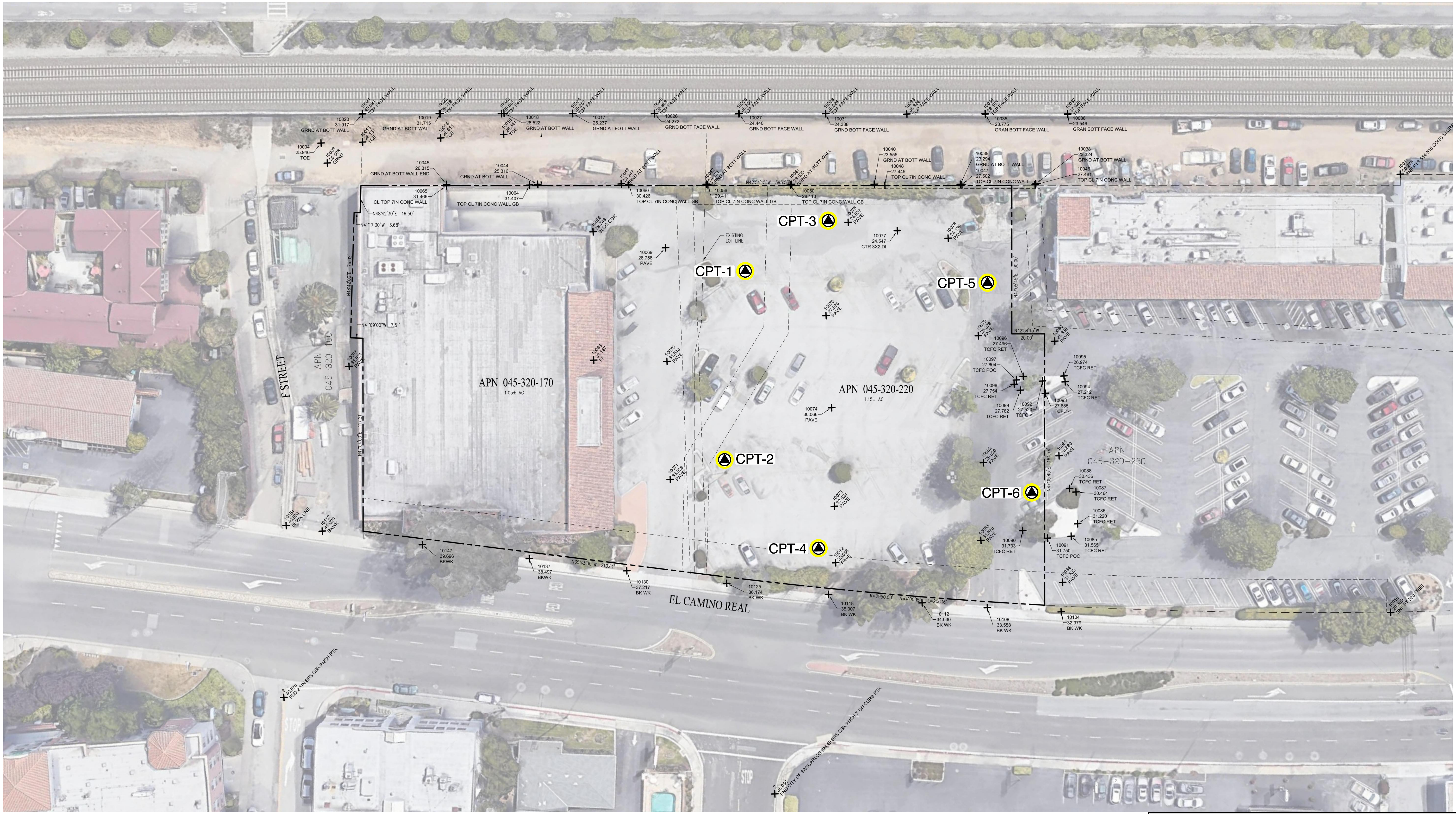
Approximate scale

11 EL CAMINO REAL
San Carlos, California

ROCKRIDGE GEOTECHNICAL

SITE LOCATION MAP

Date 05/07/21	Project No. 21-2014	Figure 1



EXPLANATION

CPT-1 Approximate location of cone penetration test by Rockridge Geotechnical, Inc., May 3, 2021

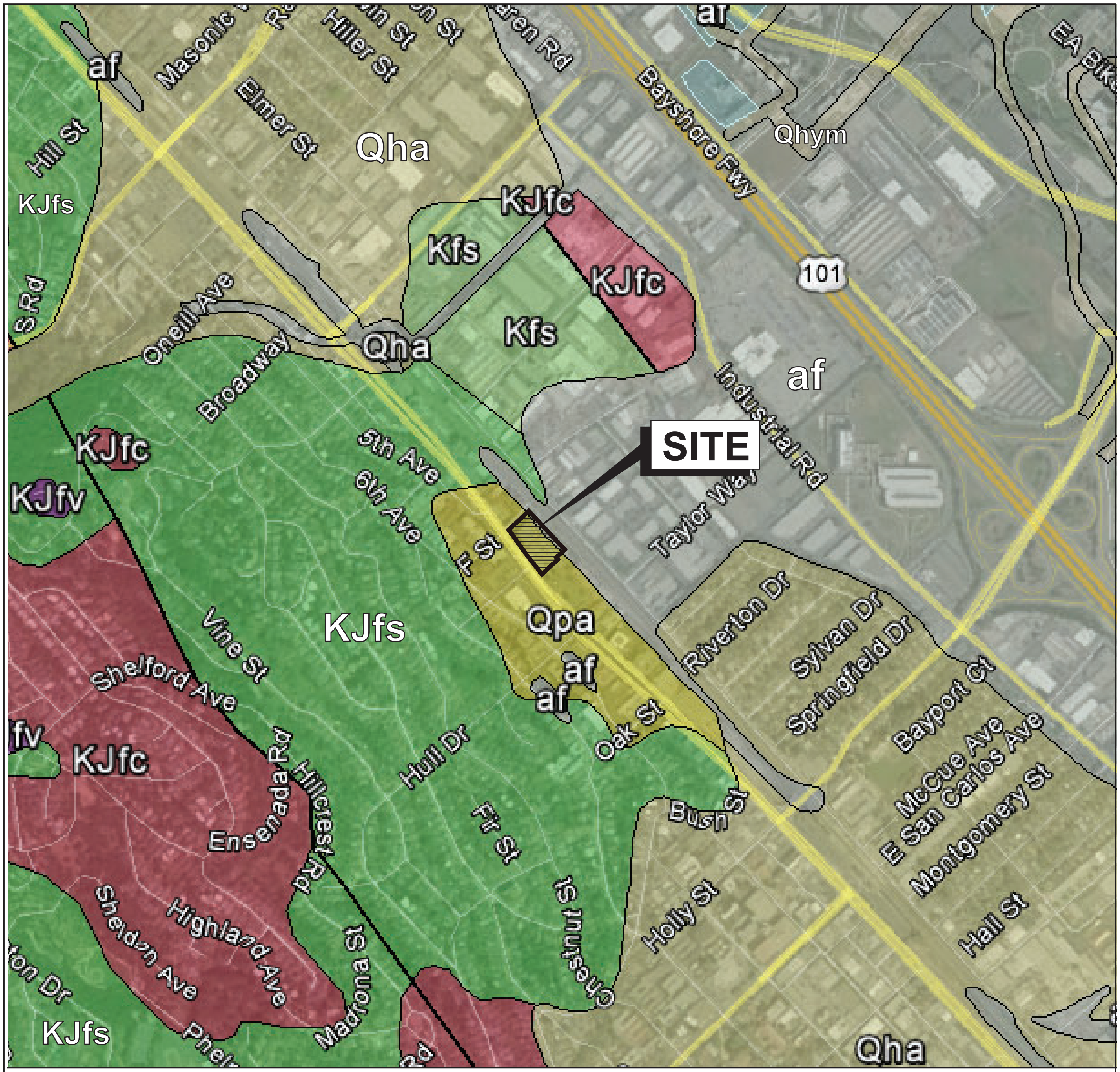
Reference: Base map from a drawing titled "Topographic Base Map", by cbg Surveyors, dated March 9, 2021.

11 EL CAMINO REAL
San Carlos, California

SITE PLAN

Date 05/07/21	Project No. 21-2014	Figure 2

ROCKRIDGE GEOTECHNICAL



Base map: Google Earth with U.S. Geological Survey (USGS), San Mateo County, 2015.

af	Artificial Fill
Qhym	Mud deposits (late Holocene)
Qha	Alluvium (Holocene)
Qpa	Alluvium (Pleistocene)
Kfs	Franciscan Complex sedimentary rocks (Cretaceous)
KJfs	Franciscan Complex sedimentary rocks (Early Cretaceous and (or) Late Jurassic)
KJfc	Franciscan Complex chert (Early Cretaceous and (or) Late Jurassic)
KJfv	Franciscan Complex volcanic rocks (Early Cretaceous and (or) Late Jurassic)

Geologic contact: dashed where approximate and dotted where concealed, queried where uncertain

0 1000 2000 Feet

Approximate scale

11 EL CAMINO REAL
San Carlos, California

ROCKRIDGE GEOTECHNICAL

REGIONAL GEOLOGIC MAP

Date 05/07/21 | Project No. 21-2014 | Figure 3

Base Map: U.S. Geological Survey (USGS), National Seismic Hazards Maps - Fault Sources, 2014.

EXPLANATION

Strike slip

Thrust (Reverse)

0 5 10 Miles

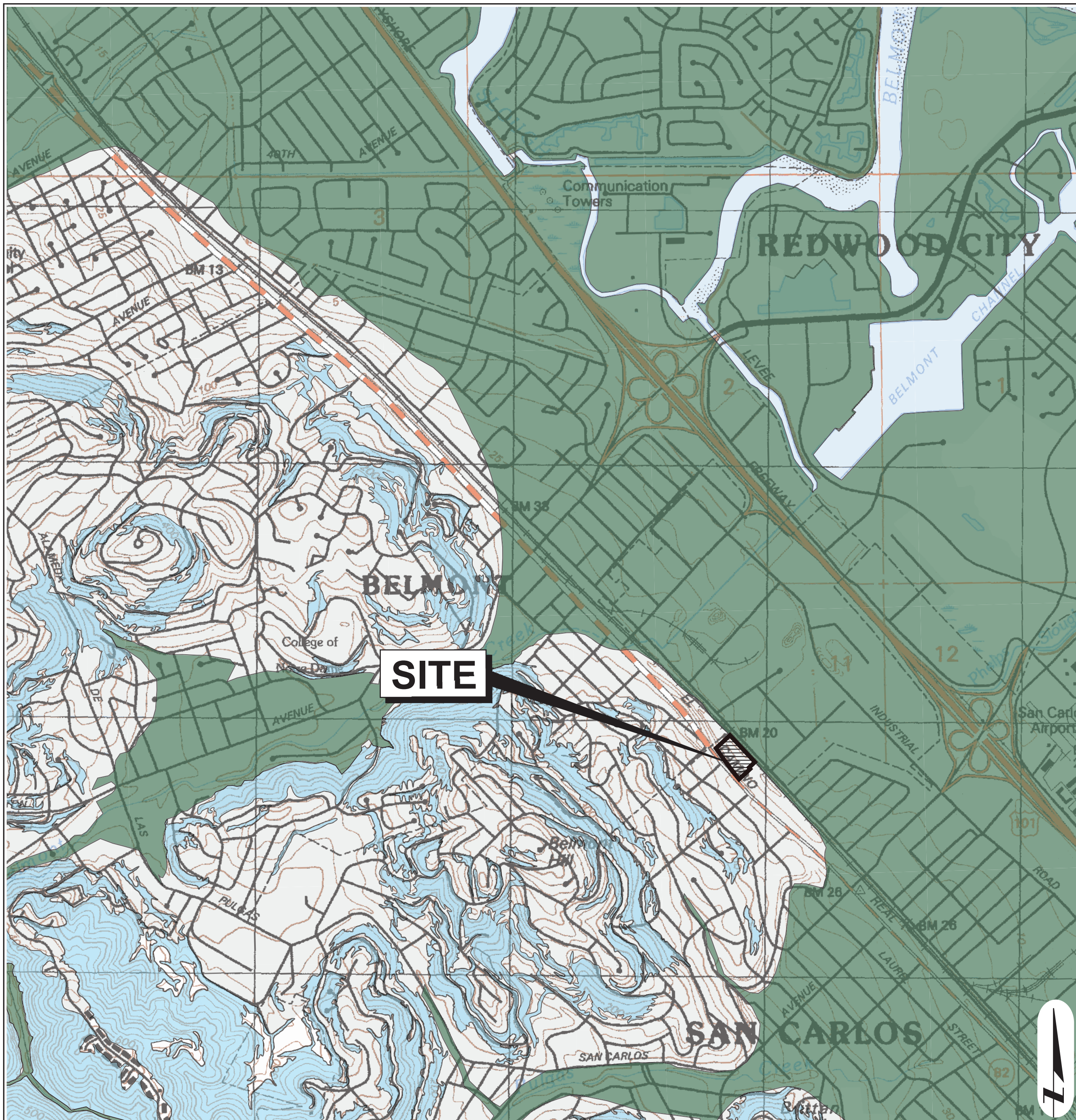
Approximate scale

11 EL CAMINO REAL
San Carlos, California

ROCKRIDGE GEOTECHNICAL

REGIONAL FAULT MAP

Date 05/05/21	Project No. 21-2014	Figure 4



Liquefaction Zones
Areas where historical occurrence of liquefaction, or local geological, geotechnical and ground water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslide Zones
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Reference:
Earthquake Zones of Required Investigation
San Mateo Quadrangle
California Geological Survey
Released January 11, 2018

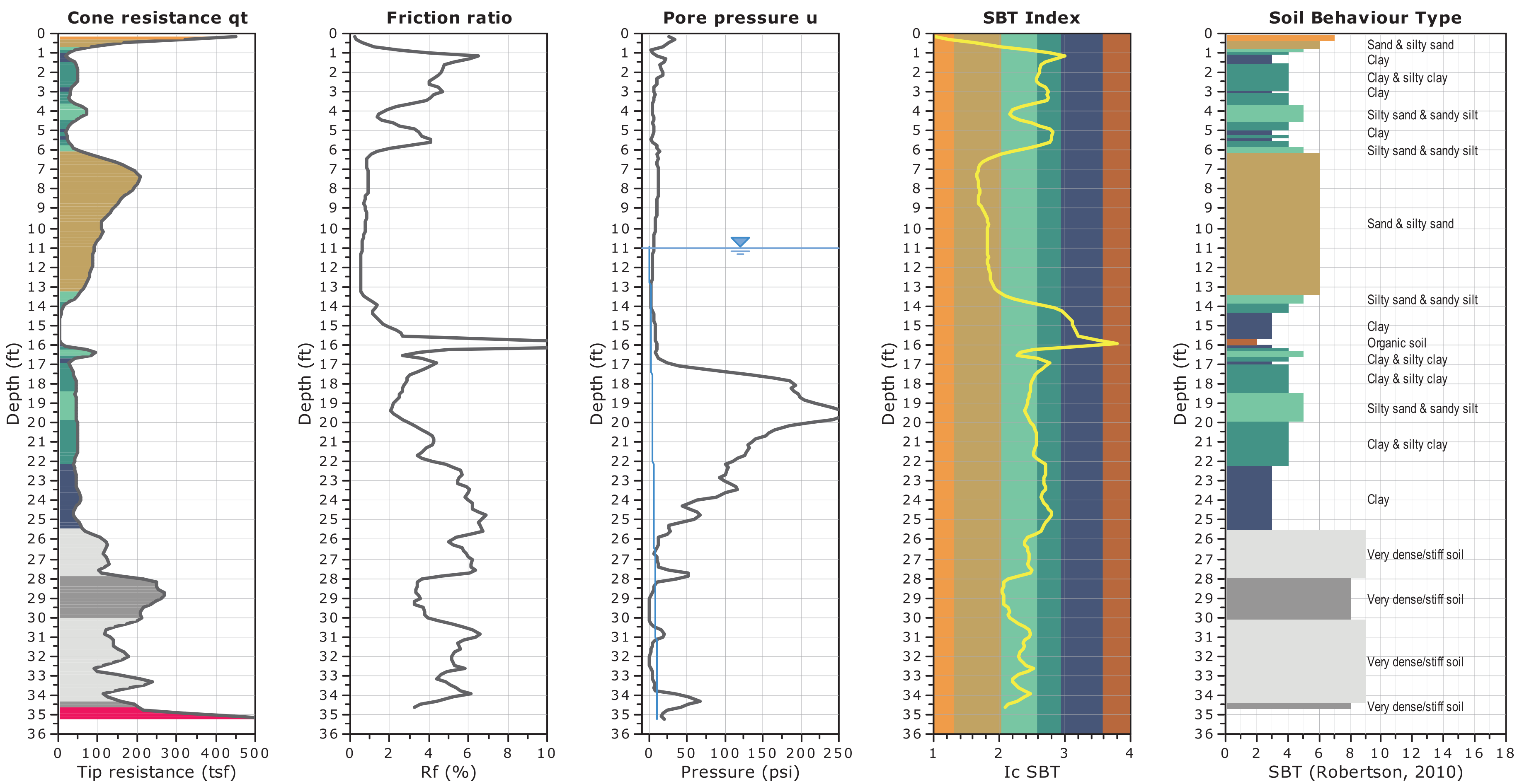
0 2,000 4,000 Feet
Approximate scale

11 EL CAMINO REAL San Carlos, California	**EARTHQUAKE ZONES OF REQUIRED INVESTIGATION MAP**
ROCKRIDGE GEOTECHNICAL	Date 05/07/21 · Project No. 21-2014 · Figure 5

ROCKRIDGE GEOTECHNICAL

APPENDIX A

Cone Penetration Test Results

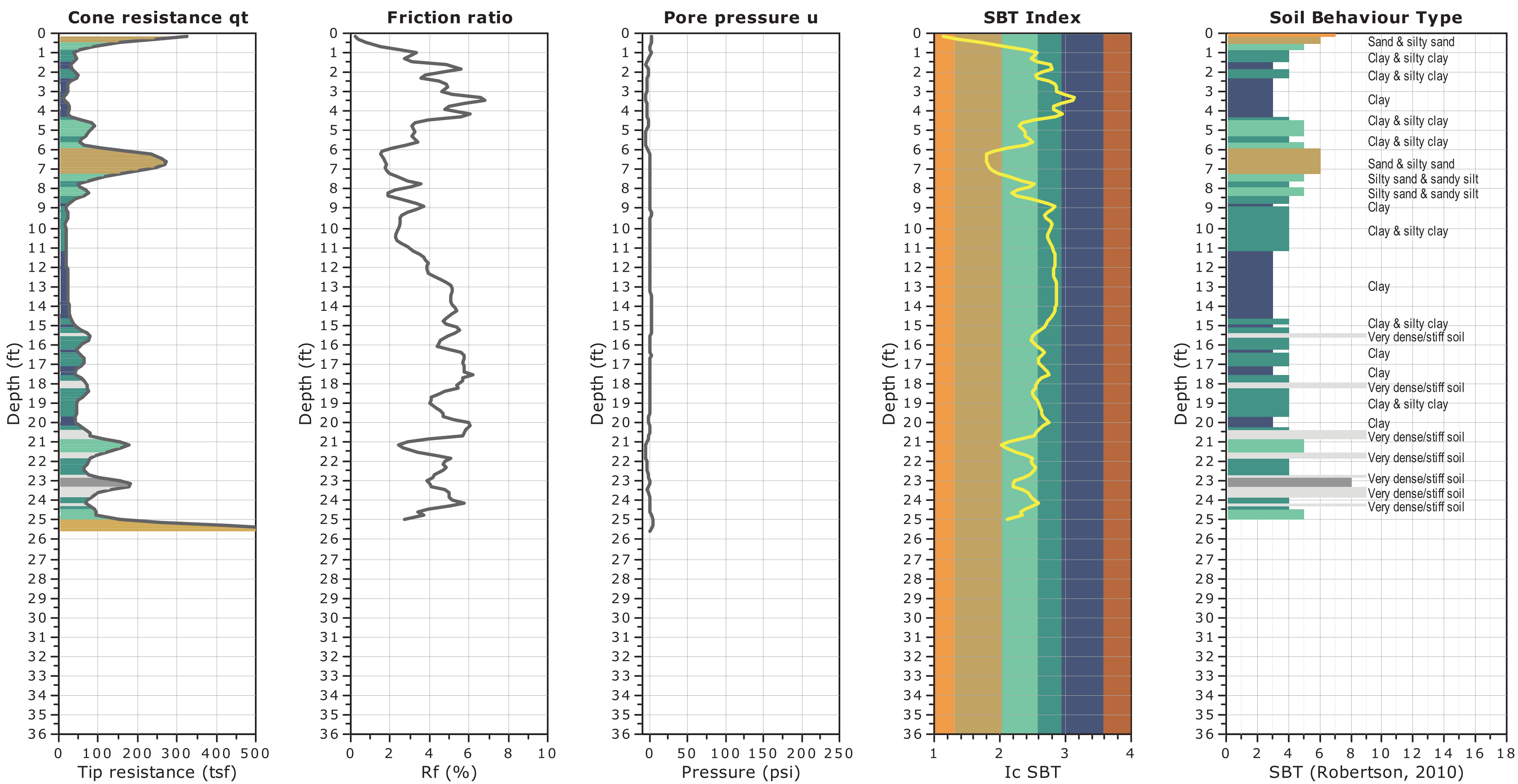


Total depth: 35.3 ft, Date: May 3, 2021
Depth to Groundwater: 11.0 feet (measured from weighted tape drop)
Cone Operator: Middle Earth Geo Testing, Inc.

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravelly sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

11 EL CAMINO REAL San Carlos, California	**CONE PENETRATION TEST RESULTS** **CPT-1**
ROCKRIDGE GEOTECHNICAL	Date 05/07/21 | Project No. 21-2014 | Figure A-1



Total depth: 25.6 ft, Date: May 3, 2021
Groundwater not Measured
Cone Operator: Middle Earth Geo Testing, Inc.

SBT legend

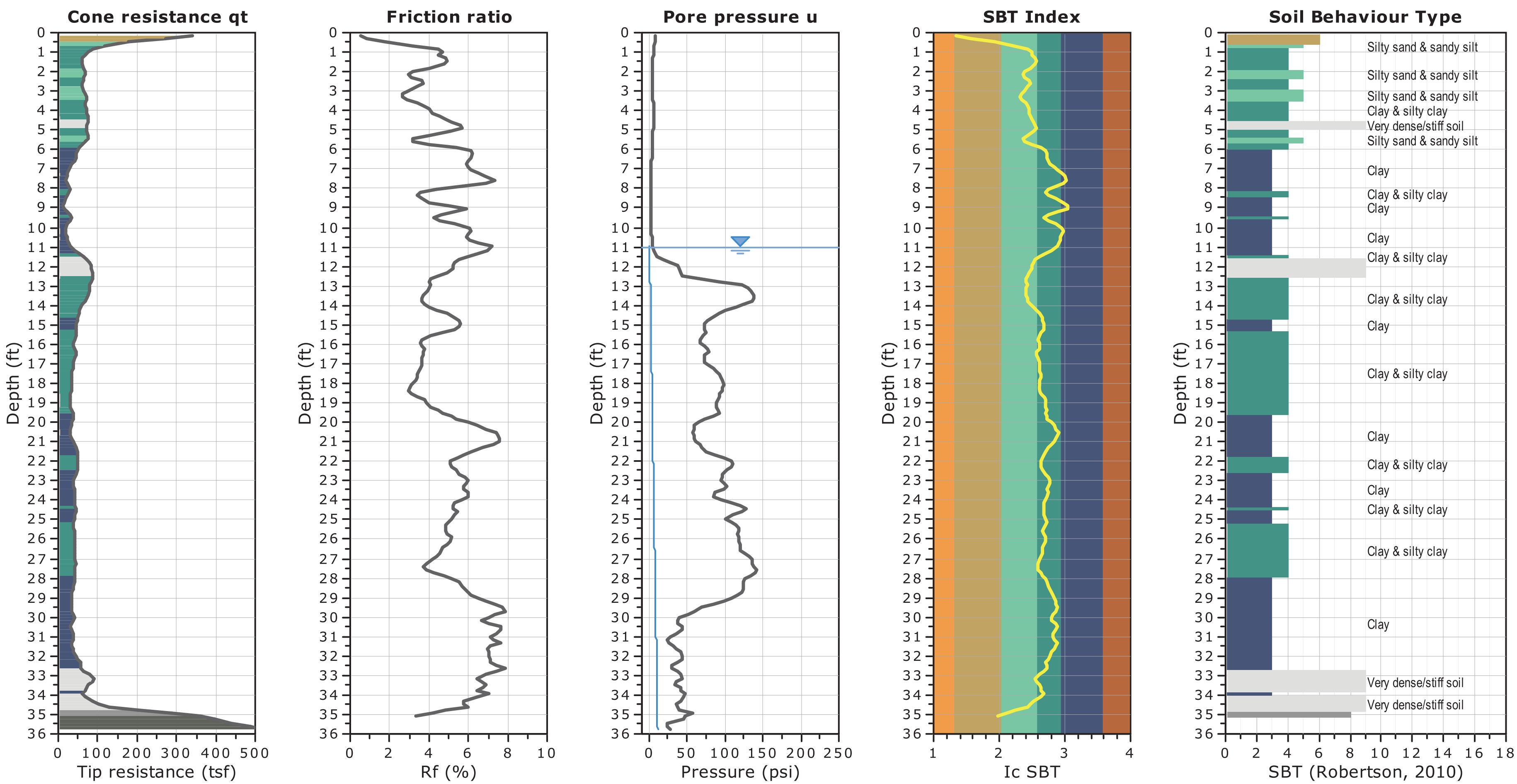
1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravelly sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

11 EL CAMINO REAL
San Carlos, California

ROCKRIDGE GEOTECHNICAL

CONE PENETRATION TEST RESULTS
CPT-2

Date 05/07/21 | Project No. 21-2014 | Figure A-2



Total depth: 35.8 ft, Date: May 3, 2021
Depth to Groundwater: 11.0 feet (measured from weighted tape drop)
Cone Operator: Middle Earth Geo Testing, Inc.

SBT legend

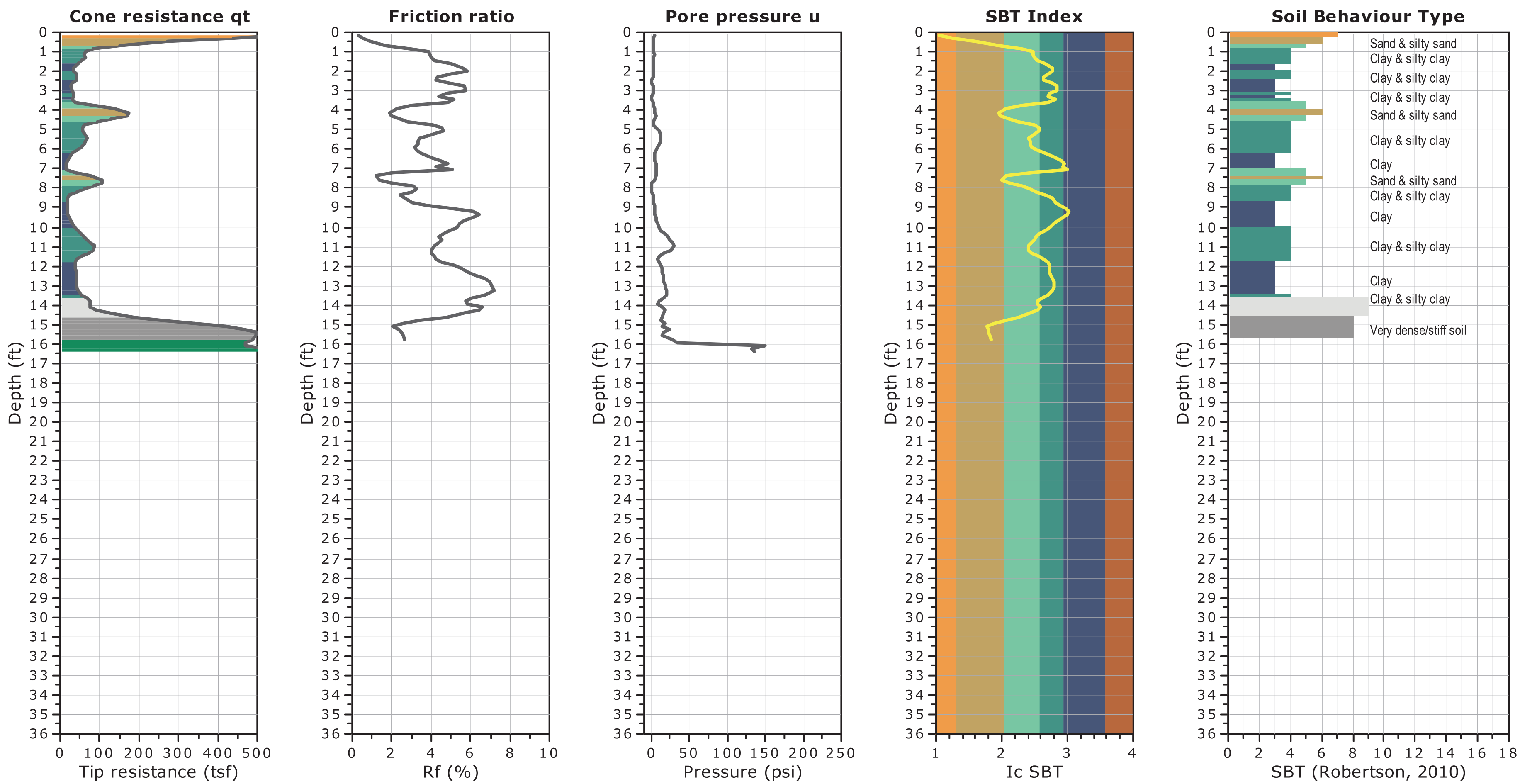
1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravelly sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

11 EL CAMINO REAL
San Carlos, California

ROCKRIDGE GEOTECHNICAL

CONE PENETRATION TEST RESULTS
CPT-3

Date 05/07/21 | Project No. 21-2014 | Figure A-3



Total depth: 16.4 ft, Date: May 3, 2021
Groundwater not Measured
Cone Operator: Middle Earth Geo Testing, Inc.

SBT legend

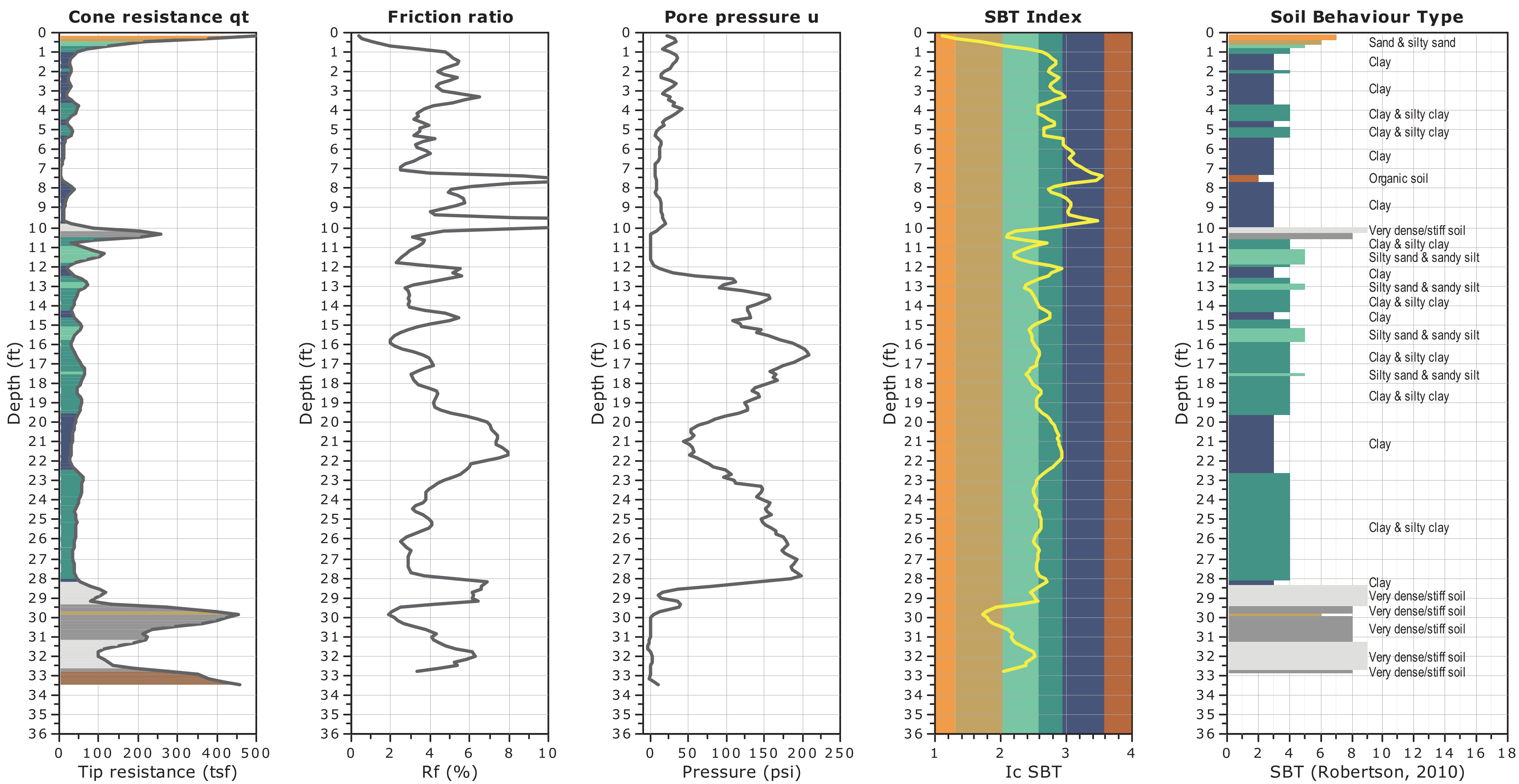
1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravelly sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

11 EL CAMINO REAL
San Carlos, California

ROCKRIDGE GEOTECHNICAL

CONE PENETRATION TEST RESULTS
CPT-4

Date 05/07/21	Project No. 21-2014	Figure A-4



Total depth: 33.5 ft, Date: May 3, 2021
Groundwater not Measured
Cone Operator: Middle Earth Geo Testing, Inc.

SBT legend

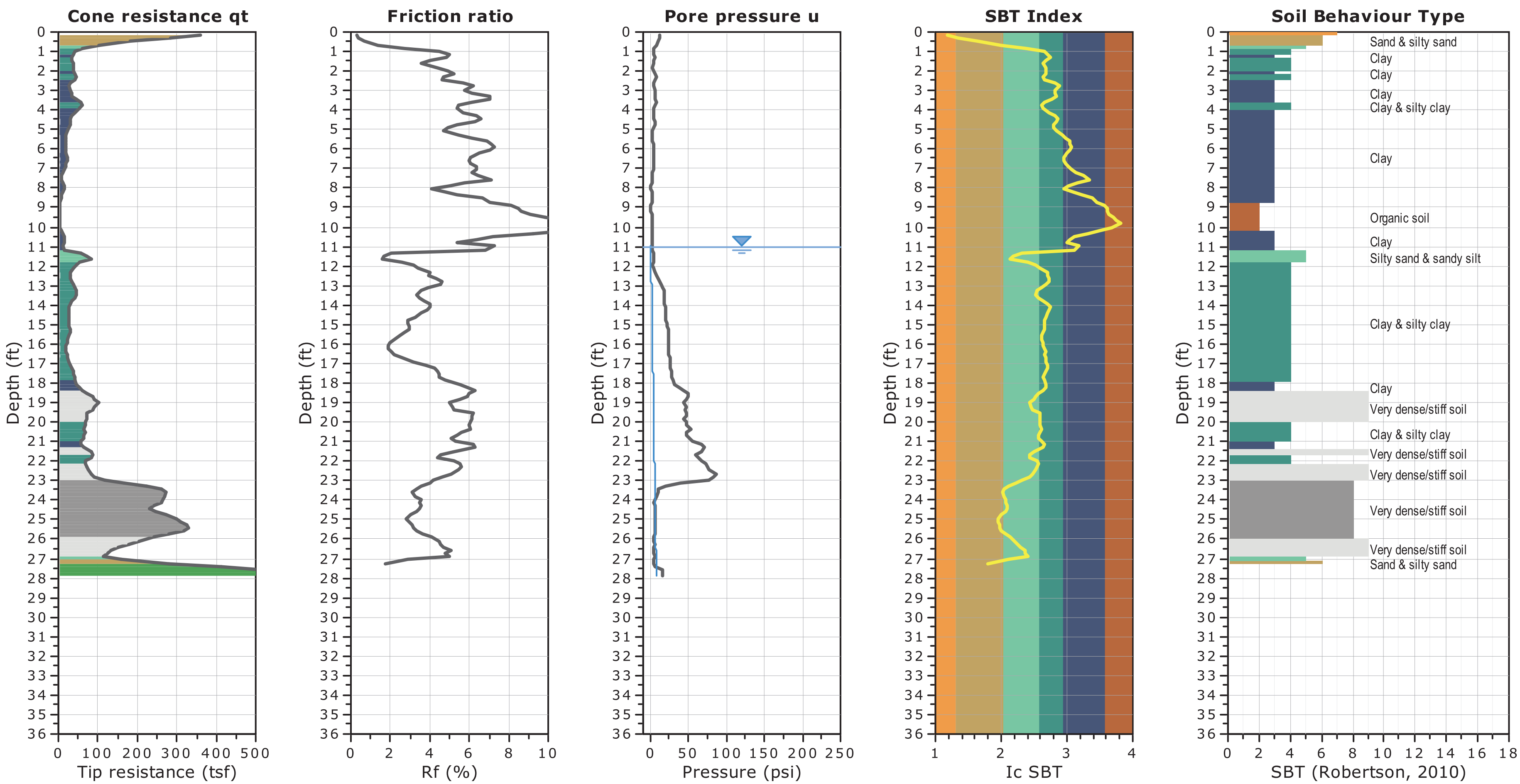
1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravelly sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

11 EL CAMINO REAL
San Carlos, California

ROCKRIDGE GEOTECHNICAL

CONE PENETRATION TEST RESULTS
CPT-5

Date 05/07/21 | Project No. 21-2014 | Figure A-5



Total depth: 27.9 ft, Date: May 3, 2021
Depth to Groundwater: 11.0 feet (measured from weighted tape drop)
Cone Operator: Middle Earth Geo Testing, Inc.

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty clay
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravelly sand to sand
8. Very stiff sand to clayey sand
9. Very stiff fine grained

11 EL CAMINO REAL
San Carlos, California

ROCKRIDGE GEOTECHNICAL

CONE PENETRATION TEST RESULTS
CPT-6

Date 05/07/21	Project No. 21-2014	Figure A-6