GEOTECHNICAL INVESTIGATION

PROPOSED RESIDENTIAL DEVELOPMENT

AUBURN GROVE

At

Woodland Avenue and Auburn Street
San Rafael, California

For

City Ventures

By
Quantum Geotechnical, Inc.

Project No. K050.G
July 11, 2024

QUANTUM GEOTECHNICAL INC.

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Mr. Kian Malek
City Ventures
444 Spear Street, Suite 200
San Francisco, CA 94105

Subject: Proposed Residential Development
Auburn Grove
Woodland Avenue and Auburn Street
San Rafael, California
GEOTECHNICAL INVESTIGATION

Dear Mr. Malek:

In accordance with your authorization, ***Quantum Geotechnical, Inc.,*** has investigated the geotechnical conditions at the subject site located in San Rafael, California

The accompanying report presents the results of our field investigation. Our findings indicate that development of the site for the proposed townhome development is feasible provided the recommendations of this report are carefully followed and are incorporated into the project plans and specifications.

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

Sincerely,
Quantum Geotechnical, Inc.

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President

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TABLE OF CONTENTS

GEOTECHNICAL INVESTIGATION

PURPOSE AND SCOPE

The purpose of our investigation was to determine the surface and subsurface soil conditions at the subject site for design of the proposed project. Based on the results of the investigation and analyses, we have developed recommended criteria for the grading of the site, the design of foundations for the proposed development, and the construction of related facilities on the property.

Our investigation included the following:

a. Field reconnaissance by the Senior Geologist.
b. Review of nearby geotechnical studies, including through the CALTRANS database.
c. Determine the general seismicity of the site in accordance with the 2022 CBC.
d. Drilling and sampling of four deep borings.
e. Advancement of four cone penetration tests.
f. Hand auguring a shallow boring next to the marsh.
g. Laboratory testing of the soil samples.
h. Analysis of the data and formulation of conclusions and recommendations; and
i. Preparation of this written report.

PROPOSED DEVELOPMENT

We understand the proposed project consists of developing the site for the construction of a 79-unit multi-family residential development on both sides of existing Woodland Avenue. The structures are planned to be 3 stories in height with the lower ground level story consisting of garages. Grading details have not yet been fully developed but are expected to be limited to cuts and fills no greater than 2 feet.

SITE LOCATION AND DESCRIPTION

The site is in southwest San Rafael, as is shown on Figure 1, Site Location Map. There are three parcels on the east side of Woodland Avenue with a combined acreage of 1.63 acres (APNs 018-075-28, 018-086-18; and 018-086-17). There are two parcels on the west side of the roadway with a combined acreage of 2.98 acres (APNs 018-074-16 and 018-085-23). The total project acreage is about 4.6 acres.

The site is bordered to the east by the Smart Rail line and the Highway 101 corridor, to the west by a wetland area that possibly was a cove of San Francisco Bay and to the northwest and southeast there are existing residences that appear to have been built in the 1970's or earlier. The site is bisected by Woodland Avenue and surrounded by hillsides that slope upward near the intersection of Woodland Avenue and Auburn Street which has two junctions as Auburn Street wraps around the area of the former cove.

The ground elevations are nearly flat but rise a few feet near the intersections of Auburn Street and Woodland Avenue at both ends, as you approach the surrounding hillsides.

The site vicinity was largely undeveloped until the construction of the local railroad and timber mills starting about 1873, when the bay started to be filled in. There was a crossing across the mouth of the cove area, but areas alongside the central portion of the cove were not filled until the mid-nineteenth century, and some areas have remained as wetlands to the present day.

General Geologic Conditions

Marin County is in the Coast Ranges Geomorphic province, a mountainous region where there is active faulting and uplift with valleys and faults mostly oriented in a northwesterly trending direction. The rock consists mainly of Late Cretaceous Franciscan Formation consisting of indurated, but fractured and weathered sedimentary, volcanic and metamorphic rocks. The valleys are filled with Quaternary sediments, including uplifted marine and alluvial terrace deposits dating to the Pleistocene; an epoch that was marked by a series of glacial and interglacial periods and the corresponding rise and fall of sea level that produced such deposits. Based on a review of geologic maps, the project site is entirely underlain by artificial fill overlying the Holocene-age Young Bay Mud (YBM) that overlies older Pleistocene-age sediments, as indicated on Figure 2, "Regional Geologic Map", attached to the Appendix.

The nearest large active faults to the site are the Hayward fault located approximately 13.3 km (8 miles) northeast of the site and the San Andreas fault about 15.4 km (10 miles) southwest of the site.

The site is in the United State Geological Survey's (USGS) San Rafael 7.5 Minute Quadrangle and has not yet been evaluated by the California Geological Survey for hazards (Earthquake Zones of

Required Investigation (ca.gov)., including liquefaction, fault rupture or landsliding. According to the Association of Bay Area Governments (ABAG) and the Marin County General Plan the site is considered to be within the 100-year flood hazard zone and has a very high liquefaction susceptibility (MTC/ABAG Hazard Viewer Map (arcgis.com)).

INVESTIGATION

Prior to the start of the field exploration, Quantum Geotechnical, Inc., performed a site reconnaissance to determine site access conditions and mark locations for underground service alert (USA). The field investigation program was performed in two phases and consisted of advancing four (4) Cone Penetrometer Tests (CPTs) on August 31, 2024, and then advancing four deep exploratory borings, Borings B-1 through B-4 on March 28 and April 1, 2024. The borings and CPTs extended to depths up to 68.5 feet below the ground. The approximate locations of the CPTs and borings are shown on Figure 3, "Site Plan".

The CPTs were advanced via a truck mounted rig, by hydraulically pushing a 1.7-inch-diameter cone-tipped probe, into the ground. The probe consists of a cone with a projected area of 15 cm^2 and a friction sleeve immediately above the cone with a surface area of 225 cm^2. Electrical strain gauges and load cells within the probe continuously measure the cone tip resistance and frictional resistance, at 5 cm intervals. The CPT logs, showing tip resistance, side friction and friction ratio by depth, as well as interpreted soil classification, are presented in Appendix A.

The borings were advanced using a track-mounted Mobil B57 track-mounted drill rig operated by Stapelton Engineering and Exploration, utilizing 7-inch diameter hollow stem augers and rotary wash methods. Visual classifications were made from auger cuttings and samples collected in the field. As the drilling proceeded, relatively undisturbed core samples were obtained by means of a 3.0-inch O.D. Modified California split-tube sampler containing 2.5-inch O.D. liners, and a 2.0-inch O.D. standard penetration test sampler. The samplers were advanced into the soils at various depths under the impact of a 140-pound hammer having a free fall of 30 inches. The number of blows required to advance the sampler 12 inches into the soil, after seating the sampler 6 inches, were recorded on the boring logs. Shelby tubes with inside diameter 3.0 inches were also advanced to collect relatively undisturbed samples of the Young Bay Mud. The stratification of the soils, descriptions, location of undisturbed soil samples and blow counts are shown on the respective "Logs of Test Borings" contained within Appendix A.

Laboratory testing was conducted for Atterberg Limits, moisture density, sieve/gradation analysis, consolidation, and corrosion potential. The data received from the lab are presented on the boring logs, and summarized in Appendix B.

SUBSURFACE CONDITIONS

The subsurface conditions encountered in the four (4) deep borings (Borings B-1 through B-4), the four (4) CPTs and the hand-augured boring (Boring B-5) were consistent. In-general, there is a layer of artificial fill placed on top of a soft shallow marine and intertidal silty clay deposit known as the Young Bay Mud (YBM). This soft mud layer is Holocene-age and is highly compressible. Underlying the YBM are older alluvial deposits of stiff to very stiff sandy and gravelly clays, overlying weak to moderately strong Franciscan bedrock.

The fill encountered in the borings and CPTs was estimated to range in thickness from about 4 to 7 feet with variable color and texture, including a mixture of clay, sand, gravel, and apparently cementitious-altered hard materials with occasional rocky debris and concrete. The fill ranged in consistency from firm to very stiff / hard, typically cohesive soils on the east side of Woodland Avenue. The fill appeared softer on the west side of the roadway (nearer the wetlands) and included loose sands and organic materials. In Boring B-4 there was apparent concrete debris penetrated from approximately 3 to 4 feet deep, while we noted there were boulders resting on the surface of the ground near Borings B-2 and B-3.

The subsurface conditions as interpreted in the CPT data by the project site (CPTs 1 through 3) were found to consist of a surficial layer of undocumented fill, estimated at 4 to 5 feet thick, then soft YBM clay that continued to total depths ranging from 32 to 40 feet. Beneath the soft mud were layers of stiff to very stiff sandy clay and gravelly clay overlying the bedrock. Bedrock was encountered in the range of 40 to 60 feet deep. CPT-4 penetrated soils closer to the hillside and indicates the bay mud thins to less than 10 feet thick near the edge of the cove, overlying very stiff alluvium, colluvium, and shallow bedrock, but was outside the latest planned development area.

The estimated depths of fill and bay mud are shown in Table 1. The depth to the bottom of the soft and compressible Young Bay Mud (YBM) consistently ranged from about 33 to 40 feet across a majority of the site, but was shallower near the east corner of the site in Boring B-3 at only 22 feet. The depth to bedrock was estimated to range from 43 to 68 feet, except near the northeast corner of the site in Boring B-3 it was much shallower, in the range of 23 to 27 feet.

Table 1: Estimated Fill and Young Bay Mud Thickness

Boring / CPT	Total Depth (ft)	Fill Thickness (ft)	Groundwater Depth (ft)	Young Bay Mud Thickness (ft)	Depth to Bottom of Young Bay Mud
B-1	**45.3**	7	5.5	31	38
B-2	**41.5**	6	6	34	40
B-3	**51.5**	6	5	16	22
B-4	**54.5**	5	6	35	40
B-5	**5.5**	4	2.5	n/a	n/a
CPT-1	**43.5**	5	7	28	33
CPT-2	**50.4**	5	8	33	38
CPT-3	**60.5**	4	5	31	35
CPT-4	**32.8**	4	8	6	10

In order to supplement our subsurface exploration program, we reviewed the California Department of Transportation Digital Archive of Geotechnical Data (Welcome to GeoDOG (ca.gov) and identified Logs of Test Borings (LOTBs) and Reports for the California Park Overhead and Reconstruction of U.S. Route 101. These borings were located on either side of the freeway bridge on the east side of the site within a few hundred feet of the proposed site. The LOTBs concur with our findings of fill placed on the YBM, while there are buried stiff and medium dense to dense older alluvium on top of Franciscan bedrock encountered at depths of 20 to 65 feet. They indicate the depth to bedrock and mud thickness decreases toward the east corner of the site.

The groundwater table estimated in the CPTs, and borings was 5 to 6 feet below the existing grade across a majority of the site. In Boring B-5 (next to the marsh) groundwater was only 2.5 feet deep. Fluctuations in the groundwater table are likely to be tidally influenced due to the proximity of San Francisco Bay.

A complete description of the soil conditions and stratifications are presented on the respective “Logs of Test Borings” and “CPT Data” in Appendix A. The approximate locations of the borings and CPTs are shown on Figure 4, “Site Plan” in Appendix A. Geologic cross sections graphically showing interpolated subsurface profile are presented in Figures 4, 5 and 6, attached to Appendix A.

EVALUATION OF GEOTECHNICAL CONDITIONS

CONSOLIDATION SETTLEMENT OF SOFT CLAY (YOUNG BAY MUD)

The soft, compressible clay soil encountered between depths will experience some degree of consolidation settlement due to the added weight of any proposed fill as well as the weight of structures proposed at grade. A three-story building will impose a load of 500 p.s.f. not including any fill.

When a saturated clay soil layer is subjected to an increase in stresses due to loading, the pore water pressure is increased. As the excess pore pressure dissipates, and the water occupying the void spaces is expelled, soil consolidation and ground settlement occurs. The rate of the consolidation is dependent on the permeability of the soil and surrounding soil drainage conditions, the thickness of the compressible layer under consideration, and the rate at which the loading is applied. Granular, well drained soils undergo consolidation settlement immediately upon application of the load. However, the less pervious clayey soils take a long time for the settlement to occur. The soft clays will undergo initial primary settlement and long-term secondary settlement. The determination of the rate of consolidation is difficult to estimate with any accuracy. Calculations of the rate based on laboratory data will only provide the order of magnitude of settlement and the amount of time.

Based on the results of the laboratory consolidation tests, and additional building load of 500 p.s.f. we estimate that total primary and secondary settlements will range from 5 to up to 7 inches. Approximately 40% of these total settlements may occur during construction and the remainder should occur within 10 to 20 years after construction. Differential settlements of half the total settlement will occur between the center and edge of a building structure and should be included in the foundation slab design.

Due to the potential variable thickness nature of the Bay Mud across the site, differential consolidation settlements of up to 3 inches in 100 feet may occur across the site and should be included in the design of gravity utilities.

2022 CBC Seismic Design Criteria

The potential damaging effects of regional earthquake activity should be considered in the design of structures. At a minimum, seismic design should be in accordance with Chapter 16 of the 2022 California Building Code (CBC). The 2022 CBC utilizes the design procedures outlined in the ASCE 7-16 Standard. Using the criteria in Chapter 20 of ASCE 7-16, in its current condition without site mitigation, the site is classified as Site Class E, due to the presence of more than 10 feet of soft YBM soil, and a site response analysis is required if S_1 is greater than 0.2 and S_s is greater than 1.0. However, as discussed earlier, ground improvement of the site is needed to mitigate against the effects of excessive settlements on the building structures. Accordingly, since the structures will be founded on ground improvement piles extending to stiff soil/bedrock, the site can be classified as Site Class D, for the purposes of structural design. The seismic design parameters have been developed using the online "Seismic Design Maps" tool by the Structural Engineering Association (SEA) and Office of Statewide Health Planning and Development (OSHPD) based on a site's longitude and latitude. The parameters generated for the subject site for a latitude of 37.95844951° N, and longitude of 122.51085256 W, are presented in Table 2. According to Section 11.4.8 of ASCE 7-16, a ground motion hazard analysis shall be performed when the coefficient S_1 has a value greater than or equal to 0.2 for Site Class D sites. A ground motion hazard analysis is excepted if the C_s value is determined by equation 12.8-2 of ASCE 7-16. This is to be determined by the structural engineer. In the event that the calculated C_s values do not trigger a ground motion hazard analysis, the following parameters may be used.

Table 2
2022 CBC Seismic Design Criteria with Ground Improvement Mitigation

Seismic Parameter	Coefficient	Value
Site Class – Stiff Soils		D
Peak Ground Acceleration (Site Modified)	PGA_M	0.561
Mapped MCE Spectral Acceleration at Short-Period 0.2 secs	S_s	1.5
Mapped MCE Spectral Acceleration at a Period of 1.0s	S_1	0.60
Adjusted MCE, 5% Damped Spectral Response Acceleration at Short Period of 0.2s	S_{MS}	1.5
Adjusted MCE, 5% Damped Spectral Response Acceleration at Period of 1.0s	S_{M1}	1.02
Design 5% Damped Spectral Response Acceleration at Short Period of 0.2s for Occupancy Category I/II/III	S_{DS}	1
Design 5% Damped Spectral Response Acceleration at Period of 1.0s for Occupancy Category I/II/III	S_{D1}	0.680

LIQUEFACTION POTENTIAL EVALUATION

Liquefaction occurs primarily in relatively loose, saturated, cohesionless soils. Under earthquake stresses, these soils become “quick”, lose their strength, and become incapable of supporting the weight of the overlying soils or structures. The data used for evaluating liquefaction potential of the subsurface soils consisted of the penetration resistance, the soil gradation, the relative density of the materials, and the groundwater level.

Loose to medium dense cohesionless soil such as sands and some silts and low plasticity clays are potentially liquefiable, while dense and very dense cohesionless sands and gravels are considered to have a very low potential for liquefaction.

Due to a predominantly clayey soil profile and the presence of dense sands where granular material was encountered, the potential for liquefaction on the site is considered very low.

DYNAMIC COMPACTION/SETTLEMENT EVALUATION

Strong earthquake shaking can cause densification of loose to medium dense cohesionless soils above the groundwater table.

There are layers of loose to medium dense cohesionless soil within the fill above the groundwater table. Our analysis indicates that these materials may undergo approximately less than 0.5 inches of total dynamic settlement. Differential settlements of approximately one half of the total are expected and we recommend that a differential deflection of 0.25 inches over 50 feet be used.

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

GENERAL

1. From a geotechnical point of view, the site is suitable for the construction of the proposed residential development provided the recommendations presented in this report are incorporated into the project plans and specifications.

2. The most prominent geotechnical features of the site as encountered in the borings are:
    1. The presence of approximately 4 to 6 feet of old variable fill blanketing the site.
    2. The presence of a groundwater table at 2.5 to 6 feet depth,
    3. The presence of very soft/weak and compressible silty clay (Young Bay Mud), immediately underlying the fill

3. The fill material was variable in consistency and material type and contained some organics and pieces of asphalt and concrete. The fill is considered un-documented fill and may not be relied on for structural support in its current condition.

4. The groundwater table was encountered at a depth of 2.5 to 6 feet and is expected to impact the construction of utilities deeper than 6 feet below the design pad grades. Constant dewatering and special treatment of trench bottoms within the YBM unit will be required. The treatment of trench bottoms for gravity utilities, typically comprises sub-excavating an additional 12 inches of the trench bottom and replacing with a 12-inch bed of crushed gravel fully wrapped in geotextile fabric. The trench bedding material is then placed over this gravel section.

5. The Bay Mud material is very soft and highly compressible. The construction of additional fill and building structures founded on an at-grade mat slab type foundation, on the site in its current condition, would lead to approximately 5 to 7 inches of consolidation settlement across the site. These levels of settlements are considered excessive and difficult to design for, over the life of the project.

6. The design of gravity fed utilities and street grades must incorporate the expected differential settlement due to consolidation and liquefaction.

7. The estimated settlements due to consolidation, dynamic compaction and liquefaction, are considered excessive for the design of mat/PT slab foundations at grade and gravity utilities without any ground mitigation, and therefore not recommended. We recommend the foundation system comprise a post-tensioned slab foundation supported on drilled displacement pile (DDP). This pile is similar to an auger cast-in-place pile system, but without the generation of spoils. A pre-drilled hole approximately 3 to 5 feet deep is drilled through the fill and then a DDP probe (18 to 24 inches in diameter) is pushed into the ground, laterally pushing the soil away from the probe to pre-determined depths within dense sand or stiff clays. The probe is then removed and during removal, grout is pumped into the hole. A steel reinforcing cage is then immediately lowered into the grouted hole, while the grout is still wet. The DDP generate very little noise and vibration. Discussions with Farrell Design Build, a DDP specialty contractor, indicate that the DDP piles can be practically drilled to depths of 50 feet. We therefore recommend that the proposed buildings be supported on an engineered mat/PT slab foundation upon deep structural DDP pile foundations. Even though the buildings will be supported on pile foundations, the site will experience continued consolidation settlement of the Bay Mud due to fill loading, of the order of 2 to 3 inches over 30 years for 1 to 2 feet of fill. The design of gravity fed utilities and street grades must incorporate the expected differential settlement due to consolidation. The buildings supported on DDP piles will settle less than the surrounding site and we recommend flexible utility connections at building perimeters. In addition, we recommend the use of a turned down concrete footing/apron around the building perimeter of at least 12 inches below design exterior grade to hide the gap that will form below the slab due to on-going areal soil settlement.

GRADING

8. The grading requirements presented herein are an integral part of the grading specifications presented in Appendix C of this report and should be considered as such.

9. Grading activities during the rainy season on cohesive soils will be hampered by excessive moisture. Grading activities may be performed during the rainy season, however, achieving proper compaction may be difficult due to excessive moisture; and delays may occur. In addition, measures to control potential erosion may need to be provided. Grading performed during the dry months will minimize the occurrence of the above problems.

10. If the buildings will be founded on a slab supported on a pile foundation system, sub-excavation of the existing undocumented fill is not needed. Site preparation could consist of deep ripping of the

exposed soil and recompact as engineered fill. If any areas outside the building pad area, are found to be unstable for earthwork, we recommend some level of sub-excavation and employing BX1200 geogrid, to stabilize the excavation area prior to placing fill.

11. After site preparation, the top 8 inches of exposed ground should be scarified and compacted to a degree of relative compaction of at least 90% at 3 percent above optimum moisture content as determined by ASTM D1557-12 Laboratory Test Procedure.

12. The site may be brought to the desired finished grades by placing engineered fill in lifts of 8 inches in uncompacted thickness and compacting to a minimum relative compaction of 90% at 3 percent above optimum moisture content for lean clay soil as determined by ASTM D1557-12 Laboratory Test Procedure.

13. All soils encountered during our investigation except appear suitable for use as engineered fill when placed and compacted at the recommended moisture content and provided it does not contain any debris.

Surface and Subsurface Drainage

14. All finish grades should be provided with a positive gradient to an adequate discharge point in order to provide rapid removal of surface water runoff away from all foundations. No ponding of water should be allowed on the pad or adjacent to the foundations. Surface drainage must be designed by the project Civil Engineer and maintained by the property owners at all times. The pad should be graded in a manner that surface flow is to a controlled discharge system.

15. Lot slopes and drainage must be provided by the project Civil Engineer to remove all storm water from the pad and to minimize storm and/or irrigation water from seeping beneath the structures. Should surface water be allowed to seep under the structure, foundation movement resulting in structural cracking and damage will occur. Where possible, finished grades around the perimeter of the structures should be compacted and should be sloped at a minimum 2% gradient away from the exterior foundation. Surface drainage requirements constructed by the builder should be maintained during landscaping. In particular, the creation of planter areas confined on all sides by concrete walkways or decks and the structure foundation is not desirable since any surface water due to rain or

irrigation becomes trapped in the planter area with no outlet. If such a landscape feature is necessary, surface area drains in the planter area or a subdrain along the foundation perimeter must be installed.

16. Continuous roof gutters are recommended. According to local government requirements, roof downspout and drain flows should be directed to at grade bio-filtration areas, or raised planter boxes next to the building perimeter, where possible. From a geotechnical and maintenance point of view it is undesirable to discharge water into at grade bio-filtration areas near foundations, because of the possibility of water ponding for sustained periods of time. Typically, the bio-filtration areas consist of an 18 inch layer of sandy loam over 18 inches of permeable gravel material. The top of the bio-filtration area is typically approximately 1 foot below pad grade, therefore, the base of the bio-filtration area will be approximately 4 feet below pad grade. The base of the bio-filtration area will typically contain a perforated pipe to drain any water that may collect within 24 hours. In some situations, the bio-filtration areas may be located as close as 2 to 3 feet from the building perimeter. If such a system is employed, we must be consulted to evaluate the impact of these systems when located in close proximity to the foundation or pavements and supplemental recommendations for waterproofing. These bio-filtration areas located very close to the buildings will not impact the pile foundation support system, but may impact soil moisture transmissivity through the slab foundation.

FOUNDATIONS

17. A combination post-tensioned slab supported on improved ground utilizing DDP pile elements is the most appropriate foundation system for these types of structures and soil conditions. The DDP pile foundations are typically designed by a specialty design build contractor. The preliminary anticipated DDP pile lengths may range from 30 to 50 feet.

18. It is anticipated that pile load testing and indicator pile construction will be performed to further refine the final design.

General Construction Requirements for Structural Mat/Post-Tensioned Slab

19. The four (4) inch (minimum thickness) layer of gravel typically placed to provide a capillary break beneath the PT slab may be omitted as the soil may settle slightly and no longer be in contact with the slab. However, we recommend that a vapor retarder be used to provide initial protection while the slab is in contact with the ground.

20. A moisture vapor retarder/barrier is recommended beneath the PT slabs that will be covered by moisture-sensitive flooring materials such as vinyl, linoleum, wood, carpet, rubber, rubber-backed carpet, tile, impermeable floor coatings, adhesives, or where moisture-sensitive equipment, products, or environments will exist. We recommend that design and construction of the moisture vapor retarder/barrier conform to Section 1805 of the 2013 CBC and relevant sections of American Concrete Institute (ACI) guidance documents 302.1R-04, 302.2R-06 and 360R-10.

21. The moisture vapor retarder/barrier can be placed directly on the soil subgrade and should consist of a minimum 10 mils thick polyethylene with a maximum perm rating of 0.1 in accordance with ASTM E 1745. Seams in the moisture vapor retarder/barrier should be overlapped no less than 6 inches or in accordance with the manufacturer's recommendations. Joints and penetrations should be sealed with the manufacturer's recommended adhesives, pressure-sensitive tape, or both. The contractor must avoid damaging or puncturing the moisture vapor retarder/barrier and repair any punctures with additional polyethylene properly lapped and sealed. The installation of the vapor retarder membrane must be in conformance with ASTM E1643.

22. We recommend that the concrete be poured directly onto the vapor barrier provided the concrete has a maximum water/cement ratio of 0.45 and a 10 mil Class A vapor retarder membrane, such as Stego® Wrap. In any case, the vapor retarder/barrier should have a maximum perm rating of 0.3 in accordance with ASTM E 1745. Seams in the moisture vapor retarder/barrier should be overlapped no less than 6 inches or in accordance with the manufacturer's recommendations. Joints and penetrations should be sealed with the manufacturer's recommended adhesives, pressure-sensitive tape, or both. The contractor must avoid damaging or puncturing the vapor retarder/barrier and repair any punctures with additional polyethylene properly lapped and sealed.

23. Any exterior concrete flatwork such as steps, patios, or sidewalks should be designed independently of the slab, and expansion joints should be provided between the flatwork and the structural unit.

SOIL CORROSIVITY

24. In order to evaluate the corrosion potential of the near surface soil toward concrete and buried metal pipe, a sample of soils cuttings from Boring B-3 at 2 feet was collected, and also from Boring B-5 at a depth of 2 feet. These samples were tested for resistivity, soluble chloride, soluble sulfate, and pH. The results of the testing are summarized as follows.

Test	Boring B-3 at 2’	Boring B-5 at 2’
Resistivity (Ohm-cm)	2,000	7,800
Chloride (mg/kg)	None-detected	None-detected
Sulfate (mg/kg)	24	None-detected
pH	8.2	8.46

25. Many factors contribute to the corrosion potential. The most important factor with respect to corrosion potential toward buried metal pipes and fittings is soil resistivity, and the most important factor with respect to corrosion potential toward concrete is the sulfate content.

26. Based on the above results, the near surface soil is considered severely to mildly corrosive to buried metal pipe and fittings. We recommend that a corrosion engineer be consulted to provide specific corrosion protection measures. Further, the sulfate exposure to concrete is negligible, and no special cements are required.

MISCELLANEOUS CONCRETE FLATWORK

27. Miscellaneous flatwork, driveways, and walkways may be designed with a minimum thickness of 4.0 inches. Control joints should be constructed to create squares or rectangles with a maximum spacing of 15 feet on large slab areas. Walkways should be separated from foundations with a thick expansion joint filler. Control joints should be constructed into walkways at a maximum of 5 feet spacing.

RETAINING WALLS

28. Retaining walls less than 5 feet high are anticipated and should be designed to resist lateral pressures exerted from a media having an equivalent fluid weight as follows:

Active Condition	=	50 p.c.f. for horizontal backslope
At-rest Condition	=	65 p.c.f.
Passive Condition	=	250 p.c.f.
Coefficient of Friction	=	0.30

29. For a non-horizontal backslope, the active condition equivalent fluid weight can be increased by 1.5 p.c.f. for each 2 degree rise in slope from the horizontal.

30. Active conditions occur when the top of the wall is free to move outward. At-rest conditions apply when the top of wall is restrained from any movement.

31. It should be noted that the effects of any surcharge, traffic or compaction loads behind the walls must be accounted for in the design of the walls.

32. The above criteria are based on fully drained conditions. If drained conditions are not possible, then the hydrostatic pressure must be included in the design of the wall. An additional linear distribution of hydrostatic pressure of 63 p.c.f. should be adopted, in this case.

33. In order to achieve fully-drained conditions, a drainage filter blanket should be placed behind the wall. The blanket should be a minimum of 12 inches thick and should extend the full height of the wall to within 12 inches of the surface. If the excavated area behind the wall exceeds 12 inches, the entire excavated space behind the 12-inch blanket should consist of compacted engineered fill or blanket material. The drainage blanket material may consist of either granular crushed rock and drain pipe fully encapsulated in geotextile filter fabric or Class II permeable material that meets CalTrans Specification, Section 68, with drainage pipe but without fabric. A 4-inch perforated drain pipe should be installed in the bottom of the drainage blanket and should be underlain by at least 4 inches of filter type material. A 12-inch cap of clayey soil material should be placed over the drainage blanket. All back drains should be outlet to suitable drainage devices. Retaining wall less than 3 feet in height should be provided with backdrains or weep holes.

34. As an alternate to the 12-inch drainage blanket, a pre-fabricated strip drain (such as Miradrain) may be used between the wall and retained soil. In this case, the wall must be designed to resist an additional lateral hydrostatic pressure of 30 p.c.f.

35. Piping with adequate gradient shall be provided to discharge water that collects behind the walls to an adequately controlled discharge system away from the structure foundation.

36. It is recommended that the retaining walls or soundwalls be founded on a spread footing foundation system. Due to the presence of shallow groundwater and Bay Mud material regular piers will be very difficult to construct and are not recommended. Spread footing design criteria are given below.

Retaining Wall/Soundwall Foundation - Spread Footings

37. Spread footings should have a minimum depth of twenty four (24) inches below lowest adjacent pad grade (i.e., trenching depth) for soil subgrade. At this depth, the recommended design bearing pressure for continuous footings should not exceed 1,000 p.s.f. due to dead plus sustained live loads and 1,300 p.s.f. due to all loads which include wind and seismic.

38. To accommodate lateral loads, the passive resistance of the foundation soil can be utilized. The passive soil pressures can be assumed to act against the front face of the footing below a depth of one foot below the ground surface. It is recommended that a passive pressure equivalent to that of a fluid weighing 250 p.c.f. be used. The weight of the soil above the footing can be used in the frictional calculations. For design purposes, an allowable friction coefficient of 0.30 can be assumed at the base of the spread footing.

Pavement Areas

39. R-value tests were not performed as part of this investigation, as the soil expected at subgrade level is not known and depends on the planned grading. It is anticipated that cuts up to 2 feet may be needed to establish subgrade, and therefore the subgrade material will consist of the non-uniform fill material. For the purpose of design, we will assume an R-value of 5 for preliminary design, which is based on a clay material. However, the final pavement section design will be based on collecting

actual subgrade samples during construction. It is noted that pavements constructed in Bay Mud environments generally have shorter design lives and will require more maintenance than normal.

40. Based on an R-Value of 5, the following flexible pavement sections are recommended.

Traffic Index	AC (inches)	Class II[1] AB (inches)
4.5	3.0	9.0
5.0	3.0	10.0
5.5	4.0	11.0
6.0	4.0	12.5
7.0	4.0	15.0

Notes: [1]Minimum R-Value = 78
R-Value = Resistance Value
All Layers in compacted thickness to Cal-Trans Standard Specifications

41. After underground facilities have been placed in the areas to receive pavement and removal of excess material has been completed, the upper 6 inches of the sub-grade soil shall be scarified, moisture conditioned, and compacted to a minimum relative compaction of 95% in accordance with the grading recommendations specified in this report.

42. All aggregate base material placed subsequently should be compacted to a minimum relative compaction of 95% based on the ASTM Test Procedure of D1557-12 (latest edition). The construction of the pavement areas should conform to the requirements set forth by the latest Standard Specifications of the Department of Transportations of the State of California and/or Marin County, Department of Public Works.

43. If planter areas are provided within or immediately adjacent to the pavement areas, or if permeable pavers are used for some areas of pavement, provisions should be made to control irrigation and surface water from entering the pavement subgrade. Water entering the pavement section at subgrade level, which does not have a means for discharge, could cause softening of this

zone and lead to pavement failure. If permeable or non-permeable pavers are used adjacent main roadway areas, we recommend that the subgrade of the pavers be graded to a low point where a subdrain is constructed to discharge any accumulated water.

UTILITY TRENCHES

44. Applicable safety standards require that trenches in excess of 5 feet must be properly shored or that the walls of the trench slope back to provide safety for installation of lines. If trench wall sloping is performed, the inclination should vary with the soil type. The underground contractor should request an opinion from the Soil Engineer as to the type of soil and the resulting inclination.

45. Trenches deeper than 5 feet, will encounter groundwater and the base of the trench will most likely comprise of soft and compressible Bay Mud. Where the base of the trench extends below the groundwater table, the trench must be dewatered to allow proper placement of bedding and shading and the trench backfill. If encountered, the soft Bay Mud will not provide a stable base to allow proper construction of the bedding and pipe. In cases where Bay Mud exists at the trench base, we recommend that the Bay Mud be sub-excavated 12 inches below the bedding and backfilled with ¾" crushed gravel completely wrapped in geotextile fabric.

46. With respect to state-of-the-art construction or local requirements, utility lines are generally bedded with granular materials. These materials can convey surface or subsurface water beneath the structures. It is, therefore, recommended that all utility trenches which possess the potential to transport water be sealed with a compacted impervious cohesive soil material or lean concrete where the trench enters/exits the building perimeter.

47. Utility trenches extending underneath all traffic areas must be backfilled with native or approved import material and compacted to a relative compaction of 90% to within 6 inches of the subgrade. The upper 6 inches should be compacted to 95% relative compaction in accordance with Laboratory Test Procedure ASTM D1557 (latest edition). Backfilling and compaction of these trenches must meet the requirements set forth by the Marin County, Department of Public Works. Utility trenches within landscape areas may be compacted to a relative compaction of 85%.

PROJECT REVIEW AND CONSTRUCTION MONITORING

48. All grading and foundation plans for the development must be reviewed by the Soil Engineer prior to contract bidding or submitted to governmental agencies so that plans are reconciled with soil conditions and sufficient time is allowed for suitable mitigative measures to be incorporated into the final grading specifications.

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

50. Field observation and testing during the demolition and/or foundation operations must be provided by representatives of ***Quantum Geotechnical, Inc.*** to enable them to form an opinion regarding the adequacy of the site preparation, the acceptability of fill materials, and the extent to which the earthwork construction and the degree of compaction comply with the specification requirements. Any work related to the grading and/or foundation operations performed without the full knowledge and under the direct observation of the Soil Engineer will render the recommendations of this report invalid. This does not imply full-time observation. The degree of observation and frequency of testing services would depend on the construction methods and schedule, and the item of work.

REFERENCES

1. Blake, M.C., Graymer, R.W., Jones, D.L., and Soule, Adam, 2000, Geologic map and map database of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California, U.S. Geological Survey, Miscellaneous Field Studies Map MF-2337, 1:75,000.

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3. Graymer, R.W., Moring, B.C., Saucedo, G.J., Wentworth, C.M., Brabb, E.E., and Knudsen, K.L. 2006. "Geologic Map of the San Francisco Bay Region". U.S. Geological Survey. Scientific Investigations Map 2918.

4. Helley, E.J., Lajoie, K.R., Spangle, W.E., Blair, M.L., and William Spangle & Associates, 1979, Flatland deposits of the San Francisco Bay region, California - their geology and engineering properties, and their importance to comprehensive planning, U.S. Geological Survey, Professional Paper 943, 1:125,000.

5. Jennings, C.W., Gutierrez, C., Bryant, W., Saucedo, G., and Wills, C., 2010, Geologic map of California, California Geological Survey, Geologic Data Map GDM-2.2010, 1:750,000.

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9. Witter, R.C., Knudsen, K.L., Sowers, J.M., Wentworth, C.M., Koehler, R.D., Randolph, C.E., Brooks, S, K., and Gans, K.D., 2006, Maps of Quaternary deposits and liquefaction susceptibility in the central San Francisco Bay region, California, U.S. Geological Survey, Open-File Report OF-2006-1037, 1:200,000.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. It should be noted that it is the responsibility of the owner or his representative to notify ***Quantum Geotechnical, Inc.,*** in writing, a minimum of two working days before any clearing, grading, or foundation excavations can commence at the site.

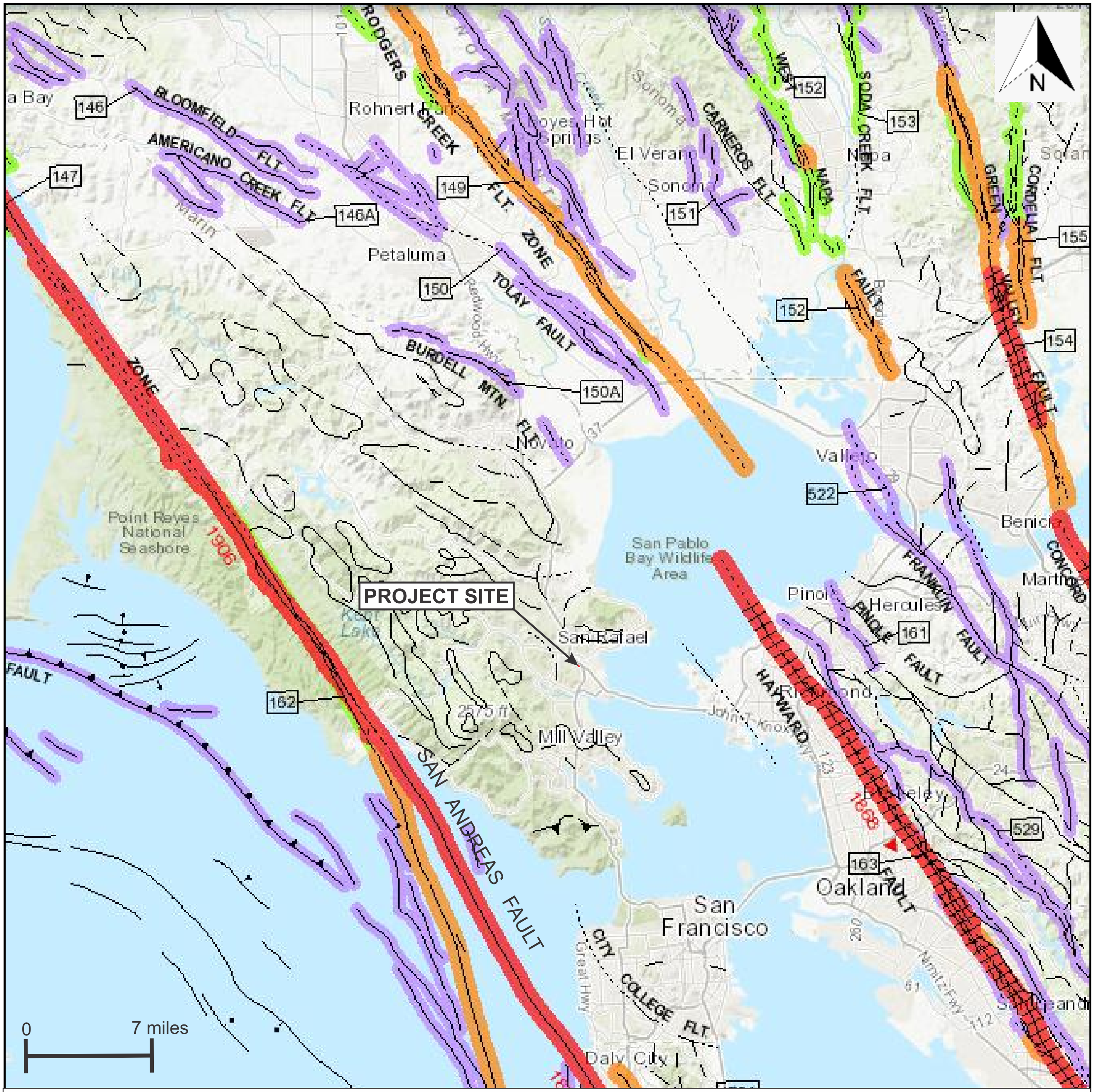
2. The recommendations of this report are based upon the assumption that the soil conditions do not deviate from those disclosed in the borings and from a reconnaissance of the site. Should any variations or undesirable conditions be encountered during the development of the site, ***Quantum Geotechnical,***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

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

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

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

APPENDIX A



LEGEND

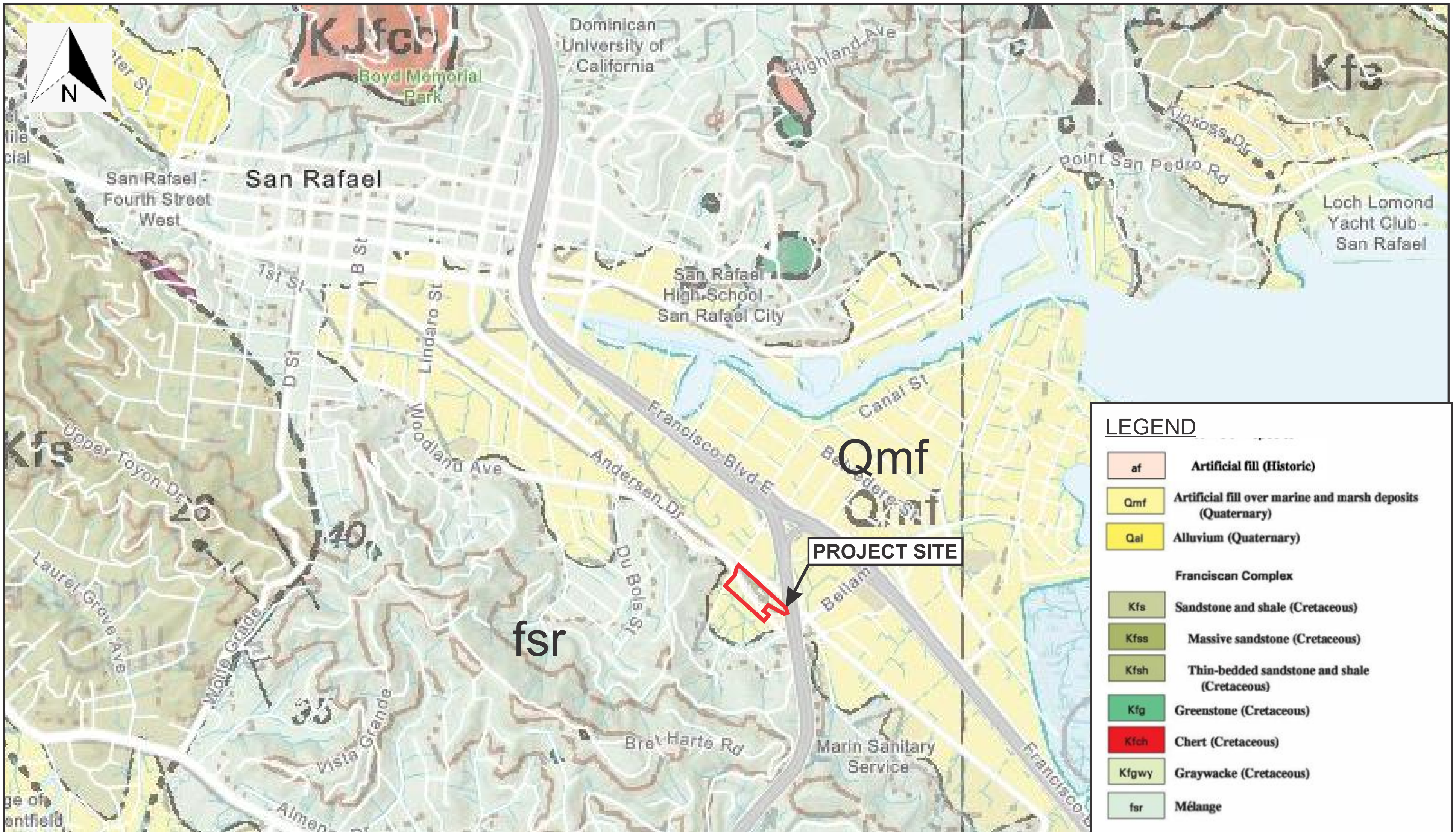
Historical Displacement (Past 200 Years)	Quaternary Fault Displacement (Age Undifferentiated)
Holocene Fault Displacement (Past 11,200 Years)	Pre-Quaternary Fault (Older than 1.6 million years)
Late Quaternary Fault Displacement (Past 700,000 years)	

Estimated Trace (Uncertain)

Relatively Certain Trace

Low Angle Fault, Barbs on Upper Plate

QUANTUM GEOTECHNICAL INC.	SITE LOCATION AND FAULT ACTIVITY MAP Geotechnical Investigation Auburn Grove Woodland Avenue and Auburn Street San Rafael, California	Project No. K050.G	Figure No. 1

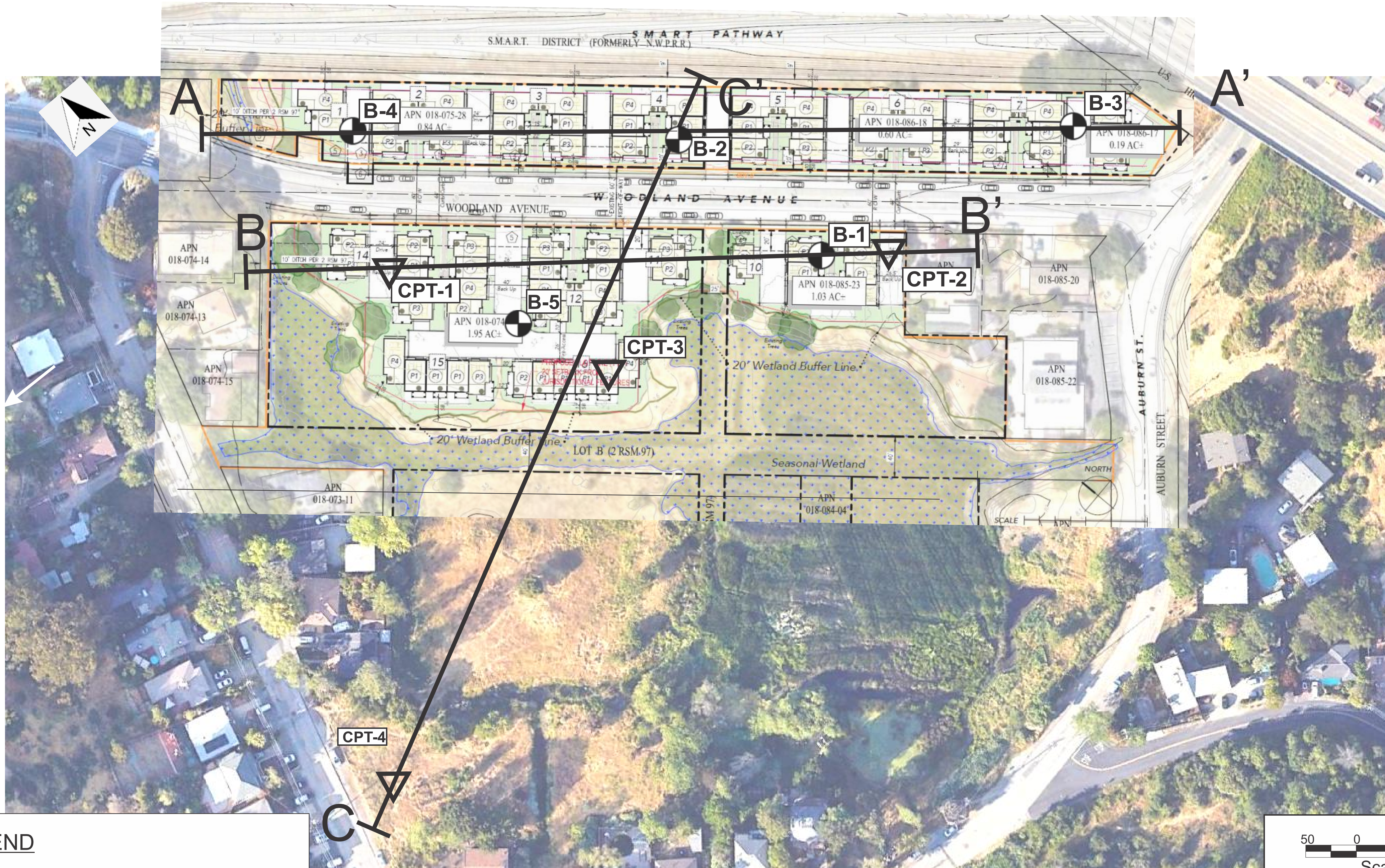


Blake, M.C., Graymer, R.W., Jones, D.L., and Soule, Adam, 2000, Geologic map and map database of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California, U.S. Geological Survey, Miscellaneous Field Studies Map MF-2337, 1:75,000..

REGIONAL GEOLOGIC MAP

QUANTUM GEOTECHNICAL INC.

Geotechnical Investigation Auburn Grove Woodland Avenue and Auburn Street San Rafael, California	Project No.	Drawn By	Figure No.
	K050.G	JF	2



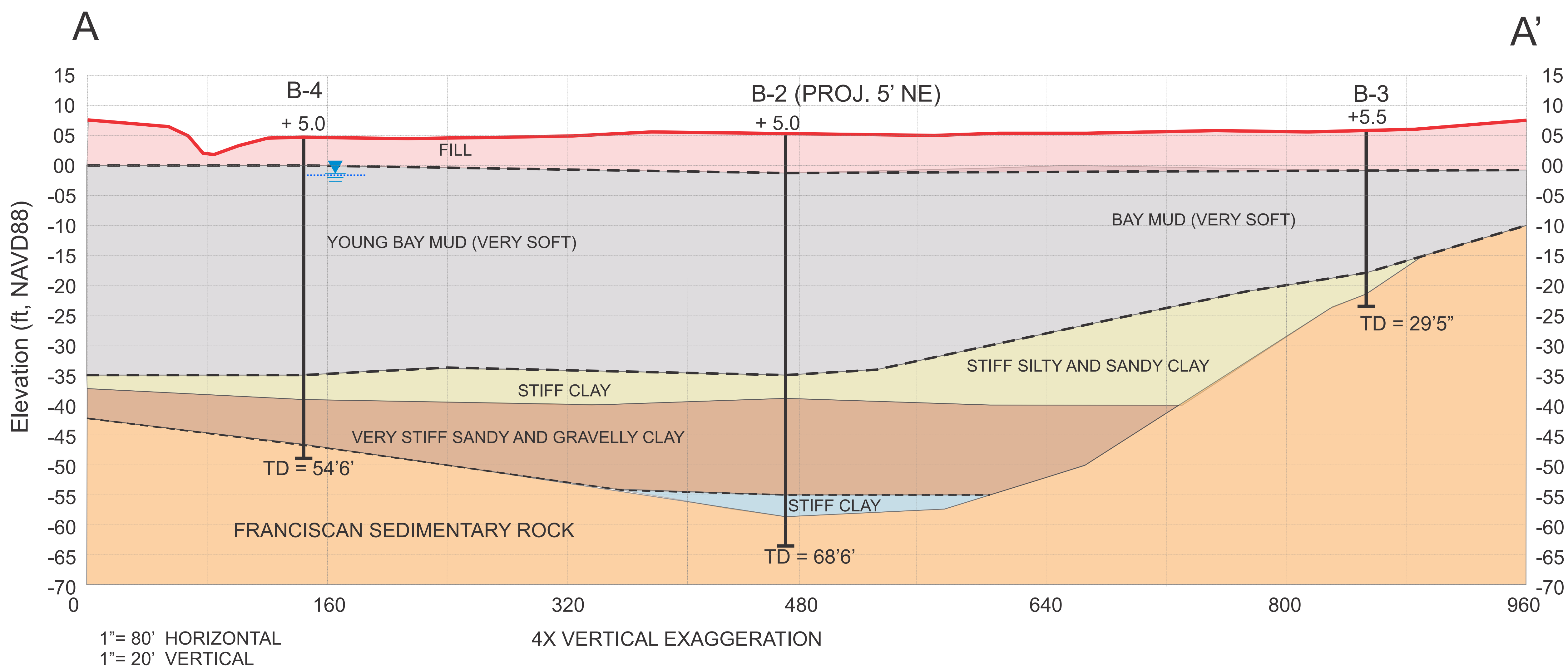
50 0 50 100 ft
Scale

LEGEND

B-5 QUANTUM SOILS BORING (2024)

CPT-4 CONE PENETRATION TEST (2023)

QUANTUM GEOTECHNICAL INC.	SITE PLAN			
	Geotechnical Investigation Auburn Grove Woodland Avenue and Auburn Street San Rafael, California	Project No. K050.G	Drawn By JF	Figure No. 3



Legend

Historical Fill

Late Holocene Bay Mud
(Soft to Very Soft Clay)

Early Holocene, Latest Pleistocene
Alluvium (Interbedded Sands and Stiff Clays)

Late Pleistocene Older
Near Shore Alluvium
(Stiff to Very Stiff Clays, Minor Sands)

Franciscan Melange / Sedimentary Rocks

Quantum Boring / CPT

B-2
Boring Name and Projection
Distance & Direction

?

TD= Total Depth (ft)

Approximate Stratigraphic Contact

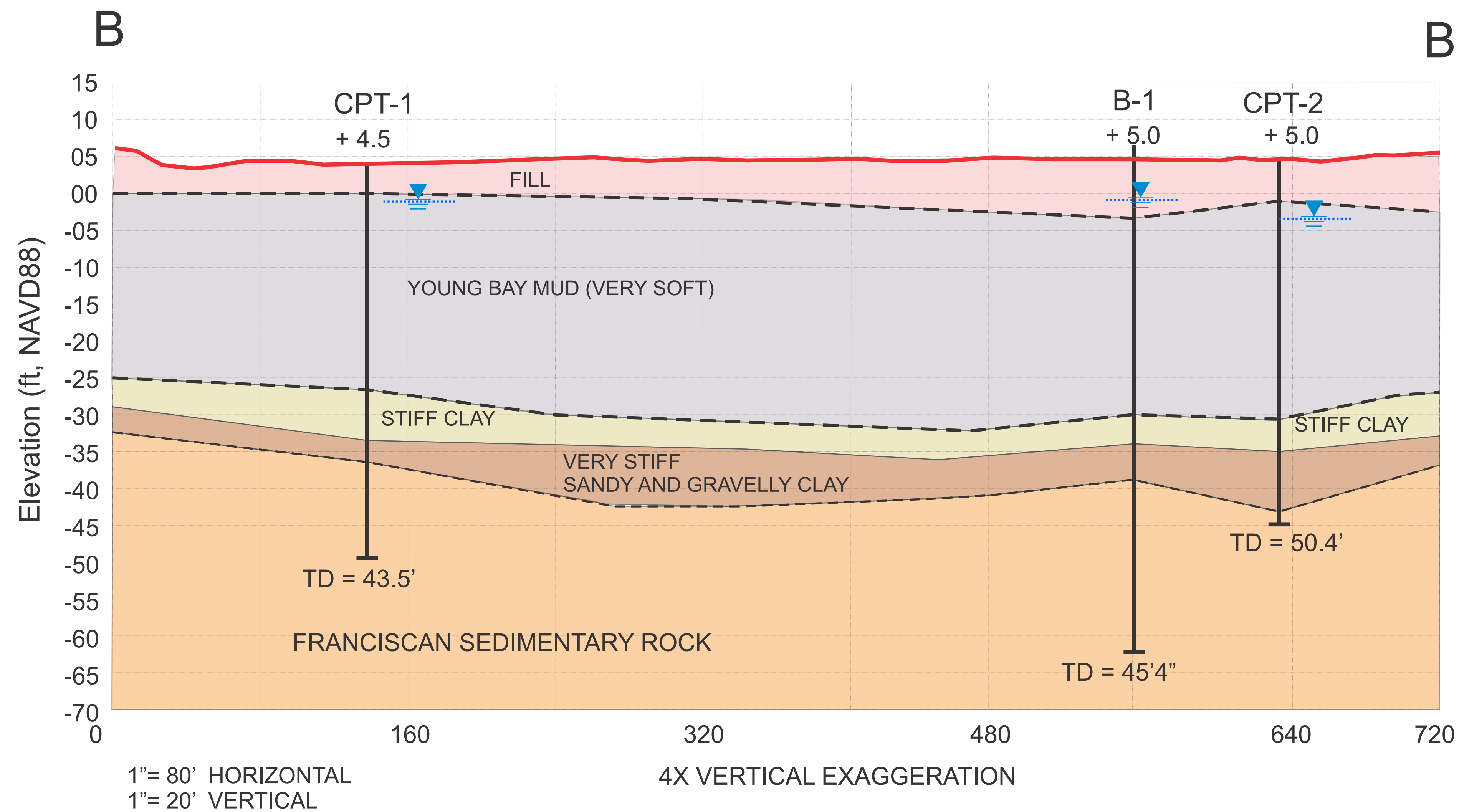
Groundwater Level
at Time of Drilling

QUANTUM GEOTECHNICAL INC.

SUBSURFACE PROFILE AA'

Geotechnical Investigation
Auburn Grove
Woodland Avenue and Auburn Street
San Rafael, California

Project No.	Drawn By	Figure No.
K050.G	JF	4



Legend

- Historical Fill
- Late Holocene Bay Mud (Soft to Very Soft Clay)
- Early Holocene, Latest Pleistocene Alluvium (Interbedded Sands and Stiff Clays)
- Late Pleistocene Older Near Shore Alluvium (Stiff to Very Stiff Clays, Minor Sands)
- Franciscan Melange / Sedimentary Rocks

Quantum Boring / CPT

B-2

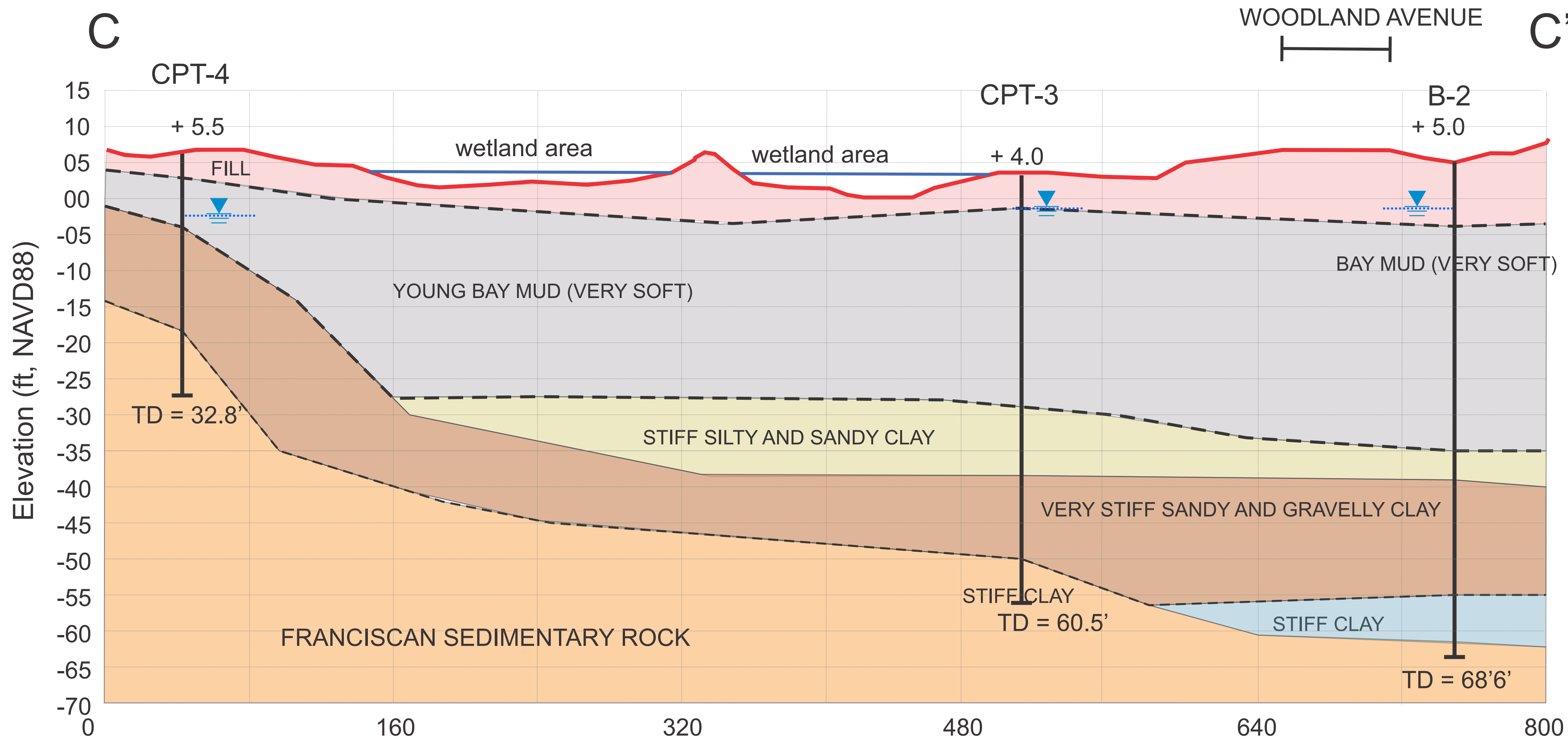
Boring Name and Projection Distance & Direction

TD= Total Depth (ft)

Approximate Stratigraphic Contact

Groundwater Level at Time of Drilling

QUANTUM GEOTECHNICAL INC.	SUBSURFACE PROFILE BB'			
	Geotechnical Investigation Auburn Grove Woodland Avenue and Auburn Street San Rafael, California	Project No. K050.G	Drawn By JF	Figure No. 5



1"= 80' HORIZONTAL
1"= 20' VERTICAL

4X VERTICAL EXAGGERATION

Legend

- Historical Fill
- Late Holocene Bay Mud (Soft to Very Soft Clay)
- Early Holocene, Latest Pleistocene Alluvium (Interbedded Sands and Stiff Clays)
- Late Pleistocene Older Near Shore Alluvium (Stiff to Very Stiff Clays, Minor Sands)
- Franciscan Melange / Sedimentary Rocks

Quantum Boring / CPT

B-2
Boring Name and Projection Distance & Direction
TD= Total Depth (ft)

Approximate Stratigraphic Contact

Groundwater Level at Time of Drilling

QUANTUM GEOTECHNICAL INC.

SUBSURFACE PROFILE CC'

Geotechnical Investigation
Auburn Grove
Woodland Avenue and Auburn Street
San Rafael, California

Project No.	Drawn By	Figure No.
K050.G	JF	6

Project: **Marin A, City Ventures** Project Location: **Woodland Avenue, San Rafael** Project Number: **K050.G**	Log of Boring B-1 **Sheet 1 of 2**	**Quantum Geotechnical Inc.** 1110 Burnett Avenue., Ste. B Concord, CA, 94520

Date(s) Drilled **03/28/24**	Logged By **JF**	Checked By
Drilling Method **Hollow Stem**	Drill Bit Size/Type **7" O.D.**	Total Depth of Borehole **45.33 feet bgs**
Drill Rig Type **Mobil B57 -Track Mounted**	Drilling Contractor **Stapleton Engineering**	Approximate Surface Elevation
Groundwater Level and Date Measured **5.5**	Sampling Method(s) **Modified California, Pitcher, SPT**	Hammer Data **Auto**
Borehole Backfill **Tremy Grout**	Location **See Site Plan**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Percent Fines	LL, %	PI, %	UC, ksf
	0				Grass								
					OL		Organic Soil (OL) - very dark gray, very moist, soft						
					CL		Sandy CLAY with Gravel (CL) - mottled dark gray and yellow-brown, wet, soft, moderately plastic, little fine gravel [FILL]						
			1	6				12.8	109.4		32	12	
							- change to stiff, coarse gravel up to est. 2-inch size						
	5		2	17				9.5	119.8				
			3	6			- change to wet, soft, few gravel, highly plastic						
					CH		Gravelly CLAY with Wood (CH) - very dark gray, wet, soft, few wood pieces, little fine subrounded gravel, few coarse gravel [FILL / DISTURBED YOUNG BAY MUD]						
	10		4	5				46.9	73.0				
					CH		Silty Fat CLAY (CH) - dark gray, wet, very soft, trace sand [YOUNG BAY MUD]						
	15												
	20						- greenish-gray, very soft [Collected Shelby Tube]						
			5	100 psf									
	25												
	30												

Quantum Geotechnical Inc.
1110 Burnett Avenue., Ste. B
Concord, CA, 94520

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Percent Fines	LL, %	PI, %	UC, ksf
	30				CH		Silty Fat CLAY (CH) continues - greenish-gray, very soft [YOUNG BAY MUD]						
	35						- becomes medium stiff (firm), few sand						
					CL		Sandy CLAY (CL) - blue-gray with yellow-brown mottles, moist, very stiff, little sand and fine subangular gravel [PLEISTOCENE-AGE ALLUVIUM]						
	40		6	65				21.6	108.8				
					Sandstone		Sandstone - brownish-yellow, fine-grained, moderately weathered, appears moderately strong and moderately hard based on drilling resistance						
	45		7				Bottom of Borehole (BOB) at 45'4" feet below the ground surface (bgs). water depth about 5.5 feet after drilling. Backfilled with grout tremied into the hole.						
	50												
	55												
	60												
	65												

Project: **Marin A, City Ventures** Project Location: **Woodland Avenue, San Rafael** Project Number: **K050.G**	Log of Boring B-2 **Sheet 1 of 3**	**Quantum Geotechnical Inc.** 1110 Burnett Avenue., Ste. B Concord, CA, 94520

Date(s) Drilled **03/28/24**	Logged By **JF**	Checked By
Drilling Method **Hollow Stem**	Drill Bit Size/Type **7" O.D.**	Total Depth of Borehole **68.5 feet bgs**
Drill Rig Type **Mobil B57 -Track Mounted**	Drilling Contractor **Stapleton Engineering**	Approximate Surface Elevation
Groundwater Level and Date Measured **6**	Sampling Method(s) **Modified California, Pitcher, SPT**	Hammer Data **Auto**
Borehole Backfill **Tremy Grout**	Location **See Site Plan**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Percent Fines	LL, %	PI, %	UC, ksf
	0				GM		Silty, Sandy Gravel with Clay (GM-GC) - gray-brown, moist, stiff, fine and coarse gravel, fine to coarse sand, few asphalt and concrete						
					CL		Gravelly, Sandy CLAY (CL) - brown, moist, stiff, moderately plastic, little to some fine and coarse gravel [FILL]						
			1	40	SM		Silty, Gravelly SAND (SM) - light gray, moist, medium dense, fine to coarse sand, little fine and coarse gravel up to est. 2-inch size, little silt [FILL]	17.3	106.3				
	5		2	31	SC		Silty, Clayey Sand with Cement (SC-SM) - light gray, moist, loose, moderately plastic fines, mixed w/ apparent cement-treated materials, few brick [FILL]	25.4					
			3	7	CH		Fat Organic CLAY(CH/OH) - black, soft [PEAT]						
	10		4	WOH 1	CH		Silty Fat CLAY (CH) - dark gray, wet, very soft, trace sand [YOUNG BAY MUD]						
	15												
	20												
	25		5	150 psf			- greenish-gray with reddish-brown mottles, soft [Collected Shelby Tube]						
	30												

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Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Percent Fines	LL, %	PI, %	UC, ksf
	30						Silty FAT Clay (CH) continues - greenish-gray w/ reddish-brown mottles, moist, soft, trace sand [YOUNG BAY MUD]						
	35												
	40		6	15			—? Fat CLAY (CH) - very dark gray, stiff, few sand, few gravel [LATE PLEISTOCENE MARINE CLAY]	24.9	100.2				
							- becomes very stiff, red and greenish-gray stains						
	45		7	36				21.9	106.2				
	50												
					CL		—? Sandy CLAY with Gravel (CL) - reddish-brown with gray mottles, moist, very stiff, fine subangular gravel [PLEISTOCENE ALLUVIUM]						
	55		8	21				28.2					
	60		9	20	CH		—? Fat CLAY with Sand (CH) -greenish-gray with brown mottles, moist, stiff [PLEISTOCENE MARINE CLAY]	48.3					
	65												

Quantum Geotechnical Inc.
1110 Burnett Avenue., Ste. B
Concord, CA, 94520

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Percent Fines	LL, %	PI, %	UC, ksf
	65				CH		Fat CLAY with Sand (CH) -greenish-gray with brown mottles, moist, stiff [PLEISTOCENE MARINE CLAY]						
			10	50 6"	Sandstone		Sandstone - dark gray, weathers brownish-yellow, fine-grained, moderately weathered, appears moderately strong and moderately hard based on drilling resistance						
	70						Bottom of Borehole (BOB) at 68'6" feet below the ground surface (bgs). Water depth after drilling about 6 feet. Backfilled with grout tremied into the hole.						
	75												
	80												
	85												
	90												
	95												
	100												

Project: **Marin A, City Ventures** Project Location: **Woodland Avenue, San Rafael** Project Number: **K050.G**	# Log of Boring B-3 **Sheet 1 of 1**	**Quantum Geotechnical Inc.** 1110 Burnett Avenue., Ste. B Concord, CA, 94520

Date(s) Drilled **04/01/24**	Logged By **JF**	Checked By
Drilling Method **Hollow Stem**	Drill Bit Size/Type **7" O.D.**	Total Depth of Borehole **29.45 feet bgs**
Drill Rig Type **Mobil B57 -Track Mounted**	Drilling Contractor **Stapleton Engineering**	Approximate Surface Elevation
Groundwater Level and Date Measured **5**	Sampling Method(s) **Modified California, Pitcher, SPT**	Hammer Data **Auto**
Borehole Backfill **Tremy Grout**	Location **See Site Plan**	

Elevation (feet)	Depth (feet)	Sample Number	Sampling Resistance, blows/ft	Material Type	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Percent Fines	LL, %	PI, %	UC, ksf
	0			Asphalt	ASPHALT - deteriorated into gravel and asphalt pieces, approximately 4-inches thick [FILL - DETERIORATED PAVEMENT]						
		1	15	CL	Gravelly, Sandy CLAY (CL) - dark brown, moist, stiff, little to some fine and coarse angular to subangular gravel to est. 2-inch size [FILL]	15.7	110.9		48	24	
				GC	Clayey, Sandy GRAVEL (GC) - light gray, moist, dense, fine to coarse sand, fine and coarse gravel, cement pieces up to est. 6-inch size [FILL]						
	5	2	11	CH	Fat CLAY with Sand and Gravel (CH) - very dark gray and brown, moist, medium stiff (firm) [FILL]	15.2	105.5				
		3	6		- change to soft						
				CH	Fat CLAY(CH) - dark gray, wet, soft [YOUNG BAY MUD]						
	10	4	WOH 1,2		- very soft, strong organic odor	79.1	52.9		86	52	
	15	5	100 psf	CH-MH	Silty Fat CLAY / Elastic SILT (CH/MH) - dark gray, wet, soft						
	20				- greenish-gray, stiff						
		6	50 6"	SM	Silty SAND (SM) - yellow-brown, moist, very dense	10.0	117.2				
	25			Sandstone	Sandstone - dark gray, weathers brownish-yellow, fine-grained, moderately strong, moderately hard. Total depth 29'5" feet bgs. Water depth after drilling about 5 feet. Backfilled with grout tremied into the hole.						
		7	50 5"								
	30										

Project: **Marin A, City Ventures**	# Log of Boring B-4	**Quantum Geotechnical Inc.**
Project Location: **Woodland Avenue, San Rafael**	**Sheet 1 of 2**	1110 Burnett Avenue., Ste. B
Project Number: **K050.G**		Concord, CA, 94520

Date(s) Drilled **04/01/24**	Logged By **JF**	Checked By
Drilling Method **Hollow Stem**	Drill Bit Size/Type **7" O.D.**	Total Depth of Borehole **54.5 feet bgs**
Drill Rig Type **Mobil B57 -Track Mounted**	Drilling Contractor **Stapleton Engineering**	Approximate Surface Elevation
Groundwater Level and Date Measured **6**	Sampling Method(s) **Modified California, Pitcher, SPT**	Hammer Data **Auto**
Borehole Backfill **Tremy Grout**	Location **See Site Plan**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Percent Fines	LL, %	PI, %	UC, ksf
	0				Asphalt		ASPHALT - soft, about 8-inches thick						
					CL		Gravelly, Sandy CLAY (CL) - brown, moist, stiff, moderately plastic, little to some fine and coarse gravel [FILL]						
			1	50 6"				63.6	55.7				
			2	16,4	Concrete		- change to gray, mixed with apparent cementitious materials [FILL]						
					CH		- cement layer, took about 5 minutes to penetrate						
	5		3	7			Fat Organic CLAY(CH/OH) - black, soft [PEAT]	65.7	57.3				
							- very soft, wet						
					CH		Fat CLAY with Organics [CH] - greenish-gray with brown mottles, wet, very soft [YOUNG BAY MUD]						
	10		4	WOH 1,1				138.9	35.4				
	15												
	20						- dark gray, trace shells, trace organics [Collected SHELBY]						
			5	100 psf									
	25												
	30												

Project: **Marin A, City Ventures**
Project Location: **Woodland Avenue, San Rafael**
Project Number: **K050.G**

Log of Boring B-4
Sheet 2 of 2

Quantum Geotechnical Inc.
1110 Burnett Avenue., Ste. B
Concord, CA, 94520

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Percent Fines	LL, %	PI, %	UC, ksf
	30						Silty FAT Clay (CH) continues - greenish-gray w/ reddish-brown mottles, moist, soft, trace sand [YOUNG BAY MUD]						
	35												
	40		6	20			Silty Fat CLAY (CH) - greenish-gray with reddish-brown mottles, moist, stiff, little sand [LATE PLEISTOCENE-AGE MARINE CLAY]	23.5	103.1				
					CH		Sandy CLAY with Gravel (CL) - brown, moist, very stiff, little fine and coarse angular gravel [PLEISTOCENE ALLUVIUM]						
	45												
	50		6	45			- reddish-brown	20.4	107.6				
					Shale		Shale - dark brownish-gray, appears moderately soft, weak, based on drilling resistance						
			8	50 6"	Sandstone		Sandstone - dark gray, weathers brownish-yellow, fine-grained, moderately strong, moderately hard.						
	55						Bottom of Borehole (BOB) at 54'6" feet below the ground surface (bgs). Water depth after drilling about 6 feet. Backfilled with grout tremied into the hole.						
	60												
	65												

Project: **Marin A, City Ventures** Project Location: **Woodland Avenue, San Rafael** Project Number: **K050.G**	Log of Boring B-5 **Sheet 1 of 1**	**Quantum Geotechnical Inc.** 1110 Burnett Avenue., Ste. B Concord, CA, 94520

Date(s) Drilled **04/01/24**	Logged By **JF**	Checked By
Drilling Method **Hand Augured**	Drill Bit Size/Type **3" O.D.**	Total Depth of Borehole **5.5 feet bgs**
Drill Rig Type	Drilling Contractor **Stapleton Engineering**	Approximate Surface Elevation
Groundwater Level and Date Measured **2.5**	Sampling Method(s) **Grab**	Hammer Data **Auto**
Borehole Backfill	Location **See Site Plan**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Percent Fines	LL, %	PI, %	UC, ksf
	0				Grass								
					OL-OH		Organic Soil (OL) - very dark gray, very moist, soft						
			1	n/a	GW-GM		Well-Graded Sandy Gravel with Silt (GW-GM) - grayish-brown, moist, loose, fine and coarse gravel, fine to coarse-grained sand [FILL]	14.0		4			
	5		2	n/a	CH		Fat CLAY with Organics [CH] - dark greenish-gray with red mottles, wet, very soft [YOUNG BAY MUD]						
							Hand augured to depth of 5.5 feet below the ground surface (bgs). Groundwater depth 2.5 feet.						
	10												
	15												
	20												
	25												
	30												

Project: **Marin A, City Ventures** Project Location: **Woodland Avenue, San Rafael** Project Number: **K050.G**	Key to Log of Boring **Sheet 1 of 1**	**Quantum Geotechnical Inc.** 1110 Burnett Avenue., Ste. B Concord, CA, 94520

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Percent Fines	LL, %	PI, %	UC, ksf
1	2	3	4	5	6	7	8	9	10	11	12	13	14

COLUMN DESCRIPTIONS

1 Elevation (feet): Elevation (MSL, feet).
2 Depth (feet): Depth in feet below the ground surface.
3 Sample Type: Type of soil sample collected at the depth interval shown.
4 Sample Number: Sample identification number.
5 Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
6 Material Type: Type of material encountered.
7 Graphic Log: Graphic depiction of the subsurface material encountered.
8 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
9 Water Content, %: Water content of the soil sample, expressed as percentage of dry weight of sample.
10 Dry Unit Weight, pcf: Dry weight per unit volume of soil sample measured in laboratory, in pounds per cubic foot.
11 Percent Fines: The percent fines (soil passing the No. 200 Sieve) in the sample. WA indicates a Wash Sieve, SA indicates a Sieve Analysis.
12 LL, %: Liquid Limit, expressed as a water content.
13 PI, %: Plasticity Index, expressed as a water content.
14 UC, ksf: Unconfined compressive strength, in kips per square foot.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

Asphaltic Concrete (AC)
Fat CLAY, CLAY w/SAND, SANDY CLAY (CH)
Fat CLAY/SILT (CH-MH)
Lean CLAY, CLAY w/SAND, SANDY CLAY (CL)
Portland Cement Concrete
Clayey GRAVEL (GC)
Silty GRAVEL (GM)
Grass and/or topsoil
Well graded GRAVEL with Silt (GW-GM)
Low plasticity PEAT (OL)
Low to High plasticity PEAT (OL-OH)
Sandstone
Clayey SAND (SC)
Shale
Silty SAND (SM)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Auger sampler
Bulk Sample
3-inch-OD California w/ brass rings
CME Sampler
Grab Sample
2.5-inch-OD Modified California w/ brass liners
Pitcher Sample
2-inch-OD unlined split spoon (SPT)
Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS

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

GENERAL NOTES

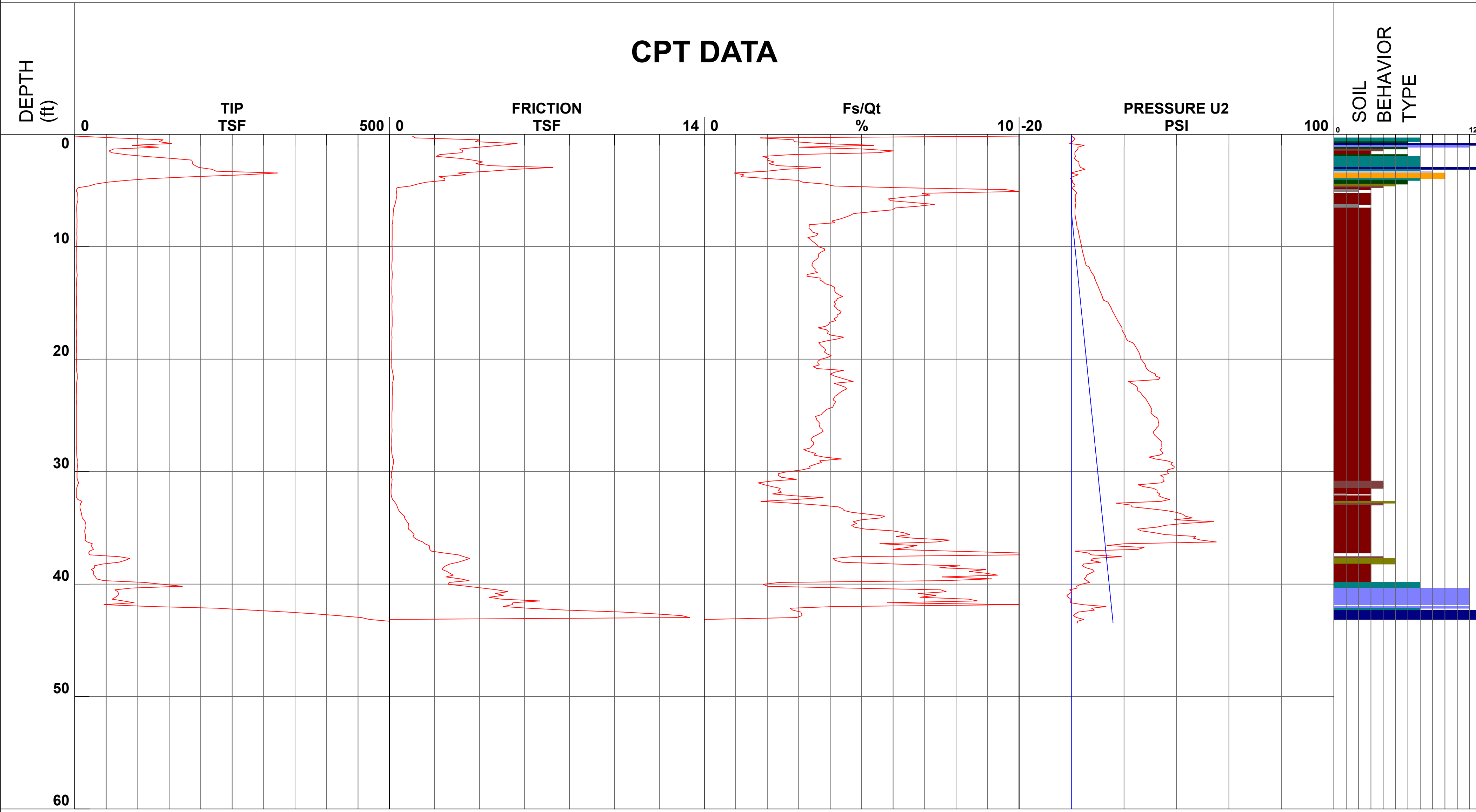
1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific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

Quantum Geotechnical

Project	Auburn Street and Woodland Avenue	Operator	AJ-ER	Filename	SDF(958).cpt
Job Number	K050.G	Cone Number	DPG1556	GPS	
Hole Number	CPT-01	Date and Time	8/31/2023 5:32:01 PM	Maximum Depth	43.47 ft
EST GW Depth During Test		7.00 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

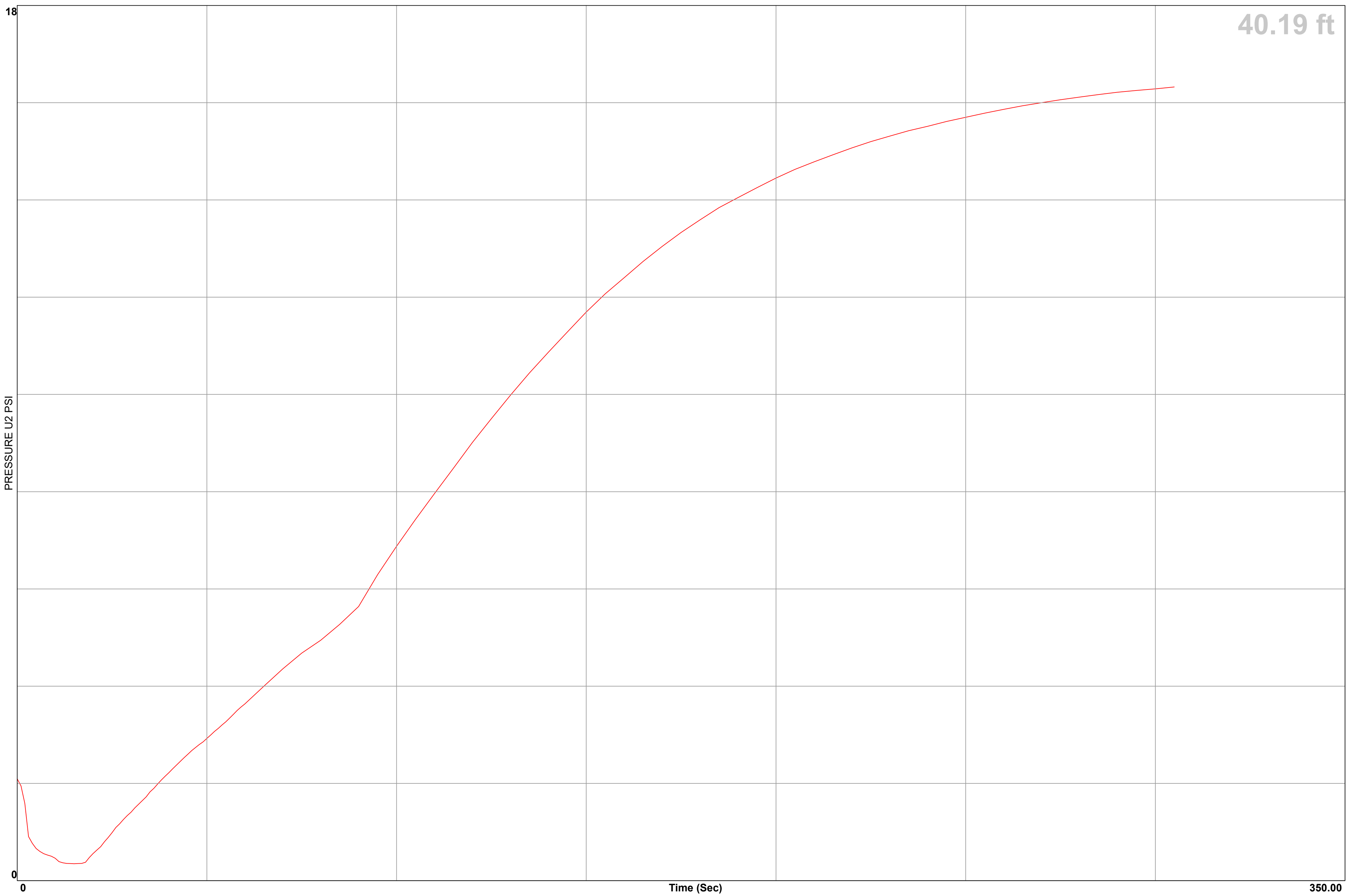
Cone Size 15cm²

S*Soil behavior type and SPT based on data from UBC-1983

Quantum Geotechnical

Location	Auburn Street and Woodland Avenue	Operator	AJ-ER
Job Number	K050.G	Cone Number	DPG1556
Hole Number	CPT-01	Date and Time	8/31/2023 5:32:01 PM
Equilized Pressure	16.3	EST GW Depth During Test	2.5

GPS

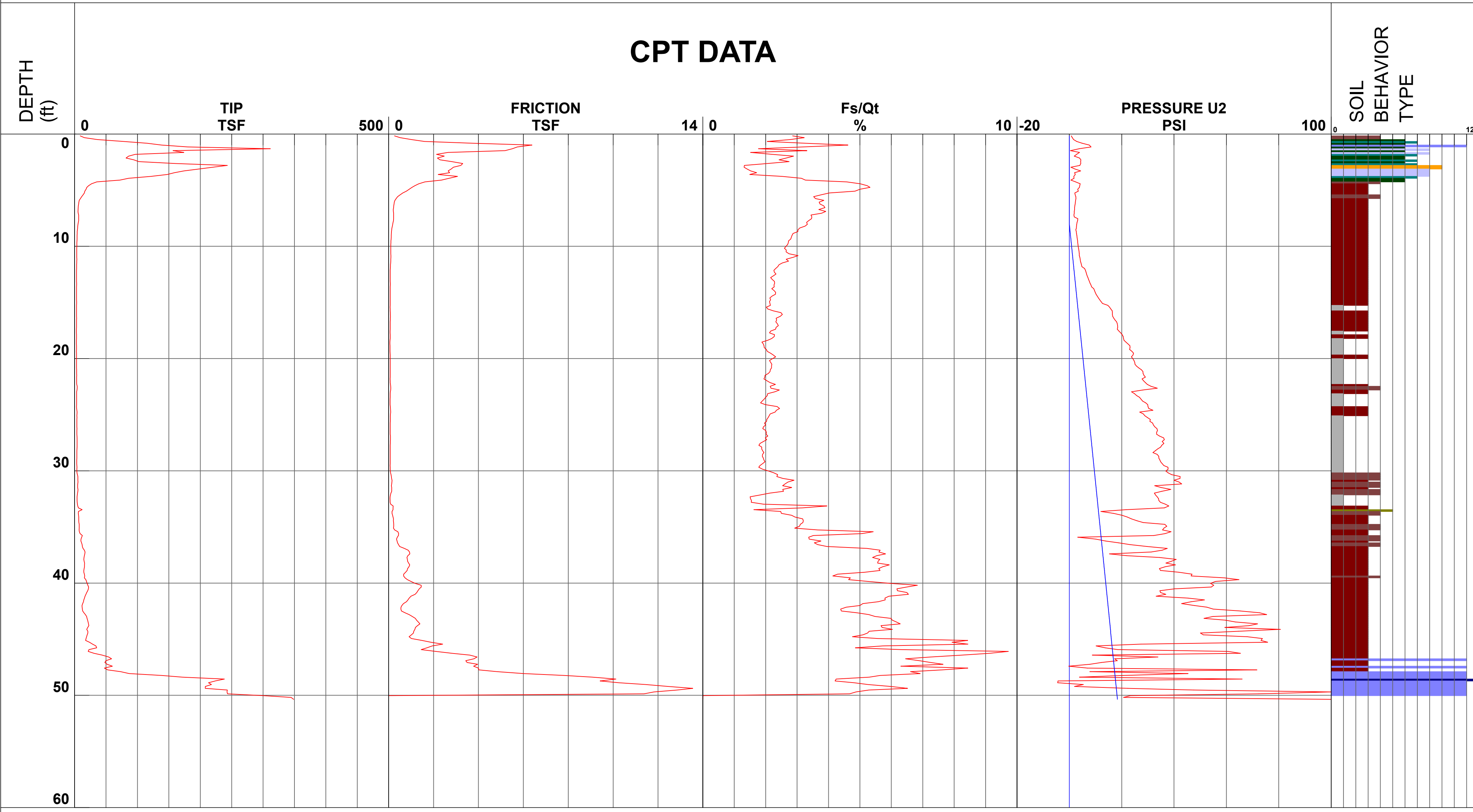


Quantum Geotechnical

Project	Auburn Street and Woodland Avenue	Operator	AJ-ER	Filename	SDF(955).cpt
Job Number	K050.G	Cone Number	DPG1556	GPS	
Hole Number	CPT-02	Date and Time	8/31/2023 3:33:13 PM	Maximum Depth	50.36 ft
EST GW Depth During Test		8.00 ft			

Net Area Ratio .8

CPT DATA



- 1 - sensitive fine grained
- 2 - organic material
- 3 - clay
- 4 - silty clay to clay
- 5 - clayey silt to silty clay
- 6 - sandy silt to clayey silt
- 7 - silty sand to sandy silt
- 8 - sand to silty sand
- 9 - sand
- 10 - gravelly sand to sand
- 11 - very stiff fine grained (*)
- 12 - sand to clayey sand (*)

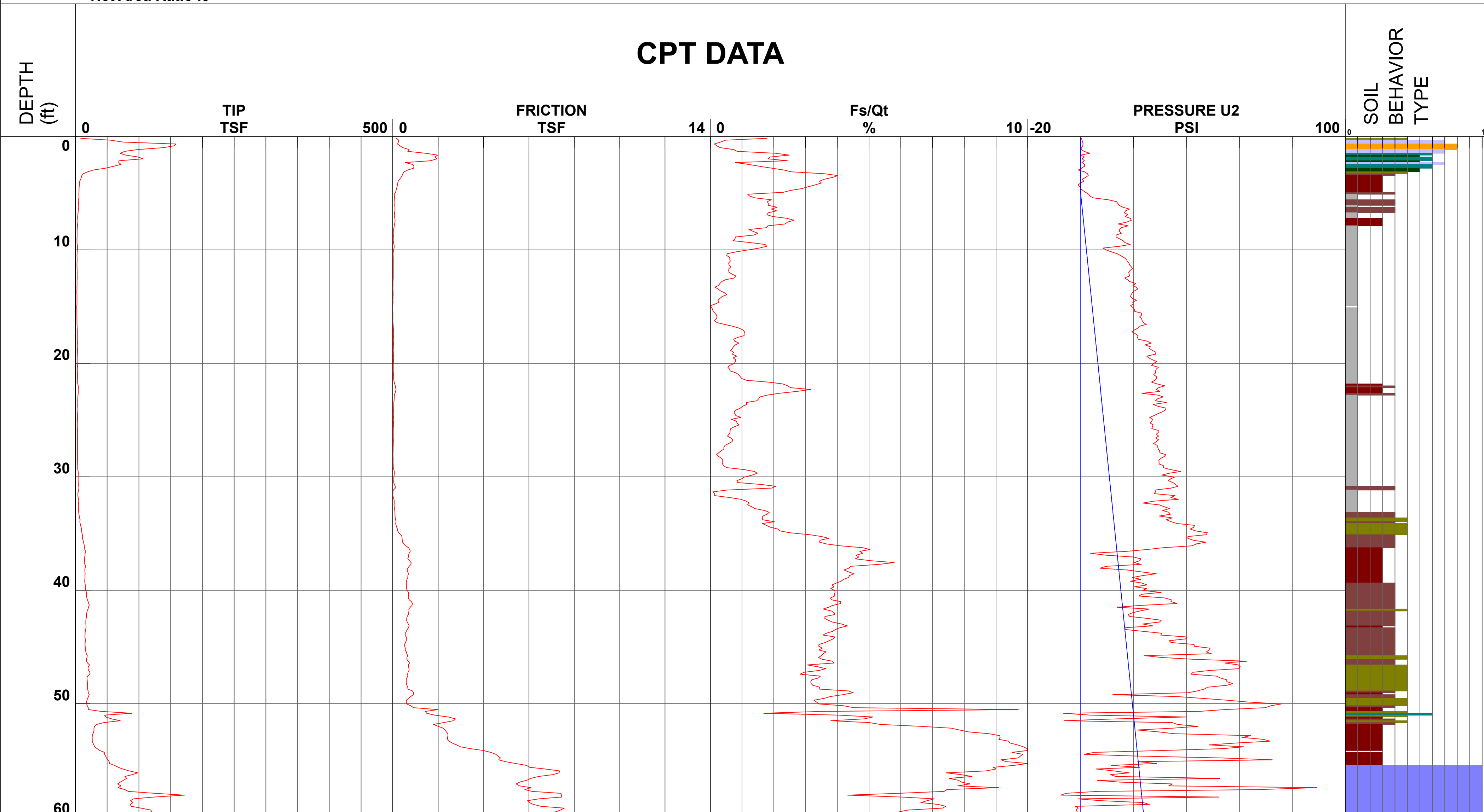
Cone Size 15cm²

S*Soil behavior type and SPT based on data from UBC-1983

Quantum Geotechnical

Project	Auburn Street and Woodland Avenue	Operator	AJ-ER	Filename	SDF(954).cpt
Job Number	K050.G	Cone Number	DPG1556	GPS	
Hole Number	CPT-03	Date and Time	8/31/2023 1:24:41 PM	Maximum Depth	60.53 ft
EST GW Depth During Test		5.00 ft			

Net Area Ratio .8



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Cone Size 15cm²

S*Soil behavior type and SPT based on data from UBC-1983

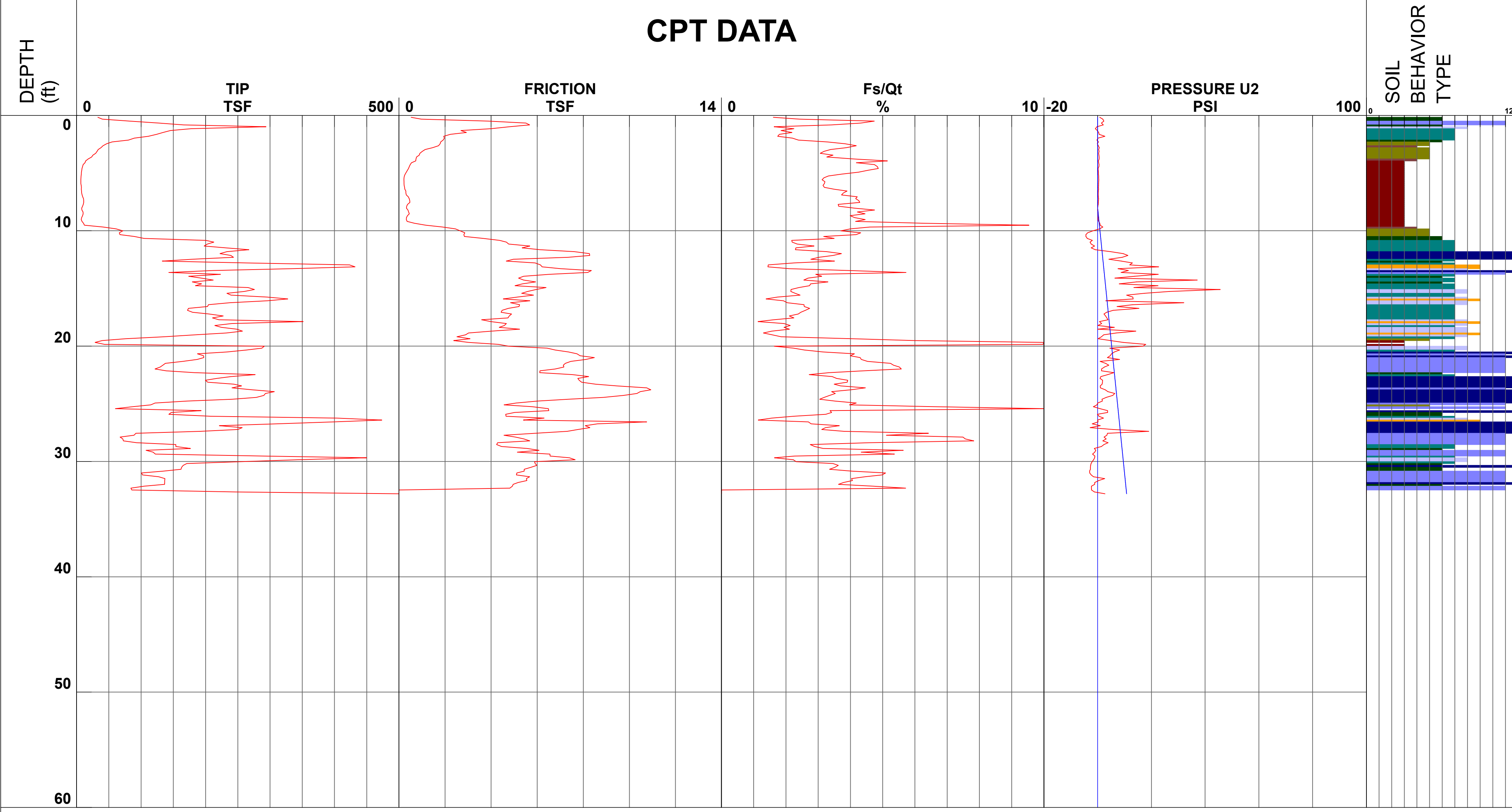
Quantum Geotechnical

Project	Auburn Street and Woodland Avenue	Operator	AJ-ER
Job Number	K050.G	Cone Number	DPG1556
Hole Number	CPT-04	Date and Time	8/31/2023 4:35:06 PM
EST GW Depth During Test			8.00 ft

Filename	SDF(956).cpt
GPS	
Maximum Depth	32.81 ft

Net Area Ratio .8

CPT DATA



- 1 - sensitive fine grained
- 2 - organic material
- 3 - clay
- 4 - silty clay to clay
- 5 - clayey silt to silty clay
- 6 - sandy silt to clayey silt
- 7 - silty sand to sandy silt
- 8 - sand to silty sand
- 9 - sand
- 10 - gravelly sand to sand
- 11 - very stiff fine grained (*)
- 12 - sand to clayey sand (*)

Cone Size 15cm²

S*Soil behavior type and SPT based on data from UBC-1983

APPENDIX B

Laboratory Investigation

Summary of Laboratory Test Results

Consolidation Test Results

Corrosion Test Results

LABORATORY INVESTIGATION

The laboratory testing program was directed towards providing sufficient information for the determination of the engineering characteristics of the site soils so that the recommendations outlined in this report could be formulated.

Moisture content and dry unit weight tests were performed on relatively undisturbed soil samples in order to determine the consistency of the soil and moisture variation throughout the explored soil profile and to estimate the compressibility of the underlying soils.

Sieve analysis testing was performed to determine the percentage of fines.

Atterberg Limits tests were performed to determine the expansion potential of the foundation soils.

The strength parameters of the foundation soils were obtained by evaluating the penetration resistance (blow counts) during sample recovery.

Consolidation Tests were performed on select samples to assess the consolidation settlement of the soft Young Bay Mud

Corrosivity Testing was performed on the near surface soil to assess corrosion potential against buried metal pipe and concrete.

A summary of all laboratory test results is presented on Table B-I of this appendix and some on the respective "Logs of Test Borings", Appendix A.

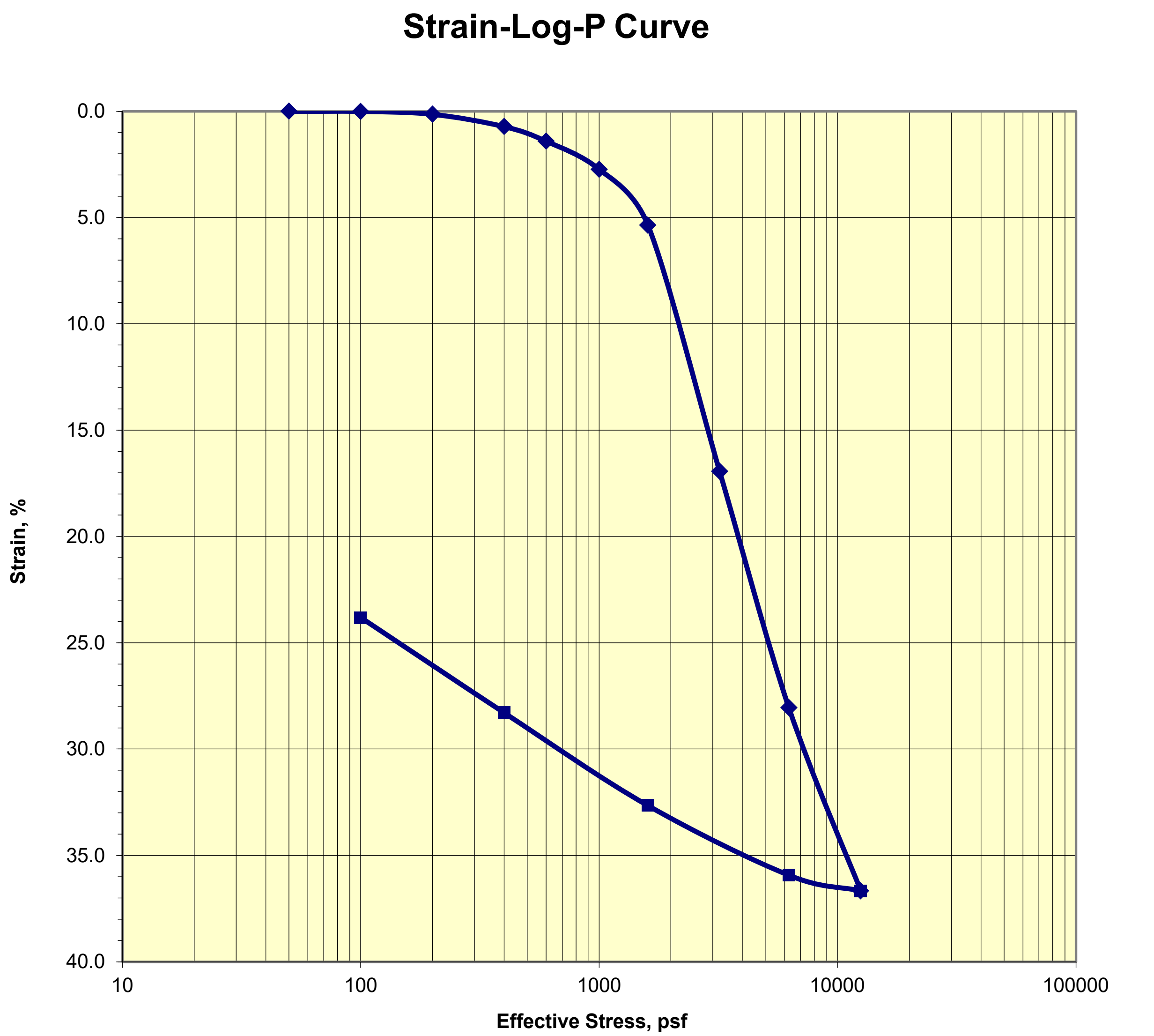
TABLE B-1 - SUMMARY OF LABORATORY TESTS

Sample Number	Depth (ft)	Dry Density (p.c.f.)	Moisture Content (% Dry Wt.)	Atterberg Limits		Sieve Analysis (% Passing No. 200 Sieve)
				Liquid Limit (%)	Plasticity Index (%)	
1-1	3	109.4	12.8	32	12	
1-2	5	119.8	9.5			
1-4	10	73.0	46.9			
1-6	41	108.8	21.6			
2-1	3	106.3	17.3			
2-2	5		25.4			
2-6	41	100.2	24.9			
2-7	46	106.2	21.9			
2-8	55	28.2				
2-9	60	48.3				
3-1	2	110.9	15.7	48	24	
3-2	4.5	105.5	15.2			
3-4	11	52.9	79.1	86	52	
3-6	25	117.2	10.0			
4-1	2	55.7	63.6			
4-3	5	57.3	65.7			
4-4	9.5	35.4	138.9			
4-6	41	103.1	23.5			
4-7	51	107.6	20.4			
5-1	2		14.0			4

COOPER TESTING LABORATORY

Consolidation Test
ASTM D2435

Job No.:	970-097	**Boring:**	B-1	**Run By:**	HM
Client:	Quantum Geotechnical	**Sample:**	5	**Reduced:**	RU
Project:	K050.G	**Depth, ft.:**	20	**Checked:**	PJ
Soil Type:	Greenish Gray CLAY (Bay Mud)			**Date:**	4/23/2024



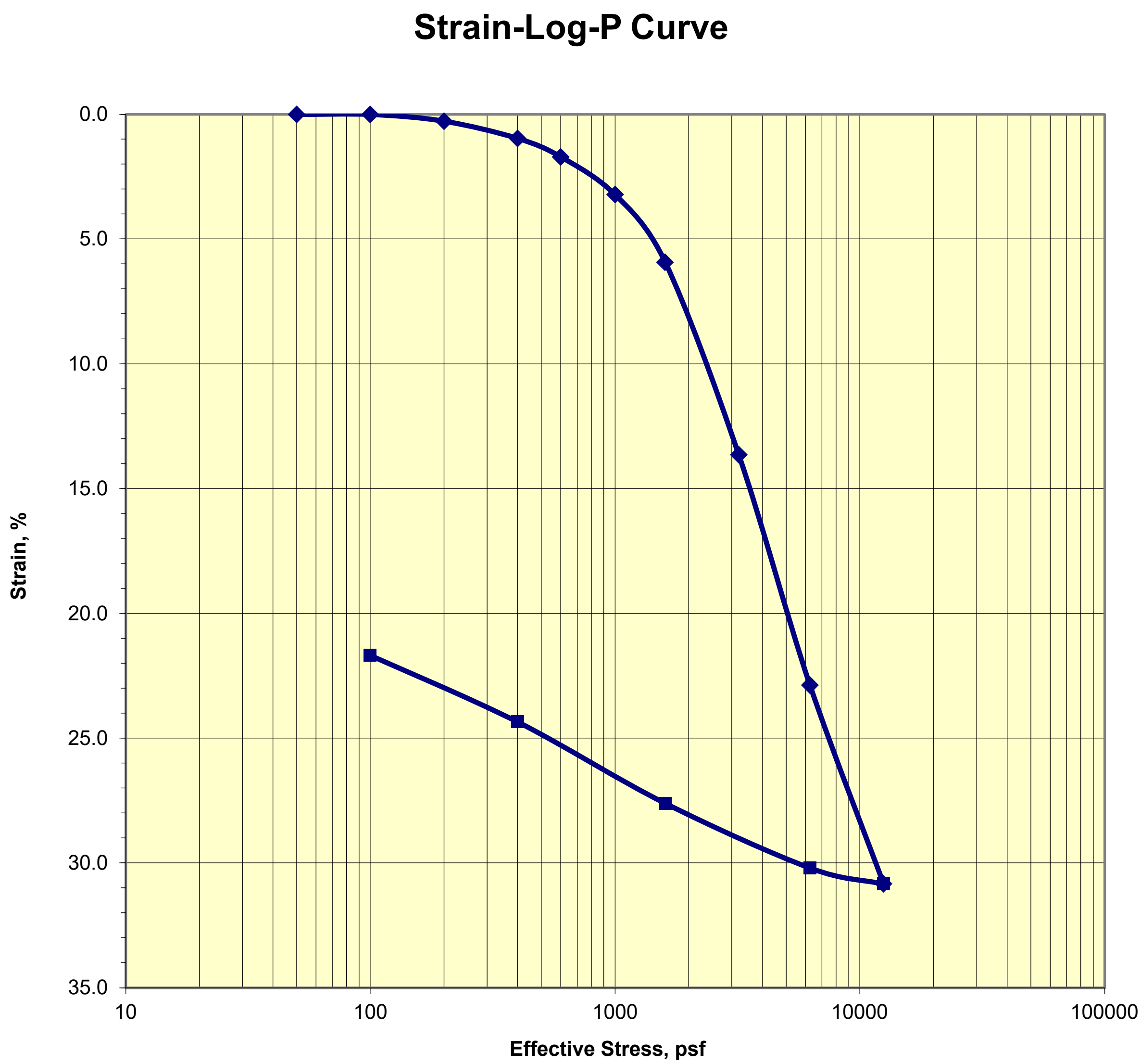
Assumed Gs 2.6	**Initial**	**Final**
Moisture %:	114.7	77.3
Dry Density, pcf:	40.3	53.9
Void Ratio:	3.030	2.009
% Saturation:	98.4	100.0

Remarks:

Consolidation Test
ASTM D2435

COOPER TESTING LABORATORY

Job No.:	970-097	**Boring:**	B-2	**Run By:**	HM
Client:	Quantum Geotechnical	**Sample:**	4	**Reduced:**	RU
Project:	K050.G	**Depth, ft.:**	11	**Checked:**	PJ
Soil Type:	Greenish Gray CLAY (Bay Mud)			**Date:**	4/23/2024



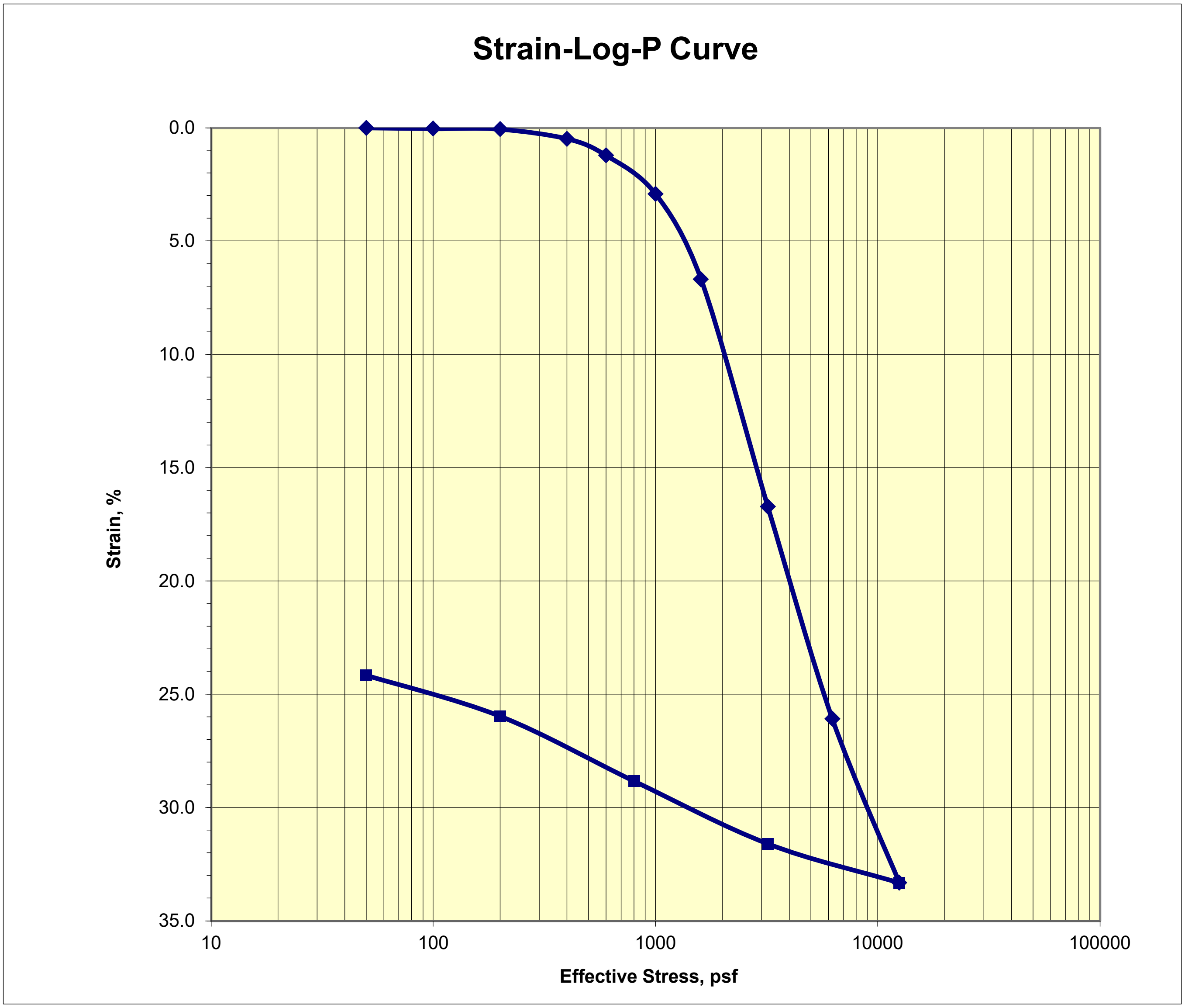
Assumed Gs 2.6	**Initial**	**Final**
Moisture %:	83.3	57.6
Dry Density, pcf:	50.8	65.0
Void Ratio:	2.192	1.498
% Saturation:	98.8	100.0

Remarks:

COOPER TESTING LABORATORY

Consolidation Test
ASTM D2435

Job No.:	970-097	**Boring:**	B-3	**Run By:**	HM
Client:	Quantum Geotechnical	**Sample:**	5	**Reduced:**	RU
Project:	K050.G	**Depth, ft.:**	15	**Checked:**	PJ
Soil Type:	Greenish Gray CLAY (Bay Mud)			**Date:**	4/24/2024



Assumed Gs 2.65	**Initial**	**Final**
Moisture %:	86.4	56.9
Dry Density, pcf:	49.8	66.0
Void Ratio:	2.323	1.508
% Saturation:	98.6	100.0

Remarks:

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

Client: Quantum Geotechnical
Client's Project No.: K050.G
Client's Project Name: Woodland Avenue, San Rafael, CA
Date Sampled: 1-Apr-2024
Date Received: 3-Apr-2024
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 10-Apr-2024

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Resistivity (As Received) (ohms-cm)	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
2404010-001	B-3 Cuttings @ 2'	-	8.20	-	2,000	-	N.D.	24
2404010-002	B-5 Grab @ 2'	-	8.46	-	7,800	-	N.D.	N.D.

Method:	ASTM D1498	ASTM D4972	ASTM G57	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	-	-	50	15	15
Date Analyzed:	-	4-Apr-2024	-	4-Apr-2024	-	4-Apr-2024	4-Apr-2024

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

Julia Clauson
Chemist

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

APPENDIX C

The Grading Specification

Guide Specifications for Rock Under Floor Slabs

THE GRADING SPECIFICATIONS

Proposed Residential Development, Auburn Grove
Woodland Avenue and Auburn Street
San Rafael, California

1. General Description

1.1 These specifications have been prepared for the grading and site development of the subject residential development. ***Quantum Geotechnical Inc.***, hereinafter described as the Soil Engineer, should be consulted prior to any site work connected with site development to ensure compliance with these specifications.

1.2 The Soil Engineer should be notified at least two working days prior to any site clearing or grading operations on the property in order to observe the stripping of organically contaminated material and to coordinate the work with the grading contractor in the field.

1.3 This item shall consist of all clearing or grubbing, preparation of land to be filled, filling of the land, spreading, compaction and control of fill, and all subsidiary work necessary to complete the grading of the filled areas to conform with the lines, grades, and slopes as shown on the accepted plans. The Soil Engineer is not responsible for determining line, grade elevations, or slope gradients. The property owner, or his representative, shall designate the person or organizations who will be responsible for these items of work.

1.4 The contents of these specifications shall be integrated with the soil report of which they are a part, therefore, they shall not be used as a self-contained document.

2. Tests

The standard test used to define maximum densities of all compaction work shall be the ASTM D1557-12 Laboratory Test Procedure. All densities shall be expressed as a relative compaction in terms of the maximum dry density obtained in the laboratory by the foregoing standard procedure.

3. Clearing, Grubbing, and Preparing Areas To Be Filled

3.1 If encountered, all vegetable matter, trees, root systems, shrubs, debris, and organic topsoil shall be removed from all structural areas and areas to receive fill.

3.2 If encountered, any soil deemed soft or unsuitable by the Soil Engineer shall be removed. Any existing debris or excessively wet soils shall be excavated and removed as required by the Soil Engineer during grading.

3.3 All underground structures shall be removed from the site such as old foundations, abandoned pipe lines, septic tanks, and leach fields.

3.4 The final stripped excavation shall be approved by the Soil Engineer during construction and before further grading is started.

3.5 After the site has been cleared, stripped, excavated to the surface designated to receive fill, and scarified, it shall be disked or bladed until it is uniform and free from large clods. The native subgrade soils shall be moisture conditioned and compacted to the requirements as specified in the grading section of this report. Fill can then be placed to provide the desired finished grades. The contractor shall obtain the Soil Engineer's approval of subgrade compaction before any fill is placed.

4. Materials

4.1 All fill material shall be approved by the Soil Engineer. The material shall be a soil or soil-rock mixture which is free from organic matter or other deleterious substances. The fill material shall not contain rocks or lumps over 6 inches in greatest dimension and not more than 15% larger than 2-1/2 inches. Materials from the site below the stripping depth are suitable for use in fills provided the above requirements are met.

4.2 Materials existing on the site are suitable for use as compacted engineered fill after the removal of all debris and organic material. All fill soils shall be approved by the Soil Engineer in the field.

4.3 Should import material be required, it should be approved by the soil Engineer before it is brought to the site.

5. Placing, Spreading, and Compacting Fill Material

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

5.2 After each layer has been placed, mixed, and spread evenly, either import material or native material shall be compacted to a relative compaction designated for engineered fill.

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

5.4 Field density tests shall be made in each compacted layer by the Soil Engineer in accordance with Laboratory Test Procedure ASTM D1556-15 or D6938-10. When footed rollers are used for compaction, the density tests shall be taken in the compacted material below the surface disturbed by the roller. When these tests indicate that the compaction requirements on any layer of fill, or portion thereof, has not been met, the particular layer, or portion thereof, shall be reworked until the compaction requirements have been met.

5.5 No soil shall be placed or compacted during periods of rain nor on ground which contains free water. Soil which has been soaked and wetted by rain or any other cause shall not be compacted until completely drained and until the moisture content is within the limits hereinbefore described or approved by the Soil Engineer. Approval by the Soil Engineer shall be obtained prior to continuing the grading operations.

6. Pavement

6.1 The proposed subgrade under pavement sections, native soil, and/or fill shall be compacted to a minimum relative compaction of 95% at 2% above optimum moisture content for a depth of 12 inches.

6.2 All aggregate base material placed subsequently should also be compacted to a minimum relative compaction of 95% based on the ASTM Test Procedure D1557-12. The construction of the pavement in the parking and traffic areas should conform to the requirements set forth by the latest Standard Specifications of the Department of Transportation of the State of California and/or Marin County, Department of Public Works.

6.3 It is recommended that soils at the proposed subgrade level be tested for a pavement design after the preliminary grading is completed and the soils at the site design subgrade levels are known.

7. Utility Trench Backfill

7.1 The utility trenches extending under concrete slabs-on-grade shall be backfilled with native on-site soils or approved import materials and compacted to the requirements pertaining to the adjacent soil. No ponding or jetting will be permitted.

7.2 Utility trenches extending under all pavement areas shall be backfilled with native or approved import material and properly compacted to meet the requirements set forth by the Marin County, Department of Public Works.*

7.3 Where any opening is made under or through the perimeter foundations for such items as utility lines and trenches, the openings must be resealed so that they are watertight to prevent the possible entrance of outside irrigation or rain water into the underneath portion of the structures.

8. Subsurface Line Removal

8.1 The methods of removal will be designated by the Soil Engineer in the field depending on the depth and location of the line. One of the following methods will be used.

8.2 Remove the pipe and fill and compact the soil in the trench according to the applicable portions of sections pertaining to compaction and utility backfill.

8.3 The pipe shall be crushed in the trench. The trench shall then be filled and compacted according to the applicable portions of Section 5.

8.4 Cap the ends of the line with concrete to prevent entrance of water. The length of the cap shall not be less than 5 feet. The concrete mix shall have a minimum shrinkage.

9. Unusual Conditions

9.1 In the event that any unusual conditions not covered by the special provisions are encountered during the grading operations, the Soil Engineer shall be immediately notified for additional recommendations.

10. General Requirements

Dust Control

10.1 The contractor shall conduct all grading operations in such a manner as to preclude windblown dirt and dust and related damage to neighboring properties. The means of dust control shall be left to the discretion of the contractor and he shall assume liability for claims related to windblown material.

GUIDE SPECIFICATIONS FOR ROCK UNDER FLOOR SLABS

Definition

Graded gravel or crushed rock for use under slabs-on-grade shall consist of a minimum thickness of mineral aggregate placed in accordance with these specifications and in conformance with the dimensions shown on the plans. The minimum thickness is specified in the accompanying report.

Material

The mineral aggregate shall consist of broken stone, crushed or uncrushed gravel, quarry waste, or a combination thereof. The aggregate shall be free from deleterious substances. It shall be of such quality that the absorption of water in a saturated dry condition does not exceed 3% of the oven dry weight of the sample.

Gradation

The mineral aggregate shall be of such size that the percentage composition by dry weight, as determined by laboratory sieves (U.S. Sieves) will conform to the following gradation:

Sieve Size	Percentage Passing
¾’’	90-100
No. 4	25-60
No. 8	18-45
No. 200	0-3

Placing

Subgrade, upon which gravel or crushed rock is to be placed, shall be prepared as outlined in the accompanying soil report.