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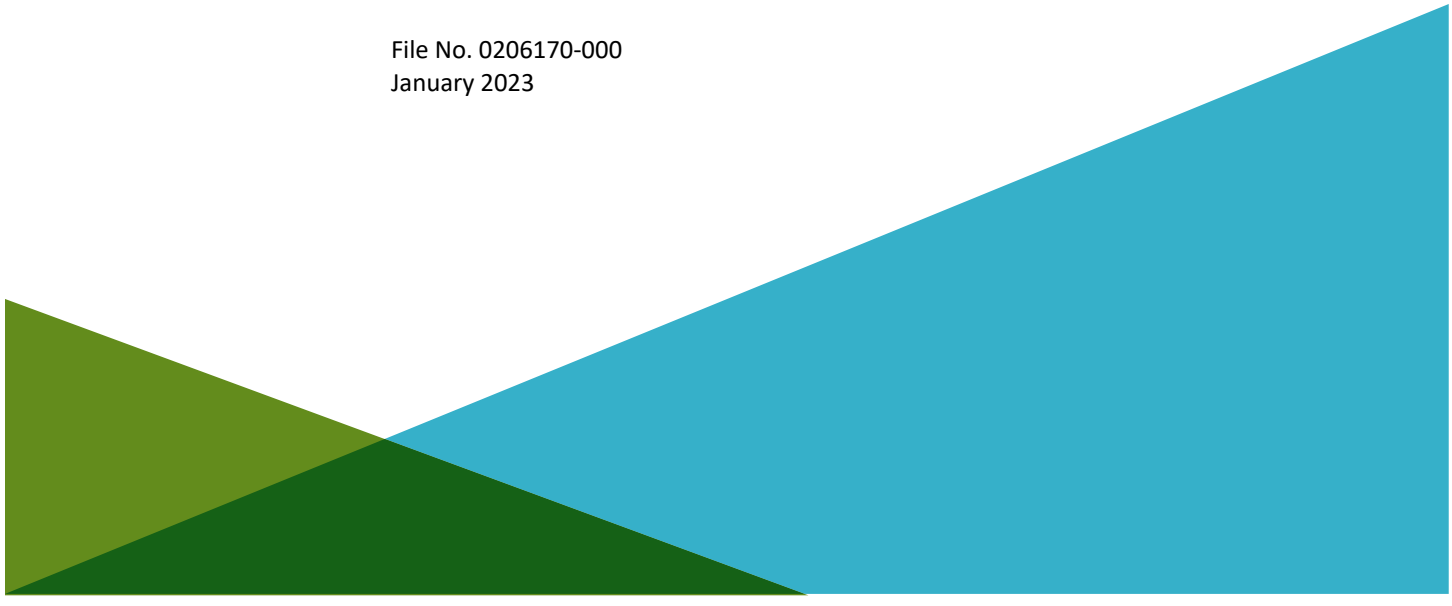
REPORT ON

DESIGN LEVEL GEOTECHNICAL INVESTIGATION
STINSON BEACH LIFEGUARD TOWER AND VISITOR SNACK BAR REPLACEMENT
MARIN COUNTY, CALIFORNIA

by
Haley & Aldrich, Inc.
Walnut Creek, California

for
DHM Design
Denver, Colorado

File No. 0206170-000
January 2023



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17 January 2023
File No. 0206170-000

DHM Design
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Attention: Aicha Menendez

Subject: Design Level Geotechnical Investigation Report
Stinson Beach Lifeguard Tower and Visitor Snack Bar Replacement
Marin County, California

Ladies and Gentlemen:

Enclosed is our draft geotechnical investigation report for the proposed Stinson Beach Lifeguard Tower and Visitor Snack Bar Replacement in Stinson Beach, California.

We understand the proposed project will include the construction of a new three-story Lifeguard Tower and Visitor Snack Bar building with a gross footprint of 2,800 square feet. The new building will include a covered deck, an at-grade parking garage, a wooden boardwalk, a wood retaining wall, and a concrete slab-on-grade. Additional improvements include underground utilities and other site improvements, including new pavements and hardscapes as well as landscape features.

This report contains discussions regarding subsurface conditions, seismicity and seismic hazards, and foundation recommendations. We find that the primary geotechnical issues that should be addressed during the design and construction of the planned project includes strong seismic shaking, potentially liquefiable soil layers up to 50 feet below ground surface, and undocumented fill. To mitigate these potential issues, we recommend that the proposed three-story building be supported on a deep foundation system of prestressed concrete piles that penetrates through the fill and potentially liquefiable soil layers to gain support in underlying native alluvial clays and sands. The deck and boardwalk will be supported on timber piles.

Without mitigation, settlement following a design level earthquake is estimated to be on the order of 6 to 8 inches total and up to 4 to 6 inches of differential settlement over 50 feet or between columns. With mitigation of deep foundations, total settlement at the columns following a design level seismic event is anticipated to be less than 1 inch with ½ inch of differential settlement between the columns. This will not, however, protect unimproved areas such as slab-on-grade or exterior improvements.

Our recommendations regarding foundations, Site grading, fill compaction, and other geotechnical aspects of this project are presented in this geotechnical investigation report. The recommendations contained in this report are based on a limited subsurface investigation. Variations between expected

and actual soil conditions may be found in localized areas during construction. Therefore, we should be retained to observe Site preparation, foundation installation, and placement of fill and backfill, during which time we may make changes to our recommendations if deemed necessary.

We appreciate the opportunity to provide our services to you on this project. If you have any questions, please call Catherine at 925.949.4407 or 971.277.8945.

Sincerely yours,
HALEY & ALDRICH, INC.

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Enclosures

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1. Introduction

Stinson Beach, located in Marin County, California, along the California coast, is part of the National Park System. Many of the built structures in this area date to the 1950s and have had limited improvement up to the present day. This report presents the results of our geotechnical investigation of the proposed Stinson Beach Lifeguard Tower and Visitor Snack Bar replacement project located at the Golden Gate National Recreation Area (GGNRA) in Stinson Beach, Marin County, California (Site), as shown on Figure 1, "Project Locus" and Figure 2, "Site Plan." This report describes the subsurface explorations performed at the Site, provides our interpretation of the subsurface data, and includes geotechnical recommendations for the proposed development.

1.1 PURPOSE AND SCOPE

The scope of our services was presented in our revised proposal dated 4 August 2022. Our investigation proposal included the advancement of three cone penetration test (CPT) soundings, including one deep seismic CPT, to perform engineering analyses to develop conclusions and recommendations regarding:

- soil and groundwater conditions at the Site;
- Site seismicity and seismic hazards, including estimates of liquefaction potential, cyclic densification, and lateral spreading, if appropriate;
- measures to mitigate potential seismic hazards, if any;
- measures to improve existing fill, if appropriate;
- appropriate foundation type(s) for the proposed building;
- foundation design criteria, including vertical and lateral capacities;
- estimates of foundation settlement;
- expansion potential of the on-Site soils based on geotechnical laboratory tests and provision of proper mitigation methods, if appropriate;
- design criteria for ground floor slabs;
- Site grading, including criteria for fill quality and compaction;
- flexible and rigid pavement designs;
- seismic design parameters in accordance with the 2019 California Building Code (CBC); and
- construction considerations.

2. Site Conditions and Proposed Construction

The Site is located in the western portion of Stinson Beach in Marin County, California, and is situated along the edge of the shoreline at approximate coordinates of 37.8959° N and 122.6395° W. The Site is included within the GGNRA and is currently occupied by the wooden lifeguard tower and the old Siren Canteen beachside grill. These facilities are accessed by an asphalt driveway and parking lot located north of the amenities. The Site is bounded by the Pacific Ocean and the active shoreline to the west, vegetation on the southeast and northwest sides, and an asphalt paved driveway on the northeast side of the building that leads to the parking lot. The elevation of the asphalt driveway adjacent to the building is 25 feet (per the Site Layout Plan prepared by DHM Design dated 5 December 2022), which decreases to the northeast with an average grade of 9 percent until the driveway changes direction. The driveway then gradually slopes towards the parking lot. The northern end of the Site includes a hill with an elevation of 30 feet at its highest point and is the maximum elevation within the Site. The lowest elevation at the Site is 19 feet and is located at the base of the hill.

2.1 PROJECT DESCRIPTION

It is our understanding that the proposed project will include the demolition of the existing lifeguard tower and grill structure, and the construction of a new Lifeguard Tower and Visitor Snack Bar building totaling three stories and a gross area of 2,800 square feet. The new building will include a partially covered deck, an at-grade parking garage, a wooden boardwalk, a wood retaining wall, and a concrete slab-on-grade. The project will also include improvement of underground utilities and other Site improvements, including new pavements and hardscapes as well as landscape features.

Based on our communications with the Structural Engineering team, we understand that maximum column loads will be on the order of 70 kips of dead plus live load. We have assumed wall loads on the order of 2 to 3 kips per linear foot.

Grading for the Site will be limited to cuts and fills on the order of 2 to 3 feet. Wood retaining walls up to 6 feet are proposed. Trenches for utilities have been assumed to be 5 feet or less in depth.

If the project differs significantly from the conditions described above, we should be consulted to review the applicability of our recommendations.

3. Geology

3.1 REGIONAL GEOLOGY

The Site is located within the Coast Ranges Geomorphic Province of California. Throughout the Cenozoic Era, the western part of California has been affected by tectonic forces associated with lateral or transform plate motion between the North American and Pacific crustal plates, which has produced a complex system of northwest-trending faults - the San Andreas, Hayward, and Calaveras Fault systems being the most prominent within the Bay Area. Uplift, erosion, and subsequent redeposition of sedimentary rocks within this province have been driven primarily by the northwest-southeast directed strike-slip movement of the tectonic plates and the associated northeast-oriented compressional stress. The northwest-trending coastal mountain ranges are the result of an orogeny believed to have been occurring since the Pleistocene epoch (approximately 2 to 3 million years before present). A Regional Geologic Map of the Site is presented in Figure 3.

The Coast Ranges Geomorphic Province is geologically separated into a series of tectonostratigraphic terranes that are northwest-oriented and fault-bounded due to the prevailing tectonic influence of the San Andreas fault system and crustal plate boundary on the area. There are generally two types of basement rocks within the region; older, highly deformed rocks that have been moved long distances by large-scale fault displacement and younger, less deformed rocks of the Tertiary Period that are relatively closer to their source of deposition (Blake et al., 1984).

The Site is situated along a spit of sand within the Bolinas Lagoon littoral cell. Littoral cells are closed systems of deposition along the coast, typically constrained between two coastal prominences or rock outcrops. North of the Site, the Duxbury Reef prominence is underlain by Santa Cruz Mudstone (Miocene) and Rocky Point; south of Stinson Beach comprises Franciscan Complex Mélange (Cretaceous). Between these two points, dune and beach sands of the Quaternary Period have accreted and formed the spit that underlies the Stinson Beach shoreline (Blake et al., 2000).

3.2 REGIONAL SEISMICITY

Coastal Northern California is a region of high seismicity, owing to the tectonics of the crustal plate boundary and the San Andreas Fault System. The major Holocene-active faults in the area are presented in Table I. For each of the Holocene-active faults within 100 kilometers (km) of the site, the distance, fault characteristics, and estimated maximum Moment magnitude, Mw, are summarized in Table I (2014 Working Group on California Earthquake Probabilities, 2015).

TABLE I
Active Faults within 100 km of the Site

Fault Name	Distance (km)	Direction from Site	Mean Characteristic or Maximum Moment Magnitude	Mean Slip Rate (mm/yr)	Fault Length (km)
San Andreas - 1906 Rupture	2	West	7.9	19	473
San Andreas - North Coast South	2	West	7.5	24	191
San Andreas - Peninsula	14	Southeast	7.2	17	85
Northern San Gregorio	14	South	7.2	7	110

Fault Name	Distance (km)	Direction from Site	Mean Characteristic or Maximum Moment Magnitude	Mean Slip Rate (mm/yr)	Fault Length (km)
Total San Gregorio	14	South	7.4	5	176
Point Reyes	18	West	6.8	0.3	47
North Hayward	27	Northeast	6.5	9	35
Total Hayward	27	Northeast	6.9	9	88
Total Hayward-Rodgers Creek	27	Northeast	7.3	9	151
Rodgers Creek	28	Northeast	7.0	9	63
South Hayward	38	East	6.7	9	53
West Napa	46	Northeast	6.5	1	30
Concord/Green Valley	52	East	6.7	--	56
Mt Diablo - MTD	53	East	6.7	2	25
Total Calaveras	56	East	6.9	--	123
Monte Vista-Shannon	62	Southeast	6.8	0.4	41
Greenville	71	East	6.9	2	51
Hunting Creek-Berryessa	73	Northeast	6.9	6	60
Maacama-Garberville	76	North	6.9	9	182
Great Valley 6	76	East	6.7	1.5	45
Great Valley 5	79	East	6.5	1.5	28
Great Valley 4	79	Northeast	6.6	1.5	42
Hayward - Southeast Extension	81	Southeast	6.4	3	26
San Andreas - Santa Cruz Mtns.	98	Southeast	7.0	17	62
Collayomi	98	North	6.5	0.6	29
Great Valley 7	100	East	6.7	1.5	45

Notes:

km = kilometer(s)

mm/yr = millimeters per year

Since 1800, four major earthquakes have been recorded on the 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, reportedly on the San Andreas Fault (Toppozada and Borchardt, 1998). The estimated Moment magnitude, M_w for this earthquake was about 6.25. This earthquake was previously thought to have occurred on the northern portion of the Hayward Fault. In 1838, an earthquake occurred on the San Andreas Fault 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 approximately 470 km in length along the San Andreas Fault, from Shelter Cove to San Juan Bautista. It had a maximum intensity of XI (MM), an M_w of about 7.9, and was felt 560 km away in Oregon, Nevada, and Los Angeles. The Loma Prieta Earthquake of 17 October 1989 occurred on the San Andreas Fault in the Santa Cruz Mountains. It had an M_w of 6.9 and was approximately 33 km from the Site.

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 was 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).

The most recent major earthquake to affect the Bay Area was the West Napa Earthquake of 24 August 2014. The West Napa Earthquake had an M_w of 6.0 and was located approximately 86 km from the Site.

The third Uniform California Earthquake Rupture Forecast (UCERF3) prepared by the U.S. Geological Survey (USGS) reports a 72 percent probability of a magnitude 6.7 or greater earthquake occurring in the San Francisco Bay region (which includes the Site) by the year 2044 (2014 Working Group on California Earthquake Probabilities, 2015). More specifically, the 30-year probabilities of a magnitude 6.7 or greater earthquake are 1.2 percent for the Monterey Bay-Tularcitos Fault, 1.4 percent for the San Gregorio Connected Fault, and 15.4 percent for the San Andreas Fault.

4. Subsurface Explorations

Haley & Aldrich, Inc. (Haley & Aldrich) based the findings presented in this report on our 2022 field investigation and the two recent geotechnical investigations by Yeh and Associates (2020) and Kleinfelder (2016) that were made available to us. Haley & Aldrich explored subsurface conditions at the Site by advancing three CPT soundings and one shallow infiltration test on 15 November 2022. Prior to performing our field investigation, we contacted Underground Service Alert (USA) and retained a private utility locator to clear the CPT locations of existing utilities. The approximate locations and designations of the subsurface explorations are shown on Figure 2, Site Plan. A summary of the various exploration programs is presented below.

4.1 CONE PENETRATION TESTS

On 15 November 2022, three (3) CPTs (designated HA-CPT-1 through HA-CPT-3) were advanced to depths between 53.81 and 97.93 feet below ground surface (bgs) by Middle Earth Geo Testing, Inc. (Middle Earth) of Hayward, California. The upper 5 feet of soil material at each CPT location was hand augered, and our field representative logged the generated spoils. The CPTs encountered refusal at depths above the planned 100-foot depth. Pore pressure dissipation tests were performed in HA-CPT-1 and HA-CPT-3 to measure hydrostatic water pressures and infer the approximate depth to groundwater.

The CPTs consisted of hydraulically pushing a 1.75-inch-diameter, cone-tipped probe into the soil using a rig with a push capacity of 20 tons. The cone tip measures tip resistance, and the friction sleeve behind the cone tip measures frictional resistance. Electrical strain gauges within the cone continuously measured soil parameters during the entire depth the cone was advanced. Soil data, including tip resistance and frictional resistance, were recorded and then processed to provide information for use in our geotechnical engineering analyses. Once completed, the CPT holes were backfilled with cement grout in accordance with the Marin County Health Department Division of Environmental Health permit requirements.

To conduct the seismic shear wave test, the penetration of the cone is stopped and the rods are decoupled from the rig. An automatic hammer is triggered to send a shear wave into the soil. The distance from the source to the cone is calculated knowing the total depth of the cone and the horizontal offset distance between the source and the cone. Seismic shear wave tests were performed at every 5-foot interval to a depth of 85 feet at HA-CPT-3.

The stratigraphic interpretation of the CPT data was performed based on relationships between cone bearing and sleeve friction versus penetration depth. The friction ratio, which is sleeve friction divided by cone bearing, is a calculated parameter used to infer soil behavior type. Generally, cohesive soils (clays) have high friction ratios, low cone bearing, and generate large excess pore water pressures. Cohesionless soils (sands) have lower friction ratios, high cone bearing, and generate small excess pore water pressures. The interpretation of soil properties from the cone data was carried out using recent correlations developed by Robertson and Cabal (2010). The CPT logs and shear wave velocity tests generated for the exploration program by Middle Earth, showing tip resistance and friction ratio by depth and interpreted soil classifications and strengths, are presented in Appendix A.

4.2 FIELD INVESTIGATION BY OTHERS

Two other geotechnical investigations were previously performed near the Site. One was conducted by Yeh and Associates (dated 22 June 2020) for the GGNRA Improvements Project, which included improvements at Stinson Beach, including rehabilitation of parking lots, access roads, drainage and flood control and improving Americans with Disabilities Act (ADA) access. The Site investigation consisted of seven hollow stem auger borings to a depth of 5 feet bgs and one to a depth of 50 feet bgs. Groundwater was encountered at approximately 1 foot bgs and 4 feet bgs during drilling. The subsurface data from the Yeh and Associates report are presented in Appendix B.

A geotechnical investigation was previously performed by Kleinfelder (dated 29 July 2016) for an ADA-compliant beach access walkway, stairway, and concrete pad located at the Stinson Beach restroom facility. The investigation consisted of one hand-augered hole advanced to about 5½ feet bgs and three Dynamic Cone Penetrometer tests to depths between about 15 and 16 feet bgs. Groundwater was measured at approximately 4.5 feet bgs in the hand-augered boring. The Site plan and boring logs are presented in Appendix B.

4.3 LABORATORY TESTING

Soil samples were collected by Haley & Aldrich from soil cuttings and transported to Inspection Services, Inc. in Berkeley, California, for geotechnical laboratory testing. The samples were tested for gradation and for Resistance (R)-Value. Additional near-surface soil samples were submitted to CERCO Analytical, Inc. in Concord, California, and tested for corrosion properties, including pH, resistivity, sulfate content, and chloride content. The laboratory test results are presented in Appendix C.

5. Subsurface Soil and Groundwater Conditions

5.1 SUBSURFACE SOIL CONDITIONS

The results of the current and past subsurface investigations indicate that the Site is underlain by alluvial materials including predominantly clayey and sandy soils as indicated on the CPT logs advanced during our investigation and included in Appendix A. The boring logs from the previous consultants' investigations are included in Appendix B. The shallow fills at the Site are underlain by alluvial overburden consisting of stiff silty clays and medium dense to dense silty sands, sands, and dense gravelly sand soils. The results from the three CPTs advanced during our investigation were relatively consistent and indicated a subsurface profile consisting of stiff, thin, silty clay layers interbedded with silty sands to a depth of approximately 25 feet bgs. Medium dense silty sand and medium stiff sandy silt were encountered to a depth of approximately 70 feet. Finally, stiff clayey silts and fine-grained soils thinly interbedded with sand were encountered to our deepest exploration depth of about 98 feet bgs.

5.2 SHEAR WAVE VELOCITY CONDITIONS

A shear wave velocity profile of subsurface soils at the Site was recorded by means of seismic CPT shear wave testing at HA-CPT-1 and -3. Since HA-CPT-1 encountered refusal at about 54 feet, we based our evaluation on the data from HA-CPT-3 which extended to about 98 feet. The test results indicate that the average shear wave velocity of the soils within the upper 100 feet (30 meters) of the Site is approximately 166 meters per second (543 feet per second [ft/s]).

5.3 GROUNDWATER CONDITIONS

The depth to groundwater at the Site was estimated using groundwater level measurements from the pore pressure dissipation test data collected at the CPT locations. Pore pressure dissipation (PPD) tests used to estimate the depth to groundwater at each location were performed at HA-CPTs 1-3 on 15 November 22. Based on the PPD test results, we estimate that groundwater at the time of testing was present at depths between 5 and 8 feet below the existing surface grade, which corresponds to approximate elevations ranging from 12 to 15 feet (NAVD 88[1]). As noted in the two studies by others where groundwater was encountered higher, between 1 and 4½ feet below grade, it can fluctuate across the Site. Groundwater levels can fluctuate based on seasonal rainfall amounts, perched groundwater conditions, and elevation changes in nearby bodies of water including tidal changes near the active shoreline. For planning and design purposes, a stabilized groundwater level at elevation 15 feet should be anticipated at the Site.

[1] North American Vertical Datum of 1988 (NAVD).

6. Discussion and Conclusions

On the basis of our review of subsurface information for the Site, we conclude that the proposed project is feasible from a geotechnical standpoint. The primary geotechnical issues that should be addressed during the design and construction of this project include:

- Site seismicity and seismic hazards, including the potential for soil liquefaction and liquefaction-induced settlement;
- The presence of undocumented fill; and
- the selection of an appropriate foundation system that will support the planned structure during static and seismic loading conditions.

Our discussion of these and other issues are presented in the remainder of this report.

6.1 SEISMICITY AND SEISMIC HAZARDS

During a major earthquake, seismic shaking has the potential to occur at the Site, as is typical throughout the Bay Area, and as experienced during the 1989 Loma Prieta event. Shaking during an earthquake can result in ground failure, such as that associated with soil liquefaction, lateral spreading, and cyclic densification. Haley & Aldrich's assessment of these potential seismic hazards are presented in the following sections.

6.1.1 Site Seismicity

A seismic hazard analysis was performed using the USGS Unified Hazard Tool website (USGS, 2021). Our deaggregation analysis utilized the USGS Dynamic Conterminous U.S. 2014 (v.4.2) edition. For our analyses, we evaluated the Site as Site Class D, based on an average shear wave velocity (Vs30) over the top 80 feet (26 meters) of the Site of about 543 ft/s; this value was calculated using the average shear wave velocity measured at sounding HA-CPT-2 during our field investigation on 15 November 2022.

Based on the seismicity of faults that may impact the Site and the results of the deaggregation analysis, a design earthquake with a mean M_w of 7.7 was selected for the seismic hazard evaluation. The peak horizontal ground acceleration (PHGA) for the Site, which is based on the Maximum Considered Earthquake (MCE) with a return interval of 2,475 years, or a 2 percent probability of exceedance in 50 years, is 0.881g. The risk-based site-modified peak ground acceleration (PGA_M) for the Site is 1.101g; this value was computed based on procedures outlined in ASCE 7-16 (ASCE, 2017). Recommended code-based seismic parameters for designing the proposed structures in conformance with the 2019 California Building Code (CBC, 2019) and ASCE 7-16 are presented in Table II.

TABLE II
Seismic Design Parameters

Seismic Parameter	Design Value[1]
Site Class (ASCE 7-16 Table 1613.5.2)	D
Risk Category	II
Seismic Design Category	E[2]

Seismic Parameter	Design Value[1]
MCE_R[3] Ground Motion (Period = 0.2 seconds), S_s	2.341
MCE_R Ground Motion (Period = 1.0 seconds), S_1	0.979
Peak Ground Acceleration, PGA	1.001g[4]
Site Amplification Factor at 0.2 seconds, F_a	1.2
Site Amplification Factor at 1.0 seconds, F_v	--[5]
Site Amplification Factor for PGA, F_{PGA}	1.1
Site-Modified Peak Ground Acceleration, PGA_M	1.101 g
Site-Modified Spectral Acceleration Value at 0.2 seconds, S_{MS}	2.341
Site-Modified Spectral Acceleration Value at 1.0 seconds, S_{M1}	--[5]
Design Spectral Acceleration at 0.2 seconds, S_{DS}	1.56
Design Spectral Acceleration at 1.0 seconds, S_{D1}	--[5]

Notes:

1) *Design values presented above are based on a site located at latitude / longitude = 37.89902 / -122.64552.*
2) *E corresponds to buildings of Occupancy Groups I, II and III in areas NEAR MAJOR ACTIVE FAULTS. Soil or rock is of no consequence.*
3) *MCE_R = Risk-targeted maximum considered earthquake*
4) *g = acceleration of gravity*
5) *Values of Fv, S_{M1}, and S_{D1} are undefined for this site class without performance of a site-specific ground motion hazard analysis.*

6.1.2 Soil Liquefaction

Liquefaction is the process in which saturated, cohesionless soil experiences a temporary loss of strength based on the buildup of excess pore water pressure during cyclic loading resulting from earthquake ground motions. The type of soils most susceptible to liquefaction are loose, clean, saturated, uniformly graded sand and silt that have low clay content. Flow failure, lateral spreading, differential settlement, loss of bearing strength, ground fissures, and sand boils are evidence of liquefaction.

Depths to groundwater at the Site during our investigation were about 5 to 8 feet bgs in November 2022. A depth of 5 feet was used in the analysis based on the conditions encountered in the field. We evaluated liquefaction potential at the Site by performing analysis using the software CLiq in accordance with the methodology by Boulanger & Idriss (2014). The parameters used in the liquefaction evaluation are shown in Table III.

TABLE III

Values Used in Liquefaction Evaluation

Liquefaction Evaluation Parameter	Value
Depth to Groundwater, during current explorations (feet bgs)	5-8
Depth to Groundwater, during current explorations (elevation, NAVD 88)	12 to 15
Depth to Groundwater, during Design Earthquake (feet bgs)	5
Design Peak Ground Acceleration	1.101g
Predominant Earthquake Moment Magnitude, M_w	7.8
Factor of Safety for Liquefaction Triggering	1.3

Based on our current geotechnical exploration at the proposed lifeguard station, we estimated that liquefaction settlement will be generally 6 to 8 inches and conclude that the potential for on-Site liquefaction to occur within the upper 50 feet bgs and adversely impact the planned structures can be high.

TABLE IV
Estimated Liquefaction Settlement

Exploration No.	Estimated Liquefaction Settlement Upper 50 feet (inches)
HA-CPT-1	6
HA-CPT-2	7½
HA-CPT-3	8

6.1.3 Cyclic Densification

Seismically-induced compaction or densification of non-saturated granular soil (such as sand above the groundwater table) based on earthquake vibrations can result in settlement of the ground surface. Based on the results of our subsurface exploration program, we estimate that settlement from cyclic densification will be less than ¼-inch based on the high groundwater table, the settlement is included in the values summarized in Table IV.

6.1.4 Lateral Spreading

Lateral spreading is a potential hazard commonly associated with liquefaction where extensional ground cracking and settlement occur as a response to lateral migration of subsurface liquefiable material. These phenomena typically occur adjacent to free faces such as slopes and creek channels. The Youd et al. study (2001) was developed using an empirical methodology for estimating the lateral spread horizontal displacement using a database where the depth from the ground surface to the top of the liquefiable layer is limited to 30 feet. Using that methodology, and the results of our subsurface exploration program, we conclude that the potential for lateral spreading at the Site to be high. The use of a pile foundation system should reduce the potential for damage to the structure.

6.1.5 Sand Boils

Based on Ishihara (1985), we believe that the potential for ground surface disruption (such as sand boils, ground fissures, etc.) to occur at this Site is high. Another major concern during an earthquake is some form of ground surface disturbance or ground failure. The ground failure can be in the form of sand boils, small ground fissures, ground oscillation, such as buckled pavements, curbs, broken pipelines, etc., and lateral ground displacement. One of the major reasons for ground surface disruption is insufficient cover thickness of a non-liquefiable layer over a liquefiable layer. Given the relatively thin cap of non-liquefiable soil above the potentially liquefiable layer, we anticipate the potential for ground surface disruption to be high.

6.1.6 Tsunami

The State of California has produced a series of maps illustrating coastal zones that are at risk of inundation during a tsunami event. The Site in its entirety is located on the “County of Marin, Tsunami Hazard Area Map” (Patton and Wilson, 2022). The entire Stinson Beach spit, including the Site, is located

within a tsunami hazard area. Therefore, we judge that the potential for a seismically induced wave to impact the Site to be high. The highlands surrounding the spit on either side are located outside of the tsunami hazard zone.

6.1.7 Fault 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. Therefore, we conclude the risk of surface faulting and secondary ground failure to be low.

6.1.8 Expansion Potential

Expansive soils are characterized by their ability to undergo significant volume change (shrink or swell) based on variations in moisture content. Changes in soil moisture content can result from rainfall, landscape irrigation, perched groundwater, drought, or other factors. Changes in soil moisture may result in unacceptable settlement or heave of structures, concrete slabs supported on-grade, or pavements supported on these materials. Given the sandy nature of the soils, the potential for expansion conditions is very low.

6.2 FOUNDATIONS AND SETTLEMENT

Fill materials primarily consisting of clay with silt, sand, and gravel were encountered within the upper 1 to 3 feet of the Site. Fill and medium dense native alluvium within about 50 feet bgs are potentially liquefiable. The results of our investigation indicate that the clayey alluvial soils increase in strength with depth. If the proposed three-story building is supported on shallow foundations that bear on the relatively weak and compressible fill and alluvial soils, the building will likely experience excessive and erratic settlement resulting in cracks and damage to the building.

To reduce the potential for building settlement, the proposed building loads should be supported on a deep foundation system that will transfer the loads to competent alluvial soils lying below the fill and weak liquefiable alluvial silt and clay deposits. Based on our qualitative evaluation of various deep foundation systems, we conclude that driven, 14-inch-square, precast, prestressed concrete piles would likely be the most economical foundation system for supporting the proposed building.

Other deep foundation systems such as drilled piers, full-displacement auger cast piles, and torque-down piles were considered for use at this Site. However, based on the downdrag load and cost considerations, we conclude that a pile rig driving precast piles into the underlying soil would be the most efficient method of installing deep foundations at the Site.

As an alternative, we considered using ground improvement to stiffen and strengthen the fill layer and the underlying weak and liquefiable alluvial soil layers. However, in our opinion, the cost of treating/improving the existing fill and native alluvium can become expensive in order to improve the potential liquefiable soil to 50 feet bgs.

7. Recommendations

Our geotechnical recommendations for the proposed building, as well as other Site improvements, are presented in this section of the report.

7.1 EARTHWORKS

7.1.1 Site Preparation and Grading

The proposed building and parking lot areas should be cleared of existing pavements, trees, abandoned utilities, and other obstructions. The proposed building and parking lot areas should be stripped of soil containing over 3 percent organic matter (if present). We anticipate the excavation for this project can be made using conventional earth-moving equipment.

Existing utilities within the proposed building's footprint should be completely removed. Existing utilities within the parking lot areas should be completely removed where appearing at depths of less than 4 feet below the proposed ground surface elevation. Where existing utilities within proposed parking lot areas are deeper than 4 feet below the proposed ground surface, the utilities may either be removed, as described above, or abandoned in place by exposing, cutting, and capping the ends of the lines, and placing cement grout within the lines to fill existing voids. We recommend that abandoned-in-place lines be grouted in 100-foot linear sections to confirm that grout has fully filled the abandoned pipe.

7.1.2 Subgrade Preparation

The Site should be rough-graded to accommodate the proposed grading plan. Recommendations for mitigating existing fill are presented for each building type below. In proposed building areas, subgrade preparation should extend at least 5 feet beyond the limits of the proposed building slabs and any adjoining flatwork. In exterior concrete slab and pavement areas, subgrade preparation should extend at least 2 feet beyond the limits of these improvements.

We estimate that approximately 6 feet of undocumented fill is present in the vicinity of the proposed building. Within the building's footprint, loose or disturbed soil or undocumented fill soils should be over-excavated to a minimum of 2 feet below the planned bottom of the slab. The exposed subgrade should be scarified to a depth of at least 12 inches, moisture-conditioned, and compacted in accordance with the recommendations given in the section entitled "Fill Placement and Compaction."

The on-Site soils can become disturbed under construction traffic, especially if the soils are wet. If soils become disturbed, they should be over-excavated to the underlying undisturbed soils. The excavated soil can then be dried and recompacted back into place, or it could be removed and replaced with drier import fill. The exposed subgrade should be scarified to a depth of at least 12 inches, moisture-conditioned, and compacted in accordance with the recommendations given in the section entitled "Fill Placement and Compaction."

In non-foundation areas that will receive new fills, building loads, and Site improvements, such as pavements, sidewalks, and slabs, the exposed soil subgrade should be evaluated by the Geotechnical Engineer. If it is fill, it should be over-excavated to a minimum of 1 foot below existing grade or finished pad elevation, whichever is deeper. The exposed subgrade should be scarified to a depth of at least

12 inches, moisture-conditioned, and compacted in accordance with the recommendations given in the section entitled “Fill Placement and Compaction.” If it is undisturbed, competent native soil, consideration may be given by the Geotechnical Engineer to reduce the over-excavation.

Prepared soil subgrades should be non-yielding when proof-rolled by a fully loaded water truck or equipment of similar weight. Moisture-conditioning subgrade soil should consist of adding water if the soil is too dry and allowing the soil to dry if the soil is too wet. After the subgrades are properly prepared, the areas may be raised to design grades by placing engineered fill.

7.1.3 Material for Fill

Except for organic laden soil, the on-Site soil is suitable for use as general engineered fill if it is free of deleterious matter and satisfies the criteria in Table V. Soil for use in engineered fill should be inorganic, and free of deleterious materials and hazardous substances. For this project, inorganic soil is soil with an organic content of less than 3 percent by weight or without visible organic matter deemed excessive by Haley & Aldrich. Site recycled material may be processed and reused as engineered fill if it meets the requirements presented in this report for the specific materials.

TABLE V
General Engineered Fill Grading Requirements

Sieve Size	Percentage Passing Sieve
3-inch	100
1½-inch	85-100

7.1.4 Reuse of On-Site Material

Any existing asphalt or aggregate base that is removed during demolition may be suitable to be pulverized and mixed with the underlying base for use as engineered fill if it has an organic content of less than 2 percent by dry weight and meets the requirements presented under the “Material for Fill” section of this report.

The processed asphalt concrete/base material may be used as Class 2 Aggregate base if it meets the following requirements from Section 26 of the Caltrans Standard Specifications:

TABLE VI
Class 2 Aggregate Base Grading Requirements

Sieve Size	Percentage Passing
1-inch	100 min.
¾-inch	90-100
No. 4	35-60
No. 30	10-30
No. 200	2-9

Note Quality Requirements:
Sand Equivalent: 25 min
R-value: 78 min

7.1.5 Imported, Non-Expansive Fill

All imported fill soils should be nearly free of organic or other deleterious debris, essentially non-plastic, and less than 3 inches in maximum dimension. Specific requirements for import fill are provided below.

TABLE VII
Imported Fill Requirements

Sieve Size	Percentage Passing Sieve
3-inch	100
1½-inch	85-100
#200 Screen	8-40
Atterberg Limits	**Percent**
Plasticity Index	12 or less
Liquid Limit	Less than 30

Fill materials should be approved by the project Geotechnical Engineer prior to placement and delivery to the Site. At least 5 working days prior to importing, a representative sample of the proposed import fill should be delivered to us for laboratory for evaluation.

7.1.6 Fill Placement and Compaction

Fill materials should be placed and compacted in horizontal lifts, each not exceeding 8 inches in uncompacted thickness. Compaction of fill should be performed by mechanical means only. Based on equipment limitations, thinner lifts may be necessary to achieve the recommended degree of compaction. Fill should be placed in accordance with Table VIII, Summary of Compaction Recommendations.

TABLE VIII
Summary of Compaction Recommendations

Area	Compaction Recommendations (See Notes 1 through 4)
Subgrade Preparation and Placement of General Engineered Fill,[5] Including Imported Non-expansive Fill	Compact upper 12 inches of subgrade and entire fill to a minimum of 90 percent relative compaction at near to slightly over optimum moisture content. Where interior flatwork is exposed to vehicular traffic, compact aggregate base to a minimum of 95 percent compaction at near optimum moisture content.
Trenches[6]	Compact trench backfill to a minimum of 90 percent relative compaction at near to slightly over optimum moisture. Where trenches will be under the pavement section, flatwork, or other improvements, the upper 12 inches, measured from finished grade of the trench backfill should be compacted to a minimum of 95 percent compaction at near optimum moisture content.
Exterior Flatwork	Compact upper 12 inches of subgrade to a minimum of 90 percent relative compaction at near to slightly over optimum moisture content. Compact aggregate base to a minimum of 90 percent compaction at or above optimum moisture content. Where exterior flatwork is exposed to vehicular traffic, compact aggregate base to a minimum of 95 percent compaction at near optimum moisture content.

Area	Compaction Recommendations (See Notes 1 through 4)
Paved Areas	Compact upper 12 inches of subgrade to a minimum of 95 percent relative compaction at near to slightly over optimum moisture content. Compact aggregate base rock to a minimum of 95 percent relative compaction at near optimum moisture content.

Notes:

1) *Depths are below finished subgrade elevation.*
2) *All compaction requirements refer to relative compaction as a percentage of the laboratory standard described by ASTM D-1557 (latest version). All lifts to be compacted shall be a maximum of 8 inches loose thickness.*
3) *All compacted surfaces, such as fills, subgrades, and backfills need to be firm and stable, and should be unyielding under compaction equipment.*
4) *Where fills, such as backfill placement after removal of existing underground utility lines, are greater than 7 feet in depth, the portion of the fill deeper than 7 feet should be compacted to a minimum of 95 percent compaction.*
5) *Includes building pads.*
6) *In landscaping areas, this percent compaction in trenches may be reduced to 85 percent. Water jetting or flooding to obtain compaction of backfill should not be permitted.*

7.1.7 Weak or Wet Subgrade Mitigation

The depths to groundwater were at around 5 and 8 feet bgs during our subsurface explorations in mid-November 2022 and may fluctuate over time. Excavations for foundations, utilities, and other improvements may encounter weak or wet soil conditions depending on the depths and elevations of these features. If weak or wet soil subgrade is encountered during grading and adequate compaction cannot be achieved, the Contracting Officer and Geotechnical Engineer should be notified immediately to assess the condition of the weak or wet subgrade and provide Site-specific recommendations for stabilizing and/or repairing the exposed subgrade. Potential subgrade repair options include:

- Over-excavating and removing the weak or wet soil and replacing it with select non-expansive fill underlain by geotextile tensile fabric (Mirafi 500X or equivalent).
- Stabilizing the exposed subgrade by thoroughly blending a lime or cement admixture into the weak or wet soil at a concentration of approximately 5 percent of dry weight of soil being treated, and subsequently compacting the treated subgrade to at least 90 percent relative compaction.

7.1.8 Underground Utilities

Excavations for utility trenches can be made with a backhoe. All trenches should conform to the current Cal/OSHA requirements. Backfill for utility trenches and other excavations is also considered fill, and it should be compacted according to the recommendations presented in the section “Fill Placement and Compaction.” Jetting of trench backfill should not be permitted. Special care should be taken when backfilling utility trenches in pavement areas. Poor compaction may cause excessive settlements, resulting in damage to the pavement section.

Underground utilities should be located above a 1.5:1 (horizontal to vertical) plane projected downward from the bottom of the new footings to avoid undermining the footings during the excavation of the utility trench.

Pipes or conduits should be supported on bedding material with a thickness equal to D/4 (with D equal to the outside diameter of the pipe) or 4 inches of sand or fine non-angular gravel below the pipe, whichever is greater. After the pipes and conduits are tested, inspected (if required), and approved, they should be covered to a minimum depth of 6 inches with sand or fine non-angular gravel, which should be mechanically tamped.

Soil excavated from utility trenches may require moisture-conditioning (drying) prior to reusing the material as compacted on-Site general fill. Although not anticipated, excavations extending below groundwater will require dewatering. Dewatering should lower the groundwater level to a minimum of 2 feet below the bottom of the excavation. If the soil exposed in the bottom of the excavation is soft or wet, it will be necessary to over-excavate the soil and replace it with crushed rock to create a working platform. The depth of over-excavation should be determined in the field at the time of construction; however, for planning purposes, a depth of 12 inches may be assumed.

7.2 PRECAST, PRESTRESSED CONCRETE PILES

The proposed building may be supported on driven concrete piles that gain support through skin friction in the alluvial soil deposits that underlie the existing fill.

7.2.1 Axial Pile Capacity

In our opinion, a driven 14-inch-square, precast, prestressed concrete pile that gains support through a combination of skin friction and end bearing is the most appropriate type of pile to support the proposed building. Support from the upper 50 feet of potentially liquefiable soil layer of fill and alluvial soil should be ignored during compression and seismic uplift conditions.

We estimate that an approximately 75-foot-long pile that is driven to a tip of elevation -55 feet will have an ultimate dead plus live load capacity of 550 kips as shown in Figure D-1 in Appendix D. With a factor of safety of 2.0 applied, the allowable static load would be 275 kips.

Following procedures from Ishihara, we considered the effects of liquefaction on the piles (Ishihara, 1995). As a result, with the downdrag from liquefaction, allowable total load capacity (including seismic and wind loads) of the piles should be limited to 100 kips of ultimate load. Applying a factor of safety of 1.5, the total allowable load pile capacity is 67 kips. No reduction factor has been applied to downdrag forces. Figure D-1 shows the ultimate compression resistance in Appendix D.

For uplift resistance in static condition, a 75-foot-long, 14-inch-square concrete pile will have an ultimate capacity of 55 kips, or an allowable uplift capacity of 18 kips; this value has a factor of safety of 3.0. Figure D-1 in Appendix D shows the ultimate uplift resistance.

The piles should be spaced no closer than three pile widths, center to center, to avoid reductions to the capacities due to group effects. An indicator pile program and pile testing should be performed to verify the capacities of the piles and the factors of safety used in the pile design.

7.2.2 Lateral Resistance of Piles

Lateral load resistance can be mobilized by the individual piles in combination with other foundation elements embedded below the ground surface. Lateral resistance of piles will depend on the stiffness of the pile, the strength of the surrounding material, allowable deflection of the pile top, and the moment induced in the pile. Lateral loads and corresponding moments have been calculated for fixed-head conditions with pile top deflections of 0.5 and 1.0 inch. The resulting deflection and moment profiles for 14-inch-square, precast, prestressed concrete piles are presented on Figures D-2 and D-3. For pile groups with center-to-center spacing of at least three pile diameters in the direction of loading, we

recommend the single pile lateral capacities, as shown on Figure D-2, be reduced by 20 percent (use 80 percent of the values shown).

Additional lateral load resistance can be obtained by passive resistance acting against the embedded faces of pile caps and grade beams. To compute passive resistance, an allowable equivalent fluid weight of 240 pounds per cubic foot (pcf) is recommended and it should be applied against embedded faces of pile caps and grade beams. This value contains a factor of safety of 1.5. The upper foot of soil should be ignored unless it is confined by a concrete slab or pavement.

Frictional resistance from the bottom of the pile caps may be used and computed using a base friction coefficient of 0.35. The upper foot of soil should be ignored unless it is confined by a concrete slab or pavement. The does not include lateral resistance contributions from the adjacent concrete slabs-on-grade.

7.2.3 Lateral Capacities

Lateral loads on the piles are resisted primarily by the horizontal bearing support of near-surface soils adjacent to the pile. The lateral capacity of a pile depends on its length, stiffness in the direction of loading, and degree of fixity at the head, as well as on the engineering properties of the soils. The design lateral capacity of the piles will depend largely on the allowable lateral deflection, shear, and moment of the piles.

The precast concrete piles may be designed using conventional lateral pile analysis software such as LPILE v2019 by Ensoft. The LPILE software computes deflection, shear, bending moment, and soil response due to lateral loads with respect to depth under several types of pile-head loading conditions. Table IX – LPILE Parameters for Precast Concrete Piles provides LPILE parameters for lateral pile analysis across the Site.

TABLE IX
LPILE Parameters for Precast Concrete Piles

Soil Layer	LPILE Model	Depth (feet)		Effective Unit Weight (pcf)	Friction Angle (deg)	Non-Default k (pci)	Undrained Cohesion (psf)	Non-Default Strain Factor E50
		Top	Bottom					
Fill	Sand (API Sand)	0	6	120	32	72	--	--
Outwash	Stiff Clay w/o Free Water	6	14	110	--	--	2000	0.007
Alluvium *(liquefiable)*[2]	Stiff Clay w/o Free Water	14	51	47.6	--	--	2000 (*660*)	0.007
Alluvium *(liquefiable)*[2]	Stiff Clay w/o Free Water	51	91	47.6	--	--	2000 (*860*)	0.007
Alluvium	Stiff Clay w/o Free Water	91	103	47.6	--	--	1000	0.004

Notes:
1) *Depths are below existing ground surface.*
2) *Italicized values are applicable for liquefied conditions, representing residual strength of liquefied mass.*

7.2.4 Indicator Pile Program

To check the driving behavior of the piles, we recommend an indicator pile program be undertaken at the building location before production piles are ordered. We recommend installing indicator piles at approximately 5 percent of the proposed production pile locations. The pile locations should be evenly distributed across the Site and within the proposed building's footprint. In addition, we recommend two 30-foot-long piles be installed at locations outside of the proposed building's footprints. These shorter piles would be used to estimate the adhesion value of the clayey fill and not be reused as part of the building foundation system. Indicator pile locations should be selected by Haley & Aldrich and approved by the structural engineer. Installation of all indicator piles should be monitored using a pile driving analyzer (PDA) to check stresses in the pile during driving. All the indicator piles should be retapped at least 1 week later and a CAPWAP analysis should be performed on each of the retapped piles. We recommend all indicator piles be at least 7 feet longer than needed for production pile purposes so that the tops of the indicator piles can remain at least 3 feet above the ground surface to accommodate the PDA equipment.

7.3 WOODEN PILES FOR BOARDWALKS AND DECK

We have assumed that up to 5 feet of pile will be exposed above the ground surface at the time of construction. Axial loads imposed by the walkway and deck can be supported by a combination of friction and end bearing capacity of timber pile foundations. For a 10 inch (butt) to 8 inch (tip) timber pile, embedded a minimum of 8 feet below existing grade, the ultimate axial capacity would be 15 kips. However, to control for fixity, we recommend that this be increased to a minimum embedment of 16 feet (total length of 21 feet with 5 feet above grade). For 12 inch (butt) and 10 inch (tip) piles, this may be reduced to 13 feet embedment (length of 18 feet including 5 feet above grade). These lengths do not consider erosion of soil at the surface following construction.

Downdrag from liquefaction induced settlement may be ignored. For evaluation of allowable axial capacity under static conditions, we recommend a factor of safety of 3 be applied to the ultimate capacity. A one-third increase in the allowable capacity may be used for consideration of the transient loads such as wind or seismic. Indicator piles are not required for the boardwalk or deck.

The piles should be spaced no closer than three pile diameters, center to center, to avoid reductions to the capacities due to group effects.

7.3.1 Lateral Resistance of Piles

Lateral load resistance can be mobilized by the individual piles in combination with other foundation elements embedded below the ground surface. Lateral resistance of piles will depend on the stiffness of the pile, the strength of the surrounding material, allowable deflection of the pile top, and the moment induced in the pile. Lateral loads and corresponding moments have been calculated for fixed-head conditions with pile top deflections of 0.5 and 1.0 inch. The resulting deflection and moment profiles for 10 inch and 12 inch timber piles are presented on Figures D-4 and D-5.

7.3.2 Lateral Capacities

The timber piles may be designed using conventional lateral pile analysis software such as LPILE v2019 by Ensoft. The LPILE software computes deflection, shear, bending moment, and soil response due to lateral loads with respect to depth under several types of pile-head loading conditions. The soil

parameters presented in the above Table IX – LPILE Parameters for Precast Concrete Piles provides LPILE parameters for lateral pile analysis across the Site. Properties for timber pile were selected based on Pacific Coast Douglas Fir and are presented in Table X – Timber Pile Properties below.

TABLE X
Timber Pile Properties

Diameter at Pile Butt (in)	Diameter at Pile Tip (in)	Area at Pile Butt (in^2)	Area at Pile Tip (in^2)	I at Pile Butt (in^4)	I at Pile Tip (in^4)	E_{timber} (psi)
10	8	78.5	50.3	490.9	201.1	1,700,000
12	10	113.1	78.5	1017.9	490.9	1,700,000

add

7.3.3 Indicator Pile Program

Based on the limited loading and number of piles, an indicator program is not required.

7.4 SLABS-ON-GRADE

Concrete slabs-on-grade are anticipated to consist of floor slabs and exterior walkways. The floor slabs can be supported on grade. The exposed subgrade soil should be moisture-conditioned and recompacted as discussed in the "Fill Placement and Compaction" section of this report.

7.4.1 Floor Slabs

The interior concrete floor slab thickness and reinforcement should be provided by the project Structural Engineer. As a minimum, the floor slab should be directly underlain by at least a 6-inch-thick layer of Class 2 aggregate base or a 6-inch-thick moisture retarder system, as described below. The soil subgrade beneath the interior floor slab system should be prepared and compacted, as described in the section "Fill Placement and Compaction." The subgrade should not be allowed to dry during construction. If the previously compacted soil subgrade is disturbed during foundation and/or utility excavation, the subgrade should be scarified, moisture-conditioned, and rerolled to provide a firm, unyielding surface prior to placing the capillary break material or casting the concrete floor.

If moisture transmission through the slab is acceptable and/or if the slab is subject to vehicle loading, the slab-on-grade floor may be placed on a 6-inch-thick layer of Caltrans Class 2 Aggregate Base that has been compacted to at least 95 percent relative compaction.

In other locations, to reduce moisture transmission through the floor slab, we recommend installing a capillary moisture break and a minimum 15-mil-thick Class C moisture retarder beneath the floor slab. Typically, finished spaces with slab-on-grade floors, such as offices, will utilize capillary moisture breaks and vapor retarders to reduce the potential for water vapor transmission through the floor, which can adversely impact flooring materials and carpeting.

A capillary moisture break consists of at least 4 inches of clean, free-draining gravel or crushed rock. The moisture retarder should be placed in general accordance with the requirements of ASTM E1643. These requirements include overlapping seams by 6 inches, taping seams, and sealing penetrations in the vapor retarder. The moisture retarder should be covered with 2 inches of sand to aid in curing the concrete and to protect the vapor retarder during slab construction. The particle size of the gravel/crushed rock and sand should meet the gradation requirements presented in Table XI.

TABLE XI
Gradation Requirements for Capillary Moisture Break

Sieve Size	Percentage Passing Sieve
Gravel or Crushed Rock	
1-inch	90-100
¾-inch	30-100
½-inch	5-25
3/8-inch	0-6
Sand	
No. 4	100
No. 200	0-5

Concrete mixes with high water/cement (w/c) ratios will result in excess water in the concrete, which increases the cure time and may result in excessive vapor transmission through the slab. Therefore, concrete for the floor slab should have a w/c ratio of less than 0.50. If approved by the project Structural Engineer, the sand can be eliminated beneath the slabs-on-grade and the concrete placed directly over the vapor retarder, provided the w/c ratio of the concrete does not exceed 0.45 and water is not added in the field. If necessary, workability should be increased by adding plasticizers. In addition, the slab should be properly cured.

Before the floor covering is placed, the Contractor should check that the concrete surface and the moisture emission levels (if emission testing is required) meet the manufacturer's requirements.

7.4.2 Exterior Flatwork

Exterior flatwork may be supported on-grade. We recommend that, at a minimum, exterior concrete slabs and pedestrian walkways be designed using 4 inches of concrete. Typically, construction joints are spaced at horizontal distances no greater than 24 times the concrete slab thickness. If there is a conflict between the civil and geotechnical design recommendations for contraction joint spacing, Haley & Aldrich defers to the Civil Engineer's recommendations. Where concrete flatwork is to be exposed to vehicle traffic, we recommend that the flatwork be supported on a minimum of 6 inches of Class 2 aggregate base rock. Recommendations for subgrade preparation and aggregate base compaction for concrete slabs and walkways are the same as those we have described in the "Fill Placement and Compaction" section.

7.5 RETAINING WALL

We understand that short retaining walls, on the order of 6 feet or less may be constructed for the project. We recommend that retaining walls be backfilled with non-expansive fill within a sloped 1H:1V (horizontal:vertical) zone that extends laterally away from the base of the wall footing and up towards the retained ground surface. For walls that are free to rotate at the top, we recommend designing the walls to resist an active lateral earth pressure with an equivalent fluid weight of 40 pcf. If the walls are restrained from movement, we recommend the walls be designed to resist an at-rest lateral earth pressure with an equivalent fluid weight of 60 pcf. These short retaining walls do not need to be designed for lateral earth pressure loads from earthquakes. However, the proposed vehicle parking or loading areas will be subject to transient surcharge loading from forklifts or other vehicles. Where vehicular loads are allowed within 4 feet of the retaining walls, we recommend that the walls be

designed to withstand a uniform (rectangular distribution) traffic surcharge of 100 pounds per square foot (psf). These design pressures assume level backfill conditions. The design pressures also assume that the walls are properly backdrained to prevent buildup of hydrostatic pressure. A prefabricated drainage panel against the backside of the wall is an acceptable method for backdraining the walls. The drainage panels should extend down to either weep-holes placed along the base of the walls or to a suitable drain inlet.

The retaining walls may be supported on shallow spread footings with minimum width of 24 inches that may be designed using an allowable dead plus live load bearing capacity of 2,000 psf. This value contains a factor of safety of at least 2 and may be increased by one-third for total loads, including wind or seismic forces. Lateral loads may be resisted by a combination of passive pressure on the embedded vertical faces of the footings and friction between the bottoms of the footings and the supporting soil. For passive resistance, we recommend using an equivalent fluid weight of 360 pcf for footings embedded in compacted fill; the upper foot of soil should be ignored unless it is confined by a concrete slab or pavement. Frictional resistance should be computed using a base friction coefficient of 0.35. The passive pressure is unfactored.

7.6 UNDERGROUND UTILITIES

Excavations for utility trenches can be made with a backhoe. Despite careful Site preparation, unexpected obstructions may make some of the trenching operations difficult. All trenches should conform to the current Cal/OSHA requirements.

Backfill for utility trenches and other excavations is also considered fill and should be compacted according to the recommendations presented in the “Fill Placement and Compaction” section. Jetting of trench backfill should not be permitted. Special care should be taken when backfilling utility trenches in pavement areas. Poor compaction may cause excessive settlements, resulting in damage to the pavement section.

Pipes or conduits should be supported on bedding material with a thickness equal to D/4 (with D equal to the outside diameter of the pipe) or 4 inches of sand or fine gravel below the pipe, whichever is greater. After the pipes and conduits are tested, inspected (if required), and approved, they should be covered to a depth of 6 inches with sand or fine gravel, which should be mechanically tamped.

7.7 FLEXIBLE PAVEMENT DESIGN

The State of California R-value method for flexible pavement design was used to develop recommendations for pavement sections. The thickness of pavement depends on the R-value of the subgrade soil and the anticipated volume of traffic. For this project, we recommend using a design soil subgrade R-value of 33 and using the subgrade preparation method discussed in the “Earthworks” section of this report.

We assume that flexible pavement throughout the Site will be designed using traffic indices (TI) ranging from 4.5 to 9.0. Design sections for flexible pavement sections bearing directly over compacted native soil ((R)-value = 33) are presented in Table XII.

TABLE XII
Flexible Pavement Design
(Subgrade R-Value = 33)

Traffic Index	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)	Total (inches)
4.5	2.5	6.0	8.5
5.0	2.5	6.0	8.5
6.0	3.0	7.5	10.5
7.0	4.0	8.5	12.5
8.0	4.5	10.5	15.0
9.0	5.5	11.5	16.0

We recommend that the subgrade soil, over which the pavement sections are to be placed, be moisture-conditioned and compacted according to the recommendations in the "Fill Placement and Compaction" section of this report. Subgrade preparation should extend a minimum of 2 feet laterally beyond the back of the curb or the edge of pavement. Paved areas should be sloped, and drainage gradients maintained to carry all surface water to appropriate collection points. Surface water ponding should not be allowed anywhere on the Site during or after construction. We recommend that the pavement section be isolated from non-developed areas and areas of intrusion of irrigation water from landscaped areas. Concrete curbs should extend a minimum of 2 inches below the base rock and into the subgrade to provide a barrier against drying of the subgrade soil, and reduce the migration of landscape water into the pavement section.

7.8 SURFACE DRAINAGE

Site grading should provide surface drainage away from the proposed structures and concrete slabs-on-grade to reduce the percolation of water into the underlying soils. Surface water should not be allowed to collect adjacent to structures and along edges of concrete slabs or pavements. Grades should be sloped away from the structures as required in the 2019 CBC. Surface water should be directed away from exposed soil slopes. Rainwater on the roof of buildings should be conveyed through gutters, downspouts, and closed pipes that discharge directly into the Site's storm water collection system or pavement. If discharging onto the pavement, safety of pedestrian traffic should be considered.

7.9 WET WEATHER CONSTRUCTION

If Site grading and construction is to be performed during the winter rainy months, the Government and contractors should be aware of the potential impact of wet weather. Rainstorms can delay construction and damage previously completed work by saturating compacted pads or subgrades or flooding excavations.

Earthwork during rainy months will require extra effort and caution by the contractors. The grading contractor should be responsible to protect his work to avoid damage by rainwater. Standing pools of water should be pumped out immediately. Construction during wet weather conditions should be addressed in the project construction bid documents and/or specifications. We recommend the grading

contractor submits a wet weather construction plan outlining the procedures they will employ to protect their work and minimize damage to their work by rainstorms.

Unit cost for stabilization and mitigating wet soil conditions, such as over-excavation as well as placement of geotextile fabric and engineered fill, should be included in the bid documents.

An additional mitigation measure for reducing the potential for saturated foundation excavations including pile caps is to over-excavate by 2 to 3 inches and placing lean concrete, or a “rat slab.” Foundation bottoms and pile caps should be approved by the project Geotechnical Engineer-of-Record prior to placing the rat slab.

7.10 CORROSION POTENTIAL

One sample was collected and tested for corrosivity characteristics by CERCO Analytical, Inc. of Concord, California. The sample (bulk sample upper 2 feet) was tested for resistivity, redox potential, sulfate and chloride ion concentrations, and pH. The test results indicate that on-Site soils should be considered “moderately corrosive” to buried iron and steel improvements, according to CERCO. The results of our corrosion testing and a copy of CERCO’s brief evaluation are presented in Appendix C.

8. Supplemental Geotechnical Services

The final project plans and specifications should be reviewed by Haley & Aldrich prior to construction to check that they are in general conformance with the intent of our recommendations. During construction, we should observe and document the pre-production pilot test programs for the lime treatment, the installation of the temporary shoring system, and the condition of the building. In addition, we should observe and test the compaction of the exposed soil subgrade and any new fill placed at the Site. These observations will allow us to check that the contractor's work conforms to the geotechnical aspects of the plans and specifications and ensures that the foundation system(s) are constructed in accordance with the project plans and specifications and our design recommendations.

9. Limitations

This report has been prepared for specific application to the proposed construction as understood at this time. In the event that changes in the nature, design, or location of the project are planned, the conclusions and recommendations contained in this report should not be considered valid, unless the changes are reviewed by Haley & Aldrich and the conclusions and recommendations of this report are modified or verified in writing.

The geotechnical analyses and recommendations are based, in part, upon the data obtained from the referenced subsurface explorations. The nature and extent of variations between explorations may not become evident until construction. If variations appear at that time, it may be necessary to re-evaluate the recommendations of this report.

This report is prepared for the exclusive use of DHM Design, the National Parks Service, and their subconsultants in connection with the design and construction of the new Lifeguard Tower and Visitor Snack Bar building. There are no intended beneficiaries other than DHM Design, the National Parks Service, and their subconsultants. Haley & Aldrich shall owe no duty whatsoever to any other person or entity on account of the agreement or the report. Use of this report by any person or entity other than DHM Design, National Parks Service, and their subconsultants for any purpose whatsoever is expressly forbidden unless such other person or entity obtains written authorization from DHM Design, National Parks Service, and from Haley & Aldrich. Use of this report by such other person or entity without the written authorization of DHM Design, the National Parks Service, and Haley & Aldrich shall be at such other person's or entity's sole risk and shall be without legal exposure or liability to Haley & Aldrich.

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FIGURES

MAP SOURCE: ESRI
SITE COORDINATES: 37°53'45"N, 122°38'22"W

HALEY ALDRICH

REPLACE STINSON BEACH LIFEGUARD TOWER
AND VISITOR SNACK BAR
NATIONAL PARK SERVICE
STINSON BEACH, CALIFORNIA

PROJECT LOCUS

APPROXIMATE SCALE: 1 IN = 2000 FT
DECEMBER 2022

FIGURE 1

GIS: \\haleyaldrich.com\share\CF\Projects\0206170\GIS\206170_STINSON_BEACH_LIFEGUARD_TOWER206170_STINSON_BEACH_LIFEGUARD_TOWER.aprx - vpehlivan - 12/19/2022 2:59 PM

LEGEND

- CONE PENETRATION TEST (HALEY & ALDRICH 2022)
- LIMIT OF DISTURBANCE

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. AERIAL IMAGERY SOURCE: NEARMAP, 19 MAY 2022

N

0 20 40
SCALE IN FEET

HALEY ALDRICH

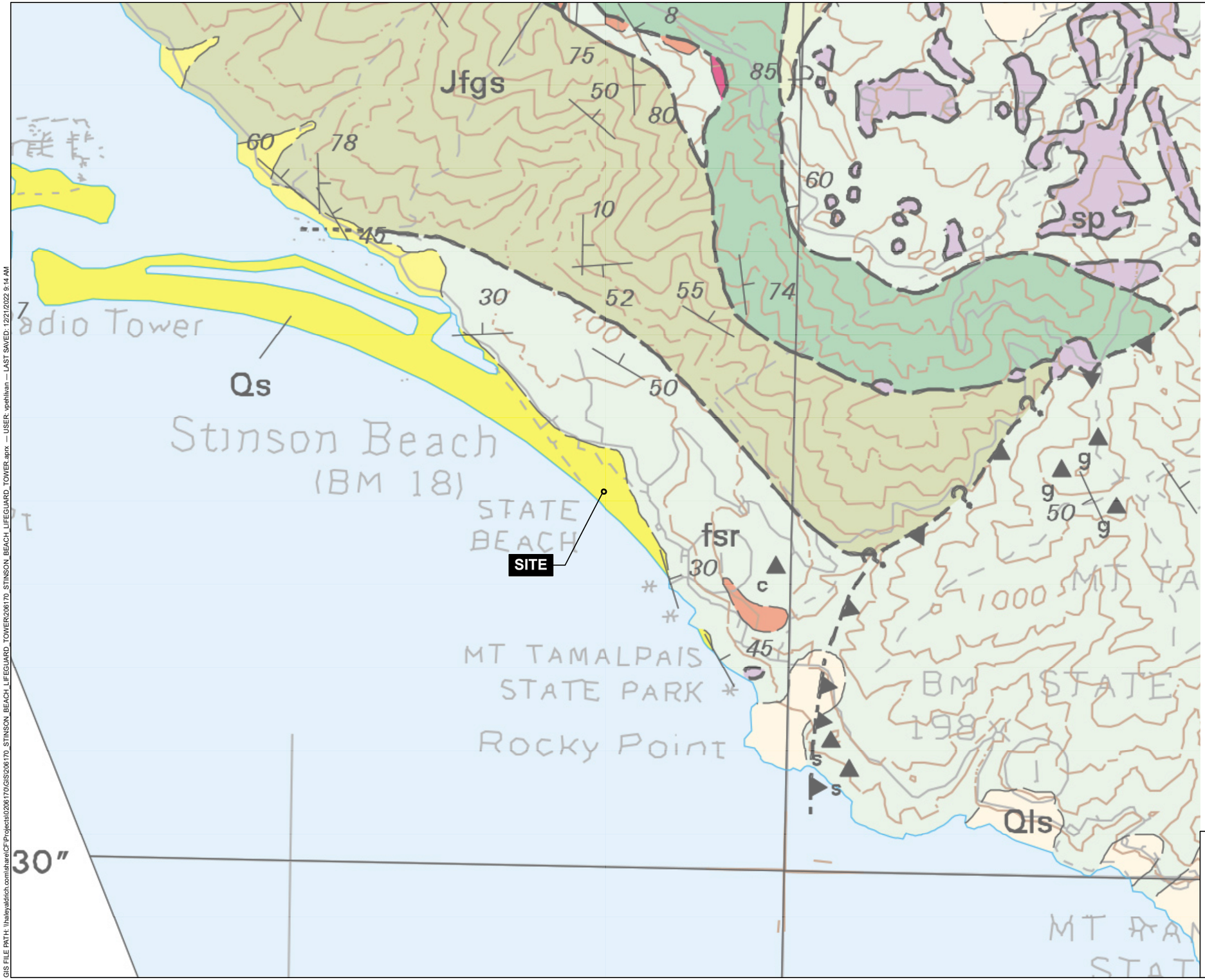
REPLACE STINSON BEACH LIFEGUARD TOWER
AND VISITOR SNACK BAR
NATIONAL PARK SERVICE
STINSON BEACH, CALIFORNIA

SITE PLAN

DECEMBER 2022

FIGURE 2

GIS FILE PATH: \\haleyaldrich.com\share\CF\Projects\0206170\GIS\206170_STINSON_BEACH_LIFEGUARD_TOWER\206170_STINSON_BEACH_LIFEGUARD_TOWER.aprx — USER: vpehlivan — LAST SAVED: 12/20/2022 1:03 PM



LIST OF MAP UNITS

[See pamphlet for Description of Map Units]

SURFICIAL DEPOSITS

- Qaf — Artificial fill (Quaternary)
- Qmf — Artificial fill over marine and marsh deposits (Quaternary)
- Qs — Beach sand (Quaternary)
- Qd — Dune sand (Quaternary)
- Qm — Marine and marsh deposits (Quaternary)
- Qls — Landslide deposits (Quaternary)
- Qal — Alluvium (Quaternary)
- Qsr — Slope debris and ravine fill (Quaternary)
- Qu — Undifferentiated surficial deposits (Quaternary)
- Qr — Volcanic gravel (Quaternary)
- Qob — Older beach deposits (Quaternary)
- Qoal — Older alluvium (Quaternary)
- Qt — Marine and stream terrace deposits (Quaternary)
- Qmi — Millerton Formation (Quaternary)
- Qc — Colma Formation (Quaternary)

ROCKS WEST OF AND WITHIN THE SAN ANDREAS FAULT ZONE

- QTm — Merced Formation (early Quaternary and late Pliocene)
- Tsc — Santa Cruz Mudstone (late Miocene)
- Tm — Monterey Shale (late and middle Miocene)

ROCKS EAST OF AND WITHIN THE SAN ANDREAS FAULT ZONE

Tertiary overlap sequence

- Twg — Wilson Grove Formation (Pliocene)
- Tps — Petaluma Formation (Pliocene) Siltstone and claystone member
- Tpc — Gray claystone member
- Tsv — Sonoma Volcanics (Pliocene and Miocene)
- Tsr — Rhyolite lava flows
- Tsri — Rhyolite plugs and dikes
- Tsa — Andesite and basalt lava flows
- Tst — Pumiceous ash flow tuff
- Ts — Sandstone (Miocene)

Franciscan Complex

- Kfs — Sandstone and shale (Cretaceous)
- Kfss — Massive sandstone (Cretaceous)
- Kfsh — Thin-bedded sandstone and shale (Cretaceous)
- Kfl — Limestone and chert (Cretaceous)
- Kfg — Greenstone (Cretaceous)
- Kfch — Chert (Cretaceous)
- Kfgwy — Graywacke (Cretaceous)
- Kfdb — Diabase (Cretaceous)
- KJfm — Metamorphic rocks (Cretaceous and Jurassic)
- KJfch — Chert (Cretaceous and Jurassic)
- KJfgc — Greenstone and chert (Cretaceous and Jurassic)
- Jfg — Greenstone (Jurassic)
- Jfmgs — Metagreenstone (Jurassic)
- Jfmch — Metachert (Jurassic)
- Jfmgc — Metagreenstone and metachert (Jurassic)
- Jfgs — Greenstone (Jurassic)
- Jfmg — Metamorphic rocks (Jurassic)
- Jspm — Massive serpentinite (Jurassic)
- sp — Serpentinite (Jurassic)
- sc — Silica-carbonate rock (Jurassic)
- fsr — Mélange

Great Valley Complex

- KJgv — Undivided Great Valley complex shale, sandstone, and conglomerate (Cretaceous and (or) Jurassic)
- Kgvn — Novato Conglomerate (Cretaceous)
- KJgvs — Sandstone and claystone (Cretaceous and (or) Jurassic)
- sp — Serpentinite (Jurassic)
- sc — Silica-carbonate rock (Jurassic)

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. GEOLOGY SOURCE: USGS MISCELLANEOUS FIELD STUDIES MF-2337

N

0 2,000 4,000
SCALE IN FEET

HALEY ALDRICH

REPLACE STINSON BEACH LIFEGUARD TOWER
AND VISITOR SNACK BAR
NATIONAL PARK SERVICE
STINSON BEACH, CALIFORNIA

REGIONAL GEOLOGIC MAP

DECEMBER 2022

FIGURE 3

GIS FILE PATH: \\haleyaldrich.com\share\CF\Projects\0206170\GIS\206170_STINSON_BEACH_LIFEGUARD_TOWER\206170_STINSON_BEACH_LIFEGUARD_TOWER.aprx — USER: vpehlivan — LAST SAVED: 12/21/2022 9:14 AM

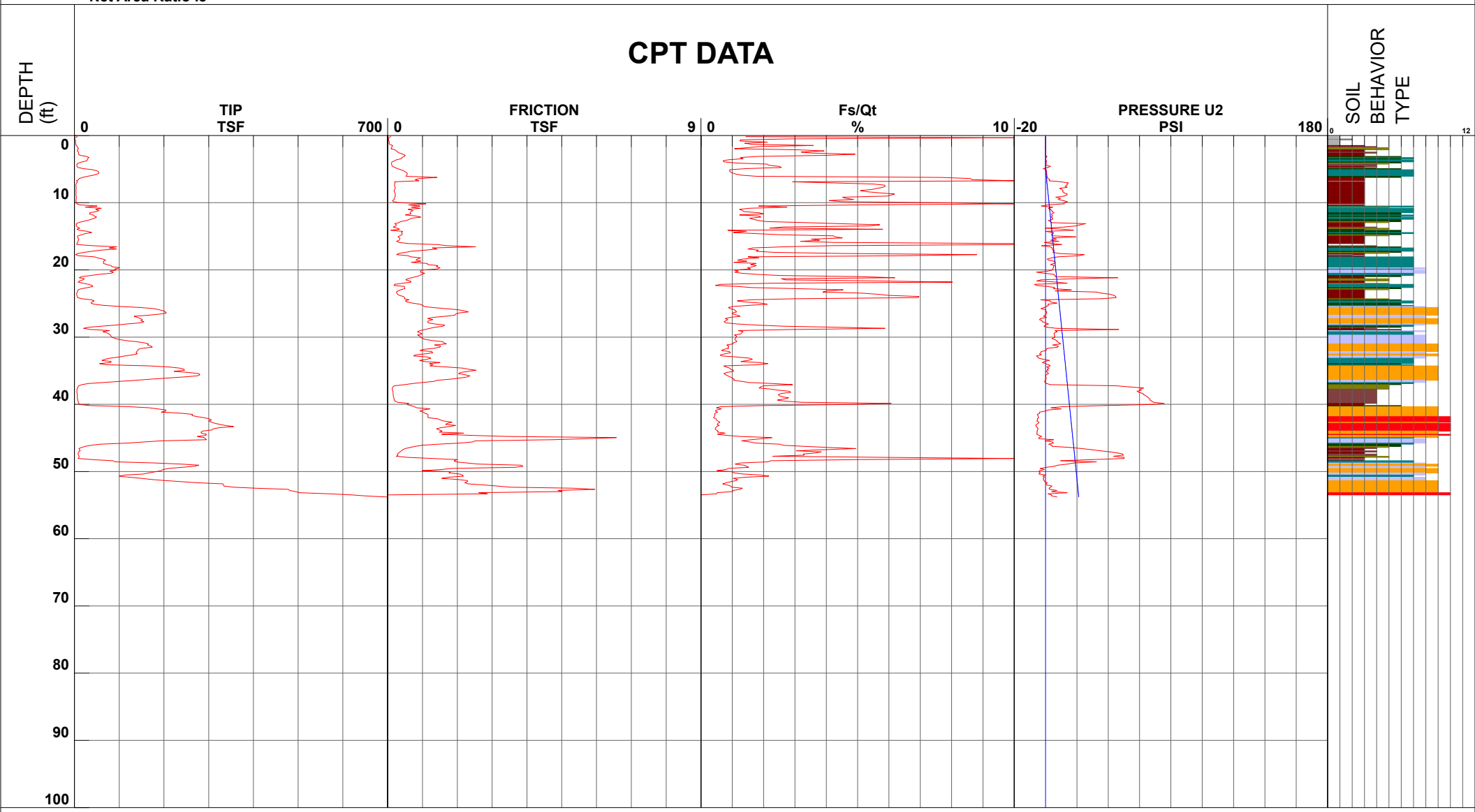
APPENDIX A
Cone Penetration Test Results

Haley & Aldrich

Project	Stinson Beach Lifeguard Tower & Cantee	Operator	JM-GM	Filename	SDF(681).cpt
Job Number	206170	Cone Number	DDG1627	GPS	
Hole Number	CPT-01	Date and Time	11/15/2022 10:08:47 AM	Maximum Depth	53.81 ft
EST GW Depth During Test		5.00 ft			

Net Area Ratio .8

CPT DATA



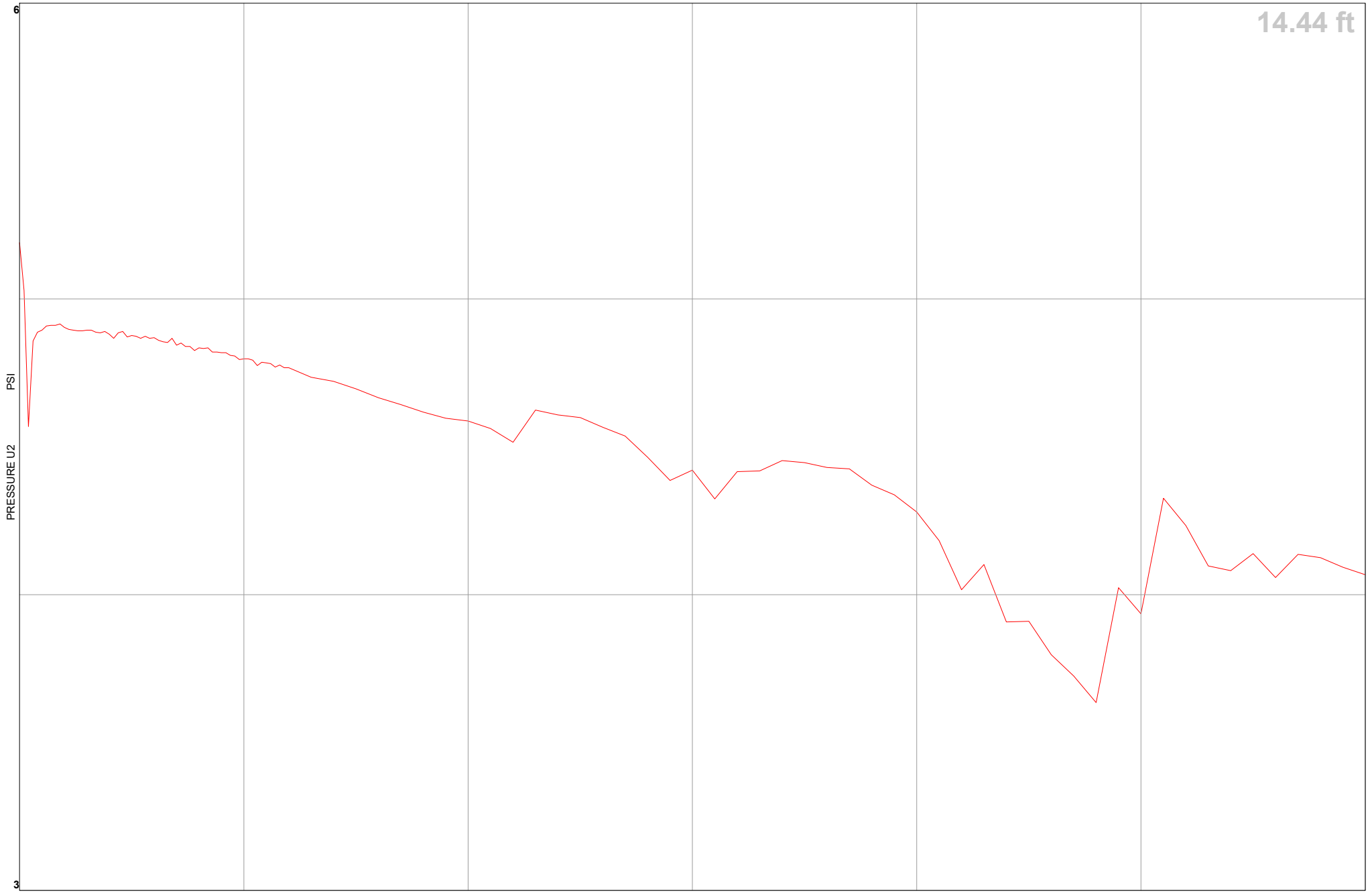
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 15cm squared

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

Haley & Aldrich

Location	Stinson Beach Lifeguard Tower & Cante	Operator	JM-GM		
Job Number	206170	Cone Number	DDG1627	GPS	
Hole Number	CPT-01	Date and Time	11/15/2022 10:08:47 AM		
Equilized Pressure	4.0	EST GW Depth During Test	5.1		



Haley & Aldrich

Location	Stinson Beach Lifeguard Tower & Cante	Operator	JM-GM		
Job Number	206170	Cone Number	DDG1627	GPS	
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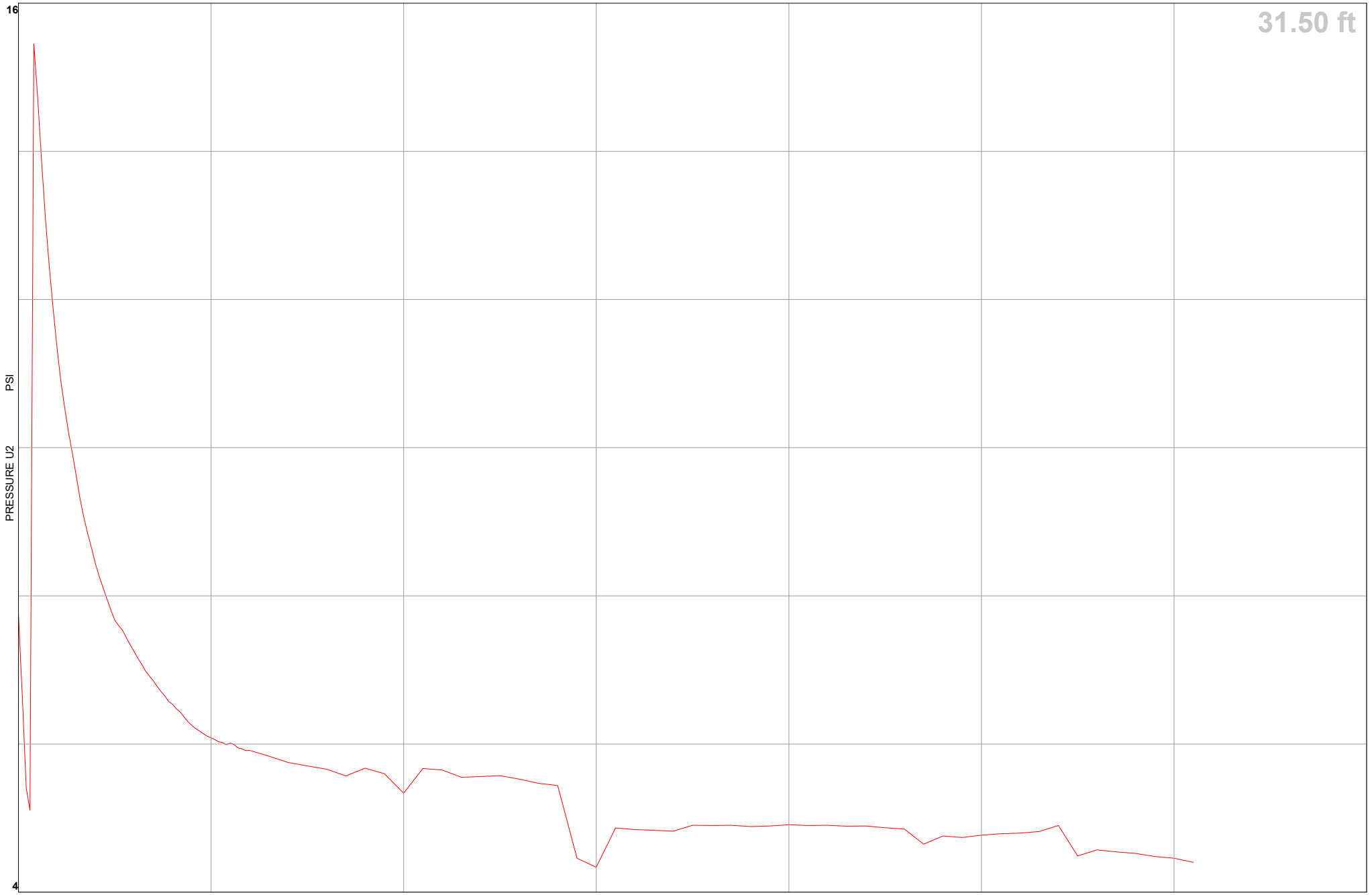
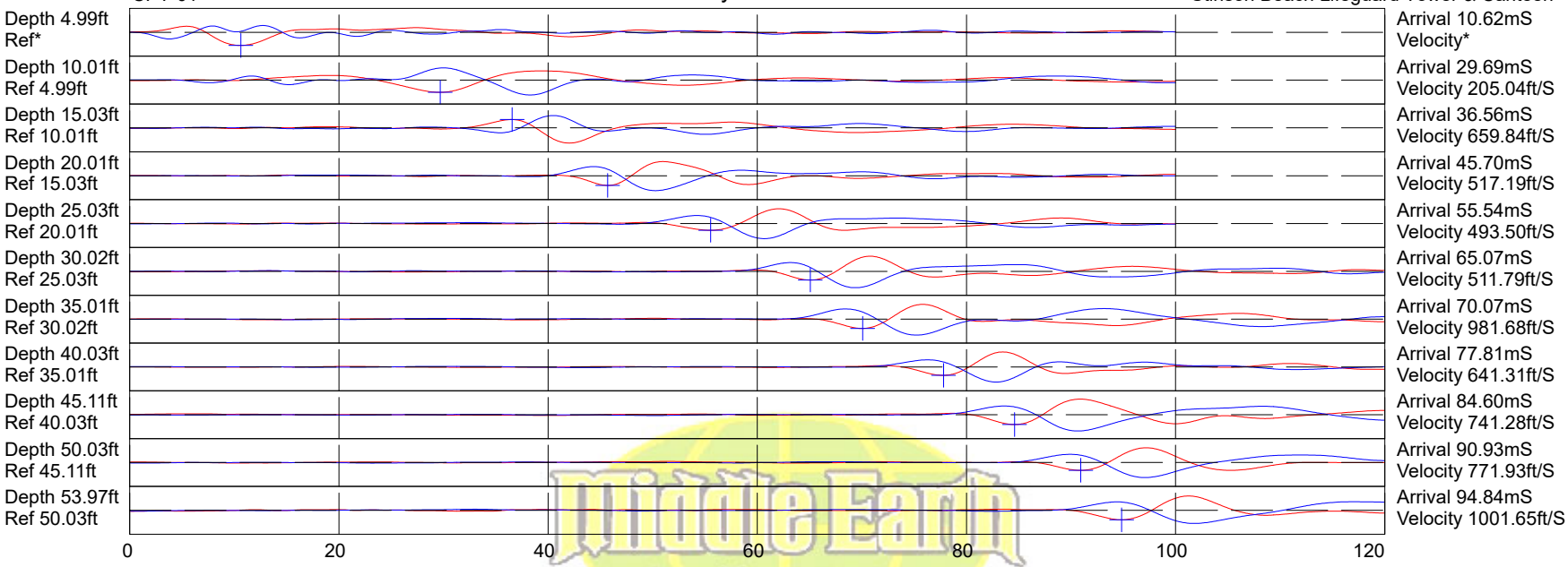
Equilized Pressure	4.4	EST GW Depth During Test	21.1		



CPT-01

Haley & Aldrich

Stinson Beach Lifeguard Tower & Canteen



Middle Earth
GEO TESTING INC.

Hammer to Rod String Distance (ft): 5.83

* = Not Determined

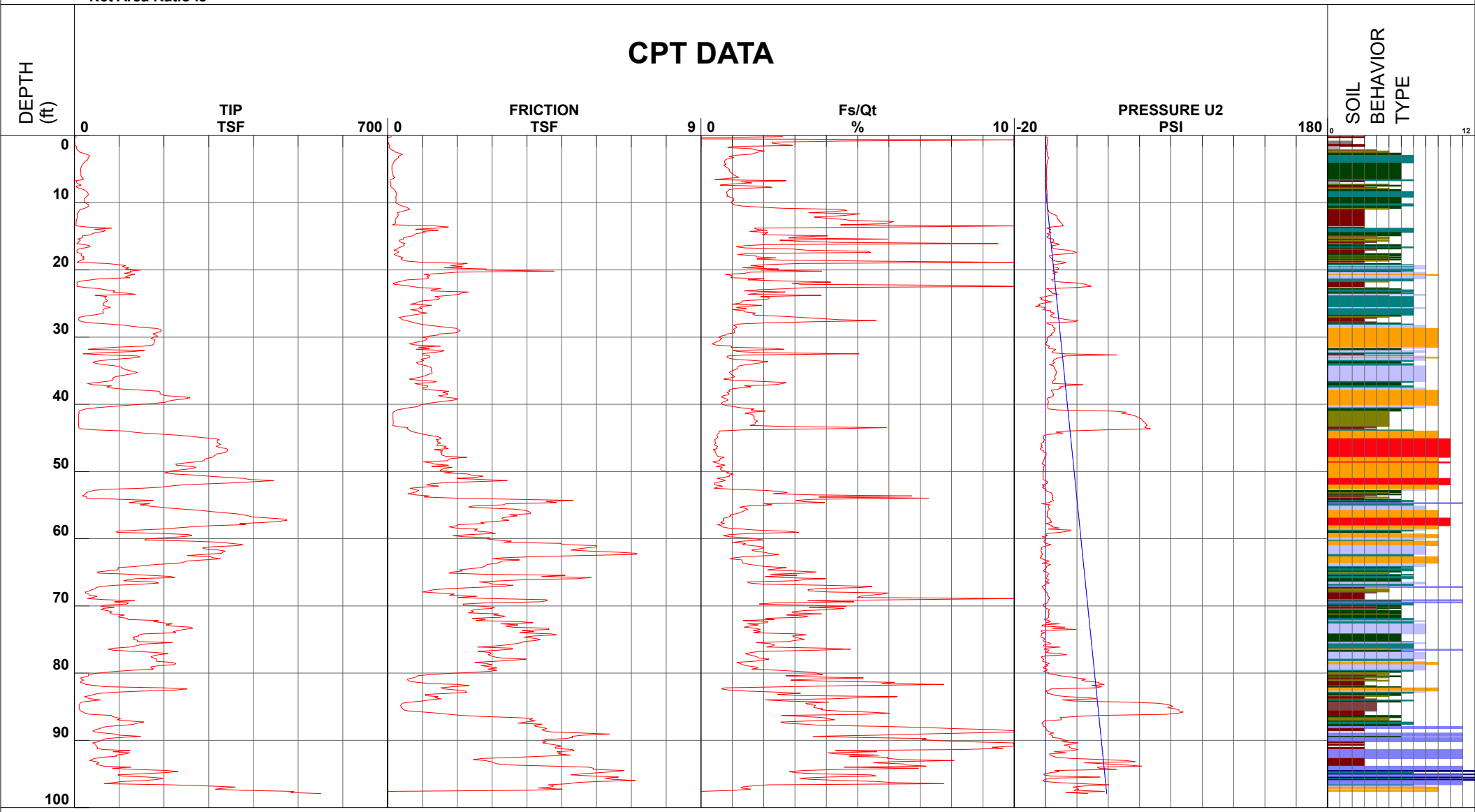
COMMENT:

Haley & Aldrich

Project	Stinson Beach Lifeguard Tower & Cantee	Operator	JM-GM	Filename	SDF(682).cpt
Job Number	206170	Cone Number	DDG1627	GPS	
Hole Number	CPT-02	Date and Time	11/15/2022 12:03:58 PM	Maximum Depth	97.93 ft
EST GW Depth During Test		8.00 ft			

Net Area Ratio .8

CPT DATA



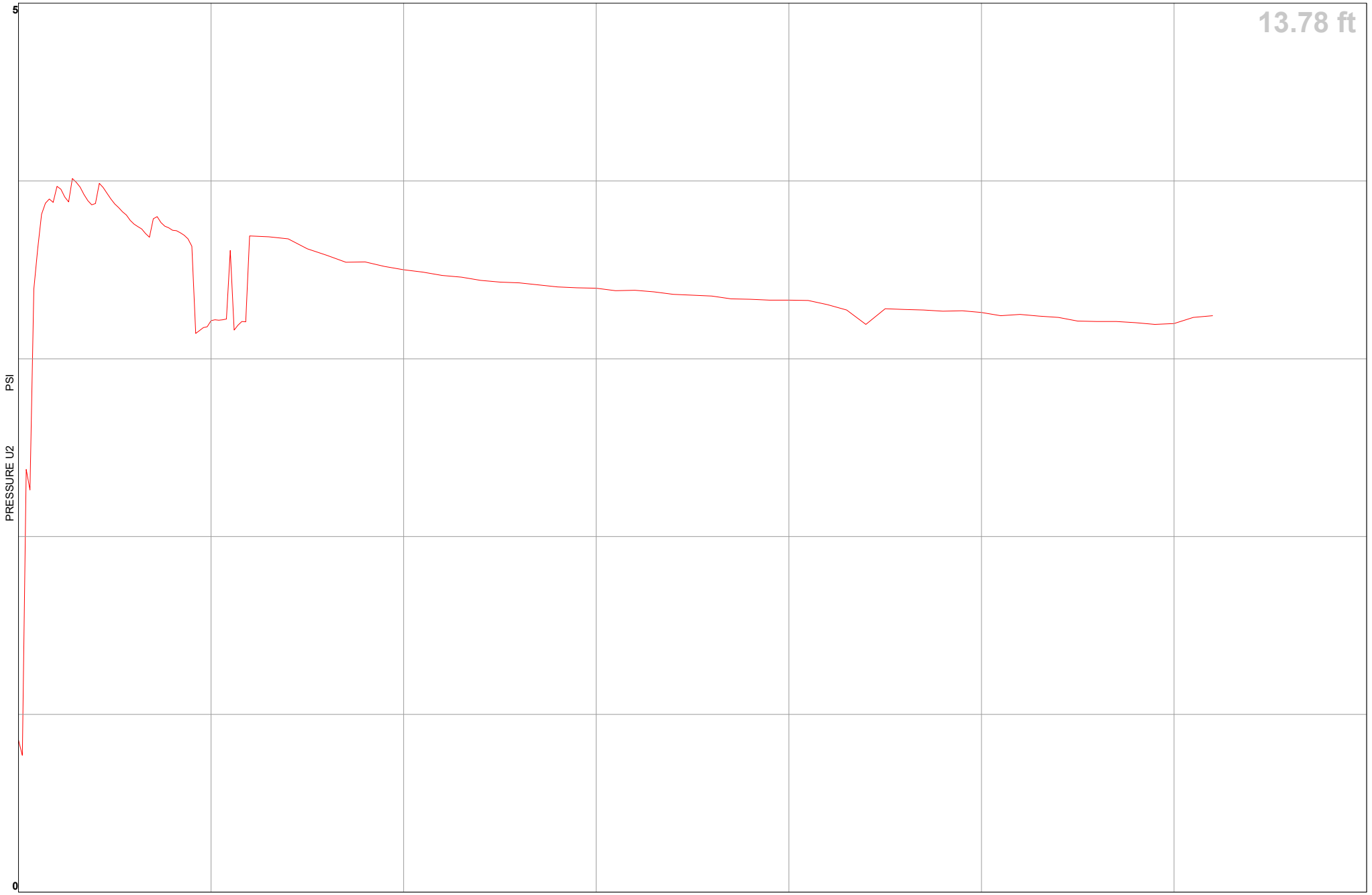
1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 15cm squared

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

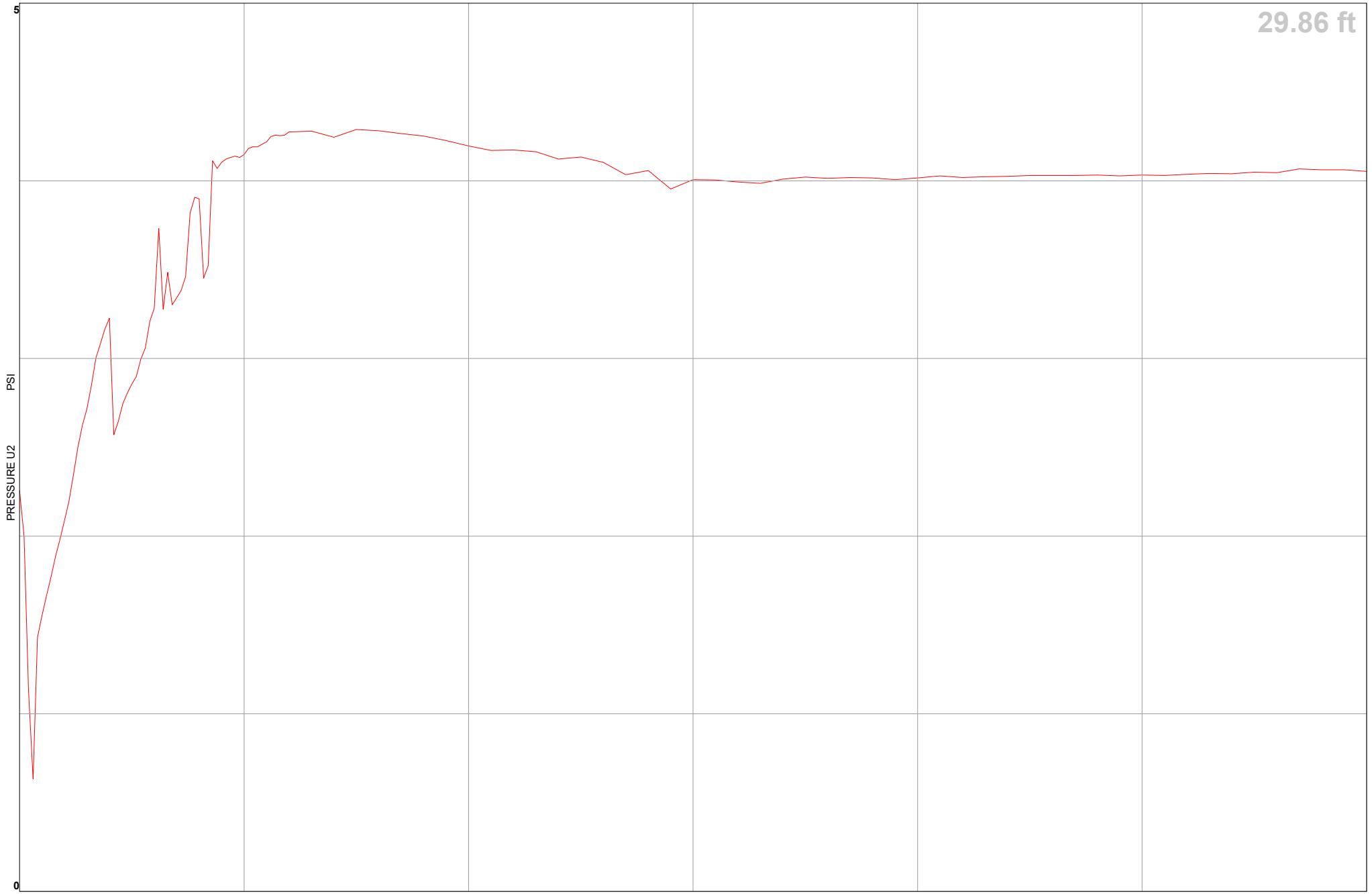
Haley & Aldrich

Location	Stinson Beach Lifeguard Tower & Cante	Operator	JM-GM		
Job Number	206170	Cone Number	DDG1627	GPS	
Hole Number	CPT-02	Date and Time	11/15/2022 12:03:58 PM		
Equilized Pressure	3.2	EST GW Depth During Test	6.2		



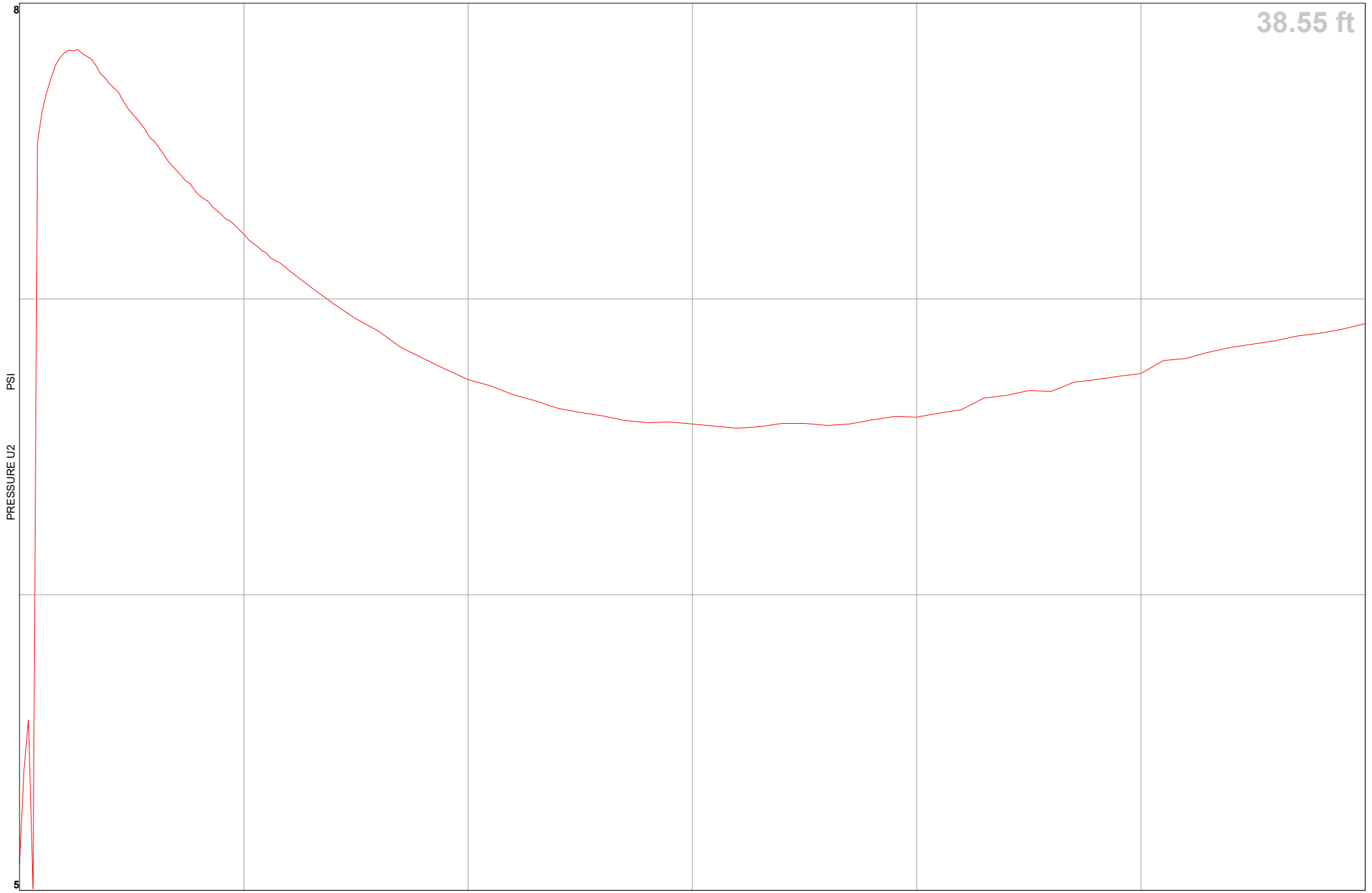
Haley & Aldrich

Location	Stinson Beach Lifeguard Tower & Cante	Operator	JM-GM		
Job Number	206170	Cone Number	DDG1627	GPS	
Hole Number	CPT-02	Date and Time	11/15/2022 12:03:58 PM		
Equilized Pressure	4.0	EST GW Depth During Test	20.5		



Haley & Aldrich

Location	Stinson Beach Lifeguard Tower & Cante	Operator	JM-GM		
Job Number	206170	Cone Number	DDG1627	GPS	
Hole Number	CPT-02	Date and Time	11/15/2022 12:03:58 PM		
Equilized Pressure	6.9	EST GW Depth During Test	22.5		

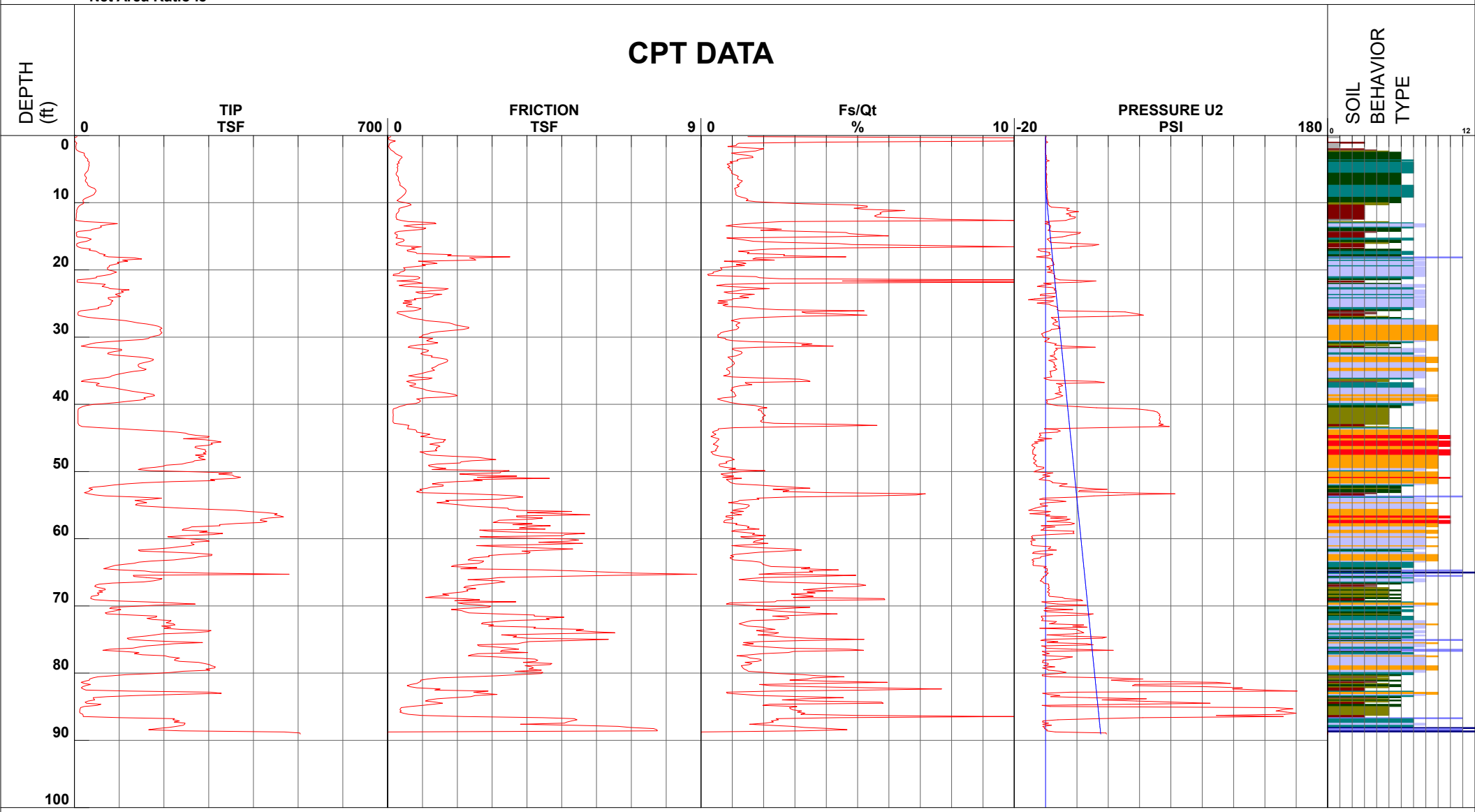


Haley & Aldrich

Project	Stinson Beach Lifeguard Tower & Cantee	Operator	JM-GM	Filename	SDF(683).cpt
Job Number	206170	Cone Number	DDG1627	GPS	
Hole Number	CPT-03	Date and Time	11/15/2022 3:18:42 PM	Maximum Depth	89.07 ft
EST GW Depth During Test		8.00 ft			

Net Area Ratio .8

CPT DATA



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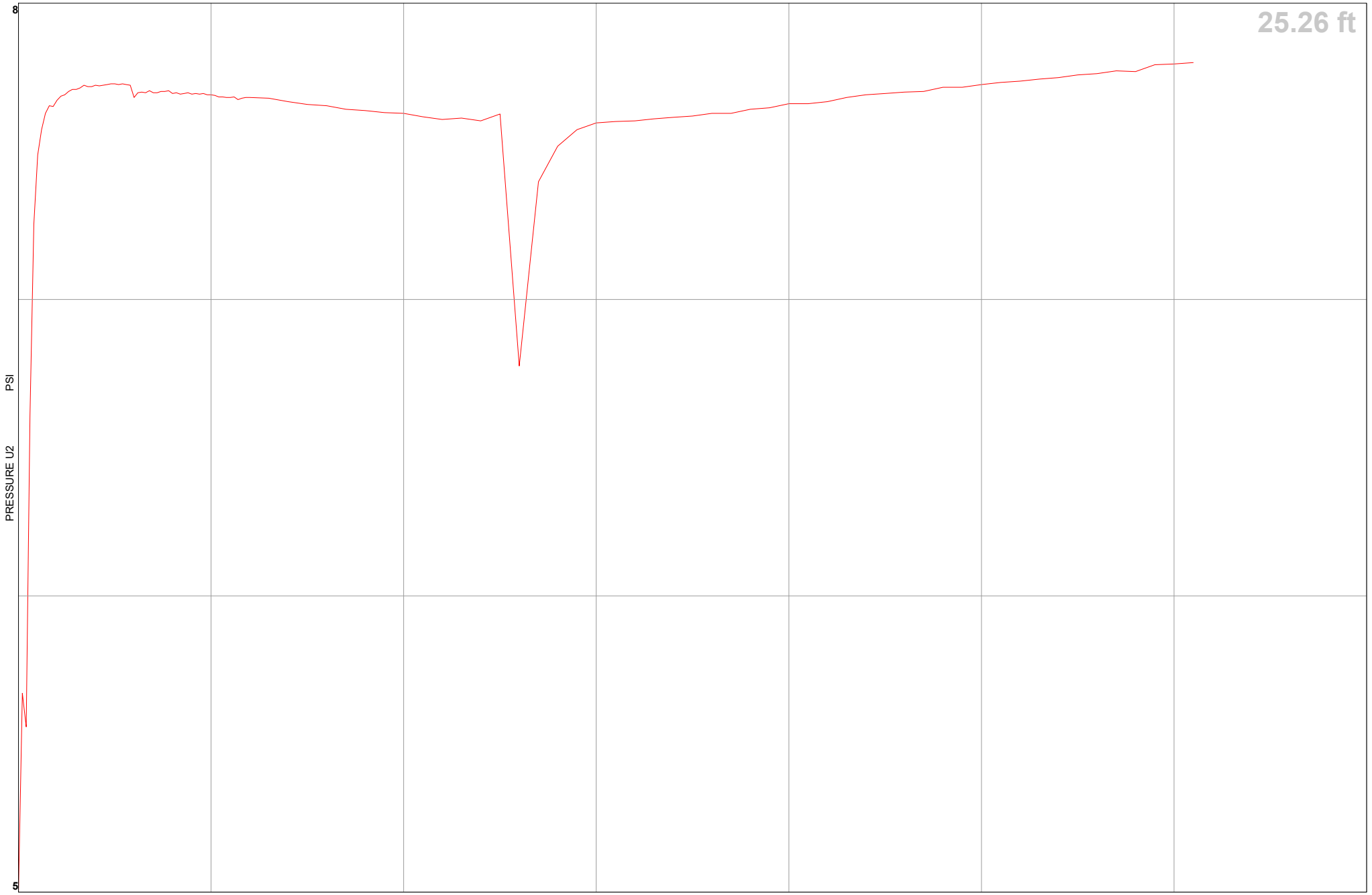
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 15cm squared

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

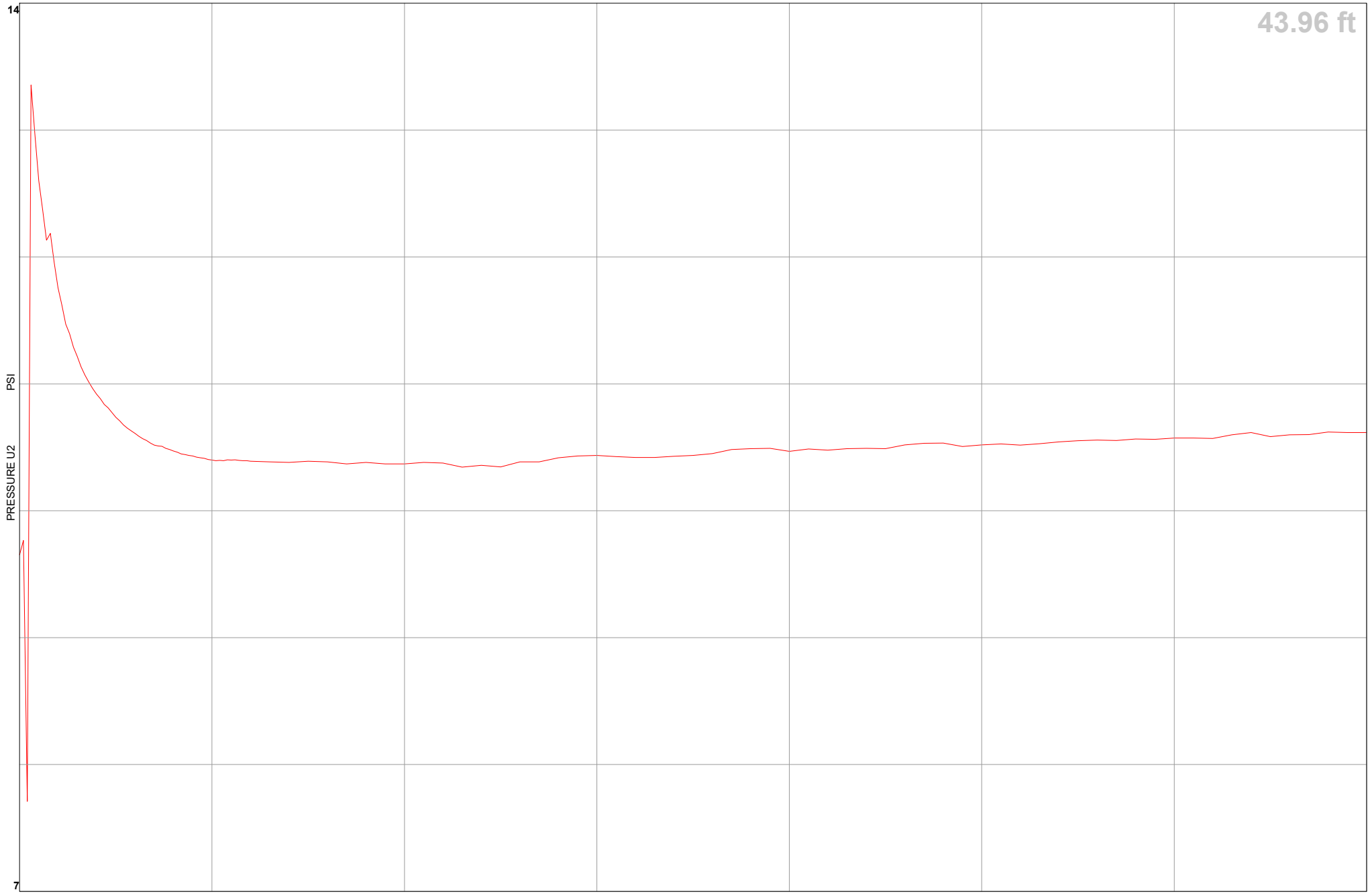
Haley & Aldrich

Location	Stinson Beach Lifeguard Tower & Cante	Operator	JM-GM		
Job Number	206170	Cone Number	DDG1627	GPS	
Hole Number	CPT-03	Date and Time	11/15/2022 3:18:42 PM		
Equilized Pressure	7.8	EST GW Depth During Test	7.2		

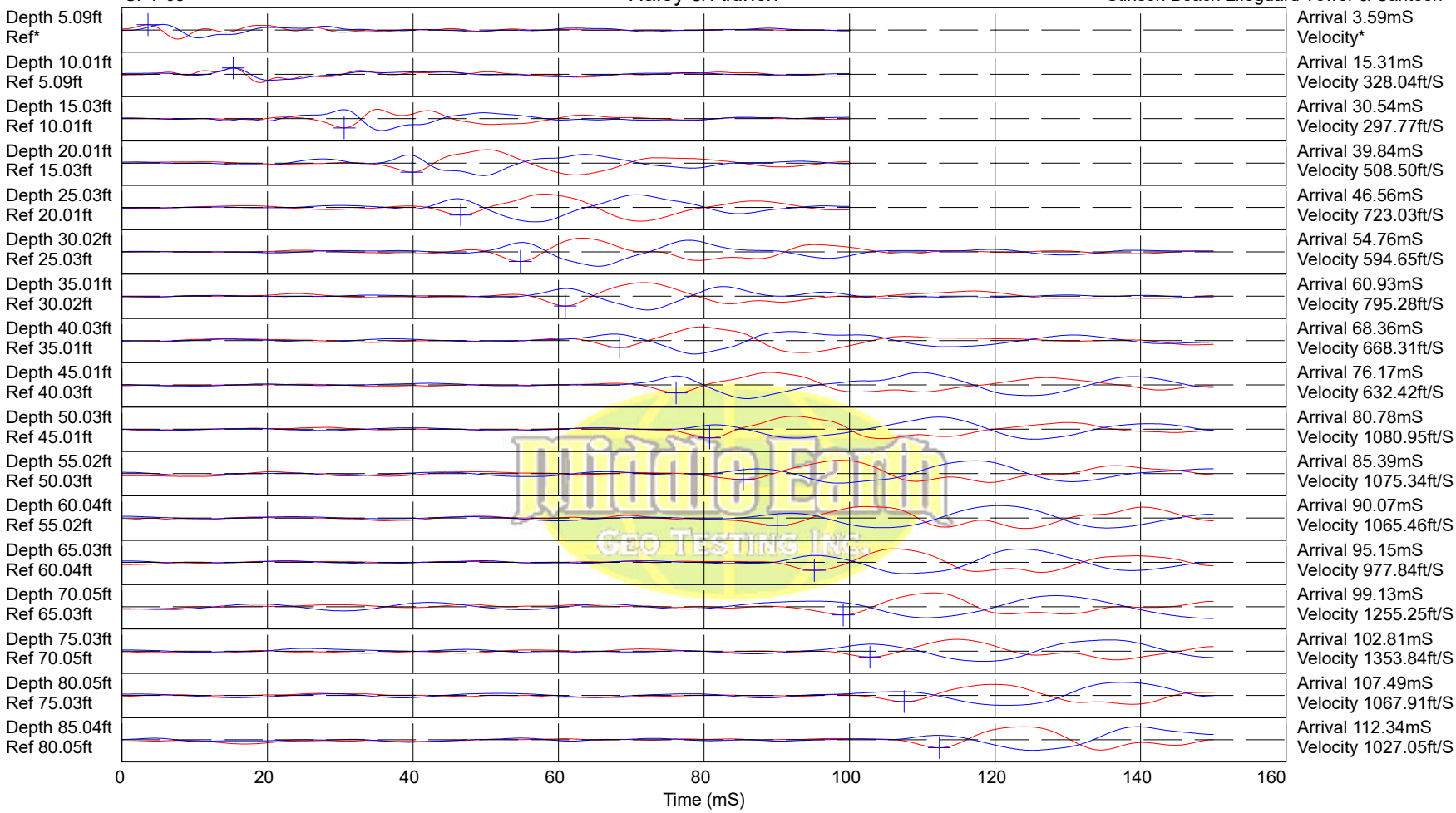


Haley & Aldrich

Location	Stinson Beach Lifeguard Tower & Cante	Operator	JM-GM		
Job Number	206170	Cone Number	DDG1627	GPS	
Hole Number	CPT-03	Date and Time	11/15/2022 3:18:42 PM		
Equilized Pressure	10.6	EST GW Depth During Test	19.4		



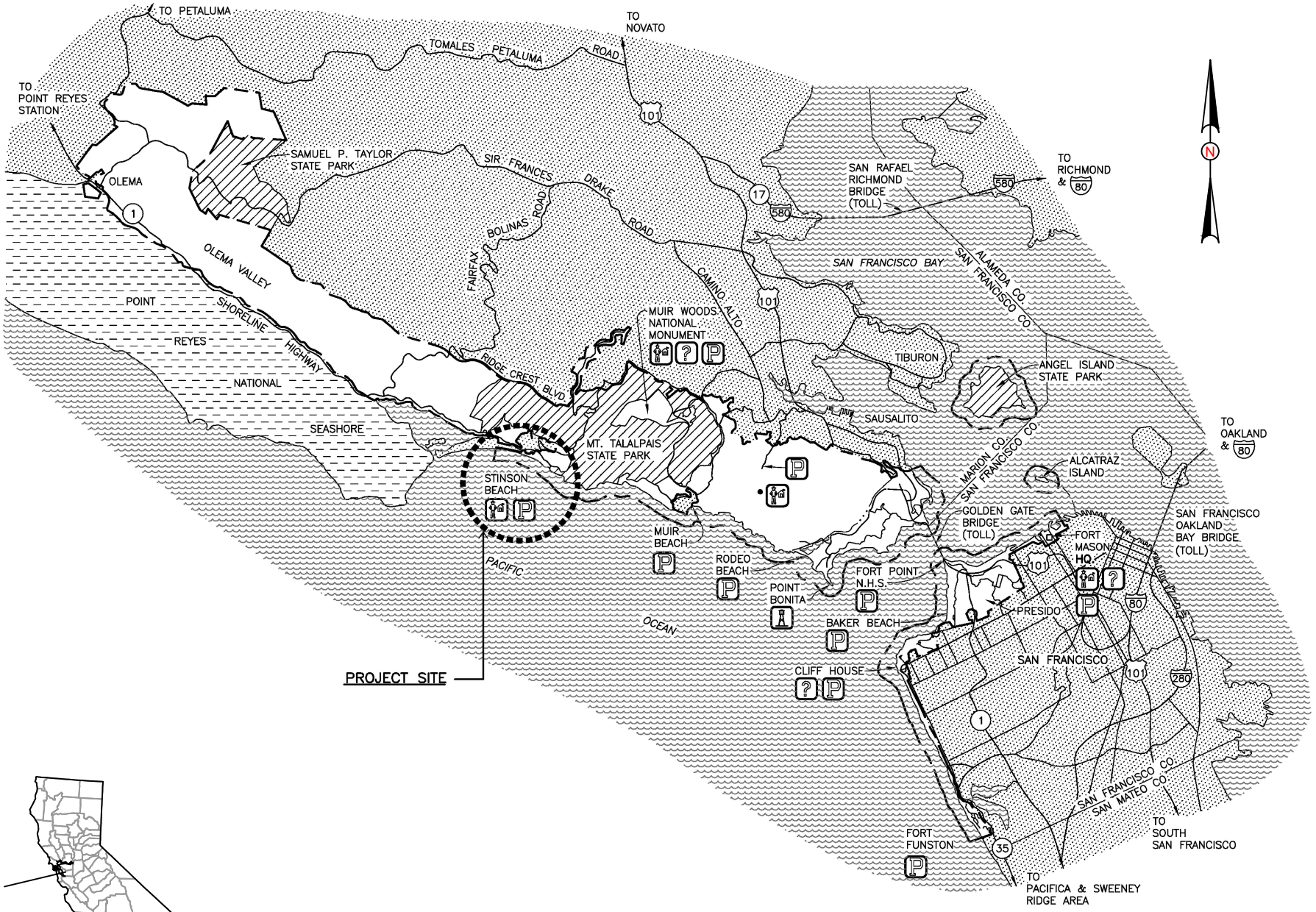
CPT-03 | Haley & Aldrich | Stinson Beach Lifeguard Tower & Canteen



Hammer to Rod String Distance (ft): 5.83
* = Not Determined

COMMENT:

APPENDIX B
Previous Investigations by Others



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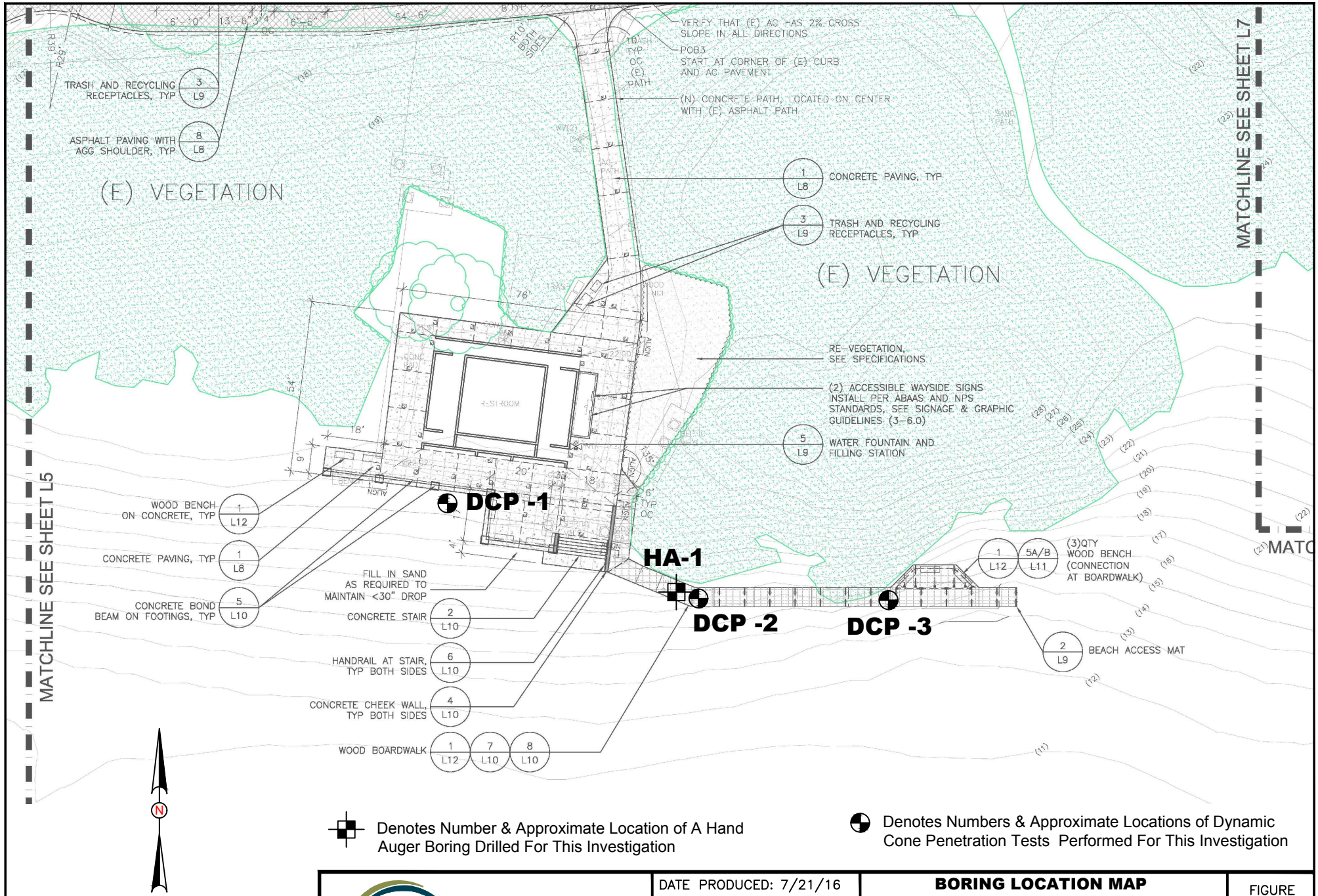
PROJ. No.: 137895	
DRAWN BY: G.G.	
CHECKED BY: N.D.	
FILE NAME: ST016D060.CAD	

SITE VICINITY MAP

Rehabilitation of Stinson Beach of Universal Access
Golden Gate National Recreation Area
San Francisco, California

FIGURE

1



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PROJ. No.: 137895	
DRAWN BY: G.G.	
CHECKED BY: N.C.	
FILE NAME: ST016D060.CAD	

BORING LOCATION MAP

Rehabilitation of Stinson Beach of Universal Access
Golden Gate National Recreation Area
San Francisco, California

FIGURE

2

SAMPLE/SAMPLER TYPE GRAPHICS

GROUND WATER GRAPHICS

- WATER LEVEL (level where first observed)
- WATER LEVEL (level after exploration completion)
- WATER LEVEL (additional levels after exploration)
- OBSERVED SEEPAGE

NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, ie., GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	**GRAVELS** (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVEL WITH <5% FINES	Cu≥4 and 1≤Cc≤3		**GW**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			Cu<4 and/ or 1>Cc>3		**GP**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH 5% TO 12% FINES	Cu≥4 and 1≤Cc≤3		**GW-GM**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
					GW-GC	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
			Cu<4 and/ or 1>Cc>3		**GP-GM**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
					GP-GC	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
		GRAVELS WITH > 12% FINES			**GM**	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
					GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
					GC-GM	CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES
	SANDS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH <5% FINES	Cu≥6 and 1≤Cc≤3		**SW**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			Cu<6 and/ or 1>Cc>3		**SP**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH 5% TO 12% FINES	Cu≥6 and 1≤Cc≤3		**SW-SM**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
					SW-SC	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
			Cu<6 and/ or 1>Cc>3		**SP-SM**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
					SP-SC	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
		SANDS WITH > 12% FINES			**SM**	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
					SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
					SC-SM	CLAYEY SANDS, SAND-SILT-CLAY MIXTURES
FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)		SILTS AND CLAYS (Liquid Limit less than 50)			**ML**	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY
					CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
					CL-ML	INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
					OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
		SILTS AND CLAYS (Liquid Limit greater than 50)			**MH**	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
					CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
					OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY

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PROJECT NO.:	137895
DRAWN BY:	
CHECKED BY:	
DATE:	
REVISED:	-

GRAPHICS KEY

Rehabilitation of Stinson Beach
for Universal Access
Golden Gate National Recreation Area
Stinson Beach, CA

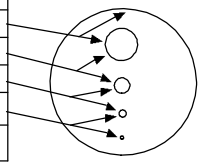
A-1

gINT FILE: V:\irosales\projects\nathan D\hand Auger 1.gpj
gINT TEMPLATE: PROJECTWISE: KLF_STANDARD_GINT_LIBRARY_2016.GLB [GEO-LEGEND 1 (GRAPHICS KEY) WITH USCS]
PLOTTED: 07/22/2016 10:48 AM BY: IRosales

PLOTTED: 07/22/2016 10:51 AM BY: IRosales

GRAIN SIZE

DESCRIPTION		SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders		>12 in. (304.8 mm.)	>12 in. (304.8 mm.)	Larger than basketball-sized
Cobbles		3 - 12 in. (76.2 - 304.8 mm.)	3 - 12 in. (76.2 - 304.8 mm.)	Fist-sized to basketball-sized
Gravel	coarse	3/4 -3 in. (19 - 76.2 mm.)	3/4 -3 in. (19 - 76.2 mm.)	Thumb-sized to fist-sized
	fine	#4 - 3/4 in. (#4 - 19 mm.)	0.19 - 0.75 in. (4.8 - 19 mm.)	Pea-sized to thumb-sized
Sand	coarse	#10 - #4	0.079 - 0.19 in. (2 - 4.9 mm.)	Rock salt-sized to pea-sized
	medium	#40 - #10	0.017 - 0.079 in. (0.43 - 2 mm.)	Sugar-sized to rock salt-sized
	fine	#200 - #40	0.0029 - 0.017 in. (0.07 - 0.43 mm.)	Flour-sized to sugar-sized
Fines		Passing #200	<0.0029 in. (<0.07 mm.)	Flour-sized and smaller



Munsell Color

NAME	ABBR
Red	R
Yellow Red	YR
Yellow	Y
Green Yellow	GY
Green	G
Blue Green	BG
Blue	B
Purple Blue	PB
Purple	P
Red Purple	RP
Black	N

ANGULARITY

DESCRIPTION	CRITERIA
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular	Particles are similar to angular description but have rounded edges
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges
Rounded	Particles have smoothly curved sides and no edges

Particles Present

Amount	Percentage
trace	<5
few	5-10
little	15-25
some	30-45
and	50
mostly	50-100

PLASTICITY

DESCRIPTION	LL	FIELD TEST
Non-plastic	NP	A 1/8-in. (3 mm.) thread cannot be rolled at any water content.
Low (L)	< 30	The thread can barely be rolled and the lump or thread cannot be formed when drier than the plastic limit.
Medium (M)	30 - 50	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump or thread crumbles when drier than the plastic limit
High (H)	> 50	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump or thread can be formed without crumbling when drier than the plastic limit

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

REACTION WITH HYDROCHLORIC ACID

DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

APPARENT DENSITY	SPT-N_{60} (# blows/ft)	MODIFIED CA SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)
Very Loose	<4	<4	<5	0 - 15
Loose	4 - 10	5 - 12	5 - 15	15 - 35
Medium Dense	10 - 30	12 - 35	15 - 40	35 - 65
Dense	30 - 50	35 - 60	40 - 70	65 - 85
Very Dense	>50	>60	>70	85 - 100

NOTE: AFTER TERZAGHI AND PECK, 1948

CONSISTENCY - FINE-GRAINED SOIL

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (q_u)(psf)	CRITERIA
Very Soft	< 1000	Thumb will penetrate soil more than 1 in. (25 mm.)
Soft	1000 - 2000	Thumb will penetrate soil about 1 in. (25 mm.)
Firm	2000 - 4000	Thumb will indent soil about 1/4-in. (6 mm.)
Hard	4000 - 8000	Thumb will not indent soil but readily indented with thumbnail
Very Hard	> 8000	Thumbnail will not indent soil

STRUCTURE

DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 1/4-in. thick, note thickness
Laminated	Alternating layers of varying material or color with the layer less than 1/4-in. thick, note thickness
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided	Fracture planes appear polished or glossy, sometimes striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness
Homogeneous	Same color and appearance throughout

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

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PROJECT NO.: 137895
DRAWN BY:
CHECKED BY:
DATE:
REVISED: -

SOIL DESCRIPTION KEY

Rehabilitation of Stinson Beach
for Universal Access
Golden Gate National Recreation Area
Stinson Beach, CA

A-2

gINT FILE: V:\irosales\projects\nathan D\hand Auger 1.gpj
gINT TEMPLATE: PROJECTWISE: KLF_STANDARD_GINT_LIBRARY_2016.GLB [GEO-LEGEND 2 (SOIL DESCRIPTION KEY)]

PLOTTED: 07/22/2016 11:02 AM BY: IRosales

Date Begin - End:	6/27/2016	**Drilling Company:**	Kleinfelder
Logged By:	Cavan Ewing	**Drill Crew:**	N/A
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger
Plunge:	-90 degrees	**Drilling Method:**	Hand Auger
Weather:	Not Available	**Exploration Diameter:**	3 in. O.D.

BORING LOG HA-1

Depth (feet)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Blows/6 in.	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		FIELD EXPLORATION				LABORATORY RESULTS							
		Poorly graded SAND (SP): fine-grained, light gray, dry											
		fine to coarse-grained, gray, moist											
		fine to medium-grained, moist											
▽ 5		**Silty SAND (SM)**: fine-grained, gray with reddish brown, wet											Free water
		wet, soft											

The hand exploration was terminated at approximately 5.5 ft. below ground surface. The hand exploration was backfilled with auger cuttings on June 27, 2016.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 4.5 ft. below ground surface during drilling.
GENERAL NOTES:

10 15 20 25 30

gINT FILE: V:\irosales\projects\nathan D\hand Auger 1.gpj
gINT TEMPLATE: PROJECTWISE: KLF_STANDARD_GINT_LIBRARY_2016.GLB [KLF_BORING/TEST PIT SOIL LOG]

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PROJECT NO.:	137895
DRAWN BY:	INR
CHECKED BY:	ND
DATE:	7/21/2016
REVISED:	-

BORING LOG HA-1

Rehabilitation of Stinson Beach
for Universal Access
Golden Gate National Recreation Area
Stinson Beach, CA

A-3

WILDCAT DYNAMIC CONE LOG

company name
company address
company city, state, zip

PROJECT NUMBER: 00137895
DATE STARTED: 06-27-2016
DATE COMPLETED: 06-27-2016

HOLE #: DCP-1
CREW: Cavan Ewing
PROJECT: Stinson Beach
ADDRESS:
LOCATION: Stinson Beach

SURFACE ELEVATION:
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
- 1 ft	8	35.5	••••••••••	10	LOOSE	STIFF
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 2 ft	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	2	8.9	••	2	VERY LOOSE	SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
- 3 ft	3	13.3	•••	3	VERY LOOSE	SOFT
- 1 m	3	13.3	•••	3	VERY LOOSE	SOFT
-	2	7.7	••	2	VERY LOOSE	SOFT
- 4 ft	2	7.7	••	2	VERY LOOSE	SOFT
-	2	7.7	••	2	VERY LOOSE	SOFT
-	2	7.7	••	2	VERY LOOSE	SOFT
- 5 ft	2	7.7	••	2	VERY LOOSE	SOFT
-	3	11.6	•••	3	VERY LOOSE	SOFT
-	7	27.0	•••••••	7	LOOSE	MEDIUM STIFF
- 6 ft	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
-	15	57.9	•••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 2 m	15	57.9	•••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 7 ft	15	51.3	••••••••••••••	14	MEDIUM DENSE	STIFF
-	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
-	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
- 8 ft	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
-	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
-	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
- 9 ft	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
-	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
-	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
- 3 m 10 ft	9	30.8	••••••••	8	LOOSE	MEDIUM STIFF
-	9	27.5	•••••••	7	LOOSE	MEDIUM STIFF
-	10	30.6	••••••••	8	LOOSE	MEDIUM STIFF
-	9	27.5	•••••••	7	LOOSE	MEDIUM STIFF
- 11 ft	10	30.6	••••••••	8	LOOSE	MEDIUM STIFF
-	7	21.4	••••••	6	LOOSE	MEDIUM STIFF
-	4	12.2	•••	3	VERY LOOSE	SOFT
- 12 ft	6	18.4	•••••	5	LOOSE	MEDIUM STIFF
-	14	42.8	••••••••••••	12	MEDIUM DENSE	STIFF
-	17	52.0	••••••••••••••••	14	MEDIUM DENSE	STIFF
- 4 m 13 ft	17	52.0	••••••••••••••••	14	MEDIUM DENSE	STIFF

Stinson

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PLOTTED: 26 Jul 2016, 12:48pm, ggomez
CAD FILE: W:\others\137895\plans\ LAYOUT: FIGURE B-1a
ATTACHED IMAGES:
ATTACHED XREFS:
OFFICE_NAME

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PROJECT NO. 137895
DRAWN: 7/26/2016
DRAWN BY: G.G.
CHECKED BY: T.D.
FILE NAME: Figure B.CAD

DYNAMIC CONE LOGS

Rehabilitation of Stinson Beach of Universal Access
Golden Gate National Recreation Area
San Francisco, California

FIGURE
B-1

HOLE #: DCP-1

WILDCAT DYNAMIC CONE LOG

PROJECT: Stinson Beach

PROJECT NUMBER: 00137895

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
	25	69.3	••••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
	24	66.5	••••••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
14 ft	20	55.4	••••••••••••••••	15	MEDIUM DENSE	STIFF
	15	41.6	••••••••••••	11	MEDIUM DENSE	STIFF
	13	36.0	••••••••••	10	LOOSE	STIFF
15 ft	11	30.5	••••••••	8	LOOSE	MEDIUM STIFF
	13	36.0	••••••••••	10	LOOSE	STIFF
	10	27.7	••••••••	7	LOOSE	MEDIUM STIFF
16 ft						
5 m						
17 ft						
18 ft						
19 ft						
6 m						
20 ft						
21 ft						
22 ft						
7 m 23 ft						
24 ft						
25 ft						
26 ft						
8 m						
27 ft						
28 ft						
29 ft						
9 m						

Stinson

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CAD FILE: W:\others\137895\plans\ LAYOUT: FIGURE B-1b
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DYNAMIC CONE LOGS

Rehabilitation of Stinson Beach of Universal Access
Golden Gate National Recreation Area
San Francisco, California

FIGURE
B-1
2 of 2

PLOTTED: 26 Jul 2016, 12:51pm, ggomez
CAD FILE: W:\others\137895\plans\ LAYOUT: FIGURE B-2a
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ATTACHED XREFS:
OFFICE_NAME

WILDCAT DYNAMIC CONE LOG

company name
company address
company city, state, zip

PROJECT NUMBER: 00137895
DATE STARTED: 06-27-2016
DATE COMPLETED: 06-27-2016

HOLE #: DCP-2
CREW: Cavan Ewing
PROJECT: Stinson Beach
ADDRESS:
LOCATION: Stinson Beach

SURFACE ELEVATION:
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	8	35.5	•••••••••	10	LOOSE	STIFF
- 1 ft	8	35.5	•••••••••	10	LOOSE	STIFF
-	7	31.1	••••••••	8	LOOSE	MEDIUM STIFF
-	10	44.4	••••••••••••	12	MEDIUM DENSE	STIFF
- 2 ft	10	44.4	••••••••••••	12	MEDIUM DENSE	STIFF
-	11	48.8	••••••••••••••	13	MEDIUM DENSE	STIFF
-	13	57.7	•••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 3 ft	14	62.2	••••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
- 1 m	12	53.3	•••••••••••••••	15	MEDIUM DENSE	STIFF
-	10	38.6	•••••••••••	11	MEDIUM DENSE	STIFF
- 4 ft	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
-	4	15.4	••••	4	VERY LOOSE	SOFT
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 5 ft	4	15.4	••••	4	VERY LOOSE	SOFT
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 6 ft	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 2 m	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 7 ft	10	34.2	•••••••••	9	LOOSE	STIFF
-	16	54.7	•••••••••••••••	15	MEDIUM DENSE	STIFF
-	15	51.3	••••••••••••••	14	MEDIUM DENSE	STIFF
- 8 ft	15	51.3	••••••••••••••	14	MEDIUM DENSE	STIFF
-	9	30.8	••••••••	8	LOOSE	MEDIUM STIFF
-	9	30.8	••••••••	8	LOOSE	MEDIUM STIFF
- 9 ft	15	51.3	••••••••••••••	14	MEDIUM DENSE	STIFF
-	17	58.1	•••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	13	44.5	••••••••••••	12	MEDIUM DENSE	STIFF
- 3 m 10 ft	6	20.5	•••••	5	LOOSE	MEDIUM STIFF
-	7	21.4	••••••	6	LOOSE	MEDIUM STIFF
-	7	21.4	••••••	6	LOOSE	MEDIUM STIFF
-	6	18.4	•••••	5	LOOSE	MEDIUM STIFF
- 11 ft	9	27.5	•••••••	7	LOOSE	MEDIUM STIFF
-	19	58.1	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	7	21.4	••••••	6	LOOSE	MEDIUM STIFF
- 12 ft	4	12.2	•••	3	VERY LOOSE	SOFT
-	5	15.3	••••	4	VERY LOOSE	SOFT
-	6	18.4	•••••	5	LOOSE	MEDIUM STIFF
- 4 m 13 ft	7	21.4	••••••	6	LOOSE	MEDIUM STIFF

Stinson

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DRAWN BY: G.G.
CHECKED BY: T.D.
FILE NAME: Figure B.CAD

DYNAMIC CONE LOGS

Rehabilitation of Stinson Beach of Universal Access
Golden Gate National Recreation Area
San Francisco, California

FIGURE
B-2

HOLE #: DCP-2

WILDCAT DYNAMIC CONE LOG

PROJECT: Stinson Beach

PROJECT NUMBER: 00137895

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
	10	27.7	••••••••	7	LOOSE	MEDIUM STIFF
	10	27.7	••••••••	7	LOOSE	MEDIUM STIFF
14 ft	22	60.9	••••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
	15	41.6	••••••••••••	11	MEDIUM DENSE	STIFF
	12	33.2	•••••••••	9	LOOSE	STIFF
15 ft						
16 ft						
5 m						
17 ft						
18 ft						
19 ft						
6 m						
20 ft						
21 ft						
22 ft						
7 m 23 ft						
24 ft						
25 ft						
26 ft						
8 m						
27 ft						
28 ft						
29 ft						
9 m						

Stinson

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CAD FILE: W:\others\137895\plans\ LAYOUT: FIGURE B-2b
ATTACHED IMAGES:
ATTACHED XREFS:
OFFICE_NAME

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PROJECT NO. 137895
DRAWN: 7/26/2016
DRAWN BY: G.G.
CHECKED BY: T.D.
FILE NAME: Figure B.CAD

DYNAMIC CONE LOGS

Rehabilitation of Stinson Beach of Universal Access
Golden Gate National Recreation Area
San Francisco, California

FIGURE
B-2
2 of 2

PLOTTED: 26 Jul 2016, 12:52pm, ggomez
CAD FILE: W:\others\137895\plans\ LAYOUT: FIGURE B-3a
ATTACHED IMAGES:
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OFFICE_NAME

WILDCAT DYNAMIC CONE LOG

company name
company address
company city, state, zip

PROJECT NUMBER: 00137895
DATE STARTED: 06-27-2016
DATE COMPLETED: 06-27-2016

HOLE #: DCP-3
CREW: Cavan Ewing
PROJECT: Stinson Beach
ADDRESS:
LOCATION: Stinson Beach

SURFACE ELEVATION:
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	8	35.5	•••••••••	10	LOOSE	STIFF
- 1 ft	2	8.9	••	2	VERY LOOSE	SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
- 2 ft	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	11	48.8	••••••••••••••	13	MEDIUM DENSE	STIFF
- 3 ft	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
- 1 m	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 4 ft	4	15.4	••••	4	VERY LOOSE	SOFT
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
-	2	7.7	••	2	VERY LOOSE	SOFT
- 5 ft	1	3.9	•	1	VERY LOOSE	VERY SOFT
-	2	7.7	••	2	VERY LOOSE	SOFT
-	2	7.7	••	2	VERY LOOSE	SOFT
- 6 ft	3	11.6	•••	3	VERY LOOSE	SOFT
-	3	11.6	•••	3	VERY LOOSE	SOFT
- 2 m	3	11.6	•••	3	VERY LOOSE	SOFT
- 7 ft	5	17.1	••••	4	VERY LOOSE	SOFT
-	5	17.1	••••	4	VERY LOOSE	SOFT
-	10	34.2	•••••••••	9	LOOSE	STIFF
- 8 ft	24	82.1	•••••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
-	11	37.6	•••••••••••	10	LOOSE	STIFF
-	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
- 9 ft	10	34.2	•••••••••	9	LOOSE	STIFF
-	12	41.0	••••••••••••	11	MEDIUM DENSE	STIFF
-	16	54.7	••••••••••••••••	15	MEDIUM DENSE	STIFF
- 3 m 10 ft	25	85.5	•••••••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
-	28	85.7	•••••••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
-	32	97.9	••••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	27	82.6	••••••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
- 11 ft	30	91.8	•••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	28	85.7	•••••••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
-	30	91.8	•••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 12 ft	22	67.3	••••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	28	85.7	•••••••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
-	30	91.8	•••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 4 m 13 ft	27	82.6	•••••••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF

Stinson

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DYNAMIC CONE LOGS

Rehabilitation of Stinson Beach of Universal Access
Golden Gate National Recreation Area
San Francisco, California

FIGURE
B-3

HOLE #: DCP-3

WILDCAT DYNAMIC CONE LOG

PROJECT: Stinson Beach

PROJECT NUMBER: 00137895

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
	27	74.8	••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
	28	77.6	••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
14 ft	30	83.1	••••••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
	37	102.5	••••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
	16	44.3	••••••••••••	12	MEDIUM DENSE	STIFF
15 ft	12	33.2	•••••••••	9	LOOSE	STIFF
	28	77.6	••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
16 ft						
5 m						
17 ft						
18 ft						
19 ft						
6 m						
20 ft						
21 ft						
22 ft						
7 m 23 ft						
24 ft						
25 ft						
26 ft						
8 m						
27 ft						
28 ft						
29 ft						
9 m						

Stinson

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DYNAMIC CONE LOGS

Rehabilitation of Stinson Beach of Universal Access
Golden Gate National Recreation Area
San Francisco, California

FIGURE
B-3
2 of 2

STINSON BEACH PARKING AREA

North

0 200
feet

All locations and dimensions are approximate

LEGEND:

- Pedestrian bridge boring drilled January 2020
- Pavement boring location to depth of ~5 feet drilled in January 2020

View looking northwest from Marine Drive toward proposed pedestrian bridge

Base Map: Atkins (2019) *Project Deliverary Plan*

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

FIELD EXPLORATION PLAN

PROJECT NAME: Golden Gate National Recreation Area, Stinson Beach, Marin County, CA

PLATE 1.1

PROJECT NUMBER: 219-400

REVISION DATE: 5.20.2020

North

0 40
feet

All locations and dimensions are approximate

LEGEND:

Pavement boring location drilled to depth of ~5 feet drilled in January 2020

Base Map: Atkins, Alternative 5, CFT Meeting hand out on April 14, 2020

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

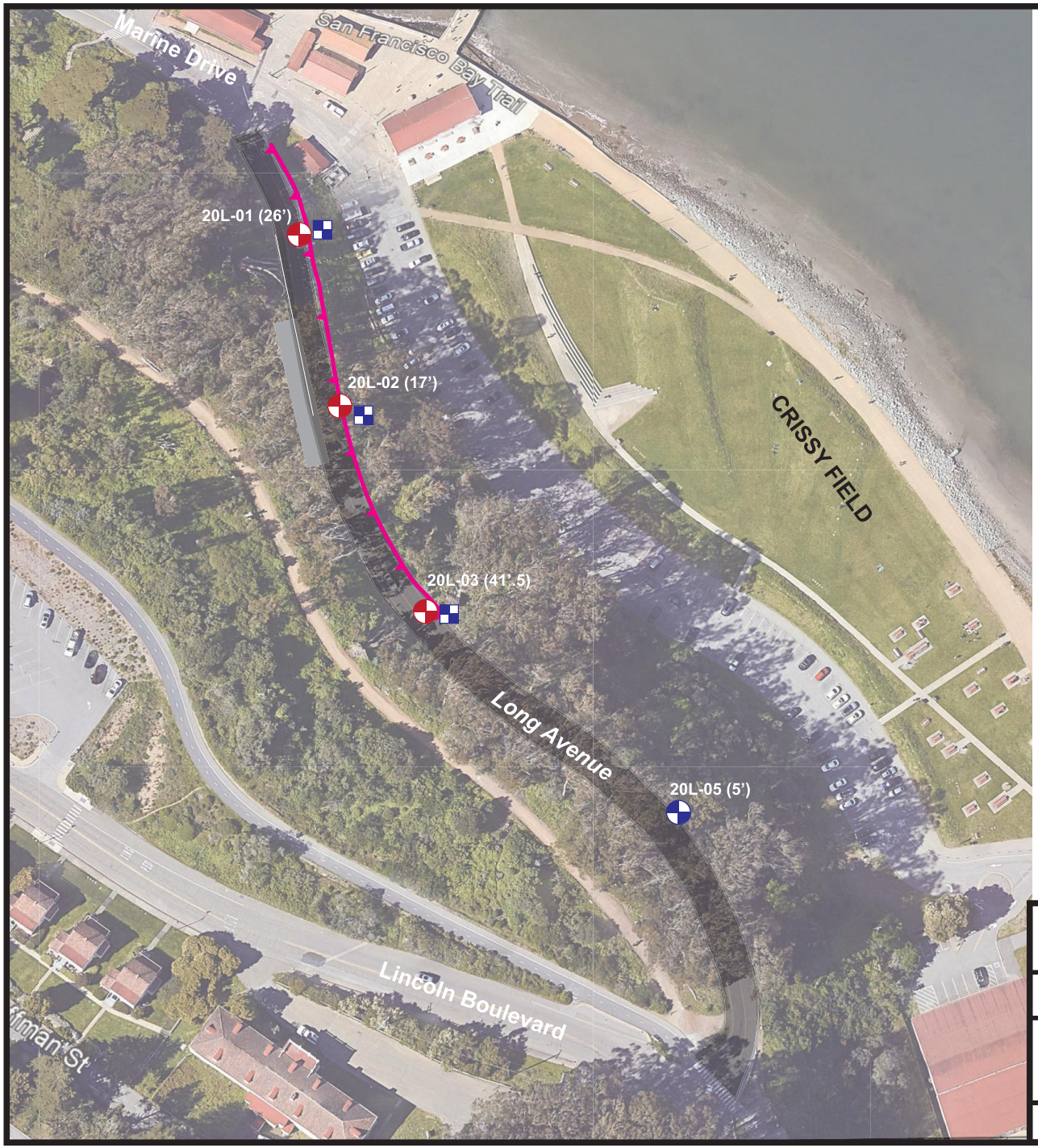
FIELD EXPLORATION PLAN

PROJECT NAME:
Golden Gate National Recreation Area
Tennessee Valley Road Trailhead Parking
Marin County, CA

PLATE
1.2

PROJECT NUMBER:
219-400

REVISION DATE:
5.26.2019



North

0 160

feet

All locations and dimensions are approximate

LEGEND:

- Retaining wall boring drilled April 2020
- Pavement boring location to depth of ~5 feet drilled in April 2020
- Hand excavation made in April 2020
- Proposed retaining wall

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

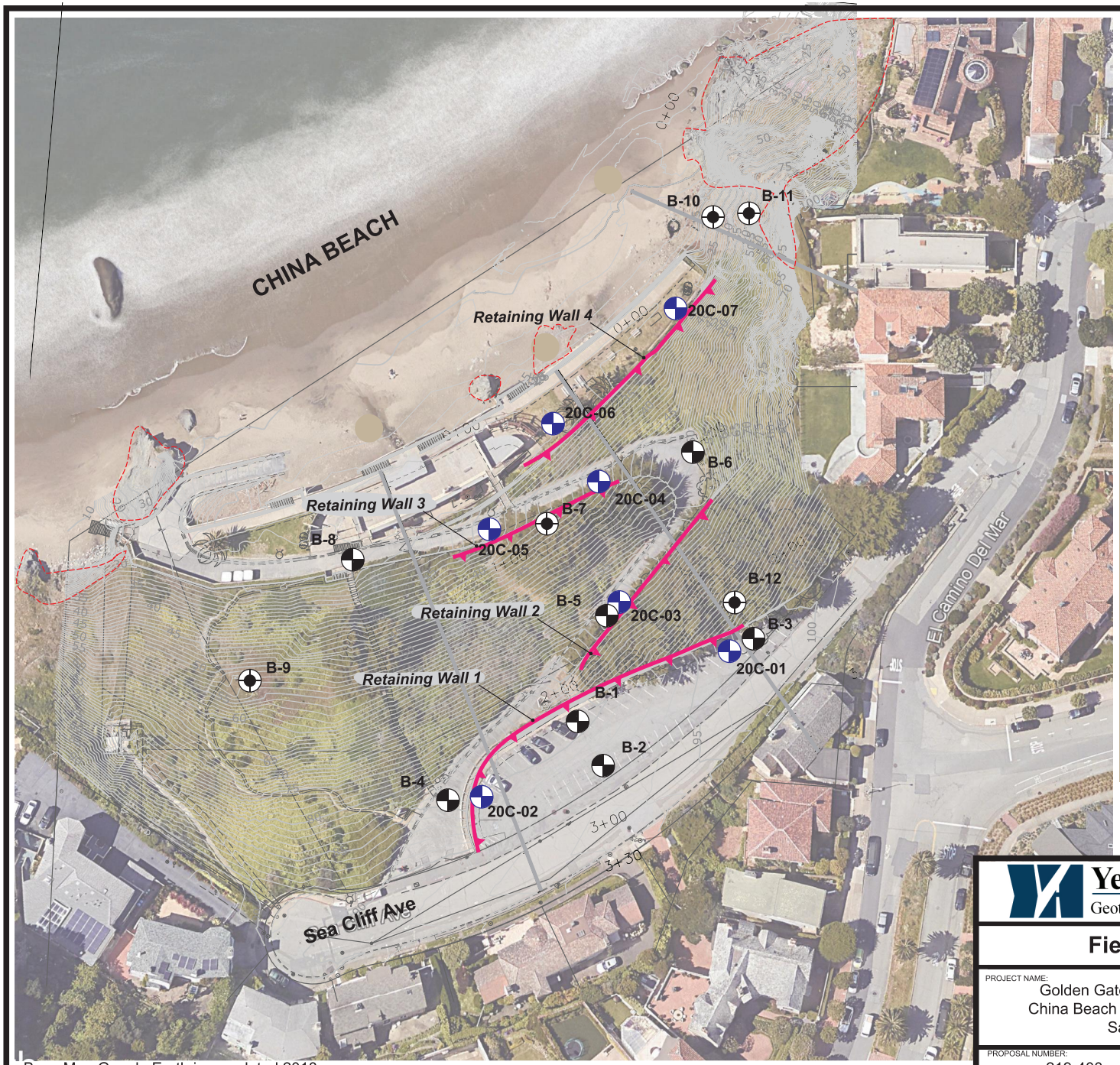
Field Exploration Plan

PROJECT NAME:
Golden Gate National Recreation Area
Long Avenue Widening
San Francisco, CA

PROPOSAL NUMBER: 219-400

REVISED DATE: 5/26/2020

PLATE **1.3**



Base Map:Google Earth image dated 2018.

North

0 100

feet

All locations and dimensions are approximate

Legend:

- Miller Pacific boring drilled with B24 truck-mounted rig in August 2018
- Miller Pacific boring drilled with portable rig in August 2018 (type assumed based on reported location)
- Yeh boring drilled with CME55 track-mounted rig in February 2020 (current study)
- Proposed new retaining wall to replace existing deteriorated walls
- Bedrock outcrops

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Field Exploration Plan

PROJECT NAME:
Golden Gate National Recreation Area
China Beach Access Trail Retaining Walls
San Francisco, CA

PLATE
1.4

PROPOSAL NUMBER: 219-400

REVISED DATE: 5/26/2020

North

0 200

feet

All locations and dimensions are approximate

LEGEND:

- Pavement boring location drilled to depth of ~5 feet in April 2020

Yeh and Associates, Inc.

Geotechnical • Geological • Construction Services

Field Exploration Plan

PROJECT NAME:	PLATE
Golden Gate National Recreation Area Fort Funston Parking Lot Improvements San Francisco, CA	1.5
PROPOSAL NUMBER: 219-400	REVISED DATE: 05/26/2020

APPENDIX A - FIELD EXPLORATION

GROUP SYMBOLS AND NAMES

Graphic / Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic / Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY elastic ELASTIC SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D2435)
CL	Collapse Potential (ASTM D5333)
CP	Compaction Curve (ASTM D1557)
CR	Corrosion, Sulfates, Chlorides (CTM 643; ASTM D4972, ASTM G187, ASTM D4327)
CU	Consolidated Undrained Triaxial (ASTM D4767)
DS	Direct Shear (ASTM D3080)
EI	Expansion Index (ASTM D4829)
M	Moisture Content (ASTM D2216)
OC	Organic Content (ASTM D2974)
P	Permeability (ASTM 5084)
PA	Particle Size Analysis (ASTM D422-63 [2007])
PI	Liquid Limit, Plastic Limit, Plasticity Index (ASTM D4318)
PL	Point Load Index (ASTM D5731)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R-Value (CTM 301)
SE	Sand Equivalent (CTM 217)
SG	Specific Gravity (AASHTO T 100)
SL	Shrinkage Limit (ASTM D427)
SW	Swell Potential (ASTM D4546)
TV	Pocket Torvane
UC	Unconfined Compression - Soil (ASTM D2166) Unconfined Compression - Rock (ASTM D7012)
UU	Unconsolidated Undrained Triaxial (ASTM D2850)
UW	Unit Weight (ASTM D4767, ASTM D7263)
VS	Vane Shear (AASHTO T 223-96 [2004])
-200	200 Wash (ASTM D1140)

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT) (2" O.D.)
- Standard California Sampler (2.5" O.D.)
- Modified California Sampler (3" O.D.)
- Shelby Tube
- Piston Sampler
- Rock Core
- Grab Sample
- Bulk Sample
- Other (see remarks)

DRILLING METHOD SYMBOLS

- Auger Drilling
- Rotary Drilling
- Dynamic Cone or Hand Driven
- Diamond Core

WATER LEVEL SYMBOLS

- First Water Level Reading (during drilling)
- Static Water Level Reading (short-term)
- Static Water Level Reading (long-term)

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

REPORT TITLE
LEGEND FOR SOIL CLASSIFICATION

PROJECT NAME
GOGA Beach Trail Access Improvements

DATE
6/16/2020

SHEET
1 of 1

ROCK GRAPHIC SYMBOLS
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC ROCK

GRAIN/CRYSTAL SIZE AND SHAPE		
Grain Size (inches)	**Description**	**Criteria**
<0.003	Very Fine	Very Fine: Not distinguishable to unaided eye. Few visible hand lens.
0.003 – 0.02	Fine	Few distinguishable with eye or seen with difficulty but can be seen with hand lens.
0.02 – 0.08	Medium	Most visible with eye and distinguishable with aid of hand lens.
0.08 – 0.2	Coarse	Visible and distinguishable with eye and hand lens.
>0.2	Very Coarse	Clearly visible and distinguishable by eye.

DEGREE OF WEATHERING		
Term	**Description**	**Grade**
Fresh	No visible sign of rock material weathering; slight discoloration on major discontinuity surface is possible.	I
Slightly Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All rock material may be discolored by weathering and the external surface may be somewhat weaker than in its fresh condition.	II
Moderately Weathered	Less than half the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones. A minimum 2-inch (50 mm) diameter sample *cannot* be broken readily by hand across the rock fabric.	III
Highly Weathered	More than half of the rock is decomposed and/or disintegrated to soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones. A minimum 2-inch (50 mm) diameter sample *can* be broken readily by hand across the rock fabric.	IV
Completely Weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact. Material can be granulated by hand.	V
Residual Soils	All rock material is converted to soil. The mass structure and material fabric are destroyed but the apparent structure may remain intact. There may be a large change in volume, but the soil has not been significantly transported. Material can be easily broken-down by hand. *Use Soil Description and Identification Guidelines to describe residual soil.*	VI

RELATIVE STRENGTH OF INTACT ROCK SPEICIMENS			
Grade	**Description**	**Field Identification**	**Approximate Uniaxial Compressive Strength***
R0	Extremely Weak	Specimen can be indented by thumbnail.	35 – 150 psi
R1	Very Weak	Specimen crumbles under sharp blow with point of geological hammer, and can be peeled with a pocket knife.	150 – 725 psi
R2	Weak	Shallow cuts or scrapes can be made in a specimen with a pocket knife. A firm blow with a geological hammer point creates shallow indents.	725 – 3,500 psi
R3	Medium Strength	Specimen cannot be scraped or cut with a pocket knife. Specimen can be fractured with a single firm blow with a geologic hammer point.	3,500 – 7250 psi
R4	Strong	Specimen requires more than one firm blow of the geologic hammer point to fracture.	7,250 – 14,500
R5	Very Strong	Specimen requires many firm blows from the hammer end of the geologic hammer to fracture.	14,500 – 36,250
R6	Extremely Strong	Specimen can only be chipped with firm blows from the hammer end of the geologic hammer.	>36,250

*Rock strength is subjective based on general qualitative field observations and may exclude layers or crystals within the rock. Rock strength will likely vary more or less from that described.

DISCONTINUITY SPACING OF JOINTS, FRACTURES, BEDDING, SHEARS AND FAULTS	
Description	**Typical Spacing of Discontinuity***
Extremely wide	>20 feet
Very wide	6 to 20 feet
Wide	2 to 6 feet
Moderate	8 inches to 2 feet
Close	2 to 8 inches
Very Close	¾ to 2 inches
Extremely Close	< ¾ inches

*Widely spaced discontinuities may not be apparent in borings

DISCONTINUITY CONDITIONS	
Description	**Field Identification**
Excellent	Very rough surfaces, no separation, hard discontinuity wall (>R2).
Good	Slightly rough surfaces, separation less than ~0.04 inches, hard discontinuity wall (>R2).
Fair	Slightly rough surface, separation greater than ~0.04 inches, soft discontinuity wall (<R3).
Poor	Slickensided surfaces, or soft gouge less than ~0.2 inches thick, or open discontinuities between ~0.04 and 0.2 inches.
Very Poor	Soft gouge greater than ~0.2 inches, or open discontinuities greater than ~0.2 inches.

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	1-10-20	1-10-20	140 lb Autotrip	20S-01
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N. Simon			--/--	15 ft. +/-
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	Sunny, warm
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Cascade Drilling			Stinson Beach. North end of Parking Area	Native with concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Dietrich D50			Not encountered	4.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													
	1		CLAYEY SAND with GRAVEL (SC), medium dense, light brown, moist, fine to coarse GRAVEL, fine to coarse SAND, (ARTIFICIAL FILL).		F											R (R-Value = 16) poor recovery, four loose rings, cobble in sampler shoe
	2		-with cobbles.		22	8 10 10	20				13					
	3				23	5 3 3	6				19					
	4		Elastic SILT (MH), soft, black, moist, trace sand, trace fine GRAVEL, (ALLUVIUM).													
	5		Bottom of borehole at 4.5 ft bgs													
	6		Boring elevation estimated from Google Earth and is not surveyed													
	7															
	8															
	9															
	10															
	11															
	12															
	13															
	14															
	15															
	16															
	17															
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	26															
	27															

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PROJECT NAME	
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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	**1-10-20**	**1-10-20**	**140 lb Autotrip**	**20S-01-BR**
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N. Simon			**--/--**	**23 ft. +/-**
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			**--**	**Clear, sunny**
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
W. Hoon			Stinson Beach Pedestrian Bridge: South shoulder of Marine Way and 320 ft. east of kiosk	**Neat cement grout**
DRILL RIG			GROUNDWATER READINGS DURING DRILLING **4.0 ft.** AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Dietrich D50				**51.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		CLAYEY SAND with GRAVEL (SC), grayish brown, moist, (ARTIFICIAL FILL).													0 to 1 ft. native backfill
	1		Fat CLAY (CH), very stiff, light yellowish brown, moist, (ALLUVIUM).		4	6 4 4	8				22	105	2.0PP			Tremi place neat cement from 1 ft. to bottom of boring
	2															
	3															
	4		Lean CLAY (CL), very soft, black, wet.													groundwater encountered at 4 ft.
	5				5	1 1 1	2				34					PI (40 LL, 24 PL, 16 PI) CR (pH = 6.86, r = 1,010 ohm-cm, SO_4^{2-} = 50 mg/kg, Cl^- = 13 mg/kg)
	6															
	7															
	8		CLAYEY SAND with GRAVEL (SC), medium dense, grayish brown, wet, subangular GRAVEL, fine to coarse SAND.													
	9															
	10				6	7 15 13	28				17	118				
	11															
	12															
	13		CLAYEY SILT (ML/CL), firm, black, moist to wet.													
	14															
	15				7	1 2 3	5									
	16															
	17															
	18															
	19															
	20		With CLAY and GRAVEL.		8	8 8 4	12				65	60				PI (41 LL, 27 PL, 14 PI) C
	21															
	22															
	23															
	24															
	25		Soft, with SAND, dark gray to black with green mottling, wet, with lenses of CLAY.		9	2 3 5	8									CR (pH = 7.00, r = 1,967 ohm-cm, SO_4^{2-} = 76 mg/kg, Cl^- = 7 mg/kg)
	26															
	27															

(continued)

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PROJECT NAME	**GOGA Beach Trail Access Improvements**
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REVISION DATE	**6/16/2020**
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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	28		CLAYEY SILT (ML/CL) *(continued)*.													
	29		CLAYEY SAND with GRAVEL (SC), dense, grayish brown, wet.													
	30				10	12 14 25	39									
	31															
	32															
	33		Lean CLAY (CL), soft, dark gray, moist, trace GRAVEL and SAND.													
	34															
	35				11	3 3 5	8						0.5PP			
	36															
	37															
	38		Lean CLAY with SAND (CL), very stiff, dark gray, moist, little GRAVEL, (OLDER ALLUVIUM).													
	39															
	40		With SAND and GRAVEL, fine to coarse SAND, fine, angular to subangular GRAVEL.		12	3 8 9	17				17	112				PI (33 LL, 17 PL, 16 PI)
	41															
	42															
	43															
	44															
	45		Interbedded with Well-Graded SAND with clay (SW-SC), medium dense, light brown, medium dense.		13	9 7 7	14									
	46															
	47															
	48															
	49															
	50				14	4 10 7	17						<= 1.0PP			
	51															
	52		Bottom of borehole at 51.5 ft bgs Boring elevation estimated from Google Earth and is not surveyed													
	53															
	54															
	55															
	56															
	57															
	58															
	59															
	60															

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PROJECT NAME	**GOGA Beach Trail Access Improvements**
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REVISION DATE	**6/16/2020**
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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	1-10-20	1-10-20	140 lb Autotrip	20S-03
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N. Simon			--/--	18 ft. +/-
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	Clear
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Cascade Drilling			Stinson Beach North Parking Area: 75 feet Se of kiosk	Native with cold patch cap
DRILL RIG			GROUNDWATER READINGS DURING DRILLING 1.0 ft. AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Dietrich D50				5.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													
	1		AGGREGATE BASE.													
	2		CLAYEY SAND with GRAVEL (SC), loose, grayish brown, wet, fine, subangular GRAVEL, fine to coarse SAND, (ARTIFICIAL FILL). Groundwater entering boring at depth of 1 foot.		3	11 6 3	9				13	124				-200 (39% G, 42% S, 19% F)
	3															
	4															
	5		Boring terminated at depth of 5 feet due to groundwater. Bottom of borehole at 5.0 ft bgs Boring elevation estimated from Google Earth and is not surveyed													
	6															
	7															
	8															
	9															
	10															
	11															
	12															
	13															
	14															
	15															
	16															
	17															
	18															
	19															
	20															
	21															
	22															
	23															
	24															
	25															
	26															
	27															

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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	1-10-20	1-10-20	140 lb Autotrip	20S-04
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N. Simon			--/--	20 ft. +/-
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	Sunny, warm
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Cascade Drilling			Stinson Beach: SW corner of Center Parking Area	Native with cold patch cap
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Dietrich D50			Not encountered	5.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													
	1		AGGREGATE BASE.		B											
	2		SILTY GRAVEL (GM), loose, light brown, moist, fine to medium SAND, (ARTIFICIAL FILL).		15	11 4 3	7				8					-200 (53% G, 33% S, 14% F)
	3															
	4															
	5		Bottom of borehole at 5.0 ft bgs Boring elevation estimated from Google Earth and is not surveyed													
	6															
	7															
	8															
	9															
	10															
	11															
	12															
	13															
	14															
	15															
	16															
	17															
	18															
	19															
	20															
	21															
	22															
	23															
	24															
	25															
	26															
	27															

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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	**1-10-20**	**1-10-20**	**140 lb Autotrip**	**20S-05**
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N. Simon			**--/--**	**22 ft. +/-**
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			**--**	**Sunny, warm**
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Cascade Drilling			**Stinson Beach: NE corner of Center Parking Area**	**Native**
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Dietrich D50			**Not encountered**	**5.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													
	1		AGGREGATE BASE.													
	2		SANDY fat CLAY with GRAVEL (CH), stiff, dark greenish gray, moist, fine, angular GRAVEL, (ARTIFICIAL FILL).		C						25	100				CR (pH = 7.31, r = 1,307 ohm-cm, SO_4^{2-} = 36 mg/kg, Cl^- = 7 mg/kg) R (R-Value = 32)
	3				16	3 4 8	12									
	4															
	5		Bottom of borehole at 5.0 ft bgs Boring elevation estimated from Google Earth and is not surveyed													
	6															
	7															
	8															
	9															
	10															
	11															
	12															
	13															
	14															
	15															
	16															
	17															
	18															
	19															
	20															
	21															
	22															
	23															
	24															
	25															
	26															
	27															

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PROJECT NAME	**GOGA Beach Trail Access Improvements**
PROJECT NUMBER	**219-400**
BORING NUMBER	**20S-05**
REVISION DATE	**6/16/2020**
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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	**1-10-20**	**1-10-20**	**140 lb Autotrip**	**20S-06**
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N. Simon			**--/--**	**24 ft. +/-**
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			**--**	**Sunny, warm**
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Cascade Drilling			Stinson Beach: Marine Way near gate to South Parking Area	**Native**
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Dietrich D50			**Not encountered**	**4.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													
	1		CLAYEY SAND with GRAVEL (SC), medium dense, light brown, moist to wet, fine, angular to subangular GRAVEL, fine to coarse SAND, (ARTIFICIAL FILL).													
	2				17	4 5 8	13				16	110				-200 (31% G, 39% S, 30% F)
	3				18	6 6 5	11									
	4															
	5		Bottom of borehole at 4.5 ft bgs Boring elevation estimated from Google Earth and is not surveyed													
	6															
	7															
	8															
	9															
	10															
	11															
	12															
	13															
	14															
	15															
	16															
	17															
	18															
	19															
	20															
	21															
	22															
	23															
	24															
	25															
	26															
	27															

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PROJECT NAME	**GOGA Beach Trail Access Improvements**
PROJECT NUMBER	**219-400**
BORING NUMBER	**20S-06**
REVISION DATE	**6/16/2020**
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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	1-10-20	1-10-20	140 lb Autotrip	20S-07
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N. Simon			--/--	17 ft. +/-
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	Sunny, warm
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Cascade Drilling			Stinson Beach: North end of South Parking Area	Native
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Dietrich D50			Not encountered	5.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		SILTY SAND with GRAVEL (SM), and cobbles.													
	1				D											
	2		CLAYEY SAND with GRAVEL (SC), dense, greenish gray, moist, fine to coarse GRAVEL, fine to coarse SAND, with fine cobbles.		19	17 21 28	49				9	109				-200 (36% G, 42% S, 22% F)
	3															
	4															
	5		Bottom of borehole at 5.0 ft bgs Boring elevation estimated from Google Earth and is not surveyed													
	6															
	7															
	8															
	9															
	10															
	11															
	12															
	13															
	14															
	15															
	16															
	17															
	18															
	19															
	20															
	21															
	22															
	23															
	24															
	25															
	26															
	27															

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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	1-10-20	1-10-20	140 lb Autotrip	20S-08
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N. Simon			--/--	15 ft. +/-
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	Clear, sunny, warm
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Cascade Drilling			Stinson Beach: South end of South Parking Area	Native
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Dietrich D50			Not encountered	5.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		CLAYEY SAND with GRAVEL (SC), dense, light brown, moist, fine to coarse GRAVEL, fine to coarse SAND, (ARTIFICIAL FILL).													
	1				E											-200 (34% G, 41% S, 25% F)
	2				20	15 31 25	56				10	108				
	3				21	9 9 5	14									low recovery, gravel in sampler shoe
	4															
	5		Bottom of borehole at 5.0 ft bgs Boring elevation estimated from Google Earth and is not surveyed													
	6															
	7															
	8															
	9															
	10															
	11															
	12															
	13															
	14															
	15															
	16															
	17															
	18															
	19															
	20															
	21															
	22															
	23															
	24															
	25															
	26															
	27															

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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	**1-9-20**	**1-9-20**	**140 lb Autotrip**	**20T-01**
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N. Simon			**--/--**	**207 ft. +/-**
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			**--**	**Clear, sunset/dusk**
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Cascade Drilling			Tennessee Valley: Northwest corner of parking lot, 51 feet west of end of pavement	**Native**
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Dietrich D50			**Not encountered**	**5.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		AGGREGATE BASE.													
	1		Fat CLAY (CH), stiff, light yellowish brown, moist, (ALLUVIUM).		A 1	4 5 9	14				21	94	2.0PP			R (R-Value = 15)
	2															
	3															
	4															
	5		Bottom of borehole at 5.0 ft bgs													
	6		Boring elevation estimated from Google Earth.													
	7															
	8															
	9															
	10															
	11															
	12															
	13															
	14															
	15															
	16															
	17															
	18															
	19															
	20															
	21															
	22															
	23															
	24															
	25															
	26															
	27															

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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	**1-9-20**	**1-9-20**	**140 lb Autotrip**	**20T-02**
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N. Simon			**--/--**	**204 ft. +/-**
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			**--**	**Clear, dark**
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Cascade Drilling			Tennessee Valley: SW corner of Parking Area, 81' SE from edge of lot	**Native**
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Dietrich D50			**Not encountered**	**5.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		AGGREGATE BASE.													
	1				B						16					CP ($\gamma_{D,MAX}$ = 120 pcf, w_{OPT} = 14%)
	2															
	3															
	4		CLAYEY SAND with GRAVEL (SC), medium dense, dark gray, moist, fine GRAVEL, fine to coarse SAND, (ALLUVIUM).		2	6 13 16	29				16	114	2.5 to 4.5PP			-200 (19% G, 40% S, 40% F) PI (33 LL, 20 PL, 13 PI)
	5		Bottom of borehole at 5.0 ft bgs													
	6		Boring elevation estimated from Google Earth.													
	7															
	8															
	9															
	10															
	11															
	12															
	13															
	14															
	15															
	16															
	17															
	18															
	19															
	20															
	21															
	22															
	23															
	24															
	25															
	26															
	27															

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PROJECT NAME	**GOGA Beach Trail Access Improvements**
PROJECT NUMBER	**219-400**
BORING NUMBER	**20T-02**
REVISION DATE	**6/16/2020**
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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	**1-9-20**	**1-9-20**	**140 lb Autotrip**	**20T-03**
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N. Simon			**--/--**	**216 ft.+/-**
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			**--**	**Clear, dark**
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Cascade Drilling			Tennessee Valley: Middle of turn around near stable area, 56 feet west of gate at Miwok Trail	**Native**
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Dietrich D50			**Not encountered**	**5.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		AGGREGATE BASE.													
	1				C											
	2															
	3		SANDY lean CLAY (CL), hard, dark brown, moist, (ALLUVIUM).		3	6 10 11	21				15	93	>=4.5PP			PI (27 LL, 18 PL, 9 PI)
	4															
	5		Bottom of borehole at 5.0 ft bgs Boring elevation estimated from Google Earth.													
	6															
	7															
	8															
	9															
	10															
	11															
	12															
	13															
	14															
	15															
	16															
	17															
	18															
	19															
	20															
	21															
	22															
	23															
	24															
	25															
	26															
	27															

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LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
J. Schmidt	4-30-20	4-30-20	140 lb Autotrip	20L-01
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N. Simon			--/--	24 ft.
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	Sunny, cool
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Britton Exlporation, Inc.			NB Long Ave. 100' S of intersection with Marine Drive	Native with concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME-55			Groundwater not encountered	25.8 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													
	1		CONCRETE.													
	2		SERPENTINITE, gray and black, moderately weathered, very weak to weak rock (R1-R2). shears and fractures fractures very closely spaced, (FRANCISCAN MELANGE).													
	3				1	15 15 18	33	100			6	106				
	4															
	5				2	9 10 12	22	100								
	6															
	7															
	8				3	10 12 16	28	100			22	103				CU
	9															
	10				4	3 16 20	36	100								
	11															
	12															
	13															
	14															
	15		Dark gray, slightly weathered, weak to medium strong rock (R2-R3). fractures and shears extremely closely spaced.		5	13 10 18	28	100			30	98				CR (pH = 8.41, r = 8,016 ohm-cm, SO_4^{2-} = 27 mg/kg, Cl^- = 120 mg/kg)
	16															
	17															rig chatter from 16.5-ft. to 20-ft.
	18															
	19															
	20		CLAYSTONE, gray, slightly weathered, very weak rock (R1). fractures and shears extremely closely spaced.		6	50/4"		100								
	21															
	22															
	23															
	24															
	25				7	33 50/3"		100			11	117				
	26		Bottom of borehole at 25.8 ft bgs													auger refusal, advanced 1" over 5 minutes
	27															

5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

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LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
J. Schmidt	4-30-20	4-30-20	140 lb Autotrip	20L-02
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N. Simon			--/--	38.0 ft.
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	sunny, cool
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Britton Exploration. Inc.			NB Long Ave 310' S of Marine Drive	Native with concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING 15.0 ft AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME-55				17.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													
	0		CONCRETE.													
	1		SANDY lean to fat CLAY (CL/CH), firm, brown, moist, (ARTIFICIAL FILL).		A						19					PI (50 LL, 18 PL, 32 PI) CP ($\gamma_{D,MAX}$ = 110 pcf, w_{OPT} = 19%) DS CR (pH = 7.96, r = 4,016 ohm-cm, SO_4^{2-} = 280 mg/kg, Cl^- = 669 mg/kg)
	3				1	4 5 6	11	72			18	76				
	5		Stiff.		2	4 4 7	11	44								
	8		CLAYEY SAND (SC), dense, brown, moist, fine to coarse SAND, few fine to coarse gravel.		3	11 22 37	59	100			24	100				-200 (2% G, 72% S, 26% F) PI (39 LL, 23 PL, 16 PI)
	10				4	9 17 17	34	100								
	13		CLAYSTONE, gray, black and bluish gray, slightly to moderately weathered, weak to very weak rock (R1-R2). fractures closely to extremely closely spaced, (FRANCISCAN MELANGE).													
	15				5	5 34 50/4"		100								drilling rods wet from 15-ft. to 16-ft.
	17		Bottom of borehole at 17.0 ft bgs													Auger refusal, drilled 1" over 5 minutes
	18															
	19															
	20															
	21															
	22															
	23															
	24															
	25															
	26															
	27															

5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

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LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
J. Schmidt	4-30-20	4-30-20	140 lb Autotrip	20L-03
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N.simon			--/--	53 ft.
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	Sunny, cool
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Britton Exploration			NB Long Ave 370' N of intersection with Lincoln Ave.	Native with concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME-55			Wet at 9 feet	41.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													
	1		CLAYEY SAND with GRAVEL (SC), medium dense, reddish brown and brown, moist, fine to coarse GRAVEL.								13	115				-200 (16% G, 38% S, 46% F)
	2															
	3				1	12 17 14	31	67					>4.5PP			
	4															
	5		Gravel up to 1-in..		2	2 13 13	26	33								-200 (16% G, 66% S, 18% F) CR (pH = 8.08, r = 1,192 ohm-cm, SO_4^{2-} = 312 mg/kg, Cl^- = 365 mg/kg)
	6															
	7															
	8		Fat CLAY with GRAVEL (CH), very stiff, brown, moist, fine clasts of angular gravel.		3	5 12 17	29	89			15	118	3.0PP			CU
	9															
	10		GRAVELLY fat CLAY (CH), stiff, dark gray, wet, coarse GRAVEL, wet with possible seepage from depth of 9 to 13 ft.		A											
	11		3-in. serpentinite fragment in sampler shoe, (COLLUVIUM / RAVINE DEPOSITS). Hard drilling 9.5-ft. to 13-ft., rock fragments in bottom of sample.		4	2 4 7	11	100			13					
	12															
	13		CLAYEY SAND with GRAVEL (SC), very dense, yellowish brown, moist.													
	14															
	15				5	35 50 50/3"		100			11	105	>4.5PP			
	16															
	17															
	18		Rig chatter, bouncing 18-ft. to 28-ft..													
	19		SHALE, dark gray, highly to completely weathered, weak to medium strong rock (R2-R3). fractures very closely to extremely closely spaced, (FRANCISCAN MELANGE).													
	20				6	30 35 50/5"		76								
	21															
	22															
	23															
	24															
	25		SERPENTINITE, gray, green, dark greenish gray, moderately weathered, weak to very weak rock (R1-R2). fractures and shears very closely to extremely closely spaced, pervasively sheared.		7	17 35 50	85	100			10	115	4.0PP			
	26															
	27															

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ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	28		(Serpentinite).													
	29															
	30		Highly to completely weathered.		8	40 50/5"		100								
	31															
	32															
	33															
	34															
	35				9	40 50/5"		100			10	119	>4.5PP			
	36															
	37															
	38															
	39															
	40				10	15 20 20	40	89								
	41															
	42		Bottom of borehole at 41.5 ft bgs													
	43															
	44															
	45															
	46															
	47															
	48															
	49															
	50															
	51															
	52															
	53															
	54															
	55															
	56															
	57															
	58															
	59															
	60															

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LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
J. Schmidt	4-29-20	4-29-20	140 lb Autotrip	20L-04
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N.simon			--/--	78.2 ft.
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	Sunny, cool
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Britton Exploration			NB Long Ave 150' N of intersection with Lincoln Ave.	Native with concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME-55			Groundwater not encountered	11.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE (ARTIFICIAL FILL).		A											
	1		CONCRETE.								8					PI (28 LL, 11 PL, 17 PI)
	2		SANDY lean CLAY (CL), firm, reddish brown, moist, few fine to coarse GRAVEL, gravel up to 3-in..		1	5 4 3	7	22			9	99	4.5PP			R (R-Value = 16) -200 (7% G, 33% S, 60% F)
	3															
	4		Very stiff, reddish brown and black.		2	4 10 12	22	44								
	5															
	6															
	7		Yellowish brown.													
	8															
	9															
	10		Hard, light brown.		3	19 26 35	61	100			12	115	>4.5PP			
	11															
	12		Bottom of borehole at 11.5 ft bgs													
	13															
	14															
	15															
	16															
	17															
	18															
	19															
	20															
	21															
	22															
	23															
	24															
	25															
	26															
	27															

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LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	2-4-20	2-4-20	140-lb Autotrip	20C-01
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
R. Hooke			--/--	96.5 ft.
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
4" Solid Stem Auger			--	Clear,chilly
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Taber Drilling			China Beach: Parking lot at east end of Wall 1	Cement grout and concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME 55			Not encountered	40.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													
	1		AGGREGATE BASE.													
			SILTY SAND (SM), dense, light brown, moist, fine SAND, (ARTIFICIAL FILL).		A											
	2				1	6 15 18	33				6	117				CP ($\gamma_{D,MAX}$ = 128 pcf, w_{OPT} = 10%) CU -200 (0% G, 86% S, 14% F)
	3															
	4															
	5				2	5 7 9	16									CR (pH = 8.30, r = 1,764 ohm-cm, SO_4^{2-} = -- mg/kg, Cl^- = -- mg/kg)
	6															
	7															
	8		Poorly graded SAND (SP), dense, grayish brown, moist, fine SAND, interbedded layers (1-3 inches thick) of Silty SAND (SM), (DUNE SAND).													
	9															
	10				3	5 11 11	22				5	107				CU
	11															
	12															
	13															
	14															
	15				4	7 11 12	23									
	16		SERPENTINITE and SANDSTONE, highly to completely weathered, very weak to extremely weak rock (R0-R1). (FRANCISCAN MELANGE).													
	17															
	18															
	19															
	20				5	13 50/4"										
	21															
	22															
	23															
	24															
	25		Serpentinite decomposed to Clayey SAND (SC), greenish gray, moist, trace fine gravel.		6	11 50/4"										PI (55 LL, 27 PL, 28 PI)
	26															
	27															

(continued)

5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

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ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	28		SERPENTINITE and SANDSTONE *(continued)*. Soft from 27.5 to 29.5.													
	29															
	30		Completely weathered, extremely weak rock (R0). soil like with zones of cobble-sized rock.		7	12 18 25	43									
	31															
	32															
	33															
	34															
	35		SERPENTINITE, green, highly weathered, very weak to extremely weak rock (R0-R1).		8	7 29 33	62									
	36															
	37															
	38															
	39		Auger penetrated 1 inch in 5 minutes.		9	16 16 19	35									Auger refusal
	40		Bottom of borehole at 40.0 ft bgs													
	41															
	42															
	43															
	44															
	45															
	46															
	47															
	48															
	49															
	50															
	51															
	52															
	53															
	54															
	55															
	56															
	57															
	58															
	59															
	60															

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LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	2-5-20	2-5-20	140-lb Autotrip	20C-02
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
R. Hooke			--/--	90 ft.
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
4" Solid Stem Auger			--	Sunny, cool
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Taber Drilling			China Beach: Parking lot at west End of Wall 1 in Curve	Cement grout and concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME 55			Not encountered	41.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													
	1		AGGREGATE BASE.													
	2		Poorly graded SAND (SP), medium dense, brown, moist, fine GRAVEL, fine SAND.		10	10 10 8	18				9	109				-200 (2% G, 87% S, 11% F)
	3		Poorly graded SAND (SP), medium dense, brown, moist, fine SAND, trace fine gravel, (ARTIFICIAL FILL).													
	4															
	5		Very loose.		11	1 1 1	2									
	6															
	7															
	8															
	9															
	10		Poorly graded SAND with SILT (SP-SM), medium dense, brown, moist, trace angular gravel, (DUNE SAND).		12	7 15 27	42				6	112				PA (0% G, 95% S, 5% F)
	11															
	12															
	13															
	14															
	15		Loose, fine SAND, moderately cemented lens at depth of 16 feet.		13	3 4 3	17									CR (pH = 8.49, r = 5,711 ohm-cm, SO_4^{2-} = -- mg/kg, Cl^- = -- mg/kg)
	16															
	17															
	18															
	19															
	20				14	5 4 5	9				5	99				PA (0% G, 98% S, 2% F)
	21															
	22															
	23															
	24															
	25		Loose, brown, moist, very fine SAND, 3" moderately cemented lens at depth of 25.5 feet.		15	3 2 4	6									
	26															
	27															

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ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	28		Poorly graded SAND with SILT (SP-SM) *(continued)*.													
	29															
	30		CLAYEY SAND (SC), medium dense, grayish brown, moist, fine to coarse SAND.		16	5 11 18	29				30	93				-200 (2% G, 18% S, 80% F) PI (58 LL, 17 PL, 41 PI)
	31		Fat CLAY (CH), stiff, greenish gray, moist.										1.5PP			
	32		SERPENTINITE and CLAYSTONE, green and black, highly to completely weathered, very weak to extremely weak rock (R0-R1). (FRANCISCAN MELANGE).													
	33															
	34															
	35				17	10 15 24	39									
	36															
	37															
	38															
	39															
	40				18	2 11 21	32									
	41															
	42		Bottom of borehole at 41.5 ft bgs													
	43															
	44															
	45															
	46															
	47															
	48															
	49															
	50															
	51															
	52															
	53															
	54															
	55															
	56															
	57															
	58															
	59															
	60															

Yeh and Associates, Inc.
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PROJECT NAME	**GOGA Beach Trail Access Improvements**
PROJECT NUMBER	**219-400**
BORING NUMBER	**20C-02**
REVISION DATE	**6/16/2020**
SHEET	**2 of 2**

5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	2-5-20	2-5-20	140-lb Autotrip	20C-03
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
R. Hooke			--/--	61.0 ft.
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
4" Solid Stem Auger			--	Clear, chilly
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Taber Drilling			China Beach: Access road in front of Wall 2	Cement grout and concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME 55			Not encountered	38.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													
	1		AGGREGATE BASE.													
	2		CLAYEY SAND with GRAVEL (SC), medium dense, greenish gray, moist, (ARTIFICIAL FILL).		19	9 9 15	24				10	128				PA (4% G, 68% S, 25% F)
	3		Poorly graded SAND (SP), medium dense, light brown, moist, fine SAND, (DUNE SAND).													
	4															
	5				20	9 10 11	21									
	6															
	7															
	8															
	9															
	10		Fine SAND, weakly cemented.		21	10 11 14	25				3	106				PA (0% G, 99% S, 1% F)
	11															
	12															
	13		SHALE and SERPENTINITE, completely weathered, very weak to weak rock (R1-R2). Sandy FAT CLAY (CH), hard, black and green, moist completely weathered to residual soil, (FRANCISCAN MELANGE).										3PP			
	14															
	15				22	3 5 9	14				22					PI (62 LL, 25 PL, 37 PI) CR (pH = 8.01, r = 248 ohm-cm, SO_4^{2-} = 52 mg/kg, Cl^- = 119 mg/kg)
	16															
	17															
	18															
	19		BLOCKS OF GRAYWACKE, grey, medium grained, moderately weathered, weak to medium strength (R1-R3). fractures very closely spaced, in matrix of Clay SHALE, dark gray to black, slightly weathered, very weak (R1), extremely closely spaced shears and fractures, fair to excellent fractures throughout.		1			100	0							Auger refusal, swith to HQ rock core at 18.5'
	20				2			43	0							
	21															
	22		Calcite veins.		3			37	0							
	23															
	24		With 1- to 4-inch blocks of GRAYWACKE, fine grained.													
	25															
	26															
	27		GRAYWACKE, grey with black inclusions, fine grained, fresh, medium strong rock (R3).		4			93	67							

(continued)

Yeh and Associates, Inc.
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PROJECT NAME	
GOGA Beach Trail Access Improvements	
PROJECT NUMBER	
219-400	
BORING NUMBER	
20C-03	
REVISION DATE	SHEET
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ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	28		fractures closely to moderately spaced. GRAYWACKE *(continued)*.		4			93	67							
	29		Extremely weak to weak rock (R0-R1). fractures closely spaced.		5			70	37			178				UC
	30															
	31															
	32		Mixed GRAYWACKE, SHALE and SERPENTINITE, fresh to slightly weathered. fractures and shears very closely to extremely closely spaced.		6			90	0							
	33															
	34		Weak rock (R2). fractures and shears moderately spaced, crushed/shear zone from 34' to 35.5'.		7			83	50							
	35															
	36											179				UC
	37		Medium strong to strong rock (R3-R4).		8			54	42							
	38															
	39		Bottom of borehole at 38.5 ft bgs													
	40															
	41															
	42															
	43															
	44															
	45															
	46															
	47															
	48															
	49															
	50															
	51															
	52															
	53															
	54															
	55															
	56															
	57															
	58															
	59															
	60															

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PROJECT NAME
GOGA Beach Trail Access Improvements

PROJECT NUMBER
219-400

BORING NUMBER
20C-03

REVISION DATE
6/16/2020

SHEET
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LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	**2-5-20**	**2-5-20**	**140-lb Autotrip**	**20C-04**
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
R. Hooke			**--/--**	**41.5 ft**
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
4" Solid Stem Auger			**--**	**Clear, chilly**
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Taber Drilling			**China Beach: Access road at east end of Wall 3**	**Cement grout and concrete patch**
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME 55			**Not encountered**	**37.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													
	1		AGGREGATE BASE.													
40	2		CLAYEY SAND (SC), medium dense, dark gray, moist, trace fine GRAVEL, fine to medium SAND, (ARTIFICIAL FILL).		23	9 17 18	35				9	123				-200 (2% G, 66% S, 32% F)
	3															
38	4				24	11 10 7	17				7					CR (pH = 8.27, r = 975 ohm-cm, SO_4^{2-} = 131 mg/kg, Cl^- = 57 mg/kg)
	5															
36	6		CLAYEY SAND (SC), medium dense, whitish gray, moist, very fine SAND.													
	7															
34	8															
	9				25	3 6 12	18				12	103				-200 (0% G, 88% S, 12% F)
32	10		Poorly graded SAND with SILT (SP-SM), medium dense, light brown, moist, fine SAND, (DUNE SAND).													
	11															
30	12		CLAY SHALE and SERPENTINE, completely weathered, extremely weak rock (R0). (FRANCISCAN MELANGE).													
	13															
28	14				27	19 30 50/5"										
	15															
26	16															
	17															Auger refusal, switch to HQ Rock Core at 16.5'
24	18		Green, fresh, weak to medium strong rock (R2-R3). fractures closely to moderately spaced, calcite veins.		9			73	37			179				UC
	19															
22	20		19.5' fractures are in poor condition, with slickensides.		10			77	63			180				UC
	21															
20	22		Strong to very strong rock (R4-R5). shears and fractures closely to extremely closely spaced, red chert inclusions and calcite veins.		11			100	55							
	23															
18	24															
	25															
16	26															
	27		Weak rock (R2). fractures very closely to		12			70	18			175				UC

(continued)

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PROJECT NAME	
GOGA Beach Trail Access Improvements	
PROJECT NUMBER	
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BORING NUMBER	
20C-04	
REVISION DATE	SHEET
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ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
14	28		extremely closely spaced. CLAY SHALE and SERPENTINE*(continued)*.		12			70	18							
	29															
12	30															
	31															
10	32		CHERT, red, fresh, medium strong to strong rock (R3). fractures closely to extremely closely spaced, with brown-green inclusions and calcite veins.		13			90	37							
	33															
8	34															
	35															
6	36											162				UC
	37		Bottom of borehole at 37.0 ft bgs													
4	38															
	39															
2	40															
	41															
-1	42															
	43															
-3	44															
	45															
-5	46															
	47															
-7	48															
	49															
-9	50															
	51															
-11	52															
	53															
-13	54															
	55															
-15	56															
	57															
-17	58															
	59															
-19	60															

Yeh and Associates, Inc.
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PROJECT NAME	**GOGA Beach Trail Access Improvements**
PROJECT NUMBER	**219-400**
BORING NUMBER	**20C-04**
REVISION DATE	**6/16/2020**
SHEET	**2 of 2**

5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	2-6-20	2-6-20	140-lb Autotrip	20C-05
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
R. Hooke			--/--	36.5 ft
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
4" Solid Stem Auger			--	Clear, sunset
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Taber Drilling			China Beach: Access road at west end of Wall 3	Cement grout and concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME 55			Not encountered	31.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													
	1		AGGREGATE BASE.													
35	2		CLAY SHALE and SERPENTINITE, black, highly to completely weathered, extremely weak to very weak rock (R0-R1). (FRANCISCAN MELANGE).		28	11 24 31	55				8	119				C
	3		Green and white, completely weathered, extremely weak rock (R0).													
33	4															
	5				29	7 13 16	29									
31	6															
	7															
29	8															
	9															
27	10		decomposed rock and residual soil, composed of Fat CLAY (CH), hard, gray, dry, very to extremely weak rock (R0-R1).		30	6 24 33	57				8	119	4.5PP			UU
	11															
25	12															
	13															
23	14															
	15				31	5 21 29	50									PI (44 LL, 18 PL, 26 PI)
21	16															
	17															
19	18															
	19															
17	20		Green, black and white.		32	7 16 30	46				10	121				CU
	21															
15	22															
	23															
13	24															
	25				33	6 23 42	65									
11	26															
	27		CLAY SHALE and SERPENTINITE													

(continued)

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

PROJECT NAME	
GOGA Beach Trail Access Improvements	
PROJECT NUMBER	
219-400	
BORING NUMBER	
20C-05	
REVISION DATE	SHEET
6/16/2020	1 of 2

5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
9	28															
	29															
7	30		Highly to completely weathered. dry to moist. Some decomposed to residual soil composed of FAT CLAY (CH), hard , gray, moist to dry..		34/35	8 21 63	84				8	110				
	31															
5	32		Bottom of borehole at 31.5 ft bgs													
	33															
3	34															
	35															
1	36															
	37															
-2	38															
	39															
-4	40															
	41															
-6	42															
	43															
-8	44															
	45															
-10	46															
	47															
-12	48															
	49															
-14	50															
	51															
-16	52															
	53															
-18	54															
	55															
-20	56															
	57															
-22	58															
	59															
-24	60															

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

PROJECT NAME
GOGA Beach Trail Access Improvements

PROJECT NUMBER
219-400

BORING NUMBER
20C-05

REVISION DATE
6/16/2020

SHEET
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LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	2-7-20	2-7-20	140-lb Autotrip	20C-06
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
R. Hooke			--/--	23.0 ft
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
4" Solid Stem Auger			--	Clear, chilly
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Taber Drilling			China Beach: Lawn in front of west end of Wall 4	Cement grout
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME 55			Not encountered	16.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		GRASS and topsoil.													
	1		SANDY fat CLAY (CH), hard, grayish brown, moist, trace fine GRAVEL, some SAND, (ARTIFICIAL FILL).		36	7 7 11	18				13	123				CU
21	2															
	3															
19	4		SERPENTINITE and CLAY SHALE, completely weathered, extremely to very weak rock (R0-R1). (FRANCISCAN MELANGE).													
	5				37	16 21 24	45				7					CR (pH = 8.91, r = 1,008 ohm-cm, SO_4^{2-} = 65 mg/kg, Cl^- = 4 mg/kg)
17	6															
	7															
15	8															
	9															
13	10		With seams of fat CLAY (CH), hard, gray, dry.		38	50/4"					5	103	>4.5PP			PI (47 LL, 13 PL, 34 PI)
	11															
11	12															
	13															
9	14															
	15				39	50/3"										
7	16		Bottom of borehole at 16.0 ft bgs													Auger refusal at 16.0'
	17															
5	18															
	19															
3	20															
	21															
1	22															
	23															
-1	24															
	25															
-3	26															
	27															

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

PROJECT NAME	
GOGA Beach Trail Access Improvements	
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BORING NUMBER	
20C-06	
REVISION DATE	SHEET
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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
W. Hoon	2-7-20	2-7-20	140-lb Autotrip	20C-07
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
R. Hooke			--/--	23.0 ft
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
4" Solid Stem Auger			--	Sunny, chilly
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Taber Drilling			China Beach: Lawn at east end of Wall 4	Cement grout
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME 55			Not encountered	37.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		GRASS and topsoil.													
	1		CLAY SHALE and SERPENTINITE, grey, completely weathered, very weak rock (R1). shears and fractures extremely closely spaced, sheared, with seams of fat CLAY (CH) gray, hard, dry to moist, (FRANCISCAN FORMATION).													
21	2															
	3															
19	4															
	5															
17	6															
	7															
15	8															
	9															
13	10				40	10 15 15	30									
	11															
11	12															
	13															
9	14															
	15															
7	16															
	17															
5	18															
	19															
3	20				41	10 17 20	37									PI (38 LL, 15 PL, 23 PI)
	21															
1	22															
	23															
-1	24															
	25															
-3	26															
	27															

(continued)

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

PROJECT NAME	
GOGA Beach Trail Access Improvements	
PROJECT NUMBER	
219-400	
BORING NUMBER	
20C-07	
REVISION DATE	SHEET
6/16/2020	1 of 2

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
-5	28		CLAY SHALE and SERPENTINITE *(continued)*.													
	29															
-7	30				42	2 7 22	29									
	31															
-9	32															
	33															
-11	34															
	35															
-13	36															
	37															
-15	38		Bottom of borehole at 37.5 ft bgs													Auger Refusal at 37.5'
	39															
-17	40															
	41															
-19	42															
	43															
-21	44															
	45															
-23	46															
	47															
-25	48															
	49															
-27	50															
	51															
-29	52															
	53															
-31	54															
	55															
-33	56															
	57															
-35	58															
	59															
-37	60															

5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

PROJECT NAME
GOGA Beach Trail Access Improvements

PROJECT NUMBER
219-400

BORING NUMBER
20C-07

REVISION DATE
6/16/2020

SHEET
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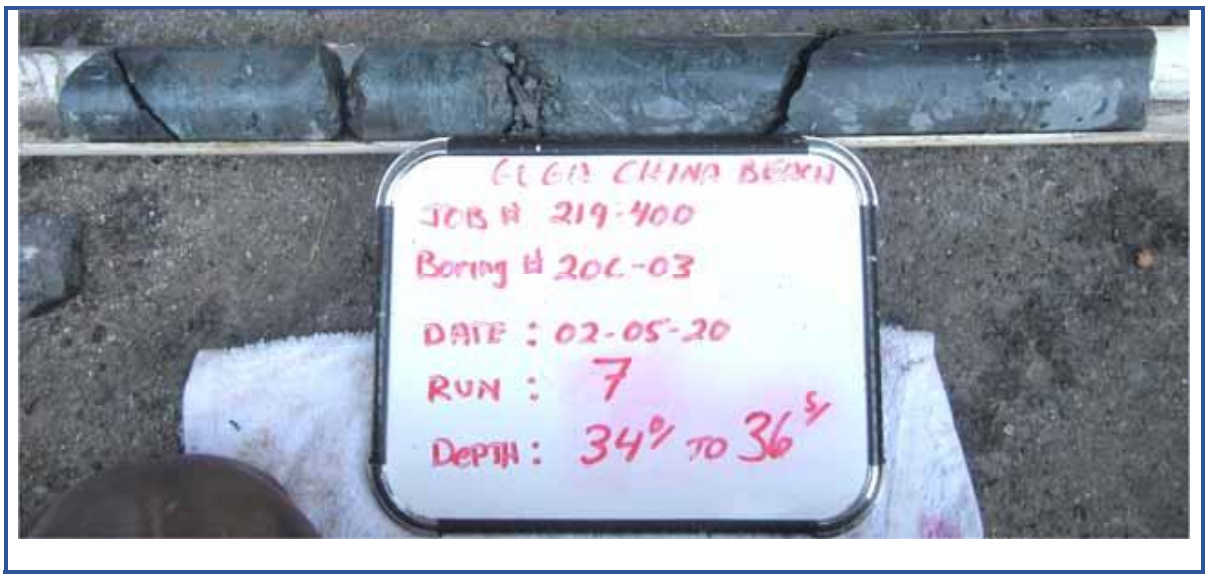
GGNRA CHINA BEACH
JOB # 219-400
Boring # 20C-03
DATE : 02-05-20
RUN : 1
DEPTH : 18' - 19'

GGNRA CHINA BEACH
JOB # 219-400
Boring # 20C-03
DATE : 02-05-20
RUN : 2
DEPTH : 19' TO 21'

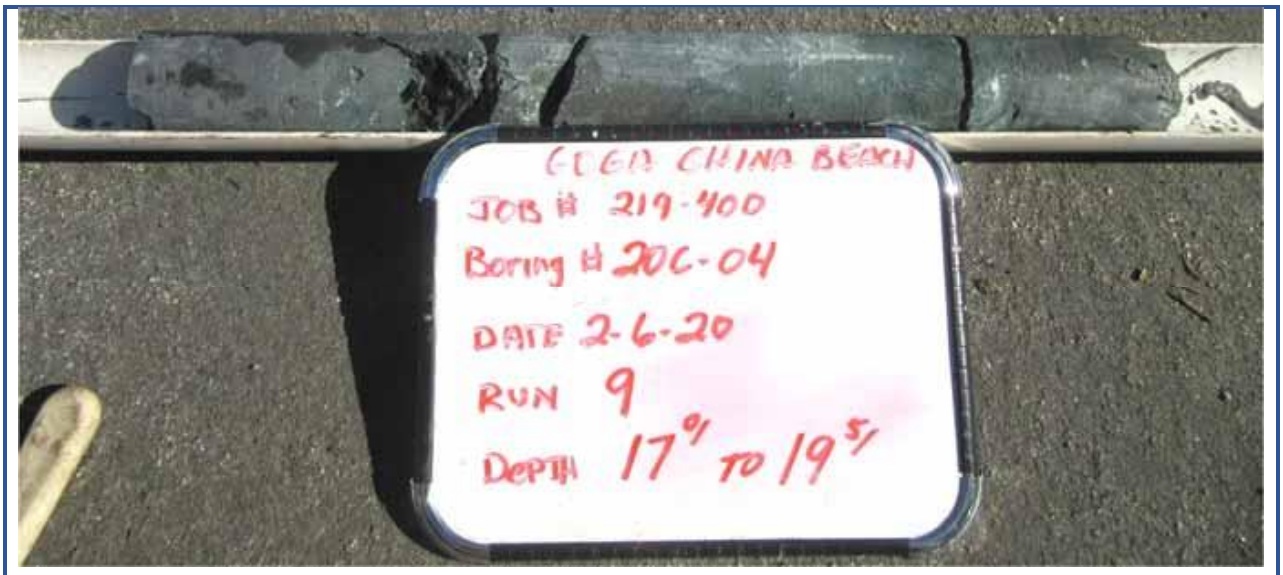
GGNRA CHINA BEACH
JOB # 219-400
Boring # 20C-03
DATE : 02-05-20
RUN : 3
DEPTH : 21' TO 26'

CLEO CHINA BEACH
JOB # 219-400
Boring # 20C-03
DATE : 02-05-20
RUN : 4
DEPTH : 26' TO 29'

CLEO CHINA BEACH
JOB # 219-400
Boring # 20C-03
DATE : 02-05-20
RUN : 5
DEPTH : 29' TO

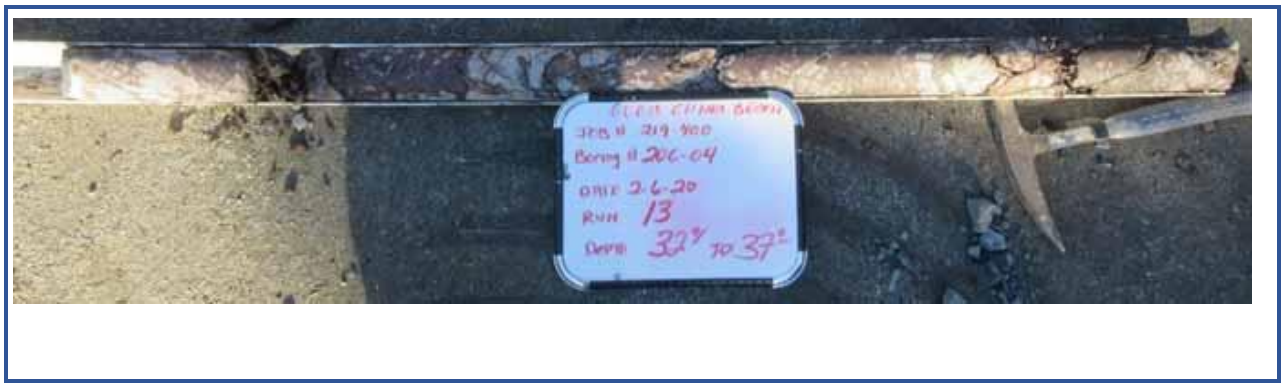


Boring 20C-03, Run 8 Depth: 36.5 to 38.5 feet Date: 2-5-20


CLIFF CHINA BEACH
JOB # 219-400
Boring # 20C-04
DATE 2-6-20
RUN 9
DEPTH 17' TO 19 5/

CLIFF CHINA BEACH
JOB # 219-400
Boring # 20C-04
DATE 2-6-20
RUN 10
DEPTH 19 5/ TO 22'

Boring # 20C-04
RUN 11



end of core photos

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
J. Schmidt	4-29-20	4-29-20	140 lb Autotrip	20F-01
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N.simon			--/--	181 ft. +/-
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	cool, foggy
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Britton Exploration			Ft. Funston SW corner of main parking lot	Native with concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME-55			Groundwater not encountered	5.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													
	1		AGGREGATE BASE.		A						2					
	2		Poorly graded SAND (SP), medium dense, reddish brown, moist, fine SAND, (DUNE SAND DEPOSITS).		1	8 10 10	20	100			2	110				No Hydrocarbon odor noted -200 (2% G, 95% S, 3% F) R (R-Value = 54) PA (0% G, 97% S, 3% F)
	3															
	4				2	4 6 5	11	100								
	5															
	6		Bottom of borehole at 5.5 ft bgs													
	7		Boring elevation estimated from Google Earth.													
	8															
	9															
	10															
	11															
	12															
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PROJECT NAME	
GOGA Beach Trail Access Improvements	
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20F-01	
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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
J. Schmidt	4-29-20	4-29-20	140 lb Autotrip	20F-02
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N.simon			--/--	182 ft. +/-
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	cool, foggy
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Britton Exploration			Ft. Funston: NE corner of main parking lot.	Native with concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME-55			Groundwater not encountered	5.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													
	1		AGGREGATE BASE.													
	2		Poorly graded SAND (SP), medium dense, reddish brown, moist, fine SAND, (DUNE SAND DEPOSITS).		1	11 15 18	33	100			3	111				No Hydrocarbon odor noted -200 (0% G, 98% S, 2% F)
	3															
	4				2	7 11 13	24	100								
	5															
	6		Bottom of borehole at 5.5 ft bgs													
	7		Boring elevation estimated from Google Earth.													
	8															
	9															
	10															
	11															
	12															
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	27															

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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
J. Schmidt	4-29-20	4-29-20	140 lb Autotrip	20F-03
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N.simon			--/--	180 ft/+/-
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	cool, foggy
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Britton Exploration			Ft. Funston: South side of intersection with FT. Funston Road	Native with concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME-55			Groundwater not encountered	5.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													PID: 0 ppm at borehole
	1		AGGREGATE BASE.		A						2					
	2		Poorly graded SAND with SILT (SP-SM), dense, reddish brown, moist, fine SAND, (DUNE SAND DEPOSITS).		1	28 31 31	62	100			2	110				no hydrocarbon odor -200 (2% G, 91% S, 6% F) R (R-Value = 63) PA (0% G, 95% S, 5% F) Maximum PID = 11 ppm at 1.5-ft. no hydrocarbon odor
	3															
	4		Medium dense.		2	5 8 10	18	100								
	5															
	6		Bottom of borehole at 5.5 ft bgs													
	7		Boring elevation estimated from Google Earth.													
	8															
	9															
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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
J. Schmidt	4-29-20	4-29-20	140 lb Autotrip	20F-04
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N.simon			--/--	187 ft. +/-
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	cool foggy
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Britton Exploration			Ft. Funston: WB lane of Ft. Funston Rd. 135' W of SR35	Native with concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME-55			Groundwater not encountered	5.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													PID = 0 ppm at borehole
	1		AGGREGATE BASE.		A						3					-200 (5% G, 86% S, 9% F)
	2		Poorly graded SAND with SILT (SP-SM), reddish brown, angular GRAVEL, trace gravel to 1.25", cemented.		1	20 30 36	66	100			2	114				CP ($\gamma_{D,MAX}$ = 129 pcf, w_{OPT} = 9%) no hydrocarbon odor -200 (0% G, 97% S, 3% F) Maximum PID = 3 ppm no hydrocarbon odor
	3		Poorly graded SAND (SP), dense, reddish brown, moist, fine SAND, (DUNE SAND DEPOSITS).													
	4		Medium dense.		2	6 10 10	20	100								
	5															
	6		Bottom of borehole at 5.5 ft bgs Boring elevation estimated from Google Earth.													
	7															
	8															
	9															
	10															
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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
J. Schmidt	4-29-20	4-29-20	140 lb Autotrip	20F-05
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N.simon			--/--	188 ft. +/-
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	cool, foggy
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Britton Exploration			Ft. Funston: North end of parking lot E by building 100	Native with concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME-55			Groundwater not encountered	5.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE.													no hydrocarbon odor
	1		AGGREGATE BASE.													PID = 0 ppm at borehole and samples
	2		Poorly graded SAND (SP), medium dense, reddish brown, moist, fine SAND, (DUNE SAND DEPOSITS).		1	12 14 16	30	100			2	109				PA (0% G, 98% S, 2% F)
	3															
	4				2	3 6 7	13	100								
	5		Light brown.													
	6		Bottom of borehole at 5.5 ft bgs													
	7		Boring elevation estimated from Google Earth.													
	8															
	9															
	10															
	11															
	12															
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20F-05	
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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
J. Schmidt	4-29-20	4-29-20	140 lb Autotrip	20F-06
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N.simon			--/--	166 ft. +/-
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	cool, foggy
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Britton Exploration			Ft. Funston: SB shoulder of SR35, 405' N of entrance	Native with concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME-55			Groundwater not encountered	5.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE Top 3-in. of AC is gap graded.													
	1		AGGREGATE BASE.													
	2		Poorly graded SAND (SP), medium dense, reddish brown, moist, fine SAND, (DUNE SAND DEPOSITS).		1	7 13 17	30	100			3	110				PA (0% G, 100% S, 0% F)
	3															
	4				2	5 7 7	14	100								
	5															
	6		Bottom of borehole at 5.5 ft bgs													
	7		Boring elevation estimated from Google Earth.													
	8															
	9															
	10															
	11															
	12															
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	27															

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PROJECT NAME	
GOGA Beach Trail Access Improvements	
PROJECT NUMBER	
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BORING NUMBER	
20F-06	
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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

LOGGED BY	BEGIN DATE	COMPLETION DATE	HAMMER TYPE	BORING NUMBER
J. Schmidt	4-29-20	4-29-20	140 lb Autotrip	20F-07
FINAL BY			BOREHOLE LOCATION (Lat/Long or North/East and Datum)	SURFACE ELEVATION
N.simon			--/--	228 ft. +/-
DRILLING METHOD			BOREHOLE LOCATION (Offset, Station, Line)	WEATHER NOTES
8" Hollow Stem Auger			--	cool, foggy
DRILLER			LOCATION DESCRIPTION	BACKFILLED WITH
Britton Exploration			Ft. Funston: SB shoulder of SR35, 610' S of entrance, 5' from EOP	Native with concrete patch
DRILL RIG			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
CME-55			Groundwater not encountered	5.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	FF (Fractures/Foot)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (ksf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT CONCRETE (ARTIFICIAL FILL).													
	1		AGGREGATE BASE 3/4-in. class 2.													
	2		Poorly graded SAND (SP), medium dense, reddish brown, moist, fine SAND, to poorly graded SAND with SILT (SP-SM), (DUNE SAND DEPOSITS).		A 1	6 16 16	32	100			4 4	102				-200 (12% G, 83% S, 5% F) R (R-Value = 55) PA (0% G, 98% S, 2% F)
	3															
	4				2	4 6 7	13	100								
	5															
	6		Bottom of borehole at 5.5 ft bgs													
	7		Boring elevation estimated from Google Earth.													
	8															
	9															
	10															
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5 BR - STANDARD 219-400_LAB AND LOGS_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/18/20

S-Series, Stinson Beach, Marin County, California

20S-01 (looking southeast 12.30.19)

20S-02 (looking north 1.10.20)

20S-01-BR (1.10.20)

20S-03 (looking northwest 12.30.19)

20S-04 (looking northwest 12.30.19)

North parking lot looking southeast 12.30.19

20S-05 (looking southeast 12.30.19)

20S-06 (looking southeast 12.30.19)

20S-07 (looking northwest 12.30.19)

20S-08 (looking southeast 12.30.19)

T-Series, Tennessee Valley Trailhead, Marin County, California

20T-01 (looking southwest 12.30.19)

20T-02 (looking west 12.30.19)

20T-03 (looking west)

L-Series, Long Avenue, San Francisco, California

20L-01 (looking northwest 4.30.20)

20L-02 (looking northeast 4.30.20)

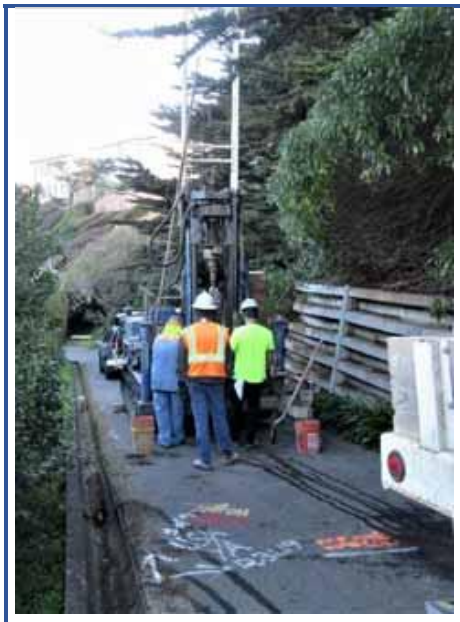
20L-03 (looking northwest 4.30.20)

20L-04 (looking southeast 4.29.30)

C-Series, China Beach, San Francisco, California

20C-01 (looking northeast 2.4.20)

20C-02 (looking west 2.5.20)



20C-03 (looking northeast 2.5.20)

20C-04 (looking west 2.5.20)

20C-05 (looking southwest 2.6.20)

20C-06 (looking south 2.7.20)

20C-07 (looking northwest 2.7.20)

F-Series, Fort Funston, San Francisco, California

20F-01 (looking southeast 4.29.20)

20F-02 (looking northwest 4.29.20)

20F-03 (looking north 4.29.20)

20F-04 (looking west 4.29.20)

20F-05 (looking southwest 4.29.20)

20F-07 (looking north 4.29.20)

20F-06 (looking north 4.29.20)

end of photos

B-10
CONCRETE SEAWALL
WALL 4
BATHHOUSE STRUCTURE
B-7
B-8
SERVICE ROAD
WALL 3
B-5
WALL 2
B-9
WALL 1
B-1
B-2
PARKING AREA
B-4

MAJOR DIVISIONS		SYMBOL	DESCRIPTION
COARSE GRAINED SOILS over 50% sand and gravel	CLEAN GRAVEL	GW	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines
	GRAVEL with fines	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	CLEAN SAND	SW	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
	SAND with fines	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS over 50% silt and clay	SILT AND CLAY liquid limit <50%	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silt-clays of low plasticity
	SILT AND CLAY liquid limit >50%	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS		PT	Peat, muck, and other highly organic soils
ROCK			Undifferentiated as to type or composition

KEY TO BORING AND TEST PIT SYMBOLS

CLASSIFICATION TESTS

PI	PLASTICITY INDEX
LL	LIQUID LIMIT
SA	SIEVE ANALYSIS
HYD	HYDROMETER ANALYSIS
P200	PERCENT PASSING NO. 200 SIEVE
P4	PERCENT PASSING NO. 4 SIEVE

SAMPLER TYPE

- MODIFIED CALIFORNIA
- STANDARD PENETRATION TEST
- THIN-WALLED / FIXED PISTON
- HAND SAMPLER
- ROCK CORE
- X DISTURBED OR BULK SAMPLE

NOTE: Test boring and test pit logs are an interpretation of conditions encountered at the excavation location during the time of exploration. Subsurface rock, soil or water conditions may vary in different locations within the project site and with the passage of time. Boundaries between differing soil or rock descriptions are approximate and may indicate a gradual transition.

STRENGTH TESTS

TV	FIELD TORVANE (UNDRAINED SHEAR)
UC	LABORATORY UNCONFINED COMPRESSION
TXCU	CONSOLIDATED UNDRAINED TRIAXIAL
TXUU	UNCONSOLIDATED UNDRAINED TRIAXIAL
	UC, CU, UU = 1/2 Deviator Stress

SAMPLER DRIVING RESISTANCE

Modified California and Standard Penetration Test samplers are driven 18 inches with a 140-pound hammer falling 30 inches per blow. Blows for the initial 6-inch drive seat the sampler. Blows for the final 12-inch drive are recorded onto the logs. Sampler refusal is defined as 50 blows during a 6-inch drive. Examples of blow records are as follows:

- 25 sampler driven 12 inches with 25 blows after initial 6-inch drive
- 85/7" sampler driven 7 inches with 85 blows after initial 6-inch drive
- 50/3" sampler driven 3 inches with 50 blows during initial 6-inch drive or beginning of final 12-inch drive

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FILENAME: 1650.116 BL.dwg

SOIL CLASSIFICATION CHART

China Beach Restoration
San Francisco, California

Project No. 1650.116 Date: 9/21/2018

Drawn JARS
Checked

B-1
FIGURE

FRACTURING AND BEDDING

Fracture Classification	Spacing	Bedding Classification
Crushed	less than 3/4 inch	Laminated
Intensely fractured	3/4 to 2-1/2 inches	Very thinly bedded
Closely fractured	2-1/2 to 8 inches	Thinly bedded
Moderately fractured	8 to 24 inches	Medium bedded
Widely fractured	2 to 6 feet	Thickly bedded
Very widely fractured	greater than 6 feet	Very thickly bedded

HARDNESS

Low	Carved or gouged with a knife
Moderate	Easily scratched with a knife, friable
Hard	Difficult to scratch, knife scratch leaves dust trace
Very hard	Rock scratches metal

STRENGTH

Friable	Crumbles by rubbing with fingers
Weak	Crumbles under light hammer blows
Moderate	Indentations <1/8 inch with moderate blow with pick end of rock hammer
Strong	Withstands few heavy hammer blows, yields large fragments
Very strong	Withstands many heavy hammer blows, yields dust, small fragments

WEATHERING

Complete	Minerals decomposed to soil, but fabric and structure preserved
High	Rock decomposition, thorough discoloration, all fractures are extensively coated with clay, oxides or carbonates
Moderate	Fracture surfaces coated with weathering minerals, moderate or localized discoloration
Slight	A few stained fractures, slight discoloration, no mineral decomposition, no affect on cementation
Fresh	Rock unaffected by weathering, no change with depth, rings under hammer impact

NOTE: Test boring and test pit logs are an interpretation of conditions encountered at the location and time of exploration. Subsurface rock, soil and water conditions may differ in other locations and with the passage of time.

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FILENAME: 1650.116 BL.dwg

ROCK CLASSIFICATION CHART

China Beach Restoration
San Francisco, California

Project No. 1650.116 Date: 9/21/2018

Drawn JARS
Checked

B-2
FIGURE

BORING 1

EQUIPMENT: Truck Mounted B24 Drill Rig with 4.0-inch Solid Flight Auger
DATE: 8/7/18
ELEVATION: 87 - feet*
*REFERENCE: Google Earth, 2018

DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (4)		BLOWS / FOOT (1)	DRY UNIT WEIGHT pcf (2)	MOISTURE CONTENT (%)	SHEAR STRENGTH psf (3)	OTHER TEST DATA	OTHER TEST DATA
0	0			3" Asphalt Concrete over 6" Aggregate Baserock						
				SAND (SP)						
				Dark brown, meduim dense, dry to moist, fine to medium grained sand, trace rounded to sub-rounded gravels (<5%), trace clay (~5-10%) [Fill/Dune Sand]	44	115	6.4	UC 100		
1	5			Grades to slightly more moist, slight increase in clay. [Fill/Dune Sand]	22	107	7.8	UC 50	P200 8.8%	
3	10			Grades to lighter color. [Dune Sand]	15	102	3.8		P200 <1.0%	SA
4	15			Grades to slightly lighter color, dry, medium dense in situ, loose when extruded. [Dune Sand]	18	103	1.4		P200 <1.0%	
5										
6	20									

▽ Water level encountered during drilling
▼ Water level measured after drilling

NOTES: (1) UNCORRECTED FIELD BLOW COUNTS
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(4) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

China Beach Restoration
San Francisco, California

Project No. 1650.116 Date: 9/21/2018

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B-3
FIGURE

BORING 1 (CONTINUED)

meters / feet DEPTH	SAMPLE	SYMBOL (4)		BLOWS / FOOT (1)	DRY UNIT WEIGHT pcf (2)	MOISTURE CONTENT (%)	SHEAR STRENGTH psf (3)	OTHER TEST DATA	OTHER TEST DATA
20			SAND (SP) Dark brown, meduim dense, dry to moist, fine to medium grained sand, trace rounded gravels. [Colluvium]	20					
7									
25			Serpentinite Green gray, hard, friable, very stiff [Bedrock]	45		28.8			
8			Boring terminated at 26.5' No groundwater encountered during exploration						
9 30									
10									
35									
11									
12 40									

▽ Water level encountered during drilling
▼ Water level measured after drilling

NOTES: (1) UNCORRECTED FIELD BLOW COUNTS
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
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B-4
FIGURE

BORING 2

EQUIPMENT: Truck Mounted B24 Drill Rig with 4.0-inch Solid Flight Auger
DATE: 8/7/18
ELEVATION: 90 - feet*
*REFERENCE: Google Earth, 2018

DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (4)		BLOWS / FOOT (1)	DRY UNIT WEIGHT pcf (2)	MOISTURE CONTENT (%)	SHEAR STRENGTH psf (3)	OTHER TEST DATA	OTHER TEST DATA
0	0			3" Asphalt Concrete over 6" Aggregate Baserock						
				Clayey SAND (SC) Dark brown, dry to moist, loose, fine to medium grained sand, ~35% low to medium plasticity clay. [Fill/Dune Sand]	28	112	8.3	UC 100		
1	5			SAND (SP) Medium tan to brown, dry to moist, very loose medium grained sand. [Fill/Dune Sand]	10	104	4.4		P200 1.7%	SA
3	10			SAND (SP) Light brown, dry to moist, loose, medium grained sand, trace fines. [Dune Sand]	8	102	5.1	UC 40	P200 2.8%	
4	15				14	105	4.9			
5										
6	20									

▽ Water level encountered during drilling
▼ Water level measured after drilling

NOTES: (1) UNCORRECTED FIELD BLOW COUNTS
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(4) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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FIGURE

DEPTH meters / feet	SAMPLE	SYMBOL (4)	BORING 2 (CONTINUED)	BLOWS / FOOT (1)	DRY UNIT WEIGHT pcf (2)	MOISTURE CONTENT (%)	SHEAR STRENGTH psf (3)	OTHER TEST DATA	OTHER TEST DATA
20			SAND (SP) Medium tan to brown, dry to moist, medium dense, medium grained sand. [Dune Sand]	25	99	4.1		P200 <1.0%	
			Boring terminated at 21.5' No groundwater encountered during exploration						
7									
25									
8									
9 30									
10									
35									
11									
12 40									

▽ Water level encountered during drilling
▼ Water level measured after drilling

NOTES: (1) UNCORRECTED FIELD BLOW COUNTS
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
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B-6
FIGURE

BORING 3

EQUIPMENT: Portable Hydraulic Drill Rig with 4.0-inch Solid Flight Auger
DATE: 8/7/18
ELEVATION: 96 - feet*
*REFERENCE: Google Earth, 2018

DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (4)		BLOWS / FOOT (1)	DRY UNIT WEIGHT pcf (2)	MOISTURE CONTENT (%)	SHEAR STRENGTH psf (3)	OTHER TEST DATA	OTHER TEST DATA
0	0			3" Asphalt Concrete over 6" Aggregate Base						
				Clayey SAND (SC) Dark brown, dry to moist, medium dense, fine to medium grained sand, ~20-25% medium to high plasticity clay. [Fill]	33	119	7.6	UC 250	P200 14.6%	
1	5			Clayey SAND (SC) Tan, moist, medium dense, fine grained sand, ~30-50% low plasticity clay, fragment of serpentinite present in sampler. [Fill/Dune Sand]	28	87	13.9	UC 100		
2										
3	10				15		3.2			
				Clayey SAND (SC) Dark brown, dry to moist, medium dense, fine to medium grained sand, ~20-25% medium to high plasticity clay. [Colluvium/Residual Soil]						
4										
	15			Franciscan Melange Hard, strong, green gray [Bedrock]	60	25.5	92	UC 3150		
5				Boring terminated at 16.5' No groundwater encountered during exploration						
6	20									

▽ Water level encountered during drilling
▼ Water level measured after drilling

NOTES: (1) UNCORRECTED FIELD BLOW COUNTS
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
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B-7
FIGURE

BORING 4

EQUIPMENT: Truck Mounted B24 Drill Rig with 4.0-inch Solid Flight Auger
DATE: 8/7/18
ELEVATION: 86 - feet*
*REFERENCE: Google Earth, 2018

DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (4)		BLOWS / FOOT (1)	DRY UNIT WEIGHT pcf (2)	MOISTURE CONTENT (%)	SHEAR STRENGTH psf (3)	OTHER TEST DATA	OTHER TEST DATA
0	0			3" Asphalt Concrete over 5" Aggregate Base						
				Clayey SAND (SC) Dark brown, dry to moist, medium dense, fine to medium grained sand, ~20-25% medium plasticity clay. [Fill]	32	122	8.8	UC 1000		
1				SAND with Clay (SP-SC) Dark brown, dry to moist, loose to medium dense, fine to medium grained sand, 5-15% low plasticity clay. [Fill/Dune Sand]	13	113	7.8		P200 12.6%	SA
	5			Grades to medium dense.	23	109	5.4	UC 150	P200 8.1%	
2										
3	10			Grades loose. [Dune Sand]	9	102	3.5			
				Boring terminated at 11.0' No groundwater encountered during exploration						
4										
	15									
5										
6	20									

▽ Water level encountered during drilling
▼ Water level measured after drilling

NOTES: (1) UNCORRECTED FIELD BLOW COUNTS
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
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B-8
FIGURE

BORING 5

EQUIPMENT: Truck Mounted B24 Drill Rig with 4.0-inch Solid Flight Auger
DATE: 8/31/18
ELEVATION: 82 - feet*
*REFERENCE: Google Earth, 2018

DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (4)		BLOWS / FOOT (1)	DRY UNIT WEIGHT pcf (2)	MOISTURE CONTENT (%)	SHEAR STRENGTH psf (3)	OTHER TEST DATA	OTHER TEST DATA
0	0			2" Asphalt Concrete						
				Sandy GRAVEL with Clay (GC) Medium brown, moist, ~30% fine to coarse sand, angular gravel up to 3/4" diameter, ~12% low plasticity clay [Fill]	33					
	1			Clayey SAND (SC) Medium brown, moist, medium dense, fine to medium grained sand, ~25-30% low plasticity clay. [Fill]	22	113	8.8		P200 26.0%	
	5			SAND with Silt (SP-SM) Medium brown, moist, medium dense, fine to medium grained sand, ~10-15% low plasticity silt. [Dune Sand]						
2					17	112	4.5			
				Boring terminated at 8.5' No groundwater encountered during exploration						
3	10									
4										
	15									
5										
6	20									

▽ Water level encountered during drilling
▼ Water level measured after drilling

NOTES: (1) UNCORRECTED FIELD BLOW COUNTS
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
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FIGURE

BORING 6

EQUIPMENT: Truck Mounted B24 Drill Rig with 4.0-inch Solid Flight Auger
DATE: 8/31/18
ELEVATION: 70 - feet*
*REFERENCE: Google Earth, 2018

DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (4)		BLOWS / FOOT (1)	DRY UNIT WEIGHT pcf (2)	MOISTURE CONTENT (%)	SHEAR STRENGTH psf (3)	OTHER TEST DATA	OTHER TEST DATA
0	0			4" Asphalt Concrete						
				Clayey GRAVEL with Sand (GC) Medium brown, moist, medium dense, angular gravel up to 3/4" diameter, ~30% fine to coarse sand, ~25-30% low plasticity clay [Fill/Aggregate Baserock]	29	89	6.0			
	1			Clayey SAND with Gravel (SC) Medium gray, moist, medium dense, fine to medium grained sand, ~20-25% low plasticity clay, ~10% angular gravel. [Fill]	26	130	11.1	UC 1900		
	5			SAND (SP) Medium brown, moist, loose, fine to medium grained sand, ~10-15% low plasticity clay. [Dune Sand]						
2					9	111	6.7	UC 250	P200 11.8%	
				Boring terminated at 8.5' No groundwater encountered during exploration						
3	10									
4										
	15									
5										
6	20									

▽ Water level encountered during drilling
▼ Water level measured after drilling

NOTES: (1) UNCORRECTED FIELD BLOW COUNTS
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
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FIGURE

BORING 7

EQUIPMENT: Truck Mounted B24 Drill Rig with 4.0-inch Solid Flight Auger
DATE: 8/17/18
ELEVATION: 52 - feet*
*REFERENCE: Google Earth, 2018

DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (4)		BLOWS / FOOT (1)	DRY UNIT WEIGHT pcf (2)	MOISTURE CONTENT (%)	SHEAR STRENGTH psf (3)	OTHER TEST DATA	OTHER TEST DATA
0	0			Clayey SAND (SC) Dark brownish gray, moist, loose, fine to medium grained sand, ~25-30% low to medium plasticity clay. [Fill]	10	107	6.8	UC 300	P200 28.4%	
	1			Clayey SAND with Gravel (SC) Dark gray, moist, medium dense, fine to medium grained sand, ~10-15% low plasticity clay, ~10% angular gravel. [Colluvium/ Residual Soil]	20	115	6.9	UC 650		
	5			Hard drilling at 9.0						
3	10			Sandstone Gray, hard. [Bedrock]						
				Boring terminated at 8.0' 3.0" No groundwater encountered during exploration	50/3"		2.9			
4	15									
5										
6	20									

▽ Water level encountered during drilling
▼ Water level measured after drilling

NOTES: (1) UNCORRECTED FIELD BLOW COUNTS
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
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B-11
FIGURE

BORING 8

EQUIPMENT: Truck Mounted B24 Drill Rig with 4.0-inch Solid Flight Auger
DATE: 8/31/18
ELEVATION: 25 - feet*
*REFERENCE: Google Earth, 2018

DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (4)		BLOWS / FOOT (1)	DRY UNIT WEIGHT pcf (2)	MOISTURE CONTENT (%)	SHEAR STRENGTH psf (3)	OTHER TEST DATA	OTHER TEST DATA
0	0			2" Asphalt Concrete over 4" Aggregate Base						
				Clayey SAND (SC) Gray brown, moist, medium dense, fine to medium grained sand, ~20-30% medium plasticity clay. [Colluvium/Residual Soil]	24					
1				Sandstone Medium to dark gray, hard, strong, fine grained matrix. [Bedrock]	87/11"		3.2			
	5									
2					50/2"		29.9			
				Boring terminated at 6 feet 2 inches No groundwater encountered during exploration						
3	10									
4										
	15									
5										
6	20									

▽ Water level encountered during drilling
▼ Water level measured after drilling

NOTES: (1) UNCORRECTED FIELD BLOW COUNTS
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
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FIGURE

BORING 9

EQUIPMENT: Truck Mounted B24 Drill Rig with 4.0-inch Solid Flight Auger
DATE: 8/31/18
ELEVATION: 36 - feet*
*REFERENCE: Google Earth, 2018

DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (4)		BLOWS / FOOT (1)	DRY UNIT WEIGHT pcf (2)	MOISTURE CONTENT (%)	SHEAR STRENGTH psf (3)	OTHER TEST DATA	OTHER TEST DATA
0	0			Clayey SAND (SC) Medium brown to gray, moist, medium dense, fine to medium grained sand, 15-30% low to moderate plasticity clay. [Fill]	25					
1				SAND (SP) Light brown, dry, loose, fine to medium grained sand, ~5-10% medium plasticity clay. [Dune Sand]	12	95	3.3		P200 9.3%	
2	5			Grades to moist, medium dense.	18	111	2.3			
3	10			Boring terminated at 6 feet 6 inches No groundwater encountered during exploration						
4										
5	15									
6	20									

▽ Water level encountered during drilling
▼ Water level measured after drilling

NOTES: (1) UNCORRECTED FIELD BLOW COUNTS
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
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FIGURE

BORING 10

EQUIPMENT: Truck Mounted B24 Drill Rig with 4.0-inch Solid Flight Auger
DATE: 8/17/18
ELEVATION: 20 - feet*
*REFERENCE: Google Earth, 2018

DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (4)		BLOWS / FOOT (1)	DRY UNIT WEIGHT pcf (2)	MOISTURE CONTENT (%)	SHEAR STRENGTH psf (3)	OTHER TEST DATA	OTHER TEST DATA
0	0			GRAVEL with Sand and Clay (GW) Tan and gray, moist, loose, angular sandstone gravel, ~10% fine grained sand, ~10-15% low plasticity clay. [Landslide Debris]	7	119	11.4			
	5			Hole would collapse when auger withdrawn.						
3	10	X X X		Clayey GRAVEL with Sand (GC) Medium brown, moist to wet, fine to coarse gravel, ~20-30% medium plasticity clay, ~20-30% fine to coarse grained sand. [Landslide Debris]			11.9			
				Boring terminated at 11.5' No groundwater encountered during exploration						
6	20									

▽ Water level encountered during drilling
▼ Water level measured after drilling

NOTES: (1) UNCORRECTED FIELD BLOW COUNTS
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
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FIGURE

BORING 11

EQUIPMENT: Truck Mounted B24 Drill Rig with 4.0-inch Solid Flight Auger
DATE: 8/17/18
ELEVATION: 53 - feet*
*REFERENCE: Google Earth, 2018

DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (4)		BLOWS / FOOT (1)	DRY UNIT WEIGHT pcf (2)	MOISTURE CONTENT (%)	SHEAR STRENGTH psf (3)	OTHER TEST DATA	OTHER TEST DATA
0	0			Clayey GRAVEL with Sand (GC) Medium brown, moist, angular gravel up to 3/4" diameter, ~30% fine to coarse grained sand, ~15-20% low plasticity clay. [Landslide Debris]	12	91	7.1			
	1									
	5			Hole would collapse when auger withdrawn.	4		6.8		P200 18.7%	
2				Sandstone Cobbles Light gray with staining on fractures, weak. [Landslide Debris]						
3	10				17		1.9			
				Boring terminated at 10.5' No groundwater encountered during exploration						
4										
	15									
5										
6	20									

▽ Water level encountered during drilling
▼ Water level measured after drilling

NOTES: (1) UNCORRECTED FIELD BLOW COUNTS
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
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FIGURE

BORING 12

EQUIPMENT: Truck Mounted B24 Drill Rig with 4.0-inch Solid Flight Auger
DATE: 8/17/18
ELEVATION: 85 - feet*
*REFERENCE: Google Earth, 2018

DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (4)		BLOWS / FOOT (1)	DRY UNIT WEIGHT pcf (2)	MOISTURE CONTENT (%)	SHEAR STRENGTH psf (3)	OTHER TEST DATA	OTHER TEST DATA
0	0			Clayey GRAVEL with Sand (GC) Medium brown, moist, ~30% fine to coarse sand, angular gravel up to 3/4" diameter, ~15-20% low plasticity clay. [Fill]	26	117	6.1	UC 700	P200 17.7%	
1	5			SAND (SP) Medium brown, moist, loose, fine to medium grained sand. [Dune Sand]	9	103	3.5		P200 1.1%	SA
3	10				5	107	3.4		P200 <1.0%	
5	15				37	108	3.1			
6	20			Boring terminated at 16.5' No groundwater encountered during exploration						

▽ Water level encountered during drilling
▼ Water level measured after drilling

NOTES: (1) UNCORRECTED FIELD BLOW COUNTS
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
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FILENAME: 1650.116 BL.dwg

BORING LOG

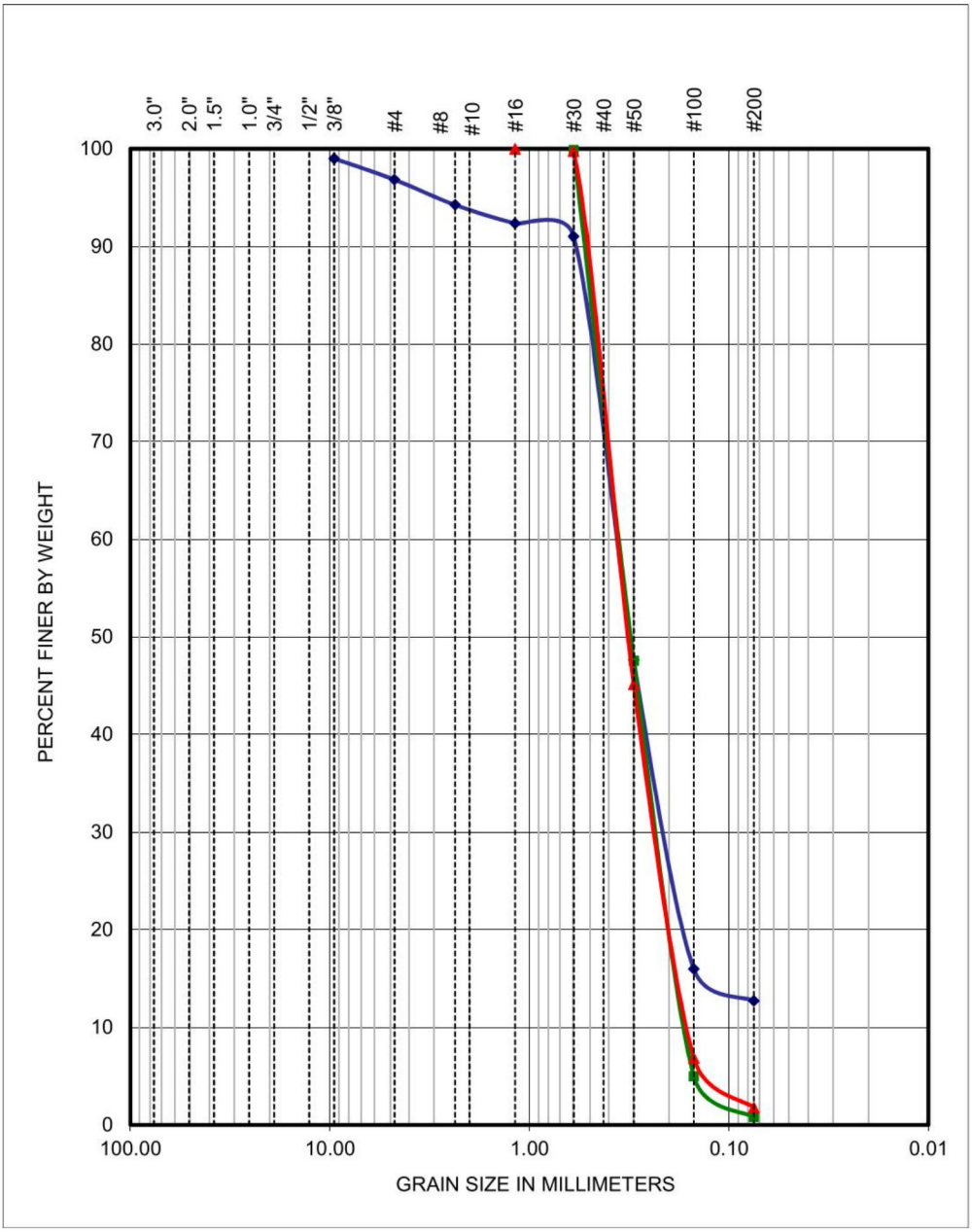
China Beach Restoration
San Francisco, California

Project No. 1650.116 Date: 9/21/2018

Drawn JARS
Checked

B-16
FIGURE

MILLER PACIFIC ENGINEERING GROUP
PARTICLE SIZE ANALYSIS - ASTM D 6913 & ASTM D 1140



SYMBOL	SAMPLE SOURCE	CLASSIFICATION
	B4@3.5	SAND with Clay (SP-SC)
	B1@11.0	SAND (SP)
	B2@5.5	SAND (SP)

MILLER PACIFIC ENGINEERING GROUP
504 Redwood Blvd.
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Novato, CA 94947
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FILENAME: 1650.116 BL.dwg

SIEVE ANALSIS RESULTS

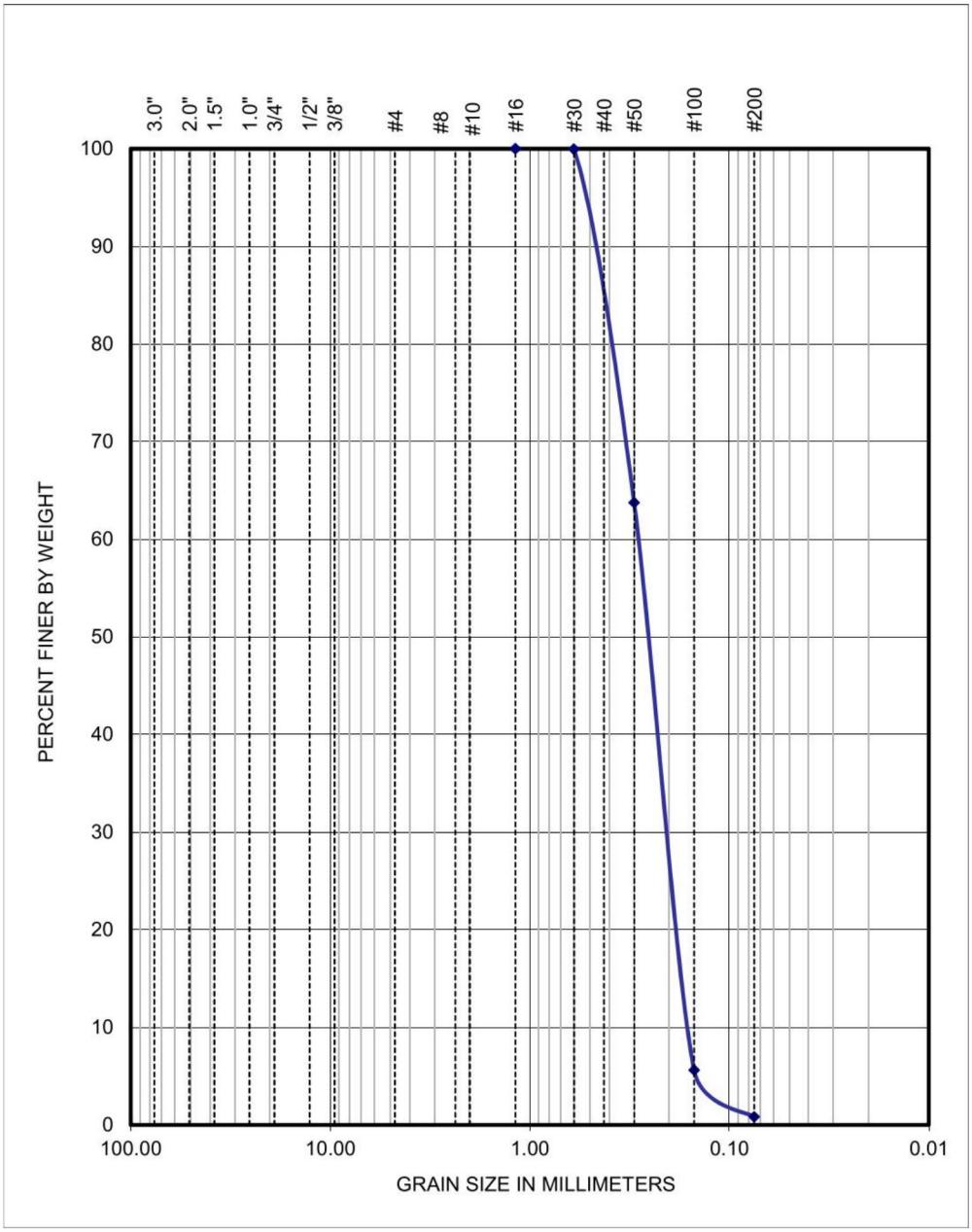
China Beach Restoration
San Francisco, California

Project No. 1650.116 Date: 9/21/2018

Drawn JARS
Checked

B-17
FIGURE

MILLER PACIFIC ENGINEERING GROUP
PARTICLE SIZE ANALYSIS - ASTM D 6913 & ASTM D 1140



SYMBOL	SAMPLE SOURCE	CLASSIFICATION
◆	B12 @ 6.0'	SAND (SP)

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SIEVE ANALSIS RESULTS

China Beach Restoration
San Francisco, California

Project No. 1650.116 Date: 9/21/2018

Drawn JARS
Checked

B-18
FIGURE

APPENDIX B - RESULTS OF LABORATORY TESTING

SUMMARY OF LABORATORY TEST RESULTS

Sample Information							Gradation			Atterberg		Corrosion				Compaction					
Boring No.	Sample No.	Depth (ft)	Sample Type	Total Unit Weight, γ_t (pcf)	Dry Unit Weight, γ_d (pcf)	Moisture Content (%)	Gravel (%)	Sand (%)	Fines (%)	Plasticity Index (PI)	Liquid Limit (LL)	pH	Resistivity (Ω-cm)	SO_4^{2-} (mg/kg)	Cl^- (mg/kg)	Max. Dry Unit Weight, $\gamma_{d,MAX}$ (pcf)	Optimum Moisture Content (%)	R-Value	Expansion Index	Additional Testing	USCS Classification
20C-01	A	1.0	BULK	--	--	--	--	--	--	--	--	--	--	--	--	128	10	--	--	CU	SILTY SAND (SM)
20C-01	1	1.5	MCAL	124	117	6	0	86	14	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND (SC)
20C-01	2	5.0	SPT	--	--	--	--	--	--	--	--	8.3	1,764	--	--	--	--	--	--	--	Poorly graded SAND (SP)
20C-01	3	10.0	MCAL	113	107	5	--	--	--	--	--	--	--	--	--	--	--	--	--	CU	SILTY SAND (SM)
20C-01	6	25.0	SPT	--	--	--	--	--	--	28	55	--	--	--	--	--	--	--	--	--	CLAYEY SAND (SC)
20C-02	10	1.0	MCAL	120	109	9	2	87	11	--	--	--	--	--	--	--	--	--	--	--	Poorly graded SAND (SP)
20C-02	12	10.0	MCAL	119	112	6	0	95	5	--	--	--	--	--	--	--	--	--	--	--	POORLY GRADED SAND (SP)
20C-02	13	15.0	SPT	--	--	--	--	--	--	--	--	8.49	5,711	--	--	--	--	--	--	--	Poorly graded SAND (SP)
20C-02	14	20.0	MCAL	103	99	5	0	98	2	--	--	--	--	--	--	--	--	--	--	--	POORLY GRADED SAND (SP)
20C-02	30	30.0	MCAL	120	93	30	2	18	80	41	58	--	--	--	--	--	--	--	--	--	SANDY fat CLAY (CH)
20C-03	19	1.0	MCAL	141	128	10	4	68	25	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND (SC)
20C-03	21	10.0	MCAL	108	106	3	0	99	1	--	--	--	--	--	--	--	--	--	--	--	POORLY GRADED SAND (SP)
20C-03	22	15.0	SPT	--	--	22	--	--	--	37	62	8.01	248	52	119	--	--	--	--	--	SANDY fat CLAY (CH)
20C-03	Run 5	29.0	RCORE HQ	--	178	--	--	--	--	--	--	--	--	--	--	--	--	--	--	UC	Graywacke
20C-03	Run 7	35.8	RCORE HQ	--	179	--	--	--	--	--	--	--	--	--	--	--	--	--	--	UC	Graywacke
20C-04	23	1.5	MCAL	134	123	9	2	66	32	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND (SC)
20C-04	24	3.5	SPT	--	--	7	--	--	--	--	--	8.27	975	131	57	--	--	--	--	--	CLAYEY SAND (SC)
20C-04	25	8.5	MCAL	116	103	12	0	88	12	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND (SC)
20C-04	Run 9	17.3	RCORE HQ	--	179	--	--	--	--	--	--	--	--	--	--	--	--	--	--	UC	Clay Shale/Serpentinite
20C-04	Run 10	19.5	RCORE HQ	--	180	--	--	--	--	--	--	--	--	--	--	--	--	--	--	UC	Clay Shale/Serpentinite

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PROJECT NAME **GOGA Beach Trail Access Improvements**	
PROJECT NO. **219-400**	REVISION DATE **6-16-20**
PROJECT MANAGER **J. Blanchard**	PREPARED BY **N. Simon**
CHECKED BY **J. Blanchard**	SHEET **1 of 5**

YEH SUMMARY OF TEST RESULTS 219-400-DRAFT.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/17/20

SUMMARY OF LABORATORY TEST RESULTS

Sample Information							Gradation			Atterberg		Corrosion				Compaction					
Boring No.	Sample No.	Depth (ft)	Sample Type	Total Unit Weight, γ_t (pcf)	Dry Unit Weight, γ_d (pcf)	Moisture Content (%)	Gravel (%)	Sand (%)	Fines (%)	Plasticity Index (PI)	Liquid Limit (LL)	pH	Resistivity (Ω-cm)	SO_4^{2-} (mg/kg)	Cl^- (mg/kg)	Max. Dry Unit Weight, $\gamma_{d,MAX}$ (pcf)	Optimum Moisture Content (%)	R-Value	Expansion Index	Additional Testing	USCS Classification
20C-04	Run 12	27.0	RCORE HQ	--	175	--	--	--	--	--	--	--	--	--	--	--	--	--	--	UC	Clay Shale/Serpentinite
20C-04	Run 13	36.3	RCORE HQ	--	162	--	--	--	--	--	--	--	--	--	--	--	--	--	--	UC	Chert
20C-05	28	1.5	MCAL	129	119	8	--	--	--	--	--	--	--	--	--	--	--	--	--	C	Clay Shale/Serpentinite
20C-05	30	10.0	MCAL	129	119	8	--	--	--	--	--	--	--	--	--	--	--	--	--	UU	Clay Shale
20C-05	31	15.0	SPT	--	--	--	--	--	--	26	44	--	--	--	--	--	--	--	--	--	Lean CLAY with SAND (CL)
20C-05	32	20.0	MCAL	133	121	10	--	--	--	--	--	--	--	--	--	--	--	--	--	CU	Fat CLAY (CH)
20C-05	34	30.0	MCAL	119	110	8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Lean to fat CLAY (CL/CH)
20C-06	36	1.0	MCAL	139	123	13	--	--	--	--	--	--	--	--	--	--	--	--	--	CU	SANDY fat CLAY (CH)
20C-06	37	5.0	SPT	--	--	7	--	--	--	--	--	8.91	1,008	65	4	--	--	--	--	--	SANDY lean CLAY (CL)
20C-06	38	10.0	MCAL	109	103	5	--	--	--	34	47	--	--	--	--	--	--	--	--	--	SANDY lean CLAY (CL)
20C-07	41	20.0	SPT	--	--	--	--	--	--	23	38	--	--	--	--	--	--	--	--	--	Lean CLAY with SAND (CL)
20F-01	A	1.0	BULK	--	--	2	2	95	3	--	--	--	--	--	--	--	--	54	--	--	Poorly graded SAND (SP)
20F-01	1	1.5	MCAL	112	110	2	0	97	3	--	--	--	--	--	--	--	--	--	--	--	POORLY GRADED SAND (SP)
20F-02	1	1.5	MCAL	115	111	3	0	98	2	--	--	--	--	--	--	--	--	--	--	--	Poorly graded SAND (SP)
20F-03	A	1.0	BULK	--	--	2	2	91	6	--	--	--	--	--	--	--	--	63	--	--	Poorly graded SAND with SILT (SP-SM)
20F-03	1	1.5	MCAL	112	110	2	0	95	5	--	--	--	--	--	--	--	--	--	--	--	POORLY GRADED SAND (SP)
20F-04	A	0.6	BULK	--	--	3	5	86	9	--	--	--	--	--	--	129	9	--	--	--	Poorly graded SAND with SILT (SP-SM)
20F-04	1	1.5	MCAL	116	114	2	0	97	3	--	--	--	--	--	--	--	--	--	--	--	Poorly graded SAND (SP)
20F-05	1	1.5	MCAL	111	109	2	0	98	2	--	--	--	--	--	--	--	--	--	--	--	POORLY GRADED SAND (SP)
20F-06	1	1.5	MCAL	114	110	3	0	100	0	--	--	--	--	--	--	--	--	--	--	--	POORLY GRADED SAND (SP)

SUMMARY OF LABORATORY TEST RESULTS

Sample Information							Gradation			Atterberg		Corrosion				Compaction					
Boring No.	Sample No.	Depth (ft)	Sample Type	Total Unit Weight, γ_t (pcf)	Dry Unit Weight, γ_d (pcf)	Moisture Content (%)	Gravel (%)	Sand (%)	Fines (%)	Plasticity Index (PI)	Liquid Limit (LL)	pH	Resistivity (Ω-cm)	SO_4^{2-} (mg/kg)	Cl^- (mg/kg)	Max. Dry Unit Weight, $\gamma_{d,MAX}$ (pcf)	Optimum Moisture Content (%)	R-Value	Expansion Index	Additional Testing	USCS Classification
20F-07	A	1.3	BULK	--	--	4	12	83	5	--	--	--	--	--	--	--	--	55	--	--	Poorly graded SAND with SILT (SP-SM)
20F-07	1	1.5	MCAL	106	102	4	0	98	2	--	--	--	--	--	--	--	--	--	--	--	POORLY GRADED SAND (SP)
20L-01	1	2.5	MCAL	113	106	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Well-graded GRAVEL with CLAY and SAND (GW-GC)
20L-01	3	7.5	MCAL	125	103	22	--	--	--	--	--	--	--	--	--	--	--	--	--	CU	Well-graded GRAVEL with CLAY and SAND (GW-GC)
20L-01	5	15.0	MCAL	127	98	30	--	--	--	--	--	8.41	8,016	27	120	--	--	--	--	--	Well-graded GRAVEL with CLAY and SAND (GW-GC)
20L-01	7	25.0	MCAL	129	117	11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Well-graded GRAVEL with CLAY and SAND (GW-GC)
20L-02	A	0.8	BULK	--	--	19	--	--	--	32	50	--	--	--	--	110	19	--	--	DS	SANDY lean to fat CLAY (CL/CH)
20L-02	1	2.5	MCAL	89	76	18	--	--	--	--	--	7.96	4,016	280	669	--	--	--	--	--	SANDY lean to fat CLAY (CL/CH)
20L-02	3	7.5	MCAL	124	100	24	2	72	26	16	39	--	--	--	--	--	--	--	--	--	CLAYEY SAND (SC)
20L-03	1	1.5	MCAL	130	115	13	16	38	46	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND with GRAVEL (SC)
20L-03	2	5.0	SPT	--	--	--	16	66	18	--	--	8.08	1,192	312	365	--	--	--	--	--	CLAYEY SAND with GRAVEL (SC)
20L-03	3	7.5	MCAL	135	118	15	--	--	--	--	--	--	--	--	--	--	--	--	--	CU	Fat CLAY with GRAVEL (CH)
20L-03	4	10.0	SPT	--	--	13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND with GRAVEL (SC)
20L-03	5	15.0	MCAL	116	105	11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND with GRAVEL (SC)
20L-03	7	25.0	MCAL	127	115	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Well-graded GRAVEL with CLAY and SAND (GW-GC)
20L-03	9	35.0	MCAL	131	119	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Well-graded GRAVEL with CLAY and SAND (GW-GC)
20L-04	A	1.0	BULK	--	--	8	--	--	--	17	28	--	--	--	--	--	--	16	--	--	SANDY lean CLAY (CL)
20L-04	1	1.5	MCAL	108	99	9	7	33	60	--	--	--	--	--	--	--	--	--	--	--	SANDY lean CLAY (CL)
20L-04	3	10.0	MCAL	129	115	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SANDY lean CLAY (CL)
20S-01	F	1.0	BULK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	16	--	--	SANDY lean CLAY with GRAVEL (CL)

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PROJECT NAME
GOGA Beach Trail Access Improvements

PROJECT NO. **219-400**	REVISION DATE **6-16-20**
PROJECT MANAGER **J. Blanchard**	PREPARED BY **N. Simon**
CHECKED BY **J. Blanchard**	SHEET **3 of 5**

SUMMARY OF LABORATORY TEST RESULTS

Sample Information							Gradation			Atterberg		Corrosion				Compaction					
Boring No.	Sample No.	Depth (ft)	Sample Type	Total Unit Weight, γ_t (pcf)	Dry Unit Weight, γ_d (pcf)	Moisture Content (%)	Gravel (%)	Sand (%)	Fines (%)	Plasticity Index (PI)	Liquid Limit (LL)	pH	Resistivity (Ω-cm)	SO_4^{2-} (mg/kg)	Cl^- (mg/kg)	Max. Dry Unit Weight, $\gamma_{d,MAX}$ (pcf)	Optimum Moisture Content (%)	R-Value	Expansion Index	Additional Testing	USCS Classification
20S-01	22	1.5	MCAL	--	--	13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND with GRAVEL (SC)
20S-01	23	3.0	SPT	--	--	19	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SANDY lean CLAY (CL)
20S-01-BR	4	1.0	MCAL	129	105	22	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Fat CLAY (CH)
20S-01-BR	5	5.0	SPT	--	--	34	--	--	--	16	40	6.86	1,010	50	13	--	--	--	--	--	Lean CLAY (CL)
20S-01-BR	6	10.0	MCAL	138	118	17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND with GRAVEL (SC)
20S-01-BR	8	20.0	MCAL	99	60	65	--	--	--	14	41	--	--	--	--	--	--	--	--	C	SILT with GRAVEL (ML)
20S-01-BR	9	25.0	SPT	--	--	--	--	--	--	--	--	7.00	1,967	76	7	--	--	--	--	--	SILT with GRAVEL (ML)
20S-01-BR	12	40.0	MCAL	131	112	17	--	--	--	16	33	--	--	--	--	--	--	--	--	--	GRAVELLY lean CLAY with SAND (CL)
20S-02	2	1.3	MCAL	122	108	13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GRAVELLY lean CLAY with SAND (CL)
20S-03	3	1.0	MCAL	139	124	13	39	42	19	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND with GRAVEL (SC)
20S-04	15	1.5	MCAL	--	--	8	53	33	14	--	--	--	--	--	--	--	--	--	--	--	CLAYEY GRAVEL with SAND (GC)
20S-05	16	1.0	MCAL	125	100	25	--	--	--	--	--	7.31	1,307	36	7	--	--	--	--	--	SANDY fat CLAY (CH)
20S-05	C	1.5	BULK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	32	--	--	CLAYEY SAND with GRAVEL (SC)
20S-06	17	1.5	MCAL	127	110	16	31	39	30	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND with GRAVEL (SC)
20S-07	19	1.5	MCAL	118	109	9	36	42	22	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND with GRAVEL (SC)
20S-08	22	1.0	MCAL	--	--	--	34	41	25	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND with GRAVEL (SC)
20S-08	E	1.5	BULK	119	108	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	CLAYEY SAND with GRAVEL (SC)
20T-01	1	1.0	MCAL	114	94	21	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Fat CLAY (CH)
20T-01	A	1.5	BULK	--	--	--	--	--	--	--	--	--	--	--	--	--	--	15	--	--	SANDY fat CLAY with GRAVEL (CH)
20T-02	B	1.0	BULK	--	--	16	--	--	--	--	--	--	--	--	--	120	14	--	--	--	CLAYEY SAND with GRAVEL (SC)

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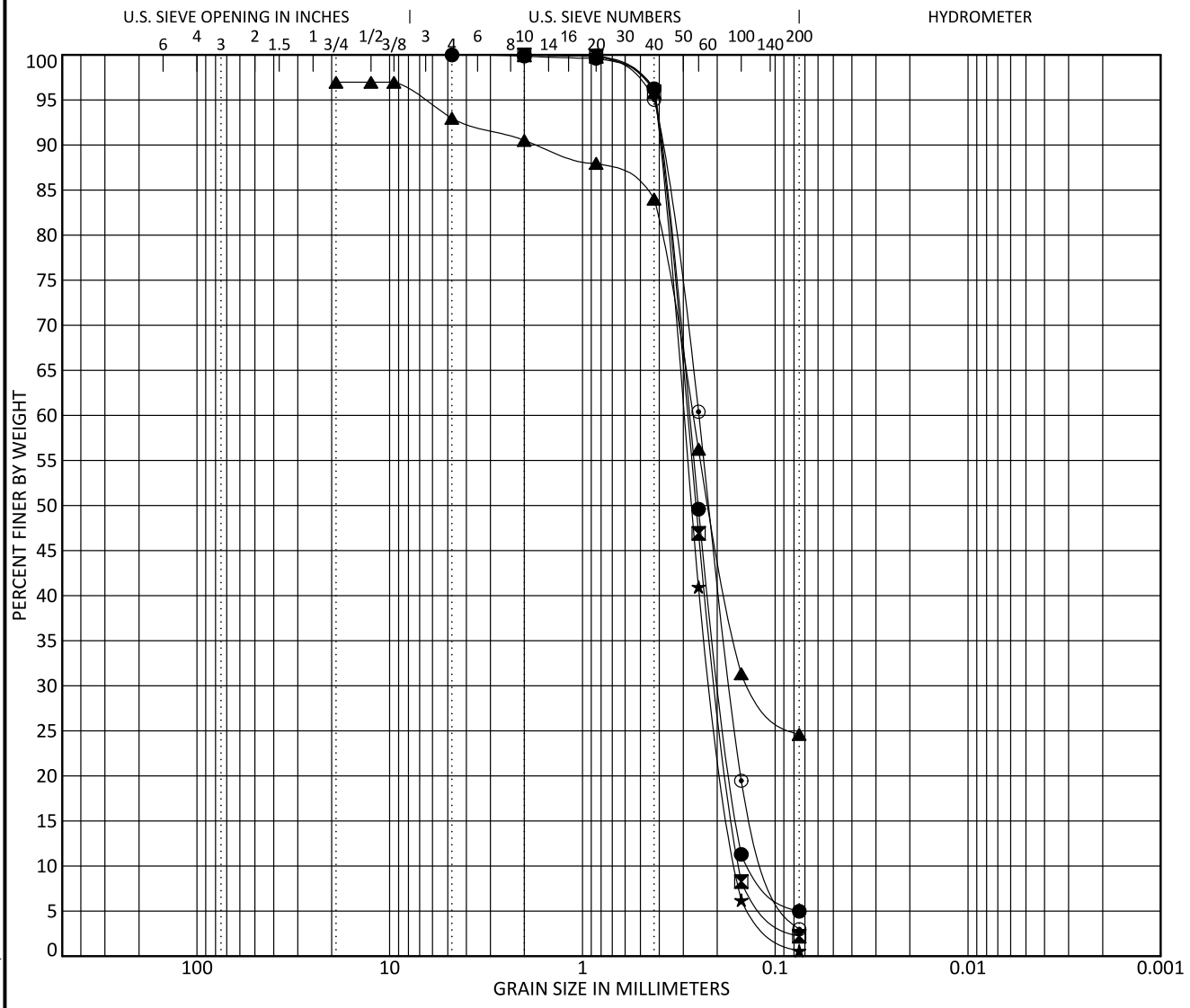
PROJECT NAME **GOGA Beach Trail Access Improvements**	
PROJECT NO. **219-400**	REVISION DATE **6-16-20**
PROJECT MANAGER **J. Blanchard**	PREPARED BY **N. Simon**
CHECKED BY **J. Blanchard**	SHEET **4 of 5**

YEH SUMMARY OF TEST RESULTS 219-400-DRAFT.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020) - CFL.GLB 6/17/20

SUMMARY OF LABORATORY TEST RESULTS

Sample Information				Total Unit Weight, γ_t (pcf)	Dry Unit Weight, γ_d (pcf)	Moisture Content (%)	Gradation			Atterberg		Corrosion				Compaction		R-Value	Expansion Index	Additional Testing	USCS Classification
Boring No.	Sample No.	Depth (ft)	Sample Type				Gravel (%)	Sand (%)	Fines (%)	Plasticity Index (PI)	Liquid Limit (LL)	pH	Resistivity (Ω-cm)	SO_4^{2-} (mg/kg)	Cl^- (mg/kg)	Max. Dry Unit Weight, $\gamma_{d,MAX}$ (pcf)	Optimum Moisture Content (%)				
20T-02	2	3.5	MCAL	131	114	16	19	40	40	13	33	--	--	--	--	--	--	--	--	--	CLAYEY SAND with GRAVEL (SC)
20T-03	3	2.5	MCAL	108	93	15	--	--	--	9	27	--	--	--	--	--	--	--	--	--	SANDY lean CLAY (CL)

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	20C-02	10.0 ft	POORLY GRADED SAND (SP)	--	--	--	--	2.16
⊠	20C-02	20.0 ft	POORLY GRADED SAND (SP)	--	--	--	--	1.88
▲	20C-03	1.0 ft	CLAYEY SAND (SC)	--	--	--	--	--
★	20C-03	10.0 ft	POORLY GRADED SAND (SP)	--	--	--	--	1.89
⊙	20F-01	1.5 ft	POORLY GRADED SAND (SP)	--	--	--	--	2.47

Specimen Identification			D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	20C-02	10.0 ft	4.75	0.281	0.251	0.192	0.13	0.0	95.0	5.0	
⊠	20C-02	20.0 ft	2	0.288	0.258	0.2	0.153	0.0	97.8	2.2	
▲	20C-03	1.0 ft	19	0.269	0.22	0.131	--	4.0	68.4	24.6	
★	20C-03	10.0 ft	2	0.3	0.273	0.213	0.159	0.0	99.4	0.6	
⊙	20F-01	1.5 ft	2	0.249	0.22	0.171	0.101	0.0	97.0	3.0	

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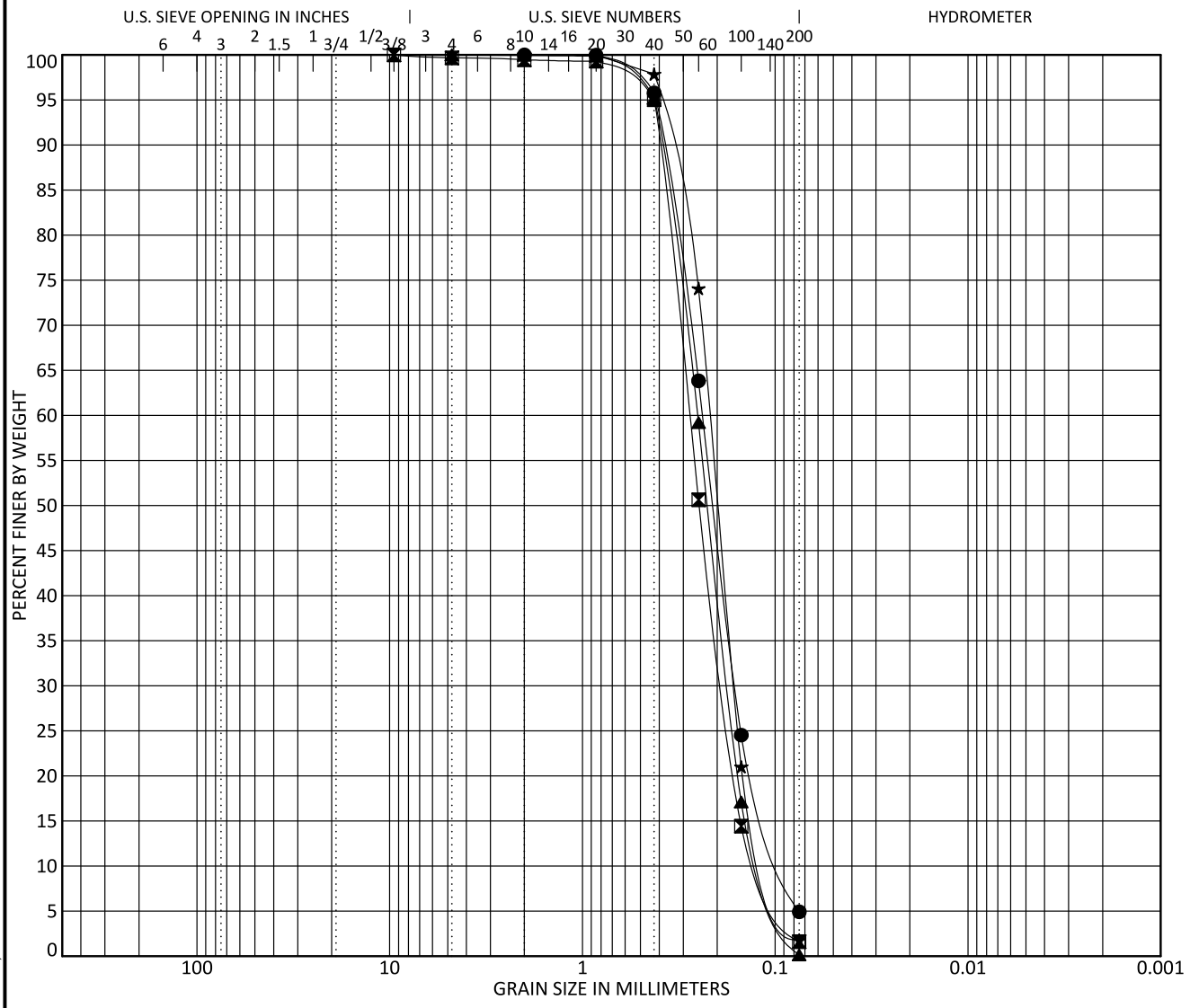
GRAIN SIZE DISTRIBUTION

PROJECT NAME	PROJECT NO.	
GOGA Beach Trail Access Improvements	219-400	
REVISION DATE	PROJECT MANAGER	
2-4-20	J. Blanchard	
PREPARED BY	CHECKED BY	SHEET
R. Hooke	J. Blanchard	1 of 2

YEH SIEVE 219-400_GOGA_FHLA_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020).GLB 5/28/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● 20F-03	1.5 ft	POORLY GRADED SAND (SP)	--	--	--	--	2.65
⊠ 20F-05	1.5 ft	POORLY GRADED SAND (SP)	--	--	--	--	2.37
▲ 20F-06	1.5 ft	POORLY GRADED SAND (SP)	--	--	--	--	2.25
★ 20F-07	1.5 ft	POORLY GRADED SAND (SP)	--	--	--	--	2.16

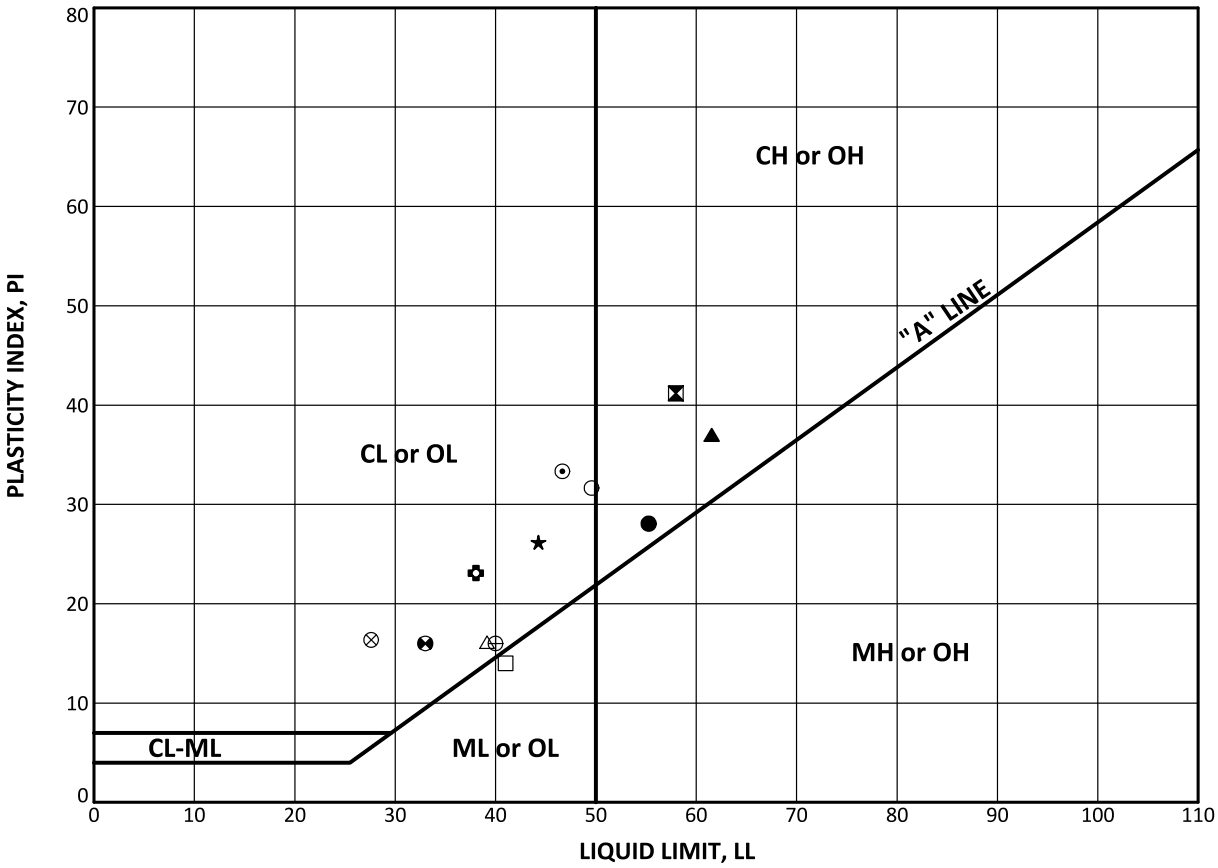
Specimen Identification		D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 20F-03	1.5 ft	2	0.238	0.209	0.161	0.09	0.0	95.1	4.9	
⊠ 20F-05	1.5 ft	9.5	0.28	0.248	0.187	0.118	0.3	98.1	1.6	
▲ 20F-06	1.5 ft	4.75	0.253	0.224	0.175	0.112	0.0	99.9	0.1	
★ 20F-07	1.5 ft	0.85	0.218	0.198	0.164	0.101	0.0	98.2	1.8	

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

GRAIN SIZE DISTRIBUTION

PROJECT NAME: GOGA Beach Trail Access Improvements		PROJECT NO.: 219-400
REVISION DATE: 2-4-20	PROJECT MANAGER: J. Blanchard	
PREPARED BY: R. Hooke	CHECKED BY: J. Blanchard	SHEET: 2 of 2

YEH SIEVE 219-400_GOGA_FHLA_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020).GLB 5/28/20



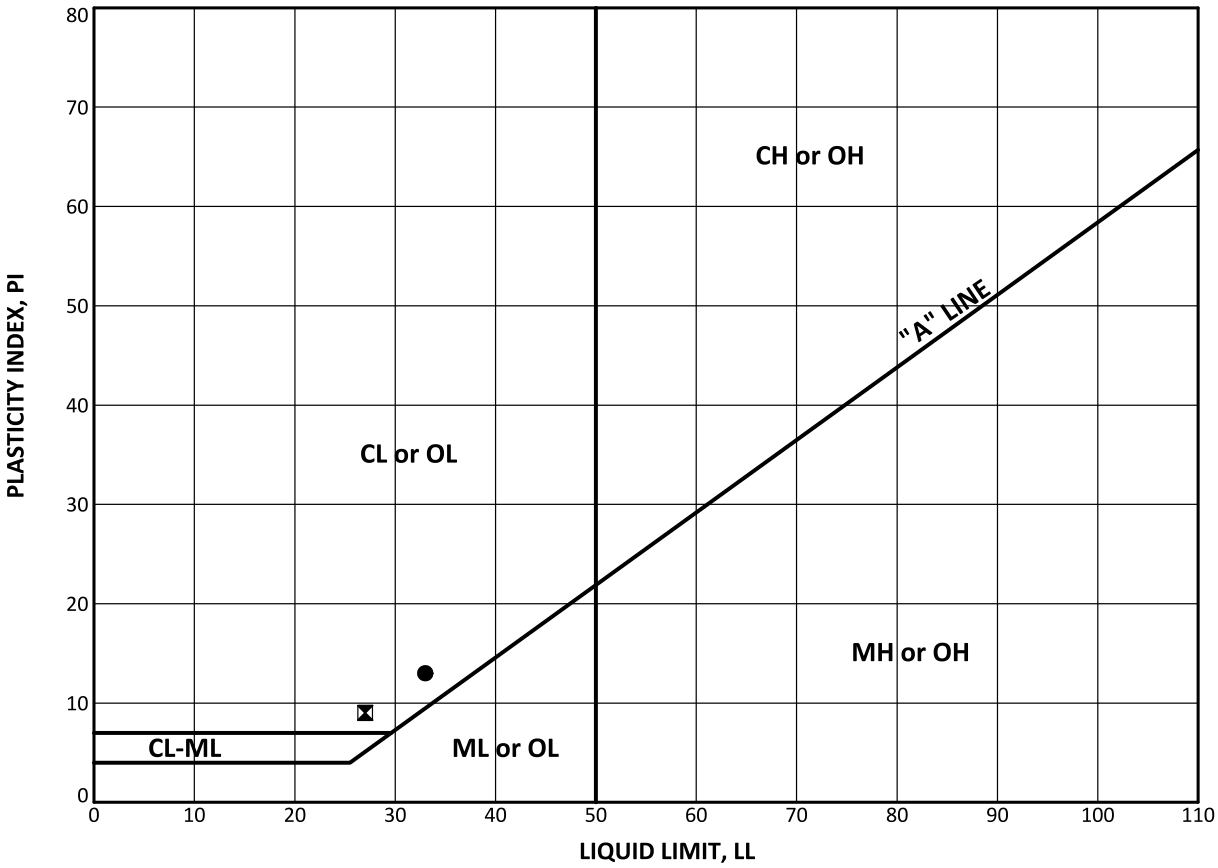
Boring Number	Sample ID	Depth (ft)	Test Symbol	MC (%)	Fines (%)	LL	PL	PI	Classification
20C-01	6	25.0	●	--	--	55	27	28	CLAYEY SAND (SC)
20C-02	30	30.0	⊠	30		58	17	41	SANDY fat CLAY (CH)
20C-03	22	15.0	▲	22	--	62	25	37	SANDY fat CLAY (CH)
20C-05	31	15.0	★	--	--	44	18	26	Lean CLAY with SAND (CL)
20C-06	38	10.0	⊙	5	--	47	13	34	SANDY lean CLAY (CL)
20C-07	41	20.0	✿	--	--	38	15	23	Lean CLAY with SAND (CL)
20L-02	A	0.8	○	19	--	50	18	32	SANDY lean to fat CLAY (CL/CH)
20L-02	3	7.5	△	24		39	23	16	CLAYEY SAND (SC)
20L-04	A	1.0	⊗	8	--	28	11	17	SANDY lean CLAY (CL)
20S-01-BR	5	5.0	⊕	34	--	40	24	16	Lean CLAY (CL)
20S-01-BR	8	20.0	□	65	--	41	27	14	SILT with GRAVEL (ML)
20S-01-BR	12	40.0	⊛	17	--	33	17	16	GRAVELLY lean CLAY with SAND (CL)

YEH ATTERBERG 219-400_GOGA_FHLA_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020).GLB 5/28/20

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

ATTERBERG LIMITS

PROJECT NAME	PROJECT NO.
GOGA Beach Trail Access Improvements	219-400
REVISION DATE: 2-4-20	PROJECT MANAGER: J. Blanchard
PREPARED BY: R. Hooke	CHECKED BY: J. Blanchard
SHEET: 1 of 2	



Boring Number	Sample ID	Depth (ft)	Test Symbol	MC (%)	Fines (%)	LL	PL	PI	Classification
20T-02	2	3.5	●	16		33	20	13	CLAYEY SAND with GRAVEL (SC)
20T-03	3	2.5	⊠	15	--	27	18	9	SANDY lean CLAY (CL)

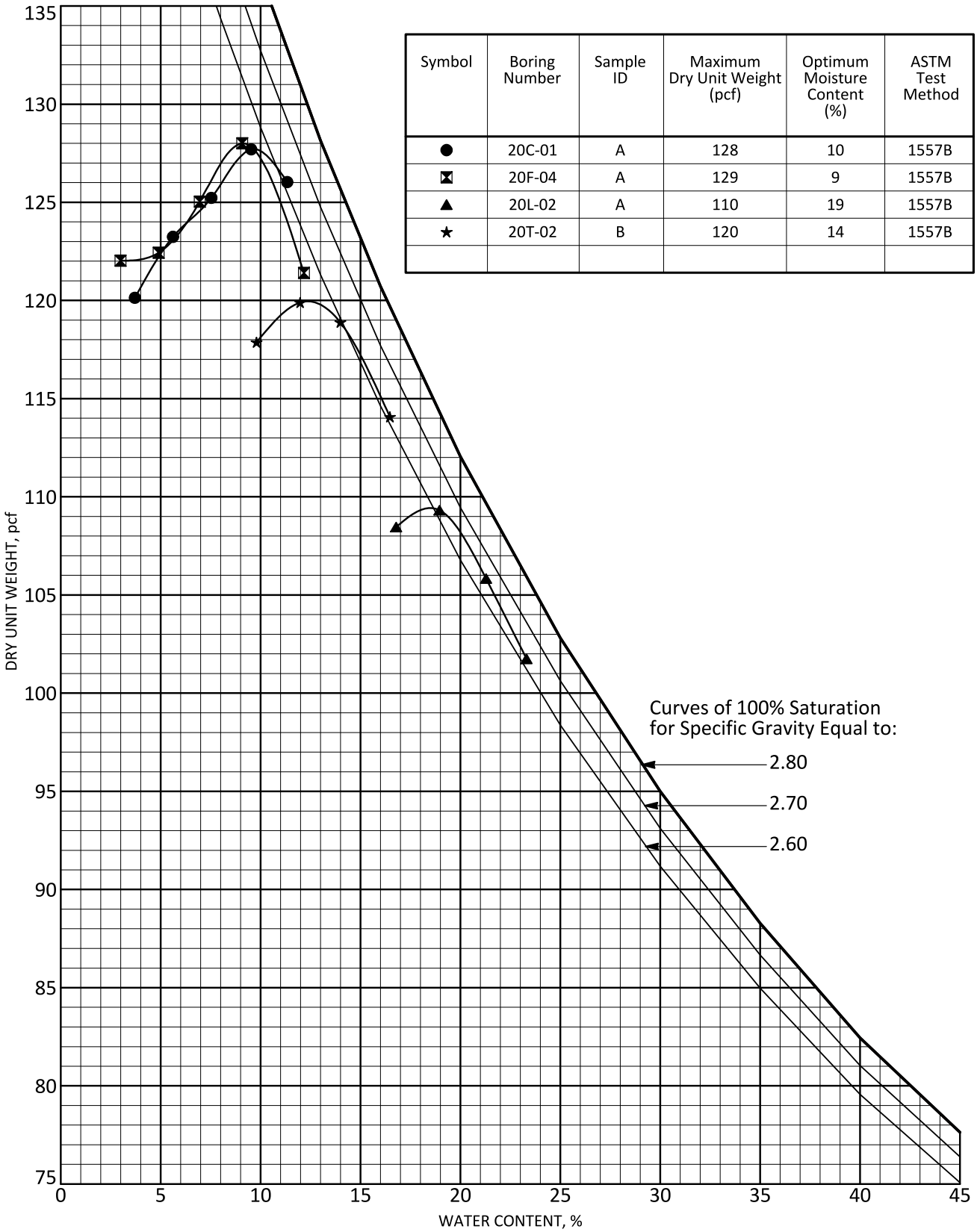
YEH ATTERBERG 219-400_GOGA_FHLA_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020).GLB 5/28/20

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

ATTERBERG LIMITS

PROJECT NAME: GOGA Beach Trail Access Improvements	PROJECT NO.: 219-400
REVISION DATE: 2-4-20	PROJECT MANAGER: J. Blanchard
PREPARED BY: R. Hooke	CHECKED BY: J. Blanchard / SHEET: 2 of 2

Symbol	Boring Number	Sample ID	Maximum Dry Unit Weight (pcf)	Optimum Moisture Content (%)	ASTM Test Method
●	20C-01	A	128	10	1557B
⊠	20F-04	A	129	9	1557B
▲	20L-02	A	110	19	1557B
★	20T-02	B	120	14	1557B



MOISTURE-DENSITY RELATIONSHIP

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

PROJECT NAME: GOGA Beach Trail Access Improvements	PROJECT NO.: 219-400
REVISION DATE: 2-4-20	PROJECT MANAGER: J. Blanchard
PREPARED BY: R. Hooke	CHECKED BY: J. Blanchard
SHEET: 1 of 1	

YEH COMPACTION 5-CURVE 219-400_GOGA_FHLA_NS.GPJ CALIFORNIA YEH LIBRARY (YEH V3 APRIL 2020).GLB 5/28/20

COOPER TESTING LABORATORY

Corrosivity Tests Summary

CTL # 687-091 **Date:** 3/6/2020 **Tested By:** PJ **Checked:** PJ

Client: Yeh & Associates **Project:** GOGA Beach Trail Access Improvements- China Beach **Proj. No:** 219-400

Remarks:

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP (Redox)		Sulfide	Moisture	Soil Visual Description
			As Rec.	Min	Sat.	mg/kg	mg/kg	%		E_H (mv)	At Test	Qualitative by Lead	At Test %	
						Dry Wt.	Dry Wt.	Dry Wt.						
Boring	Sample, No.	Depth, ft.	ASTM G57	Cal 643	ASTM G57	ASTM D4327	ASTM D4327	ASTM D4327	ASTM G51	ASTM G200	Temp °C	Acetate Paper	ASTM D2216	
20C-03	22	15.0	-	-	-	119	52	0.0052	-	-	-	-	21.9	Dark Greenish Gray Sandy CLAY
20C-04	24	3.5	-	-	-	57	131	0.0131	-	-	-	-	6.8	Olive Brown Clayey SAND
20C-06	37	5	-	-	-	4	65	0.0065	-	-	-	-	6.6	Very Dark Gray Sandy CLAY

Corrosivity Tests Summary

CTL # 687-089 **Date:** 1/30/2020 **Tested By:** PJ **Checked:** PJ
Client: Yeh & Associates **Project:** GOGA Stinson Beach **Proj. No:** 219-400
Remarks:

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP (Redox)		Sulfide	Moisture	Soil Visual Description
			As Rec.	Min	Sat.	mg/kg	mg/kg	%				Qualitative	At Test	
						Dry Wt.	Dry Wt.	Dry Wt.		E_H (mv)	At Test	by Lead	%	
Boring	Sample, No.	Depth, ft.	ASTM G57	Cal 643	ASTM G57	ASTM D4327	ASTM D4327	ASTM D4327	ASTM G51	ASTM G200	Temp °C	Acetate Paper	ASTM D2216	
20S-01-BR	5	5	-	-	-	13	50	0.0050	-	-	-	-	26.8	Dark Brown Sandy CLAY w/ Gravel
20S-01-BR	9	25	-	-	-	7	76	0.0076	-	-	-	-	21.7	Very Dark Gray Sandy CLAY w/ Gravel
20S-05	16	1	-	-	-	7	36	0.0036	-	-	-	-	24.4	Gray Sandy CLAY

Corrosivity Tests Summary

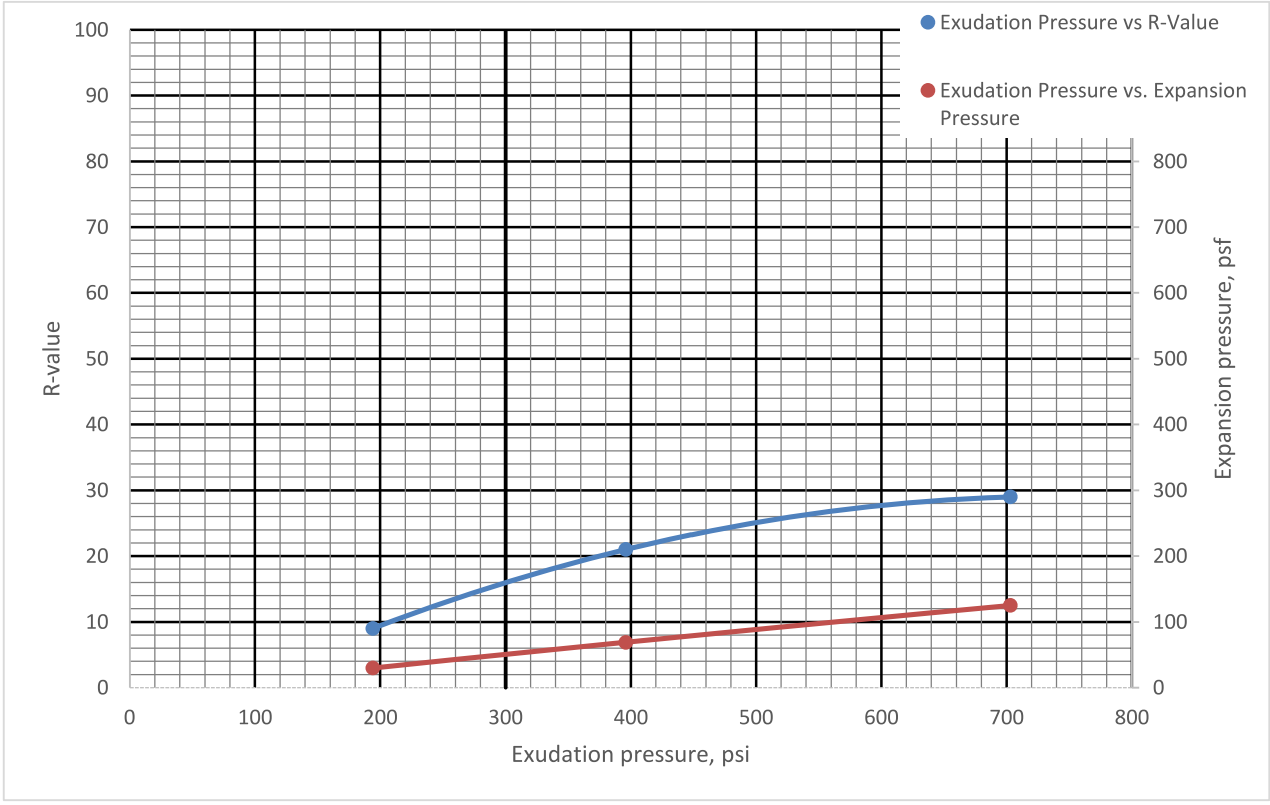
CTL # 687-098 **Date:** 5/20/2020 **Tested By:** PJ **Checked:** PJ
Client: Yeh & Associates **Project:** Goga Beach Trail Access Improvements **Proj. No:** 219-400
Remarks:

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP (Redox)		Sulfide	Moisture	Soil Visual Description
			As Rec.	Min	Sat.	mg/kg	mg/kg	%		E_H (mv)	At Test	Qualitative by Lead	At Test %	
						Dry Wt.	Dry Wt.	Dry Wt.						
Boring	Sample, No.	Depth, ft.	ASTM G57	Cal 643	ASTM G57	ASTM D4327	ASTM D4327	ASTM D4327	ASTM G51	ASTM G200	Temp °C	Acetate Paper	ASTM D2216	
20L-01	5	15	-	-	-	120	27	0.0027	-	-	-	-	25.4	Gray Silty GRAVEL w/ Sand (Weathered Rock)
20L-02	1	2.5	-	-	-	669	280	0.0280	-	-	-	-	17.7	Brown Sandy CLAY w/ Gravel
20L-03	2	5	-	-	-	365	312	0.0312	-	-	-	-	13.1	Olive Brown Clayey GRAVEL w/ Sand

R-Value
CTM 301

CTL Job No.:	687-087	Boring:	20S-01	Reduced By:	RU
Client:	Yeh & Associates	Sample:	F	Checked By:	PJ
Project Number:	219-400	Depth:	1-4	Date:	1/27/2020
Project Name:	GOGA Trail Access		**R-Value**		**16**
Soil Description:	Yellowish Brown Sandy CLAY w/ Gravel				
Remarks:			**Expansion Pressure**		**50**

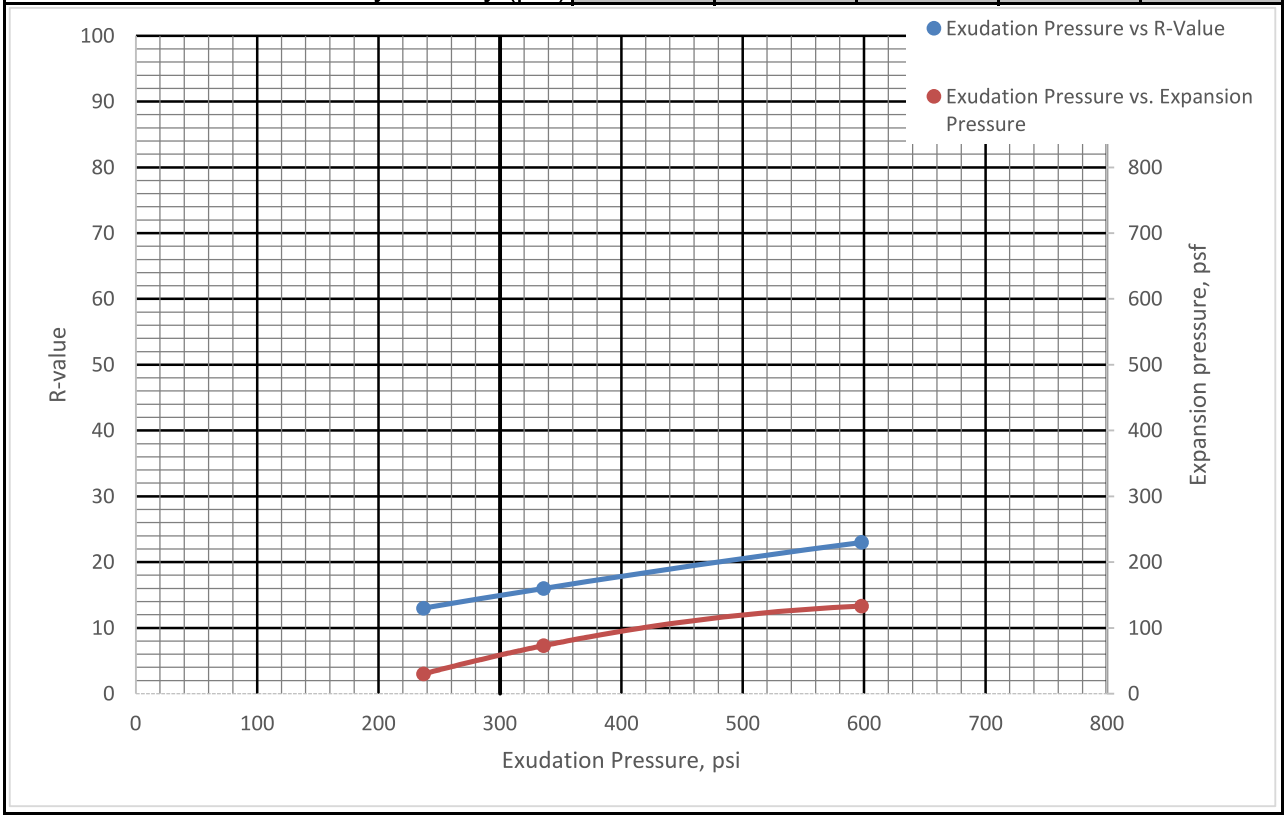
Specimen Designation	A	B	C	D	E
Compactor Foot Pressure (psi)	145	50	350		
Exudation Pressure (psi)	396	194	703		
Exudation Load (psf)	4976	2438	8834		
Height After Compaction (in)	2.56	2.60	2.40		
Expansion Pressure (psf)	69	30	125		
Stabilometer @ 2000	120	140	96		
Turns Displacement	3.20	3.78	3.74		
R-value	21	9	31		
Corrected R-Value	21	9	29		
Moisture Content (%)	13.4	16.0	10.7		
Wet Density (pcf)	137.5	133.5	141.6		
Dry Density (pcf)	121.3	115.0	127.9		



R-Value
CTM 301

CTL Job No.:	687-087	Boring:	20T-01	Reduced By:	RU
Client:	Yeh & Associates	Sample:	A	Checked By:	PJ
Project Number:	219-400	Depth:	1-4	Date:	1/27/2020
Project Name:	GOGA Trail Access		**R-Value**		**15**
Soil Description:	Dark Brown Sandy CLAY w/ Gravel				
Remarks:			**Expansion Pressure**		**60**

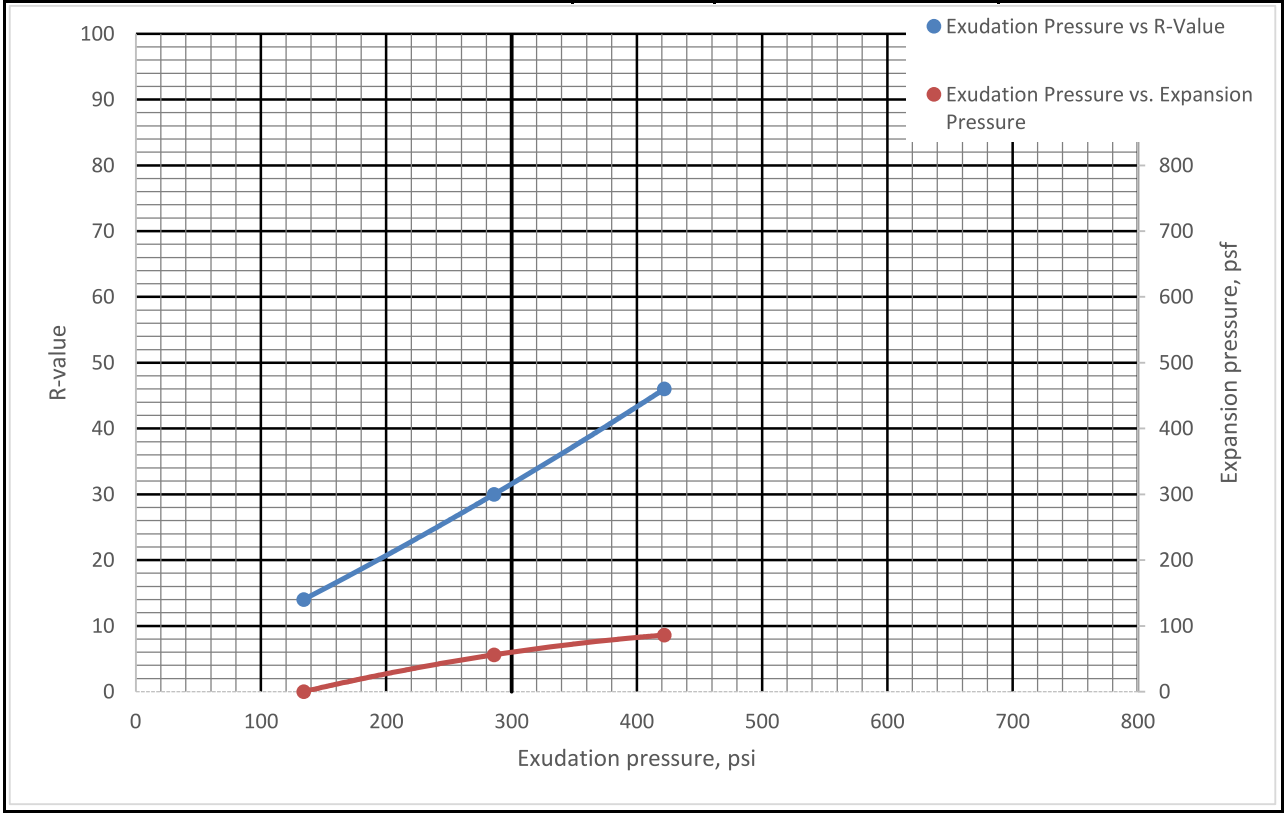
Specimen Designation	A	B	C	D	E
Compactor Foot Pressure (psi)	290	120	70		
Exudation Pressure (psi)	598	336	237		
Exudation Load (psf)	7515	4222	2978		
Height After Compaction (in)	2.48	2.70	2.51		
Expansion Pressure (psf)	133	73	30		
Stabilometer @ 2000	120	124	132		
Turns Displacement	2.80	4.36	3.56		
R-value	23	14	13		
Corrected R-Value	23	16	13		
Moisture Content (%)	16.4	18.7	21.0		
Wet Density (pcf)	131.9	127.4	129.6		
Dry Density (pcf)	113.3	107.4	107.1		



R-Value
CTM 301

CTL Job No.:	687-087	Boring:	20S-05	Reduced By:	RU
Client:	Yeh & Associates	Sample:	C	Checked By:	PJ
Project Number:	219-400	Depth:	1-4	Date:	1/27/2020
Project Name:	GOGA Trail Access		**R-Value**		**32**
Soil Description:	Dark Gray Clayey SAND w/ Gravel				
Remarks:			**Expansion Pressure**		**60**

Specimen Designation	A	B	C	D	E
Compactor Foot Pressure (psi)	300	350	70		
Exudation Pressure (psi)	286	422	134		
Exudation Load (psf)	3594	5303	1684		
Height After Compaction (in)	2.45	2.40	2.68		
Expansion Pressure (psf)	56	86	0		
Stabilometer @ 2000	98	68	128		
Turns Displacement	3.70	3.52	4.26		
R-value	30	49	13		
Corrected R-Value	30	46	14		
Moisture Content (%)	16.8	15.4	19.6		
Wet Density (pcf)	133.4	132.4	123.7		
Dry Density (pcf)	114.2	114.7	103.5		



NV5 WEST, INC.
1868 Palma Drive, Suite A, Ventura, CA 93003
Telephone (805) 656-6074; Fax (805)650-6264

RESISTANCE "R" VALUE TEST
(ASTM D2844/CTM301)

June 12, 2020

Yeh & Associates, Inc.
391 Front St., Suite D
Grover Beach, CA 93433

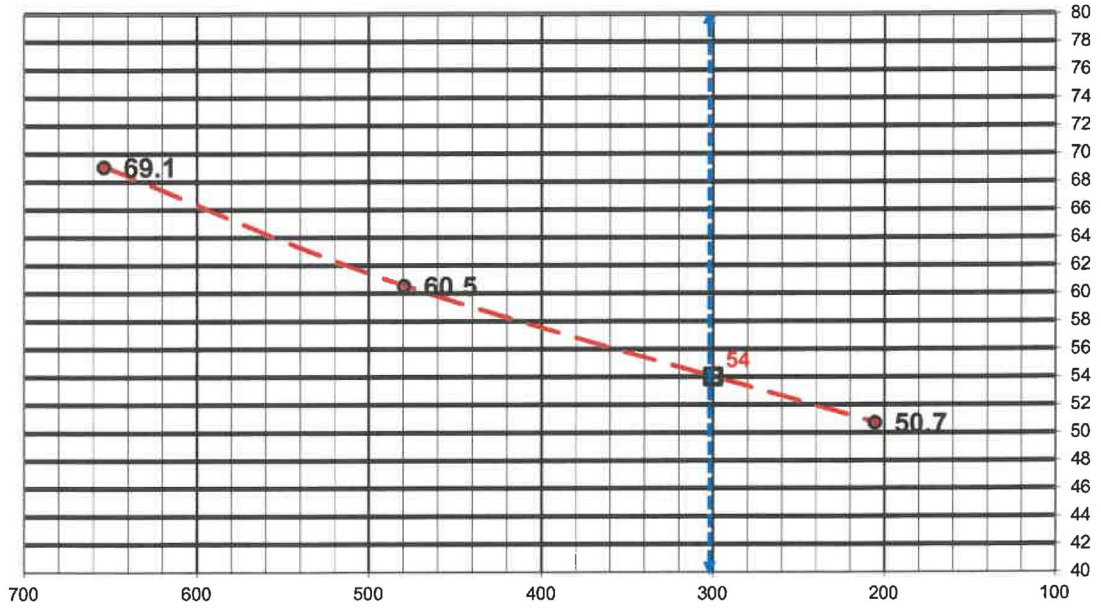
NV5 JOB No: **16-001890**
LAB No: 87718

Project: Yeh & Associates, Inc. - Proj. 219-400

Material: Brown Silty Sand (SM)
Location: 20F-01 #A, 0-5ft
Sampled By: Client
Date Sampled: 5/14/20
Date Received: 5/14/20

Depth: N/A

"R" VALUE BY EXUDATION GRAPH



TEST SPECIMEN	A	B	C	D
COMP. FOOT PRESSURE, psi	280	250	200	
INITIAL MOISTURE %	6.2	6.2	6.2	
MOISTURE @ COMPACTION %	13.7	12.9	12.1	
DRY DENSITY, pcf	109.8	110.9	111.1	
EXUDATION PRESSURE, psi	205	479	654	
STABILOMETER VALUE 'R'	50.7	60.5	69.1	
			R-Value @ Equilibrium =	**54**

Reviewed By: _____

NV5 WEST, INC.
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RESISTANCE "R" VALUE TEST
(ASTM D2844/CTM301)

June 12, 2020

Yeh & Associates, Inc.
391 Front St., Suite D
Grover Beach, CA 93433

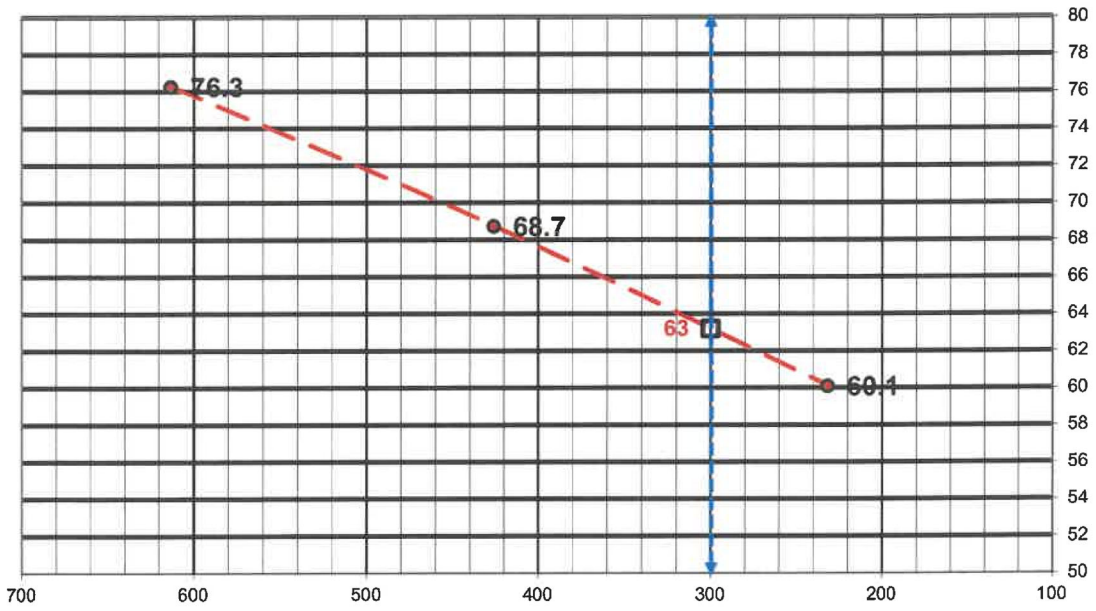
NV5 JOB No: **16-001890**
LAB No: 87718

Project: Yeh & Associates, Inc. - Proj. 219-400

Material: Brown Silty Fine- to Coarse-Grained Sand (SM)
Location: 20F-03 #A - 0-5 ft
Sampled By: Client
Date Sampled: 5/14/20
Date Received: 5/14/20

Depth: 0 - 5 ft

"R" VALUE BY EXUDATION GRAPH



TEST SPECIMEN	A	B	C	D
COMP. FOOT PRESSURE, psi	250	300	350	
INITIAL MOISTURE %	7.3	7.3	7.3	
MOISTURE @ COMPACTION %	15.3	14.3	13.3	
DRY DENSITY, pcf	120.4	124.3	124.9	
EXUDATION PRESSURE, psi	232	426	613	
STABILOMETER VALUE 'R'	60.1	68.7	76.3	
			R-Value @ Equilibrium =	**63**

Reviewed By: _____

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RESISTANCE "R" VALUE TEST
(ASTM D2844/CTM301)

June 12, 2020

Yeh & Associates, Inc.
391 Front St., Suite D
Grover Beach, CA 93433

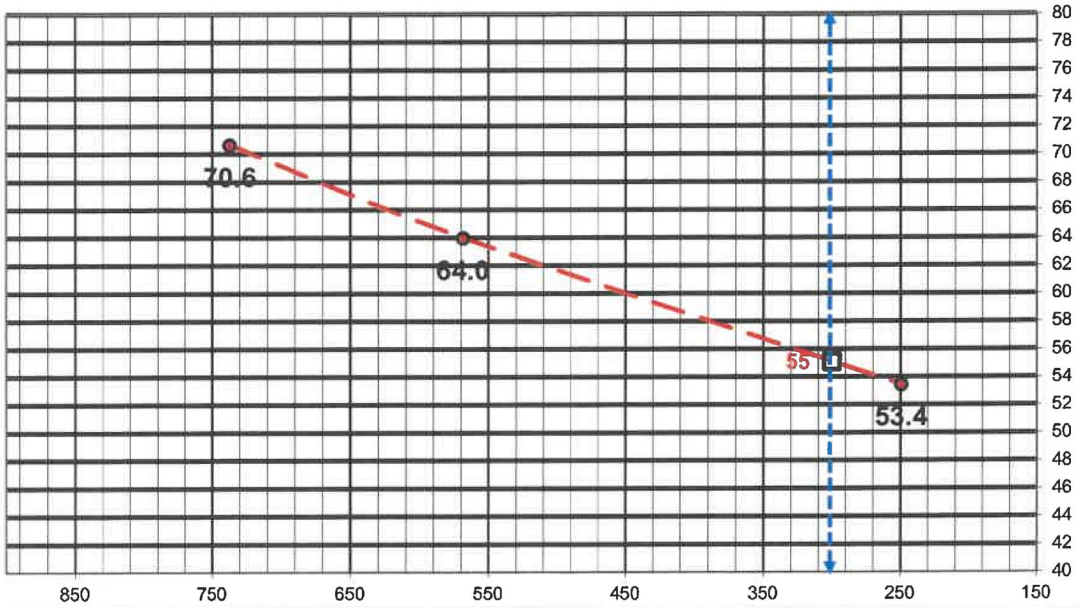
NV5 JOB No: **16-001890**
LAB No: 87718

Project: Yeh & Associates, Inc. - Proj. 219-400

Material: Brown Silty Sand (SM)
Location: 20F-07 #A @ 0-5 ft
Sampled By: Client
Date Sampled: 5/14/20
Date Received: 5/14/20

Depth: 0 - 5 ft

"R" VALUE BY EXUDATION GRAPH



TEST SPECIMEN	A	B	C	D
COMP. FOOT PRESSURE, psi	220	200	150	
INITIAL MOISTURE %	8.7	8.7	8.7	
MOISTURE @ COMPACTION %	18.2	17.2	15.7	
DRY DENSITY, pcf	108.5	109.1	111.2	
EXUDATION PRESSURE, psi	249	568	737	
STABILOMETER VALUE 'R'	53.4	64.0	70.6	
			R-Value @ Equilibrium =	**55**

Reviewed By: _____

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RESISTANCE "R" VALUE TEST
(ASTM D2844/CTM301)

June 12, 2020

Yeh & Associates, Inc.
391 Front St., Suite D
Grover Beach, CA 93433

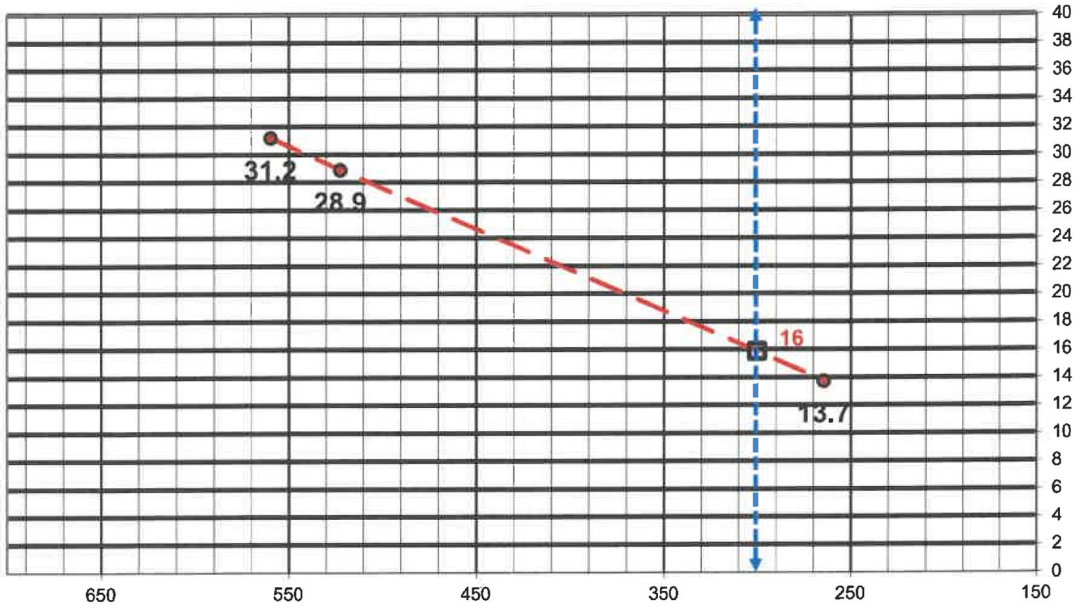
NV5 JOB No: **16-001890**
LAB No: 87718

Project: Yeh & Associates, Inc. - Proj. 219-400

Material: Brown Silty Clay (CL)
Location: 20L-04 #A - 0-5ft
Sampled By: Client
Date Sampled: 5/14/20
Date Received: 5/14/20

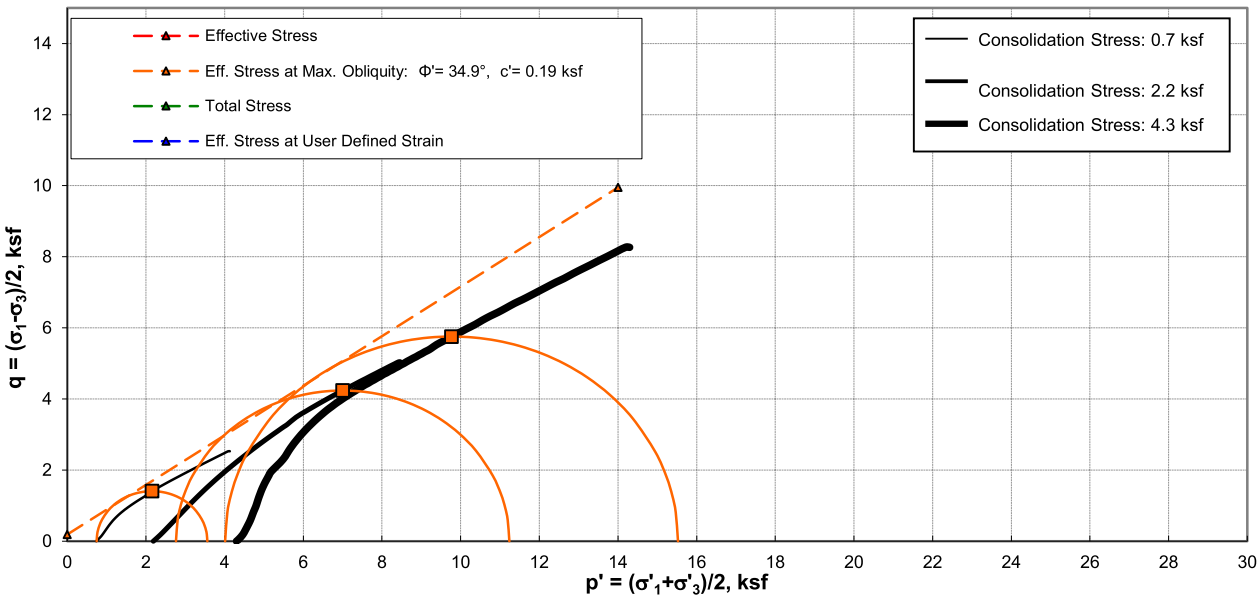
Depth: 0 - 5 ft

"R" VALUE BY EXUDATION GRAPH



TEST SPECIMEN	A	B	C	D
COMP. FOOT PRESSURE, psi	110	120	150	
INITIAL MOISTURE %	5.6	5.6	5.6	
MOISTURE @ COMPACTION %	11.6	10.6	9.6	
DRY DENSITY, pcf	121.6	121.3	124.2	
EXUDATION PRESSURE, psi	264	522	560	
STABILOMETER VALUE 'R'	13.7	28.9	31.2	
			R-Value @ Equilibrium =	**16**

Reviewed By: _____



SAMPLE ID

Boring Number	20C-01
Sample Number	A
Specimen Depth	1-5 ft
USCS Classification	Silty SAND (SM): brown, moist, trace gravel

INITIAL

Trial ID	A	B	C
Water Content, %	5.5%	16.6%	16.6%
Dry Unit Weight, pcf	114.4	116.3	116.3
Saturation, %	31%	100%	100%
Void Ratio	0.47	0.45	0.45
Diameter, in	2.42	2.43	2.45
Height, in	5.00	4.89	4.80

PRE-SHEAR

Water Content, %	16.6%	16.6%	16.5%
Dry Unit Weight, pcf	116.3	116.3	116.6
Saturation, %	100%	100%	100%
Void Ratio	0.45	0.45	0.44

REMARKS

Test Method: ASTM 4767 (modified for staged testing)
Project: GOGA China Beach
Specimen was reconstituted to about 90 % R.C.
By: N. Derbidge, Cal Poly Geo-E Lab, San Luis Obispo, CA
Checked: J. Blanchard, Yeh and Associates, Inc.

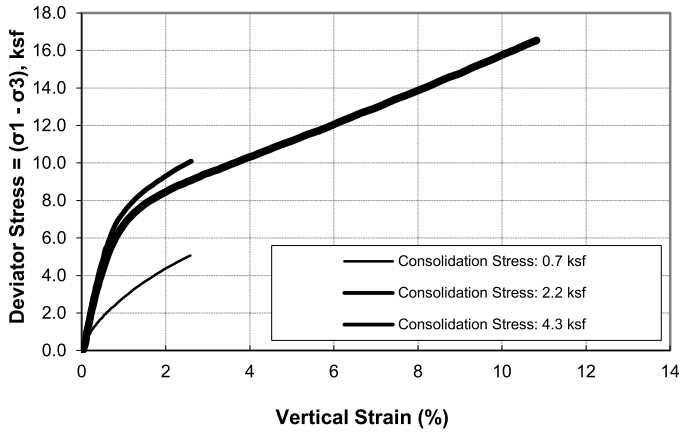
CLASSIFICATION

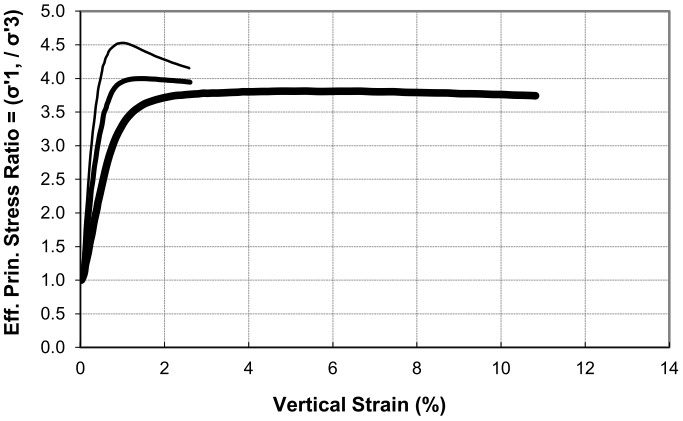
Trial ID	A	B	C
Liquid Limit	---	---	---
Plastic Limit	---	---	---
Plastic Index	---	---	---
Passing #4 (4.75 mm)	---	---	---
Passing #200 (0.075 mm)	---	---	---
Estimated Gs	2.70	2.70	2.70

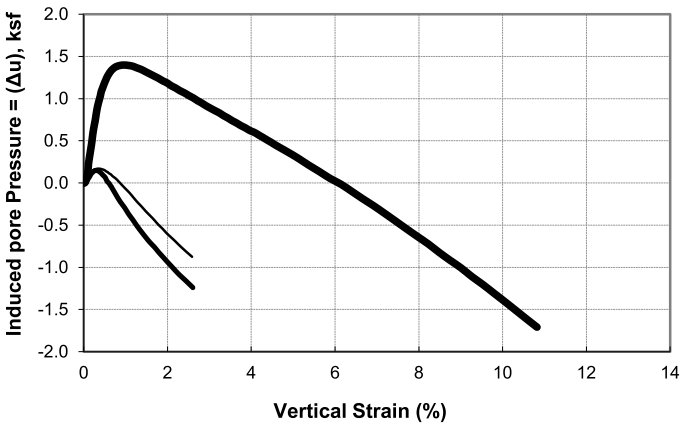
TEST SUMMARY

Trial ID	A	B	C
B-Parameter	0.98	0.98	0.98
t_{50}, minutes	N/A	N/A	N/A
Strain Rate, %/min	0.05	0.05	0.05
Cell Pressure, ksf	9.5	10.9	13.0
Back Pressure, ksf	8.7	8.7	8.7
Consolidation Stress, ksf	0.7	2.2	4.3
Deviator Stress @ Failure, ksf	2.8	8.4	11.4
Axial Strain @ Failure, %	1.0	1.5	5.4
σ'_{1F}, ksf	3.5	11.1	15.4
σ'_{3F}, ksf	0.7	2.8	4.0
Tested By:	ND	ND	ND
Date Tested:	3/9/20	3/10/20	3/10/20

CONSOLIDATED UNDRAINED TRIAXIAL TEST

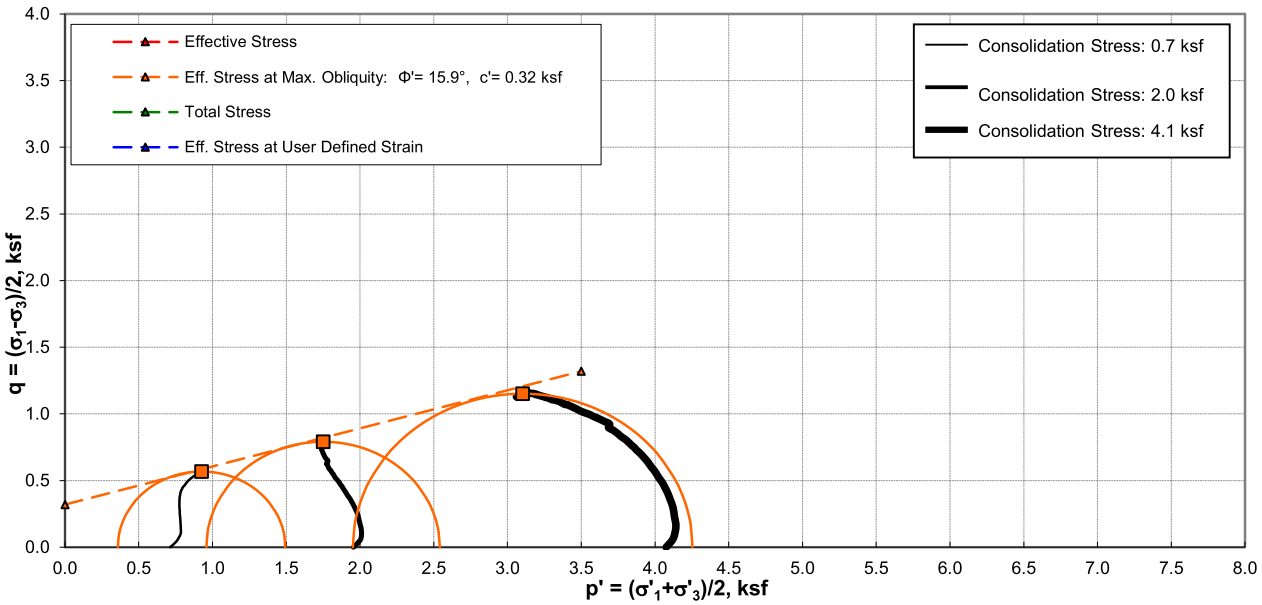






A	20C-01	#A	43,835.0 ft	Silty SAND (SM): brown, moist, trace gravel
B	20C-01	#A	43,835.0 ft	
C	20C-01	#A	43,835.0 ft	

CONSOLIDATED UNDRAINED TRIAXIAL TEST



SAMPLE ID

Boring Number	20C-05
Sample Number	32
Specimen Depth	20.0 ft
USCS Classification	Fat CLAY (CH): gray, moist

INITIAL

Trial ID	A	B	C
Water Content, %	10.3%	25.2%	23.7%
Dry Unit Weight, pcf	120.5	100.2	102.7
Saturation, %	70%	100%	100%
Void Ratio	0.40	0.68	0.64
Diameter, in	2.42	2.68	2.68
Height, in	5.00	4.91	4.79

PRE-SHEAR

Water Content, %	25.2%	23.7%	22.4%
Dry Unit Weight, pcf	100.2	102.7	105.0
Saturation, %	100%	100%	100%
Void Ratio	0.68	0.64	0.60

REMARKS

Test Method: ASTM 4767 (modified for staged testing)
Project: GOGA China Beach
By: N. Derbidge, Cal Poly Geo-E Lab, San Luis Obispo, CA
Checked: J. Blanchard, Yeh and Associates, Inc.

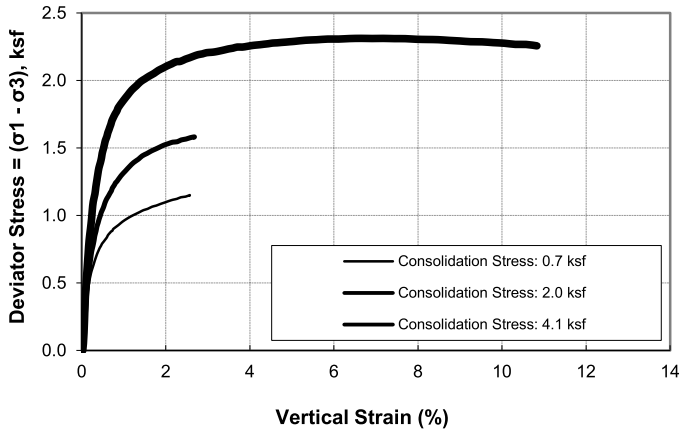
CLASSIFICATION

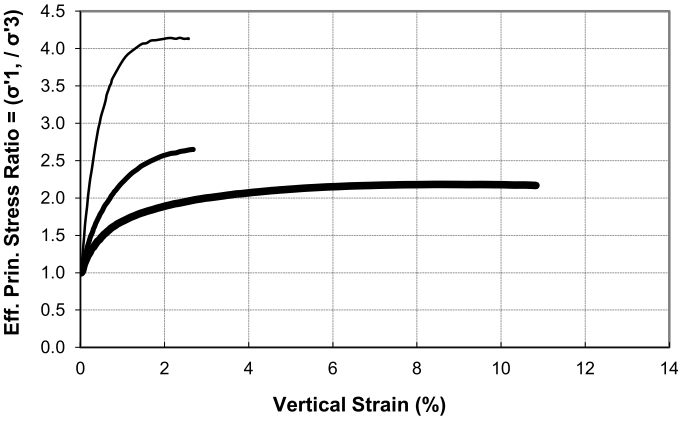
Trial ID	A	B	C
Liquid Limit	---	---	---
Plastic Limit	---	---	---
Plastic Index	---	---	---
Passing #4 (4.75 mm)	---	---	---
Passing #200 (0.075 mm)	---	---	---
Estimated Gs	2.70	2.70	2.70

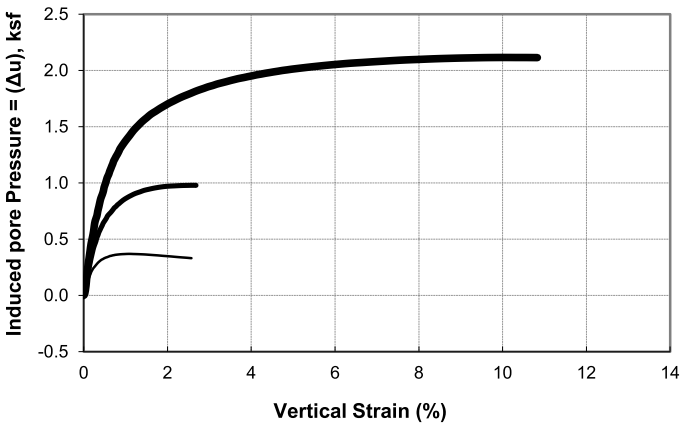
TEST SUMMARY

Trial ID	A	B	C
B-Parameter	0.98	0.98	0.98
t_{50}, minutes	N/A	N/A	N/A
Strain Rate, %/min	0.02	0.02	0.02
Cell Pressure, ksf	9.4	10.8	12.9
Back Pressure, ksf	8.7	8.8	8.9
Consolidation Stress, ksf	0.7	2.0	4.1
Deviator Stress @ Failure, ksf	1.1	1.6	2.3
Axial Strain @ Failure, %	2.4	2.7	8.5
σ'_{1F}, ksf	1.5	2.5	4.2
σ'_{3F}, ksf	0.4	1.0	2.0
Tested By:	ND	ND	ND
Date Tested:	3/2/20	3/4/20	3/5/20

CONSOLIDATED UNDRAINED TRIAXIAL TEST

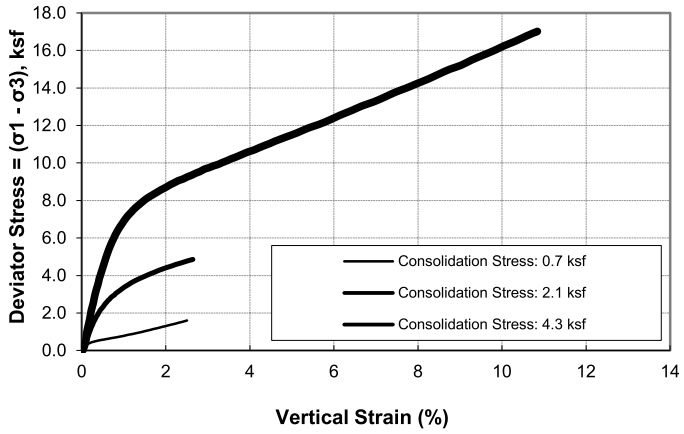


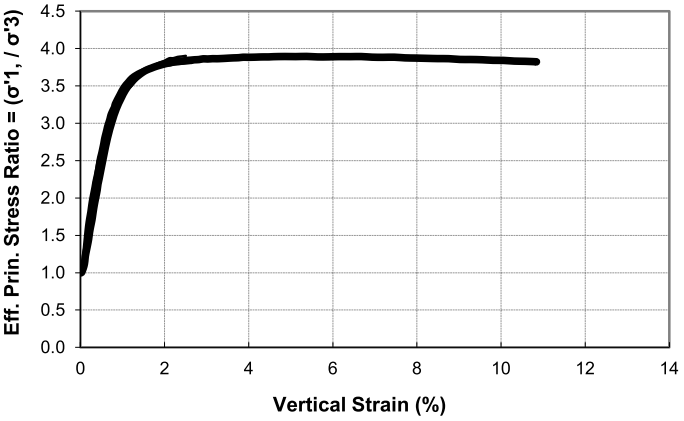


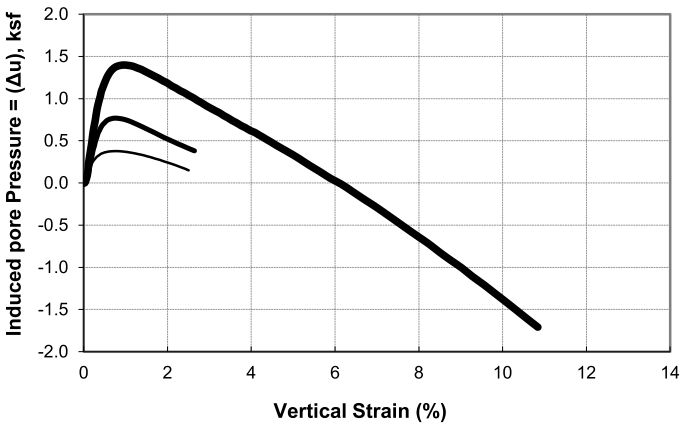


A	20C-05	#32	20.0 ft	Fat CLAY (CH): gray, moist
B	20C-05	#32	20.0 ft	
C	20C-05	#32	20.0 ft	

CONSOLIDATED UNDRAINED TRIAXIAL TEST

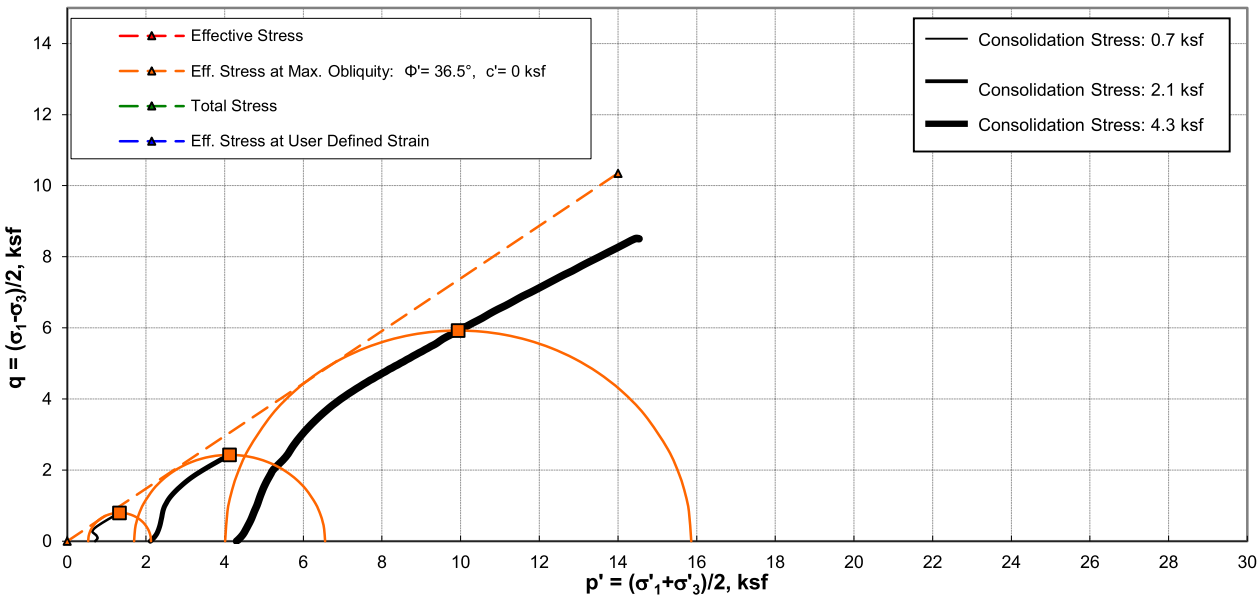






A	20C-01	#3	10.0 ft	Silty SAND grading to Poorly-graded SAND with silt (SP-SM): brown, dry, slightly cemented
B	20C-01	#3	10.0 ft	
C	20C-01	#3	10.0 ft	

CONSOLIDATED UNDRAINED TRIAXIAL TEST



SAMPLE ID

Boring Number	20C-01
Sample Number	3
Specimen Depth	10.0 ft
USCS Classification	Silty SAND grading to Poorly-graded SAND with silt (SP-SM): brown, dry, slightly cemented

INITIAL

Trial ID	A	B	C
Water Content, %	5.2%	19.5%	18.8%
Dry Unit Weight, pcf	106.7	110.4	111.8
Saturation, %	24%	100%	100%
Void Ratio	0.58	0.53	0.51
Diameter, in	2.42	2.41	2.42
Height, in	5.00	4.88	4.79

PRE-SHEAR

Water Content, %	19.5%	18.8%	18.2%
Dry Unit Weight, pcf	110.4	111.8	113.0
Saturation, %	100%	100%	100%
Void Ratio	0.53	0.51	0.49

REMARKS

Test Method: ASTM 4767 (modified for staged testing)
Project: GOGA China Beach
By: N. Derbidge, Cal Poly Geo-E Lab, San Luis Obispo, CA
Checked: J. Blanchard, Yeh and Associates, Inc.

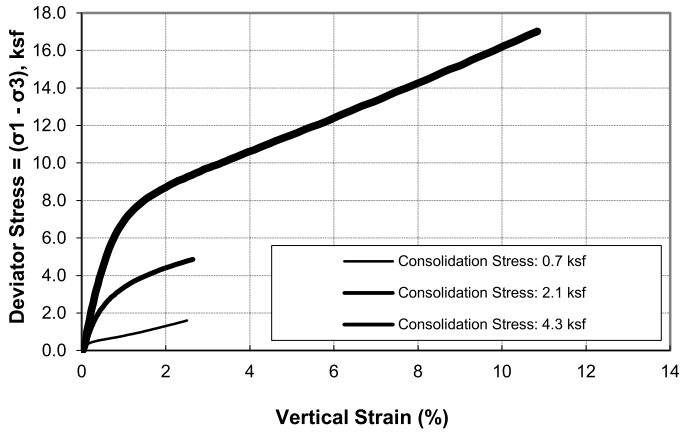
CLASSIFICATION

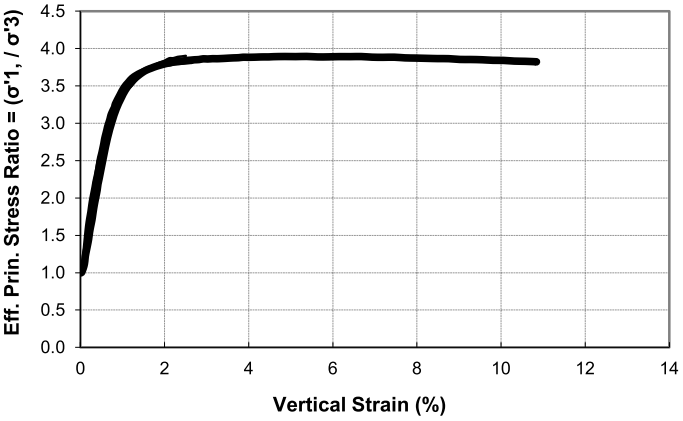
Trial ID	A	B	C
Liquid Limit	---	---	---
Plastic Limit	---	---	---
Plastic Index	---	---	---
Passing #4 (4.75 mm)	---	---	---
Passing #200 (0.075 mm)	---	---	---
Estimated Gs	2.70	2.70	2.70

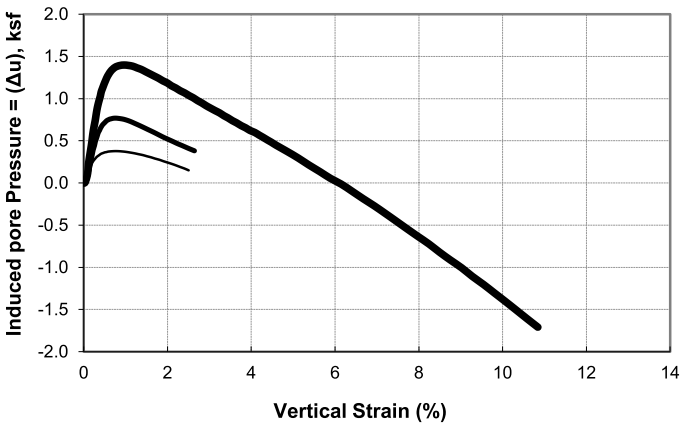
TEST SUMMARY

Trial ID	A	B	C
B-Parameter	0.98	0.98	0.98
t_{50}, minutes	N/A	N/A	N/A
Strain Rate, %/min	0.02	0.02	0.02
Cell Pressure, ksf	9.4	10.8	13.0
Back Pressure, ksf	8.7	8.7	8.7
Consolidation Stress, ksf	0.7	2.1	4.3
Deviator Stress @ Failure, ksf	1.6	4.8	11.7
Axial Strain @ Failure, %	2.5	2.6	5.4
σ'_{1F}, ksf	2.1	6.5	15.7
σ'_{3F}, ksf	0.5	1.7	4.0
Tested By:	ND	ND	ND
Date Tested:	3/2/20	3/3/20	3/4/20

CONSOLIDATED UNDRAINED TRIAXIAL TEST

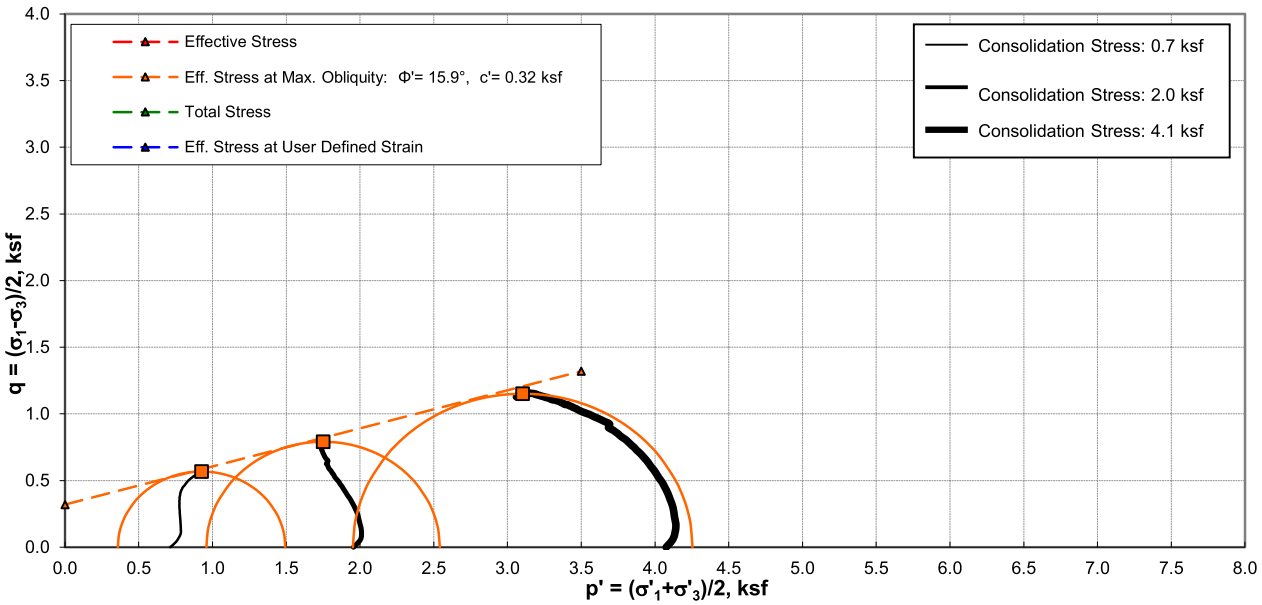






A	20C-01	#3	10.0 ft	Silty SAND grading to Poorly-graded SAND with silt (SP-SM): brown, dry, slightly cemented
B	20C-01	#3	10.0 ft	
C	20C-01	#3	10.0 ft	

CONSOLIDATED UNDRAINED TRIAXIAL TEST



SAMPLE ID

Boring Number	20C-05
Sample Number	32
Specimen Depth	20.0 ft
USCS Classification	Fat CLAY (CH): gray, moist

INITIAL

Trial ID	A	B	C
Water Content, %	10.3%	25.2%	23.7%
Dry Unit Weight, pcf	120.5	100.2	102.7
Saturation, %	70%	100%	100%
Void Ratio	0.40	0.68	0.64
Diameter, in	2.42	2.68	2.68
Height, in	5.00	4.91	4.79

PRE-SHEAR

Water Content, %	25.2%	23.7%	22.4%
Dry Unit Weight, pcf	100.2	102.7	105.0
Saturation, %	100%	100%	100%
Void Ratio	0.68	0.64	0.60

REMARKS

Test Method: ASTM 4767 (modified for staged testing)
Project: GOGA China Beach
By: N. Derbidge, Cal Poly Geo-E Lab, San Luis Obispo, CA
Checked: J. Blanchard, Yeh and Associates, Inc.

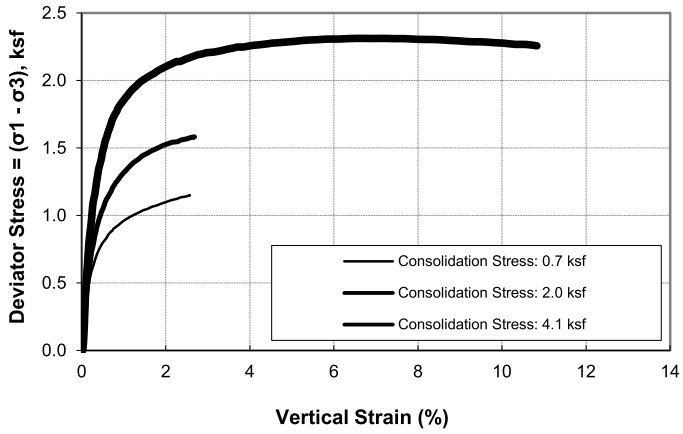
CLASSIFICATION

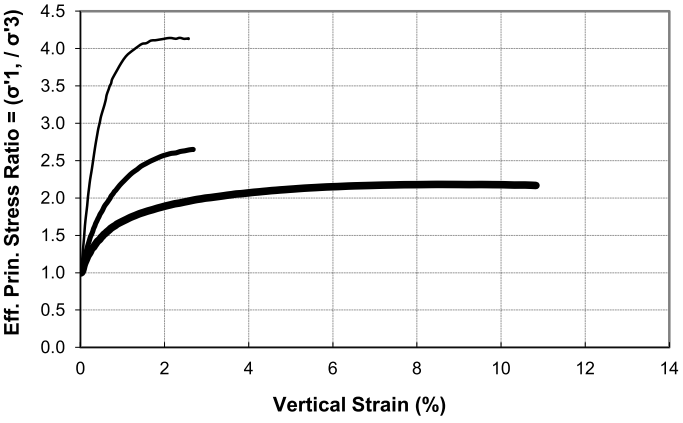
Trial ID	A	B	C
Liquid Limit	---	---	---
Plastic Limit	---	---	---
Plastic Index	---	---	---
Passing #4 (4.75 mm)	---	---	---
Passing #200 (0.075 mm)	---	---	---
Estimated Gs	2.70	2.70	2.70

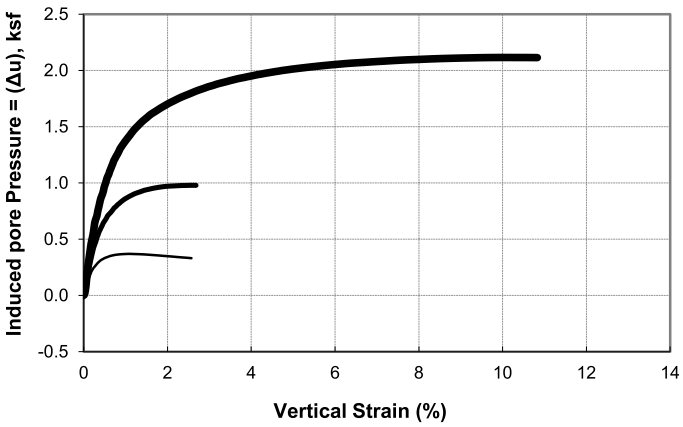
TEST SUMMARY

Trial ID	A	B	C
B-Parameter	0.98	0.98	0.98
t_{50}, minutes	N/A	N/A	N/A
Strain Rate, %/min	0.02	0.02	0.02
Cell Pressure, ksf	9.4	10.8	12.9
Back Pressure, ksf	8.7	8.8	8.9
Consolidation Stress, ksf	0.7	2.0	4.1
Deviator Stress @ Failure, ksf	1.1	1.6	2.3
Axial Strain @ Failure, %	2.4	2.7	8.5
σ'_{1F}, ksf	1.5	2.5	4.2
σ'_{3F}, ksf	0.4	1.0	2.0
Tested By:	ND	ND	ND
Date Tested:	3/2/20	3/4/20	3/5/20

CONSOLIDATED UNDRAINED TRIAXIAL TEST

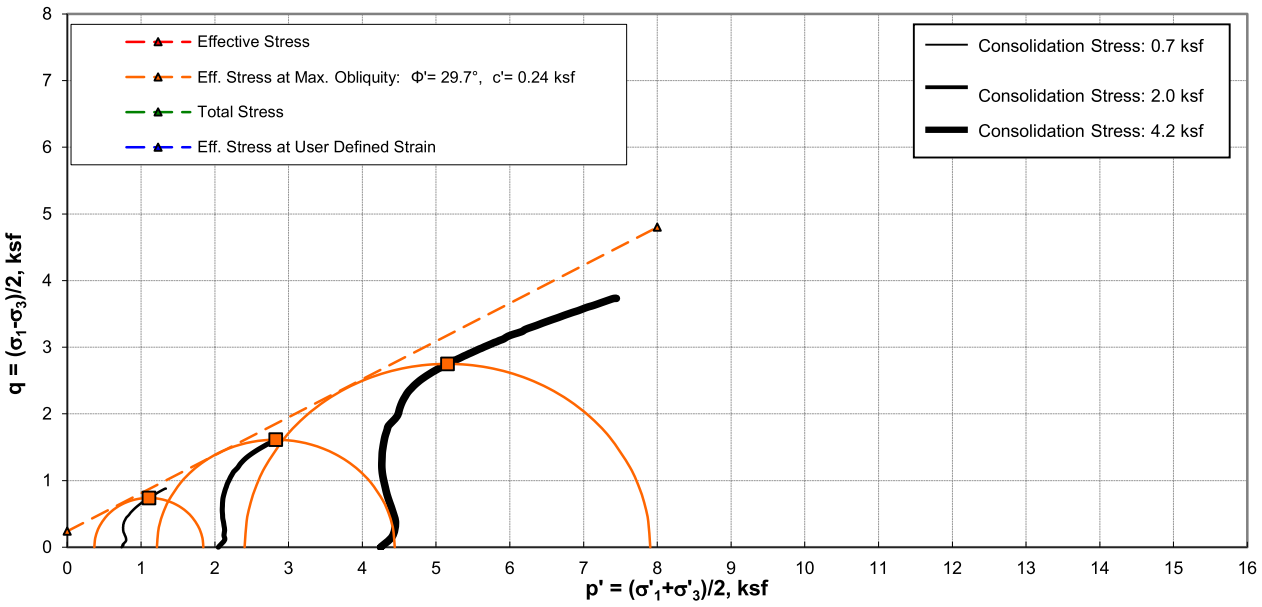






A	20C-05	#32	20.0 ft	Fat CLAY (CH): gray, moist
B	20C-05	#32	20.0 ft	
C	20C-05	#32	20.0 ft	

CONSOLIDATED UNDRAINED TRIAXIAL TEST



SAMPLE ID

Boring Number	20C-06
Sample Number	36
Specimen Depth	1.0 ft
USCS Classification	Sandy fat CLAY (CH): gray, moist, with roots

INITIAL

Trial ID	A	B	C
Water Content, %	12.7%	16.3%	15.6%
Dry Unit Weight, pcf	123.1	117.0	118.5
Saturation, %	93%	100%	100%
Void Ratio	0.37	0.44	0.42
Diameter, in	2.42	2.51	2.52
Height, in	5.00	4.88	4.79

PRE-SHEAR

Water Content, %	16.3%	15.6%	14.3%
Dry Unit Weight, pcf	117.0	118.5	121.5
Saturation, %	100%	100%	100%
Void Ratio	0.44	0.42	0.39

REMARKS

Test Method: ASTM 4767 (modified for staged testing)
Project: GOGA China Beach
By: N. Derbidge, Cal Poly Geo-E Lab, San Luis Obispo, CA
Checked: J. Blanchard, Yeh and Associates, Inc.

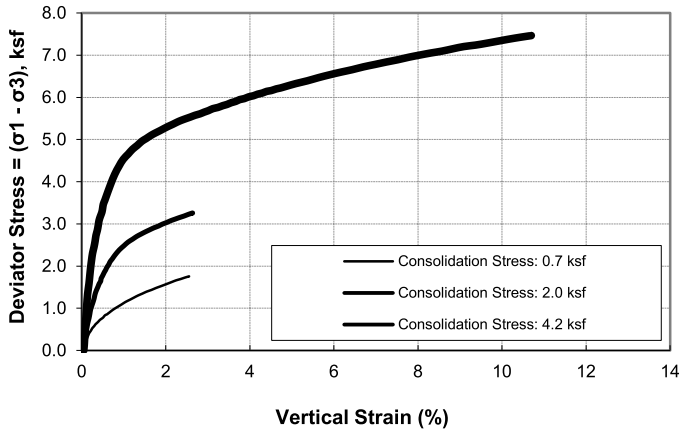
CLASSIFICATION

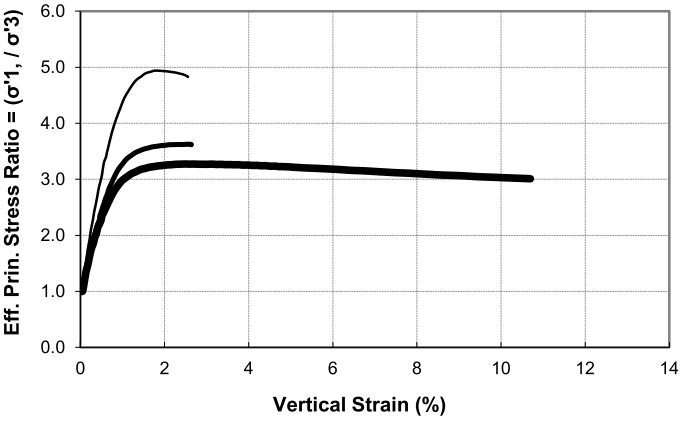
Trial ID	A	B	C
Liquid Limit	---	---	---
Plastic Limit	---	---	---
Plastic Index	---	---	---
Passing #4 (4.75 mm)	---	---	---
Passing #200 (0.075 mm)	---	---	---
Estimated Gs	2.70	2.70	2.70

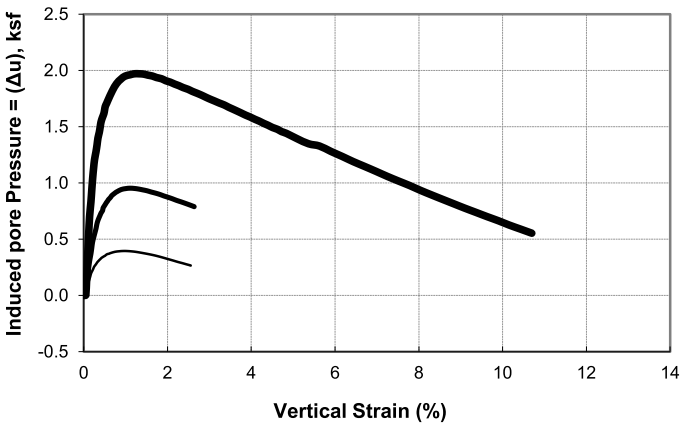
TEST SUMMARY

Trial ID	A	B	C
B-Parameter	0.98	0.98	0.98
t_{50}, minutes	N/A	N/A	N/A
Strain Rate, %/min	0.02	0.02	0.02
Cell Pressure, ksf	9.4	10.8	12.9
Back Pressure, ksf	8.7	8.7	8.7
Consolidation Stress, ksf	0.7	2.0	4.2
Deviator Stress @ Failure, ksf	1.5	3.2	5.4
Axial Strain @ Failure, %	1.8	2.5	2.5
σ'_{1F}, ksf	1.8	4.4	7.8
σ'_{3F}, ksf	0.4	1.2	2.4
Tested By:	ND	ND	ND
Date Tested:	3/2/20	3/3/20	3/5/20

CONSOLIDATED UNDRAINED TRIAXIAL TEST

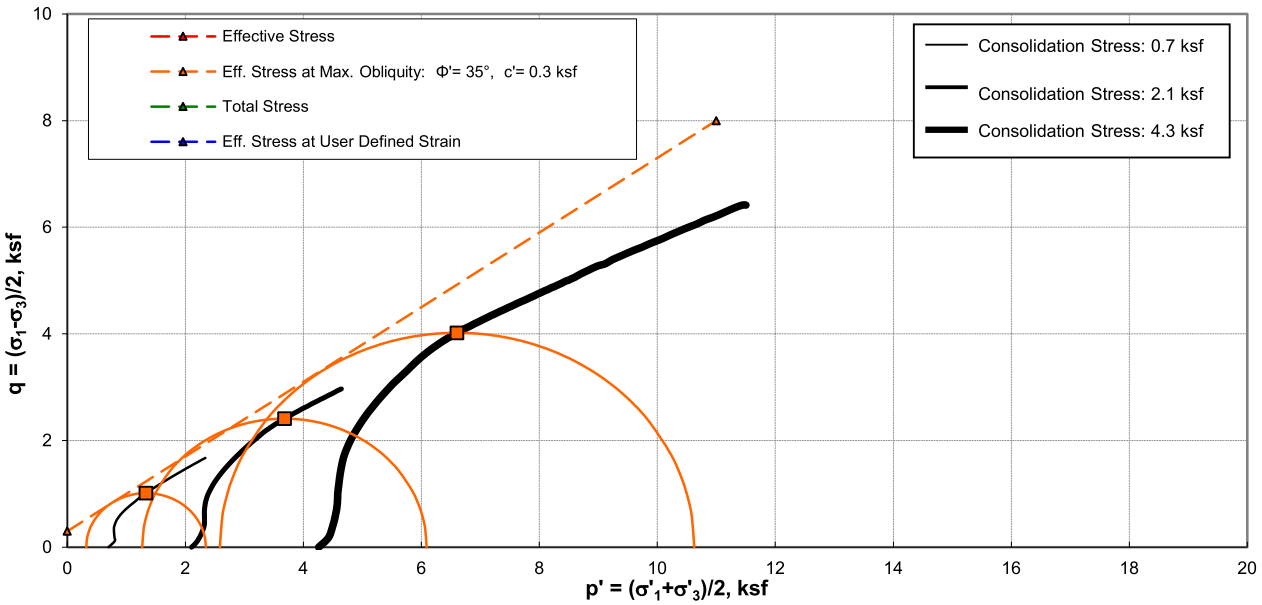






A	20C-06	#36	1.0 ft	Sandy fat CLAY (CH): gray, moist, with roots
B	20C-06	#36	1.0 ft	
C	20C-06	#36	1.0 ft	

CONSOLIDATED UNDRAINED TRIAXIAL TEST



SAMPLE ID

Boring Number	20L-01
Sample Number	3
Specimen Depth	7.5 ft
USCS Classification	SERPENTINITE, gray and black, moderately weathered, very closely spaced shears and fractures

INITIAL

Trial ID	A	B	C
Water Content, %	21.6%	24.5%	23.9%
Dry Unit Weight, pcf	102.6	101.3	102.3
Saturation, %	91%	100%	100%
Void Ratio	0.64	0.66	0.65
Diameter, in	2.42	2.46	2.48
Height, in	5.00	4.88	4.79

PRE-SHEAR

Water Content, %	24.5%	23.9%	23.4%
Dry Unit Weight, pcf	101.3	102.3	103.2
Saturation, %	100%	100%	100%
Void Ratio	0.66	0.65	0.63

REMARKS

Test Method: ASTM 4767 (modified for staged testing)
Project: GOGA Beach Trail Access Improvements
By: N. Derbidge, Cal Poly Geo-E Lab, San Luis Obispo, CA
Checked: J. Blanchard, Yeh and Associates, Inc.

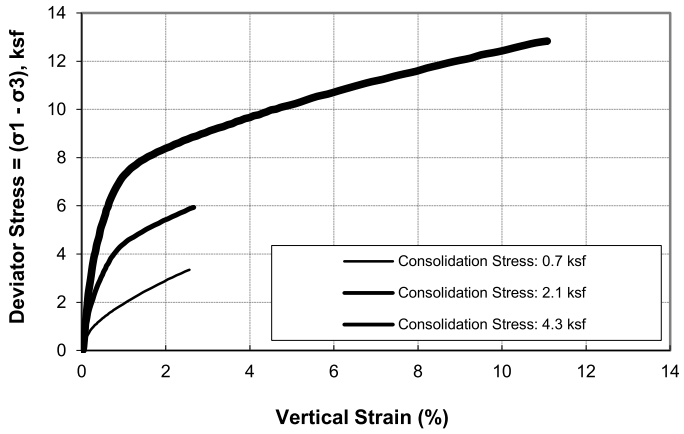
CLASSIFICATION

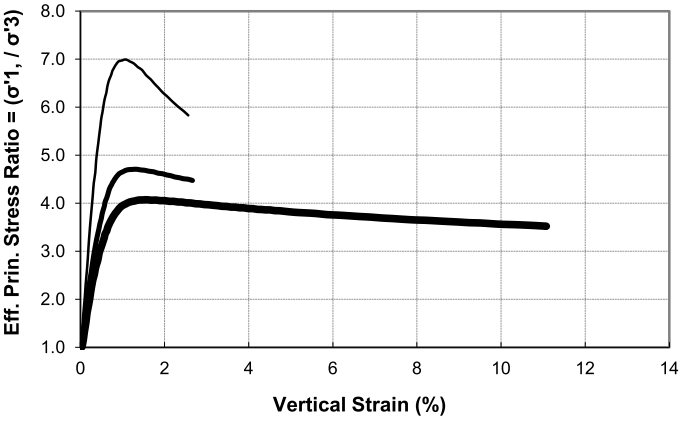
Trial ID	A	B	C
Liquid Limit	---	---	---
Plastic Limit	---	---	---
Plastic Index	---	---	---
Passing #4 (4.75 mm)	---	---	---
Passing #200 (0.075 mm)	---	---	---
Estimated Gs	2.70	2.70	2.70

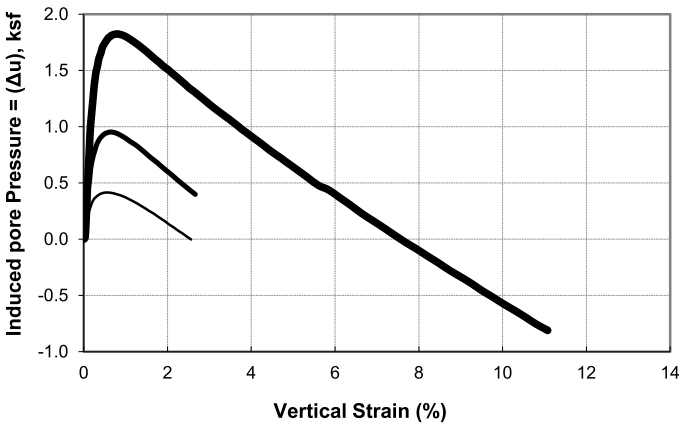
TEST SUMMARY

Trial ID	A	B	C
B-Parameter	0.98	0.98	0.98
t_{50}, minutes	N/A	N/A	N/A
Strain Rate, %/min	0.02	0.02	0.02
Cell Pressure, ksf	10.8	12.2	14.4
Back Pressure, ksf	10.1	10.1	10.1
Consolidation Stress, ksf	0.7	2.1	4.3
Deviator Stress @ Failure, ksf	2.0	4.8	7.9
Axial Strain @ Failure, %	1.1	1.3	1.6
σ'_{1F}, ksf	2.3	6.0	10.5
σ'_{3F}, ksf	0.3	1.3	2.6
Tested By:	ND	ND	ND
Date Tested:	6/3/20	6/4/20	6/5/20

CONSOLIDATED UNDRAINED TRIAXIAL TEST

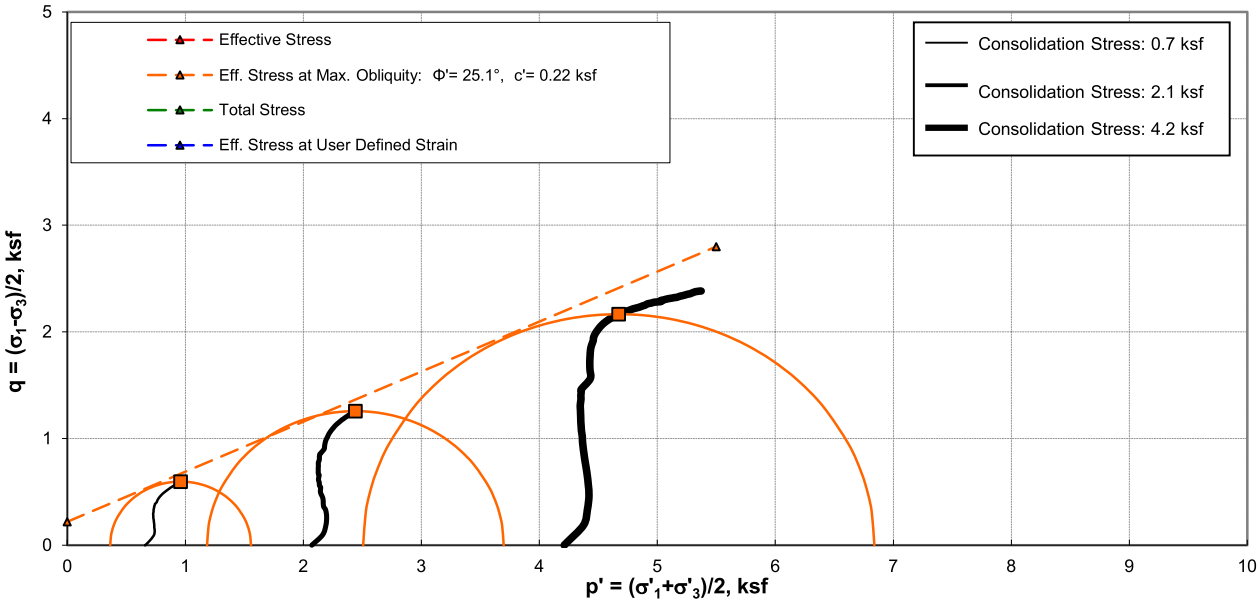






A	20L-01	#3	7.5 ft	Decomposing Serpentinite - "Lean CLAY (CL)": greenish gray, moist
B	20L-01	#3	7.5 ft	
C	20L-01	#3	7.5 ft	

CONSOLIDATED UNDRAINED TRIAXIAL TEST



SAMPLE ID

Boring Number	20L-03
Sample Number	3
Specimen Depth	7.5 ft
USCS Classification	Fat CLAY (CH): dark brown, moist, trace sand and gravel

INITIAL

Trial ID	A	B	C
Water Content, %	14.6%	16.9%	15.5%
Dry Unit Weight, pcf	117.7	115.6	118.7
Saturation, %	91%	100%	100%
Void Ratio	0.43	0.46	0.42
Diameter, in	2.42	2.47	2.48
Height, in	5.00	4.87	4.73

PRE-SHEAR

Water Content, %	16.9%	15.5%	14.4%
Dry Unit Weight, pcf	115.6	118.7	121.3
Saturation, %	100%	100%	100%
Void Ratio	0.46	0.42	0.39

REMARKS

Test Method: ASTM 4767 (modified for staged testing)
Project: GOGA Beach Trail Access Improvements
By: N. Derbidge, Cal Poly Geo-E Lab, San Luis Obispo, CA
Checked: J. Blanchard, Yeh and Associates, Inc.

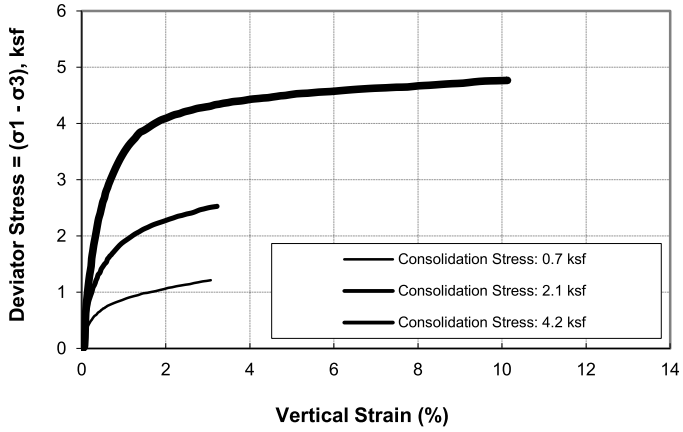
CLASSIFICATION

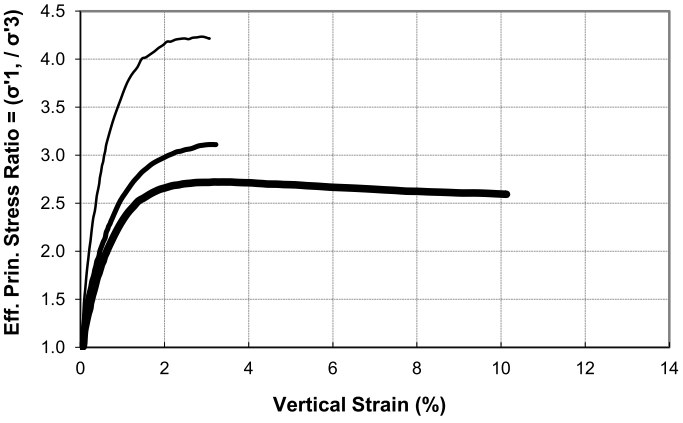
Trial ID	A	B	C
Liquid Limit	---	---	---
Plastic Limit	---	---	---
Plastic Index	---	---	---
Passing #4 (4.75 mm)	---	---	---
Passing #200 (0.075 mm)	---	---	---
Estimated Gs	2.70	2.70	2.70

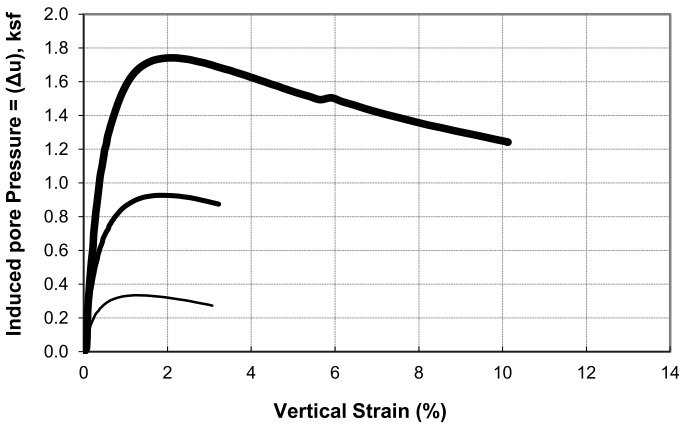
TEST SUMMARY

Trial ID	A	B	C
B-Parameter	0.98	0.98	0.98
t_{50}, minutes	N/A	N/A	N/A
Strain Rate, %/min	0.02	0.02	0.02
Cell Pressure, ksf	10.8	12.2	14.4
Back Pressure, ksf	10.2	10.2	10.2
Consolidation Stress, ksf	0.7	2.1	4.2
Deviator Stress @ Failure, ksf	1.2	2.5	4.3
Axial Strain @ Failure, %	2.9	3.1	3.2
σ'_{1F}, ksf	1.5	3.7	6.8
σ'_{3F}, ksf	0.4	1.2	2.5
Tested By:	ND	ND	ND
Date Tested:	6/3/20	6/4/20	6/5/20

CONSOLIDATED UNDRAINED TRIAXIAL TEST

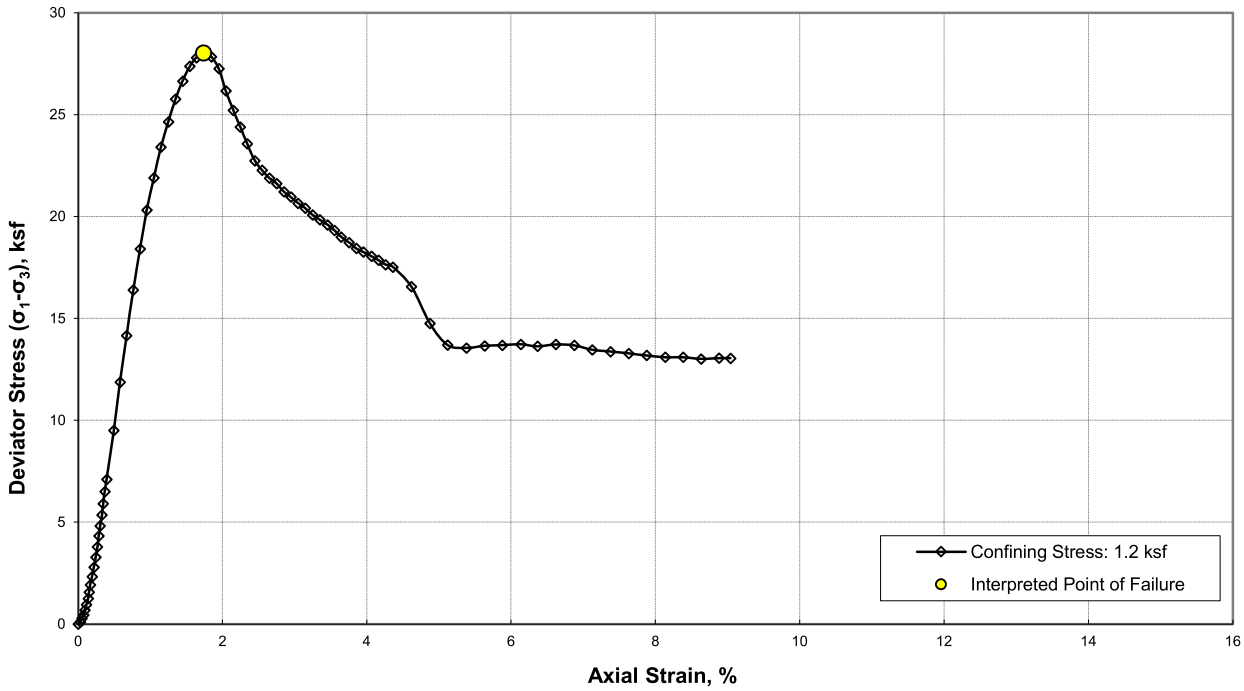






A	20L-03	#3	7.5 ft	Fat CLAY (CH): dark brown, moist, trace sand and gravel
B	20L-03	#3	7.5 ft	
C	20L-03	#3	7.5 ft	

CONSOLIDATED UNDRAINED TRIAXIAL TEST



SAMPLE ID

Boring Number:	20C-05
Sample Number:	30
Sample Depth:	10.0 ft
USCS Classification:	Claystone: light gray

PROPERTIES

Water Content, %	8.2%
Dry Unit Weight, pcf	118.8
Saturation, %	51%
Void Ratio	0.44
Diameter, in	2.42
Height, in	5.00

SAMPLE IMAGES

CLASSIFICATION

Sieve Size	% Passing	Other Parameters	
3/8-in. (9.5mm)	---	Liquid Limit	---
#4 (4.75mm)	---	Plastic Limit	---
#16 (1.18mm)	---	Plasticity Index	---
#30 (0.6mm)	---	Estimated Gs	2.75
#100 (0.150mm)	---	S_u from T_v, ksf	---
#200 (0.075mm)	---	S_u from PP, ksf	---

TEST SUMMARY

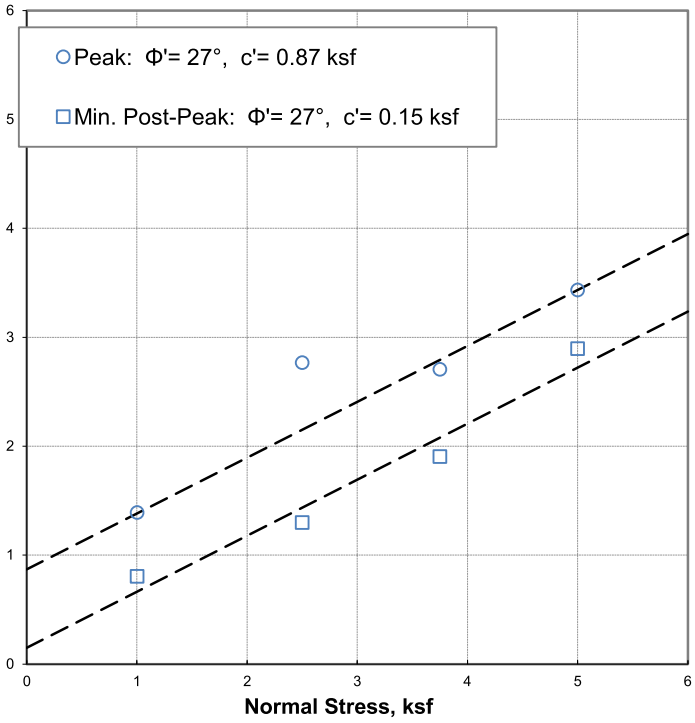
Maximum Deviator Stress, ksf	28.0
Undrained Shear Strength, ksf	14.0
Axial Strain at Failure, %	1.7
Strain Rate, %/min	0.3
Cell Pressure, ksf	1.2

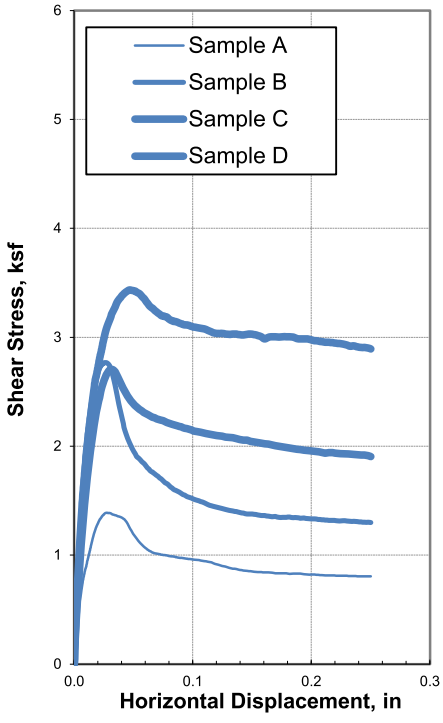
By: N. Derbidge, Cal Poly Geo-E Lab, San Luis Obispo, CA
Date Tested: 3/10/20
Checked: J. Blanchard, Yeh and Associates, Inc.

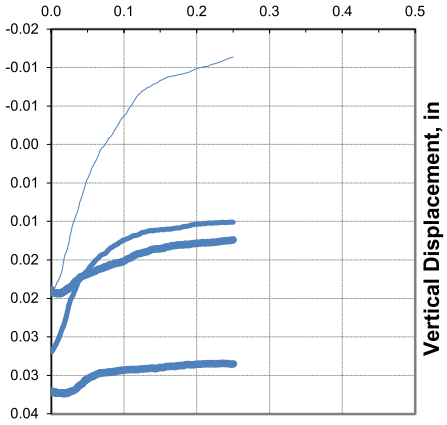
REMARKS

Test Method: ASTM 2850
Project: GOGA China Beach

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST







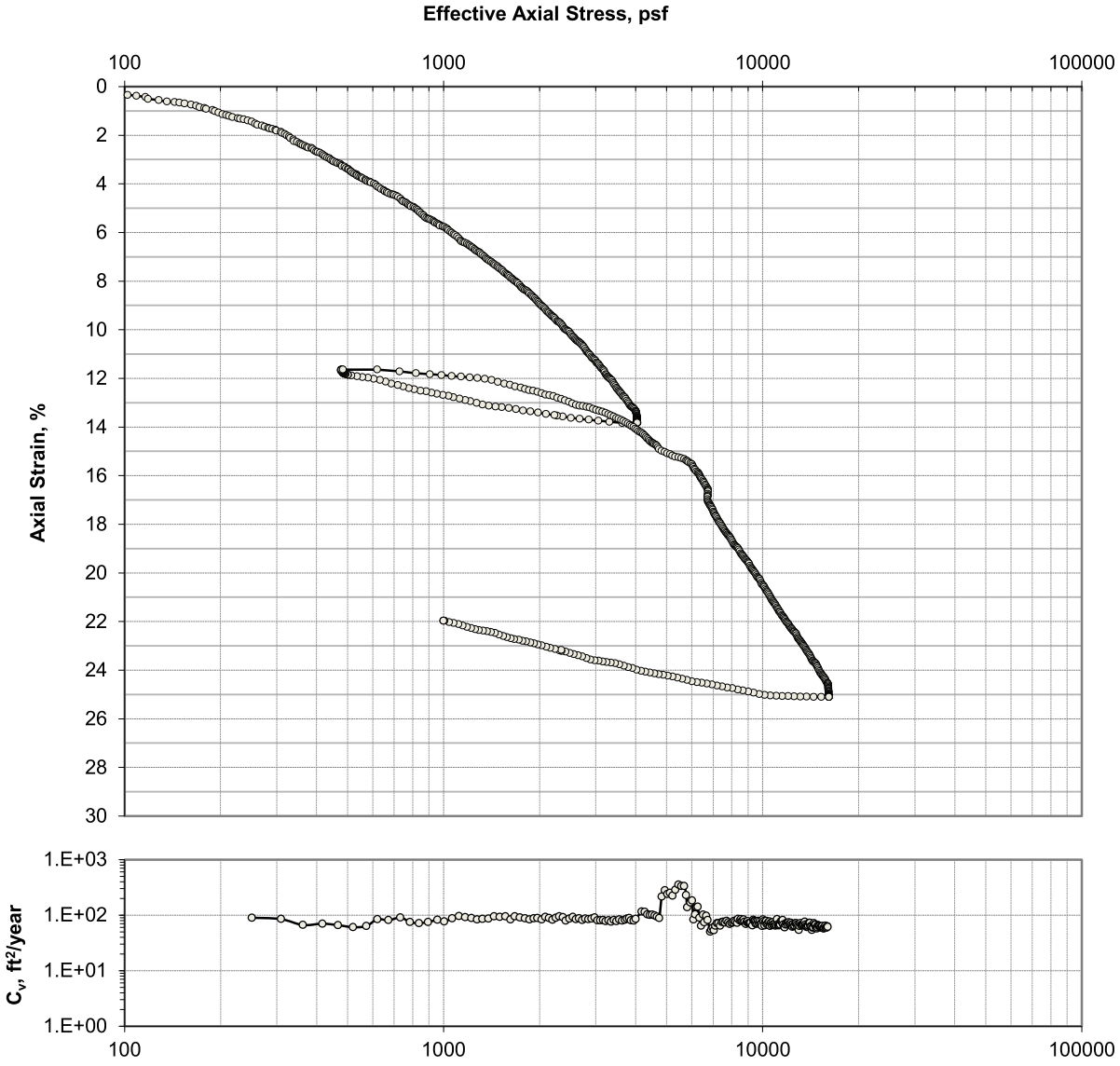
SAMPLE ID	Boring Number:	20L-02			
	Sample Number:	A			
	Sample Depth:	0.0 ft			
	USCS Classification:	Sandy Lean CLAY (CL): gray brown, moist			
INITIAL	Specimen	A	B	C	D
	Water Content, %	13.7%	13.7%	13.7%	13.7%
	Dry Unit Weight, pcf	111.7	111.8	110.3	111.0
	Saturation, %	68%	69%	66%	67%
	Void Ratio	0.56	0.56	0.58	0.57
	Diameter, in	2.42	2.42	2.42	2.42
	Height, in	1.00	1.00	1.00	1.00
FINAL	Water Content, %	21.8%	22.6%	23.2%	22.2%
	Dry Unit Weight, pcf	108.0	107.3	105.5	108.3
	Void Ratio	0.61	0.62	0.65	0.61
TEST SUMMARY	Displacement at Peak, in	0.03	0.03	0.03	0.05
	Displacement Rate, in/min	0.0002	0.0002	0.0002	0.0002
	Normal Stress, ksf	1.0	2.5	3.8	5.0
	Peak Shear Stress, ksf	1.39	2.77	2.71	3.44
	Min. Post-Peak Stress, ksf	0.81	1.30	1.91	2.90
	Residual, ksf	0.34	1.07	1.48	
	Test Method: ASTM D3080				
REMARKS	Project: GOGA Beach Trail Access Improvements				
	"Min. Post-Peak" is the lowest shear strength after peak strength.				
	By: N. Derbidge, Cal Poly Geo-E Lab, San Luis Obispo, CA				
	Checked: J. Blanchard, Yeh and Associates, Inc.				

CLASSIFICATION

Sieve Size	% Passing
3/8-in. (9.5mm)	---
#4 (4.75mm)	---
#16 (1.18mm)	---
#30 (0.6mm)	---
#100 (0.150mm)	---
#200 (0.075mm)	---

Atterberg Limits	
Liquid Limit, %	---
Plastic Limit, %	---
Plasticity Index, %	---
Estimated Gs	2.79
k_{avg} 20ºC, cm/sec	---

DIRECT SHEAR TEST



SAMPLE ID	Boring, Sample #, Depth	20S-01 , #8 , 20.0 ft	SUMMARY	Strain Rate, %/hr	0.7
	USCS Classification:	Lean CLAY with sand (CL): dark gray, wet, organic		Liquid Limit, %	--
				Plastic Limit, %	--
				Plasticity Index, %	--
				Passing #200	--
PROPERTIES		Initial / Final		Estimated Gs	2.75
	Water Content, %	64.9% / 45.0%			
	Dry Unit Weight, pcf	60.3 / 76.5			
	Saturation, %	97% / 100%	REMARKS	Test Method: D4186	
	Void Ratio	1.85 / 1.24			
	Diameter, in	2.42 / 2.42			
	Height, in	0.88 / 0.69			

CONSOLIDATION TEST

Unconfined Uniaxial Compressive Strength Test of Intact Rock Cores

ASTM D7012 - 1.5.1 Method C: Uniaxial Compressive Strength of Intact Rock Cores

PROJECT		
	Job No.:	219-400
	Project:	GOGA China Beach
	Client:	Yeh & Associates
	Date:	2/28/2020
	Test Method:	ASTM D7012 (1.5.3 Method C: Uniaxial Compressive Strength of Intact Rock Core Specimens)

add summary sheet

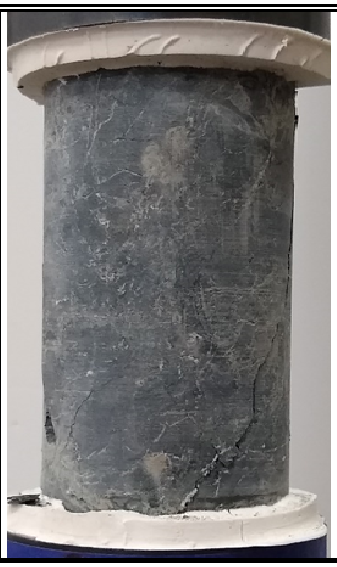
Sample ID		
	Boring Number:	20C-03
	Sample ID:	Run 5
	Sample Depth:	29-29.5 ft
	Classification:	Graywacke
Properties		
	Moisture Condition:	As Received
	Moisture Content:	Moisture Cont. (%
	Unit Weight (pcf):	145.8
	Dry Unit Weight (pcf):	N/A
	Length/Diameter :	1.68
	Comp. Strength (psi):	Comp. Strength

Images

Not tested...sample too fragile, broke during preparation.

Sample ID		
	Boring Number:	20C-03
	Sample ID:	Run 7
	Sample Depth:	35.8-36.5 ft
	Classification:	Graywacke
Properties		
	Moisture Condition:	As Received
	Moisture Content:	Moisture Cont. (%
	Unit Weight (pcf):	177.5
	Dry Unit Weight (pcf):	N/A
	Length/Diameter :	2.07
	Comp. Strength (psi):	2,820

Images



No moisture data. Tested as received.

Unconfined Uniaxial Compressive Strength Test of Intact Rock Cores

ASTM D7012 - 1.5.1 Method C: Uniaxial Compressive Strength of Intact Rock Cores

PROJECT	
Job No.:	219-400
Project:	GOGA China Beach
Client:	Yeh & Associates
Date:	2/28/2020
Test Method:	ASTM D7012 (1.5.3 Method C: Uniaxial Compressive Strength of Intact Rock Core Specimens)

Sample ID	
Boring Number:	20C-04
Sample ID:	Run 9
Sample Depth:	17.3-18.1 ft
Classification:	Serpentine/Clays

Properties	
Moisture Condition:	As Received
Moisture Content:	Moisture Cont. (9
Unit Weight (pcf):	178.6
Dry Unit Weight (pcf):	N/A
Length/Diameter :	2.29
Comp. Strength (psi):	3,300

Images

No moisture data. Tested as received.

Sample ID	
Boring Number:	20C-04
Sample ID:	Run 10
Sample Depth:	19.5-20.1 ft
Classification:	Serpentine/Clays

Properties	
Moisture Condition:	As Received
Moisture Content:	Moisture Cont. (9
Unit Weight (pcf):	179.5
Dry Unit Weight (pcf):	N/A
Length/Diameter :	2.19
Comp. Strength (psi):	3,040

Images

No moisture data. Tested as received.

Unconfined Uniaxial Compressive Strength Test of Intact Rock Cores

ASTM D7012 - 1.5.1 Method C: Uniaxial Compressive Strength of Intact Rock Cores

PROJECT		
	Job No.:	219-400
	Project:	GOGA China Beach
	Client:	Yeh & Associates
	Date:	2/28/2020
	Test Method:	ASTM D7012 (1.5.3 Method C: Uniaxial Compressive Strength of Intact Rock Core Specimens)

Sample ID		
	Boring Number:	20C-04
	Sample ID:	Run 12
	Sample Depth:	27-27.7 ft
	Classification:	Serpentine/Clays
Properties		
	Moisture Condition:	As Received
	Moisture Content:	Moisture Cont. (%
	Unit Weight (pcf):	175.0
	Dry Unit Weight (pcf):	N/A
	Length/Diameter :	1.73
	Comp. Strength (psi):	1,600

Images

No moisture data. Tested as received.

Specimen Length:Diameter slightly smaller than 'desireable' range of 2.0:1 to 2.5:1 per ASTM D7012 section 8.1.1

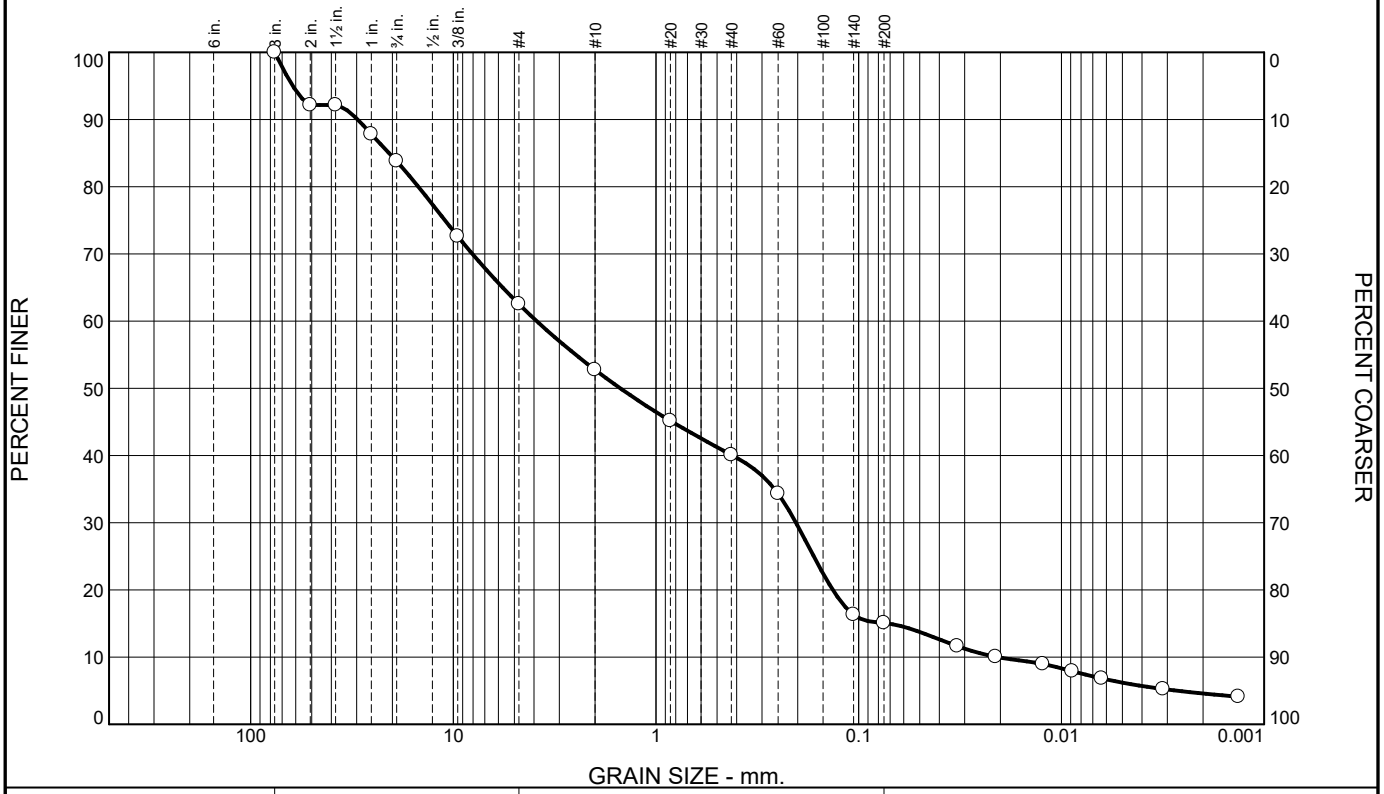
Sample ID		
	Boring Number:	20C-04
	Sample ID:	Run 13
	Sample Depth:	36.3-37 ft
	Classification:	Chert
Properties		
	Moisture Condition:	As Received
	Moisture Content:	Moisture Cont. (%
	Unit Weight (pcf):	162.3
	Dry Unit Weight (pcf):	N/A
	Length/Diameter :	2.28
	Comp. Strength (psi):	5,180

Images

No moisture data. Tested as received.

APPENDIX C
Laboratory Testing

Particle Size Distribution Report ASTM D422



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	16	21	10	13	25	9	6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100		
2	92		
1.5	92		
1	88		
3/4	84		
3/8	73		
#4	63		
#10	53		
#20	45		
#40	40		
#60	34		
#140	16		
#200	15		
0.0326 mm.	12		
0.0211 mm.	10		
0.0123 mm.	9.0		
0.0088 mm.	7.9		
0.0063 mm.	6.8		
0.0031 mm.	5.3		
0.0013 mm.	4.1		

* (no specification provided)

Soil Description

Grayish brown silty sand with gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 29.6826 D_{85}= 20.7542 D_{60}= 3.8794
D_{50}= 1.5008 D_{30}= 0.2041 D_{15}= 0.0715
D_{10}= 0.0208 C_u= 186.69 C_c= 0.52

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: Onsite **Depth:** Bulk
Sample Number: 1

Date: 12-10-22

Client: Haley & Aldrich, Inc.
Project: Stinson Beach
0206170
Project No: 2831-068.0

Figure

Tested By: SK **Checked By:** JH

R-Value ASTM D2844 / CT301

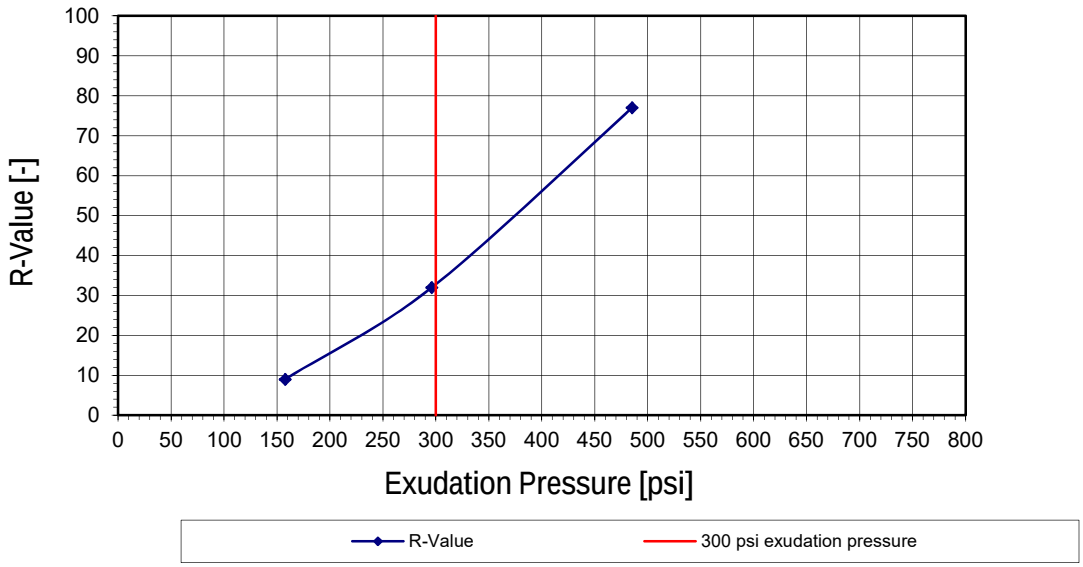
Clients Project No.: 0206170

ISI Project No.: 2831-068.0

ISI Lab No.: G-67172

Project Name:	Stinson Beach		
Client Name:	Haley & Aldrich, Inc.		
Descripton (Visual):	Grayish brown silty sand with gravel		
Boring:	Onsite	Test Date:	12/9/22
Sample No.:	1	Run By:	JH
Depth (ft):	Bulk	Checked By:	JH

Specimen #	1		2		3	
Compaction Pressure [psi/kPa]	125	862	270	1862	350	2413
Total Moisture [%]	10.0		8.7		7.9	
Density[pcf]	128.5		131.7		132.5	
Expansion Pressure [psi/kPa]	0.00	0.00	0.00	0.00	0.00	0.00
Horizontal Pressure at 160 psi [psi/kPa]	139	958	96	662	31	214
Number of Turns D [-]	4.05		3.59		3.30	
Sample Height [in./mm]	2.55	64.8	2.47	62.7	2.54	64.5
Exudation Pressure [psi/kPa]	158	1087	296	2042	485	3345
R-Value [-]	8.5		31.7		75.9	
Corrected R-Value [-]	9		32		77	



Corrected R-Value at 300 psi / 2.07 MPa Exudation Pressure = 33

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

12 December, 2022

Job No. 2211038
Cust. No. 12468

Ms. Alanna Carreira
Haley & Aldrich
2033 No. Main Street, Suite 309
Walnut Creek, CA 94596-7260

Subject: Project No.: 206170
Project Name: Stinson Beach
Corrosivity Analysis –ASTM Test Methods

Dear Ms. Carreira:

Pursuant to your request, CERCO Analytical has analyzed the soil sample submitted on November 28, 2022. Based on the analytical results, this brief corrosivity evaluation is enclosed for your consideration.

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

The chloride ion concentration is 20 mg/kg and is determined to be insufficient to attack steel embedded in a concrete mortar coating.

The sulfate ion concentration reflects none detected with a reporting limit of 15 mg/kg.

The pH of the soil is 7.93 which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potential is 240-mVand is indicative of potentially "slightly corrosive" soils resulting from anaerobic soil conditions.

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

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

Very truly yours,
CERCO ANALYTICAL, INC.

Shaw Moore
for J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

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

Client: Haley & Aldrich, Inc.
Client's Project No.: 206170
Client's Project Name: Stinson Beach
Date Sampled: 28-Nov-22
Date Received: 29-Nov-22
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 12-Dec-2022

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
2211038-001	Upper 2' Bulk	240	7.93	-	4,700	-	20	N.D.

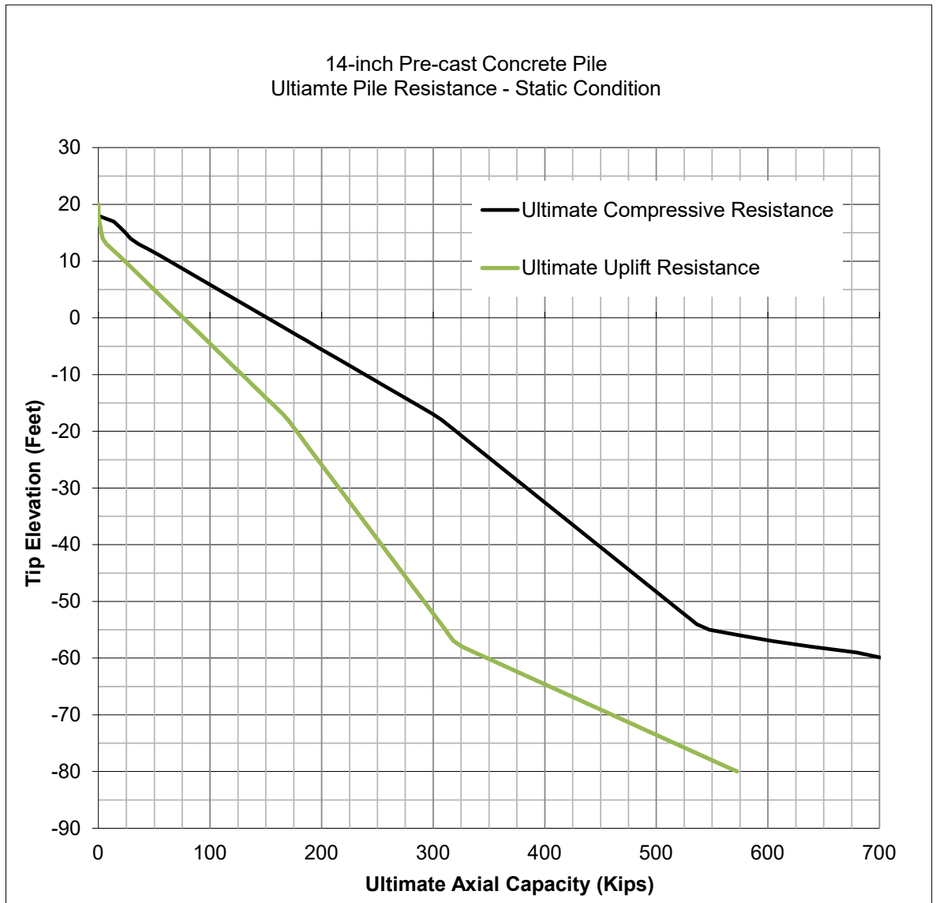
Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	10	-	50	15	15
Date Analyzed:	8-Dec-2022	9-Dec-2022	-	9-Dec-2022	-	9-Dec-2022	9-Dec-2022

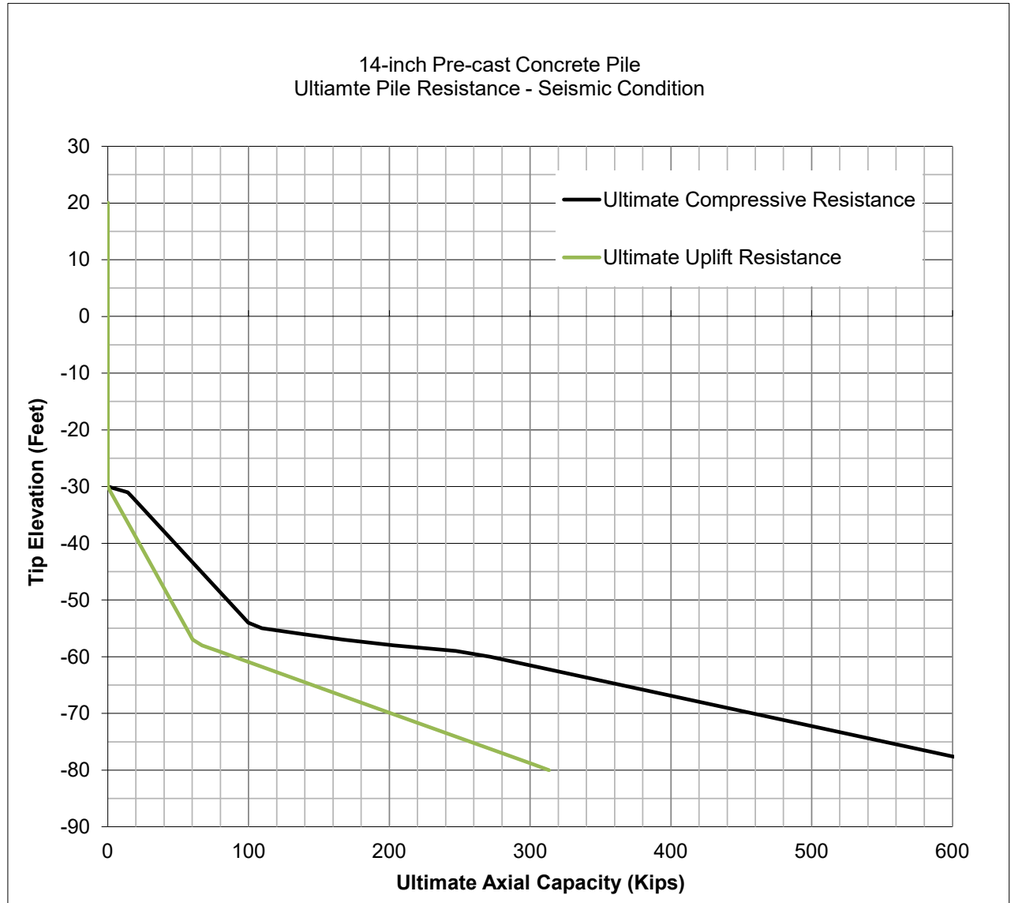
Sherri Moore
Chemist

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

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

APPENDIX D
Piles Design Charts





Notes:
1. The assumed ground elevation = 20 feet
2. The net weight of the pile should be treated as a load applied to the top of the pile in compression. This load is not accounted for in these charts. This weight may be considered as additional resistance in uplift.
3. A recommended factor of safety (FS) of 2.0 should be applied to the ultimate compressive resistance shown above. For uplift considerations, a FS of 3.0 should be applied to the side resistance shown above.

Notes:
1. The assumed ground elevation = 20 feet
2. The net weight of the pile should be treated as a load applied to the top of the pile in compression. This load is not accounted for in these charts. This weight may be considered as additional resistance in uplift.
3. A recommended FS of 1.5 should be applied to the ultimate resistance shown above. For uplift considerations, the same FS of 2.0 should be applied to the side resistance shown above.
4. An unfactored liquefaction-induced downdrag of 161.8 kips was calculated and should be considered as a structural seismic load. This load does not need to be considered when calculating the geotechnical capacity of the pile.

HALEY ALDRICH

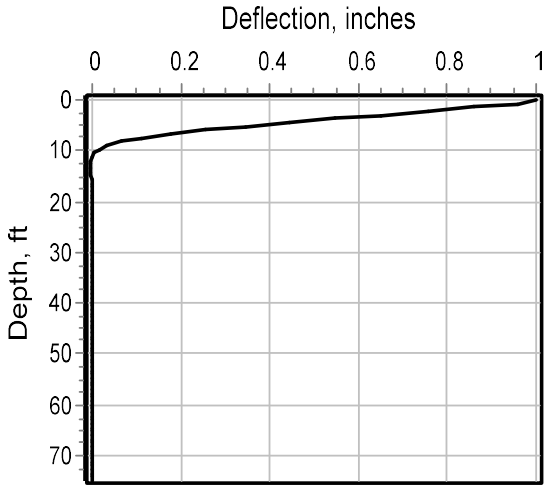
Stinson Beach Liftguard Tower and Grill
Stinson Beach, CA

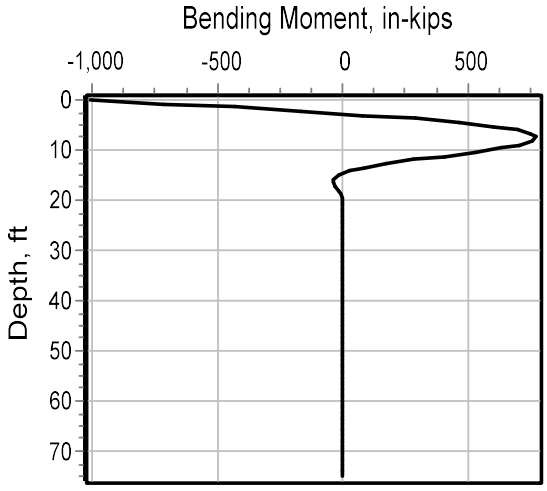
14-inch Precast Concrete Pile
Ultimate Pile Resistance

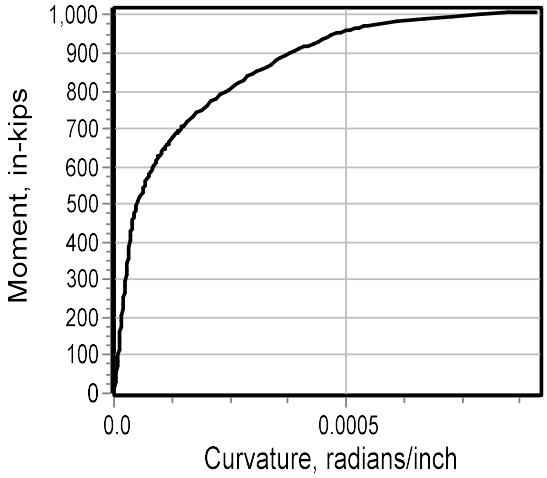
December 27, 2022

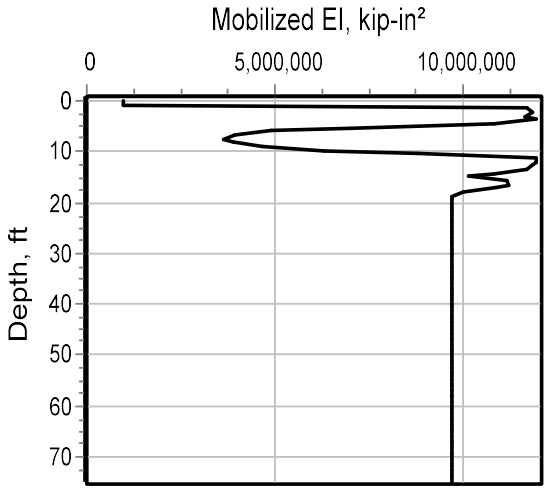
FIGURE D-1

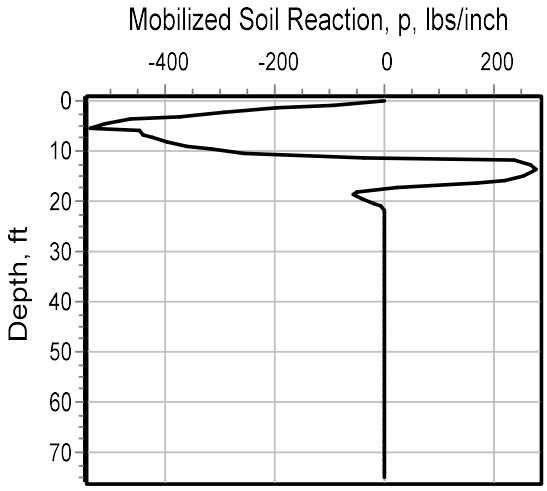
\\haleyaldrich.com\share\CF\Projects\0206170\000-Design\Project_Data\Calculations\4-Pile Design\[Data Processing from A-pile 14 in_PreCast Concrete (1).xlsx]14inch precast pile_Plot











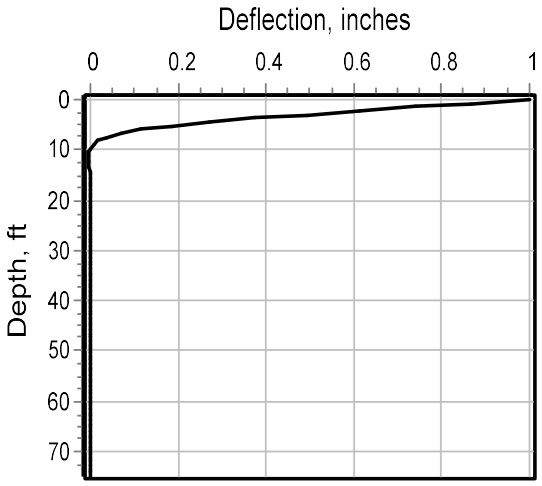
HALEY ALDRICH

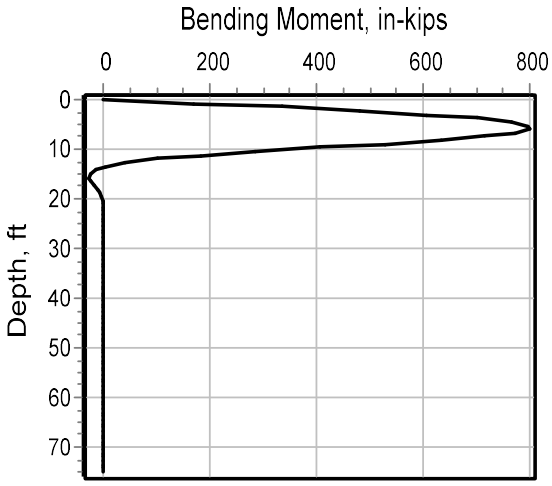
REPLACE STINSON BEACH LIFEGUARD TOWER
AND VISITOR SNACK BAR
NATIONAL PARK SERVICE
STINSON BEACH, CALIFORNIA

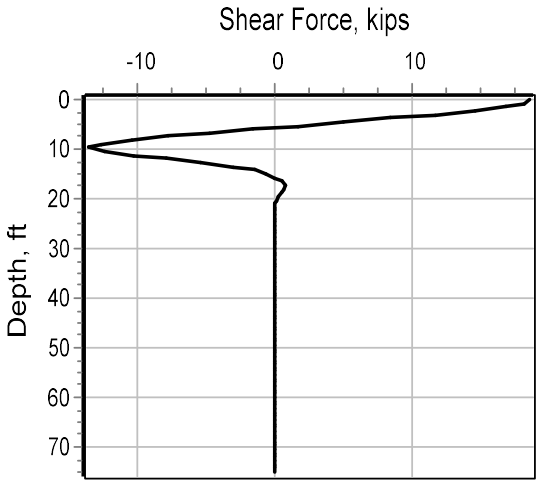
14-INCH PRECAST COCRETE PILE
LATERAL PILE ANALYSIS OUTPUT
STATIC CONDITION

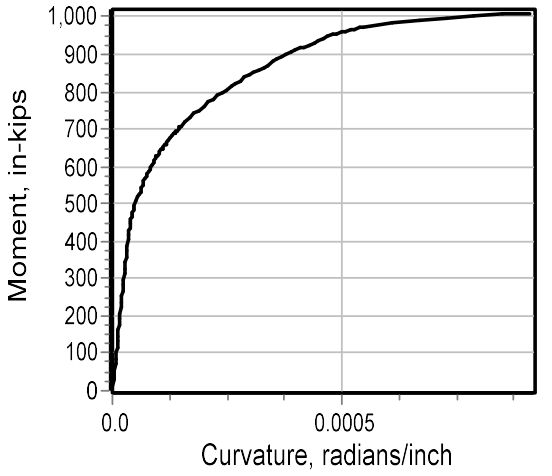
SCALE: AS SHOWN
JANUARY 2024

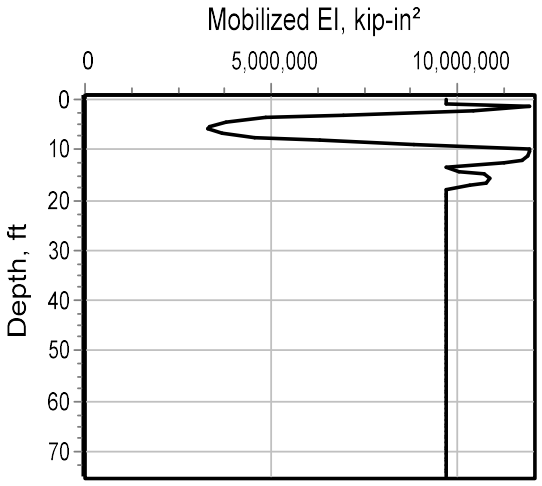
FIGURE D-2

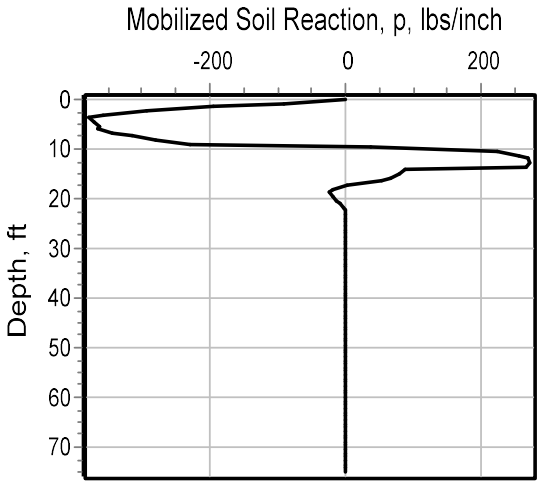












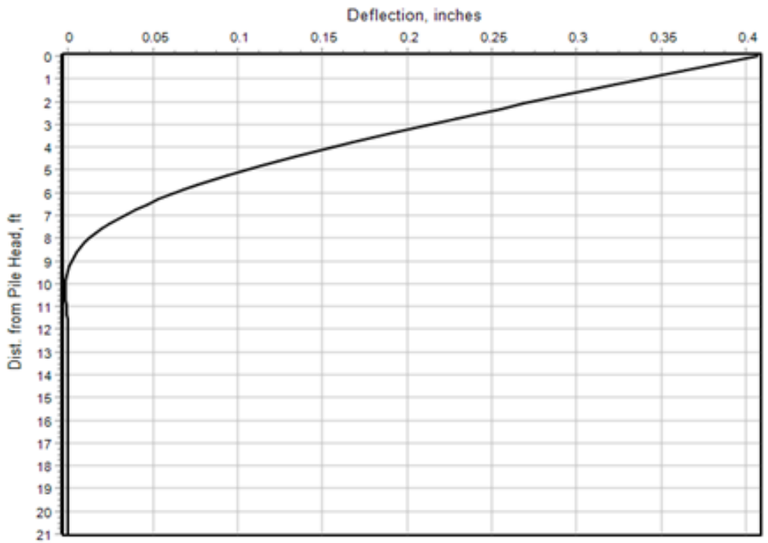
HALEY ALDRICH

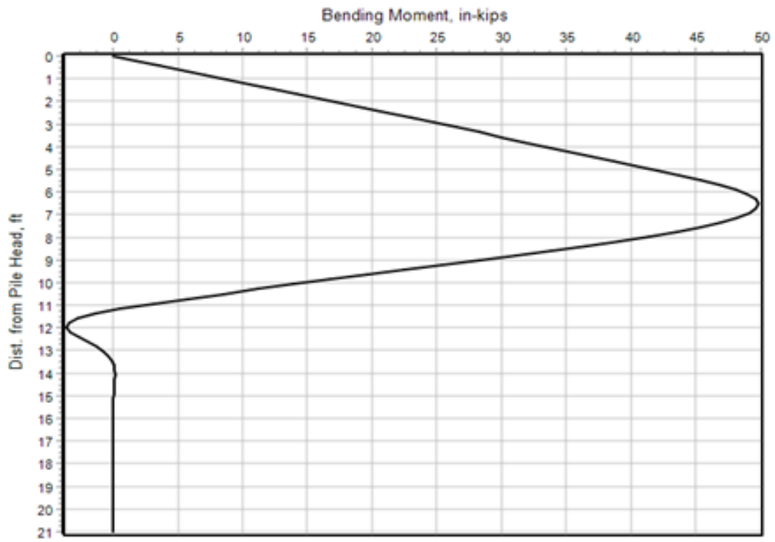
REPLACE STINSON BEACH LIFEGUARD TOWER
AND VISITOR SNACK BAR
NATIONAL PARK SERVICE
STINSON BEACH, CALIFORNIA

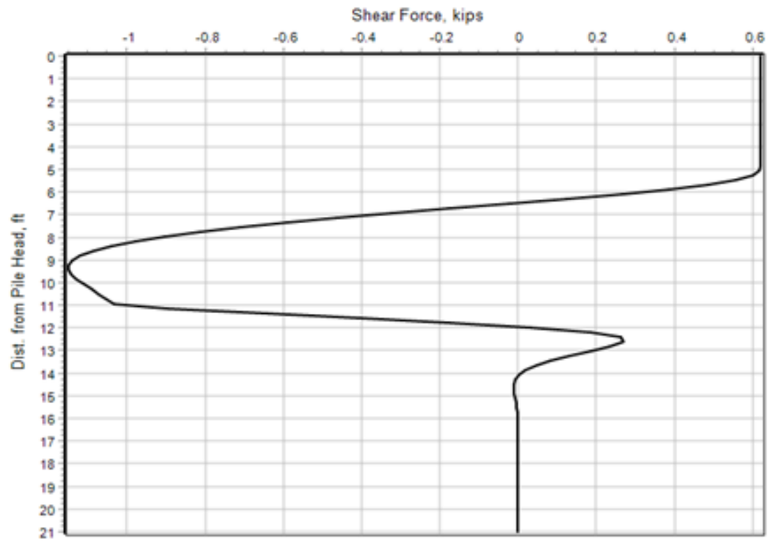
14-INCH PRECAST COCRETE PILE
LATERAL PILE ANALYSIS OUTPUT
SEISMIC CONDITION

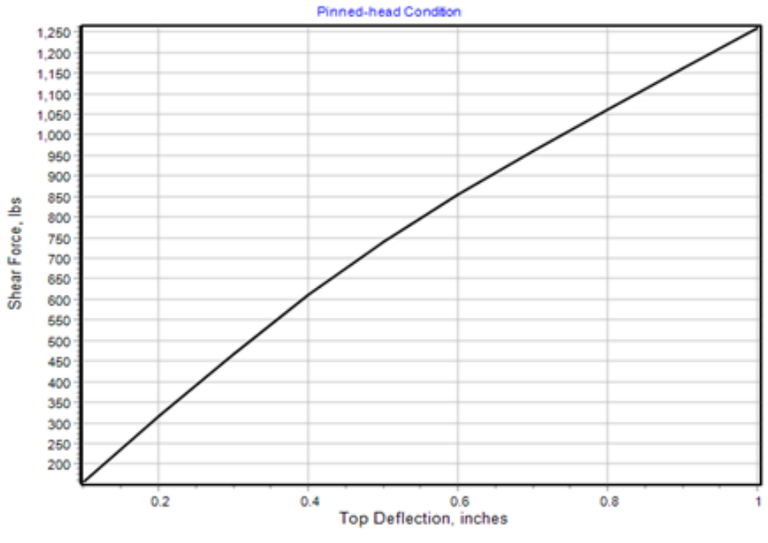
SCALE: AS SHOWN
JANUARY 2024

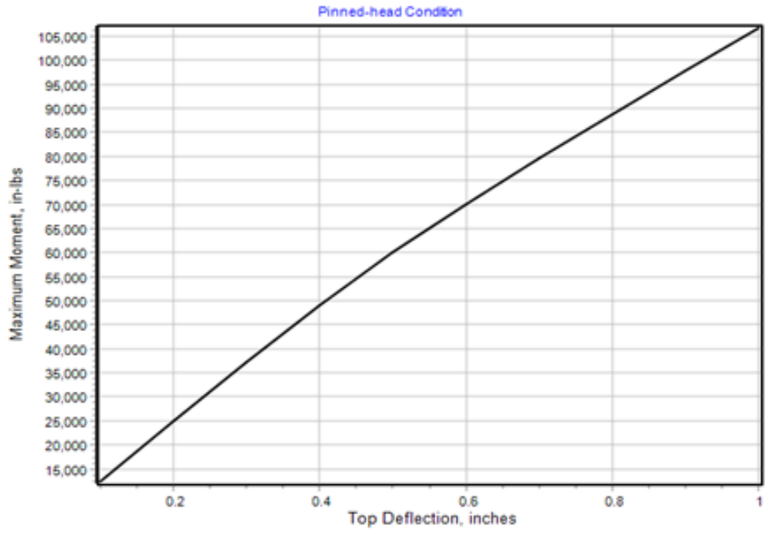
FIGURE D-3

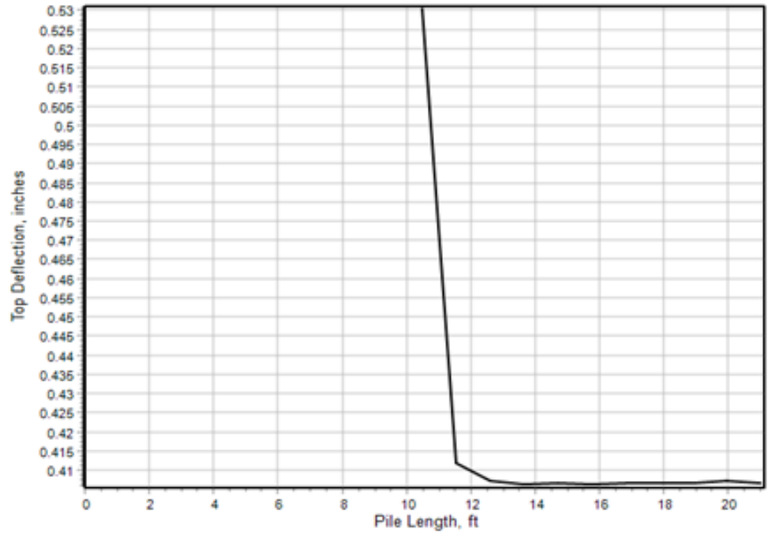












HALEY ALDRICH

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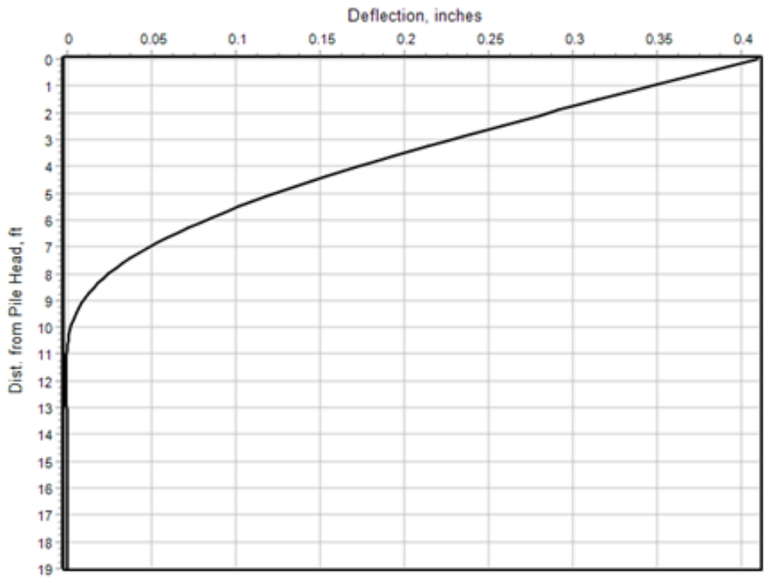
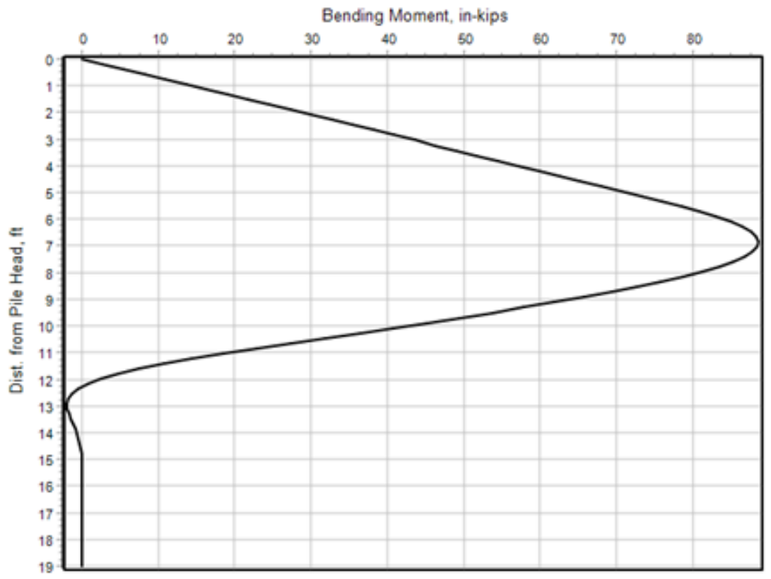
NATIONAL PARK SERVICE
STINSON BEACH, CALIFORNIA

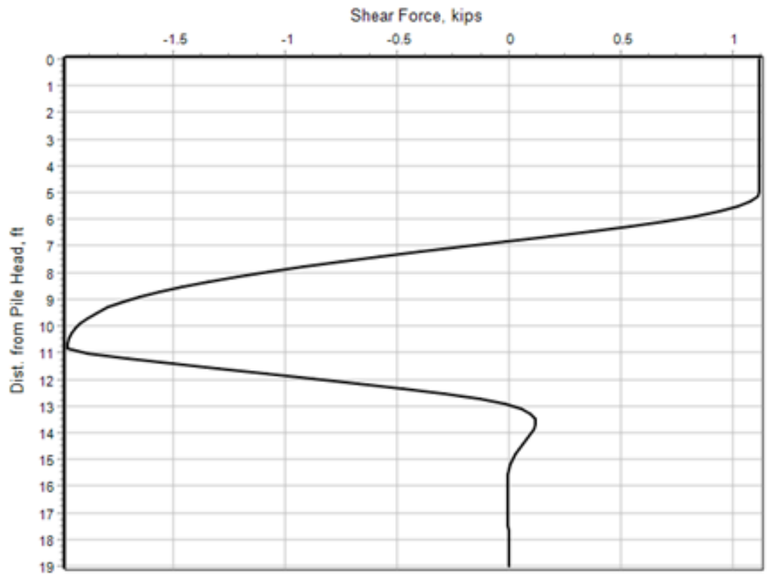
10-INCH TIMBER PILES
LATERAL PILE ANALYSIS OUTPUT

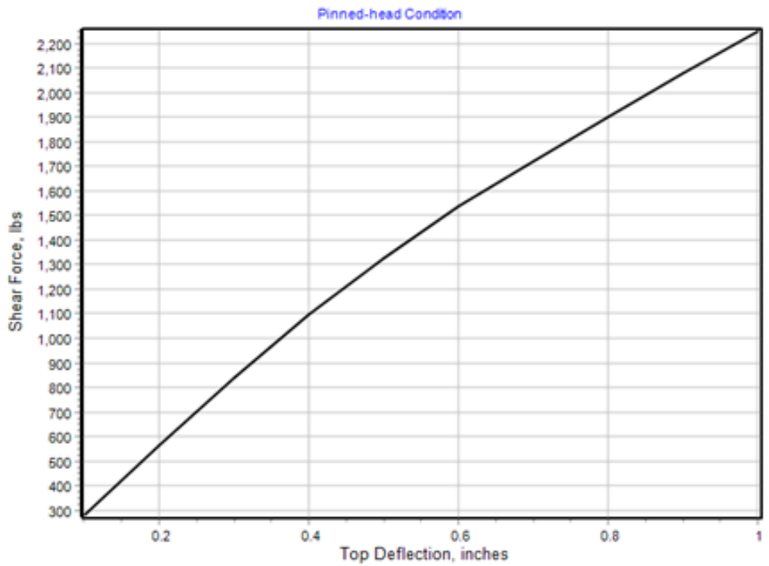
SCALE: AS SHOWN
JANUARY 2024

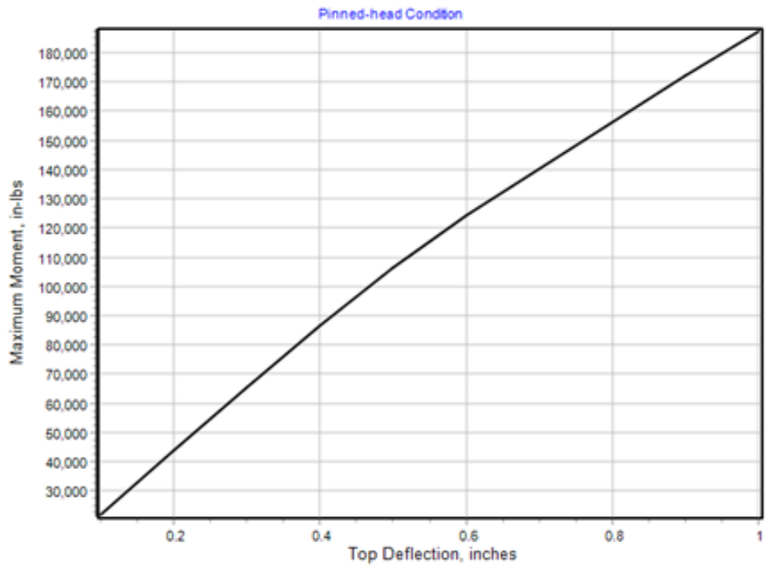
FIGURE D-4

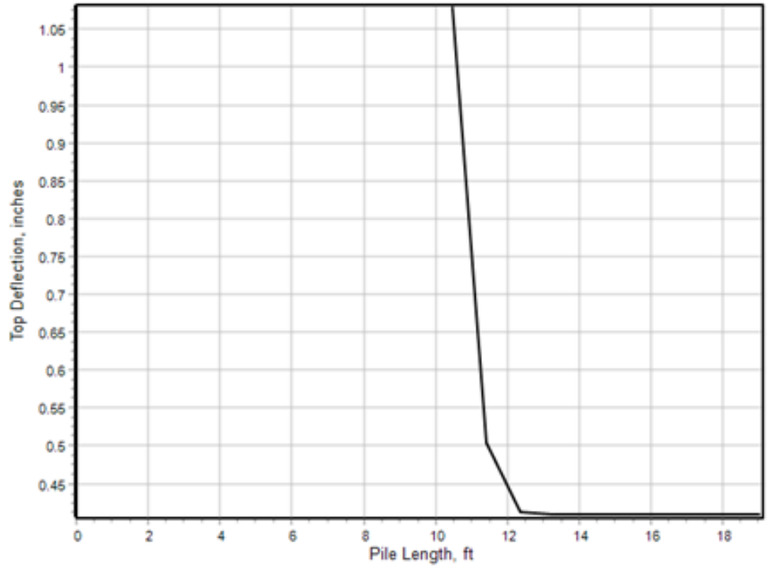












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STINSON BEACH, CALIFORNIA

10-INCH TIMBER PILES
LATERAL PILE ANALYSIS OUTPUT

SCALE: AS SHOWN
JANUARY 2024

FIGURE D-5