Appendix D:

Supplemental Geotechnical Subsurface Exploration and Due Diligence Study

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February 14, 2024

Project No. 23150-01

To: Meritage Homes
5 Peters Canyon Road, Suite 310
Irvine, California 90026

Attention: Ms. Johanna Crooker

Subject: Supplemental Geotechnical Subsurface Exploration and Due Diligence Study for the Proposed Residential Development, 3150 Bear Street, City of Costa Mesa, California

At your request, SA Geotechnical, Inc. (SA GEO) has conducted subsurface exploration and geotechnical due diligence study for the proposed residential development at 3150 Bear Street in the City of Costa Mesa, California (Figure 1). The purpose of our subsurface exploration and study was to evaluate the geotechnical site conditions in light of the proposed grading and improvements in order to provide a geotechnical summary and preliminary geotechnical recommendations for project design, grading, and construction. Our evaluation included review of collected geologic and geotechnical engineering reports and maps pertinent to the subject site; review of the site-specific geotechnical report provided by you; subsurface exploration; and preparation of this updated report. Please note that this report includes the results of our supplemental subsurface exploration consisting of advancement of six cone penetrometer tests (CPTs) which were performed recently. The supplemental subsurface exploration was performed in order to update the seismic liquefaction hazard analysis per the 2022 California Building Code.

The subject site is currently developed with a 2-story commercial building, adjacent at-grade concrete paved parking and associated drive aisles, and extensive hardscape/landscape improvements, all of which will be demolished as part of the proposed project. Based on our review, the primary geotechnical constraints include the presence of wet and/or saturated, highly expansive clayey soils, potentially liquefiable soils, potentially difficult remedial grading due to wet material, and seismic shaking during a strong seismic event. The subsurface soils at the site are primarily clayey with interlayered sandy silt, silty sand, and sands. Near-surface onsite soils are generally soft, compressible, and highly expansive, which will require remedial grading measures. Groundwater was encountered during onsite drilling at depths ranging from 18.3 to 20.7 feet (GMU, 2019). Percolation testing performed during the prior study indicates that stormwater infiltration is not feasible.

This report presents our findings, conclusions, and preliminary design recommendations for the subject residential development. Based on our subsurface exploration, analysis, and review, the proposed grading and development is considered geotechnically feasible provided the recommendations in this report are implemented during design, grading, and construction. Additional evaluation and analysis may need to be performed once the project plans for grading and foundations are developed.

References pertinent to the site are included in Appendix A. Boring/CPT logs and laboratory test data are included in Appendix B and C, respectively. Seismic design parameters are presented in Appendix D. Percolation test data performed during the prior study is presented in Appendix E. Liquefaction hazard analysis is presented in Appendix F. General earthwork and grading specifications are presented in Appendix G.

If you have any questions regarding this report, please contact our office. We appreciate the opportunity to provide our services.

Respectfully submitted,

SA GEOTECHNICAL, INC.

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EXECUTIVE SUMMARY

The subject site is underlain by thick Quaternary-age native alluvium that generally consists of interlayered clays, silty/sandy clays, clayey sands, and silty sands. The primary geotechnical constraints at the site include the following:

- Soft, compressible, wet/saturated, and highly expansive near-surface clayey soils;
- Potentially liquefiable subsurface soils;
- Potential difficulty performing remedial grading requiring special handling (i.e. top loading) and/or soft and saturated soil mitigation; and
- The potential for seismic shaking during an earthquake event.

Remedial grading for the site should consist of the removal and re-compaction of all undocumented fill materials, topsoil, and weathered or disturbed alluvium. Remedial removals are anticipated to be on the order of 5 feet below existing grades within the proposed building pads. Remedial grading for minor structures and within the proposed drive areas may be limited to removal and re-compaction of the soils in the upper 2 to 3 feet. Deeper removals may be required where existing trees, utility lines, structures, and foundations are to be abandoned/removed or where deeper undocumented fills are encountered. Considering that the onsite soils consist of wet/saturated highly expansive soils, achieving adequate compaction at acceptable moisture contents during fill placement may be difficult. Therefore, cement treating of the onsite soils should be considered. Cement treatment, if necessary, should consist of mixing the onsite soils with 6 percent cement.

As discussed above and per our review of the prior data, the removal bottoms and/or trench excavations for utility lines may be saturated, soft, and require stabilization of the bottom. Near-surface soils may pump or be unable to support the weight of heavy equipment. Special handling (e.g., top-loading with excavator) may be required to complete remedial grading. Removal bottoms may require stabilization to support heavy compaction equipment and can be stabilized with a layer of geotextile material (Mirafi HP270 or equivalent) placed at the bottom of the excavation, with 12 to 24 inches of ¾-inch or 1-inch gravel (or crushed aggregate base) over the geotextile. Alternatively, removal bottoms may be stabilized with one foot of cement-treated soil with a minimum of 6 percent cement.

Groundwater was encountered during prior exploration by others, at depths ranging from 18.3 to 20.7 feet. Historic high groundwater is mapped between 10 and 30 feet below grade. In general, we anticipate groundwater to remain at least 10 feet below design grades upon the completion of grading. However, seepage/groundwater may be present at shallower depth locally and can fluctuate on an annual and seasonal basis. In general, we anticipate that localized dewatering, such as with a sump pump, may be feasible and sufficient during construction, if groundwater is encountered at shallow depth or within excavations for deep utility lines.

Considering the relatively minor grading anticipated to achieve design elevations, the laboratory test data, and liquefaction analysis, building foundations and slabs should be designed to tolerate a total settlement of 1.5 inches and a differential settlement of ¾-inch over a span of 40 feet. Onsite soils are anticipated to have "High" to "Very High" expansion potential at the completion of grading and are considered corrosive to concrete and metals.

Based on our findings, we conclude that the proposed residential development is feasible from a geotechnical viewpoint, provided it is designed and constructed in accordance with the recommendations presented in this report and any future design/plan review report(s). The site is not considered suitable for infiltration of storm water.

1.0 INTRODUCTION

1.1 Introduction and Scope of Services

At your request, SA Geotechnical, Inc. (SA GEO) has conducted subsurface exploration and geotechnical due diligence study for the proposed residential development located at 3150 Bear Street in the City of Costa Mesa, California (Figure 1). The purpose of our study was to assess the onsite geologic and geotechnical conditions and provide preliminary recommendations for design, grading, and construction of the proposed improvements. At this time, no conceptual site plan or topographic survey was available for our review. We have utilized a Google Earth satellite image as the base for our Geotechnical Map (Plate 1).

Our scope of services for this due diligence study included the following tasks:

- Review of available geologic and geotechnical maps, reports, and data for the subject site and surrounding area, include the site-specific study performed by others. A list of references is included in Appendix A.
- Historic aerial photograph review, dating back to 1952.
- Notification and coordination with DigAlert to identify and clear Cone Penetrometer Test (CPT) locations of underground utilities.
- Subsurface exploration consisting of advancement of six CPTs (CPT-1S through CPT-6S) to a depth of approximately 50 feet below ground surface (bgs). CPT logs are included in Appendix B.
- Review of boring logs, laboratory test data, and percolation test data by others included in Appendices B, C, and E, respectively.
- Geotechnical evaluation and analysis of the compiled data with respect to the proposed grading and development.
- Preliminary evaluation of faulting, seismicity, and seismic and static settlement in accordance with the 2022 California Building Code (CBC).
- Preparation of this report including our findings, conclusions, preliminary recommendations, and accompanying illustrations.
- Consultations with the project team.

SA GEO's expertise and scope of services do not include assessment of potential subsurface environmental contaminants or environmental health hazards.

1.2 Site Condition and History

The subject site is located at 3150 Bear Street, Costa Mesa, California (see Figure 1). The approximately 6.2-acre site is bounded by Interstate 405 freeway to the north, residential neighborhoods to the east and south, and Bear Street to the west. The site is currently developed, with a two-story commercial building with at-grade concrete paved parking lot, drive aisles, and landscaping/hardscaping in the northern and central portions of the property.

Based on our review of available historic aerial photographs dating back to 1952, the earliest land use at the subject site and surrounding areas were for agricultural purposes (row crops). Development of the surrounding area for residential use began by 1972, although the subject site remained undeveloped. The existing two-story commercial building at the site was constructed by 1980. No significant changes were observed on the subject site since initial development and construction of the existing commercial building.

1.3 Proposed Grading and Improvements

Prior to any site development or grading, the existing structures, pavements, utilities, and hardscape will be demolished. Considering the site is relatively flat, we anticipate design grading to consist of cuts and fills on the order of 1 to 3 feet to reach pad grades and provide proper site drainage.

The proposed project is anticipated to include grading/construction for residential development, and street and utility infrastructure to support the development. At this time, the building size, story count/height, and type (single-family, multifamily, etc.) are unknown.

1.4 Prior Geotechnical Studies

GMU Geotechnical, Inc. (GMU) performed a preliminary geotechnical exploration and infiltration study at the subject site in 2019. Their subsurface exploration included excavation of nine hollow-stem auger borings (DH-1 through DH-5, DH-7, and DH-9 through DH-11) and two hand-auger borings (DH-6 and DH-8), to depths ranging from 5 to 31.5 feet. Percolation testing to determine stormwater infiltration feasibility was also performed in three borings (DH-3, DH-7, and DH-9) at a depth of 5 feet. Four Cone Penetration Tests (CPTs) (CPT-1, CPT-2A, CPT-3A, and CPT-4) were also performed to a maximum depth of 50.5 feet.

Laboratory testing included moisture content and dry density, grain size analysis, Atterberg limits, consolidation, direct shear, expansion index, maximum density and optimum moisture content, R-value, and chemical/corrosivity. The approximate boring locations are shown on the Geotechnical Map (Plate 1). The associated boring/CPT logs and laboratory test data are provided in Appendices B and C, respectively. The percolation test data is provided in Appendix E.

1.5 Subsurface Exploration

Our supplemental field exploration was performed on February 12, 2024, and included advancement of six CPTs (CPT-1S through CPT-6S) to a depth of approximately 50 feet. The uppermost five feet at each CPT location was hand-augered for private utility clearance. The CPTs use an integrated electronic cone system which measures and records cone tip resistance, sleeve friction, and friction ratio parameters at 5-centimeter depth intervals by advancement of a 1.25-inch diameter, pointed steel probe that is hydraulically pushed into the ground at a constant rate. The CPT provides a detailed subsurface profile to allow for assessment of potential liquefaction hazards and static settlement. The CPT data was used in conjunction with boring and laboratory test data to develop our interpretation of the subsurface conditions. At the completion of testing, the CPTs were backfilled with bentonite granules and the pavement was patched with quickset concrete. The approximate CPT locations are shown on Plate 1 (Geotechnical Map). CPT logs are included in Appendix B.

2.0 GEOTECHNICAL FINDINGS

2.1 Geologic Setting and Geotechnical Conditions

The subject site is located in the southwestern portion of the Tustin Plain, near the northwestern margin of the Newport Bay watershed, within the Peninsular Ranges geomorphic province of Southern California. The site is mapped by the U.S. Geological Survey (USGS, 2006) as underlain by extensive Quaternary-age alluvial fan deposits. The alluvium encountered during the prior subsurface exploration (GMU, 2019) generally consisted of olive brown, yellowish brown, brown, and brownish gray clay, silty clay, sandy clay, clayey sands, and silty sands. Limited topsoil materials were encountered in several borings, up to 1.2 feet thick.

Based on our review of the prior geotechnical boring and laboratory testing data (Appendix C; GMU, 2019), the site geotechnical conditions are generally as follows:

Soil Moisture Content and Dry Density: Native alluvial soils had in-situ moisture contents and dry densities ranging from 4.0 to 38.8 percent and 77 to 136 pounds per cubic foot (pcf), respectively. Blow counts in the alluvial materials generally ranged from 11 to 51 and locally up to 80+ blows per foot. Alluvial soils were generally found to be moist to wet and soft to stiff/loose to dense.

Soil Properties: Grain-size distribution tests were conducted on three ring samples collected at depths of 5, 15, and 30 feet. The shallowest sample was classified in accordance with the Unified Soil Classification System (USCS) as fat clay (CH), while both other tested samples were classified as sand with silt (SP-SM), with fines contents (passing No. 200 sieve) of 97, 11, and 10 percent, respectively.

Soil plasticity testing was performed on three ring samples. Two samples were collected at a depth of 5 feet bgs, and one was collected at a depth of 15 feet bgs. The 5-foot samples were classified as CH with Plasticity Indices of 40 and 66 and Liquid Limits of 61 and 97 percent. Testing of the sample collected at 15 feet bgs, which contained only 11% fines passing the #200 sieve, was non-plastic (USCS classification of SP-SM).

Maximum dry density testing of three near surface samples (collected from the uppermost 5 feet) indicates that the near surface clayey soil (CL/CH) has maximum dry densities ranging from 113.5 to 124.0 pcf at optimum moisture contents of 11.5 to 15.5 percent.

Shear Strength: Three direct shear tests were conducted which included one remolded sample prepared from a bulk sample collected from the uppermost 5 feet, and two undisturbed samples collected at depths of 2.5 and 5 feet. The remolded direct shear test results indicate that the sample had ultimate and peak internal friction angles of 28.1 and 26.0 degrees, with ultimate and peak cohesions of 324 and 564 pounds per square foot (psf), respectively. The undisturbed direct shear test results indicate that the samples had ultimate and peak internal friction angle of 19.5 degrees (2.5-foot sample) and 27.0 and 31.0 degrees (5-foot sample). Ultimate and peak cohesions were 558 and 708 psf (2.5-foot sample), and 18 and 84 psf (5-foot sample), respectively.

Consolidation: Tests were performed on seven samples collected at depths ranging from 5 to 12.5 feet. The testing showed that the materials are low to moderately compressible. The samples generally had minor collapse and swell (less than 1 percent) upon the addition of water at various loads. The majority of the samples swelled upon the addition of water which indicates that the onsite soils are expansive.

Expansion Potential: Expansion index testing was performed on three samples collected in the upper 0 to 5 feet. The results indicate a "High" expansion potential (EI ranging from 120 to 129).

Chemical Properties: Chemical properties testing was performed on three bulk samples collected from the uppermost 5 feet. Testing included electrical resistivity, pH, soluble sulfate, and chloride content. The electrical resistivity tests (515 to 692 ohm-cm) indicate that the onsite soils are severely corrosive to ferrous metals. Soil pH value ranged from 7.4 to 8.5. Chloride contents ranged from 696 to 936 ppm and soluble sulfate contents ranged from 68 to 2943 ppm. Soluble sulfate contents indicate the soils are classified as "S0" and "S2" per Table 19.3.1.1 of ACI-318-14.

R-Value: R-value testing was performed on a sample collected from 1 to 5 feet. The test results indicate an R-value of 8.

2.2 Groundwater

Groundwater was encountered during the prior exploration at depths ranging from 18.3 to 20.7 feet bgs. Historic high groundwater mapping indicates high groundwater between 10 and 30 feet bgs (CDMG, 1997). Groundwater well data available on the State of California Water Resources Control Board database ("GeoTracker") shows depth to groundwater at nearby sites have been recorded between 20 and 29 feet bgs. Groundwater is anticipated to fluctuate both seasonally and annually.

2.3 Regional Faulting and Seismicity

Regional Faults: The site is not located within a fault-rupture hazard zone as defined by the Alquist-Priolo Special Studies Zones Act (CGS, 2018). Also, based on mapping by the State (Jennings and Bryant, 2010), there are no active faults mapped at the site.

Seismicity: Properties in southern California are subject to seismic hazards of varying degrees depending upon the proximity, degree of activity, and capability of nearby faults. These hazards can be primary (i.e., directly related to the energy release of an earthquake) or secondary (i.e., related to the effect of earthquake energy on the physical world). Since there are no active faults at the site, the potential for primary ground rupture is considered very low. The primary seismic hazard for this site is ground shaking during a future earthquake.

Using the USGS deaggregation computer program (USGS, 2023) and the site coordinates of 33.6862 north latitude and –117.8911 west longitude, the closest major active faults include the Newport-Inglewood Fault and San Joaquin Hills Fault. The maximum moment magnitude for the controlling fault is 7.1 Mw, which would be generated from the San Joaquin Hills Fault; however, numerous other regionally active faults could also produce ground shaking at the site during an earthquake.

The site is located within an area of potential liquefaction, as defined by the State's Seismic Hazard Mapping (CDMG, 1997). Liquefaction hazard assessment is discussed in the following section. Other secondary seismic hazards, such as tsunami and seiche are considered nil due to site elevation and distance from the ocean or other confined body of water (CGS, 2021).

2.4 Liquefaction Potential

Liquefaction is a phenomenon in which earthquake-induced stress generates excess pore water pressure in low density, saturated, sandy and silty soils below the groundwater table. Liquefaction causes a loss of strength and is often accompanied by ground settlement. For liquefaction to occur, the following four conditions must be present at the site: 1) Severe ground shaking, such as during a strong earthquake, 2) Soil must be saturated or nearly saturated, generally below the groundwater table, 3) Corrected normalized standard penetration test (SPT) blow counts (N1) and/or CPT tip resistance (Qt) must be relatively low, and 4) Soils must be granular (typically sand or sandy silt) with low plasticity; clays and silts of relatively high plasticity are generally not liquefiable.

Our assessment was performed using the collected CPT data (CPT-1S through CPT-6S) and CLiq software, version 3.5.2.17 by Geologismiki. Liquefaction potential was performed using the Robertson method (NCEER R&W 2009a). We have also implemented the depth weighting factor for calculation of the equivalent volumetric strain of the soil profile, included in CLiq and per the study by Cetin, et. Al. (2009). CLiq provides CPT data interpretation, final plots of factor-of-safety, liquefaction potential index, and post-earthquake displacement, and vertical settlement.

The liquefaction potential of onsite soils was estimated based on a peak ground acceleration of 0.61g and a maximum earthquake magnitude of 7.1M_W, as determined in our site seismicity analysis, discussed in Sections 2.3 and 3.6. An in-situ groundwater table of 18 feet bgs and a seismic (design) groundwater table of 10 feet was used in our analysis for all CPTs.

Seismic Settlement: The results of our analysis indicate that liquefiable layers are present and, when subject to ground accelerations generated during a large earthquake event near the subject site, may be prone to settlement. Based on our calculations, settlement due to liquefaction is estimated to be less than ½-inch. The graphic representations of the CPT soundings are included in Appendix B and the liquefaction analysis is presented in Appendix F.

Loss of Bearing and Surface Manifestations: The potential for loss of bearing and surface manifestations was reviewed based on the thickness of the liquefiable layers that will be left in-place, versus the amount of fill and non-liquefiable native soils overlying liquefiable soils. Considering the depth to design groundwater, the clayey nature of the soils in the upper 10 feet, and that the proposed structures will be underlain by compacted fill, the potential for local surface disruptions, loss of bearing strength and surface manifestation is considered very low. Please also note that the liquefiable layers are generally deep (below 24 feet bgs) which further reduces the potential for loss of bearing and surface manifestations.

Lateral Spread: Considering the proposed improvements are not located near any sloping ground or free face and the relatively flat grades across the site, we anticipate the potential for lateral spread as a result of seismic shaking to be very low (less than the maximum acceptable values specified in the building code for conventional foundations).

2.5 Settlement and Foundation Considerations

In general, the anticipated settlements depend upon the building loads, type of foundations, and the geotechnical properties of the supporting subgrade. We performed settlement analysis using the CPT, boring, and consolidation test data. Considering the relatively flat grades across the site, we do not anticipate significant design fills to be placed during grading (3 feet or less).

Considering the subsurface soil conditions and laboratory test data, and relatively lightly loaded residential structures, we estimate the total static settlement to be on the order of 1 inch and the differential static settlement to be on the order of ½-inch over a 40-foot span. This assumes remedial grading measures recommended in Section 3.2 of this report are implemented during site grading.

The total seismic settlement at the site is anticipated to be on the order of ½-inch. Differential seismic settlement is estimated to be ¼-inch over a 40-foot span.

2.6 Stormwater Infiltration Feasibility

Percolation testing was performed in three exploratory borings, DH-3, DH-7, and DH-9 (GMU, 2019). The borings were 5 feet deep each and were tested in general accordance with County of Orange requirements. Tested infiltration rates (no factor-of-safety applied) were found to range from 0.02 to 0.04 inches per hour. The percolation test data sheets are provided in Appendix E.

2.7 Shrinkage and Bulking

The shrinkage and bulking (reduction or increase in volume of excavated materials on recompaction as fill) varies by soil type and location. The volume changes depend primarily on in-situ density and the maximum dry density of the soil type. We anticipate that the near surface (uppermost 5 feet) alluvial materials will have shrinkage of 2 to 7 percent. Ground subsidence at the site is estimated to be on the order of 0.1 foot. These values exclude losses due to removal of vegetation and debris and are dependent on the accuracy of the site topographic survey and type of equipment and compaction method used by the contractor.

3.0 CONCLUSION AND PRELIMINARY RECOMMENDATIONS

3.1 General Conclusion and Recommendation

Based on our review, construction of the proposed residential development, as described herein, is considered geotechnically feasible provided the preliminary recommendations in this report are implemented during design, grading, and construction. Additional geotechnical exploration is not considered necessary provided there are no significant plan changes. Grading, foundation, structural and wall plans for the project should be reviewed by the geotechnical consultant during the design phase. Updated recommendations should be provided once the project plans are finalized and as needed.

The recommendations in this report should be considered minimum and may be superseded by more restrictive requirements of others. In addition to the following recommendations, General Earthwork and Grading Specifications are provided in Appendix G.

3.2 Site Preparation and Earthwork

Site preparation and grading should be performed in accordance with the recommendations herein and the requirements of the City of Costa Mesa.

3.2.1 Site Demolition and Clearing

Prior to remedial grading, the existing structures, foundations, hardscape/landscape, and utilities to be abandoned should be demolished and removed. Deleterious materials and debris should be cleared from the site and disposed of offsite. Concrete material may be mixed with onsite soils and placed as compacted fill provided it is broken into pieces that are smaller than 6 inches in the largest diameter. Placement of concrete as compacted fill should also be approved by the project environmental consultant. Excavations for the removal of existing foundations, utilities, and vegetation, including onsite trees, should be observed by the geotechnical consultant. Large roots, highly organic soils, and existing utilities should be removed and should not be incorporated into new fills.

Cesspools, septic tanks and/or wells may be encountered at the site. If encountered, they should be removed in accordance with Orange County Health Care Agency requirements and the project environmental consultant's recommendations.

Soil that is disturbed as part of excavations or removal of trees or underground utilities should be evaluated by the geotechnical consultant. Excavations that require backfill should be properly documented and compacted under the observation and testing of the geotechnical consultant in accordance with the recommendations provided in Section 3.2.4.

3.2.2 Protection of Existing Improvements and Utilities

Existing improvements, and utilities on or adjacent to the site that are to be protected in place should be located and visually marked prior to grading operations. Excavations adjacent to improvements to be protected in-place or any utility easement should be performed with care, so as not to undermine existing foundations or destabilize the adjacent ground.

Stockpiling of soils more than 5 feet in height at or near existing structures and over utility lines should not be allowed. If deeper removals are required, shoring or other special measures (i.e., setback or laybacks) to provide safety and mitigate the potential for lateral/vertical movements may be required.

3.2.3 Remedial Grading Measures

Remedial grading at the site should consist of removal of undocumented fill materials in their entirety and weathered/unsuitable alluvium. In general, we recommend that remedial grading for the proposed building pads consist of removal and recompaction of soils in the upper 5 feet (from existing grade) to remove any undocumented artificial fill materials and unsuitable/weathered native alluvial soils. Removals within the proposed drive areas and for minor site structures may be limited to removal and re-compaction of the upper 2 to 3 feet, below existing grades. Where deeper undocumented fill/unsuitable material is encountered, the removals should be extended to the bottom of undocumented fill and/or unsuitable materials to competent native soils.

Based on our review of prior onsite data, saturated and soft soils may be encountered as shallow as 2.5 feet bgs. The near-surface soils may pump and/or lose bearing under the weight of heavy equipment. Special handling (e.g., top-loading with excavator) may be required to complete the remedial grading. In addition, we anticipate that achieving adequate compaction at acceptable moisture contents will be difficult considering the presence of wet/saturated highly expansive soils at the site. Therefore, cement treatment of the soils may be necessary and should be anticipated during the grading. If needed, we recommend that the onsite soils be mixed with 6 percent cement.

If removal bottoms expose wet/saturated soft materials, stabilization of the removal bottom will be required. Removal bottoms may be stabilized with a layer of geotextile material (Mirafi HP270 or equivalent) placed at the bottom of the excavation, with 12 to 24 inches of ¾-inch or 1-inch gravel (or crushed aggregate base) over the geotextile. Alternatively, bottoms may be stabilized with one foot of cement-treated soil with a minimum of 6 percent cement.

The geotechnical consultant should review and approve the removal bottoms prior to fill placement and should provide additional specific recommendations based on actual conditions, if necessary.

Excavations deeper than 4 feet will need to be laid back at a minimum inclination of 1:1 (horizontal to vertical) or provided with shoring. Shallow excavations (4 feet or less) may consist of near-vertical excavation. Excavations should be performed in accordance with Cal/OSHA requirements for Soil Type "B"; however, Type "C" soils may also be encountered and require a 1.5:1 layback. The contractor's qualified person should verify compliance with Cal/OSHA requirements. Excavations near existing structures (within a 1:1 projection) should be provided with shoring that is designed to support the surcharge load of the existing structure. If groundwater is encountered in near-vertical excavations, caving should be anticipated.

3.2.4 Fill Placement

Upon the completion of remedial grading measures, the approved removal bottoms should be scarified a minimum of 6 inches. Onsite soils may be used as fill material, provided that adequate compaction at acceptable moisture contents is achievable. In general, we anticipate that achieving adequate compaction at acceptable moisture contents will be difficult considering the presence of wet/saturated highly expansive soils at the site. Therefore, cement treatment of the soils may be necessary and should be anticipated during the grading and fill placement. If needed, we recommend that the onsite soils be mixed with 6 percent cement. Other measures such as mixing, drying, etc. may also be used; however, these measures are typically time-consuming and logistically difficult to perform. The removal bottoms and fill materials should be compacted to at least 90 percent of maximum dry density, as determined by ASTM Test Method D1557. The moisture content of the fill materials should be 3 to 4 percent above the optimum moisture content but within the compactable levels. Fill materials should be placed in loose lifts no thicker than 8 inches.

Concrete material may be mixed with onsite soils and placed as compacted fill if it is broken into pieces that are smaller than 6 inches in the largest diameter. Placement of concrete as compacted fill should be approved by the project environmental consultant.

3.2.5 Import

The geotechnical consultant should evaluate and accept any import soils prior to transportation to the subject site. We recommend that import soils have similar or better engineering properties to onsite soils. At minimum, the import materials should have an Expansion Index of less than 90 and a Plasticity Index of less than 25.

3.3 Settlement Potential

The amount of settlement will depend upon the type of foundation(s) selected and future loading by additional fill and structures. Based on our subsurface exploration and review of the subsurface data performed during the prior study, our liquefaction analysis, considering the remedial grading recommendations provided in this report are implemented during grading, and structural loads typically associated with the anticipated 2- to 3-story residential units, we estimate that total and differential post-construction settlement (combined static and seismic) will be on the order of 1.5 inches and ¾-inch over a span of 40 feet, respectively.

SA GEO should be provided with the foundation plans and structural loads, once available, in order to further evaluate the potential for post-construction settlement of the proposed building and associated improvements. The parameters provided herein will then be confirmed/updated based on the planned foundations and loads and additional testing and/or analysis.

3.4 Foundation Design

The slab and foundations should be designed by the project structural engineer based on the proposed structure type and the anticipated loading conditions. The foundation soils are anticipated to have expansive soil conditions ("High" to "Very High expansion potential) and will be subject to climatic and landscape moisture fluctuations. Post-tensioned slab should be anticipated for the proposed residential buildings. The following foundation recommendations are provided with the assumption that the recommendations included in Section 3.2 of this report are implemented during site grading.

The recommended net allowable bearing capacity for continuous and isolated footings may be calculated based on the following equation:

$q_{all} = 500\,D + 200\,B + 800$ (but not to exceed 3,000 psf, see below for post-tensioned/mat slabs)

where:
D = embedment depth of footing, in feet
B = width of footing, in feet

Also, the following parameters may be used for design of foundation and slabs:

- Soil unit weight = 120 pcf
- Soil internal friction angle = 27 degrees
- Coefficient of Friction = 0.33
- Subgrade modulus (k) of 50 pci (corrected for large slabs)
- Soil elastic modulus (Es) of 1,000 psi

The allowable bearing capacity of 1,200 psf may be used for design of post-tensioned/mat foundation.

The dead load of concrete below adjacent grades (buried concrete foundations) may be neglected. The allowable bearing pressure and friction coefficient may be increased by one-third for wind and seismic loading.

We recommend that strip and isolated footings for the buildings have a minimum embedment depth of 18 inches below the lowest adjacent grade. Continuous footings should be at least 12 inches wide and isolated column footings should be at least 24 inches wide. The footings of freestanding and isolated structures, such as walls and pilasters, should have a minimum embedment depth of 24 inches into approved soils.

The following table provides our general guidelines and preliminary recommendations for design of post-tensioned foundations and slabs on expansive soil in accordance with the 2022 California Building Code (CBC) and Post-Tension Institute (PTI) DC 10.5 Edition provisions.

**GEOTECHNICAL GUIDELINES
FOR DESIGN OF POST-TENSIONED SLABS**

Parameter	Recommendation
Center Lift	
Edge Moisture Variation Distance, e_m	7.00 feet
Center Lift, y_m	1.20 inches
Edge Lift	
Edge Moisture Variation Distance, e_m	3.5 feet
Edge Lift, y_m	1.50 inch
Presaturation, as needed, to obtain the minimum moisture down to the minimum depth	1.4 x optimum down to 24 inches

We recommend that post-tensioned slabs have a thickened edge such that the slab is embedded a minimum of 18 inches below the lowest adjacent grade.

In addition, as indicated in the DC 10.5 Edition of PTI, shape factor calculations should be performed by the project structural engineer in order to determine if strengthening/modification of foundations are necessary. Per PTI guidelines, modifications to the foundations design should be considered if the shape factor (ratio of square of foundation perimeter over foundation area) exceeds 24.

If non-post-tensioned slabs-on-grade and foundations are considered at the site, an effective Plasticity Index of 50 is considered appropriate for the upper 15 feet of soil materials, in accordance with Wire Reinforcement Institute (WRI) method (per the 2022 CBC). For non-post-tensioned slabs, we recommend a minimum embedment of 24 inches below the lowest adjacent grade for the perimeter footings. Also, the upper 24 inches of subgrade soil should be pre-saturated to 140 percent of optimum moisture content prior to placement of moisture barrier and concrete.

The foundations and slabs should also be designed to tolerate the total and differential settlements discussed in Section 3.3 of this report.

For the design of pole-type foundations (i.e., light poles, shade structures, etc.), an allowable soil-bearing pressure (S_1) of 320 psf/ft may be used for Equation 18-1 (the "pole" equation) of the 2022 CBC Section 1807.3.2.1 to determine the depth of embedment for the footings, considering level ground conditions. The equation is applicable for designed embedment depths of less than 12 feet for the purpose of computing lateral pressure. Also, for vertical loads on pole-type foundations, an allowable skin friction of 250 pounds per square foot may be used. Pole foundations should have a minimum embedment of 30 inches below adjacent grades. For cast-in-place pole-type foundations, the vertical end bearing pressure should be neglected.

3.5 Retaining Walls Design and Lateral Earth Pressures

Recommendations for lateral earth pressures for permanent retaining walls and structures (if any) with approved onsite drained soils and above the groundwater table are as follows:

Conditions	*Level (pcf)*	*2:1 Sloping*
Active	45	75
At-Rest	65	100
Passive	320	160 (sloping down)

These parameters are based on a soil internal friction angle of 27 degrees and soil unit weight of 120 pcf.

To design an unrestrained retaining wall, such as a cantilever wall, the active earth pressure may be used. For a restrained retaining wall, the at-rest pressure should be used. Passive pressure is used to compute lateral soils resistance developed against lateral structural movement. The passive pressures provided above may be increased by one-third for wind and seismic loads. The passive resistance is taken into account only if it is ensured that the soil against embedded structure will remain intact with time. Future landscaping/planting and improvements adjacent to the retaining walls should also be taken into account in the design of the retaining walls. Excessive soil disturbance, trenches (excavation and backfill), future landscaping adjacent to footings and over-saturation can adversely impact retaining structures and result in reduced lateral resistance.

For sliding resistance, the friction coefficient of 0.33 may be used at the concrete and soil interface. The coefficient of friction may be increased by one-third for wind and seismic loading. The retaining walls may also need to be designed for additional lateral loads if other structures or walls are planned within a 1H:1V projection.

The seismic lateral earth pressure for walls retaining more than 6 feet of soil, if any, and level backfill conditions may be estimated to be an additional 18 pcf for active and at-rest conditions. The earthquake soil pressure has a triangular distribution and is added to the static pressures. For the active and at-rest conditions, the additional earthquake loading is zero at the top and maximum at the base. The seismic lateral earth pressure does not apply to walls retaining less than, or equal to, 6 feet of soil (2022 CBC Section 1803.5.12).

Drainage behind walls retaining more than 30 inches of soil should also be provided in accordance with the attached Figure 4. Specific drainage connections, outlets and avoiding open joints should be considered for the retaining wall design.

3.6 Seismic Design Parameters

The following table summarizes the seismic design criteria for the subject site. The seismic design parameters are developed in accordance with ASCE 7-16 and 2022 CBC. Please note that, considering the proposed structures and anticipated structural periods, site-specific ground-motion hazard analysis was not performed for the site. Per Supplement 3 of ASCE 7-16, the value of S_{M1}, and therefore S_{D1}, have been increased by 50 percent. The seismic response coefficient, Cs, should be determined per the parameters provided below and using equation 12.8-2 of ASCE 7-16.

Selected Seismic Design Parameters from 2022 CBC/ASCE 7-16	***Seismic Design Values***	***Reference***
Latitude	33.6862 North	
Longitude	-117.8911 West	
Controlling Seismic Source	San Joaquin Hills	USGS, 2023
Site Class per Table 20.3-1 of ASCE 7-16	D	
Spectral Acceleration for Short Periods (Ss)	1.298 g	SEA/OSHPD, 2023
Spectral Accelerations for 1-Second Periods (S_1)	0.465 g	SEA/OSHPD, 2023
Site Coefficient F_a, Table 11.4-1 of ASCE 7-16	1.0	SEA/OSHPD, 2023
Site Coefficient F_v, Table 11.4-2 of ASCE 7-16	1.835	
Design Spectral Response Acceleration at Short Periods (S_{DS}) from Equation 11.4-4 of ASCE 7-16	0.865 g	SEA/OSHPD, 2023
Design Spectral Response Acceleration at 1-Second Period (S_{D1}) from Equation 11.4-4 of ASCE 7-16 (Includes 50% increase per Supplement 3)	0.853 g	
T_S, S_{D1} /S_{DS} 11.4.6 of ASCE 7-16	0.986 sec	
T_L, Long-Period Transition Period	8 sec	SEA/OSHPD, 2023
Peak Ground Acceleration Corrected for Site Class Effects (PGA_M) from Equation 11.8-1 of ASCE 7-16	0.612 g	SEA/OSHPD, 2023
Seismic Design Category, Section 11.6 of ASCE 7-16	D	SEA/OSHPD, 2023

3.7 Corrosivity

Based on prior laboratory testing, soluble sulfates exposure in the onsite soils were classified as "S2" per Table 19.3.1.1 of ACI-318-14. Structural concrete elements in contact with soil include footings and building slabs-on-grade. The flatwork and sidewalk concrete are typically not considered structural elements. Concrete mix for structural elements should be based on the "S2" soluble sulfate exposure class of Table 19.3.2.1 in ACI-318-14. Other ACI guidelines for structural concrete are recommended. Also, based on the prior laboratory testing, onsite soils are severely corrosive to metals.

3.8 Expansion Potential

At the completion of grading, we anticipate that onsite soils will have "High" to "Very High" expansion potential. The geotechnical recommendations provided in this report including the design parameters for foundations, slab-on-grade and flatwork improvement should be implemented during design and construction. Updated recommendations will be provided upon additional testing at the completion of grading at the site and as needed.

Homeowners and their design/construction team should be familiar with the recommendations in this report as well as principles described in a useful reference published by the California Geotechnical Engineers Association (CalGeo), titled, "Coexisting with Expansive Soil: An Informational Guide for Homeowners." This free booklet can be downloaded at www.calgeo.org.

3.9 Interior Slab Moisture Mitigation

In addition to geotechnical and structural considerations, the project owner should also consider interior moisture mitigation when designing and constructing slabs-on-grade.

The intended use of the interior space, type of flooring, and the type of goods in contact with the floor may dictate the need for, and design of, measures to mitigate potential effects of moisture emission from and/or moisture vapor transmission through the slab. Typically, for human occupied structures, a vapor retarder or barrier is recommended under the slab to help mitigate moisture transmission through slabs. The most recent guidelines by the American Concrete Institute (ACI 302.1R-04) suggest that the vapor retarder be placed directly under the slab (no sand layer). However, the location of the vapor retarder may also be subject to the builder's past successful practice. Placement of 1 or 2 inches of sand over the moisture retardant has been common practice by builders in southern California. Specifying the strength of the retarder to resist puncture and its permeance rating is important. These qualities are not necessarily a function of the retarder thickness. A minimum of 10-mil is typical but some materials, such as 10-mil polyethylene ("Visqueen"), may not meet the desired standards for toughness and permeance.

Vapor retarders, when used, should be installed in accordance with standards such as ASTM E 1643 and/or those specified by the manufacturer.

Concrete mix design and curing are also significant factors in mitigating slab moisture problems. Concrete with lower water/cement ratios results in denser, less permeable slabs that also "dry" faster with regard to when flooring can be installed (reduced moisture emissions quantities and rates). Rewetting of the slab following curing should be avoided since it can result in additional drying time required prior to flooring installation. Proper concrete slab testing prior to flooring installation is also important.

Concrete mix design, the type and location of the vapor retarder should be determined in coordination with all parties involved in the finished product, including the project owner, architect, structural engineer, geotechnical consultant, concrete subcontractors, and flooring subcontractors.

3.10 Exterior Concrete

The driveway, patio slabs and other flatwork elements should be at least 4 inches thick. We recommend that the concrete flatwork be reinforced with No. 3 bars be placed at 24 inches on center both ways. Concrete slabs should be provided with construction or weakened plane control joints at a maximum spacing of 6 feet. The control joints should have a thickness that is ¼ of the total concrete thickness. Upon the placement and compaction of subgrade soils (per Section 3.2 of these recommendations), the upper 24 inches of the subgrade soils should be pre-saturated to 140 percent of optimum moisture content prior to placement of concrete and reinforcement. We also recommend that 6 inches of granular materials/aggregate base be placed over the compacted subgrade prior to placement of reinforcement and concrete.

For exterior slabs, the use of a granular sublayer is primarily intended to facilitate presaturation and subsequent construction by providing a better working surface over the saturated soil. It also helps retain the added moisture in the native soil in the event that the slab is not placed immediately.

Exterior concrete elements such as curb and gutter, driveways, sidewalks, and patios are susceptible to lifting and cracking when constructed over expansive soils. With expansive soils, the impacts to flatwork/hardscape can be significant, generally requiring removal and replacement of the affected improvements. Please also note that reducing concrete problems is often a function of proper slab design, concrete mix design, placement, and curing/finishing practices. Adherence to guidelines of the American Concrete Institute (ACI) is recommended. Also, the amount of post-construction watering, or lack thereof, can have a very significant impact on the adjacent concrete flatwork.

On projects with expansive soils, additional measures such as thickened concrete edges/footings, subdrains and/or moisture barriers should be considered where planter or natural areas with irrigation are located adjacent to the concrete improvements. Design and maintenance of proper surface drainage is also very important. If the concrete will be subject to heavy loading from cars/trucks or other heavy objects, thicker pavement section will be required the design of which should be performed by the geotechnical consultant, as needed.

The above recommendations typically are not applied to curb and gutter but should be considered in areas with highly expansive soils.

3.11 Preliminary Asphalt Concrete Pavement Design

Final structural pavement sections should be based on R-value testing after the completion of grading and in accordance with city of Costa Mesa requirements. Based on an R-value of 5 and estimated traffic indices (TIs), we recommend the following preliminary pavement sections:

Street Location	***Estimated TIs***	***Pavement Section***
Parking Stalls	TI – 4.0	0.25' AC / 0.50' AB
General Drives	TI – 5.5	0.35' AC / 0.80' AB
AC = Asphalt Concrete, AB = Aggregate Base		

Please note that for two-stage paving operations, we recommend that the final AC cap be a minimum of 0.10 foot thick and the base AC course have a minimum thickness of 0.25 foot.

Asphalt concrete pavement should be placed in accordance with the requirements of Sections 301 and 302 of the Standard Specifications of Public Works Construction (the Greenbook). Prior to construction of pavement sections, the subgrade soils should be scarified to a minimum depth of 6 inches, moisture-conditioned as needed, and recompacted in-place to a minimum of 90 percent relative compaction (per ASTM D1557). Subgrade should be firm prior to AB placement.

AB materials can be crushed aggregate base or crushed miscellaneous base in accordance with the Greenbook (Section 200-2). The materials should be free of any deleterious materials. Aggregate base materials should be placed in 6- to 8-inch-thick loose lifts, moisture-conditioned as necessary, and compacted to a minimum of 95 percent relative compaction (per ASTM D1557). Asphalt concrete should also be compacted to a minimum relative compaction of 95 percent.

Unpaved median and parkway areas should be provided with vertical moisture barriers.

3.12 Trench Excavation and Backfill

Excavations should be performed in accordance with the requirements set forth by Cal/OSHA Excavation Safety Regulations (Construction Safety Orders, Section 1504, 1539 through 1547, Title 8, California Code of Regulations). In general, onsite soils may be classified as Type "B" soils for excavations into compacted fill and fine-grained native alluvium and Type "C" for any excavations with groundwater/seepage or friable sand. Cal/OSHA regulations indicate that, for workmen in confined conditions, the steepest allowable slopes in Type "B" and "C" soils are 1:1 and 1.5:1 (horizontal to vertical), respectively, for excavations less than 20 feet deep. Where there is no room for these layback slopes, we anticipate that shoring will be necessary. The subsurface soils may be wet to saturated and prone to caving. Adequate shoring (i.e., shields) should be provided, as deemed necessary. The soils within the adjacent streets are anticipated to be similar to onsite soils. Excavations should be reviewed periodically by the contractor's qualified person to confirm compliance with Cal/OSHA requirements.

As discussed previously, wet, soft, and highly expansive clays that may require stabilization measures prior to placement of the utility lines should be anticipated. Excavation bottoms may be stabilized with a layer of geotextile material (Mirafi HP270 or equivalent) placed at the bottom of the excavation, with 6 to 18 inches of ¾-inch or 1-inch gravel (or crushed aggregate base) over the geotextile. Alternatively, bottoms may be stabilized with one 12 to 18 inches of ¾-inch or 1-inch gravel (or crushed aggregate base).

Native soils should be suitable for use as trench backfill with the exception of wet/saturated materials. Utility trench backfill should be in accordance with City of Costa Mesa and/or the governing jurisdiction's specifications. Native backfill materials should be compacted to a minimum of 90 percent relative compaction (per ASTM D1557). Rocks greater than 3 inches in largest diameter should generally not be used as trench backfill unless approved by the agency and geotechnical consultant of record. Excavation and backfilling of HDPE pipes (if any) should be in accordance with the manufacturer’s requirement and the Greenbook. Select granular backfill (i.e., clean sand with SE 30 or better) may be used in lieu of native soils but should also be compacted or densified with water jetting and flooding.

Trenches excavated next to structures and foundations should also be properly backfilled and compacted to provide full lateral support and reduce settlement potential.

3.13 Groundwater

Groundwater was encountered during the GMU exploration at depths ranging from 18.3 to 20.7 feet in Borings DH-1, DH-2, DH-4, DH-5, DH-10, and DH-11. While some saturated soil may be encountered during grading and/or utility trench excavation, we do not anticipate significant dewatering/mitigation measures will be necessary. In general, groundwater is anticipated to remain more than 5 feet below the building foundations. However, shallow, perched groundwater/seepage may occur on an annual and seasonal basis as a result of rainfall, irrigation and/or seepage from adjacent properties.

3.14 Stormwater Infiltration

Based on the preliminary testing by others, onsite stormwater infiltration rates were found to be very low. Additionally, considering the susceptibility to liquefaction, presence of near-surface highly expansive soils, and relatively shallow groundwater, stormwater infiltration at the site is not feasible from a geotechnical viewpoint. Other methods of filtration/treatment should be evaluated by the project civil engineer.

3.15 Surface Drainage and Irrigation

Maintaining adequate surface drainage, proper disposal of run-off water, and control of irrigation will help reduce the potential for future moisture-related problems and differential movements from soil heave/settlement. This is especially important considering the highly expansive nature of the onsite soils.

Surface drainage should be carefully taken into consideration during grading, landscaping, and building construction. Positive surface drainage should be provided to direct surface water away from structures and slopes and toward the street or suitable drainage devices. Ponding of water adjacent to the structures should not be allowed. Buildings should have roof gutter systems and the run-off should be directed to parking lot/street gutters by area drainpipes or by sheet flow over paved areas. Paved areas should be provided with adequate drainage devices, gradients, and curbing to prevent run-off flowing from paved areas onto adjacent unpaved areas.

Considering the climatic conditions in southern California and provided that the recommendations included in this report are implemented during grading and construction, a minimum two-percent slope away from structures is considered acceptable and in substantial compliance with the 2022 CBC. Also, swales with one-percent slopes are acceptable from a geotechnical standpoint and are common practice in this locale.

Construction of planter areas immediately adjacent to structures should be avoided if possible. If planter boxes are constructed adjacent to or near buildings, the planters should be provided with controls to prevent excessive penetration of the irrigation water into the foundation and flatwork subgrades. Provisions should be made to drain excess irrigation water from the planters without saturating the subgrade below or adjacent to the planters. Raised planter boxes may be drained with weepholes. Deep planters (such as palm tree planters) should be drained with below-ground, water-tight drainage lines connected to a suitable outlet. Moisture barriers should also be considered.

It is also important to maintain a consistent level of soil moisture, not allowing the subgrade soils to become overly dry or overly wet. Properly designed landscaping and irrigation systems can help in that regard.

3.16 Additional Subsurface Exploration and Laboratory Testing

Additional subsurface exploration during the design phase of the project is not anticipated provided no significant plan changes occur. Additional laboratory testing should be performed during and upon completion of the grading to confirm/update the design parameters provided herein.

3.17 Review of Future Plans

The project grading, foundation, street improvement, wall, and landscape plans should be reviewed and accepted by the geotechnical consultant prior to grading and construction. Additional recommendations should be provided upon the review of the project plans and as needed.

3.18 Observation and Testing during Grading and Construction

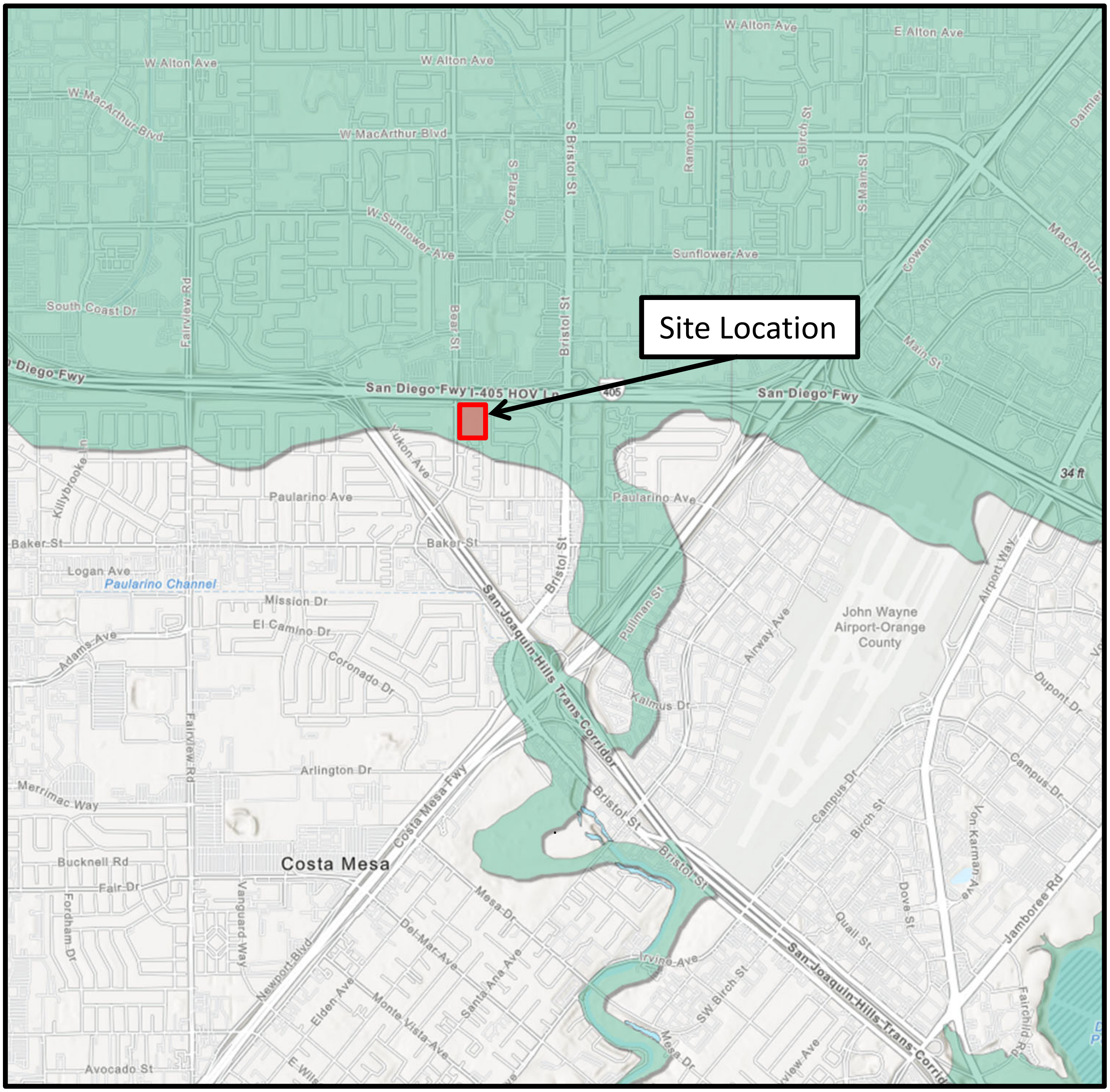
Geotechnical observation and testing should be performed by SA GEO during the following phases of grading and construction:

- During site demolition, preparation and clearing;
- During excavations performed for the remedial grading and to relocate or remove existing underground improvements;
- During earthwork, including observation and acceptance of remedial removal bottoms and fill placement, including import material (if any);
- During subgrade stabilization and soil-cement mixing operation (if needed);
- Following the completion of grading, in order to verify soil properties for foundations, slab-on-grade and pavements;
- Upon completion of any foundation or structural excavation, prior to pouring concrete;
- During slab and flatwork subgrade preparation prior to pouring of concrete;
- During placement of backfill for utility trenches;
- During construction of stormwater filtration devices/basins;
- During placement of backfill for retaining structures (if any);
- During installation and backfill of subdrainage systems (if any); and
- When any unusual soil conditions are encountered.

4.0 LIMITATIONS

This report has been prepared for the exclusive use of our client, Meritage Homes, within the scope of services requested for the subject property described herein. This report or its contents should not be used or relied upon for other projects or purposes, or by other parties without the acknowledgement of SA GEO and the consultation of a geotechnical professional. The means and methods used by SA GEO for this study are based on local geotechnical standards of practice, care, and requirements of governing agencies. No warranty or guarantee, expressed or implied, is given.

Our findings, conclusions, and recommendations are professional opinions based on interpretations and inferences made from geologic and engineering data from specific locations and depths, observed or collected at a given time. By nature, geologic conditions can vary from point to point, can be very different in-between exploration points, and can also change over time. Our conclusions and recommendations are, by nature, preliminary and subject to verification and/or modification during grading and construction when more subsurface data is exposed.



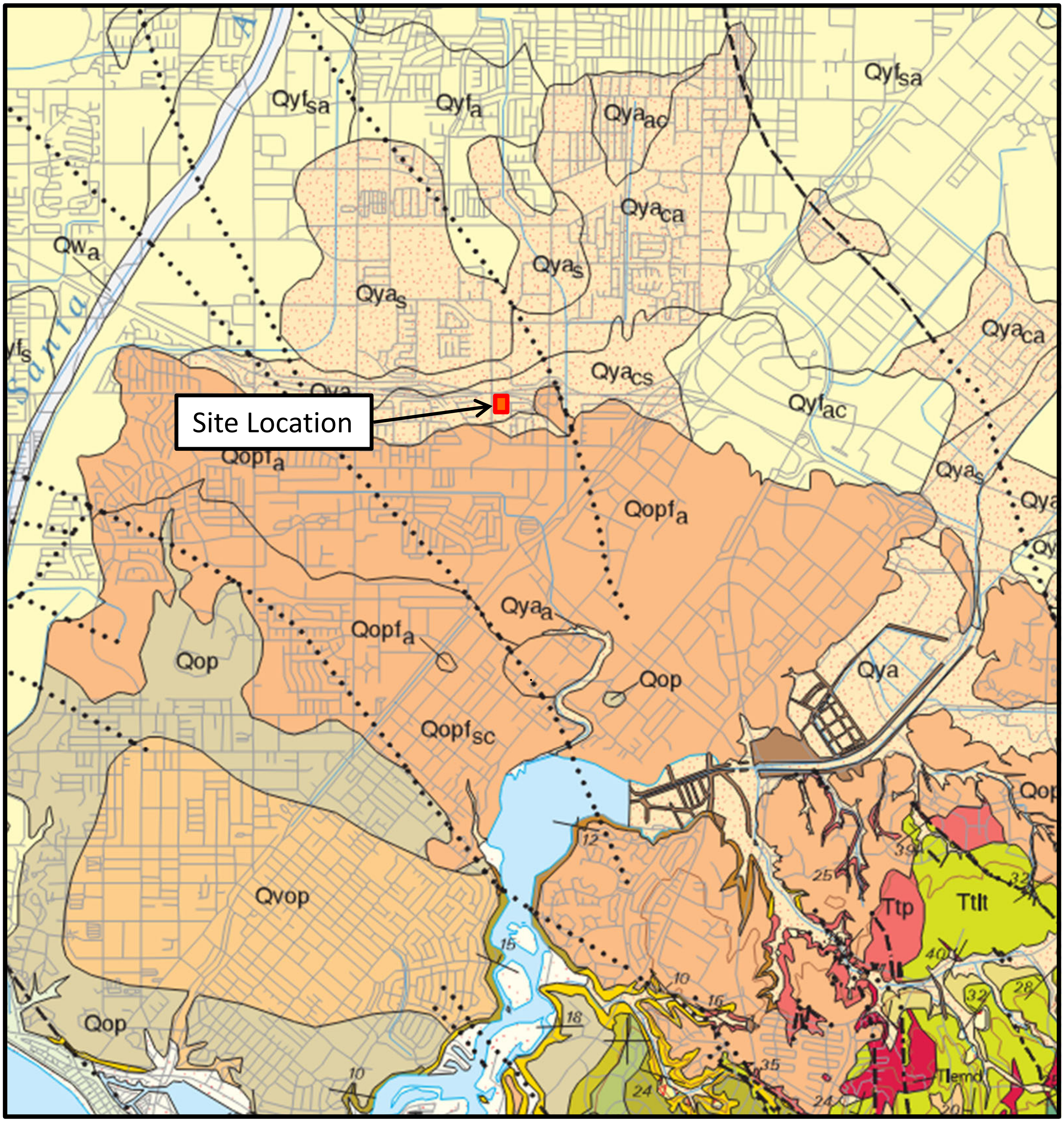
Source: Seismic Hazard Zones Map, Newport Beach Quadrangle (CDMG, 1998)

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

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

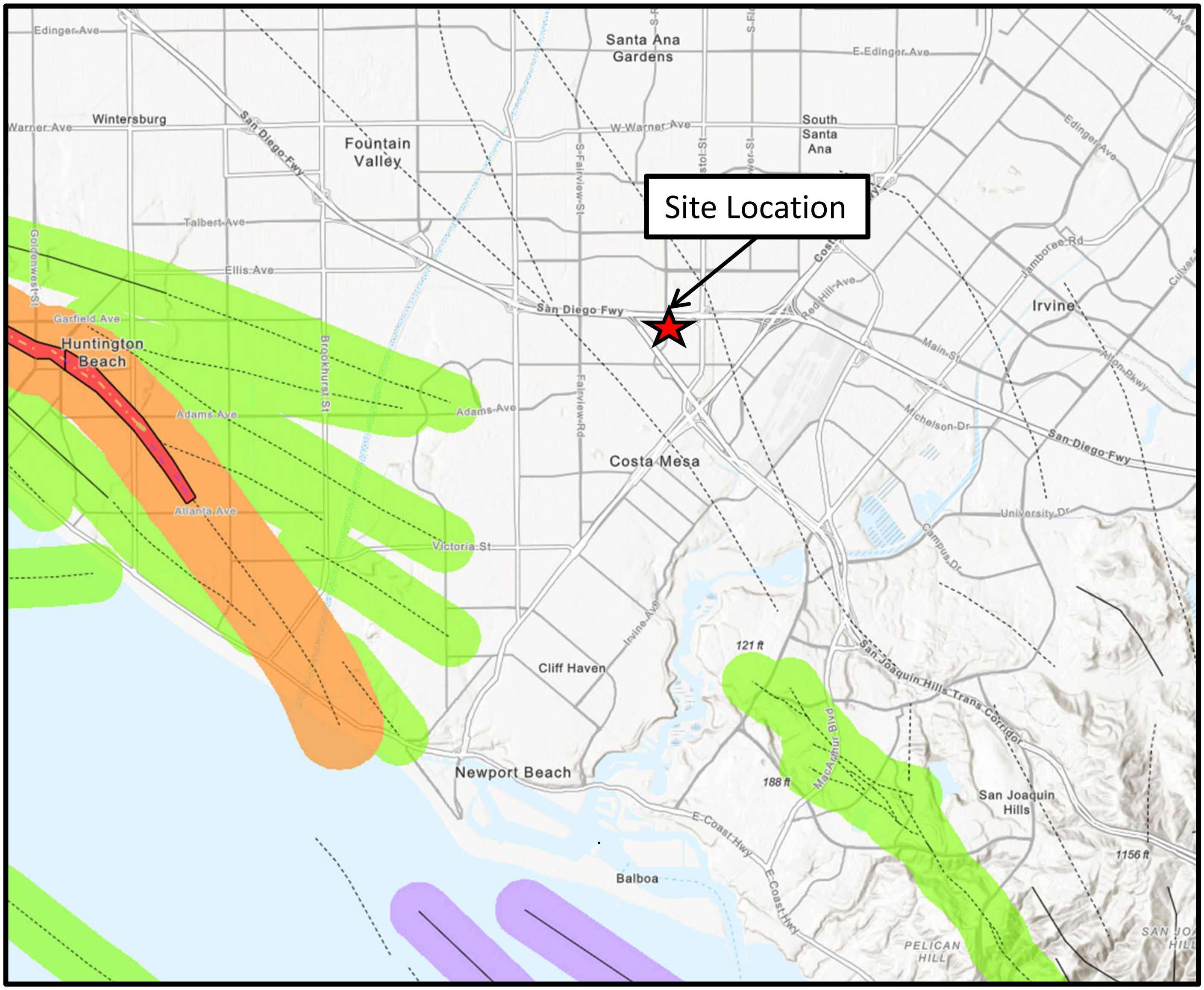
Site Location & Seismic Hazard Map

Meritage Homes Proposed Residential Development 3150 Bear Street Costa Mesa, California	Project Number: 23150-01 Date: February 14, 2024 Figure 1



Source: Geologic Map of the San Bernadino and Santa Ana 30’x60’ Quadrangles (USGS, 2006)

Regional Geologic Map	
Meritage Homes Proposed Residential Development 3150 Bear Street Costa Mesa, California	Project Number: 23150-01 Date: February 14, 2024 Figure 2



Source: Fault Activity Map of California (Jennings and Bryant, 2010)

Holocene fault displacement (during past 11,700 years) without historic record. Geomorphic evidence for Holocene faulting includes sag ponds, scarps showing little erosion, or the following features in Holocene age deposits: offset stream courses, linear scarps, shutter ridges, and triangular faceted spurs. Recency of faulting offshore is based on the interpreted age of the youngest strata displaced by faulting.

Late Quaternary fault displacement (during past 700,000 years). Geomorphic evidence similar to that described for Holocene faults except features are less distinct. Faulting may be younger, but lack of younger overlying deposits precludes more accurate age classification.

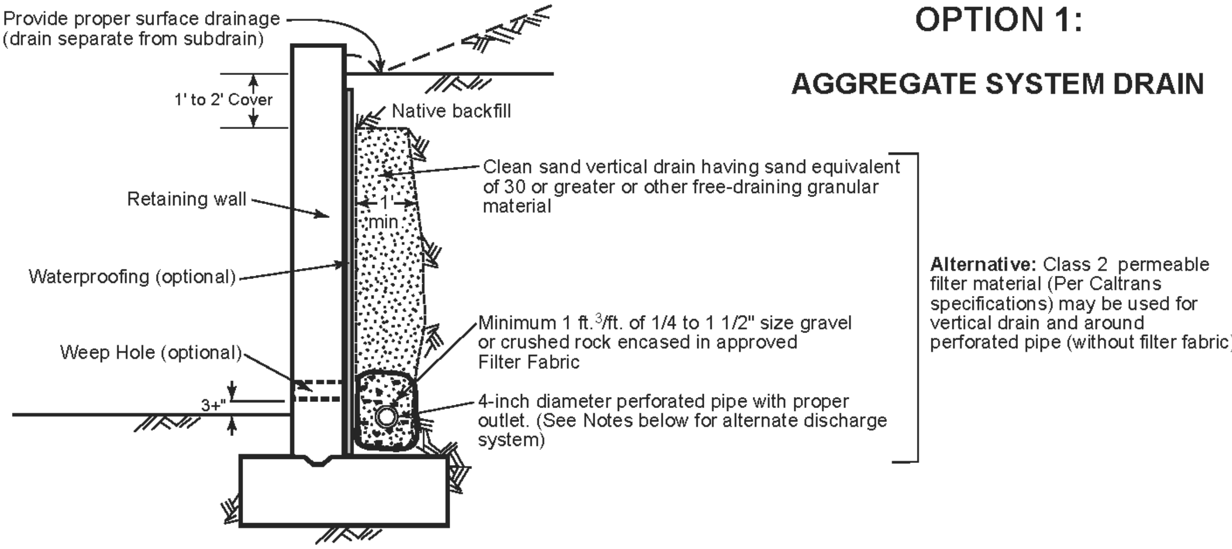
Quaternary fault (age undifferentiated). Most faults of this category show evidence of displacement sometime during the past 1.6 million years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age. Unnumbered Quaternary faults were based on Fault Map of California, 1975. See Bulletin 201, Appendix D for source data.

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement. Some faults are shown in this category because the source of mapping used was of reconnaissnce nature, or was not done with the object of dating fault displacements. Faults in this category are not necessarily inactive.

Regional Fault Map		S/A
Meritage Homes Proposed Residential Development 3150 Bear Street Costa Mesa, California	Project Number: 23150-01 Date: February 14, 2024 Figure 3	

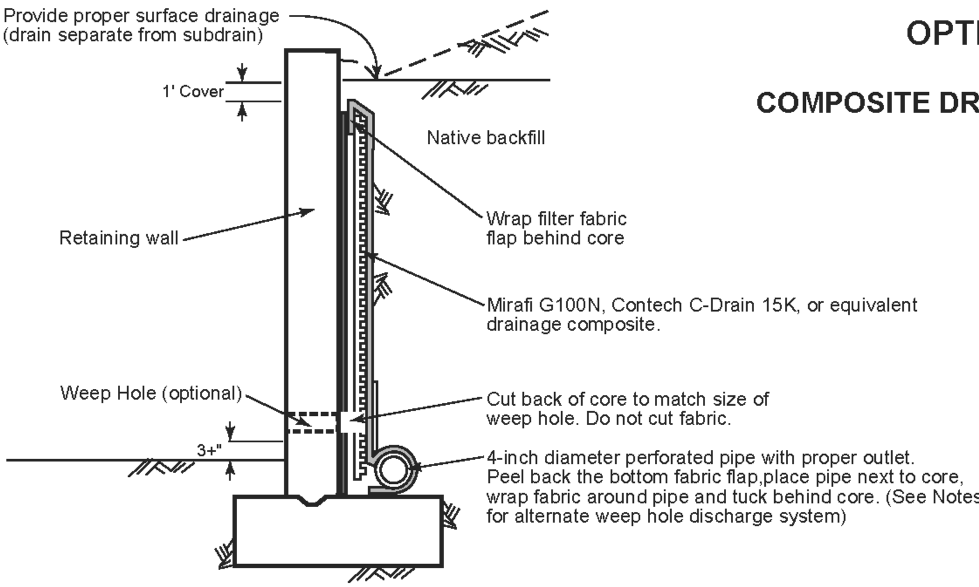
OPTION 1:

AGGREGATE SYSTEM DRAIN



OPTION 2:

COMPOSITE DRAINAGE SYSTEM



NOTES:

1. PIPE TYPE SHOULD BE PVC OR ABS, SCHEDULE 40 OR SDR35 SATISFYING THE REQUIREMENTS OF ASTM TEST STANDARD D1527, D1785, D2751 , OR D3034.
2. FILTER FABRIC SHALL BE APPROVED PERMEABLE NON-WOVEN POLYESTER, NYLON, OR POLYPROPYLENE MATERIAL.
3. DRAIN PIPE SHOULD HAVE A GRADIENT OF 1 PERCENT MINIMUM.
4. WATERPROOFING MEMBRANE MAY BE REQUIRED FOR A SPECIFIC RETAINING WALL (SUCH AS A STUCCO OR BASEMENT WALL).
5. WEEP HOLES MAY BE PROVIDED FOR LOW RETAINING WALLS (LESS THAN 3 FEET IN HEIGHT) IN LIEU OF A VERTICAL DRAIN AND PIPE AND WHERE POTENTIAL WATER FROM BEHIND THE RETAINING WALL WILL NOT CREATE A NUISANCE WATER CONDITION. IF EXPOSURE IS NOT PERMITTED, A PROPER SUBDRAIN OUTLET SYSTEM SHOULD BE PROVIDED.
6. IF EXPOSURE IS PERMITTED, WEEP HOLES SHOULD BE 2-INCH MINIMUM DIAMETER AND PROVIDED AT 25-FOOT MAXIMUM SPACING ALONG WALL. WEEP HOLES SHOULD BE LOCATED 3+ INCHES ABOVE FINISHED GRADE.
7. SCREENING SUCH AS WITH A FILTER FABRIC SHOULD BE PROVIDED FOR WEEP HOLES/OPEN JOINTS TO PREVENT EARTH MATERIALS FROM ENTERING THE HOLES/JOINTS.
8. OPEN VERTICAL MASONRY JOINTS (I.E., OMIT MORTAR FROM JOINTS OF FIRST COURSE ABOVE FINISHED GRADE) AT 32-INCH MAXIMUM INTERVALS MAY BE SUBSTITUTED FOR WEEP HOLES.
9 THE GEOTECHNICAL CONSULTANT MAY PROVIDE ADDITIONAL RECOMMENDATIONS FOR RETAINING WALLS DESIGNED FOR SELECT SAND BACKFILL.

Retaining Wall Drainage Detail

S/A

Figure 4

Appendix A

APPENDIX A

REFERENCES

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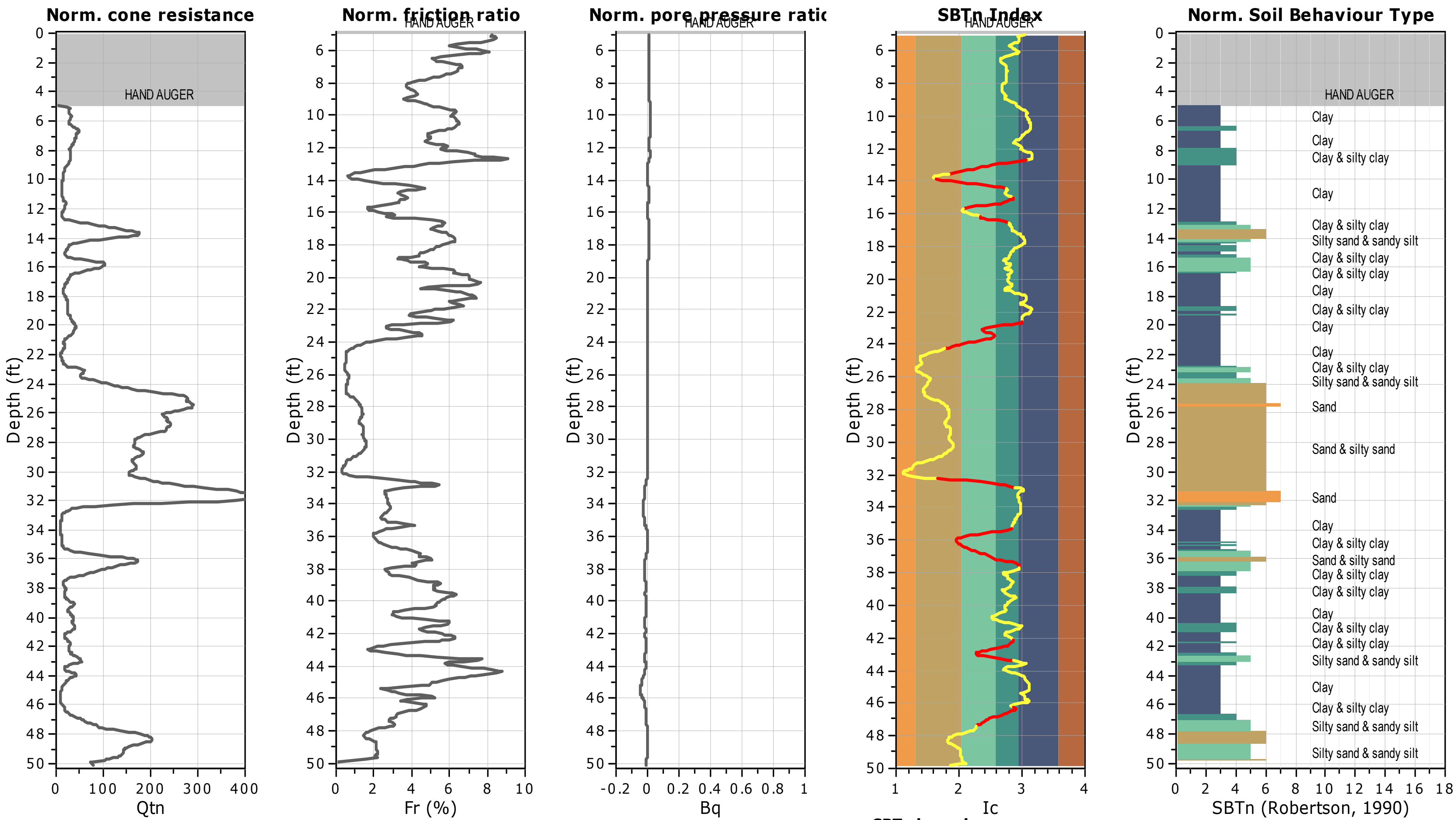
Appendix B

SA Geotechnical, Inc.
1000 N Coast Highway #10
Laguna Beach, California
sageotechnical.com

CPT-1S

Project: **Meritage/3150 Bear St.**
Location: **Costa Mesa, CA**

Total depth: 50.14 ft, Date: 2/12/2024
Cone Operator: Kehoe Testing & Engineering



SBTn legend

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

SA Geotechnical, Inc.
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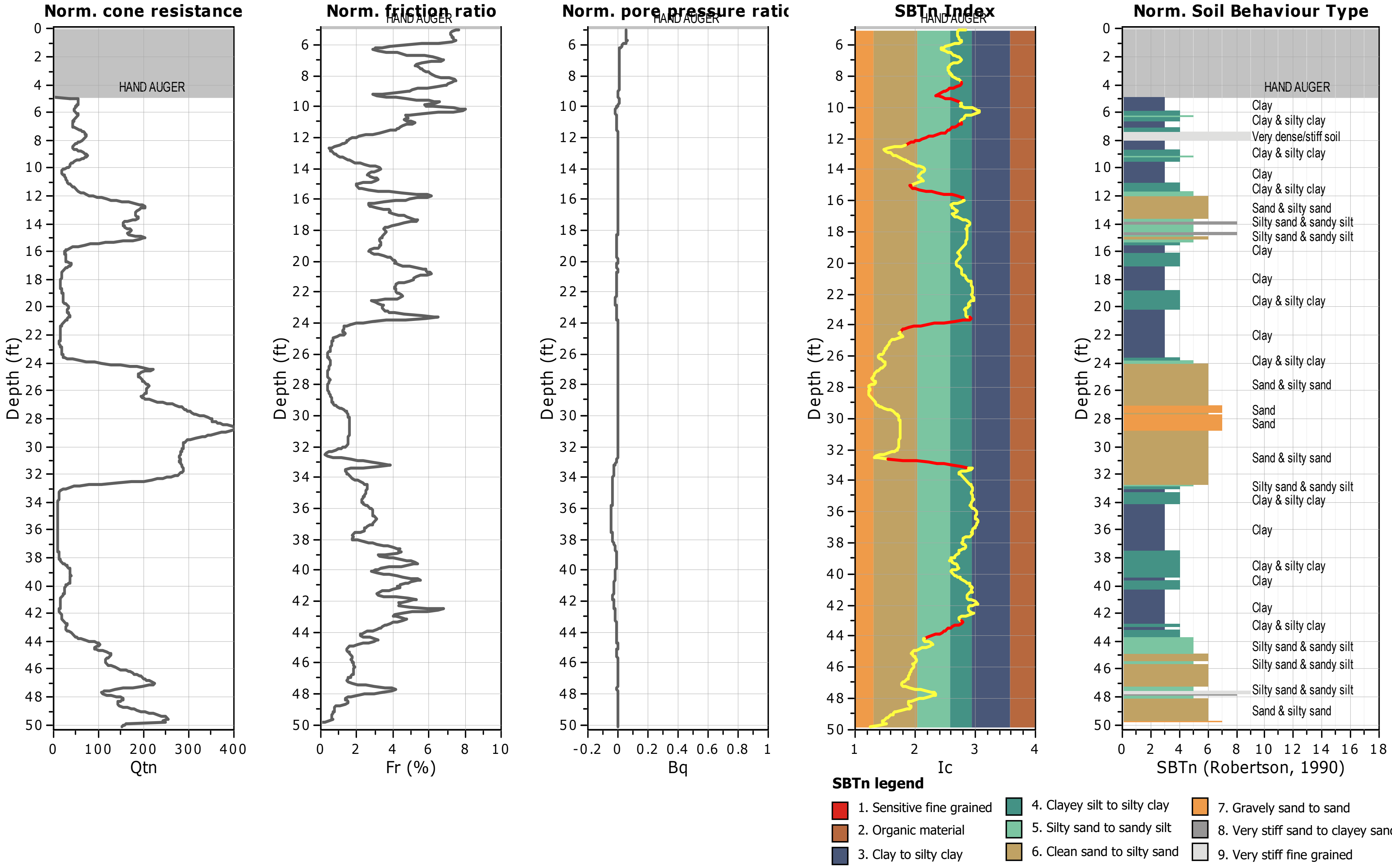
Laguna Beach, California
sageotechnical.com

CPT-2S

Project: Meritage/3150 Bear St.
Location: Costa Mesa, CA

Total depth: 50.14 ft, Date: 2/12/2024
Cone Operator: Kehoe Testing & Engineering



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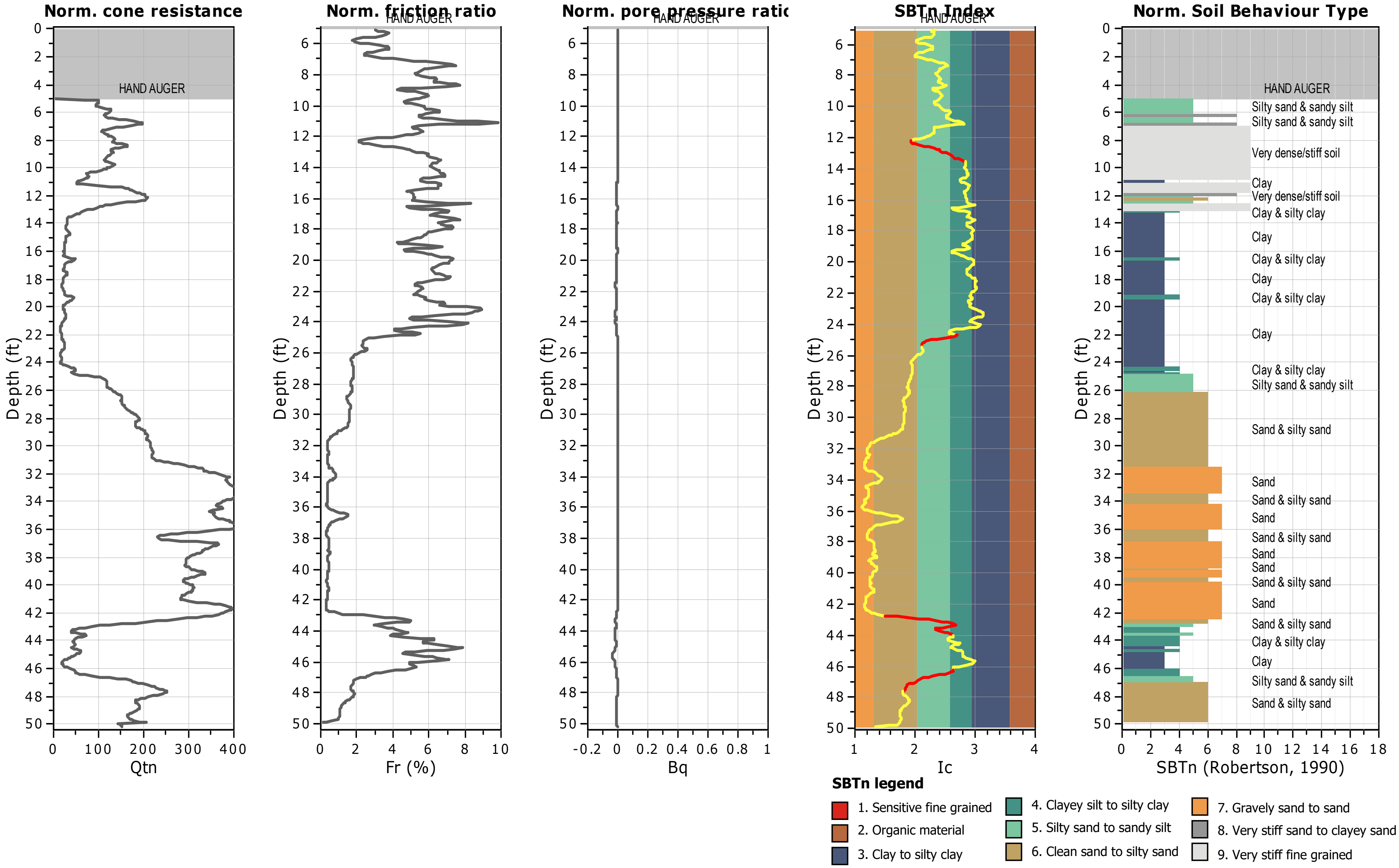
CPT-3S

Project: Meritage/3150 Bear St.
Location: Costa Mesa, CA

Total depth: 50.20 ft, Date: 2/12/2024
Cone Operator: Kehoe Testing & Engineering



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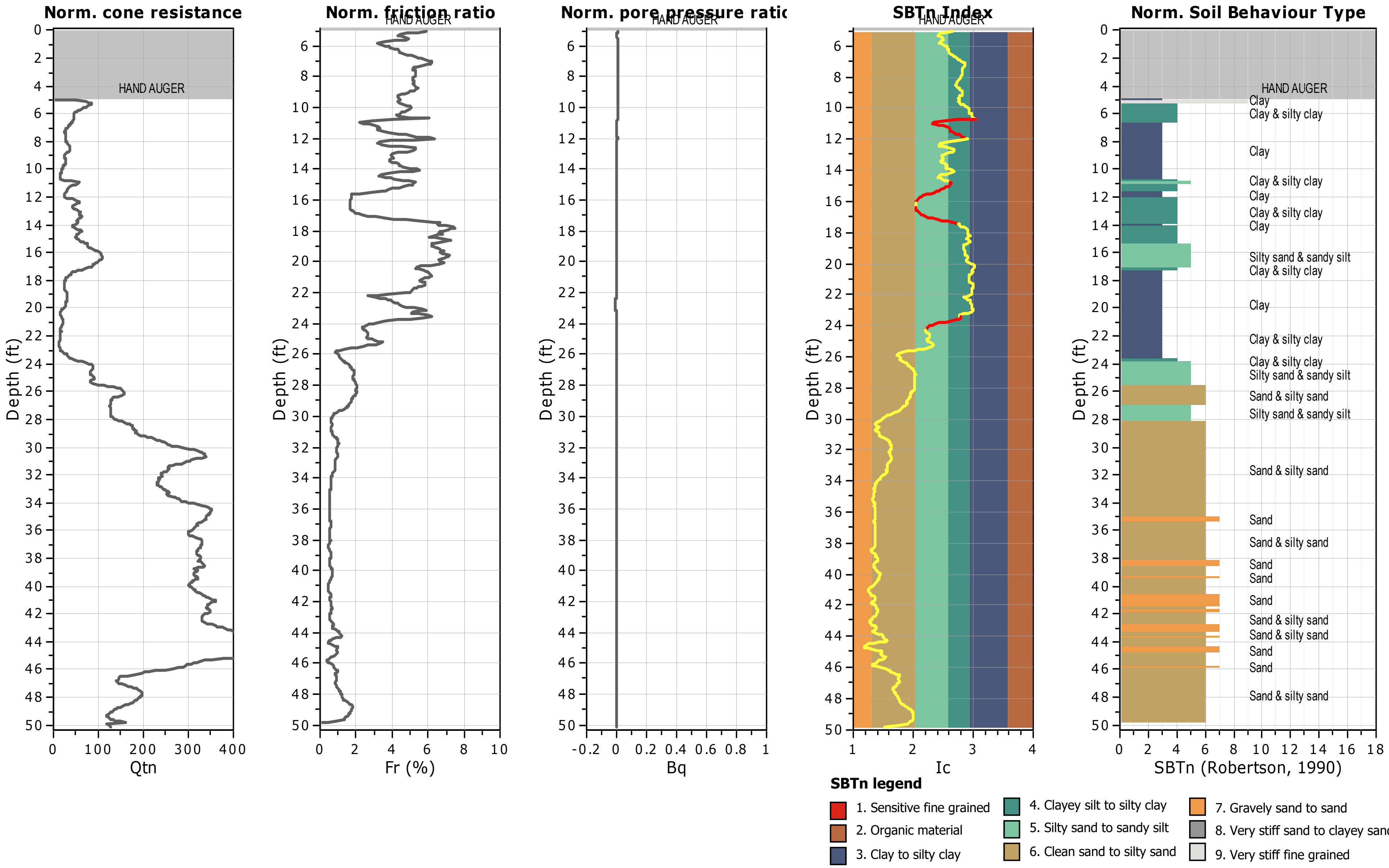
CPT-4S

Project: Meritage/3150 Bear St.

Location: Costa Mesa, CA

Total depth: 50.14 ft, Date: 2/12/2024

Cone Operator: Kehoe Testing & Engineering



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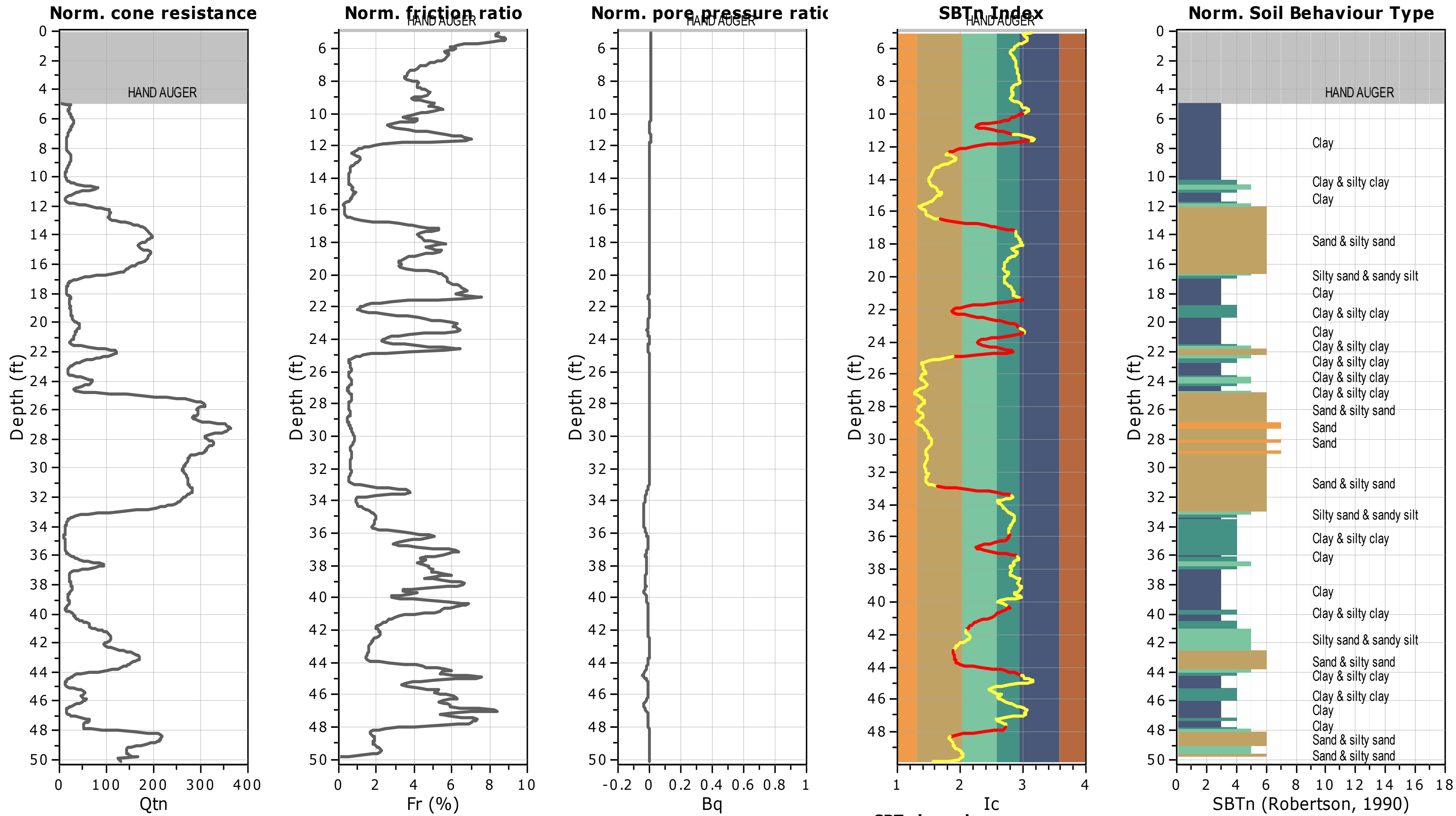
CPT-5S

Project: Meritage/3150 Bear St.
Location: Costa Mesa, CA

Total depth: 50.14 ft, Date: 2/12/2024
Cone Operator: Kehoe Testing & Engineering



SBTn legend

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

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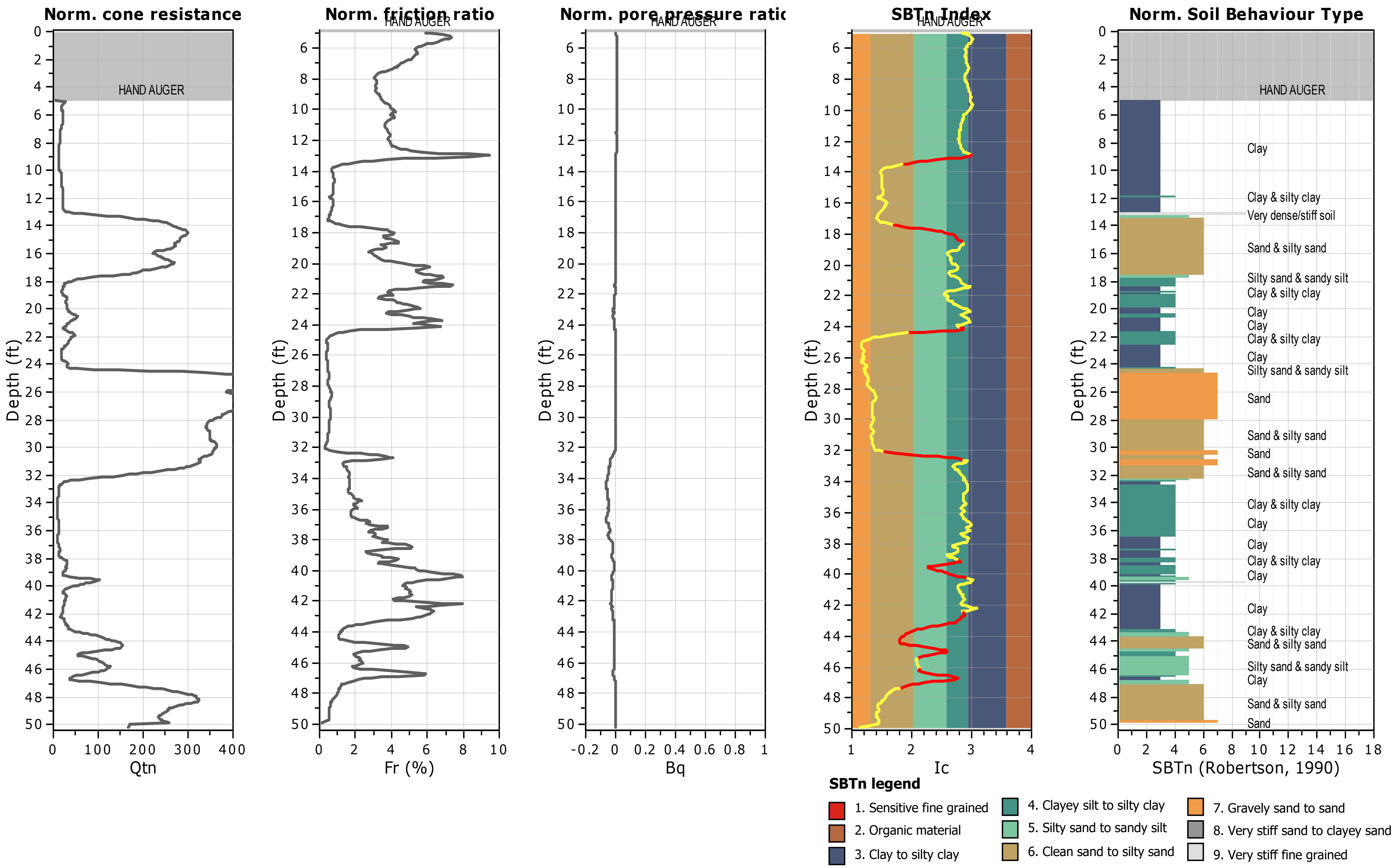
CPT-6S

Project: Meritage/3150 Bear St.
Location: Costa Mesa, CA

Total depth: 50.20 ft, Date: 2/12/2024
Cone Operator: Kehoe Testing & Engineering



Boring & CPT Logs by GMU Geotechnical, Inc.

(2019)

MAJOR DIVISIONS			Group Letter	Symbol	TYPICAL NAMES
COARSE-GRAINED SOILS More Than 50% Retained On No.200 Sieve Based on The Material Passing The 3-Inch (75mm) Sieve. Reference: ASTM Standard D2487	**GRAVELS** 50% or More of Coarse Fraction Retained on No.4 Sieve	Clean Gravels	GW		Well Graded Gravels and Gravel-Sand Mixtures, Little or No Fines.
			GP		Poorly Graded Gravels and Gravel-Sand Mixtures Little or No Fines.
		Gravels With Fines	GM		Silty Gravels, Gravel-Sand-Silt Mixtures.
			GC		Clayey Gravels, Gravel-Sand-Clay Mixtures.
	SANDS More Than 50% of Coarse Fraction Passes No.4 Sieve	Clean Sands	SW		Well Graded Sands and Gravelly Sands, Little or No Fines.
			SP		Poorly Graded Sands and Gravelly Sands, Little or No Fines.
		Sands With Fines	SM		Silty Sands, Sand-Silt Mixtures.
			SC		Clayey Sands, Sand-Clay Mixtures.
FINE-GRAINED SOILS 50% or More Passe The No.200 Sieve Based on The Material Passing The 3-Inch (75mm) Sieve. Reference: ASTM Standard D2487	**SILTS AND CLAYS** Liquid Limit Less Than 50%		ML		Inorganic Silts, Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts With Slight Plasticity.
			CL		Inorganic Clays of Low To Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays.
			OL		Organic Silts and Organic Silty Clays of Low Plasticity
	SILTS AND CLAYS Liquid Limit 50% or Greater		MH		Inorganic Silts, Micaceous or Diatomaceous Fine Sandy or Silty Soils, Elastic Silts.
			CH		Inorganic Clays of High Plasticity, Fat Clays.
			OH		Organic Clays of Medium To High Plasticity, Organic Silts.
HIGHLY ORGANIC SOILS			PT		Peat and Other Highly Organic Soils.

The descriptive terminology of the logs is modified from current ASTM Standards to suit the purposes of this study

ADDITIONAL TESTS

DS = Direct Shear
HY = Hydrometer Test
TC = Triaxial Compression Test
UC = Unconfined Compression
CN = Consolidation Test
(T) = Time Rate
EX = Expansion Test
CP = Compaction Test
PS = Particle Size Distribution
EI = Expansion Index
SE = Sand Equivalent Test
AL = Atterberg Limits
FC = Chemical Tests
RV = Resistance Value
SG = Specific Gravity
SU = Sulfates
CH = Chlorides
MR = Minimum Resistivity
pH
(N) = Natural Undisturbed Sample
(R) = Remolded Sample
CS = Collapse Test/Swell-Settlement

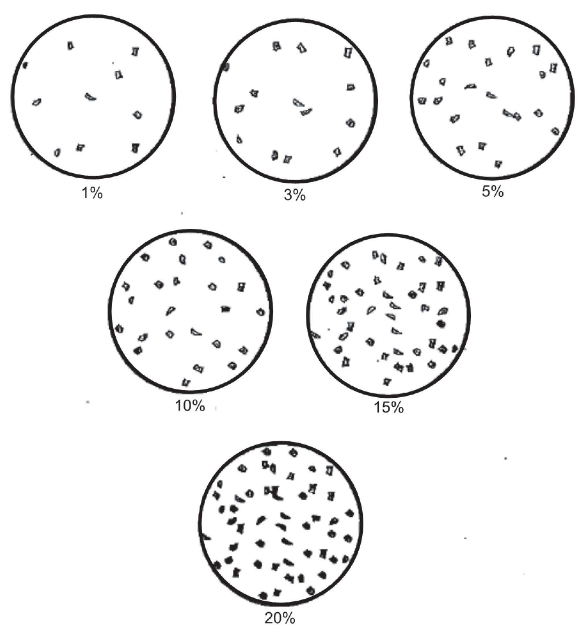
GEOLOGIC NOMENCLATURE

B = Bedding C = Contact J = Joint
F = Fracture Flt = Fault S = Shear
RS = Rupture Surface = Seepage
= Groundwater

SAMPLE SYMBOLS

Undisturbed Sample (California Sample)
Undisturbed Sample (Shelby Tube)
Bulk Sample
Unsuccessful Sampling Attempt
SPT Sample

10: 10 Blows for 12-Inches Penetration
6/4: 6 Blows Per 4-Inches Penetration
P: Push
(13): Uncorrected Blow Counts ("N" Values) for 12-Inches Penetration- Standard Penetration Test (SPT)



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LEGEND TO LOGS
ASTM Designation: D 2487
(Based on Unified Soil Classification System)

Plate
A-1

SOIL DENSITY/CONSISTENCY

FINE GRAINED

Consistency	Field Test	SPT (#blows/foot)	Mod (#blows/foot)
Very Soft	Easily penetrated by thumb, exudes between fingers	<2	<3
Soft	Easily penetrated one inch by thumb, molded by fingers	2-4	3-6
Firm	Penetrated over 1/2 inch by thumb with moderate effort	4-8	6-12
Stiff	Penetrated about 1/2 inch by thumb with great effort	8-15	12-25
Very Stiff	Readily indented by thumbnail	15-30	25-50
Hard	Indented with difficulty by thumbnail	>30	>50

COARSE GRAINED

Density	Field Test	SPT (#blows/foot)	Mod (#blows/foot)
Very Loose	Easily penetrated with 0.5" rod pushed by hand	<4	<5
Loose	Easily penetrated with 0.5" rod pushed by hand	4-10	5-12
Medium Dense	Easily penetrated 1' with 0.5" rod driven by 5lb hammer	10-30	12-35
Dense	Dificult to penetrat 1' with 0.5" rod driven by 5lb hammer	31-50	35-60
Very Dense	Penetrated few inches with 0.5" rod driven by 5lb hammer	>50	>60

BEDROCK HARDNESS

Density	Field Test	SPT (#blows/foot)
Soft	Can be crushed by hand, soil like and structureless	1-30
Moderately Hard	Can be grooved with fingernails, crumbles with hammer	30-50
Hard	Can't break by hand, can be grooved with knife	50-100
Very Hard	Scratches with knife, chips with hammer blows	>100

MODIFIERS

Trace	1%
Few	1-5%
Some	5-12%
Numerous	12-20%
Abundant	>20%

GRAIN SIZE

Description		Sieve Size	Grain Size	Approximate Size
Boulders		>12"	>12"	Larger than a basketball
Cobbles		3-12"	3-12"	Fist-sized to basketball-sized
Gravel	Coarse	3/4-3"	3/4-3"	Thumb-sized to fist-sized
	Fine	#4-3/4"	0.19-0.75"	Pea-sized to thumb-sized
Sand	Coarse	#10-#4	0.079-0.19"	Rock-salt-sized to pea-sized
	Medium	#40-#10	0.017-0.079"	Sugar-sized to rock salt-sized
	Fine	#200-#40	0.0029-0.017"	Flour-sized to sugar-sized
Fines		passing #200	<0.0029"	Flour-sized and smaller

MOISTURE CONTENT

Dry- Very little or no moisture
Damp- Some moisture but less than optimum
Moist- Near optimum
Very Moist- Above optimum
Wet/Saturated- Contains free moisture

GMU GEOTECHNICAL, INC.

LEGEND TO LOGS

Plate **A-2**

Project: EF International Language Campus **Project Location:** 3150 Bear Street, Costa Mesa **Project Number:** 18-252-00	**Log of Drill Hole DH- 1** Sheet 1 of 2

Date(s) Drilled	**1/2/19**	Logged By	**AAV**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling, Inc.**	Total Depth of Drill Hole	**30.9 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**34.7**
Groundwater Depth [Elevation], feet	**20.5 [14.2]**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Bentonite Chips and Native**
Remarks				Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	NUMBER OF BLOWS / 6"	DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			TOPSOIL some rootlets		SILTY CLAY (CL); olive brown with white and olive mottling, moist, firm to stiff, some fine to medium grained sand, some fine gravel						
			YOUNG AXIAL CHANNEL DEPOSITS (Qya)		FAT CLAY (CH); olive brown with white and olive mottling, moist, firm to stiff, some fine to medium grained sand, some fine gravel		4 8 8	140	21	101	
30	5		some caliche		stiff		4 5 8	140	38	82	
			increase in caliche				7 11 13	140	30	89	
25	10				becomes olive with orange root stains, trace fine to medium grained sand		8 8 10	140	28	94	
					SILTY CLAY (CL); yellowish brown, moist, stiff		5 5 10	140	16	113	
					POORLY GRADED SAND WITH SILT (SP-SM); yellowish brown with orange staining, moist, medium dense, sand is very fine to fine grained						
20	15				sand becomes fien to medium grained with some coarse grained sand, some fine gravel with trace coarse gravel		8 10 13	140	4		
			some caliche		SILTY CLAY (CL); olive brown, very moist to wet, stiff, trace gravel						
15											

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			some caliche		▽		11 16 22	140	20	107	
10	25						6 19 25	140			
					SILTY SAND (SM); yellowish brown, wet, medium dense to dense, sand is fine to medium grained with coarse grained, some fine gravel						
					POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); yellowish brown, wet, very dense, sand is medium to coarse grained, gravel is fine to coarse						
5	30						26 50/5"	140	8	136	
					Total Depth = 30.92 ft Groundwater encountered at 20.5 ft below ground surface						

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

Project: EF International Language Campus **Project Location:** 3150 Bear Street, Costa Mesa **Project Number:** 18-252-00	**Log of Drill Hole DH- 2** Sheet 1 of 2

Date(s) Drilled	**1/2/19**	Logged By	**AAV**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling, Inc.**	Total Depth of Drill Hole	**31.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**35.3**
Groundwater Depth [Elevation], feet	**18.3 [16.9]**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Bentonite Chips and Native**
Remarks				Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
35			**TOPSOIL** some rootlets		LEAN CLAY (CL); brown to dark brown with some orange mottling, moist to very moist, stiff						
			YOUNG AXIAL CHANNEL DEPOSITS (Qya) some rootlets, some caliche		FAT CLAY (CH); brown to dark brown with some orange mottling, moist to very moist, stiff						
							5 7 12	140	23	99	
30	5						5 6 9	140	28	92	
					brown, moist, stiff, some fine grained sand						
					becomes brown with orange and black mottling		8 11 14	140	15	117	
25	10				becomes light brown with some very fine grained sand pockets		6 7 12	140	21	106	
					SANDY SILT (ML); light brown with orange staining, damp to moist, stiff, sand is very fine grained, few fine gravel		8 11 13	140	17	115	
			some caliche		CLAYEY SILT (ML); light brown, moist, stiff, some very fine grained sand pockets						
20	15				SANDY CLAY (CL); light brown with orange mottling and white veins, moist, stiff		9 10 12	140	26	100	
					▽						

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Drill Hole DH- 2

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
15					no white veins, becomes very moist, some fine grained sand		3 4 7	140			
10	25				SILTY SAND (SM); light yellowish brown, wet, dense, sand is very fine to fine grained with trace coarse sand		13 16 29	140	17	114	
					POORLY GRADED SAND (SP) with GRAVEL; light brown, wet, medium dense to dense, sand is fine to medium grained with some coarse grained sand, some fine to coarse gravel						
5	30						12 14 19	140			
					Total Depth = 31.5 ft Groundwater encountered at 18.33 ft below ground surface						

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

Project: EF International Language Campus Project Location: 3150 Bear Street, Costa Mesa Project Number: 18-252-00	**Log of Drill Hole DH- 3** Sheet 1 of 1

Date(s) Drilled	**1/2/19**	Logged By	**AAV**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling, Inc.**	Total Depth of Drill Hole	**5.0 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**34.7**
Groundwater Depth [Elevation], feet	**N/A []**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Native**
Remarks	**Infiltration test location**			Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			TOPSOIL some rootlets, some caliche		SILTY CLAY (CL); dark brown with some orange mottling, moist, stiff, trace fine to medium grained sand						
			YOUNG AXIAL CHANNEL DEPOSITS (Qya)		SILTY CLAY (CL); dark brown with some orange mottling, moist, stiff, trace fine to medium grained sand						
							6 6 13	140	19	108	
30	5										
					Total Depth = 5 ft No groundwater encountered Performed infiltration testing at this location						

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

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Project: EF International Language Campus Project Location: 3150 Bear Street, Costa Mesa Project Number: 18-252-00	**Log of Drill Hole DH- 4** Sheet 1 of 2

Date(s) Drilled	1/4/19	Logged By	MTF	Checked By	NS
Drilling Method	Hollow Stem Auger	Drilling Contractor	2R Drilling, Inc.	Total Depth of Drill Hole	31.5 feet
Drill Rig Type	CME 75	Diameter(s) of Hole, inches	8	Approx. Surface Elevation, ft MSL	34.7
Groundwater Depth [Elevation], feet	20.0 [14.7]	Sampling Method(s)	Open drive sampler with 6-inch sleeve, SPT, and bulk samples	Drill Hole Backfill	Bentonite Chips and Native
Remarks				Driving Method and Drop	140lb hammer, 30" drop

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			TOPSOIL some rootlets		SILTY CLAY (CL); brown, very moist, firm to stiff, with trace fine to medium grained sand						
			YOUNG AXIAL CHANNEL DEPOSITS		FAT CLAY (CH); brown, very moist, firm to stiff, with trace fine to medium grained sand						
					brown, gray, and dark gray, very moist, stiff		4 6 9	140	24	99	
30	5						7 8 13	140	28	86	
			some caliche		becomes light gray		7 9 11	140	32	84	
25	10		numerous caliche		SILTY CLAY (CL); light brown, very moist, stiff		8 10 11	140	17	113	
					LEAN CLAY (CL); light gray and white, very moist, very stiff		8 10 18	140	17	108	
20	15		numerous concretions		SITLY CLAY (CL); light brown, very moist, stiff		4 6 8	140			
15					▽						

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Drill Hole DH- 4

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
							11 14 17	140	16	112	
10	25				CLAYEY SAND (SC); brown and light brown, very moist to saturated, dense, sand is fine to medium grained		6 12 22	140			
					POORLY GRADED SAND (SP); light brown, saturated, dense to very dense, sand is medium grained						
5	30						8 22 38	140	16	118	
					Total Depth = 31.0 ft Groundwater Encountered at 20.0 ft below ground surface						

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

Project: EF International Language Campus **Project Location:** 3150 Bear Street, Costa Mesa **Project Number:** 18-252-00	**Log of Drill Hole DH- 5** Sheet 1 of 2

Date(s) Drilled	**1/4/19**	Logged By	**MTF**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling, Inc.**	Total Depth of Drill Hole	**31.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**34.7**
Groundwater Depth [Elevation], feet	**20.7 [14.0]**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Bentonite Chips and Native**
Remarks				Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			TOPSOIL some rootlets		SILTY CLAY (CL); brown, very moist, firm to stiff, with some fine to medium grained sand						
			YOUNG AXIAL CHANNEL DEPOSITS		SILTY CLAY (CL); brown, very moist, firm to stiff, with some fine to medium grained sand						
					CLAYEY SAND (SC); orangeish brown, moist to very moist, medium dense, fine to medium grained sand with trace coarse grained sand		9 10 13	140	10	105	
30	5				SILTY CLAY (CL); light brown, damp to moist, very stiff, with some fine grained sand		15 15 29	140	6	120	
							10 14 24	140	11	124	
25	10				CLAYEY SAND (SC); light brown, moist to very moist, medium dense, medium grained sand		12 11 13	140	8	114	
					SILTY SAND (SM); light gray, very moist, very stiff, with some fine grained sand		9 12 16	140	5	107	
20	15		numerous caliche		SILTY CLAY (CL); light gray, very moist to saturated, stiff		5 7 12	140	20	104	
15											

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

Log of Drill Hole DH- 5

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE	NUMBER OF BLOWS / 6"	DRIVING WEIGHT, lbs	MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
					▽		7 10 13	140	26	95	
10	25				becomes saturated		8 10 10	140			
					POORLY GRADED SAND WITH SILT (SP-SM); white, gray, and black, saturated, medium dense, medium grained sand						
5	30						4 7 13	140			
					Total Depth = 31.5 ft Groundwater encountered at 20.7 ft below ground surface						

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

Project: EF International Language Campus Project Location: 3150 Bear Street, Costa Mesa Project Number: 18-252-00	**Log of Drill Hole DH- 6** Sheet 1 of 1

Date(s) Drilled	1/2/19	Logged By	MTF	Checked By	NS
Drilling Method	Hand Auger	Drilling Contractor	Earthworks Techniques, Inc.	Total Depth of Drill Hole	5.8 feet
Drill Rig Type	N/A	Diameter(s) of Hole, inches	3	Approx. Surface Elevation, ft MSL	36.0
Groundwater Depth [Elevation], feet	N/A []	Sampling Method(s)	Open drive sampler with 6-inch sleeve, SPT, and bulk samples	Drill Hole Backfill	Native
Remarks				Driving Method and Drop	140lb hammer, 30" drop

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			TOPSOIL		CLAYEY SAND (SC); brown, moist, medium dense, sand is fine to medium grained						
35			**YOUNG AXIAL CHANNEL DEPOSITS (Qya)**		SANDY CLAY (CL); brown, moist, stiff, sand is fine to medium grained						
					becomes orangish brown, moist to wet				15	107	
					becomes very moist, sand is fine to coarse grained						
	5				FAT CLAY (CH); dark grayish brown, very moist, stiff to very stiff				30	77	
					Total Depth = 5.83 ft No groundwater encountered						

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

Project: EF International Language Campus Project Location: 3150 Bear Street, Costa Mesa Project Number: 18-252-00	# Log of Drill Hole DH- 7 Sheet 1 of 1

Date(s) Drilled	**1/2/19**	Logged By	**AAV**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling, Inc.**	Total Depth of Drill Hole	**5.0 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**33.5**
Groundwater Depth [Elevation], feet	**N/A**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Native**
Remarks	**Infiltration test location**			Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			TOPSOIL some rootlets		SILTY CLAY (CL); brown to dark gray with white and orange mottling, moist, stiff						
30			**YOUNG AXIAL CHANNEL DEPOSITS (Qya)**		FAT CLAY (CH); brown to dark gray with white and orange mottling, moist, stiff		4 7 11	140	39	82	
	5				Total Depth = 5 ft No groundwater encountered Performed infiltration testing at this location						

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

Drill Hole DH- 7

Project: EF International Language Campus Project Location: 3150 Bear Street, Costa Mesa Project Number: 18-252-00	**Log of Drill Hole DH- 8** Sheet 1 of 1

Date(s) Drilled	1/2/19	Logged By	MTF	Checked By	NS
Drilling Method	Hand Auger	Drilling Contractor	Earthworks Techniques, Inc.	Total Depth of Drill Hole	5.7 feet
Drill Rig Type	N/A	Diameter(s) of Hole, inches	3	Approx. Surface Elevation, ft MSL	35.4
Groundwater Depth [Elevation], feet	N/A []	Sampling Method(s)	Open drive sampler with 6-inch sleeve, SPT, and bulk samples	Drill Hole Backfill	Native
Remarks				Driving Method and Drop	140lb hammer, 30" drop

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	NUMBER OF BLOWS / 6"	DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
35			**TOPSOIL**		CLAYEY SAND (SC); brown, damp to moist, medium dense, sand is fine to medium grained						
			YOUNG AXIAL CHANNEL DEPOSITS (Qya) some rootlets		SANDY CLAY (CL); brown to light brown, very moist, sand is fine grained, highly plastic				23	94	
					becomes light yellowish brown, with siltstone fragments						
30	5				FAT CLAY (CH); dark grayish black, moist, stiff to very stiff				15	90	
					Total Depth = 5.67 ft No groundwater encountered						

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

Drill Hole DH- 8

Project: EF International Language Campus Project Location: 3150 Bear Street, Costa Mesa Project Number: 18-252-00	**Log of Drill Hole DH- 9** Sheet 1 of 1

Date(s) Drilled	1/2/19	Logged By	AAV	Checked By	NS
Drilling Method	Hollow Stem Auger	Drilling Contractor	2R Drilling, Inc.	Total Depth of Drill Hole	5.0 feet
Drill Rig Type	CME 75	Diameter(s) of Hole, inches	8	Approx. Surface Elevation, ft MSL	34.0
Groundwater Depth [Elevation], feet	N/A []	Sampling Method(s)	Open drive sampler with 6-inch sleeve, SPT, and bulk samples	Drill Hole Backfill	Native
Remarks	Infiltration test location			Driving Method and Drop	140lb hammer, 30" drop

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			TOPSOIL some rootlets, some caliche		SILTY CLAY (CL); dark brown with some orange mottling, moist, stiff, trace fine to medium grained sand						
30			**YOUNG AXIAL CHANNEL DEPOSITS (Qya)**		SILTY CLAY (CL); dark brown with some orange mottling, moist, stiff, trace fine to medium grained sand	X					
	5				Total Depth = 5 ft No groundwater encountered Performed infiltration testing at this location						

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

Project: EF International Language Campus **Project Location: 3150 Bear Street, Costa Mesa** **Project Number: 18-252-00**	# Log of Drill Hole DH-10 Sheet 1 of 2

Date(s) Drilled	**1/2/19**	Logged By	**AAV**	Checked By	**NS**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**2R Drilling, Inc.**	Total Depth of Drill Hole	**31.5 feet**
Drill Rig Type	**CME 75**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**34.6**
Groundwater Depth [Elevation], feet	**18.5 [16.1]**	Sampling Method(s)	**Open drive sampler with 6-inch sleeve, SPT, and bulk samples**	Drill Hole Backfill	**Bentonite Chips and Native**
Remarks				Driving Method and Drop	**140lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			PORTLAND CEMENT CONCRETE (PCC)		PORTLAND CEMENT CONCRETE (PCC) = 6-inches						
			AGGREGATE BASE (AB)		AGGREGATE BASE (AB); 3/4-inch crushed aggregate, dry to damp, very dense, subangular to angular, significant fines						
			YOUNG AXIAL CHANNEL DEPOSITS (Qya)								
					SILTY CLAY (CL); brown to dark brown, damp to moist, stiff, some fine to coarse grained sand, some fine to coarse gravel becomes dark gray		14 8 10	140	11	98	
					becomes brown						
30	5						7 7 17	140	21	104	
					becomes light gray, dry to damp, no sand or gravel						
					becomes gray with orange staining, some fine to medium grained sand		10 10 13	140	10	122	
25	10				becomes brown with orange staining, few fine gravel		10 13 20	140	10	124	
					CLAYEY SAND (SC); orangish brown, damp, dense, sand is fine to medium grained with coarse grained sand, some fine to coarse gravel		12 15 21	140	4	119	
20	15				SANDY CLAY (CL) with GRAVEL; yellowish brown, moist, dense to very dense, sand is fine to coarse grained, gravel is fine to coarse		13 22 29	140	11	122	
					∇						
15											

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

Project: EF International Language Campus	Log of Drill Hole DH-10
Project Location: 3150 Bear Street, Costa Mesa	Sheet 2 of 2
Project Number: 18-252-00	

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
					CLAYEY SAND (SC); yellowish brown, wet, dense, sand is fine to coarse grained, some fine gravel		14 23 23	140			
10	25				GRAVELLY SAND (SG) with CLAY; yellowish brown, wet, very dense, sand is medium to coarse grained, gravel is fine to coarse		32 50/5"	140	11	130	
5	30				POORLY GRADED SAND (SP) with SILT; grayish brown, wet, medium dense, sand is very fine to fine grained		7 12 10	140			
					Total Depth = 31.5 ft Groundwater encountered at 18.5 ft below ground surface						

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

Drill Hole DH-10

Project: EF International Language Campus **Project Location:** 3150 Bear Street, Costa Mesa **Project Number:** 18-252-00	**Log of Drill Hole DH-11** Sheet 1 of 2

Date(s) Drilled	1/2/19	Logged By	AAV	Checked By	NS
Drilling Method	Hollow Stem Auger	Drilling Contractor	2R Drilling, Inc.	Total Depth of Drill Hole	31.5 feet
Drill Rig Type	CME 75	Diameter(s) of Hole, inches	8	Approx. Surface Elevation, ft MSL	33.7
Groundwater Depth [Elevation], feet	18.9 [14.8]	Sampling Method(s)	Open drive sampler with 6-inch sleeve, SPT, and bulk samples	Drill Hole Backfill	Bentonite Chips and Native
Remarks				Driving Method and Drop	140lb hammer, 30" drop

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
			TOPSOIL some rootlets		SILTY CLAY (CL); dark brown, damp, firm to stiff, some fine to medium grained sand						
			YOUNG AXIAL CHANNEL DEPOSITS (Qya)		SILTY CLAY (CL); dark brown, damp, firm to stiff, some fine to medium grained sand		4 5 7	140	14	118	
30					SANDY CLAY (CL); reddish brown, damp, firm, sand is very fine to fine grained						
	5				SILTY CLAY (CL); reddish brown, moist, firm, some very fine to fine grained sand		3 5 6	140			
25					SANDY CLAY (CL); yellowish brown, moist to very moist, stiff, sand is very fine to fine grained		6 12 12	140	14	114	
	10						6 9 11	140			
20					CLAYEY SAND (SM); light yellowish brown, damp, medium dense, sand is very fine to fine grained		9 12 15	140	8	110	
	15				CLAYEY SILT (ML); light olive brown, moist to very moist, firm		4 5 7	140			
15					SILTY SAND (SM); light yellowish brown, wet, medium dense, sand is very fine to fine grained ∇						

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

Drill Hole DH-11

Log of Drill Hole DH-11

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
							7 9 14	140	21	110	
					SILTY CLAY (CL); ligth yellowish brown with orange staining, wet, stiff, trace fine gravel						
10	25				becomes very moist		5 12 15	140			
5	30				POORLY GRADED SAND (SP); light yellowish brown, wet, dense, sand is fine grained with medium grained sand		7 14 26	140	22	102	
					Total Depth = 31.5 ft Groundwater encountered at 18.92 ft below ground surface						

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

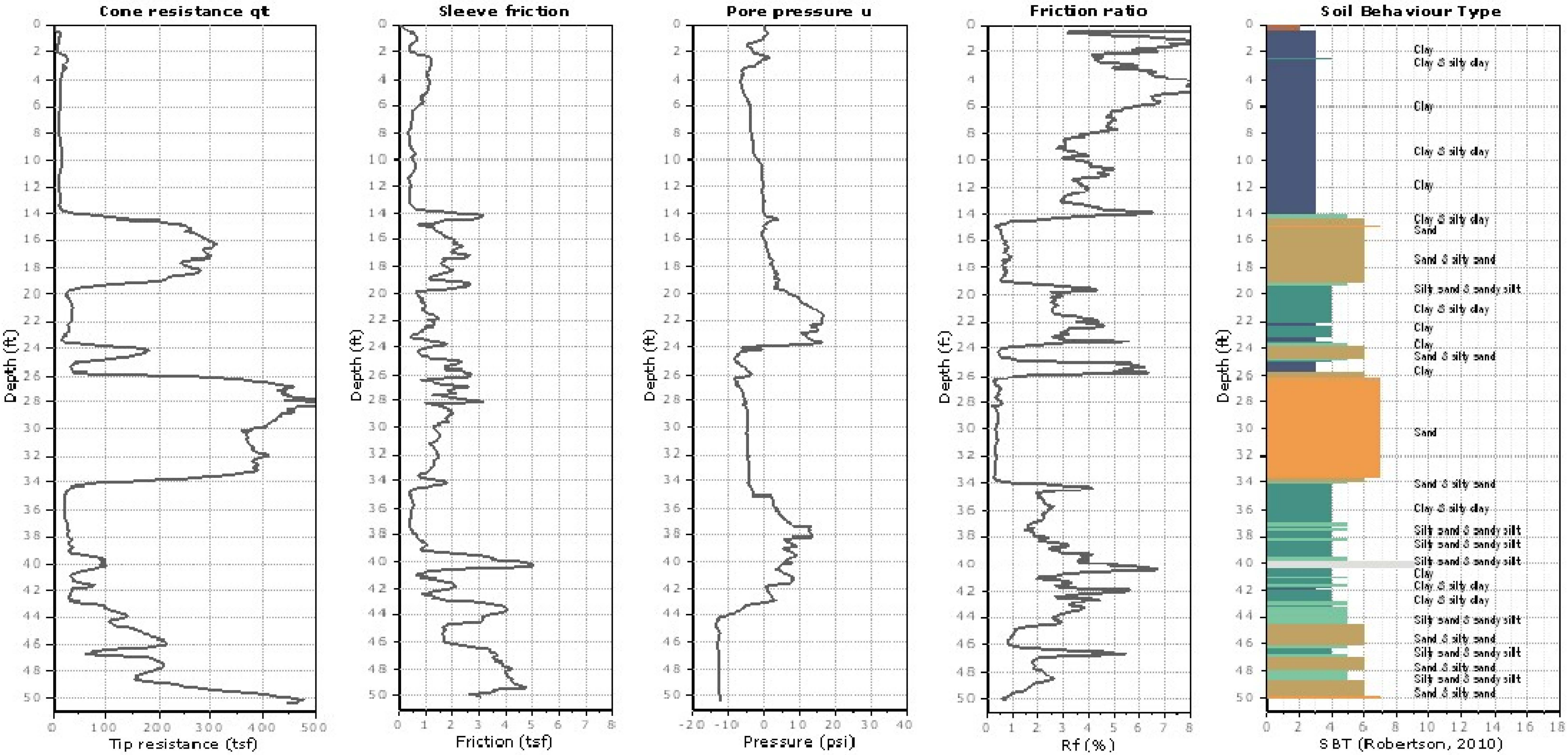
CPT-1

Project: GMU Geotechnical / EF International

Location: 3150 Bear St, Costa Mesa, CA

Total depth: 50.46 ft, Date: 1/2/2019

Cone Type: Vertek



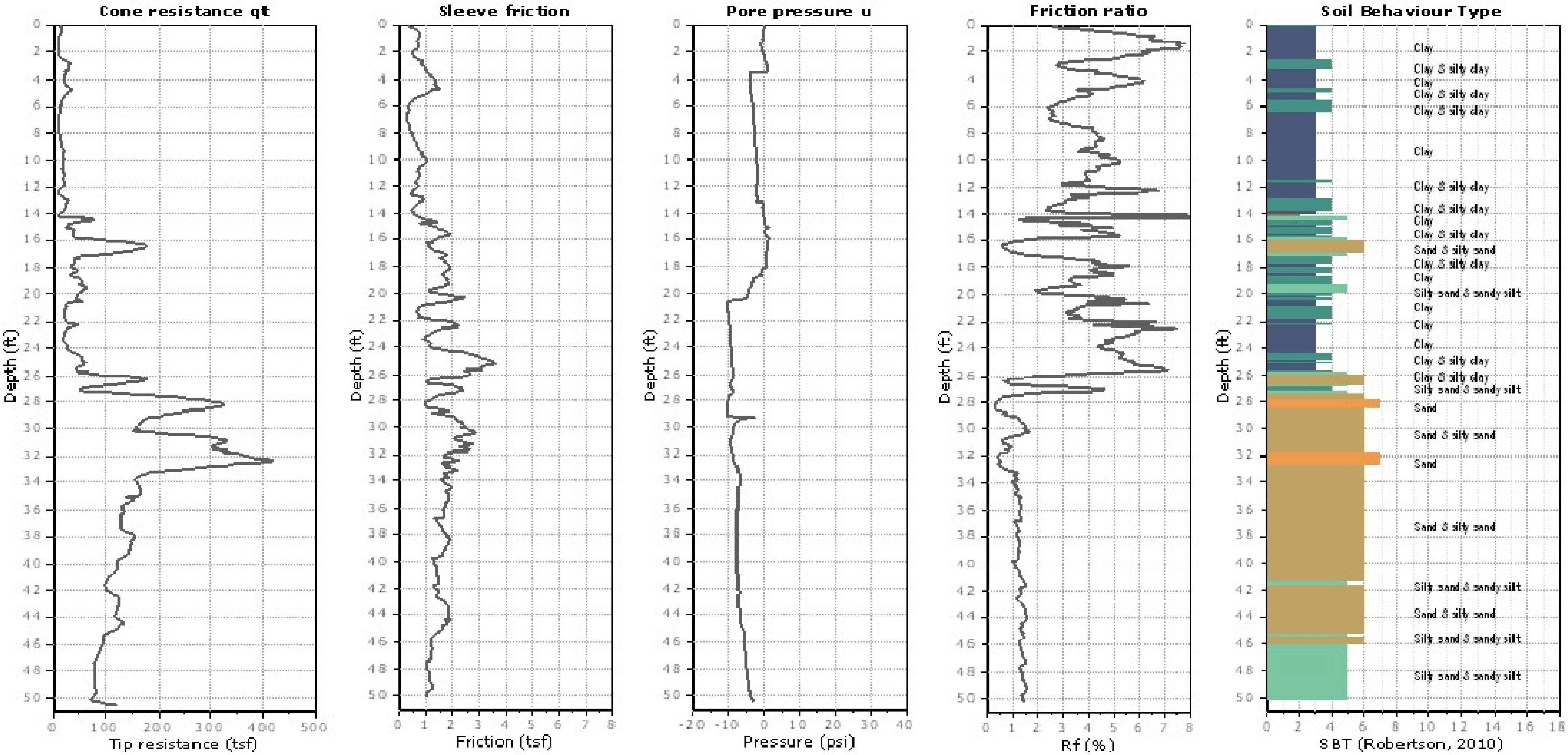
Project file:

Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

CPT-2A

Project: GMU Geotechnical / EF International
Location: 3150 Bear St, Costa Mesa, CA

Total depth: 50.54 ft, Date: 1/2/2019
Cone Type: Vertek



Kehoe Testing and Engineering
714-901-7270
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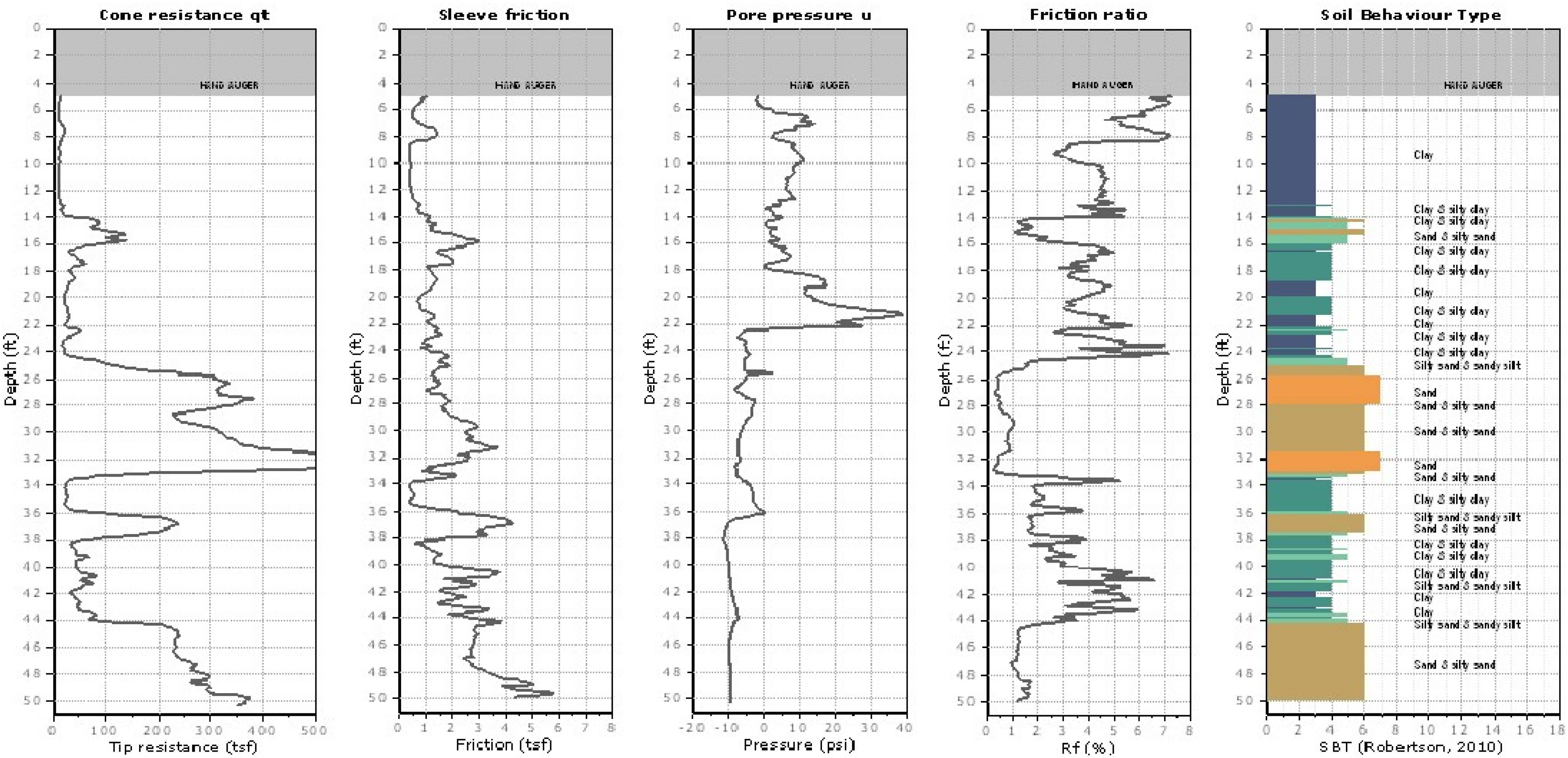
www.kehoetesting.com

CPT-3A

Project: GMU Geotechnical / EF International
Location: 3150 Bear St, Costa Mesa, CA

Total depth: 50.34 ft, Date: 1/2/2019
Cone Type: Vertek



Kehoe Testing and Engineering
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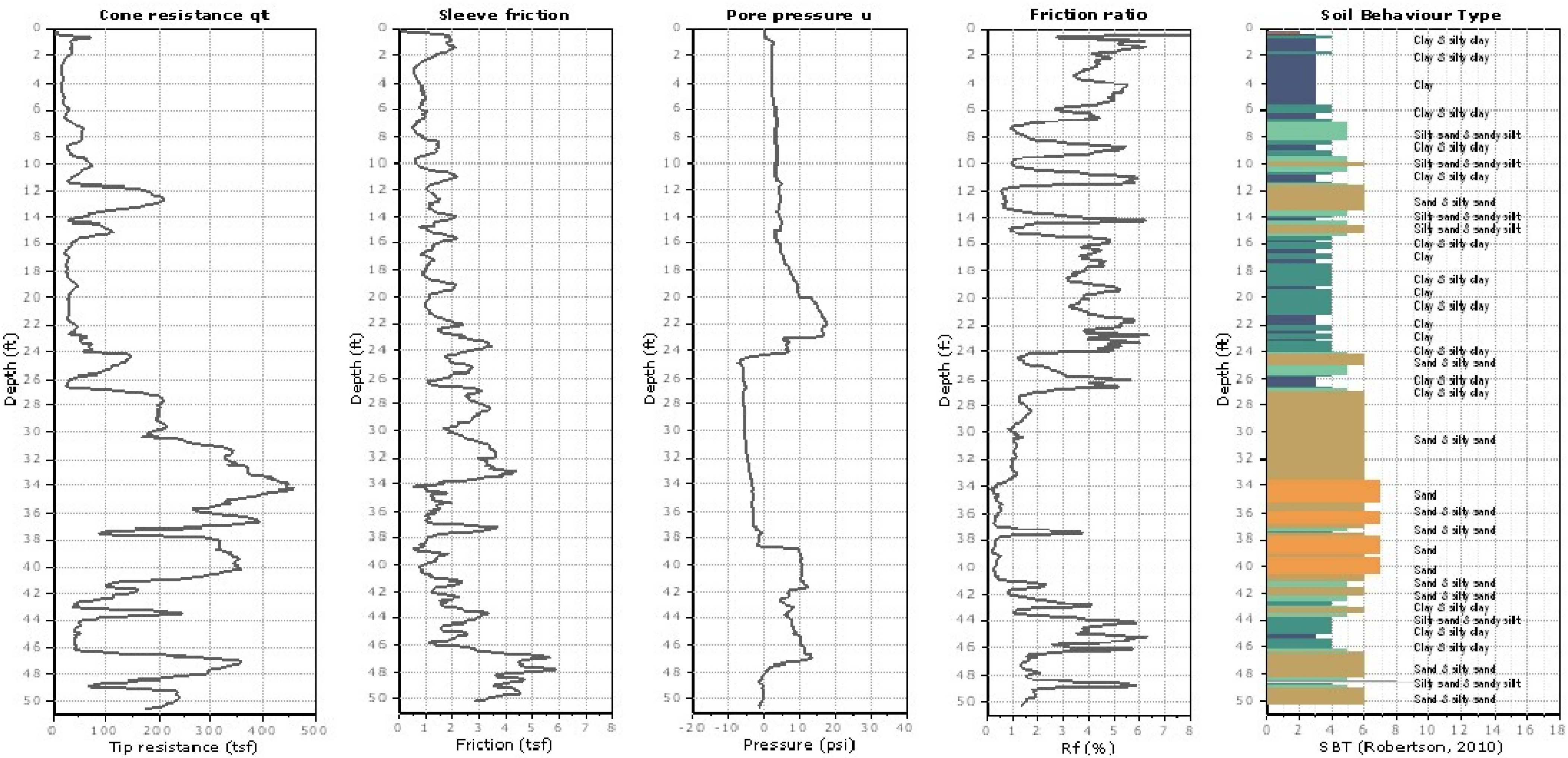
CPT-4

Project: **GMU Geotechnical / EF International**
Location: **3150 Bear St, Costa Mesa, CA**

Total depth: 50.61 ft, Date: 1/2/2019
Cone Type: Vertek



Appendix C

Laboratory Test Results
by GMU Geotechnical, Inc.
(2019)

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			Geologic Unit	USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, pcf	In Situ Satur-ation, %	Sieve/Hydrometer				Atterberg Limits			Compaction		Expansion Index	R-Value	Chemical Test Results			
Boring Number	Depth, feet	Elevation, feet						Gravel, %	Sand, %	<#200, %	<2μ, %	LL	PL	PI	Maximum Dry Unit Weight, pcf	Optimum Water Content, %			pH	Sulfate (ppm)	Chloride (ppm)	Min. Resistivity (ohm/cm)
DH- 1	0	34.7	Qya	CL													121		7.8	68	696	692
DH- 1	2.5	32.2	Qya	CH	21.3	101	89															
DH- 1	5	29.7	Qya	CH	38.1	82	99															
DH- 1	7.5	27.2	Qya	CH	30.3	89	93															
DH- 1	10	24.7	Qya	CH	28.3	94	100															
DH- 1	12.5	22.2	Qya	CL	15.6	113	89															
DH- 1	15	19.7	Qya	SP-SM	4.0			11	78	11	5	NP	NP	NP								
DH- 1	20	14.7	Qya	CL	20.5	107	99															
DH- 1	30	4.7	Qya	SP-SM	8.1	136	97															
DH- 2	0	35.3	Qal/Qt	CL											113.5	15.5						
DH- 2	2.5	32.8	Qya	CH	23.2	99	93															
DH- 2	5	30.3	Qya	CH	28.0	92	93					61	21	40								
DH- 2	7.5	27.8	Qya	CH	15.2	117	96															
DH- 2	10	25.3	Qya	CH	20.6	106	99															
DH- 2	12.5	22.8	Qya	ML	16.5	115	100															
DH- 2	15	20.3	Qya	CL	26.3	100	106															
DH- 2	25	10.3	Qya	SM	17.4	114	101															
DH- 3	2.5	32.2	Qya	CL	19.4	108	97															
DH- 4	0	34.7	Qya	CL													129		7.4	2943	936	515
DH- 4	2.5	32.2	Qya	CH	24.3	99	96															
DH- 4	5	29.7	Qya	CH	28.4	86	81	0	3	97	69	97	31	66								
DH- 4	7.5	27.2	Qya	CH	32.1	84	88															
DH- 4	10	24.7	Qya	CL	17.0	113	97															
DH- 4	12.5	22.2	Qya	CL	17.0	108	86															
DH- 4	20	14.7	Qya	CL	16.2	112	91															

Project: EF International Language Campus
Project No. 18-252-00

GMU
GEOTECHNICAL, INC.

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			Geologic Unit	USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, pcf	In Situ Satur-ation, %	Sieve/Hydrometer				Atterberg Limits			Compaction		Expansion Index	R-Value	Chemical Test Results			
Boring Number	Depth, feet	Elevation, feet						Gravel, %	Sand, %	<#200, %	<2µ, %	LL	PL	PI	Maximum Dry Unit Weight, pcf	Optimum Water Content, %			pH	Sulfate (ppm)	Chloride (ppm)	Min. Resistivity (ohm/cm)
DH- 4	30	4.7	Qya	SP	15.6	118	102															
DH- 5	0	34.7	Qya	CL											114.0	14.0	120		8.5	443	696	692
DH- 5	2.5	32.2	Qya	CL	9.9	105	45															
DH- 5	5	29.7	Qya	CL	5.9	120	41															
DH- 5	7.5	27.2	Qya	CL	11.1	124	87															
DH- 5	10	24.7	Qya	SC	7.6	114	45															
DH- 5	12.5	22.2	Qya	SM	5.4	107	26															
DH- 5	15	19.7	Qya	CL	20.4	104	93															
DH- 5	20	14.7	Qya	CL	26.2	95	94															
DH- 5	30	4.7	Qya	SP-SM				0	90	10	5											
DH- 6	2.5	33.5	Qya	CL	15.0	107	72															
DH- 6	5	31.0	Qya	CH	29.5	77	68															
DH- 7	2.5	31.0	Qya	CH	38.8	82	101															
DH- 8	2.5	32.9	Qya	CL	22.5	94	78															
DH- 8	5	30.4	Qya	CH	15.5	90	49															
DH- 9	0	34.0	Qya	CL														8				
DH-10	0	34.6	Qya	CL											124.0	11.5						
DH-10	2.5	32.1	Qya	CL	10.7	98	41															
DH-10	5	29.6	Qya	CL	21.2	104	94															
DH-10	7.5	27.1	Qya	CL	10.4	122	77															
DH-10	10	24.6	Qya	CL	10.2	124	80															
DH-10	12.5	22.1	Qya	SC	4.1	119	28															
DH-10	15	19.6	Qya	CL	10.9	122	81															
DH-10	25	9.6	Qya	SG	10.5	130	103															
DH-11	2.5	31.2	Qya	CL	14.2	118	93															

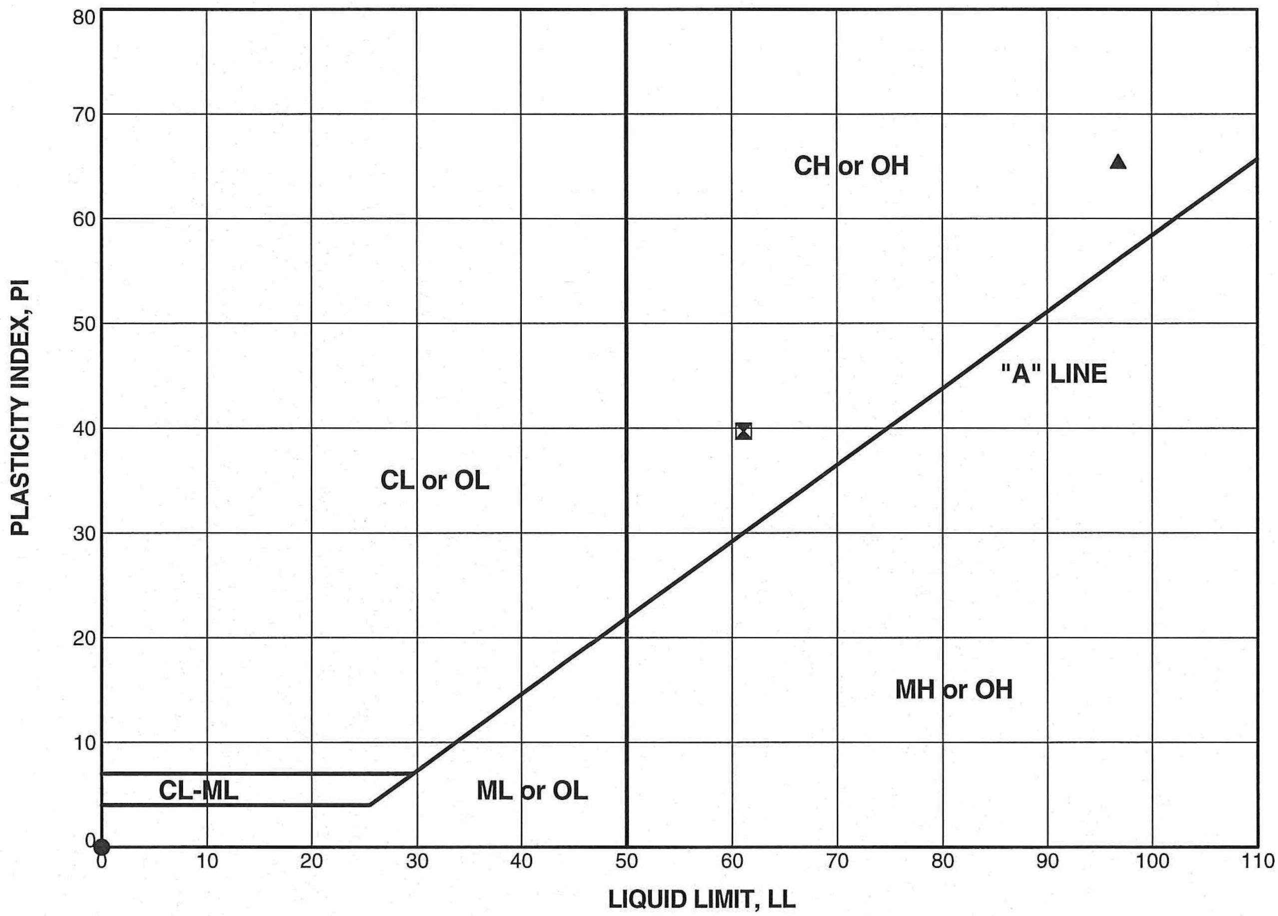
Project: EF International Language Campus
Project No. 18-252-00

GMU GEOTECHNICAL, INC.

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information								Sieve/Hydrometer				Atterberg Limits			Compaction				Chemical Test Results			
Boring Number	Depth, feet	Elevation, feet	Geologic Unit	USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, pcf	In Situ Satur- ation, %	Gravel, %	Sand, %	<#200, %	<2µ, %	LL	PL	PI	Maximum Dry Unit Weight, pcf	Optimum Water Content, %	Expansion Index	R-Value	pH	Sulfate (ppm)	Chloride (ppm)	Min. Resistivity (ohm/cm)
DH-11	7.5	26.2	Qya	CL	14.0	114	83															
DH-11	12.5	21.2	Qya	SC	8.5	110	44															
DH-11	20	13.7	Qya	SM	20.9	110	109															
DH-11	30	3.7	Qya	SP	22.2	102	95															

GMU_TABLE_SOIL_LAB_DATA 18-252-00.GPJ FNC AB GWGN01.GDT 1/30/19



Boring Number	Depth (feet)	Geologic Unit	Test Symbol	Water Content (%)	LL	PL	PI	Classification
DH- 1	15.0	Qya	●	4	NP	NP	NP	POORLY GRADED SAND WITH SILT (SP-SM)
DH- 2	5.0	Qya	⊠	28	61	21	40	FAT CLAY (CH)
DH- 4	5.0	Qya	▲	28	97	31	66	FAT CLAY (CH)

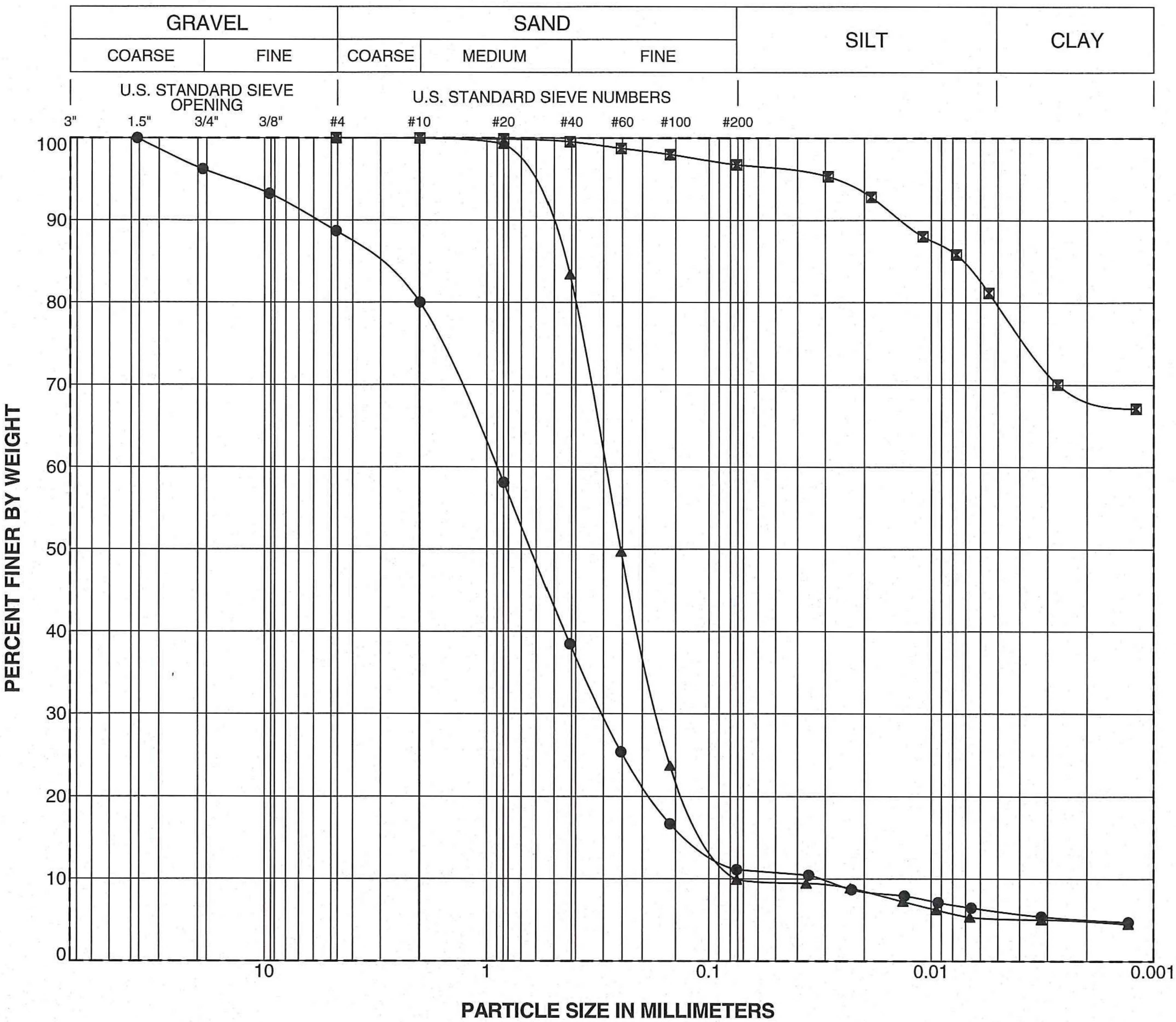
GMU_ATTERBERG_LIMITS_12 PTS 18-252-00.GPJ GM&U.GDT 1/30/19

ATTERBERG LIMITS

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.



Boring Number	Depth (feet)	Geologic Unit	Symbol	LL	PI	Classification
DH- 1	15.0	Qya	●	NP	NP	POORLY GRADED SAND WITH SILT (SP-SM)
DH- 4	5.0	Qya	⊠	97	66	FAT CLAY (CH)
DH- 5	30.0	Qya	▲			POORLY GRADED SAND WITH SILT (SP-SM)

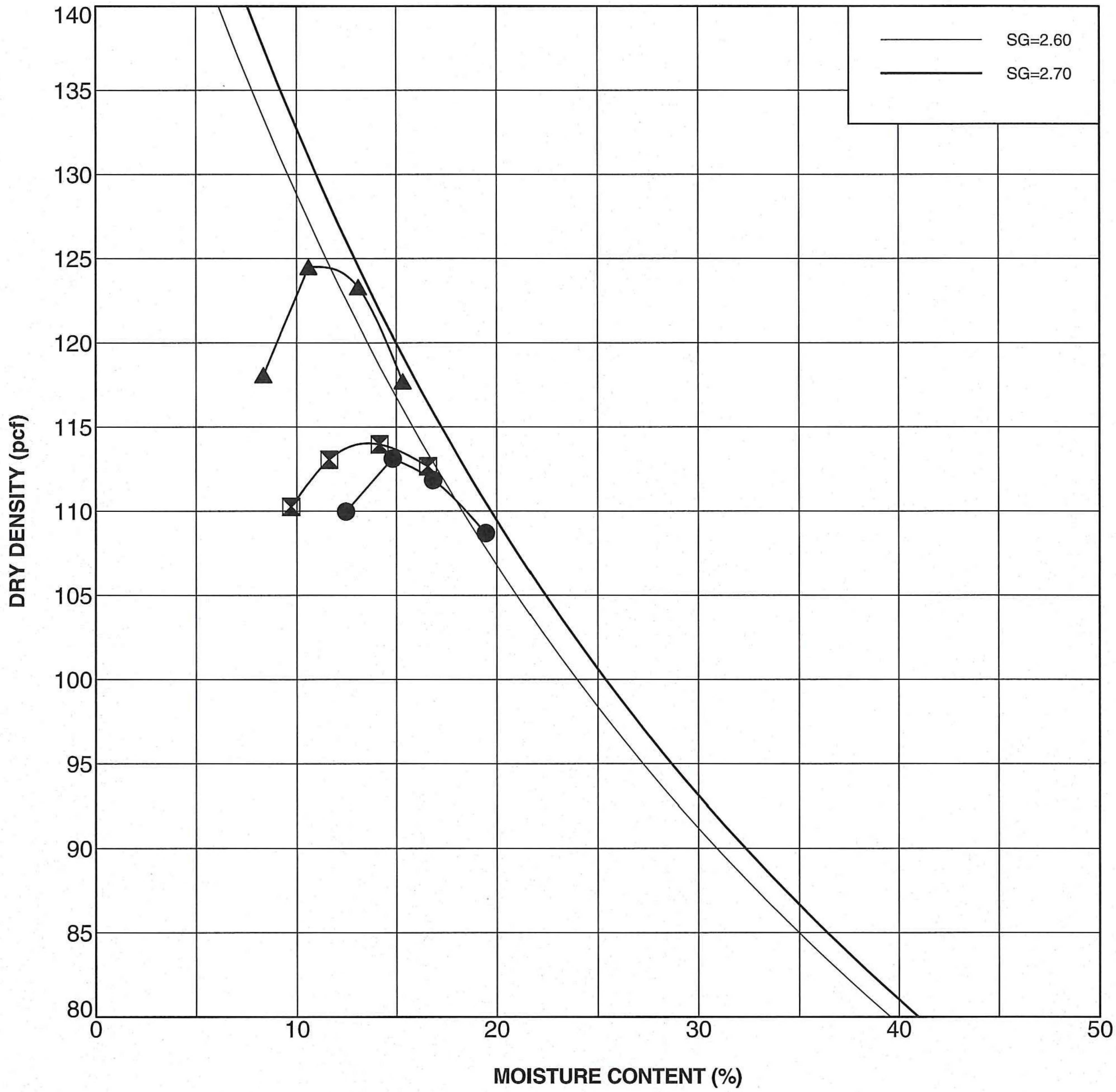
GMU_GRAIN_SIZE 18-252-00.GPJ 1/30/19

PARTICLE SIZE DISTRIBUTION

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.



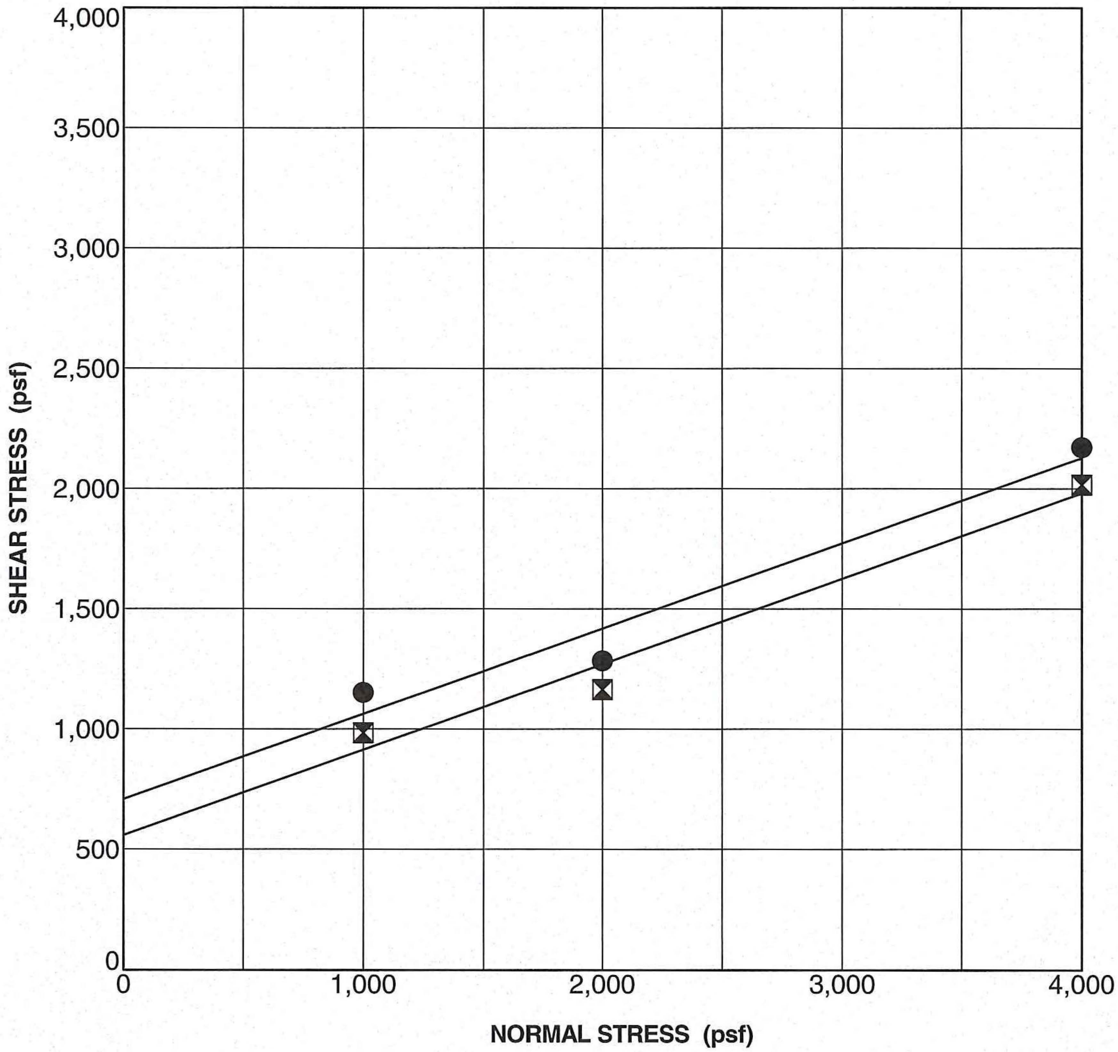
Boring Number	Depth (feet)	Geologic Unit	Symbol	Maximum Dry Density, pcf	Optimum Moisture Content, %	Classification
DH- 2	0.0	Qal/Qt	●	113.5	15.5	LEAN CLAY (CL)
DH- 5	0.0	Qya	⊠	114	14	SILTY CLAY (CL)
DH-10	0.0	Qya	▲	124	11.5	SITLY CLAY (CL)

GMU_COMPACTION_4_SETS 18-252-00.GPJ 1/30/19

COMPACTION TEST DATA

Project: EF International Language Campus
Project No. 18-252-00

GMU GEOTECHNICAL, INC.



SAMPLE AND TEST DESCRIPTION
Sample Location: DH- 1 @ 2.5 ft **Geologic Unit:** Qya **Classification:** FAT CLAY (CH)
Strain Rate (in/min): 0.005 **Sample Preparation:** Undisturbed
Notes: Sample saturated prior and during shearing

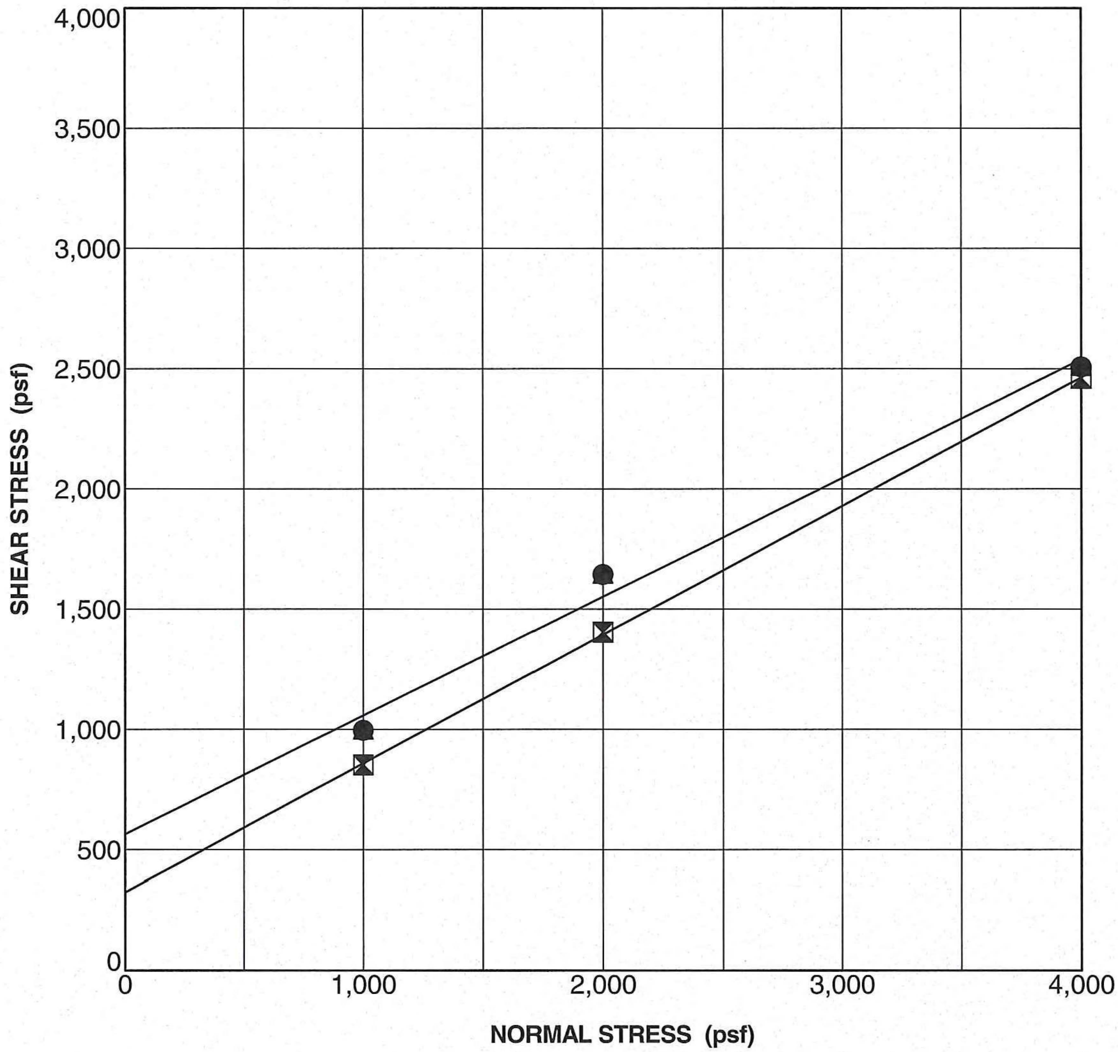
STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	708	19.5
⊠ Ultimate Strength	558	19.5

SHEAR TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.



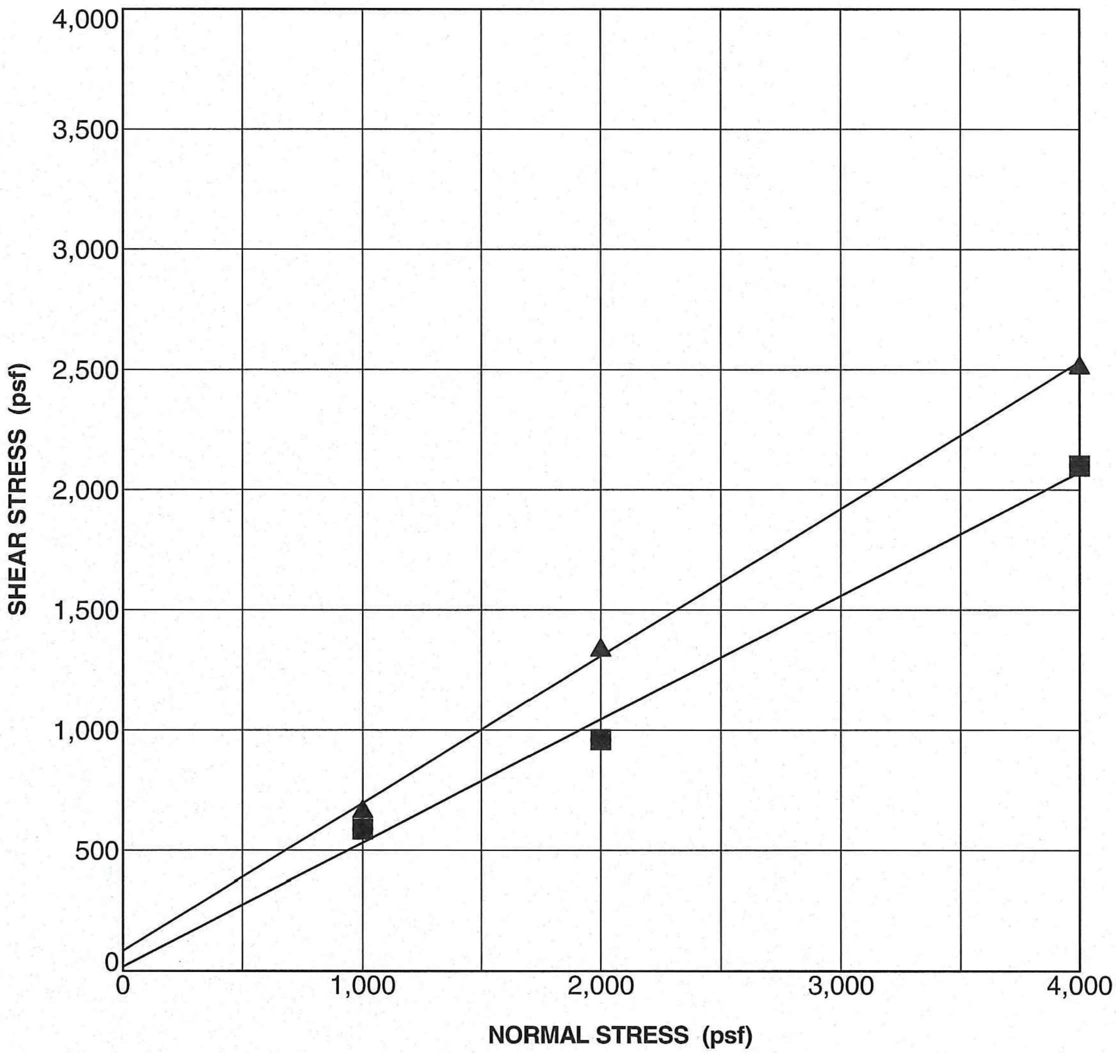
SAMPLE AND TEST DESCRIPTION		
Sample Location: DH- 4 @ 0.0 ft	**Geologic Unit:** Qya	**Classification:** SILTY CLAY (CL)
Strain Rate (in/min): 0.005	**Sample Preparation:** Remolded	
Notes:		

STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	564	26.0
⊠ Ultimate Strength	324	28.1

SHEAR TEST DATA

Project: EF International Language Campus
Project No. 18-252-00

GMU GEOTECHNICAL, INC.



SAMPLE AND TEST DESCRIPTION
Sample Location: DH- 5 @ 5.0 ft **Geologic Unit:** Qya **Classification:** SILTY CLAY (CL)
Strain Rate (in/min): 0.005 **Sample Preparation:** Undisturbed
Notes: Sample saturated prior and during shearing

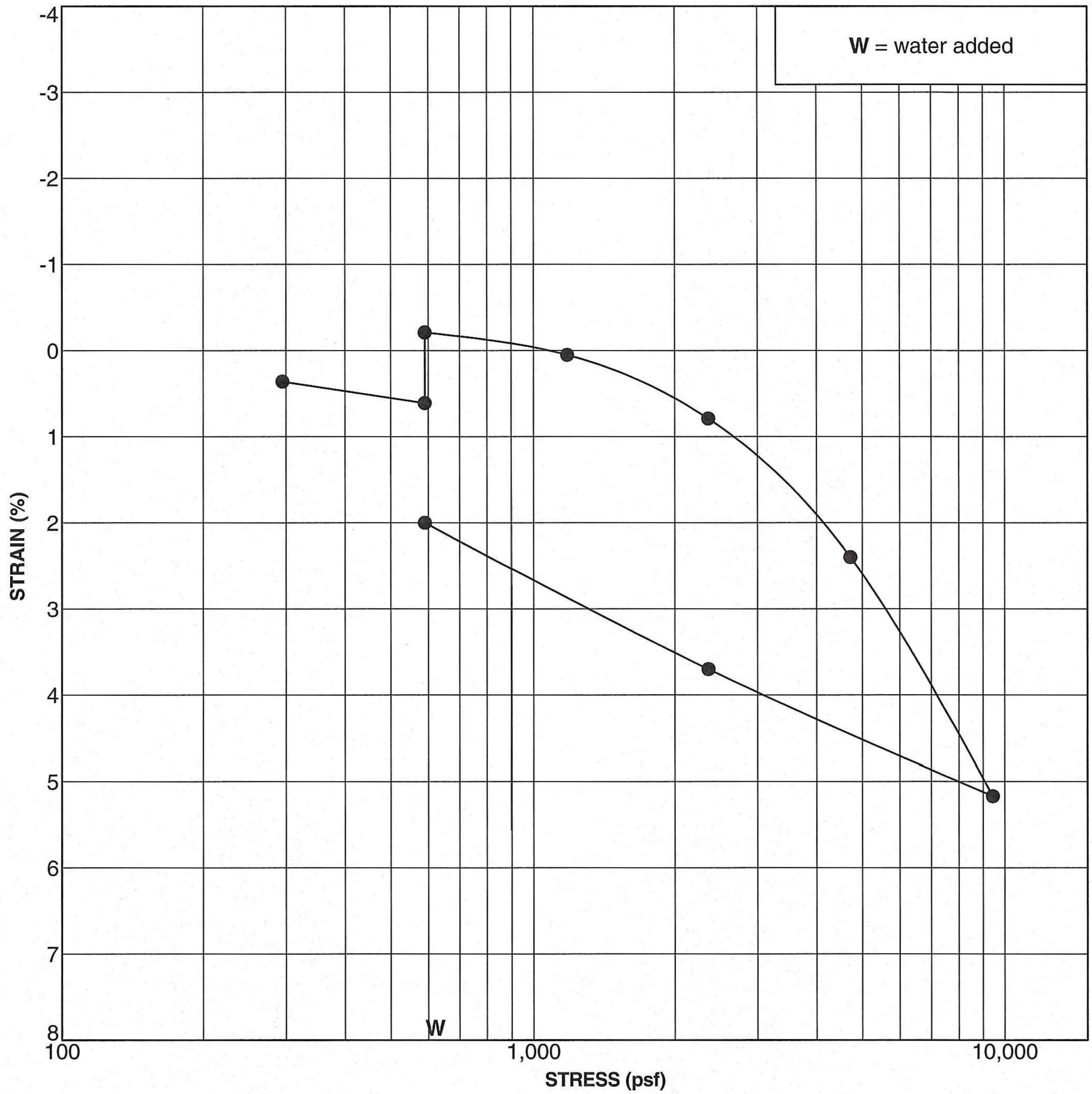
STRENGTH PARAMETERS		
STRENGTH TYPE	COHESION (psf)	FRICTION ANGLE (degrees)
● Peak Strength	84	31.0
⊠ Ultimate Strength	18	27.0

GMU_DIRECT_SHEAR 18-252-00.GPJ GM&U.GDT 1/30/19

SHEAR TEST DATA

Project: EF International Language Campus
Project No. 18-252-00

GMU GEOTECHNICAL, INC.



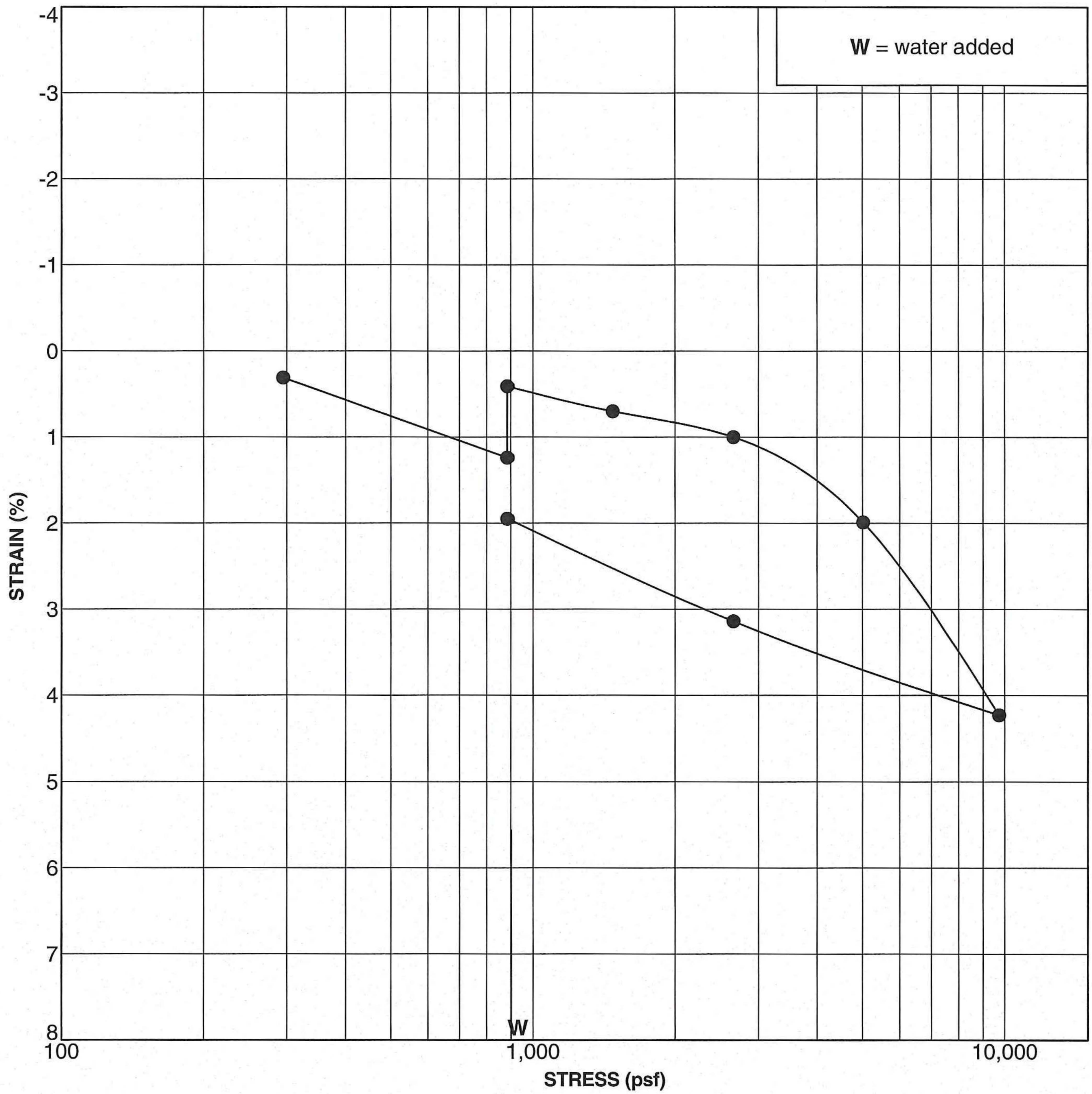
Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH- 1	5.0	Qya	●	In Situ	-0.82	FAT CLAY (CH)

GMU_CONSOL 18-252-00.GPJ GM&U.GDT 1/30/19

CONSOLIDATION TEST DATA

Project: EF International Language Campus
Project No. 18-252-00

GMU GEOTECHNICAL, INC.



GMU_CONSOL 18-252-00.GPJ GM&U.GDT 1/30/19

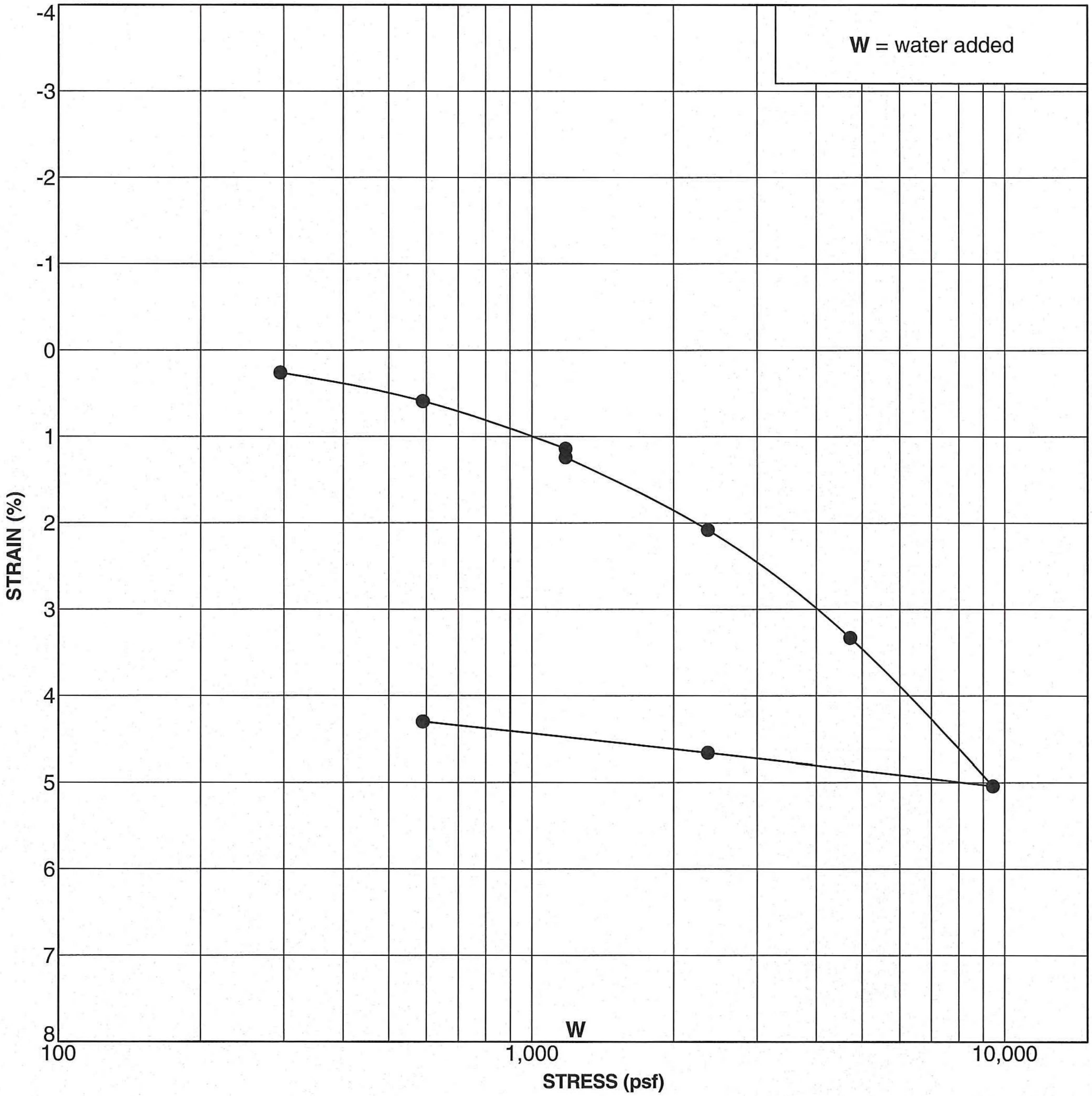
Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH- 1	7.5	Qya	●	In Situ	-0.83	FAT CLAY (CH)

CONSOLIDATION TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.

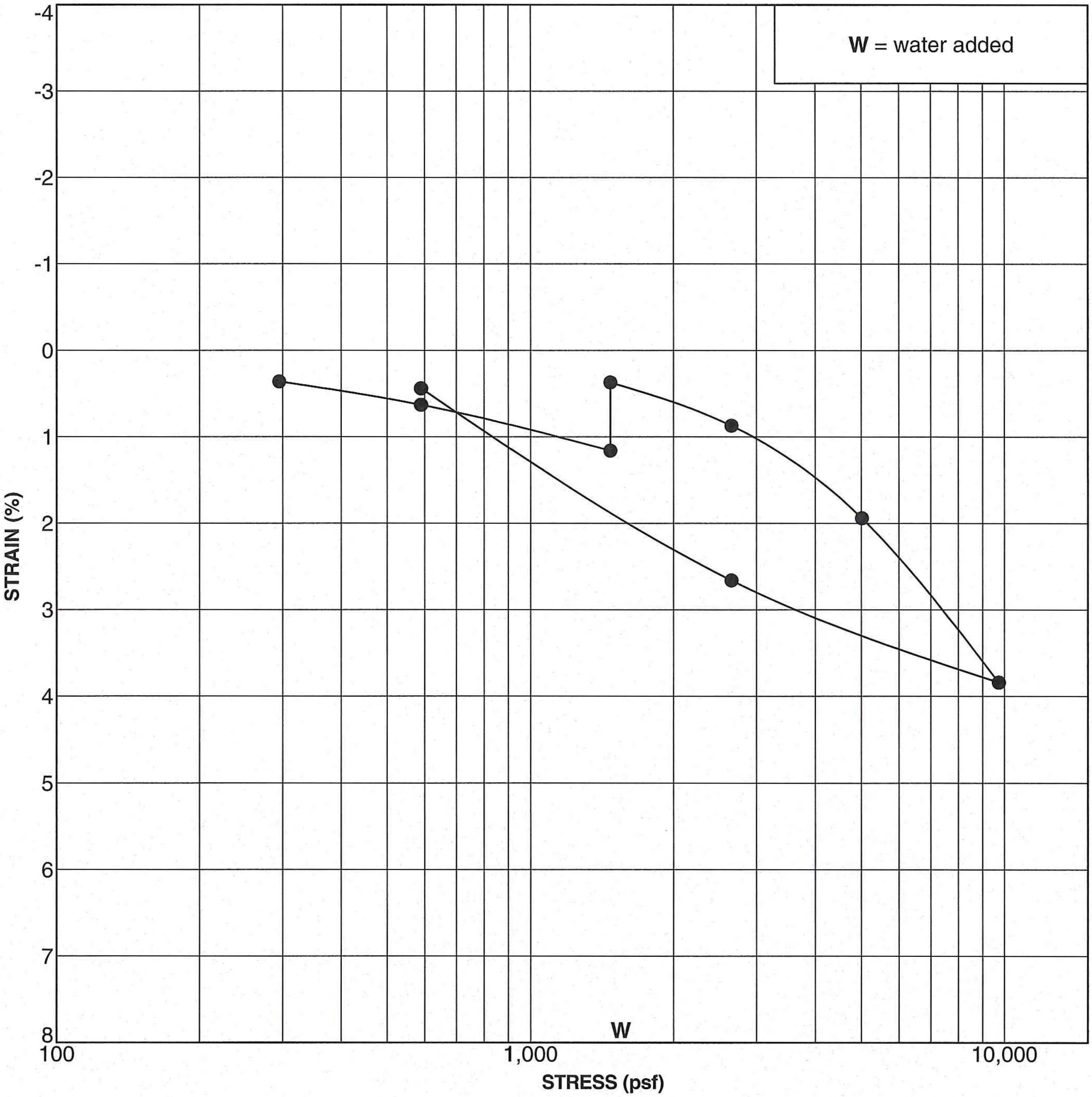


Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH- 2	10.0	Qya	●	In Situ	0.1	FAT CLAY (CH)

CONSOLIDATION TEST DATA

Project: EF International Language Campus
Project No. 18-252-00

GMU GEOTECHNICAL, INC.

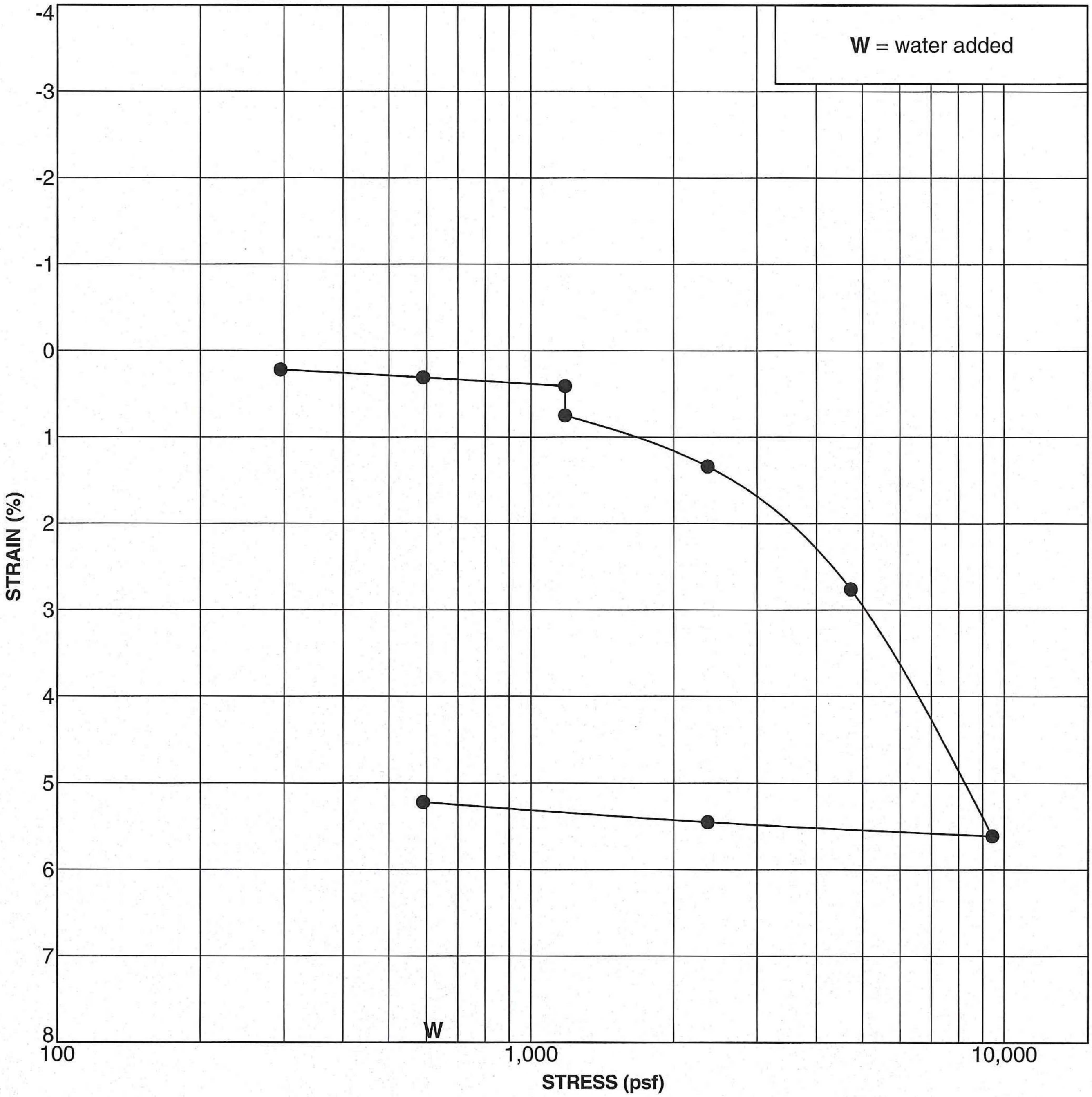


Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH- 4	12.5	Qya	●	In Situ	-0.79	LEAN CLAY (CL)

CONSOLIDATION TEST DATA

Project: EF International Language Campus
Project No. 18-252-00

GMU GEOTECHNICAL, INC.



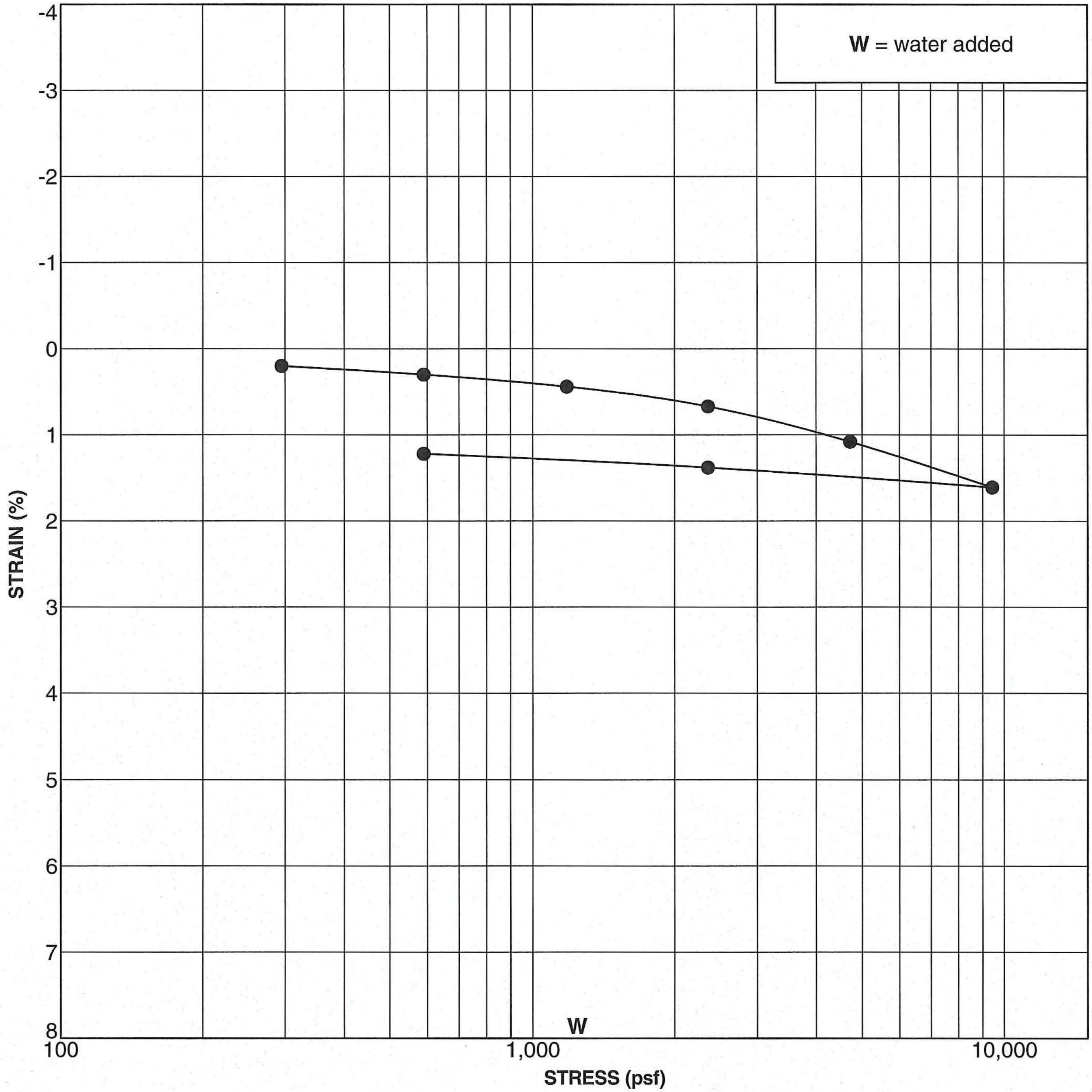
Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH- 5	5.0	Qya	●	In Situ	0.34	SILTY CLAY (CL)

GMU_CONSOL 18-252-00.GPJ GM&U.GDT 1/30/19

CONSOLIDATION TEST DATA

Project: EF International Language Campus
Project No. 18-252-00

GMU GEOTECHNICAL, INC.

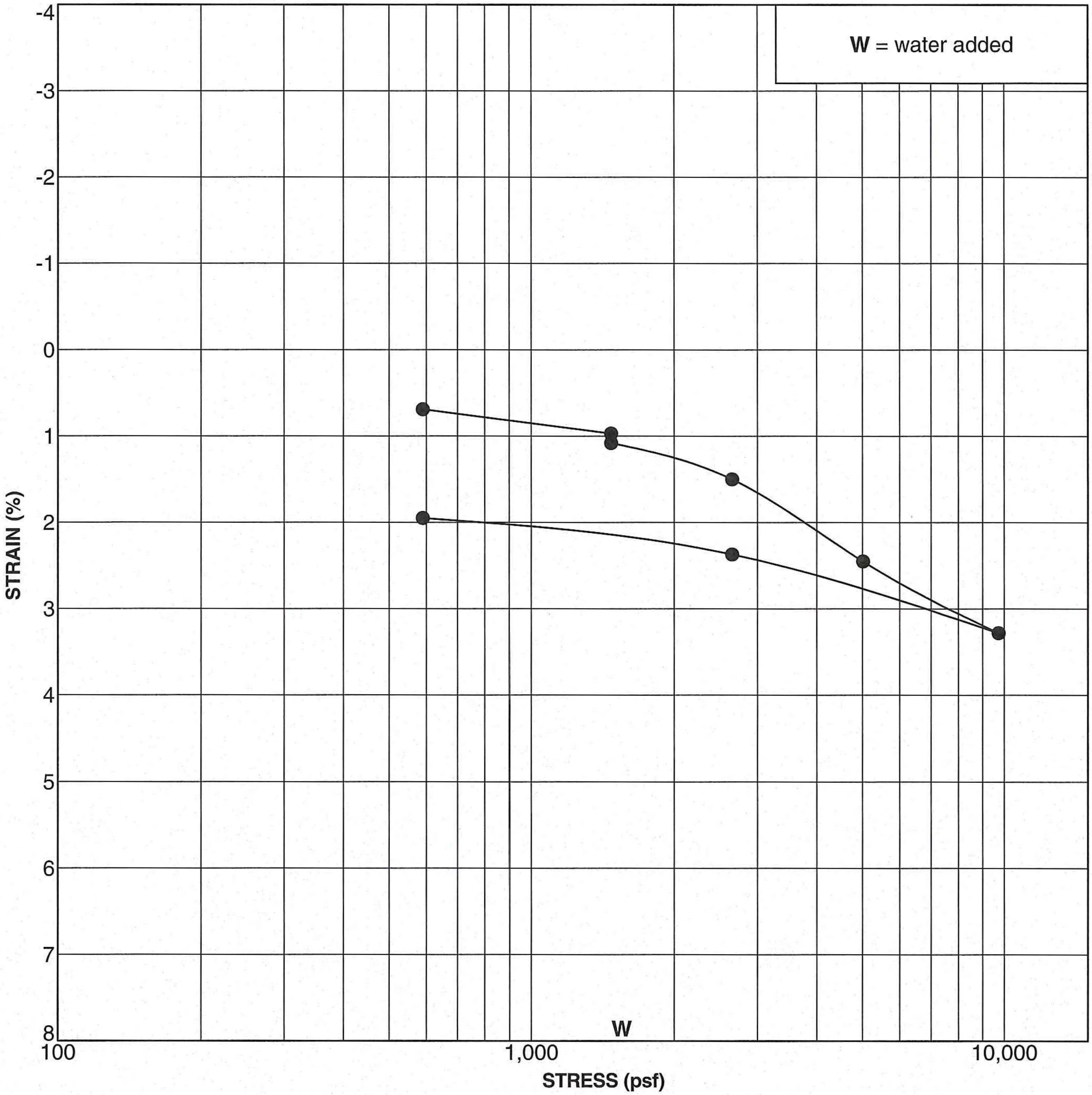


Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH-10	10.0	Qya	●	In Situ	0	SITLY CLAY (CL)

CONSOLIDATION TEST DATA

Project: EF International Language Campus
Project No. 18-252-00

GMU GEOTECHNICAL, INC.



Boring Number	Depth (feet)	Geologic Unit	Symbol	In Situ or Remolded Sample	% Hydro-Collapse	Classification
DH-10	12.5	Qya	●	In Situ	11	CLAYEY SAND (SC)

CONSOLIDATION TEST DATA

Project: EF International Language Campus
Project No. 18-252-00

GMU GEOTECHNICAL, INC.

Appendix D

USGS web services were down for some period of time and as a result this tool wasn't operational, resulting in *timeout* error.
USGS web services are now operational so this tool should work as expected.

OSHPD

Latitude, Longitude: 33.6862, -117.8911

Date	12/21/2023, 10:08:50 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.298	MCE_R ground motion. (for 0.2 second period)
S_1	0.465	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.298	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	0.865	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.557	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.612	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.298	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.407	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.112	Factored deterministic acceleration value. (0.2 second)
S1RT	0.465	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.503	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.729	Factored deterministic acceleration value. (1.0 second)
PGAd	0.868	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.557	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.922	Mapped value of the risk coefficient at short periods
C_{R1}	0.925	Mapped value of the risk coefficient at a period of 1 s
C_V	1.36	Vertical coefficient

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Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new USGS Earthquake Hazard Toolbox for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

Input

Edition

Dynamic: Conterminous U.S. 2014 (updat…

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

33.6862

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

-117.8911

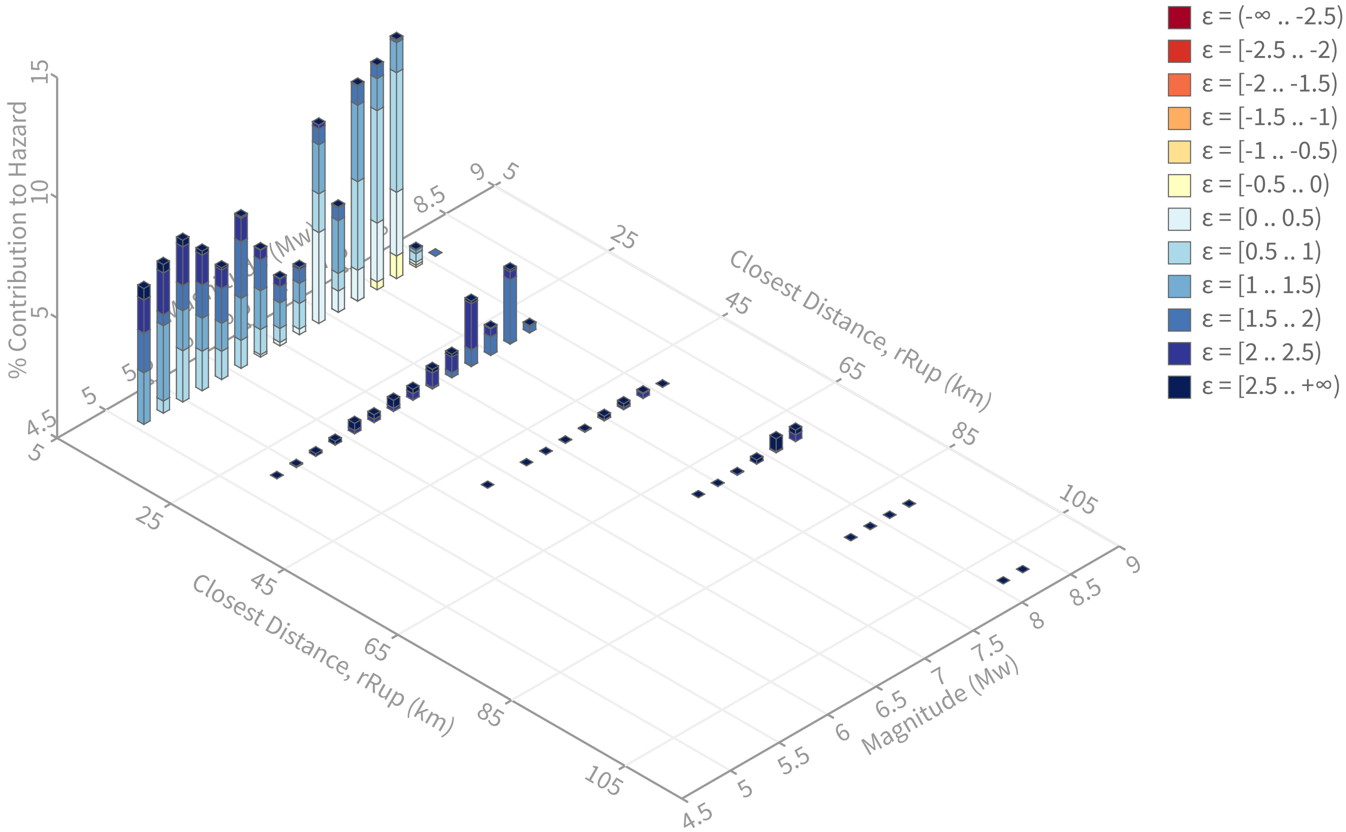
Site Class

259 m/s (Site class D)

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.65272917 g

Recovered targets

Return period: 2960.4814 yrs
Exceedance rate: 0.0003377829 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.06 %

Mean (over all sources)

m: 6.64
r: 11.33 km
ε_0: 1.29 σ

Mode (largest m-r bin)

m: 7.69
r: 6.83 km
ε_0: 0.58 σ
Contribution: 9.94 %

Mode (largest m-r-ε_0 bin)

m: 7.68
r: 7.63 km
ε_0: 0.68 σ
Contribution: 4.98 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM32	System							29.75
San Joaquin Hills [0]		3.45	7.14	0.48	117.895°W	33.672°N	191.48	10.41
Newport-Inglewood alt 2 [0]		8.18	7.49	0.88	117.956°W	33.638°N	228.08	5.49
Compton [0]		14.99	7.34	1.12	118.043°W	33.702°N	277.37	3.58
Palos Verdes [6]		26.18	7.46	2.02	118.134°W	33.567°N	239.46	1.68
Whittier alt 2 [2]		26.39	7.65	1.88	117.755°W	33.895°N	28.40	1.09
Newport-Inglewood (Offshore) [0]		10.85	6.61	1.62	117.915°W	33.591°N	191.60	1.04
Anaheim [0]		12.46	6.94	1.36	117.943°W	33.780°N	335.47	1.02
UC33brAvg_FM31	System							26.35
San Joaquin Hills [0]		3.45	7.52	0.38	117.895°W	33.672°N	191.48	7.28
Newport-Inglewood alt 1 [0]		8.28	7.45	0.88	117.958°W	33.639°N	229.49	6.06
Compton [0]		14.99	7.27	1.15	118.043°W	33.702°N	277.37	3.41
Palos Verdes [6]		26.18	7.29	2.12	118.134°W	33.567°N	239.46	1.55
Whittier alt 1 [3]		26.46	7.59	1.91	117.758°W	33.897°N	27.62	1.37
Newport-Inglewood (Offshore) [0]		10.85	6.52	1.66	117.915°W	33.591°N	191.60	1.11
Anaheim [0]		12.46	6.89	1.38	117.943°W	33.780°N	335.47	1.01
UC33brAvg_FM31 (opt)	Grid							22.11
PointSourceFinite: -117.891, 33.700		5.30	5.60	1.12	117.891°W	33.700°N	0.00	5.30
PointSourceFinite: -117.891, 33.700		5.30	5.60	1.12	117.891°W	33.700°N	0.00	5.30
PointSourceFinite: -117.891, 33.763		8.95	5.94	1.55	117.891°W	33.763°N	0.00	1.54
PointSourceFinite: -117.891, 33.763		8.95	5.94	1.55	117.891°W	33.763°N	0.00	1.54
PointSourceFinite: -117.891, 33.799		12.04	5.97	1.88	117.891°W	33.799°N	0.00	1.04
PointSourceFinite: -117.891, 33.799		12.04	5.97	1.88	117.891°W	33.799°N	0.00	1.04
PointSourceFinite: -117.891, 33.772		10.17	5.77	1.77	117.891°W	33.772°N	0.00	1.03
PointSourceFinite: -117.891, 33.772		10.17	5.77	1.77	117.891°W	33.772°N	0.00	1.03
UC33brAvg_FM32 (opt)	Grid							21.80
PointSourceFinite: -117.891, 33.700		5.31	5.58	1.12	117.891°W	33.700°N	0.00	5.13
PointSourceFinite: -117.891, 33.700		5.31	5.58	1.12	117.891°W	33.700°N	0.00	5.13
PointSourceFinite: -117.891, 33.763		8.96	5.93	1.55	117.891°W	33.763°N	0.00	1.55
PointSourceFinite: -117.891, 33.763		8.96	5.93	1.55	117.891°W	33.763°N	0.00	1.55
PointSourceFinite: -117.891, 33.772		10.19	5.76	1.78	117.891°W	33.772°N	0.00	1.07
PointSourceFinite: -117.891, 33.772		10.19	5.76	1.78	117.891°W	33.772°N	0.00	1.07
PointSourceFinite: -117.891, 33.799		12.05	5.97	1.89	117.891°W	33.799°N	0.00	1.01
PointSourceFinite: -117.891, 33.799		12.05	5.97	1.89	117.891°W	33.799°N	0.00	1.01

Appendix E

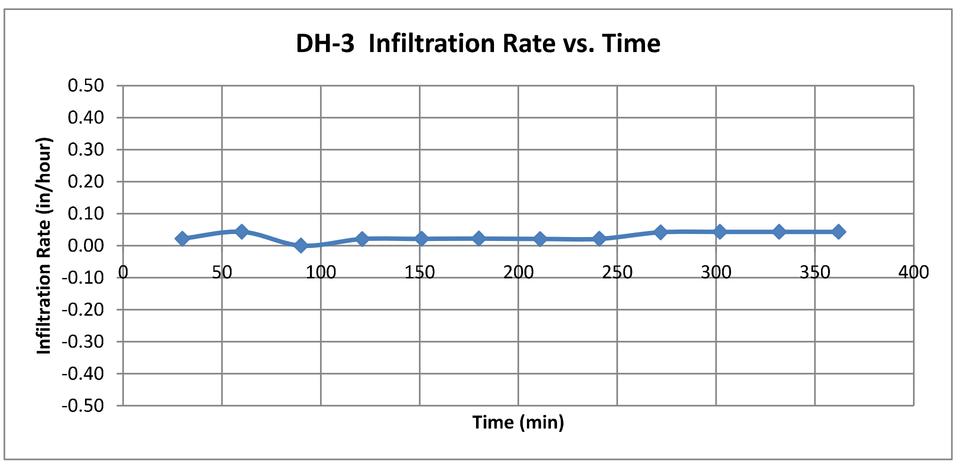
Riverside/Orange County - Infiltration Test in a Boring

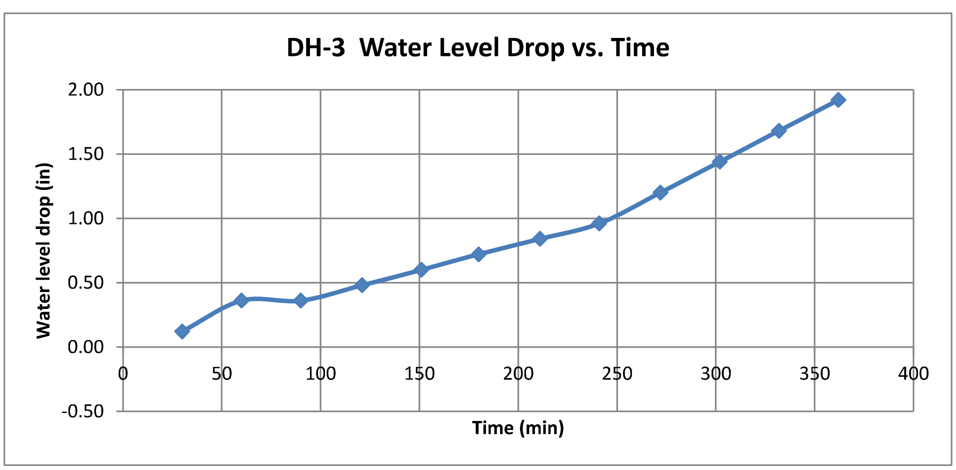
Project Name: EF International Language Campus
Project Number: 18-252-00

Test Hole Number: DH-3
Total Depth : 4.92 feet
Test Hole Diameter: 8.00 inches radius= 4 inches

Trial	Start Time	End Time	∆T	Total Time	Initial Depth of Water	Final Depth of Water	∆D	∑∆D	∆Havg	Infiltration Rate
			(min)	*(min)*	*(ft)*	*(ft)*	*(in)*	*(in)*	*(in)*	*(in/hour)*
1	7:55	8:25	30.0	30.0	3.22	3.23	0.12	0.12	20.34	0.02
2	8:25	8:55	30.0	60.0	3.23	3.25	0.24	0.36	20.16	0.04
3	8:55	9:25	30.0	90.0	3.21	3.21	0.00	0.36	20.52	0.00
4	9:25	9:56	31.0	121.0	3.21	3.22	0.12	0.48	20.46	0.02
5	9:56	10:26	30.0	151.0	3.21	3.22	0.12	0.60	20.46	0.02
6	10:26	10:55	29.0	180.0	3.21	3.22	0.12	0.72	20.46	0.02
7	10:55	11:26	31.0	211.0	3.21	3.22	0.12	0.84	20.46	0.02
8	11:26	11:56	30.0	241.0	3.21	3.22	0.12	0.96	20.46	0.02
9	11:56	12:27	31.0	272.0	3.21	3.23	0.24	1.20	20.40	0.04
10	12:27	12:57	30.0	302.0	3.21	3.23	0.24	1.44	20.4	0.04
11	12:57	13:27	30.0	332.0	3.21	3.23	0.24	1.68	20.4	0.04
12	13:27	13:57	30.0	362.0	3.21	3.23	0.24	1.92	20.4	0.04

Average Infiltration Rate (in/hour) 0.04





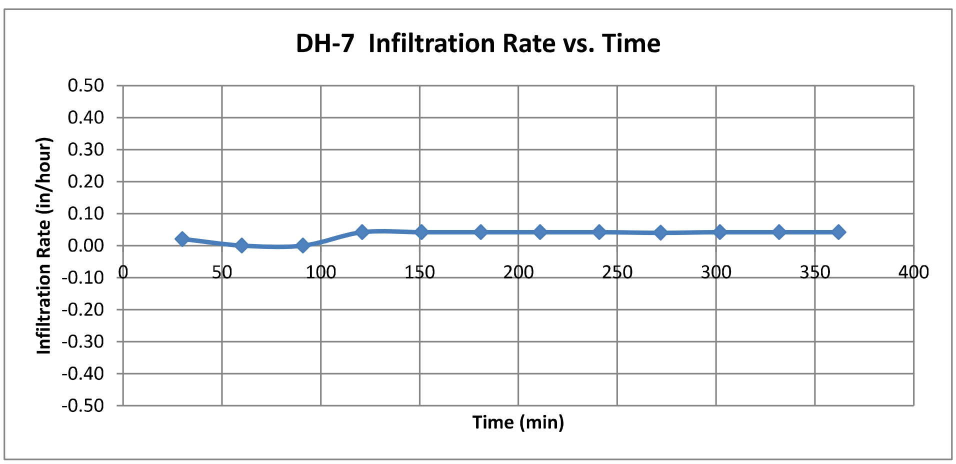
Riverside/Orange County - Infiltration Test in a Boring

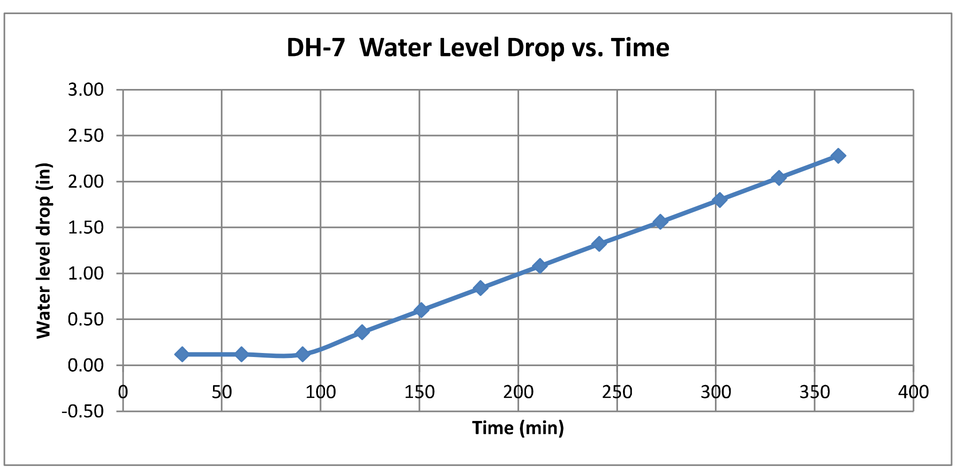
Project Name: EF International Language Campus
Project Number: 18-252-00

Test Hole Number: DH-7
Total Depth : 5.00 feet
Test Hole Diameter: 8.00 inches radius= 4 inches

Trial	Start Time	End Time	∆T	Total Time	Initial Depth of Water	Final Depth of Water	∆D	∑∆D	∆Havg	Infiltration Rate
			(min)	*(min)*	*(ft)*	*(ft)*	*(in)*	*(in)*	*(in)*	*(in/hour)*
1	8:02	8:32	30.0	30.0	3.23	3.24	0.12	0.12	21.18	0.02
2	8:32	9:02	30.0	60.0	3.24	3.24	0.00	0.12	21.12	0.00
3	9:02	9:33	31.0	91.0	3.24	3.24	0.00	0.12	21.12	0.00
4	9:33	10:03	30.0	121.0	3.24	3.26	0.24	0.36	21.00	0.04
5	10:03	10:33	30.0	151.0	3.24	3.26	0.24	0.60	21.00	0.04
6	10:33	11:03	30.0	181.0	3.24	3.26	0.24	0.84	21.00	0.04
7	11:03	11:33	30.0	211.0	3.24	3.26	0.24	1.08	21.00	0.04
8	11:33	12:03	30.0	241.0	3.24	3.26	0.24	1.32	21.00	0.04
9	12:03	12:34	31.0	272.0	3.24	3.26	0.24	1.56	21.00	0.04
10	12:34	13:04	30.0	302.0	3.24	3.26	0.24	1.80	21	0.04
11	13:04	13:34	30.0	332.0	3.24	3.26	0.24	2.04	21	0.04
12	13:34	14:04	30.0	362.0	3.24	3.26	0.24	2.28	21	0.04

Average Infiltration Rate (in/hour) 0.04





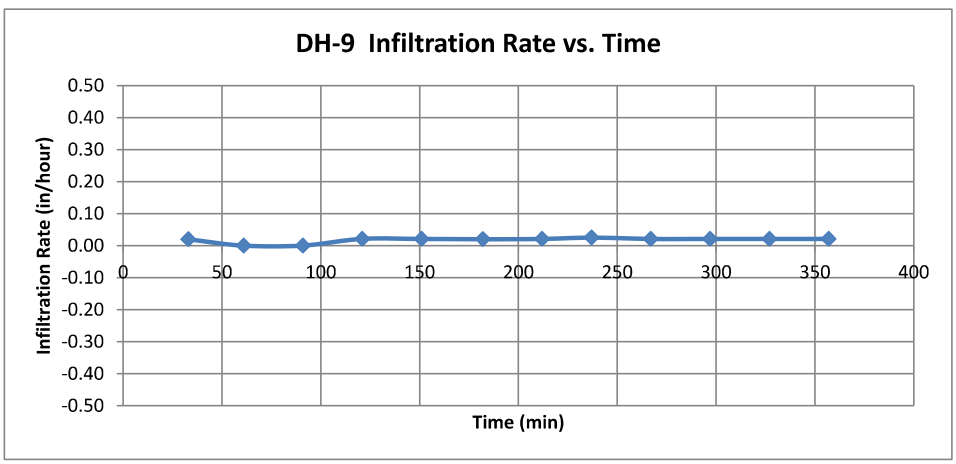
Riverside/Orange County - Infiltration Test in a Boring

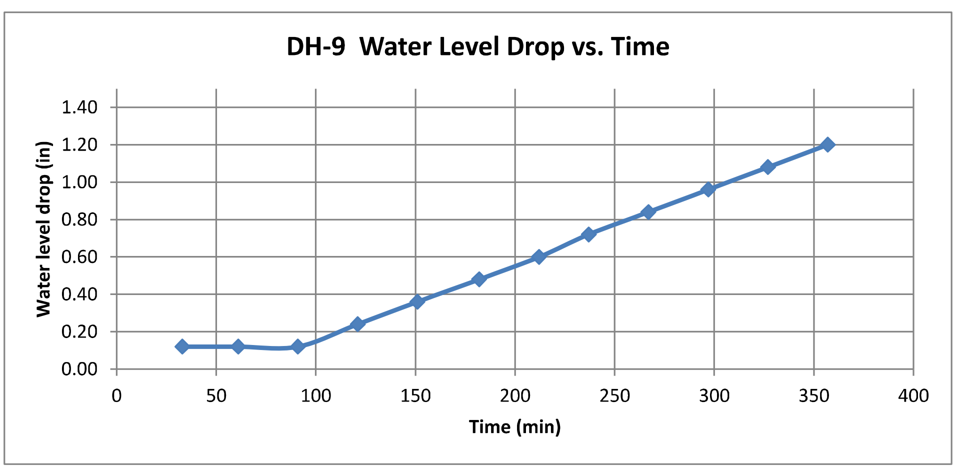
Project Name: EF International Language Campus
Project Number: 18-252-00

Test Hole Number: DH-9
Total Depth : 5.00 feet
Test Hole Diameter: 8.00 inches radius= 4 inches

Trial	Start Time	End Time	ΔT	Total Time	Initial Depth of Water	Final Depth of Water	ΔD	$\sum\Delta D$	ΔHavg	Infiltration Rate
			(min)	*(min)*	*(ft)*	*(ft)*	*(in)*	*(in)*	*(in)*	*(in/hour)*
1	8:10	8:43	33.0	33.0	3.33	3.34	0.12	0.12	19.98	0.02
2	8:43	9:11	28.0	61.0	3.28	3.28	0.00	0.12	20.64	0.00
3	9:11	9:41	30.0	91.0	3.28	3.28	0.00	0.12	20.64	0.00
4	9:41	10:11	30.0	121.0	3.26	3.27	0.12	0.24	20.82	0.02
5	10:11	10:41	30.0	151.0	3.26	3.27	0.12	0.36	20.82	0.02
6	10:41	11:12	31.0	182.0	3.26	3.27	0.12	0.48	20.82	0.02
7	11:12	11:42	30.0	212.0	3.26	3.27	0.12	0.60	20.82	0.02
8	11:42	12:07	25.0	237.0	3.26	3.27	0.12	0.72	20.82	0.03
9	12:07	12:37	30.0	267.0	3.26	3.27	0.12	0.84	20.82	0.02
10	12:37	13:07	30.0	297.0	3.26	3.27	0.12	0.96	20.82	0.02
11	13:07	13:37	30.0	327.0	3.26	3.27	0.12	1.08	20.82	0.02
12	13:37	14:07	30.0	357.0	3.26	3.27	0.12	1.20	20.82	0.02

Average Infiltration Rate (in/hour) 0.02





Appendix F

SA Geotechnical, Inc.
1000 N Coast Highway #10
Laguna Beach, California
sageotechnical.com

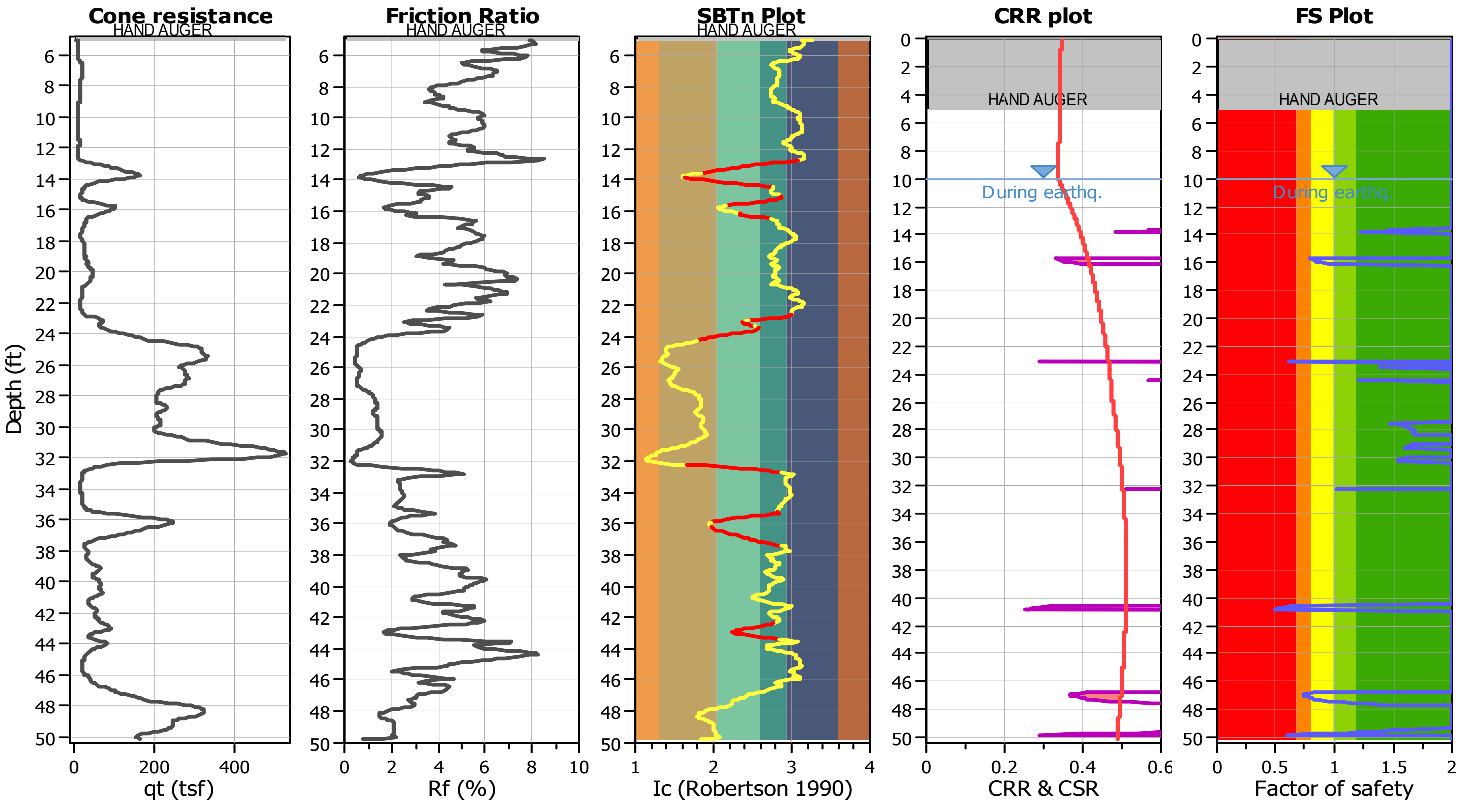
LIQUEFACTION ANALYSIS REPORT

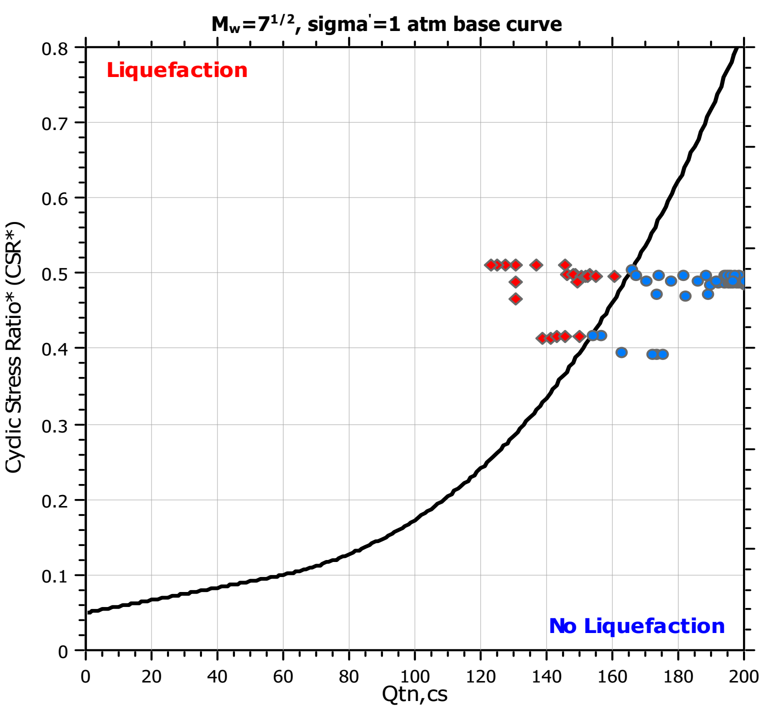
Project title : Meritage/3150 Bear St. **Location : Costa Mesa, CA**

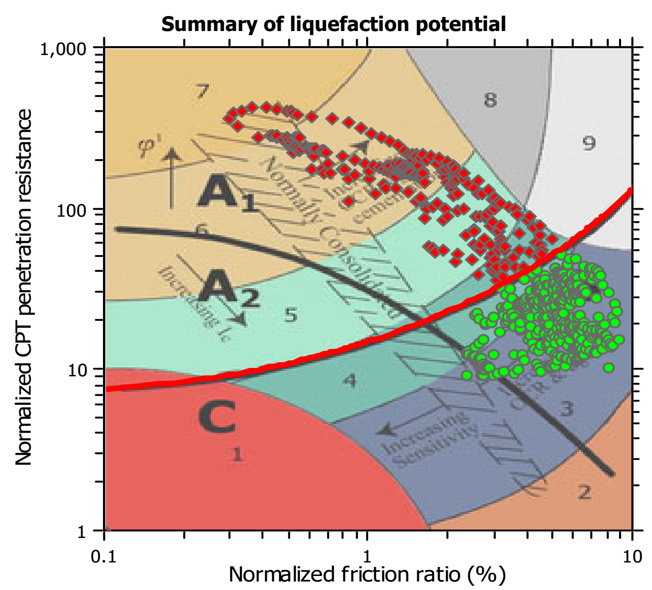
CPT file : CPT-1S

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	18.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

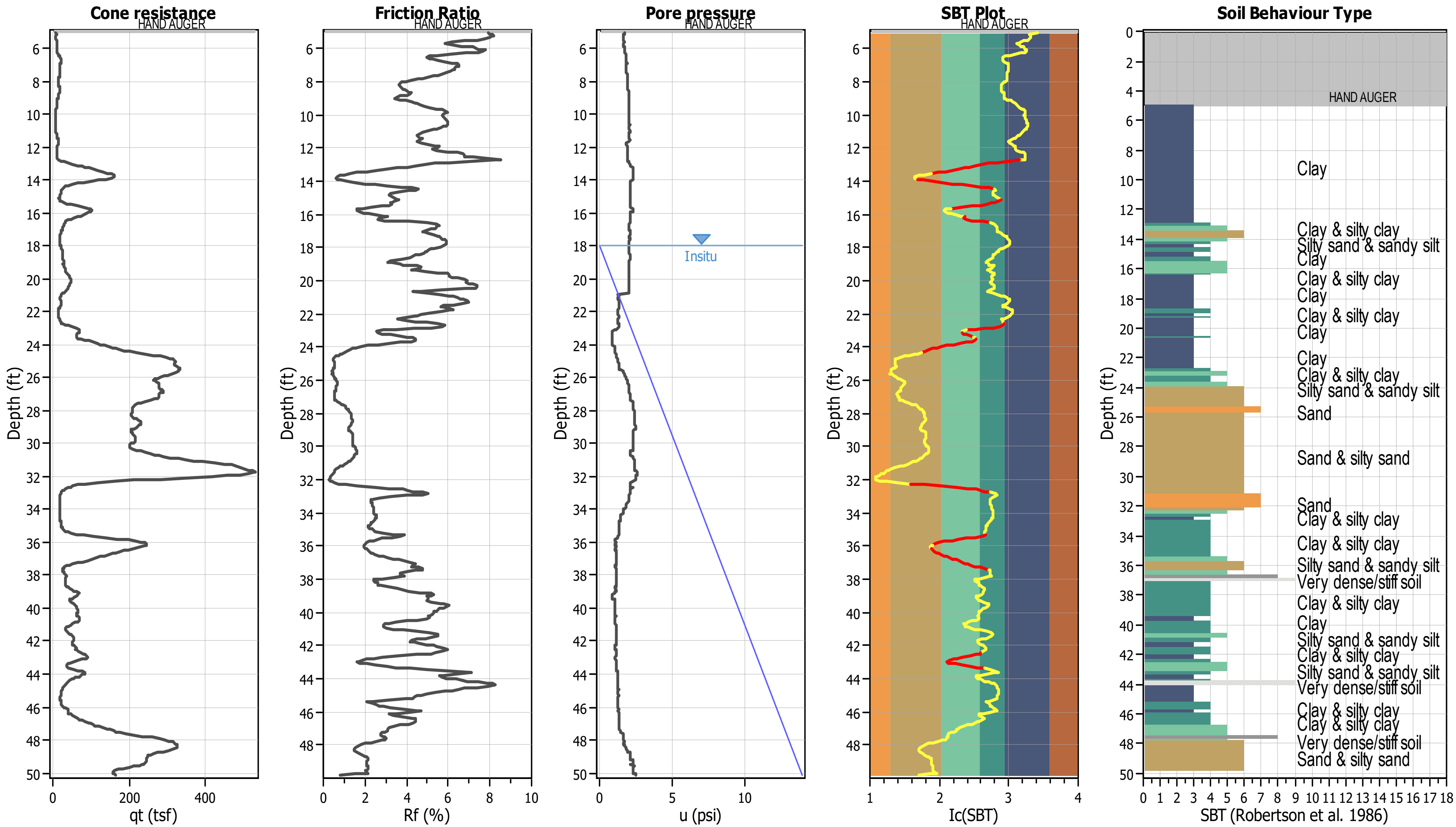






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



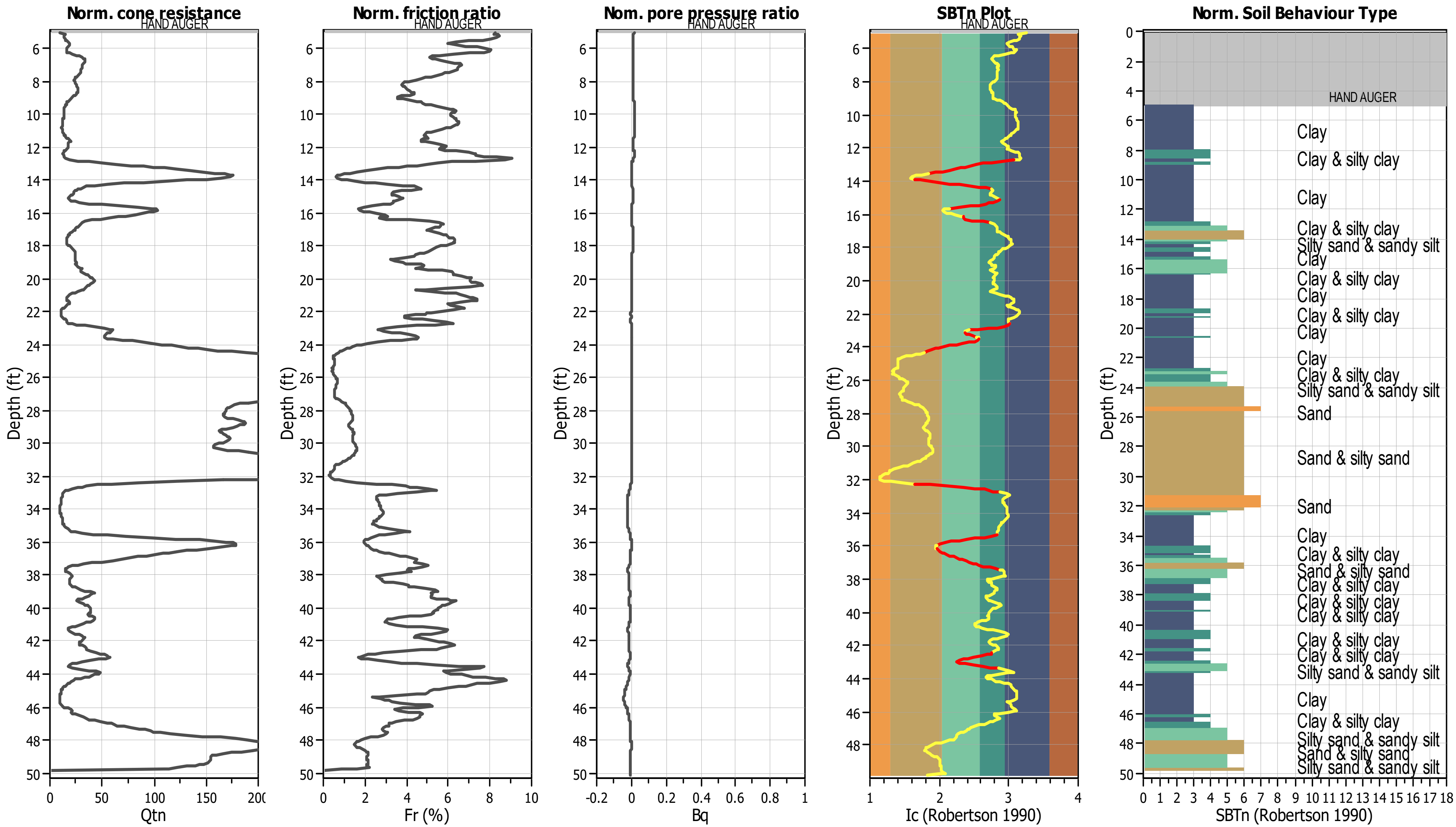
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



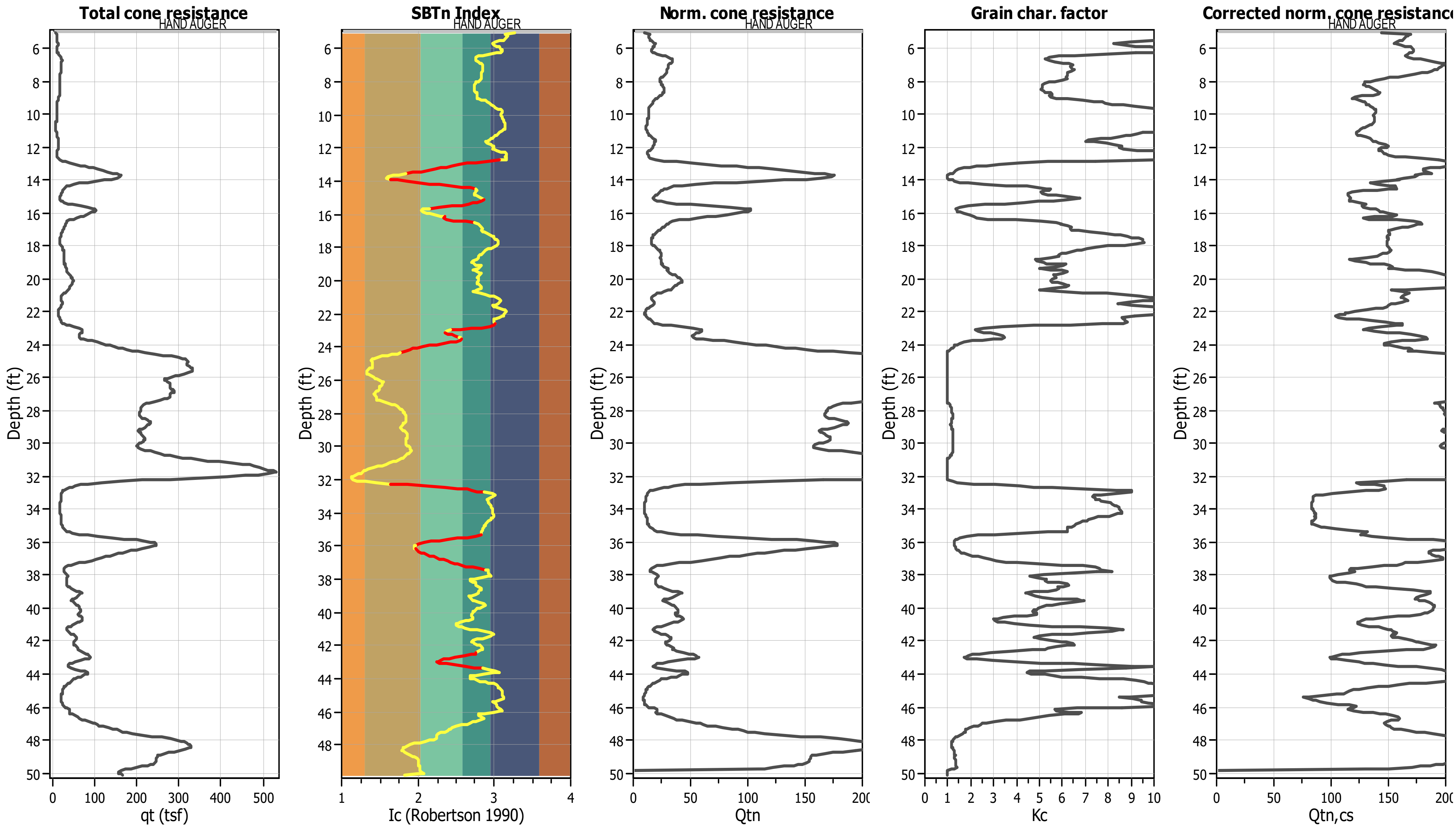
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

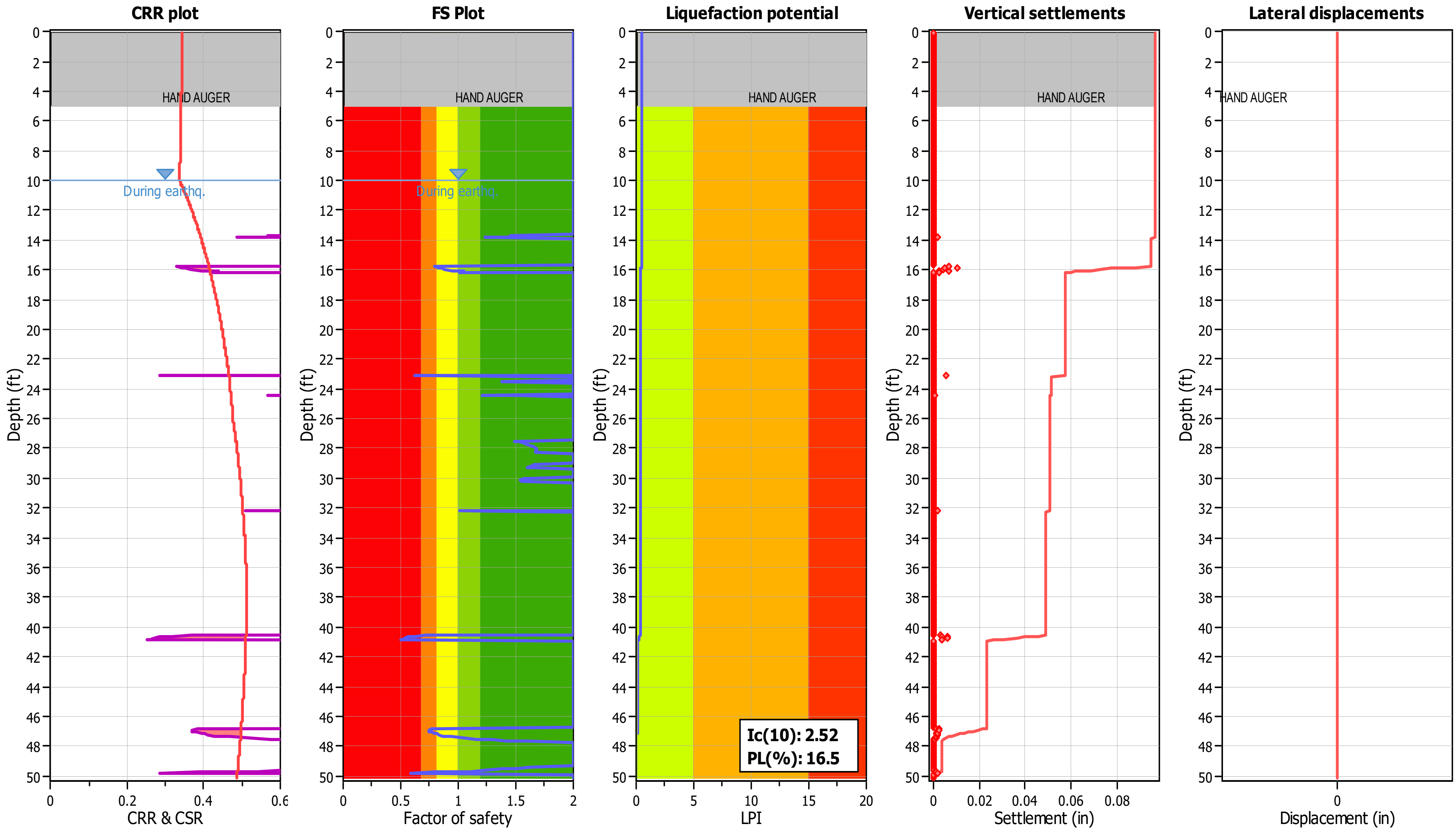
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

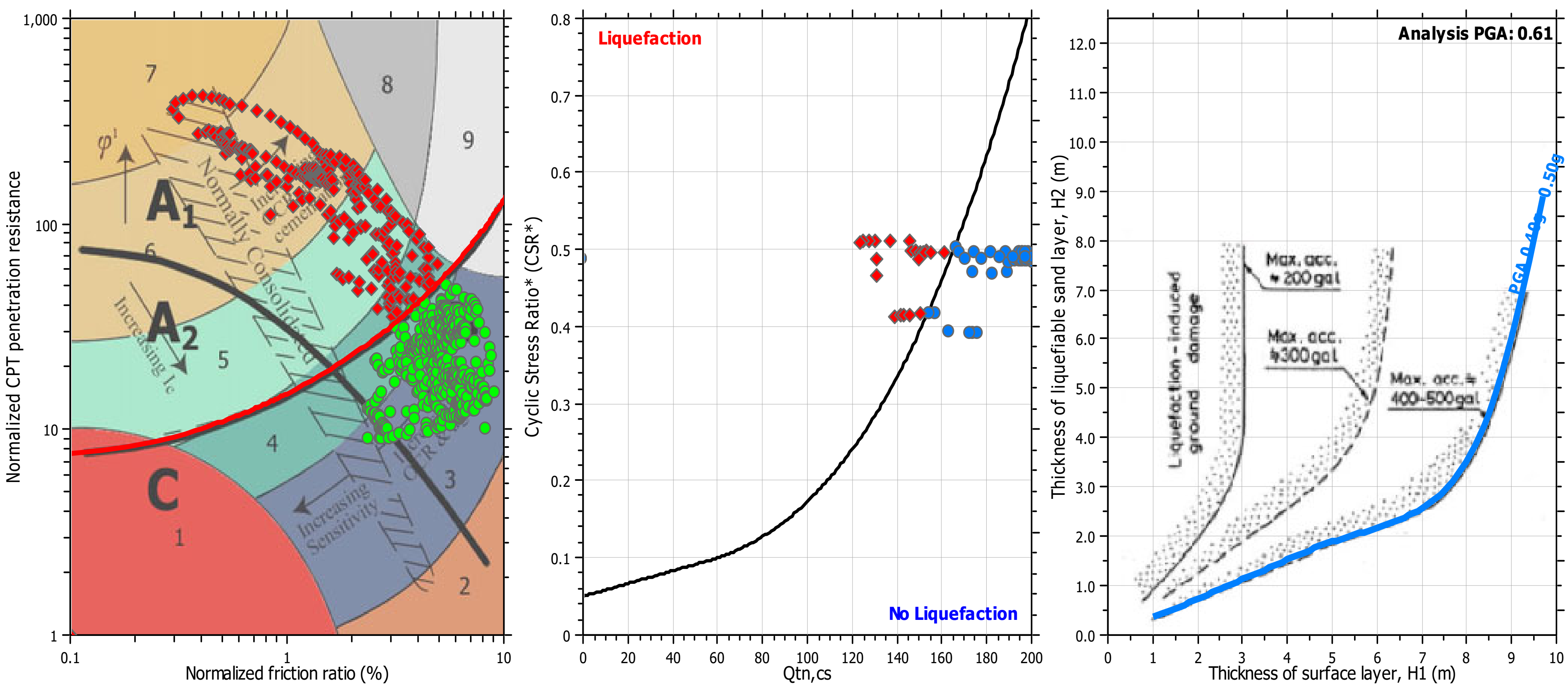
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

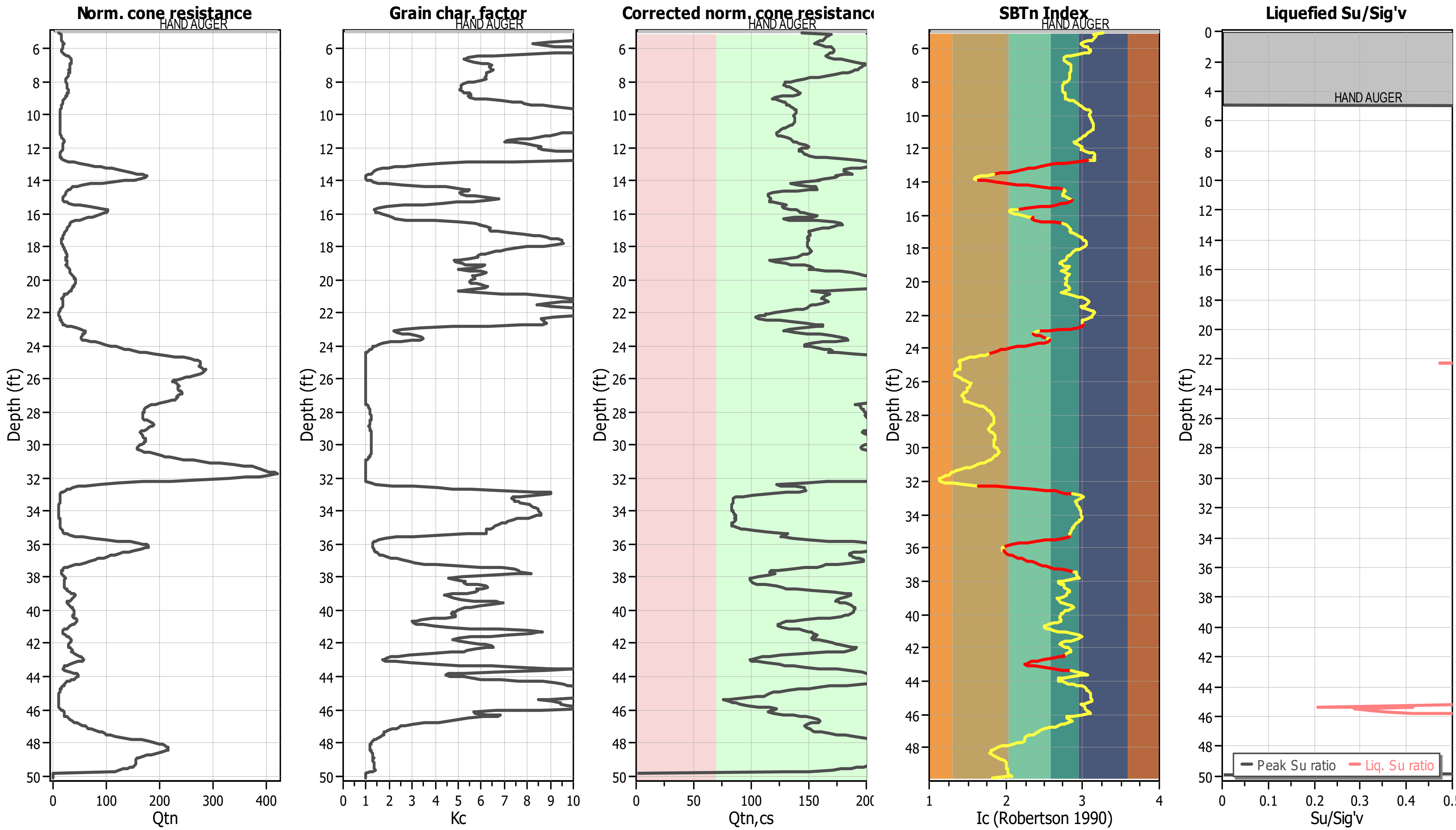
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SA GEOTECHNICAL OPTIMIZED SOIL ENGINEERING

SA Geotechnical, Inc.
1000 N Coast Highway #10
Laguna Beach, California
sageotechnical.com

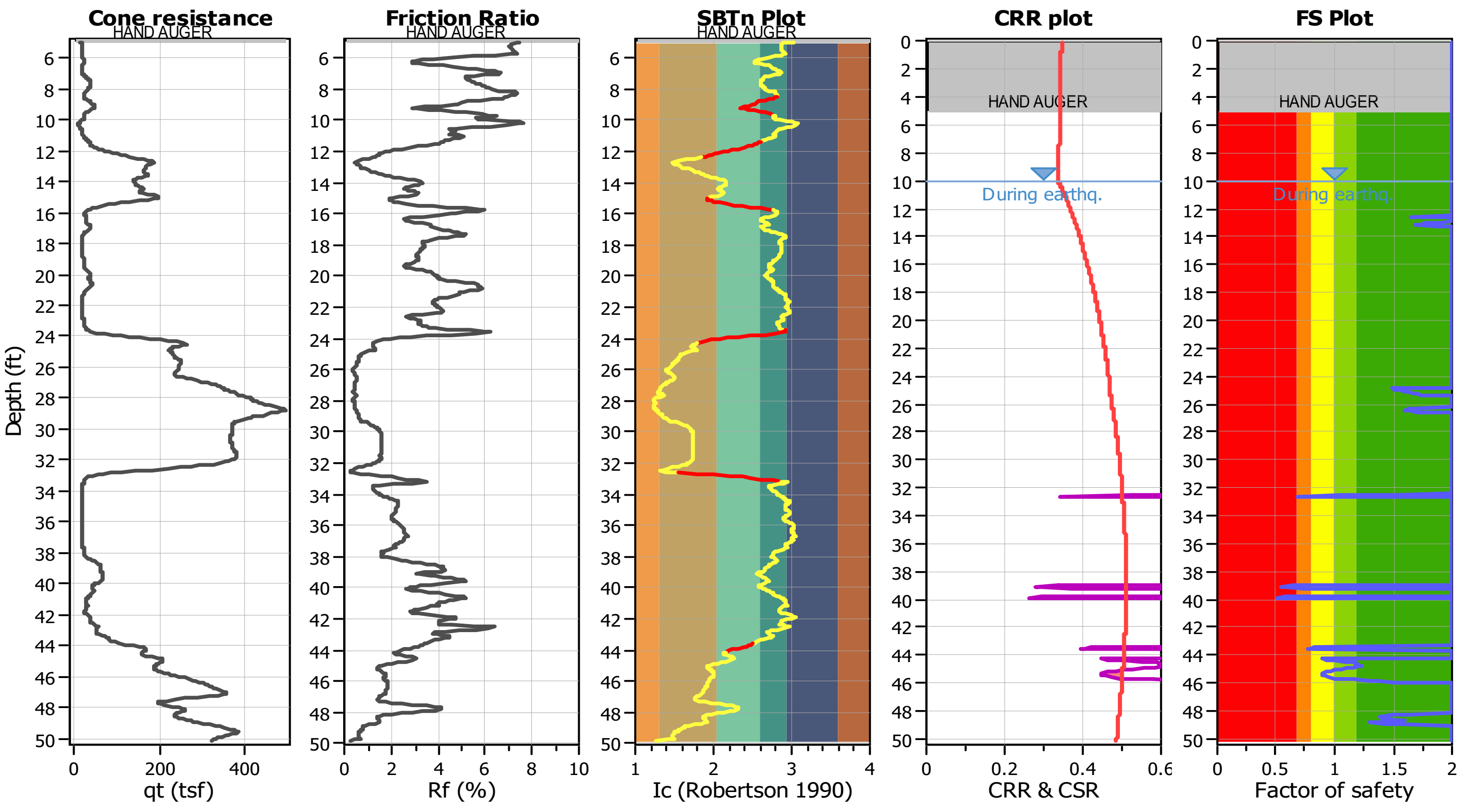
LIQUEFACTION ANALYSIS REPORT

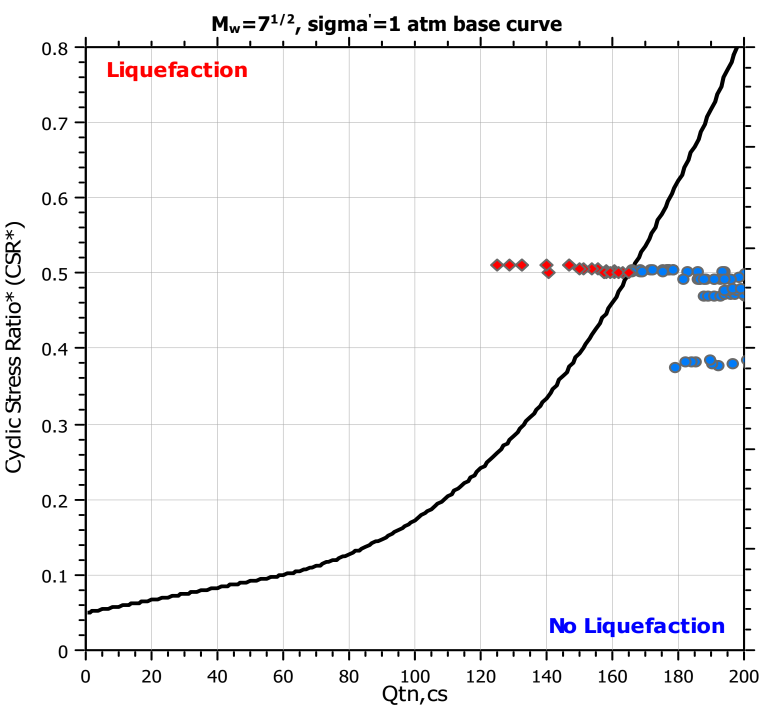
Project title : Meritage/3150 Bear St. **Location : Costa Mesa, CA**

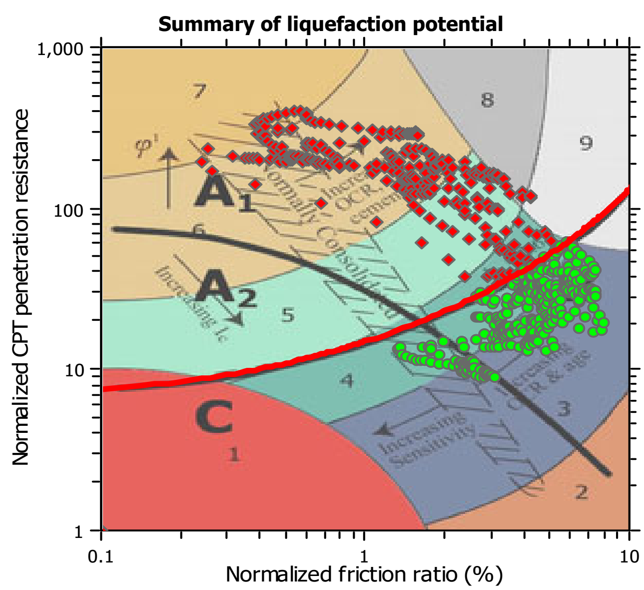
CPT file : CPT-2S

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	18.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

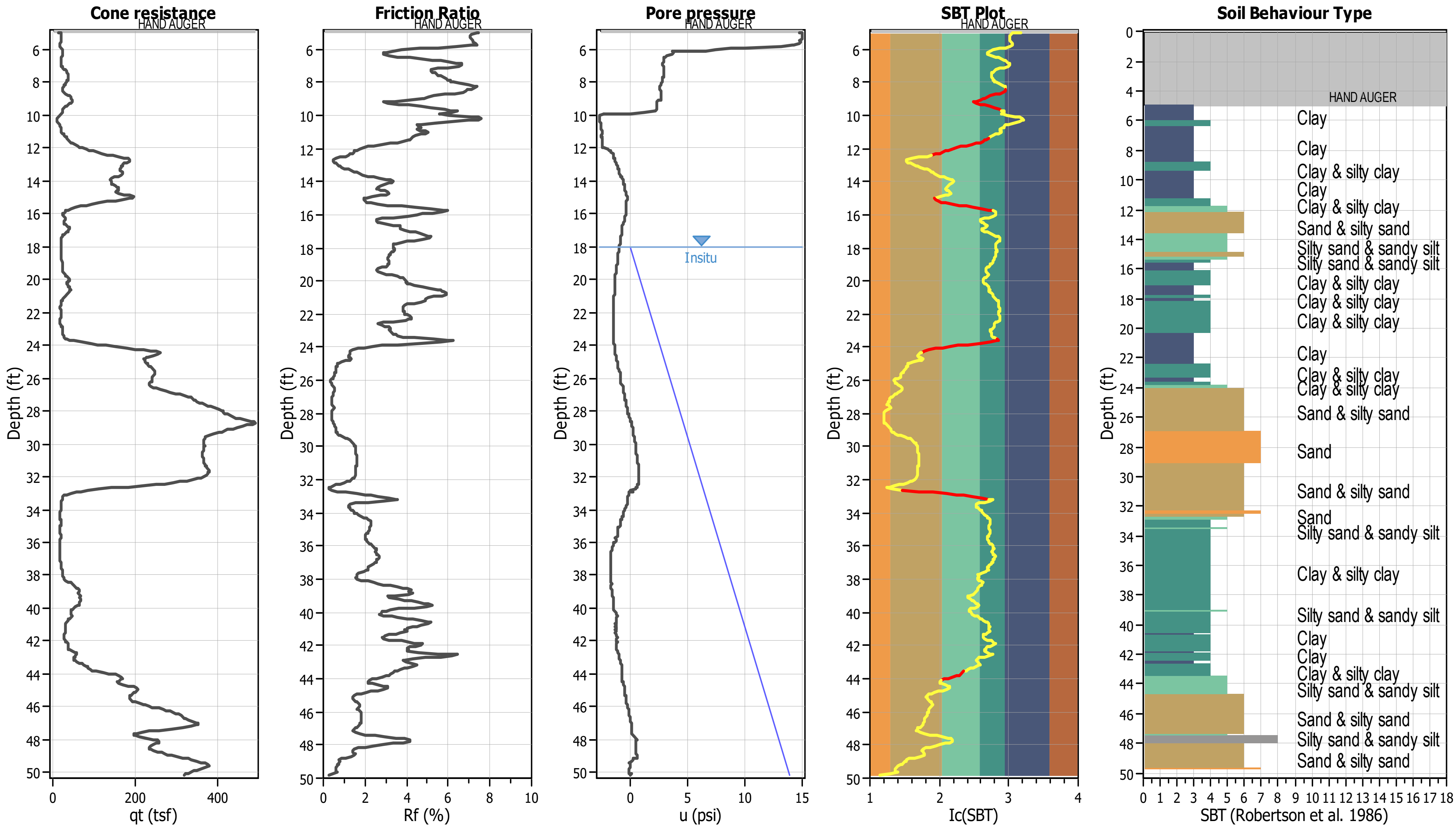






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



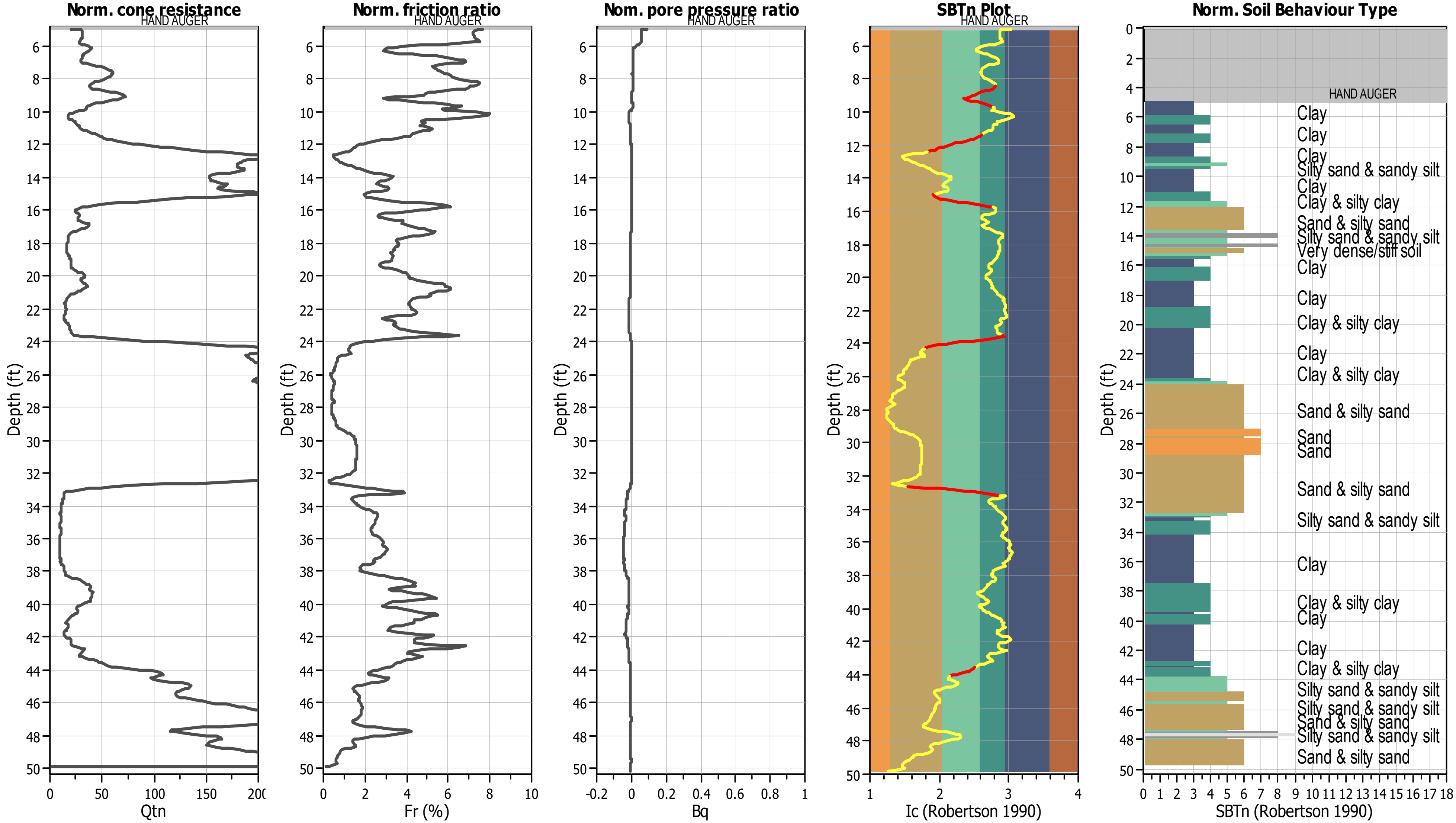
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

- 1. Sensitive fine grained
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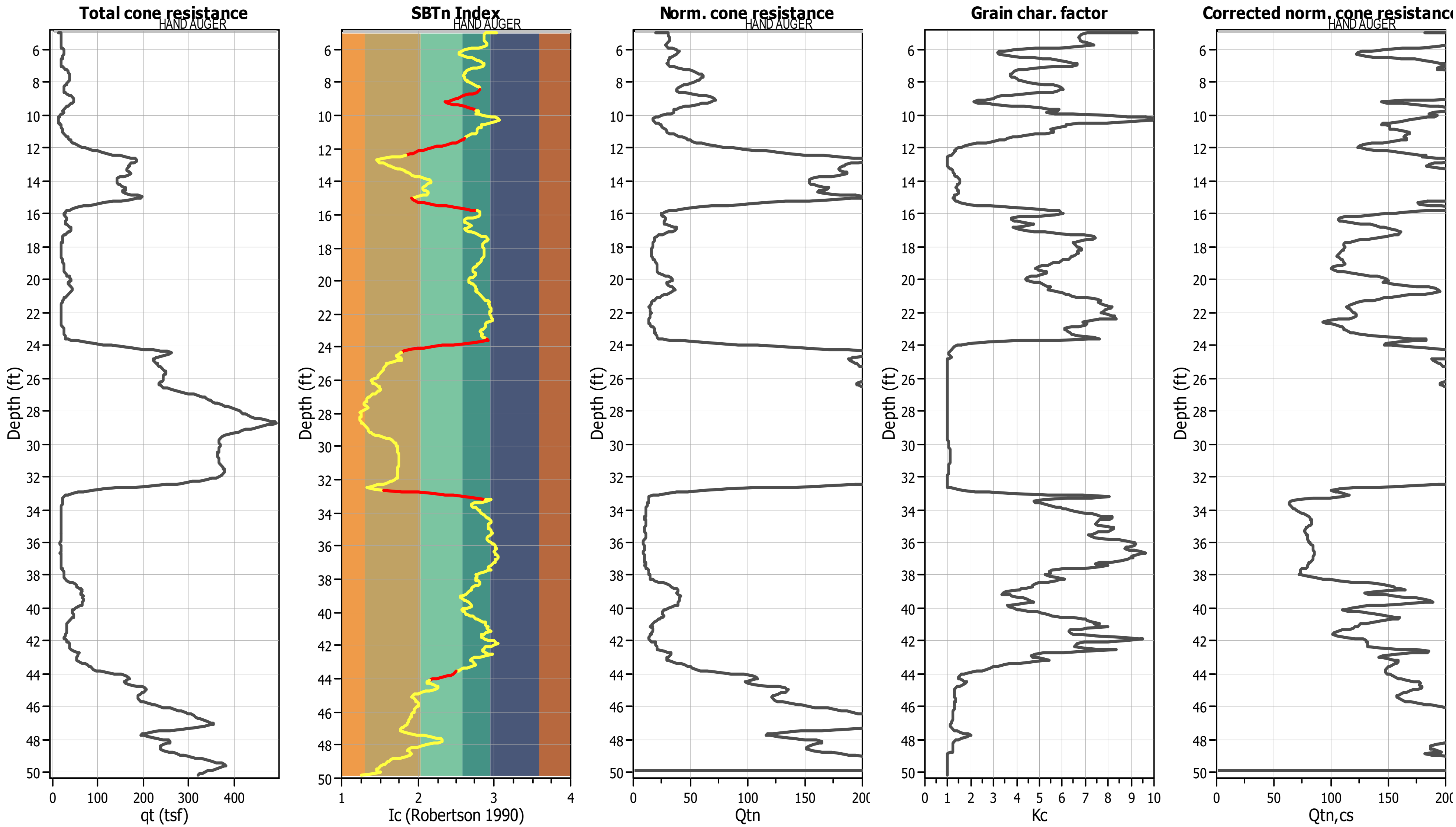
- 3. Clay to silty clay
- 4. Clayey silt to silty
- 5. Silty sand to sandy silt
- 6. Clean sand to silty sand
- 7. Gravely sand to sand
- 8. Very stiff sand to
- 9. Very stiff fine grained

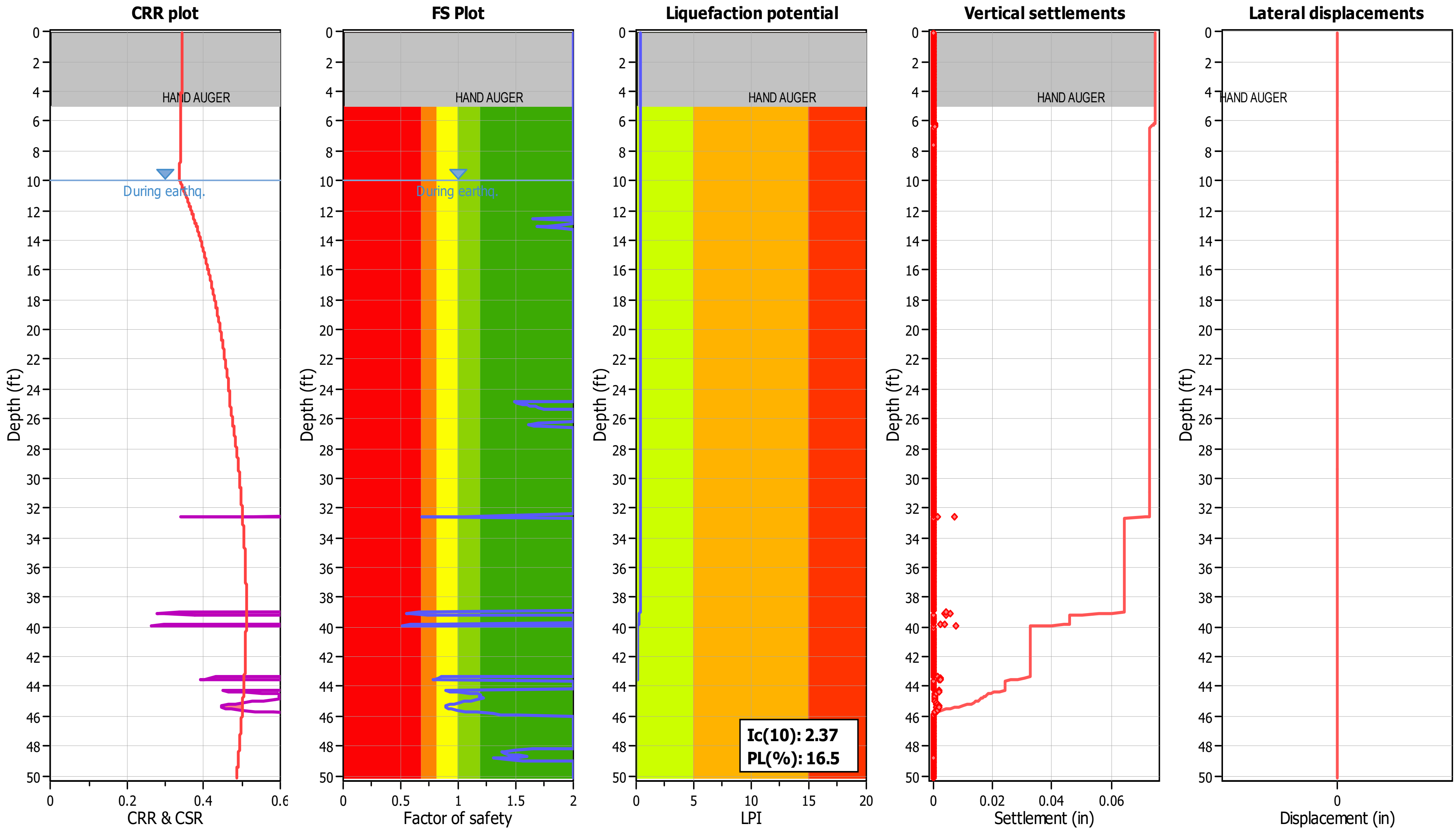
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

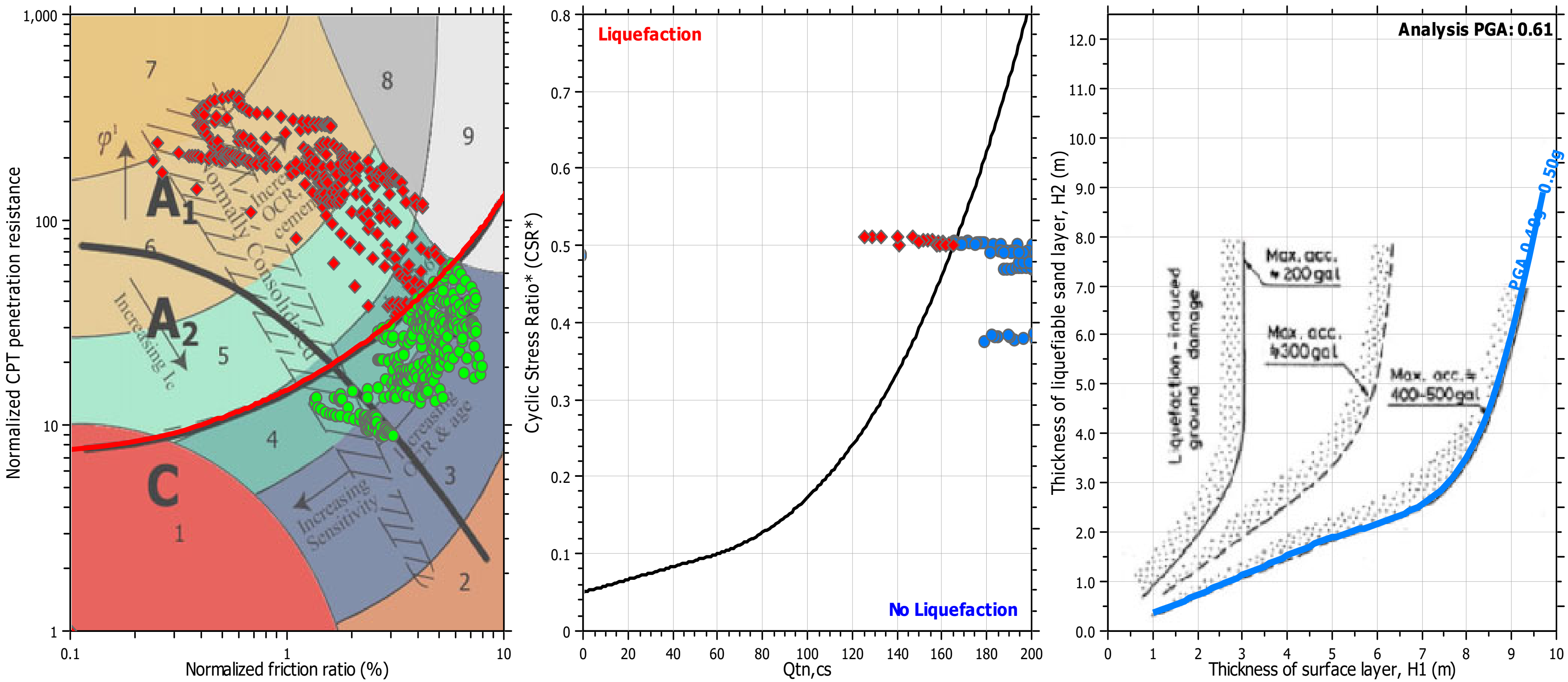
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

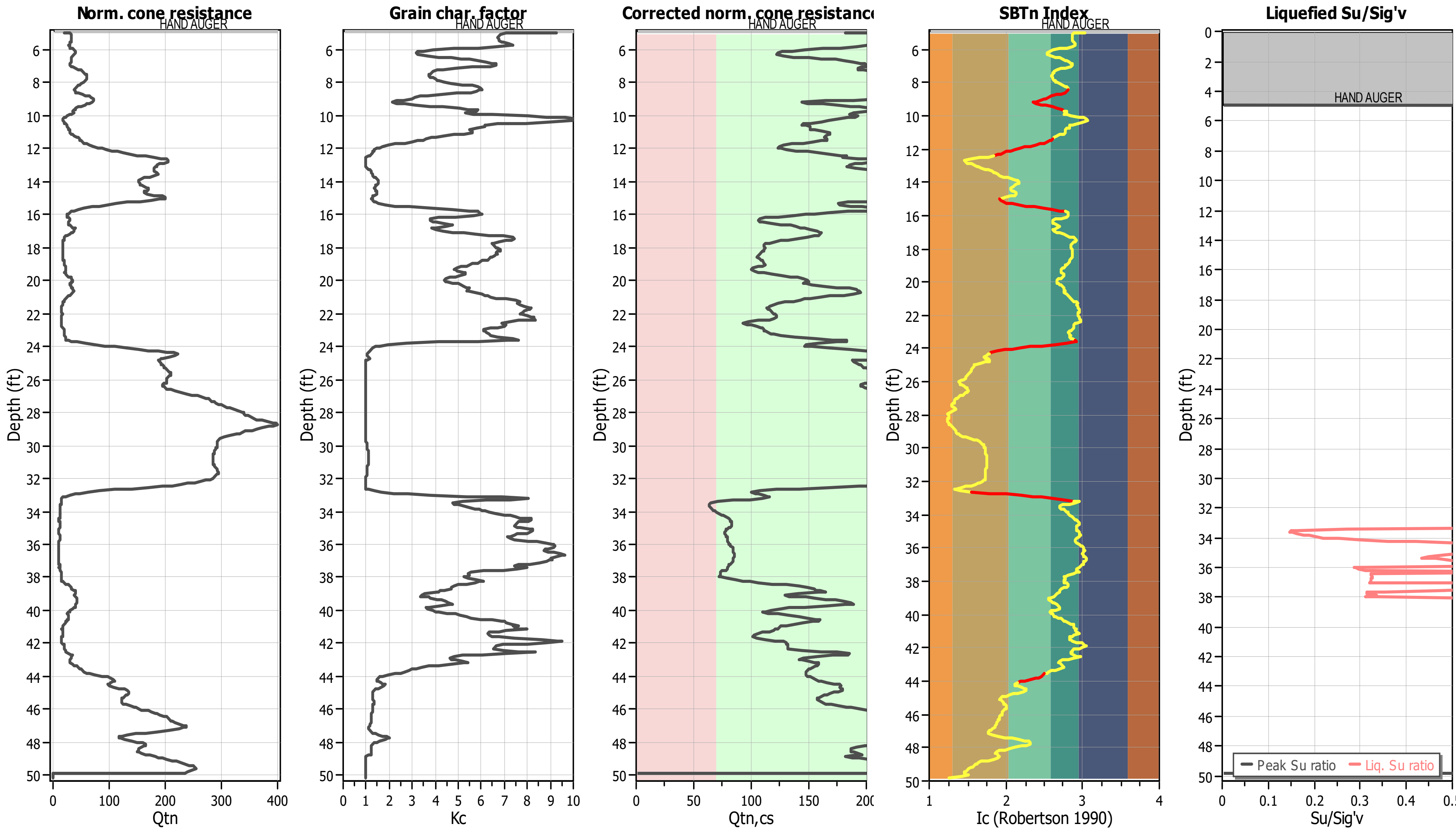
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SA Geotechnical, Inc.
1000 N Coast Highway #10
Laguna Beach, California
sageotechnical.com

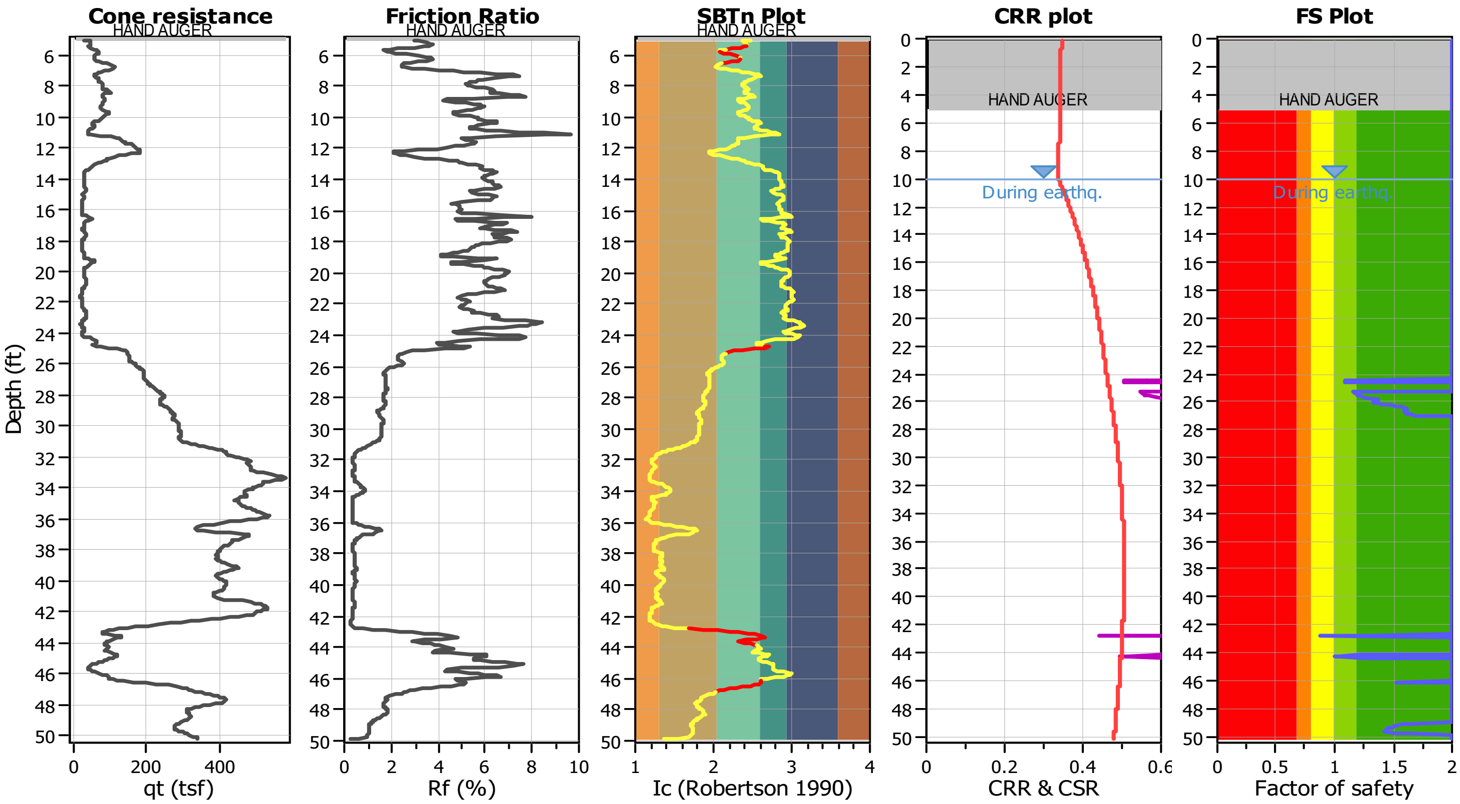
LIQUEFACTION ANALYSIS REPORT

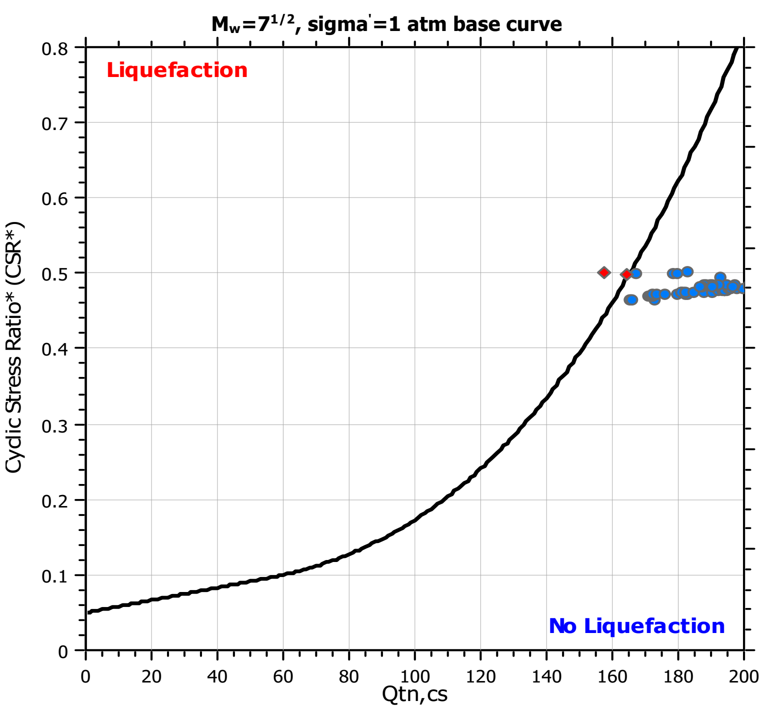
Project title : Meritage/3150 Bear St. **Location : Costa Mesa, CA**

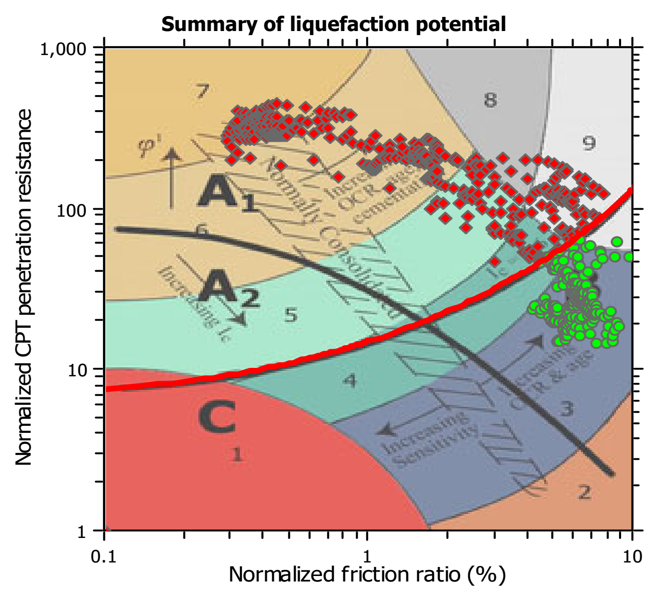
CPT file : CPT-3S

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	18.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	N/A
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

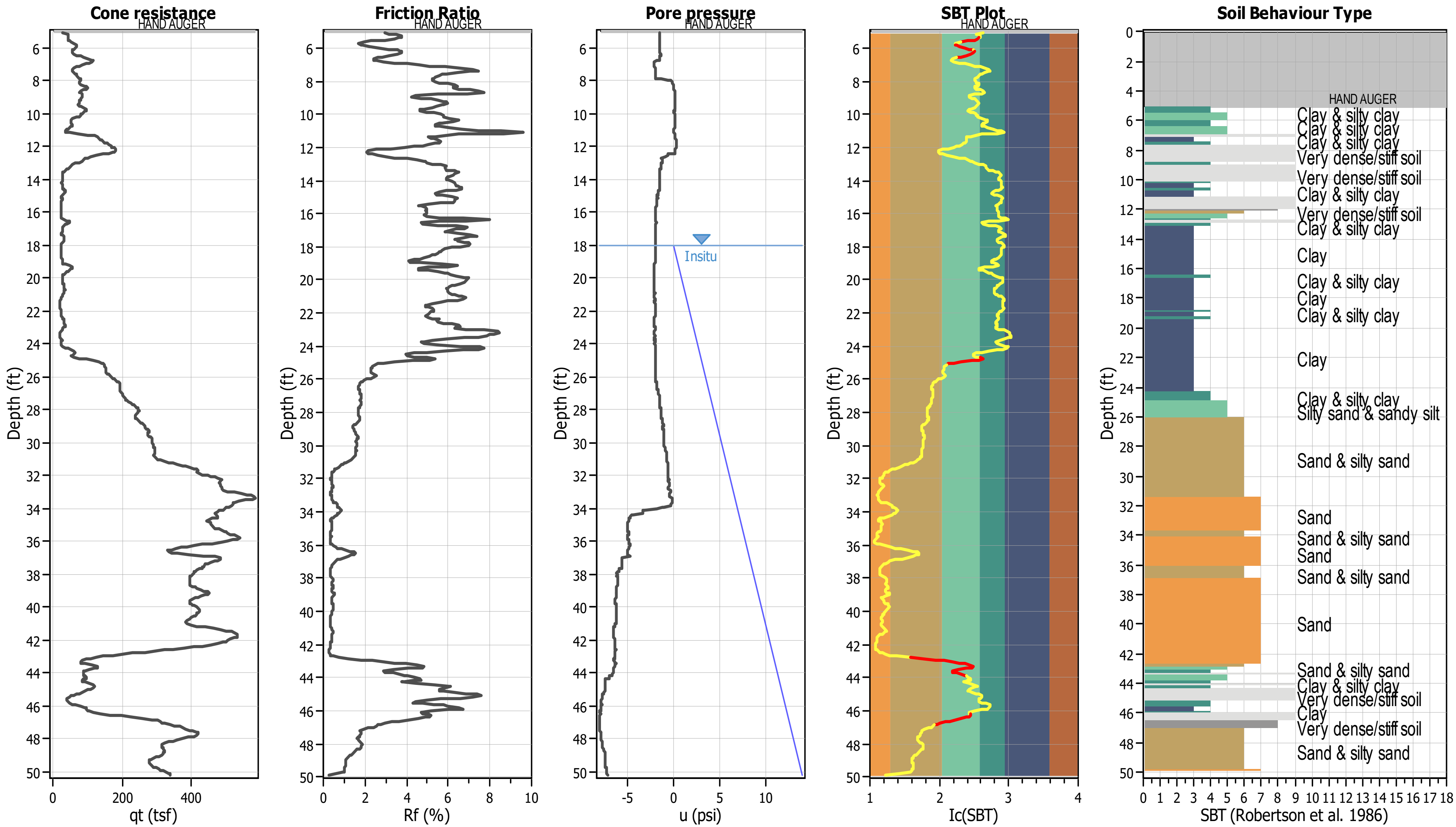






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



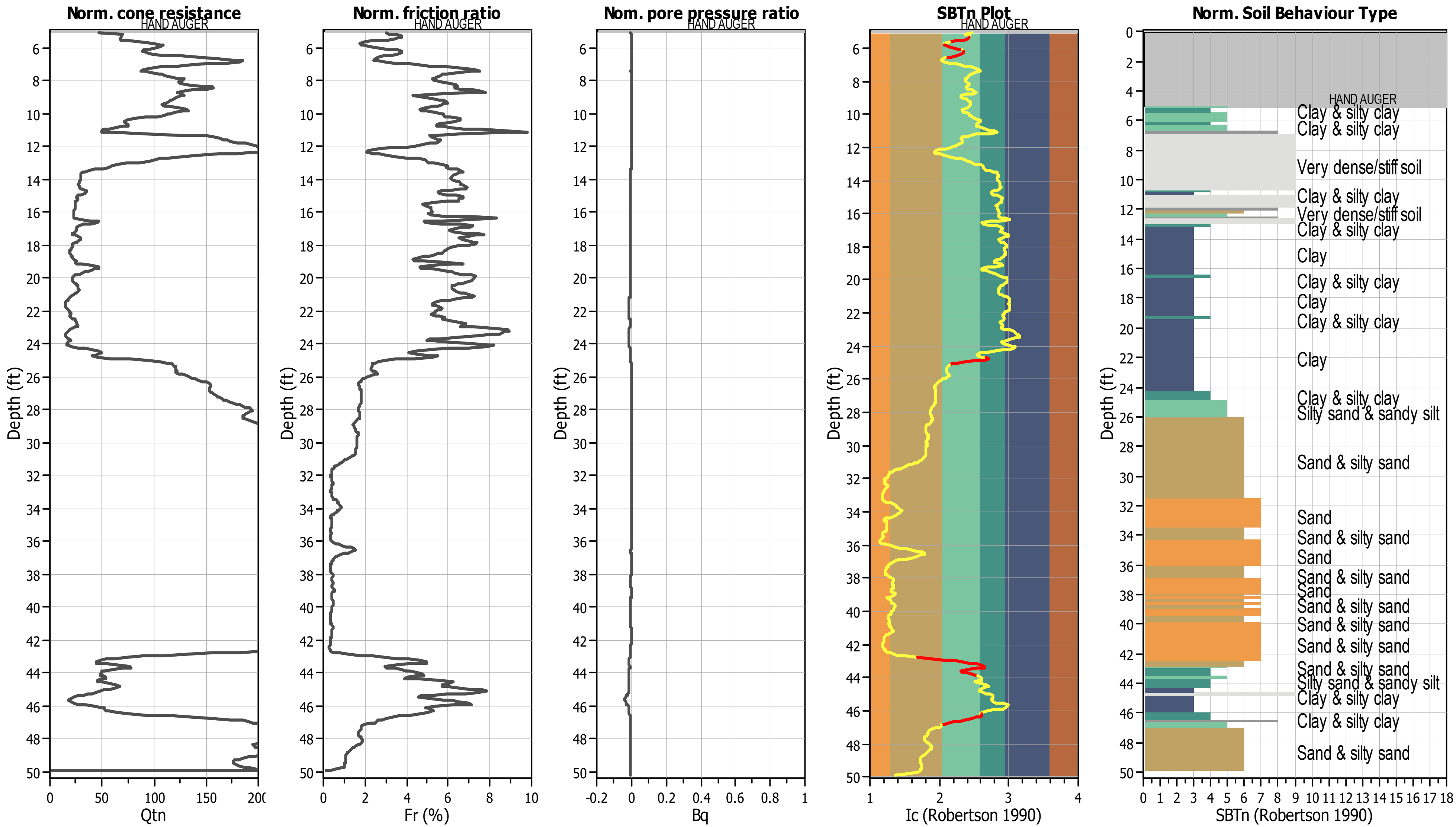
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
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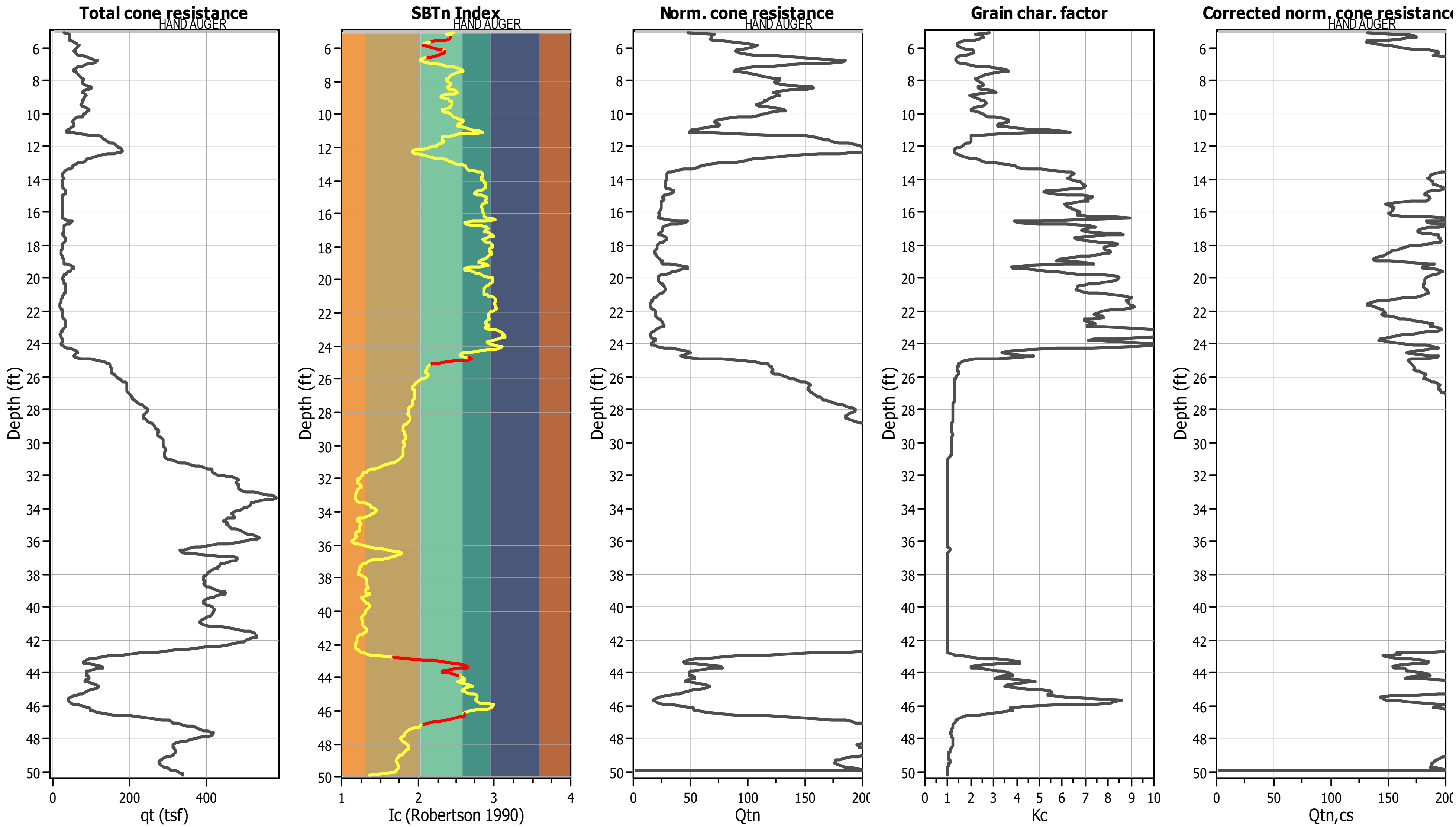
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

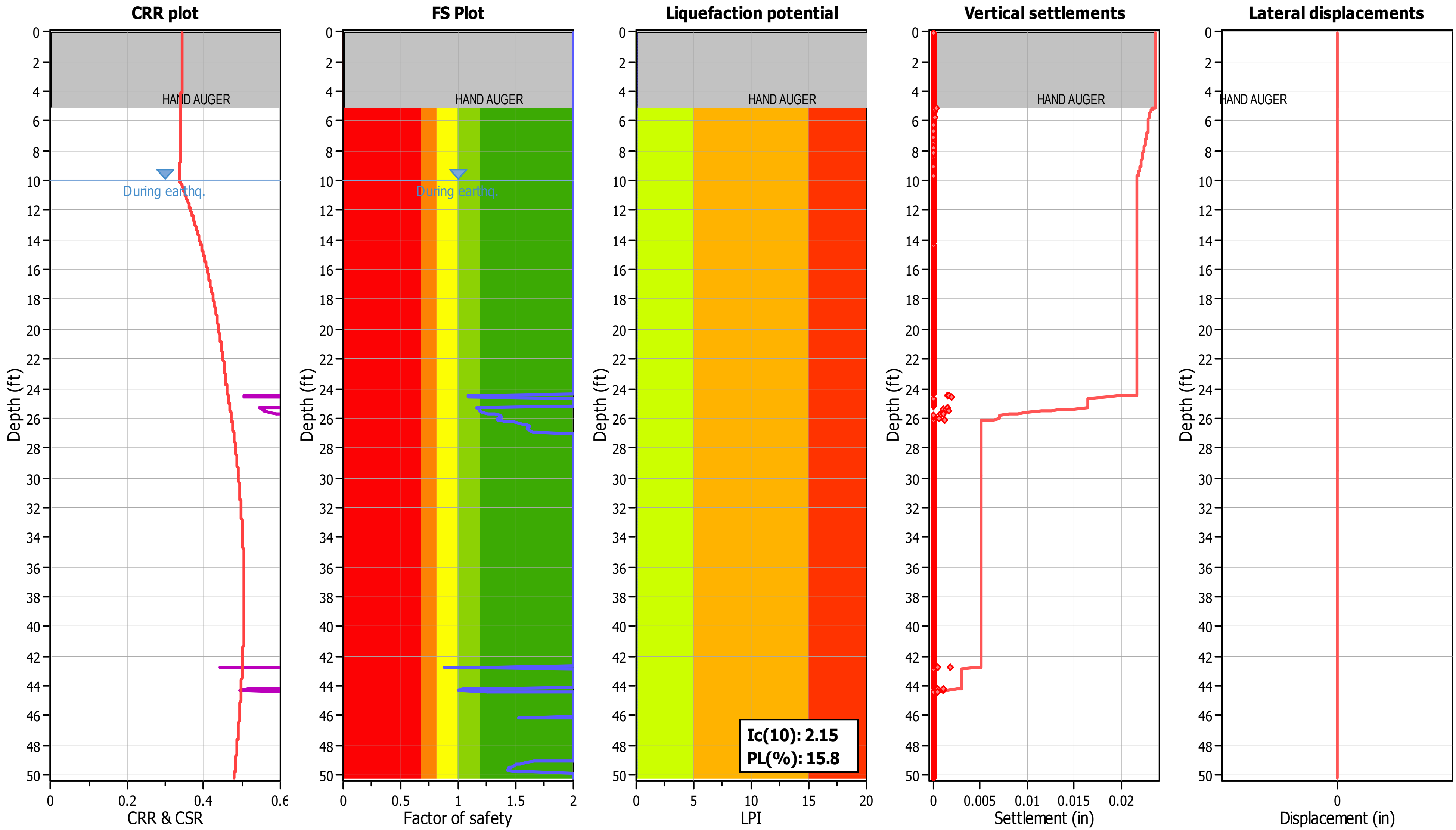
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

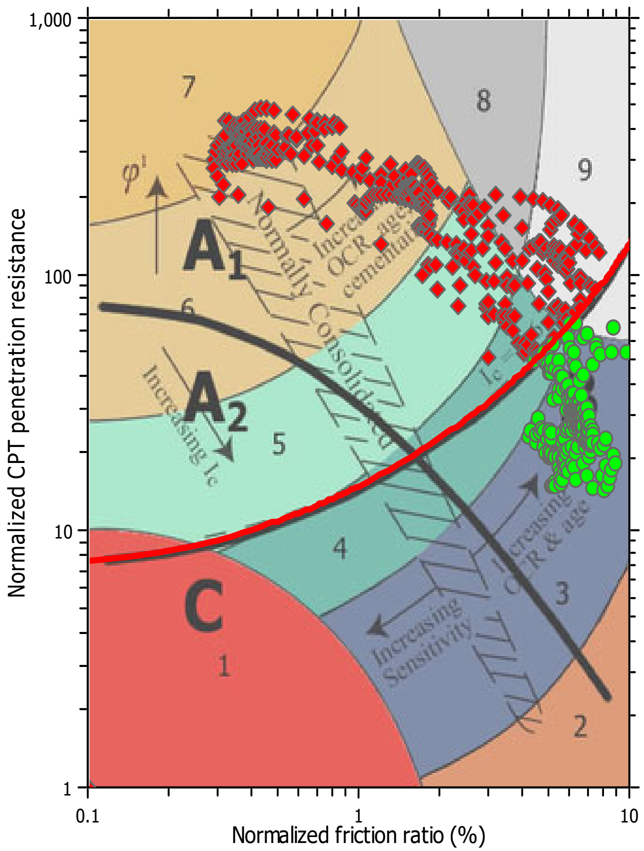
F.S. color scheme

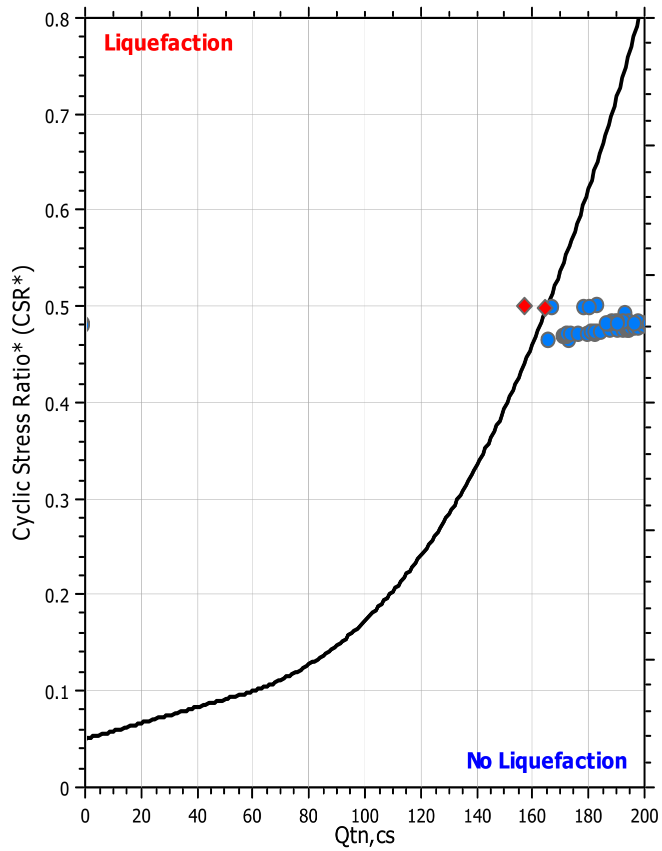
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

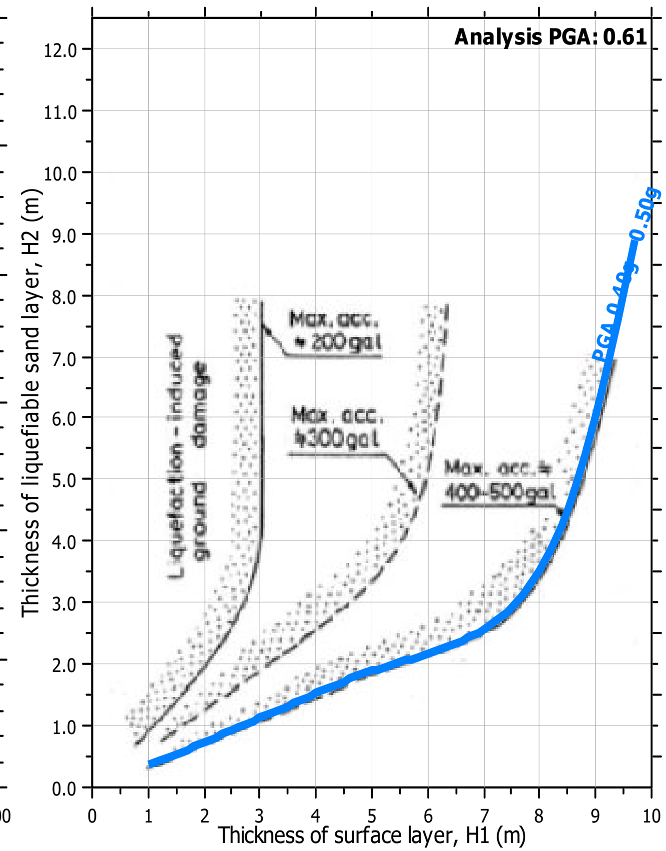
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots







Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
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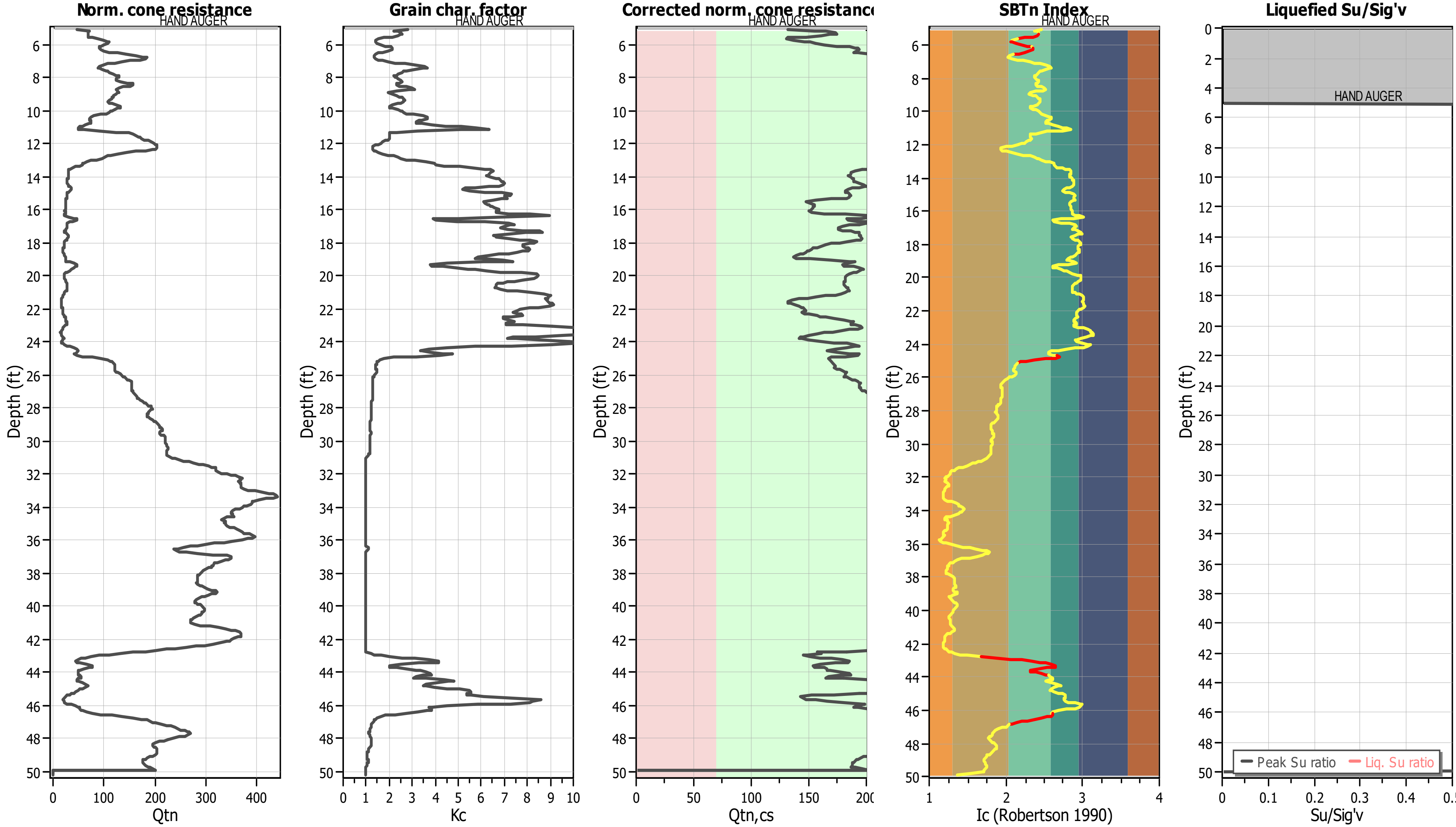
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

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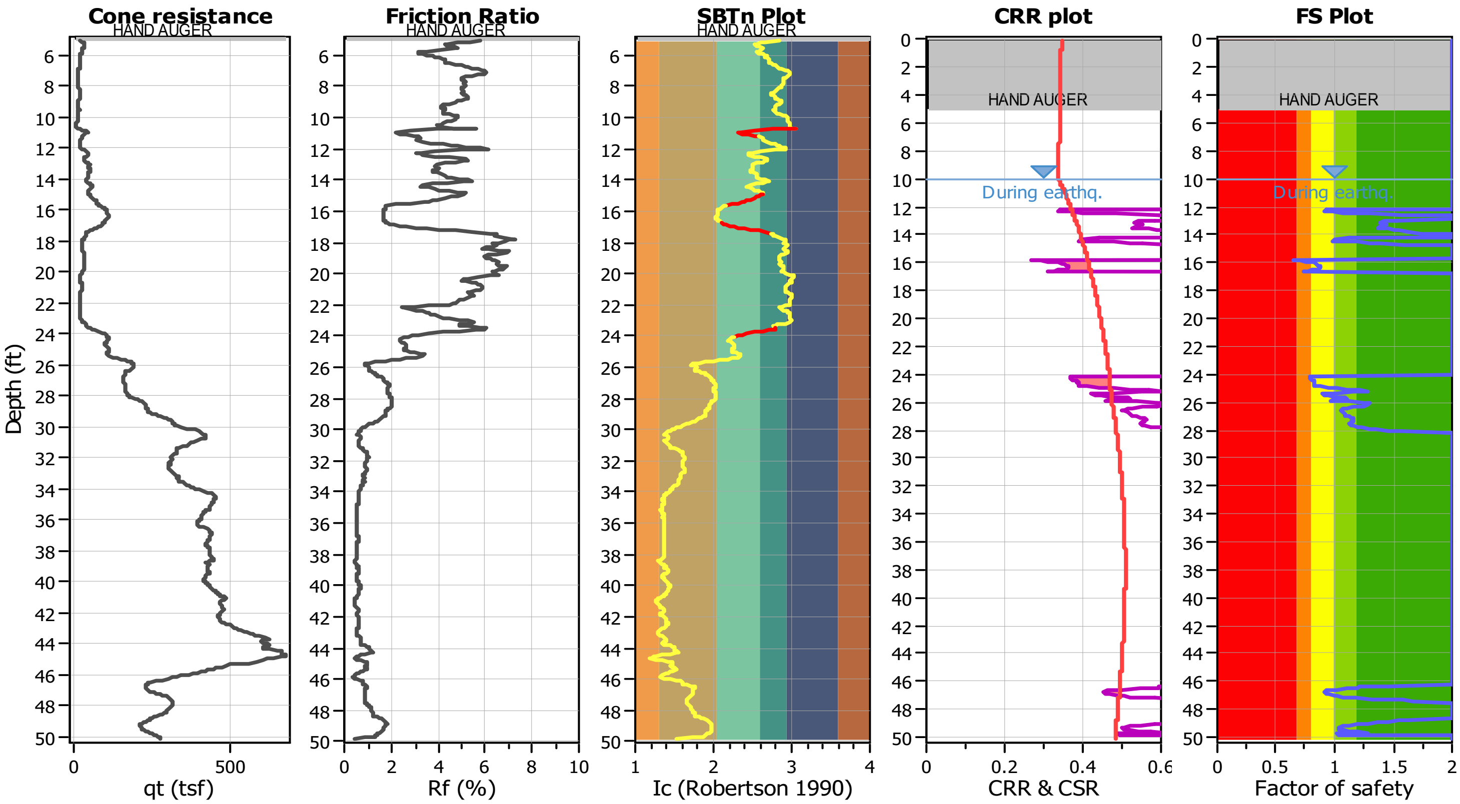
LIQUEFACTION ANALYSIS REPORT

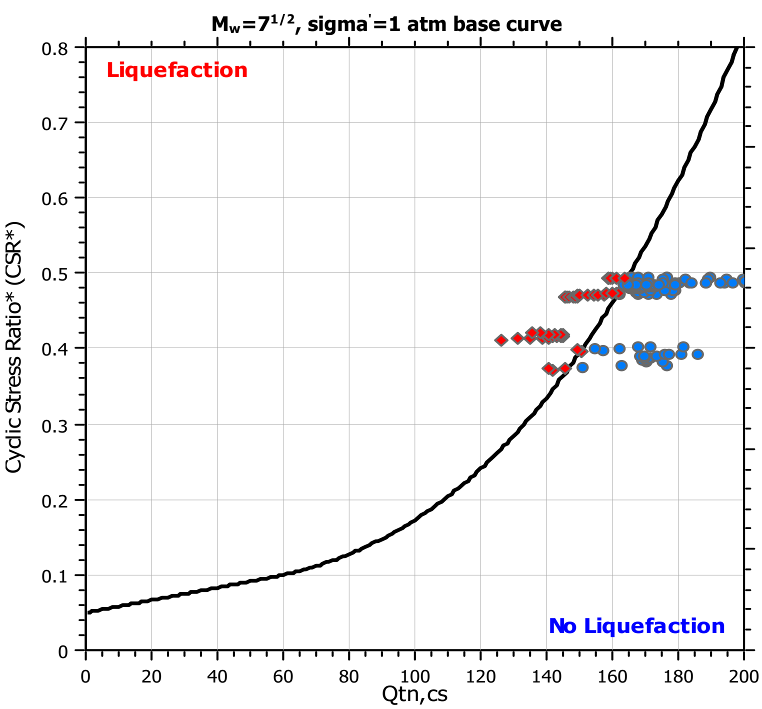
Project title : Meritage/3150 Bear St. **Location : Costa Mesa, CA**

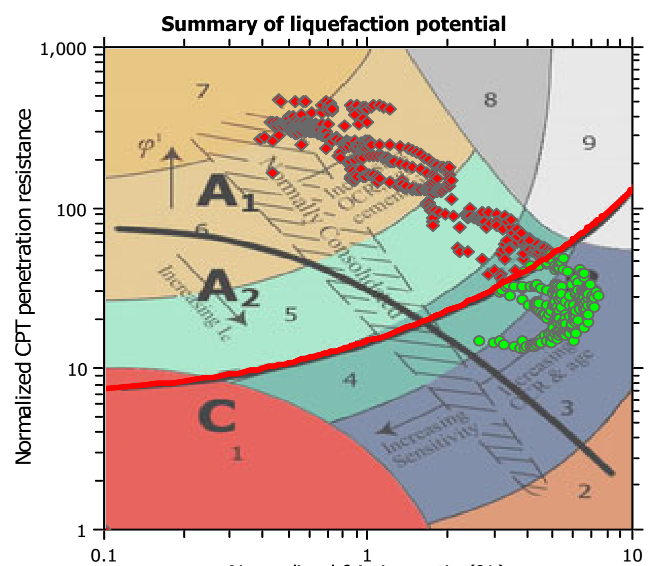
CPT file : CPT-4S

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	18.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

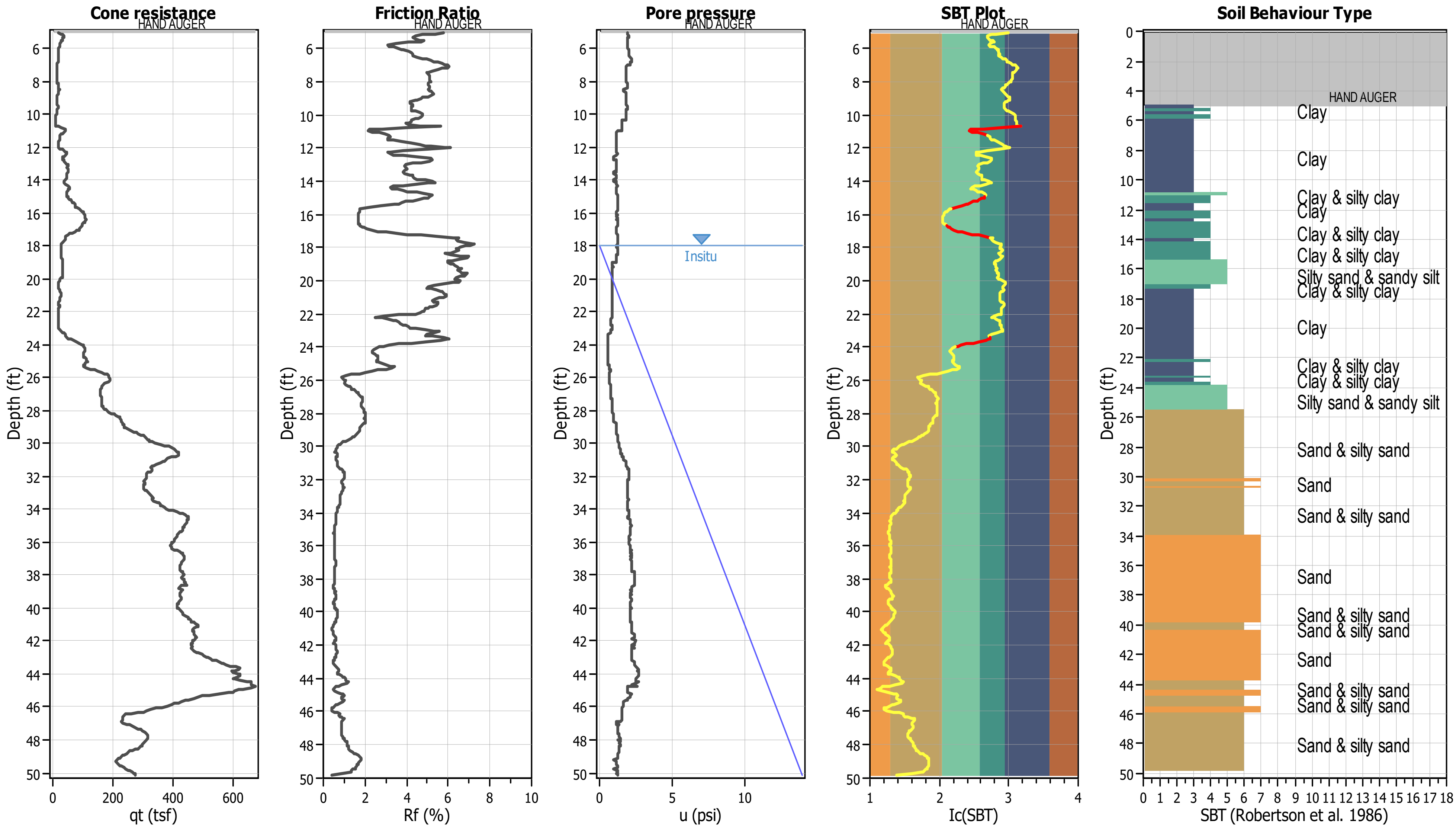






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



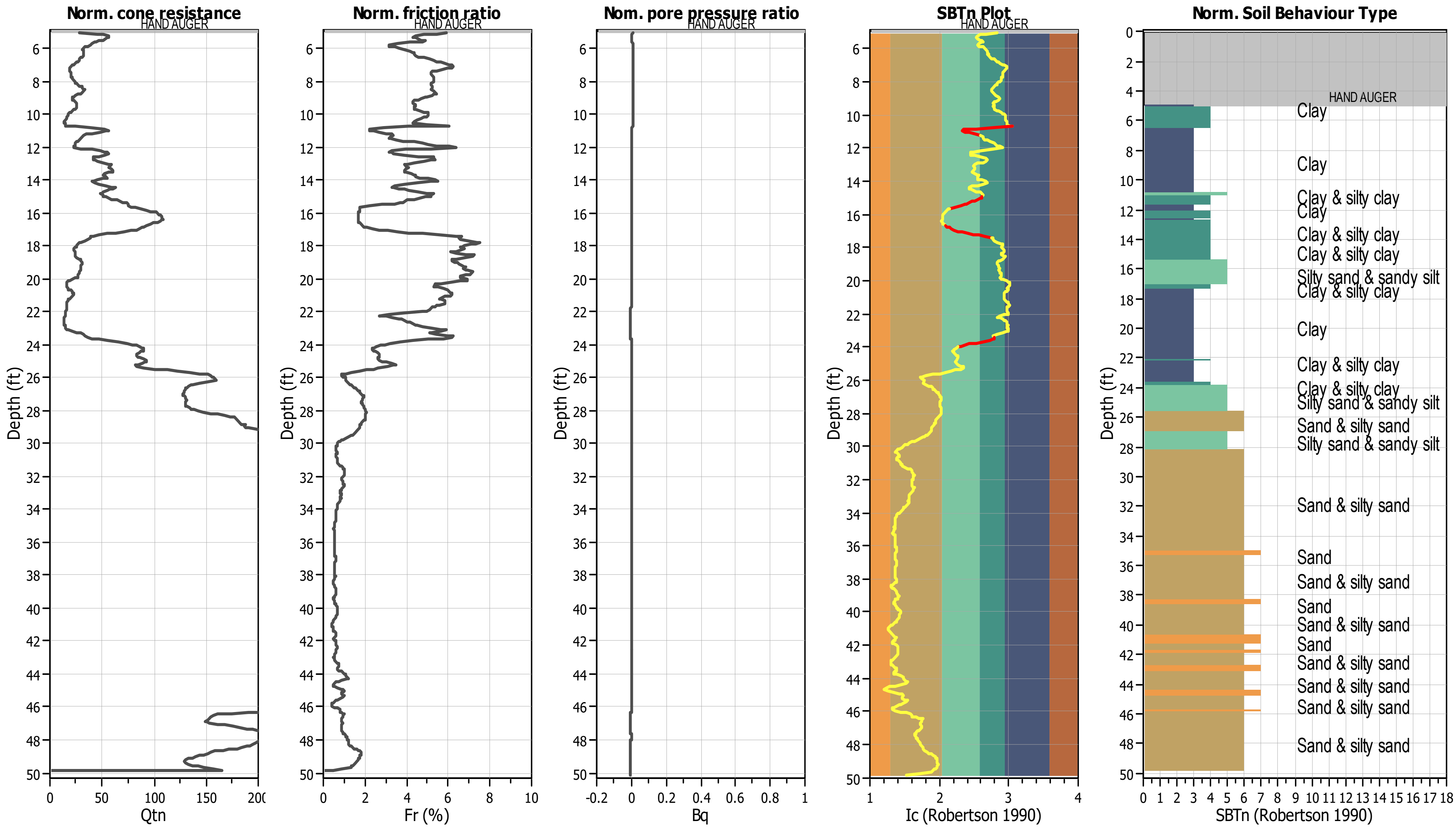
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



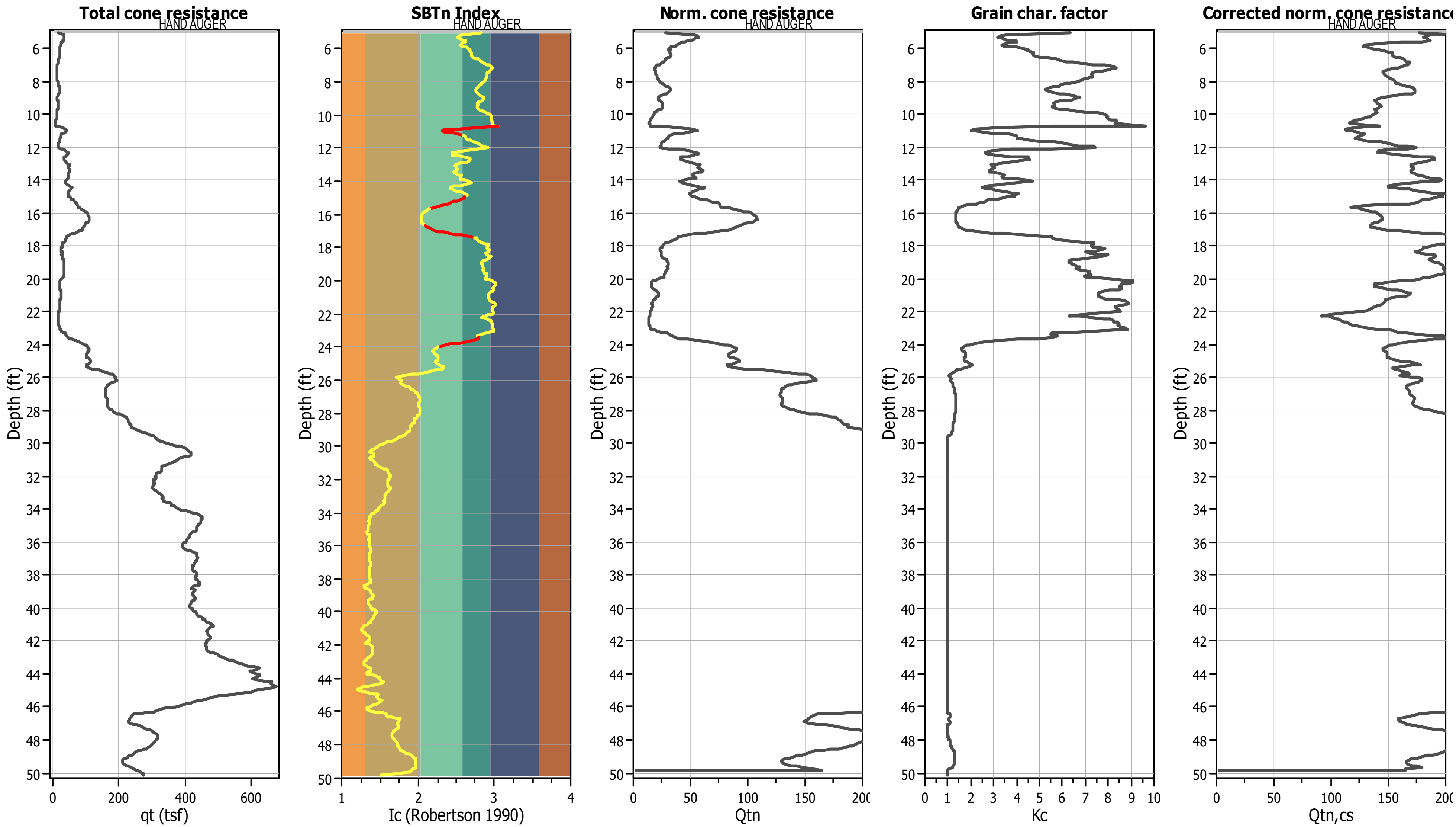
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

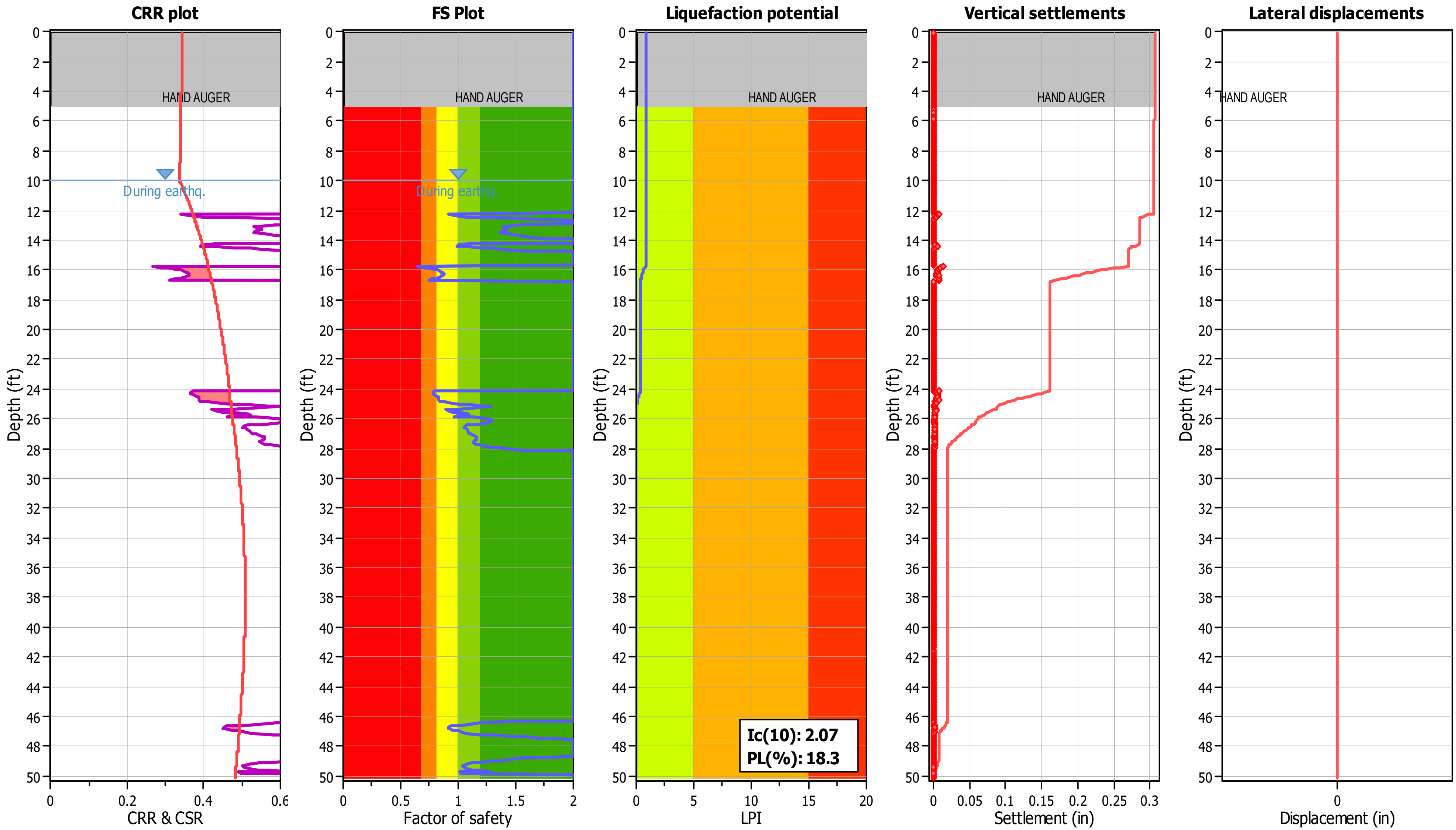
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

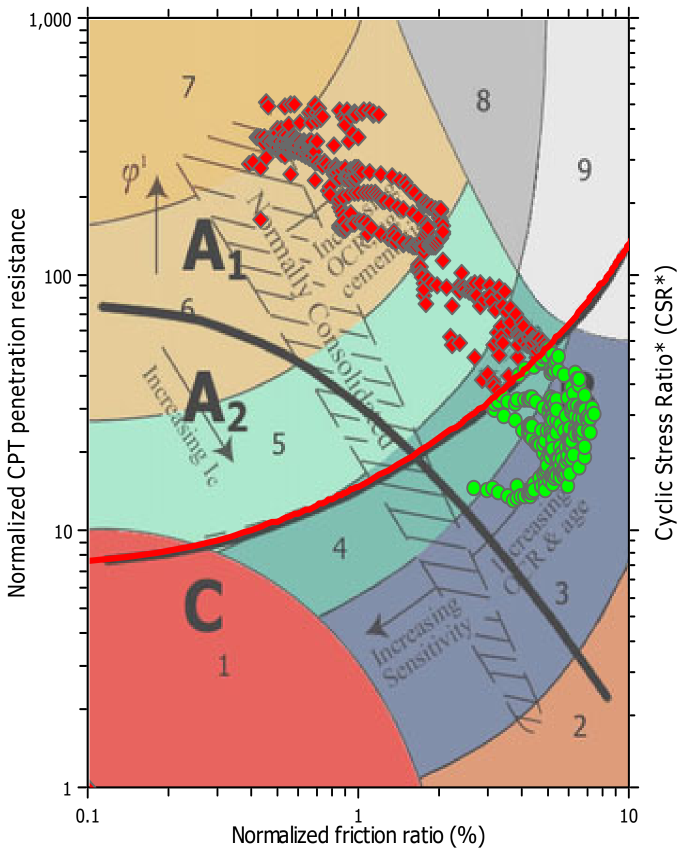
F.S. color scheme

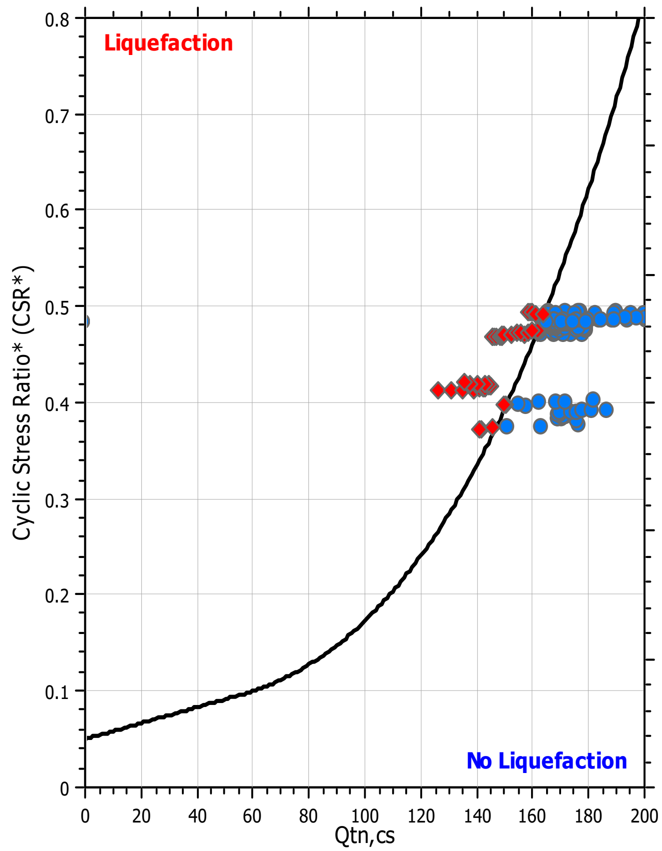
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

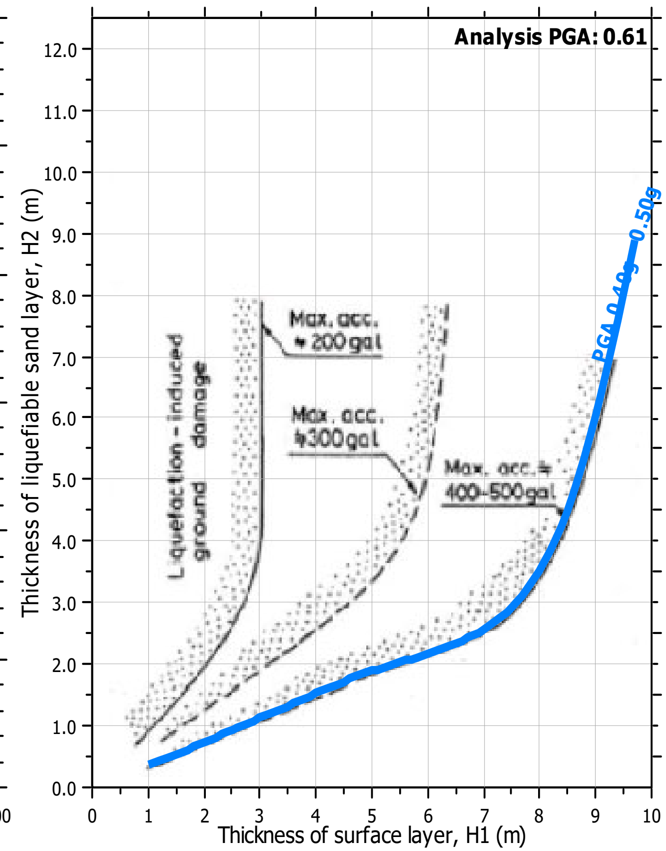
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



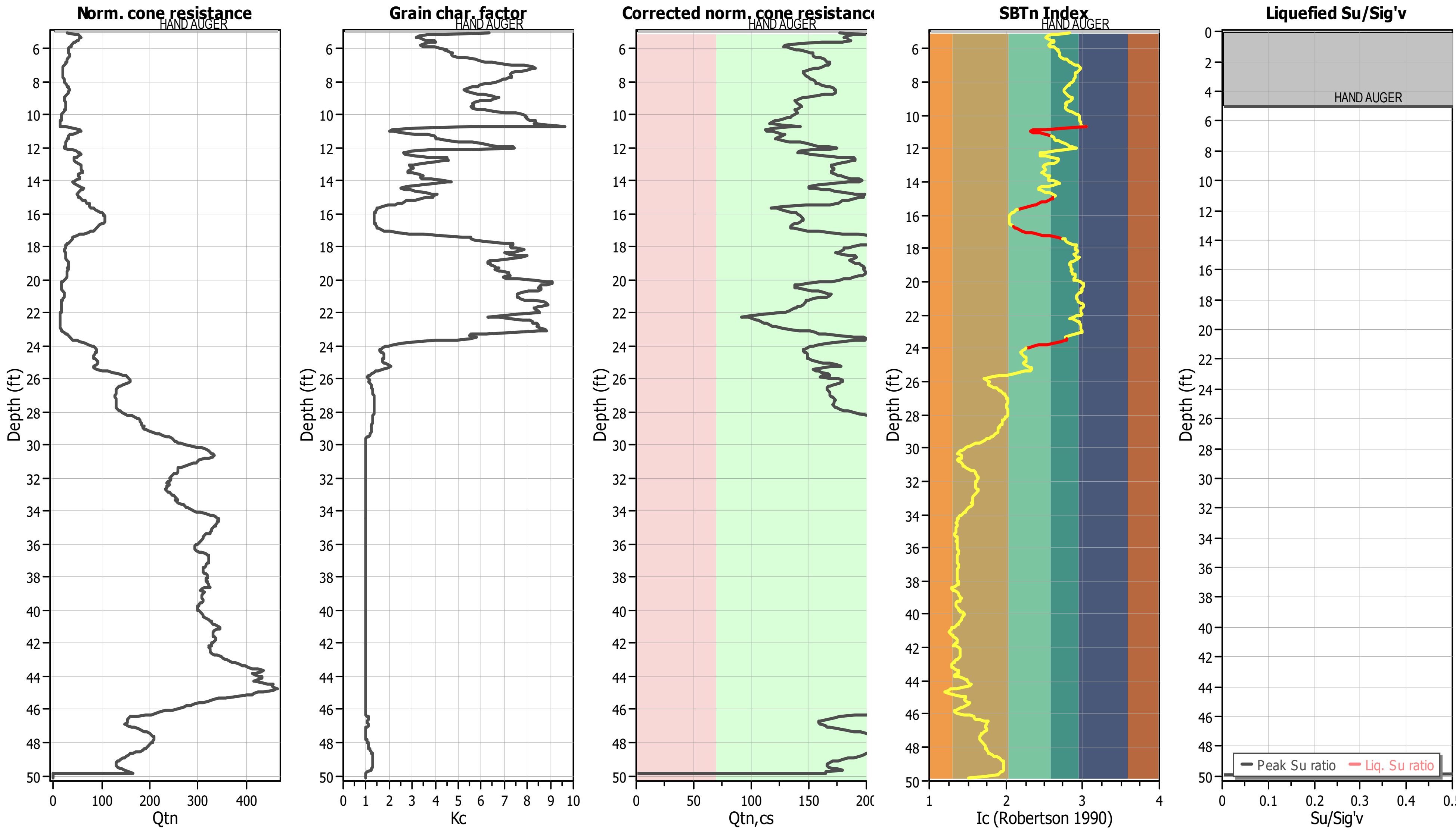




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

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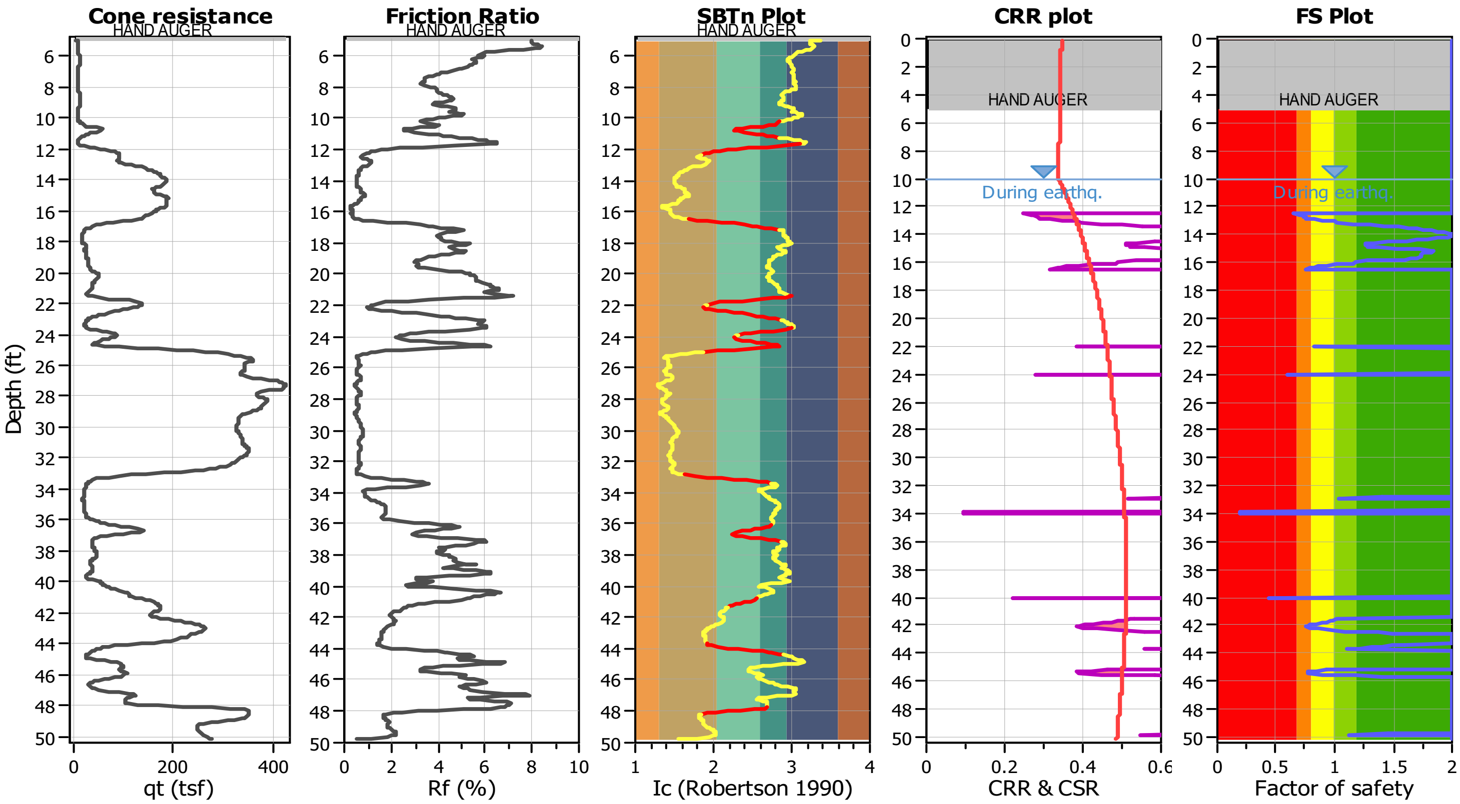
LIQUEFACTION ANALYSIS REPORT

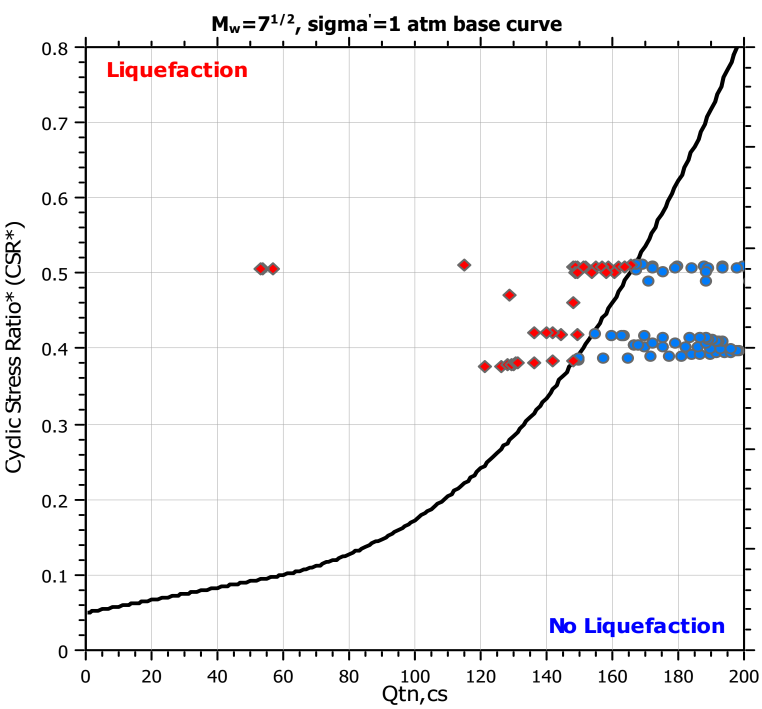
Project title : Meritage/3150 Bear St. **Location : Costa Mesa, CA**

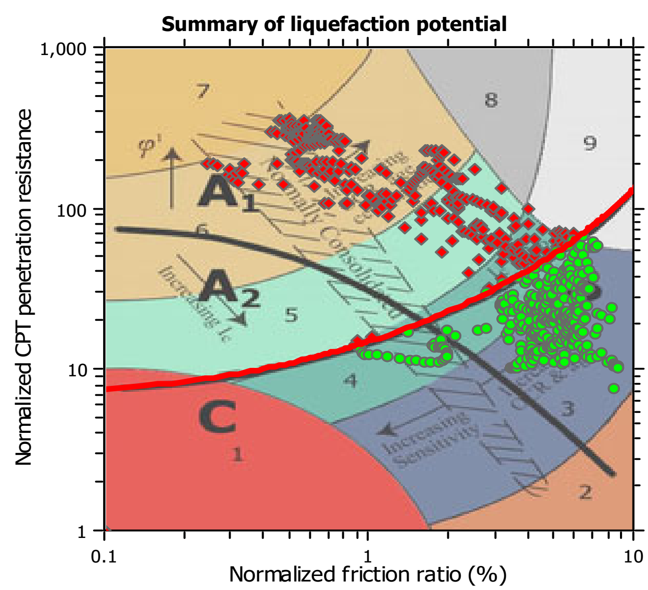
CPT file : CPT-5S

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	18.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

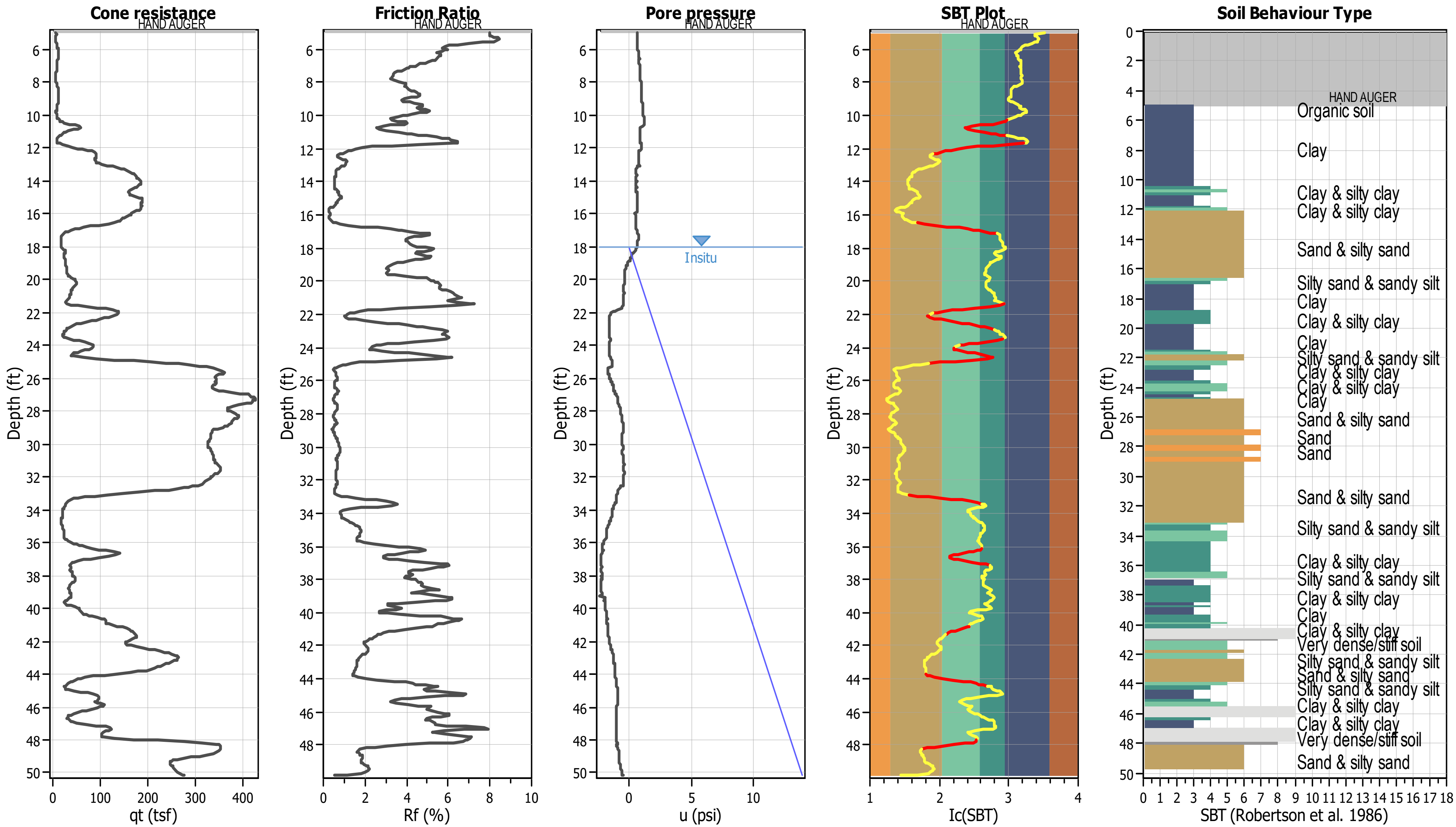






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



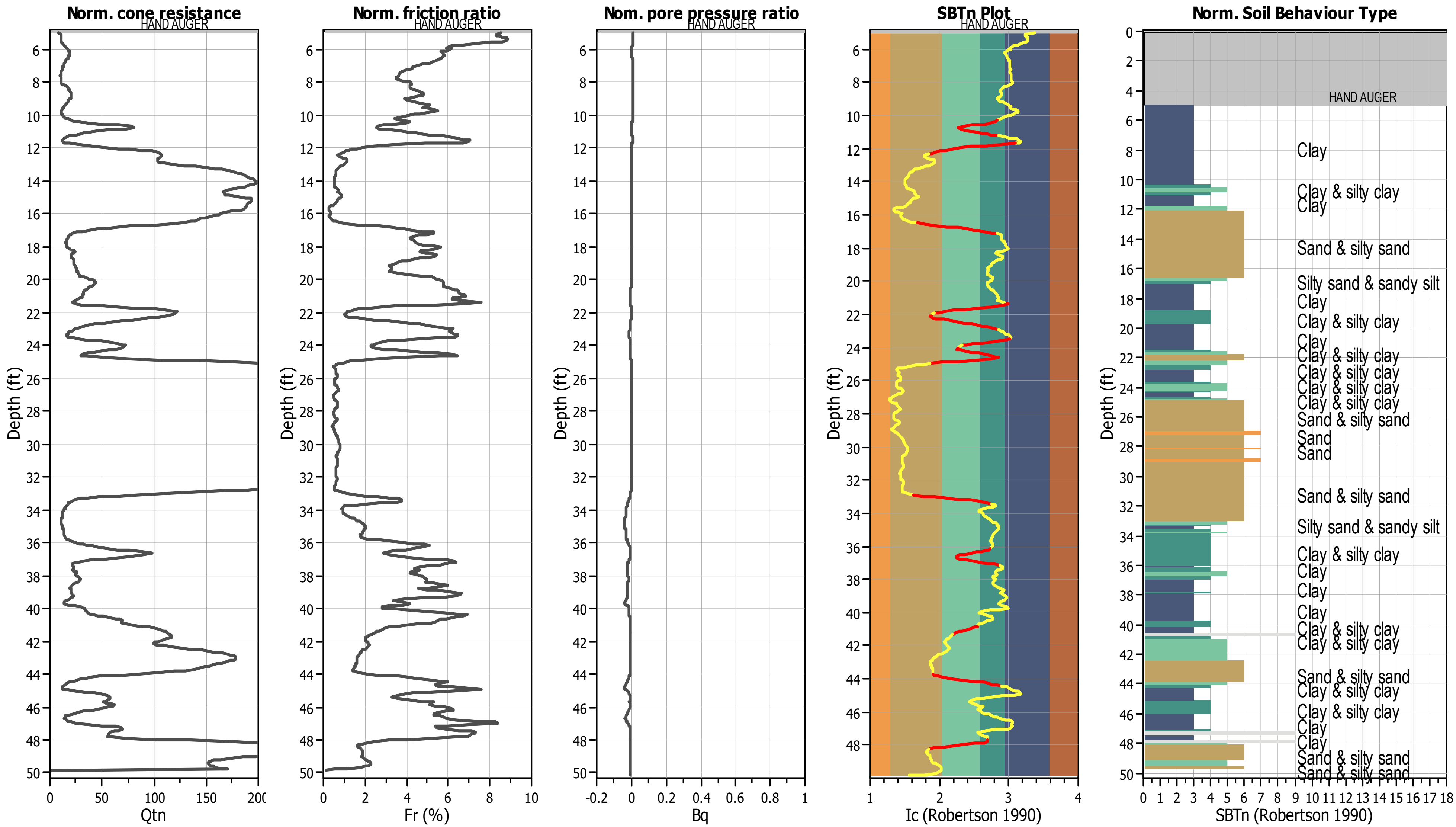
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



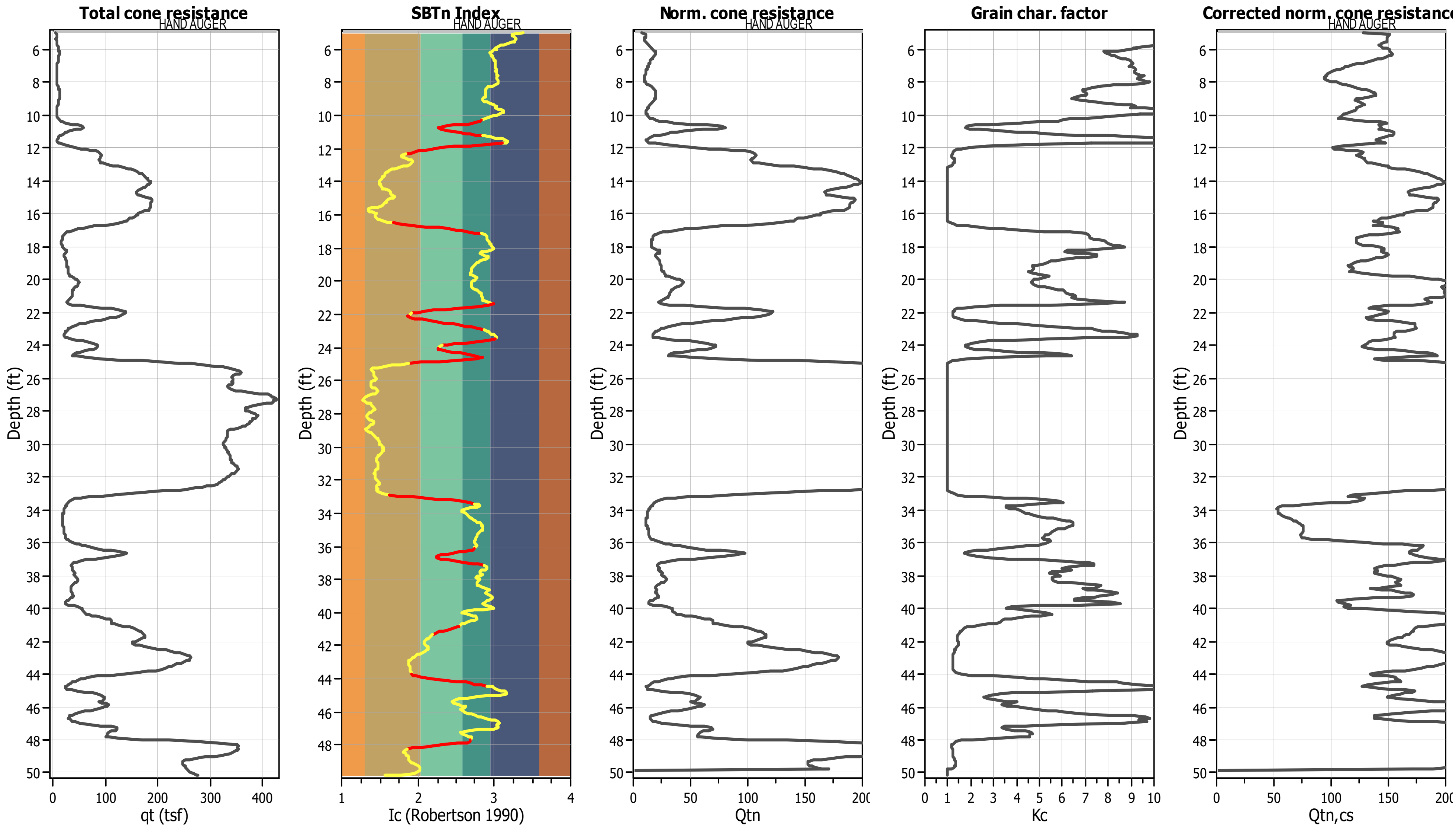
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

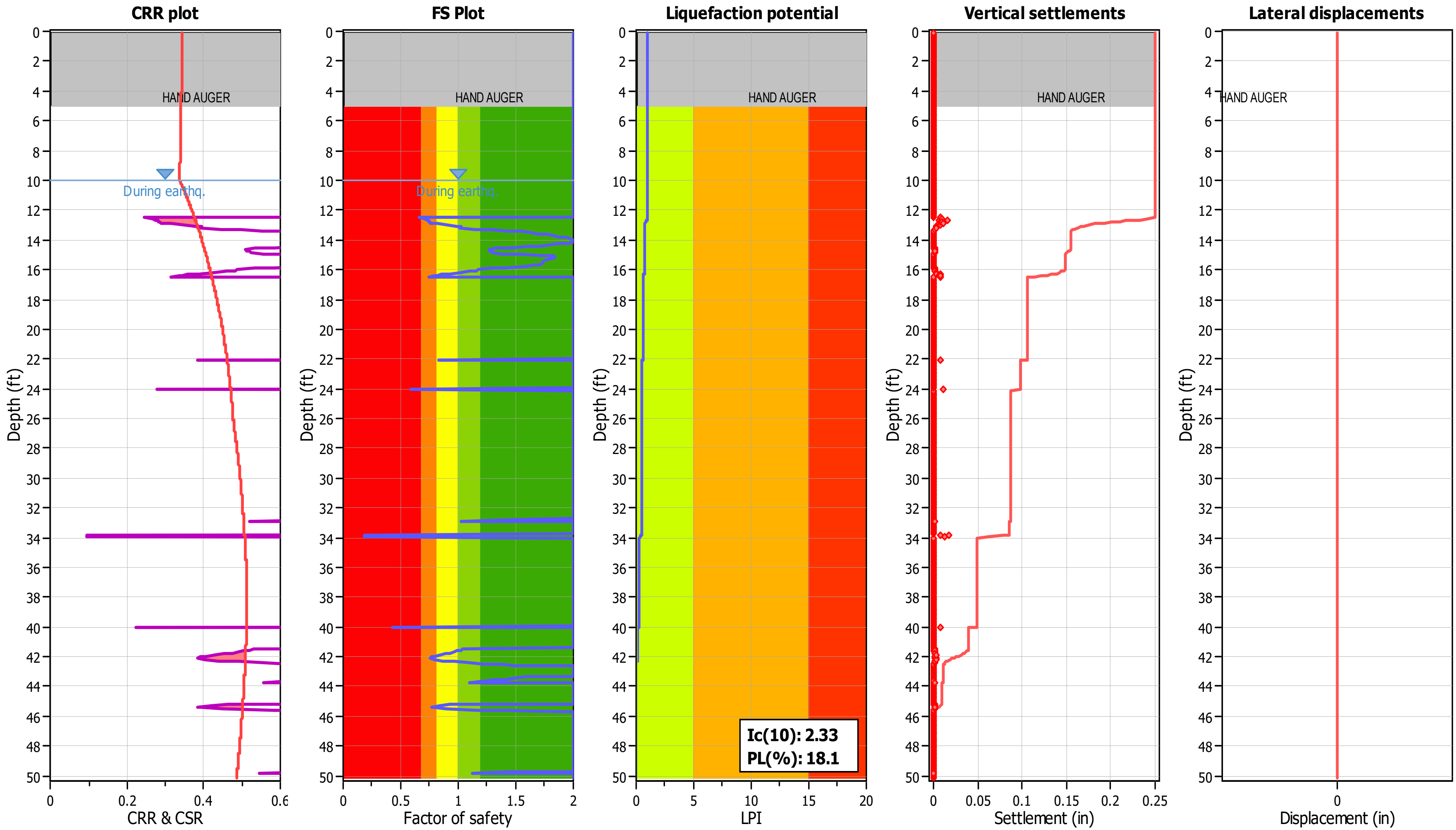
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

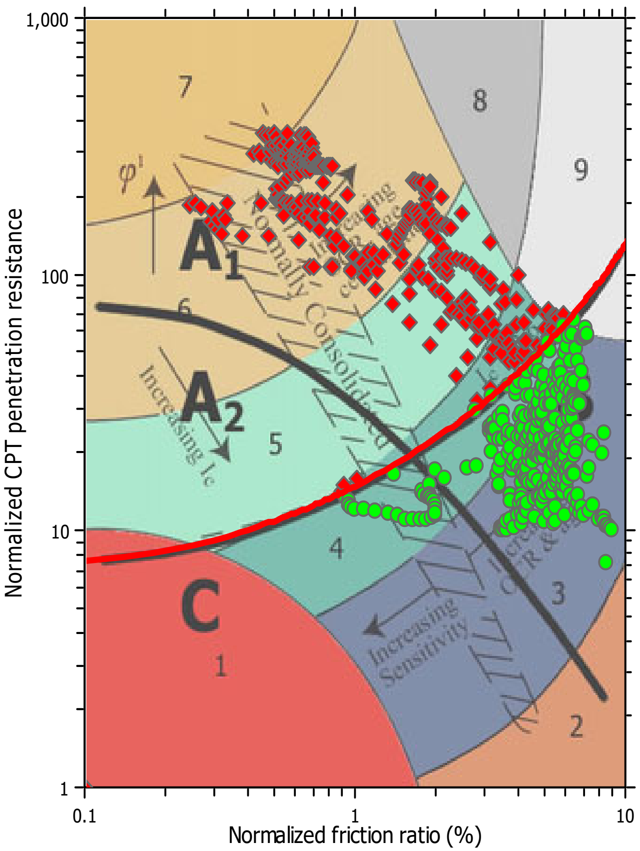
F.S. color scheme

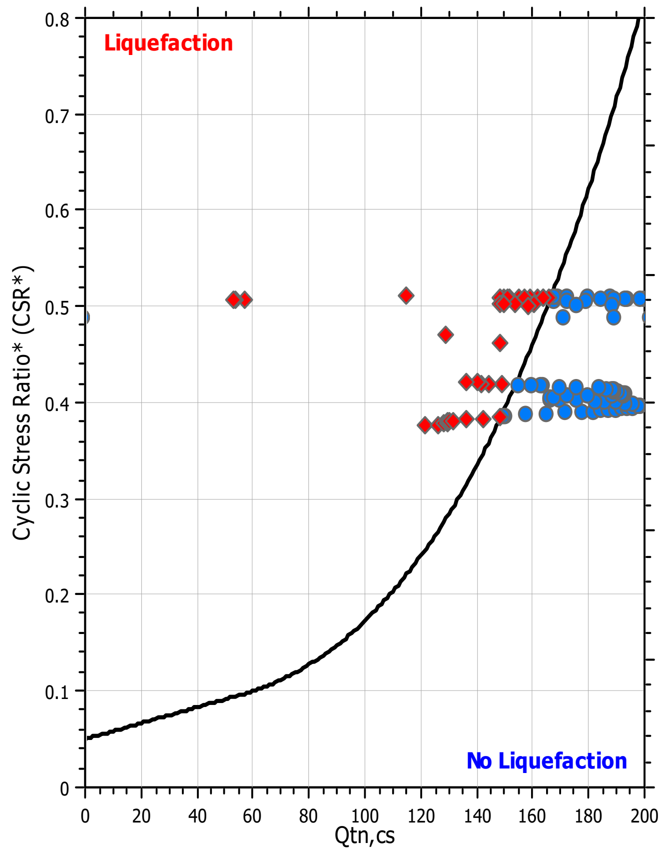
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

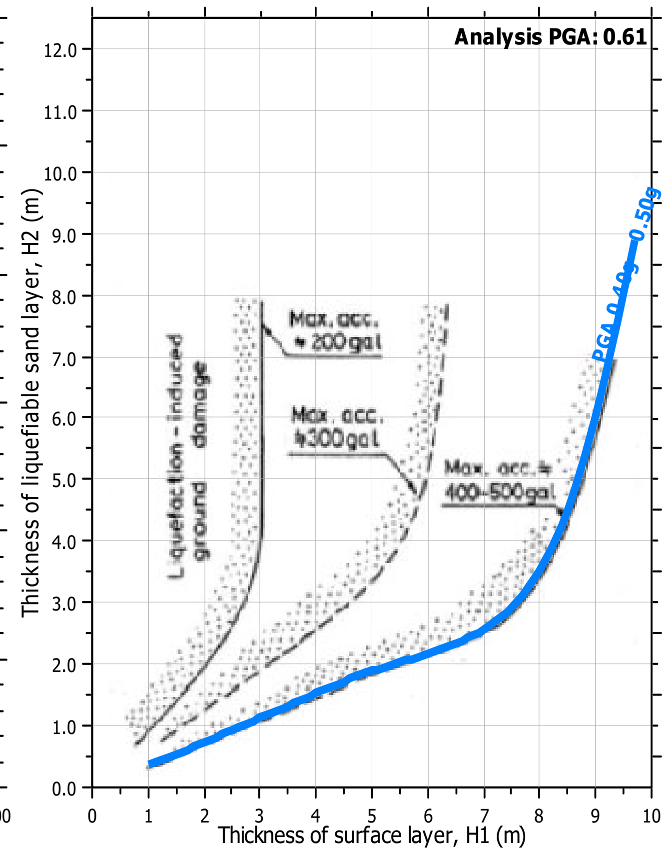
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



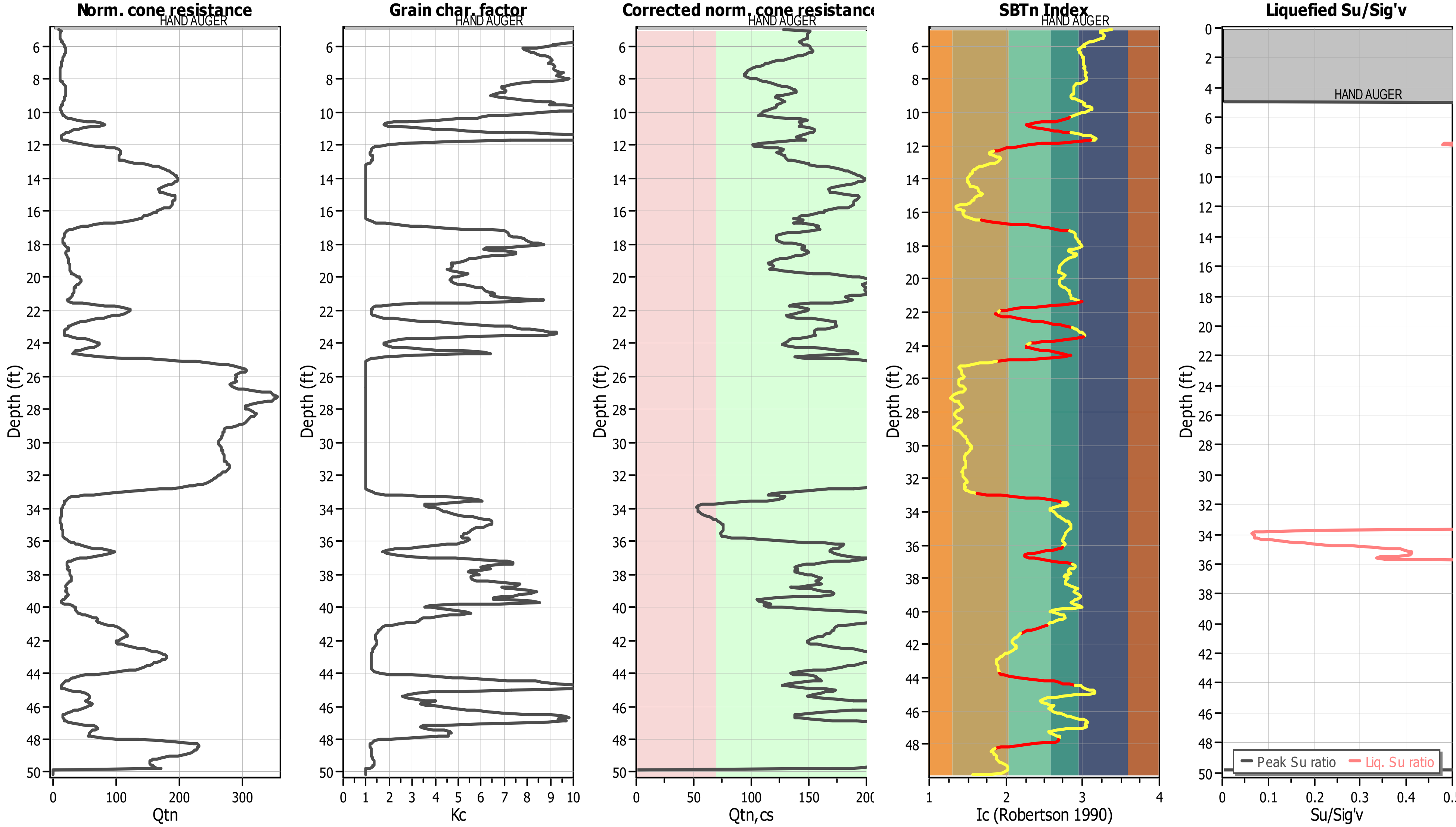




Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

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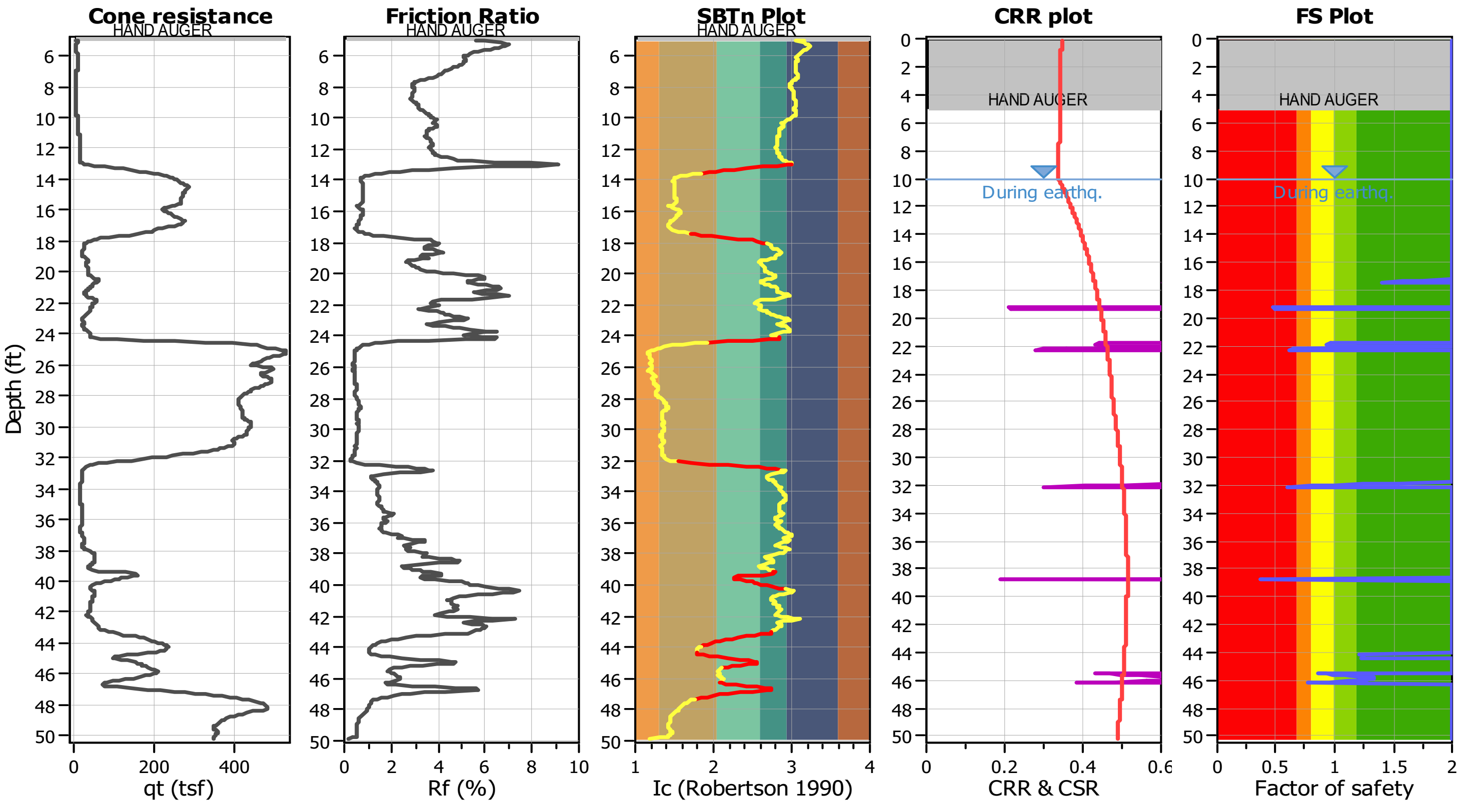
LIQUEFACTION ANALYSIS REPORT

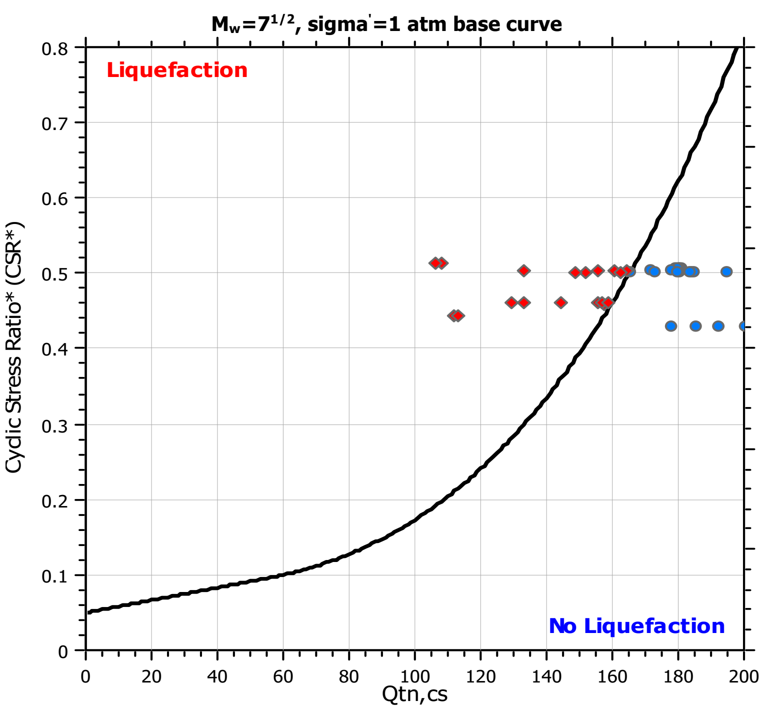
Project title : Meritage/3150 Bear St. **Location : Costa Mesa, CA**

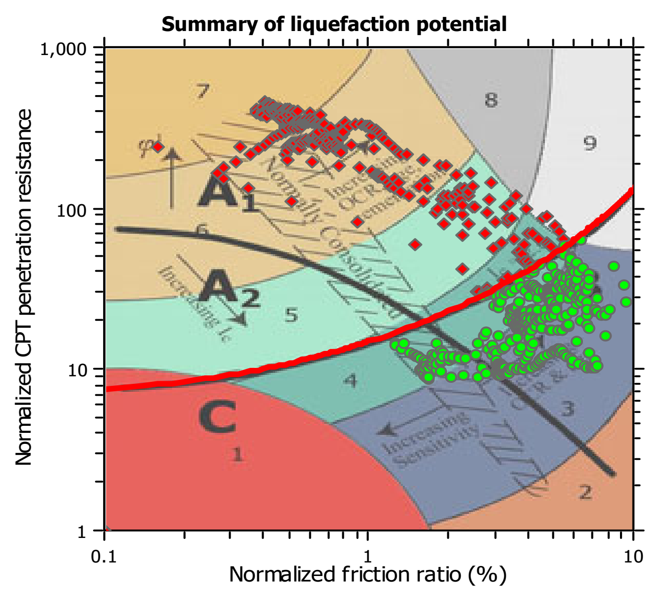
CPT file : CPT-6S

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	18.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	10.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.61	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

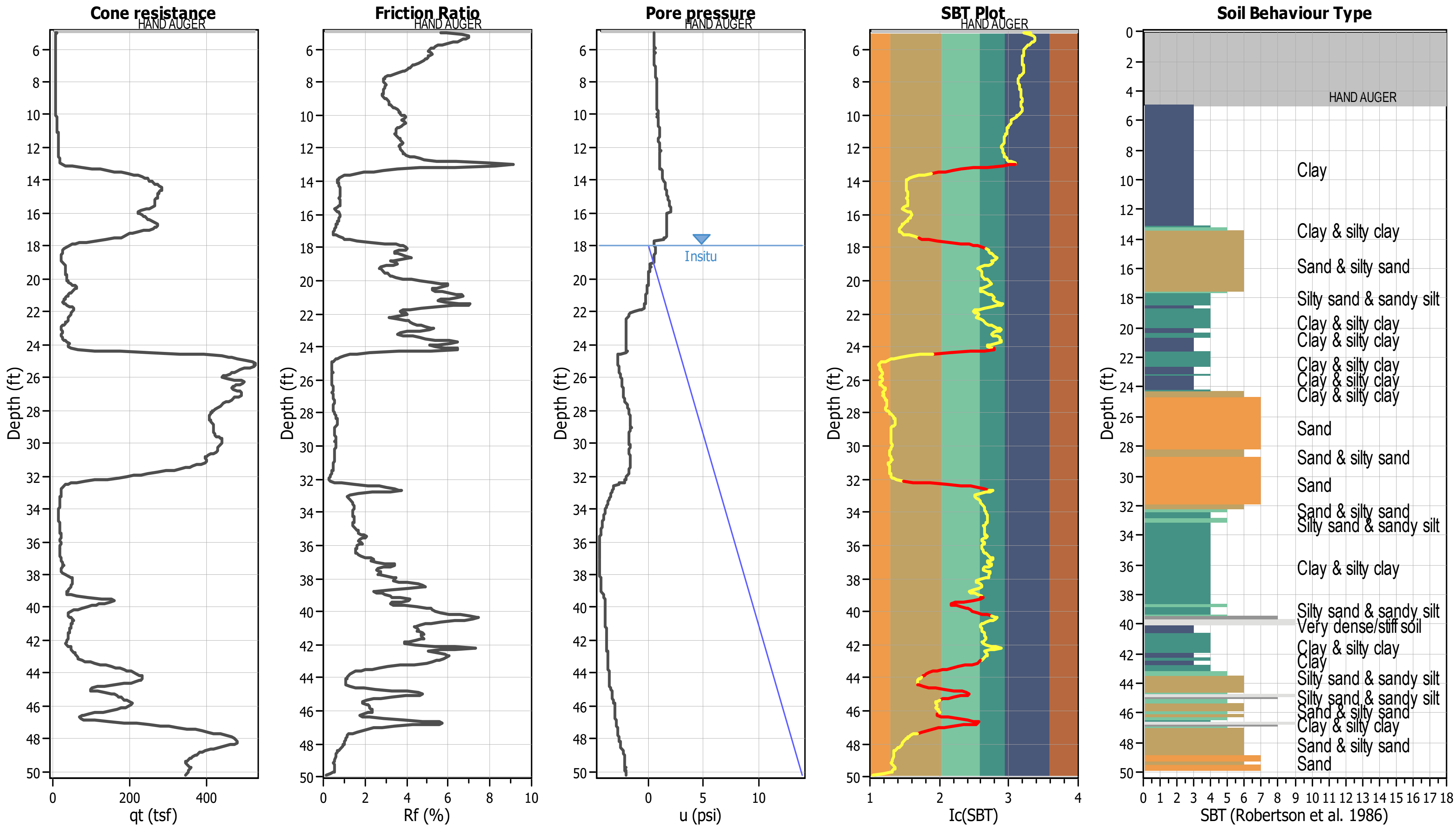






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



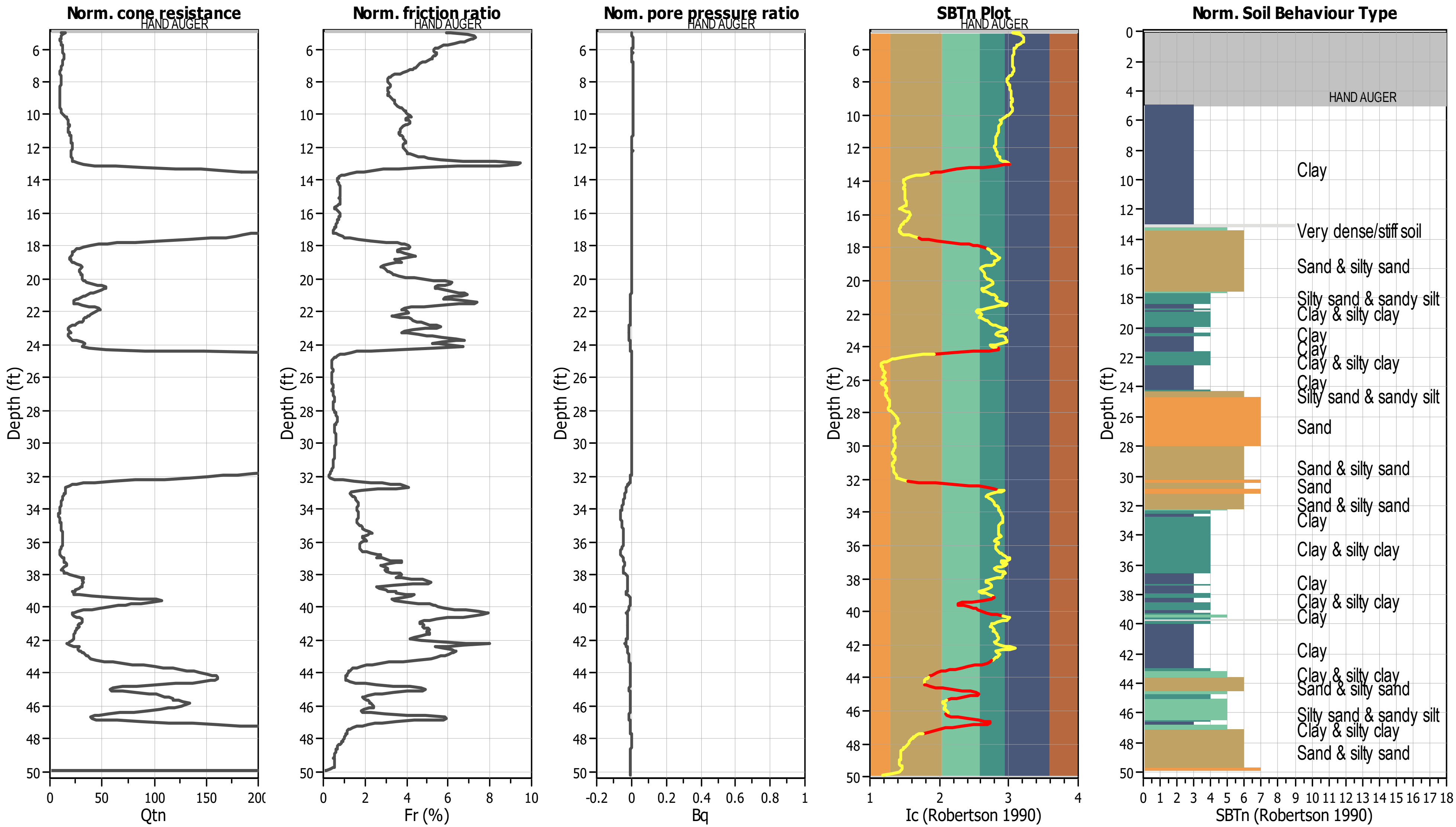
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



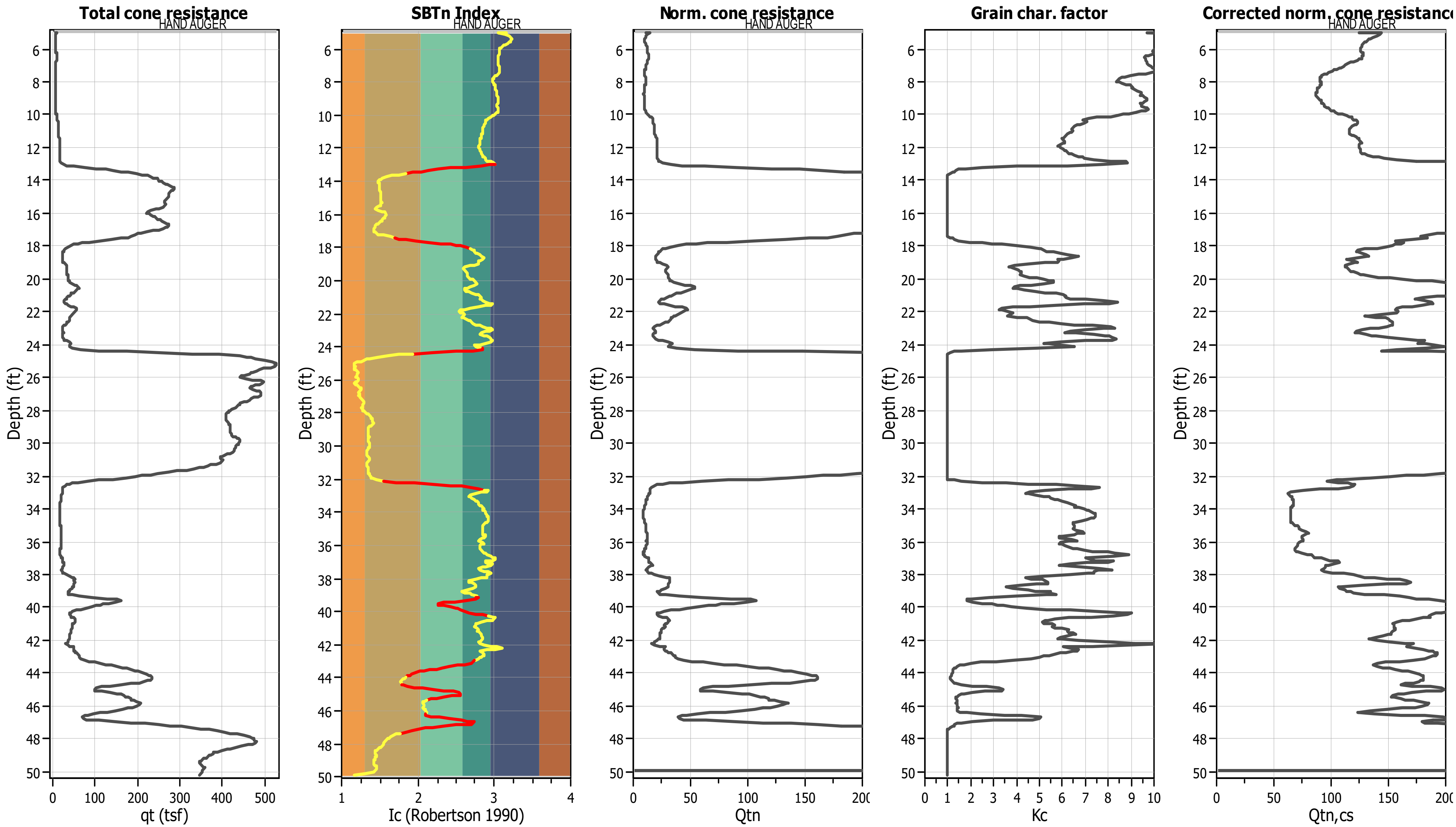
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

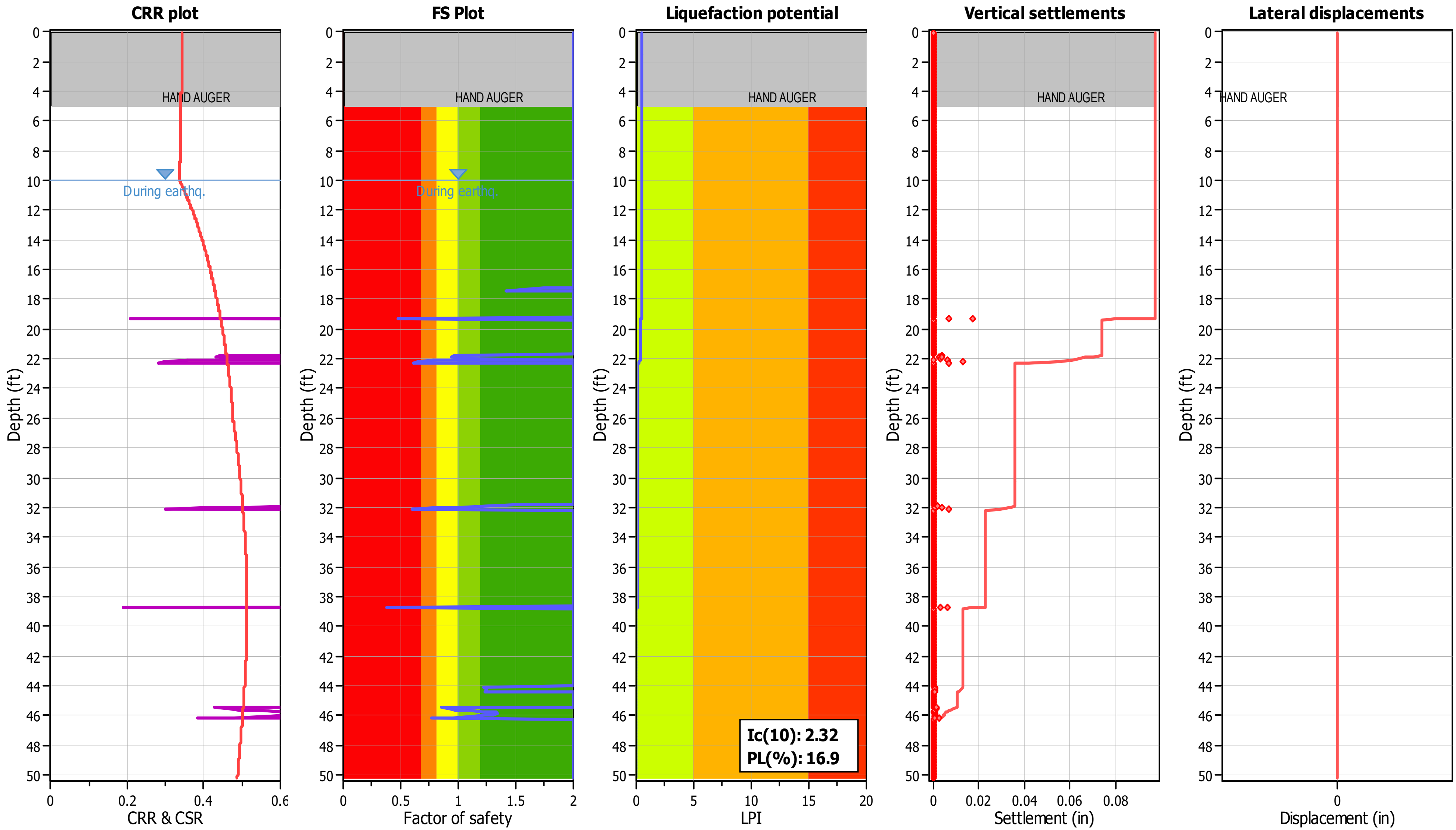
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

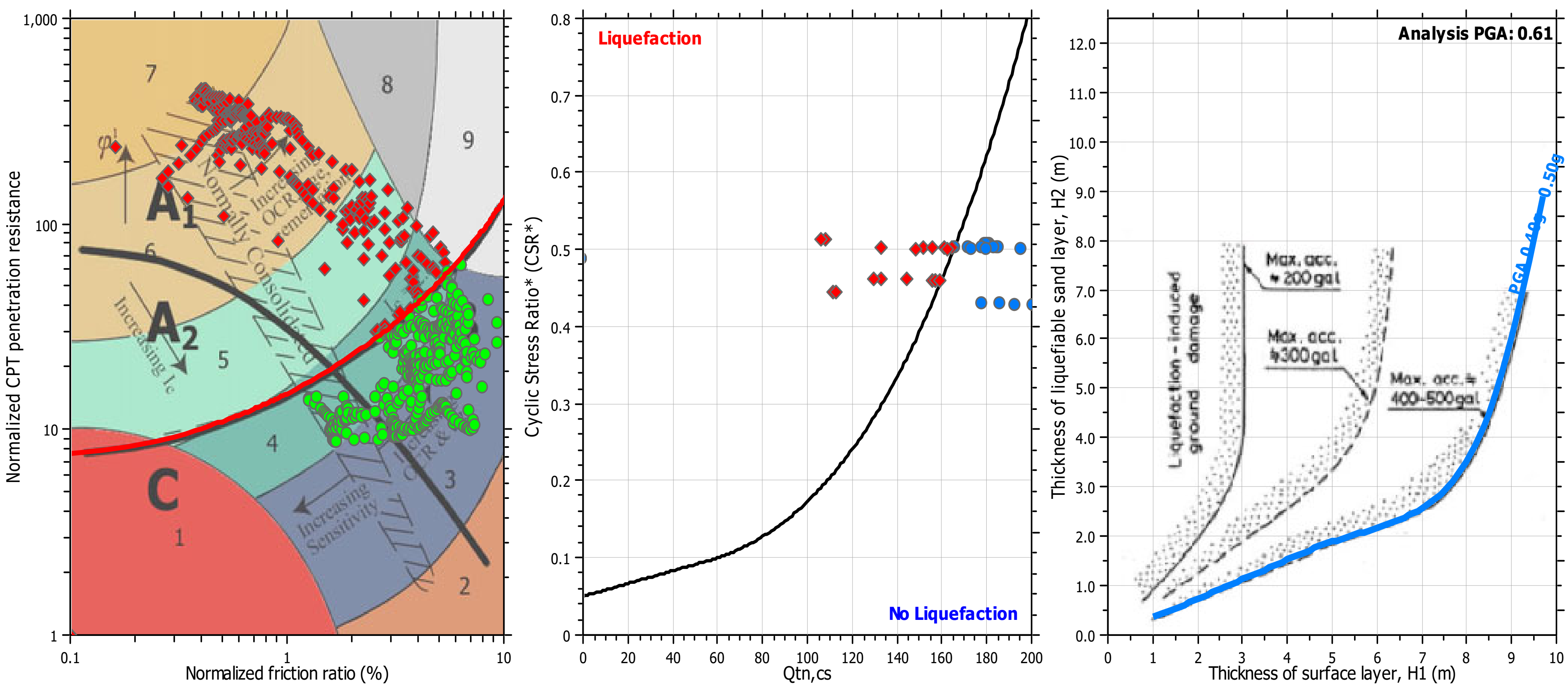
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

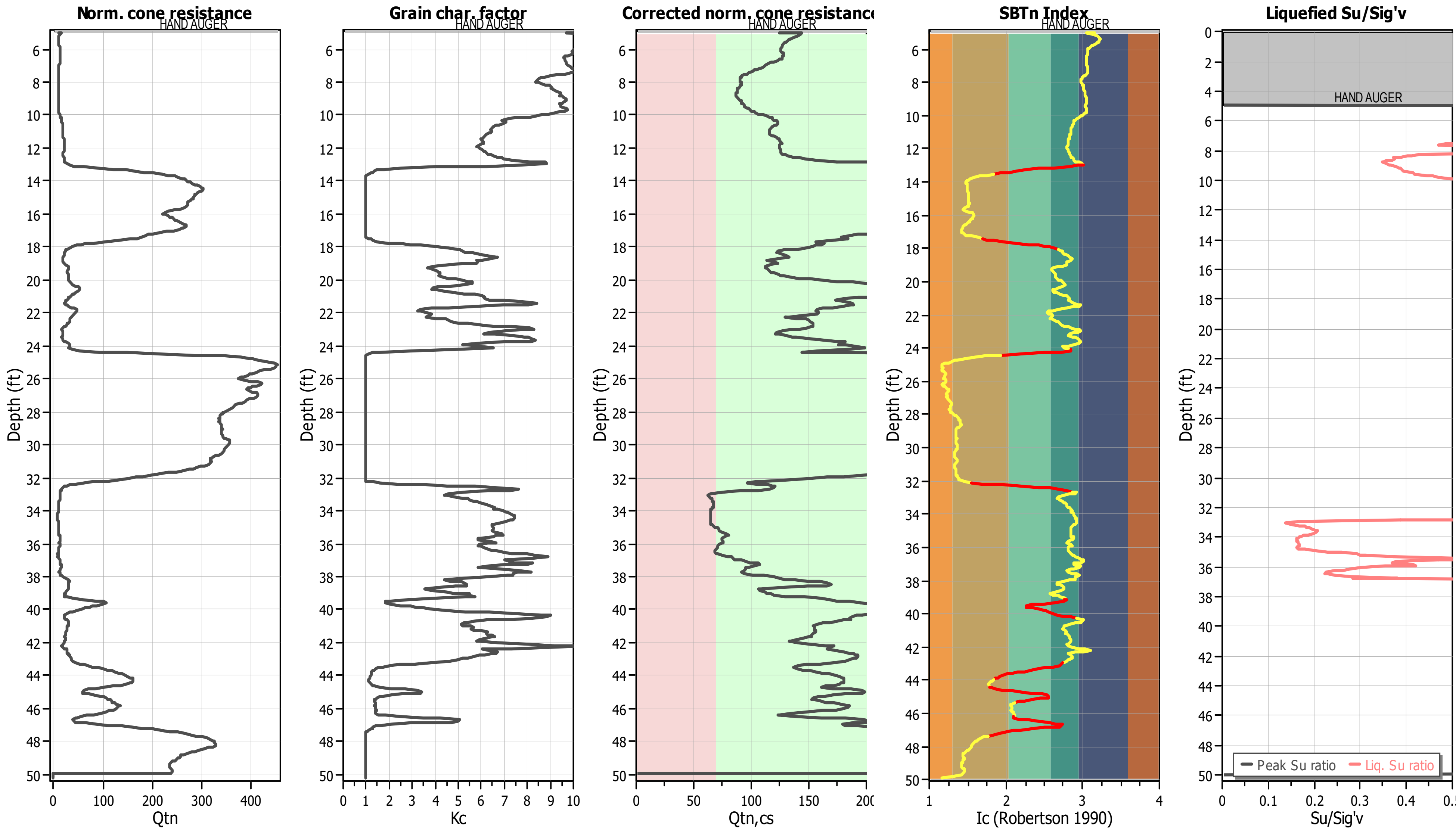
Liquefaction analysis summary plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	10.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.61	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	18.00 ft	Fill height:	N/A	Limit depth:	N/A

Appendix G

APPENDIX G

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

1.0 GENERAL

1.1 **Intent:** These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these general Specifications. Observations of the earthwork by the project Geotechnical Consultant during grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 **Geotechnical Consultant:** Prior to commencement of work, the project owner shall employ a geotechnical consultant. The geotechnical consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all keyway bottoms, and benches made on sloping ground to receive fill.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of subgrade and fill materials and perform adequate relative compaction testing of fill to determine the attained level of compaction and assess if, in their opinion, if the work was performed in substantial compliance with the geotechnical report(s) and these specifications. The Geotechnical Consultant shall provide test results to the owner on a routine and frequent basis.

1.3 **<u>The Earthwork Contractor</u>:** The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with applicable grading codes, the project plans, and these specifications.

The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork planned for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are corrected.

2.0 PREPARATION OF FILL AREAS

2.1 **<u>Clearing and Grubbing</u>:** Areas to be excavated and filled shall be cleared and grubbed. Vegetation, such as brush, grass, roots, and other deleterious material, man-made structures, and similar debris shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant. Borrow areas shall be cleared and grubbed to the extent necessary to provide a suitable fill material.

Concrete fragments that are free of reinforcing street may be placed in fills, provided they are placed in accordance with Section 3 and 4. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent organic matter. Nesting of organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area. As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, etc.) have chemical constituents that are considered hazardous waste. As such, the indiscriminate dumping or spillage of such fluids may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

The Geotechnical Consultant shall not be responsible for the identification or analysis of potentially hazardous materials; however, if observations, odors, or soil discoloration are suspect, the Geotechnical Consultant may request from the owner the termination of grading operations until such materials are deemed not hazardous as defined by applicable laws and regulations.

2.2 **<u>Evaluation/Acceptance of Fill Areas</u>:** All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

2.3 **<u>Processing</u>:** Ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Ground that is not satisfactory shall be removed/overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction. After scarification, the surface should be moisture conditioned, as necessary, to achieve the proper moisture content and compacted in accordance with Section 4 of these specifications.

2.4 **<u>Overexcavation</u>:** In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured, or otherwise unsuitable ground shall be overexcavated to competent ground as recommended by the Geotechnical Consultant during grading.

2.5 **<u>Benching</u>:** Fills to be placed on ground sloping steeper than 5H:1V (horizontal to vertical units) shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for fill placement.

3.0 FILL MATERIAL

3.1 **<u>General</u>:** Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 **<u>Oversize</u>:** Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or other underground construction.

3.3 **<u>Import</u>:** If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1 and/or requirements defined in the project geotechnical report(s). The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before import begins so that suitability can be determined, and appropriate laboratory tests performed.

4.0 FILL PLACEMENT AND COMPACTION

4.1 **<u>Fill Layers</u>:** Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 **<u>Fill Moisture Conditioning</u>:** Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with ASTM International (ASTM Test Method D1557).

4.3 **<u>Compaction of Fill</u>:** After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction and uniformity.

<u>Compaction of Fill Slopes</u>: In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557.

4.4 **<u>Compaction Testing</u>:** Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.5 **<u>Frequency of Compaction Testing</u>:** Tests shall be taken at intervals required by the governing agency and as deemed necessary by the Geotechnical Consultant in order to adequately qualify the fill material. In general, it should be anticipated that tests will be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill, unless recommended otherwise by the Geotechnical Consultant. In addition, test(s) shall be taken on slope faces and/or each 10 feet of vertical height of slope as deemed necessary by the Geotechnical Consultant. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.6 **Compaction Test Locations:** The Geotechnical Consultant shall document the approximate elevation and location of each compaction test. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided. Alternatively, GPS units may be used to determine the approximate location/coordinates of the field density tests.

5.0 SUBDRAIN INSTALLATION

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and standard details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys. The Contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The Contractor is responsible for the performance of subdrains.

6.0 EXCAVATION

Excavations, including over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical report(s) and plans are estimates. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 TRENCH BACKFILLS

7.1 Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

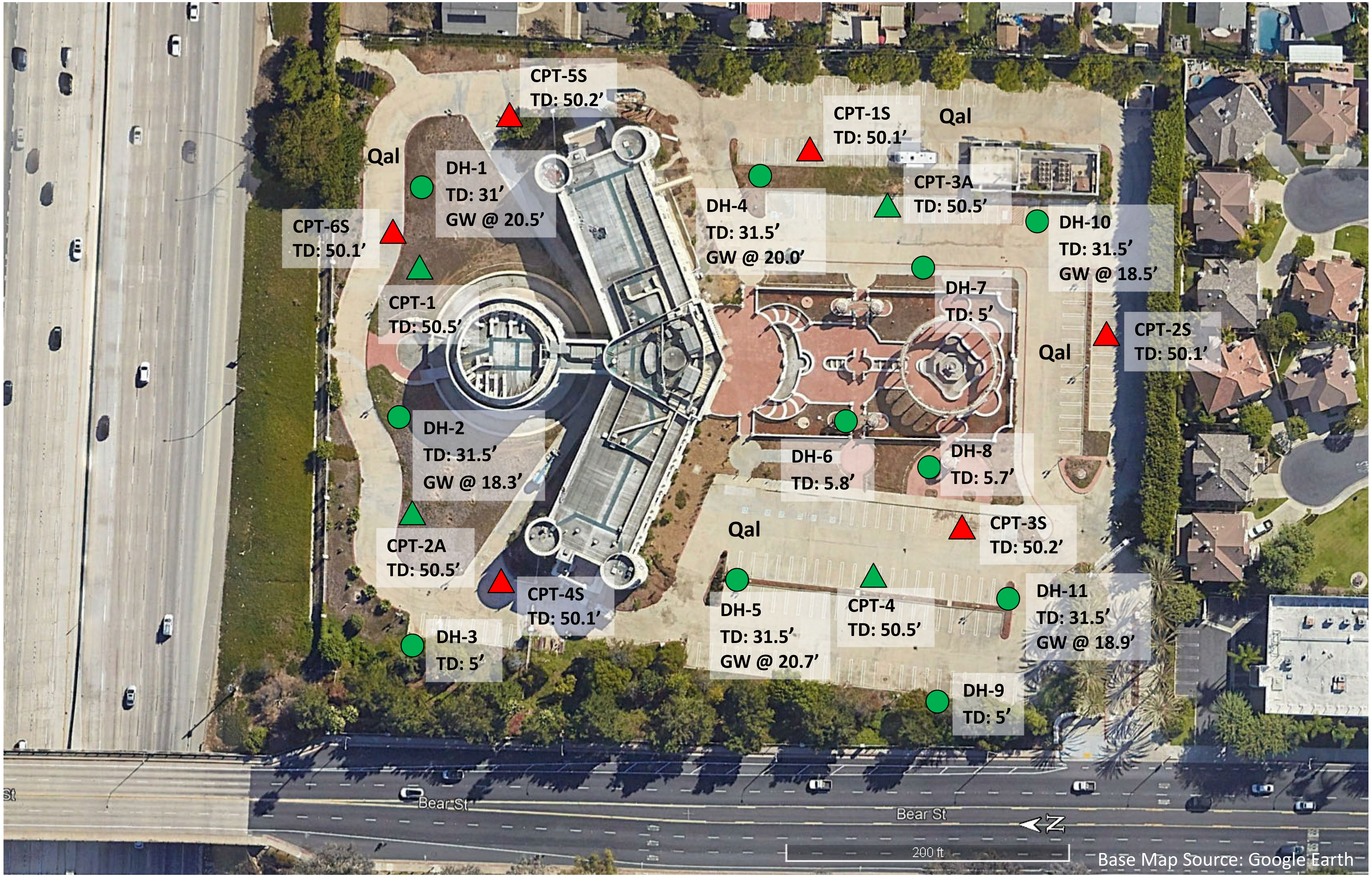
7.2 Bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum 90 percent of maximum from 1 foot above the top of the conduit to the surface, except in traveled ways (see Section 7.6 below).

7.3 Jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

7.4 Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill, unless required differently by the governing agency or the Geotechnical Consultant.

7.5 Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

7.6 Trench backfill in the upper foot measured from finish grade within existing or future traveled way, shoulder, and other paved areas (or areas to receive pavement) should be placed to a minimum 95 percent relative compaction.



Legend

CPT-6S TD: 50.1'	Cone Penetrometer Test Location by SA GEO, Showing Total Depth.
DH-11 TD: 31.5 GW @ 18.9'	Approximate Hollow Stem Auger Boring/Percolation Test Location by others (GMU, 2019), Showing Total Depth and Depth to Groundwater in Feet.
CPT-4 TD: 50.5'	Cone Penetrometer Test Location by others (GMU, 2019), Showing Total Depth in Feet.

Earth Units

Qal Alluvium

GEOTECHNICAL MAP

Meritage Homes
Proposed Residential Development
3150 Bear Street
Costa Mesa, California

Project Number: 23150-01
Date: February 14, 2024
Plate 1

S/A