# APPENDIX D

# GEOTECHNICAL REPORTS

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# *APPENDIX D-1*

# *PRELIMINARY GEOTECHNICAL REPORT*

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# Preliminary Geotechnical Report

# Workforce Reentry Center

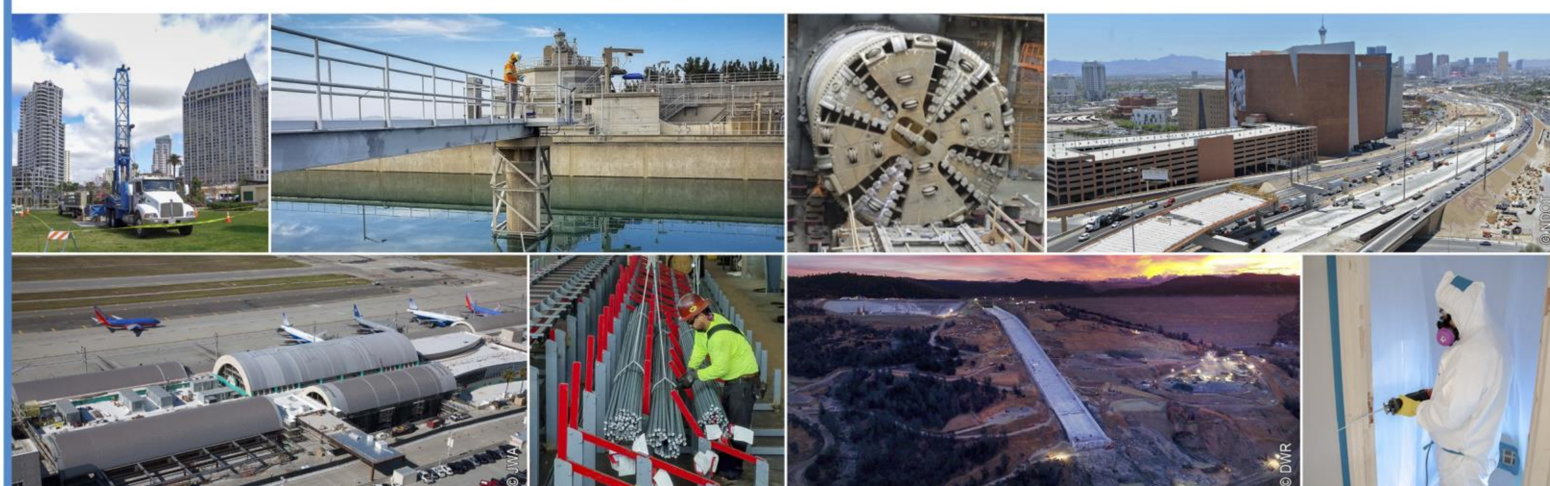
# 561 The City Drive South

## Orange, California

## County of Orange Executive Office
## Real Estate/Land Development

400 West Civic Center Drive, 5th Floor | Santa Ana, California 92701

June 14, 2024 | Project No. 212172012

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# Preliminary Geotechnical Report

# Workforce Reentry Center
# 561 The City Drive South
## Orange, California

Mr. Ryan Rigalli
County of Orange Executive Office
Real Estate/Land Development
400 West Civic Center Drive, 5th Floor | Santa Ana, California 92701

June 14, 2024 | Project No. 212172012


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## APPENDIX

## 1 INTRODUCTION

In accordance with your request and authorization, we have prepared this preliminary geotechnical report for the Workforce Reentry Center Project located at 561 The City Drive South in Orange, California (Figure 1) for the County of Orange Executive Office. The purpose of this report was to summarize our preliminary findings, conclusions, and recommendations regarding the site geotechnical conditions to aid in the preliminary planning of the project.

## 2 SCOPE OF SERVICES

The scope of our geotechnical services included the following:

- Project coordination and planning.
- Review of readily available background materials, including published geologic maps and literature, in-house information, and stereoscopic aerial photographs.
- Review of a conceptual site plan for the project and a previous report prepared by Ninyo & Moore (2022) for a security wall at the site.
- Review of seismic data, including fault hazard maps, seismic hazard maps, and other readily available data regarding geologic and seismic hazards within the project area.
- Geotechnical evaluation of the collected data from our review of the background documents.
- Preparation of this preliminary report presenting general information regarding the geologic and seismic conditions at the subject site and our preliminary opinions regarding geotechnical constraints affecting the project.

## 3 SITE DESCRIPTION

The proposed Workforce Reentry Center Project is located at 561 The City Drive South in Orange, California. The majority of the project area is currently developed as the former Orange County Animal Care Shelter with an associated parking lot. The southeast portion of the project area is an unused recreation yard area for the Theo Lacy Facility (Figure 2). The project area is bound by The City Drive South to the west, Theo Lacy Facility to the north, State Route 22 to the south, and the Santa Ana River and Levee to the east.

There are numerous structures at the site associated with the former animal care shelter along with chain link security fencing and walls along the boundary with the Theo Lacy Facility. Additional improvements include concrete and asphalt concrete paving, a cell tower near the southern boundary of the site, and light poles. The Theo Lacy recreation yard area is covered by grass.

## 3.1 Previous Geotechnical Study

As a part of our current evaluation, we reviewed a technical memorandum prepared by Ninyo & Moore providing a limited geotechnical evaluation for a proposed security wall between the Animal Care Shelter and the recreation yard area dated November 2, 2022 (Ninyo & Moore, 2022). The previous study included drilling fourteen exploratory borings along the alignment of the security wall that was proposed at that time to depths ranging from approximately 16.5 to 31.5 feet. The approximate locations of the previous borings are shown on Figures 2 and 4, and the boring logs and laboratory test results are included in Appendix A.

Undocumented fill of up to approximately 20.5 feet in depth was encountered during the first phase of the study in two borings while less than 5 feet of fill was encountered in the other borings. The fill contained construction debris, was potentially compressible, and was not considered suitable for the support of the security wall foundation. Due to the variable fill thickness encountered in our initial borings, ten additional borings were performed to further evaluate the depth and quality of the fill in the area of the security wall. Recommendations were provided in our referenced report for shallow foundations for the portion of the security wall that had shallow fill beneath the alignment and for deep cast-in-drilled-hole pile foundations where the wall alignment had deeper fill that would be difficult to remove and recompact along the property boundary. The deep fill areas coincided with the former alignment of the Santa Ana River as discussed in Section 3.2.

## 3.2 Historical Aerial Photographs

As a part of our evaluation, we reviewed historical aerial photographs publicly available from the University of California, Santa Barbara online aerial photo library. The historical aerial photograph dates reviewed include 1931, 1947, 1952, 1960 and 1977. The 1931 photo (Figure 3) shows the site as undeveloped with adjacent areas being used for agriculture. The 1931 photo also shows the Santa Ana River crossing the southern portion of the site in a northeast to southwest direction prior to the river being channelized to its current configuration. An unpaved road is adjacent to the site to the east, which roughly corresponds to the location of the current west bank of the Santa Ana River.

The 1947 and 1952 photos show the site as relatively unchanged with further improvement and widening of the road to the east. The site has been levelled in the 1960 photo, having received fill since the 1952 photo with the Theo Facility present to the north. The existing site improvements and facilities are shown in the 1977 photo.

# 4 PROJECT UNDERSTANDING

The project is currently in the planning phase for site development. Based on our discussions with the County of Orange and our review of the conceptual site plan prepared by Griffin Swinerton, we understand that the County plans to construct a new workforce reentry center within the approximately 4.57-acre property. As shown on Figure 4, the site plan includes three new building structures for housing and facilities for trades apprenticeship, retail and culinary training. We anticipate that the new buildings will be one- to two-story at-grade structures. Additional improvements will include new parking lots, a trash enclosure area, and pet area.

# 5 GEOLOGIC CONDITIONS

## 5.1 Regional Geologic Setting

The subject site is located within the southerly portion of the Los Angeles Basin, which is situated near the northern end of the Peninsular Ranges Geomorphic Province. The Los Angeles Basin has been divided into four structural blocks, which are generally bounded by prominent fault systems: The Northwestern Block, the Southwestern Block, the Central Bock, and the Northeastern Block (Norris and Webb, 1990). The subject site is located within the Central Block, which is bordered on the west by the Newport-Inglewood fault, on the east by the Whittier-Elsinore fault, on the north by the Malibu Coast-Santa Monica-Raymond fault, and on the south by the San Joaquin Hills. The Central Block is characterized by thick sequences of alluvium overlying predominantly sedimentary rock of Cretaceous through Pleistocene age. The depths to crystalline basement rocks are known from petroleum well logs and geophysical data. The total thickness of sedimentary section is roughly 4,000 meters (i.e., about 13,000 feet) near the southern end of the Los Angeles Basin, and exceeds 9,000 meters (i.e., about 30,000 feet in the deepest portion of the block) (Norris and Webb, 1990).

## 5.2 Project Area Geology

Based on our review, the site is mapped as being underlain by Holocene to late Pleistocene-age alluvial-fan deposits consisting of silt, sand, pebbly cobbly sand, and boulders (Morton and Miller, 2006) as shown on Figure 5.

### 5.2.1 Site-Specific Soil Conditions

Our previous subsurface exploration (2022), included fourteen geotechnical borings drilled to depths ranging from approximately 16.5 to 31.5 feet below the ground surface (Figures 2 and 4). Fill was encountered in our borings at the surface or below the pavements to a depth up to approximately 20.5 feet. Alluvium was encountered below the fill materials to the explored depth of up to approximately 31.5 feet in each boring. Fill soils generally consisted of moist, loose to very dense, silty sand, clayey sand, and poorly graded sand, and stiff to hard, sandy lean clay, and lean clay with sand. Varying amounts of gravel, cobbles, concrete and asphalt concrete fragments, and construction debris were encountered in the fill materials that resulted in difficult drilling conditions. The deeper fill areas encountered in our borings generally coincide with the former alignment of the Santa Ana River as shown on Figure 3. The alluvium generally consisted of moist, loose to dense, silty sand, clayey sand, poorly graded sand, and sandy silt, and stiff to hard silt, sandy lean clay, and lean clay with varying amounts of sand. Varying amounts of gravel were also encountered in alluvium.

## 5.3 Groundwater

Groundwater was not encountered in our previous borings that were drilled up to a depth of 31.5 feet. However, seepage was encountered in boring B-13 at a depth of approximately 20 feet. The historic high groundwater depth for the project area is reported to be approximately 30 feet below the ground surface (California Department of Conservation, Division of Mines and Geology [CDMG], 1997). Fluctuations in groundwater levels will occur due to variations in precipitation, ground surface topography, subsurface stratification, irrigation, groundwater pumping, and other factors that may not have been evident at the time of our previous field evaluation.

# 6 FAULTING AND SEISMIC HAZARDS

The project site is not located within a State of California Earthquake Fault Zone (formerly known as Alquist-Priolo Special Studies Zone). However, the site is located in a seismically active area, as is the majority of southern California, and the potential for strong ground motion in the project area is considered significant during the design life of the proposed structure. The approximate locations of major faults in the site vicinity and their geographic relationship to the site are shown on Figure 6.

In general, seismic hazards evaluated at the subject site include ground surface rupture, ground motion, liquefaction, dynamic settlement, lateral spreading, and tsunamis and seiches. These potential hazards are discussed in the following sections.

## 6.1 Surface Fault Rupture

Surface fault rupture is the offset or rupturing of the ground surface by relative displacement across a fault during an earthquake. Based on our review of the referenced published data, the project site is not transected by known active faults. Therefore, the potential for surface rupture is relatively low. However, lurching or cracking of the ground surface as a result of nearby seismic events is possible.

## 6.2 Seismic Ground Shaking

Earthquake events from one of the regional active or potentially active faults near the site could result in strong ground shaking which could affect the project area. The level of ground shaking at a given location depends on many factors, including the size and type of earthquake, distance from the earthquake, and subsurface geologic conditions. The type of construction also affects how particular structures and improvements perform during ground shaking.

Considering the proximity of the site to active faults capable of producing a maximum moment magnitude of 6.0 or more, the proposed improvements have a high potential for experiencing strong ground motion. The 2022 California Building Code (CBC) specifies that the potential for liquefaction and soil strength loss be evaluated, where applicable, for the mapped maximum considered earthquake geometric mean ($MCE_G$) peak ground acceleration ($PGA_M$) with adjustment for site class effects in accordance with the American Society of Civil Engineers 7-16 Standard. The $MCE_G$ PGA is based on the geometric mean PGA with a 2 percent probability of exceedance in 50 years. The $PGA_M$ was calculated as 0.687g using the 2024 Applied Technology Council (ATC) hazard tool (web-based).

This potential level of ground shaking could have high impacts on site improvements without appropriate design mitigation, and should be considered during the detailed design phase of the project. Mitigation of the potential impacts of seismic ground shaking can be achieved through project structural design. Structural elements of planned improvements can be designed to resist or accommodate appropriate site-specific ground motions and to conform to the current seismic design standards. Appropriate structural design and mitigation techniques would reduce the impacts related to seismic ground shaking to low levels.

## 6.3 Liquefaction and Seismically Induced Settlement

Liquefaction is the phenomenon in which loosely deposited granular soils and non-plastic silts located below the water table undergo rapid loss of shear strength when subjected to strong earthquake-induced ground shaking. Ground shaking of sufficient duration results in the loss of grain-to-grain contact due to a rapid rise in pore water pressure, and causes the soil to behave as a fluid for a short period of time. Liquefaction is known generally to occur in saturated or near-saturated cohesionless soils at depths shallower than 50 feet below the ground surface. Factors known to influence liquefaction potential include composition and thickness of soil layers, grain size, relative density, groundwater level, degree of saturation, and both intensity and duration of ground shaking. The potential damaging effects of liquefaction include differential settlement, loss of ground support for foundations, ground cracking, heaving and cracking of slabs due to sand boiling, and/or buckling of deep foundations due to liquefaction-induced ground settlement.

Based on the State of California Seismic Hazard Map for the Orange Quadrangle (CDMG, 1998), the site is located in an area mapped as being susceptible to seismically induced liquefaction (Figure 7). Based on our review of regional geologic maps and the referenced geotechnical report, the site is predominantly underlain by relatively young alluvial materials, which are susceptible to liquefaction and should be further evaluated during the detailed design phase of the project.

## 6.4 Lateral Spreading

Lateral spread of the ground surface during an earthquake usually takes place along weak shear zones that have formed within a liquefiable soil layer. Lateral spread has generally been observed to take place in the direction of a free-face (i.e., retaining wall, slope, creek) but has also been observed to a lesser extent on ground surfaces with very gentle slopes. For sites located in proximity to a free face, the amount of lateral ground displacement is strongly correlated with the distance of the site from the free-face. Other factors such as earthquake magnitude, distance from the earthquake epicenter, thickness of the liquefiable layers, and the fines content and particle sizes of the liquefiable layers also affect the amount of lateral ground displacement.

The mixed rip rap and concrete-lined Santa Ana River is approximately 160 feet to the east side of the site. The estimated depth of the river is approximately 10 to 15 feet. Based on review to the Conceptual Plan prepared by Griffin Swinerton, the shortest distance between the nearest building and the Santa Ana River is approximately 250 feet. The site may be susceptible to liquefaction-induced lateral spread during a seismic event and should be further evaluated during the detailed design phase of the project.

## 6.5 Tsunamis and Seiches

Tsunamis are long wavelength seismic sea waves (long compared to ocean depth) generated by the sudden movements of the ocean floor during submarine earthquakes, landslides, or volcanic activity. Seiches are waves generated in a large enclosed body of water. The project site is not mapped in an area considered susceptible to tsunami or seiche inundation.

# 7 MISCELLANEOUS HAZARDS

## 7.1 Flood Hazards

Based on our review of flood insurance rate maps for the project area (Federal Emergency Management Agency [FEMA], 2009), the project site is not located in the 100-year Flood Hazard Zone, A99. Zone A99 includes areas to be protected from a 100-year flood by the Federal Flood Protection System under construction at the time of publication of the FEMA map. However, the project site is located within FEMA's designated Other Areas - Zone X, which includes areas with reduced flood risk due to levee.

## 7.2 Expansive Soils

Expansive soils include clay minerals that are characterized by their ability to undergo significant volume change (shrink or swell) due to variations in moisture content. Sandy soils are generally not expansive. Changes in soil moisture content can result from rainfall, irrigation, pipeline leakage, surface drainage, perched groundwater, drought, or other factors. Volumetric change of expansive soil may cause excessive cracking and heaving of structures with shallow foundations, concrete slabs-on-grade, or pavements supported on these materials.

Detailed assessment of the potential for expansive soils should be evaluated during the design phase of the project through additional subsurface exploration and laboratory testing. Based on our previous subsurface exploration, the majority of the soils are granular and there are lesser amounts of clayey soils, which are anticipated to be expansive. Mitigation techniques should be developed, as appropriate, to reduce the impacts related to expansive soils to low levels. This could include removing the expansive material and replacing the soil with non-expansive soils, or mixing of the clayey soils with granular soils to reduce the expansion potential, and/or specific structural design for expansive soil conditions. Therefore, the potential impacts due to expansive soils should be reduced to low levels with incorporation of these techniques that will need to be further developed during the design phase of the project.

## 7.3 Compressible and Collapsible Soils

Compressible soils are generally comprised of soils that undergo time-dependent consolidation when exposed to new loading, such as fill or foundation loads. Soil collapse is a phenomenon where the soils undergo a significant decrease in volume upon increase in moisture content, with or without an increase in external loads. The undocumented fill soils are potentially compressible and not considered suitable for the support of foundations or compacted fill. Buildings, structures, and other improvements may be subject to excessive settlement-related distress when compressible soils or collapsible soils are present. The undocumented fill soils should be removed and replaced as engineered fill or the settlement-sensitive structures should be supported on deep foundations that derive support from the underlying native soils.

## 8 PRELIMINARY CONCLUSIONS

Based on our preliminary evaluation, previous subsurface exploration and laboratory testing, and engineering analysis, it is our opinion that the construction of the new Workforce Reentry Center is feasible from a preliminary geotechnical standpoint, provided that the recommendations presented in this report are incorporated into the design of the project.

The primary geotechnical considerations for the design and construction of the new Workforce Reentry Center include the presence of relatively deep undocumented fill at the site that include oversize cobbles and construction debris that will be encountered during excavations, and evaluating the liquefaction and lateral spread hazard for the proposed site improvements in accordance with the California Geological Survey Special Publication 117A (Guidelines for Evaluating and Mitigating Seismic Hazards in California).

The undocumented fill encountered in our previous borings is up to approximately 20.5 feet deep and is potentially compressible and not considered suitable for the support of the new building structures. Deeper fill may be present in other areas of the site that were not revealed in our previous exploratory borings. In order to mitigate the undocumented fill condition at the site, the undocumented fill can either be removed down to competent alluvium and the material placed back as engineered fill, or the new building structures can be supported on a deep foundation system that derives support from the underlying alluvial soils. Considering that the project is in the conceptual design phase, consideration should be given to repositioning the buildings to the northern and eastern portions of the site, in the areas where the existing fill is shallower, so that the depths of remedial grading to reach native alluvium would also be shallower. Difficult excavating conditions should be anticipated during construction and special handling of oversize materials should be anticipated. Caving of soils should be anticipated when seepage or wet conditions are encountered in granular materials with low cohesion.

A detailed geotechnical evaluation including subsurface exploration should be performed during the design phase of the project to develop additional site-specific information and develop appropriate geotechnical recommendations for the design and construction of the new structures and any other proposed new site improvements. When the project improvements and their locations are confirmed, a geotechnical exploration plan can be prepared for review by the project team. Our current findings pertaining to the geotechnical aspects of the proposed Workforce Reentry Center are presented below.

- Based on our review of regional geologic maps, the site is predominantly underlain by relatively young alluvial materials, which are susceptible to liquefaction and lateral spread. The liquefaction and lateral spread hazard should be evaluated during the detailed design phase of the project. Performing cone penetration tests (CPTs) beneath the major building structures will be appropriate to evaluate the liquefaction induced dynamic settlements at the site.

- Materials encountered during the previous subsurface exploration generally consisted of undocumented fill underlain by young alluvium. The fill was encountered in our borings to depths of up to approximately 20.5 feet and generally included oversize cobbles and construction debris. Prior to site development, the undocumented fill will need to be removed and replaced with compacted fill or the settlement-sensitive structures (buildings) will need to be supported on deep foundations that derive their bearing capacity from competent native soils at depths.

- Groundwater was not encountered during our previous site exploration; however, some seepage was encountered at a depth of approximately 20 feet in one boring. The historic high depth to groundwater is approximately 30 feet below the ground surface in the site vicinity. Seepage/nuisance water may be encountered during deep remedial grading or in pile foundation excavations.

- On-site soils should be considered as Type C soils in accordance with the Occupational Safety and Health Administration (OSHA) soil classifications. Temporary shoring should be provided in accordance with the OSHA regulations, if needed.

- The site is not located within an Earthquake Fault Zone with the potential for fault rupture as defined by the Alquist-Priolo Earthquake Fault Zoning Act (Hart and Bryant, 2018).

- Previous limited laboratory corrosivity testing indicated that the near-surface soils can be classified as non-corrosive per the Caltrans (2021) corrosion guidelines.

# 9 GEOTECHNICAL CONSIDERATIONS

The following geotechnical considerations are presented for preliminary planning purposes. The design of the project should be based on the detailed geotechnical evaluation during the design phase.

## 9.1 Construction Plan Review

We recommend that the conceptual site plan that will be used for the final design phase of the project be submitted to Ninyo & Moore for review. The site plan will be used to prepare a subsurface exploration plan and will show the recommended locations for additional borings and cone penetration tests that will be needed to further evaluate the depths of fill beneath the proposed structures and the liquefaction potential.

## 9.2 Earthwork

Based on our understanding of the project, earthwork will include excavation and recompaction of existing undocumented fill for site preparation, and backfilling and compaction. However, deep foundations may be chosen to support the proposed buildings in lieu of performing deep remedial grading. The on-site soils will be generally excavatable utilizing conventional excavation equipment. Some oversize concrete/rubble or other types of debris in existing fills will be encountered. In addition, abandoned, buried utilities and/or structures may be present. Specific recommendations regarding unsuitable materials should be based on site-specific subsurface exploration. In general, earthwork should be performed in accordance with the standard specifications for public works construction.

### 9.2.1 Excavation Characteristics

Based on the previous subsurface exploration data, we anticipate that excavations within the fill and alluvium at the site should be feasible with earthmoving equipment in good working condition. The sandy on-site soils have zero to little cohesion and have a high potential for caving. Caving should also be anticipated when seepage is encountered. Varying amounts of gravel, cobbles, asphalt concrete and Portland cement concrete fragments, and construction debris were encountered in the fill materials. The contractor should anticipate special handling and off-site disposal of oversize and unsuitable materials. Contractors should make their own independent evaluation of the excavatability of the on-site materials prior to submitting their bids. Additionally, drill-holes for deep foundations may be subject to caving and drilling mud or casing may be needed to stabilize the holes.

### 9.2.2 Remedial Grading

If the use of deep foundations for the proposed building structures is not considered to be a viable option, then foundations for these structures may consist of shallow spread or continuous footings or mat foundations provided that remedial grading is performed as recommend in this section. Remedial grading consists of the excavation of undocumented fill to competent native alluvium and backfilling with compacted fill. Based on our previous subsurface exploration, remedial grading in excess of 20 feet below the ground surface should be anticipated. Due to the variability in the depths of fill at the site, additional excavation of native soils may be needed if specific buildings will have significant differential fill thickness within the influence zone of the building. In general, we recommend that the thickness of compacted fill underneath the building structures be one-third or more of the maximum anticipated fill thickness within the individual building areas. Additional remedial grading may also be needed to mitigate the liquefaction hazard. The actual depths and horizontal limits of remedial grading beneath the individual building areas should be further evaluated based on additional subsurface exploration.

In areas where alluvium is relatively shallow and deeper remedial grading will not be needed to remove the existing undocumented fill, we recommend that excavation and recompaction extend to a depth that would provide 3 feet or more of compacted fill below the bottom of the proposed foundations. The horizontal limits of remedial excavation should laterally extend at least 8 feet beyond the footings, removing existing undocumented fill, and exposing relatively dense native soils. The removal and recompaction work should consist of 1) excavating to the depths discussed above, 2) scarifying, moisture-conditioning, and compacting the exposed subgrade soils to a depth of 8 inches or more, and 3) replacing the excavated materials with suitable fill soils. The fill soils should be moisture-conditioned to generally above the optimum moisture content and compacted to a relative compaction of 90 percent as evaluated by the ASTM International (ASTM) test method D 1557.

### 9.2.3 Fill Materials

In general, the on-site granular soils should be suitable for re-use as fill provided that they are free of trash, debris, roots, vegetation, expansive clayey soils, or other deleterious materials. Fill should generally be free of rocks or lumps of material in excess of 4 inches in diameter. Oversize cobbles, concrete fragments, or hard lumps larger than 4 inches in diameter should be broken into smaller pieces (less than 4 inches in diameter) or removed from the site.

Imported materials, if needed, should consist of clean, non-expansive, granular material, which conforms to the “Greenbook” for structure backfill. “Non-expansive” can be defined as soil having an expansion index of 20 or less in accordance with ASTM D 4829. The imported materials should also meet the Caltrans (2021) criteria for non-corrosive soils (i.e., soils having a chloride concentration of 500 parts per million [ppm] or less, a soluble sulfate content of approximately 0.15 percent (1,500 ppm) or less, a pH value of 5.5 or higher, or an electrical resistivity of 1,500 ohm-centimeters or more). Materials for use as fill should be evaluated by Ninyo & Moore prior to importing. The contractor should be responsible for the uniformity of import material brought to the site.

### 9.2.4 Fill Placement and Compaction

Fill should be placed and compacted in accordance with project specifications, the requirements of the governing agency, and sound construction practices. Fill materials should be moisture conditioned to slightly above the optimum laboratory moisture content. The lift thickness for fill soils will vary depending on the type of compaction equipment used, but should generally be placed in horizontal lifts not exceeding 8 inches in loose thickness. Fill materials should be compacted to a relative compaction of 90 percent as evaluated by ASTM D 1557. Special care should be taken to avoid pipe damage when compacting trench backfill above pipes. Fill should be tested for specified compaction level by Ninyo & Moore.

## 9.3 Seismicity

Design of the proposed improvements should be performed in accordance with the requirements of the governing jurisdictions and applicable building codes. Table 1 presents the seismic design parameters for the site in accordance with the CBC (2022) guidelines.

**Table 1 – 2019 California Building Code Seismic Design Criteria**

| Site Coefficients and Spectral Response Acceleration Parameters | Values |
|---|---|
| Site Class | D |
| Site Coefficient, Fa | 1.2 |
| Site Coefficient, Fv | 1.819g |
| Mapped Spectral Response Acceleration at 0.2-second Period, $S_s$ | 1.355g |
| Mapped Spectral Response Acceleration at 1.0-second Period, $S_1$ | 0.481g |
| Spectral Response Acceleration at 0.2-second Period Adjusted for Site Class, $S_{MS}$ | 1.626g |
| Spectral Response Acceleration at 1.0-second Period Adjusted for Site Class, $S_{M1}$ | 0.875g |
| Design Spectral Response Acceleration at 0.2-second Period, $S_{DS}$ | 1.084g |
| Design Spectral Response Acceleration at 1.0-second Period, $S_{D1}$ | 0.583g |
| Site Modified Peak Ground Acceleration, $PGA_M$ | 0.687g |

## 9.4 Preliminary Foundation Recommendations

As discussed before, both conventional spread footings (i.e., continuous and isolated footings, and mat foundations) and deep foundations (i.e., driven piles and drilled piers) are feasible for supporting the proposed building structures at this site. Use of spread footings would require implementation of significant remedial grading as described in the Earthwork section of this report. In order to avoid significant remedial grading, the deep foundation option may be chosen. A detailed geotechnical evaluation including subsurface exploration and laboratory testing should be performed during the design phase of the project to develop the final foundation recommendations for this project.

## 9.5 Corrosivity

Limited corrosivity testing from our previous study (Ninyo & Moore, 2022) indicates that the soils at the project site can be generally classified as non-corrosive, which is defined as having earth materials with less than 500 ppm chlorides, less than 1,500 ppm sulfates, a pH of 5.5 or more and an electrical resistivity of more than 1,500 ohm-centimeters per the Caltrans (2021) corrosion guidelines.

## 10 FUTURE WORK

Additional geotechnical engineering studies for the proposed new improvements should be performed during the future design phase of the project. When preliminary design plans are prepared, they should be forwarded to this office for review so that the locations of the proposed geotechnical soil borings and CPTs can be evaluated. Detailed geotechnical design recommendations regarding the project should be provided in our final geotechnical evaluation report.

## 11 LIMITATIONS

The purpose of this study was to evaluate geotechnical conditions and potential geologic and seismic hazards at the site by reviewing readily available geotechnical data, to present preliminary geotechnical opinions and recommendations that can be utilized in the preparation of a scope of work for subsurface exploration for the design phase of the project. This report is intended for preliminary planning purposes only. A detailed geotechnical evaluation, including subsurface exploration should be performed prior to detailed design and construction of new structures.

The geotechnical analyses presented in this report have been conducted in accordance with current engineering practice and the standard of care exercised by reputable geotechnical consultants performing similar tasks in this area. No other warranty, implied or expressed, is made regarding the preliminary conclusions, recommendations, and professional opinions expressed in this report. Our preliminary conclusions and recommendations are based on a review of readily available geotechnical literature, geologic and seismic data, and an analysis of the observed conditions. Variations may exist and conditions not observed or described in this report may be encountered.

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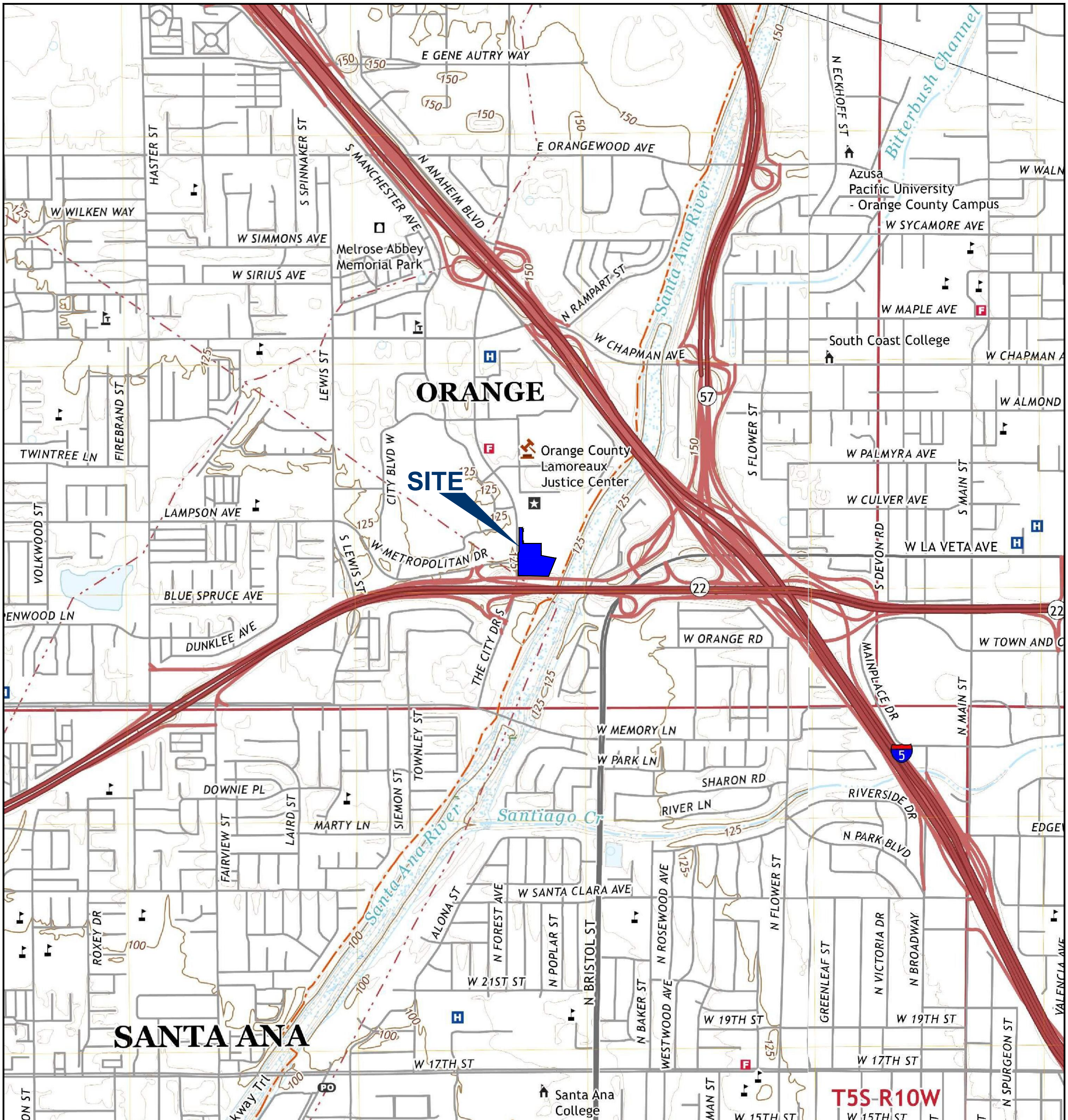
# FIGURES




NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE. I REFERENCE: USGS, 2022.

N

FEET

0 2,000 4,000

212172012.dwg_SL 06/12/2024 JDP

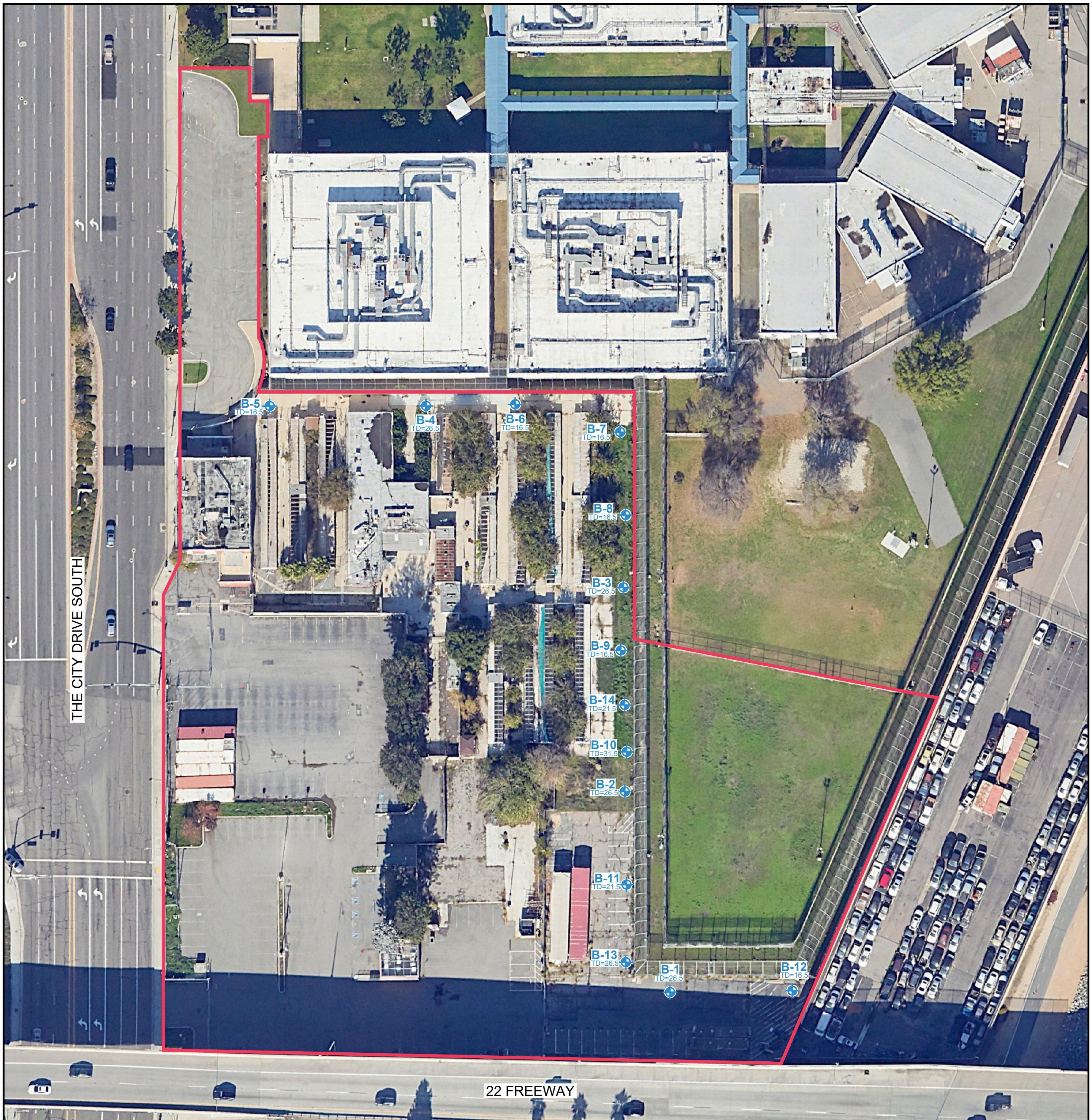
**FIGURE 1**

# SITE LOCATION

WORKFORCE REENTRY CENTER
ORANGE, CALIFORNIA

212172012 I 6/24

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants




**LEGEND**

SITE BOUNDARY

B-14 TD=21.5 BORING (NINYO & MOORE, 2022); TD=TOTAL DEPTH IN FEET

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE. I REFERENCE: GOOGLE EARTH, 2024.

N

FEET

0 100 200

212172012.dwg_SABL 06/12/2024 JDP

**FIGURE 2**

Ninyo & Moore

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## SITE AERIAL AND BORING LOCATIONS

WORKFORCE REENTRY CENTER
ORANGE, CALIFORNIA

212172012 I 6/24


**LEGEND**

SITE BOUNDARY

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE. I REFERENCE: UCSB, 1931.

N

FEET

0 400 800

212172012.dwg_HAPBL 06/12/2024 JDP

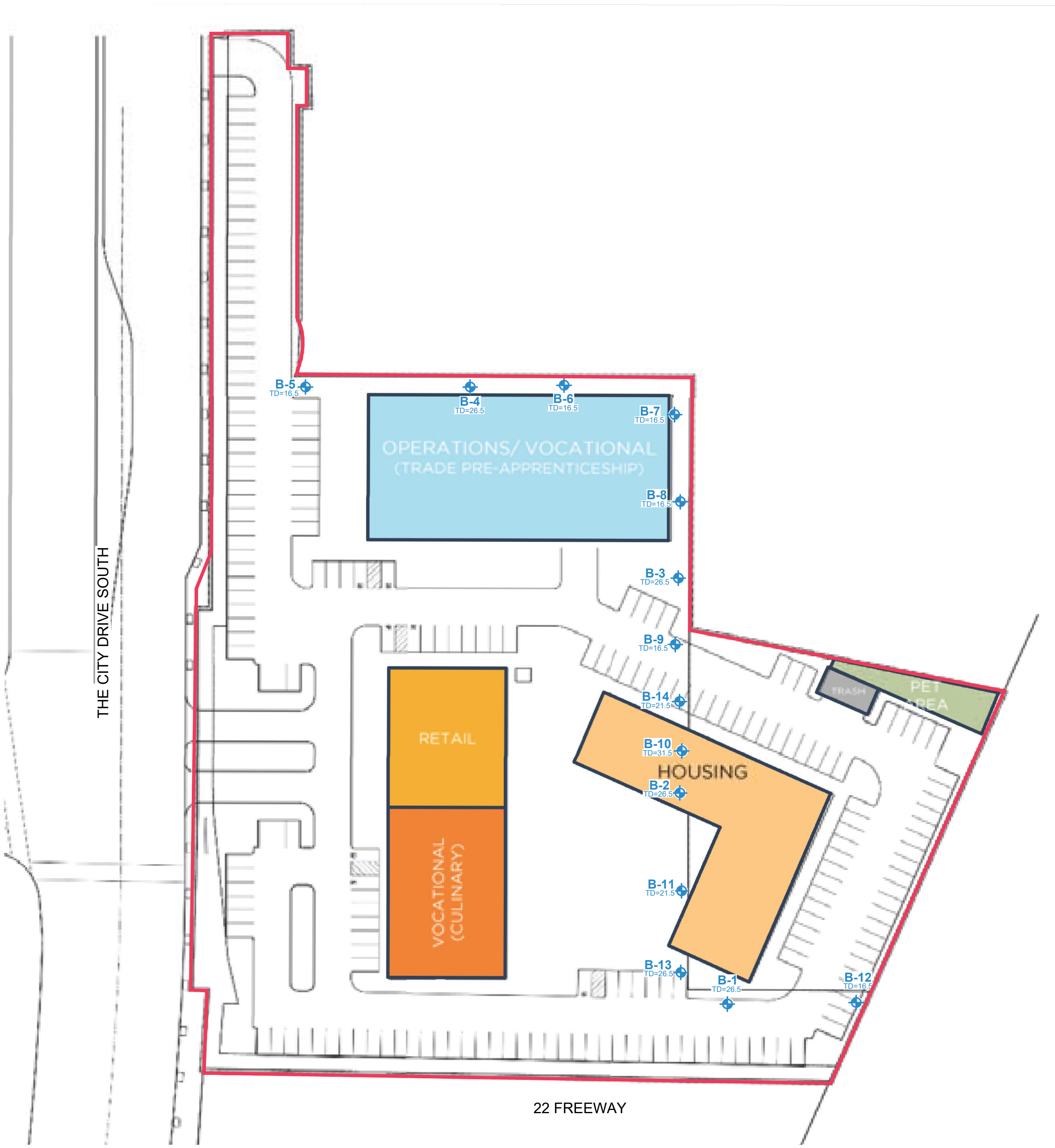
**FIGURE 3**

# 1931 HISTORICAL AERIAL PHOTOGRAPH

WORKFORCE REENTRY CENTER
ORANGE, CALIFORNIA

212172012 I 6/24

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants




**LEGEND**

SITE BOUNDARY

B-14 TD=21.5 BORING NINYO & MOORE, 2022);
TD=TOTAL DEPTH IN FEET

N

FEET

0 100 200

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE. I REFERENCE: GRIFFIN-SWINTERTON, 2024.

212172012.dwg_SPBL 06/12/2024 JDP

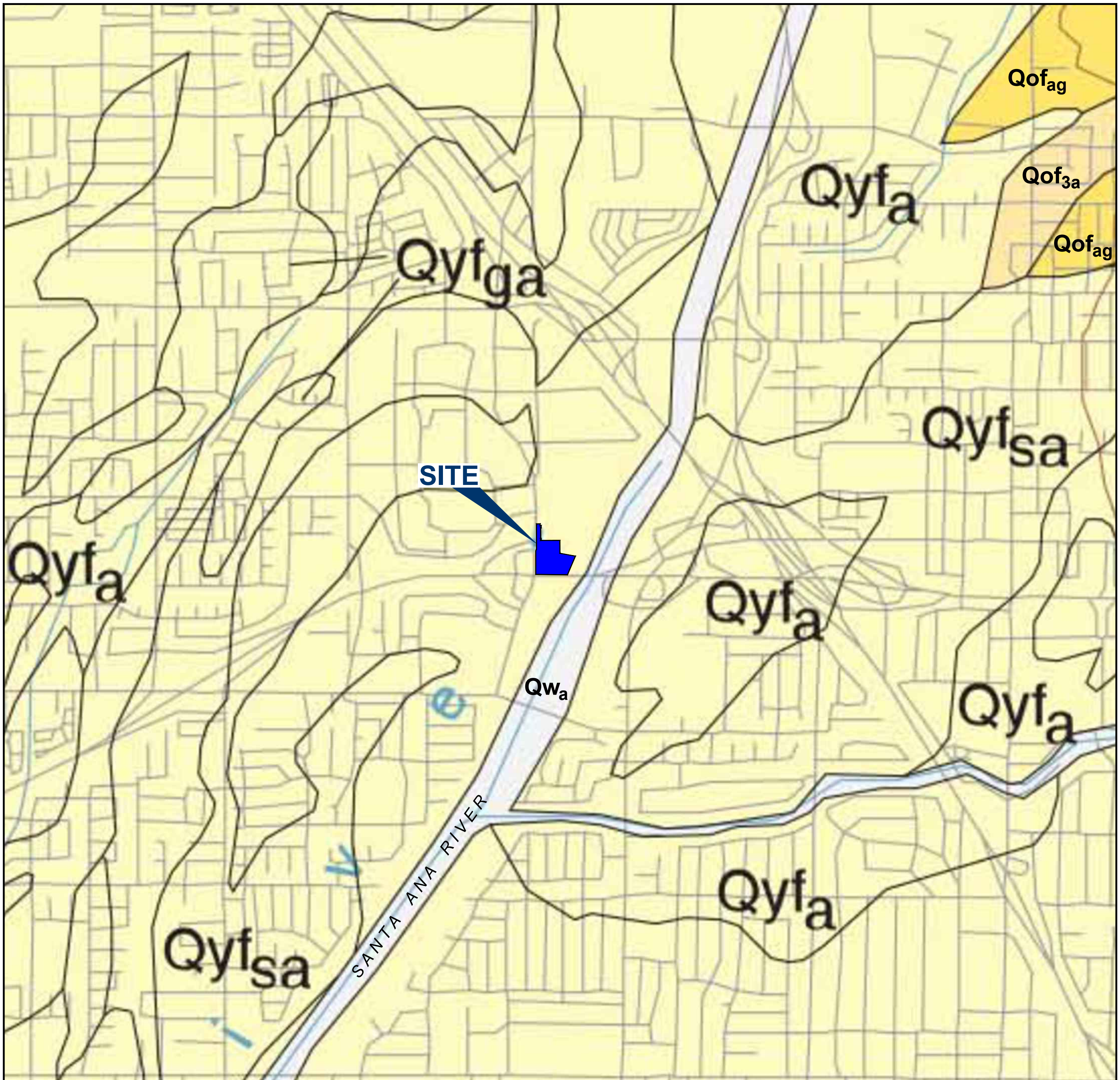
**FIGURE 4**

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

**SITE PLAN AND BORING LOCATIONS**

WORKFORCE REENTRY CENTER
ORANGE, CALIFORNIA

212172012 I 6/24




LEGEND

| | |
|---|---|
| Qw | WASH DEPOSITS |
| Qyf | YOUNG ALLUVIAL FAN DEPOSITS |
| Qof | OLD ALLUVIAL FAN DEPOSITS |

GEOLOGIC CONTACT

N

FEET

0 2,000 4,000

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE. I REFERENCE: MORTON & MILLER, 2006.

212172012.dwg_RG 06/13/2024 JDP

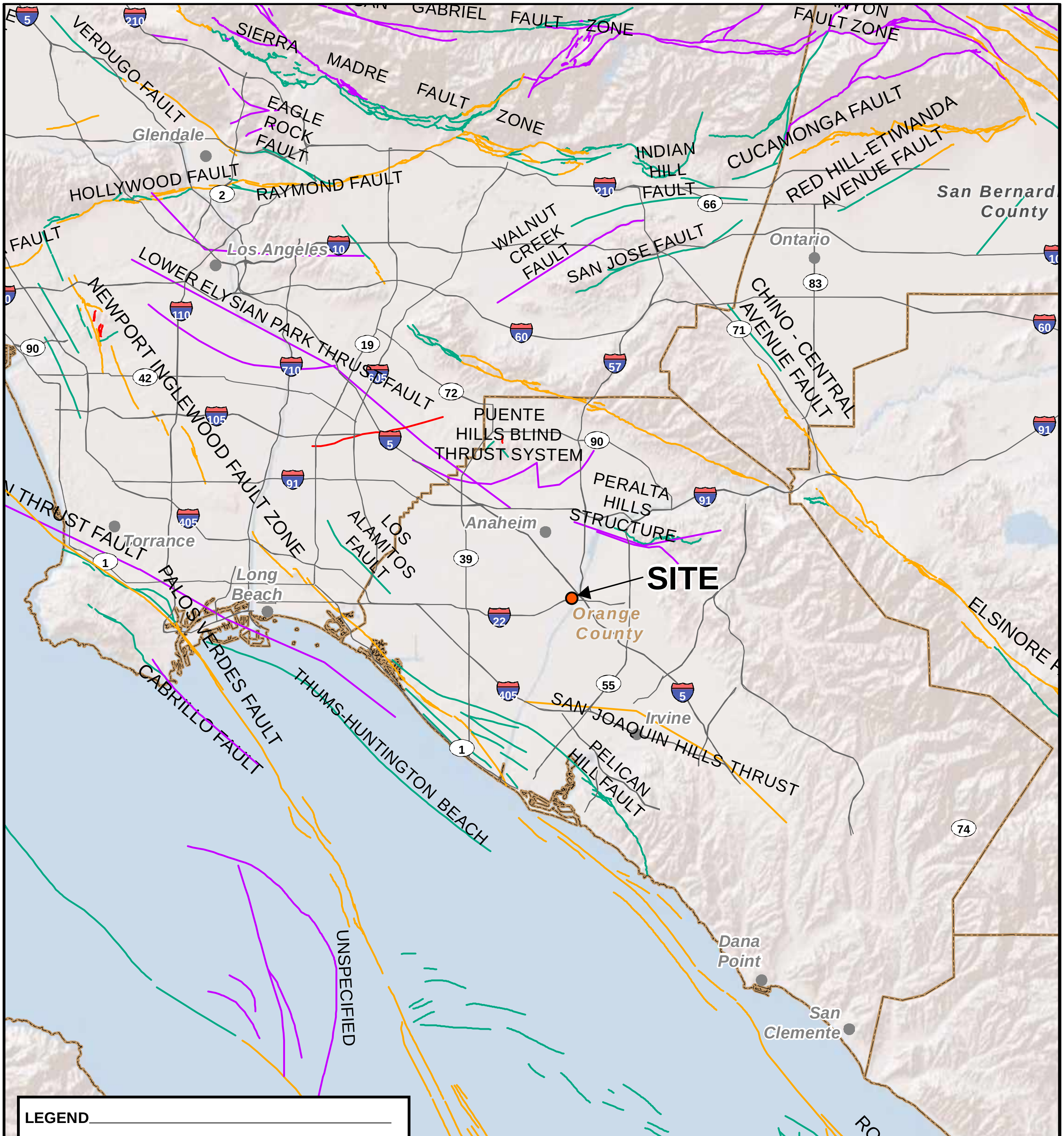
FIGURE 5

## REGIONAL GEOLOGY

WORKFORCE REENTRY CENTER
ORANGE, CALIFORNIA

212172012 I 6/24

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants




**LEGEND**

CALIFORNIA FAULT ACTIVITY

- HISTORICALLY ACTIVE
- HOLOCENE ACTIVE
- LATE QUATERNARY (POTENTIALLY ACTIVE)
- QUATERNARY (POTENTIALLY ACTIVE)
- STATE/COUNTY BOUNDARY

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

SOURCES: QUATERNARY FAULTS DATABASE - U.S. GEOLOGICAL SURVEY AND CALIFORNIA GEOLOGICAL SURVEY, QUATERNARY FAULT AND FOLD DATABASE FOR THE UNITED STATES, ACCESSED MAY 27, 2024, AT: https://www.usgs.gov/programs/earthquake-hazards/faults, ESRI, 2023.

212172012_FL.mxd 5/27/2024 JDP

**FIGURE 6**

**FAULT LOCATIONS**

Ninyo & Moore
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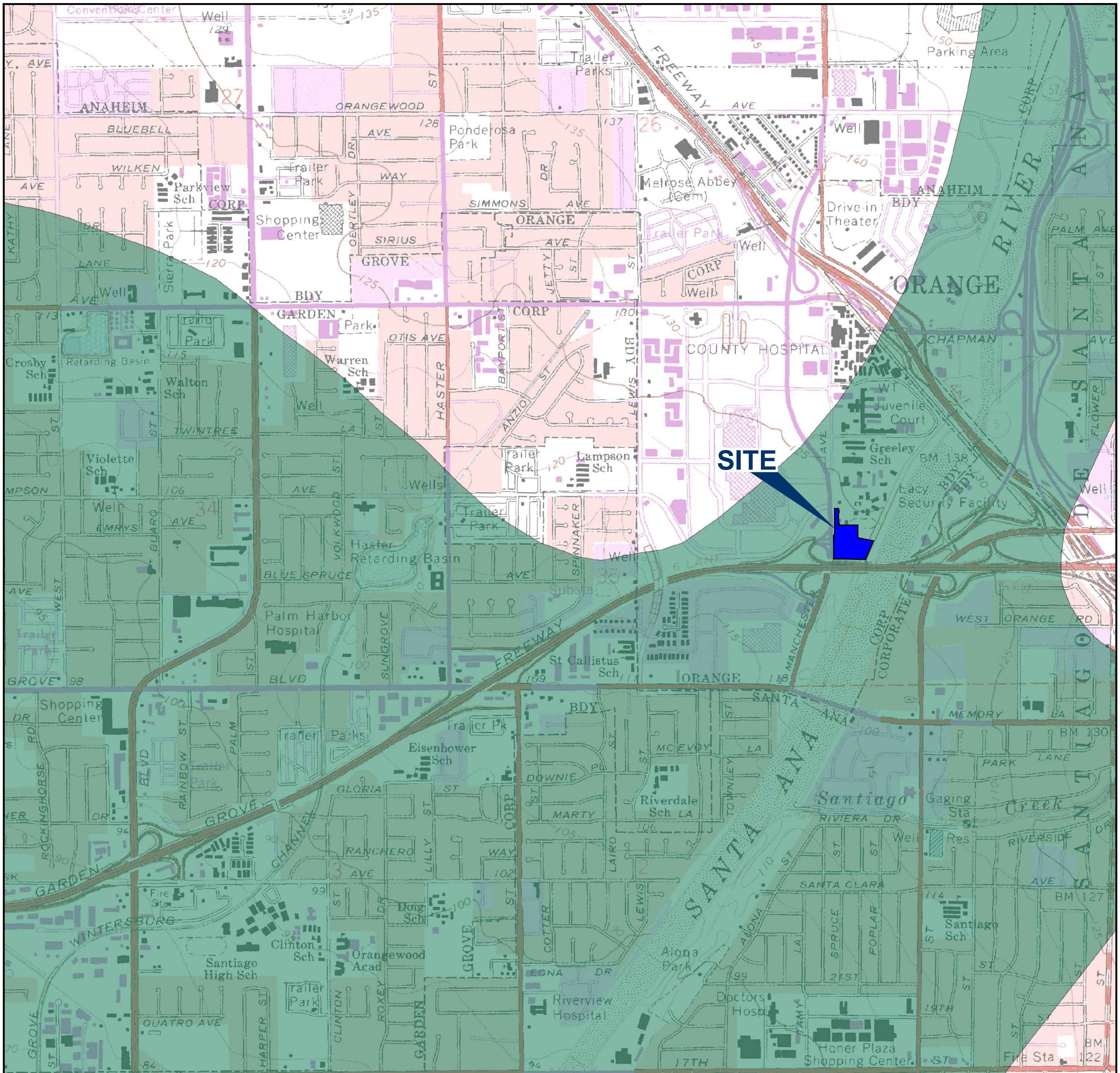
OWORKFORCE REENTRY CENTER
ORANGE, CALIFORNIA

212172012 | 6/24




**LEGEND**

**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 Resources Code Section 2693(c) would be required.

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE. I REFERENCE: CGS, 1998.

N

FEET
0 2,000 4,000

212172012.dwg_SHZ 06/12/2024 JDP

**FIGURE 7**

## SEISMIC HAZARD ZONES

WORKFORCE REENTRY CENTER
ORANGE, CALIFORNIA

212172012 I 6/24

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

# APPENDIX A
# Boring Logs and Laboratory Test Results
# (Ninyo & Moore, 2022)

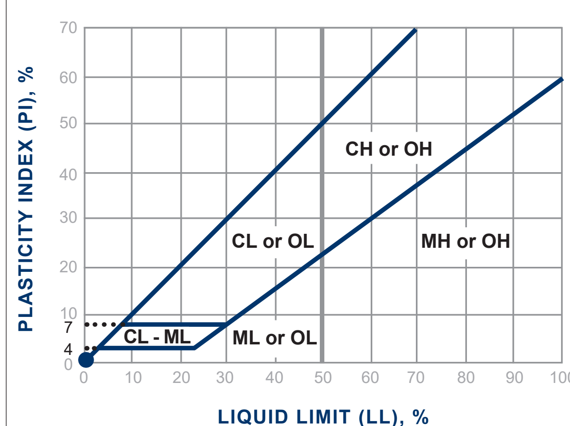
## Soil Classification Chart Per ASTM D 2488

| Primary Divisions | | | Secondary Divisions: Group Symbol | Group Name |
|---|---|---|---|---|
| COARSE-GRAINED SOILS more than 50% retained on No. 200 sieve | GRAVEL more than 50% of coarse fraction retained on No. 4 sieve | CLEAN GRAVEL less than 5% fines | GW | well-graded GRAVEL |
| | | | GP | poorly graded GRAVEL |
| | | GRAVEL with DUAL CLASSIFICATIONS 5% to 12% fines | GW-GM | well-graded GRAVEL with silt |
| | | | GP-GM | poorly graded GRAVEL with silt |
| | | | GW-GC | well-graded GRAVEL with clay |
| | | | GP-GC | poorly graded GRAVEL with clay |
| | | GRAVEL with FINES more than 12% fines | GM | silty GRAVEL |
| | | | GC | clayey GRAVEL |
| | | | GC-GM | silty, clayey GRAVEL |
| | SAND 50% or more of coarse fraction passes No. 4 sieve | CLEAN SAND less than 5% fines | SW | well-graded SAND |
| | | | SP | poorly graded SAND |
| | | SAND with DUAL CLASSIFICATIONS 5% to 12% fines | SW-SM | well-graded SAND with silt |
| | | | SP-SM | poorly graded SAND with silt |
| | | | SW-SC | well-graded SAND with clay |
| | | | SP-SC | poorly graded SAND with clay |
| | | SAND with FINES more than 12% fines | SM | silty SAND |
| | | | SC | clayey SAND |
| | | | SC-SM | silty, clayey SAND |
| FINE-GRAINED SOILS 50% or more passes No. 200 sieve | SILT and CLAY liquid limit less than 50% | INORGANIC | CL | lean CLAY |
| | | | ML | SILT |
| | | | CL-ML | silty CLAY |
| | | ORGANIC | OL (PI > 4) | organic CLAY |
| | | | OL (PI < 4) | organic SILT |
| | SILT and CLAY liquid limit 50% or more | INORGANIC | CH | fat CLAY |
| | | | MH | elastic SILT |
| | | ORGANIC | OH (plots on or above "A"-line) | organic CLAY |
| | | | OH (plots below "A"-line) | organic SILT |
| | Highly Organic Soils | | PT | Peat |

## Grain Size

| Description | | Sieve Size | Grain Size | Approximate Size |
|---|---|---|---|---|
| Boulders | | > 12" | > 12" | Larger than basketball-sized |
| 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 |

## Plasticity Chart




## Apparent Density - Coarse-Grained Soil

| Apparent Density | Spooling Cable or Cathead: SPT (blows/foot) | Spooling Cable or Cathead: Modified Split Barrel (blows/foot) | Automatic Trip Hammer: SPT (blows/foot) | Automatic Trip Hammer: Modified Split Barrel (blows/foot) |
|---|---|---|---|---|
| Very Loose | ≤ 4 | ≤ 8 | ≤ 3 | ≤ 5 |
| Loose | 5 - 10 | 9 - 21 | 4 - 7 | 6 - 14 |
| Medium Dense | 11 - 30 | 22 - 63 | 8 - 20 | 15 - 42 |
| Dense | 31 - 50 | 64 - 105 | 21 - 33 | 43 - 70 |
| Very Dense | > 50 | > 105 | > 33 | > 70 |

## Consistency - Fine-Grained Soil

| Consistency | Spooling Cable or Cathead: SPT (blows/foot) | Spooling Cable or Cathead: Modified Split Barrel (blows/foot) | Automatic Trip Hammer: SPT (blows/foot) | Automatic Trip Hammer: Modified Split Barrel (blows/foot) |
|---|---|---|---|---|
| Very Soft | < 2 | < 3 | < 1 | < 2 |
| Soft | 2 - 4 | 3 - 5 | 1 - 3 | 2 - 3 |
| Firm | 5 - 8 | 6 - 10 | 4 - 5 | 4 - 6 |
| Stiff | 9 - 15 | 11 - 20 | 6 - 10 | 7 - 13 |
| Very Stiff | 16 - 30 | 21 - 39 | 11 - 20 | 14 - 26 |
| Hard | > 30 | > 39 | > 20 | > 26 |

Ninyo & Moore

Geotechnical & Environmental Sciences Consultants

**USCS METHOD OF SOIL CLASSIFICATION**

| DATE DRILLED | 5/18/22 | BORING NO. | B-1 |
|---|---|---|---|
| GROUND ELEVATION | 117' ± (MSL) | SHEET 1 OF 1 | |
| METHOD OF DRILLING | 8" Hollow-Stem Auger (Baja Exploration) | | |
| DRIVE WEIGHT | 140 lbs. (Auto. Trip Hammer) | DROP | 30" |
| SAMPLED BY | GM | LOGGED BY GM | REVIEWED BY MLP |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|
| 0 | | | | | | GM | ASPHALT CONCRETE: Approximately 4 inches thick. |
| | | | | | | SM | AGGREGATE BASE: Gray, moist, medium dense, silty GRAVEL with sand; approximately 2 inches thick. |
| | X | | | | | | FILL: Grayish brown, moist, medium dense, silty SAND with gravel and gravel-sized asphalt concrete and Portland cement concrete fragments. |
| 5 | | X | 8 | | | | @ 5': Loose. |
| | | | | | | CL | Reddish brown, dark grayish brown, mottled, moist, stiff, lean CLAY with sand; trace gravel; trace sand pockets; trace asphalt concrete fragments. |
| 10 | | X | 14 | 23.9 | 98.9 | | Very stiff. |
| 15 | | X | 12 | | | | Olive brown; stiff. |
| | | | | | | SP | ALLUVIUM: Yellowish brown, moist, medium dense, poorly graded SAND. |
| 20 | | X | 15 | | | | |
| | | | | | | SM | Dark yellowish brown, moist, medium dense, silty SAND. |
| 25 | | X | 11 | | | CL | Yellowish brown, moist, stiff, lean CLAY. |
| | | | | | | | Total Depth = 26.5 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil and patched with rapid-set concrete dyed black on 5/18/22. |
| 30 | | | | | | | |
| 40 | | | | | | | |

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.

**FIGURE A- 1**

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

**THEO LACY FACILITY SECURITY WALL**
**ORANGE, CALIFORNIA**
**211948002 | 6/24**

| DATE DRILLED | 5/18/22 | BORING NO. | B-2 |
|---|---|---|---|
| GROUND ELEVATION | 119' ± (MSL) | SHEET 1 OF 1 | |
| METHOD OF DRILLING | 8" Hollow-Stem Auger (Baja Exploration) | | |
| DRIVE WEIGHT | 140 lbs. (Auto. Trip Hammer) | DROP | 30" |
| SAMPLED BY GM | LOGGED BY GM | REVIEWED BY | MLP |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | ■ | | | | | | SM | FILL: Grayish brown, moist, medium dense, silty SAND with angular to sub-angular gravel; few gravel-sized asphalt concrete and Portland cement concrete fragments. |
| | | ■ | 23 | 2.4 | 108.8 | | | |
| | | | | | | | | Difficult drilling conditions; possible cobbles and/or cobble-size construction debris. |
| 10 | | ■ | 20 | | | | | Few small gravel-sized asphalt concrete fragments. |
| | | ■ | 26 | | | | | Portland cement concrete fragment in sampler tip. |
| 20 | | ■ | 27 | | | | SP | ALLUVIUM: Yellowish brown, moist, medium dense, poorly graded SAND. |
| | | | | | | | CL | Yellowish brown, moist, very stiff, lean CLAY. |
| | | ■ | 19 | | | | SC | Yellowish brown, moist, medium dense, clayey SAND. |
| | | | | | | | | Total Depth = 26.5 feet.<br>Groundwater was not encountered during drilling.<br>Backfilled with on-site soil on 5/18/22.<br><br>Notes:<br>Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.<br><br>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

DATE DRILLED 5/18/22 BORING NO. B-3

GROUND ELEVATION 120' ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 8" Hollow-Stem Auger (Baja Exploration)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY GM LOGGED BY GM REVIEWED BY MLP

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | SM | FILL: Grayish brown, moist, medium dense, silty SAND; trace gravel and gravel-sized asphalt concrete fragments. Some fill lifts contain clayey zones. |
| | | | 25 | 9.9 | 117.0 | | | |
| | | | | | | | SP | ALLUVIUM: Grayish brown, moist, loose, poorly graded SAND. |
| 10 | | | 9 | 3.7 | 97.9 | | | |
| | | | | | | | CL | Yellowish brown, moist, stiff, sandy lean CLAY. |
| | | | | | | | SC | Yellowish brown, moist, loose, clayey SAND. |
| | | | 12 | | | | | |
| 20 | | | 40 | | | | SM | Grayish brown, moist, medium dense, silty SAND. |
| | | | | | | | CL | Yellowish brown, moist, very stiff, lean CLAY. |
| | | | 26 | | | | | |
| | | | | | | | SM | Grayish brown, moist, medium dense, silty SAND. |
| | | | | | | | | Total Depth = 26.5 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil on 5/18/22. |
| 30 | | | | | | | | Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 40 | | | | | | | | |

DATE DRILLED 5/18/22 BORING NO. B-4

GROUND ELEVATION 120' ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 8" Hollow-Stem Auger (Baja Exploration)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY GM LOGGED BY GM REVIEWED BY MLP

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | SP | PORTLAND CEMENT CONCRETE: Approximately 5 inches thick; no base. FILL: Yellowish brown, moist, medium dense, poorly graded SAND; trace angular to sub-angular gravel. |
| | | | 24 | | | | SP | ALLUVIUM: Light yellowish brown, moist, medium dense, poorly graded SAND. |
| 10 | | | 12 | 25.4 | 95.9 | | CL | Yellowish brown, moist, stiff, lean CLAY with sand. |
| | | | | | | | ML | Yellowish brown, moist, medium dense, sandy SILT. |
| | | | 27 | | | | CL | Yellowish brown, moist, hard, sandy CLAY. |
| 20 | | | 29 | | | | SM | Grayish brown, moist, medium dense, silty SAND. |
| | | | | | | | CL | Yellowish brown, moist, hard, sandy lean CLAY. |
| | | | 28 | | | | SM | Grayish brown, moist, medium dense, silty SAND. |
| | | | | | | | | Total Depth = 26.5 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil and patched with rapid-set concrete on 5/18/22. |
| 30 | | | | | | | | Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 40 | | | | | | | | |

DATE DRILLED 9/21/22 BORING NO. B-5

GROUND ELEVATION 120' ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 8" Hollow-Stem Auger (MR Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY GM LOGGED BY GM REVIEWED BY MLP

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | SM | PORTLAND CEMENT CONCRETE: Approximately 5 inches thick; no base. |
| | | | | | | | SP | FILL: Reddish brown, moist, medium dense, silty SAND with gravel; gravel angular to sub-angular. |
| | | | | | | | SP | Yellowish brown, moist, medium dense, poorly graded SAND; trace angular to sub-angular gravel. |
| | | | 28 | 6.9 | 104.2 | | | ALLUVIUM: Yellowish brown, moist, medium dense, poorly graded SAND; trace gravel rounded to sub-rounded. |
| | | | | | | | ML | Gray, moist, hard, SILT. |
| 10 | | | 22 | | | | | |
| | | | | | | | CL | Olive brown, moist, very stiff, lean CLAY. |
| | | | 18 | | | | | |
| | | | | | | | | Total Depth = 16.5 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil and patched with rapid-set concrete on 9/21/22. |
| 20 | | | | | | | | Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

| DATE DRILLED | 9/21/22 | BORING NO. | B-6 |
|---|---|---|---|
| GROUND ELEVATION | 120' ± (MSL) | SHEET 1 OF 1 | |
| METHOD OF DRILLING | 8" Hollow-Stem Auger (MR Drilling) | | |
| DRIVE WEIGHT | 140 lbs. (Auto. Trip Hammer) | DROP | 30" |
| SAMPLED BY | GM | LOGGED BY GM | REVIEWED BY MLP |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | SM | PORTLAND CEMENT CONCRETE: Approximately 5 inches thick; no base. |
| | | | | | | | SP | FILL: Reddish brown, moist, medium dense, silty SAND with gravel; cobble-sized Portland cement concrete fragments at 1 foot deep; few rootlets. |
| | | | | | | | | Yellowish brown, moist, medium dense, poorly graded SAND; trace angular to sub-angular gravel. |
| | | ■ | 24 | 3.4 | 94.6 | | SP | ALLUVIUM: Yellowish brown, moist, medium dense, poorly graded SAND; trace rounded to sub-rounded gravel. |
| | | | | | | | CL | Dark yellowish brown, moist, very stiff, sandy lean CLAY. |
| 10 | | ◣ | 12 | | | | | |
| | | | | | | | ML | Olive brown, moist, hard, SILT. |
| | | ◣ | 25 | | | | | |
| | | | | | | | | Total Depth = 16.5 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil and patched with rapid-set concrete on 9/21/22. |
| 20 | | | | | | | | Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. |
| | | | | | | | | The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

| DATE DRILLED | 9/21/22 | BORING NO. | B-7 |
|---|---|---|---|
| GROUND ELEVATION | 120' ± (MSL) | SHEET 1 OF 1 | |
| METHOD OF DRILLING | 8" Hollow-Stem Auger (MR Drilling) | | |
| DRIVE WEIGHT | 140 lbs. (Auto. Trip Hammer) | DROP | 30" |
| SAMPLED BY | GM | LOGGED BY GM | REVIEWED BY MLP |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | SM | FILL:<br>Gray, dry, medium dense, silty SAND with gravel; few tree roots. |
| | | | | | | | SP | Yellowish brown, moist, medium dense, poorly graded SAND; few gravel; trace clay pockets.<br>@ 3': Few clay pockets. |
| | | | | | | | CL | Gray, moist, stiff, sandy CLAY; trace angular fine gravel. |
| | | | 31 | 5.0 | 95.9 | | SP | ALLUVIUM:<br>Light yellowish brown, moist, medium dense, poorly graded SAND; trace rounded to sub-rounded gravel. |
| 10 | | | 18 | | | | CL | Dark yellowish brown, moist, very stiff, sandy lean CLAY. |
| | | | 21 | | | | | Hard; decrease in sand. |
| 20 | | | | | | | | Total Depth = 16.5 feet.<br>Groundwater was not encountered during drilling.<br>Backfilled with on-site soil on 9/21/22.<br><br>Notes:<br>Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.<br><br>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | SM | FILL: Grayish brown, moist, medium dense, silty SAND; trace gravel and gravel-sized asphalt concrete fragments. Some fill lifts contain clayey zones. @ 3': Few clay pockets. |
| | | | 39 | 12.6 | 92.7 | | SP | ALLUVIUM: Light yellowish brown, moist, medium dense, poorly graded SAND; trace rounded to sub-rounded gravel. |
| 10 | | | 17 | | | | CL | Reddish brown, moist, very stiff, sandy lean CLAY. |
| | | | 21 | | | | | Hard. |
| | | | | | | | | Total Depth = 16.5 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil on 9/21/22. |
| 20 | | | | | | | | Notes: The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| | | | | | | | | The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

DATE DRILLED 9/21/22 BORING NO. B-8

GROUND ELEVATION 120' ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 8" Hollow-Stem Auger (MR Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY GM LOGGED BY GM REVIEWED BY MLP

| DATE DRILLED | 9/21/22 | BORING NO. | B-9 |
|---|---|---|---|
| GROUND ELEVATION | 120' ± (MSL) | SHEET 1 OF 1 | |
| METHOD OF DRILLING | 8" Hollow-Stem Auger (MR Drilling) | | |
| DRIVE WEIGHT | 140 lbs. (Auto. Trip Hammer) | DROP | 30" |
| SAMPLED BY | GM | LOGGED BY GM | REVIEWED BY MLP |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | SM | FILL: Grayish brown, moist, medium dense, silty SAND with angular to sub-angular gravel; few gravel-sized asphalt concrete and Portland cement concrete fragments. Difficult hand auguring conditions. |
| | | | 35 | 1.3 | 101.4 | | SP | ALLUVIUM: Light yellowish brown, moist, medium dense, poorly graded SAND; trace rounded to sub-rounded gravel. |
| 10 | | | 19 | | | | CL | Reddish brown, moist, very stiff, sandy lean CLAY. |
| | | | 25 | | | | | Hard. |
| | | | | | | | | Total Depth = 16.5 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil on 9/21/22. |
| 20 | | | | | | | | Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

| DATE DRILLED | 9/21/22 | BORING NO. | B-10 |
|---|---|---|---|
| GROUND ELEVATION | 120' ± (MSL) | SHEET 1 OF 1 | |
| METHOD OF DRILLING | 8" Hollow-Stem Auger (MR Drilling) | | |
| DRIVE WEIGHT | 140 lbs. (Auto. Trip Hammer) | DROP | 30" |
| SAMPLED BY | GM | LOGGED BY GM | REVIEWED BY MLP |

| DEPTH (feet) | SAMPLES (Bulk / Driven) | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|
| 0 | | | | | | SM | FILL:<br>Grayish brown, moist, medium dense, silty SAND with angular to sub-angular gravel; few gravel-sized asphalt concrete and Portland cement concrete fragments. |
| | Driven | 48 | | | | | Few cobble-sized asphalt concrete fragments. |
| | Driven | 33 | 6.5 | 109.8 | | | Medium dense. |
| 10 | Driven | 51 | | | | | Black with asphalt concrete fragments; dense. |
| | | | | | | CL | Olive brown, moist, hard, sandy CLAY; trace gravel. |
| | Driven | 58 | 22.5 | 101.6 | | | |
| 20 | Driven | 60 | | | | SM | ALLUVIUM:<br>Yellowish brown, moist, dense, silty SAND; trace iron oxide staining. |
| | | | | | | CL | Yellowish brown, moist, hard, lean CLAY. |
| | Driven | 28 | | | | | |
| | | | | | | SM | Gray, moist, very dense, silty SAND. |
| 30 | Driven | 42 | | | | | |
| | | | | | | | Total Depth = 31.5 feet.<br>Groundwater was not encountered during drilling.<br>Backfilled with on-site soil on 9/21/22.<br><br>Notes:<br>Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.<br><br>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 40 | | | | | | | |

| DATE DRILLED | 9/27/22 | BORING NO. | B-11 |
|---|---|---|---|
| GROUND ELEVATION | 120' ± (MSL) | SHEET 1 OF 1 | |
| METHOD OF DRILLING | 8" Hollow-Stem Auger (MR Drilling) | | |
| DRIVE WEIGHT | 140 lbs. (Auto. Trip Hammer) | DROP | 30" |
| SAMPLED BY | GM | LOGGED BY GM | REVIEWED BY MLP |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | GM | ASPHALT CONCRETE: Approximately 2 inches thick. |
| | | | | | | | SM | AGGREGATE BASE: Gray, moist, medium dense, silty GRAVEL with sand; approximately 5 inches thick. |
| | | | | | | | | FILL: Gray, moist, medium dense, silty SAND with gravel and gravel-sized asphalt concrete and Portland cement concrete fragments. |
| | | | 50/5" | | | | | @ 5': Very dense. |
| | | | 40 | | | | | Few asphalt chunks; medium dense. |
| 10 | | | 48 | 2.5 | 102.9 | | SP | ALLUVIUM: Light gray, moist, dense, poorly graded SAND; few gravel. |
| | | | | | | | CL | Olive brown, moist, hard, sandy CLAY. |
| | | | 52 | | | | | |
| | | | | | | | SM | Gray to olive brown, moist, dense, silty SAND. |
| 20 | | | 28 | | | | | |
| | | | | | | | | Total Depth = 21.5 feet.<br>Groundwater was not encountered during drilling.<br>Backfilled with on-site soil and patched with rapid-set concrete dyed black on 9/27/22.<br><br>Notes:<br>Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.<br><br>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. |
|---|---|---|---|---|---|---|---|

DATE DRILLED 9/27/22 BORING NO. B-12

GROUND ELEVATION 120' ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 8" Hollow-Stem Auger (MR Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY GM LOGGED BY GM REVIEWED BY MLP

**DESCRIPTION/INTERPRETATION**

| Depth (feet) | Bulk | Driven | Blows/Foot | Moisture (%) | Dry Density (PCF) | Classification U.S.C.S. | Description/Interpretation |
|---|---|---|---|---|---|---|---|
| 0 | | | | | | | ASPHALT CONCRETE:<br>Approximately 3 inches thick. |
| | | | | | | GM | AGGREGATE BASE:<br>Gray, moist, medium dense, silty GRAVEL with sand; approximately 5 inches thick. |
| | X | | | | | SM | FILL:<br>Grayish brown and dark yellowish brown, moist, medium dense, silty SAND with gravel and gravel-sized asphalt concrete fragments and Portland cement concrete fragments. |
| | | X | 49 | | | | Dense. |
| | | | | | | SP | ALLUVIUM:<br>Yellowish brown, moist, medium dense, poorly graded SAND; few gravel. |
| | | X | 30 | 24.5 | 97.2 | CL | Olive brown, moist, hard, sandy CLAY. |
| 10 | | | | | | | |
| | | X | 28 | | | | Trace oxidation staining. |
| | | | | | | | Total Depth = 16.5 feet.<br>Groundwater was not encountered during drilling.<br>Backfilled with on-site soil and patched with rapid-set concrete dyed black on 9/27/22. |
| 20 | | | | | | | Notes:<br>Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.<br><br>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 30 | | | | | | | |
| 40 | | | | | | | |

DATE DRILLED 9/27/22 BORING NO. B-13

GROUND ELEVATION 120' ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 8" Hollow-Stem Auger (MR Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY GM LOGGED BY GM REVIEWED BY MLP

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | GM | ASPHALT CONCRETE: Approximately 2 inches thick. |
| | | | | | | | SM | AGGREGATE BASE: Gray, moist, medium dense, silty GRAVEL with sand; approximately 7 inches thick. |
| | | | | | | | | FILL: Grayish brown and dark yellowish brown, moist, medium dense, silty SAND with gravel and gravel-sized asphalt concrete and Portland cement concrete fragments. |
| | | | | | | | SC | Grayish brown and dark yellowish brown, moist, medium dense, clayey SAND with gravel and gravel-sized asphalt concrete and Portland cement concrete fragments. |
| | | | 41 | 9.3 | 108.9 | | | |
| | | | 50/4" | | | | | Very dense. |
| 10 | | | | | | | CL | Dark olive brown to dark yellowish brown, moist, hard, sandy CLAY; trace gravel-sized Portland cement concrete fragments. |
| | | | 44 | 20.8 | 104.4 | | | |
| | | | 39 | | | | | |
| | | | | | | | SM | ALLUVIUM: Yellowish brown, moist, medium dense, silty SAND; oxidation staining. |
| 20 | | | 33 | | | | | @ 20': Seepage encountered during drilling; wet. |
| | | | | | | | CL | Dark yellowish brown, moist, hard, sandy CLAY; trace caliche. |
| | | | 24 | | | | | |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

Total Depth = 26.5 feet.
Groundwater was not encountered during drilling.
Seepage was encountered at approximately 20 feet during drilling.
Backfilled with on-site soil and patched with rapid-set concrete dyed black on 9/27/22.

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.

| | | | | |
|---|---|---|---|---|
| DATE DRILLED | 9/27/22 | BORING NO. | B-14 | |
| GROUND ELEVATION | 120' ± (MSL) | SHEET 1 OF 1 | | |
| METHOD OF DRILLING | 8" Hollow-Stem Auger (MR Drilling) | | | |
| DRIVE WEIGHT | 140 lbs. (Auto. Trip Hammer) | DROP | 30" | |
| SAMPLED BY | GM | LOGGED BY GM | REVIEWED BY | MLP |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | SM | FILL:<br>Grayish brown, moist, medium dense, silty SAND with angular and sub-rounded gravel; few gravel-sized asphalt concrete and Portland cement concrete fragments. |
| | | | | | | | | * Possible cobble/cobble-sized debris at 5 feet; sample taken at 5.5 feet. * |
| | | | 50/5" | | | | | Very dense. |
| | | | 51 | | | | | Dense. |
| 10 | | | 50/4" | 13.9 | 93.1 | | CL | Dark olive brown, moist, hard, sandy CLAY with gravel-sized asphalt concrete and Portland cement concrete fragments. |
| | | | 43 | | | | SP | ALLUVIUM:<br>Light gray, moist, dense, poorly graded SAND. |
| | | | 61 | | | | | Few gravel. |
| | | | | | | | CL | Olive brown, moist, hard, CLAY with sand; trace gravel. |
| 20 | | | 41 | | | | ML | Olive brown, moist, very dense, sandy SILT. |
| | | | | | | | | Total Depth = 21.5 feet.<br>Groundwater was not encountered during drilling.<br>Backfilled with on-site soil on 9/27/22. |
| | | | | | | | | Notes:<br>Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.<br><br>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

FIGURE A- 14

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA
211948002 | 6/24

| SAMPLE LOCATION | SAMPLE DEPTH (ft) | DESCRIPTION | PERCENT PASSING NO. 4 | PERCENT PASSING NO. 200 | USCS (TOTAL SAMPLE) |
|---|---|---|---|---|---|
| B-1 | 10.0-11.5 | LEAN CLAY WITH SAND | 100 | 78 | CL |
| B-3 | 0.0-5.0 | SILTY SAND | 97 | 16 | SM |
| B-4 | 10.0-11.5 | LEAN CLAY WITH SAND | 100 | 75 | CL |
| B-4 | 20.0-21.5 | SILTY SAND | 100 | 32 | SM |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 1140

FIGURE B-1

**NO. 200 SIEVE ANALYSIS TEST RESULTS**

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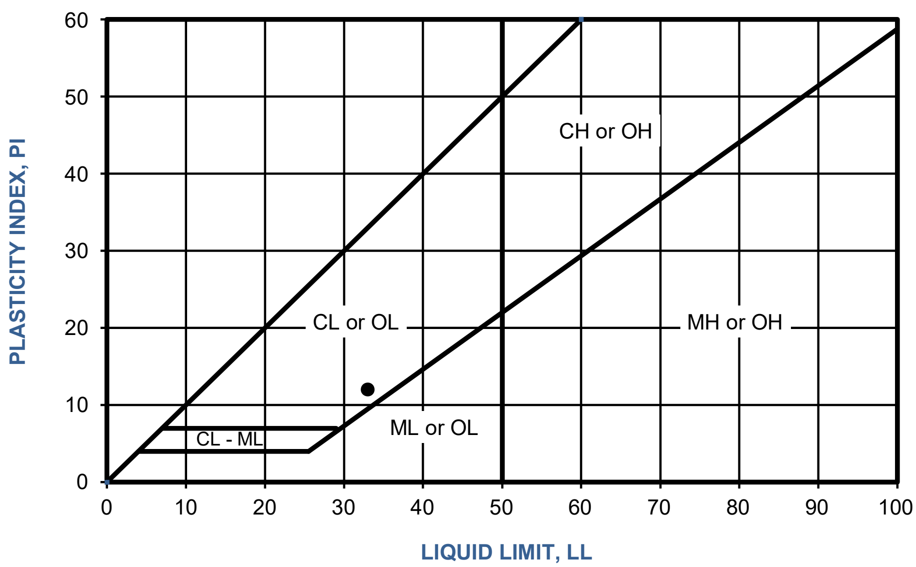
THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA

211948002 | 6/24

| SYMBOL | LOCATION | DEPTH (ft) | LIQUID LIMIT | PLASTIC LIMIT | PLASTICITY INDEX | USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve) | USCS |
|---|---|---|---|---|---|---|---|
| ● | B-4 | 10.0-11.5 | 33 | 21 | 12 | CL | CL |




PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318

**FIGURE B-2**

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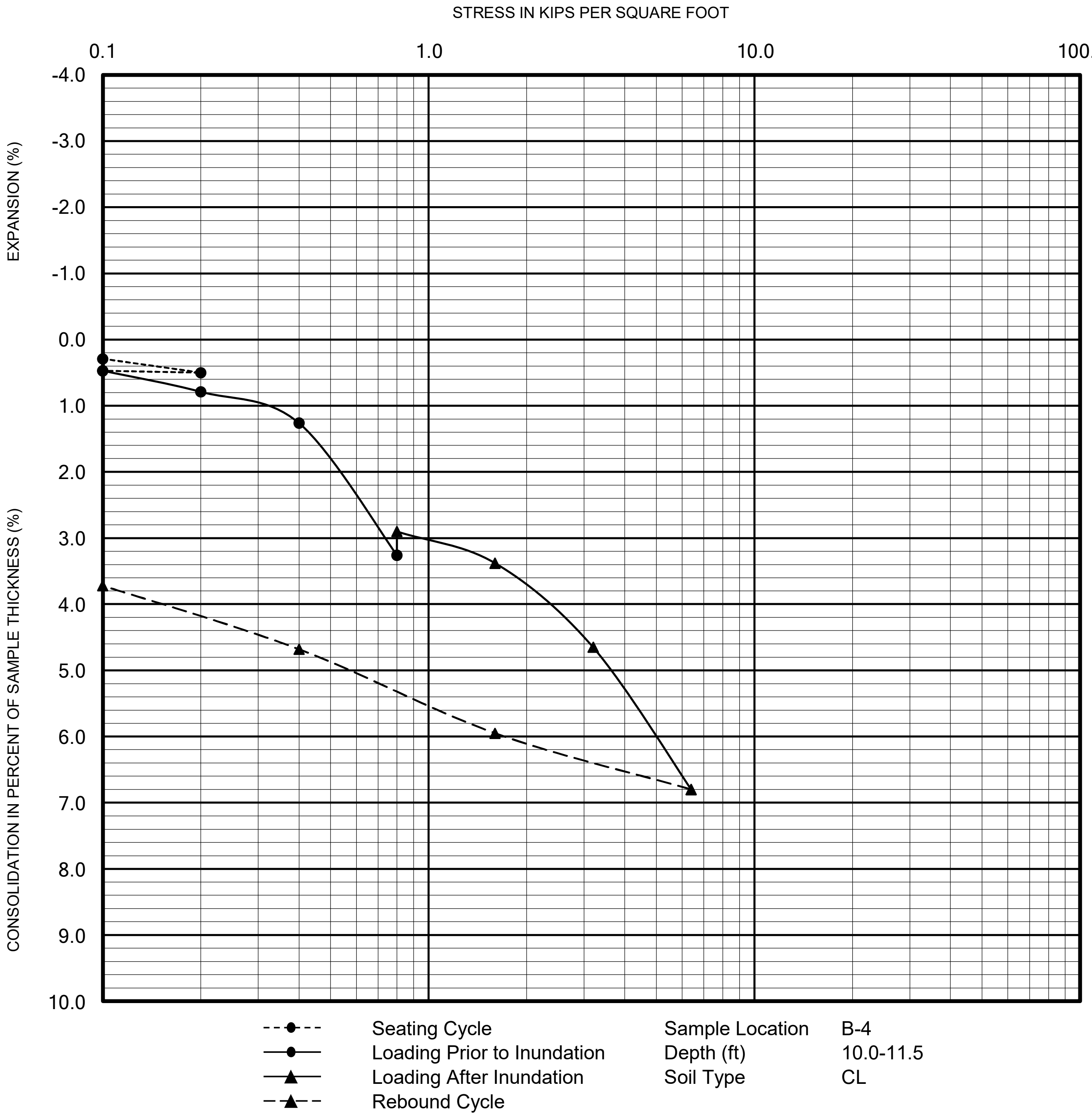
**ATTERBERG LIMITS TEST RESULTS**

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA

211948002 | 6/24




| | |
|---|---|
| Sample Location | B-4 |
| Depth (ft) | 10.0-11.5 |
| Soil Type | CL |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

**FIGURE B-3**

**CONSOLIDATION TEST RESULTS**

Ninyo & Moore
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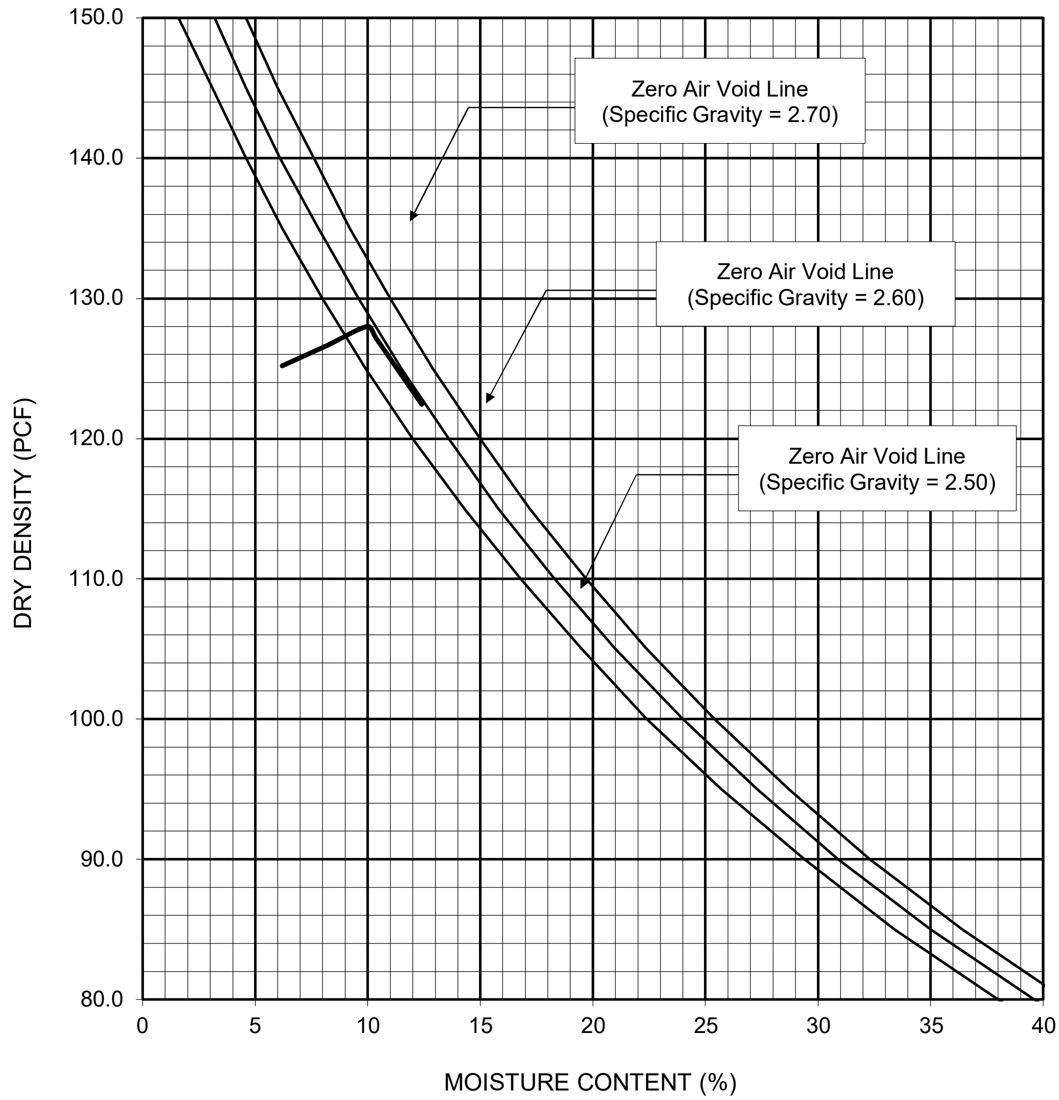
THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA

211948002 | 6/24




| Sample Location | Depth (ft) | Soil Description | Maximum Dry Density (pcf) | Optimum Moisture Content (percent) |
|---|---|---|---|---|
| B-3 | 0.0-5.0 | Grayish Brown Silty Sand | 128.0 | 10.0 |
| Dry Density and Moisture Content Values Corrected for Oversize (ASTM D 4718) | | | N/A | N/A |

PERFORMED IN GENERAL ACCORDANCE WITH ☑ ASTM D 1557 ☐ ASTM D 698 METHOD ☐ A ☑ B ☐ C

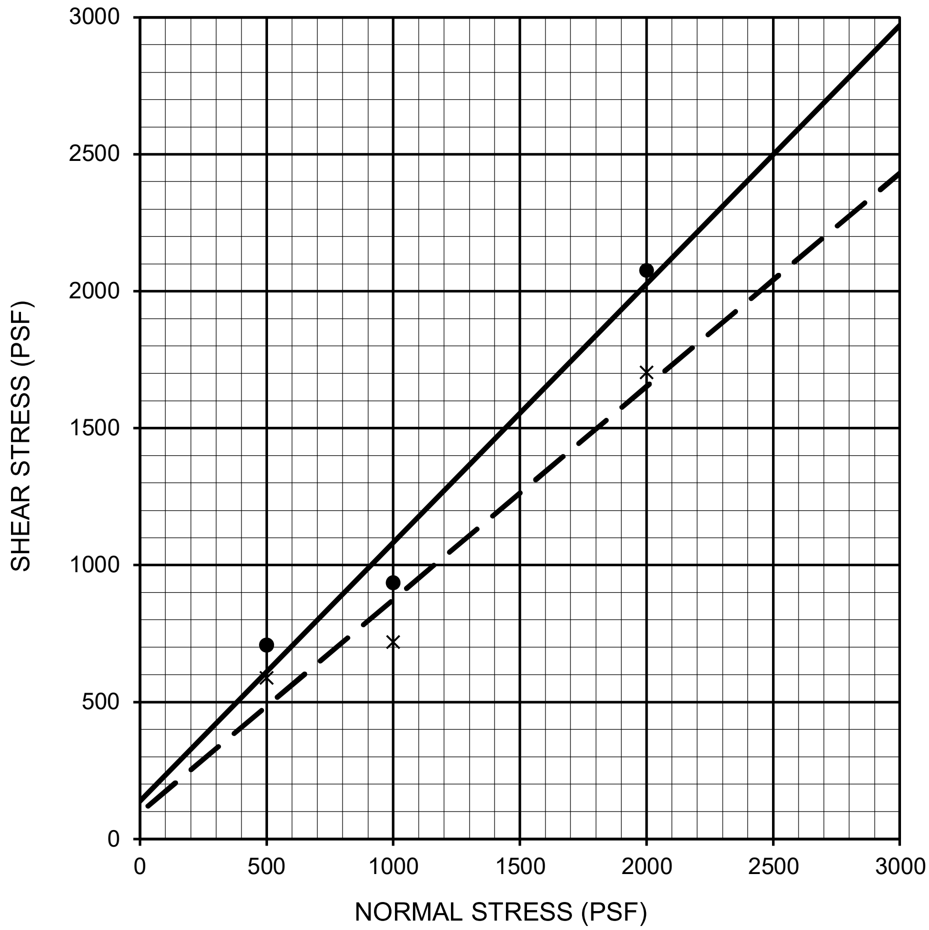
**FIGURE B-4**

**PROCTOR DENSITY TEST RESULTS**

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA

211948002 | 6/24




| Description | Symbol | Sample Location | Depth (ft) | Shear Strength | Cohesion (psf) | Friction Angle (degrees) | Soil Type |
|---|---|---|---|---|---|---|---|
| SILTY SAND | ——●—— | B-3 | 0.0-5.0 | Peak | 138 | 43 | SM |
| SILTY SAND | – – X – – | B-3 | 0.0-5.0 | Ultimate | 96 | 38 | SM |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080 ON A SAMPLE REMOLDED TO 90% RELATIVE COMPACTION

**FIGURE B-5**

**DIRECT SHEAR TEST RESULTS**

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA

211948002 | 6/24

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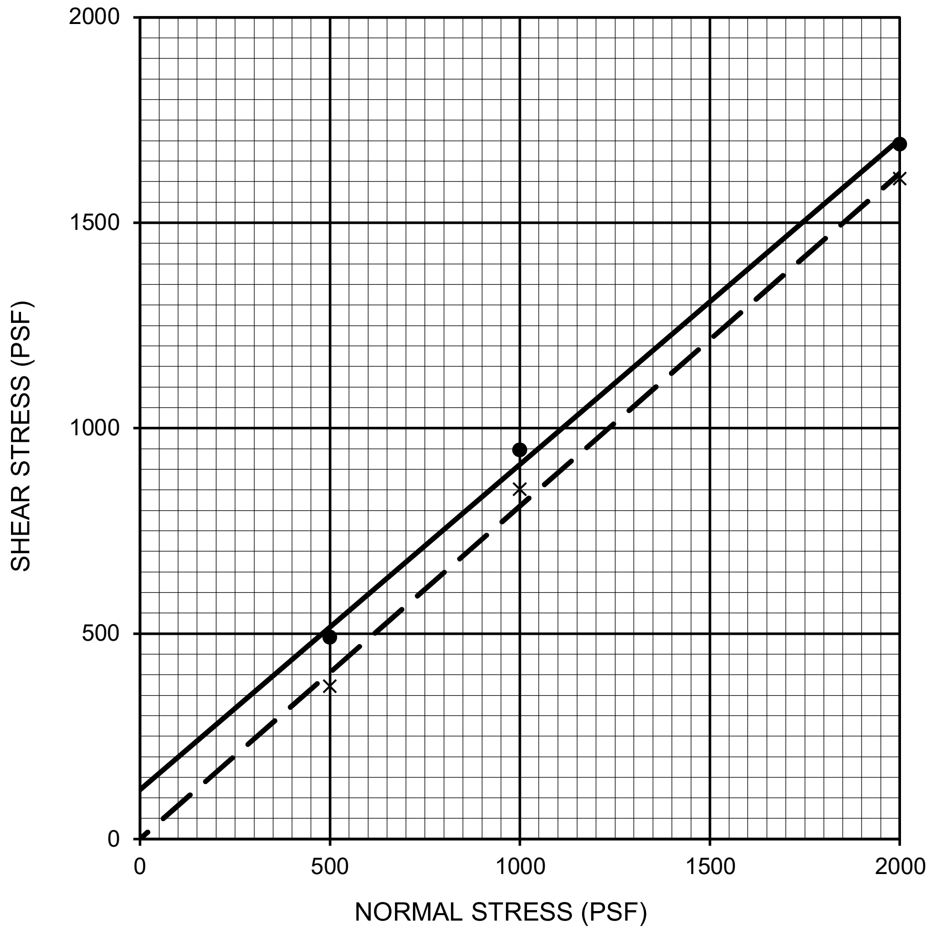


| Description | Symbol | Sample Location | Depth (ft) | Shear Strength | Cohesion (psf) | Friction Angle (degrees) | Soil Type |
|---|---|---|---|---|---|---|---|
| SILTY SAND | —●— | B-10 | 7.5-9.0 | Peak | 120 | 38 | SM |
| SILTY SAND | – – X – – | B-10 | 7.5-9.0 | Ultimate | 0 | 39 | SM |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080

**FIGURE B-6**

**DIRECT SHEAR TEST RESULTS**

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA

211948002 | 6/24

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Geotechnical & Environmental Sciences Consultants

| SAMPLE LOCATION | SAMPLE DEPTH (ft) | pH [1] | RESISTIVITY [1] (ohm-cm) | SULFATE CONTENT [2] | | CHLORIDE CONTENT [3] (ppm) |
|---|---|---|---|---|---|---|
| | | | | (ppm) | (%) | |
| B-3 | 0.0-5.0 | 7.5 | 5,963 | 10 | 0.001 | 10 |

[1] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 643
[2] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 417
[3] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 422

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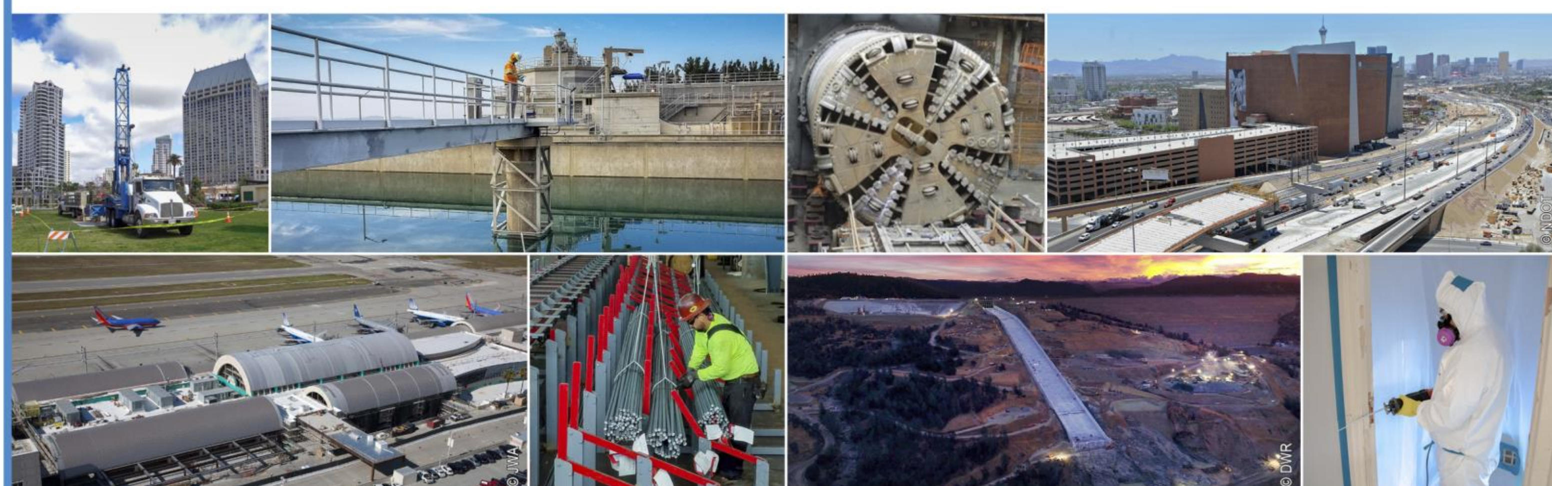
FIGURE B-7

## CORROSIVITY TEST RESULTS

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA

211948002 | 6/24

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# *APPENDIX D-2*

# *GEOTECHNICAL EXPLORATION REPORT*

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# Geotechnical Exploration Report
# Proposed Workforce Reentry Center
# 591 The City Drive South
# City of Orange, California

**Prepared for:**

Griffin Structures, Inc.
2 Technology, Suite 150
Irvine, California 92618

**Prepared by:**

Verdantas Inc.
2600 Michelson Drive, Suite 400
Irvine, California 92612

**Project No. 20833**

**August 7, 2024**

verdantas

August 7, 2024

Project No. 20833

Mr. Deryl Robinson, VP
Griffin Structures, Inc.
2 Technology, Suite 150
Irvine, California 92618

**Subject:** **Geotechnical Exploration Report**
**Proposed Workforce Reentry Center**
**591 The City Drive South**
**City of Orange, California**

Per your request and authorization, Verdantas Inc. (Verdantas) has prepared this geotechnical exploration report for the subject project. We understand the proposed development will consist of a one-story retail/culinary building, a two-story vocational building, a two-story housing building, and associated paved surface parking and access. A new security wall is planned along the northeastern portion of the project adjacent to the Theo Lacy Facility. Ancillary improvements likely consist of utility infrastructure, flatwork, and landscaping.

The purpose of our geotechnical exploration was to evaluate subsurface conditions at the site, identify potential geologic and seismic hazards that may impact the project, and provide geotechnical recommendations for design and construction of the proposed development as currently planned.

The project is considered feasible from a geotechnical standpoint. The results of our exploration, conclusions, and recommendations are presented in this report.

We appreciate the opportunity to be of service to you on this project. If you have any questions or if we can be of further service, please contact us at (949) 250-1421; or at the e-mail addresses listed below.

Respectfully submitted,

VERDANTAS INC.

CERTIFIED ENGINEERING GEOLOGIST JEFFREY M. PFLUEGER No. 2499 STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER CARL C. KIM No. 2620 GEOTECHNICAL STATE OF CALIFORNIA

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ECB/JMP/CCK/lr

Distribution: (1) Addressee

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Attachments



Figures



Plates

## Appendices

# 1.0 Introduction

## 1.1 Site Description and Proposed Development

The project site is located at 591 The City Drive South in the city of Orange, Orange County, California. The site location (latitude 33.7802°, longitude -117.8879) and immediate vicinity are shown on Figure 1, *Site Location Map.*

The project site is rectangular in shape and covers approximately 4.7 acres. The site is bordered by The City Drive South to the west, State Route 22 to the south, and the Theo Lacy Facility (Orange County Jail) to the east and north. The Santa Ana River channel is located immediately to the east of the Theo Lacy Facility. Access to the site is via The City Drive South on the west. The site is currently occupied by the former Orange County Animal Shelter (abandoned) consisting of several buildings and associated asphalt concrete (AC) and Portland cement concrete (PCC) paved parking and access. The southeastern portion of the project site area is located within the currently existing security walls of the Theo Lacy Facility.

The project site is relatively level with sheet flow generally directed to the south over paved surfaces to curbs and gutters. Review of the United States Geological Survey (USGS) 7.5-Minute Anaheim Quadrangle (USGS, 1965) indicates the site is between approximately Elevation (El.) +120 to +125 feet mean sea level (msl).

Based on review of historic aerial photographs (NETR, 2024), the project site appears to have been primarily undeveloped from 1953 until at least 1963, with the west central portion of the site in use as a citrus orchard and a small structure located to the northwest of the orchard. Also visible on aerial photographs during this time is evidence of the western margins of the former Santa Ana River drainage course that crossed the southeastern portion of the site prior it being channelized. This is also consistent with historic topographic maps dating back to 1898 (USGS, 1898), and later in 1950 where a topographic depression is shown in the southeastern portion of the site (USGS, 1950). Between 1963 and 1972, the orchard and the small structure was cleared, and a building was constructed in its place. At this time, the existing northern building facing The City Drive South and kennels associated with the previous animal shelter was constructed, and the southern portion of the site was paved to support surface parking. In 1980, another building was constructed in the western center of the site and additional animal kennels were constructed in the southeast portion of the site. In 1995, one of the western buildings was demolished and replaced by paved parking. By 2009, the second western building was demolished and the existing southeastern building was constructed. The site has remained in the same configuration since then.

Based on review of the *County of Orange, Workforce Reentry Center, Conceptual Pricing Set*, dated May 28, 2024, we understand that the proposed development consists of a one-story retail/culinary building, a two-story vocational building, a two-story housing building, and associated paved surface parking and access. A new security wall is planned along the northeastern portion of the project adjacent to the Theo Lacy Facility. Ancillary improvements likely consist of utility infrastructure, flatwork, and landscaping. Structural loading information was not yet available at the time this report was prepared.

## 1.2 Purpose and Scope

The purpose of our geotechnical exploration was to evaluate the subsurface conditions at the site relative to the proposed development concept and provide geotechnical recommendations to aid in the design and construction for the project as currently planned. The scope of this geotechnical exploration included the following tasks:

- *Background Review* – We reviewed readily available in-house geotechnical reports, literature, aerial photographs, and maps relevant to the site. We evaluated geological hazards and potential geotechnical issues that may significantly impact the site. The documents reviewed are listed in Section 5.0, *References*.

- *Pre-Field Exploration Activities* – A site visit was performed by a member of our technical staff to mark the proposed exploration locations. DigAlert (811) was notified to locate and mark existing underground utilities prior to our subsurface exploration.

- *Field Exploration* – Our subsurface exploration, performed on July 1, 2024, included drilling, logging, and sampling of five (5) hollow-stem auger borings (designated LB-1 through LB-5) to depths between approximately 31 and 51½ feet below the existing ground surface (bgs) and six (6) cone penetration test (CPT) soundings advanced to approximately 50 feet bgs. Two (2) additional borings (designated LP-1 and LP-2) were drilled to an approximate depth of 10 feet bgs for subsequent percolation testing. The approximate locations of the explorations are shown on Plate 1, *Exploration Location Map.* The boring logs and CPT logs are presented in Appendix A, *Exploration Logs.*

  Bulk and drive samples were obtained from the hollow-stem auger borings for geotechnical laboratory testing. Driven ring samples were collected from the borings using a Modified California ring-lined sampler conducted in accordance with ASTM Test Method D 3550. Standard Penetration Tests (SPTs) were also performed within the borings in accordance with ASTM Test Method D 1586. Samples were collected at 2½-foot to 5-foot intervals throughout the depth of exploration. In both test methods, the sampler is driven below the bottom of the borehole by a 140-pound weight (hammer) free-falling 30 inches. The drilling rig was equipped with an automatic hammer to provide greater consistency in the drop height and striking frequency. The number of blows to drive the sampler the final 12 inches of the 18-inch drive interval is termed the "blowcount" or SPT N-value. The N-values provide a measure of relative density in granular (non-cohesive) soils and comparative consistency in cohesive soils. The number of blows per 6 inches of penetration was recorded on the boring logs, see Appendix A.

  The borings were logged in the field by a geologist from our firm. Each soil sample collected was reviewed and described in accordance with the Unified Soil Classification System (USCS). The samples were sealed and packaged for transportation to our laboratory. After completion of drilling, the borings were backfilled to the ground surface with soils generated during the exploration and patched with cold-mix asphalt concrete to match existing surface conditions. Excess soil cuttings from the borings were spread in planter areas.

  The upper 5 feet was hand excavated at each of the CPT locations to clear potential buried utility conflict and to collect representative bulk soil samples for laboratory testing. After completion of CPT advancement, the CPTs were backfilled to the ground surface with cement grout and patched with cold-mix asphalt concrete at the surface.

- *Percolation Testing* – Borings LP-1 and LP-2 were converted to temporary percolation test wells upon completion of drilling and sampling. The test wells consisted of 2-inch slotted (0.020") PVC well casing surrounded by #3 Monterey Sand placed in the annulus of the well within the test zone. In-situ percolation testing was performed on July 3, 2024 in general accordance with the *Orange County Technical Guidance Document (TGD) for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Programs (WQMPs)* (OCPW, 2013). The results of the percolation testing are presented in Appendix B, *Percolation Test Data*. Refer to the discussion of infiltration rate presented in Section 2.4.1, *Infiltration*. Upon completion of the percolation testing, the well casing was removed from each boring and the borings were backfilled with soil cuttings and patched at the surface with cold-mix asphalt concrete to match existing site conditions.

- *Laboratory Testing* – Laboratory tests were performed on selected soil samples obtained from the borings during our field investigation. The laboratory testing program was designed to evaluate the physical and engineering characteristics of the onsite soil. Tests performed during this investigation include:

  - In- situ Moisture Content and Dry Density (ASTM D 2216 and ASTM D 2937);
  - Maximum Dry Density (ASTM D 1557);
  - Expansion Index (ASTM D 4829);
  - Consolidation (ASTM D 2435);
  - Direct Shear (ASTM D 3080);
  - R-value; and
  - Corrosivity Suite – pH, Sulfate, Chloride, and Resistivity (California Test Methods 417, 422, and 532/643).

  Results of the in-situ moisture content and dry density testing are presented on the boring logs in Appendix A. Other laboratory test results are presented in Appendix C, *Laboratory Test Results*

- *Engineering Analysis* – The data obtained from our background review and field exploration were evaluated and analyzed to develop recommendations for the proposed development.

- *Report Preparation* – This report presents our findings, conclusions, and recommendations for the proposed development.

## 1.3 Previous Study

In 2002 Ninyo & Moore, Inc. performed a previous geotechnical investigation at the site in support of the planned security wall for the Theo Leo Facility (Ninyo & Moore, 2022). As a part of their investigation, fourteen (14) hollow-stem auger borings (designated B-1 thru B-14) were drilled to approximate depths ranging from 16½ to 31½ feet bgs and geotechnical laboratory testing was performed on selected samples. The approximate locations of the previous borings by Ninyo & Moore are shown on the attached Plate 1, and copies of the previous exploration logs are included in Appendix D, *Exploration Logs (Ninyo & Moore, 2022).* Copies of the previous laboratory test results are included in Appendix E, *Laboratory Test Results (Ninyo & Moore, 2022)*.

# 2.0 Geotechnical Findings

## 2.1 Regional Geologic Setting

The site is located within the Peninsular Ranges geomorphic province of California. The Peninsular Ranges province extends approximately 900 miles southward from the Santa Monica Mountains to the tip of Baja California (Yerkes et al., 1965) and is characterized by elongated, northwest-trending mountain ridges and sediment-floored valleys. The province includes numerous northwest-trending fault zones, most of which either die out, merge with, or are terminated by faults that form the southern margin of the Transverse Ranges province. These northwest-trending fault zones include the San Jacinto, Whittier-Elsinore, Palos Verdes, and Newport-Inglewood fault zones. East of the site are the northwest-trending Santa Ana Mountains, a large range that has been uplifted on its eastern side along the Whittier-Elsinore Fault Zone, producing a tilted, irregular highland that slopes westward toward the sea.

Locally, the subject site is located in the margin between the Tustin Plain and the southern Los Angeles Basin, a large structural depression within the Peninsular Ranges geomorphic province of California. The subject site has been part of a flood plain, receiving finer-grained materials during flood and heavy storm events derived from the adjacent Santa Ana River and its tributaries. The Tustin Plain separates the Santa Ana Mountains to the north and east from the San Joaquin Hills to the south and is comprised of relatively flat-lying unconsolidated to semi-consolidated Quaternary-age clastic sediments that are up to approximately 900 feet thick beneath the site (Singer, 1973; Fuller et al., 1980). The near surface, unconsolidated sediments of Holocene to Late Pleistocene age beneath the site predominantly consist of sediments derived from the Santa Ana River and its tributaries draining from Santa Ana and San Bernardino Mountains.

## 2.2 Surficial Geology

The project site is located immediately to the west of the Santa Ana River channel. Geologic mapping of the project area indicates that near-surface native soils consist of Quaternary-aged (Holocene to late Pleistocene) young alluvial fan deposits derived primarily from the Santa Ana River floodplain. These sediments are generally comprised of unconsolidated to slightly consolidated, undissected to slightly dissected boulder, cobble, gravel, sand, and silt deposits issued from a confined valley or canyon (Bedrossian and Roffers, 2010; Morton and Miller, 2006). The surficial geologic units mapped in the vicinity of the project site are shown on Figure 2, *Regional Geology Map*.

## 2.3 Subsurface Soil Conditions

Based on our subsurface explorations and review of the previous explorations by Ninyo & Moore (2022), the site is underlain by a layer of undocumented artificial fill materials (Afu) overlying Quaternary-age (Holocene to late Pleistocene) young alluvial fan deposits (Qyf). The artificial fill encountered in the borings generally ranges from approximately 2 to 7½ feet bgs across the site. However, deeper fill materials were encountered in our borings and were reported to have been encountered by others (Ninyo & Moore, 2022) at depths ranging from approximately 12 to 20 feet bgs in the southeastern portion of the site. The fill soils consist primarily of locally derived silty sand and sandy silt with minor to abundant amounts of debris. The thicker accumulation of undocumented fill materials in the southeastern portion of the site is consistent with the former topographic depression that existed in the southeastern portion of the site (USGS, 1950) associated with the natural Santa Ana River drainage course that crossed the site in this area prior it being channelized. Localized thicker accumulations of undocumented fill materials may also in the unexplored portions of the site, particularly beneath the existing structures. We are not aware of any available reports documenting the placement and compaction testing of the existing artificial fill at the site; therefore, it is considered unsuitable for support of new structures in its current condition.

Below the artificial fill materials, young alluvial fan deposits (Qyf) were encountered in the borings to the maximum depth explored (51½ feet bgs). The alluvial sediments encountered generally consist of slightly moist to wet, loose to dense, poorly-graded sand and silty sand; and slightly moist to very moist, very soft to very stiff, silty clay, clayey silt, silt, clay and sandy silt.

Detailed descriptions of the subsurface soils encountered in the borings are presented on the logs included in Appendices A and D. The locations of the borings are shown on Plate 1 and the general subsurface conditions across the site are shown on Plate 2, *Geotechnical Cross-Sections A-A' and B-B'*. Some of the engineering properties of these soils are described in the following sections.

### 2.3.1 Expansive Soil Characteristics

Expansive soils contain significant amounts of clay particles that swell considerably when wetted and which shrink when dried. Foundations constructed on these soils are subject to uplifting forces caused by the swelling. Without proper mitigation measures, heaving and cracking of both building foundations and slabs-on-grade could result.

One (1) near-surface soil sample obtained during our subsurface exploration was tested for expansion potential. The test results indicate an Expansion Index (EI) value of 1 ("very low" potential for expansion). The Expansion Index laboratory test results are included in Appendix C of this report.

Expansive soils will likely not impact the proposed construction. Variance in expansion potential of onsite soil is anticipated; therefore, additional testing is recommended upon completion of site grading and excavation to confirm the expansion potential presented in this report. For purposes of this report and based upon visual characterization of alluvial materials at approximate foundation depth, very low expansion potential of site materials may be considered to support design and verified upon completion of earthwork grading.

### 2.3.2 Soil Corrosivity

One (1) near-surface soil sample obtained during our subsurface exploration was tested for corrosivity to assess corrosion potential to buried concrete. The chemical analysis test results for the onsite soil from our geotechnical exploration are included in Appendix C of this report.

The test results indicate a soluble sulfate concentration of 107 parts per million (ppm), chloride content of 180 ppm, pH value of 8.76, and a minimum resistivity value of 5278 ohm-cm.

The results of the resistivity tests indicate the underlying soil is mildly corrosive to buried ferrous metals per ASTM STP 1013. Based on the measured water-soluble sulfate contents from the soil samples, concrete in contact with the soil is expected to have negligible exposure to sulfate attack (Exposure Class S0) per ACI 318 (ACI, 2014). The samples tested for water-soluble chloride content indicate a low potential for corrosion of steel in concrete due to the chloride content of the soil. However, an Exposure Class of C1 may be assumed for concrete in contact with soil exposed to moisture per ACI 318 (ACI, 2014), but not to external sources of chlorides.

### 2.3.3 Soil Compressibility

Three (3) samples of the onsite soils recovered from the borings were subjected to consolidation testing to evaluate the compressibility of these materials under assumed loads representative of anticipated structural bearing stresses. The results of testing indicate these soils exhibit a low to moderate compressibility potential. The results of testing performed as a part of this study are presented in Appendix C.

### 2.3.4 Shear Strength

Evaluation of the shear strength characteristics of the onsite soil and bedrock materials included laboratory direct shear testing of four (4) samples recovered from the borings as a part of this study. The results of testing are included in Appendix C.

### 2.3.5 Excavation Characteristics

Based on our subsurface explorations performed at the site and our experience from grading jobs in the vicinity of the site, we anticipate the onsite artificial fill and alluvial materials can generally be excavated using conventional excavation equipment in good operating condition.

## 2.4 Groundwater Conditions

Groundwater was encountered at the site in our subsurface investigation at depths ranging between approximately 27.8 feet and 35.9 feet bgs. Review of the *Seismic Hazard Zone Report for the Anaheim and Newport Beach Quadrangles* (CGS, 1997) indicates the historically shallowest depth to groundwater beneath the site is between approximately 25 and 30 feet bgs. Based on groundwater monitoring data available through the State Water Resources Control Board's GeoTracker website for the site associated with a former gas station, groundwater levels were measured at approximately 36 to 41 feet bgs between approximately 1992 and 2002 (TRC, 2003). For the purposes of our study, the design groundwater depth used in our analysis is 25 feet bgs.

Based on these findings, groundwater is not expected to pose a constraint during or after construction. Fluctuations of the groundwater level, localized zones of perched water, and an increase in soil moisture, should be anticipated during and following the rainy seasons or periods of locally intense rainfall or storm water runoff.

### 2.4.1 Infiltration

Percolation testing was performed within temporary percolation wells installed in borings LP-1 and LP-2 to evaluate the infiltration characteristics of subsurface soils. The percolation tests were conducted in general accordance with the *Orange County Technical Guidance Document (TGD) for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Programs (WQMPs)* (OCPW, 2013). Results of the percolation testing are presented in Appendix B. The test locations and zones tested are shown on Plate 1.

A boring percolation test is useful for field measurements of the infiltration rate of soils and is suited for testing when the design depth of the infiltration device is deeper than current existing grades, especially in areas where it is difficult to dig test pits, or where the depths of these test pits would be considerably deep. At the subject site, testing consisted of advancing the borings to general depths anticipated for the invert of typical near-surface infiltration devices.

Due to the predominately granular and permeable characteristics of the subsurface soils within the test zone at the percolation test locations, a constant-head test method was employed for testing in both LP-1 and LP-2. The constant-head method records the approximate volume of water delivered to the test zone while maintaining a relatively constant height of water in the well over the testing period. Since the subsurface materials at this location were generally favorable for percolation (sandy soils), a water source was used to deliver water to the well at a relatively constant rate while recording the water height in the well. The measured infiltration rate for the constant-head percolation test was calculated by dividing the total volume of water infiltrated by the total duration of the test and dividing by the percolation surface area.

Detailed results of the field testing data and measured infiltration rate for the test well are presented in Appendix B. The test results are summarized in the table below:

**Table 1 – Measured (Unfactored) Infiltration Rate**

| Test Well Designation | Approximate Depth of Test Zone (feet bgs) | Measured Unfactored Infiltration Rate (inch per hour) |
|---|---|---|
| LP-1 | 5 to 10 | 60.4 |
| LP-2 | 5 to 10 | 76.6 |

The measured (unfactored) infiltration rate for the two (2) tests performed were performed were 60.4 inch per hour (LP-1) and 76.6 inches per hour (LP-2), respectively. In accordance with the TGD (OCPW, 2013), a minimum factor of safety of 2 or more should be applied to the measured infiltration rates for design of the system.

Due to the variability of test results, the lower infiltration rate measured at test well LP-1 should be considered for design purposes. In addition, based on the variability of the results and unknown location and depth of the planned stormwater infiltration device(s), additional testing may be required.

## 2.5 Surface Fault Rupture

Our review of available literature indicates that no known active faults have been mapped across the site, and the site is **not** located within a currently established *Alquist-Priolo Earthquake Fault Zone* (CGS, 2018; Bryant and Hart, 2007). Therefore, a surface fault rupture hazard evaluation is not mandated for this site and the potential for surface fault rupture at the site is expected to be low.

The location of the closest active faults to the site was evaluated using the United States Geological Survey (USGS) Earthquake Hazards Program National Seismic Hazard Maps (USGS, 2008). The closest active faults to the site with the potential for surface fault rupture are the

Newport-Inglewood and Elsinore fault, located approximately 9.3 miles and 10.2 miles from the site, respectively. The San Andreas fault, which is the largest active fault in California, is approximately 41 miles northeast of the site on the north side of the San Gabriel Mountains. Major regional faults with surface expression in proximity to the site are shown on Figure 3, *Regional Fault and Historic Seismicity Map*.

## 2.6 Strong Ground Shaking

The principal seismic hazard to the site is ground shaking resulting from an earthquake occurring along any of several major active and potentially active faults in southern California (Figure 3). The intensity of ground shaking at a given location depends primarily upon the earthquake magnitude, the distance from the source, and the site response characteristics.

Accordingly, design of the project should be performed in accordance with all applicable current codes and standards utilizing the appropriate seismic design parameters to reduce seismic risk as defined by California Geological Survey (CGS) Chapter 2 of Special Publication 117A (CGS, 2008). The 2022 edition of the California Building Code (CBC) is the current edition of the code. Through compliance with these regulatory requirements and the utilization of appropriate seismic design parameters selected by the design professionals, potential effects relating to seismic shaking can be reduced.

The following code-based seismic parameters should be considered for design under the 2022 CBC:

**Table 2 – 2022 CBC Seismic Design Parameters (Mapped Values)**

| Categorization/Coefficient | Value |
|---|---|
| Site Latitude | 33.7802° |
| Site Longitude | -117.8879° |
| Site Class | D |
| Mapped Spectral Response Acceleration at Short Period (0.2 sec), $S_S$ | 1.355 g |
| Mapped Spectral Response Acceleration at Long Period (1 sec), $S_1$ | 0.481 g |
| Short Period (0.2 sec) Site Coefficient, $F_a$ | 1 |
| Long Period (1 sec) Site Coefficient, $F_v$ | 1.819[1] |
| Adjusted Spectral Response Acceleration at Short Period (0.2 sec), $S_{MS}$ | 1.355 g |
| Adjusted Spectral Response Acceleration at Long Period (1 sec), $S_{M1}$ | 0.875[1] g |
| Design Spectral Response Acceleration at Short Period (0.2 sec), $S_{DS}$ | 0.903 g |
| Design Spectral Response Acceleration at Long Period (1 sec), $S_{D1}$ | 0.584[1] g |
| Site-adjusted geometric mean Peak Ground Acceleration, $PGA_M$ | 0.629 g |

[1]See Section 11.4.8 of ASCE 7-16. A site-specific ground motion hazard analysis in accordance with Section 21.2 of ASCE 7-16 is required for this site. Per Supplement 3 to ASCE 7-16, a site-specific ground motion hazard analysis is not required where the value of the parameters $S_{M1}$ and $S_{D1}$ in the table are increased by 50%.

## 2.7 Liquefaction Potential

Liquefaction is a seismic phenomenon in which loose, saturated, fine-grained granular soils behave similarly to a fluid when subjected to high-intensity ground shaking. Liquefaction occurs when three general conditions exist: 1) shallow groundwater; 2) low density, fine, clean sandy soils; and 3) high-intensity ground motion. Studies indicate that saturated, loose and medium dense, near-surface cohesionless soils exhibit the highest liquefaction potential, while dry, dense, cohesionless soils and cohesive soils exhibit low to negligible liquefaction potential.

In general, adverse effects of liquefaction or cyclic softening include excessive ground settlement, loss of bearing support for structural foundations, and seismically-induced lateral ground deformations such as lateral spreading. Depending upon the relative thickness of the liquefied strata with respect to overlying non-liquefiable soils, other potentially adverse effects such as ground oscillation and ground fissuring may occur.

As shown on the *Seismic Hazard Zones* map for the Anaheim and Newport Beach Quadrangles (CGS, 1998), the project site **is** located within an area that has been identified by the State of California as being potentially susceptible to liquefaction (Figure 4, *Seismic Hazard Map*). In addition, the historically shallowest depth to groundwater at the site is between 25 and 30 feet bgs.

As a part of this geotechnical exploration, we have evaluated the liquefaction potential at the site using the data obtained from the CPT soundings with the computer program Cliq (v.3.5.2.22). Based on our evaluation using the using the Maximum Considered Earthquake (MCE) and a design groundwater level of 25 feet bgs for the CPTs performed at the site, the potential for liquefaction to occur at the site is low with little to no expression at the surface. The results of our analysis are presented in Appendix F, *Liquefaction Analysis*.

## 2.8 Seismically-Induced Settlement

Seismically-induced settlement consists of dynamic settlement of unsaturated soil (above groundwater) and liquefaction-induced settlement (below groundwater). These settlements occur primarily within low density sandy soil due to reduction in volume during and shortly after an earthquake event.

As a part of the liquefaction analysis, we estimated the corresponding seismically-induced ground deformations using the computer program Cliq (v.3.5.2.22). Under existing conditions, the total seismically-induced settlement is estimated to be on the order of 1 inch or less. Differential settlement is expected to be on the order of ¼ inch or less over a horizontal distance of 30 feet. The results of our analysis are presented in Appendix F.

## 2.9 Seismically-Induced Lateral Ground Displacements

Liquefaction may also cause lateral spreading. For lateral spreading to occur, the liquefiable zone must be continuous, unconstrained laterally, and free to move along gently sloping ground toward an unconfined area. The Santa Ana River channel is located about 160 feet away from the southeastern property boundary. The channel embankment is approximately 10 feet high. We performed a lateral deformation analysis for all CPTs assuming that they are all located within 160 feet of the channel. Based on the results, seismically-induced lateral displacement is anticipated to be negligible (Appendix F).

## 2.10 Earthquake-Induced Landsliding

As shown on Figure 4, the site is **not** mapped within a seismically-induced landslide hazard zone identified by the State of California (CGS, 1998). In addition, due to project site being relatively flat, it is our opinion that the potential for seismically-induced landslide hazard at the site is negligible.

## 2.11 Flooding

According to a Federal Emergency Management Agency (FEMA) flood insurance rate map (FEMA, 2009), the project site is located within a flood hazard area identified as “Zone X”, which is defined as an area of reduced flood risk due to levee. Accordingly, and as shown on Figure 5, *Flood Hazard Zone Map*, the site **is** located within a 500-year flood hazard zone. Regionally, storm runoff flow is generally directed to the southwest.

Earthquake-induced flooding can be caused by failure of dams or other water-retaining structures as a result of earthquakes. The project site **is** located within a flood impact zone from Prado Dam and Santiago Creek Dam as indicated on Figure 6, *Dam Inundation Map*. However, due to the location and distance of the site from these dams, the potential for earthquake-induced flooding to occur due to a failure of this dam is considered low. Catastrophic failure of this dam is expected to be a very unlikely event in that dam safety regulations exist and are enforced by the DOSD, Army Corps of Engineers and Department of Water Resources. Inspectors may require dam owners to perform work, maintenance or implement controls if issues are found with the safety of the dam.

## 2.12 Seiches and Tsunamis

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Tsunamis are waves generated in large bodies of water by fault displacement or major ground movement. Based on the absence of an enclosed water body near the site and the inland location of the site, seiche and tsunami risks at the site are considered negligible.

## 2.13 Methane

Based on review of State of California Geologic Energy Management Division (CalGEM) records, the project site is **not** located within an oil field boundary (CalGEM, 2024). The nearest documented oil well to the site (Chevron U.S.A. Well No. 1) is located approximately 0.6 mile west of the site and is reported as plugged (CalGEM, 2024). Based on these findings, the potential for methane hazard at the site is considered low.

# 3.0 Geotechnical Design Recommendations

Based upon this study, we conclude that the proposed development for the subject site is feasible from a geotechnical standpoint, provided that the recommendations presented in this report are properly incorporated in design and construction.

Based on our review of available site-specific geotechnical data and our professional experience, the earth materials on the site are suitable for support of the proposed development, provided they are subjected to a phase of remedial rough grading. The purpose of the grading would be to establish conditions suitable for the use of conventional shallow foundations (spread footings).

The proposed structures may be supported on shallow spread-type foundations established over engineered fill. We estimate removals of existing undocumented fill will generally be on the order of approximately 3 to 7½ feet, with areas in the southeastern portion of the site where removals are expected to be up to approximately 20 feet below existing grades or more. The floor slab may be supported directly on grade. Unexplored portions of the site and areas disturbed during demolition of existing buildings and improvements may require deeper removals. Removals should be performed such that all undocumented fill and unsuitable materials are removed to expose suitable native alluvial soils and replaced as engineered fill. There may be existing underground utilities that will also be impacted. Information on these utilities should be provided to Verdantas for evaluation. All existing undocumented fill is recommended to be removed from the proposed building/structure footprint areas prior to placement of engineered fill.

Alternatively, due to the depth of undocumented fill soils beneath the planned building footprints and site boundary constraints, implementation of ground improvement in lieu of remedial rough grading in these areas of deep existing undocumented fill soils may be considered within the planned building footprint areas if reviewed and accepted by the local reviewing agency. Feasible alternatives for ground improvement at this site that may be considered are Geopiers® or rammed aggregate piers, drilled displacement columns, and stone columns. Ground improvement should densify the subsurface below the proposed building footprint(s) down to a depth of 15 feet. In addition, perimeter site walls may be supported on deep foundations with a grade beam in areas where complete removals are not feasible.

The recommendations below are based upon the exhibited geotechnical engineering properties of the soils and their anticipated response both during and after construction. The recommendations are also based upon proper field observation and testing during construction. The project geotechnical engineer should be notified of suspected variances in field conditions to determine the effect upon the recommendations subsequently presented. These recommendations are considered minimal and may be superseded by more restrictive requirements of the civil and structural engineers, the City of Orange, the County of Orange, and other governing agencies.

Verdantas should review the grading and foundation plans and project specifications as they become available to verify that the recommendations presented in this report have been incorporated into the plans for this project.

## 3.1 Site Grading

Earthwork for the project is expected to consist of removal of unsuitable soil materials, overexcavation, and placement of compacted fill. We recommend all earthwork on the site be performed in accordance with the recommendations presented in this report and the project specifications as prepared by others. The *Earthwork and Grading Guide Specifications* included in Appendix G may be used for guidance in developing the project specifications. If conflict arises, the recommendations in Appendix E shall be superseded by the project specifications, recommendations contained in this report and/or the County of Orange Grading Guidelines, whichever is more stringent. All site grading should be performed in accordance with the applicable local codes and in accordance with the project specifications that are prepared by the appropriate design professional.

### 3.1.1 Site Preparation

Prior to construction, the site should be cleared of any vegetation, trash, and/or debris within the area of proposed grading. These materials should be removed from the site. Any underground obstructions onsite should be removed. Efforts should be made to locate any existing utility lines to be removed or rerouted where interfering with the proposed construction. Any resulting cavities should be properly backfilled and compacted. After the site is cleared, the soils should be carefully observed for the removal of all unsuitable deposits. All undocumented fill or man-made debris, unsuitable native soils and former foundation remnants should be excavated and removed from the proposed building/structure footprint areas prior to placement of engineered fill.

### 3.1.2 Removals and Overexcavations

To provide uniform foundation support and reduce the potential for excessive static settlement, all existing undocumented fill and any unsuitable soil, as deemed by the geotechnical engineer, should be removed to expose suitable native alluvial soils and replaced as engineered fill below the proposed buildings and other structural improvements. Based on our field explorations and the previous explorations performed at the site by others (Ninyo & Moore, 2022), we estimate removals of existing undocumented fill at the site will generally be on the order of approximately 3 to 7½ feet. However, fill materials were encountered in our borings or reported to have been encountered (Ninyo & Moore, 2022) at depths ranging from approximately 12 to 20 feet bgs in the southeastern portion of the site. Localized areas may also require deeper removals as determined during grading by a representative of the geotechnical engineer depending on observed subsurface conditions. Unexplored portions of the site including areas beneath existing buildings and in areas of existing utilities, and areas disturbed during demolition of existing buildings and improvements may also require deeper removals.

In addition, we recommend overexcavations be performed to allow placement of least 3 feet of engineered fill below the proposed building foundation elements. The lateral extent of removals and overexcavations beyond foundations should be equal to the depth of excavation below the proposed foundation elements.

The depth of overexcavation in non-structural areas planned for new pavement construction is recommended to be 2 feet below the current grade or planned subgrade elevation to develop a suitable bearing subgrade for pavement support. Deeper overexcavations in localized areas may be recommended during grading by a representative of the geotechnical engineer depending on observed subsurface conditions. Preparation limited to 2 feet of overexcavation below subgrade may result in the need for increased pavement maintenance and periodic repairs where existing undocumented fill is left in place below the recommended overexcavation depth of 2 feet. Alternatively, removals can be performed such that all undocumented fill is removed to expose suitable natural soils (alluvium) and replaced as engineered fill.

### 3.1.3 Excavation Bottom Preparation

All excavation or removal bottoms should be observed by a representative of the geotechnical engineer prior to placement of fill or other improvements to determine that geotechnically suitable soil is exposed. Excavation bottoms observed to be suitable for fill placement or other improvements should be scarified to a depth of at least 8 inches, moisture-conditioned as necessary to achieve a moisture content within 2 percentage points of the optimum moisture content, and then compacted to a minimum of 90 percent of the laboratory derived maximum density as determined by ASTM Test Method D 1557 (Modified Proctor).

### 3.1.4 Fill Materials

On-site soil that is free of construction debris, organics, cobbles, boulders, rubble, or rock larger than 4 inches in largest dimension is suitable to be used as fill for support of structures. If required, any imported fill soil should be approved by the geotechnical engineer prior to import or use onsite.

### 3.1.5 Fill Placement and Compaction

Fill soils should be placed in thin lifts, moisture-conditioned to within 2 percent of optimum moisture content and compacted using appropriate equipment and methods to achieve a minimum of 90 percent of the maximum dry density as determined by ASTM Test Method D 1557. Aggregate base should be compacted to a minimum of 95 percent relative compaction.

### 3.1.6 Shrinkage

The change in volume of excavated and recompacted soil varies according to soil type and location. This volume change is represented as a percentage increase (bulking) or decrease (shrinkage) in volume of fill after removal and recompaction. Field and laboratory data used in our calculations included laboratory-measured maximum dry density for the general soil type encountered at the subject site, the measured in-place densities of near surface soils encountered and our experience.

Based upon the results of the in-place density and the moisture-density relationship exhibited by representative bulk samples of the near surface soils, recompaction of the soils is anticipated to result in volume shrinkage in the range of 10 to 15 percent. The estimated shrinkage does not include material losses due to removal of organic material or other unsuitable bearing materials (debris, rubble, oversize material greater than 6-inches) and the actual shrinkage that occurs during grading may vary throughout the site.

### 3.1.7 Reuse of Concrete and Asphalt Rubble

If encountered during site clearing and/or during preparation activities, construction rubble (i.e., Portland cement concrete and asphalt concrete) may be incorporated in the proposed development. For use as structural fill, the processed material should be crushed to develop a relatively well-graded mixture with a maximum particle size of 3-inch nominal diameter. Concrete rubble should be free of rebar and processed asphalt pavement rubble may be used if mixed with the existing base course (where present). Processed material may be used as structural fill if uniformly mixed with onsite soils in proportion of 1 part processed material to 3 parts soil. For use as pavement base course, crushed material should satisfy gradation requirements of Section 200-2.4 of the *Standard Specifications for Public Works Construction* (Greenbook), current edition. Such materials must be free of and segregated from any hazardous materials and/or organic material of any kind.

## 3.2 Ground Improvement

Due to the depth of undocumented fill soils beneath the planned building footprints and site boundary constraints, implementation of ground improvement in lieu of remedial rough grading in these areas of deep existing undocumented fill soils may be considered within the planned building footprint areas if reviewed and accepted by the local reviewing agency. Feasible alternatives for ground improvement at this site that may be considered are Geopiers® or rammed aggregate piers, drilled displacement columns, and stone columns. Ground improvement should densify the subsurface below the proposed building footprint(s) down to a depth of 15 feet..

## 3.3 Foundation Design

Conventional spread footings established on engineered fill soils may be used to support the proposed building and other structural elements. Footings should be embedded a minimum of 12 inches below the lowest adjacent grade. An allowable soil bearing pressure of 3,000 pounds per square foot (psf) may be used for footings with a minimum width of 12 inches for continuous footings and 18 inches for isolated footings. Footings should have a minimum embedment of 12 inches below the lowest adjacent grade. Higher bearing capacities may be feasible depending on the design of the ground improvement system, if applicable.

The ultimate bearing capacity can be taken as 9,000 psf, which does not incorporate a factor of safety. A resistance factor of 0.45 should be used for initial bearing capacity evaluation with factored loads.

A one-third increase in the bearing value for short duration loading, such as wind or seismic forces may be used. The recommended bearing values are net values, and the weight of concrete in the footings can be taken as 50 pounds per cubic foot (pcf); the weight of soil backfill can be neglected when determining the downward loads.

The allowable bearing capacity for shallow footings is based on a total static settlement of ¾ inch. Differential settlement can be taken as half the total settlement over a horizontal distance of 40 feet.

For static loading, 50 pounds per cubic inch (pci) may be assumed as the modulus of subgrade reaction (*k*). For seismic loading, a *k* value of 150 pci may be assumed.

Since settlement is a function of footing size and contact bearing pressure, differential settlement can be expected between adjacent columns or walls where a large differential loading condition exists. Once developed by the structural engineer, we should review total dead and sustained live loads for each column including plan location and span distance, to evaluate if differential settlements between dissimilarly loaded columns will be tolerable. Excessive differential settlement can be mitigated with the use of reduced bearing pressures, deeper footing embedment, possibly changing overexcavation schemes and using imported base material under spread footings, or possibly other methods.

Resistance to lateral loads will be provided by a combination of friction between the soil and structure interface and passive pressure acting against the vertical portion of the footings. For calculating lateral resistance, a passive pressure of 300 psf per foot of depth to a maximum of 3,000 psf and a frictional coefficient of 0.3 may be used. Note that the passive and frictional coefficients do not include a factor of safety. The frictional resistance and the passive resistance of the soils can be combined without reduction in determining the total lateral resistance.

## 3.4 Flagpole Footings

Flagpole type footings (short caissons) established either in undisturbed natural soils or engineered fill may be used to support ancillary structures such as perimeter walls, flagpoles, light poles, and canopies.

Short caissons should extend through any existing undocumented fill and derive support from the underlying undisturbed natural soils. Caisson segments through undocumented fill should be isolated from contacting those materials by using Sonotubes or equivalents.

Flagpole type footings established directly on undisturbed natural soils or on engineered fill underlain by natural soils may be designed to impose an allowable bearing pressure due to dead-plus-live (static) loads of 3,000 psf.

A one-third increase can be used for wind or seismic loads. The recommended bearing value is net value, and the weight of concrete in the footings can be taken as 50 pcf.

The estimated total settlement of the structures supported on spread footings not established over refuse is on the order of ½ inch or less. Differential settlement is anticipated to be on the order of ¼ inch over 30 feet. Most of the settlement is anticipated to occur within a few months of the application of dead loads.

Lateral loads can be resisted by the passive resistance of the soils. The passive resistance of natural soils or engineered fill against flagpole type footings, with on-center spacing of at least 3 diameters, may be assumed to be equal to the pressure developed by a fluid with a density of 600 pcf. The passive resistance of undocumented fill against flagpole type footings, with on-center spacing of at least 3 diameters, may be assumed to be equal to the pressure developed by a fluid with a density of 300 pcf.

A one-third increase in the passive value can be used for wind or seismic loads. The frictional resistance and the passive resistance of the soils can be combined without reduction in determining the total lateral resistance.

A friction coefficient of 0.3 may be used at the soil-concrete interface for calculating uplift resistance. The coefficient of horizontal earth pressure (ratio of horizontal vs vertical earth pressure) may be assumed to be 0.5.

## 3.5 Slabs-on-Grade

Unloaded concrete slabs may be designed using a modulus of subgrade reaction of 100 pci provided the subgrade is prepared as described in Section 3.1. From a geotechnical standpoint, we recommend slab-on-grade be a minimum 5 inches thick with No. 3 rebar placed at the center of the slab at 24 inches on center in each direction. The structural engineer should design the actual thickness and reinforcement based on anticipated loading conditions. Where moisture-sensitive floor coverings or equipment is planned, the slabs should be protected by a minimum 10-mil-thick vapor barrier between the slab and subgrade. A coefficient of friction of 0.35 can be used between the floor slab and the vapor barrier.

Minor cracking of concrete after curing due to drying and shrinkage is normal and should be expected; however, concrete is often aggravated by a high water/cement ratio, high concrete temperature at the time of placement, small nominal aggregate size, and rapid moisture loss due to hot, dry, and/or windy weather conditions during placement and curing. Cracking due to temperature and moisture fluctuations can also be expected. The use of low-slump concrete or low water/cement ratios can reduce the potential for shrinkage cracking. Additionally, our experience indicates that the use of reinforcement in slabs and foundations can generally reduce the potential but not eliminate for concrete cracking.

To reduce the potential for excessive cracking, concrete slabs-on-grade should be provided with construction or weakened plane joints at frequent intervals. Joints should be laid out to form approximately square panels.

## 3.6 Cement Type and Corrosion Protection

Based on the results of laboratory testing, concrete structures in contact with the onsite soil are expected to have negligible exposure to water-soluble sulfates in the soil (Exposure Class S0). Based on ACI 318, concrete exposed to moisture but not to external sources of chlorides is classified as having <u>low exposure</u> (Exposure Class C1). Common Type II cement may be used for concrete construction onsite and the concrete should be designed in accordance with CBC 2022 requirements. However, concrete exposed to recycled water should be designed using Type V cement.

Based on our laboratory testing, the onsite soil is considered mildly corrosive to ferrous metals. Ferrous pipe should be avoided by using high-density polyethylene (HDPE) or other non-ferrous pipe when possible. Ferrous pipe, if used, should be protected by polyethylene bags, tap or coatings, di-electric fittings or other means to separate the pipe from onsite soils.

## 3.7 Retaining Walls

Recommended lateral earth pressures are provided as equivalent fluid unit weights, in psf/ft. or pcf. These values do not contain an appreciable factor of safety, so the structural engineer should apply the applicable factors of safety and/or load factors during design.

Onsite soils may be suitable to be used as retaining wall backfill due to its very low expansion potential. However, field and laboratory verification are recommended before use. Site soils can be variable in composition, clast size and expansive characteristics. Should onsite soil be considered for reuse behind retaining walls, it should be tested to ensure the expansion potential is less than 20 (EI<20). Recommended lateral earth pressures for retaining walls backfilled with sandy soils with drained conditions as shown on Figure 7, *Retaining Wall Backfill and Subdrain Detail* are as follows:

**Table 3 – Retaining Wall Design Earth Pressures**

| Retaining Wall Condition (Level Backfill) | Equivalent Fluid Pressure (pounds-per-cubic-foot)* |
|---|---|
| Active (cantilever) | 40 |
| At-Rest (braced) | 60 |
| Passive Resistance (compacted fill) | 300 |
| Seismic Increment | 25 |

*Only for level and drained properly compacted backfill

Walls that are free to rotate or deflect may be designed using active earth pressure. For basement walls or walls that are fixed against rotation, the at-rest pressure should be used. For the seismic condition, the pressure should be distributed as an inverted triangular distribution and the dynamic thrust should be applied at a height of 0.6H above the base of the wall.

### 3.7.1 Sliding and Overturning

Total depth of retained earth for design of walls and for uplift resistance, should be measured as the vertical height of the stem below the ground surface at the wall face for stem design, or measured at the heel of the footing for overturning and sliding. A soil unit weight of 120 pcf may be assumed for calculating the actual weight of the soil over the wall footing, if drained, or 60 pcf if submerged, for properly compacted backfill.

### 3.7.2 Drainage

Adequate drainage may be provided by a subdrain system positioned behind the walls (Figure 7). Typically, this system consists of a 4-inch minimum diameter perforated pipe placed near the base of the wall (perforations placed downward). The pipe should be bedded and backfilled with pervious backfill material described in Section 300-3.6 of the *Standard Specifications for Public Works Construction* (Greenbook), current edition. This pervious backfill should extend at least 2 feet out from the wall and to within 2 feet of the outside finished grade. This pervious backfill and pipe should be wrapped in filter fabric, such as Mirafi 140N or equivalent, placed as described in Section 300-8.1 of the *Standard Specifications for Public Works Construction* (Greenbook), current edition. The subdrain outlet should be connected to a free-draining outlet or sump.

Miradrain, Geotech Drainage Panels, or Enkadrain drainage geocomposites, or similar, may be used for wall drainage as an alternative to the Class 2 Permeable Material or drain rock backfill, particularly where horizontal space is limited adjacent to shoring (where walls are cast against shoring). These drainage panels should be connected to the perforated drainpipe at the base of the wall.

## 3.8 Paving

To provide support for paving, the subgrade soils should be prepared as recommended in the Section 3.1. Compaction of the subgrade, including trench backfills, to at least 90 percent of the maximum dry density as determined by ASTM Test Method D 1557, and achieving a firm, hard, and unyielding surface will be important for paving support. The preparation of the paving area subgrade should be performed immediately prior to placement of the base course.

Proper drainage of the paved areas should be provided since this will reduce moisture infiltration into the subgrade and increase the life of the paving.

### 3.8.1 Asphalt Concrete

The required paving and base thicknesses will depend on the expected wheel loads and volume of traffic (Traffic Index or TI). Assuming that the paving subgrade will consist of engineered fill with an R-value greater than 40, compacted to at least 90 percent as recommended, the minimum recommended paving thicknesses are presented in the following table. Results of R-value testing on near surface samples of existing onsite soils indicate a value of 72.

**Table 4 – Asphalt Concrete Pavement Sections**

| Area | Traffic Index | Asphalt Concrete (inches) | Base Course (inches) |
|---|---|---|---|
| Parking Areas | 4 | 3 | 4 |
| Light Truck | 5 | 3 | 4 |
| Heavy Truck | 6 | 3 | 6½ |
| Main Drives | 7 | 4 | 7 |

The asphalt paving sections were determined using the Caltrans design method. We can determine the recommended paving and base course thicknesses for other Traffic Indices if required. Careful inspection is recommended to verify that the recommended thicknesses or greater are achieved, and that proper construction procedures are followed.

### 3.8.2 Portland Cement Concrete Paving

We have assumed that such a subgrade will have an R-value of at least 40, which will need to be verified after the completion of site grading. Portland cement concrete (PCC) paving sections were determined in accordance with procedures developed by the Portland Cement Association. Concrete paving sections for a range of Traffic Indices are presented in the following table. We have assumed that the Portland cement concrete will have a compressive strength of at least 4,000 pounds per square inch.

**Table 5 – PCC Pavement Sections**

| Area | Traffic Index | Portland Cement Concrete (inches) | Base Course (inches) |
|---|---|---|---|
| Parking Areas | 4 | 5 | 4 |
| Light Truck | 5 | 5½ | 4 |
| Heavy Truck | 6 | 6 | 4 |
| Main Drives | 7 | 6½ | 4 |

The paving should be provided with control joints or expansion joints at regular intervals no more than 15 feet in each direction. Load transfer devices, such as dowels or keys, are recommended at joints in the paving to reduce possible offsets. The paving sections in the above table have been developed based on the strength of unreinforced concrete. Steel reinforcing may be added to the paving to reduce cracking and to prolong the life of the paving.

### 3.8.3 Base Course

The base course for both asphalt concrete and Portland cement concrete paving should meet the specifications for Class 2 Aggregate Base as defined in Section 26 of the latest edition of the State of California, Department of Transportation, Standard Specifications. Alternatively, the base course could meet the specifications for untreated base as defined in Section 200-2 of the latest edition of the *Standard Specifications for Public Works Construction* (Greenbook), current edition. The base course should be compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM Test Method D 1557.

## 3.9 Infiltration BMP Design Considerations

It should be noted that the measured infiltration rates presented herein may degrade over time due to complete saturation of underlying soils, and fines build-up and plugging if pretreatment of the storm water is not performed. As such, a reduction of the measured infiltration rates using a factor of safety of at least 2 or more should be considered to establish a conservative infiltration rate for the service life of the system. This factor should not be less than 2, but may be higher at the discretion of the design engineer.

In general, a vast majority of geotechnical distress issues are related to improper drainage. Distress in the form of foundation movement could occur. Direct infiltration to the subsurface is not recommended adjacent to curb and gutter, public pavements or within 10 feet away from the design saturation zone as soil saturation could lead to a loss of soil support, settlement or collapse, and internal erosion (piping). The design saturation zone may be assumed as a 1:1 plane projected downward from the top of an infiltration device's discharge zone. Additionally, infiltration water will migrate along pipe backfill (typically sand or gravel bedding) affecting improvements far from the point of infiltration. Proposed direct open bottom infiltration systems, should be located as far away from existing or proposed foundations, rigid improvements and utilities as is practical in order to reduce the geotechnical distress issues related to water. Where sufficient distance from improvements cannot be achieved, additional recommendations may be warranted and can be provided during plan review.

Prior to construction of any infiltration device intended for the site, the plans should be reviewed by the geotechnical consultant to verify that our geotechnical recommendations have been appropriately incorporated into the plans and not compromised by the addition of an infiltration system to the site. The designer of any infiltration system should contact the geotechnical consultant for geotechnical input during the design process as they feel necessary.

## 3.10 Temporary Excavations

All temporary excavations, including utility trenches, retaining wall excavations, and foundation excavations should be performed in accordance with project plans, specifications, and all OSHA requirements. Excavations 4 feet or deeper should be laid back or shored in accordance with OSHA requirements before personnel are allowed to enter.

No surcharge loads should be permitted within a horizontal distance equal to the height of cut or 5 feet, whichever is greater from the top of the cut, unless the cut is shored appropriately. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any adjacent existing site foundation should be properly shored to maintain support of the adjacent structure.

Temporary excavations should be treated in accordance with the State of California version of OSHA excavation regulations, Construction Safety Orders for Excavation General Requirements, Article 6, Section 1541, effective October 1, 1995. The sides of excavations should be shored or sloped in accordance with OSHA regulations. OSHA allows the sides of unbraced excavations, up to a maximum height of 20 feet, to be cut to a ¾H:1V (horizontal:vertical) slope for Type A soils, 1H:1V for Type B soils, and 1½H:1V for Type C soils. Near-surface onsite soils are to be considered Type C soils.

During construction, the soil conditions should be regularly evaluated to verify that conditions are as anticipated. The contractor shall be responsible for providing the “competent person” required by OSHA standards to evaluate soil conditions. Close coordination between the competent person and the geotechnical engineer should be maintained to facilitate construction while providing safe excavations.

## 3.11 Trench Backfill

Utility trenches should be backfilled with compacted fill in accordance with Sections 306-1 and 306-6 of the *Standard Specifications for Public Works Construction* (Greenbook), current edition. Utility trenches can be backfilled with onsite sandy material free of rubble, debris, organic and oversized material up to (≤) 3-inches in largest dimension. Prior to backfilling trenches, pipes should be bedded in and covered with either:

(1) **Sand:** A uniform, sand material that has a Sand Equivalent (SE) greater-than-or-equal-to (≥) 30, passing the No. 4 U.S. Standard Sieve (or as specified by the pipe manufacturer), water densified in place, or

(2) **CLSM:** Controlled Low Strength Material (CLSM) conforming to Section 201-6 of the *Standard Specifications for Public Works Construction,* (Greenbook), current edition. CLSM should not be jetted.

Pipe bedding should extend at least 4 inches below the pipeline invert and at least 12 inches over the top of the pipeline. Native and clean fill soils can be used as backfill over the pipe bedding zone, and should be placed in thin lifts, moisture conditioned above optimum, and mechanically compacted to at least 90 percent relative compaction, relative to the ASTM D 1557 laboratory maximum density.

## 3.12 Drainage and Landscaping

Building walls below grade should be waterproofed or at least damp proofed, depending upon the degree of moisture protection desired. Surface drainage should be designed to direct water away from foundations and toward approved drainage devices. Irrigation of landscaping should be controlled to maintain, as much as possible, consistent moisture content sufficient to provide healthy plant growth without overwatering.

## 3.13 Additional Geotechnical Services

Verdantas should review the grading plans, foundation plans, and specifications when they are available to verify that the recommendations presented in this report have been properly interpreted and incorporated.

Geotechnical observation and testing should be provided during the following activities:

- Grading and excavation of the site;
- Installation of ground improvement;
- Subgrade preparation;
- Compaction of all fill materials;
- Utility trench backfilling and compaction;
- Footing excavation and slab-on-grade preparation;
- Pavement subgrade and base preparation;
- Placement of asphalt concrete and/or concrete; and
- When any unusual conditions are encountered.

# 4.0 Limitations

This geotechnical exploration does not address the potential for encountering hazardous soil at this site. In addition, this report was necessarily based in part upon data obtained from a limited number of observances, site visits, soil samples, tests, analyses, histories of occurrences, spaced subsurface explorations and limited information on historical events and observations. Such information is, by necessity, incomplete. Please also refer GBA's *Important Information About Your Geotechnical Report* (included at the rear of the text), presenting additional information and limitations regarding geotechnical engineering studies and reports. The nature of many sites is such that differing soil or geologic conditions can be present within small distances and under varying climatic conditions. Changes in subsurface conditions can and do occur over time. Therefore, the findings, conclusions, and recommendations presented in this report are only valid if Verdantas, Inc. has the opportunity to observe subsurface conditions during grading and construction, to confirm that our data are representative for the site. Verdantas, Inc. should also review the construction plans and project specifications, when available, to comment on the geotechnical aspects.

This report was prepared using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing at this time in Orange County. We do not make any warranty, either expressed or implied.

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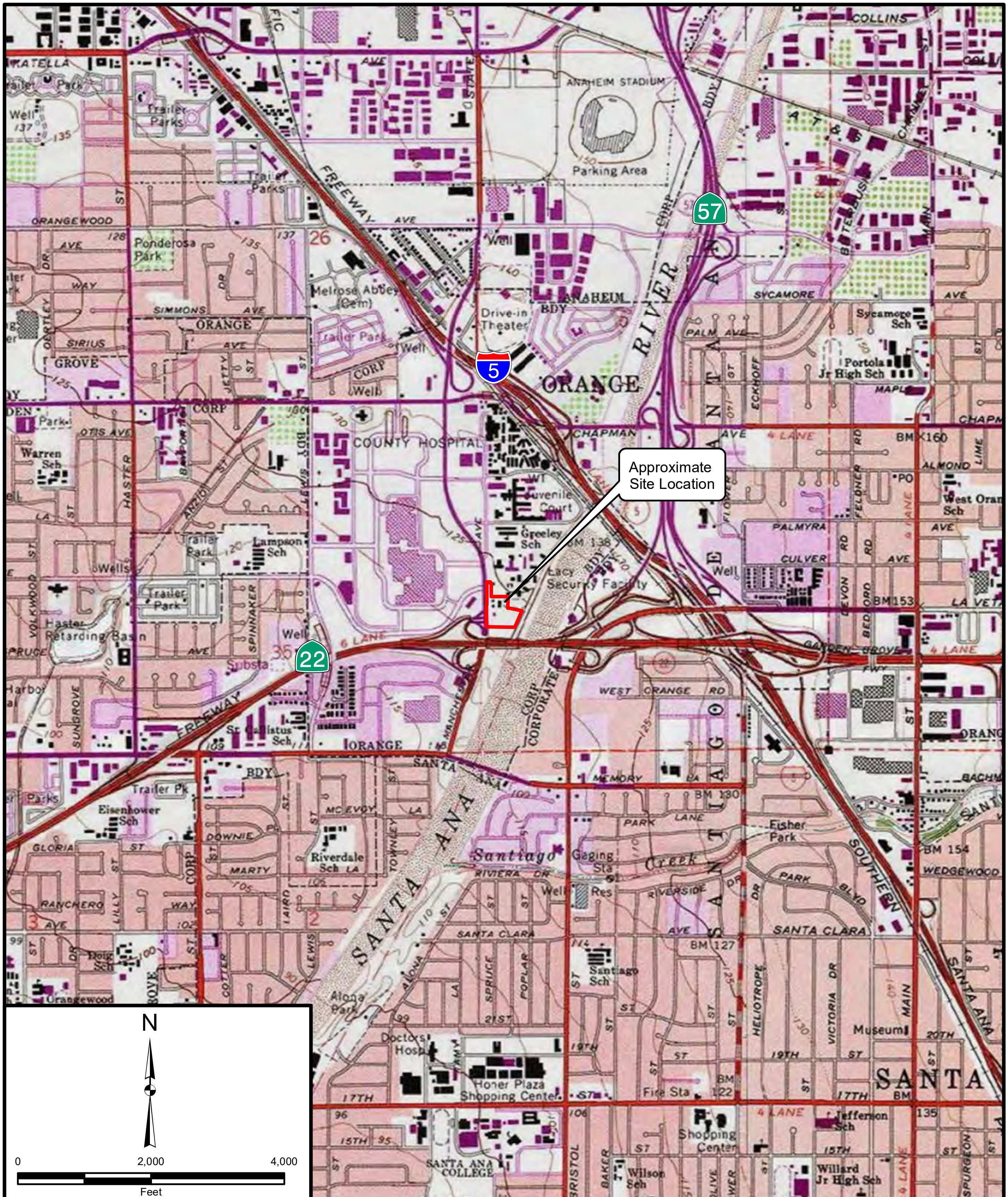
# Figures and Plates

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| Scale: 1 " = 2,000 ' | Date: August 2024 |

Reference: Copyright:© 2013 National Geographic Society, i-cubed

# SITE LOCATION MAP

Proposed Workforce Reentry Project
591 The City Drive South
City of Orange, California

**FIGURE 1**

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| Project: 20833 | Eng/Geol: CCK/JMP |
| Scale: 1 " = 2,000 ' | Date: August 2024 |

Reference: Geologic Map of the Santa Ana and San Bernardino Quads (30'x60') by Morton & Miller, 2006.

# REGIONAL GEOLOGY MAP

Proposed Workforce Reentry Project
591 The City Drive South
City of Orange, California

FIGURE 2

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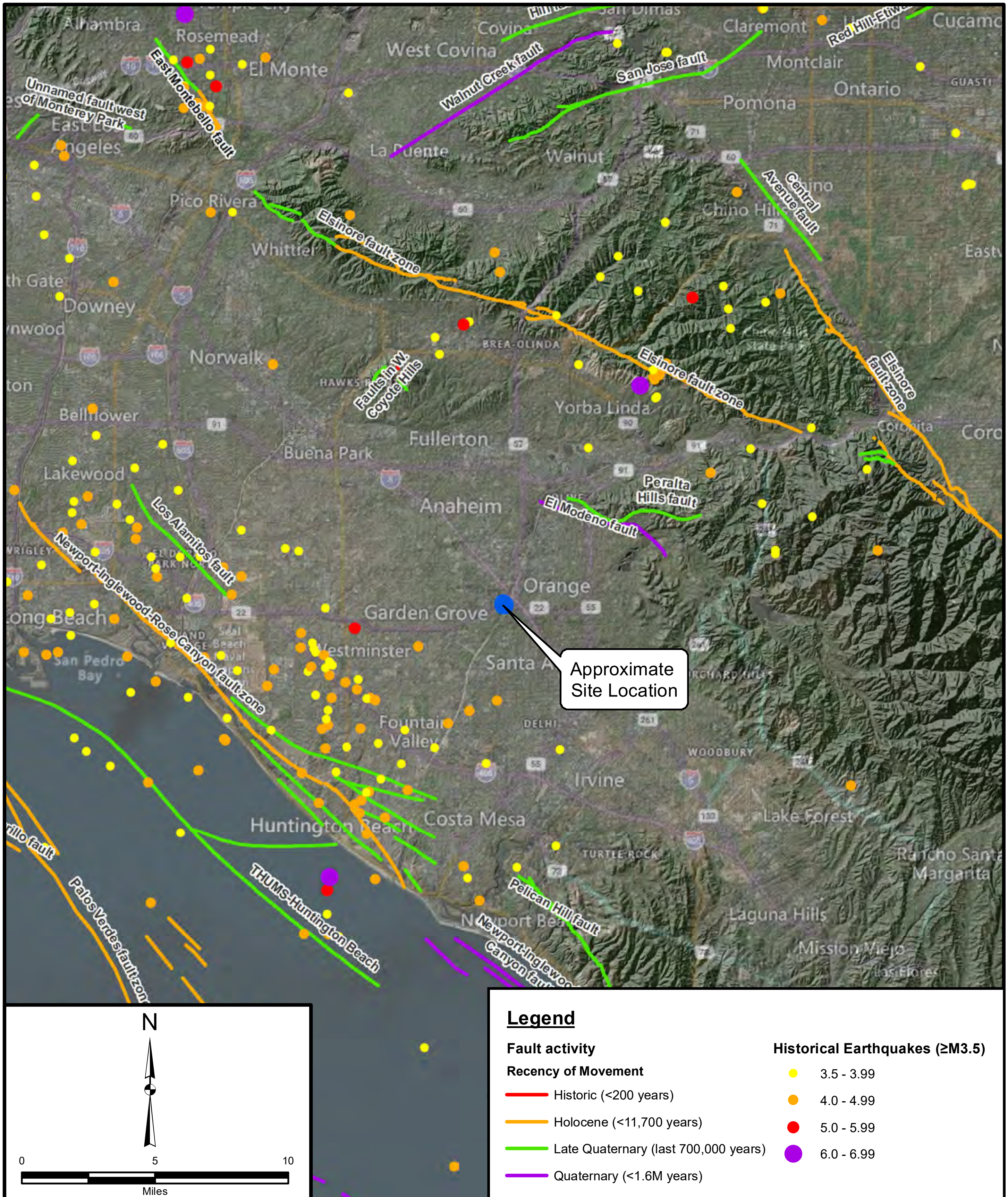


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| Project: 20833 | Eng/Geol: CCK/JMP |
| Scale: 1 " = 5 miles | Date: August 2024 |

Basemap Reference: © 2024 Microsoft Corporation
Earthstar Geographics SIO © 2024 TomTom
Seismicity Data Reference: maps.conservation.ca.gov

# REGIONAL FAULT AND HISTORIC SEISMICITIY MAP

Proposed Workforce Reentry Project
591 The City Drive South
City of Orange, California

FIGURE 3

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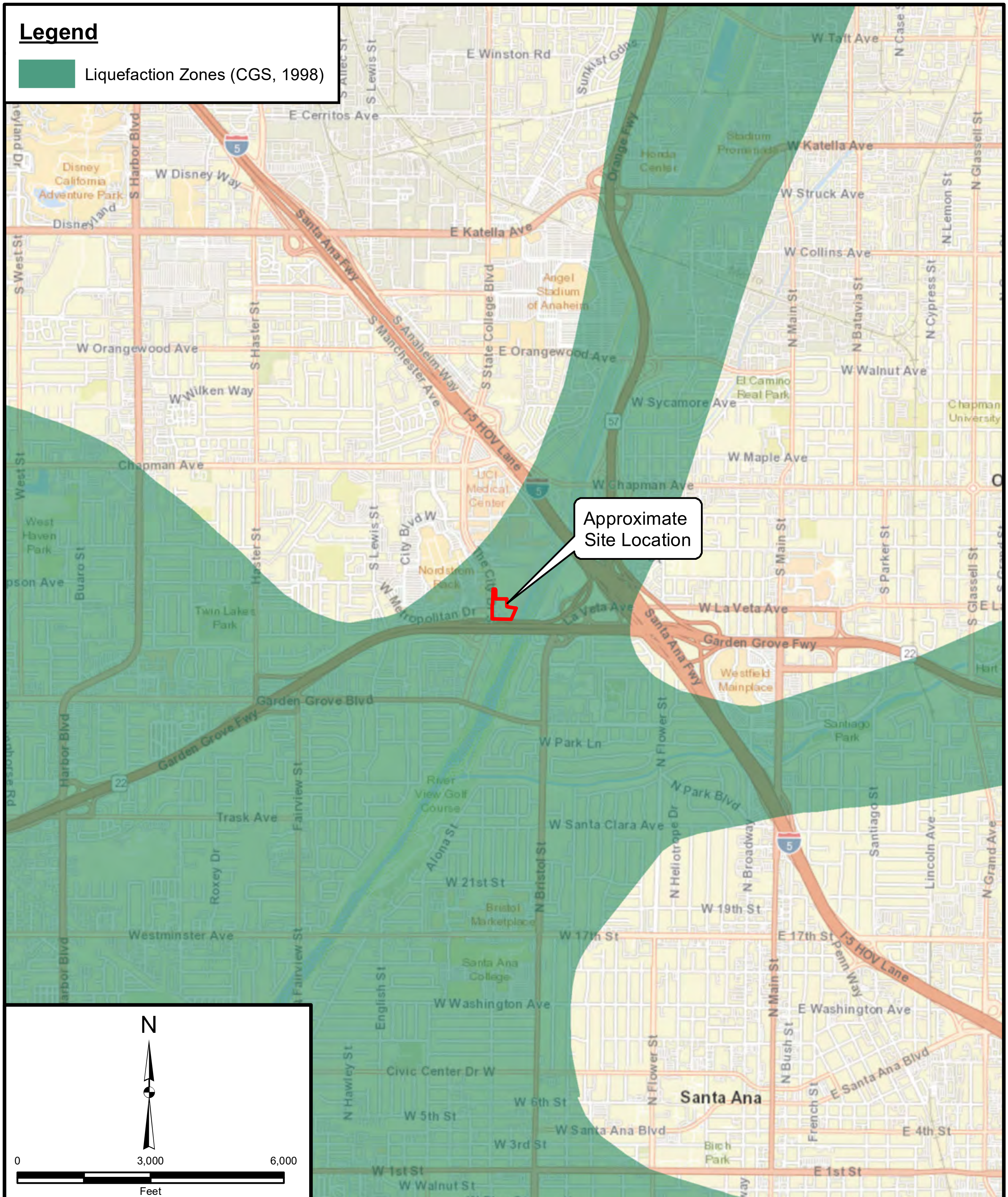


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Seismic Hazards Program, California Geological Survey, California Department of Conservation

# SEISMIC HAZARD MAP

Proposed Workforce Reentry Project
591 The City Drive South
City of Orange, California

**FIGURE 4**

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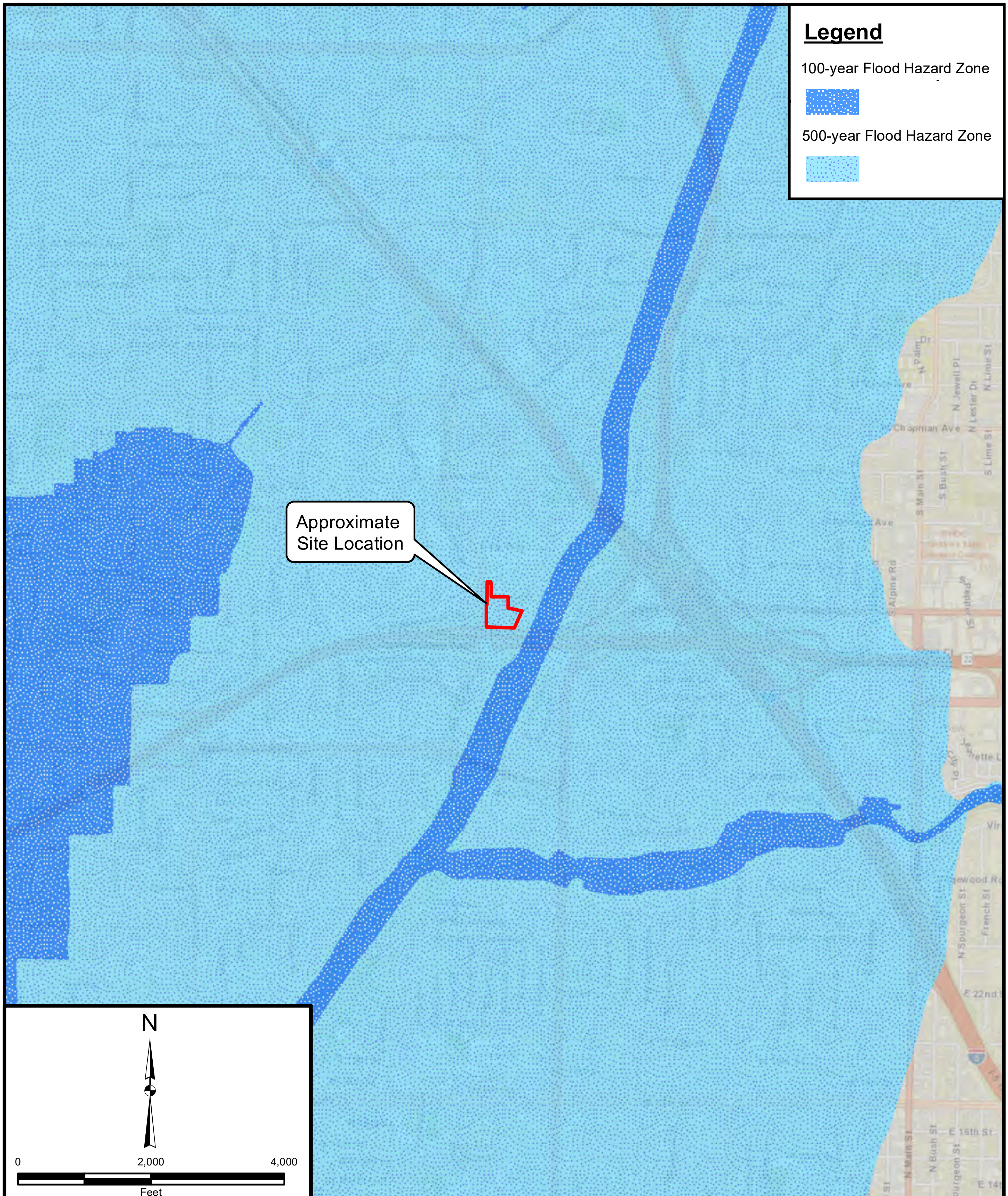


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Reference: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
FEMA (http://www.fema.gov/index.shtm), DWR (http://www.dwr.ca.gov)

# FLOOD HAZARD ZONE MAP

Proposed Workforce Reentry Project
591 The City Drive South
City of Orange, California

**FIGURE 5**

verdantas

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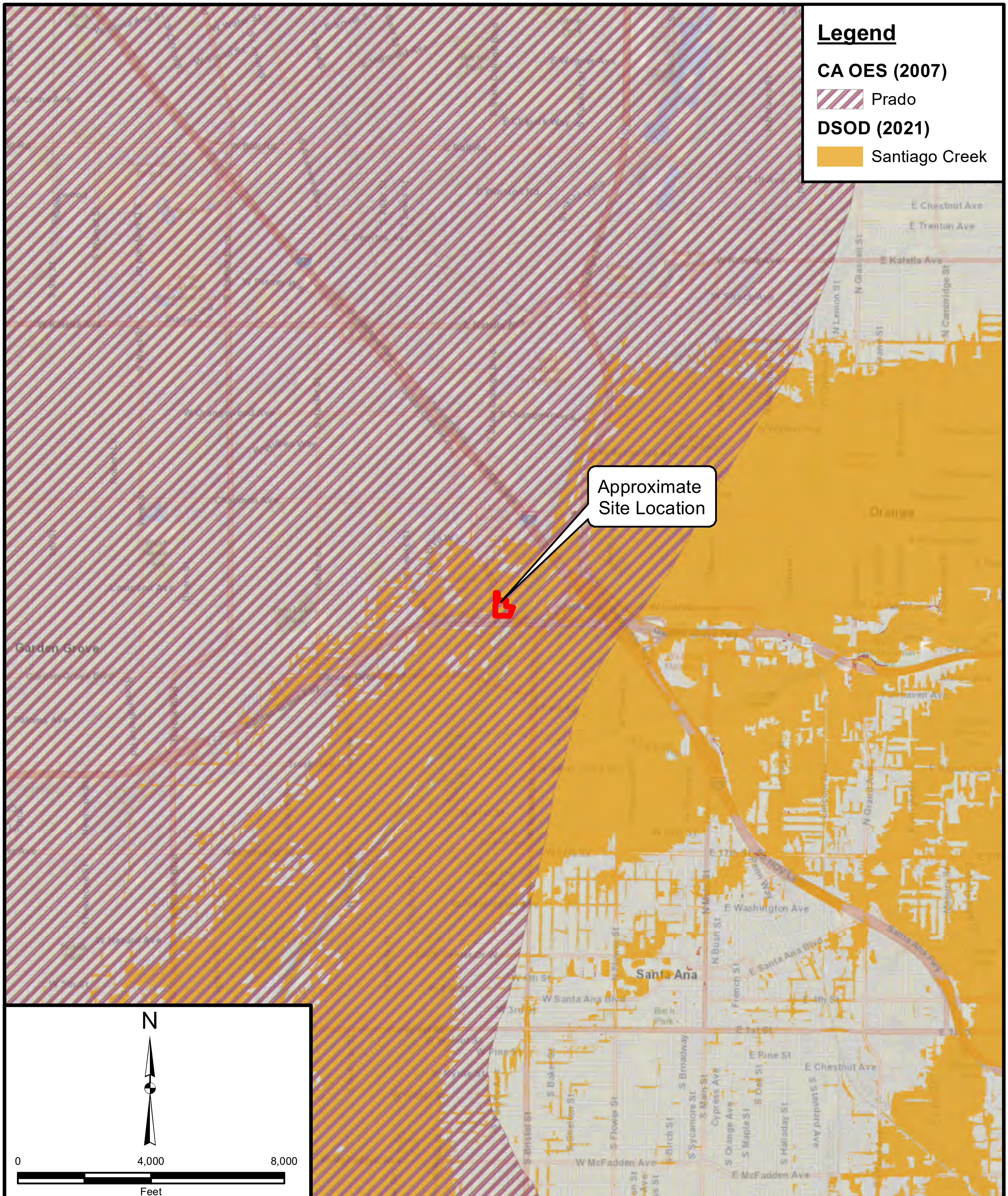


| Project: 20833 | Eng/Geol: CCK/JMP |
| --- | --- |
| Scale: 1 " = 4,000 ' | Date: August 2024 |

Basemap Reference: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China
Reference: Office of Emergency Services (2007),
Dept of Safety of Dams (2021)
National Inventory of Dams, Army Corps of Engrs (2021)

# DAM INUNDATION MAP

Proposed Workforce Reentry Project
591 The City Drive South
City of Orange, California

FIGURE 6

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Map Saved as Z:\Project Files\GA-HZ\Griffin\20833 - Griffin OC Workforce Reentry Geo\GIS\Maps\20833_F06_DIM_2024-08-06.mxd on 7/24/2024 2:37:19 PM Author: KVM (btran)


**Legend**

| Symbol | Description |
|---|---|
| LB-4 T.D. 31.5' Afu @0-7.5' Qyf @7.5' No GW | Approximate location of hollow-stem auger boring showing total depth (T.D.), groundwater conditions and depth to earth units in feet below existing grade. (Current investigation) |
| CPT-5/5A T.D. 50.28' | Approximate of cone penetration test showing total depth (T.D.) in feet below existing grade. (current investigation) |
| LP-2 T.D. 10' Afu @0-4' Qyf @4' Perc Test @5-10' No GW | Approximate location of percolation test boring showing total depth (T.D.), groundwater conditions, depth to earth units, and depth to percolation test zone in feet below existing grade. (Current investigation) |
| B-12 T.D. 16.5' Afu @0-7' Qyf @7' No GW | Approximate Location of hollow stem auger boring showing total depth (T.D.), groundwater conditions and depth to earth units in feet below existing grade (Ninyo and Moore, 2022). |
| B B' | Cross-Section Line |
| 125' | Predevelopment topographic contour line (USGS, 1950) |
| 142' | Existing ground surface elevation in feet (white contour line) |
| | Proposed Building Footprint |
| | Approximate Site Boundary |
| Afu | Artificial fill, undocumented |
| Qyf | Quaternary Age Young Alluvial Fan Deposits |

# EXPLORATION LOCATION MAP

Proposed Workforce Reentry Project
591 The City Drive South
City of Orange, California

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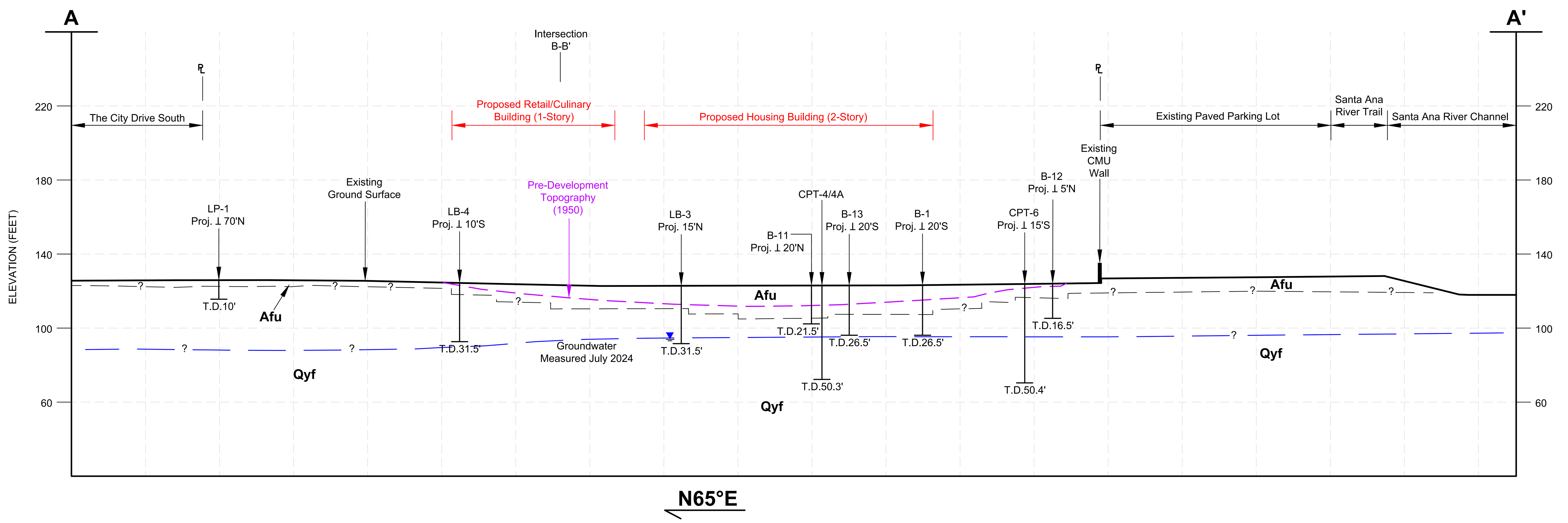
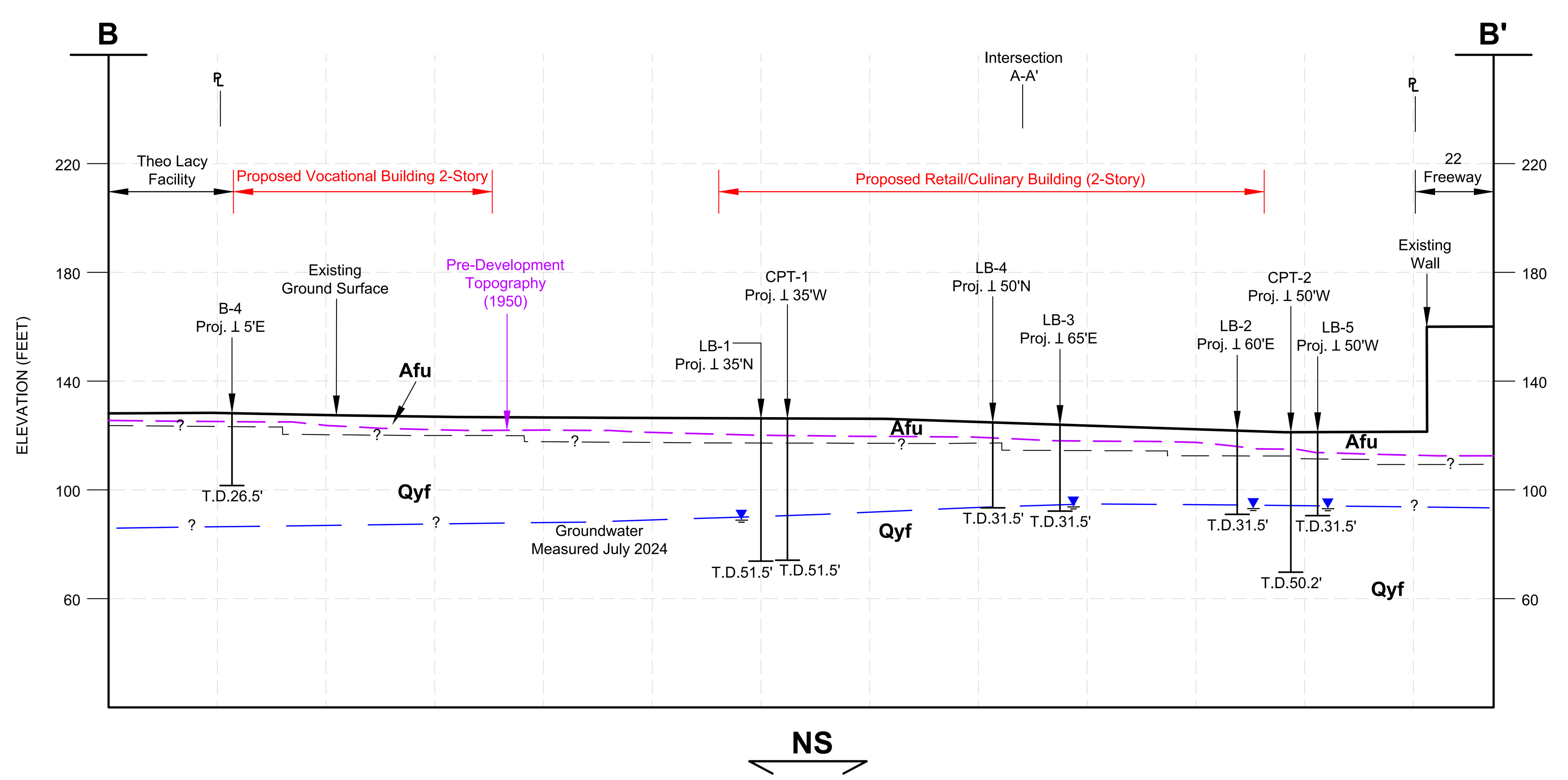
| | |
|---|---|
| Plate 1 | |
| Scale: 1 " = 40 feet | |
| Date: August 2024 | |
| Project: 20833 | |
| Eng/Geol: CCK/JMP | |

Base Map:




| GEOLOGIC CROSS SECTIONS A-A' AND B-B'<br>Proposed Workforce Reentry Center<br>591 The City Drive South<br>City of Orange, California | PLATE 2 |
|---|---|
| | Scale: 1"=40' |
| | Date: August 2024 |
| verdantas | Proj: 20833 |
| | Eng/Geol: CCK/JMP |

Z:\PROJECT FILES\GA-HZ\GRIFFIN\20833 - GRIFFIN OC WORKFORCE REENTRY GEO\VERDANTAS FOLDERS\CAD\SHEETS AND PLANS\20833_P02_CS_2024-08-06.DWG (08-06-24 2:45:37PM) Plotted by: btran

# Appendix A

Exploration Logs

# GEOTECHNICAL BORING LOG LB-1

| | | | |
|---|---|---|---|
| **Project No.** | 20833 | **Date Drilled** | 7-1-24 |
| **Project** | Griffin OC Workforce Reentry Center | **Logged By** | JMP |
| **Drilling Co.** | Martini Drilling Inc. | **Hole Diameter** | 8" |
| **Drilling Method** | Hollow Stem Auger - 140lb - Autohammer - 30" Drop | **Ground Elevation** | 126' |
| **Location** | See Plate 1 - Exploration Location Map | **Sampled By** | JMP |

## SOIL DESCRIPTION

*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*

| Elevation Feet | Depth Feet | Graphic Log (N S) | Attitudes | Sample No. | Blows Per 6 Inches | Dry Density pcf | Moisture Content, % | Soil Class. (U.S.C.S.) | SOIL DESCRIPTION | Type of Tests |
|---|---|---|---|---|---|---|---|---|---|---|
| 125 | 0 | | | B-1 | | | | SM | @Surface: 3-inch Asphalt over subgrade (no base)<br>**Artificial fill, undocumented (Afu)**<br>@0.25': Silty SAND with gravel, light to medium brown, slightly moist, fine to medium sand, fine gravel | MD,EI, DS,CN, RV,CR |
| | | | | | | | | SP-SM | **Quaternary Young Alluvial Fan Deposits (Qyf)**<br>@2': Poorly-graded SAND to Silty SAND, light brown, uniform, fine grained | |
| 120 | 5 | | | S-1 | 2<br>3<br>4 | | 4 | SP | @5': Poorly-graded SAND, light brown, slightly moist, medium dense, fine sand | |
| | | | | R-1 | 4<br>5<br>7 | | | | @7.5': Poorly-graded SAND, light brow, slihglty moist, medium dense, fine to medium sand | DS |
| 115 | 10 | | | S-2 | 2<br>5<br>4 | | 4 | | @10': medium dense | |
| | | | | | | | | ML | @11': SILT (in shoe of sampler), medium brown, slightly moist to moist, meidum stiff, micaceous | |
| | | | | R-2 | 4<br>6<br>6 | | | | @12.5': SILT, medium brown, slighlty moist, stiff, micaceous | DS,CN |
| 110 | 15 | | | S-3 | 1<br>2<br>3 | | 19 | CL-ML | @15': Silty CLAY, brown to orange brown (oxidation), moist, medium stiff, low plasticity | |
| 105 | 20 | | | R-3 | 4<br>5<br>8 | 96 | 16 | ML | @20': SILT, medium gray brown with orange oxidiation, slighlty moist, stiff, few CaCO3 nodules, slight visible porosity | |
| 100 | 25 | | | S-4 | 3<br>4<br>5 | | 20 | ML\CL | @25': SILT to CLAY, medium brown, moist, stiff | |
| | 30 | | | | | | | | | |

**SAMPLE TYPES:**
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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# GEOTECHNICAL BORING LOG LB-1

| | | | |
|---|---|---|---|
| **Project No.** | 20833 | **Date Drilled** | 7-1-24 |
| **Project** | Griffin OC Workforce Reentry Center | **Logged By** | JMP |
| **Drilling Co.** | Martini Drilling Inc. | **Hole Diameter** | 8" |
| **Drilling Method** | Hollow Stem Auger - 140lb - Autohammer - 30" Drop | **Ground Elevation** | 126' |
| **Location** | See Plate 1 - Exploration Location Map | **Sampled By** | JMP |

## SOIL DESCRIPTION

*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*

| Elevation Feet | Depth Feet | Graphic Log (N S) | Attitudes | Sample No. | Blows Per 6 Inches | Dry Density pcf | Moisture Content, % | Soil Class. (U.S.C.S.) | Soil Description | Type of Tests |
|---|---|---|---|---|---|---|---|---|---|---|
| 95 | 30 | | | R-4 | 2<br>5<br>7 | 110 | 17 | CL-ML | @30': Silty CLAY, brown, moist, stiff, trace fine sand | |
| 90 | 35 | | | S-5 | 3<br>7<br>12 | | 21 | SP | @35': Poorly-graded SAND, gray brown, wet, medium dense, fine to medium sand<br>@35.9': Final groundwater reading at 1030<br>@36.4': Initial groundwater reading | |
| 85 | 40 | | | R-5 | 9<br>29<br>21 | 107 | 22 | | @40': dense | |
| 80 | 45 | | | S-6 | 4<br>17<br>13 | | 22 | SM | @45': Silty fine SAND, gray brown, wet, meidum dense to dense, fine sand | |
| 75 | 50 | | | R-6 | 4<br>5<br>6 | 94 | 30 | CL | @50': CLAY, brown to orange brown, very moist, stiff, oxidized | |
| 70 | 55 | | | | | | | | | |
| | 60 | | | | | | | | | |

**Total Depth 51.5 feet bgs**
**Groundwater initially encountered at during drilling at 36.4 feet bgs, settled at 35.9 feet bgs.**
**Boring backfilled to surface with spoils and surface cold-patched asphalt.**

**SAMPLE TYPES:**
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**

| | | | | | |
|---|---|---|---|---|---|
| -200 | % FINES PASSING | DS | DIRECT SHEAR | SA | SIEVE ANALYSIS |
| AL | ATTERBERG LIMITS | EI | EXPANSION INDEX | SE | SAND EQUIVALENT |
| CN | CONSOLIDATION | H | HYDROMETER | SG | SPECIFIC GRAVITY |
| CO | COLLAPSE | MD | MAXIMUM DENSITY | UC | UNCONFINED COMPRESSIVE STRENGTH |
| CR | CORROSION | PP | POCKET PENETROMETER | | |
| CU | UNDRAINED TRIAXIAL | RV | R VALUE | | |

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*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

# GEOTECHNICAL BORING LOG LB-2

| | | | |
|---|---|---|---|
| **Project No.** | 20833 | **Date Drilled** | 7-1-24 |
| **Project** | Griffin OC Workforce Reentry Center | **Logged By** | JMP |
| **Drilling Co.** | Martini Drilling Inc. | **Hole Diameter** | 8" |
| **Drilling Method** | Hollow Stem Auger - 140lb - Autohammer - 30" Drop | **Ground Elevation** | 122' |
| **Location** | See Plate 1 - Exploration Location Map | **Sampled By** | JMP |

## SOIL DESCRIPTION

*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*

| Elevation Feet | Depth Feet | Attitudes | Sample No. | Blows Per 6 Inches | Dry Density pcf | Moisture Content, % | Soil Class. (U.S.C.S.) | Soil Description | Type of Tests |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | | | | @Surface: 4-inch Asphalt over 4-inch Base | |
| 120 | | | B-1 | | | | SM | **Artificial fill, undocumented (Afu)**<br>@0.6': Silty SAND with gravel, brown to gray, moist, some asphalt and debris | |
| | 5 | | S-1 | 5<br>26<br>5 | | 9 | | @5': Silty SAND with AC and Concrete debris, slightly moist, dense | |
| 115 | | | R-1 | 50/5" | 109 | 8 | | @7.5': very dense | |
| | 10 | | S-2 | 10<br>42<br>11 | | 4 | | @10': Apshalt and Concrete Debris, little/no soil | |
| 110 | | | R-2 | 5<br>5<br>7 | 98 | 22 | ML | **Quaternary Young Alluvial Fan Deposits (Qyf)**<br>@12.5': SILT, brown to orange brown with oxidation, moist, stiff, micaceous | |
| | 15 | | S-3 | 1<br>1<br>2 | | 28 | CL | @15': CLAY, brown to orange brown, oxidation, moist, soft, CaCO3 nodules | |
| 105 | | | | | | | | | |
| | 20 | | R-3 | 4<br>4<br>4 | 94 | 26 | ML | @20': SILT, gray brown, very moist, medium stiff, micacous, trace fine sand | |
| 100 | | | | | | | | | |
| | 25 | | S-4 | push<br>push<br>2 | | 22 | CL | @25': CLAY, brown to gray brown, very moist, soft, micaceous, trace fine sand | |
| 95 | | | | | | | | | |
| | 30 | | | | | | | | |

**SAMPLE TYPES:**
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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* * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * *

# GEOTECHNICAL BORING LOG LB-2

| | | | |
|---|---|---|---|
| **Project No.** | 20833 | **Date Drilled** | 7-1-24 |
| **Project** | Griffin OC Workforce Reentry Center | **Logged By** | JMP |
| **Drilling Co.** | Martini Drilling Inc. | **Hole Diameter** | 8" |
| **Drilling Method** | Hollow Stem Auger - 140lb - Autohammer - 30" Drop | **Ground Elevation** | 122' |
| **Location** | See Plate 1 - Exploration Location Map | **Sampled By** | JMP |

| Elevation Feet | Depth Feet | Graphic Log (N S) | Attitudes | Sample No. | Blows Per 6 Inches | Dry Density pcf | Moisture Content, % | Soil Class. (U.S.C.S.) | SOIL DESCRIPTION<br>*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.* | Type of Tests |
|---|---|---|---|---|---|---|---|---|---|---|
| | 30 | | | R-4 | 5<br>10<br>31 | 100 | 24 | SP/ML | @30': Interlayered SAND and SILT, medium brown, very moist, dense/very stiff, fine to medium sand | |
| 90 | | | | | | | | | **Total Depth 31.5 feet bgs**<br>**Groundwater encountered during drilling at 27.8 feet bgs**<br>**Boring backfilled to surface with spoils and surface cold-patched asphalt.** | |
| | 35 | | | | | | | | | |
| 85 | | | | | | | | | | |
| | 40 | | | | | | | | | |
| 80 | | | | | | | | | | |
| | 45 | | | | | | | | | |
| 75 | | | | | | | | | | |
| | 50 | | | | | | | | | |
| 70 | | | | | | | | | | |
| | 55 | | | | | | | | | |
| 65 | | | | | | | | | | |
| | 60 | | | | | | | | | |

**SAMPLE TYPES:**
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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# GEOTECHNICAL BORING LOG LB-3

| | | | |
|---|---|---|---|
| **Project No.** | 20833 | **Date Drilled** | 7-1-24 |
| **Project** | Griffin OC Workforce Reentry Center | **Logged By** | JMP |
| **Drilling Co.** | Martini Drilling Inc. | **Hole Diameter** | 8" |
| **Drilling Method** | Hollow Stem Auger - 140lb - Autohammer - 30" Drop | **Ground Elevation** | 123' |
| **Location** | See Plate 1 - Exploration Location Map | **Sampled By** | JMP |

**SOIL DESCRIPTION**

*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*

| Elevation Feet | Depth Feet | Graphic Log (N S) | Attitudes | Sample No. | Blows Per 6 Inches | Dry Density pcf | Moisture Content, % | Soil Class. (U.S.C.S.) | Soil Description | Type of Tests |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | | | | | @Surface: 6-inch PPC over 4-inch Base | |
| | | | | | | | | SM | **Artificial fill, undocumented (Afu)**<br>@0.8': Silty SAND, brown to dark gray, slightly moist, fine to coarse sand, some gravels and peices of asphalt and debris | |
| 120 | | | | | | | | | | |
| | 5 | | | R-1 | 14<br>14<br>10 | 113 | 4 | | @5': Asphalt debris with gray Silty SAND, slightly moist, dense, fine to coarse grained | |
| 115 | | | | S-1 | push<br>push<br>1 | | 18 | | @7.5': Silty SAND, gray, moist, very loose | |
| | 10 | | | R-2 | 16<br>24<br>17 | 109 | 6 | | @10': Asphalt Debris, primarily asphalt, little/no soil, dark gray to black | |
| 110 | | | | S-2 | 2<br>2<br>4 | | 22 | CL | **Quaternary Young Alluvial Fan Deposits (Qyf)**<br>@12.5': CLAY to Silty CLAY, brown to orange brown with oxidation, moist, medium stiff to stiff | |
| | 15 | | | R-3 | 3<br>5<br>7 | 100 | 23 | | @15': stiff | |
| 105 | | | | | | | | | | |
| | 20 | | | S-3 | 2<br>2<br>3 | | 24 | SM/ML | @20': Silty fine SAND to Sandy SILT, brown to gray brown with orange oxidation, very moist, loose to meidum stiff, fine sand | |
| 100 | | | | | | | | | | |
| | 25 | | | R-4 | 2<br>3<br>5 | 103 | 22 | CL | @25': CLAY, gray brown to orange brown, very moist, medium stiff | |
| 95 | | | | | | | | | | |
| | | | | | | | | | @29': Groundwater encountered | |
| | 30 | | | | | | | | | |

**SAMPLE TYPES:**
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

# GEOTECHNICAL BORING LOG LB-3

| | | | |
|---|---|---|---|
| **Project No.** | 20833 | **Date Drilled** | 7-1-24 |
| **Project** | Griffin OC Workforce Reentry Center | **Logged By** | JMP |
| **Drilling Co.** | Martini Drilling Inc. | **Hole Diameter** | 8" |
| **Drilling Method** | Hollow Stem Auger - 140lb - Autohammer - 30" Drop | **Ground Elevation** | 123' |
| **Location** | See Plate 1 - Exploration Location Map | **Sampled By** | JMP |

| Elevation Feet | Depth Feet | Graphic Log (N S) | Attitudes | Sample No. | Blows Per 6 Inches | Dry Density pcf | Moisture Content, % | Soil Class. (U.S.C.S.) | SOIL DESCRIPTION | Type of Tests |
|---|---|---|---|---|---|---|---|---|---|---|
| | 30 | | | S-4 | 2<br>3<br>7 | | 27 | SM | @30': Silty SAND, gray brown, wet, medium dense, fine sand | |
| 90 | | | | | | | | | **Total Depth 31.5 feet bgs**<br>**Groundwater encountered during drilling at 29 feet bgs**<br>**Boring backfilled to surface with spoils and surface cold-patched asphalt.** | |
| | 35 | | | | | | | | | |
| 85 | | | | | | | | | | |
| | 40 | | | | | | | | | |
| 80 | | | | | | | | | | |
| | 45 | | | | | | | | | |
| 75 | | | | | | | | | | |
| | 50 | | | | | | | | | |
| 70 | | | | | | | | | | |
| | 55 | | | | | | | | | |
| 65 | | | | | | | | | | |
| | 60 | | | | | | | | | |

*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*

**SAMPLE TYPES:**
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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# GEOTECHNICAL BORING LOG LB-4

| | | | |
|---|---|---|---|
| **Project No.** | 20833 | **Date Drilled** | 7-1-24 |
| **Project** | Griffin OC Workforce Reentry Center | **Logged By** | JMP |
| **Drilling Co.** | Martini Drilling Inc. | **Hole Diameter** | 8" |
| **Drilling Method** | Hollow Stem Auger - 140lb - Autohammer - 30" Drop | **Ground Elevation** | 126' |
| **Location** | See Plate 1 - Exploration Location Map | **Sampled By** | JMP |

**SOIL DESCRIPTION**

*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*

| Elevation Feet | Depth Feet | Graphic Log (N S) | Attitudes | Sample No. | Blows Per 6 Inches | Dry Density pcf | Moisture Content, % | Soil Class. (U.S.C.S.) | SOIL DESCRIPTION | Type of Tests |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | | | | | @Surface: 4-inch Asphalt over 4-inch Base | |
| 125 | | | | B-1 | | | | SM | **Artificial fill, undocumented (Afu)**<br>@0.66': Silty SAND, moist, medium brown, fine sand, few peices of aspalt and metal (rusty) | |
| 120 | 5 | | | R-1 | 8<br>6<br>10 | 118 | 13 | ML/SM | @5': Sandy SILT to Silty SAND, reddish brown to black, moist, stiff/medium dense, pieces of asphalt and debris | |
| | | | | S-1 | 3<br>5<br>6 | | 5 | SP | **Quaternary Young Alluvial Fan Deposits (Qyf)**<br>@7.5': Poorly-graded SAND, light brown, slighlty moist, medium dense, fine sand, uniform | |
| 115 | 10 | | | R-2 | 3<br>4<br>3 | 105 | 10 | SP/ML | @10': Interlayered Poorly-graded SAND (same as above) and Sandy SILT, medium to dark brown, moist, medium stiff, fine sand | |
| | | | | S-2 | push<br>1<br>1 | | 26 | CL | @12.5': CLAY, dark brown, very moist, very soft, trace silt, some orange oxidation | |
| 110 | 15 | | | R-3 | 2<br>3<br>7 | 102 | 22 | | @15': medum stiff | |
| 105 | 20 | | | S-3 | push<br>2<br>2 | | 28 | | @20': soft | |
| 100 | 25 | | | R-4 | 3<br>3<br>5 | 91 | 28 | CL/ML | @25': Interlayered CLAY (same as above) and Sandy SILT, moist, medium stiff, fine sand | |
| | 30 | | | | | | | | | |

**SAMPLE TYPES:**
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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# GEOTECHNICAL BORING LOG LB-4

| | | | |
|---|---|---|---|
| **Project No.** | 20833 | **Date Drilled** | 7-1-24 |
| **Project** | Griffin OC Workforce Reentry Center | **Logged By** | JMP |
| **Drilling Co.** | Martini Drilling Inc. | **Hole Diameter** | 8" |
| **Drilling Method** | Hollow Stem Auger - 140lb - Autohammer - 30" Drop | **Ground Elevation** | 126' |
| **Location** | See Plate 1 - Exploration Location Map | **Sampled By** | JMP |

| Elevation Feet | Depth Feet | Graphic Log (N S) | Attitudes | Sample No. | Blows Per 6 Inches | Dry Density pcf | Moisture Content, % | Soil Class. (U.S.C.S.) | **SOIL DESCRIPTION** *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.* | Type of Tests |
|---|---|---|---|---|---|---|---|---|---|---|
| 95 | 30 | | | S-4 | 1<br>3<br>4 | | 18 | ML | @20': Sandy SILT, brown, moist, stiff, fine sand, micaceous | |
| | | | | | | | | | **Total Depth 31.5 feet bgs**<br>**No groundwater encoutered during drilling.**<br>**Boring backfilled to surface with spoils and surface cold-patched asphalt.** | |
| 90 | 35 | | | | | | | | | |
| 85 | 40 | | | | | | | | | |
| 80 | 45 | | | | | | | | | |
| 75 | 50 | | | | | | | | | |
| 70 | 55 | | | | | | | | | |
| | 60 | | | | | | | | | |

**SAMPLE TYPES:**
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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# GEOTECHNICAL BORING LOG LB-5

| | | | |
|---|---|---|---|
| **Project No.** | 20833 | **Date Drilled** | 7-1-24 |
| **Project** | Griffin OC Workforce Reentry Center | **Logged By** | JMP |
| **Drilling Co.** | Martini Drilling Inc. | **Hole Diameter** | 8" |
| **Drilling Method** | Hollow Stem Auger - 140lb - Autohammer - 30" Drop | **Ground Elevation** | 123' |
| **Location** | See Plate 1 - Exploration Location Map | **Sampled By** | JMP |

| Elevation Feet | Depth Feet | Graphic Log (N / S) | Attitudes | Sample No. | Blows Per 6 Inches | Dry Density pcf | Moisture Content, % | Soil Class. (U.S.C.S.) | SOIL DESCRIPTION<br>*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.* | Type of Tests |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | | | | | @Surface: 3-inch Asphalt over 4-inch Base | |
| | | | | B-1 | | | | SM | **Artificial fill, undocumented (Afu)**<br>@0.6': Silty SAND, brown, moist, fine to coarse sand, some gravel and asphalt/concrete debris | |
| 120 | | | | | | | | | | |
| | 5 | | | R-1 | 8<br>11<br>15 | 119 | 11 | | @5': Silty SAND, brown, moist, medium dense, fine to caorse sand, large asphalt chunk in sampler shoe | |
| 115 | | | | S-1 | 1<br>1<br>2 | | 21 | ML | **Quaternary Young Alluvial Fan Deposits (Qyf)**<br>@7.5': SILT, brown, moist, soft to medium stiff, micaceous | |
| | 10 | | | R-2 | 2<br>3<br>4 | | | CL | @10': CLAY to Silty CLAY, brown to orange brown with oxidation, moist to very moist, medium stiff | DS,CN |
| 110 | | | | S-2 | push<br>1<br>1 | | 24 | | @12.5': soft, few CaCO3 nodules | |
| | 15 | | | R-3 | 2<br>4<br>6 | 96 | 27 | | @15': CLAY, brown to orange brown with oxidation, moist to very moist, stiff, few CaCO3 nodules | |
| 105 | | | | | | | | | | |
| | 20 | | | S-3 | 3<br>5<br>4 | | 20 | SM | @20': Silty fine SAND, brown to orange brown with oxidation, very moist, medium dense, fine sand | |
| 100 | | | | | | | | | | |
| | 25 | | | R-4 | 3<br>4<br>6 | 100 | 24 | CL | @25': CLAY, brown to orange brown with oxidation, very moist, stiff | |
| 95 | | | | | | | | | | |
| | | | | | | | | | @28.8': Groundwater encountered | |
| | 30 | | | | | | | | | |

**SAMPLE TYPES:**
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**

| | | | | | |
|---|---|---|---|---|---|
| -200 | % FINES PASSING | DS | DIRECT SHEAR | SA | SIEVE ANALYSIS |
| AL | ATTERBERG LIMITS | EI | EXPANSION INDEX | SE | SAND EQUIVALENT |
| CN | CONSOLIDATION | H | HYDROMETER | SG | SPECIFIC GRAVITY |
| CO | COLLAPSE | MD | MAXIMUM DENSITY | UC | UNCONFINED COMPRESSIVE STRENGTH |
| CR | CORROSION | PP | POCKET PENETROMETER | | |
| CU | UNDRAINED TRIAXIAL | RV | R VALUE | | |

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* * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * *

# GEOTECHNICAL BORING LOG LB-5

| | | | |
|---|---|---|---|
| **Project No.** | 20833 | **Date Drilled** | 7-1-24 |
| **Project** | Griffin OC Workforce Reentry Center | **Logged By** | JMP |
| **Drilling Co.** | Martini Drilling Inc. | **Hole Diameter** | 8" |
| **Drilling Method** | Hollow Stem Auger - 140lb - Autohammer - 30" Drop | **Ground Elevation** | 123' |
| **Location** | See Plate 1 - Exploration Location Map | **Sampled By** | JMP |

| Elevation Feet | Depth Feet | Graphic Log (N S) | Attitudes | Sample No. | Blows Per 6 Inches | Dry Density pcf | Moisture Content, % | Soil Class. (U.S.C.S.) | SOIL DESCRIPTION | Type of Tests |
|---|---|---|---|---|---|---|---|---|---|---|
| | 30 | | | S-4 | 3<br>7<br>8 | | 23 | SP | @30': Poorly-graded SAND, gray brown, wet, medium dense, fine to medium sand | |
| 90 | | | | | | | | | **Total Depth 31.5 feet bgs**<br>**Groundwater encountered during drilling at 28.8 feet bgs.**<br>**Boring backfilled to surface with spoils and surface cold-patched asphalt.** | |
| | 35 | | | | | | | | | |
| 85 | | | | | | | | | | |
| | 40 | | | | | | | | | |
| 80 | | | | | | | | | | |
| | 45 | | | | | | | | | |
| 75 | | | | | | | | | | |
| | 50 | | | | | | | | | |
| 70 | | | | | | | | | | |
| | 55 | | | | | | | | | |
| 65 | | | | | | | | | | |
| | 60 | | | | | | | | | |

*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*

**SAMPLE TYPES:**
**B** BULK SAMPLE
**C** CORE SAMPLE
**G** GRAB SAMPLE
**R** RING SAMPLE
**S** SPLIT SPOON SAMPLE
**T** TUBE SAMPLE

**TYPE OF TESTS:**
**-200** % FINES PASSING
**AL** ATTERBERG LIMITS
**CN** CONSOLIDATION
**CO** COLLAPSE
**CR** CORROSION
**CU** UNDRAINED TRIAXIAL
**DS** DIRECT SHEAR
**EI** EXPANSION INDEX
**H** HYDROMETER
**MD** MAXIMUM DENSITY
**PP** POCKET PENETROMETER
**RV** R VALUE
**SA** SIEVE ANALYSIS
**SE** SAND EQUIVALENT
**SG** SPECIFIC GRAVITY
**UC** UNCONFINED COMPRESSIVE STRENGTH

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*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

# GEOTECHNICAL BORING LOG LP-1

| | | | |
|---|---|---|---|
| **Project No.** | 20833 | **Date Drilled** | 7-1-24 |
| **Project** | Griffin OC Workforce Reentry Center | **Logged By** | JMP |
| **Drilling Co.** | Martini Drilling Inc. | **Hole Diameter** | 8" |
| **Drilling Method** | Hollow Stem Auger - 140lb - Autohammer - 30" Drop | **Ground Elevation** | 126' |
| **Location** | See Plate 1 - Exploration Location Map | **Sampled By** | JMP |

## SOIL DESCRIPTION

*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*

| Elevation Feet | Depth Feet | Graphic Log (N S) | Attitudes | Sample No. | Blows Per 6 Inches | Dry Density pcf | Moisture Content, % | Soil Class. (U.S.C.S.) | Soil Description | Type of Tests |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | | | | ML/SM | @Surface: 2-inch Ashpalt over subgrade (no base) | |
| 125 | | | | | | | | | **Artificial fill, undocumented (Afu)**<br>@0.2': SILT to Silty SAND, brown moist, fine sand, mottled | |
| | | | | | | | | | **Quaternary Young Alluvial Fan Deposits (Qyf)**<br>@2': Silty SAND, light to meidum brwon, moist, uniform | |
| | 5 | | | S-1 | 1<br>2<br>2 | | 4 | SP | @5': Poorly-graded SAND, light brown, moist, loose, poorly graded, fine sand | |
| 120 | | | | | | | | | | |
| | | | | S-2 | push<br>push<br>1 | | 16 | SM | @7': Silty SAND, light to medium brown, moist, very loose, fine grained | |
| | | | | S-3 | 2<br>2<br>3 | | 6 | SP | @8.5': Poorly-graded SAND, light brown, moist, loose, fine to medium sand | |
| | 10 | | | | | | | | | |
| 115 | | | | | | | | | **Total Depth 10 feet bgs**<br>**No groundwater encountered during drilling.**<br>**Temporary percolation test well installed using 2-inch diameter PVC pipe. Solid pipe from 0-5 feet and 0.020-inch slotted pipe from 5-10 feet. Industrial SAND placed in annulus from 4-10 feet. Upon completion of testing, pipe was removed and boring was backfilled with soil cuttings. Surface patched with cold-mix asphalt.** | |
| | 15 | | | | | | | | | |
| 110 | | | | | | | | | | |
| | 20 | | | | | | | | | |
| 105 | | | | | | | | | | |
| | 25 | | | | | | | | | |
| 100 | | | | | | | | | | |
| | 30 | | | | | | | | | |

**SAMPLE TYPES:**
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**

| | | | | | |
|---|---|---|---|---|---|
| -200 | % FINES PASSING | DS | DIRECT SHEAR | SA | SIEVE ANALYSIS |
| AL | ATTERBERG LIMITS | EI | EXPANSION INDEX | SE | SAND EQUIVALENT |
| CN | CONSOLIDATION | H | HYDROMETER | SG | SPECIFIC GRAVITY |
| CO | COLLAPSE | MD | MAXIMUM DENSITY | UC | UNCONFINED COMPRESSIVE STRENGTH |
| CR | CORROSION | PP | POCKET PENETROMETER | | |
| CU | UNDRAINED TRIAXIAL | RV | R VALUE | | |

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# GEOTECHNICAL BORING LOG LP-2

| | | | |
|---|---|---|---|
| **Project No.** | 20833 | **Date Drilled** | 7-1-24 |
| **Project** | Griffin OC Workforce Reentry Center | **Logged By** | JMP |
| **Drilling Co.** | Martini Drilling Inc. | **Hole Diameter** | 8" |
| **Drilling Method** | Hollow Stem Auger - 140lb - Autohammer - 30" Drop | **Ground Elevation** | 124' |
| **Location** | See Plate 1 - Exploration Location Map | **Sampled By** | JMP |

**SOIL DESCRIPTION**

*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*

| Elevation Feet | Depth Feet | Graphic Log (N S) | Attitudes | Sample No. | Blows Per 6 Inches | Dry Density pcf | Moisture Content, % | Soil Class. (U.S.C.S.) | SOIL DESCRIPTION | Type of Tests |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | | | | | @Surface: 3-inch Ashpalt over 4-inch Base | |
| | | | | | | | | SW | **Artificial fill, undocumented (Afu)**<br>@0.6': Gravelly SAND, brown | |
| | | | | | | | | ML/SM | @1.6': Asphalt Debris layer overtopSilty SAND to Sandy SILT, mottled brown, moist, fine to coarse sand, some gravels | |
| 120 | | | | | | | | SP | **Quaternary Young Alluvial Fan Deposits (Qyf)**<br>@4': Poorly-graded SAND, light to meidum brown, slightly moist, fine sand, uniform | |
| | 5 | | | S-1 | 5<br>6<br>6 | | 3 | | @5': medium dense | |
| | | | | S-2 | 4<br>6<br>7 | | 2 | SW | @7': Well-graded SAND, light brown, slightly moist, medium dense, fine to coarse sand | |
| 115 | | | | S-3 | 1<br>1<br>2 | | 17 | ML | @8.5': SILT to Sandy SILT, gray brown, moist, soft, fine sand | |
| | 10 | | | | | | | | **Total Depth 10 feet bgs**<br>**No groundwater encountered during drilling.**<br>**Temporary percolation test well installed using 2-inch diameter PVC pipe. Solid pipe from 0-5 feet and 0.020-inch slotted pipe from 5-10 feet. Industrial SAND placed in annulus from 4-10 feet. Upon completion of testing, pipe was removed and boring was backfilled with soil cuttings. Surface patched with cold-mix asphalt.** | |
| 110 | | | | | | | | | | |
| | 15 | | | | | | | | | |
| 105 | | | | | | | | | | |
| | 20 | | | | | | | | | |
| 100 | | | | | | | | | | |
| | 25 | | | | | | | | | |
| 95 | | | | | | | | | | |
| | 30 | | | | | | | | | |

**SAMPLE TYPES:**
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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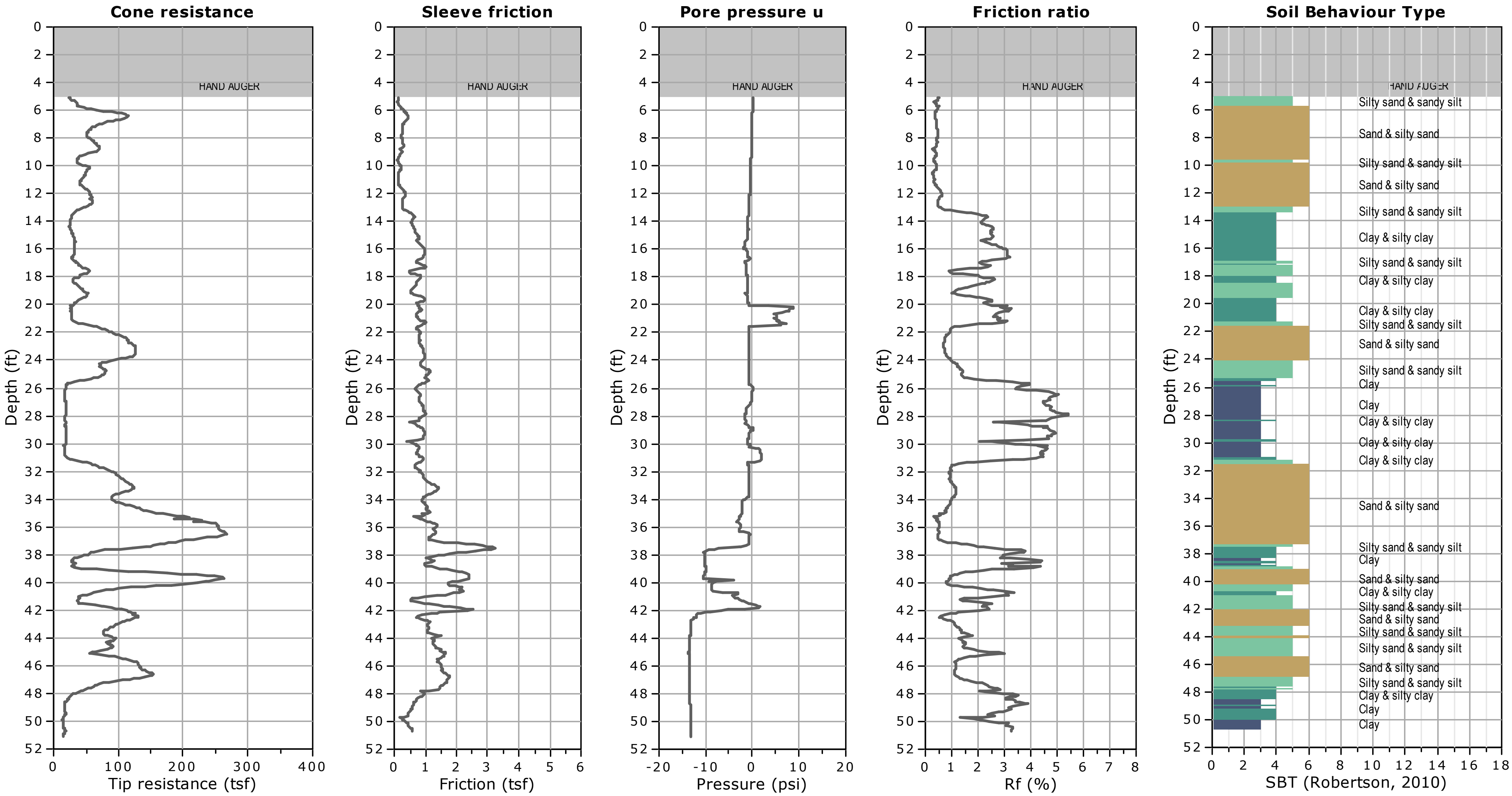
**Kehoe Testing and Engineering**
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

**Project:** **Verdantas / Griffin OC Workforce Reentry**

**Location:** **591 The City Drive South, Orange, CA**

**CPT-1**

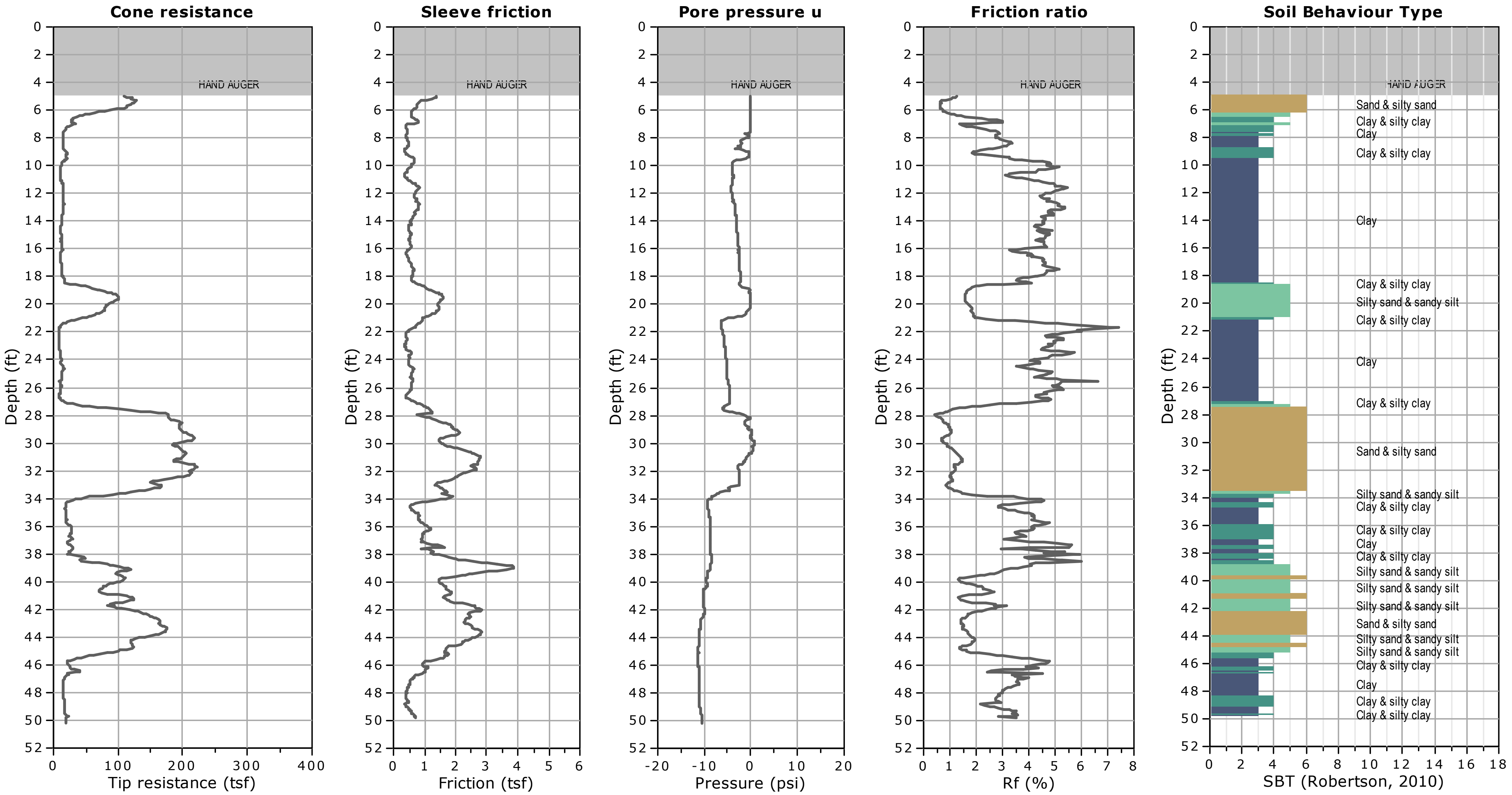
Total depth: 51.13 ft, Date: 7/1/2024



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

**Project:** Verdantas / Griffin OC Workforce Reentry
**Location:** 591 The City Drive South, Orange, CA

**CPT-2**
Total depth: 50.22 ft, Date: 7/1/2024



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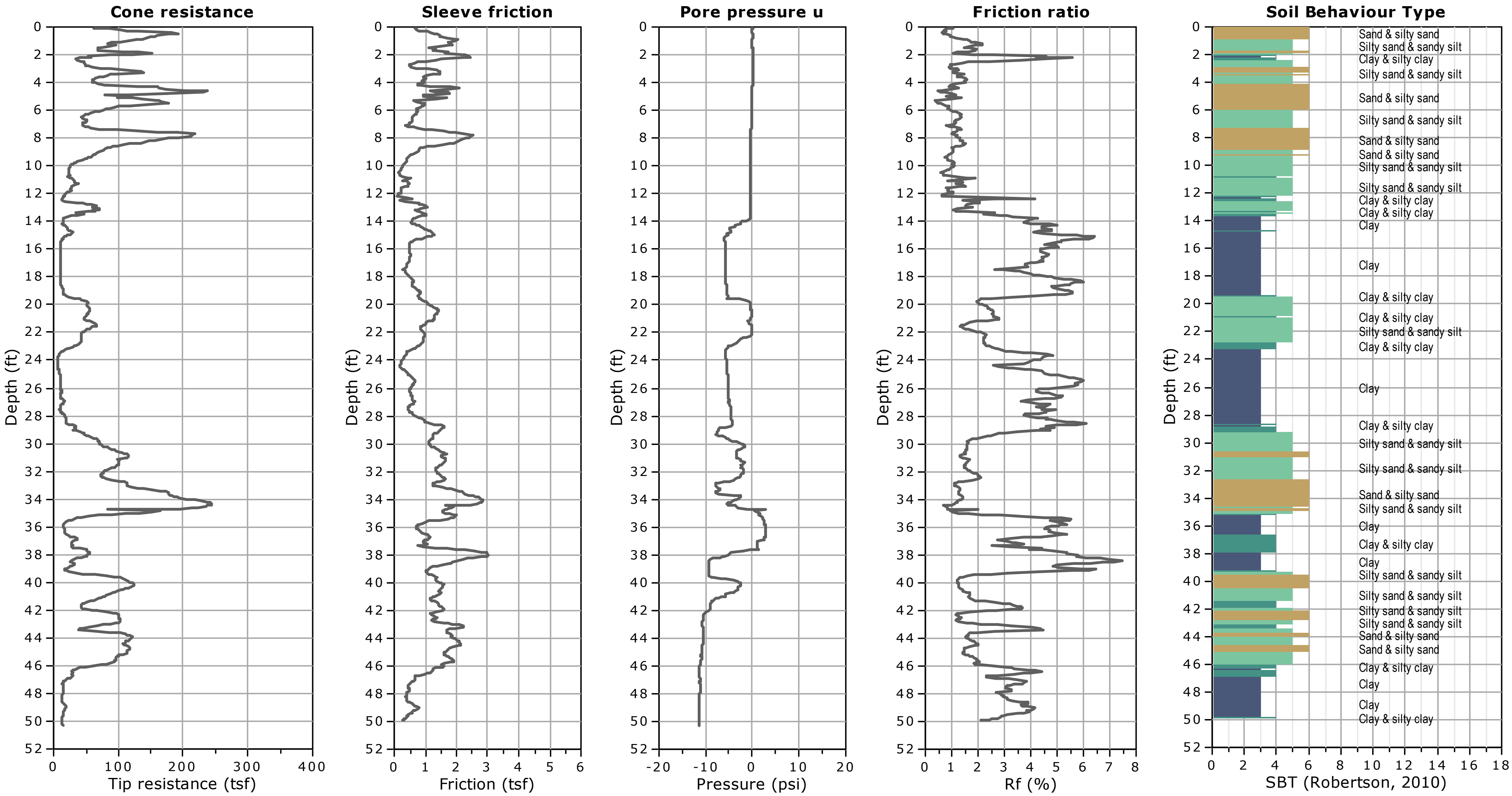
**Project:** Verdantas / Griffin OC Workforce Reentry

**Location:** 591 The City Drive South, Orange, CA

**CPT-3**

Total depth: 50.34 ft, Date: 7/1/2024



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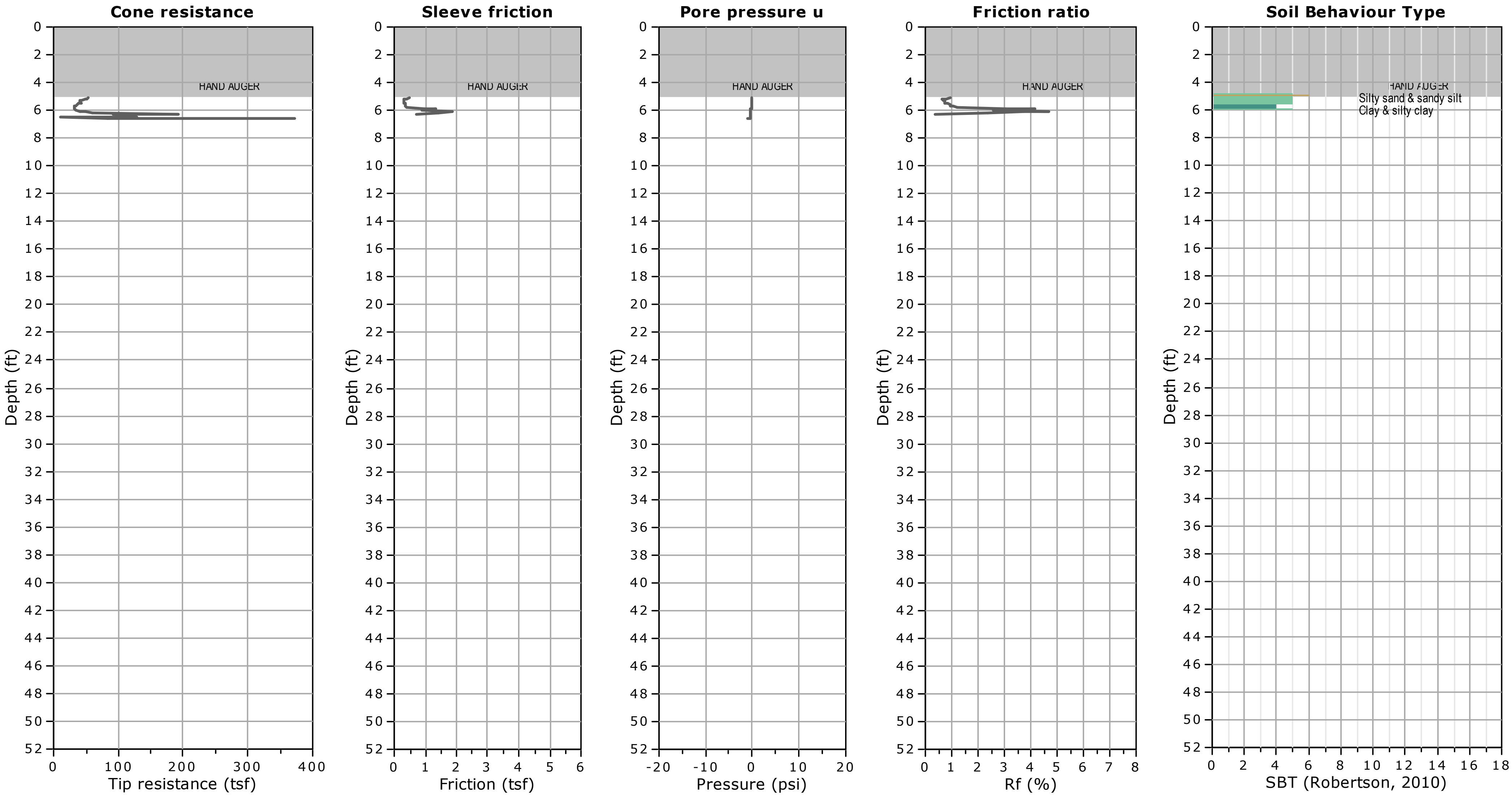
**Project:** **Verdantas / Griffin OC Workforce Reentry** **CPT-4**

**Location:** **591 The City Drive South, Orange, CA** Total depth: 6.64 ft, Date: 7/1/2024



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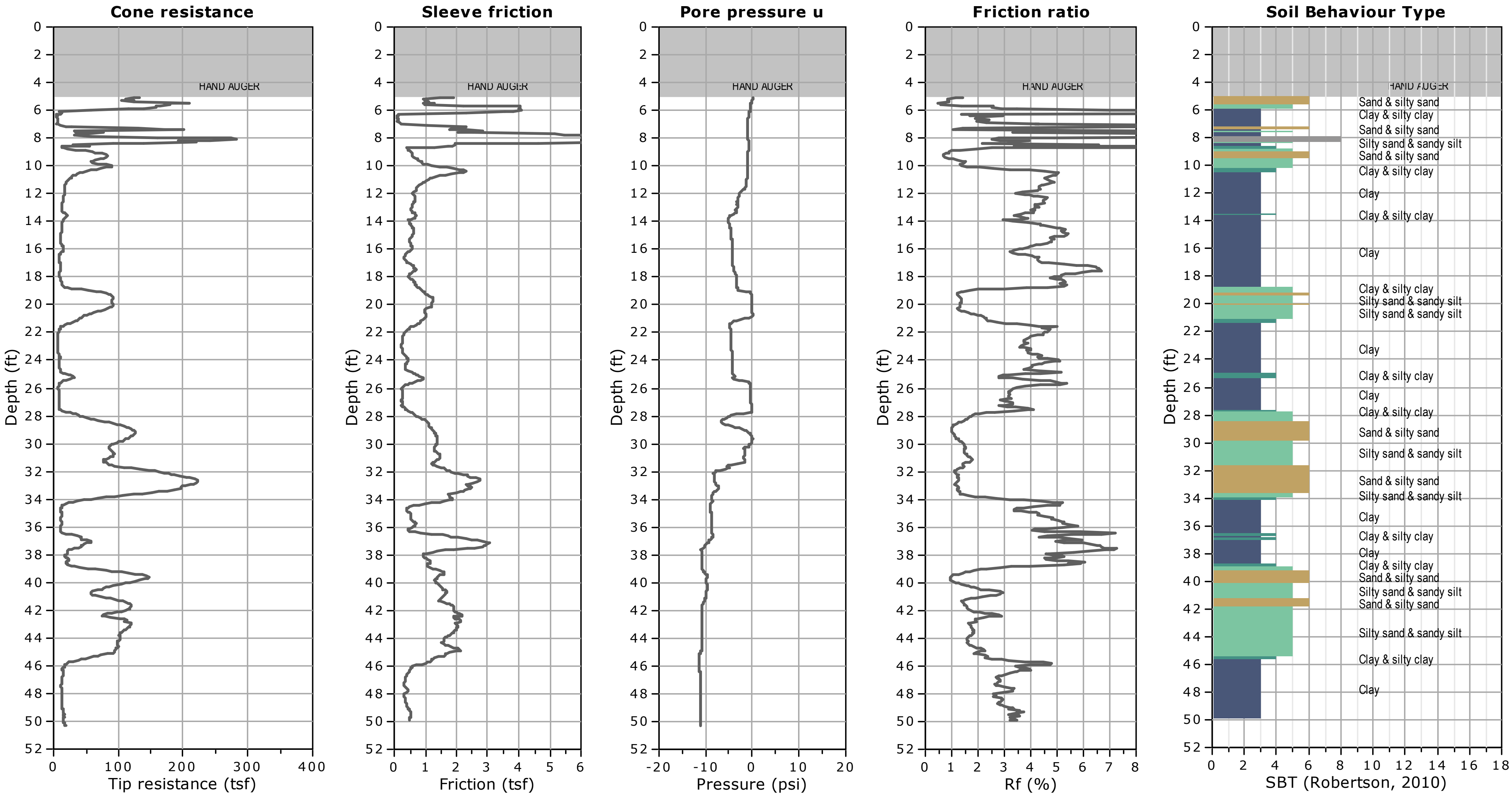
www.kehoetesting.com

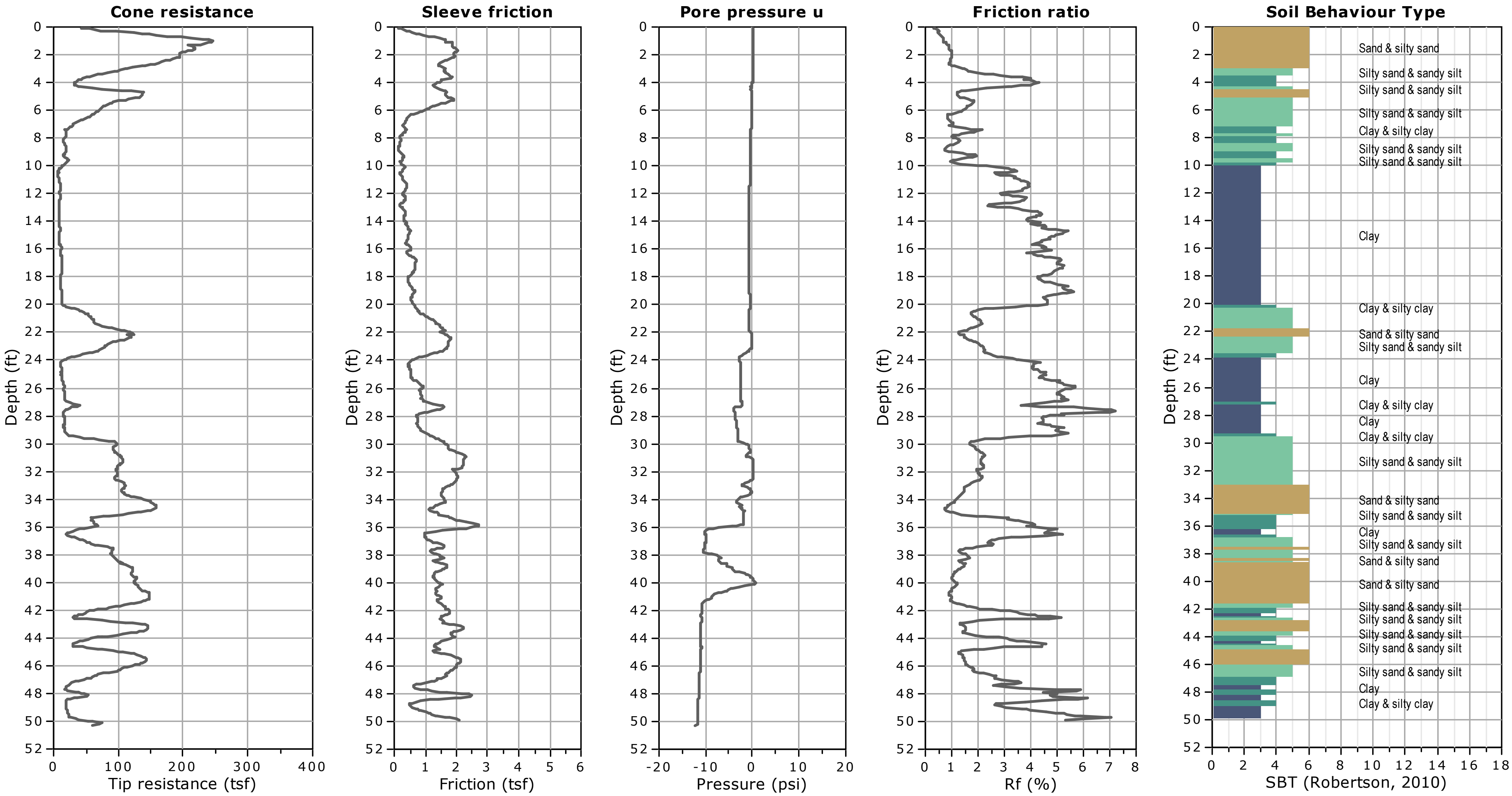
**Project:** **Verdantas / Griffin OC Workforce Reentry**
**Location:** **591 The City Drive South, Orange, CA**

**CPT-4A**
Total depth: 50.34 ft, Date: 7/1/2024



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

**Project:** **Verdantas / Griffin OC Workforce Reentry** **CPT-5**
**Location:** **591 The City Drive South, Orange, CA** Total depth: 50.28 ft, Date: 7/1/2024



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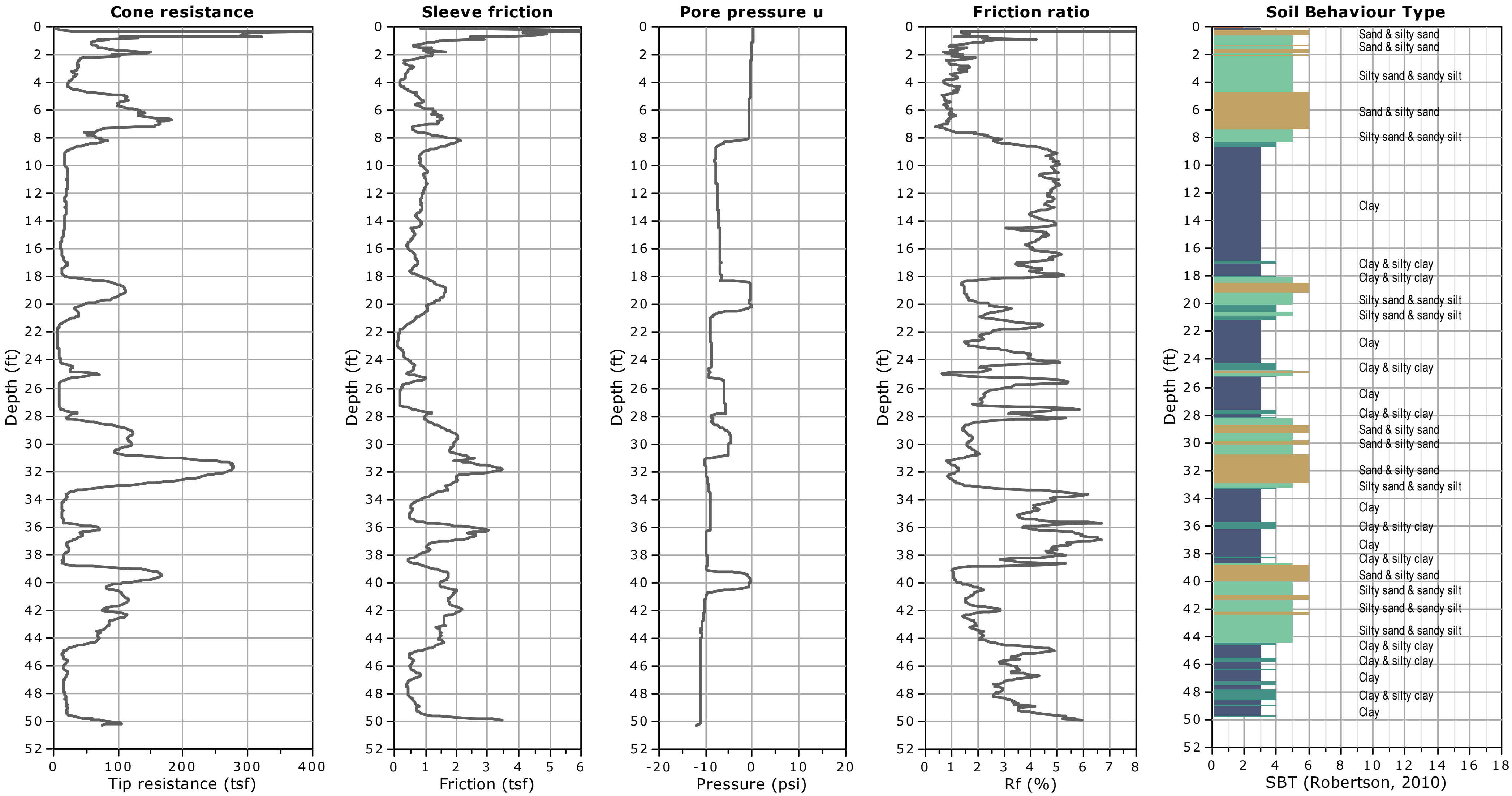
**Project:** Verdantas / Griffin OC Workforce Reentry **CPT-6**

**Location:** 591 The City Drive South, Orange, CA

Total depth: 50.27 ft, Date: 7/1/2024



# Appendix B

Percolation Test Data

## Boring Percolation Test Data Sheet

| | | | |
|---|---|---|---|
| **Project Number:** | 20833 | **Test Hole Number:** | LP-1 |
| **Project Name:** | OC Workforce Reentry | **Date Excavated:** | 7/1/2024 |
| **Earth Description:** | Alluvium | **Date Tested:** | 7/3/2024 |
| **Liquid Description:** | Tap water | **Depth of boring (ft):** | 10 |
| **Tested By:** | JMP | **Radius of boring, r (in):** | 4 |
| | | **Radius of casing (in):** | 1 |
| | | **Length of slotted of casing (ft):** | 5 |
| | | **Porosity of Annulus Material, *n* :** | 0.37 |
| | | **Bentonite Plug at Bottom:** | No |

Field Percolation Data - High Flow Constant Head Test

| Reading | Time | Time Interval, Δt (minutes) | Depth to Water (feet bgs) | Water Height, H (inches) | Cumulative Water Volume Delivered (gallons) |
|---|---|---|---|---|---|
| 1 | 8:20 | - | - | - | - |
| 2 | 8:25 | 5 | 4.90 | 61.2 | 40.4 |
| 3 | 8:30 | 5 | 4.80 | 62.4 | 80.7 |
| 4 | 8:35 | 5 | 4.65 | 64.2 | 121.1 |
| 5 | 8:40 | 5 | 4.40 | 67.2 | 161.4 |
| 6 | 8:45 | 5 | 4.95 | 60.6 | 196.4 |
| 7 | 8:50 | 5 | 4.94 | 60.7 | 231.4 |
| 8 | 8:55 | 5 | 4.87 | 61.6 | 266.4 |
| 9 | 9:00 | 5 | 4.84 | 61.9 | 301.4 |
| 10 | 9:05 | 5 | 4.83 | 62.0 | 336.4 |
| 11 | 9:10 | 5 | 4.78 | 62.6 | 371.4 |
| 12 | 9:15 | 5 | 4.77 | 62.8 | 406.4 |
| 13 | 9:20 | 5 | 4.74 | 63.1 | 441.4 |
| 14 | 9:25 | 5 | 4.70 | 63.6 | 476.4 |
| 15 | 9:30 | 5 | 4.72 | 63.4 | 511.4 |
| 16 | 9:35 | 5 | 4.68 | 63.8 | 546.4 |
| 17 | 9:40 | 5 | 4.67 | 64.0 | 581.4 |
| 18 | 9:45 | 5 | 4.65 | 64.2 | 616.4 |
| 19 | 9:50 | 5 | 4.63 | 64.4 | 651.4 |
| 20 | 9:55 | 5 | 4.61 | 64.7 | 686.4 |
| 21 | 10:00 | 5 | 4.60 | 64.8 | 721.4 |
| 22 | 10:05 | 5 | 4.59 | 64.9 | 756.4 |
| 23 | 10:10 | 5 | 4.58 | 65.0 | 791.4 |
| 24 | 10:15 | 5 | 4.55 | 65.4 | 826.4 |
| 25 | 10:20 | 5 | 4.55 | 65.4 | 861.4 |

**High Flowrate Percolation Test Calculation**

| | |
|---|---|
| Total Volume of Water Delivered (gallons) | 861.4 |
| Total Volume of Water Delivered (cubic inches) | 198983.4 |
| Average Water Height (inches) | 63.5 |
| Average Percolation Surface Area (cubic Inches) | 1646.2 |
| Duration of Test (minutes) | 120 |
| Duration of Test (hours) | 2.00 |

$$\text{Measured Infiltration Rate} = (\text{Total Volume})/(\text{Test Duration})/(\text{Surface Area})$$

**Measured Infiltration Rate = 60.4 in./hr.**

## Boring Percolation Test Data Sheet

| | | | |
|---|---|---|---|
| **Project Number:** | 20833 | **Test Hole Number:** | LP-2 |
| **Project Name:** | OC Workforce Reentry | **Date Excavated:** | 7/1/2024 |
| **Earth Description:** | Alluvium | **Date Tested:** | 7/3/2024 |
| **Liquid Description:** | Tap water | **Depth of boring (ft):** | 10 |
| **Tested By:** | JMP | **Radius of boring, r (in):** | 4 |
| | | **Radius of casing (in):** | 1 |
| | | **Length of slotted of casing (ft):** | 5 |
| | | **Porosity of Annulus Material, *n* :** | 0.37 |
| | | **Bentonite Plug at Bottom:** | No |

Field Percolation Data - High Flow Constant Head Test

| Reading | Time | Time Interval, Δt (minutes) | Depth to Water (feet bgs) | Water Height, H (inches) | Cumulative Water Volume Delivered (gallons) |
|---|---|---|---|---|---|
| 1 | 10:35 | - | - | - | - |
| 2 | 10:40 | 5 | 5.90 | 49.2 | 45.7 |
| 3 | 10:45 | 5 | 5.60 | 52.8 | 91.3 |
| 4 | 10:50 | 5 | 5.34 | 55.9 | 137.0 |
| 5 | 10:55 | 5 | 5.07 | 59.2 | 182.6 |
| 6 | 11:00 | 5 | 4.90 | 61.2 | 228.3 |
| 7 | 11:05 | 5 | 4.84 | 61.9 | 273.9 |
| 8 | 11:10 | 5 | 4.78 | 62.6 | 319.6 |
| 9 | 11:15 | 5 | 4.73 | 63.2 | 365.2 |
| 10 | 11:20 | 5 | 4.69 | 63.7 | 410.9 |
| 11 | 11:25 | 5 | 4.64 | 64.3 | 456.5 |
| 12 | 11:30 | 5 | 4.61 | 64.7 | 502.2 |
| 13 | 11:35 | 5 | 4.58 | 65.0 | 547.8 |
| 14 | 11:40 | 5 | 4.55 | 65.4 | 593.5 |
| 15 | 11:45 | 5 | 4.52 | 65.8 | 639.1 |
| 16 | 11:50 | 5 | 4.48 | 66.2 | 684.8 |
| 17 | 11:55 | 5 | 4.46 | 66.5 | 730.4 |
| 18 | 12:00 | 5 | 4.44 | 66.7 | 776.1 |
| 19 | 12:05 | 5 | 4.42 | 67.0 | 821.7 |
| 20 | 12:10 | 5 | 4.40 | 67.2 | 867.4 |
| 21 | 12:15 | 5 | 4.36 | 67.7 | 913.0 |
| 22 | 12:20 | 5 | 4.33 | 68.0 | 958.7 |
| 23 | 12:25 | 5 | 4.30 | 68.4 | 1004.3 |
| 24 | 12:30 | 5 | 4.28 | 68.6 | 1050.0 |
| 25 | 12:35 | 5 | 4.27 | 68.8 | 1095.6 |

**High Flowrate Percolation Test Calculation**

| | |
|---|---|
| Total Volume of Water Delivered (gallons) | 1095.6 |
| Total Volume of Water Delivered (cubic inches) | 253083.6 |
| Average Water Height (inches) | 63.8 |
| Average Percolation Surface Area (cubic Inches) | 1652.6 |
| Duration of Test (minutes) | 120 |
| Duration of Test (hours) | 2.00 |

$$\text{Measured Infiltration Rate} = (\text{Total Volume})/(\text{Test Duration})/(\text{Surface Area})$$

**Measured Infiltration Rate = 76.6 in./hr.**

# Appendix C

Laboratory Test Results

# MODIFIED PROCTOR COMPACTION TEST

**ASTM D 1557**

| | | | | | |
|---|---|---|---|---|---|
| Project Name: | Griffin OC Workforce Reentry | Tested By: | P. Martin | Date: | 07/08/24 |
| Project No.: | 036.0000020833 | Checked By: | A. Santos | Date: | 07/09/24 |
| Boring No.: | LB-1 | Depth (ft.): | 0-5 | | |
| Sample No.: | B-1 | | | | |
| Soil Identification: | Olive brown sandy silt s(ML) | | | | |

Note: Corrected dry density calculation assumes specific gravity of 2.70 and moisture content of 1.0% for oversize particles

| | | | Scalp Fraction (%) | | |
|---|---|---|---|---|---|
| Preparation Method: | X | Moist | #3/4 | | Rammer Weight (lb.) = 10.0 |
| | | Dry | #3/8 | | Height of Drop (in.) = 18.0 |
| Compaction Method | X | Mechanical Ram | #4 | 9.6 | Mold Volume (ft³) 0.03320 |
| | | Manual Ram | | | |

| TEST NO. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Wt. Compacted Soil + Mold (g) | 3886 | 3985 | 3957 | | | |
| Weight of Mold (g) | 1780 | 1780 | 1780 | | | |
| Net Weight of Soil (g) | 2106 | 2205 | 2177 | | | |
| Wet Weight of Soil + Cont. (g) | 539.0 | 575.7 | 561.3 | | | |
| Dry Weight of Soil + Cont. (g) | 508.8 | 533.2 | 509.5 | | | |
| Weight of Container (g) | 88.7 | 77.0 | 75.8 | | | |
| Moisture Content (%) | 7.19 | 9.32 | 11.94 | | | |
| Wet Density (pcf) | 139.8 | 146.4 | 144.6 | | | |
| Dry Density (pcf) | 130.5 | 133.9 | 129.1 | | | |

| | | | |
|---|---|---|---|
| **Maximum Dry Density (pcf)** | **134.0** | **Optimum Moisture Content (%)** | **9.4** |
| **Corrected Dry Density (pcf)** | **136.7** | **Corrected Moisture Content (%)** | **8.6** |

☒ **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

☐ **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

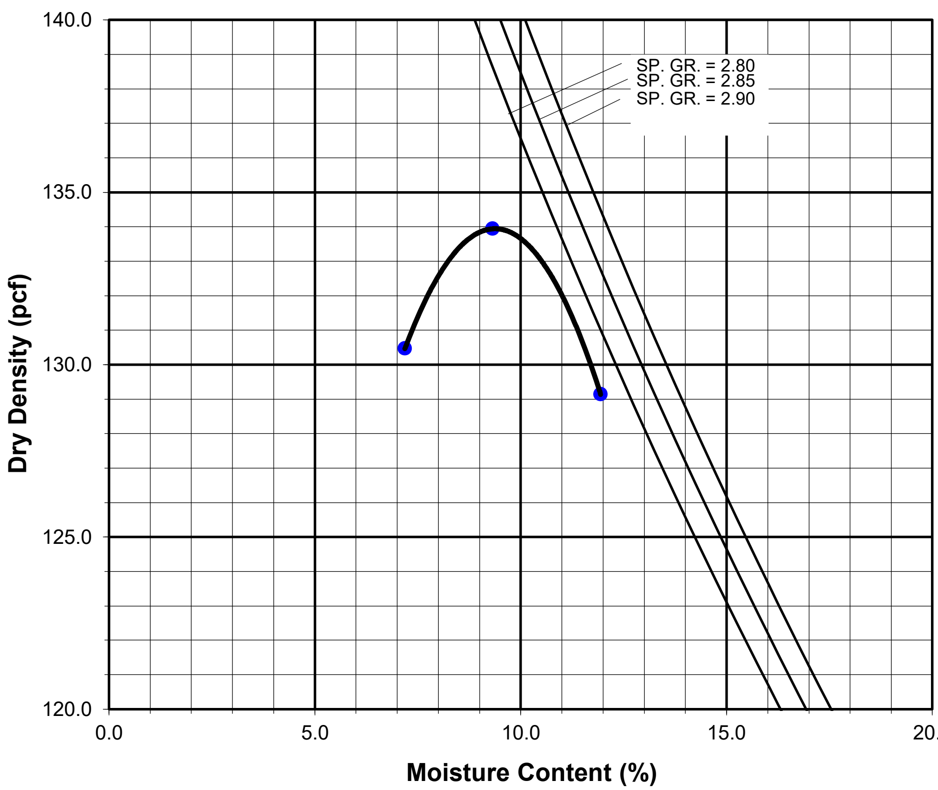
☐ **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

**Particle-Size Distribution:**

GR:SA:FI

**Atterberg Limits:**

LL,PL,PI



# EXPANSION INDEX of SOILS
## ASTM D 4829

| | | | | | |
|---|---|---|---|---|---|
| Project Name: | Griffin OC Workforce Reentry | Tested By: | G. Bathala | Date: | 07/11/24 |
| Project No.: | 036.0000020833 | Checked By: | A. Santos | Date: | 08/01/24 |
| Boring No.: | LB-1 | Depth (ft.): | 0-5 | | |
| Sample No.: | B-1 | | | | |
| Soil Identification: | Olive brown sandy silt s(ML) | | | | |

| | | |
|---|---|---|
| Dry Wt. of Soil + Cont. | (g) | 1000.00 |
| Wt. of Container No. | (g) | 0.00 |
| Dry Wt. of Soil | (g) | 1000.00 |
| Weight Soil Retained on #4 Sieve | | 0.00 |
| Percent Passing # 4 | | 100.00 |

| **MOLDED SPECIMEN** | | Before Test | After Test |
|---|---|---|---|
| Specimen Diameter | (in.) | 4.01 | 4.01 |
| Specimen Height | (in.) | 1.0000 | 1.0000 |
| Wt. Comp. Soil + Mold | (g) | 613.62 | 441.52 |
| Wt. of Mold | (g) | 187.65 | 0.00 |
| Specific Gravity (Assumed) | | 2.70 | 2.70 |
| Container No. | | O | O |
| Wet Wt. of Soil + Cont. | (g) | 847.50 | 629.17 |
| Dry Wt. of Soil + Cont. | (g) | 786.20 | 582.81 |
| Wt. of Container | (g) | 0.00 | 187.65 |
| Moisture Content | (%) | 7.80 | 11.73 |
| Wet Density | (pcf) | 128.5 | 133.2 |
| Dry Density | (pcf) | 119.2 | 119.2 |
| Void Ratio | | 0.414 | 0.414 |
| Total Porosity | | 0.293 | 0.293 |
| Pore Volume | (cc) | 60.6 | 60.6 |
| Degree of Saturation (%) [ S meas] | | **50.8** | 76.5 |

**SPECIMEN INUNDATION** in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

| Date | Time | Pressure (psi) | Elapsed Time (min.) | Dial Readings (in.) |
|---|---|---|---|---|
| 07/11/24 | 15:29 | 1.0 | 0 | 0.4160 |
| 07/11/24 | 15:39 | 1.0 | 10 | 0.4150 |
| Add Distilled Water to the Specimen | | | | |
| 07/11/24 | 16:07 | 1.0 | 28 | 0.4155 |
| 07/12/24 | 10:12 | 1.0 | 1113 | 0.4155 |
| 07/12/24 | 11:17 | 1.0 | 1178 | 0.4160 |
| | | | | |

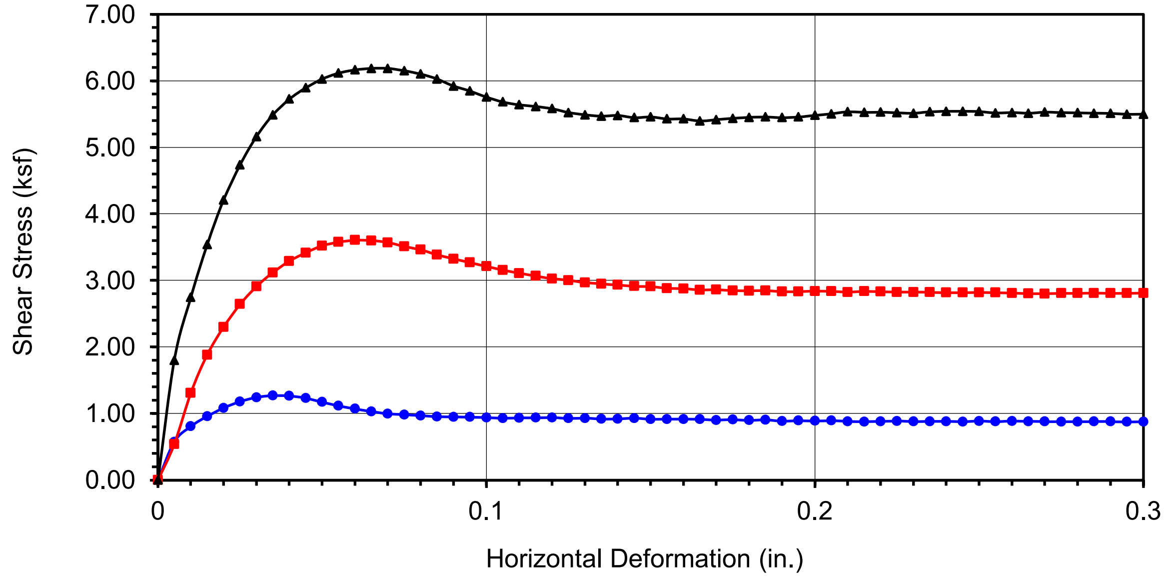
| | |
|---|---|
| Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000 | **1** |

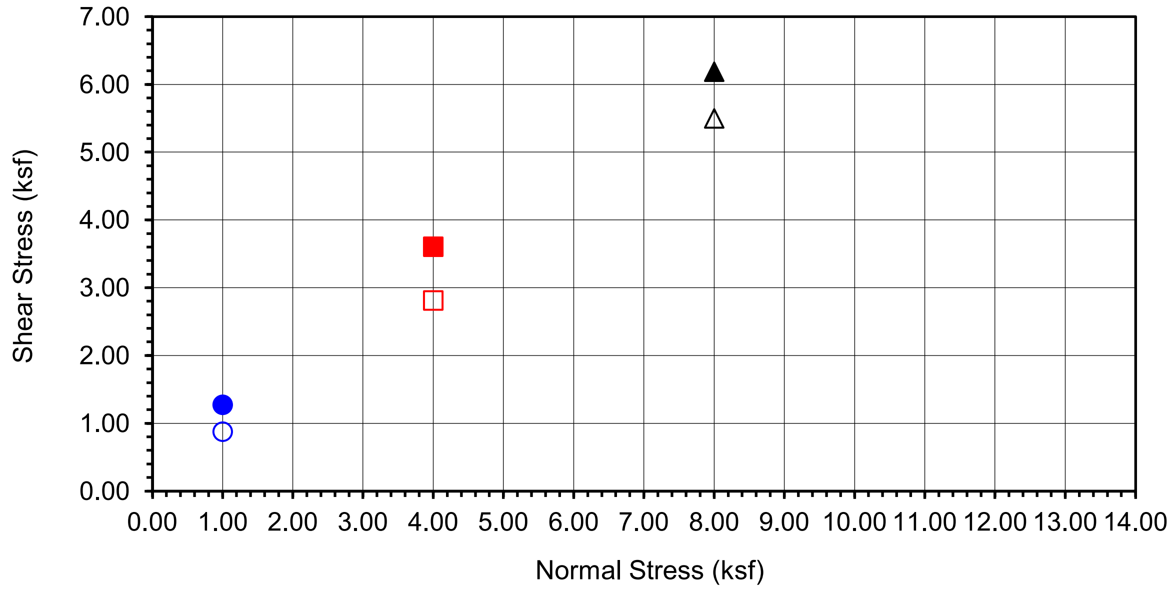
# DIRECT SHEAR TEST

**Consolidated Drained - ASTM D 3080**

| | | | | | |
|---|---|---|---|---|---|
| Project Name: | Griffin OC Workforce Reentry | Tested By: | G. Bathala | Date: | 07/09/24 |
| Project No.: | 036.0000020833 | Checked By: | A. Santos | Date: | 08/01/24 |
| Boring No.: | LB-1 | Sample Type: | Bulk | | |
| Sample No.: | B-1 | Depth (ft.): | 0-5 | | |
| Soil Identification: | Olive brown sandy silt s(ML) | | | | |

| | | | |
|---|---|---|---|
| Sample Diameter(in): | 2.415 | 2.415 | 2.415 |
| Sample Thickness(in.): | 1.000 | 1.000 | 1.000 |
| Weight of Sample + ring(gm): | 204.16 | 203.46 | 201.69 |
| Weight of Ring(gm): | 45.13 | 44.33 | 42.41 |
| **Before Shearing** | | | |
| Weight of Wet Sample+Cont.(gm): | 192.07 | 192.07 | 192.07 |
| Weight of Dry Sample+Cont.(gm): | 181.20 | 181.20 | 181.20 |
| Weight of Container(gm): | 68.52 | 68.52 | 68.52 |
| Vertical Rdg.(in): Initial | 0.2431 | 0.2501 | 0.0000 |
| Vertical Rdg.(in): Final | 0.2530 | 0.2695 | -0.0236 |
| **After Shearing** | | | |
| Weight of Wet Sample+Cont.(gm): | 224.25 | 221.80 | 199.18 |
| Weight of Dry Sample+Cont.(gm): | 205.82 | 203.56 | 181.13 |
| Weight of Container(gm): | 62.60 | 60.27 | 37.00 |
| Specific Gravity (Assumed): | 2.70 | 2.70 | 2.70 |
| Water Density(pcf): | 62.43 | 62.43 | 62.43 |




| | |
|---|---|
| **Boring No.** | **LB-1** |
| **Sample No.** | **B-1** |
| **Depth (ft)** | **0-5** |

Sample Type:

Bulk

Soil Identification:

Olive brown sandy silt s(ML)

| | | | |
|---|---|---|---|
| Normal Stress (kip/ft²) | 1.000 | 4.000 | 8.000 |
| Peak Shear Stress (kip/ft²) | ● 1.270 | ■ 3.606 | ▲ 6.187 |
| Shear Stress @ End of Test (ksf) | ○ 0.877 | □ 2.811 | △ 5.498 |
| Deformation Rate (in./min.) | 0.0025 | 0.0025 | 0.0025 |
| Initial Sample Height (in.) | 1.000 | 1.000 | 1.000 |
| Diameter (in.) | 2.415 | 2.415 | 2.415 |
| Initial Moisture Content (%) | 9.65 | 9.65 | 9.65 |
| Dry Density (pcf) | 120.6 | 120.7 | 120.8 |
| Saturation (%) | 65.5 | 65.7 | 65.9 |
| Soil Height Before Shearing (in.) | 0.9901 | 0.9806 | 0.9764 |
| Final Moisture Content (%) | 12.9 | 12.7 | 12.5 |

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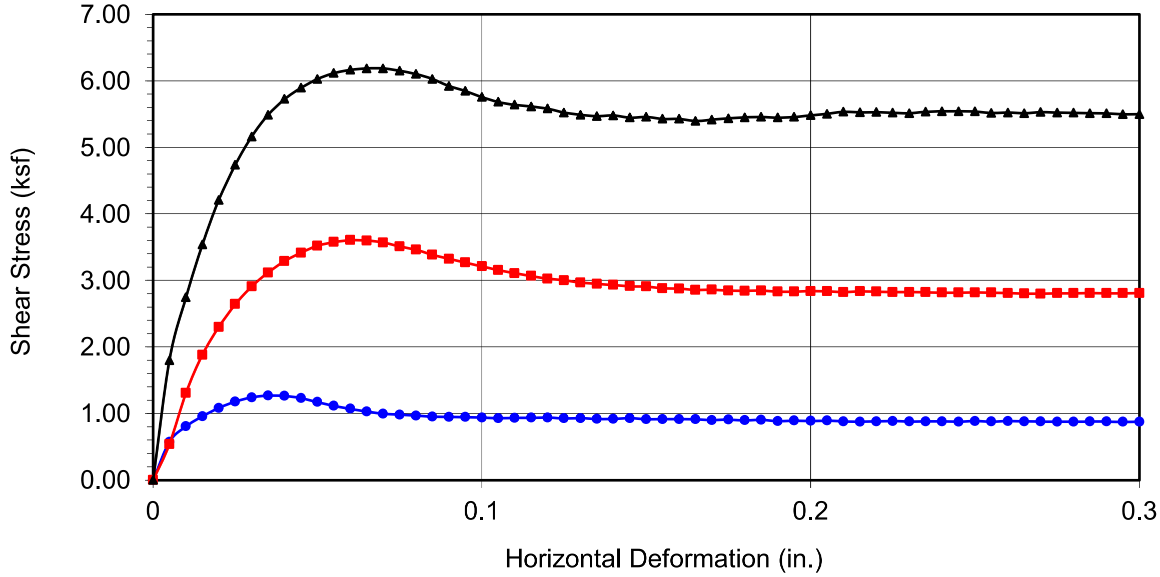
**DIRECT SHEAR TEST RESULTS**

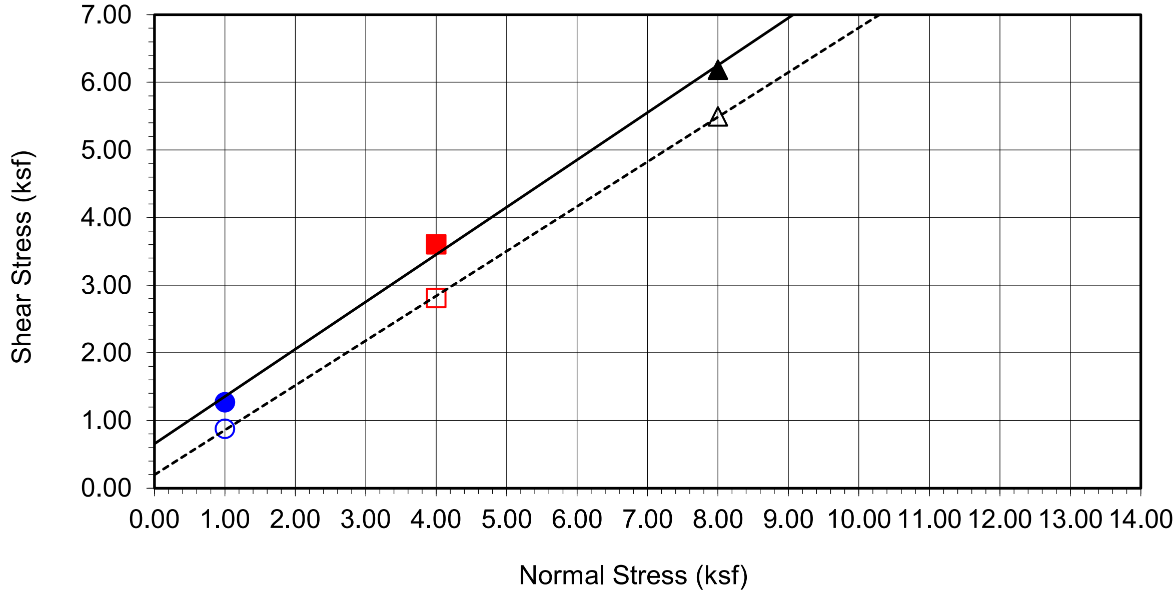
**Consolidated Drained - ASTM D 3080**

Project No.: 036.0000020833

Griffin OC Workforce Reentry

07-24




| | |
|---|---|
| **Boring No.** | **LB-1** |
| **Sample No.** | **B-1** |
| **Depth (ft)** | **0-5** |
| Sample Type: | Bulk |

Soil Identification:
Olive brown sandy silt s(ML)

**Strength Parameters**

| | C (psf) | ϕ (°) |
|---|---|---|
| Peak | 657 | 35 |
| Ultimate | 199 | 33 |

| | | | |
|---|---|---|---|
| Normal Stress (kip/ft²) | 1.000 | 4.000 | 8.000 |
| Peak Shear Stress (kip/ft²) | ● 1.270 | ■ 3.606 | ▲ 6.187 |
| Shear Stress @ End of Test (ksf) | ○ 0.877 | □ 2.811 | △ 5.498 |
| Deformation Rate (in./min.) | 0.0025 | 0.0025 | 0.0025 |
| Initial Sample Height (in.) | 1.000 | 1.000 | 1.000 |
| Diameter (in.) | 2.415 | 2.415 | 2.415 |
| Initial Moisture Content (%) | 9.65 | 9.65 | 9.65 |
| Dry Density (pcf) | 120.6 | 120.7 | 120.8 |
| Saturation (%) | 65.5 | 65.7 | 65.9 |
| Soil Height Before Shearing (in.) | 0.9901 | 0.9806 | 0.9764 |
| Final Moisture Content (%) | 12.9 | 12.7 | 12.5 |

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**DIRECT SHEAR TEST RESULTS**
**Consolidated Drained - ASTM D 3080**

Project No.: 036.0000020833

Griffin OC Workforce Reentry

07-24

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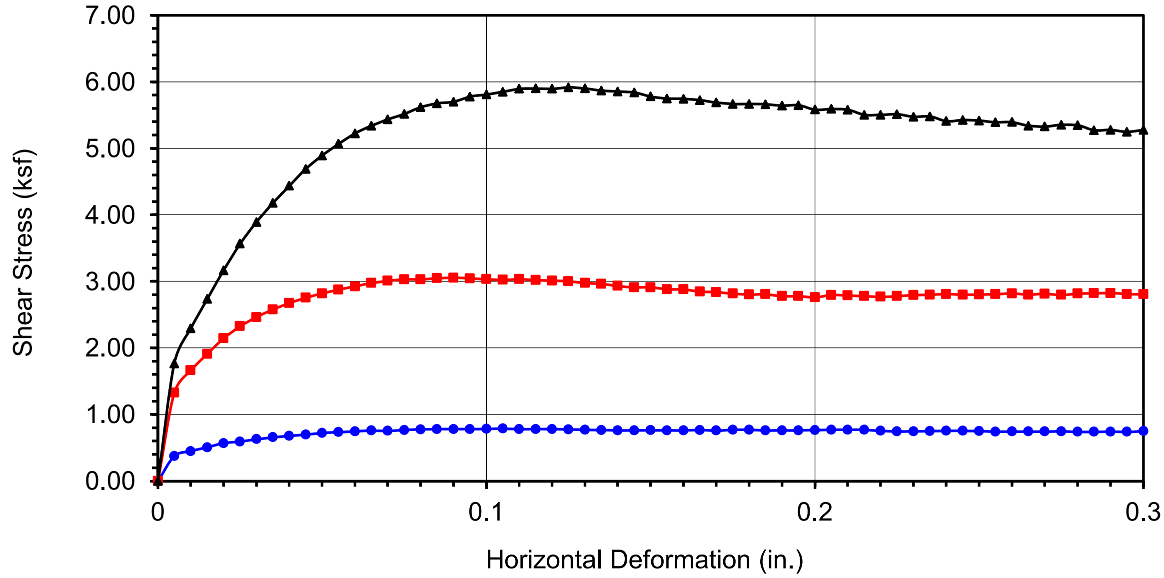
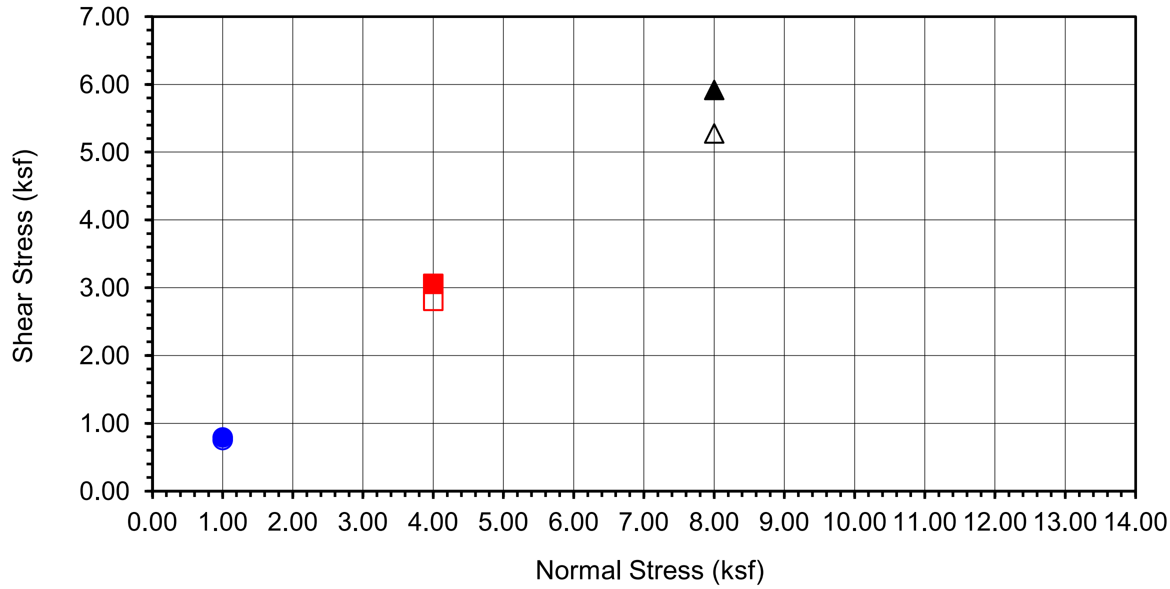
# DIRECT SHEAR TEST

**Consolidated Drained - ASTM D 3080**

| | | | | | |
|---|---|---|---|---|---|
| Project Name: | Griffin OC Workforce Reentry | Tested By: | G. Bathala | Date: | 07/10/24 |
| Project No.: | 036.0000020833 | Checked By: | A. Santos | Date: | 07/31/24 |
| Boring No.: | LB-1 | Sample Type: | Ring | | |
| Sample No.: | R-1 | Depth (ft.): | 7.5 | | |
| Soil Identification: | Light brown poorly-graded sand (SP) | | | | |

| | | | |
|---|---|---|---|
| Sample Diameter(in): | 2.415 | 2.415 | 2.415 |
| Sample Thickness(in.): | 1.000 | 1.000 | 1.000 |
| Weight of Sample + ring(gm): | 164.37 | 165.43 | 173.12 |
| Weight of Ring(gm): | 45.07 | 41.27 | 45.50 |
| **Before Shearing** | | | |
| Weight of Wet Sample+Cont.(gm): | 178.52 | 178.52 | 178.52 |
| Weight of Dry Sample+Cont.(gm): | 176.08 | 176.08 | 176.08 |
| Weight of Container(gm): | 52.93 | 52.93 | 52.93 |
| Vertical Rdg.(in): Initial | 0.0000 | 0.2557 | 0.2588 |
| Vertical Rdg.(in): Final | -0.0116 | 0.2857 | 0.2899 |
| **After Shearing** | | | |
| Weight of Wet Sample+Cont.(gm): | 198.84 | 174.04 | 177.70 |
| Weight of Dry Sample+Cont.(gm): | 177.52 | 153.54 | 158.51 |
| Weight of Container(gm): | 64.77 | 36.53 | 38.48 |
| Specific Gravity (Assumed): | 2.70 | 2.70 | 2.70 |
| Water Density(pcf): | 62.43 | 62.43 | 62.43 |




| | |
|---|---|
| **Boring No.** | **LB-1** |
| **Sample No.** | **R-1** |
| **Depth (ft)** | **7.5** |

<u>Sample Type:</u>

Ring

<u>Soil Identification:</u>
Light brown poorly-graded sand (SP)

| | | | |
|---|---|---|---|
| Normal Stress (kip/ft²) | 1.000 | 4.000 | 8.000 |
| Peak Shear Stress (kip/ft²) | ● 0.789 | ■ 3.056 | ▲ 5.917 |
| Shear Stress @ End of Test (ksf) | ○ 0.751 | □ 2.807 | △ 5.278 |
| Deformation Rate (in./min.) | 0.0050 | 0.0050 | 0.0050 |
| Initial Sample Height (in.) | 1.000 | 1.000 | 1.000 |
| Diameter (in.) | 2.415 | 2.415 | 2.415 |
| Initial Moisture Content (%) | 1.98 | 1.98 | 1.98 |
| Dry Density (pcf) | 97.3 | 101.3 | 104.1 |
| Saturation (%) | 7.3 | 8.0 | 8.6 |
| Soil Height Before Shearing (in.) | 0.9884 | 0.9700 | 0.9689 |
| Final Moisture Content (%) | 18.9 | 17.5 | 16.0 |

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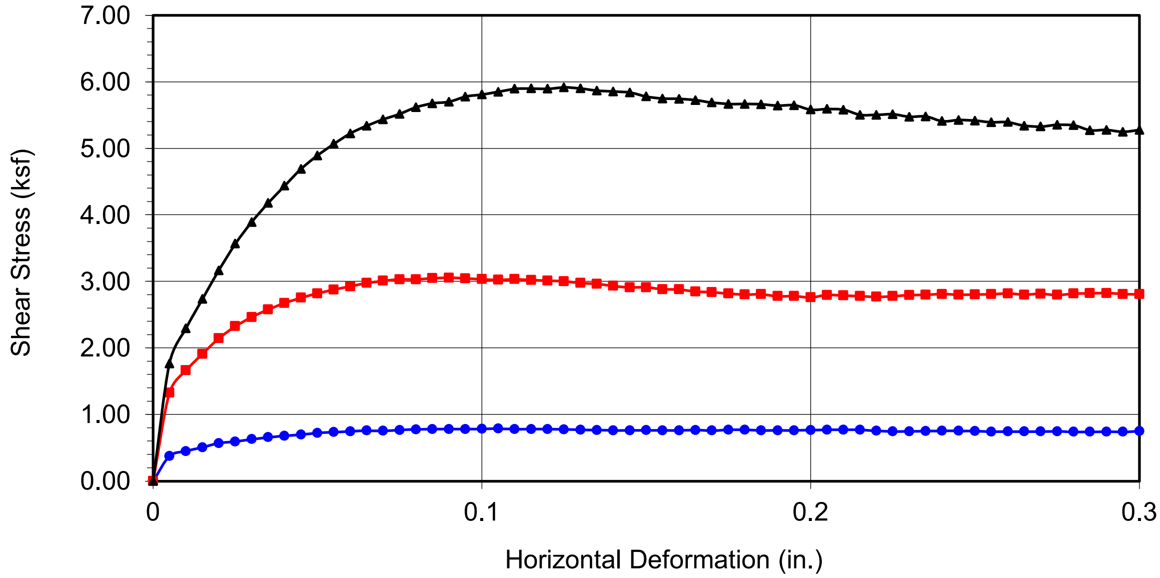
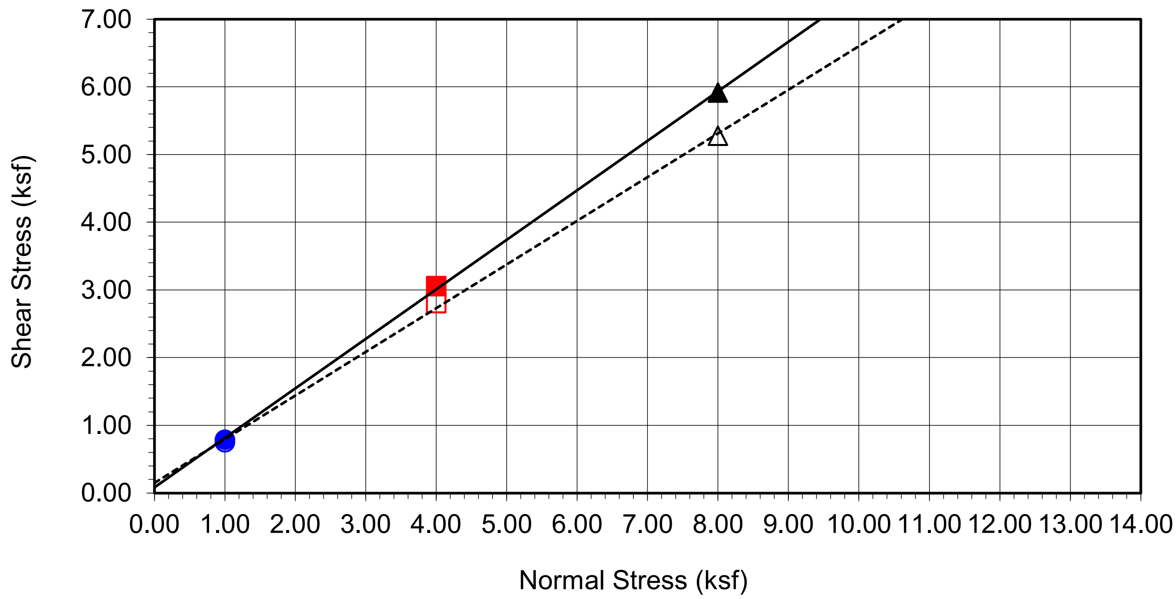
**DIRECT SHEAR TEST RESULTS**
**Consolidated Drained - ASTM D 3080**

Project No.: 036.0000020833

Griffin OC Workforce Reentry

07-24




| | |
|---|---|
| **Boring No.** | **LB-1** |
| **Sample No.** | **R-1** |
| **Depth (ft)** | **7.5** |
| Sample Type: | Ring |
| Soil Identification: Light brown poorly-graded sand (SP) | |

**Strength Parameters**

| | C (psf) | ϕ (°) |
|---|---|---|
| Peak | 84 | 36 |
| Ultimate | 150 | 33 |

| | | | |
|---|---|---|---|
| Normal Stress (kip/ft²) | 1.000 | 4.000 | 8.000 |
| Peak Shear Stress (kip/ft²) | ● 0.789 | ■ 3.056 | ▲ 5.917 |
| Shear Stress @ End of Test (ksf) | ○ 0.751 | □ 2.807 | △ 5.278 |
| Deformation Rate (in./min.) | 0.0050 | 0.0050 | 0.0050 |
| Initial Sample Height (in.) | 1.000 | 1.000 | 1.000 |
| Diameter (in.) | 2.415 | 2.415 | 2.415 |
| Initial Moisture Content (%) | 1.98 | 1.98 | 1.98 |
| Dry Density (pcf) | 97.3 | 101.3 | 104.1 |
| Saturation (%) | 7.3 | 8.0 | 8.6 |
| Soil Height Before Shearing (in.) | 0.9884 | 0.9700 | 0.9689 |
| Final Moisture Content (%) | 18.9 | 17.5 | 16.0 |

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**DIRECT SHEAR TEST RESULTS**
**Consolidated Drained - ASTM D 3080**

Project No.: 036.0000020833

Griffin OC Workforce Reentry

07-24

# DIRECT SHEAR TEST

**Consolidated Drained - ASTM D 3080**

Project Name: Griffin OC Workforce Reentry
Tested By: G. Bathala
Date: 07/17/24

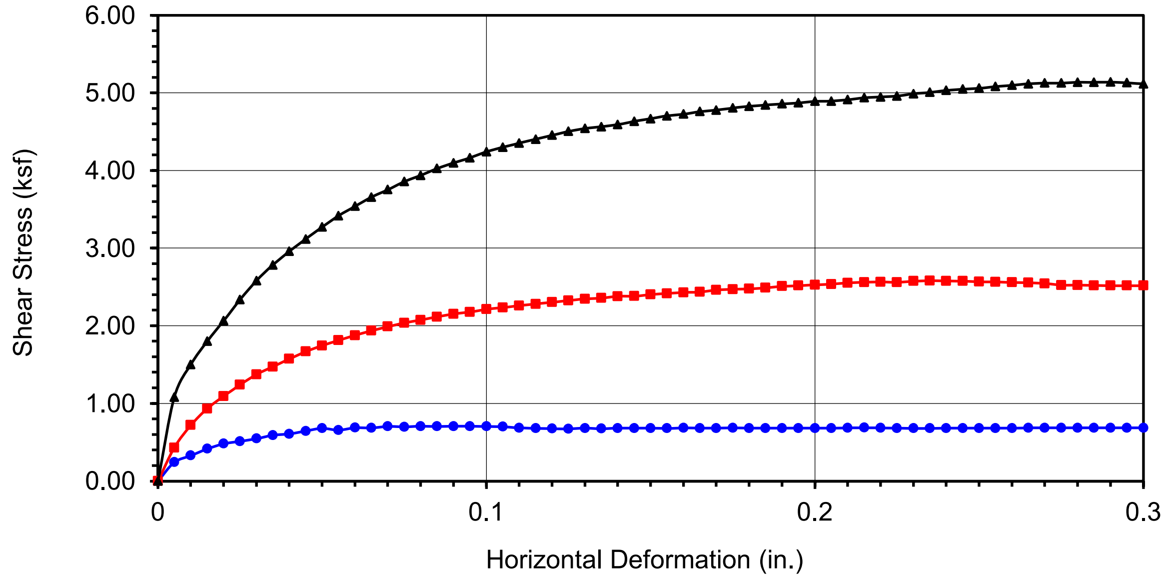
Project No.: 036.0000020833
Checked By: A. Santos
Date: 07/31/24

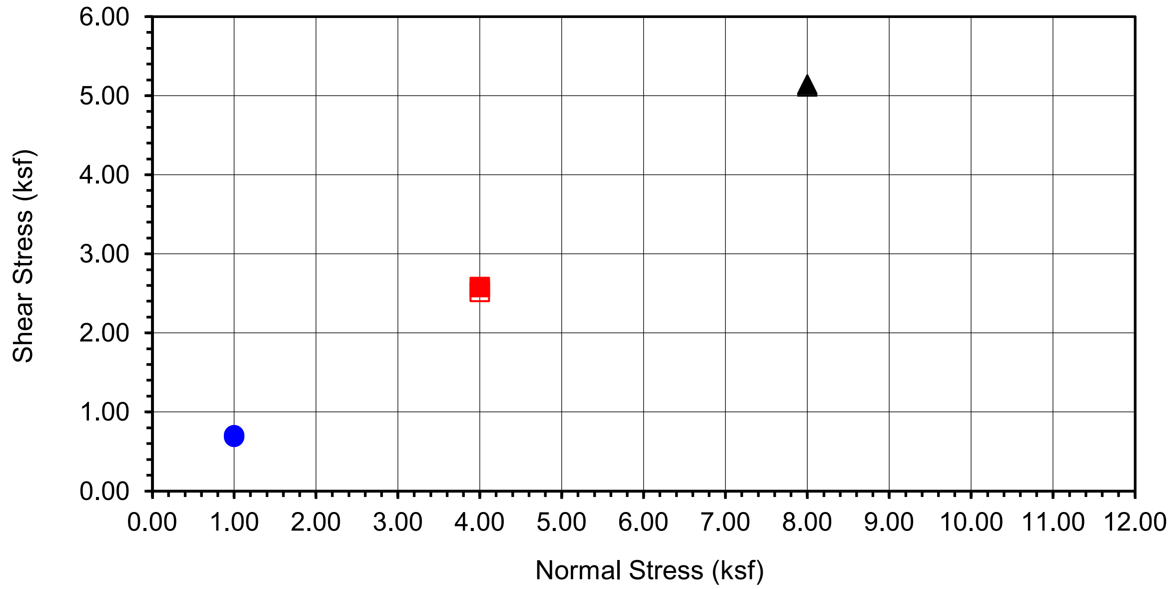
Boring No.: LB-1
Sample Type: Ring

Sample No.: R-2
Depth (ft.): 12.5

Soil Identification: Olive gray silty clay (CL-ML)

| | | | |
|---|---|---|---|
| Sample Diameter(in): | 2.415 | 2.415 | 2.415 |
| Sample Thickness(in.): | 1.000 | 1.000 | 1.000 |
| Weight of Sample + ring(gm): | 172.40 | 168.84 | 176.65 |
| Weight of Ring(gm): | 44.31 | 37.44 | 43.48 |
| **Before Shearing** | | | |
| Weight of Wet Sample+Cont.(gm): | 174.35 | 174.35 | 174.35 |
| Weight of Dry Sample+Cont.(gm): | 165.33 | 165.33 | 165.33 |
| Weight of Container(gm): | 59.16 | 59.16 | 59.16 |
| Vertical Rdg.(in): Initial | 0.2506 | 0.2615 | 0.0000 |
| Vertical Rdg.(in): Final | 0.2694 | 0.3096 | -0.0650 |
| **After Shearing** | | | |
| Weight of Wet Sample+Cont.(gm): | 198.11 | 201.98 | 196.97 |
| Weight of Dry Sample+Cont.(gm): | 172.19 | 178.48 | 175.15 |
| Weight of Container(gm): | 57.12 | 60.26 | 55.13 |
| Specific Gravity (Assumed): | 2.70 | 2.70 | 2.70 |
| Water Density(pcf): | 62.43 | 62.43 | 62.43 |




| | |
|---|---|
| **Boring No.** | **LB-1** |
| **Sample No.** | **R-2** |
| **Depth (ft)** | **12.5** |

Sample Type:

Ring

Soil Identification:

Olive gray silty clay (CL-ML)

| | | | |
|---|---|---|---|
| Normal Stress (kip/ft²) | 1.000 | 4.000 | 8.000 |
| Peak Shear Stress (kip/ft²) | ● 0.707 | ■ 2.581 | ▲ 5.140 |
| Shear Stress @ End of Test (ksf) | ○ 0.685 | □ 2.518 | △ 5.118 |
| Deformation Rate (in./min.) | 0.0017 | 0.0017 | 0.0017 |
| Initial Sample Height (in.) | 1.000 | 1.000 | 1.000 |
| Diameter (in.) | 2.415 | 2.415 | 2.415 |
| Initial Moisture Content (%) | 8.50 | 8.50 | 8.50 |
| Dry Density (pcf) | 98.2 | 100.7 | 102.1 |
| Saturation (%) | 32.0 | 34.1 | 35.2 |
| Soil Height Before Shearing (in.) | 0.9812 | 0.9519 | 0.9350 |
| Final Moisture Content (%) | 22.5 | 19.9 | 18.2 |

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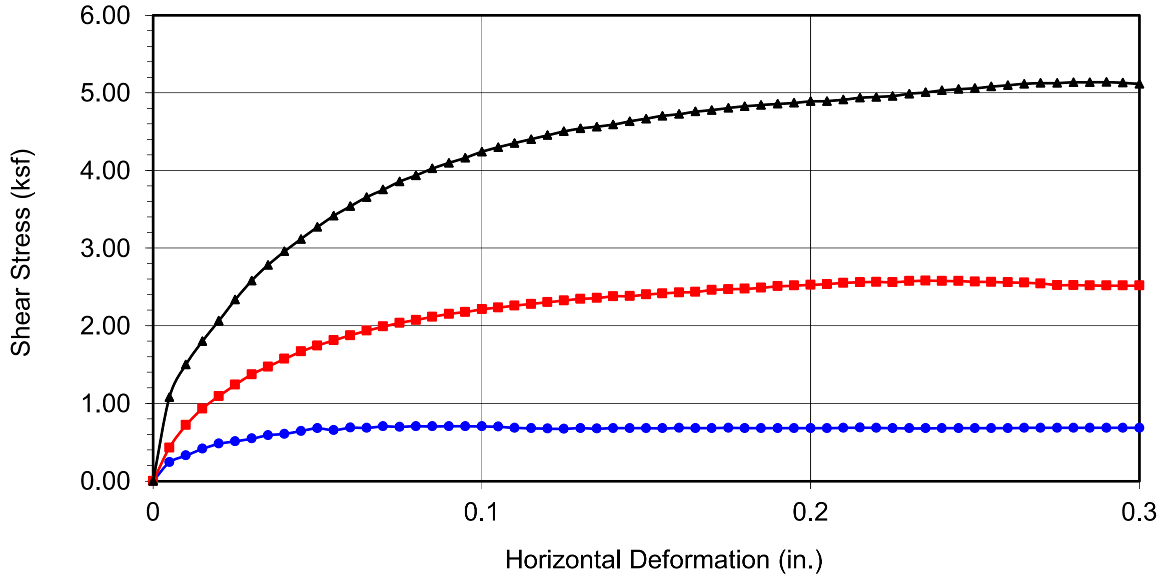
**DIRECT SHEAR TEST RESULTS**

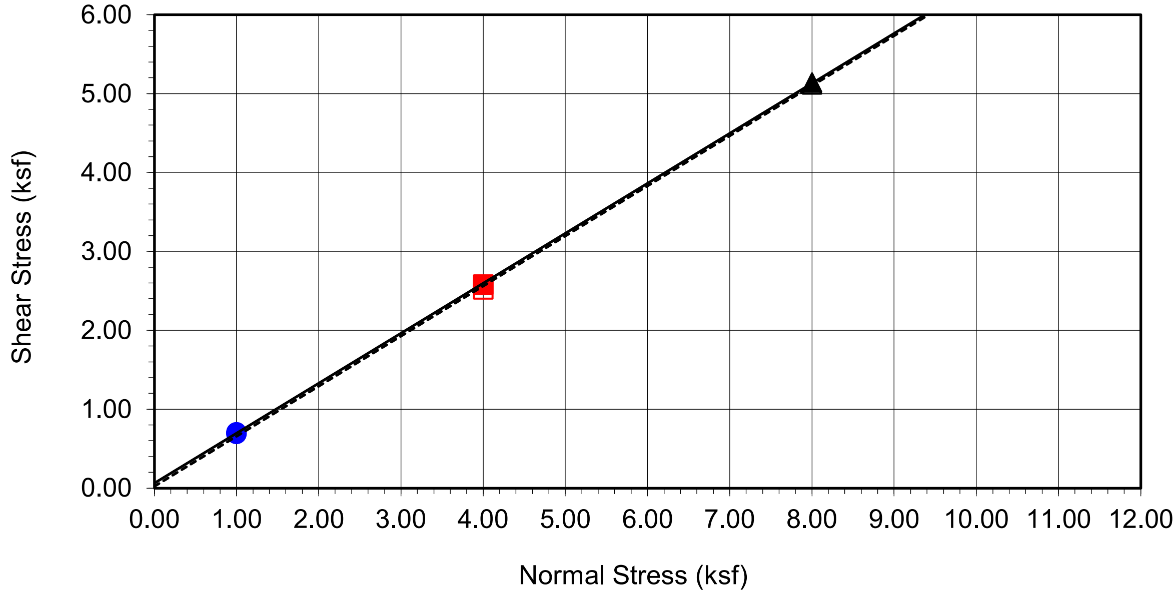
**Consolidated Drained - ASTM D 3080**

Project No.: 036.0000020833

Griffin OC Workforce Reentry

07-24




| | |
|---|---|
| **Boring No.** | **LB-1** |
| **Sample No.** | **R-2** |
| **Depth (ft)** | **12.5** |
| Sample Type: | Ring |

Soil Identification:

Olive gray silty clay (CL-ML)

**Strength Parameters**

| | C (psf) | $\phi$ ($^o$) |
|---|---|---|
| Peak | 64 | 32 |
| Ultimate | 26 | 32 |

| | | | |
|---|---|---|---|
| Normal Stress (kip/ft²) | 1.000 | 4.000 | 8.000 |
| Peak Shear Stress (kip/ft²) | ● 0.707 | ■ 2.581 | ▲ 5.140 |
| Shear Stress @ End of Test (ksf) | ○ 0.685 | □ 2.518 | △ 5.118 |
| Deformation Rate (in./min.) | 0.0017 | 0.0017 | 0.0017 |
| Initial Sample Height (in.) | 1.000 | 1.000 | 1.000 |
| Diameter (in.) | 2.415 | 2.415 | 2.415 |
| Initial Moisture Content (%) | 8.50 | 8.50 | 8.50 |
| Dry Density (pcf) | 98.2 | 100.7 | 102.1 |
| Saturation (%) | 32.0 | 34.1 | 35.2 |
| Soil Height Before Shearing (in.) | 0.9812 | 0.9519 | 0.9350 |
| Final Moisture Content (%) | 22.5 | 19.9 | 18.2 |

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**DIRECT SHEAR TEST RESULTS**

**Consolidated Drained - ASTM D 3080**

Project No.: 036.0000020833

Griffin OC Workforce Reentry

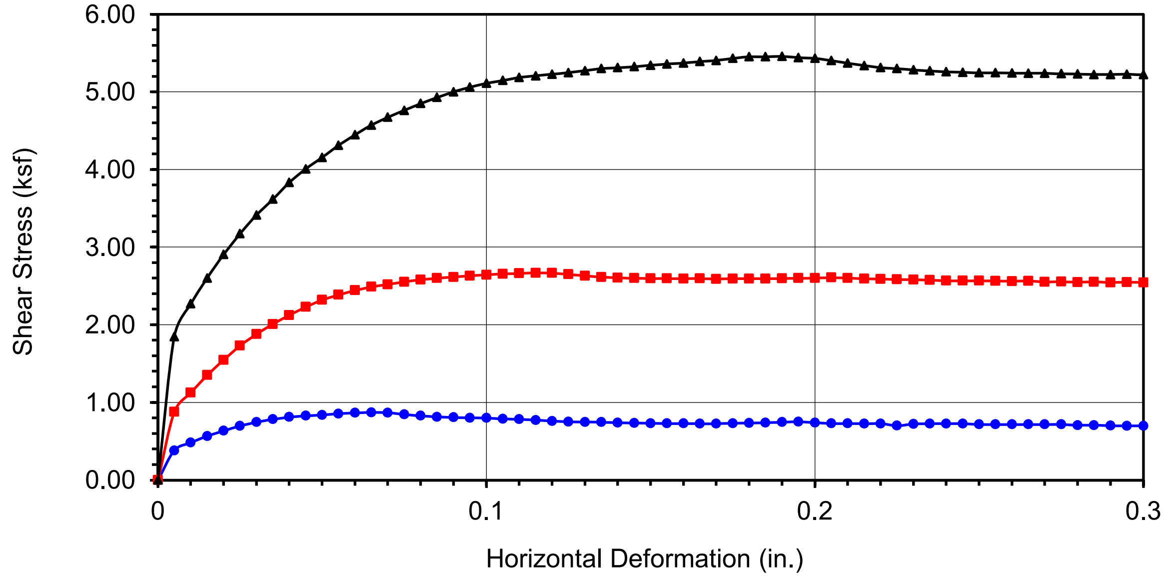
07-24

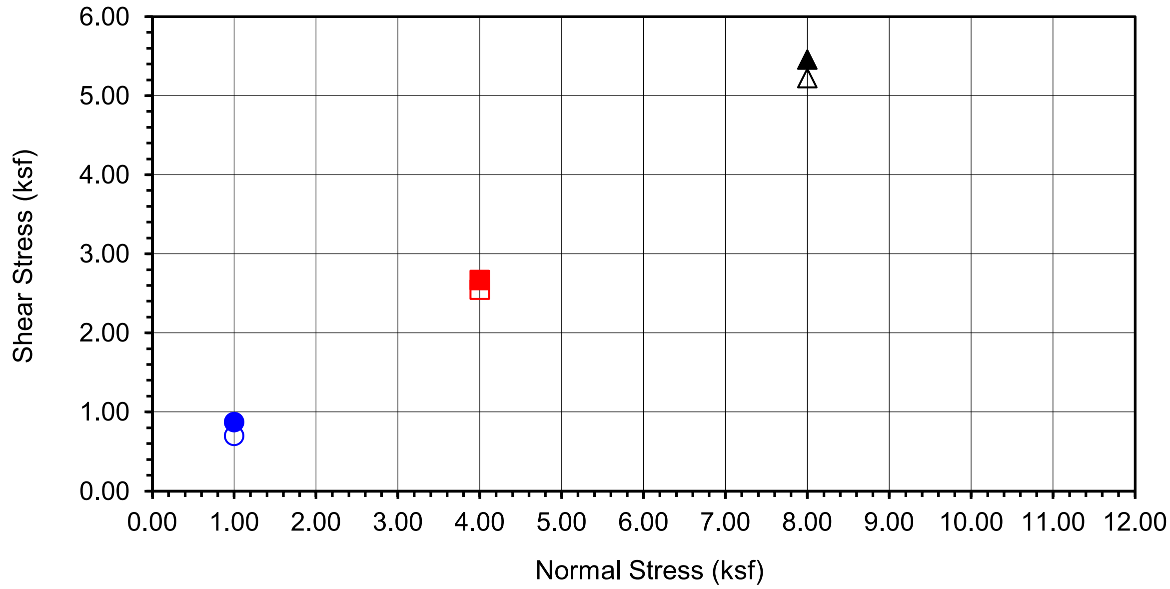
# DIRECT SHEAR TEST

**Consolidated Drained - ASTM D 3080**

| | | | | | |
|---|---|---|---|---|---|
| Project Name: | Griffin OC Workforce Reentry | Tested By: | G. Bathala | Date: | 07/17/24 |
| Project No.: | 036.0000020833 | Checked By: | A. Santos | Date: | 07/31/24 |
| Boring No.: | LB-5 | Sample Type: | Ring | | |
| Sample No.: | R-2 | Depth (ft.): | 10.0 | | |
| Soil Identification: | Olive gray silty clay (CL-ML) | | | | |

| | | | |
|---|---|---|---|
| Sample Diameter(in): | 2.415 | 2.415 | 2.415 |
| Sample Thickness(in.): | 1.000 | 1.000 | 1.000 |
| Weight of Sample + ring(gm): | 188.40 | 188.78 | 189.67 |
| Weight of Ring(gm): | 41.76 | 41.32 | 40.87 |
| **Before Shearing** | | | |
| Weight of Wet Sample+Cont.(gm): | 217.95 | 217.95 | 217.95 |
| Weight of Dry Sample+Cont.(gm): | 188.87 | 188.87 | 188.87 |
| Weight of Container(gm): | 60.36 | 60.36 | 60.36 |
| Vertical Rdg.(in): Initial | 0.2622 | 0.2852 | 0.0000 |
| Vertical Rdg.(in): Final | 0.2733 | 0.3483 | -0.0551 |
| **After Shearing** | | | |
| Weight of Wet Sample+Cont.(gm): | 201.55 | 205.63 | 215.96 |
| Weight of Dry Sample+Cont.(gm): | 169.93 | 178.22 | 191.48 |
| Weight of Container(gm): | 55.45 | 61.80 | 72.04 |
| Specific Gravity (Assumed): | 2.70 | 2.70 | 2.70 |
| Water Density(pcf): | 62.43 | 62.43 | 62.43 |




| | |
|---|---|
| **Boring No.** | **LB-5** |
| **Sample No.** | **R-2** |
| **Depth (ft)** | **10** |
| Sample Type: | |
| Ring | |
| Soil Identification: | |
| Olive gray silty clay (CL-ML) | |

| | | | |
|---|---|---|---|
| Normal Stress (kip/ft²) | 1.000 | 4.000 | 8.000 |
| Peak Shear Stress (kip/ft²) | ● 0.871 | ■ 2.669 | ▲ 5.458 |
| Shear Stress @ End of Test (ksf) | ○ 0.698 | □ 2.546 | △ 5.222 |
| Deformation Rate (in./min.) | 0.0017 | 0.0017 | 0.0017 |
| Initial Sample Height (in.) | 1.000 | 1.000 | 1.000 |
| Diameter (in.) | 2.415 | 2.415 | 2.415 |
| Initial Moisture Content (%) | 22.63 | 22.63 | 22.63 |
| Dry Density (pcf) | 99.5 | 100.0 | 100.9 |
| Saturation (%) | 87.9 | 89.1 | 91.1 |
| Soil Height Before Shearing (in.) | 0.9889 | 0.9369 | 0.9449 |
| Final Moisture Content (%) | 27.6 | 23.5 | 20.5 |

Leighton

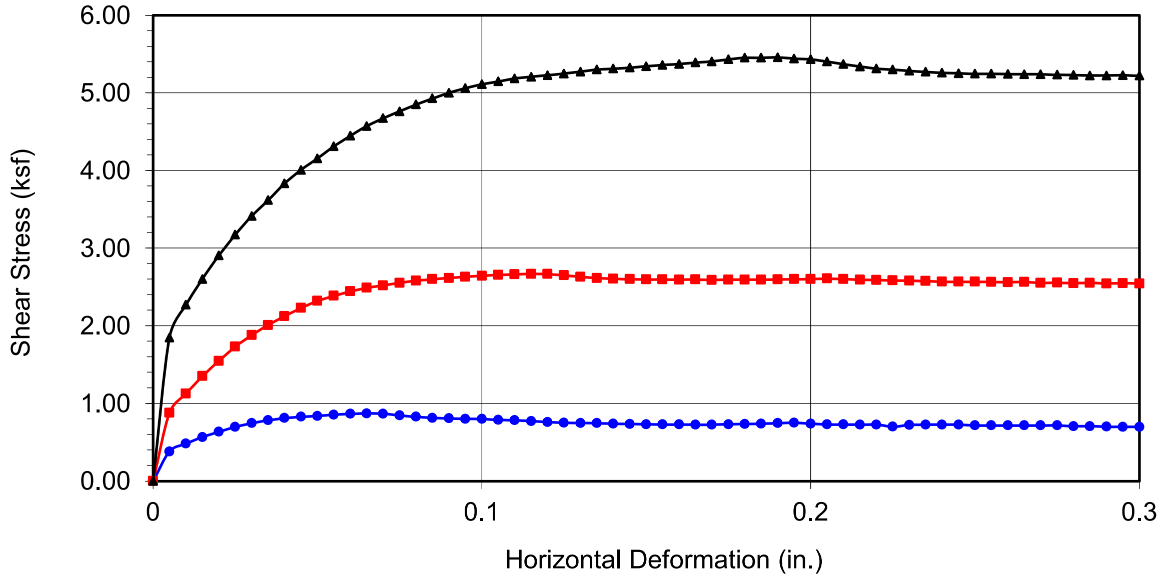
**DIRECT SHEAR TEST RESULTS**

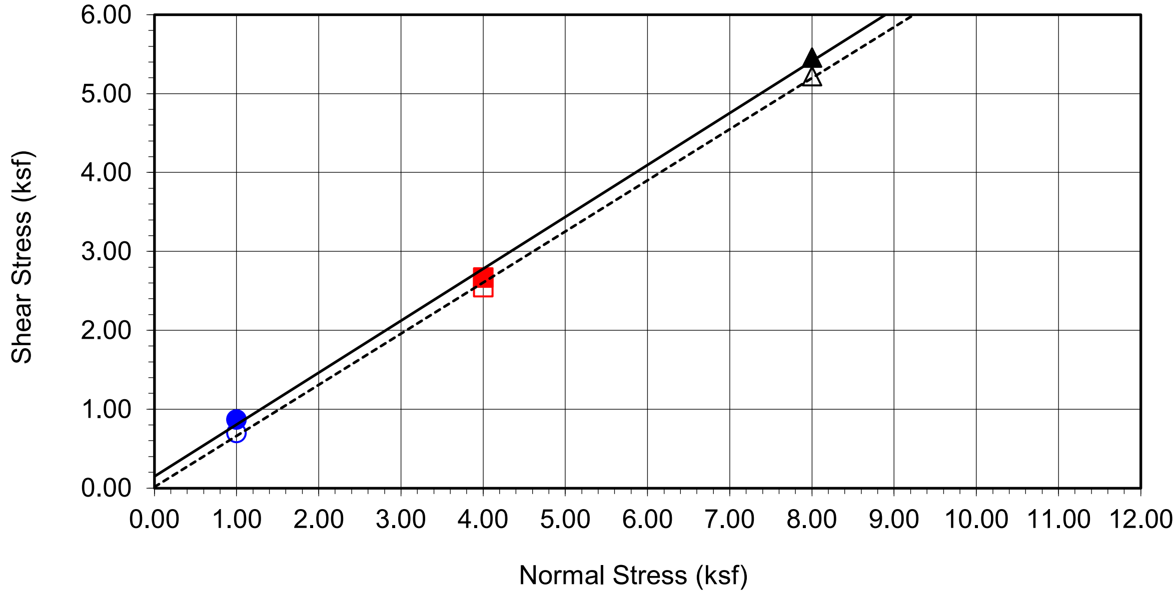
**Consolidated Drained - ASTM D 3080**

Project No.: 036.0000020833

Griffin OC Workforce Reentry

07-24




| | |
|---|---|
| **Boring No.** | **LB-5** |
| **Sample No.** | **R-2** |
| **Depth (ft)** | **10** |
| Sample Type: | Ring |
| Soil Identification: Olive gray silty clay (CL-ML) | |

**Strength Parameters**

| | C (psf) | ϕ (°) |
|---|---|---|
| Peak | 150 | 33 |
| Ultimate | 16 | 33 |

| | | | |
|---|---|---|---|
| Normal Stress (kip/ft²) | 1.000 | 4.000 | 8.000 |
| Peak Shear Stress (kip/ft²) | ● 0.871 | ■ 2.669 | ▲ 5.458 |
| Shear Stress @ End of Test (ksf) | ○ 0.698 | □ 2.546 | △ 5.222 |
| Deformation Rate (in./min.) | 0.0017 | 0.0017 | 0.0017 |
| Initial Sample Height (in.) | 1.000 | 1.000 | 1.000 |
| Diameter (in.) | 2.415 | 2.415 | 2.415 |
| Initial Moisture Content (%) | 22.63 | 22.63 | 22.63 |
| Dry Density (pcf) | 99.5 | 100.0 | 100.9 |
| Saturation (%) | 87.9 | 89.1 | 91.1 |
| Soil Height Before Shearing (in.) | 0.9889 | 0.9369 | 0.9449 |
| Final Moisture Content (%) | 27.6 | 23.5 | 20.5 |

Leighton

**DIRECT SHEAR TEST RESULTS**

**Consolidated Drained - ASTM D 3080**

Project No.: 036.0000020833

Griffin OC Workforce Reentry

07-24

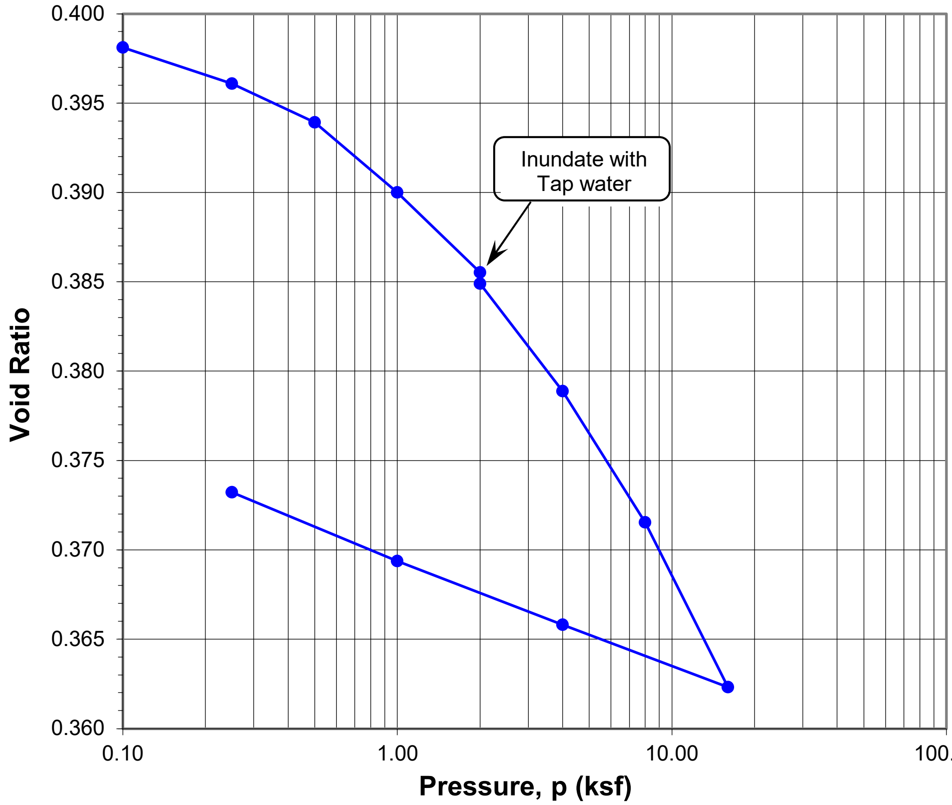
DS LB-5, R-2 @ 10

# ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

**ASTM D 2435**

| | | | |
|---|---|---|---|
| Project Name: | Griffin OC Workforce Reentry | Tested By: GB/JD | Date: 07/09/24 |
| Project No.: | 036.0000020833 | Checked By: A. Santos | Date: 07/31/24 |
| Boring No.: | LB-1 | Depth (ft.): 0-5 | |
| Sample No.: | B-1 | Sample Type: | Bulk |
| Soil Identification: | Olive brown sandy silt s(ML) | | |

| | |
|---|---|
| Sample Diameter (in.): | 2.415 |
| Sample Thickness (in.): | 1.000 |
| Weight of Sample + ring (g): | 204.68 |
| Weight of Ring (g): | 45.76 |
| Height after consol. (in.): | 0.9820 |
| **Before Test** | |
| Wt. of Wet Sample+Cont. (g): | 192.07 |
| Wt. of Dry Sample+Cont. (g): | 181.20 |
| Weight of Container (g): | 68.52 |
| Initial Moisture Content (%) | 9.6 |
| Initial Dry Density (pcf) | 120.5 |
| Initial Saturation (%): | 65 |
| Initial Vertical Reading (in.) | 0.0921 |
| **After Test** | |
| Wt. of Wet Sample+Cont. (g): | 261.71 |
| Wt. of Dry Sample+Cont. (g): | 243.75 |
| Weight of Container (g): | 52.94 |
| Final Moisture Content (%) | 12.38 |
| Final Dry Density (pcf): | 122.8 |
| Final Saturation (%): | 90 |
| Final Vertical Reading (in.) | 0.1118 |
| Specific Gravity (assumed): | 2.70 |
| Water Density (pcf): | 62.43 |

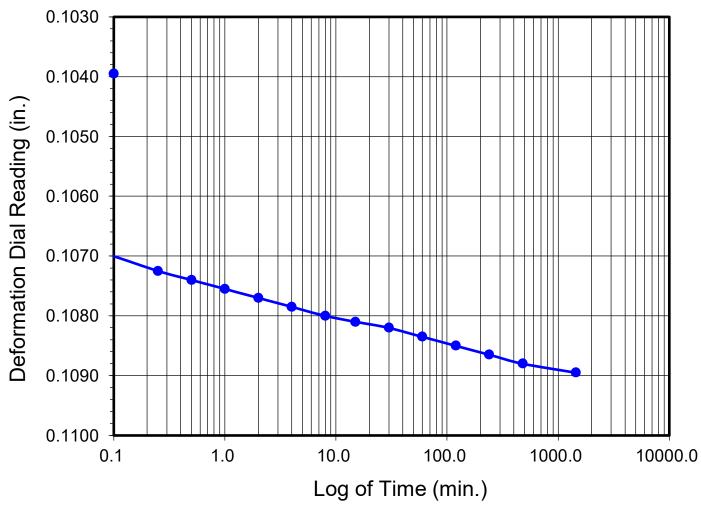


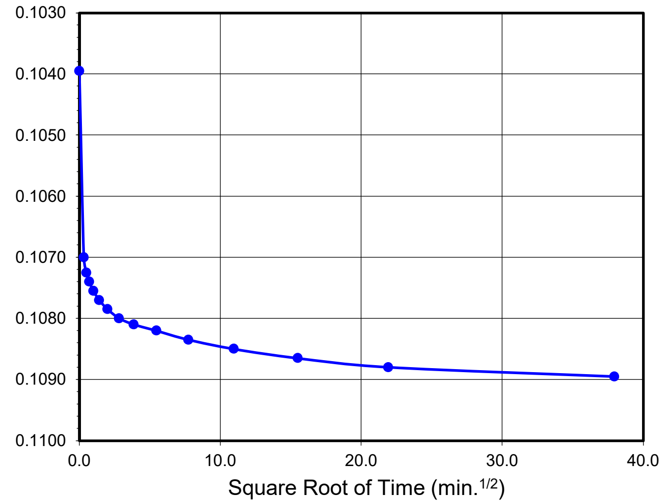

| Pressure (p) (ksf) | Final Reading (in.) | Apparent Thickness (in.) | Load Compliance (%) | Deformation % of Sample Thickness | Void Ratio | Corrected Deforma-tion (%) |
|---|---|---|---|---|---|---|
| 0.10 | 0.0923 | 0.9998 | 0.00 | 0.02 | 0.398 | 0.02 |
| 0.25 | 0.0942 | 0.9980 | 0.04 | 0.21 | 0.396 | 0.17 |
| 0.50 | 0.0962 | 0.9959 | 0.09 | 0.41 | 0.394 | 0.32 |
| 1.00 | 0.0996 | 0.9925 | 0.15 | 0.75 | 0.390 | 0.60 |
| 2.00 | 0.1035 | 0.9886 | 0.22 | 1.14 | 0.386 | 0.92 |
| 2.00 | 0.1040 | 0.9882 | 0.22 | 1.19 | 0.385 | 0.97 |
| 4.00 | 0.1090 | 0.9832 | 0.29 | 1.69 | 0.379 | 1.40 |
| 8.00 | 0.1150 | 0.9771 | 0.37 | 2.29 | 0.372 | 1.92 |
| 16.00 | 0.1227 | 0.9694 | 0.48 | 3.06 | 0.362 | 2.58 |
| 4.00 | 0.1190 | 0.9731 | 0.36 | 2.69 | 0.366 | 2.33 |
| 1.00 | 0.1154 | 0.9768 | 0.25 | 2.33 | 0.369 | 2.08 |
| 0.25 | 0.1118 | 0.9803 | 0.17 | 1.97 | 0.373 | 1.80 |

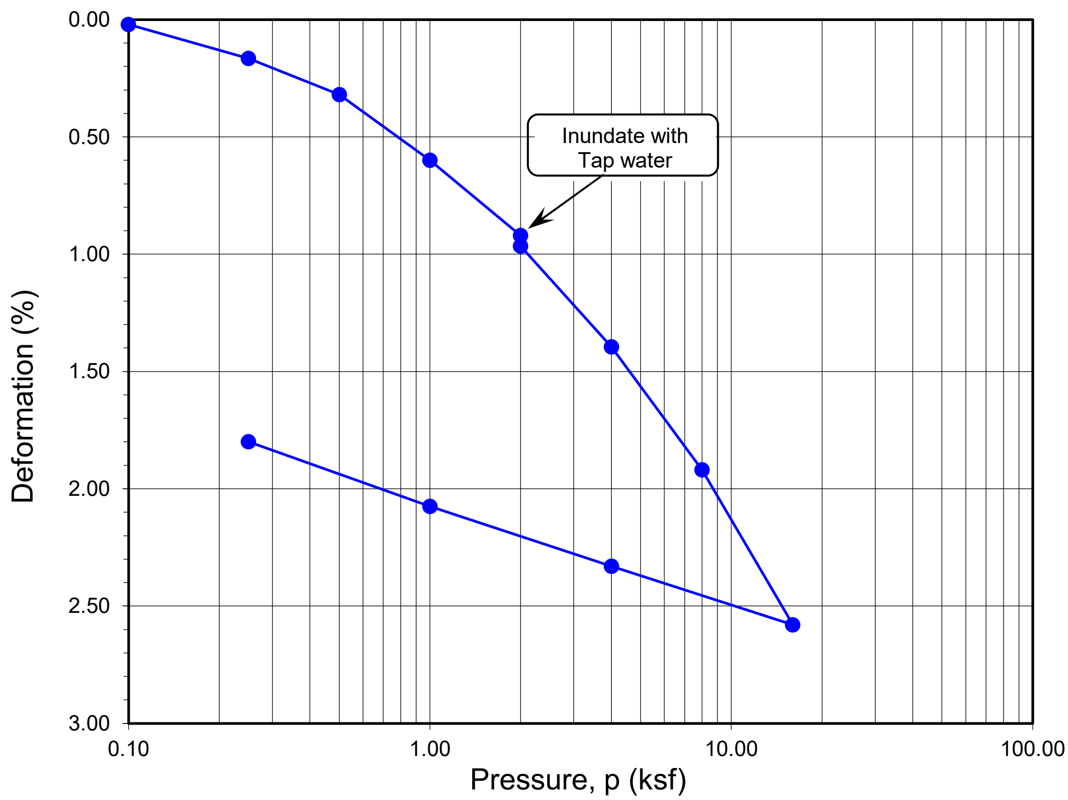
**Time Readings @ 4.0 ksf**

| Date | Time | Elapsed Time (min) | Square Root of Time | Dial Rdgs. (in.) |
|---|---|---|---|---|
| 7/12/24 | 7:40:00 | 0.0 | 0.0 | 0.1040 |
| 7/12/24 | 7:40:06 | 0.1 | 0.3 | 0.1070 |
| 7/12/24 | 7:40:15 | 0.2 | 0.5 | 0.1073 |
| 7/12/24 | 7:40:30 | 0.5 | 0.7 | 0.1074 |
| 7/12/24 | 7:41:00 | 1.0 | 1.0 | 0.1076 |
| 7/12/24 | 7:42:00 | 2.0 | 1.4 | 0.1077 |
| 7/12/24 | 7:44:00 | 4.0 | 2.0 | 0.1079 |
| 7/12/24 | 7:48:00 | 8.0 | 2.8 | 0.1080 |
| 7/12/24 | 7:55:00 | 15.0 | 3.9 | 0.1081 |
| 7/12/24 | 8:10:00 | 30.0 | 5.5 | 0.1082 |
| 7/12/24 | 8:40:00 | 60.0 | 7.7 | 0.1084 |
| 7/12/24 | 9:40:00 | 120.0 | 11.0 | 0.1085 |
| 7/12/24 | 11:40:00 | 240.0 | 15.5 | 0.1087 |
| 7/12/24 | 15:40:00 | 480.0 | 21.9 | 0.1088 |
| 7/13/24 | 7:40:00 | 1440.0 | 37.9 | 0.1090 |

Time Readings @ 4.0 ksf




| Boring No. | Sample No. | Depth (ft.) | Moisture Content (%) | | Dry Density (pcf) | | Void Ratio | | Degree of Saturation (%) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Initial | Final | Initial | Final | Initial | Final | Initial | Final |
| **LB-1** | **B-1** | **0-5** | **9.6** | **12.4** | **120.5** | **122.8** | **0.398** | **0.373** | **65** | **90** |

Soil Identification: Olive brown sandy silt s(ML)

Leighton

**ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS**
**ASTM D 2435**

Project No.: 036.0000020833

Griffin OC Workforce Reentry

08-24

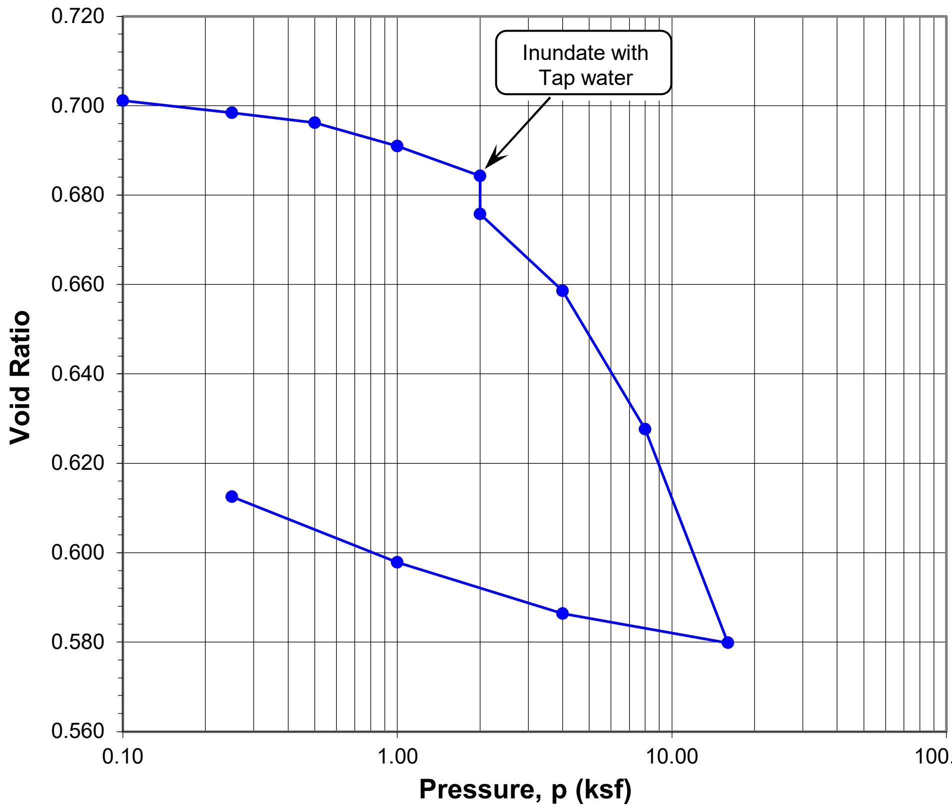
# ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

**ASTM D 2435**

Leighton

| | | | |
|---|---|---|---|
| Project Name: | Griffin OC Workforce Reentry | Tested By: GB/JD | Date: 07/09/24 |
| Project No.: | 036.0000020833 | Checked By: A. Santos | Date: 07/31/24 |
| Boring No.: | LB-1 | Depth (ft.): 12.5 | |
| Sample No.: | R-2 | Sample Type: | Ring |
| Soil Identification: | Olive gray silty clay (CL-ML) | | |

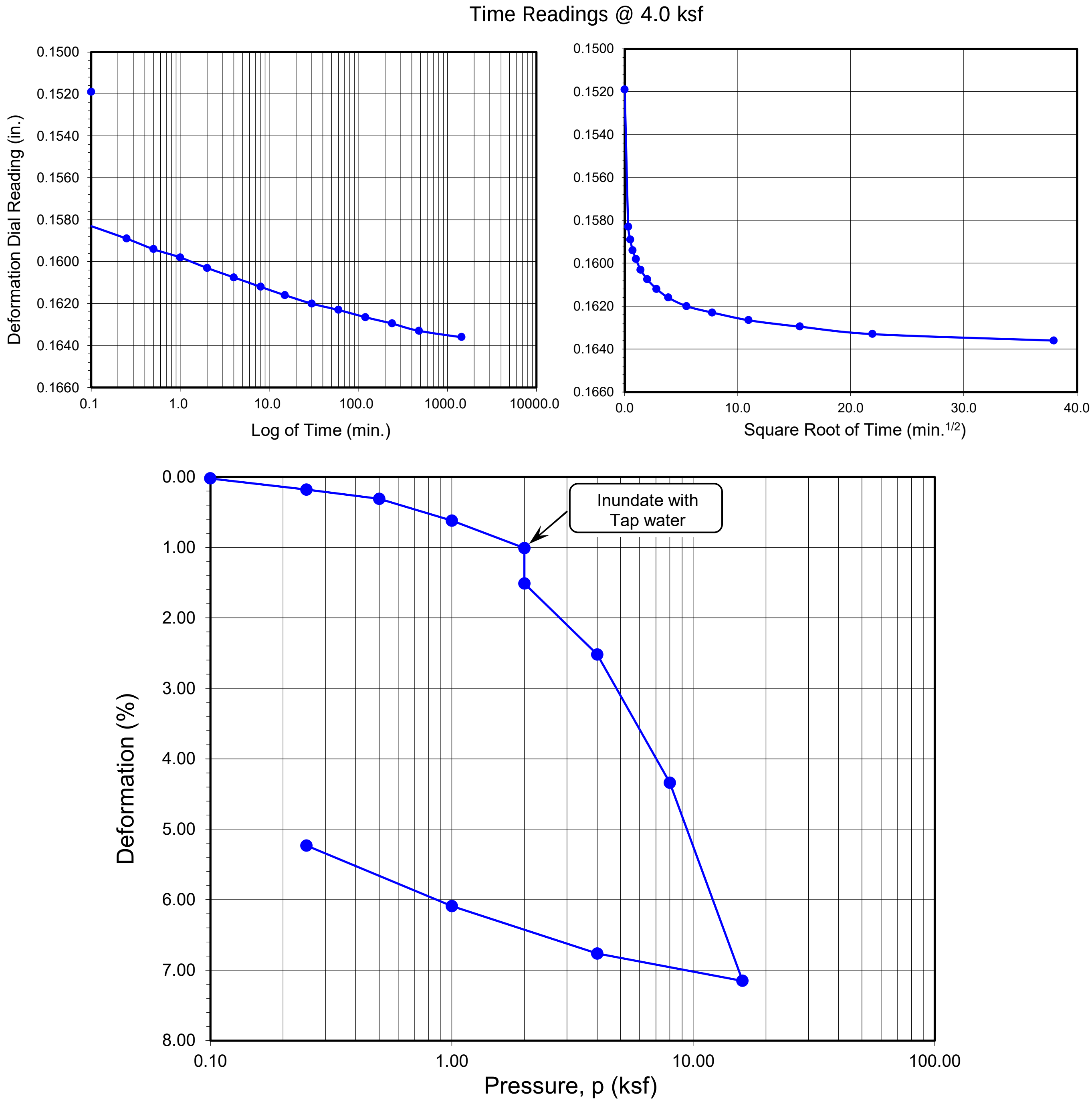
| | |
|---|---|
| Sample Diameter (in.): | 2.415 |
| Sample Thickness (in.): | 1.000 |
| Weight of Sample + ring (g): | 174.16 |
| Weight of Ring (g): | 44.92 |
| Height after consol. (in.): | 0.9477 |
| **Before Test** | |
| Wt. of Wet Sample+Cont. (g): | 174.35 |
| Wt. of Dry Sample+Cont. (g): | 165.33 |
| Weight of Container (g): | 59.16 |
| Initial Moisture Content (%) | 8.5 |
| Initial Dry Density (pcf) | 99.1 |
| Initial Saturation (%): | 33 |
| Initial Vertical Reading (in.) | 0.1303 |
| **After Test** | |
| Wt. of Wet Sample+Cont. (g): | 264.49 |
| Wt. of Dry Sample+Cont. (g): | 238.92 |
| Weight of Container (g): | 76.75 |
| Final Moisture Content (%) | 21.81 |
| Final Dry Density (pcf): | 102.9 |
| Final Saturation (%): | 92 |
| Final Vertical Reading (in.) | 0.1905 |
| Specific Gravity (assumed): | 2.70 |
| Water Density (pcf): | 62.43 |




| Pressure (p) (ksf) | Final Reading (in.) | Apparent Thickness (in.) | Load Compliance (%) | Deformation % of Sample Thickness | Void Ratio | Corrected Deforma-tion (%) |
|---|---|---|---|---|---|---|
| 0.10 | 0.1305 | 0.9998 | 0.00 | 0.02 | 0.701 | 0.02 |
| 0.25 | 0.1335 | 0.9968 | 0.14 | 0.32 | 0.698 | 0.18 |
| 0.50 | 0.1364 | 0.9939 | 0.30 | 0.61 | 0.696 | 0.31 |
| 1.00 | 0.1414 | 0.9889 | 0.49 | 1.11 | 0.691 | 0.62 |
| 2.00 | 0.1469 | 0.9834 | 0.65 | 1.66 | 0.684 | 1.01 |
| 2.00 | 0.1519 | 0.9784 | 0.65 | 2.16 | 0.676 | 1.51 |
| 4.00 | 0.1636 | 0.9667 | 0.81 | 3.33 | 0.659 | 2.52 |
| 8.00 | 0.1832 | 0.9471 | 0.95 | 5.29 | 0.628 | 4.34 |
| 16.00 | 0.2127 | 0.9176 | 1.09 | 8.24 | 0.580 | 7.15 |
| 4.00 | 0.2079 | 0.9225 | 0.99 | 7.76 | 0.586 | 6.77 |
| 1.00 | 0.2001 | 0.9302 | 0.89 | 6.98 | 0.598 | 6.09 |
| 0.25 | 0.1905 | 0.9398 | 0.79 | 6.02 | 0.612 | 5.23 |

Time Readings @ 4.0 ksf

| Date | Time | Elapsed Time (min) | Square Root of Time | Dial Rdgs. (in.) |
|---|---|---|---|---|
| 7/12/24 | 7:30:00 | 0.0 | 0.0 | 0.1519 |
| 7/12/24 | 7:30:06 | 0.1 | 0.3 | 0.1583 |
| 7/12/24 | 7:30:15 | 0.2 | 0.5 | 0.1589 |
| 7/12/24 | 7:30:30 | 0.5 | 0.7 | 0.1594 |
| 7/12/24 | 7:31:00 | 1.0 | 1.0 | 0.1598 |
| 7/12/24 | 7:32:00 | 2.0 | 1.4 | 0.1603 |
| 7/12/24 | 7:34:00 | 4.0 | 2.0 | 0.1608 |
| 7/12/24 | 7:38:00 | 8.0 | 2.8 | 0.1612 |
| 7/12/24 | 7:45:00 | 15.0 | 3.9 | 0.1616 |
| 7/12/24 | 8:00:00 | 30.0 | 5.5 | 0.1620 |
| 7/12/24 | 8:30:00 | 60.0 | 7.7 | 0.1623 |
| 7/12/24 | 9:30:00 | 120.0 | 11.0 | 0.1627 |
| 7/12/24 | 11:30:00 | 240.0 | 15.5 | 0.1630 |
| 7/12/24 | 15:30:00 | 480.0 | 21.9 | 0.1633 |
| 7/13/24 | 7:30:00 | 1440.0 | 37.9 | 0.1636 |




| Boring No. | Sample No. | Depth (ft.) | Moisture Content (%) | | Dry Density (pcf) | | Void Ratio | | Degree of Saturation (%) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Initial | Final | Initial | Final | Initial | Final | Initial | Final |
| **LB-1** | **R-2** | **12.5** | **8.5** | **21.8** | **99.1** | **102.9** | **0.701** | **0.612** | **33** | **92** |

Soil Identification: Olive gray silty clay (CL-ML)

Leighton

**ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS**
**ASTM D 2435**

Project No.: 036.0000020833

Griffin OC Workforce Reentry

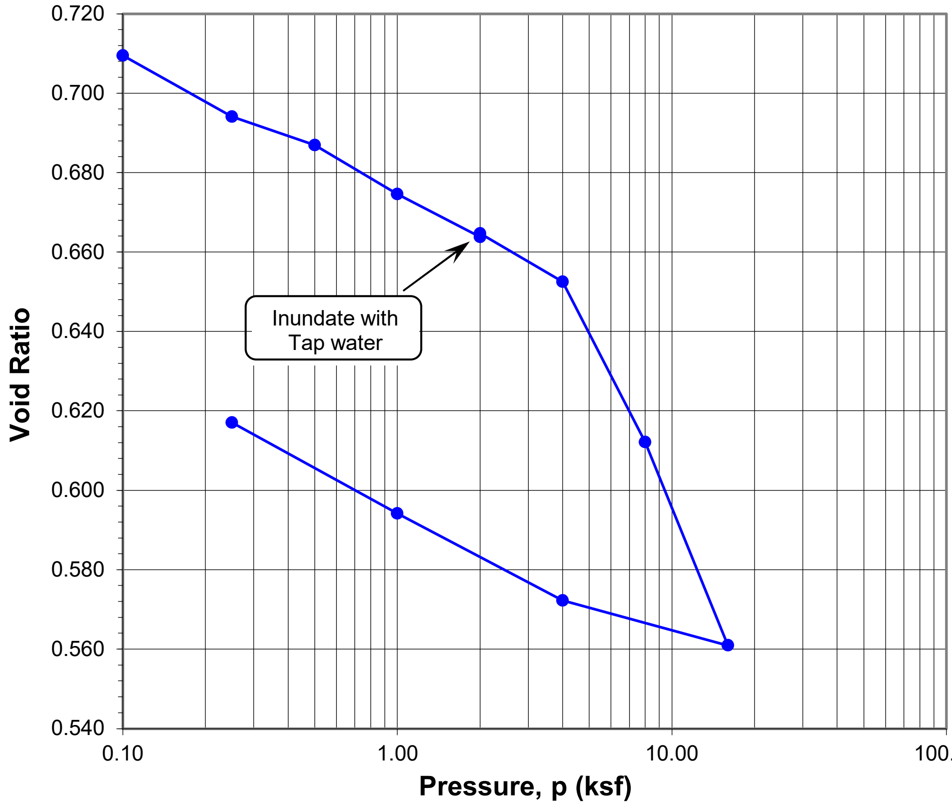
08-24

# ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

**ASTM D 2435**

| | | | |
|---|---|---|---|
| Project Name: | Griffin OC Workforce Reentry | Tested By: GB/JD | Date: 07/09/24 |
| Project No.: | 036.0000020833 | Checked By: A. Santos | Date: 07/31/24 |
| Boring No.: | LB-5 | Depth (ft.): 10.0 | |
| Sample No.: | R-2 | Sample Type: | Ring |
| Soil Identification: | Olive gray silty clay (CL-ML) | | |

| | |
|---|---|
| Sample Diameter (in.): | 2.415 |
| Sample Thickness (in.): | 1.000 |
| Weight of Sample + ring (g): | 190.97 |
| Weight of Ring (g): | 44.68 |
| Height after consol. (in.): | 0.9448 |
| **Before Test** | |
| Wt. of Wet Sample+Cont. (g): | 217.95 |
| Wt. of Dry Sample+Cont. (g): | 188.87 |
| Weight of Container (g): | 60.36 |
| Initial Moisture Content (%) | 22.6 |
| Initial Dry Density (pcf) | 99.2 |
| Initial Saturation (%): | 86 |
| Initial Vertical Reading (in.) | 0.1354 |
| **After Test** | |
| Wt. of Wet Sample+Cont. (g): | 249.86 |
| Wt. of Dry Sample+Cont. (g): | 220.92 |
| Weight of Container (g): | 62.03 |
| Final Moisture Content (%) | 25.34 |
| Final Dry Density (pcf): | 100.5 |
| Final Saturation (%): | 100 |
| Final Vertical Reading (in.) | 0.1926 |
| Specific Gravity (assumed): | 2.72 |
| Water Density (pcf): | 62.43 |

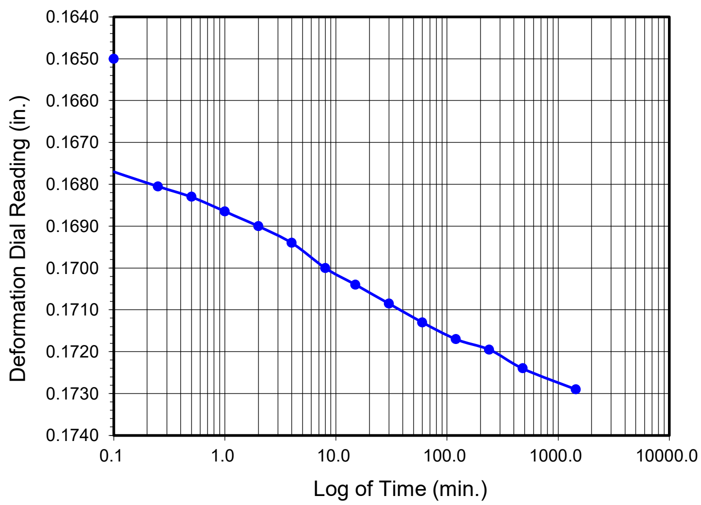


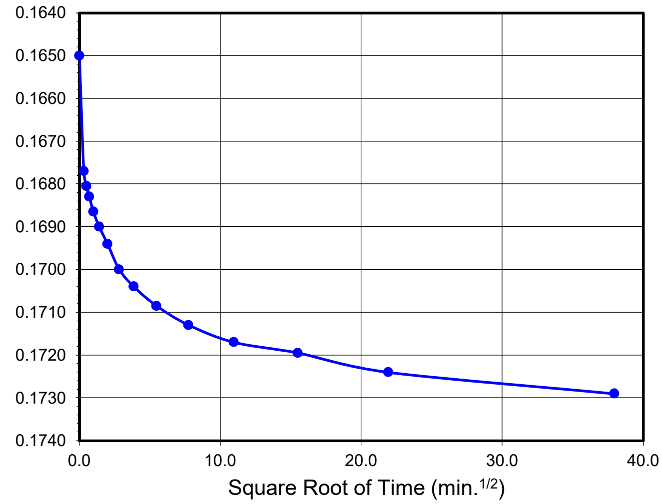

| Pressure (p) (ksf) | Final Reading (in.) | Apparent Thickness (in.) | Load Compliance (%) | Deformation % of Sample Thickness | Void Ratio | Corrected Deformation (%) |
|---|---|---|---|---|---|---|
| 0.10 | 0.1366 | 0.9988 | 0.00 | 0.12 | 0.710 | 0.12 |
| 0.25 | 0.1460 | 0.9894 | 0.04 | 1.06 | 0.694 | 1.02 |
| 0.50 | 0.1507 | 0.9847 | 0.09 | 1.53 | 0.687 | 1.44 |
| 1.00 | 0.1585 | 0.9769 | 0.15 | 2.31 | 0.675 | 2.16 |
| 2.00 | 0.1655 | 0.9699 | 0.22 | 3.01 | 0.664 | 2.79 |
| 2.00 | 0.1650 | 0.9704 | 0.22 | 2.96 | 0.665 | 2.74 |
| 4.00 | 0.1729 | 0.9625 | 0.30 | 3.75 | 0.653 | 3.45 |
| 8.00 | 0.1975 | 0.9379 | 0.40 | 6.21 | 0.612 | 5.81 |
| 16.00 | 0.2287 | 0.9067 | 0.53 | 9.33 | 0.561 | 8.80 |
| 4.00 | 0.2209 | 0.9145 | 0.41 | 8.55 | 0.572 | 8.14 |
| 1.00 | 0.2070 | 0.9284 | 0.30 | 7.16 | 0.594 | 6.86 |
| 0.25 | 0.1926 | 0.9428 | 0.20 | 5.72 | 0.617 | 5.52 |

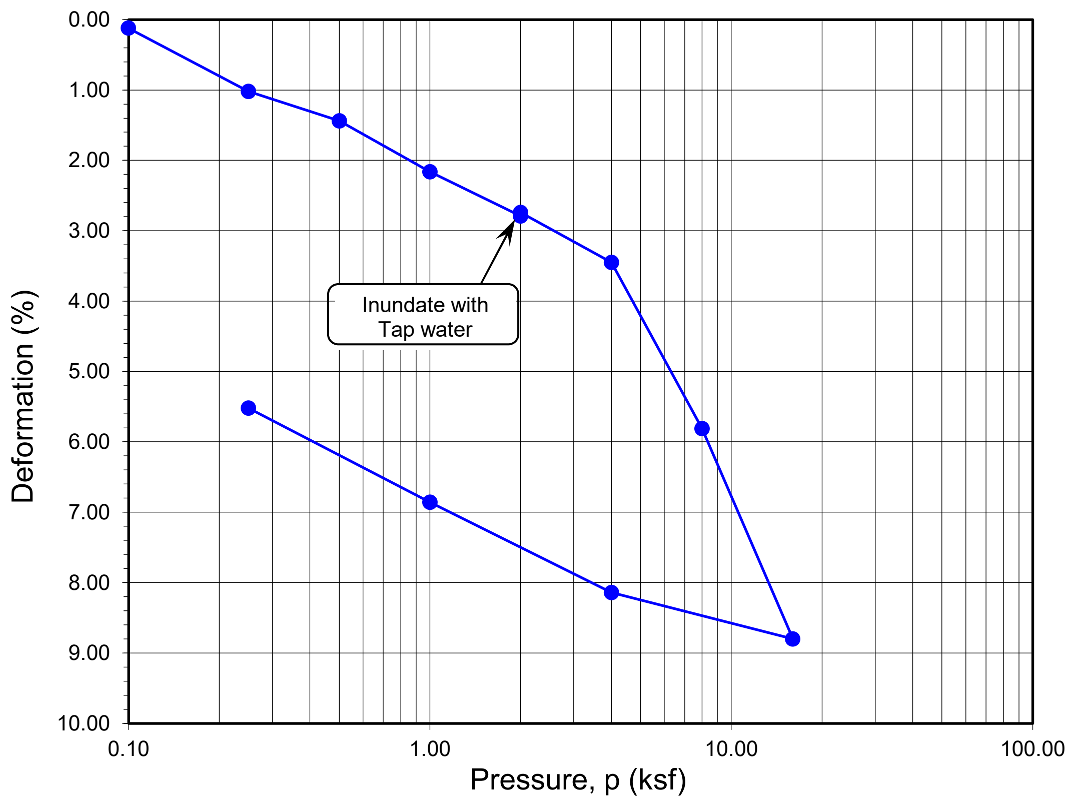
**Time Readings @ 4.0 ksf**

| Date | Time | Elapsed Time (min) | Square Root of Time | Dial Rdgs. (in.) |
|---|---|---|---|---|
| 7/12/24 | 7:35:00 | 0.0 | 0.0 | 0.1650 |
| 7/12/24 | 7:35:06 | 0.1 | 0.3 | 0.1677 |
| 7/12/24 | 7:35:15 | 0.2 | 0.5 | 0.1681 |
| 7/12/24 | 7:35:30 | 0.5 | 0.7 | 0.1683 |
| 7/12/24 | 7:36:00 | 1.0 | 1.0 | 0.1687 |
| 7/12/24 | 7:37:00 | 2.0 | 1.4 | 0.1690 |
| 7/12/24 | 7:39:00 | 4.0 | 2.0 | 0.1694 |
| 7/12/24 | 7:43:00 | 8.0 | 2.8 | 0.1700 |
| 7/12/24 | 7:50:00 | 15.0 | 3.9 | 0.1704 |
| 7/12/24 | 8:05:00 | 30.0 | 5.5 | 0.1709 |
| 7/12/24 | 8:35:00 | 60.0 | 7.7 | 0.1713 |
| 7/12/24 | 9:35:00 | 120.0 | 11.0 | 0.1717 |
| 7/12/24 | 11:35:00 | 240.0 | 15.5 | 0.1720 |
| 7/12/24 | 15:35:00 | 480.0 | 21.9 | 0.1724 |
| 7/13/24 | 7:35:00 | 1440.0 | 37.9 | 0.1729 |

Time Readings @ 4.0 ksf




| Boring No. | Sample No. | Depth (ft.) | Moisture Content (%) | | Dry Density (pcf) | | Void Ratio | | Degree of Saturation (%) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Initial | Final | Initial | Final | Initial | Final | Initial | Final |
| **LB-5** | **R-2** | **10** | **22.6** | **25.3** | **99.2** | **100.5** | **0.712** | **0.617** | **86** | **100** |

Soil Identification: Olive gray silty clay (CL-ML)

Leighton

**ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS**
**ASTM D 2435**

Project No.: 036.0000020833

Griffin OC Workforce Reentry

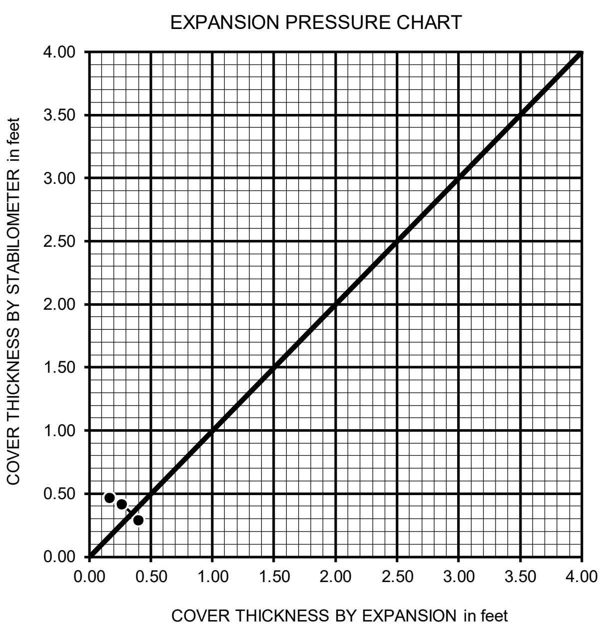
08-24

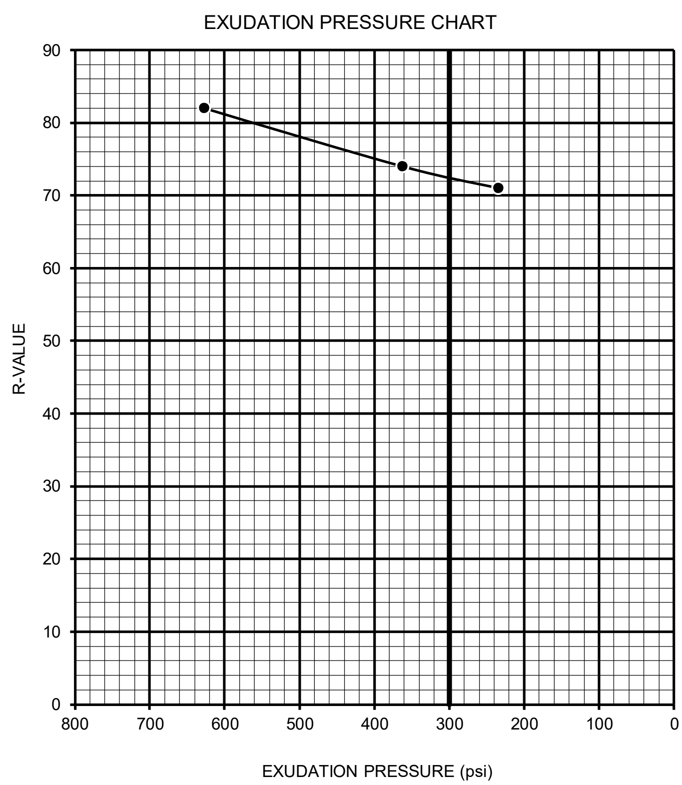
# R-VALUE TEST RESULTS
## DOT CA Test 301

| | | | |
|---|---|---|---|
| PROJECT NAME: | Griffin OC Workforce Reentry | PROJECT NUMBER: | 036.0000020833 |
| BORING NUMBER: | LB-1 | DEPTH (FT.): | 0-5 |
| SAMPLE NUMBER: | B-1 | TECHNICIAN: | O. Figueroa |
| SAMPLE DESCRIPTION: | Olive brown sandy silt s(ML) | DATE COMPLETED: | 7/16/2024 |

| **TEST SPECIMEN** | a | b | c |
|---|---|---|---|
| MOISTURE AT COMPACTION % | 8.6 | 9.1 | 9.6 |
| HEIGHT OF SAMPLE, Inches | 2.49 | 2.50 | 2.53 |
| DRY DENSITY, pcf | 125.5 | 125.4 | 125.0 |
| COMPACTOR PRESSURE, psi | 350 | 300 | 260 |
| EXUDATION PRESSURE, psi | 628 | 363 | 235 |
| EXPANSION, Inches x 10exp-4 | 12 | 8 | 5 |
| STABILITY Ph 2,000 lbs (160 psi) | 19 | 24 | 27 |
| TURNS DISPLACEMENT | 4.65 | 4.85 | 5.05 |
| R-VALUE UNCORRECTED | 80 | 74 | 71 |
| R-VALUE CORRECTED | 82 | 74 | 71 |

| **DESIGN CALCULATION DATA** | a | b | c |
|---|---|---|---|
| GRAVEL EQUIVALENT FACTOR | 1.0 | 1.0 | 1.0 |
| TRAFFIC INDEX | 5.0 | 5.0 | 5.0 |
| STABILOMETER THICKNESS, ft. | 0.29 | 0.42 | 0.46 |
| EXPANSION PRESSURE THICKNESS, ft. | 0.40 | 0.27 | 0.17 |




| | |
|---|---|
| R-VALUE BY EXPANSION: | 78 |
| R-VALUE BY EXUDATION: | 72 |
| EQUILIBRIUM R-VALUE: | 72 |

Leighton

# TESTS for SULFATE CONTENT CHLORIDE CONTENT and pH of SOILS

| | | | | | |
|---|---|---|---|---|---|
| Project Name: | Griffin OC Workforce Reentry | Tested By : | KJ/GEB | Date: | 07/11/24 |
| Project No. : | 036.0000020833 | Checked By: | A. Santos | Date: | 07/31/24 |

| | | | | |
|---|---|---|---|---|
| Boring No. | LB-1 | | | |
| Sample No. | B-1 | | | |
| Sample Depth (ft) | 0-5 | | | |
| Soil Identification: | Olive brown s(ML) | | | |
| Wet Weight of Soil + Container (g) | 0.00 | | | |
| Dry Weight of Soil + Container (g) | 0.00 | | | |
| Weight of Container (g) | 1.00 | | | |
| Moisture Content (%) | 0.00 | | | |
| Weight of Soaked Soil (g) | 100.60 | | | |

**SULFATE CONTENT, DOT California Test 417, Part II**

| | | | | |
|---|---|---|---|---|
| Beaker No. | 7 | | | |
| Crucible No. | 301 | | | |
| Furnace Temperature (°C) | 860 | | | |
| Time In / Time Out | 8:15/9:00 | | | |
| Duration of Combustion (min) | 45 | | | |
| Wt. of Crucible + Residue (g) | 61.9101 | | | |
| Wt. of Crucible (g) | 61.9075 | | | |
| Wt. of Residue (g) (A) | 0.0026 | | | |
| PPM of Sulfate (A) x 41150 | 106.99 | | | |
| **PPM of Sulfate, Dry Weight Basis** | **107** | | | |

**CHLORIDE CONTENT, DOT California Test 422**

| | | | | |
|---|---|---|---|---|
| ml of Extract For Titration (B) | 15 | | | |
| ml of AgNO3 Soln. Used in Titration (C) | 1.1 | | | |
| PPM of Chloride (C -0.2) * 100 * 30 / B | 180 | | | |
| **PPM of Chloride, Dry Wt. Basis** | **180** | | | |

**pH TEST, DOT California Test 643**

| | | | | |
|---|---|---|---|---|
| **pH Value** | **8.76** | | | |
| **Temperature °C** | 22.0 | | | |

# SOIL RESISTIVITY TEST

## DOT CA TEST 643

| | | | |
|---|---|---|---|
| Project Name: | Griffin OC Workforce Reentry | Tested By : | G. Berdy Date: 07/17/24 |
| Project No. : | 036.0000020833 | Checked By: | A. Santos Date: 07/31/24 |
| Boring No.: | LB-1 | Depth (ft.) : | 0-5 |
| Sample No. : | B-1 | | |

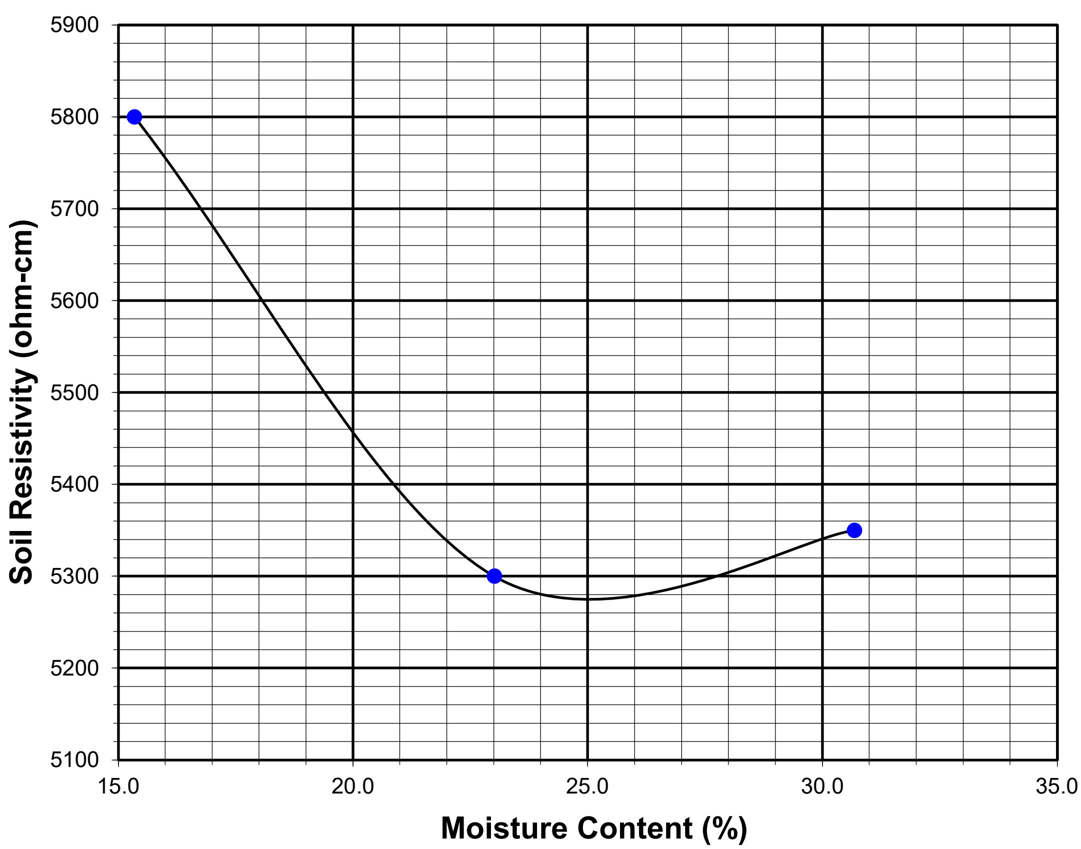
Soil Identification:* Olive brown s(ML)

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

| Specimen No. | Water Added (ml) (Wa) | Adjusted Moisture Content (MC) | Resistance Reading (ohm) | Soil Resistivity (ohm-cm) |
|---|---|---|---|---|
| 1 | 20 | 15.34 | 5800 | 5800 |
| 2 | 30 | 23.01 | 5300 | 5300 |
| 3 | 40 | 30.69 | 5350 | 5350 |
| 4 | | | | |
| 5 | | | | |

| | |
|---|---|
| Moisture Content (%) (MCi) | 0.00 |
| Wet Wt. of Soil + Cont. (g) | 0.00 |
| Dry Wt. of Soil + Cont. (g) | 0.00 |
| Wt. of Container (g) | 1.00 |
| Container No. | |
| Initial Soil Wt. (g) (Wt) | 130.35 |
| Box Constant | 1.000 |
| MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100 | |

| Min. Resistivity (ohm-cm) | Moisture Content (%) | Sulfate Content (ppm) | Chloride Content (ppm) | Soil pH | |
|---|---|---|---|---|---|
| | | | | pH | Temp. (°C) |
| DOT CA Test 643 | | DOT CA Test 417 Part II | DOT CA Test 422 | DOT CA Test 643 | |
| 5278 | 25.0 | 107 | 180 | 8.76 | 22.0 |



# Appendix D

Exploration Logs
(Ninyo & Moore, 2022)

DATE DRILLED 5/18/22 BORING NO. B-1

GROUND ELEVATION 117' ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 8" Hollow-Stem Auger (Baja Exploration)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY GM LOGGED BY GM REVIEWED BY MLP

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | GM | ASPHALT CONCRETE: Approximately 4 inches thick. |
| | | | | | | | SM | AGGREGATE BASE: Gray, moist, medium dense, silty GRAVEL with sand; approximately 2 inches thick. |
| | | | | | | | | FILL: Grayish brown, moist, medium dense, silty SAND with gravel and gravel-sized asphalt concrete and Portland cement concrete fragments. |
| | | | 8 | | | | | @ 5': Loose. |
| | | | | | | | CL | Reddish brown, dark grayish brown, mottled, moist, stiff, lean CLAY with sand; trace gravel; trace sand pockets; trace asphalt concrete fragments. |
| 10 | | | 14 | 23.9 | 98.9 | | | Very stiff. |
| | | | 12 | | | | | Olive brown; stiff. |
| 20 | | | 15 | | | | SP | ALLUVIUM: Yellowish brown, moist, medium dense, poorly graded SAND. |
| | | | | | | | SM | Dark yellowish brown, moist, medium dense, silty SAND. |
| | | | 11 | | | | CL | Yellowish brown, moist, stiff, lean CLAY. |
| 30 | | | | | | | | Total Depth = 26.5 feet.<br>Groundwater was not encountered during drilling.<br>Backfilled with on-site soil and patched with rapid-set concrete dyed black on 5/18/22.<br><br>Notes:<br>Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.<br><br>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 40 | | | | | | | | |

| | |
|---|---|
| DATE DRILLED | 5/18/22 |
| BORING NO. | B-2 |
| GROUND ELEVATION | 119' ± (MSL) |
| SHEET | 1 OF 1 |
| METHOD OF DRILLING | 8" Hollow-Stem Auger (Baja Exploration) |
| DRIVE WEIGHT | 140 lbs. (Auto. Trip Hammer) |
| DROP | 30" |
| SAMPLED BY | GM |
| LOGGED BY | GM |
| REVIEWED BY | MLP |

| DEPTH (feet) | SAMPLES (Bulk / Driven) | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|
| 0 | Bulk | | | | SM | FILL: Grayish brown, moist, medium dense, silty SAND with angular to sub-angular gravel; few gravel-sized asphalt concrete and Portland cement concrete fragments. |
| | Driven | 23 | 2.4 | 108.8 | | |
| | | | | | | Difficult drilling conditions; possible cobbles and/or cobble-size construction debris. |
| 10 | Driven | 20 | | | | Few small gravel-sized asphalt concrete fragments. |
| | Driven | 26 | | | | Portland cement concrete fragment in sampler tip. |
| 20 | Driven | 27 | | | SP | ALLUVIUM: Yellowish brown, moist, medium dense, poorly graded SAND. |
| | | | | | CL | Yellowish brown, moist, very stiff, lean CLAY. |
| | Driven | 19 | | | SC | Yellowish brown, moist, medium dense, clayey SAND. |
| | | | | | | Total Depth = 26.5 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil on 5/18/22. |
| 30 | | | | | | Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 40 | | | | | | |

**FIGURE A- 2**

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

**THEO LACY FACILITY SECURITY WALL**
**ORANGE, CALIFORNIA**
**211948002 | 11/22**

| DATE DRILLED | 5/18/22 | BORING NO. | B-3 |
|---|---|---|---|
| GROUND ELEVATION | 120' ± (MSL) | SHEET 1 OF 1 | |
| METHOD OF DRILLING | 8" Hollow-Stem Auger (Baja Exploration) | | |
| DRIVE WEIGHT | 140 lbs. (Auto. Trip Hammer) | DROP | 30" |
| SAMPLED BY | GM | LOGGED BY GM | REVIEWED BY MLP |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | X | | | | | | SM | FILL: Grayish brown, moist, medium dense, silty SAND; trace gravel and gravel-sized asphalt concrete fragments. Some fill lifts contain clayey zones. |
| | | X | 25 | 9.9 | 117.0 | | | |
| | | | | | | | SP | ALLUVIUM: Grayish brown, moist, loose, poorly graded SAND. |
| 10 | | X | 9 | 3.7 | 97.9 | | | |
| | | | | | | | CL | Yellowish brown, moist, stiff, sandy lean CLAY. |
| | | | | | | | SC | Yellowish brown, moist, loose, clayey SAND. |
| | | X | 12 | | | | | |
| 20 | | X | 40 | | | | SM | Grayish brown, moist, medium dense, silty SAND. |
| | | | | | | | CL | Yellowish brown, moist, very stiff, lean CLAY. |
| | | X | 26 | | | | | |
| | | | | | | | SM | Grayish brown, moist, medium dense, silty SAND. |
| | | | | | | | | Total Depth = 26.5 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil on 5/18/22. |
| 30 | | | | | | | | Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 40 | | | | | | | | |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DATE DRILLED 5/18/22 BORING NO. B-4<br>GROUND ELEVATION 120' ± (MSL) SHEET 1 OF 1<br>METHOD OF DRILLING 8" Hollow-Stem Auger (Baja Exploration)<br>DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"<br>SAMPLED BY GM LOGGED BY GM REVIEWED BY MLP<br>**DESCRIPTION/INTERPRETATION** |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | <u>PORTLAND CEMENT CONCRETE</u>:<br>Approximately 5 inches thick; no base. |
| | | | | | | | SP | <u>FILL</u>:<br>Yellowish brown, moist, medium dense, poorly graded SAND; trace angular to sub-angular gravel. |
| | | | | | | | SP | <u>ALLUVIUM</u>:<br>Light yellowish brown, moist, medium dense, poorly graded SAND. |
| | | | 24 | | | | | |
| 10 | | | 12 | 25.4 | 95.9 | | CL | Yellowish brown, moist, stiff, lean CLAY with sand. |
| | | | | | | | ML | Yellowish brown, moist, medium dense, sandy SILT. |
| | | | 27 | | | | | |
| | | | | | | | CL | Yellowish brown, moist, hard, sandy CLAY. |
| 20 | | | 29 | | | | SM | Grayish brown, moist, medium dense, silty SAND. |
| | | | | | | | CL | Yellowish brown, moist, hard, sandy lean CLAY. |
| | | | 28 | | | | SM | Grayish brown, moist, medium dense, silty SAND. |
| | | | | | | | | Total Depth = 26.5 feet.<br>Groundwater was not encountered during drilling.<br>Backfilled with on-site soil and patched with rapid-set concrete on 5/18/22.<br><br><u>Notes</u>:<br>Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.<br><br>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

| DATE DRILLED | 9/21/22 | BORING NO. | B-5 |
|---|---|---|---|
| GROUND ELEVATION | 120' ± (MSL) | SHEET 1 OF 1 | |
| METHOD OF DRILLING | 8" Hollow-Stem Auger (MR Drilling) | | |
| DRIVE WEIGHT | 140 lbs. (Auto. Trip Hammer) | DROP | 30" |
| SAMPLED BY GM | LOGGED BY GM | REVIEWED BY | MLP |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | SM | PORTLAND CEMENT CONCRETE: Approximately 5 inches thick; no base. |
| | | | | | | | SP | FILL: Reddish brown, moist, medium dense, silty SAND with gravel; gravel angular to sub-angular. Yellowish brown, moist, medium dense, poorly graded SAND; trace angular to sub-angular gravel. |
| | | | 28 | 6.9 | 104.2 | | SP | ALLUVIUM: Yellowish brown, moist, medium dense, poorly graded SAND; trace gravel rounded to sub-rounded. |
| 10 | | | 22 | | | | ML | Gray, moist, hard, SILT. |
| | | | 18 | | | | CL | Olive brown, moist, very stiff, lean CLAY. |
| 20 | | | | | | | | Total Depth = 16.5 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil and patched with rapid-set concrete on 9/21/22. Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

**FIGURE A- 5**

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA
211948002 | 11/22

| DATE DRILLED | 9/21/22 | BORING NO. | B-6 |
|---|---|---|---|
| GROUND ELEVATION | 120' ± (MSL) | SHEET 1 OF 1 | |
| METHOD OF DRILLING | 8" Hollow-Stem Auger (MR Drilling) | | |
| DRIVE WEIGHT | 140 lbs. (Auto. Trip Hammer) | DROP | 30" |
| SAMPLED BY GM | LOGGED BY GM | REVIEWED BY | MLP |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | PORTLAND CEMENT CONCRETE: Approximately 5 inches thick; no base. |
| | | | | | | | SM | FILL: Reddish brown, moist, medium dense, silty SAND with gravel; cobble-sized Portland cement concrete fragments at 1 foot deep; few rootlets. |
| | | | | | | | SP | Yellowish brown, moist, medium dense, poorly graded SAND; trace angular to sub-angular gravel. |
| | | | | | | | SP | ALLUVIUM: Yellowish brown, moist, medium dense, poorly graded SAND; trace rounded to sub-rounded gravel. |
| | | ■ | 24 | 3.4 | 94.6 | | | |
| | | | | | | | CL | Dark yellowish brown, moist, very stiff, sandy lean CLAY. |
| 10 | | ◣ | 12 | | | | | |
| | | | | | | | ML | Olive brown, moist, hard, SILT. |
| | | ◣ | 25 | | | | | |
| | | | | | | | | Total Depth = 16.5 feet.<br>Groundwater was not encountered during drilling.<br>Backfilled with on-site soil and patched with rapid-set concrete on 9/21/22.<br><br>Notes:<br>Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.<br><br>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 20 | | | | | | | | |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

DATE DRILLED 9/21/22 BORING NO. B-7

GROUND ELEVATION 120' ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 8" Hollow-Stem Auger (MR Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY GM LOGGED BY GM REVIEWED BY MLP

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | SM | FILL: Gray, dry, medium dense, silty SAND with gravel; few tree roots. |
| | | | | | | | SP | Yellowish brown, moist, medium dense, poorly graded SAND; few gravel; trace clay pockets. @ 3': Few clay pockets. |
| | | | | | | | CL | Gray, moist, stiff, sandy CLAY; trace angular fine gravel. |
| | | | 31 | 5.0 | 95.9 | | SP | ALLUVIUM: Light yellowish brown, moist, medium dense, poorly graded SAND; trace rounded to sub-rounded gravel. |
| 10 | | | 18 | | | | CL | Dark yellowish brown, moist, very stiff, sandy lean CLAY. |
| | | | 21 | | | | | Hard; decrease in sand. |
| 20 | | | | | | | | Total Depth = 16.5 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil on 9/21/22. |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.

| DEPTH (feet) | SAMPLES: Bulk | SAMPLES: Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | DATE DRILLED 9/21/22 BORING NO. B-8<br>GROUND ELEVATION 120' ± (MSL) SHEET 1 OF 1<br>METHOD OF DRILLING 8" Hollow-Stem Auger (MR Drilling)<br>DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"<br>SAMPLED BY GM LOGGED BY GM REVIEWED BY MLP |
| 0 | | | | | | | SM | FILL:<br>Grayish brown, moist, medium dense, silty SAND; trace gravel and gravel-sized asphalt concrete fragments.<br><br>Some fill lifts contain clayey zones.<br>@ 3': Few clay pockets. |
| | | | 39 | 12.6 | 92.7 | | SP | ALLUVIUM:<br>Light yellowish brown, moist, medium dense, poorly graded SAND; trace rounded to sub-rounded gravel. |
| 10 | | | 17 | | | | CL | Reddish brown, moist, very stiff, sandy lean CLAY. |
| | | | 21 | | | | | Hard. |
| | | | | | | | | Total Depth = 16.5 feet.<br>Groundwater was not encountered during drilling.<br>Backfilled with on-site soil on 9/21/22.<br><br>Notes:<br>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.<br><br>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 20 | | | | | | | | |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

**FIGURE A- 8**

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

**THEO LACY FACILITY SECURITY WALL**
**ORANGE, CALIFORNIA**
**211948002 | 11/22**

| DATE DRILLED | 9/21/22 | BORING NO. | B-9 |
|---|---|---|---|
| GROUND ELEVATION | 120' ± (MSL) | SHEET | 1 OF 1 |
| METHOD OF DRILLING | 8" Hollow-Stem Auger (MR Drilling) | | |
| DRIVE WEIGHT | 140 lbs. (Auto. Trip Hammer) | DROP | 30" |
| SAMPLED BY | GM | LOGGED BY | GM |
| REVIEWED BY | MLP | | |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | X | | | | | | SM | FILL: Grayish brown, moist, medium dense, silty SAND with angular to sub-angular gravel; few gravel-sized asphalt concrete and Portland cement concrete fragments. Difficult hand auguring conditions. |
| | | X | 35 | 1.3 | 101.4 | | SP | ALLUVIUM: Light yellowish brown, moist, medium dense, poorly graded SAND; trace rounded to sub-rounded gravel. |
| 10 | | X | 19 | | | | CL | Reddish brown, moist, very stiff, sandy lean CLAY. |
| | | X | 25 | | | | | Hard. |
| | | | | | | | | Total Depth = 16.5 feet.<br>Groundwater was not encountered during drilling.<br>Backfilled with on-site soil on 9/21/22. |
| 20 | | | | | | | | Notes:<br>Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.<br>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

DATE DRILLED 9/21/22 BORING NO. B-10

GROUND ELEVATION 120' ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 8" Hollow-Stem Auger (MR Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY GM LOGGED BY GM REVIEWED BY MLP

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | SM | FILL: Grayish brown, moist, medium dense, silty SAND with angular to sub-angular gravel; few gravel-sized asphalt concrete and Portland cement concrete fragments. |
| | | | 48 | | | | | Few cobble-sized asphalt concrete fragments. |
| | | | 33 | 6.5 | 109.8 | | | Medium dense. |
| 10 | | | 51 | | | | | Black with asphalt concrete fragments; dense. |
| | | | | | | | CL | Olive brown, moist, hard, sandy CLAY; trace gravel. |
| | | | 58 | 22.5 | 101.6 | | | |
| 20 | | | 60 | | | | SM | ALLUVIUM: Yellowish brown, moist, dense, silty SAND; trace iron oxide staining. |
| | | | | | | | CL | Yellowish brown, moist, hard, lean CLAY. |
| | | | 28 | | | | | |
| | | | | | | | SM | Gray, moist, very dense, silty SAND. |
| 30 | | | 42 | | | | | |
| | | | | | | | | Total Depth = 31.5 feet.<br>Groundwater was not encountered during drilling.<br>Backfilled with on-site soil on 9/21/22.<br><br>Notes:<br>Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.<br><br>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 40 | | | | | | | | |



Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA
211948002 | 11/22

DATE DRILLED 9/27/22 BORING NO. B-11

GROUND ELEVATION 120' ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 8" Hollow-Stem Auger (MR Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY GM LOGGED BY GM REVIEWED BY MLP

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | GM | ASPHALT CONCRETE: Approximately 2 inches thick. |
| | | | | | | | SM | AGGREGATE BASE: Gray, moist, medium dense, silty GRAVEL with sand; approximately 5 inches thick. |
| | | | | | | | | FILL: Gray, moist, medium dense, silty SAND with gravel and gravel-sized asphalt concrete and Portland cement concrete fragments. |
| | | | 50/5" | | | | | @ 5': Very dense. |
| | | | 40 | | | | | Few asphalt chunks; medium dense. |
| 10 | | | 48 | 2.5 | 102.9 | | SP | ALLUVIUM: Light gray, moist, dense, poorly graded SAND; few gravel. |
| | | | 52 | | | | CL | Olive brown, moist, hard, sandy CLAY. |
| 20 | | | 28 | | | | SM | Gray to olive brown, moist, dense, silty SAND. |

Total Depth = 21.5 feet.
Groundwater was not encountered during drilling.
Backfilled with on-site soil and patched with rapid-set concrete dyed black on 9/27/22.

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.

30

40



Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA
211948002 | 11/22

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DATE DRILLED 9/27/22 BORING NO. B-12 GROUND ELEVATION 120' ± (MSL) SHEET 1 OF 1 METHOD OF DRILLING 8" Hollow-Stem Auger (MR Drilling) DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30" SAMPLED BY GM LOGGED BY GM REVIEWED BY MLP DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | GM | ASPHALT CONCRETE: Approximately 3 inches thick. |
| | | | | | | | SM | AGGREGATE BASE: Gray, moist, medium dense, silty GRAVEL with sand; approximately 5 inches thick. |
| | | | | | | | | FILL: Grayish brown and dark yellowish brown, moist, medium dense, silty SAND with gravel and gravel-sized asphalt concrete fragments and Portland cement concrete fragments. |
| | | | 49 | | | | | Dense. |
| | | | | | | | SP | ALLUVIUM: Yellowish brown, moist, medium dense, poorly graded SAND; few gravel. |
| | | | 30 | 24.5 | 97.2 | | CL | Olive brown, moist, hard, sandy CLAY. |
| 10 | | | | | | | | |
| | | | 28 | | | | | Trace oxidation staining. |
| | | | | | | | | Total Depth = 16.5 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil and patched with rapid-set concrete dyed black on 9/27/22. |
| 20 | | | | | | | | Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. |
|---|---|---|---|---|---|---|---|

DATE DRILLED 9/27/22 BORING NO. B-13

GROUND ELEVATION 120' ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 8" Hollow-Stem Auger (MR Drilling)

DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) DROP 30"

SAMPLED BY GM LOGGED BY GM REVIEWED BY MLP

**DESCRIPTION/INTERPRETATION**

| DEPTH (feet) | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|
| 0 | | | | GM | ASPHALT CONCRETE: Approximately 2 inches thick. |
| | | | | SM | AGGREGATE BASE: Gray, moist, medium dense, silty GRAVEL with sand; approximately 7 inches thick. |
| | | | | | FILL: Grayish brown and dark yellowish brown, moist, medium dense, silty SAND with gravel and gravel-sized asphalt concrete and Portland cement concrete fragments. |
| | | | | SC | Grayish brown and dark yellowish brown, moist, medium dense, clayey SAND with gravel and gravel-sized asphalt concrete and Portland cement concrete fragments. |
| | 41 | 9.3 | 108.9 | | |
| | 50/4" | | | | Very dense. |
| 10 | | | | CL | Dark olive brown to dark yellowish brown, moist, hard, sandy CLAY; trace gravel-sized Portland cement concrete fragments. |
| | 44 | 20.8 | 104.4 | | |
| | 39 | | | | |
| | | | | SM | ALLUVIUM: Yellowish brown, moist, medium dense, silty SAND; oxidation staining. |
| 20 | 33 | ♀ | | | @ 20': Seepage encountered during drilling; wet. |
| | | | | CL | Dark yellowish brown, moist, hard, sandy CLAY; trace caliche. |
| | 24 | | | | |
| 30 | | | | | |
| 40 | | | | | |

Total Depth = 26.5 feet.
Groundwater was not encountered during drilling.
Seepage was encountered at approximately 20 feet during drilling.
Backfilled with on-site soil and patched with rapid-set concrete dyed black on 9/27/22.

Notes:
Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.

The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.

| | | |
|---|---|---|
| DATE DRILLED 9/27/22 | BORING NO. B-14 | |
| GROUND ELEVATION 120' ± (MSL) | SHEET 1 OF 1 | |
| METHOD OF DRILLING 8" Hollow-Stem Auger (MR Drilling) | | |
| DRIVE WEIGHT 140 lbs. (Auto. Trip Hammer) | DROP 30" | |
| SAMPLED BY GM | LOGGED BY GM | REVIEWED BY MLP |

| DEPTH (feet) | SAMPLES Bulk | SAMPLES Driven | BLOWS/FOOT | MOISTURE (%) | DRY DENSITY (PCF) | SYMBOL | CLASSIFICATION U.S.C.S. | DESCRIPTION/INTERPRETATION |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | SM | FILL: Grayish brown, moist, medium dense, silty SAND with angular and sub-rounded gravel; few gravel-sized asphalt concrete and Portland cement concrete fragments. |
| | | | 50/5" | | | | | * Possible cobble/cobble-sized debris at 5 feet; sample taken at 5.5 feet. * Very dense. |
| | | | 51 | | | | | Dense. |
| 10 | | | 50/4" | 13.9 | 93.1 | | CL | Dark olive brown, moist, hard, sandy CLAY with gravel-sized asphalt concrete and Portland cement concrete fragments. |
| | | | 43 | | | | SP | ALLUVIUM: Light gray, moist, dense, poorly graded SAND. |
| | | | 61 | | | | | Few gravel. |
| 20 | | | | | | | CL | Olive brown, moist, hard, CLAY with sand; trace gravel. |
| | | | 41 | | | | ML | Olive brown, moist, very dense, sandy SILT. |
| | | | | | | | | Total Depth = 21.5 feet. Groundwater was not encountered during drilling. Backfilled with on-site soil on 9/27/22. |
| | | | | | | | | Notes: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. |
| | | | | | | | | The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. |
| 30 | | | | | | | | |
| 40 | | | | | | | | |

# Appendix E

Laboratory Test Results
(Ninyo & Moore, 2022)

| SAMPLE LOCATION | SAMPLE DEPTH (ft) | DESCRIPTION | PERCENT PASSING NO. 4 | PERCENT PASSING NO. 200 | USCS (TOTAL SAMPLE) |
|---|---|---|---|---|---|
| B-1 | 10.0-11.5 | LEAN CLAY WITH SAND | 100 | 78 | CL |
| B-3 | 0.0-5.0 | SILTY SAND | 97 | 16 | SM |
| B-4 | 10.0-11.5 | LEAN CLAY WITH SAND | 100 | 75 | CL |
| B-4 | 20.0-21.5 | SILTY SAND | 100 | 32 | SM |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 1140

**FIGURE B-1**

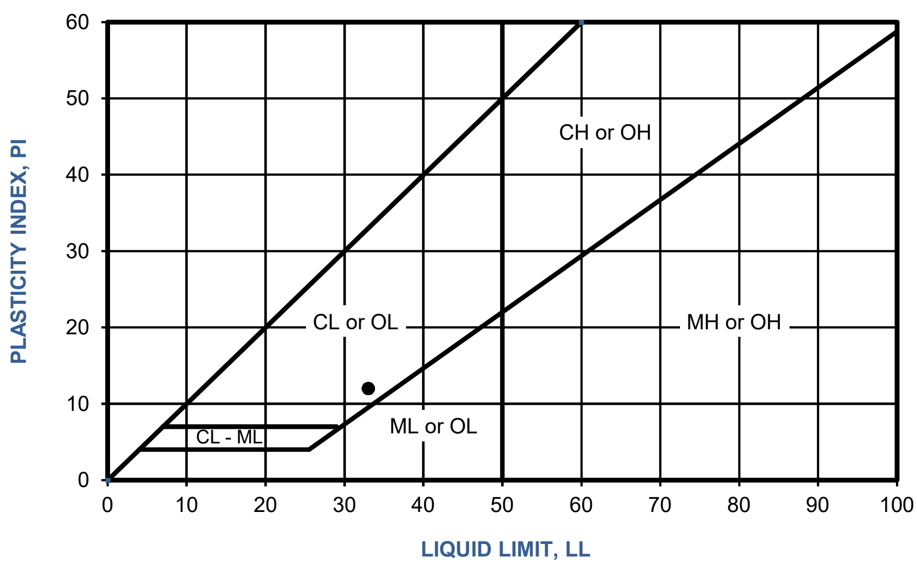
**NO. 200 SIEVE ANALYSIS TEST RESULTS**

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA

211948002 | 11/22

| SYMBOL | LOCATION | DEPTH (ft) | LIQUID LIMIT | PLASTIC LIMIT | PLASTICITY INDEX | USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve) | USCS |
|---|---|---|---|---|---|---|---|
| ● | B-4 | 10.0-11.5 | 33 | 21 | 12 | CL | CL |




PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318

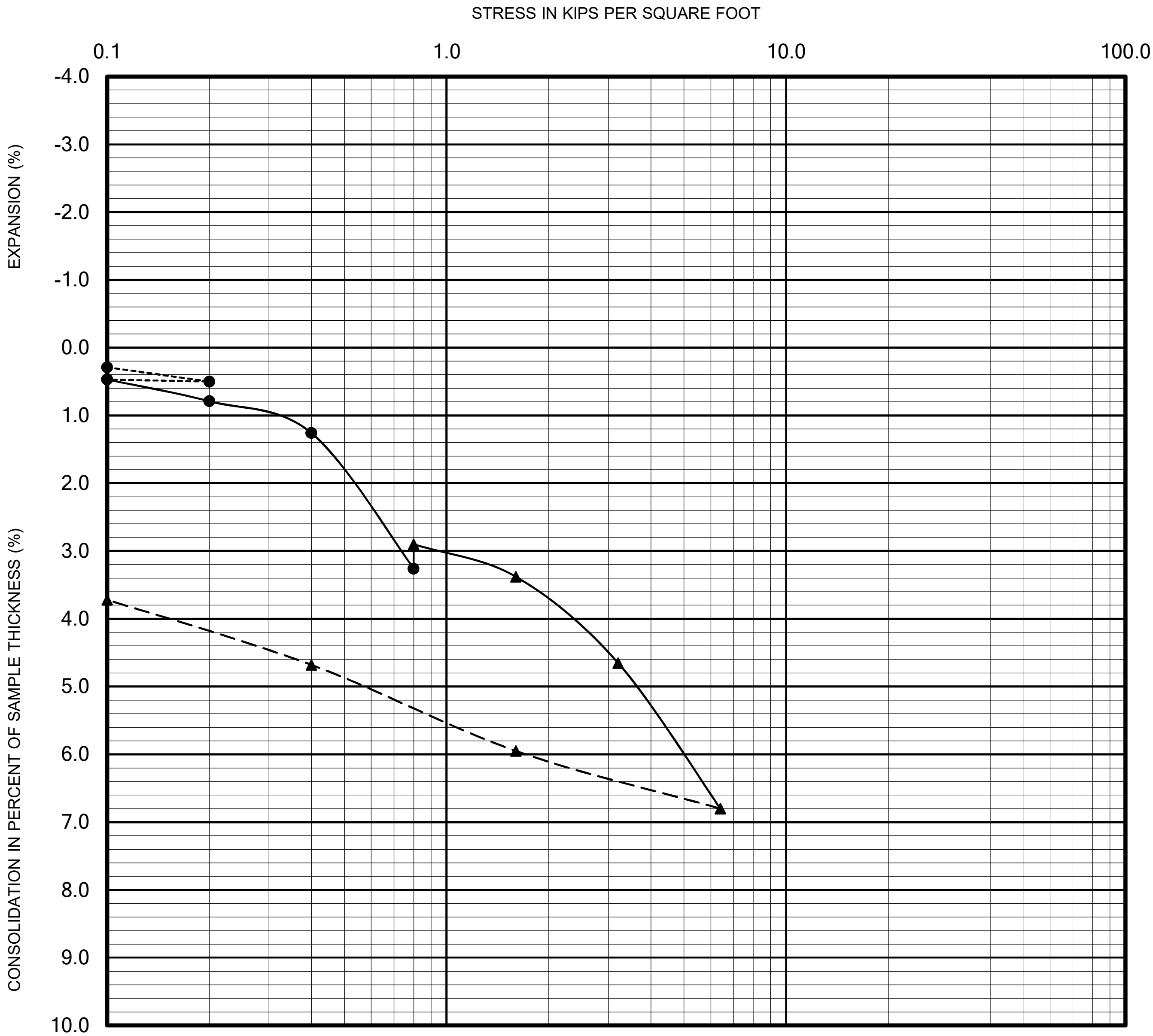
FIGURE B-2

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

**ATTERBERG LIMITS TEST RESULTS**

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA

211948002 | 11/22




| | | | |
|---|---|---|---|
| --●-- | Seating Cycle | Sample Location | B-4 |
| —●— | Loading Prior to Inundation | Depth (ft) | 10.0-11.5 |
| —▲— | Loading After Inundation | Soil Type | CL |
| --▲-- | Rebound Cycle | | |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

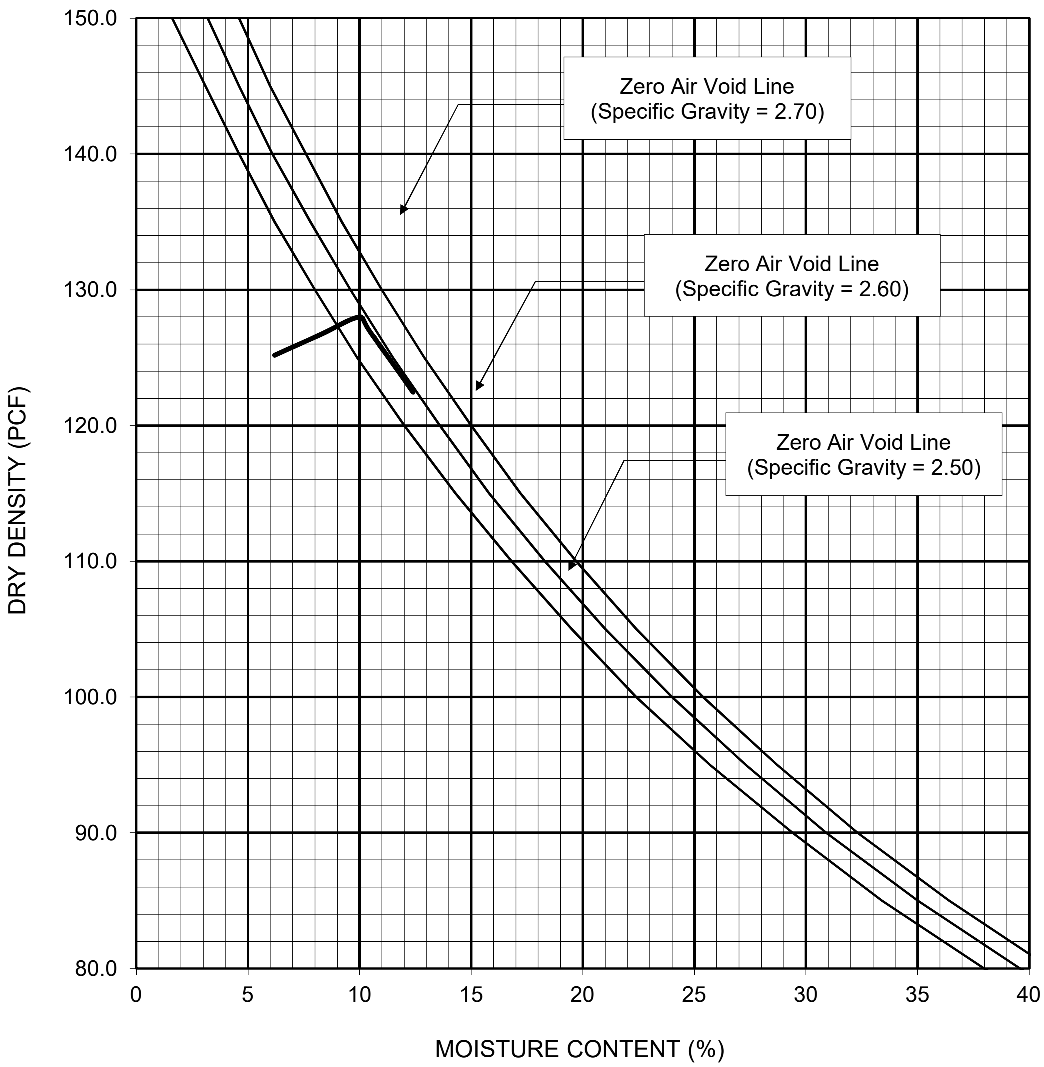
**FIGURE B-3**

**CONSOLIDATION TEST RESULTS**

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA

211948002 | 11/22

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants




| Sample Location | Depth (ft) | Soil Description | Maximum Dry Density (pcf) | Optimum Moisture Content (percent) |
|---|---|---|---|---|
| B-3 | 0.0-5.0 | Grayish Brown Silty Sand | 128.0 | 10.0 |
| Dry Density and Moisture Content Values Corrected for Oversize (ASTM D 4718) | | | N/A | N/A |

PERFORMED IN GENERAL ACCORDANCE WITH ☑ ASTM D 1557 ☐ ASTM D 698 METHOD ☐ A ☑ B ☐ C

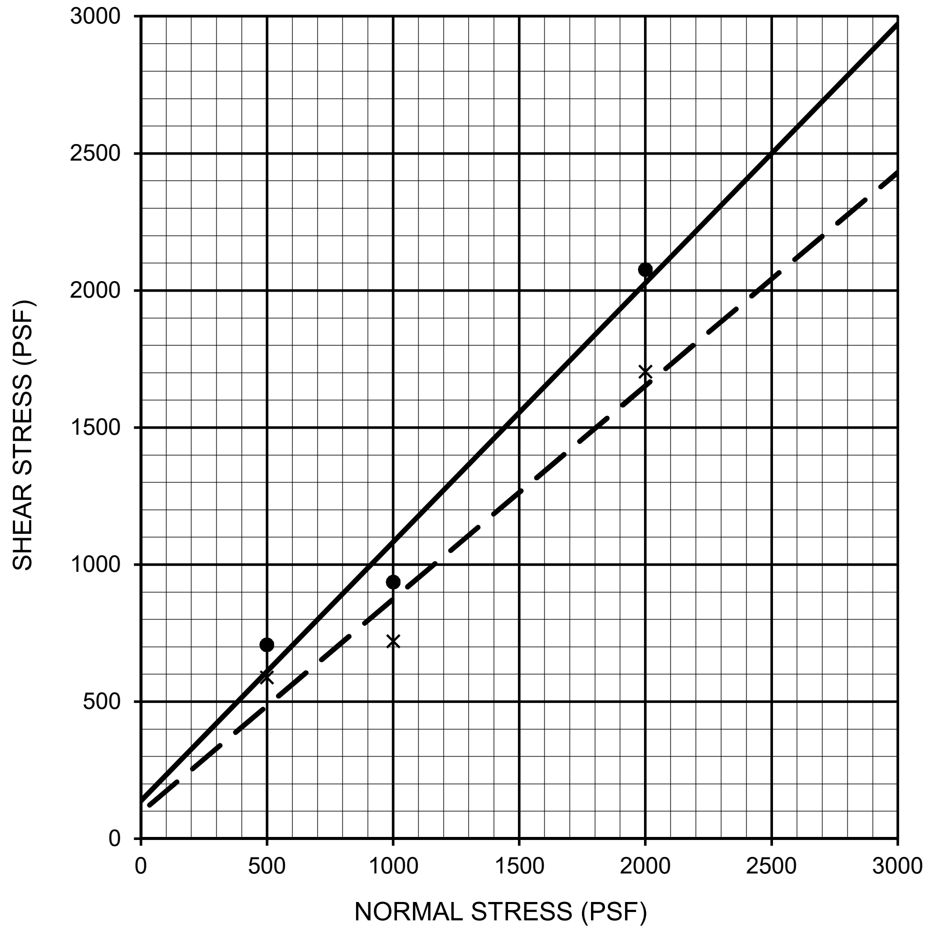
**FIGURE B-4**

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

**PROCTOR DENSITY TEST RESULTS**

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA

211948002 | 11/22




| Description | Symbol | Sample Location | Depth (ft) | Shear Strength | Cohesion (psf) | Friction Angle (degrees) | Soil Type |
|---|---|---|---|---|---|---|---|
| SILTY SAND | ——●—— | B-3 | 0.0-5.0 | Peak | 138 | 43 | SM |
| SILTY SAND | – – X – – | B-3 | 0.0-5.0 | Ultimate | 96 | 38 | SM |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080 ON A SAMPLE REMOLDED TO 90% RELATIVE COMPACTION

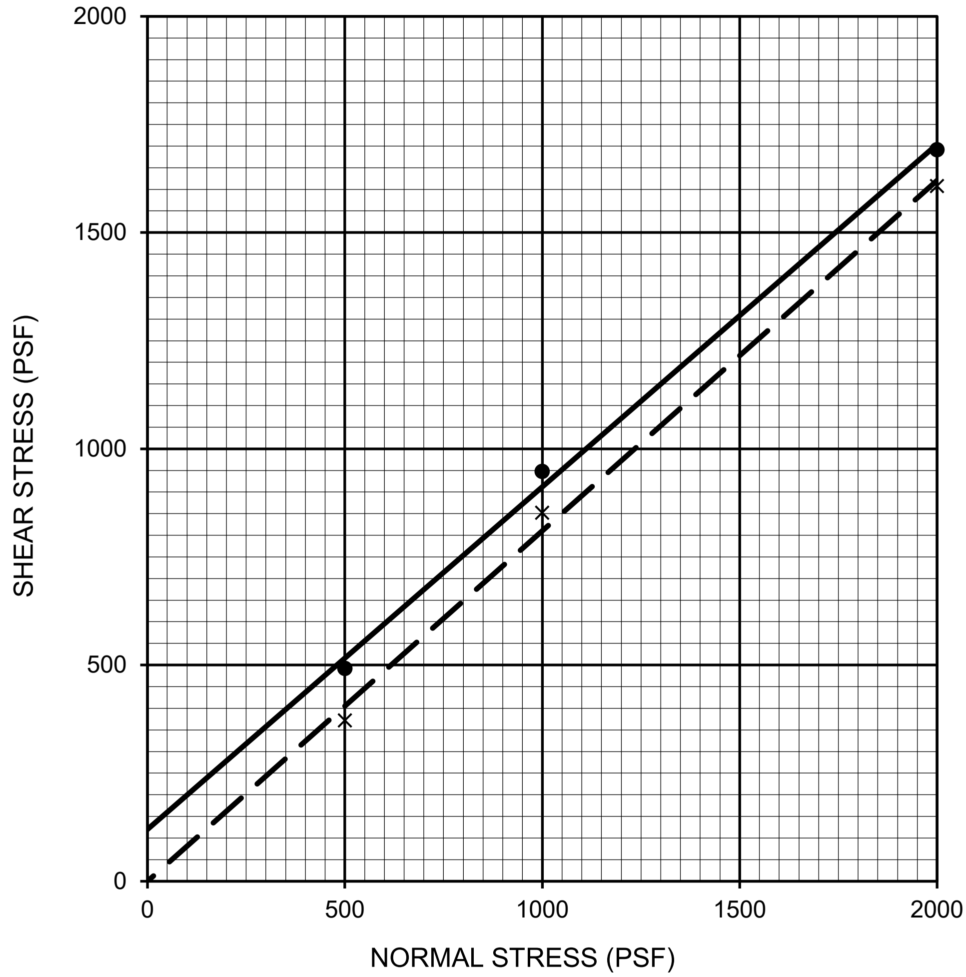
**FIGURE B-5**

**DIRECT SHEAR TEST RESULTS**

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA

211948002 | 11/22

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants




| Description | Symbol | Sample Location | Depth (ft) | Shear Strength | Cohesion (psf) | Friction Angle (degrees) | Soil Type |
|---|---|---|---|---|---|---|---|
| SILTY SAND | ——●—— | B-10 | 7.5-9.0 | Peak | 120 | 38 | SM |
| SILTY SAND | – – X – – | B-10 | 7.5-9.0 | Ultimate | 0 | 39 | SM |

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080

**FIGURE B-6**

**DIRECT SHEAR TEST RESULTS**

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

211948002 | 11/22

| SAMPLE LOCATION | SAMPLE DEPTH (ft) | pH [1] | RESISTIVITY [1] (ohm-cm) | SULFATE CONTENT [2] | | CHLORIDE CONTENT [3] (ppm) |
|---|---|---|---|---|---|---|
| | | | | (ppm) | (%) | |
| B-3 | 0.0-5.0 | 7.5 | 5,963 | 10 | 0.001 | 10 |

[1] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 643
[2] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 417
[3] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 422

FIGURE B-7

**CORROSIVITY TEST RESULTS**

THEO LACY FACILITY SECURITY WALL
ORANGE, CALIFORNIA

211948002 | 11/22

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

# Appendix F

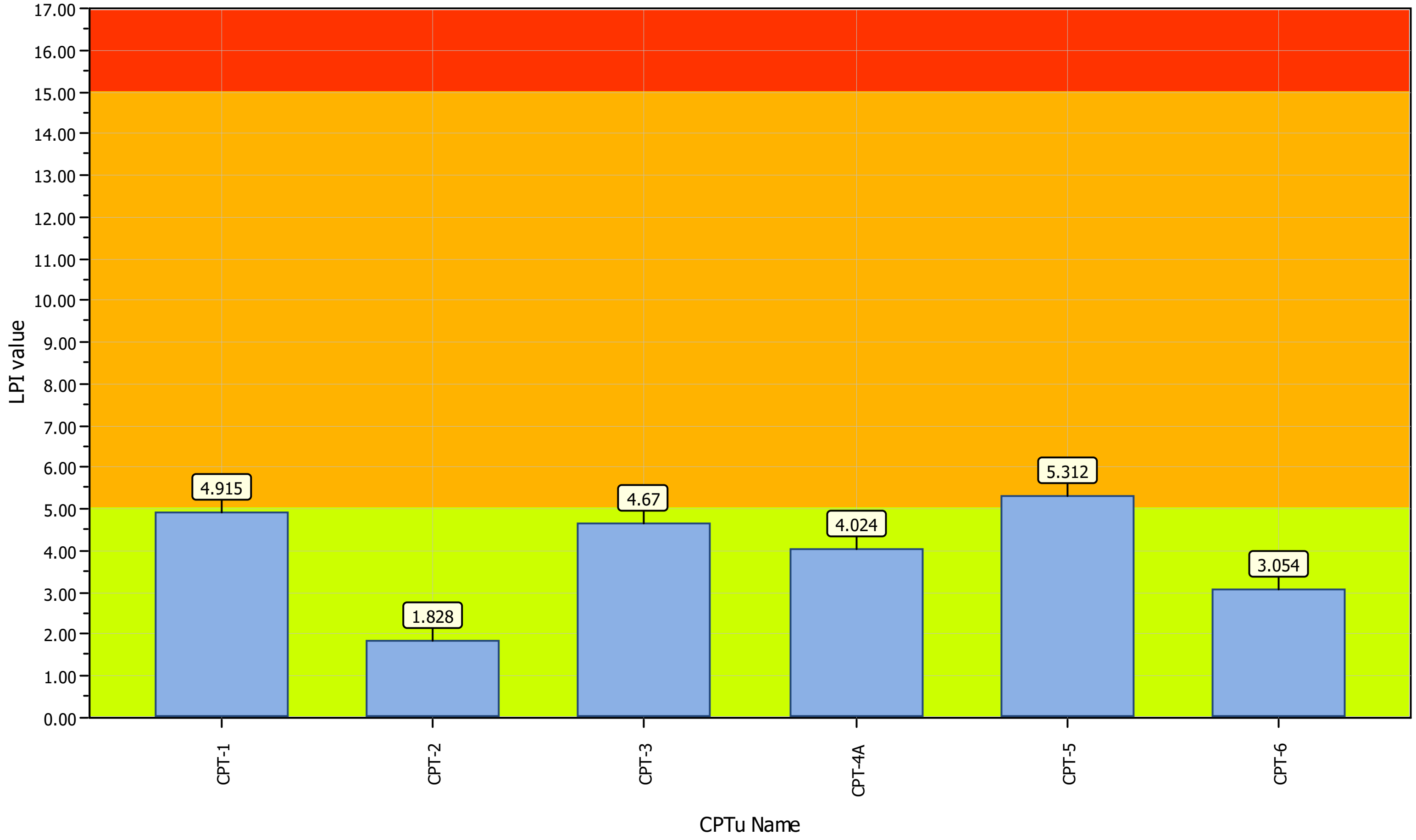
Liquefaction Analysis

**Verdantas**
2600 Michelson Drive, Suite 400
Irvine, CA 92612

**Project title : Verdantas / Griffin OC Workforce Reentry**

**Location : 591 The City Drive South, Orange, CA**

## Overall Liquefaction Potential Index report




**LPI color scheme**

- Very high risk
- High risk
- Low risk

**Basic statistics**

Total CPT number: 6

83% low risk

17% high risk

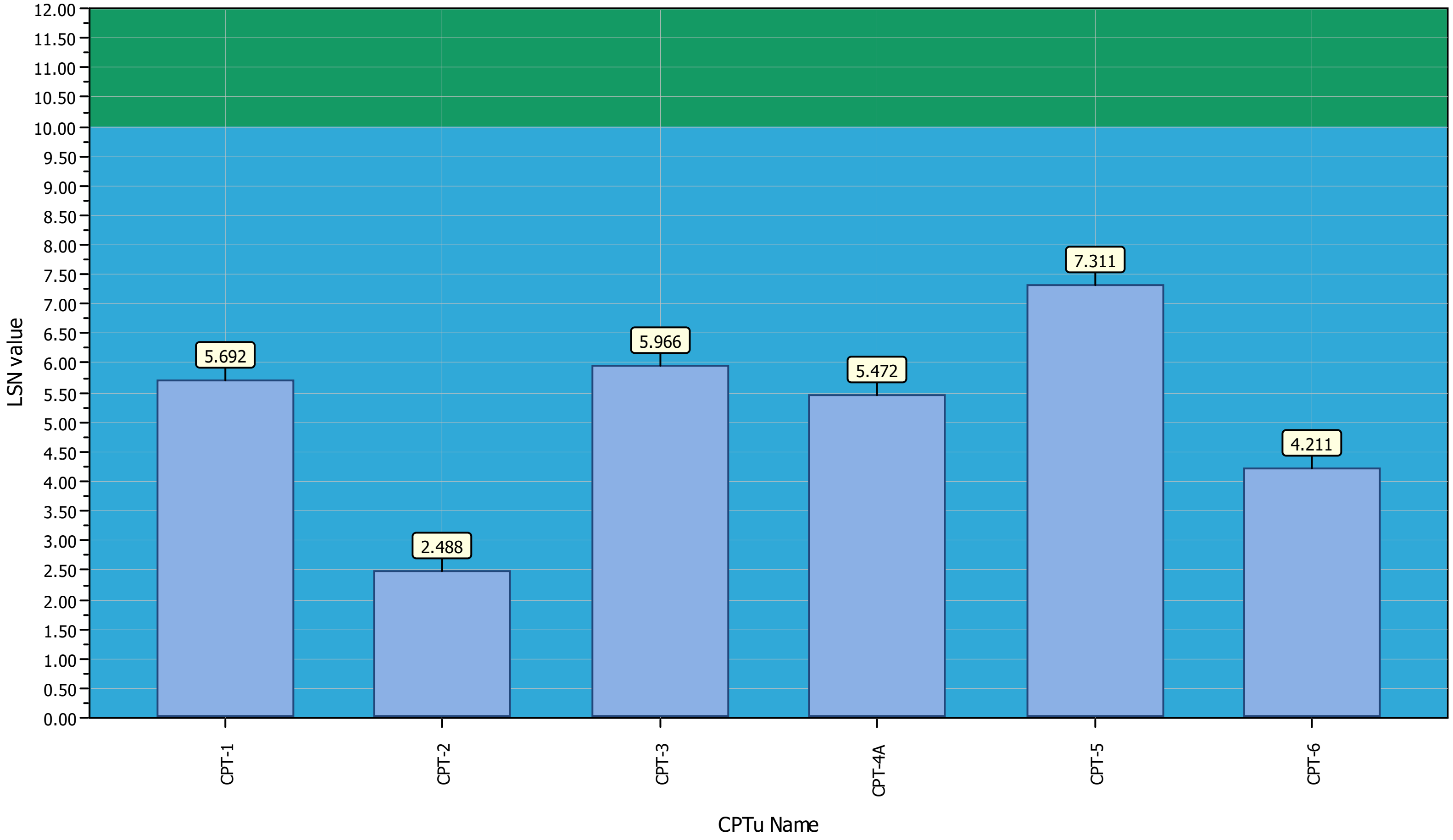
0% very high risk

**Verdantas**
2600 Michelson Drive, Suite 400
Irvine, CA 92612

**Project title : Verdantas / Griffin OC Workforce Reentry**

**Location : 591 The City Drive South, Orange, CA**

## Overall Liquefaction Severity Number report




**LSN color scheme**

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

**Basic statistics**

Total CPT number: 6

100% little liquefaction

0% minor liquefaction

0% moderate liquefaction

0% moderate to major liquefaction

0% major liquefaction

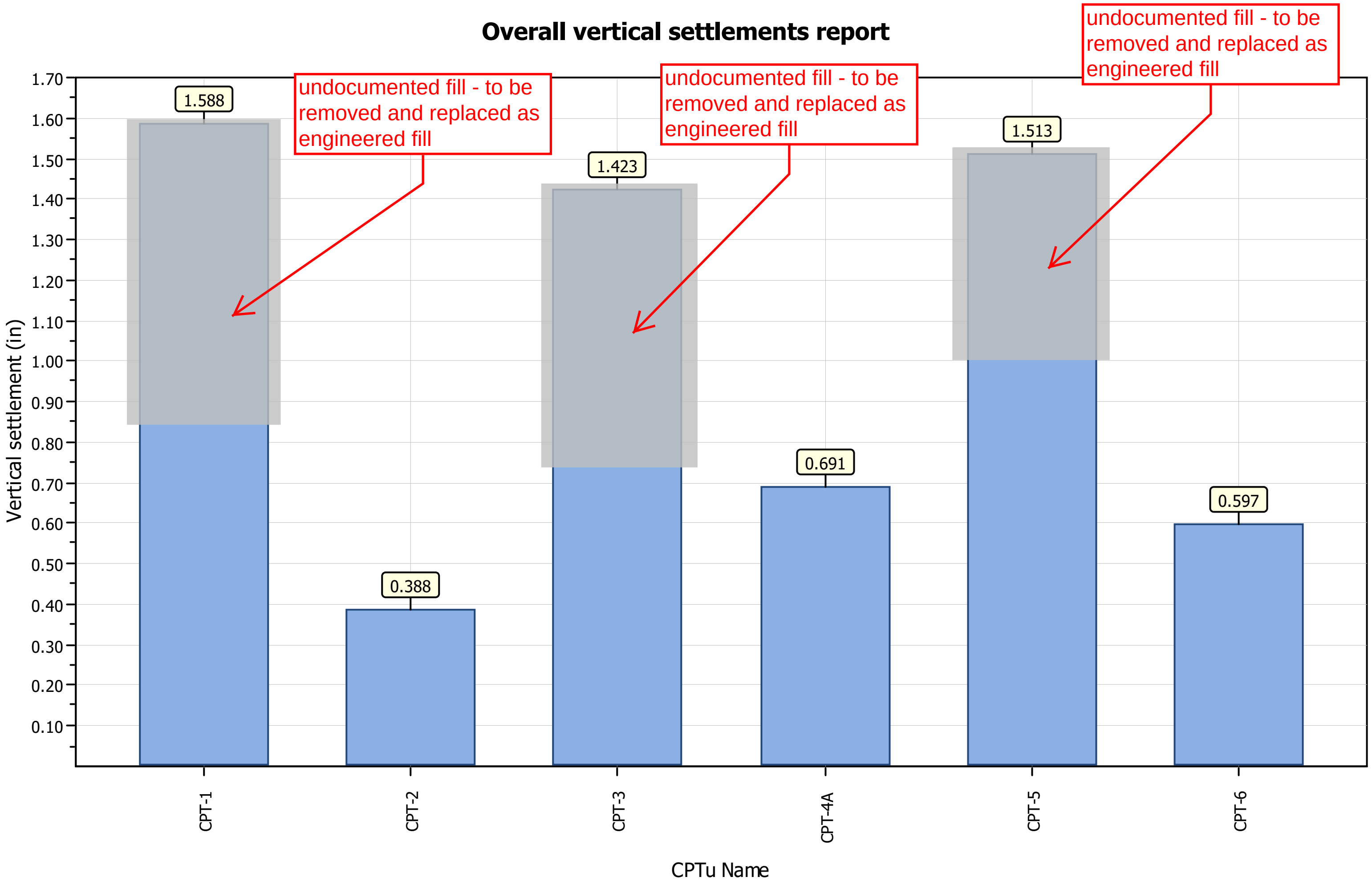
0% severe liquefaction

**Verdantas**
2600 Michelson Drive, Suite 400
Irvine, CA 92612

**Project title : Verdantas / Griffin OC Workforce Reentry**

**Location : 591 The City Drive South, Orange, CA**

## Overall vertical settlements report

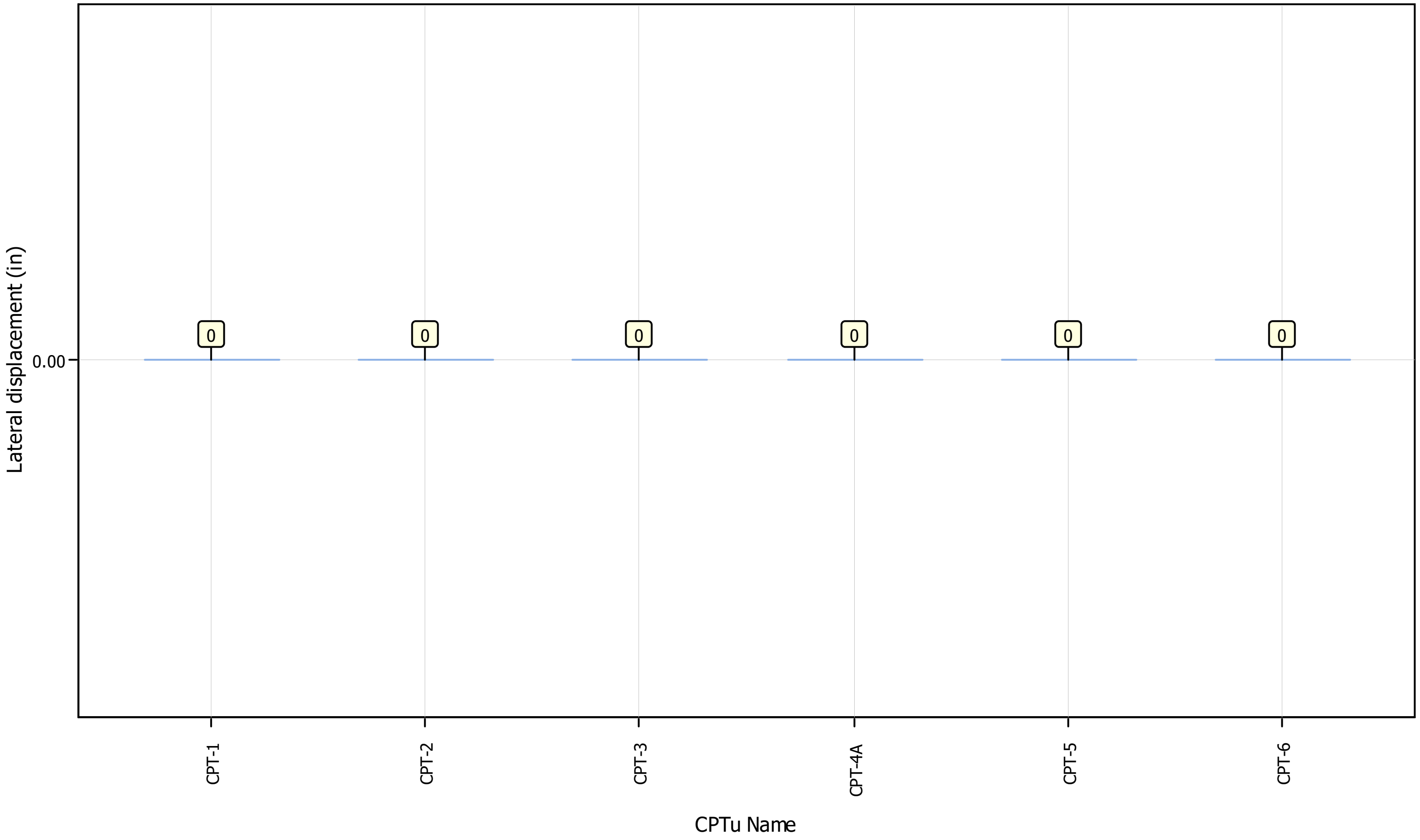


**Verdantas**
2600 Michelson Drive, Suite 400
Irvine, CA 92612

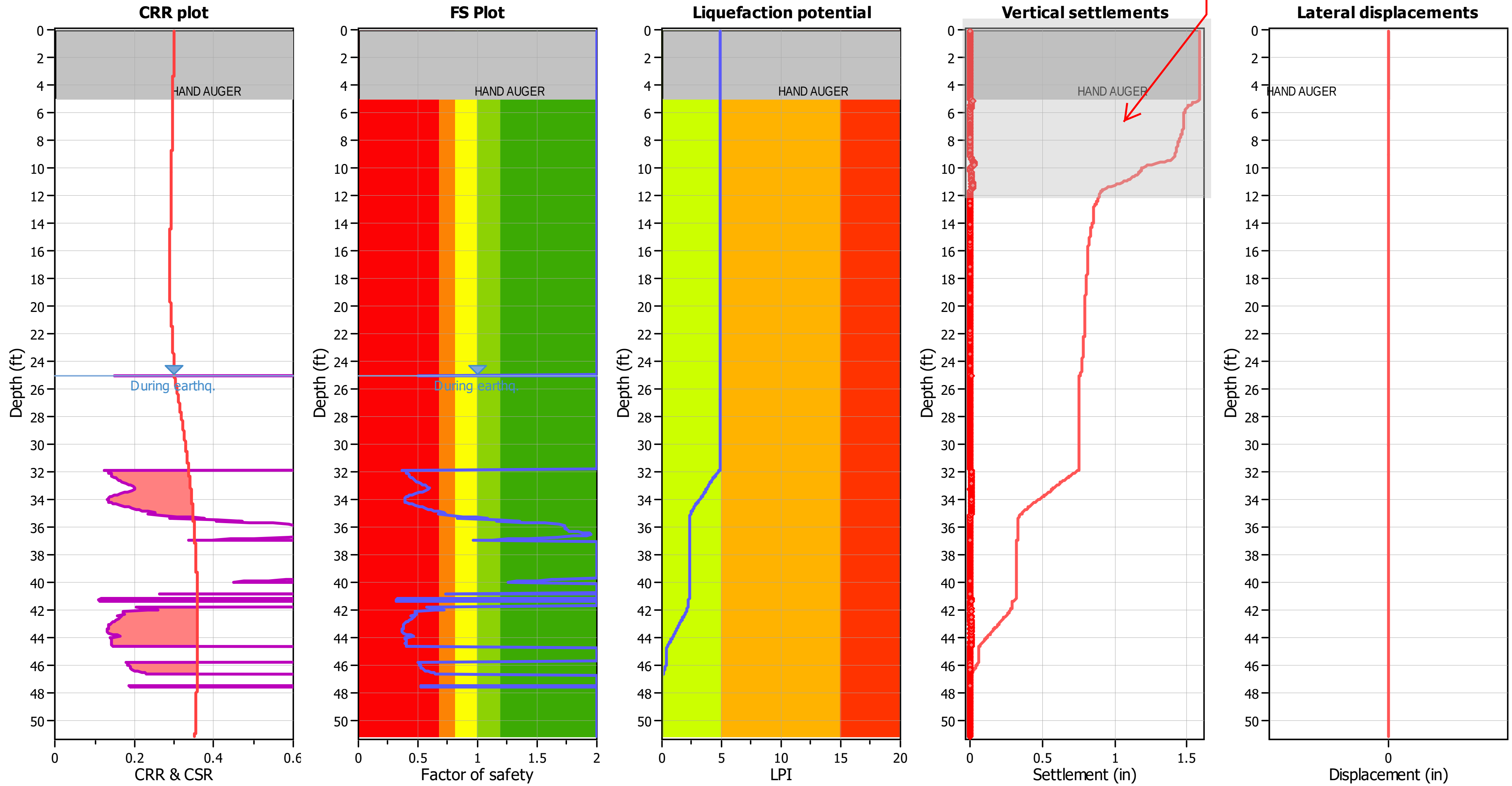
**Project title : Verdantas / Griffin OC Workforce Reentry**

**Location : 591 The City Drive South, Orange, CA**

## Overall lateral displacements report



## Liquefaction analysis overall plots




### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | NCEER (1998) | Depth to water table (erthq.): | 25.00 ft | Fill weight: | N/A |
| Fines correction method: | NCEER (1998) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.64 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.63 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 29.00 ft | Fill height: | N/A | Limit depth: | N/A |

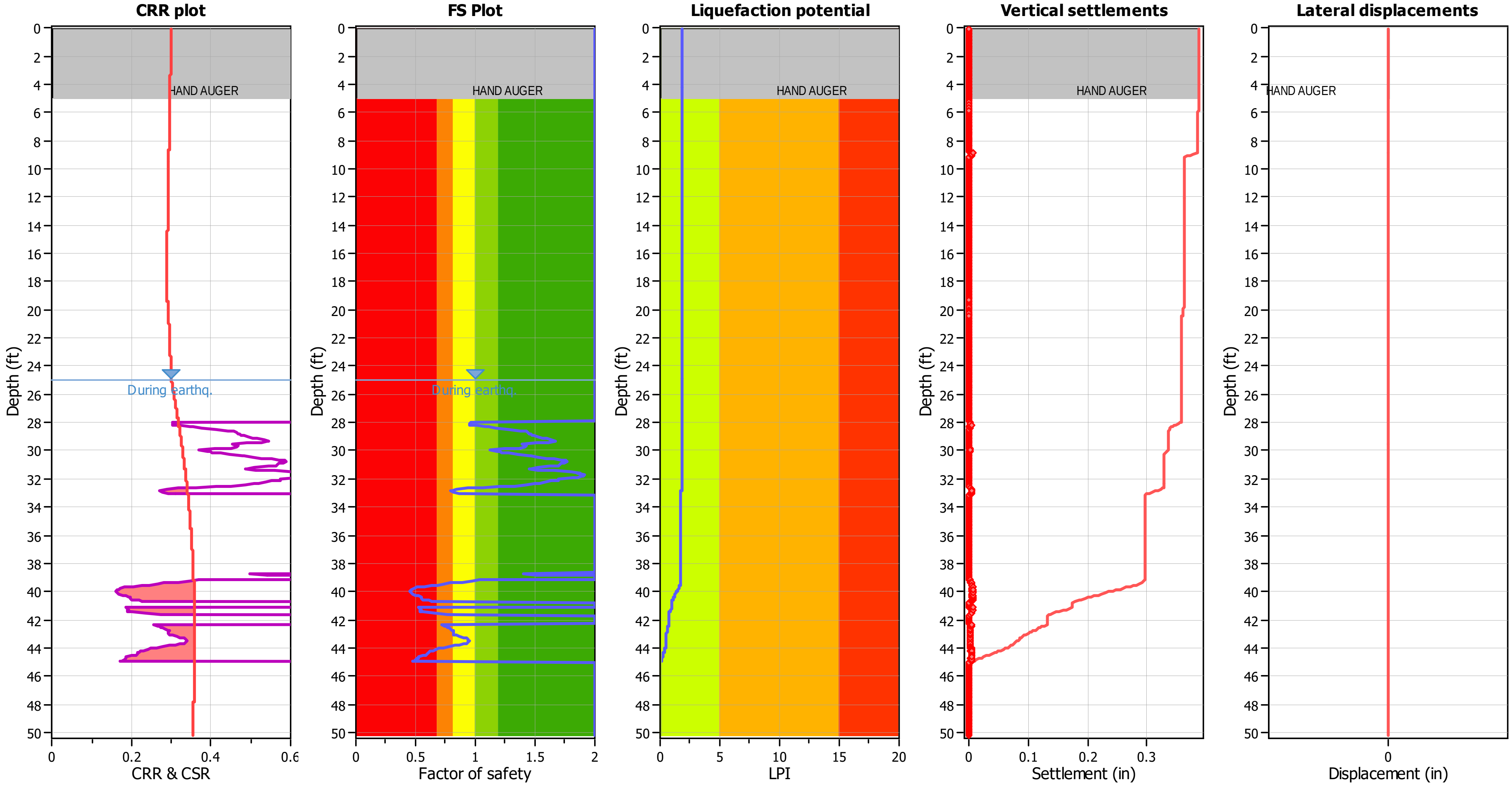
### F.S. color scheme

- 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 overall plots




**Input parameters and analysis data**

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | NCEER (1998) | Depth to water table (erthq.): | 25.00 ft | Fill weight: | N/A |
| Fines correction method: | NCEER (1998) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.64 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.63 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 29.00 ft | Fill height: | N/A | Limit depth: | N/A |

**F.S. color scheme**

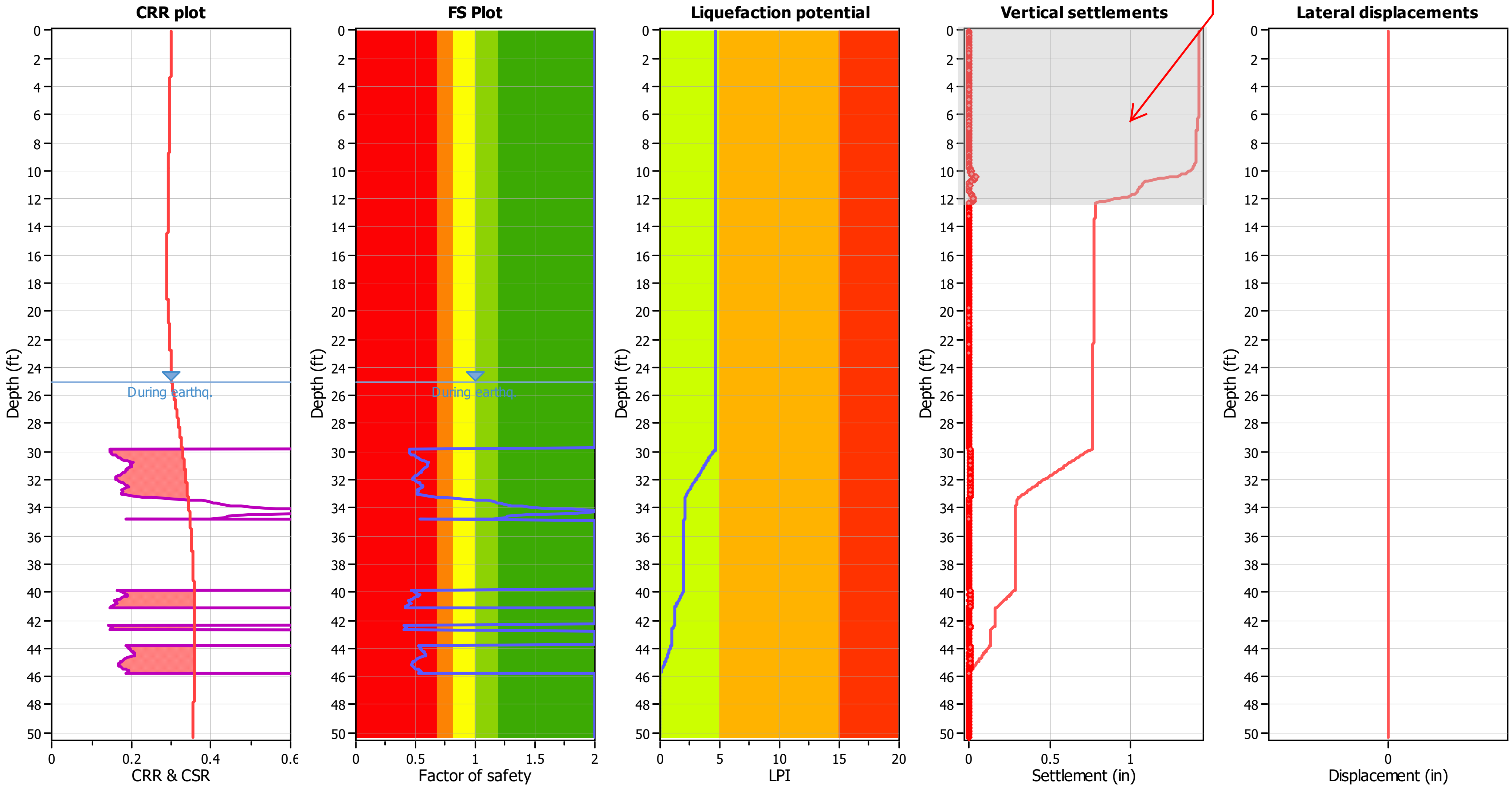
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LPI color scheme**

- Very high risk
- High risk
- Low risk

undocumented fill - to be removed and replaced as engineered fill

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | NCEER (1998) | Depth to water table (erthq.): | 25.00 ft | Fill weight: | N/A |
| Fines correction method: | NCEER (1998) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.64 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.63 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 29.00 ft | Fill height: | N/A | Limit depth: | N/A |

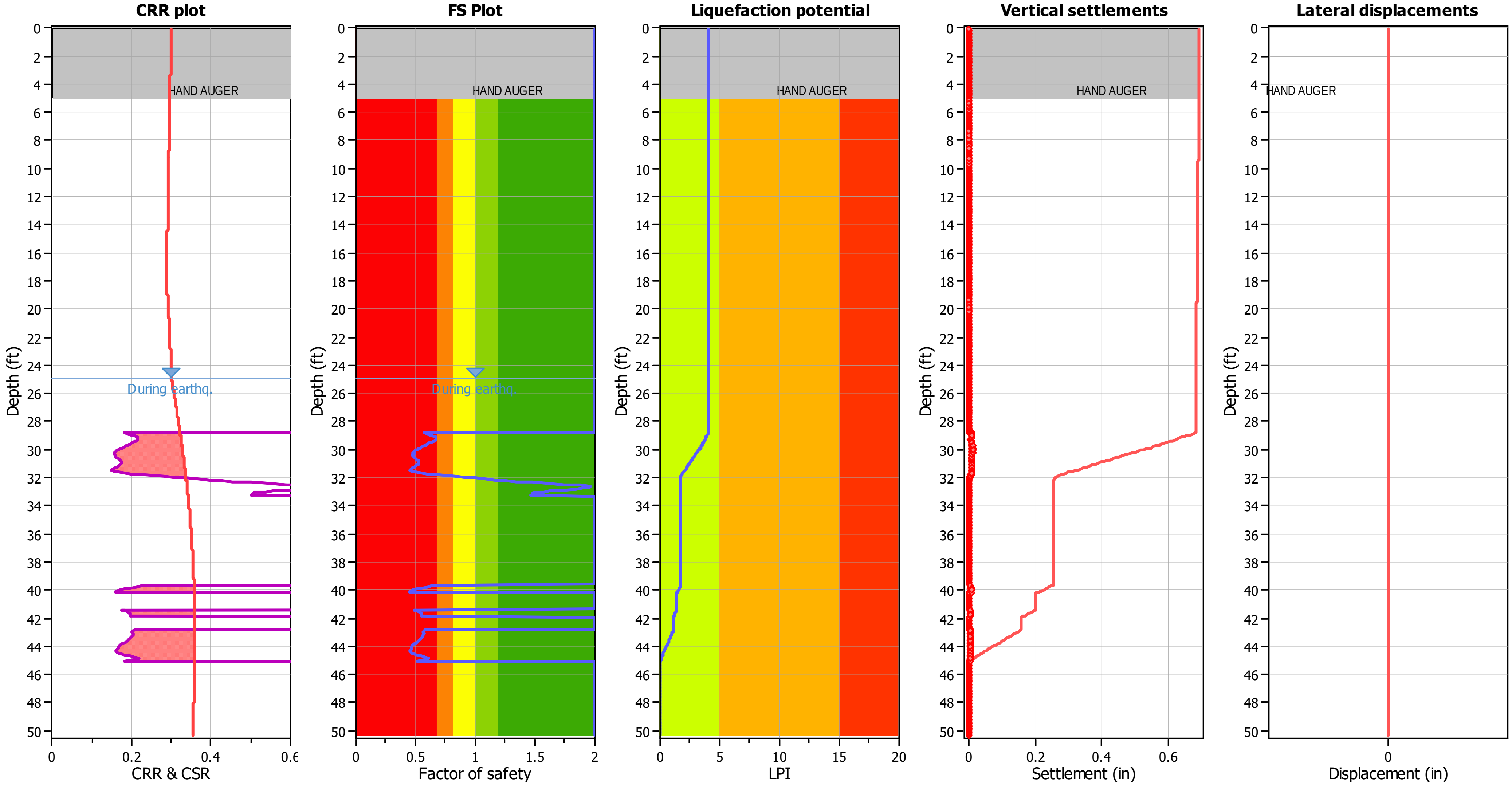
## F.S. color scheme

- 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 overall plots




**Input parameters and analysis data**

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | NCEER (1998) | Depth to water table (erthq.): | 25.00 ft | Fill weight: | N/A |
| Fines correction method: | NCEER (1998) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.64 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.63 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 29.00 ft | Fill height: | N/A | Limit depth: | N/A |

**F.S. color scheme**

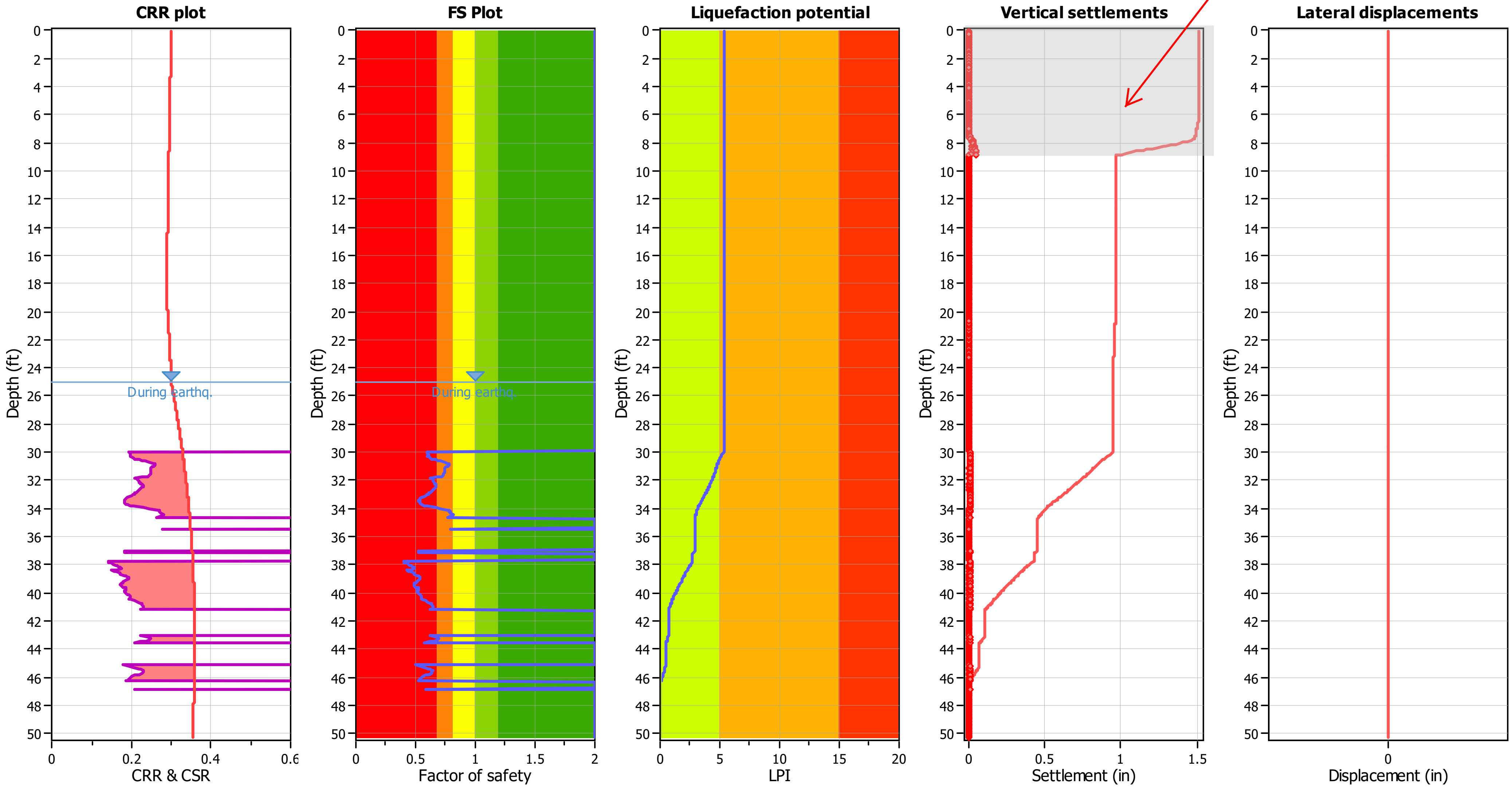
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**LPI color scheme**

- Very high risk
- High risk
- Low risk

undocumented fill - to be removed and replaced as engineered fill

## Liquefaction analysis overall plots




**Input parameters and analysis data**

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | NCEER (1998) | Depth to water table (erthq.): | 25.00 ft | Fill weight: | N/A |
| Fines correction method: | NCEER (1998) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.64 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.63 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 29.00 ft | Fill height: | N/A | Limit depth: | N/A |

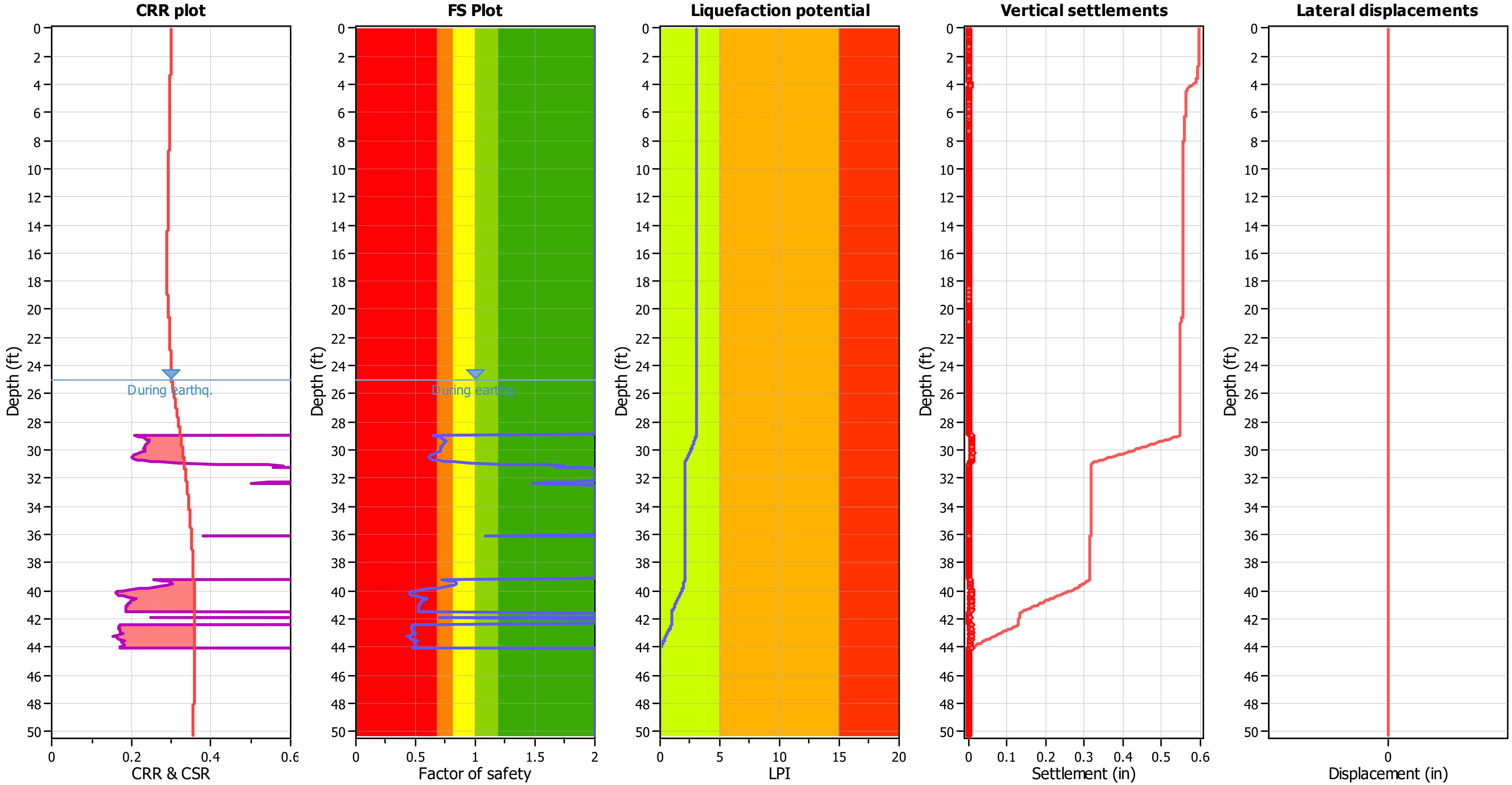
**F.S. color scheme**

- 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 overall plots




**Input parameters and analysis data**

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | NCEER (1998) | Depth to water table (erthq.): | 25.00 ft | Fill weight: | N/A |
| Fines correction method: | NCEER (1998) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.64 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.63 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 29.00 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

# Appendix G

Earthwork and Grading Guide Specifications

# APPENDIX G

# EARTHWORK AND GRADING GUIDE SPECIFICATIONS

## Table of Contents

# 1.0 General

## 1.1 Intent

These Earthwork and Grading Guide Specifications are for grading and earthwork shown on the current, approved grading plan(s) and/or indicated in the Verdantas Inc. geotechnical report(s). These Guide Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the project-specific recommendations in the geotechnical report shall supersede these Guide Specifications. Verdantas Inc. shall provide geotechnical observation and testing during earthwork and grading. Based on these observations and tests, Verdantas Inc. may provide new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

## 1.2 Role of Verdantas Inc.

Prior to commencement of earthwork and grading, Verdantas Inc. shall meet with the earthwork contractor to review the earthwork contractor's work plan, to schedule sufficient personnel to perform the appropriate level of observation, mapping and compaction testing. During earthwork and grading, Verdantas Inc. shall observe, map, and document subsurface exposures to verify geotechnical design assumptions. If observed conditions are found to be significantly different than the interpreted assumptions during the design phase, Verdantas Inc. shall inform the owner, recommend appropriate changes in design to accommodate these observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include (1) natural ground after clearing to receiving fill but before fill is placed, (2) bottoms of all "remedial removal" areas, (3) all key bottoms, and (4) benches made on sloping ground to receive fill.

Verdantas Inc. shall observe moisture-conditioning and processing of the subgrade and fill materials, and perform relative compaction testing of fill to determine the attained relative compaction. Verdantas Inc. shall provide *Daily Field Reports* to the owner and the Contractor on a routine and frequent basis.

## 1.3 The Earthwork Contractor

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 Guide Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing grading and backfilling in accordance with the current, approved plans and specifications.

The Contractor shall inform the owner and Verdantas Inc. of changes in work schedules at least one working day in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that Verdantas Inc. is aware of all grading operations.

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

# 2.0 Preparation of Areas to be Filled

## 2.1 Clearing and Grubbing

Vegetation, such as brush, grass, roots and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies and Verdantas Inc.. Care should be taken not to encroach upon or otherwise damage native and/or historic trees designated by the Owner or appropriate agencies to remain. Pavements, flatwork or other construction should not extend under the “drip line” of designated trees to remain.

Verdantas Inc. shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 3 percent of organic materials (by dry weight: ASTM D 2974). Nesting of the 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, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

## 2.2 Processing

Existing ground that has been declared satisfactory for support of fill, by Verdantas Inc., shall be scarified to a minimum depth of 6 inches (15 cm). Existing ground that is not satisfactory shall be over-excavated as specified in the following Section A-2.3. 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.

## 2.3 Overexcavation

In addition to removals and over-excavations 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 over-excavated to competent ground as evaluated by Verdantas Inc. during grading. All undocumented fill soils under proposed structure footprints should be excavated

## 2.4 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), (>20 percent grade) the ground shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet (4.5 m) wide and at least 2 feet (0.6 m) deep, into competent material as evaluated by Verdantas Inc.. Other benches shall be excavated a minimum height of 4 feet (1.2 m) into competent material or as otherwise recommended by Verdantas Inc.. Fill placed on ground sloping flatter than 5:1 (horizontal to vertical units), (<20 percent grade) shall also be benched or otherwise over-excavated to provide a flat subgrade for the fill.

## 2.5 Evaluation/Acceptance of Fill Areas

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 Verdantas Inc. as suitable to receive fill. The Contractor shall obtain a written acceptance (*Daily Field Report*) from Verdantas Inc. prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys and benches.

# 3.0 Fill Material

## 3.1 Fill Quality

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by Verdantas Inc. 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 Verdantas Inc. or mixed with other soils to achieve satisfactory fill material.

## 3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 6 inches (15 cm), shall not be buried or placed in fill unless location, materials and placement methods are specifically accepted by Verdantas Inc.. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 feet (3 m) measured vertically from finish grade, or within 2 feet (0.61 m) of future utilities or underground construction.

## 3.3 Import

If importing of fill material is required for grading, proposed import material shall meet the requirements of Section A-3.1, and be free of hazardous materials ("contaminants") and rock larger than 3-inches (8 cm) in largest dimension. All import soils shall have an Expansion Index (EI) of 20 or less and a sulfate content no greater than (≤) 500 parts-per-million (ppm). A representative sample of a potential import source shall be given to Verdantas Inc. at least four full working days before importing begins, so that suitability of this import material can be determined and appropriate tests performed.

# 4.0 Fill Placement and Compaction

## 4.1 Fill Layers

Approved fill material shall be placed in areas prepared to receive fill, as described in Section A-2.0, above, in near-horizontal layers not exceeding 8 inches (20 cm) in loose thickness. Verdantas Inc. may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers, and only if the building officials with the appropriate jurisdiction approve. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

## 4.2 Fill Moisture Conditioning

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 the American Society of Testing and Materials (ASTM) Test Method D 1557.

## 4.3 Compaction of Fill

After each layer has been moisture-conditioned, mixed, and evenly spread, each layer shall be uniformly compacted to not-less-than (≥) 90 percent of the maximum dry density as determined by ASTM Test Method D 1557. In some cases, structural fill may be specified (see project-specific geotechnical report) to be uniformly compacted to at-least (≥) 95 percent of the ASTM D 1557 modified Proctor laboratory maximum dry density. For fills thicker than (>) 15 feet (4.5 m), the portion of fill deeper than 15 feet below proposed finish grade shall be compacted to 95 percent of the ASTM D 1557 laboratory maximum density. 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 with uniformity.

## 4.4 Compaction of Fill Slopes

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by back rolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet (1 to 1.2 m) in fill elevation, or by other methods producing satisfactory results acceptable to Verdantas Inc.. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of the ASTM D 1557 laboratory maximum density.

## 4.5 Compaction Testing

Field-tests for moisture content and relative compaction of the fill soils shall be performed by Verdantas Inc.. Location and frequency of tests shall be at our field representative(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).

## 4.6 Compaction Test Locations

Verdantas Inc. shall document the approximate elevation and horizontal coordinates of each density test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that Verdantas Inc. can determine the test locations with sufficient accuracy. Adequate grade stakes shall be provided.

# 5.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by Verdantas Inc. during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by Verdantas Inc. 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, then observed and reviewed by Verdantas Inc. prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by Verdantas Inc..

# 6.0 Trench Backfills

## 6.1 Safety

The Contractor shall follow all OSHA and Cal/OSHA requirements for safety of trench excavations. Work should be performed in accordance with Article 6 of the *California Construction Safety Orders*, 2009 Edition or more current (see also: http://www.dir.ca.gov/title8/sb4a6.html ).

## 6.2 Bedding and Backfill

All utility trench bedding and backfill shall be performed in accordance with applicable provisions of the 2018 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Bedding material shall have a Sand Equivalent greater than 30 (SE>30). Bedding shall be placed to 1-foot (0.3 m) over the top of the conduit, and densified by jetting in areas of granular soils, if allowed by the permitting agency. Otherwise, the pipe-bedding zone should be backfilled with Controlled Low Strength Material (CLSM) consisting of at least one sack of Portland cement per cubic-yard of sand, and conforming to Section 201-6 of the 2018 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Backfill over the bedding zone shall be placed and densified mechanically to a minimum of 90 percent of relative compaction (ASTM D 1557) from 1 foot (0.3 m) above the top of the conduit to the surface. Backfill above the pipe zone shall **not** be jetted. Jetting of the bedding around the conduits shall be observed by Verdantas Inc. and backfill above the pipe zone (bedding) shall be observed and tested by Verdantas Inc..

## 6.3 Lift Thickness

Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to Verdantas Inc. that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method, and only if the building officials with the appropriate jurisdiction approve.