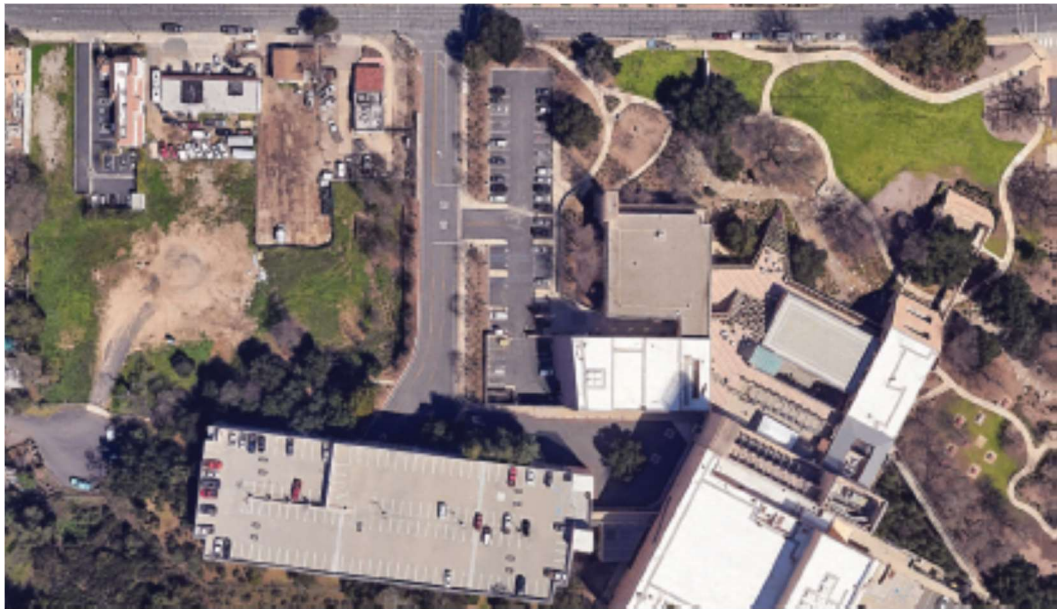


# Appendix H

## Geotechnical Investigation

# PRELIMINARY GEOTECHNICAL INVESTIGATION

**Civic Arts Plaza Master Plan  
City of Thousand Oaks  
2100 Thousand Oaks Blvd  
Thousand Oaks, California 91362**



Prepared for:

**Mr. Anthony Tomasello  
Manager of Planning  
RRM Design Group  
422 East Main Street  
Ventura, California 93001**

**May 2025**



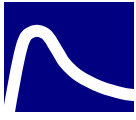
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# COTTON, SHIRES AND ASSOCIATES, INC.

CONSULTING ENGINEERS AND GEOLOGISTS

May 29, 2025

SC6174

Mr. Anthony Tomasello  
Manager of Planning  
RRM Design Group  
422 E Main Street  
Ventura, California 93001

SUBJECT: **Preliminary Geotechnical Investigation**  
RE: Civic Arts Plaza Master Plan  
City of Thousand Oaks  
2100 Thousand Oaks Blvd, Thousand Oaks, California 91362

Dear Mr. Tomasello:

**Cotton, Shires, and Associates, Inc. (CSA)** is pleased to present **RRM Design Group (RRM)** with the results of our preliminary geotechnical investigation for the proposed City of Thousand Oaks (City) Civic Arts Plaza Mater Plan project. Geotechnical consulting services for this project were provided in accordance with our proposal dated October 17, 2024, and the consultant service agreement (2994-03-PP24) authorized December 12, 2024.

The purpose of our geotechnical investigation to date has been to generally characterize earth materials at the site and to develop preliminary geotechnical recommendations for the proposed improvements. We appreciate the opportunity to have been of service to you on this project.

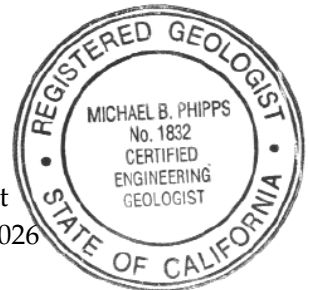
Sincerely,

**COTTON, SHIRES AND ASSOCIATES, INC.**

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**PRELIMINARY GEOTECHNICAL INVESTIGATION  
CIVIC ARTS PLAZA MASTER PLAN  
City of Thousand Oaks, California**

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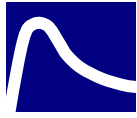
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**PRELIMINARY GEOTECHNICAL INVESTIGATION  
CIVIC ARTS PLAZA MASTER PLAN  
City of Thousand Oaks, California**

**1.0      INTRODUCTION**

**Cotton, Shires and Associates, Inc. (CSA)** is pleased to present **RRM Design Group (RRM)** with the results of our preliminary geotechnical investigation for the proposed **City of Thousand Oaks' (City)** Civic Arts Plaza (CAP) Master Plan project. Geotechnical consulting services for this project were provided in accordance with our proposal dated October 17, 2024, and the consultant service agreement (2994-03-PP24) signed December 12, 2024.

**1.1      Project Description**

Based on site plans provided by RRM (2025) and meetings with the project team, we understand that the project will include new construction including several multi-story mixed-use buildings, a hotel, substantial remodel of the existing City Hall building, a cafe, retaining walls, storm drain realignment and access roads. Much of the new development may also include partial or completely subterranean levels.

The general project site location is shown on attached Figure 1 – Site Vicinity Map. CSA and historical exploration locations are shown on attached Figure 2 – Site Exploration Map. Generalized soil and bedrock profiles through the major proposed site improvement areas are shown on attached Figures 3 through 8, Engineering Geologic Cross Sections A-A' through F-F'.

Project plans are currently in the conceptual phase and the City may proceed with project design based in part on the results of this preliminary investigation, which also incorporates the findings from our 2024 constraints evaluation as well as historical exploration by other consultants. The preliminary findings and recommendations presented in this report are to support project entitlement and will most likely need to be updated or confirmed with additional subsurface exploration, laboratory soil testing and geotechnical analyses, depending on the final structure locations, configurations, and depths as determined during the forthcoming design phase.

## **1.2 Purpose and Scope of Work**

Our primary objective for this study was to generally characterize the soil, bedrock and groundwater conditions within the anticipated grading and construction limits of the currently proposed project components. A summary of the work we performed is outlined as follows.

**1.2.1 Research and Review of Available Data** – We researched, reviewed, and compiled data from available historic aerial photographs and published and readily available documents, including previous geotechnical investigations on and near the site, and partial as-built geotechnical information and record drawings for the site to gain background data regarding previous site uses, development history, and geotechnical conditions. Specifically reviewed documents are discussed in the following section.

### **1.2.2 Previous Investigations**

- A geotechnical and geologic constraints evaluation was conducted by CSA in 2023-24 for the City's proposed CAP expansion. The results of our evaluation, including limited field exploration and laboratory testing, are incorporated into this report.
- The geotechnical investigation for the existing CAP Campus was conducted by Dames & Moore between 1990 and 1991. During their investigation, Dames & Moore excavated a total of 28 exploratory borings ranging in depth from about 15 to 55 feet and retained Endacott & Associates to conduct a total of 5 seismic refraction lines. Dames & Moore generally characterized subsurface conditions at the site as colluvium/alluvium underlain by very weathered to weathered volcanic conglomerate underlain by moderately to slightly weathered and hard to very hard Conejo Volcanics (note: the slightly weathered very hard basalt bedrock is colloquially known as "blue rock"). Earth materials encountered during Dames and Moore's exploration programs are generally consistent with the materials encountered in our exploration program.
- A Rough Grading Compaction Test Report was prepared in 1992 by Gorian and Associates, Inc. for the existing CAP building pads, parking garage building pad, eastern access road, and adjacent cut and fill slopes.
- Pacific Materials Laboratory, Inc. (PML) conducted a geotechnical investigation in 2001 for a two-story commercial building at 1868 Thousand Oaks Boulevard, which is located directly north of the proposed CAP campus expansion area. During their investigation, PML excavated a total of three exploratory borings ranging in depth

from about 10 to 20 feet. PML generally characterized subsurface conditions at the site as surficial artificial fill underlain by native soils (alluvium) identified as moderately firm clayey sand and firm sandy clay. Earth materials encountered during PML's exploration program are generally consistent with the materials encountered in our exploration program.

- Gorian and Associates conducted a geotechnical evaluation in 2017 for a multi-story multi-use development on the former Lupe's Restaurant site at 1710 Thousand Oaks Boulevard which is located west of the proposed CAP campus expansion area. Gorian and Associates compiled previous geotechnical information and excavated three exploratory borings ranging in depth from 20.5 to 28 feet. Three seismic refraction lines were also performed to evaluate rippability characteristics of the site bedrock. Gorian generally characterized subsurface conditions at the site as thin fill underlain by alluvial soils and volcanoclastic bedrock in the flatter portion of the site and volcanoclastic bedrock with minor deposits of colluvial soil in the incised drainages in the hilly portion of the site. Earth materials characterized at the site are generally consistent with the materials encountered in our exploration of the CAP site.

**1.2.3 Subsurface Exploration** – CSA completed multiple data collections for the City's Master Plan project. Preliminary exploration was conducted in December 2023 and consisted of seismic refraction survey lines and exploratory test pits at various on the western portion of the site. Additional exploration was conducted in January and February 2025 and consisted of exploratory hollow-stem auger borings and rock coring and percolation tests across the site. The exploration locations are shown in Figures 2 through 8. Summaries of field exploration procedures and exploration logs are presented in Appendix A – Site Exploration.

**Exploratory Test Pits.** We explored subsurface conditions at the site by means of seven (7) exploratory test pits excavated within the proposed improvement areas to depths ranging from about 7.5 to 17 feet bgs. Test pits were conducted near the seismic refraction lines to evaluate medium-sized excavator characteristics (a Hyundai 235 LRC-9 excavator was used) compared to the compression wave velocities interpreted from seismic refraction lines. The excavator was provided by DE Eddings of Acton, California. A summary of field exploration procedures and the test pit logs are presented in Appendix A – Field Exploration.

**Exploratory Hollow-Stem Auger and Rock Coring.** We completed fourteen (14) exploratory hollow-stem auger borings and five (5) percolation test holes between January 27, 2025 and February 4, 2025, to depths ranging from about 20.5 to 39 feet bgs. In three (3) of the

borings, rock coring was used to sample intact rock material below the depth of hollow-stem refusal. Drilling services were provided by 2R Drilling, Inc. of Chino, California. A summary of field exploration procedures and the boring and percolation hole logs are presented in Appendix A.

**Seismic Refraction Survey Lines.** We evaluated subsurface conditions at the site by means of six (6) non-invasive seismic refraction survey lines to investigate subsurface velocity (compression wave velocities) conditions of the development area, and to evaluate the rippability of subsurface earth materials using published correlation of compression wave velocities to rippability with various types of excavation equipment. These survey lines were conducted by CSA's registered geophysicist. Summaries of survey line procedures and conclusions, and interpreted subsurface velocity models, are presented in Appendix B – Seismic Refraction Survey.

**1.2.4 Geotechnical Laboratory Testing** – Laboratory tests were performed on select soil samples obtained from the test pits and borings. Laboratory tests consisted of moisture content, wet and dry unit weight determinations, particle size analysis, Atterberg limits, consolidation, direct shear strength, maximum unit weight/optimum moisture content, Expansion Index, R-value, and general corrosion (resistivity, pH, sulfates, and chlorides). A summary of the laboratory testing program is presented in Appendix C – Laboratory Testing.

**1.2.5 Geotechnical Evaluation and Reporting** – Geotechnical evaluation of the subject site consisted of characterizing field and laboratory test data and developing conclusions and recommendations regarding geotechnical and seismic hazards, excavatability and rippability, and preliminary foundation design criteria. Based on data obtained from our subsurface exploration and geotechnical laboratory testing programs, we have provided geotechnical opinions regarding site conditions and geotechnical hazards, and provided preliminary recommendations for the conceptually-designed improvements, including the following items, descriptions or recommendations:

- Site exploration and geotechnical map, engineering geologic cross sections, boring logs, test pit logs, percolation testing logs, seismic refraction line sections, and laboratory test results;
- Soil, rock and groundwater conditions at the site;
- Geohazard evaluation consisting of strong ground shaking, fault surface rupture, liquefaction potential, seismically-induced settlement, and expansive/ collapsible soils;
- Geotechnical and seismic design parameters for use with the California Building Code;

- Site preparation and grading and compaction requirements for fill placement;
- Excavatability/rippability and temporary excavations (maximum cut slope heights for loaded and unloaded conditions);
- Subgrade stabilization measures for soft or yielding subgrade conditions;
- Suitability of onsite and import soils proposed for use as compacted fill;
- Design criteria of foundations (depth and type of foundations, over-excavation recommendations, maximum allowable bearing pressures and potential foundation settlement);
- Resistance to lateral loads based on passive soil pressures and friction coefficients;
- Utility trench backfill;
- Design criteria for pavement areas and slabs-on-grade;
- Percolation testing results and design recommendations; and
- General corrosion potential of onsite soils for buried metal and concrete.

## **2.0 SITE CONDITIONS**

### **2.1 Surface Conditions**

The project site is located south of Thousand Oaks Boulevard, west of The Lakes Drive, north of the CAP parking structure, and on both sides of Dallas Drive, which runs north-south between Thousand Oaks Boulevard and the existing parking structure at the toe of the State Highway 101 embankment (Figure 1). The site also includes existing one- to two-story commercial buildings and associated asphalt parking lots along the south side of Thousand Oaks Boulevard and west of Dallas Drive.

The western portion of the site, which consists of the existing buildings and open field to the south, slopes gently to the north and west with elevations ranging from about +821 feet (relative to the NAVD88 datum) near the toe of the ascending slope to about +812 feet near the site's western property line. There is an approximately 9-foot-high earthen access ramp ascending from this flatter portion of the site to the north end of the Oakwood Drive cul-de-sac, which is situated at about elevation +825 feet.

South of the open field and east of the Oakwood Drive cul-de-sac is an approximate 19-foot-high slope with elevations ranging from about +821 feet at the toe of slope to about +840 feet at the top of slope along the north side of the existing parking structure. Locally, slope gradients range from about 3:1 to 2:1 (H:V).

Elevations along Dallas Drive range from about +816 feet near Thousand Oaks Boulevard to about +840 feet at the entrance to the parking structure. Dallas Drive is situated atop an embankment fill with a variable-height descending slope (partially supported by a retaining wall) on the west side of Dallas Drive, toward the flatter area of the site, and on the east side, toward an existing asphalt paved parking area and loading dock for the Ahmanson Forum at about +830 feet. A significant grade break exists between Dallas Drive and the access road to Kavli Theater, and the Ahmanson Forum loading dock. This grade break is supported by retaining walls ranging in height from 1 to 16 feet.

Between Dallas Drive and The Lakes Drive, the site generally slopes down to the southwest towards a rock drainage where the minimum elevation is about +815 feet, which then slopes up towards the south with the maximum elevation of about +852 feet on the slope south of the Fred Kavli Theater access road. Along Thousand Oaks Boulevard, the elevation generally rises gently towards the northeast with elevations ranging between +809 feet near the medical building at 1868 Thousand Oaks Boulevard and +823 feet at the intersection of Thousand Oaks Boulevard and The Lakes Drive.

## **2.2 Geologic Setting**

The site is located in the southern part of the west-central portion of the Transverse Ranges Physiographic Province of Southern California. The general structural and geomorphic trend of the Transverse Ranges is east-west in contrast to the dominant northwest-southeast trend of both the Coast Range Province to the northwest and the Peninsular Ranges Province to the south. The primary geologic structure in the Transverse Ranges Province is a series of broad east-west trending anticlinal and synclinal folds which form structural "highs" (e.g., Santa Monica Mountains, Simi Hills, and north of the Simi Valley) and "lows" (Conejo, Las Virgenes, San Fernando and Simi Valleys).

Geologic units in the region consist of Tertiary marine sedimentary and volcanic rocks, along with local accumulations of Quaternary alluvium and valley fill. The subject site is located along the northern flank of the foothills of the Santa Monica Mountains along the southern edge of Arroyo Conejo, a narrow west-northwest trending valley located between the Conejo Valley to the west and the Russell Valley to the southeast.

The northern half of the site is relatively flat-lying and the southern half of the site is characterized by low hills with gentle to steep slopes. The site is underlain by Miocene volcanic conglomerate (Calabasas Formation of Campbell, et al., 2014, also mapped as Detrital Sediments of Lindero Canyon by Dibblee, 1993) which crops out in the hills that make up the southern

portion of the site and Holocene to late-Pleistocene age colluvium and alluvium which cover the flatter northern half of the site. Data obtained from our study and previous investigations by others indicate that hard to very hard volcanic basalt of the middle Miocene Conejo Volcanics (possibly the Basaltic Lower Zone of the Conejo Volcanics of Campbell, et al., 2014) underlies the volcanic conglomerate and colluvial/alluvial soils. Regional geology is shown on the attached Figure 9 – Regional Geologic Map.

### **2.3 General Site Subsurface Conditions**

The project area is characterized by sloping hillside topography covered by shallow artificial fill and/or topsoil/slopewash, colluvial soils and/or alluvium overlying volcanoclastic (detrital) bedrock of the Calabasas Formation and volcanic bedrock of the Conejo Volcanics Formation. These materials are generally depicted in the test pit, boring, and percolation hole logs in Appendix A, and their corresponding compression wave velocities are represented in the seismic refraction results in Appendix B. The soil and bedrock materials encountered during our study have properties consistent with the materials and velocities described in previous nearby studies by Dames & Moore (1990 and 1991) and PML (2001), as well as with published geologic maps (Figure 9). Generalized earth unit descriptions are provided in the following sections.

**2.3.1 Artificial Fill (caf and af)** – Based upon the information provided to us, the fill materials encountered in our explorations are either documented as certified (map symbol “caf-G92”), believed to be certified, but no documentation has been provided (map symbol “caf”) or undocumented (map symbol “af”). Compacted fill placed during rough grading of the CAP buildings, parking structure, and east access road is documented by Gorian and Associates (1992) and the approximate limits of this fill (map unit “caf-G92”) are illustrated on our Engineering Geologic Map (Figure 2) and applicable Engineering Geologic Cross-Sections (Figures 3 through 8). The fill materials that are believed to be certified as compacted fills include Dallas Drive south of Thousand Oaks Boulevard to the CAP parking structure, and the City Hall lower parking lot area.

Undocumented fill was generally encountered outside of the 1992 CAP improvement areas; specifically, within the areas of Buildings A, B and C. Some of this fill, including beneath and above the existing 8' x 16' reinforced concrete box storm drain, may have been certified, but was placed in the 1960's at compaction standards that are considered outdated today. We have estimated the approximate limits of these fills on our Engineering Geologic Map (Figure 2) based upon comparisons of original and proposed grade elevations on the grading plan record drawing (map unit “af” on Figure 1). Limits of fills are also interpreted on Cross-Sections A-A' through F-F' (Figures 3 through 8).

**2.3.2 Colluvium (Qc) and Alluvium (Qal)** – Native soils consisting of colluvium and alluvium were encountered at the surface or beneath the fill materials, and generally overlie bedrock. Encountered colluvial and alluvial soils generally consisted of medium dense clayey and silty sand, and stiff to very sandy clay with varying amounts of gravel. Based on our laboratory testing and historical data, native soils generally demonstrate low to moderate expansion potential, low to moderate compressibility, and very low potential for hydro-consolidation.

**2.3.3 Bedrock (Tcbvc and Tcv)** – Bedrock underlying the natural soils at the site consists of detrital volcanic conglomerate assigned to the Calabasas Formation (map unit “Tcbvc”) overlying basalt and andesite-dacite breccia or agglomerate (map unit “Tcv”) and believed to be correlative with the Basaltic Lower Zone of the Conejo Volcanics Formation per the stratigraphic nomenclature of Campbell, et al. (2014). The nearest regionally-mapped outcrops of the Conejo Volcanics-Basaltic Lower Zone are located south of the 101 Ventura Freeway.

As observed in our exploration, the volcanic conglomerate consisted of a firmly consolidated, moderately cemented, very weathered to weathered dark yellowish-brown to orange-brown silty clayey sand and gravel with cobbles and rare boulders (Dames & Moore, 1990, 1991). The clasts are typically subangular to subrounded and consist of basalt and andesite derived from the Conejo Volcanics (Gorian and Associates, 2017; Dibblee, 1993). We observed this unit in the 2:1 cut slope ascending south from the parking structure to the 101 Ventura Freeway, where it was generally moderately weathered following ~32 years of exposure after the CAP development.

Underlying the volcanic conglomerate is an upper layer of yellowish-brown, moderately weathered andesite-dacite breccia in a weathered basaltic matrix of the Conejo Volcanics Formation. As encountered in our exploration, this layer is moderately hard, grading to hard, tightly fractured and jointed, and oxidized.

The upper layer of weathered to moderately weathered basalt is generally underlain by slightly/little weathered and much harder, dark bluish-gray to dark gray basalt of the Conejo Volcanics (i.e., “blue rock”), as reported by Dames & Moore (1990 and 1991) and corroborated by the seismic refraction lines conducted for this study. This harder layer was not encountered in our exploration as the equipment met refusal in the aforementioned overlying bedrock materials. However, Dames & Moore (1990) reported very difficult drilling and boring refusal within this material during their initial field exploration. This material was subsequently sampled with

continuous coring in three borings (B-18 through B-20) in the southern portion of the CAP site during their supplemental investigation (Dames & Moore, 1991).

## **2.4 Building-Specific Subsurface Conditions**

The following sections provide encountered subsurface conditions and lab testing summaries for each major building site.

### **2.4.1 Building A Site**

**Earth Materials:** Undocumented artificial fill underlies the majority of the proposed Building A footprint and generally consisted of loose to medium dense clayey sand with gravel to depths ranging between about 0.5 and 4 feet below ground surface (bgs). Native soils consisting of colluvium and alluvium were encountered at the surface or below the artificial fill in the test pits, and borings to depths ranging between 9.5 and 18.5 feet bgs. Native soils were underlain by completely weathered to moderately weathered volcanic conglomerate consisting of clay with varying amounts of gravel and sand, and sand with varying amounts of gravel and clay, to depths ranging between about 16.25 to 23 feet bgs. The volcanic conglomerate was underlain by weathered to unweathered Conejo Volcanics to the maximum depth explored.

**Groundwater:** Static groundwater was encountered in the borings and test pits completed within the footprint of proposed Building A at elevations ranging from about +799 feet to +802.25 feet.

### **Engineering Properties:**

- The tested dry unit weights ranged from about 87.1 to 108.5 pcf in the alluvium, from about 96.7 to 106.2 pcf in the volcanic conglomerate, and from about 88 to 116.2 pcf in the Conejo Volcanics.
- The tested moisture contents ranged from about 6 to 9.7 percent in the artificial fill, from about 7.3 to 29.6 percent in the alluvium, from about 9.5 to 26.9 percent in the volcanic conglomerate, and from about 14.1 to 34.3 percent in the Conejo Volcanics.
- The tested fines contents ranged between about 33.7 and 46.4 percent in the granular alluvium, and between about 50.4 and 52.7 percent in the cohesive alluvium.
- The plasticities of the tested materials indicated liquid limits (LLs) of 23 to 37, and plasticity indices (PIs) of 1 to 22, indicating low to moderate plasticity.

- The alluvium had tested peak friction angles ranging from about 28 to 32 degrees and peak cohesion ranging from about 96 to 438 psf.
- The near-surface earth materials had tested Expansion Indices (EIs) ranging from about 11 to 79, indicating low to medium expansion potential.

#### **2.4.2 Buildings B1, B2, and C1 Sites**

**Earth Materials:** Undocumented artificial fill was encountered in the upper 3 to 4 feet bgs at these proposed building sites and generally consisted of clayey sand with varying amounts of gravel. Deeper undocumented fill is interpreted to be present beneath, above, and adjacent to the existing 8'x16' reinforced concrete box storm drain, portions of which were constructed along (and within?) a natural drainage channel that traversed the site pre-development (i.e., evident in early aerial photographs dating between 1928 and 1947). Documentation of grading and compacted fill placement associated with the storm drain and/or backfilling of the natural drainage channel has not been provided or located.

Alluvium was encountered below the artificial fill to depths ranging between 18 and 24 feet bgs and generally consisted of sand with varying amounts of clay and gravel and clay with varying amounts of sand and gravel. Alluvium deposits were underlain by completely to slightly weathered volcanic conglomerate consisting of gravel with clay and sand and clayey gravel with sand to the maximum depth explored.

**Groundwater:** Static groundwater was encountered in the borings completed within the footprint of proposed buildings B1, B2 and C1 at elevations ranging from +800.5 to +803.2 feet.

#### **Engineering Properties:**

- The tested dry unit weights ranged from about 99.9 to 102.5 pcf in the artificial fill, from about 93.4 to 109.9 pcf in the alluvium, and from about 89.5 to 115.7 pcf in the volcanic conglomerate.
- The tested moisture contents ranged from about 6.7 to 19.0 percent in the artificial fill, from about 12.3 to 27.6 percent in the alluvium, and from about 16.7 to 26.6 percent in the volcanic conglomerate.
- The tested fines contents ranged from about 12.8 percent and 46.4 percent in the granular alluvium, and about 66.8 percent in the cohesive alluvium.
- The plasticity of the tested material indicate a liquid limit (LL) of 20, and a plasticity index (PI) of 19, indicating moderate plasticity.

- The alluvium had tested peak friction angles ranging from 28 to 33 degrees and peak cohesion ranging from 90 to 324 psf.
- The tested near-surface materials had a maximum dry unit weight of about 119.2 pcf and an optimum moisture content of about 11.3 percent.

#### **2.4.3 Hotel Site**

**Earth Materials:** At the proposed Hotel site, artificial fill was encountered in the upper 6.5 to 6.75 feet of the borings (BH-8 and BH-11) and generally consisted of clayey sand with varying amounts of gravel. This fill currently underlies/supports Dallas Drive and the City Hall parking lot and was likely placed as a controlled and tested fill; however, no documentation of this grading has been provided or located at this time. In Boring BH-9, the artificial fill was underlain by weathered volcanic conglomerate. In Boring BH-11, the artificial fill was underlain by alluvium consisting of clayey sand with varying amounts of gravel to depths of about 9 feet bgs. The alluvium was underlain by completely weathered volcanic conglomerate which consisted of sand with varying amounts of clay and gravel, and clay with varying amounts of sand and gravel, to depths ranging from about 20 to 21 feet bgs. The volcanic conglomerate was underlain by the Conejo Volcanics to the maximum depth explored.

**Groundwater:** Static groundwater was encountered within the proposed Hotel footprint at an elevation of about +801.75 feet.

#### **Engineering Properties:**

- The tested dry unit weights ranged from about 108.6 to 116.1 pcf in the artificial fill, from about 114.0 pcf in the alluvium, and from about 86.4 to 118.7 pcf in the volcanic conglomerate.
- The tested moisture contents ranged from about 13.2 to 19.4 percent in the artificial fill, about 13.7 percent in the alluvium, and from about 12.0 to 33.6 percent in the volcanic conglomerate.
- The tested fines content was about 42.5 percent in artificial fill, about 47.8 percent in the granular alluvium, and about 15.6 percent in the volcanic conglomerate.
- The plasticities of the tested materials indicated liquid limits (LLs) of 31 to 41, and plasticity indices (PIs) of 10 to 22, indicating low to moderate plasticity.
- The alluvium had tested peak friction angles ranging from about 25 to 30 degrees and peak cohesions ranging from about 522 to 792 psf. The tested volcanic conglomerate had a peak friction angle of about 36 degrees and peak cohesion of about 546 psf.

- Tested near-surface materials had maximum dry unit weights ranging from about 118.0 to 118.1 pcf and optimum moisture contents ranging from about 12.4 to 12.9 percent.
- Tested near-surface materials had an Expansion Index (EI) of 40, indicating low expansion potential.

#### **2.4.4 Café Site**

**Earth Materials:** A significant portion of the proposed Café footprint is underlain by certified artificial fill documented by Gorian and Associates (1992). This fill appears to have been placed, in part, above an existing 12'x8' RCB storm drain and may have been an excess fill disposal area. Artificial fill was encountered in the upper 2.5 feet of the boring and our percolation test hole located about 70 feet west of the proposed Café building, and generally consisted of silty sand with gravel. Alluvium was encountered below the artificial fill to a depth of about 20 feet bgs. The upper 6.5 feet of alluvium consisted of alternating layers of silt with sand, silty sand, and sand with a clay layer from 3.5 to 4.5 feet bgs. This was underlain by alternating layers of sand with varying amounts of clay and gravel and clay with varying amounts of sand and gravel. Alluvium was underlain by completely weathered to unweathered volcanic conglomerate consisting of a sand with clay and gravel matrix to the maximum depth explored.

**Groundwater:** Static groundwater was encountered in the boring near the proposed café site at an elevation of about +812.5 feet.

#### **Engineering Properties:**

- The tested dry unit weights ranged from about 86.8 to 99.6 pcf in the alluvium, and from about 122.1 to 126.3 pcf in the volcanic conglomerate.
- The tested moisture contents ranged from about 8.2 to 26.8 percent in the alluvium, and from about 11.6 to 14.7 percent in the volcanic conglomerate.
- The tested fines content was about 30.1 percent in the granular alluvium.
- The plasticity of the tested materials indicated a liquid limit (LL) of 39, and a plasticity index (PI) of 21, indicating moderate plasticity.
- The alluvium had a tested peak friction angle of about 34 degrees and peak cohesion of about 36 psf.

#### **2.4.5 Adaptive Reuse (City Hall) Site**

**Earth Materials:** The existing City Hall structure is underlain by a variable thickness of certified artificial fill tested and documented by Gorian and Associates, Inc. (1992). Building and roadway area fills were compacted to a minimum of 95 percent relative compaction. General fills were compacted to a minimum of 90 percent relative compaction. Gorian reported that unsuitable soil removals were extended to either clayey soils having a minimum 90 percent relative compaction, medium dense sand and gravels (of Dames & Moore, 1991), or bedrock. Removals ranged from 3 to 10+/- feet below the final pad grade. Bedrock exposed at pad grade was reportedly over-excavated by a minimum of 3 feet.

We have interpreted the configuration of certified fill beneath the City Hall structure on Cross-Sections E-E' and F-F' based upon reported minimum removal elevations and certain reported compaction test elevations. CSA's borings (BH-9, BH-12 and BH-13) and percolation test holes (P-3 and P-5) were located just outside the limits of certified artificial fill documented by Gorian and Associates, Inc. (1992).

Artificial fill was encountered in the upper 6 feet of the borings and percolation test holes and generally consisted of sandy clay. Alluvium was encountered below the artificial fill to depths ranging from between 9 and 15 feet bgs. In BH-9, the alluvium consisted of clay with varying amounts of sand and gravel underlain by sand with varying amounts of silt and gravel, over a sandy clay with gravel layer. In borings BH-12 and BH-13, the alluvium consisted of clay with varying amounts of sand, and gravel and sand with varying amounts of clay. The alluvium was underlain by volcanic conglomerate to depths ranging between 17 and 31 feet bgs. In borings BH-9 and BH-12, the volcanic conglomerate consisted of clayey sand with gravel, silty sand, sand with gravel, and sand with silt and gravel. In boring BH-13, the volcanic conglomerate consisted of alternating layers of clayey sand with gravel, sandy clays, and gravel with clay and sand. The volcanic conglomerate was underlain by the Conejo Volcanics to the maximum depth explored.

**Groundwater:** Static groundwater was encountered in the borings completed around the existing City Hall building at elevations ranging from about +804.5 to +811 feet.

#### **Engineering Properties:**

- The tested dry unit weight was about 101.5 pcf in artificial fill, ranged from about 99.6 to 112.4 pcf in the alluvium, from about 84.2 to 122.0 pcf in the volcanic conglomerate, and about 127.0 pcf in the Conejo Volcanics.

- The tested moisture contents ranged from about 10.1 to 24.5 percent in the artificial fill and alluvium, from about 9.1 percent to 43.9 percent in the volcanic conglomerate, and about 13.5 percent in the Conejo Volcanics.
- The tested fines contents ranged between about 18.3 to 37.9 percent in the granular alluvium, and about 46.2 percent in the volcanic conglomerate.
- The plasticities of the tested materials indicated liquid limits (LLs) of 20 to 24, and plasticity indices (PIs) of 17 to 20, indicating moderate plasticity.
- The alluvium had tested peak friction angles ranging from about 32 to 42 degrees and peak cohesions ranging from about 180 to 414 psf.

## 2.5 Existing Pavement Sections

The following Table 1 below summarizes measured pavement component thicknesses measured during exploration at boring locations located within pavement areas.

**Table 1. Summary of Existing Pavement Sections**

| <b>Boring Number</b> | <b>Approx. Asphalt Thickness (in)</b> | <b>Approx. Aggregate Base Thickness (in)</b> |
|----------------------|---------------------------------------|----------------------------------------------|
| BH-7                 | 3.5                                   | 5.0                                          |
| BH-8                 | 2.0                                   | 10.0                                         |
| BH-10                | 3.5                                   | 9.0                                          |
| BH-11                | 4.5                                   | 5.0                                          |

## 2.6 Groundwater Conditions

Groundwater was present at depths of about 14 to 17 feet below ground surface (bgs) in the test pits and borings excavated during our subsurface explorations conducted in December 2023 and January/February 2025. Groundwater was also encountered in previous explorations performed by other consultants proximal to the subject site. Dames & Moore (1990 and 1991) reported that some higher groundwater levels consisted of perched groundwater overlying relatively impermeable bedrock or occurring near the volcanic conglomerate/basalt contact.

Data published by CDMG (2000) indicate a historical high groundwater level of about 10 feet below ground surface (bgs) at the site. Fluctuations in groundwater levels may occur from variations in rainfall, irrigation, flooding and other factors, and groundwater levels may be different at different times and locations. The estimated groundwater table (as of 12/19/23) within the site alluvial deposits is shown on Cross-Section A-A' (Figure 2). The following Table 2 presents a summary of measured groundwater levels and corresponding elevations.

**Table 2. Measured Groundwater Levels**

| <b>Exploration I.D.</b> | <b>Firm</b> | <b>Measured Groundwater Depth (feet bgs)</b> | <b>Estimated Groundwater Elevation (feet in NAVD88)</b> | <b>Measurement Date</b> |
|-------------------------|-------------|----------------------------------------------|---------------------------------------------------------|-------------------------|
| CSA TP-3                | CSA (2023)  | 16.0                                         | 802.0                                                   | 12/19/2023              |
| CSA TP-5                | CSA (2023)  | 14.0                                         | 799.0                                                   | 12/19/2023              |
| CSA TP-6                | CSA (2023)  | 15.0                                         | 799.0                                                   | 12/19/2023              |
| CSA TP-7                | CSA (2023)  | 17.0                                         | 798.0                                                   | 12/19/2023              |
| CSA BH-2                | CSA (2025)  | 13.0                                         | 800.75                                                  | 1/29/2025               |
| CSA BH-3                | CSA (2025)  | 15.8                                         | 803.2                                                   | 1/28/2025               |
| CSA BH-5                | CSA (2025)  | 16.5                                         | 801.75                                                  | 1/29/2025               |
| CSA BH-6                | CSA (2025)  | 15.3                                         | 800.45                                                  | 1/28/2025               |
| CSA BH-7                | CSA (2025)  | 14.3                                         | 801.45                                                  | 1/28/2025               |
| CSA BH-8                | CSA (2025)  | 31.5                                         | 803.25                                                  | 1/27/2025               |
| CSA BH-9                | CSA (2025)  | 14.0                                         | 804.5                                                   | 2/3/2025                |
| CSA BH-10               | CSA (2025)  | 20.4                                         | 802.85                                                  | 1/27/2025               |
| CSA BH-11               | CSA (2025)  | 26.0                                         | 801.75                                                  | 1/30/2025               |
| CSA BH-12               | CSA (2025)  | 4.8                                          | 811.7                                                   | 2/3/2025                |
| CSA BH-13               | CSA (2025)  | 8.8                                          | 812.7                                                   | 1/31/2025               |
| CSA BH-14               | CSA (2025)  | 10.0                                         | 812.5                                                   | 2/3/2025                |
| D&M B-9                 | D&M (1990)  | 11.0                                         | 821.5                                                   | 7/27/1990               |
| D&M B-10                | D&M (1990)  | 18.5                                         | 814.0                                                   | 7/27/1990               |
| D&M B-12                | D&M (1990)  | 11.5                                         | 849.0                                                   | 7/30/1990               |
| D&M B-13                | D&M (1990)  | 18.5                                         | 807.0                                                   | 7/27/1990               |
| D&M B-14                | D&M (1990)  | 14.5                                         | 808.0                                                   | 7/30/1990               |
| D&M B-15                | D&M (1990)  | 16.0                                         | 806.5                                                   | 7/31/1990               |
| D&M B-17                | D&M (1990)  | 18.0                                         | 801.5                                                   | 7/30/1990               |
| D&M B-18                | D&M (1991)  | 27.0                                         | 845.5                                                   | 4/12/1991               |
| D&M B-19                | D&M (1991)  | 34.0                                         | 838.5                                                   | 4/11/1991               |
| D&M B-20                | D&M (1991)  | 20.0                                         | 820.5                                                   | 4/5/1991                |
| D&M B-23                | D&M (1991)  | 7.0                                          | 815.5                                                   | 4/4/1991                |
| D&M B-24                | D&M (1991)  | 11.0                                         | 811.5                                                   | 4/4/1991                |
| D&M B-25                | D&M (1991)  | 10.0                                         | 812.5                                                   | 4/4/1991                |
| D&M B-26                | D&M (1991)  | 13.0                                         | 809.5                                                   | 4/4/1991                |
| D&M B-27                | D&M (1991)  | 19.0                                         | 808.5                                                   | 4/8/1991                |
| PML B-3                 | PML (2001)  | 17.0                                         | 797.0                                                   | 10/5/2001               |

### 3.0 SEISMICITY

Seismicity evaluation for the project consisted of the assessment of earthquake hazards such as seismic setting and nearby faults, CBC seismic design criteria and estimated strong ground motion, as summarized below.

#### 3.1 Seismic Setting and Nearby Fault Sources

The project site is in a very seismically active area. Historically, this area has been subjected to strong seismic ground shaking from major earthquakes and will continue to experience strong ground shaking in the future. The Simi-Santa Rosa Fault [3] is the closest controlling active fault to the site (about 10.09 kilometers to the northwest).

#### 3.2 2022 California Building Code Seismic Design Criteria

Based on our geotechnical investigation, the site location (latitude N 34.175° and longitude W 118.849°) and our interpretation of the 2022 CBC and ASCE 7 Hazards Report for ASCE/SEI 7-22 related to Earthquake Loads and using the online tool, we have provided the following Table 3 that lists our seismic design parameter recommendations derived from the corresponding figures and tables. The computed ASCE 7 Hazards Report is presented in Appendix C – Seismic Design Parameters.

**Table 3. 2022 CBC Seismic Design Criteria**

| Parameter                                                         | Value           |
|-------------------------------------------------------------------|-----------------|
| Site Classification                                               | CD              |
| Spectral Acceleration at 2 sec                                    | $S_s = 1.67$    |
| Spectral Acceleration at 1 sec                                    | $S_1 = 0.52$    |
| Spectral Acceleration at Short Periods<br>Adjusted for Site Class | $S_{MS} = 1.88$ |
| Spectral Acceleration at 1 sec<br>Adjusted for Site Class         | $S_{M1} = 1.04$ |
| Design Spectral Acceleration at<br>Short Periods                  | $S_{DS} = 1.26$ |
| Design Spectral Acceleration at<br>1-Second Period                | $S_{D1} = 0.70$ |
| Mapped Peak Ground Acceleration                                   | $PGA_M = 0.69$  |

### **3.3 Peak Ground Acceleration**

We performed a probabilistic seismic hazard analysis for the site using the USGS Unified Hazard Tool. Taking into account the faults described above, the 2022 California Building Code (CBC), the ASCE 7-22 code coefficients presented in Section 3.2, the results of the peak ground acceleration, and a return period of 2475 years (i.e., 2 percent probability of being exceeded in 50 years), it is our opinion that the proposed improvements could experience a Maximum Considered Earthquake Geometric Mean ( $MCE_G$ ) Peak Ground Acceleration (PGA) as high as 0.73g, with a corresponding estimated earthquake mean magnitude of 6.71. The computed uniform hazard response spectrum is presented graphically in attached Appendix C.

## **4.0 SEISMIC GEOHAZARDS**

### **4.1 Ground Rupture Potential**

The subject site is not located within a designated Alquist-Priolo Earthquake Fault Zone (CGS, 2000). Active or potentially active faults are not known to be present on or trend toward the site. As such, the potential for primary ground surface rupture due to faulting is considered to be very low.

### **4.2 Tsunami and Seiche Hazard**

Based on the general site elevation (+812 to +856 feet) and distance to the Pacific Ocean (about 9.5 miles), potential impacts from tsunami hazard appear to be very low to nil. There are two reservoirs less than 3.5 miles away from the project site. However, based on elevation of the project site relative to the reservoirs and the regional topography, the potential impact of an earthquake induced seiche is very low.

### **4.3 Liquefaction Potential and Related Settlement**

Liquefaction occurs when saturated, loose to medium dense, sands and low-plasticity silts and clays are subjected to seismically-induced strong shaking. Liquefiable soils typically lose a portion of or all their shear strength and regain strength sometime after the shaking stops. Soil movements, both vertical and lateral, can occur as a result of liquefaction and ground shaking.

The site is not located within a Liquefaction Hazard Zone as mapped by the State of California (CGS, 2000) under the Seismic Hazards Mapping Act of 1990. Subsurface conditions encountered during our study, which are similar to conditions encountered by others in previous

studies proximal to the subject site, generally consist of medium dense and stiff native alluvial soils with moderately plastic fines overlying bedrock with variable depths of perched groundwater within the native soils. Based on these conditions, liquefaction is not considered a significant hazard at the site.

#### **4.4 Earthquake-Induced Landslides**

The subject site is not located within an Earthquake-Induced Landslide Hazard Zone as mapped by the State of California (CGS, 2000), and no evidence of landsliding was observed during our study.

### **5.0 CONCLUSIONS AND RECOMMENDATIONS**

The conclusions and preliminary recommendations for site grading and foundation design, as presented below, are based on our field explorations for the subject site performed in October and December 2024, and January and February 2025, limited laboratory testing, and our experience with similar projects. Recommendations presented below are preliminary and are intended to address potential constraints, facilitate feasible design finish floor elevations, advance the project beyond the conceptual entitlement stage, and identify data gaps where further investigation is necessary. Some recommendations are likely to be modified based upon design-level geotechnical investigations which should be performed for final project design. Recommendations should be incorporated into the project plans and specifications and should be adhered to during construction. Prior to contract bidding, site grading and foundation plans should be reviewed by Cotton, Shires and Associates, Inc. for consistency with our recommendations.

#### **5.1 Site Development and Grading**

**5.1.1 Site Preparation** – Prior to commencing grading operations, soil materials containing debris, organics, pavement, or other unsuitable materials should be stripped from the building areas. Demolition of on-grade improvements should include removal of old foundations, pavements, slabs, abandoned utilities, and soils disturbed during the demolition process. All existing undocumented artificial fill (af) located within the footprint of proposed buildings and retaining walls (as determined by a CSA representative in the field) should be removed and replaced with engineered compacted fill (if required for design grades). Depressions or disturbed areas left from the removal of such material should be replaced with compacted fill.

**5.1.2 Soil Excavatability and Bedrock Rippability** – The artificial fill and native soil materials encountered at the subject site were excavated by a mid-size excavator and hollow-stem augers with minor to moderate effort. These materials should be considered excavatable using standard construction earthwork equipment.

Excavations into the volcanic conglomerate will be required based on our understanding of the conceptual design and anticipated building pad elevations. Dames & Moore (1990) found that measured seismic velocities in the volcanic conglomerate ranged from about 4,000 ft/sec to 8,500 ft/sec and they stated that a range of 5,000-6,000 ft/sec is generally indicative of the upper range of hard to very hard ripping in rock; however, due to the sandy/gravelly nature of the volcanic conglomerate, they anticipated that this unit would be rippable without blasting. To our knowledge, no blasting was performed for the construction of the existing CAP project.

Excavations extending into the volcanic basalt bedrock may be planned during future site grading, but should be avoided in the project design if possible. While the uppermost weathered basalt ( $T_{cv_{weath}}$  unit on our cross-sections) may be rippable, the use of heavy equipment and special methods of excavation should be anticipated in the basalt. The Caterpillar (2019) handbook charts suggest that volcanic bedrock materials are rippable with a D9R/D9T bulldozer with single- or multi-shank rippers up to compression velocities of about 7,600 ft/sec, marginally rippable up to about 8,000 ft/sec and non-rippable over about 8,600 ft/sec. Dames & Moore (1990) measured seismic velocities in the range of 8,000 ft/sec to 12,000 ft/sec in the underlying weathered and slightly weathered basalt bedrock.

Velocities exceeding 8,000 ft/sec were recorded at this site at depths of approximately 11 to 40 feet below the ground surface (with one anomalous area only a few feet below ground surface described below), with the shallower high velocities measured within and near the slope at the south end of the site (i.e., north of the parking structure). An example is presented on Engineering Geologic Cross-Section A-A' (Figure 2) which depicts the interpreted upper extent (i.e., velocity horizon) of bedrock exceeding a compression velocity of 8,000 ft/sec based upon a projection of data from Seismic Line L-2. The 8,000 ft/sec velocity horizon reaches an elevation as high as 795 feet along Seismic Line L-2; however, this peak in the velocity horizon is located about 20 feet below existing grade.

The potentially most critical area based upon our seismic refraction data is along Engineering Geologic Cross-Section B-B' (Figure 3) at Seismic Line L-3. At this location, an undulatory horizon of bedrock exceeding a compression velocity of 8,000 ft/sec and increasing with depth up to 12,000 ft/sec is present below elevation 825 feet (the top of this velocity horizon

is depicted with a blue dashed line on Engineering Geologic Cross-Section B-B'. However, an anomalous high velocity zone (~8,000 ft/sec) was also interpreted within a few feet of the ground surface in a zone about 25 to 60 feet west of the east end of Seismic Line L-3. This zone appears, in part, to be underlain by lower velocity materials in the 4,000-6,000 ft/sec range before increasing back to the 8,000-12,000 ft/s range at depth. This anomaly could be representative of a zone of moderately to slightly weathered (and marginally rippable) bedrock but could also be due to interference from the concrete V-ditch that runs parallel to the seismic line. Subsurface exploration would be necessary about 50 feet west of the east end of Seismic Line L-3 to resolve this anomaly. Please refer to Appendix B for further descriptions of measured bedrock seismic velocities and equipment/interpretation limits.

**5.1.3 Temporary Excavations** – Temporary excavations will be required during the construction of the project. The temporary excavations are expected to expose artificial fill, colluvium and alluvium, and weathered bedrock. The temporary excavations and shoring are to be performed in compliance with all applicable codes and the minimum recommendations discussed below.

Temporary excavations in artificial fill, colluvium and alluvium, and weathered bedrock, which are not surcharged, may be excavated vertically up to five feet (5') in height. Vertical excavations that exceed the previous heights are to have the upper portion trimmed to a 1:1 (H:V) gradient.

The above temporary excavation recommendations are not applicable for materials with a high moisture content, including excavations below the groundwater level. The above temporary excavation heights do not take any surcharge loads into consideration; accordingly, any surcharge load is to be kept back from the top of the excavation a minimum horizontal distance equal to the depth of the excavation.

Where sloped embankments are utilized, the tops of the slopes should be barricaded to prevent vehicles and storage loads near the top of slope within a horizontal distance equal to the depth of the excavation. If temporary construction embankments are to be maintained during the rainy season, berms are suggested along the top of slopes where necessary to prevent runoff water from entering the excavation and eroding slope faces. Water should not be allowed to pond on top of the excavation nor flow toward it.

Temporary slopes and excavations should conform to Federal Occupational Safety and Health Administration (OSHA) and/or California Division of Occupational Safety and Health (DOSH) regulations and other applicable local ordinances and building codes, as required.

However, the contractor should be made responsible for all safety issues regarding open excavations.

Excavations which will be surcharged by adjacent traffic or structures, or do not permit adequate room to slope lay back, should be shored. Lateral pressures applicable for the design will depend on the type of shoring system selected by the contractor, surcharge loads due to construction equipment and traffic, and any dewatering methods that are used. The final temporary bracing/shoring design shall be provided by the project shoring engineer. CSA can provide shoring recommendations during the design stage after building configurations and excavation depths have been determined.

**5.1.4 Dewatering** – As summarized in Section 2.6 above, groundwater was encountered in sixteen (16) of the test pits and borings completed for this investigation, and dewatering may be required within those excavation areas depending upon the final design subgrade elevations. If dewatering is required, a dewatering system capable of temporarily dewatering project construction excavations will need to be designed and installed by an experienced contractor specializing in groundwater dewatering systems. A dewatering system should be capable of lowering the groundwater surface to a depth of at least 3 feet below the required depth of excavation.

Flow rates for dewatering systems are considerably difficult to estimate. Therefore, a qualified dewatering consultant, such as a licensed Civil Engineer and/or Certified Hydrogeologist, should be engaged to evaluate the potential groundwater impacts to determine an appropriate dewatering system flow rate, and to provide the final design of any recommended temporary dewatering system.

**5.1.5 Subgrade Stabilization** – Excavations within high moisture content areas could lead to difficulty in achieving required compaction levels requiring the use of subgrade stabilization measures. Special subgrade stabilization measures that have been successfully used on other projects consist of:

- Placing a 1- to 2-foot-thick layer of 3- to 4-inch rock on the excavation bottom;
- Placing a 1- to 2-foot-thick layer of ½-inch to ¾-inch clean crushed drain rock sandwiched by two layers of filter fabric; and/or
- Use of a geosynthetic placed beneath a minimum 1-foot lift of gravel or rock fill.

Whether these measures are required will depend on the condition of the subgrade at the time of construction, the moisture content of the subgrade materials, and the nature of the construction activities (e.g., equipment type and loading, number of equipment passes, etc.).

**5.1.6 Foundation and Pavement Area Over-excavation** – Over-excavation and recompaction of artificial fill and upper alluvial materials in the building, retaining wall and pavement areas is recommended to reduce the potential for settlement and to provide uniform bearing conditions. Over-excavation recommendations presented below are based on the test pit and boring data obtained from our geotechnical exploration and laboratory testing of representative samples of earth materials.

Certified engineered fill, colluvium, and alluvium within building, retaining wall, and pavement areas should be over-excavated to a depth of at least 2 feet below existing grade, 2 feet below finish grade, or 2 feet below proposed foundations, whichever is deeper. As stated in Section 5.1.1, all undocumented artificial fill (af) material should be removed within building footprint and retaining wall areas to native materials. An effort should be made to procure missing documentation of likely compacted fill placement for the existing CAP development areas and the RCB storm drain areas noted above in Section 2.4.3 and 2.4.2, respectively.

At the discretion of the Project Geotechnical Engineer and their observation of field conditions, certified engineered fill beneath pavement and hardscape area may be left in place. However, excavation bottoms should be deepened, as needed, to remove loose artificial fill or organic soil if encountered (as determined by CSA personnel in the field).

After observation of building, retaining wall, or hardscape excavation bottoms, the exposed surface should be scarified to a depth of 8 inches, aerated or moisture conditioned to within 2 percent of optimum moisture content, and compacted at a minimum of 95 percent of relative compaction, as determined from ASTM D1557.

**5.1.7 Compacted Fill** – Following compaction of the excavation bottoms, excavations may be backfilled with engineered, compacted onsite excavated materials or imported granular select fill materials. We recommend that, unless otherwise noted, general, and select fill materials should be compacted to at least 95 percent of the maximum dry unit weight, determined from ASTM D1557.

General and select fill should be placed and compacted at a moisture content within 2 percent above optimum moisture. Each layer should be spread evenly and should be thoroughly blade-mixed during the spreading to provide relative uniformity of material within each layer.

Soft or yielding materials should be removed and be replaced with properly compacted fill material, prior to placing the next layer.

When the moisture content of the fill material is below optimum moisture, water should be added to the fill. While water is being added, the soil should be bladed and mixed to provide relatively uniform moisture content throughout the material. When the moisture content of the fill material is excessive, excavated materials should be spread and disced or scarified to aerate. Compacted fill materials should be spread in lifts no thicker than approximately 6 inches prior to being compacted. Fill and backfill materials may need to be placed in thinner lifts to achieve the recommended compaction depending on the compaction equipment being used.

Rocks, gravel and other oversized material, greater than 4 inches in diameter, should be removed from the fill material being placed. Rocks less than 4 inches in diameter should not be nested and voids caused by inclusion of rock in the fill should be filled with sand or other approved material.

**5.1.8 Onsite Soils Used As Compacted Fill** – Based on the exploration and laboratory test results, artificial fill, colluvium/alluvium and bedrock materials may be reused as compacted fill. Rocks larger than 4 inches in maximum dimension should be removed from the compacted fill materials prior to placement. Cobble-size clasts exceeding this dimension are likely to be encountered within the previous stream bed alignment that may be exposed during excavation for Buildings B1/B2/C subterranean level.

**5.1.9 Cut/Fill Slope Design** – Any new permanent cut slopes should not exceed an inclination of 2:1 (H:V). During the dry season, temporary cut slopes of 1:1 (H:V) should generally be satisfactory for construction purposes, provided that they are inspected and approved by our field representative at the time of construction and monitored daily during construction. Excavation methods, bracing and safety of excavations are the responsibility of the contractor. All excavations should comply with applicable local, State and Federal safety regulations.

All permanent fill slopes constructed with tested onsite or import materials should have a maximum inclination of 2:1 (H:V). Fill materials placed on slopes steeper than 6:1 should have a keyway at the toe extending a minimum of 2 feet in into competent materials, no less than 10 feet wide and be continuously benched at least 1 foot into surrounding alluvium or engineered fill. The exposed subgrade should be inspected by our representative for firmness prior to placement of any new fill materials.

**5.1.10 Site Drainage** – Positive drainage should be developed and maintained away from over-excavated and foundation areas. Water should not be allowed to pond near foundations or on-grade improvements. Landscaped areas adjacent to foundations should be avoided or should be planted in watertight planter boxes that effectively separate irrigated areas from foundation soils to reduce fluctuations in moisture content. A system of catch basins/area drains in low areas should be implemented and collected drainage should be directed away from the structures to the nearest street, driveway, or drainage structure.

## **5.2 Foundation Design**

Based on the lowest floor elevations currently depicted on the conceptual plans (RRM, 2025), the proposed structures may be supported by shallow spread, continuous, or mat foundations. The recommended allowable bearing pressure for foundations in compacted fill directly underlain by colluvial and alluvial soils is 3,000 psf. The recommended allowable bearing pressure for foundations in up to 2 feet of compacted fill directly underlain by weathered volcanic conglomerate or weathered basalt bedrock is 6,000 psf.

Foundations should be at least 2 feet wide, founded a minimum of 24 inches below the lowest adjacent finish grade, and embedded a minimum of 2 feet into compacted fill. All foundations should be underlain by a minimum of 2 to 5 feet of compacted fill; the depth of over-excavation below the foundations should be determined for each structure in the design phase of the project. The factor of safety for the allowable bearing value is not less than 3. The allowable bearing pressure may be increased by one-third for wind and design earthquake loads.

Ultimate sliding resistance generated through compacted fill generated from onsite material may be estimated by multiplying the total dead weight structural loads by a coefficient of 0.4. Ultimate passive resistance of compacted fill against bearing foundation elements (e.g., footing sides) may be estimated using an equivalent fluid weight of 400 pounds per cubic foot (pcf), to a maximum of 3,500 psf, beginning below an embedment depth of 1 foot.

## **5.3 Retaining Wall Design**

Static lateral earth pressures listed in the following Table 4 may be used in the design of proposed retaining walls or similar structures on the subject site that are backfilled with low expansivity onsite silty and clayey sand materials or import non-expansive materials within the active wedge (i.e., within a 30-degree inclination from vertical from the back face of the wall). An appropriate factor of safety (FS) should be used for design calculations (minimum FS of 1.5 is recommended). The values listed in Table 4 do not include earth pressures for site walls that will

be restrained with tiebacks or rock anchors, which will require more specific analysis during the design phase of the project.

**Table 4. Retaining Wall Lateral Earth Pressures**

| Material                                                       | Equivalent Fluid Weight (pcf) |                         |
|----------------------------------------------------------------|-------------------------------|-------------------------|
|                                                                | Active Earth Pressure         | Passive Earth Pressure* |
| Active, onsite soils and granular import soils, level backfill | 35                            | 400                     |
| Active, onsite soils and granular import soils, 2:1 backfill   | 45                            | 400                     |
| At-rest (restrained) wall, level backfill                      | 60                            | 400                     |
| At-rest (restrained) wall, 2:1 backfill                        | 75                            | 400                     |

\*Note: For passive pressure, the upper 1-foot of soil should be neglected unless confined by pavement or slab-on-grade.

If surcharge loads are to be present, the lateral earth pressure to be resisted by retaining walls should be increased to allow for the surcharge loads. The surcharge considered should include the loads from any structures or vehicle traffic within a distance approximately equal to the height of the retaining wall and will require more specific analysis during the design phase of the project.

According to the 2022 CBC (1803.5.12), lateral earth pressures due to earthquakes must be considered for walls that retain more than 6 feet of earth on projects of Seismic Design Categories D, E and F. Site walls retaining over 6 feet of earth material should be designed to resist a seismic load (in addition to the active load) equal to an equivalent fluid pressure of  $17H^2$  pcf (where H is the height of the retaining wall) for cantilever walls with level backfill,  $28H^2$  for cantilever walls with sloping backfill, and  $27H^2$  for restrained walls with level backfill.

Backfill behind retaining walls should consist of soils that have been moisture conditioned to within 2 percent above of optimum moisture and then compacted to at least 90 percent of the maximum dry unit weight, as determined using test method ASTM D1557. To aid in the compaction operation, retaining wall backfill should be placed in lifts not exceeding 4 to 6 inches loose thickness. Compaction within the area of a 1H:1V slope from the bottom of wall excavations should be performed by hand-operated compaction equipment. This is intended to reduce potential "locked-in" lateral pressures on the walls caused by compaction with heavy grading equipment.

Backdrains should be constructed behind all retaining walls regardless of the foundation type. The backdrain should be a minimum 12-inch-wide continuous blanket of either Caltrans Class 2 Permeable Material or 3/4-inch x 1/2-inch clean crush drainrock enclosed in Mirafi 140N

(or approved equivalent) filter fabric, and extended to within 1 to 1-½ feet of the ground surface where an impervious fill and/or asphaltic concrete cap should be placed. A minimum 4-inch-diameter PVC Schedule 40 perforated drain pipe should be placed near the bottom of the drainrock (perforations down), surrounded by a minimum of 4 inches of drainrock with at least 2 inches of drainrock underlying the pipe. All backdrain pipes should be sloped to drain at a minimum of 1/2 percent and collected in 4-inch diameter non-perforated Schedule 40 PVC pipes that are sloped a minimum of 2 percent and discharged into the site storm drainage system. The exterior retaining wall backdrains should also discharge to a suitable location away from structures, into the storm drain system, or onto an impermeable surface provided it does not create a nuisance or a hazard. Waterproofing of retaining walls will depend on the type of wall constructed and should be designed by a waterproofing specialist to meet the needs of the project team. All backdrain pipes should be provided with capped and protected clean-outs at the ground surface, and no bends greater than 45 degrees should be installed, for future maintenance/clean-out purposes.

#### **5.4 Utility Trenches, and Trench Backfill**

Utilities at the site are likely to include water, sewer, gas, electrical and communication. Utility trenches excavated deeper than 5 feet within the compacted fill materials should be braced and shored in accordance with good construction practice and all applicable safety ordinances, including OSHA requirements.

If utilities are placed in areas of vehicle travel, bedding for utilities should consist of sand having a minimum Sand Equivalent of 30. The sand should be placed in a zone that extends from a minimum of 6 inches below to 12 inches above the utilities for the full trench width. Bedding materials should be compacted to a minimum of 90 percent relative compaction based on ASTM 1557.

The trench width should be sufficient to allow compaction equipment to operate between any utility casing and trench wall. Jetting of trench backfill materials should not be permitted. Trench backfill materials and their placement above the pipe bedding should be in accordance with the local governing authority. At a minimum, trench backfill should be compacted to the standard of surrounding soils (e.g., at least 90 or 95 percent of the maximum dry unit weight, as determined using test method ASTM D1557).

## 5.5 General Corrosivity Considerations

Four bulk samples were tested for resistivity, pH, sulfates, and chlorides. Bulk samples were taken from near-surface materials. The results are presented in the following Table 5.

**Table 5. Summary of Corrosivity Test Results**

| Boring/Sample Depth | Material Description | Resistivity (ohm) | pH   | Sulfates percent | Chlorides percent |
|---------------------|----------------------|-------------------|------|------------------|-------------------|
| BH-2 @ 0-5 feet     | Silty/Clayey Sand    | 1,400             | 7.19 | 0.0115           | 0.0040            |
| BH-6 @ 0-5 feet     | Clayey Sand          | 775               | 7.85 | 0.0160           | 0.0290            |
| BH-11 @ 0-5 feet    | Clayey Sand          | 1,100             | 7.91 | 0.0095           | 0.0110            |
| BH-12 @ 0-5 feet    | Clayey Sand          | 1,300             | 7.98 | 0.0120           | 0.0030            |

The resistivity values presented above suggest that onsite soil materials are severely corrosive to underground steel. Tests results for chlorides indicate that onsite soils may be classified as C0 per ACI 318 Table 19.3.1.1. Tests results for sulfates indicate that onsite soils may be classified as S0 per ACI 318 Table 19.3.1.1. On the basis of sulfate concentration, we recommend that Type II cement be used for concrete in contact with earth materials, in accordance with the CBC.

CSA does not practice in the field of corrosion engineering and the test results and recommendations presented herein are preliminary. Test results should be evaluated by a corrosion engineer to assess how foundations and underground utilities should be protected from anticipated subsurface materials.

## 5.6 Pavement Design

Either flexible pavement such as asphaltic concrete or rigid pavement such as concrete, or both, will be used in roadways areas and driveways within the improvement areas. Flexible pavement sections consisting of asphaltic concrete and aggregate base were evaluated using the methods recommended by Ventura County (2020). Rigid pavement consisting of concrete and aggregate base was evaluated according to Caltrans Highway Design Manual Section 620 (2020).

The measured R-values for tested samples of the onsite clayey sand subgrade ranged from 24 to 25. A Traffic Index (TI) range of 5 to 7 was used. TI values do not include any construction traffic after the pavement is placed. If design TI values are different from the assumed values, CSA should be notified accordingly to reevaluate recommended pavement section thicknesses.

**5.6.1 New Flexible Pavement** – Recommended minimum flexible pavement sections, comprising asphaltic concrete over aggregate base, for the assumed TI range and design R-value

of 24, are presented in the following Table 6. In areas where new asphalt is placed next to existing asphalt, the new asphalt and aggregate base thickness should not be less than the existing adjacent pavement section.

**Table 6. Summary of Minimum Flexible Pavement Sections**

| <b>Traffic Index</b> | <b>Asphalt Thickness (in)</b> | <b>Aggregate Base Thickness (in)</b> |
|----------------------|-------------------------------|--------------------------------------|
| 5                    | 3.0                           | 6.5                                  |
| 6                    | 3.5                           | 9.0                                  |
| 7                    | 4.0                           | 11.0                                 |

**5.6.2 Rigid Pavement** – Recommended minimum rigid pavement sections, comprising concrete over aggregate base, for the assumed TI range and an R-value of 24, are presented in the following Table 7.

**Table 7. Summary of Minimum Rigid Pavement Sections**

| <b>Traffic Index (TI)</b> | <b>Concrete Thickness (in)</b> | <b>Aggregate Base Thickness (in)</b> |
|---------------------------|--------------------------------|--------------------------------------|
| 5 to 7                    | 7.0                            | 12                                   |

Concrete should have a minimum 28-day compressive strength of 4,000 pounds per square inch (psi). Minimum concrete pavement reinforcement should consist of No. 4 bars spaced at 16 inches each way. Reinforcement should not be less than structural requirements for shrinkage and temperature. Crack control joints should be placed every 12 feet in each direction.

Aggregate base materials placed beneath flexible and rigid pavement should meet the requirements for Processed Miscellaneous Base presented in Section 200-2.5.2 of the Standard Specifications for Public Works Construction ("Greenbook", 2021).

**5.6.3 Pavement Construction Considerations** – Asphalt and concrete pavement subgrade should be prepared in accordance with the grading recommendations presented in Section 5.1 above. Aggregate base material should be compacted in lifts not exceeding 6 inches in thickness to at least 95 percent of the maximum dry unit weight determined by ASTM D1557, latest edition. As-compacted moisture contents for aggregate base materials should be within 2 percent of the optimum moisture, as determined from ASTM D1557, latest edition.

Proper drainage of the paved and surrounding unpaved areas is essential. Grades should be established to expedite runoff away from pavements and reduce moisture infiltration into the base and subgrade.

**5.6.4 Percolation Testing Results and Recommendations** – In accordance with the project team’s request, we conducted soil percolation testing at the subject site as part of the field exploration program. The purpose of our testing was to determine infiltration rates to be utilized in the design of infiltration areas and potential storm drain realignment. Percolation testing areas were provided by KPFF (the Project Civil Engineer). Percolation test method and procedure and logs are presented in attached Appendix A.

We conducted falling head percolation testing at five locations across the site, as shown on Figure 2. The total depth of percolation testing ranged from about 5.2 to 9.9 feet. Percolation test zone materials generally consisted of loose to medium dense clayey sand and sand, and very stiff sandy clay with varying amounts of gravel. Groundwater was not encountered within the percolation test holes. Furthermore, groundwater is not anticipated to adversely impact performance of relatively shallow infiltration areas established near existing grade. Measured percolation rates (inches/hour) from the field testing are presented in the following Table 8.

**Table 8. Summary of Field Measured Percolation Rates**

| Percolation Hole No. | Percolation Test Zone Depth (ft) | Field Percolation Rates (in/hr.)                                                                             |
|----------------------|----------------------------------|--------------------------------------------------------------------------------------------------------------|
| PERC-1               | 0 to 9.9                         | Reading 1: 118*<br>Reading 2: 118*<br>Reading 3: 118*<br><u>Reading 4: 118*</u><br><b>Average: 118</b>       |
| PERC-2               | 0 to 9.6                         | Reading 1: 6.50<br>Reading 2: 6.75<br>Reading 3: 6.00<br><u>Reading 4: 6.25</u><br><b>Average: 6.38</b>      |
| PERC-3               | 0 to 5.8                         | Reading 1: 3.25<br>Reading 2: 2.50<br>Reading 3: 2.25<br><u>Reading 4: 2.00</u><br><b>Average: 2.50</b>      |
| PERC-4               | 0 to 5.2                         | Reading 1: 8.25<br>Reading 2: 7.50<br>Reading 3: 7.00<br><u>Reading 4: 6.50</u><br><b>Average: 7.31</b>      |
| PERC-5               | 0 to 5.2                         | Reading 1: 50.28<br>Reading 2: 48.60<br>Reading 3: 50.40<br><u>Reading 4: 52.20</u><br><b>Average: 50.37</b> |

\* indicates test zone completely drained in less than 1 hour.

Based on our field measurements, test hole geometry conversions (e.g. Porchet conversion), and experience with similar projects, we recommend the unfactored infiltration rates presented below in the following Table 9. The rates listed in Table 8 are applicable only to the immediate tested areas. If alternate infiltration areas are to be considered, then additional testing should be performed at those specific locations.

**Table 9. Recommended Unfactored Infiltration Rates**

| <b>Percolation Hole No.</b> | <b>Percolation Test Zone Depth (ft)</b> | <b>Unfactored Infiltration Rates (in/hr.)</b> |
|-----------------------------|-----------------------------------------|-----------------------------------------------|
| PERC-1                      | 0 to 9.9                                | 46.4                                          |
| PERC-2                      | 0 to 9.6                                | 0.11                                          |
| PERC-3                      | 0 to 5.8                                | 0.06                                          |
| PERC-4                      | 0 to 5.2                                | 0.23                                          |
| PERC-5                      | 0 to 5.2                                | 2.43                                          |

The feasibility of infiltration onsite should be evaluated by the Project Civil Engineer. Long-term sustainable infiltration rates may be affected by several factors including the degree of saturation of the adjacent ground and the infiltration of potentially finer grained soils into the system. To account for these factors, the applicator of these rates should therefore consider the use of an appropriate factor of safety. The development of the factor of safety should be based upon the more conservative rate obtained and include consideration of the impacts of deteriorated performance, life/health safety issues and should anticipate that the rates established in these tests may be reduced over time. Final selection of the appropriate reduction coefficients and factors of safety should be made by the Project Civil Engineer based on the local laws and ordinances and desired level of conservatism.

## **5.7 Technical Review**

This report, and any supplemental investigations and recommendations, should be reviewed by the contractor as part of the bid process. Supplemental geotechnical design recommendations should be provided by our firm based on specific design needs developed by the other project design professionals. It is strongly recommended that no construction be commenced nor grading undertaken until the final drawings, specifications, and calculations have been reviewed and approved in writing by a representative of our firm.

## **5.8 Earthwork Construction Inspection and Testing**

All excavations should be inspected by a representative of our firm during site grading and foundation installation. Grading should also be inspected and tested, as appropriate, to confirm adequate stripping, subgrade preparation, and compaction. Our office should be contacted within a minimum of 48 hours' advance notice of construction activities requiring inspection and/or testing services.

## **6.0 INVESTIGATION LIMITATIONS**

Our services consist of professional opinions and recommendations made in accordance with generally accepted engineering geology and geotechnical engineering principles and practices. No warranty, express or implied, or merchantability or fitness, is made or intended in connection with our work, by the proposal for consulting or other services, or by the furnishing of oral or written reports or findings.

This report has been prepared for the exclusive use by the City of Thousand Oaks and their authorized agents for preliminary design of the proposed **City of Thousand Oaks' (City)** Civic Arts Plaza (CAP) Master Plan project. This report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are called to the attention of the project engineer and incorporated into the design plans, as appropriate.

## 7.0 REFERENCES

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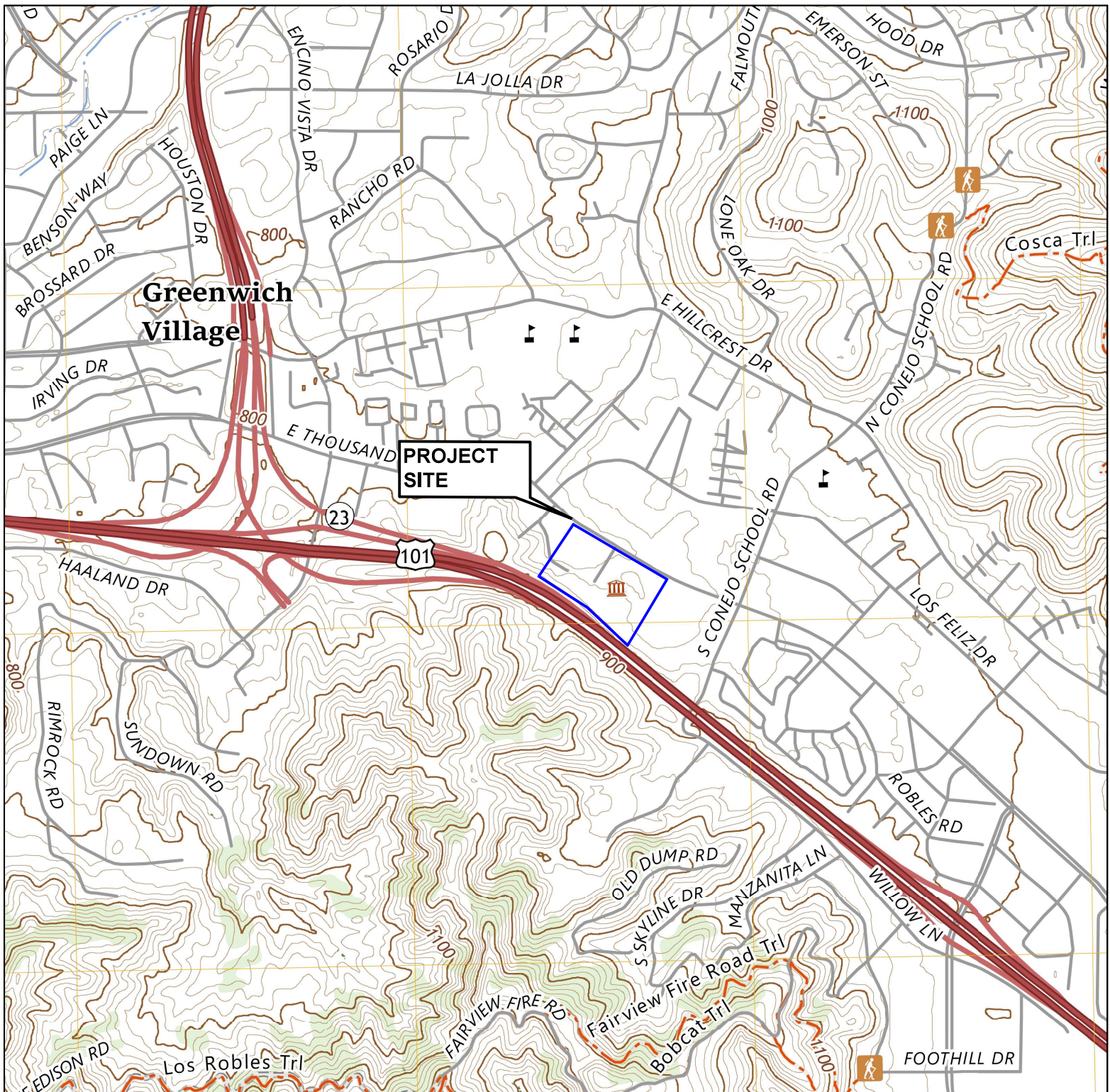
Aerial Photographs Reviewed (digital copies from UCSB Library; URL: [https://mil.library.ucsb.edu/ap\\_indexes/FrameFinder/](https://mil.library.ucsb.edu/ap_indexes/FrameFinder/) (accessed on 1/9/2024):

Flight GS-EM, August 15, 1947, Frames 1-18, 1-19, Scale 1:24,000

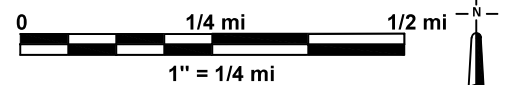
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## FIGURES



Reference: Topographic Map of the Thousand Oaks Quadrangle, Ventura County California, Map Produced by US Geologic Survey data provided by The National Map, accessed May 2025

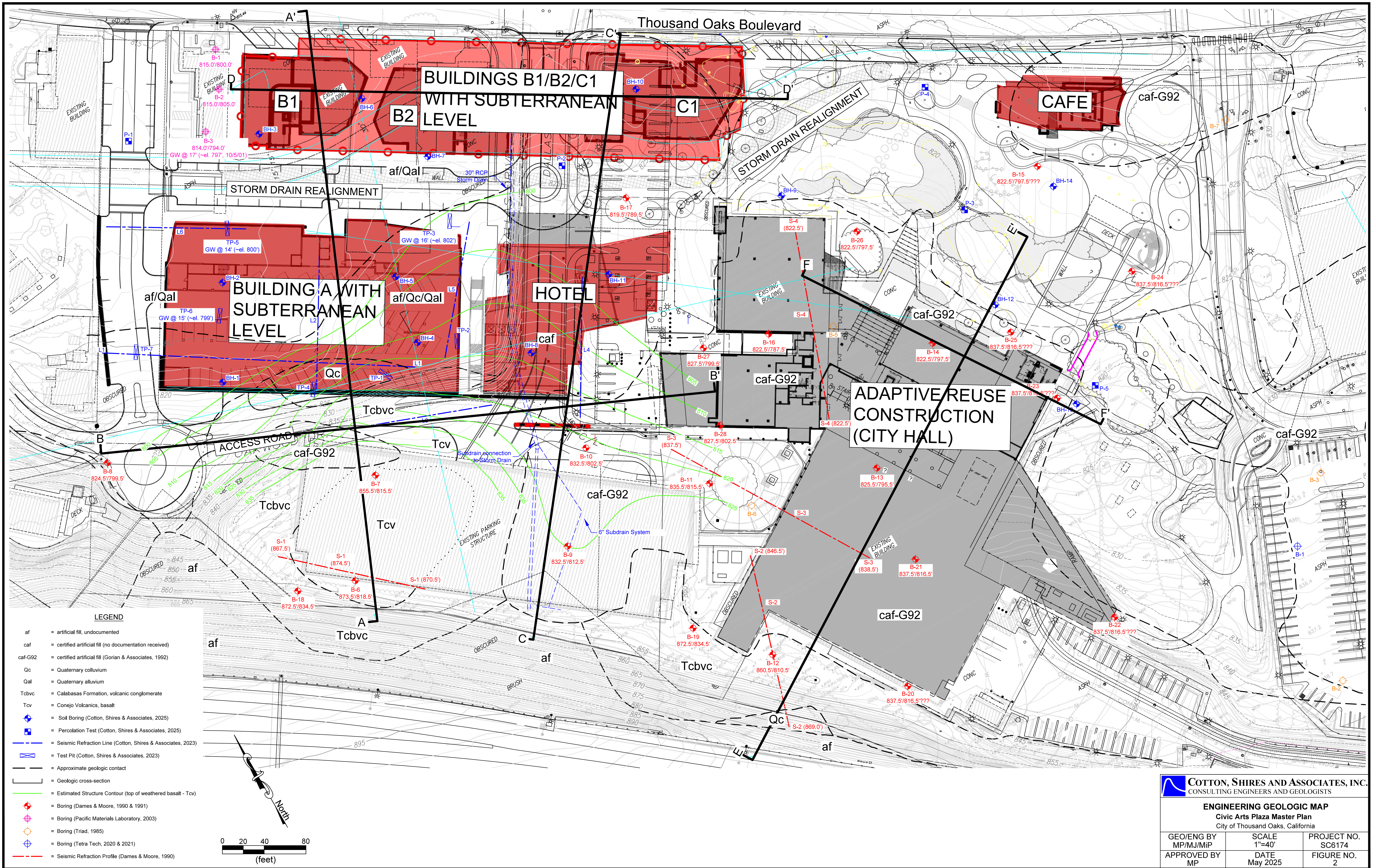


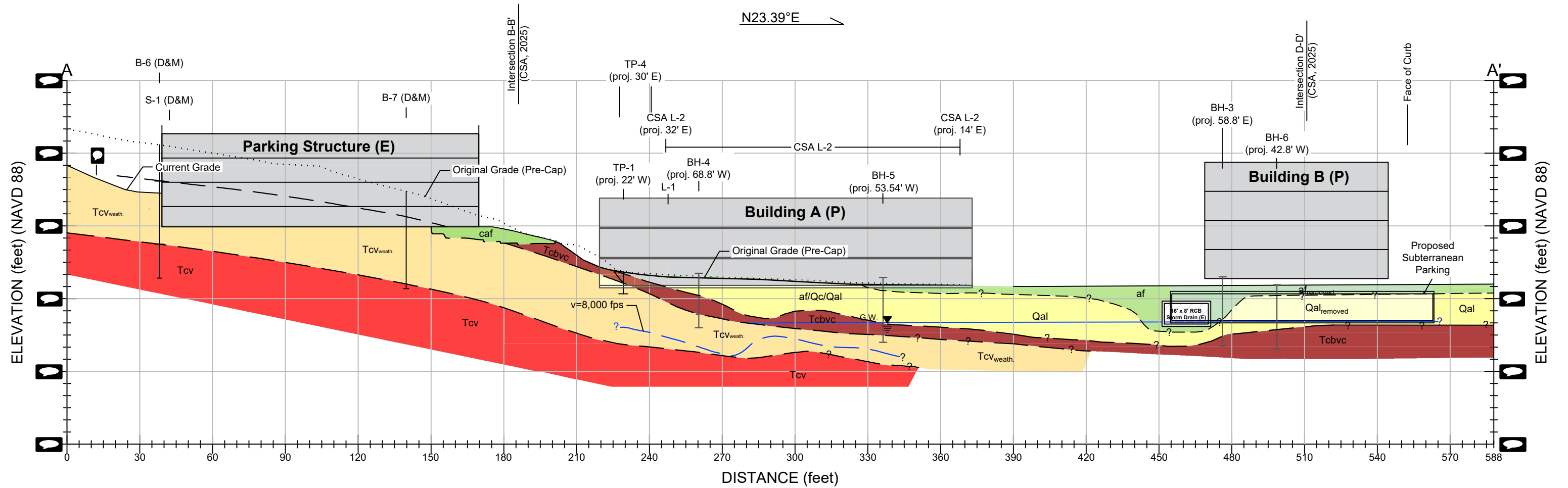
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CONSULTING ENGINEERS AND GEOLOGISTS

### Site Vicinity Map

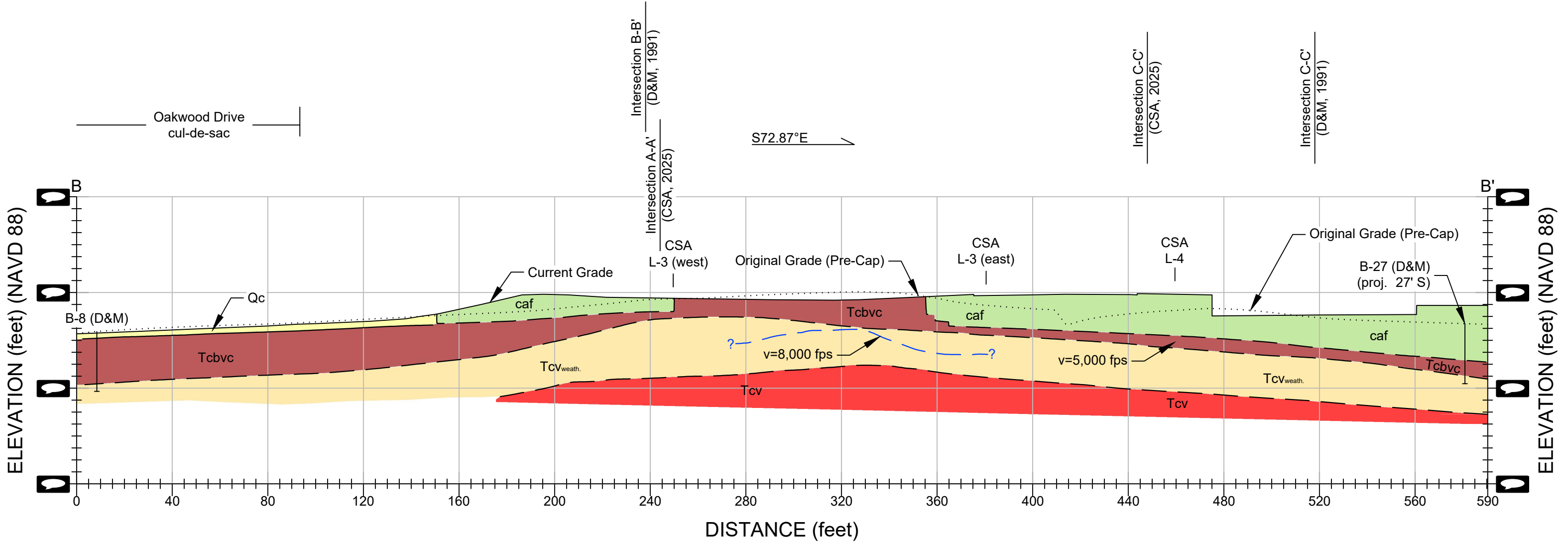
Civic Arts Plaza Master Plan  
City of Thousand Oaks, California

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| GEO/ENG BY<br>MiP  | SCALE<br>1" = 1/4 mi | PROJECT NO.<br>SC6174 |
| APPROVED BY<br>MJJ | DATE<br>May 2025     | FIGURE NO.<br>1       |

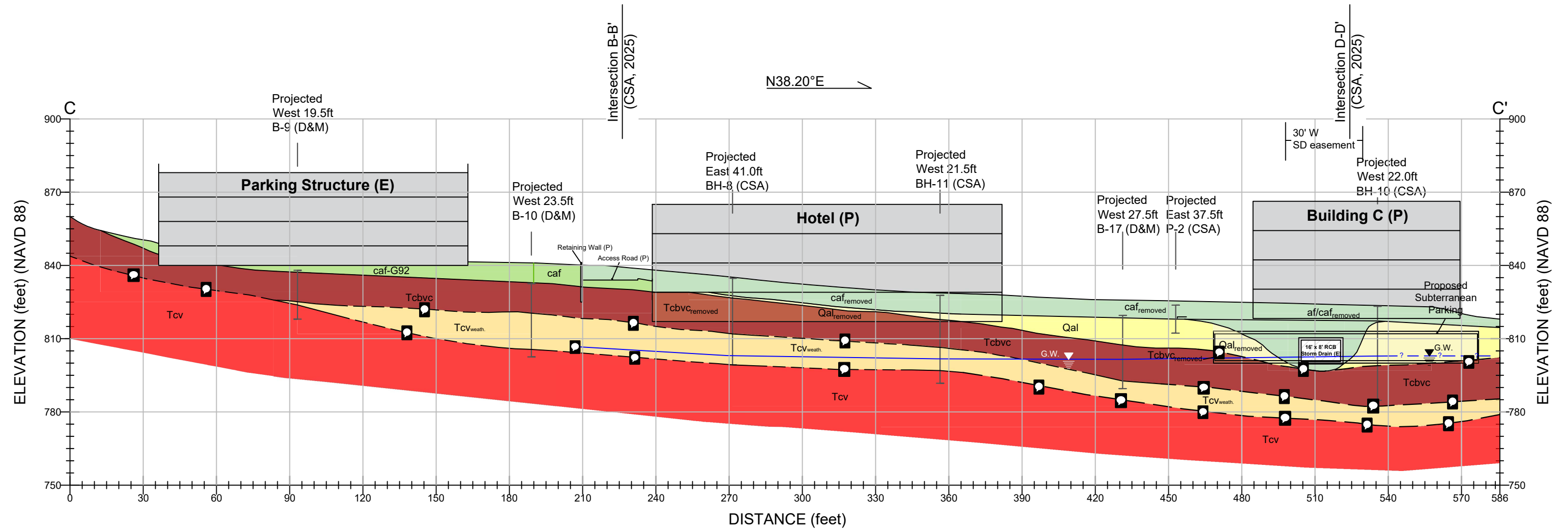


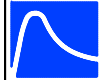


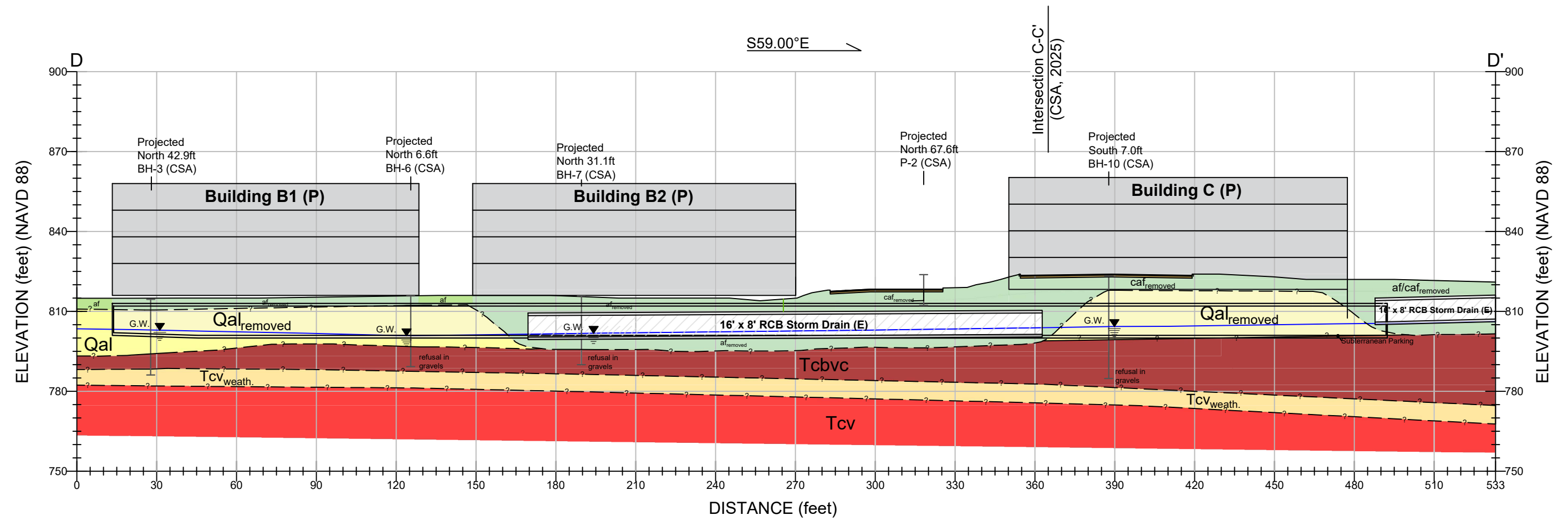
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|  <b>COTTON, SHIRES AND ASSOCIATES, INC.</b><br>CONSULTING ENGINEERS AND GEOLOGISTS |                   |                       |
| <b>Engineering Geologic Cross-Section A-A'</b><br><b>Civic Arts Plaza Master Plan</b><br>City of Thousand Oaks, California                                              |                   |                       |
| GEO/ENG BY<br>MP/MJ/MiP                                                                                                                                                 | SCALE<br>1" = 40' | PROJECT NO.<br>SC6174 |
| APPROVED BY<br>MP                                                                                                                                                       | DATE<br>May 2025  | FIGURE NO.<br>3       |

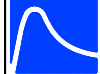


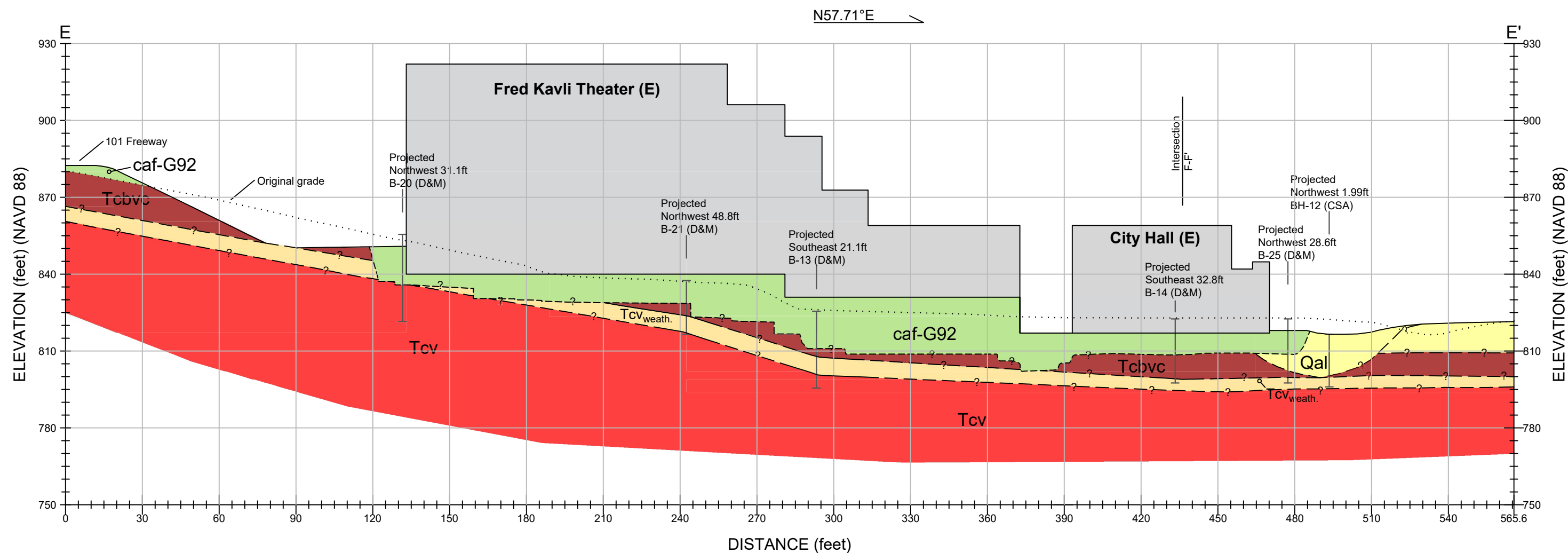
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|  <b>COTTON, SHIRES AND ASSOCIATES, INC.</b><br>CONSULTING ENGINEERS AND GEOLOGISTS |                  |                       |
| <b>Engineering Geologic Cross-Section B-B'</b><br><b>Civic Arts Plaza Master Plan</b><br>City of Thousand Oaks, California                                              |                  |                       |
| GEO/ENG BY<br>MP/MJJ/MiP                                                                                                                                                | SCALE<br>1"=40'  | PROJECT NO.<br>SC6174 |
| APPROVED BY<br>MP                                                                                                                                                       | DATE<br>May 2025 | FIGURE NO.<br>4       |

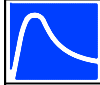


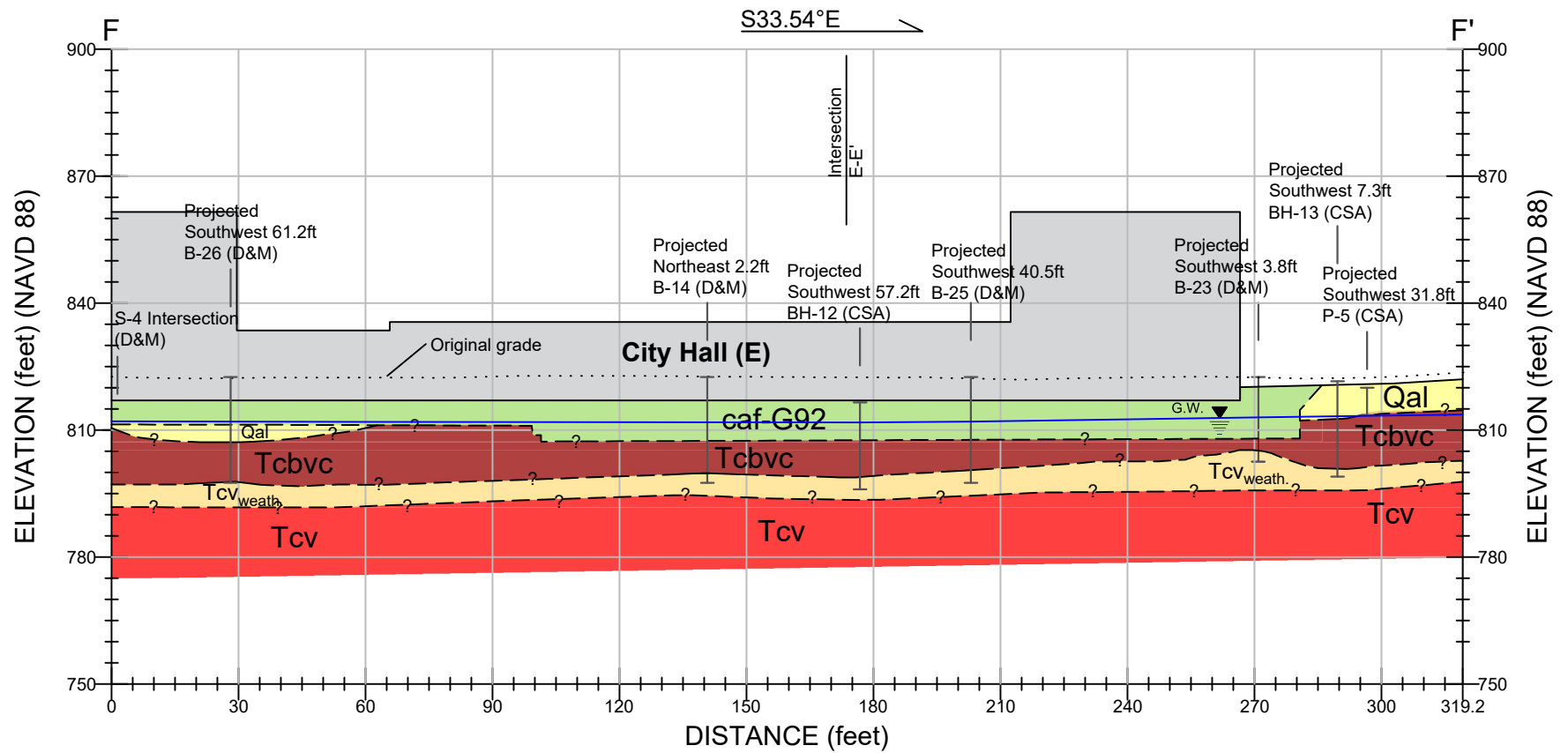
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|  <b>COTTON, SHIRES AND ASSOCIATES, INC.</b><br>CONSULTING ENGINEERS AND GEOLOGISTS |                  |                       |
| <b>Engineering Geologic Cross-Section C-C'</b><br><b>Civic Arts Plaza Master Plan</b><br>City of Thousand Oaks, California                                              |                  |                       |
| GEO/ENG BY<br>MiP                                                                                                                                                       | SCALE<br>1"=40'  | PROJECT NO.<br>SC6174 |
| APPROVED BY<br>MP/MJJ                                                                                                                                                   | DATE<br>May 2025 | FIGURE NO.<br>5       |

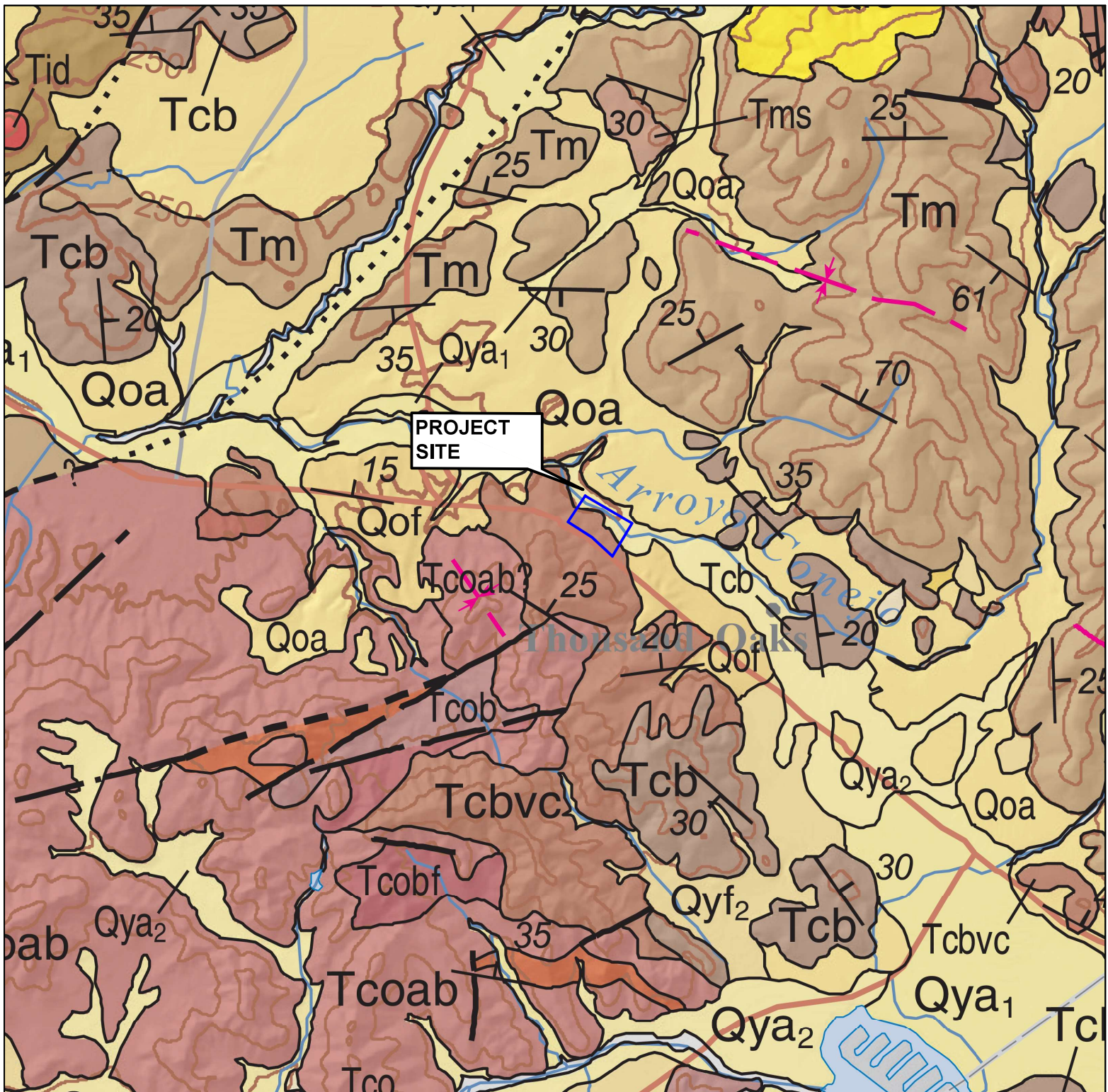


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| <b>Engineering Geologic Cross-Section D-D'</b><br><b>Civic Arts Plaza Master Plan</b><br>City of Thousand Oaks, California                                              |                  |                       |
| GEO/ENG BY<br>MP/MiP                                                                                                                                                    | SCALE<br>1"=40'  | PROJECT NO.<br>SC6174 |
| APPROVED BY<br>MP/MJJ                                                                                                                                                   | DATE<br>May 2025 | FIGURE NO.<br>6       |



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| <b>Engineering Geologic Cross-Section E-E'</b><br><b>Civic Arts Plaza Master Plan</b><br>City of Thousand Oaks, California                                              |                  |                       |
| GEO/ENG BY<br>MP/MiP                                                                                                                                                    | SCALE<br>1"=40'  | PROJECT NO.<br>SC6174 |
| APPROVED BY<br>MP/MJJ                                                                                                                                                   | DATE<br>May 2025 | FIGURE NO.<br>7       |

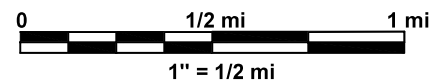




Reference: Geologic Map of the Los Angeles 30' x 60' Quadrangle, California, by Campbell, Russell H., Wills, Chris J., Irvine, Pamela J., Swanson, Brian J., 2014

#### EXPLANATION:

- Qya - Young alluvium (Late Pleistocene to Mid Holocene)
- Qyf - Young alluvial fan deposits (Late Pleistocene to Mid Holocene)
- Qof - Old alluvial fan deposits (Mid to Late Pleistocene)
- Qoa - Older alluvium (Mid to Late Pleistocene)
- Tm - Modelo Formation (Late Miocene)
- Tcbvc - Calabasas Formation (Late Middle Miocene)
- Tcv - Conejo Volcanics (Early to Mid Miocene)
- Tcb
- Tcoab
- Tcob
- Tcobf



**COTTON, SHIRES AND ASSOCIATES, INC.**  
CONSULTING ENGINEERS AND GEOLOGISTS

#### Regional Geologic Map

Civic Arts Plaza Master Plan

City of Thousand Oaks, California

|                    |                      |                       |
|--------------------|----------------------|-----------------------|
| GEO/ENG BY<br>MiP  | SCALE<br>1" = 1/2 mi | PROJECT NO.<br>SC6174 |
| APPROVED BY<br>MJJ | DATE<br>May 2025     | FIGURE NO.<br>9       |

**APPENDIX A**  
**FIELD EXPLORATION**

## **APPENDIX A – FIELD EXPLORATION**

### **TEST PITS**

CSA performed a subsurface exploration program on December 19, 2023 consisting of seven (7) exploratory test pits excavated within the proposed improvement areas to depths ranging from about 7.5 to 17.5 feet bgs. Test pits were excavated by means of track-mounted Hyundai 235 LRC-9 excavator equipped with a 36-inch bucket provided by DE Eddings of Acton, California. A CSA certified engineering geologist logged the test pits and visually classified the soils and bedrock in accordance with ASTM D-2487. Bulk samples were obtained of the materials encountered at selected depths. Upon completion, the test pits were backfilled with the excavated cuttings and compacted with a sheepsfoot roller. No compaction testing was performed on the backfill materials. Logs of the test pits are presented as Figures A-1 through A-7. The locations of the test pits are shown on Figure 2.

The logs depict our interpretation of the subsurface conditions at the date and location indicated based on visual observation of the excavated cuttings. It is not warranted that they are representative of subsurface conditions at other times and locations. The contacts on the logs represent the approximate boundaries between earth materials, and the transitions between these materials may be gradual.

### **EXPLORATORY BORINGS**

CSA completed a supplementary subsurface exploration program between January 27 and March 4, 2025, consisting of (14) total exploratory borings conducted in the proposed expansion areas. The completed borings ranged in depth from about 20.5 to 39 feet bgs and were excavated by means of either truck- or track-mounted drill rigs equipped with either 8-inch diameter hollow-stem augers or HQ wireline rock coring provided by 2R Drilling of Chino, California. The locations of the fourteen (14) completed exploratory borings are shown on Figures 2 through 8.

Borings were logged by a CSA registered geologist or a CSA engineer under the direct supervision of a registered geotechnical engineer. Subsurface materials were visually classified in accordance with ASTM D-2487 or ASTM D-5434, as applicable. Where HSA drilling was conducted, bulk samples, relatively undisturbed, and disturbed samples were obtained of the materials encountered at selected depths. Relatively undisturbed samples were obtained with a

3-inch diameter modified split-barrel California Sampler and disturbed samples were obtained with a 2-inch diameter split barrel standard penetration sampler. Both samplers were driven by an automatic, 140-lb hammer dropped from a height of 30 inches. Individual hammer calibration sheets are provided in this appendix. The relatively undisturbed samples were typically collected in brass liners that were 2.5 inches in outside diameter and 1 inch tall. Where rock coring was conducted, 2.5-inch diameter HQ rock cores were collected in approximate 5-foot runs, depending on how much sample could be recovered.

Logs of the borings are presented as Figure Nos. A-8 through A-21. The logs depict our interpretation of the subsurface conditions at the date and location indicated based on representative samples collected during drilling or coring. It is not warranted that they are representative of subsurface conditions at other times and locations. The contacts on the log represent the approximate boundaries between earth materials, and the transitions between these materials may be gradual.

### **PERCOLATION TESTING**

Percolation testing was conducted at five (5) locations across the project site. The test holes were excavated by means of either truck- or track-mounted drill rigs equipped with 8-inch diameter hollow-stem augers. Percolation test holes P-1, P-2, P-3, and P-4 were backfilled with a 3-inch diameter slotted PVC pipe and 3/4-inch gravel. P-5 was backfilled with a 2-inch diameter slotted PVC pipe and medium grained sand. The percolation test locations are shown on Figure 2.

Prior to field testing, the percolation test holes were pre-soaked. Following pre-soak, the test holes were filled to the top of the testing zone and the drop in water was measured over a timed interval. Water depth measurements were taken to the nearest 0.10-inch increment using a weighted measuring tape. Upon completion of testing, the PVC casings were removed from all test holes and backfilled with soil cuttings to the ground surface. The percolation gravel and sand used were left in place.

Logs of the percolation test holes are presented as Figure Nos. A-22 through A-26. The logs depict our interpretation of the subsurface conditions at the date and location indicated based on representative samples collected during drilling. It is not warranted that they are representative of subsurface conditions at other times and locations. The contacts on the log represent the approximate boundaries between earth materials, and the transitions between these materials may be gradual.

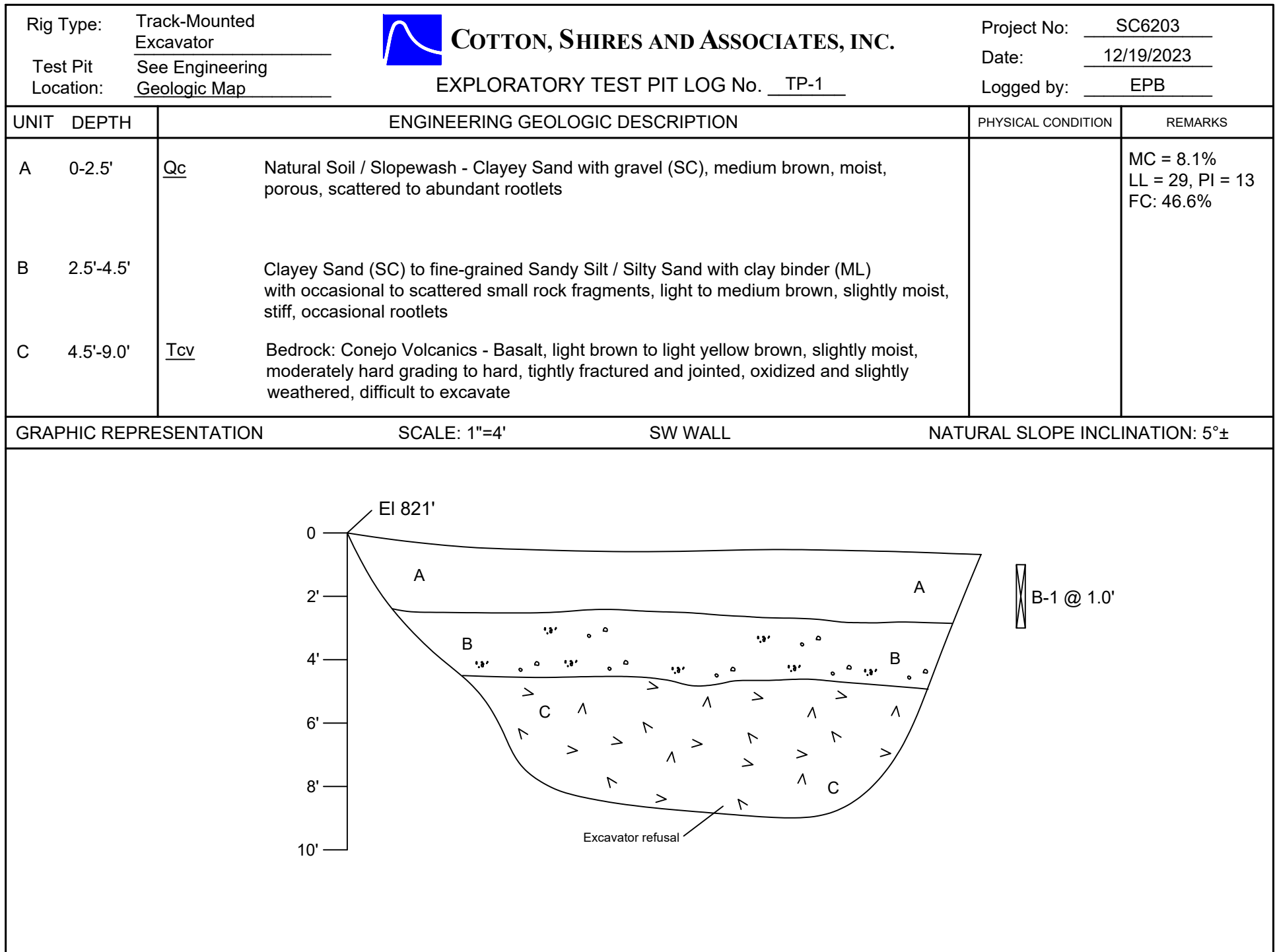


FIGURE A-1

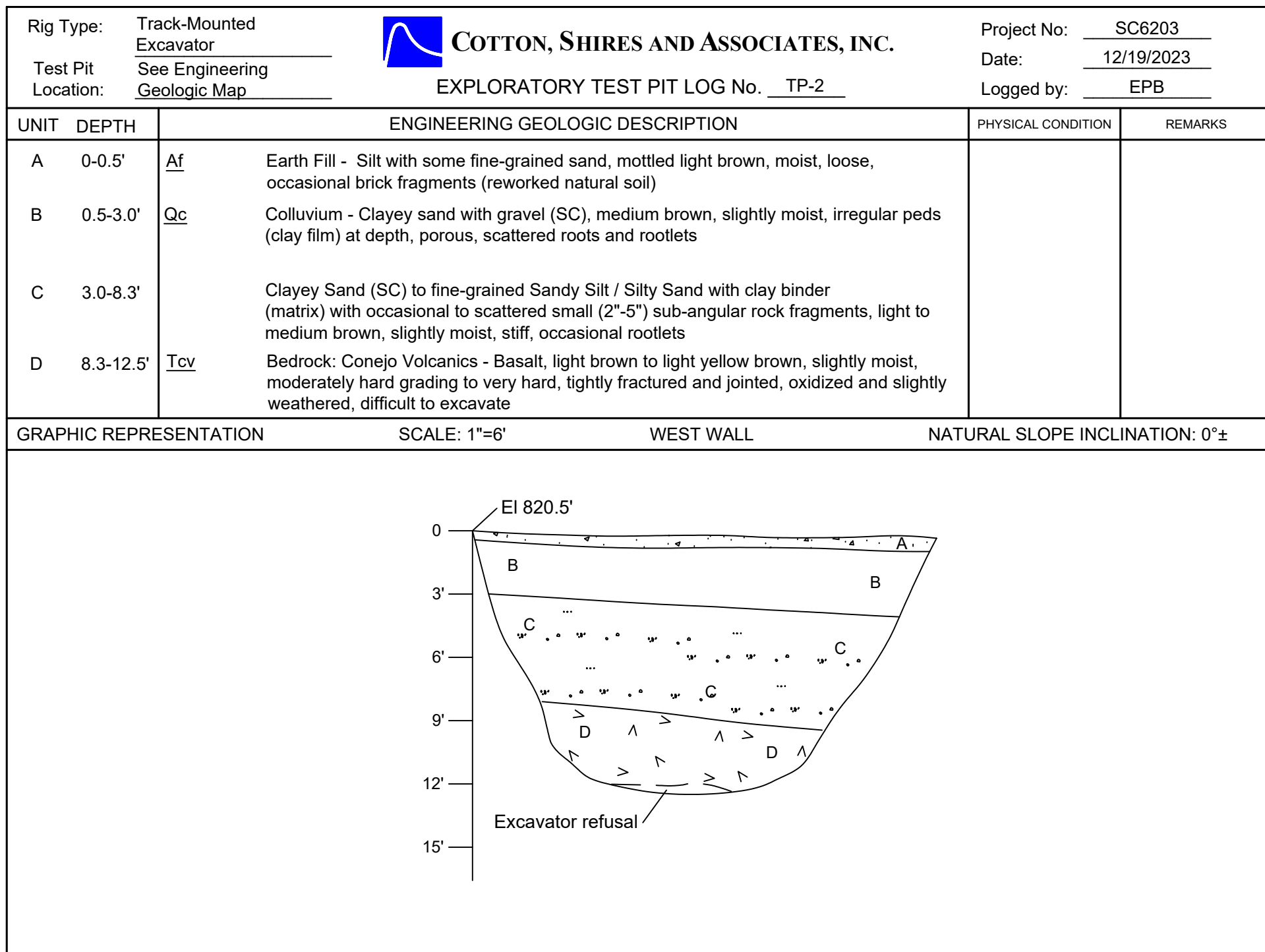


**FIGURE A-2**

Rig Type: Track-Mounted  
Excavator

Test Pit  
Location: See Engineering  
Geologic Map



**COTTON, SHIRES AND ASSOCIATES, INC.**

EXPLORATORY TEST PIT LOG No. TP-3

Project No: SC6203

Date: 12/19/2023

Logged by: EPB

| UNIT | DEPTH     | ENGINEERING GEOLOGIC DESCRIPTION |                                                                                                                                                                                                                             | PHYSICAL CONDITION | REMARKS                                                      |
|------|-----------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------------------------------------|
| A    | 0-3.5'    | <u>Af</u>                        | Earth Fill - Silt with some fine-grained sand, mottled light brown, moist, loose, occasional brick fragments (reworked natural soil)                                                                                        |                    | MC = 6.0%<br>LL = 32, PI = 14<br>FC: 33.7%                   |
| B    | 3.5-6.0'  | <u>Qc</u>                        | Colluvium - Clayey sand with gravel (SC), medium brown, slightly moist, medium firm, locally porous, scattered roots and rootlets                                                                                           |                    | MC = 12.8 -18.9%<br>EI = 79<br>LL = 37, PI = 13<br>FC: 52.7% |
| C    | 6.0-11.0' |                                  | Clayey Sand (SC) to fine-grained Sandy Silt / Silty Sand with clay binder (matrix) with occasional to scattered small (2"-6") sub-angular rock fragments, light to medium brown, slightly moist, stiff, occasional rootlets |                    | MC = 17.4%<br>EI = 13<br>LL = 26, PI = 4<br>FC: 46.4%        |
| D    | 11-17.0'  | <u>Qal</u>                       | 8.5' - lean Sandy Clay (CL)<br>Alluvium - Fine grained Sandy Silt / Silty Sand (ML/SM), light brown to light olive brown, moist to wet (groundwater at 16')                                                                 |                    |                                                              |

GRAPHIC REPRESENTATION

SCALE: 1"=6'

WEST WALL

NATURAL SLOPE INCLINATION: 0°±

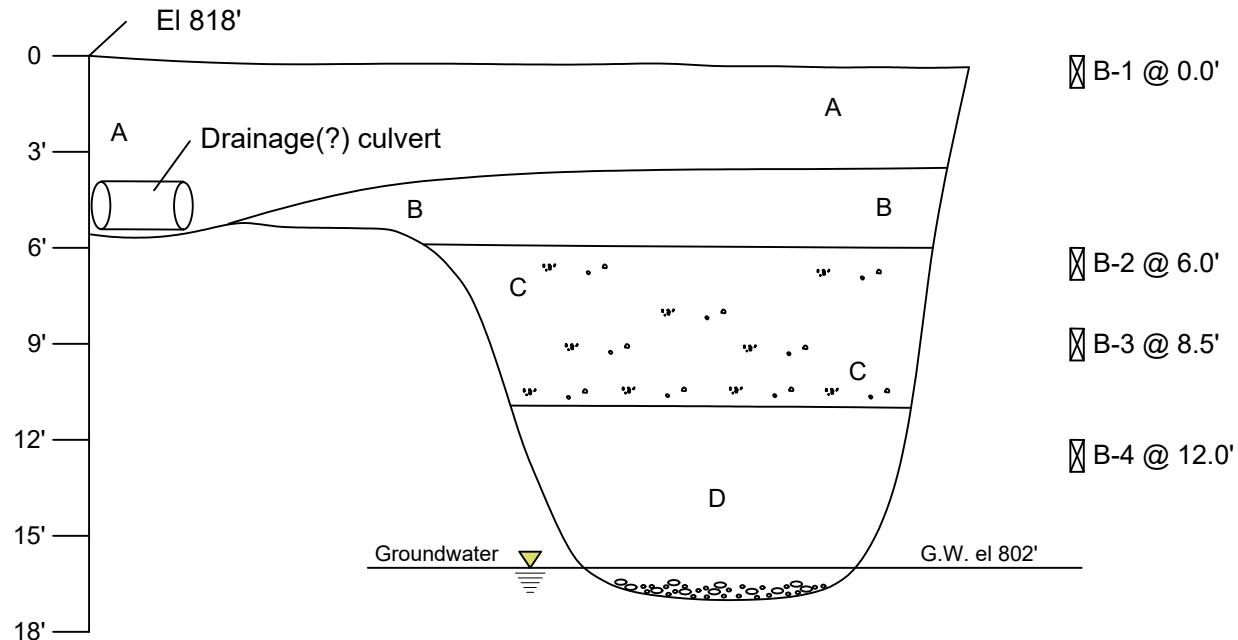


**FIGURE A-3**

Rig Type: Track-Mounted  
Excavator  
Test Pit See Engineering  
Location: Geologic Map



**COTTON, SHIRES AND ASSOCIATES, INC.**

EXPLORATORY TEST PIT LOG No. TP-4

Project No: SC6203  
Date: 12/19/2023  
Logged by: EPB

| UNIT | DEPTH     | ENGINEERING GEOLOGIC DESCRIPTION                                                                                                                                                                                            | PHYSICAL CONDITION | REMARKS                                              |
|------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------------------------------------------------------|
| A    | 0-3.5'    | <u>Qc</u><br>Natural Soil / Slopewash - Silt with some sand and trace clay (ML), medium brown, moist, firm, porous, scattered to abundant rootlets; slightly gradational contact with underlying Qc                         |                    |                                                      |
| B    | 3.5'-6.5' | Clayey Sand (SC) to fine-grained Sandy Silt / Silty Sand with clay binder (ML) with occasional to scattered small (1"-4") sub-angular rock fragments, light to medium brown, slightly moist, stiff, occasional rootlets     |                    |                                                      |
| C    | 6.5'-7.5' | <u>Tcv</u><br>Bedrock: Conejo Volcanics - Basalt, light brown to light yellow brown, slightly moist, moderately hard grading to hard, tightly fractured and jointed, oxidized and slightly weathered, difficult to excavate |                    | MC = 9.3%<br>EI = 11<br>LL = 34, PI = 8<br>FC: 24.4% |

GRAPHIC REPRESENTATION

SCALE: 1"=4'

WEST WALL

NATURAL SLOPE INCLINATION: 10°±

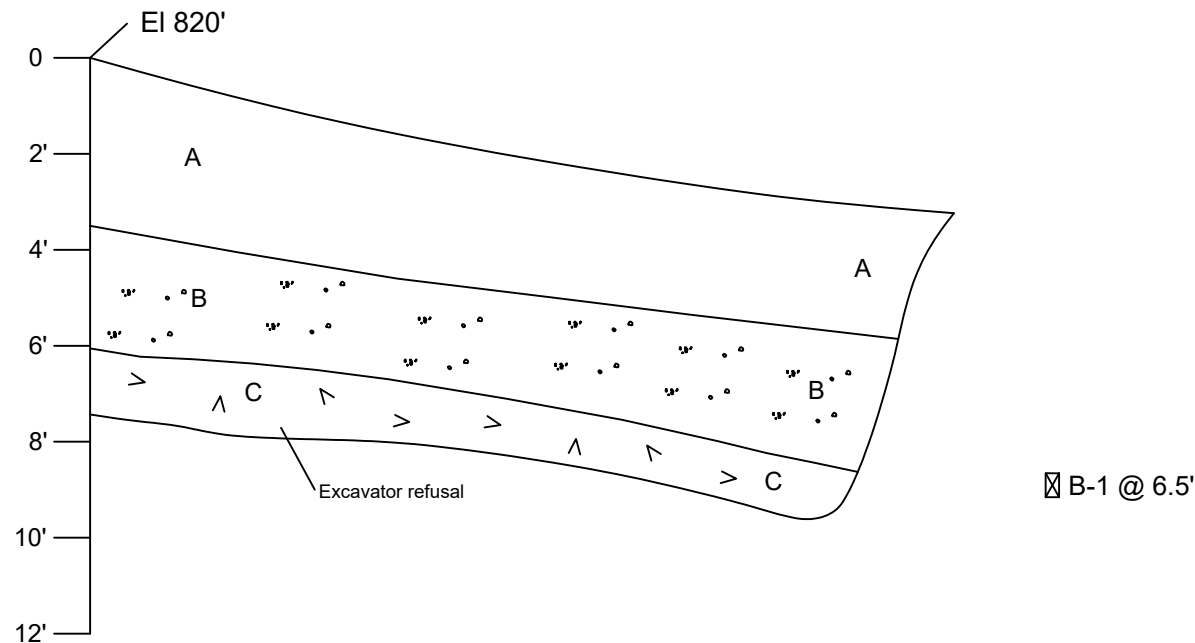
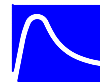


FIGURE A-4

Rig Type: Track-Mounted  
Excavator  
Test Pit See Engineering  
Location: Geologic Map



**COTTON, SHIRES AND ASSOCIATES, INC.**

EXPLORATORY TEST PIT LOG No. TP-5

Project No: SC6203

Date: 12/19/2023

Logged by: EPB

| UNIT | DEPTH     | ENGINEERING GEOLOGIC DESCRIPTION |                                                                                                                                                                                                                                                  | PHYSICAL CONDITION | REMARKS |
|------|-----------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------|
| A    | 0-4.0'    | <u>Af</u>                        | Earth Fill - Silt with some fine-grained sand, mottled light brown, moist, slightly to moderately compact                                                                                                                                        |                    |         |
| B    | 4.0-9.3'  | <u>Qal</u>                       | Alluvium - Fine-grained Sandy Silt (ML), light to medium brown, slightly moist, moderately firm, porous, occasional small gravel; transition to Sandy Silt with clay to Clayey Silt (ML) - dark brown to dark grayish brown, moist to very moist |                    |         |
| C    | 9.3-14.5' |                                  | Fine-grained Sandy Silt with trace clay (ML), light brown to light olive brown to light yellow brown, moist to wet (groundwater at 14'), medium stiff                                                                                            |                    |         |

GRAPHIC REPRESENTATION

SCALE: 1"=6'

WEST WALL

NATURAL SLOPE INCLINATION: 0°±

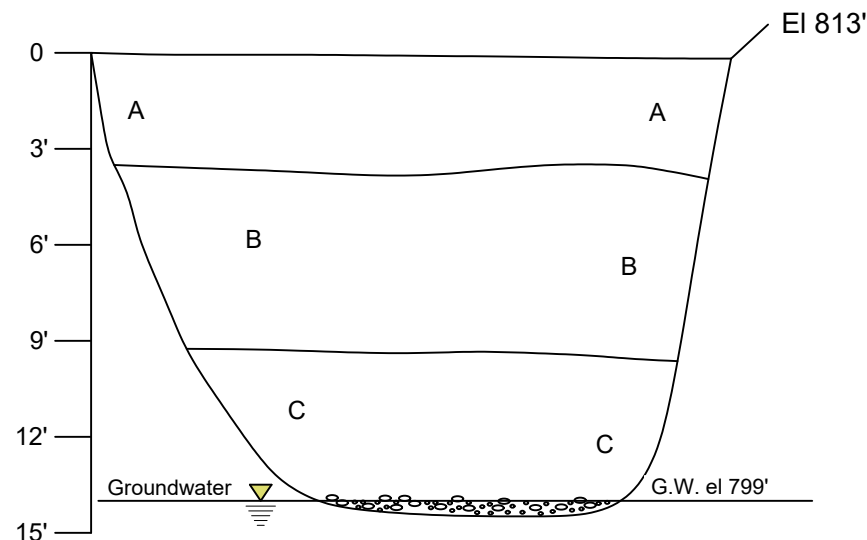


**FIGURE A-5**

Rig Type: Track-Mounted  
Excavator

Test Pit Location: See Engineering  
Geologic Map



**COTTON, SHIRES AND ASSOCIATES, INC.**

EXPLORATORY TEST PIT LOG No. TP-6

Project No: SC6203

Date: 12/19/2023

Logged by: EPB

| UNIT | DEPTH     | ENGINEERING GEOLOGIC DESCRIPTION |                                                                                                                                                                                                                                                   | PHYSICAL CONDITION | REMARKS |
|------|-----------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------|
| A    | 0-3.8'    | <u>Af</u>                        | Earth Fill - Silt with some fine-grained sand, mottled light brown, moist, slightly to moderately compact, scattered trash (pvc pipe, concrete fragments, rebar)                                                                                  |                    |         |
| B    | 3.8-9.5'  | <u>Qal</u>                       | Alluvium - Fine-grained Sandy Silt (ML), light to medium brown, slightly moist, moderately firm, porous, occasional small gravel; transitions to Sandy Silt with clay to Clayey Silt (ML) - dark brown to dark grayish brown, moist to very moist |                    |         |
| C    | 9.5-15.5' |                                  | Clayey Silt (ML) with scattered, small sub-angular to sub-rounded gravel, light gray brown, moist<br>13.0' - grades to fine-grained Sandy Silt / Silty Sand, light yellow olive, very moist, medium stiff, groundwater at 15'                     |                    |         |

GRAPHIC REPRESENTATION

SCALE: 1"=6'

WEST WALL

NATURAL SLOPE INCLINATION: 0°±

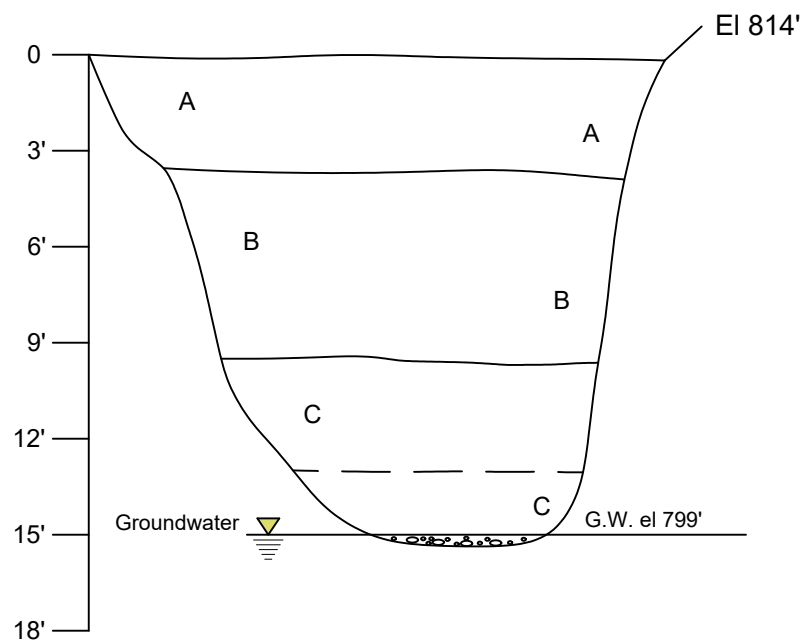


**FIGURE A-6**

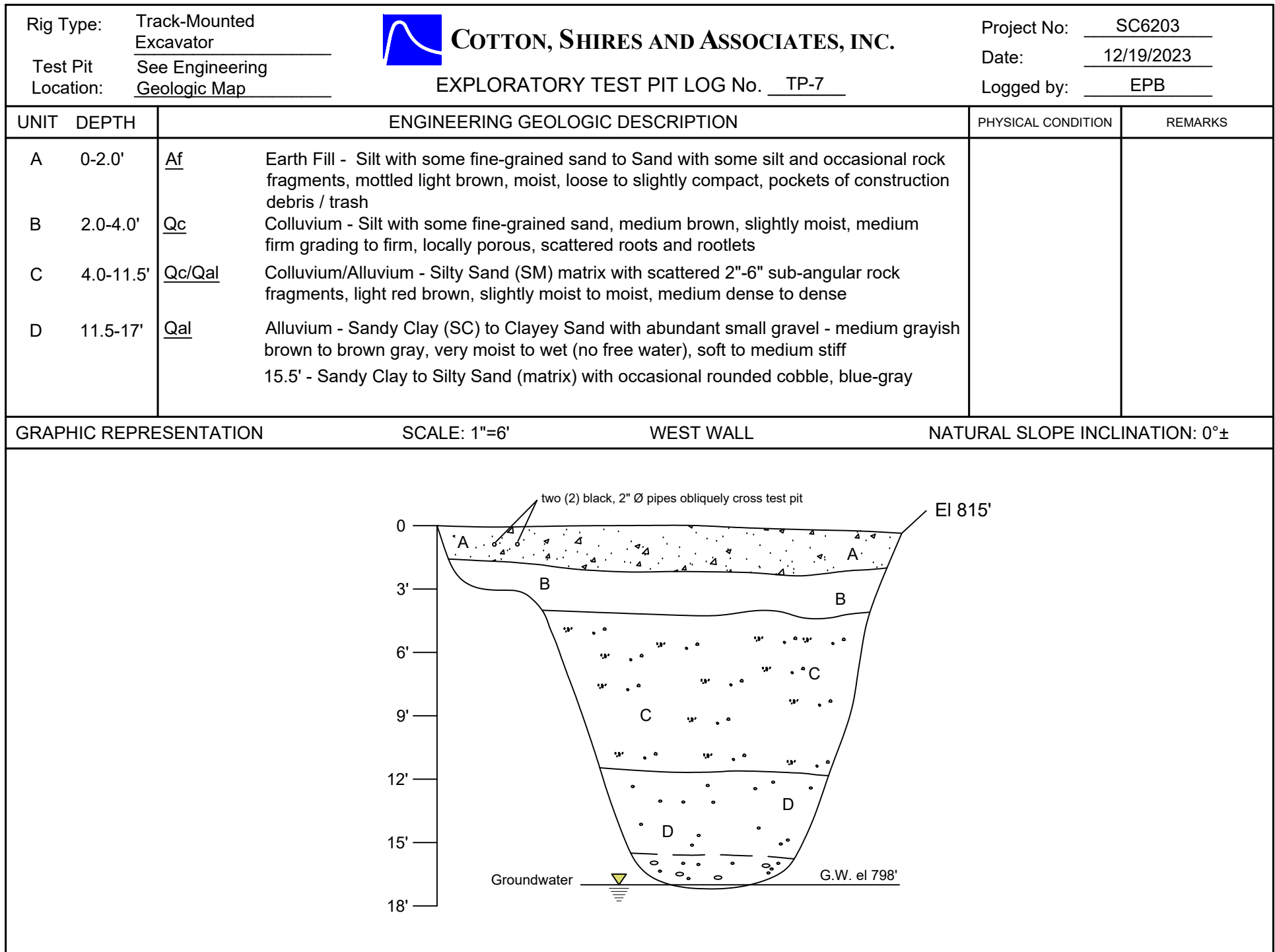


**FIGURE A-7**

## LOG OF EXPLORATORY DRILLING

Drilling Contractor/Rig: 2R Drilling/GT-8 Max Drill Date: 1/29/25 Hole Diameter (in): 8

Figure No.: A-8

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP Project Number: SC6174 Boring: BH-2

Location: See Engineering Geologic Map Elevation (ft): 813.75 Weather: Clear/Warm

Drilling Contractor/Rig: 2R Drilling/GT-8 Max Drill Date: 1/29/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS  | DESCRIPTION                                                                                                                                                                                                                                                       | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks                                        |
|------------|----------------|-------------|-------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|------------------------------------------------|
| 0          | 813            |             |             | SC    | <b>Artificial Fill (af);</b><br>Clayey sand with gravel (SC); medium brown, dry to slightly moist, loose to medium dense, fine to medium sand, fine to coarse gravel                                                                                              |                    |                       |                      |           |             |                  | Bulk 1: 0-5'<br>Moisture: 9.7%<br>Fines: 43.4% |
| 1          | 812            |             |             | SM    | Silty sand (SM); light to medium brown, dry to slightly moist, medium dense, fine to coarse sand, some fine gravel                                                                                                                                                |                    |                       |                      |           |             | 6                |                                                |
| 2          | 811            |             |             |       |                                                                                                                                                                                                                                                                   | R1                 | 87.1                  | 15.9                 | -         | MC          | 7                |                                                |
| 3          | 810            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 8                |                                                |
| 4          | 809            |             |             |       | <b>Alluvium (Qal);</b><br>Clayey sand with gravel (SC); dark brown, moist, loose, fine to coarse sand, fine to coarse gravel, carbonate stringers                                                                                                                 |                    |                       |                      |           |             | 5                |                                                |
| 5          | 808            |             |             |       |                                                                                                                                                                                                                                                                   | R2                 | 90.0                  | 17.1                 | -         | MC          | 5                |                                                |
| 6          | 807            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 7                |                                                |
| 7          | 806            |             |             | SC    | --medium dense, at 7 feet                                                                                                                                                                                                                                         |                    |                       |                      |           |             | 8                |                                                |
| 8          | 805            |             |             |       |                                                                                                                                                                                                                                                                   | R3                 | 92.4                  | 25.7                 | -         | MC          | 14               |                                                |
| 9          | 804            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 20               |                                                |
| 10         | 803            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 5                |                                                |
| 11         | 802            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 8                |                                                |
| 12         | 801            |             |             | SC    | Clayey sand (SC); dark olive brown, moist, medium dense, fine to medium grained                                                                                                                                                                                   | R4                 | 87.5                  | 29.6                 | -         | MC          | 12               |                                                |
| 13         | 800            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 3                |                                                |
| 14         | 799            |             |             |       |                                                                                                                                                                                                                                                                   | R5                 | 96.7                  | 26.9                 | -         | MC          | 5                |                                                |
| 15         | 798            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 9                |                                                |
| 16         | 797            |             |             | Tcbvc | <b>Volcanic Conglomerate (Tcbvc);</b><br>Sand with clay (SP-SC); medium grayish brown, wet, medium dense, fine to coarse sand, fine to coarse gravel, completely weathered                                                                                        |                    |                       |                      |           |             | 6                | No Recovery                                    |
| 17         | 796            |             |             |       |                                                                                                                                                                                                                                                                   | -                  | -                     | -                    | -         | MC          | 11               |                                                |
| 18         | 795            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 19               |                                                |
| 19         | 794            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 4                |                                                |
| 20         | 793            |             |             |       |                                                                                                                                                                                                                                                                   | R6                 | 115.1                 | 15.6                 | -         | MC          | 50/4"            |                                                |
| 21         | 792            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                                |
| 22         | 791            |             |             | Tcv   | <b>Conejo Volcanics (Tcv);</b><br>Andesite-dacite breccia; sand with clay matrix, orangeish brown, poorly sorted angular cobble-boulder fragments, heavily oxidized, soft to moderately hard, weathered to completely weathered, weathering decreasing with depth | R7                 | 94                    | 14.1                 | -         | MC          | 50/5"            |                                                |
| 23         | 790            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                                |
| 24         | 789            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                                |
| 25         | 788            |             |             |       |                                                                                                                                                                                                                                                                   | R8                 | 88                    | 34.3                 | -         | MC          | 24               |                                                |
| 26         | 787            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 50/4"            |                                                |
| 27         | 786            |             |             |       | Practical Refusal at 26 feet.<br>Groundwater stabilized at 13.0 feet.<br>Boring backfilled with cuttings.                                                                                                                                                         |                    |                       |                      |           |             |                  |                                                |
| 28         | 785            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                                |
| 29         | 784            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                                |
| 30         |                |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                                |

## LOG OF EXPLORATORY DRILLING

Drilling Contractor/Rig: 2R Drilling/GT-8 Max Drill Date: 1/28/25 Hole Diameter (in): 8

Figure No.:A-10

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP/EPB Project Number: SC6174 Boring: BH-4  
 Location: See Engineering Geologic Map Elevation (ft): 820.5 Weather: Clear/Cool  
 Drilling Contractor/Rig: 2R Drilling/GT-8 Max and GT-16 Track Rig Drill Date: 1/28,31/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS  | DESCRIPTION                                                                                                                                                                                                                                                                 | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks                                                                          |
|------------|----------------|-------------|-------------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|----------------------------------------------------------------------------------|
| 0          | 820            |             |             |       | <b>Alluvium (Qal);</b><br>Clayey sand with gravel (SC); medium brown, dry to slightly moist, dense, fine to coarse sand, fine to coarse gravel                                                                                                                              |                    |                       |                      |           |             |                  | Bulk 1: 0-5'<br>Moisture: 8.5%                                                   |
| 1          | 819            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             |                  |                                                                                  |
| 2          | 818            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             | 43               |                                                                                  |
| 3          | 817            |             |             |       |                                                                                                                                                                                                                                                                             | R1                 | 101.1                 | 10                   | -         | MC          | 41               |                                                                                  |
| 4          | 816            |             |             | SC    | --medium dense, at 5 feet                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 23               |                                                                                  |
| 5          | 815            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             | 14               |                                                                                  |
| 6          | 814            |             |             |       |                                                                                                                                                                                                                                                                             | R2                 | 102.8                 | 7.3                  | 39.2      | MC          | 23               |                                                                                  |
| 7          | 813            |             |             |       | --slightly moist, dense, some pore holes, at 7.5 feet                                                                                                                                                                                                                       |                    |                       |                      |           |             | 24               |                                                                                  |
| 8          | 812            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             | 15               |                                                                                  |
| 9          | 811            |             |             |       |                                                                                                                                                                                                                                                                             | R3                 | 96.9                  | 11.1                 | -         | MC          | 26               |                                                                                  |
| 10         | 810            |             |             |       | <b>Volcanic Conglomerate (Tcbvc);</b><br>Sandy clay matrix, mostly weathered, orangeish brown, moist, hard, poorly sorted angular cobble-boulder fragments, heavily oxidized, weathered to completely weathered, weathering decreasing with depth                           |                    |                       |                      |           |             | 16               | No Recovery<br>Refusal of<br>hollow-stem<br>method<br>Switched to<br>rock coring |
| 11         | 809            |             |             |       |                                                                                                                                                                                                                                                                             | R4                 | 105.3                 | 10.3                 | -         | MC          | 31               |                                                                                  |
| 12         | 808            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             | 50/5"            |                                                                                  |
| 13         | 807            |             |             | Tcbvc |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             | 37               |                                                                                  |
| 14         | 806            |             |             |       |                                                                                                                                                                                                                                                                             | R5                 | 97.7                  | 12.7                 | -         | MC          | 50/4"            |                                                                                  |
| 15         | 805            |             |             |       | --unweathered, at 15 feet                                                                                                                                                                                                                                                   | -                  | -                     | -                    | -         | MC          | 50/3"            |                                                                                  |
| 16         | 804            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             |                  |                                                                                  |
| 17         | 803            |             |             |       | <b>Conejo Volcanics (Tcv);</b><br>Andesite-dacite breccia; sand with clay matrix, light gray to medium gray, poorly sorted angular cobble-boulder fragments, heavily oxidized, soft to moderately hard, slightly weathered to unweathered, weathering decreasing with depth |                    |                       |                      |           |             |                  |                                                                                  |
| 18         | 802            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             |                  |                                                                                  |
| 19         | 801            |             |             | Tcv   |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             |                  |                                                                                  |
| 20         | 800            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             |                  |                                                                                  |
| 21         | 799            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             |                  |                                                                                  |
| 22         | 798            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             |                  |                                                                                  |
| 23         | 797            |             |             |       | Total Depth: 22.5 feet<br>No groundwater encountered.<br>Boring backfilled with cuttings.                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                                                                  |
| 24         | 796            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             |                  |                                                                                  |
| 25         | 795            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             |                  |                                                                                  |
| 26         | 794            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             |                  |                                                                                  |
| 27         | 793            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             |                  |                                                                                  |
| 28         | 792            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             |                  |                                                                                  |
| 29         | 791            |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             |                  |                                                                                  |
| 30         |                |             |             |       |                                                                                                                                                                                                                                                                             |                    |                       |                      |           |             |                  |                                                                                  |

## LOG OF EXPLORATORY DRILLING

Drilling Contractor/Rig: 2R Drilling/GT-8 Max Drill Date: 1/29/25 Hole Diameter (in): 8

Figure No.:A-12

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP Project Number: SC6174 Boring: BH-6  
 Location: See Engineering Geologic Map Elevation (ft): 815.75 Weather: Clear/Warm  
 Drilling Contractor/Rig: 2R Drilling/GT-8 Max Drill Date: 1/28/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS  | DESCRIPTION                                                                                                                                                                                                       | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks                                         |
|------------|----------------|-------------|-------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|-------------------------------------------------|
| 0          | 815            |             |             | SC    | <b>Artificial Fill (af);</b><br>Clayey sand (SC); medium brown, moist, loose, fine sand, fine gravel                                                                                                              |                    |                       |                      |           |             |                  | Bulk 1: 0-5'<br>Moisture: 14.2%<br>Fines: 38.2% |
| 1          | 814            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             | 5                |                                                 |
| 2          | 813            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             | 3                |                                                 |
| 3          | 812            |             |             | SC    | <b>Alluvium (Qal);</b><br>Clayey sand (SC); medium brown, moist, loose, fine to coarse sand, fine gravel                                                                                                          | R1                 | 94.1                  | 17.3                 | -         | MC          | 3                |                                                 |
| 4          | 811            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                                 |
| 5          | 810            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             | 2                |                                                 |
| 6          | 809            |             |             |       |                                                                                                                                                                                                                   | R2                 | 96.2                  | 17.3                 | -         | MC          | 4                |                                                 |
| 7          | 808            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                                 |
| 8          | 807            |             |             | CL    | Sandy clay (CL); dark brown, moist, very stiff, fine to medium sand                                                                                                                                               |                    |                       |                      |           |             | 5                |                                                 |
| 9          | 806            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             | 9                |                                                 |
| 10         | 805            |             |             |       |                                                                                                                                                                                                                   | R3                 | 100.6                 | 23.0                 | -         | MC          | 15               |                                                 |
| 11         | 804            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                                 |
| 12         | 803            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             | 7                |                                                 |
| 13         | 802            |             |             |       |                                                                                                                                                                                                                   | R4                 | 102.3                 | 21.4                 | -         | MC          | 17               |                                                 |
| 14         | 801            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                                 |
| 15         | 800            |             |             | SC    | Clayey sand (SC); medium brown, moist to wet, medium dense, fine to medium sand, sparse coarse gravel                                                                                                             |                    |                       |                      |           |             | 5                |                                                 |
| 16         | 799            |             |             |       |                                                                                                                                                                                                                   | R6                 | 96.6                  | 26.4                 | -         | MC          | 10               |                                                 |
| 17         | 798            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             | 8                |                                                 |
| 18         | 797            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             | 12               |                                                 |
| 19         | 796            |             |             | Tcbvc | <b>Volcanic Conglomerate (Tcbvc);</b><br>Gravel with clay and sand (GP-GC); medium brown, wet, dense, fine to coarse sand, fine to coarse gravel, chatter from cobbles, quantity of cobbles increasing with depth |                    |                       |                      |           |             |                  |                                                 |
| 20         | 795            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             | 19               |                                                 |
| 21         | 794            |             |             |       |                                                                                                                                                                                                                   | R7                 | 90.7                  | 26.6                 | -         | MC          | 37               |                                                 |
| 22         | 793            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             | 50/4"            |                                                 |
| 23         | 792            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                                 |
| 24         | 791            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                                 |
| 25         | 790            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             | 9                |                                                 |
| 26         | 789            |             |             |       |                                                                                                                                                                                                                   | R8                 | 110.9                 | 17.8                 | -         | MC          | 21               |                                                 |
| 27         | 788            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             | 42               |                                                 |
| 28         | 787            |             |             |       | Practical refusal at 26.5 feet.<br>Groundwater stabilized at 15.3 feet.<br>Boring backfilled with cuttings.                                                                                                       |                    |                       |                      |           |             |                  |                                                 |
| 29         | 786            |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                                 |
| 30         |                |             |             |       |                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                                 |

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP Project Number: SC6174 Boring: BH-7  
 Location: See Engineering Geologic Map Elevation (ft): 815.75 Weather: Clear/Warm  
 Drilling Contractor/Rig: 2R Drilling/GT-8 Max Drill Date: 1/28/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS  | DESCRIPTION                                                                                                                                                                                                                     | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks                                         |
|------------|----------------|-------------|-------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|-------------------------------------------------|
| 0          |                |             |             |       | 3.5" AC over 5" aggregate base                                                                                                                                                                                                  |                    |                       |                      |           |             |                  |                                                 |
| 1          | 815            |             |             | SC    | <b>Artificial Fill (af);</b><br>Clayey sand (SC); dark brown, moist, loose, fine to coarse sand, fine to coarse gravel                                                                                                          |                    |                       |                      |           |             |                  | Bulk 1: 0-5'<br>Moisture: 18.4%<br>Fines: 40.9% |
| 2          | 814            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 6                |                                                 |
| 3          | 813            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 6                |                                                 |
| 4          | 812            |             |             | SC    | <b>Alluvium (Qal);</b><br>Clayey sand (SC); dark brown, moist, loose, fine to medium sand, fine to coarse gravel                                                                                                                | R1                 | 99.7                  | 18.7                 | -         | MC          | 7                |                                                 |
| 5          | 811            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 4                |                                                 |
| 6          | 810            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 5                |                                                 |
| 7          | 809            |             |             | CL    | Sandy clay with gravel (CL); dark brown, moist, stiff, fine to coarse sand, fine to coarse gravel                                                                                                                               | R2                 | 97.5                  | 20.5                 | -         | MC          | 9                |                                                 |
| 8          | 808            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 9                |                                                 |
| 9          | 807            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 17               |                                                 |
| 10         | 806            |             |             | SC    | --slightly oxidized, at 10 feet                                                                                                                                                                                                 |                    |                       |                      |           |             | 20               |                                                 |
| 11         | 805            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 7                |                                                 |
| 12         | 804            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 10               |                                                 |
| 13         | 803            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 13               |                                                 |
| 14         | 802            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 19               |                                                 |
| 15         | 801            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 21               |                                                 |
| 16         | 800            |             |             | SP-SC | Sand with gravel and clay (SP-SC); medium brown, moist to wet (lower rings), medium dense to dense, fine to coarse sand, fine to coarse gravel, slightly oxidized                                                               | R5                 | 109.0                 | 12.3                 | -         | MC          |                  |                                                 |
| 17         | 799            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 10               |                                                 |
| 18         | 798            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 11               |                                                 |
| 19         | 797            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 11               |                                                 |
| 20         | 796            |             |             |       | --heavy chatter, at 20 feet                                                                                                                                                                                                     |                    |                       |                      |           |             |                  |                                                 |
| 21         | 795            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 44               |                                                 |
| 22         | 794            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 21               |                                                 |
| 23         | 793            |             |             | Tcbvc | <b>Volcanic Conglomerate (Tcbvc);</b><br>Clayey gravel with sand (GC); medium oliveish brown, wet, dense, fine to coarse sand, fine to coarse gravel, some cobbles, (Tcbes quantity increasing with depth, completely weathered | R7                 | 109.3                 | 21.0                 | -         | MC          | 26               |                                                 |
| 24         | 792            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 25         | 791            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 26         | 790            |             |             | Tcbvc | Gravel with sand and clay (GP-GC); oliveish brown, wet, dense to very dense, fine to coarse sand, coarse gravel, cobbles, slightly to moderately weathered                                                                      | R8                 | 115.7                 | 20.2                 | -         | MC          | 20               |                                                 |
| 27         | 789            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             | 50/4"            |                                                 |
| 28         | 788            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 29         | 787            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 30         | 786            |             |             |       |                                                                                                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
|            |                |             |             |       | Practical refusal at 25.75 feet.<br>Groundwater stabilized at 14.3 feet.<br>Boring backfilled with cuttings.                                                                                                                    |                    |                       |                      |           |             |                  |                                                 |

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP Project Number: SC6174 Boring: BH-8  
 Location: See Engineering Geologic Map Elevation (ft): 834.75 Weather: Clear/Warm  
 Drilling Contractor/Rig: 2R Drilling/GT-8 Max Drill Date: 1/27/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS  | DESCRIPTION                                                                                                                                                                                                                                                       | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks          |
|------------|----------------|-------------|-------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|------------------|
| 0          |                |             |             |       | 2" AC over 10" Aggregate Base                                                                                                                                                                                                                                     |                    |                       |                      |           |             |                  |                  |
| 1          | 834            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                  |
| 2          | 833            |             |             |       | <b>Artificial Fill (caf);</b><br>Clayey sand (CL); dark grayish brown, moist, stiff, fine to medium sand, fine to coarse gravel                                                                                                                                   |                    |                       |                      |           |             |                  |                  |
| 3          | 832            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 5                |                  |
| 4          | 831            |             |             |       |                                                                                                                                                                                                                                                                   | R1                 | 116.1                 | 14.3                 | -         | MC          | 18               |                  |
| 5          | 830            |             |             | SC    |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 17               |                  |
| 6          | 829            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 25               |                  |
| 7          | 828            |             |             |       |                                                                                                                                                                                                                                                                   | R2                 | 113.6                 | 16.5                 | 42.5      | MC          | 26               |                  |
| 8          | 827            |             |             |       | <b>Volcanic Conglomerate (Tcbvc);</b><br>Clayey sand with gravel (SC); dark reddish brown, moist, stiff, fine to coarse gravel, completely weathered                                                                                                              |                    |                       |                      |           |             | 8                |                  |
| 9          | 826            |             |             |       |                                                                                                                                                                                                                                                                   | R3                 | 118.7                 | 12.7                 | -         | MC          | 22               |                  |
| 10         | 825            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 9                |                  |
| 11         | 824            |             |             |       |                                                                                                                                                                                                                                                                   | R4                 | 109.4                 | 19.0                 | -         | MC          | 21               |                  |
| 12         | 823            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 8                |                  |
| 13         | 822            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 18               |                  |
| 14         | 821            |             |             | Tcbvc | --dense, fine to medium sand, at 14 feet                                                                                                                                                                                                                          | R5                 | 106.1                 | 19.9                 | -         | MC          | 29               |                  |
| 15         | 820            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 15               |                  |
| 16         | 819            |             |             |       |                                                                                                                                                                                                                                                                   | R6                 | 111.8                 | 13.9                 | -         | MC          | 34               |                  |
| 17         | 818            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                  |
| 18         | 817            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                  |
| 19         | 816            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                  |
| 20         | 815            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                  |
| 21         | 814            |             |             |       | <b>Conejo Volcanics (Tcv);</b><br>Andesite-dacite breccia; sand with clay matrix, orangeish brown, poorly sorted angular cobble-boulder fragments, heavily oxidized, soft to moderately hard, weathered to completely weathered, weathering decreasing with depth | R7                 | -                     | -                    | -         | MC          | 50/3"            | Sample Disturbed |
| 22         | 813            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                  |
| 23         | 812            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                  |
| 24         | 811            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                  |
| 25         | 810            |             |             | Tcv   | --difficulty of drilling increase, color change to light gray, at 25 feet                                                                                                                                                                                         |                    |                       |                      |           |             | 8                |                  |
| 26         | 809            |             |             |       |                                                                                                                                                                                                                                                                   | R8                 | -                     | -                    | -         | MC          | 50/4"            | Sample Disturbed |
| 27         | 808            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                  |
| 28         | 807            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                  |
| 29         | 806            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                  |
| 30         | 805            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                  |

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP Project Number: SC6174 Boring: BH-8

Location: See Engineering Geologic Map Elevation (ft): 834.75 Weather: Clear/Warm

Drilling Contractor/Rig: 2R Drilling/GT-8 Max Drill Date: 1/27/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level                                                                                                                   | Graphic Log                                                                       | USCS | DESCRIPTION | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks          |
|------------|----------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|-------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|------------------|
| 30         | 804            | ▽                                                                                                                             |  | Tcv  |             | R9                 | -                     | -                    | -         | MC          | 50/5"            | Sample Disturbed |
| 31         | 803            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 32         | 802            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 33         | 801            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 34         | 800            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 35         | 799            |                                                                                                                               |                                                                                   |      |             | R10                | -                     | -                    | -         | MC          | 50/5"            | Sample Disturbed |
| 36         | 798            | Total Depth: 35.5 feet<br>Groundwater encountered at 31.5 feet.<br>Boring backfilled with cuttings and capped with coldpatch. |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 37         | 797            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 38         | 796            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 39         | 795            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 40         | 794            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 41         | 793            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 42         | 792            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 43         | 791            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 44         | 790            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 45         | 789            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 46         | 788            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 47         | 787            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 48         | 786            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 49         | 785            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 50         | 784            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 51         | 783            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 52         | 782            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 53         | 781            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 54         | 780            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 55         | 779            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 56         | 778            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 57         | 777            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 58         | 776            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 59         | 775            |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |
| 60         |                |                                                                                                                               |                                                                                   |      |             |                    |                       |                      |           |             |                  |                  |

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP/EPD Project Number: SC6174 Boring: BH-9

Location: See Engineering Geologic Map Elevation (ft): 818.5 Weather: Clear/Warm

Drilling Contractor/Rig: 2R Drilling/GT-16 Track Rig Drill Date: 1/31,2/3/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS  | DESCRIPTION                                                                                                                                                          | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks          |
|------------|----------------|-------------|-------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|------------------|
| 0          | 818            |             |             |       | <b>Artificial Fill (af);</b><br>Sandy clay (CL); light to medium brown, moist, stiff, fine to medium sand, some fine to coarse gravel                                |                    |                       |                      |           |             |                  |                  |
| 1          | 817            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             |                  |                  |
| 2          | 816            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             | 7                |                  |
| 3          | 815            |             |             | CL    |                                                                                                                                                                      | R1                 | 101.5                 | 15.9                 | -         | MC          | 9                |                  |
| 4          | 814            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             | 12               |                  |
| 5          | 813            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             |                  |                  |
| 6          | 812            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             | 7                |                  |
| 7          | 811            |             |             | CL    | <b>Alluvium (Qal);</b><br>Clay (CL); dark brown, moist, stiff, occasional fine gravel, occasional charcoal fragment                                                  | R2                 | -                     | -                    | -         | MC          | 8                |                  |
| 8          | 810            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             | 9                | Sample Disturbed |
| 9          | 809            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             |                  |                  |
| 10         | 808            |             |             | GC    | Clayey gravel with sand (GC); light gray brown, moist, medium dense, fine to coarse sand, fine gravel                                                                | R3                 | 112.4                 | 10.1                 | 18.3      | MC          | 16               |                  |
| 11         | 807            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             | 22               |                  |
| 12         | 806            |             |             | SM    | Silty sand (SM); mottled light yellow brown, moist, medium dense, fine grained                                                                                       |                    |                       |                      |           |             |                  |                  |
| 13         | 805            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             | 8                |                  |
| 14         | 804            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             | 11               |                  |
| 15         | 803            |             |             | SP    | Sand (SP); mottled light yellow brown, moist, medium dense, fine grained                                                                                             | R4                 | 99.6                  | 24.5                 | -         | MC          | 14               |                  |
| 16         | 802            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             |                  |                  |
| 17         | 801            |             |             | GP    | Sandy gravel (GP); brown, very moist, dense, fine to coarse sand, coarse gravel                                                                                      |                    |                       |                      |           |             |                  |                  |
| 18         | 800            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             | 14               |                  |
| 19         | 799            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             | 24               |                  |
| 20         | 798            |             |             | CL    | Sandy clay with gravel (CL); dark brown, very moist to wet, very stiff to hard, coarse gravel                                                                        | R5                 | 112.1                 | 11.2                 | -         | MC          | 24               |                  |
| 21         | 797            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             |                  |                  |
| 22         | 796            |             |             | Tcbvc | <b>Volcanic Conglomerate (Tcbvc);</b><br>Clayey sand with gravel (SC); gray brown, wet, medium dense, fine to coarse sand, coarse shale gravel, completely weathered | R6                 | 99.0                  | 25.8                 | -         | MC          | 7                |                  |
| 23         | 795            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             | 19               |                  |
| 24         | 794            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             | 23               |                  |
| 25         | 793            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             |                  |                  |
| 26         | 792            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             |                  |                  |
| 27         | 791            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             |                  |                  |
| 28         | 790            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             |                  |                  |
| 29         | 789            |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             |                  |                  |
| 30         |                |             |             |       |                                                                                                                                                                      |                    |                       |                      |           |             |                  |                  |

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP/EPD Project Number: SC6174 Boring: BH-9

Location: See Engineering Geologic Map Elevation (ft): 818.5 Weather: Clear/Warm

Drilling Contractor/Rig: 2R Drilling/GT-16 Track Rig Drill Date: 1/31,2/3/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log                                                                       | USCS  | DESCRIPTION                                                                                                                                                                                                                        | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks                                             |
|------------|----------------|-------------|-----------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|-----------------------------------------------------|
| 30         | 788            |             |  | Tcbvc |                                                                                                                                                                                                                                    |                    |                       |                      |           |             | 24               |                                                     |
| 31         | 787            |             |  | Tcv   | <b>Conjeo Volcanics (Tcv);</b><br>Andesite-dacite breccia; sand with clay matrix, blue gray, poorly sorted angular cobble-boulder fragments, relatively unoxidized, very hard, scattered white plagioclase, pherocrysts throughout | R6                 | 112.4                 | 14.5                 | -         | MC          | 50/6"            | Refusal of hollow-stem method switch to rock coring |
| 32         | 786            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 33         | 785            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 34         | 784            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 35         | 783            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 36         | 782            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 37         | 781            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 38         | 780            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 39         | 779            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 40         | 778            |             |                                                                                   |       | Total Depth: 39.3 feet<br>Groundwater stabilized at 14 feet.<br>Boring backfilled with cuttings.                                                                                                                                   |                    |                       |                      |           |             |                  |                                                     |
| 41         | 777            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 42         | 776            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 43         | 775            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 44         | 774            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 45         | 773            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 46         | 772            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 47         | 771            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 48         | 770            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 49         | 769            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 50         | 768            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 51         | 767            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 52         | 766            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 53         | 765            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 54         | 764            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 55         | 763            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 56         | 762            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 57         | 761            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 58         | 760            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 59         | 759            |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |
| 60         |                |             |                                                                                   |       |                                                                                                                                                                                                                                    |                    |                       |                      |           |             |                  |                                                     |

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP Project Number: SC6174 Boring: BH-10

Location: See Engineering Geologic Map Elevation (ft): 823.25 Weather: Clear/Warm

Drilling Contractor/Rig: 2R Drilling/GT-8 Max Drill Date: 1/27/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS  | DESCRIPTION                                                                                                                                                                                           | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks |
|------------|----------------|-------------|-------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|---------|
| 0          | 823            |             |             |       | 3.5" AC over 9" Aggregate Base                                                                                                                                                                        |                    |                       |                      |           |             |                  |         |
| 1          | 822            |             |             |       |                                                                                                                                                                                                       |                    |                       |                      |           |             |                  |         |
| 2          | 821            |             |             |       | <b>Artificial Fill (caf);</b><br>Clay with sand and gravel (CL); dark grayish brown, moist, medium stiff, fine to coarse sand, fine to coarse gravel                                                  |                    |                       |                      |           |             | 5                |         |
| 3          | 820            |             |             | CL    |                                                                                                                                                                                                       |                    |                       |                      |           |             | 5                |         |
| 4          | 819            |             |             |       |                                                                                                                                                                                                       | R1                 | 99.9                  | 19.0                 | -         | MC          | 8                |         |
| 5          | 818            |             |             |       | --stiff, at 5 feet                                                                                                                                                                                    |                    |                       |                      |           |             |                  |         |
| 6          | 817            |             |             |       |                                                                                                                                                                                                       |                    |                       |                      |           |             | 3                |         |
| 7          | 816            |             |             |       |                                                                                                                                                                                                       | R2                 | 109.9                 | 17.3                 | -         | MC          | 7                |         |
| 8          | 815            |             |             |       | <b>Alluvium (Qal);</b><br>Clay with sand and gravel (CL); dark grayish brown, moist, stiff, fine to coarse sand, fine to coarse gravel                                                                |                    |                       |                      |           |             |                  |         |
| 9          | 814            |             |             | CL    | --medium stiff to stiff, at 7.5 feet                                                                                                                                                                  | R3                 | -                     | -                    | -         | MC          | 10               |         |
| 10         | 813            |             |             |       |                                                                                                                                                                                                       |                    |                       |                      |           |             | 8                |         |
| 11         | 812            |             |             |       | --stiff and reduced coarse gravel, at 10 feet                                                                                                                                                         |                    |                       |                      |           |             | 4                |         |
| 12         | 811            |             |             |       |                                                                                                                                                                                                       | R4                 | 105.5                 | 20.5                 | -         | MC          | 8                |         |
| 13         | 810            |             |             |       |                                                                                                                                                                                                       |                    |                       |                      |           |             |                  |         |
| 14         | 809            |             |             | SC    | Clayey sand (SC); dark orangeish brown, moist, medium dense, fine to coarse grained                                                                                                                   | R5                 | 101.8                 | 18.3                 | 46.4      | MC          | 3                |         |
| 15         | 808            |             |             |       |                                                                                                                                                                                                       |                    |                       |                      |           |             | 5                |         |
| 16         | 807            |             |             | CL    | Sandy clay (CL); dark reddish brown, moist, very stiff, fine to medium sand, fine gravel                                                                                                              | R6                 | 103.4                 | 21.5                 | -         | MC          | 10               |         |
| 17         | 806            |             |             |       |                                                                                                                                                                                                       |                    |                       |                      |           |             | 16               |         |
| 18         | 805            |             |             |       |                                                                                                                                                                                                       |                    |                       |                      |           |             |                  |         |
| 19         | 804            |             |             |       |                                                                                                                                                                                                       |                    |                       |                      |           |             |                  |         |
| 20         | 803            |             |             | SC    | Clayey sand with gravel (SC); medium orangeish brown, moist, medium dense, fine to coarse sand, fine gravel                                                                                           |                    |                       |                      |           |             | 10               |         |
| 21         | 802            |             |             |       |                                                                                                                                                                                                       | R7                 | 104.7                 | 21.4                 | -         | MC          | 12               |         |
| 22         | 801            |             |             |       |                                                                                                                                                                                                       |                    |                       |                      |           |             | 4                |         |
| 23         | 800            |             |             |       | <b>Volcanic Conglomerate (Tcbvc);</b><br>Gravel with clay and sand (GP-GC); light brown, wet, dense, fine to coarse sand, fine to coarse gravel, some cobbles, cobbles quantity increasing with depth |                    |                       |                      |           |             |                  |         |
| 24         | 799            |             |             |       |                                                                                                                                                                                                       |                    |                       |                      |           |             |                  |         |
| 25         | 798            |             |             |       |                                                                                                                                                                                                       |                    |                       |                      |           |             | 16               |         |
| 26         | 797            |             |             | Tcbvc |                                                                                                                                                                                                       | R8                 | 89.5                  | 31.3                 | -         | MC          | 29               |         |
| 27         | 796            |             |             |       |                                                                                                                                                                                                       |                    |                       |                      |           |             | 32               |         |
| 28         | 795            |             |             |       |                                                                                                                                                                                                       |                    |                       |                      |           |             |                  |         |
| 29         | 794            |             |             |       |                                                                                                                                                                                                       |                    |                       |                      |           |             |                  |         |
| 30         |                |             |             |       |                                                                                                                                                                                                       |                    |                       |                      |           |             |                  |         |

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP Project Number: SC6174 Boring: BH-10

Location: See Engineering Geologic Map Elevation (ft): 823.25 Weather: Clear/Warm

Drilling Contractor/Rig: 2R Drilling/GT-8 Max Drill Date: 1/27/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log                                                                       | USCS  | DESCRIPTION | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%)        | Fines (%) | Sample Type | Field Blow Count | Remarks                                                                                                                                                |       |  |             |
|------------|----------------|-------------|-----------------------------------------------------------------------------------|-------|-------------|--------------------|-----------------------|-----------------------------|-----------|-------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--|-------------|
| 30         | 793            |             |  | Tcbvc |             | R9                 | -                     | -                           | -         | MC          | 50/2"            | No Recovery                                                                                                                                            |       |  |             |
| 31         | 792            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 32         | 791            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 33         | 790            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 34         | 789            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 35         | 788            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        | 17    |  |             |
| 36         | 787            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        | 15    |  |             |
| 37         | 786            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        | 50/6" |  |             |
| 38         | 785            |             |                                                                                   |       |             |                    |                       | --heavy chatter, at 38 feet | R10       | 104.9       | 23.1             | -                                                                                                                                                      | MC    |  | No Recovery |
| 39         | 784            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 40         | 783            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 41         | 782            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  | Total Depth: 38.5 feet<br>Groundwater encountered at 20.4 feet.<br>Boring backfilled with cuttings and capped at the surface with concrete dyed black. |       |  |             |
| 42         | 781            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 43         | 780            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 44         | 779            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 45         | 778            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 46         | 777            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 47         | 776            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 48         | 775            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 49         | 774            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 50         | 773            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 51         | 772            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 52         | 771            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 53         | 770            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 54         | 769            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 55         | 768            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 56         | 767            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 57         | 766            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 58         | 765            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 59         | 764            |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |
| 60         |                |             |                                                                                   |       |             |                    |                       |                             |           |             |                  |                                                                                                                                                        |       |  |             |

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP/EBP Project Number: SC6174 Boring: BH-11

Location: See Engineering Geologic Map Elevation (ft): 827.75 Weather: Clear/Warm

Drilling Contractor/Rig: 2R Drilling/GT-8 Max Drill Date: 1/27,30/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS  | DESCRIPTION                                                                                                                                                                     | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks                                         |
|------------|----------------|-------------|-------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|-------------------------------------------------|
| 0          |                |             |             |       | 4.5" AC over 5" Aggregate Base                                                                                                                                                  |                    |                       |                      |           |             |                  |                                                 |
| 1          | 827            |             |             |       |                                                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 2          | 826            |             |             |       | <b>Artificial Fill (caf);</b><br>Clayey sand with gravel (SC); dark gray brown, moist, loose, fine to coarse sand, fine gravel                                                  |                    |                       |                      |           |             | 3                | Bulk 1: 0-5'<br>Moisture: 19.4%<br>Fines: 47.8% |
| 3          | 825            |             |             |       |                                                                                                                                                                                 |                    |                       |                      |           |             | 10               |                                                 |
| 4          | 824            |             |             | SC    |                                                                                                                                                                                 | R1                 | 108.6                 | 19.1                 | -         | MC          | 3                |                                                 |
| 5          | 823            |             |             |       | --medium dense, fine to coarse gravel, at 5 feet                                                                                                                                |                    |                       |                      |           |             | 13               |                                                 |
| 6          | 822            |             |             |       |                                                                                                                                                                                 |                    |                       |                      |           |             | 12               |                                                 |
| 7          | 821            |             |             |       |                                                                                                                                                                                 | R2                 | 114.3                 | 13.2                 | -         | MC          | 13               |                                                 |
| 8          | 820            |             |             | SC    | <b>Alluvium (Qal);</b><br>Clayey sand with gravel (SC); dark orangeish brown, moist, medium dense, fine to medium sand, fine gravel                                             |                    |                       |                      |           |             | 9                |                                                 |
| 9          | 819            |             |             |       |                                                                                                                                                                                 |                    |                       |                      |           |             | 10               |                                                 |
| 10         | 818            |             |             |       |                                                                                                                                                                                 | R3                 | 114.0                 | 13.7                 | -         | MC          | 12               |                                                 |
| 11         | 817            |             |             | Tcbvc | <b>Volcanic Conglomerate (Tcbvc);</b><br>Sandy clay with gravel (CL); dark orangeish brown, moist, very stiff, fine to medium sand, fine to coarse gravel, completely weathered |                    |                       |                      |           |             | 10               | Sample Disturbed                                |
| 12         | 816            |             |             |       |                                                                                                                                                                                 |                    |                       |                      |           |             | 15               |                                                 |
| 13         | 815            |             |             |       |                                                                                                                                                                                 | R4                 | -                     | -                    | -         | MC          | 17               |                                                 |
| 14         | 814            |             |             |       |                                                                                                                                                                                 |                    |                       |                      |           |             | 9                |                                                 |
| 15         | 813            |             |             | Tcbvc | Clayey sand with gravel (SC); dark orangeish brown, moist, medium dense, fine to coarse sand, fine to coarse gravel, completely weathered                                       |                    |                       |                      |           |             | 13               |                                                 |
| 16         | 812            |             |             |       |                                                                                                                                                                                 |                    |                       |                      |           |             | 7                |                                                 |
| 17         | 811            |             |             |       |                                                                                                                                                                                 | R5                 | 103.0                 | 12.0                 | -         | MC          | 12               |                                                 |
| 18         | 810            |             |             |       |                                                                                                                                                                                 |                    |                       |                      |           |             | 10               |                                                 |
| 19         | 809            |             |             | Tcbvc | Sand with clay and gravel (SP-SC); dark reddish brown, moist, medium dense, fine to coarse sand, fine to coarse gravel, completely weathered                                    |                    |                       |                      |           |             | 5                |                                                 |
| 20         | 808            |             |             |       |                                                                                                                                                                                 |                    |                       |                      |           |             | 6                |                                                 |
| 21         | 807            |             |             |       |                                                                                                                                                                                 | R6                 | 105.6                 | 10.7                 | 15.6      | MC          | 11               |                                                 |
| 22         | 806            |             |             |       |                                                                                                                                                                                 |                    |                       |                      |           |             | 8                |                                                 |
| 23         | 805            |             |             |       |                                                                                                                                                                                 | R7                 | 102.4                 | 17.6                 | -         | MC          | 10               |                                                 |
| 24         | 804            |             |             |       |                                                                                                                                                                                 |                    |                       |                      |           |             | 10               |                                                 |
| 25         | 803            |             |             |       |                                                                                                                                                                                 | R8                 | 92.3                  | 22.3                 | -         | MC          | 10               |                                                 |
| 26         | 802            |             |             | Tcv   | <b>Conejo Volcanics (Tcv);</b><br>Sandy clay (CL); dark grayish brown, moist, stiff, fine sand, completely weathered (weathered basalt?)                                        |                    |                       |                      |           |             | 4                |                                                 |
| 27         | 801            |             |             |       | --very moist to wet, tipped into water, at 26 feet                                                                                                                              |                    |                       |                      |           |             | 7                |                                                 |
| 28         | 800            |             |             |       |                                                                                                                                                                                 |                    |                       |                      |           |             | 8                |                                                 |
| 29         | 799            |             |             |       |                                                                                                                                                                                 | R9                 | 86.4                  | 33.6                 | 56.8      | MC          |                  |                                                 |
| 30         | 798            |             |             |       |                                                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP/EBP Project Number: SC6174 Boring: BH-11

Location: See Engineering Geologic Map Elevation (ft): 827.75 Weather: Clear/Warm

Drilling Contractor/Rig: 2R Drilling/GT-8 Max Drill Date: 1/27,30/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS | DESCRIPTION | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks |
|------------|----------------|-------------|-------------|------|-------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|---------|
| 30         |                |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 31         | 797            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 32         | 796            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 33         | 795            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 34         | 794            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 35         | 793            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 36         | 792            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 37         | 791            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 38         | 790            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 39         | 789            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 40         | 788            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 41         | 787            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 42         | 786            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 43         | 785            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 44         | 784            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 45         | 783            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 46         | 782            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 47         | 781            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 48         | 780            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 49         | 779            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 50         | 778            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 51         | 777            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 52         | 776            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 53         | 775            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 54         | 774            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 55         | 773            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 56         | 772            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 57         | 771            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 58         | 770            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 59         | 769            |             |             |      |             |                    |                       |                      |           |             |                  |         |
| 60         | 768            |             |             |      |             |                    |                       |                      |           |             |                  |         |



Tcv

Andesite-dacite breccia; sand with clay matrix, blue gray, poorly sorted angular cobble-boulder fragments, relatively unoxidized, very hard, scattered white plagioclase, pherocrysts throughout

R10

-

-

-

MC

50/4"

No Recovery Switched from hollow-stem to rock coring

Total Depth: 36 feet  
Groundwater encountered at about 26 feet.  
Boring backfilled with cuttings and capped at the surface with cold patch.

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP Project Number: SC6174 Boring: BH-12

Location: See Engineering Geologic Map Elevation (ft): 816.5 Weather: Clear/Warm

Drilling Contractor/Rig: 2R Drilling/GT-16 Track Rig Drill Date: 2/3/2025 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS  | DESCRIPTION                                                                                                                                                                   | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks                                                                                           |
|------------|----------------|-------------|-------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|---------------------------------------------------------------------------------------------------|
| 0          | 816            |             |             | GP    | <b>Alluvium (Qal);</b><br>Gravel (GP); light gray, dry, loose, coarse grained                                                                                                 |                    |                       |                      |           |             |                  | Bulk 1: 0-5'<br>Moisture: 17.7%<br>Fines: 37.9%                                                   |
| 1          | 815            |             |             | SC    | Clayey sand with gravel (SC); dark brown, moist, medium dense, fine to medium sand, fine to coarse gravel                                                                     |                    |                       |                      |           |             | 7                |                                                                                                   |
| 2          | 814            |             |             |       | --very moist lense of sand with clay and gravel, fine to coarse sand, fine to coarse gravel, at 3 feet                                                                        |                    |                       |                      |           |             | 7                |                                                                                                   |
| 3          | 813            |             |             |       |                                                                                                                                                                               | R1                 | 102.6                 | 15.8                 | -         | MC          | 10               |                                                                                                   |
| 4          | 812            |             |             | CL    | Sandy clay with gravel (CL); oliveish dark brown, very moist to wet, very stiff to hard                                                                                       |                    |                       |                      |           |             | 16               |                                                                                                   |
| 5          | 811            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             | 22               |                                                                                                   |
| 6          | 810            |             |             |       |                                                                                                                                                                               | R2                 | -                     | -                    | -         | MC          | 25               |                                                                                                   |
| 7          | 809            |             |             | SP-SC | Sand with clay and gravel (SP-SC); medium grayish brown, wet, medium dense, fine to coarse sand, fine gravel                                                                  |                    |                       |                      |           |             | 5                |                                                                                                   |
| 8          | 808            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             | 12               |                                                                                                   |
| 9          | 807            |             |             |       |                                                                                                                                                                               | R3                 | 101.5                 | 23.6                 | -         | MC          | 14               |                                                                                                   |
| 10         | 806            |             |             |       | <b>Volcanic Conglomerate (Tcbvc);</b><br>Sand with gravel (SP); grayish brown, wet, dense, fine to coarse sand, fine gravel, completely weathered                             |                    |                       |                      |           |             | 8                | Sample Disturbed                                                                                  |
| 11         | 805            |             |             |       |                                                                                                                                                                               | R4                 | 109.9                 | 20.0                 | -         | MC          | 28               |                                                                                                   |
| 12         | 804            |             |             | Tcbvc |                                                                                                                                                                               |                    |                       |                      |           |             |                  |                                                                                                   |
| 13         | 803            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             |                  |                                                                                                   |
| 14         | 802            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             |                  |                                                                                                   |
| 15         | 801            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             | 25               |                                                                                                   |
| 16         | 800            |             |             |       |                                                                                                                                                                               | R5                 | 116.7                 | 17.3                 | -         | MC          | 35               |                                                                                                   |
| 17         | 799            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             | 40               |                                                                                                   |
| 18         | 798            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             |                  |                                                                                                   |
| 19         | 797            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             |                  |                                                                                                   |
| 20         | 796            |             |             | Tcv   | <b>Conejo Volcanics (Tcv);</b><br>Andesite-dacite breccia; sand with clay matrix, blue gray, poorly sorted angular cobble-boulder fragments, relatively unoxidized, very hard |                    |                       |                      |           |             |                  | Total Depth: 20.5 feet<br>Groundwater stabilized at 4.8 feet.<br>Boring backfilled with cuttings. |
| 21         | 795            |             |             |       |                                                                                                                                                                               | R6                 | 127.0                 | 13.5                 | -         | MC          | 50/6"            |                                                                                                   |
| 22         | 794            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             |                  |                                                                                                   |
| 23         | 793            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             |                  |                                                                                                   |
| 24         | 792            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             |                  |                                                                                                   |
| 25         | 791            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             |                  |                                                                                                   |
| 26         | 790            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             |                  |                                                                                                   |
| 27         | 789            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             |                  |                                                                                                   |
| 28         | 788            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             |                  |                                                                                                   |
| 29         | 787            |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             |                  |                                                                                                   |
| 30         |                |             |             |       |                                                                                                                                                                               |                    |                       |                      |           |             |                  |                                                                                                   |

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP Project Number: SC6174 Boring: BH-13

Location: See Engineering Geologic Map Elevation (ft): 821.5 Weather: Clear/Warm

Drilling Contractor/Rig: 2R Drilling/GT-8 Track Rig Drill Date: 1/31/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS  | DESCRIPTION                                                                                                                                                                                                                                                       | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks                         |
|------------|----------------|-------------|-------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|---------------------------------|
| 0          | 821            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                 |
| 1          | 820            |             |             | CL    | <b>Alluvium (Qal);</b><br>Sandy clay with gravel (CL);<br>dark brown, moist, medium stiff, fine to medium sand, fine to coarse gravel                                                                                                                             |                    |                       |                      |           |             |                  | Bulk 1: 0-5'<br>Moisture: 18.4% |
| 2          | 819            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 3                |                                 |
| 3          | 818            |             |             |       |                                                                                                                                                                                                                                                                   | R1                 | 105.8                 | 17.6                 | -         | MC          | 9                |                                 |
| 4          | 817            |             |             | SP-SC | Sand with clay and gravel (SP-SC); medium brown, moist, medium dense, fine to coarse sand, fine to coarse gravel, slightly oxidized                                                                                                                               |                    |                       |                      |           |             | 3                | No Recovery                     |
| 5          | 816            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 6                |                                 |
| 6          | 815            |             |             |       |                                                                                                                                                                                                                                                                   | R2                 | 104.0                 | 14.4                 | -         | MC          | 12               |                                 |
| 7          | 814            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 4                |                                 |
| 8          | 813            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 7                |                                 |
| 9          | 812            |             |             |       |                                                                                                                                                                                                                                                                   | R3                 | -                     | -                    | -         | MC          | 3                |                                 |
| 10         | 811            |             |             | Tcbvc | <b>Volcanic Conglomerate (Tcbvc);</b><br>Clayey sand with gravel (SC); grayish brown, wet, loose, fine to medium sand, mottled oxidation, completely weathered                                                                                                    |                    |                       |                      |           |             | 4                |                                 |
| 11         | 810            |             |             |       |                                                                                                                                                                                                                                                                   | R4                 | 84.2                  | 43.9                 | 46.2      | MC          | 5                |                                 |
| 12         | 809            |             |             | Tcbvc | Clayey sand with gravel (SC); light grayish brown, wet, medium dense, fine to coarse sand, fine to coarse gravel, completely weathered                                                                                                                            |                    |                       |                      |           |             | 7                |                                 |
| 13         | 808            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             | 17               |                                 |
| 14         | 807            |             |             |       |                                                                                                                                                                                                                                                                   | R5                 | 100.6                 | 25.8                 | -         | MC          | 13               |                                 |
| 15         | 806            |             |             | Tcbvc | Gravel with clay and sand (GP-GC); medium brown, wet, medium dense, fine to coarse sand, fine to coarse gravel, some oxidation, completely weathered                                                                                                              |                    |                       |                      |           |             | 9                |                                 |
| 16         | 805            |             |             |       |                                                                                                                                                                                                                                                                   | R6                 | 109.2                 | 15.5                 | -         | MC          | 19               |                                 |
| 17         | 804            |             |             | Tcbvc | Sandy clay (CL); grayish brown, very moist to wet, very stiff, fine to medium sand, some oxidation, completely weathered                                                                                                                                          |                    |                       |                      |           |             |                  |                                 |
| 18         | 803            |             |             | Tcbvc | Clayey sand (SC); gray brown, wet, medium dense, fine to medium sand, some oxidation, completely weathered                                                                                                                                                        |                    |                       |                      |           |             |                  |                                 |
| 19         | 802            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                 |
| 20         | 801            |             |             |       |                                                                                                                                                                                                                                                                   | R7                 | 120.4                 | 14.9                 | -         | MC          | 50/6"            |                                 |
| 21         | 800            |             |             | Tcv   | <b>Conejo Volcanics (Tcv);</b><br>Andesite-dacite breccia; sand with clay matrix, orangeish brown, poorly sorted angular cobble-boulder fragments, heavily oxidized, soft to moderately hard, weathered to completely weathered, weathering decreasing with depth |                    |                       |                      |           |             |                  |                                 |
| 22         | 799            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                 |
| 23         | 798            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                 |
| 24         | 797            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                 |
| 25         | 796            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                 |
| 26         | 795            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                 |
| 27         | 794            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                 |
| 28         | 793            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                 |
| 29         | 792            |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                 |
| 30         |                |             |             |       |                                                                                                                                                                                                                                                                   |                    |                       |                      |           |             |                  |                                 |

--sample driven with no recovery, at 22.5 feet (material likely slightly weathered to unweathered)

Total Depth: 22.5 feet  
Groundwater stabilized at 8.8 feet.  
Boring backfilled with cuttings.

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP Project Number: SC6174 Boring: BH-14  
 Location: See Engineering Geologic Map Elevation (ft): 822.5 Weather: Clear/Warm  
 Drilling Contractor/Rig: 2R Drilling/GT-16 Track Rig Drill Date: 2/3/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS  | DESCRIPTION                                                                                                                                                                                            | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks                                         |
|------------|----------------|-------------|-------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|-------------------------------------------------|
| 0          | 822            |             |             |       | <b>Artificial Fill (af);</b>                                                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 1          | 821            |             |             | SM    | Silty sand with gravel (SM); dark brown, moist, medium dense, fine to medium sand, fine to coarse gravel                                                                                               |                    |                       |                      |           |             |                  | Bulk 1: 0-5'<br>Moisture: 10.1%<br>Fines: 30.1% |
| 2          | 820            |             |             | SM    |                                                                                                                                                                                                        |                    |                       |                      |           |             | 6                |                                                 |
| 3          | 819            |             |             | SP    | <b>Alluvium (Qal);</b>                                                                                                                                                                                 |                    |                       |                      |           |             | 8                |                                                 |
| 4          | 818            |             |             | CL    | Silty sand with gravel (SM); medium brown, moist, medium dense, fine to medium sand, fine to coarse gravel                                                                                             | R1                 | 92.2                  | 8.2                  | -         | MC          | 8                |                                                 |
| 5          | 817            |             |             |       | Sand (SP); tan, dry to slightly moist, medium dense, fine to coarse sand, sparse fine gravel                                                                                                           |                    |                       |                      |           |             | 4                |                                                 |
| 6          | 816            |             |             | SM    | Sandy clay (CL); medium brown, moist, medium stiff, fine to medium sand                                                                                                                                | R2                 | 92.9                  | 12.4                 | -         | MC          | 7                |                                                 |
| 7          | 815            |             |             |       | Silty sand (SM); medium brown, moist, medium dense, fine to medium sand, sparse fine to coarse gravel                                                                                                  |                    |                       |                      |           |             | 4                |                                                 |
| 8          | 814            |             |             | ML    |                                                                                                                                                                                                        |                    |                       |                      |           |             | 4                |                                                 |
| 9          | 813            |             |             |       | Silty with sand (ML); medium brown, moist, medium stiff, fine sand                                                                                                                                     | R3                 | 86.8                  | 26.7                 | -         | MC          | 7                |                                                 |
| 10         | 812            |             |             | SP-SC | Sand with clay (SP-SC); medium brown, moist, loose to medium dense, fine grained                                                                                                                       |                    |                       |                      |           |             | 6                |                                                 |
| 11         | 811            |             |             |       | Sand with clay and gravel (SP-SC); medium brown, moist to wet, loose to medium dense, fine to coarse sand, fine gravel                                                                                 | R4                 | 99.6                  | 17.4                 | 9.2       | MC          | 5                |                                                 |
| 12         | 810            |             |             | SP-SC |                                                                                                                                                                                                        |                    |                       |                      |           |             |                  |                                                 |
| 13         | 809            |             |             |       |                                                                                                                                                                                                        |                    |                       |                      |           |             |                  |                                                 |
| 14         | 808            |             |             |       |                                                                                                                                                                                                        |                    |                       |                      |           |             |                  |                                                 |
| 15         | 807            |             |             |       |                                                                                                                                                                                                        |                    |                       |                      |           |             | 9                |                                                 |
| 16         | 806            |             |             | SC    | Clayey sand (SC); oliveish brown, wet, medium dense, fine to medium grained                                                                                                                            | R5                 | 97.1                  | 26.8                 | -         | MC          | 10               |                                                 |
| 17         | 805            |             |             |       | Sand with clay and gravel (SP-SC); medium brown, wet, medium dense, fine to coarse sand, fine to coarse gravel                                                                                         |                    |                       |                      |           |             |                  |                                                 |
| 18         | 804            |             |             | SP-SC |                                                                                                                                                                                                        |                    |                       |                      |           |             |                  |                                                 |
| 19         | 803            |             |             |       |                                                                                                                                                                                                        |                    |                       |                      |           |             |                  |                                                 |
| 20         | 802            |             |             |       | <b>Volcanic Conglomerate (Tcbvc);</b>                                                                                                                                                                  |                    |                       |                      |           |             | 45               |                                                 |
| 21         | 801            |             |             |       | Sand with clay matrix, orangeish brown, poorly sorted angular cobble-boulder fragments, heavily oxidized, soft to moderately hard, weathered to completely weathered, weathering decreasing with depth | R4                 | 126.3                 | 11.6                 | -         | MC          | 50/4"            |                                                 |
| 22         | 800            |             |             |       |                                                                                                                                                                                                        |                    |                       |                      |           |             |                  |                                                 |
| 23         | 799            |             |             |       |                                                                                                                                                                                                        |                    |                       |                      |           |             |                  |                                                 |
| 24         | 798            |             |             | Tcbvc |                                                                                                                                                                                                        |                    |                       |                      |           |             |                  |                                                 |
| 25         | 797            |             |             |       |                                                                                                                                                                                                        |                    |                       |                      |           |             |                  |                                                 |
| 26         | 796            |             |             |       | --increase in drilling difficulty, at 26.5 feet                                                                                                                                                        |                    |                       |                      |           |             |                  |                                                 |
| 27         | 795            |             |             |       |                                                                                                                                                                                                        |                    |                       |                      |           |             |                  | possible Tcv                                    |
| 28         | 794            |             |             |       |                                                                                                                                                                                                        | R5                 | 122.1                 | 14.7                 | -         | MC          | 50/4"            |                                                 |
| 29         | 793            |             |             |       | Total Depth: 28.3 feet<br>Groundwater encountered at about 10 feet.<br>Boring backfilled with cuttings.                                                                                                |                    |                       |                      |           |             |                  |                                                 |
| 30         |                |             |             |       |                                                                                                                                                                                                        |                    |                       |                      |           |             |                  |                                                 |

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan      Logged By: MiP    Project Number: SC6174    Boring: P-1  
 Location: See Engineering Geologic Map      Elevation (ft): 813.5    Weather: Clear/Warm  
 Drilling Contractor/Rig: 2R Drilling/GT-8 Max      Drill Date: 1/28/25    Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS | DESCRIPTION                                                                                                      | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks                                         |
|------------|----------------|-------------|-------------|------|------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|-------------------------------------------------|
| 0          | 813            |             |             |      | <b>Alluvium (Qa);</b><br>Clayey sand (SC); dark brown, moist, loose, fine to coarse sand, fine to coarse gravel  |                    |                       |                      |           |             |                  | Possible Af in upper 4'                         |
| 1          | 812            |             |             |      |                                                                                                                  |                    |                       |                      |           |             |                  | Bulk 1: 0-5'<br>Moisture: 13.5%<br>Fines: 30.1% |
| 2          | 811            |             |             |      |                                                                                                                  |                    |                       |                      |           |             | 4                |                                                 |
| 3          | 810            |             |             |      |                                                                                                                  |                    |                       |                      |           |             | 5                |                                                 |
| 4          | 809            |             |             | SC   |                                                                                                                  | R1                 | 94.9                  | 25                   | -         | MC          | 7                |                                                 |
| 5          | 808            |             |             |      |                                                                                                                  |                    |                       |                      |           |             | 5                |                                                 |
| 6          | 807            |             |             |      |                                                                                                                  | R2                 | 96.7                  | 15.6                 | -         | MC          | 5                |                                                 |
| 7          | 806            |             |             |      |                                                                                                                  |                    |                       |                      |           |             |                  |                                                 |
| 8          | 805            |             |             |      |                                                                                                                  |                    |                       |                      |           |             | 0                |                                                 |
| 9          | 804            |             |             | SP   | Sand (SP); dark brown, moist, loose, fine to coarse sand, fine to coarse gravel                                  | R3                 | 88.4                  | 22.7                 | -         | MC          | 1                |                                                 |
| 10         | 803            |             |             | CL   | Sandy clay (CL); dark brown, moist, soft, fine to coarse sand, fine to coarse gravel                             |                    |                       |                      |           |             | 2                |                                                 |
| 11         | 802            |             |             | SC   | Clayey sand (SC); dark brown, moist, loose, fine to coarse sand, fine to coarse gravel                           | R4                 | 96.5                  | 23.3                 | -         | MC          | 6                |                                                 |
| 12         | 801            |             |             |      | Total Depth: 11.5 feet<br>No groundwater encountered.<br>Boring backfilled with percolation gravel and cuttings. |                    |                       |                      |           |             |                  |                                                 |
| 13         | 800            |             |             |      |                                                                                                                  |                    |                       |                      |           |             |                  |                                                 |
| 14         | 799            |             |             |      |                                                                                                                  |                    |                       |                      |           |             |                  |                                                 |
| 15         |                |             |             |      |                                                                                                                  |                    |                       |                      |           |             |                  |                                                 |

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP Project Number: SC6174 Boring: P-2  
 Location: See Engineering Geologic Map Elevation (ft): 823.75 Weather: Clear/Warm  
 Drilling Contractor/Rig: 2R Drilling/GT-8 Max Drill Date: 1/27/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS | DESCRIPTION                                                                                                                                     | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks                                         |
|------------|----------------|-------------|-------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|-------------------------------------------------|
| 0          |                |             |             |      | 4" AC over 8" Aggregate Base                                                                                                                    |                    |                       |                      |           |             |                  |                                                 |
| 823        |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 1          |                |             |             |      | <b>Artificial Fill (caf);</b><br>Sandy clay with gravel (CL); dark grayish brown, moist, very stiff, fine to medium sand, fine to coarse gravel |                    |                       |                      |           |             |                  | Bulk 1: 0-5'<br>Moisture: 13.4%<br>Fines: 38.9% |
| 822        |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 2          |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             | 6                |                                                 |
| 821        |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             | 10               |                                                 |
| 3          |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             | 14               |                                                 |
| 820        |                |             |             |      |                                                                                                                                                 | R1                 | 110.5                 | 18.1                 | -         | MC          |                  |                                                 |
| 4          |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 819        |                |             |             | CL   |                                                                                                                                                 |                    |                       |                      |           |             | 8                |                                                 |
| 5          |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             | 8                |                                                 |
| 818        |                |             |             |      |                                                                                                                                                 | R2                 | 112.5                 | 17.1                 | -         | MC          | 20               |                                                 |
| 6          |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 817        |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             | 13               |                                                 |
| 7          |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             | 19               |                                                 |
| 816        |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 815        |                |             |             |      |                                                                                                                                                 | R3                 | 96.6                  | 15.2                 | -         | MC          | 23               |                                                 |
| 9          |                |             |             |      | <b>Alluvium (Qa);</b><br>Clay with sand and gravel (CL); dark grayish brown, moist, stiff, fine to medium sand, fine to coarse gravel           |                    |                       |                      |           |             |                  |                                                 |
| 814        |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             | 6                |                                                 |
| 10         |                |             |             | CL   |                                                                                                                                                 |                    |                       |                      |           |             | 7                |                                                 |
| 813        |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             | 8                |                                                 |
| 11         |                |             |             |      | --dark orangeish brown, at 11 feet                                                                                                              | R4                 | 99.2                  | 18.1                 | -         | MC          |                  |                                                 |
| 812        |                |             |             |      | Total Depth: 11.5 feet<br>No groundwater encountered.<br>Boring backfilled with percolation gravel and cuttings and capped with coldpatch.      |                    |                       |                      |           |             |                  |                                                 |
| 12         |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 811        |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 13         |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 810        |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 14         |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 809        |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |
| 15         |                |             |             |      |                                                                                                                                                 |                    |                       |                      |           |             |                  |                                                 |

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP Project Number: SC6174 Boring: P-3  
 Location: See Engineering Geologic Map Elevation (ft): 820.0 Weather: Clear/Warm  
 Drilling Contractor/Rig: 2R Drilling/GT-16 Track Rig Drill Date: 2/3/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS | DESCRIPTION                                                                                                                                       | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks |
|------------|----------------|-------------|-------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|---------|
| 0          | 820            |             |             |      | <b>Artificial Fill (af);</b><br>Clayey sand (SC); dark brown, moist, medium dense, fine to medium sand, fine to coarse gravel, rootlets in sample |                    |                       |                      |           |             |                  |         |
| 1          | 819            |             |             |      |                                                                                                                                                   |                    |                       |                      |           |             |                  |         |
| 2          | 818            |             |             |      |                                                                                                                                                   |                    |                       |                      |           |             |                  |         |
| 3          | 817            |             |             | SC   |                                                                                                                                                   |                    |                       |                      |           |             | 11               |         |
|            |                |             |             |      |                                                                                                                                                   |                    |                       |                      |           |             | 10               |         |
| 4          | 816            |             |             |      |                                                                                                                                                   | R1                 | 108.7                 | 17.6                 | 37.2      | MC          | 20               |         |
| 5          | 815            |             |             |      |                                                                                                                                                   |                    |                       |                      |           |             |                  |         |
|            |                |             |             |      |                                                                                                                                                   |                    |                       |                      |           |             | 10               |         |
| 6          | 814            |             |             |      | <b>Alluvium (Qa);</b><br>Clay with sand and gravel (CL); dark brown, moist, medium stiff, fine to medium sand, fine gravel                        |                    |                       |                      |           |             |                  |         |
|            |                |             |             |      |                                                                                                                                                   |                    |                       |                      |           |             | 11               |         |
|            |                |             |             |      |                                                                                                                                                   | R2                 | -                     | -                    | -         | MC          | 10               |         |
|            |                |             |             |      |                                                                                                                                                   |                    |                       |                      |           |             |                  |         |
| 7          | 813            |             |             | CL   |                                                                                                                                                   |                    |                       |                      |           |             | 4                |         |
|            |                |             |             |      |                                                                                                                                                   |                    |                       |                      |           |             | 4                |         |
|            |                |             |             |      |                                                                                                                                                   | S1                 | -                     | 23.5                 | -         | SPT         | 4                |         |
| 8          | 812            |             |             |      | Total Depth: 8.0 feet<br>No groundwater encountered.<br>Boring backfilled with percolation gravel and cuttings.                                   |                    |                       |                      |           |             |                  |         |
| 9          | 811            |             |             |      |                                                                                                                                                   |                    |                       |                      |           |             |                  |         |
| 10         | 810            |             |             |      |                                                                                                                                                   |                    |                       |                      |           |             |                  |         |
| 11         | 809            |             |             |      |                                                                                                                                                   |                    |                       |                      |           |             |                  |         |
| 12         | 808            |             |             |      |                                                                                                                                                   |                    |                       |                      |           |             |                  |         |
| 13         | 807            |             |             |      |                                                                                                                                                   |                    |                       |                      |           |             |                  |         |
| 14         | 806            |             |             |      |                                                                                                                                                   |                    |                       |                      |           |             |                  |         |
| 15         |                |             |             |      |                                                                                                                                                   |                    |                       |                      |           |             |                  |         |

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP Project Number: SC6174 Boring: P-4  
 Location: See Engineering Geologic Map Elevation (ft): 822.5 Weather: Clear/Warm  
 Drilling Contractor/Rig: 2R Drilling/GT-16 Track Rig Drill Date: 2/3/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS | DESCRIPTION                                                                                                                               | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks                                         |
|------------|----------------|-------------|-------------|------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|-------------------------------------------------|
| 0          |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 822        |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 1          |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 821        |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 2          |                |             |             | CL   | <b>Alluvium (Qa);</b><br>Sandy clay (CL); medium brown, slightly moist to moist, medium dense, fine to coarse sand, fine to coarse gravel |                    |                       |                      |           |             |                  | Bulk 1: 0-5'<br>Moisture: 12.8%<br>Fines: 48.2% |
| 820        |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 3          |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 819        |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 4          |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 818        |                |             |             |      | Sandy clay (CL); medium brown, slightly moist to moist, stiff, fine to coarse sand, fine gravel                                           |                    |                       |                      |           |             |                  |                                                 |
| 5          |                |             |             | CL   |                                                                                                                                           |                    |                       |                      |           |             | 6                |                                                 |
| 817        |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             | 6                |                                                 |
| 6          |                |             |             |      |                                                                                                                                           | R1                 | 108.0                 | 15.2                 | -         | MC          | 9                |                                                 |
| 816        |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 7          |                |             |             |      | Total Depth: 6.5 feet<br>No groundwater encountered.<br>Boring backfilled with percolation gravel cuttings.                               |                    |                       |                      |           |             |                  |                                                 |
| 815        |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 8          |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 814        |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 9          |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 813        |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 10         |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 812        |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 11         |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 811        |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 12         |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 810        |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 13         |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 809        |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 14         |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 808        |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |
| 15         |                |             |             |      |                                                                                                                                           |                    |                       |                      |           |             |                  |                                                 |

# COTTON, SHIRES AND ASSOCIATES, INC.

## LOG OF EXPLORATORY DRILLING

Project: Thousand Oaks CAP Master Plan Logged By: MiP Project Number: SC6174 Boring: P-5  
 Location: See Engineering Geologic Map Elevation (ft): 820.0 Weather: Clear/Warm  
 Drilling Contractor/Rig: 2R Drilling/GT-8 Track Rig Drill Date: 1/31/25 Hole Diameter (in): 8

| Depth (ft) | Elevation (ft) | Water Level | Graphic Log | USCS | DESCRIPTION                                                                                                                                                   | Sample Designation | Dry Unit Weight (pcf) | Moisture Content (%) | Fines (%) | Sample Type | Field Blow Count | Remarks |
|------------|----------------|-------------|-------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------|-----------|-------------|------------------|---------|
| 0          | 820            |             |             |      | <b>Alluvium (Qa);</b><br>Clayey sand with gravel (SC); dark brown, slightly moist to moist, loose to medium dense, fine to coarse sand, fine to coarse gravel |                    |                       |                      |           |             |                  |         |
| 1          | 819            |             |             |      |                                                                                                                                                               |                    |                       |                      |           |             |                  |         |
| 2          | 818            |             |             | SC   |                                                                                                                                                               |                    |                       |                      |           |             | 4                |         |
| 3          | 817            |             |             |      |                                                                                                                                                               |                    |                       |                      |           |             | 6                |         |
| 4          | 816            |             |             | SP   | Sand with clay and gravel (SP); medium orangeish brown, slightly moist, medium dense, fine to coarse sand, fine to coarse gravel,                             | R1                 | 120.5                 | 12.3                 | -         | MC          | 8                |         |
| 5          | 815            |             |             |      |                                                                                                                                                               |                    |                       |                      |           |             |                  |         |
| 6          | 814            |             |             | GC   | Clayey gravel with sand (GC); orangeish brown, slightly moist to moist, dense, fine to coarse sand, coarse gravel, slightly oxidized                          |                    |                       |                      |           |             | 13               |         |
|            |                |             |             |      |                                                                                                                                                               |                    |                       |                      |           |             | 27               |         |
|            |                |             |             |      |                                                                                                                                                               | R2                 | 108.5                 | 13.1                 | -         | MC          | 31               |         |
| 7          | 813            |             |             |      | Total Depth: 6.5 feet<br>No groundwater encountered.<br>Boring backfilled with percolation sand and cuttings.                                                 |                    |                       |                      |           |             |                  |         |
| 8          | 812            |             |             |      |                                                                                                                                                               |                    |                       |                      |           |             |                  |         |
| 9          | 811            |             |             |      |                                                                                                                                                               |                    |                       |                      |           |             |                  |         |
| 10         | 810            |             |             |      |                                                                                                                                                               |                    |                       |                      |           |             |                  |         |
| 11         | 809            |             |             |      |                                                                                                                                                               |                    |                       |                      |           |             |                  |         |
| 12         | 808            |             |             |      |                                                                                                                                                               |                    |                       |                      |           |             |                  |         |
| 13         | 807            |             |             |      |                                                                                                                                                               |                    |                       |                      |           |             |                  |         |
| 14         | 806            |             |             |      |                                                                                                                                                               |                    |                       |                      |           |             |                  |         |
| 15         |                |             |             |      |                                                                                                                                                               |                    |                       |                      |           |             |                  |         |

**APPENDIX B**  
**SEISMIC REFRACTION SURVEY**

## **APPENDIX B – SEISMIC REFRACTION SURVEY**

### **1.0 INTRODUCTION**

In this appendix, we describe the methods and equipment used, interpreted results, limitations and conclusions and recommendations of our seismic refraction survey of the subject City of Thousand Oaks CAP site located in Thousand Oaks, California. The geophysical exploration was conducted in December 2023 and consisted of the performance of six seismic refraction survey lines.

#### **1.1 Purpose and Scope of Geophysical Investigation**

The purpose of our investigation was to: 1) investigate subsurface velocity (compression wave velocities) conditions of the development area using the seismic refraction geophysical method, and to 2) evaluate the depth to earth materials with differing characteristics in the vicinity of the proposed development, particularly to evaluate whether hard bedrock that might pose difficulties to excavation equipment is present in the shallow subsurface. The scope of work included a field seismic refraction survey followed by geophysical analysis of the acquired data, geologic analysis of the subsurface conditions with respect to the proposed development and preparation of this appendix to our report.

#### **1.2 Geologic and Groundwater Setting**

The project area is characterized by sloping hillside topography covered by shallow artificial fill and/or colluvial soils (including topsoil/slopewash) and/or alluvium overlying volcanic conglomerate of the Calabasas Formation, which overlies volcanic bedrock of the Conejo Volcanics Formation. The soils are characterized as sandy silt to silty sand and are moist, firm to stiff and non-plastic. The volcanic conglomerate bedrock is a volcanoclastic sedimentary unit that is locally characterized as silty clayey sand and gravel with cobbles and rare boulders that is firmly consolidated and moderately cemented. The underlying Conejo Volcanics bedrock is locally characterized as weathered to relatively fresh basalt.

Groundwater was present at depths of 14 to 17 feet below ground surface (bgs) in the deeper test pits excavated during our subsurface exploration conducted on December 19, 2023.

## **2.0 SEISMIC REFRACTION SURVEY**

A total of six (6) individual seismic refraction lines with a combined spread length of 950 feet were recorded on December 11 and 12, 2023 in the locations shown on Figure 1 (Engineerign Geologic Map) of this report. The interpreted results are presented on Figures B-1 (A & B) through B-6 (A & B). For the purposes of this report, a seismic refraction line is defined as twelve geophones spaced at equal intervals of 10 to 25 feet along a straight line and monitored simultaneously while a sledge hammer is repeatedly impacted 10 to 12.5 feet off each end of the twelve-geophone array and at the center of the 300-foot array. The method and equipment used, the interpreted results, limitations and a summary of pertinent conclusions are discussed in the following sections of this report.

### **2.1 Method and Equipment Used**

The seismic refraction survey procedure used consisted of placing twelve (12) geophones in as straight a line as practical (in plan) spaced at 10- to 25-foot intervals along as constant a slope as practical (in profile). A large sledge-hammer was impacted at 10 to 12.5 feet off each end of all lines and at the center of the 300-foot line. The hammer impacts generated seismic compression waves which were refracted through subsurface materials and received by the deployed geophones. The signal from the energy source initiation (time-break) started the instrument sweep as signals from the geophones were monitored (amplified, filtered and stacked) simultaneously by a digital seismograph with an on-board computer and displayed graphically in analog form on the built-in computer monitor. Digital records stored in the computer were field checked, stored on magnetic disk and returned to our office for printing, data reduction and interpretation.

The seismic refraction lines were plotted on the provided base map for location and elevations. Elevations were also field surveyed using rod and hand level methods. The data reduction and interpretation procedure consisted of the following sequence of tasks:

- computerized picking of first breaks of compression waves (P-waves) from the digital records of the seismic system computer,
- visual adjustment of first break picks by observing the analog record,
- plotting of time-distance graphs utilizing raw data,
- plotting of elevation data along the profiles,

- computer analysis using SeisOpt @2D Version 5.0 computer program by OPTIM Software and Data Solutions (2006),
- correlation of results with known geologic factors, and
- final preparation of interpreted subsurface velocity profiles.

The equipment used for the seismic refraction survey consisted of twelve (12) geophones at one time of 10 Hz natural frequency. The geophones were connected to 10-foot to 25-foot take-out spacing cables using Mueller clips. The combination seismograph/oscillograph used was a 24-channel ABEM™ Terraloc Mark 3 Seismic System mounted on a pack frame for portability. The energy source used consisted of a 16-pound sledge-hammer equipped with a seismograph triggering mechanism. The sledge-hammer was repeatedly impacted on a steel plate placed in a cleared area on the ground surface. Repeated impact signals were stacked for each seismic record.

## **2.2 Interpreted Results**

**2.2.1 Seismic Refraction Line L-1** – Seismic refraction line L-1 was conducted from southeast to northwest across the northern vacant lot in the location shown on Figure 1. Twelve geophones were spaced at 25 feet on centers with a total spread length of 300 feet, including hammer impacts at 12.5 feet off both ends of the line and at the center of the line. The data and results for L-1 are depicted graphically on the attached Figures B-1A (Time-Distance Graph for L-1) and B-1B (Interpreted Subsurface Velocity Model for L-1), respectively. Results indicate roughly four zones of velocity increasing with depth. The upper zone extends from the ground surface to depths of 0 to 18 feet below ground surface (bgs), the velocity ranges from about 1,000 to 1,500 feet per second (ft/s) and it is interpreted to be representative of artificial fill or surficial soil/slopewash, colluvium and/or highly weathered bedrock that is relatively dry. The underlying zone extends from 0 to 18 feet bgs to 18 to 37 feet bgs, the velocity ranges from 4,000 to 8,000 ft/s and it is probably representative of either saturated soils (up to about 5,000 ft/s), volcanic conglomerate bedrock, or weathered volcanic rock (basalt). The zone below that zone extends from 18 to 37 feet on down to 29 to 48 feet bgs, the velocity ranges from 8,000 to 12,000 ft/s and it is probably representative of little weathered to relatively fresh volcanic (basalt) bedrock. The lowest zone extends from 29 to 48 feet to the depth limit of information obtained at about 66 feet, the velocity ranges from 12,000 to >15,000 ft/s and it is probably representative of fresh, hard volcanic bedrock.

Test pit TP-1 was excavated approximately 27 to 40 feet northwest of the southeast end of Line L-1. Surficial soils extended to a depth of 4.5 feet in this test pit where weathered Conejo Volcanics were encountered. The Hyundai 235 excavator met refusal at a depth of about 9 feet. The seismic velocity at a depth of 9 feet was about 5,000 ft/s. Test pit TP-4 was excavated approximately 93 to 95 feet northwest of the southeast end of Line L-1 about 10 to 26 feet southwest of Line L-1. Surficial soils extended to a depth of 6.5 feet bgs in this test pit where weathered Conejo Volcanics were encountered. The Hyundai 235 LRC-9 excavator met refusal at a depth of about 7.5 feet bgs. The seismic velocity at a depth of 7.5 feet bgs in this area was about 4,000 ft/s. Test pit TP-7 was excavated approximately 30 to 33 feet southeast of the northwest end of Line L-1. Surficial soils and alluvium extended to the termination depth of 17.5 feet bgs in this test pit. Groundwater was encountered at a depth of 17 feet bgs. The seismic velocity interpreted at a depth of 17 feet in the vicinity of TP-7 was about 4,000 ft/s.

**2.2.2 Seismic Refraction Line L-2** – Seismic refraction line L-2 was conducted perpendicular to and crossing L-1, in the location shown on Figure 1. Twelve geophones were spaced at 10 feet on centers with a total spread length of 130 feet, including hammer impacts at 10 feet off both ends of the line. The data and results for L-2 are depicted graphically on the attached Figures B-2A (Time-Distance Graph for L-2) and B-2B (Interpreted Subsurface Velocity Model for L-2), respectively. Results indicate roughly four zones of velocity increasing with depth. The upper zone extends from the ground surface to depths of 6 to 16 feet below ground surface (bgs), the velocity ranges from about 1,000 to 1,500 feet per second (ft/s) and it is interpreted to be representative of artificial fill or colluvium (including surficial soil/slopewash) and/or highly weathered bedrock that is relatively dry. The underlying zone extends from 6 to 16 feet bgs to 18 to 25 feet bgs, the velocity ranges from 4,000 to 8,000 ft/s and it is probably representative of either saturated soils (up to about 5,000 ft/s), volcanic conglomerate bedrock or weathered volcanic (basalt) bedrock. The zone below that zone extends from 18 to 25 feet on down to 27 to 31 feet bgs, the velocity ranges from 8,000 to 12,000 ft/s and it is probably representative of little weathered to relatively fresh bedrock. The lowest zone extends from 27 to 31 feet to the depth limit of information obtained at about 37 feet, the velocity ranges from 12,000 to >15,000 ft/s and it is probably representative of fresh, hard volcanic bedrock.

Test pit TP-4 was excavated in the vicinity of the southwest end of Line L-2. Surficial soils extended to a depth of 6.5 feet bgs in this test pit where weathered Conejo Volcanics were encountered. The Hyundai 235 LRC-9 excavator met refusal at a depth of about 7.5 feet bgs. The seismic velocity at a depth of 7.5 feet bgs in this area was about 4,000 ft/s.

**2.2.3 Seismic Refraction Line L-3** – Seismic refraction line L-3 was conducted just downslope of the parking structure in the location shown on Figure 1. Twelve (12) geophones were spaced at 10 feet on centers with a total spread length of 130 feet, including hammer impacts at 10 feet off both ends of the line. The data and results for L-3 are depicted graphically on the attached Figures B-3A (Time-Distance Graph for L-3) and B-3B (Interpreted Subsurface Velocity Model for L-3), respectively. Results indicate roughly four zones of velocity increasing with depth, although results may have been influenced by a concrete V-ditch running roughly parallel to the line (concrete having a compression wave velocity of approximately 4,000 ft/s and steel reinforcement having a compression wave velocity of approximately 18,000 ft/s, impacting the middle 80 to 90 feet of the line). At both ends of the line (probably not impacted by the V-ditch), the upper zone extends from the ground surface to depths of 3 to 8 feet bgs, the velocity ranges from about 1,000 to 1,500 ft/s and it is probably representative of artificial fill as it is consistent with the documented limits of compacted fill placed (per Gorian and Associates, 1992). The underlying zone at the ends of the line extends from 3 to 8 feet bgs to 3 to 20 feet bgs, the velocity ranges from 1,500 to 4,000 ft/s and it is probably representative of either saturated soils (up to about 5,000 ft/s) or weathered volcanic conglomerate bedrock. Near the center of the line, about 25 to 60 feet west of the east end of the line, there appears to be an anomalous high velocity (8,000 ft/s) zone at shallow depth (a few feet bgs). This zone extends down to 18 to 28 feet bgs, the velocity ranges from 8,000 to 12,000 ft/s and it could be representative of little weathered to relatively fresh bedrock. The lowest zone extends from 18 to 28 feet to the depth limit of information obtained at about 35 feet, the velocity ranges from 12,000 to >15,000 ft/s and it is probably representative of fresh, hard volcanic bedrock.

No test pits were excavated in the vicinity of Line L-3 due to the difficult access and dense oak trees there. Subsurface exploration would be necessary about 50 feet west of the east end of this line to determine if the apparent shallow high velocity zone is hard volcanic bedrock or simply interference of the concrete V-ditch that runs parallel to the line.

**2.2.4 Seismic Refraction Line L-4** – Seismic refraction line L-4 was conducted parallel to Dallas Drive in a planter area between Dallas Drive and the parking lot area and loading dock for the Ahmanson Forum and adjacent buildings in the location shown on Figure 1. Twelve geophones were spaced at 10 feet on centers with a total spread length of 130 feet, including hammer impacts at 10 feet off both ends of the line. The data and results for L-4 are depicted graphically on the attached Figures B-4A (Time-Distance Graph for L-4) and B-4B (Interpreted Subsurface Velocity Model for L-4), respectively. Results indicate roughly two zones of velocity increasing with depth. The upper zone extends from the ground surface to depths of 5 to 13 feet bgs, the velocity ranges from about 1,000 to 1,500 ft/s and it is probably representative of artificial fill or highly weathered bedrock that is relatively dry. This is consistent with the grading plan record drawing indicating that fill on the order of 5 to 9 feet thick was programmed for this area, and the fill is likely deeper based upon removal of unsuitable soils prior to the placement of fill. The lower zone extends from 5 to 13 feet on down to the depth limit of information obtained at about 32 feet, the velocity ranges from 4,000 to 7,000 ft/s and it is probably representative of saturated soils (up to about 5,000 ft/s) or weathered bedrock.

No test pits were excavated in the vicinity of Line L-4.

**2.2.5 Seismic Refraction Line L-5** – Seismic refraction line L-5 was conducted parallel to Dallas Drive, but on the other side of Dallas Drive from Line L-4, in the location shown on Figure 1. Twelve geophones were spaced at 10 feet on centers with a total spread length of 130 feet, including hammer impacts at 10 feet off both ends of the line. The data and results for L-5 are depicted graphically on the attached Figures B-5A (Time-Distance Graph for L-5) and B-5B (Interpreted Subsurface Velocity Model for L-5), respectively. Results indicate roughly four zones of velocity increasing with depth. The upper zone extends from the ground surface to depths of 7 to 15 feet bgs, the velocity ranges from about 1,000 to 1,500 ft/s and it is probably representative of artificial fill or colluvium (including surficial soil/slopewash) and/or highly weathered bedrock that is relatively dry. The underlying zone extends from 7 to 15 feet bgs to 18 to 29 feet bgs, the velocity ranges from 4,000 to 8,000 ft/s and it is probably representative of either saturated soils (up to about 5,000 ft/s) or weathered volcanic bedrock. The zone below that zone extends from 18 to 29 feet on down to 27 to 33 feet bgs, the velocity ranges from 8,000 to 12,000 ft/s and it is probably representative of little weathered to relatively fresh bedrock. The lowest zone extends from 27 to 33 feet to the depth limit of information obtained at about 37 feet, the velocity ranges from 12,000 to >15,000 ft/s and it is probably representative of fresh, hard volcanic bedrock.

Test pit TP-2 was excavated adjacent to Line L-5, approximately 18 to 31 feet northeast of the southwest end of Line L-5. Surficial soils extended to a depth of 8.2 feet in this test pit where weathered Conejo Volcanics were encountered. The Hyundai 235 excavator met refusal at a depth of about 12.5 feet. The seismic velocity at a depth of 12.5 feet was about 5,000 ft/s. Test pit TP-3 was excavated approximately 15 feet west of the northwest end of Line L-2. Surficial soils extended to the termination depth of 17 feet bgs in this test pit in alluvial soil materials. Groundwater was encountered at a depth of 16 feet bgs. The seismic velocity at a depth of 16 feet bgs was about 4,000 ft/s.

**2.2.6 Seismic Refraction Line L-6** – Seismic refraction line L-6 was conducted parallel to and north of Line L-1, in the location shown on Figure 1. Twelve geophones were spaced at 10 feet on centers with a total spread length of 130 feet, including hammer impacts at 10 feet off both ends of the line. The data and results for L-6 are depicted graphically on the attached Figures B-6A (Time-Distance Graph for L-6) and B-6B (Interpreted Subsurface Velocity Model for L-6), respectively. Results indicate roughly four zones of velocity increasing with depth. The upper zone extends from the ground surface to depths of 12 to 14 feet bgs, the velocity ranges from about 1,000 to 1,500 ft/s and it is probably representative of artificial fill or surficial soil/slopewash, colluvium and/or highly weathered bedrock that is relatively dry. The underlying zone extends from 12 to 14 feet bgs to 18 to 20 feet bgs, the velocity ranges from 4,000 to 8,000 ft/s and it is probably representative of either saturated soils (up to about 5,000 ft/s) or weathered volcanic conglomerate bedrock. The zone below that zone extends from 18 to 20 feet on down to 24 to at least 32 feet bgs, the velocity ranges from 8,000 to 12,000 ft/s and it is probably representative of moderately weathered to slightly weathered volcanic bedrock. The lowest zone is only present beneath the southeast end of Line L-6 and extends from 24 to greater than 32 feet to the depth limit of information obtained at about 32 feet, the velocity ranges from 12,000 to >15,000 ft/s and it is probably representative of fresh, hard volcanic bedrock.

Test pit TP-5 was excavated along Line L-6, approximately 16 to 19 feet northwest of the southeast end of Line L-6. Surficial soils and alluvium extended to the termination depth of 14.5 feet bgs in this test pit. Groundwater was encountered at a depth of 14 feet bgs. The seismic velocity at a depth of 14 feet bgs in this area was about 4,500 ft/s.

### **3.0 CONCLUSIONS AND RECOMMENDATIONS**

Based on our understanding of the site geology and the results of the geophysical exploration described above, it is our opinion that the site is underlain by resistant volcanic bedrock that becomes more resistant and competent with depth. While this should be favorable for relatively stable cut faces for proposed excavations, the materials at depth (typically below a depth of 11 to 40 feet beneath the ground surface, and possibly shallower near the middle of Line L-3) will likely be very difficult, if not impossible, to excavate using conventional excavation equipment and hard rock excavation techniques may be necessary if excavation below those depths are required.

In general, there are four velocity zones within the upper 32 to 66 feet beneath the ground surface in the vicinity of the seismic refraction lines. The zone closest to the ground surface is characterized by low velocity (1,000 to 1,500 ft/s) materials to a depth bgs of about 0 to 16 feet beneath the ground surface. This upper zone likely corresponds to artificial fill or colluvium (including surficial soil/slopewash) and/or highly weathered bedrock (predominantly volcanic conglomerate) that are relatively dry. The underlying zone consists of medium to high velocity (4,000 to 8,000 ft/s) materials, extending from 0 to 16 feet on down to 3 to 29 feet bgs. This zone likely corresponds to either saturated soils (up to about 5,000 ft/s) or weathered volcanic conglomerate bedrock. The next underlying zone down consists of high velocity (8,000 to 12,000 ft/s) materials that extend from 3 to 29 feet to 18 to 48 feet bgs. This zone likely corresponds to moderately weathered to little weathered bedrock. The deepest zone encountered consists of very high velocity (12,000 to >15,000 ft/s) materials that extend from 18 to 48 feet to the full depth limit of information obtained (about 32 to 66 feet). This zone likely corresponds to unweathered/fresh, hard volcanic bedrock materials.

We also reviewed the report by Endacott & Associates, Inc. (Endacott) dated August 10, 1990 entitled "Geophysical Investigation Thousand Oaks Civic Center for Dames & Moore". Endacott conducted five seismic refraction lines as part of the exploration for the civic center. They interpreted the results of their seismic refraction survey as two subsurface velocity zones for each line, the upper zone ranging from 2,500 to 4,200 ft/s to depths of 0 to 48 feet bgs where a higher velocity zone ranging from 7,250 to 12,650 ft/s was encountered. Their Line S-1 was located about 140 feet southwest of our Line L-3 and was interpreted to have lower velocity material with a compression wave velocity of 3,810 ft/s to depths of 1 to 13 feet bgs where higher velocity material with a velocity of 10,300 ft/s was encountered. The northwest end of their Line S-3 was located about 90 feet southeast of the southeast end of

our Line L-4 and was interpreted to have lower velocity material with a compression wave velocity of 3,800 ft/s to depths of 6 to 30 feet bgs where higher velocity material with a velocity of 8,500 ft/s was encountered. Their Line S-4 was located about 220 feet east of our Line L-4 and was interpreted to have lower velocity material with a compression wave velocity of 4,200 ft/s to depths of 1 to 13 feet bgs where higher velocity material with a velocity of 12,650 ft/s was encountered. While our higher resolution interpretation of multiple compression wave velocities increasing with depth shows more of a transition in increasing velocities with depth, the interpreted velocities and depths to them are similar. In general, we interpreted somewhat higher compression wave velocities (8,000 to >15,000 ft/s) present at depth than the velocities (7,250 to 12,650 ft/s) interpreted by Endacott.

While our higher resolution interpretation of multiple compression wave velocities increasing with depth shows more of a transition in increasing velocities with depth, the interpreted velocities and depths to them are similar. In general, we interpreted somewhat higher compression wave velocities (8,000 to >15,000 fps) present at depth than the velocities (7,250 to 12,650 fps) interpreted by Endacott.

#### **4.0 BEDROCK RIPPABILITY (EXCAVATION CHARACTERISTICS)**

The attached excerpt from the Caterpillar Performance Handbook 49 (2019) illustrates a relationship between various seismic compression velocities and rippability characteristics when using Caterpillar D8 through D11 dozers in combination with corresponding single shank or multi-shank rippers. The bedrock materials at this site are comprised of volcanoclastic sedimentary rock and volcanic (igneous rock). Based on the handbook charts, volcanic bedrock materials are rippable with a D9 up to compression velocities of about 7,600 ft/s, marginally rippable up to about 8,000 ft/s and non-rippable over about 8,600 ft/s. Velocities exceeding 8,000 ft/s were recorded at this site at depths of generally 18 to 37 feet below the ground surface, and possibly as shallow as 2 feet beneath a portion of Line L-3. The limitations of correlating seismic velocity charts to rippability are discussed on Page 19-85 of the attached excerpt from the Caterpillar Performance Handbook 49 (2019). It should be noted that the Hyundai 235 LRC-9 excavator met with refusal in weathered volcanic bedrock materials with a seismic velocity of about 4,000 to 5,000 ft/s.

## 5.0 SEISMIC REFRACTION SURVEY LIMITATIONS

The subsurface velocity profiles presented in this appendix represent the most reasonable interpretation of geophysical survey data based on our limited knowledge of the existing geologic conditions at the site. The results are presented for evaluation information only and are not intended to serve as information for determining construction procedures. Interpretations were made in accordance with generally accepted geophysical methods and practices. This warranty is in lieu of all other warranties, expressed or implied.

It should be understood that the computer-generated velocity layers involve a smoothing process such that in areas, higher or lower velocity materials may cross over the computer-generated layer lines. Contouring of velocity layers by hand using the color renderings for each interpretation cell may result in more precise depths to velocity layers than the layers interpreted by the SeisOpt@2D computer program.

The quality of seismic refraction data for this survey was acceptable, but affected by background noise and lateral inhomogeneity. These factors produce noise signals and/or scatter in the recorded data, limiting the accuracy of first break compression wave picks and interpretation. The seismic refraction method used has some inherent limitations such as the possibility for undetectable hidden layers, blind zones, and velocity inversions. Seismic refraction results were correlated with direct subsurface exploration at six sites. It should be understood that additional correlation would be desirable to confirm interpretations. The maximum depth of reliable seismic information obtained during this survey can be assumed to generally be less than one-third of the length of the individual lines (given an increase in velocity with depth), with information at a maximum depth underlying roughly the middle one-third of the lines. These results are not intended to determine construction procedures and the contractor should make their own interpretation of excavation conditions.

Attachments:

Figure B-1A - Time-Distance Graph for L-1

Figure B-1B - Interpreted Subsurface Velocity Model for L-1

Figure B-2A - Time-Distance Graph for L-2

Figure B-2B - Interpreted Subsurface Velocity Model for L-2

Figure B-3A - Time-Distance Graph for L-3

Figure B-3B - Interpreted Subsurface Velocity Model for L-3

Figure B-4A - Time-Distance Graph for L-4

Figure B-4B - Interpreted Subsurface Velocity Model for L-4

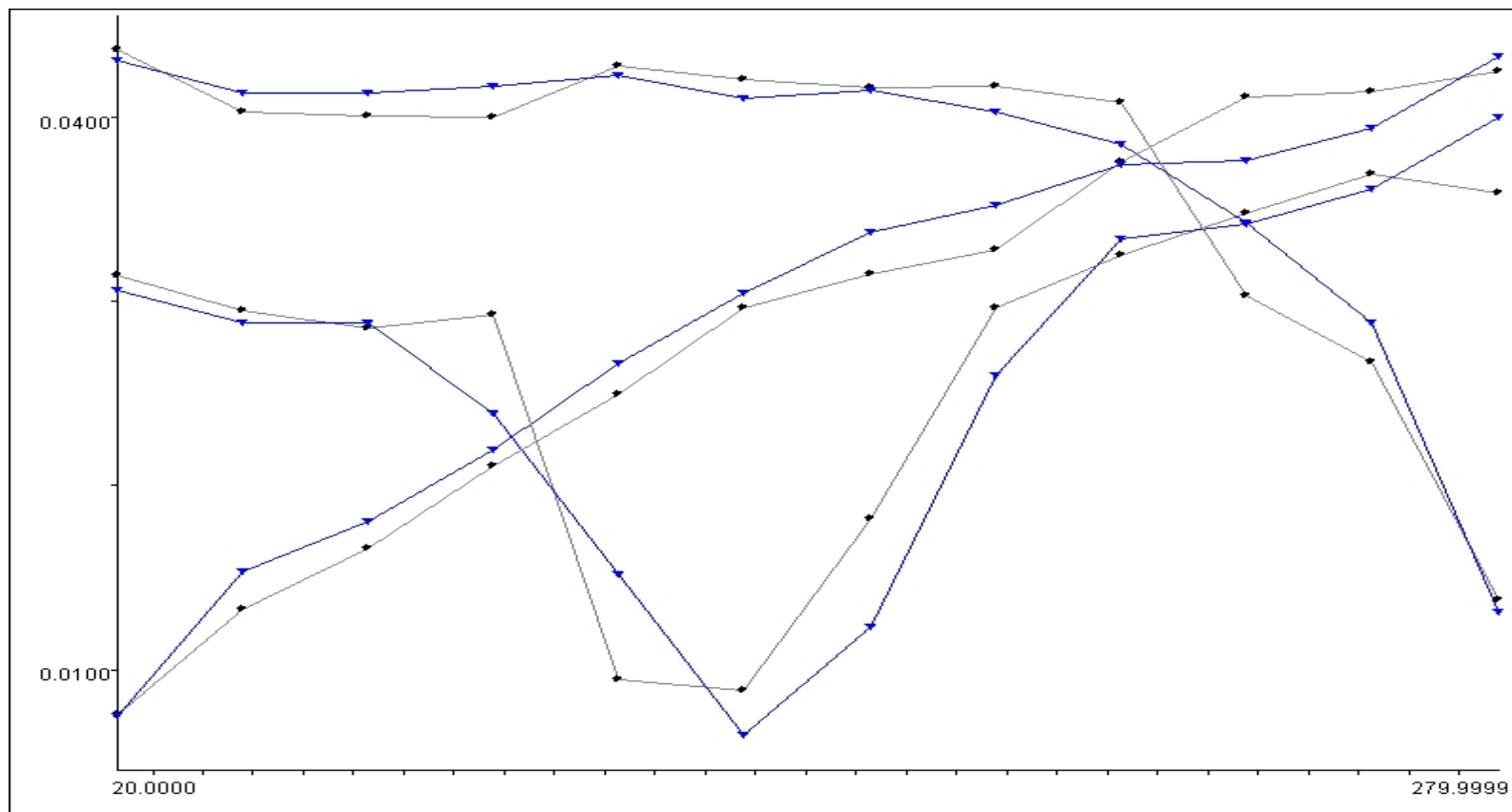
Figure B-5A - Time-Distance Graph for L-5

Figure B-5B - Interpreted Subsurface Velocity Model for L-5

Figure B-6A - Time-Distance Graph for L-6

Figure B-6B - Interpreted Subsurface Velocity Model for L-6

Excerpt from Caterpillar Performance Handbook 49



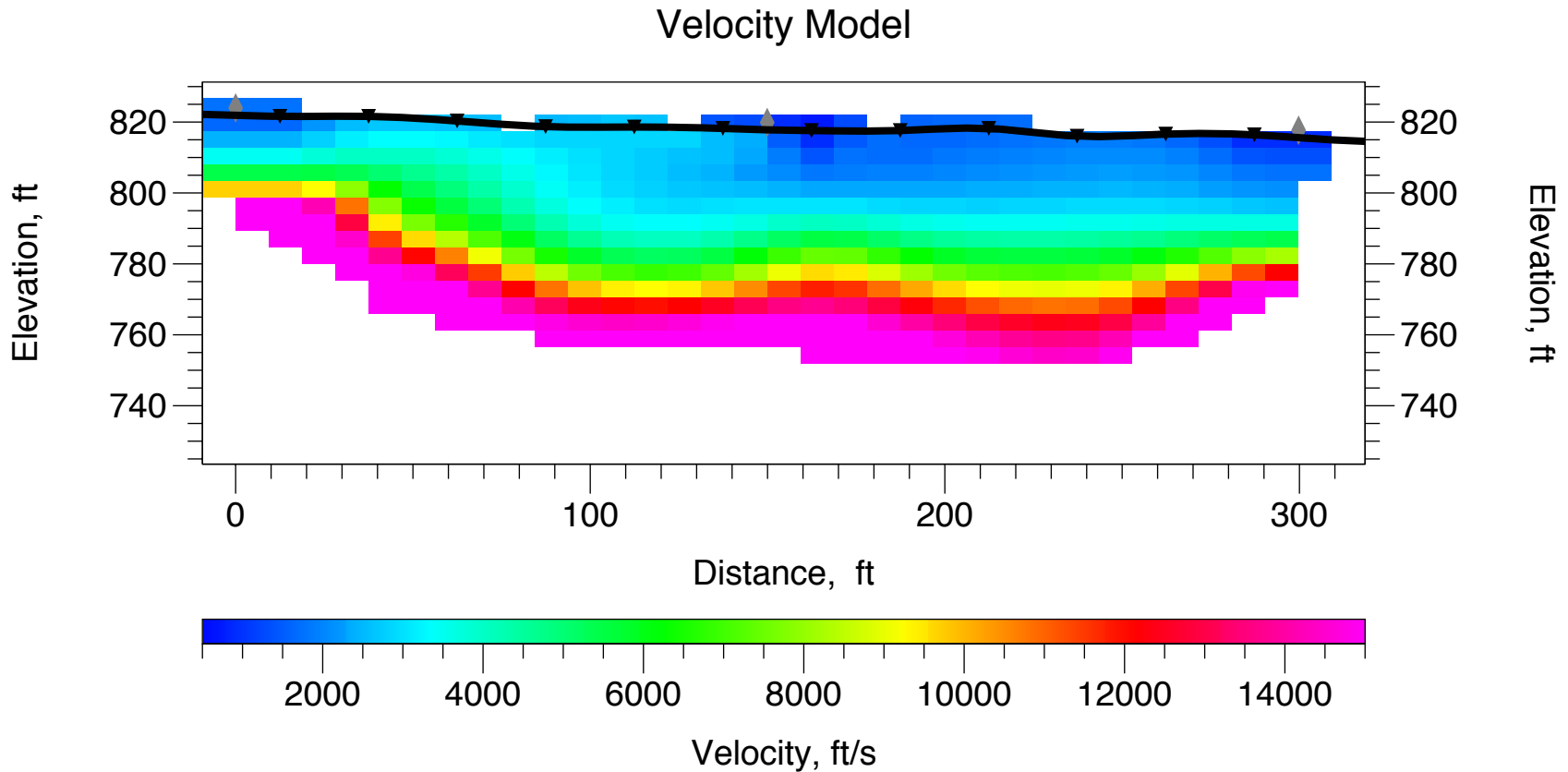
SOUTHEAST

SCALES AS SHOWN

NORTHWEST

TIME (Y-AXIS IN SECONDS) – DISTANCE (X-AXIS IN FEET) DATA  
SEISMIC REFRACTION LINE L-1  
City of Thousand Oaks CAP Project  
Thousand Oaks, California  
FIGURE NO. B-1A

COTTON, SHIRES AND ASSOCIATES, INC.



SOUTHEAST

SCALE: 1" = 50'

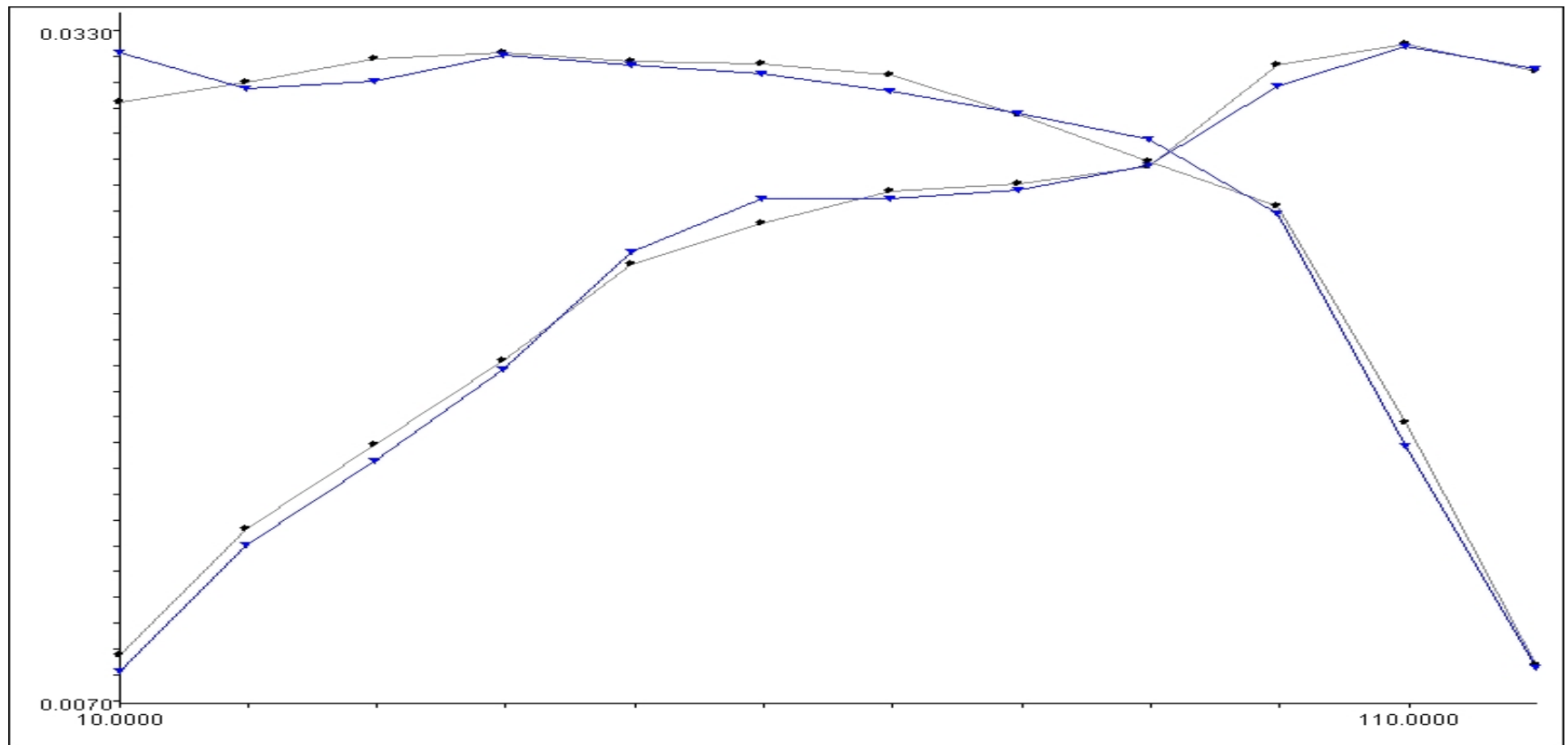
NORTHWEST

**INTERPRETED SUBSURFACE VELOCITY MODEL  
SEISMIC REFRACTION LINE L-1 (Highest Resolution)**

**City of Thousand Oaks CAP Project  
Thousand Oaks, California**

FIGURE NO. B-1B

**COTTON, SHIRES AND ASSOCIATES, INC.**



SOUTHWEST

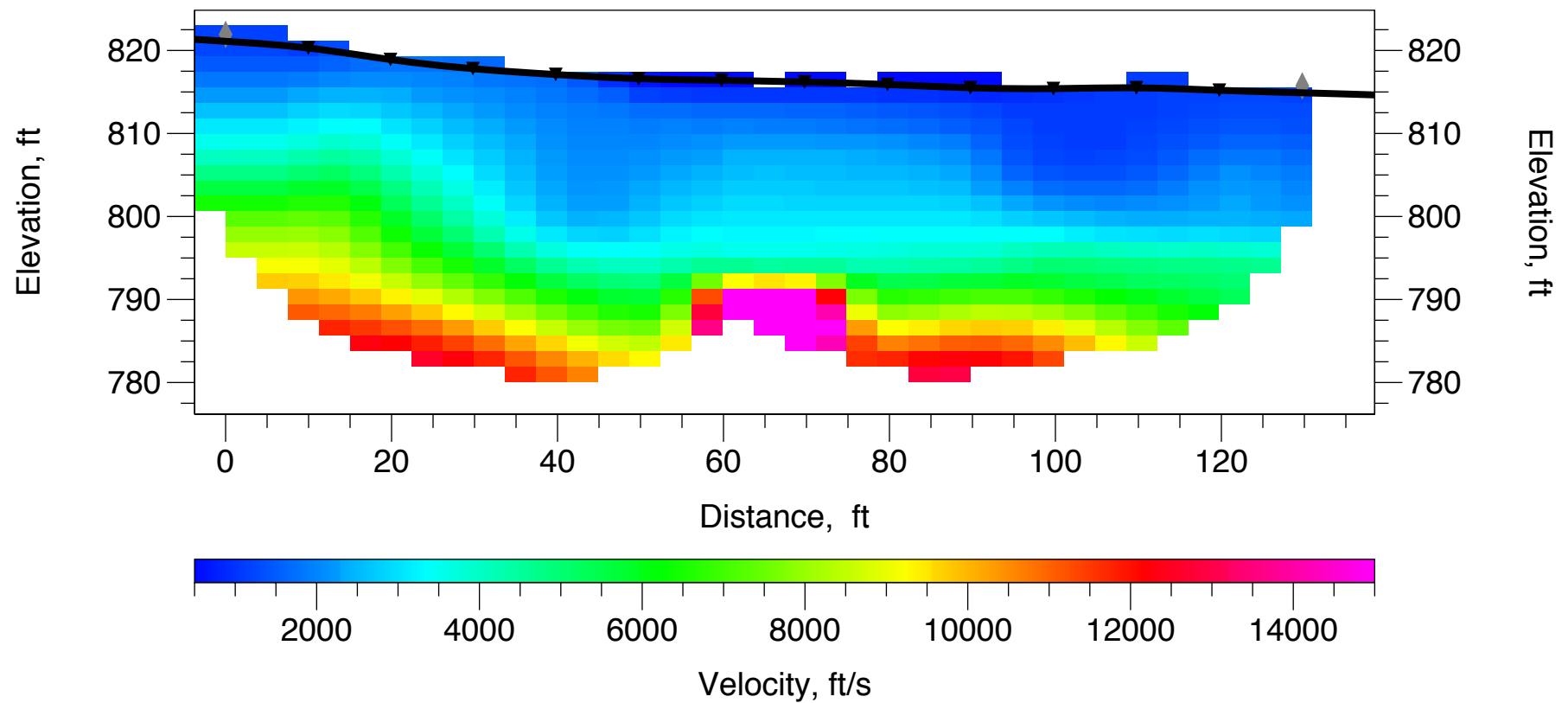
SCALES AS SHOWN

NORTHEAST

TIME (Y-AXIS IN SECONDS) – DISTANCE (X-AXIS IN FEET) DATA  
SEISMIC REFRACTION LINE L-2  
City of Thousand Oaks CAP Project  
Thousand Oaks, California  
FIGURE NO. B-2A

COTTON, SHIRES AND ASSOCIATES, INC.

## Velocity Model



SOUTHWEST

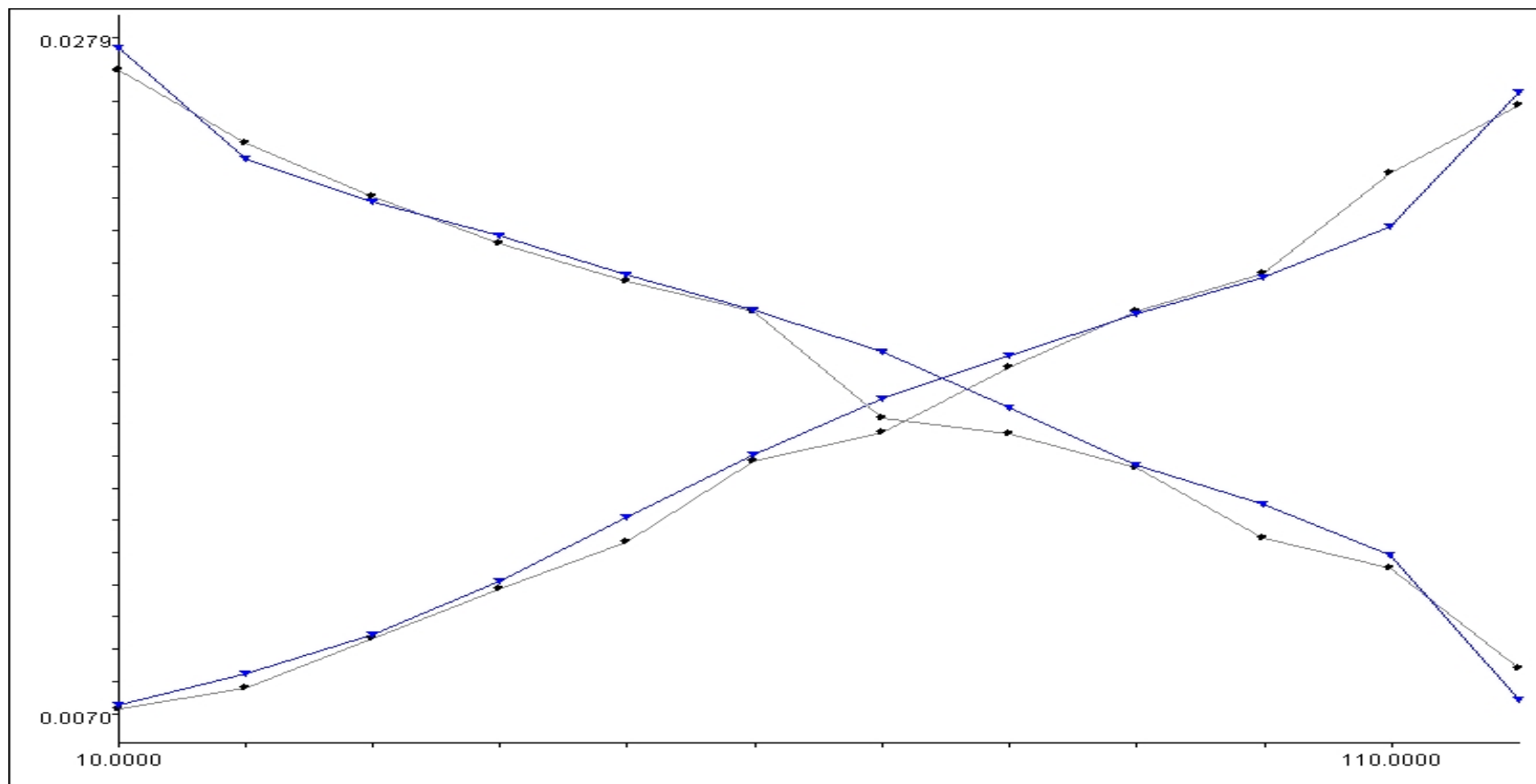
SCALE: 1" = 20'

NORTHEAST

**INTERPRETED SUBSURFACE VELOCITY MODEL  
SEISMIC REFRACTION LINE L-2 (Highest Resolution)**

**City of Thousand Oaks CAP Project  
Thousand Oaks, California  
FIGURE NO. B-2B**

**COTTON, SHIRES AND ASSOCIATES, INC.**



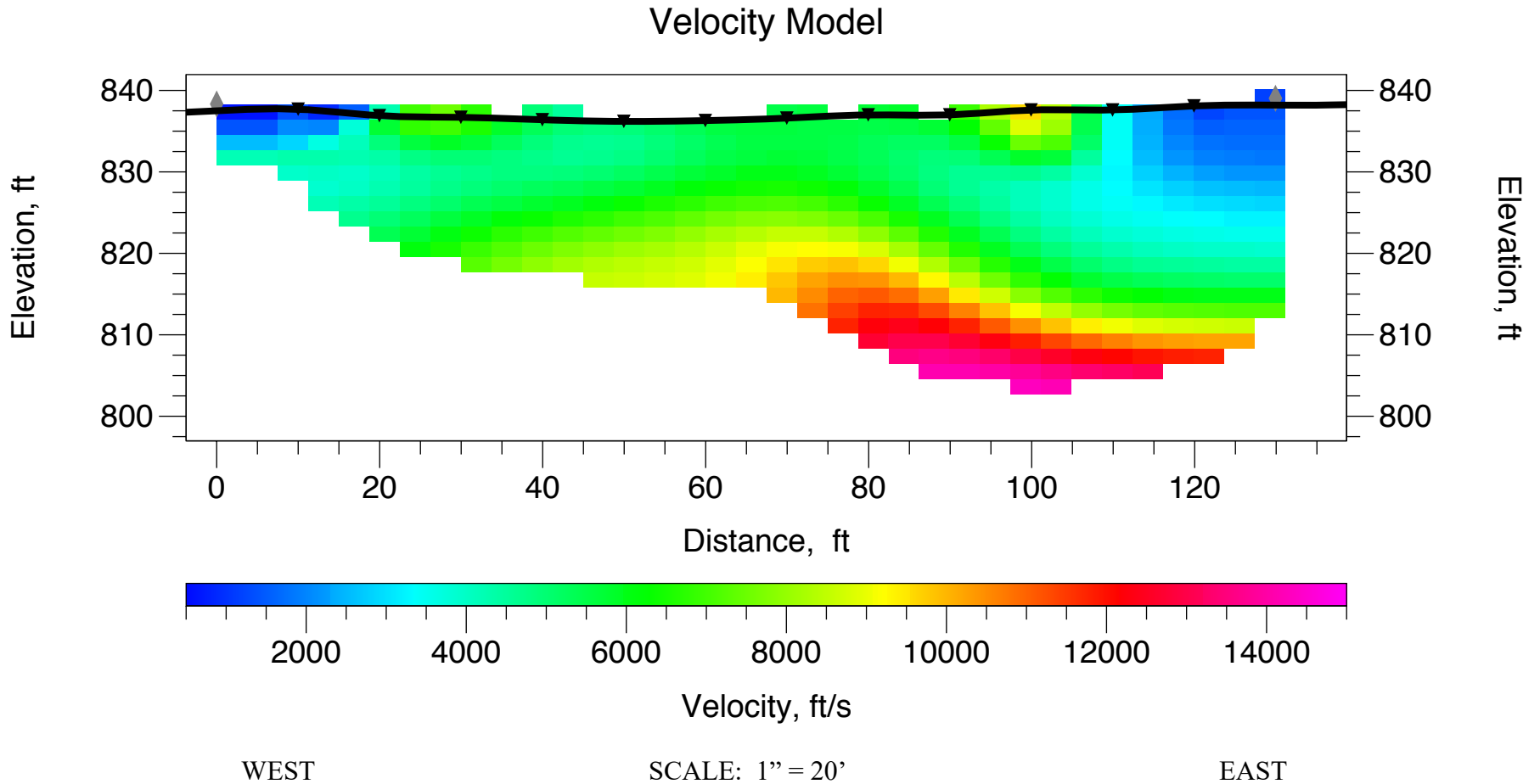
WEST

SCALES AS SHOWN

EAST

**TIME (Y-AXIS IN SECONDS) – DISTANCE (X-AXIS IN FEET) DATA**  
**SEISMIC REFRACTION LINE L-3**  
**City of Thousand Oaks CAP Project**  
**Thousand Oaks, California**  
**FIGURE NO. B-3A**

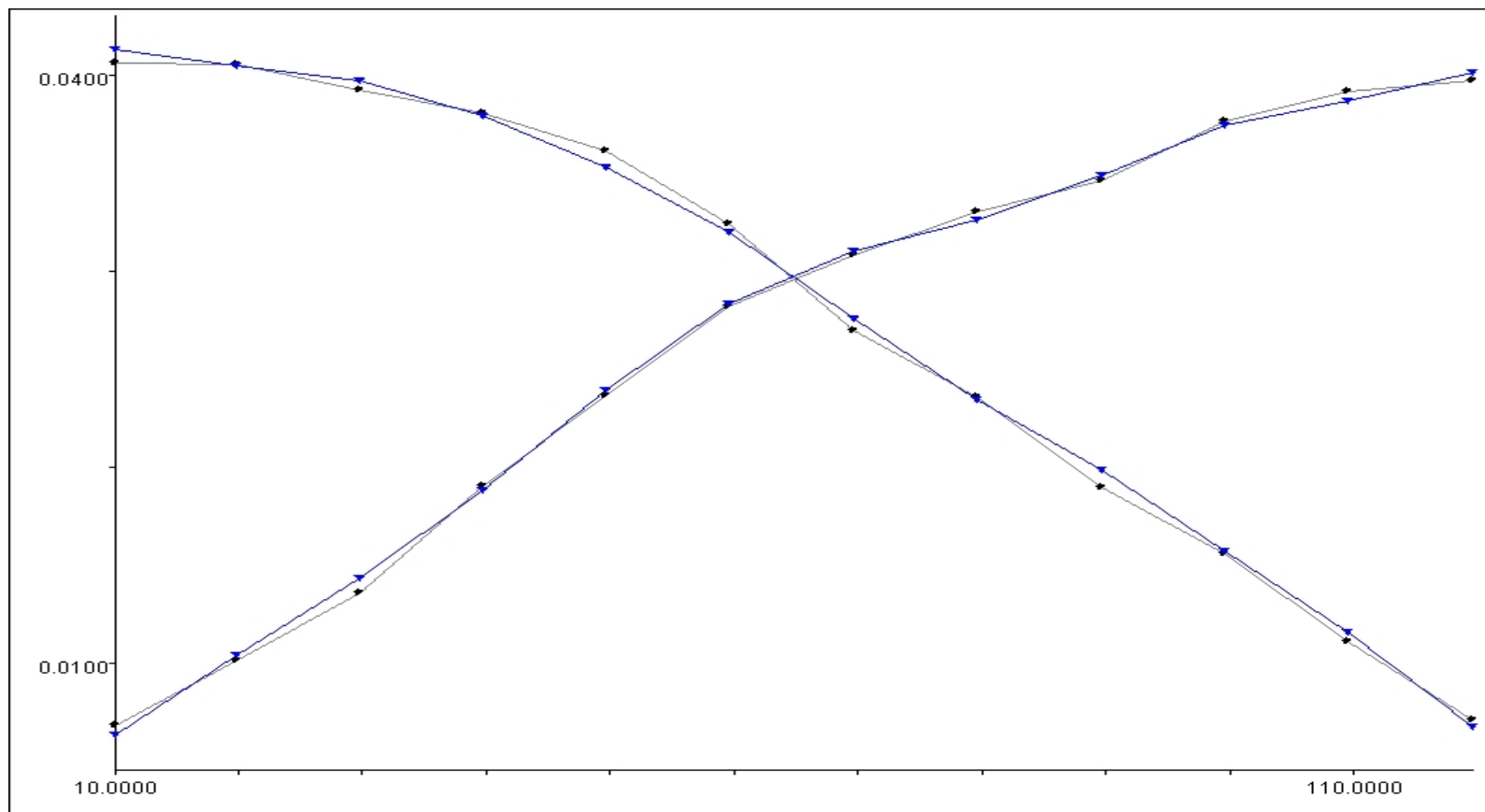
**COTTON, SHIRES AND ASSOCIATES, INC.**



**INTERPRETED SUBSURFACE VELOCITY MODEL  
SEISMIC REFRACTION LINE L-3 (Highest Resolution)**

City of Thousand Oaks CAP Project  
Thousand Oaks, California  
FIGURE NO. B-3B

**COTTON, SHIRES AND ASSOCIATES, INC.**



SOUTHWEST

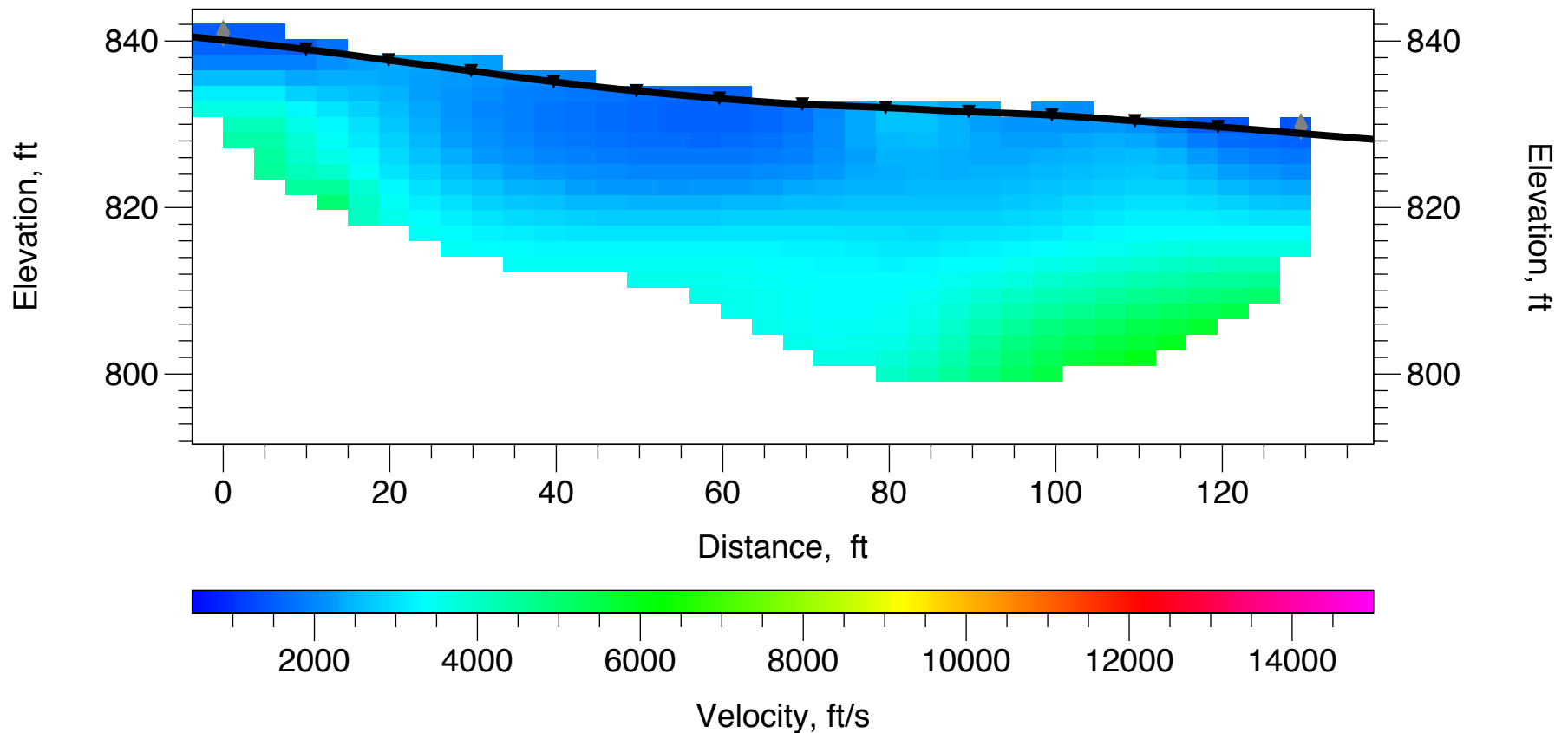
SCALES AS SHOWN

NORTHEAST

**TIME (Y-AXIS IN SECONDS) – DISTANCE (X-AXIS IN FEET) DATA**  
**SEISMIC REFRACTION LINE L-4**  
**City of Thousand Oaks CAP Project**  
**Thousand Oaks, California**  
**FIGURE NO. B-4A**

**COTTON, SHIRES AND ASSOCIATES, INC.**

## Velocity Model



SOUTHWEST

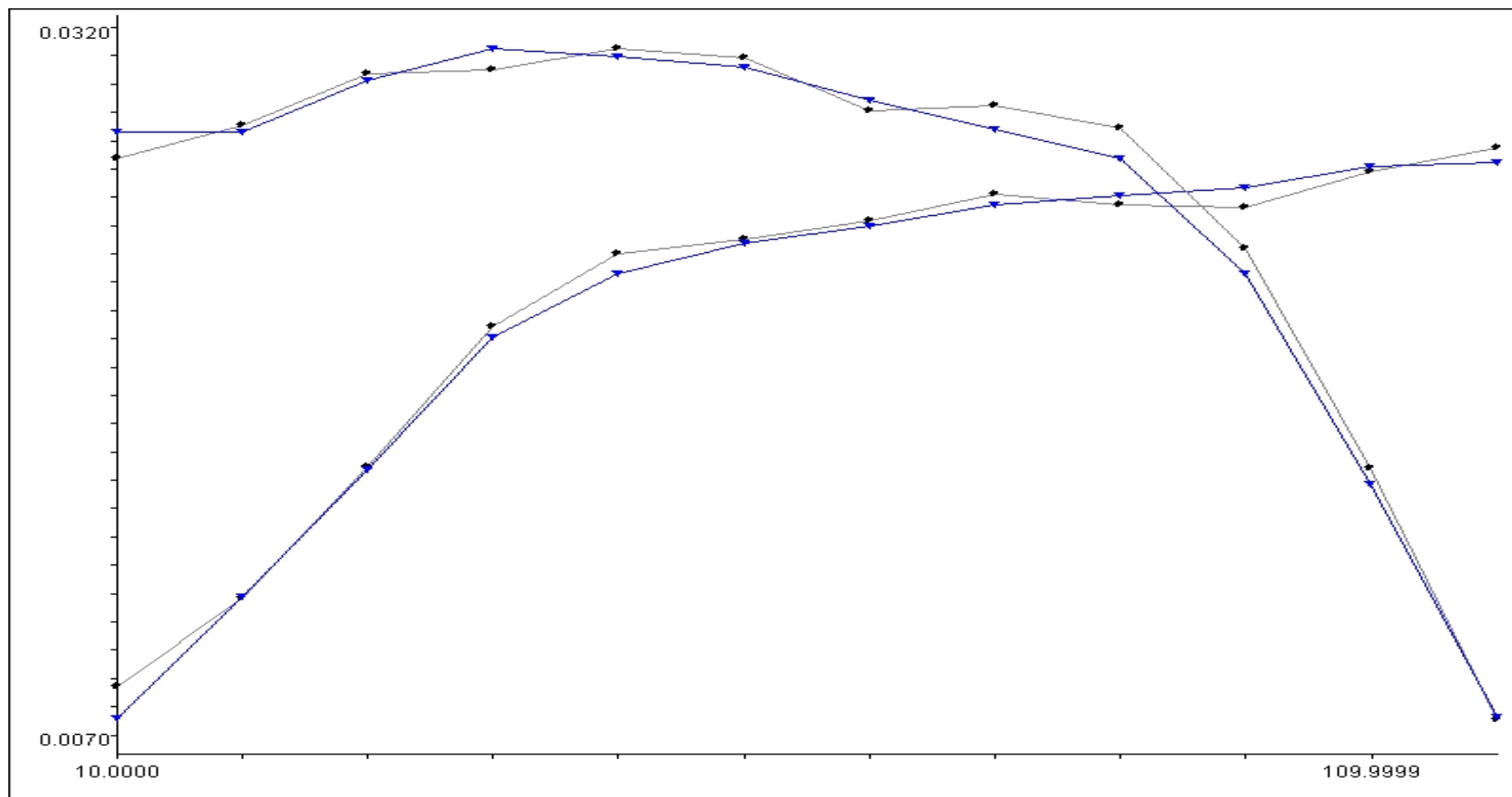
SCALE: 1" = 20'

NORTHEAST

**INTERPRETED SUBSURFACE VELOCITY MODEL  
SEISMIC REFRACTION LINE L-4 (Highest Resolution)**

**City of Thousand Oaks CAP Project  
Thousand Oaks, California  
FIGURE NO. B-4B**

**COTTON, SHIRES AND ASSOCIATES, INC.**



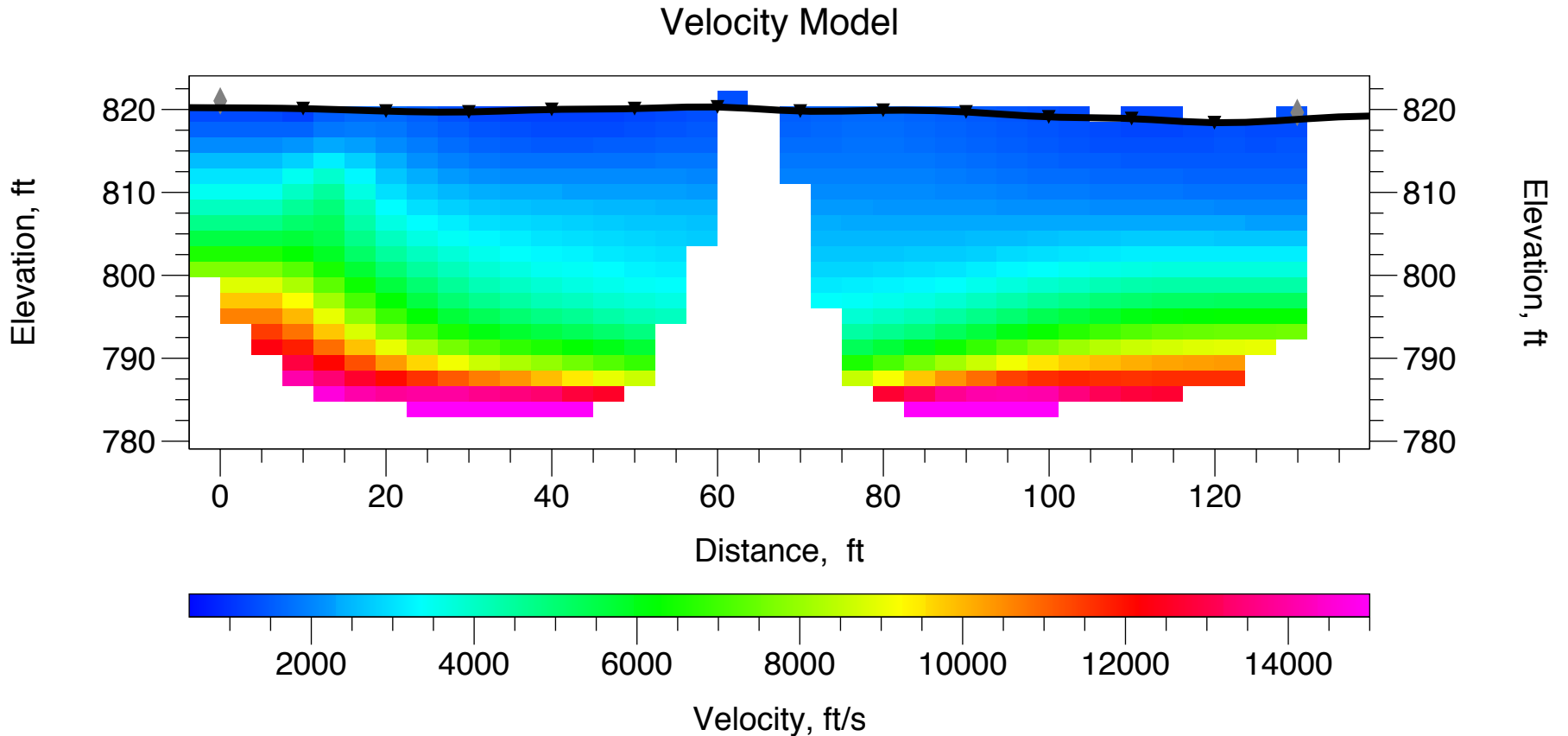
SOUTHWEST

SCALES AS SHOWN

NORTHEAST

TIME (Y-AXIS IN SECONDS) – DISTANCE (X-AXIS IN FEET) DATA  
SEISMIC REFRACTION LINE L-5  
City of Thousand Oaks CAP Project  
Thousand Oaks, California  
FIGURE NO. B-5A

COTTON, SHIRES AND ASSOCIATES, INC.



SOUTHWEST

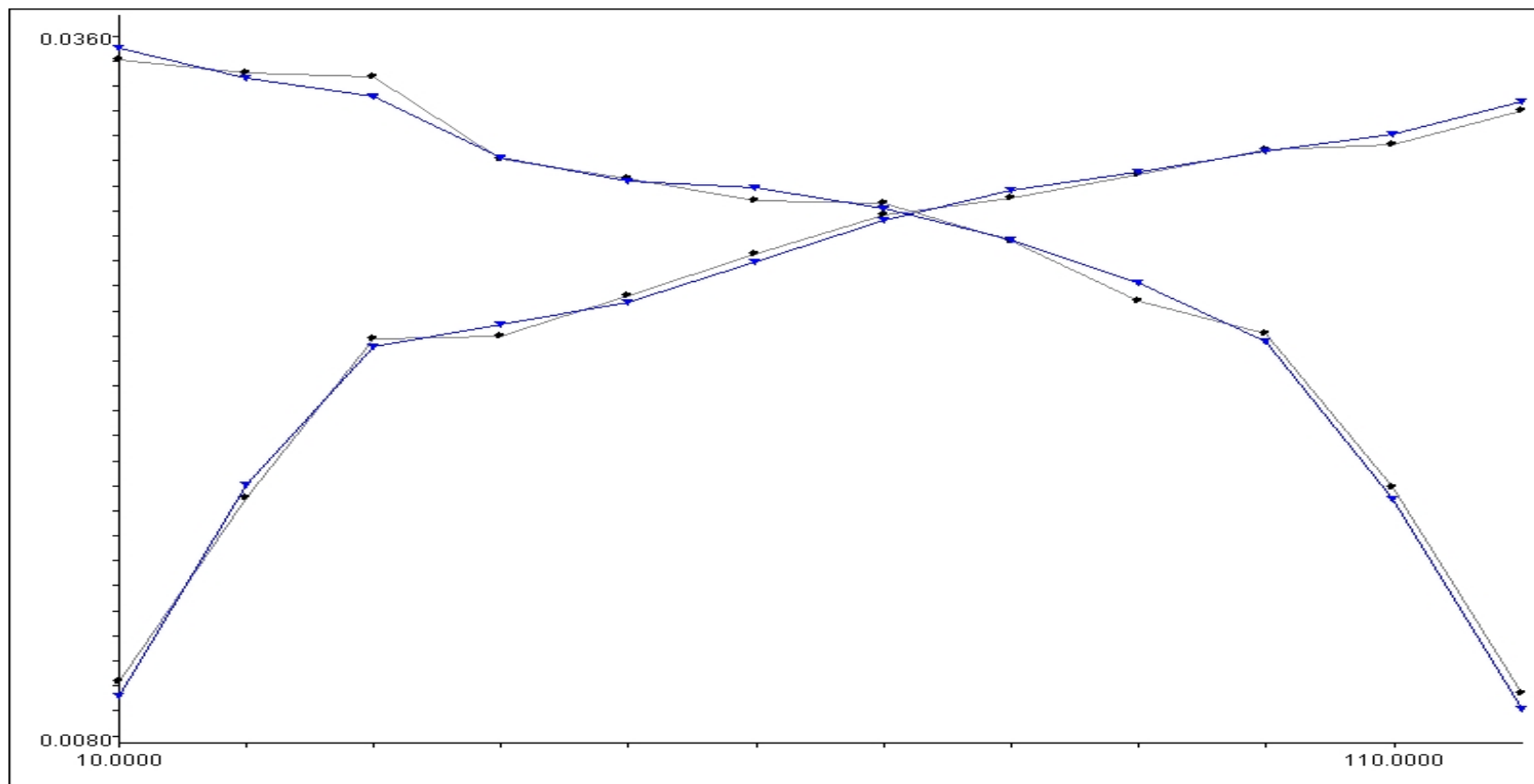
SCALE: 1" = 20'

NORTHEAST

**INTERPRETED SUBSURFACE VELOCITY MODEL  
SEISMIC REFRACTION LINE L-5 (Highest Resolution)**

**City of Thousand Oaks CAP Project  
Thousand Oaks, California  
FIGURE NO. B-5B**

**COTTON, SHIRES AND ASSOCIATES, INC.**



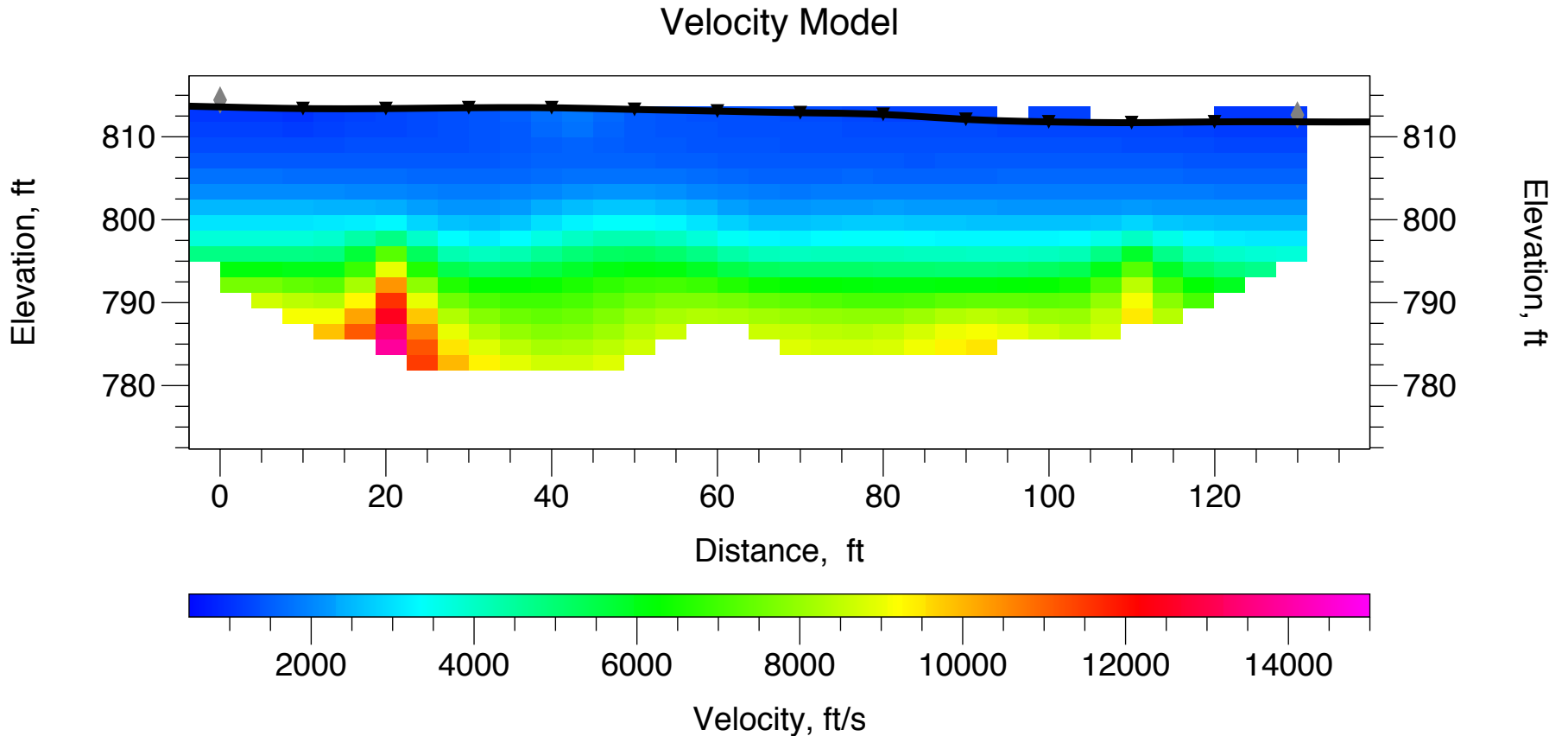
SOUTHEAST

SCALES AS SHOWN

NORTHWEST

**TIME (Y-AXIS IN SECONDS) – DISTANCE (X-AXIS IN FEET) DATA**  
**SEISMIC REFRACTION LINE L-6**  
**City of Thousand Oaks CAP Project**  
**Thousand Oaks, California**  
**FIGURE NO. B-6A**

**COTTON, SHIRES AND ASSOCIATES, INC.**



SOUTHEAST

SCALE: 1" = 20'

NORTHWEST

**INTERPRETED SUBSURFACE VELOCITY MODEL  
SEISMIC REFRACTION LINE L-6 (Highest Resolution)**

City of Thousand Oaks CAP Project  
Thousand Oaks, California  
FIGURE NO. B-6B

**COTTON, SHIRES AND ASSOCIATES, INC.**

# **Caterpillar Performance Handbook**

# **49**

**CATERPILLAR®**

# CATERPILLAR PERFORMANCE HANDBOOK

a publication by Caterpillar, Peoria, Illinois, U.S.A.

2019

Performance information in this booklet is intended for estimating purposes only. Because of the many variables peculiar to individual jobs (including material characteristics, operator efficiency, underfoot conditions, altitude, etc.), neither Caterpillar nor its dealers warrant that the machines described will perform as estimated.

**NOTE: Always refer to the appropriate Operation and Maintenance Manual for specific product information.**

Materials and specifications are subject to change without notice.

CAT, CATERPILLAR, LET'S DO THE WORK, their respective logos, "Caterpillar Yellow," the "Power Edge" and Cat "Modern Hex" trade dress as well as corporate and product identity used herein, are trademarks of Caterpillar and may not be used without permission.

### Solution:

1. Total Cycle Time =  $3.41 + 0.25 = 3.66$  min  

$$\text{Cycles/hour} = \frac{60 \text{ min/hr}}{3.66 \text{ min/cycle}} = 16.4$$
2. Production per cycle =  $\frac{300 \times 3 \times 2}{27} = 66.7$  BCY/cycle
3. Production =  $66.7 \text{ BCY/cycle} \times 16.4 \text{ cycles/hr} = 1094 \text{ BCY/hour}$
4. Remember results of this method are usually 10 to 20% high.  

$$\begin{aligned} \text{Actual Production} &= 80\% \times 1094 \\ &= 875 \text{ BCY/hr} \\ \text{or } 90\% \times 1094 &= 984 \text{ BCY/hr} \end{aligned}$$
5. Owning and Operating Costs  
 A D10T2 (ripping only) could have a \$115.00/hr  
 O & O costs including \$30/hr operator
6. Loosening Costs  

$$\begin{aligned} \$115.00/\text{hr} \div 875 \text{ BCY/hr} &= \$0.131/\text{BCY} \\ \$115.00/\text{hr} \div 984 \text{ BCY/hr} &= \$0.117/\text{BCY} \end{aligned}$$
 The loosening cost should range from 11.7¢ to 13.1¢/BCY



- Low seismic velocities of sedimentaries can indicate probable rippability. However, if the fractures and bedding joints do not allow tooth penetration, the material may not be ripped effectively.
- Pre-blasting or “popping” may induce sufficient fracturing to permit tooth entry, particularly in the caliches, conglomerates and some other rocks; but the economics should be checked carefully when considering popping in the higher grades of sandstones, limestones and granites.

Ripping is still more art than science, and much will depend on operator skill and experience. Ripping for scraper loading may call for different techniques than if the same material is to be dozed away. Cross-ripping requires a change in approach. The number of shanks used, length and depth of shank, tooth angle, direction, throttle position — all must be adjusted according to field conditions. Ripping success may well depend on the operator finding the proper combination for those conditions.

## USE OF SEISMIC VELOCITY CHARTS

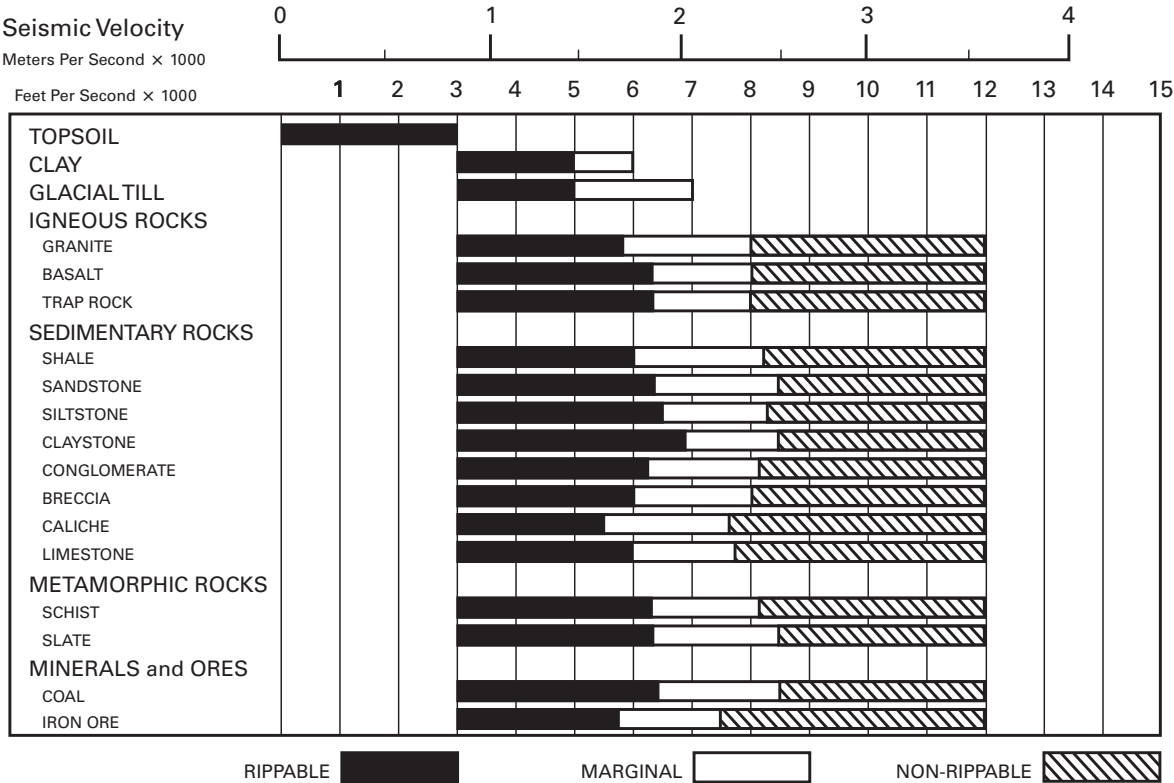
The charts of ripper performance estimated by seismic wave velocities have been developed from field tests conducted in a variety of materials. Considering the extreme variations among materials and even among rocks of a specific classification, the charts must be recognized as being at best only one indicator of rippability.

Accordingly, consider the following precautions when evaluating the feasibility of ripping a given formation:

- Tooth penetration is often the key to ripping success, regardless of seismic velocity. This is particularly true in homogeneous materials such as mudstones and claystones and the fine-grained caliches. It is also true in tightly cemented formations such as conglomerates, some glacial tills and caliches containing rock fragments.

D8R/D8T

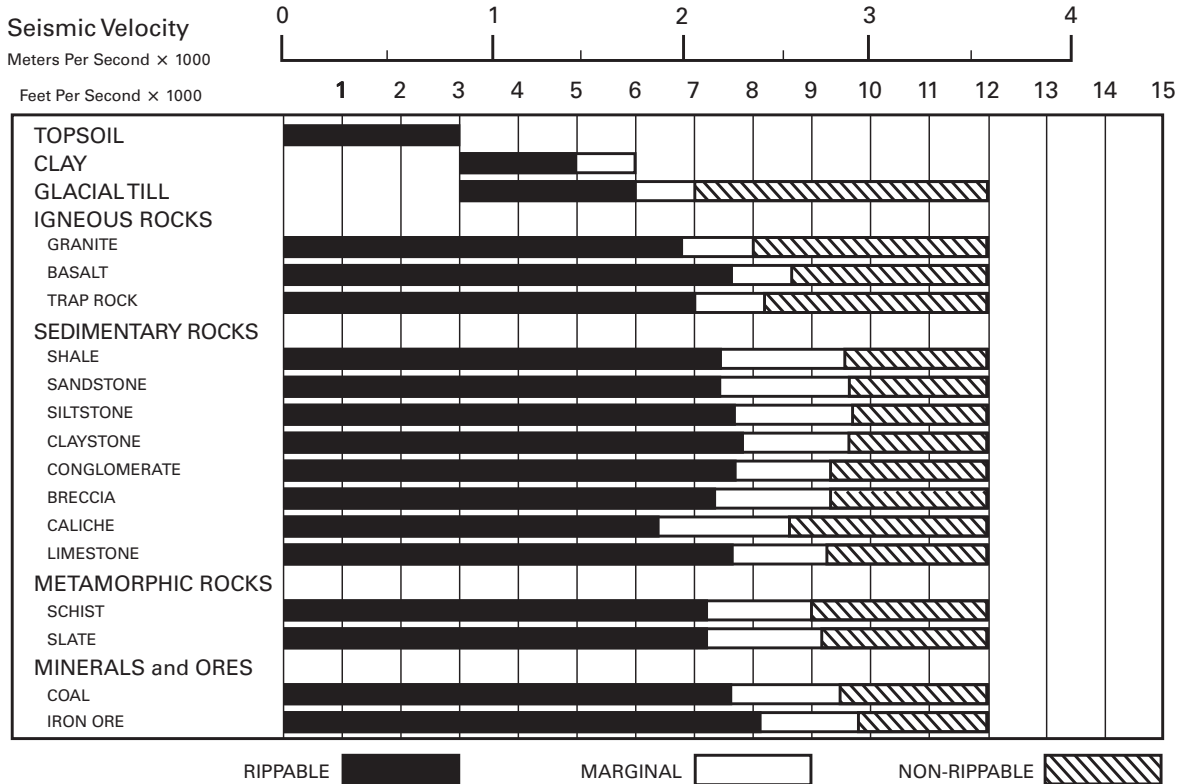
- Multi- or Single Shank No. 8 Ripper
- Estimated by Seismic Wave Velocities



# D9R/D9T

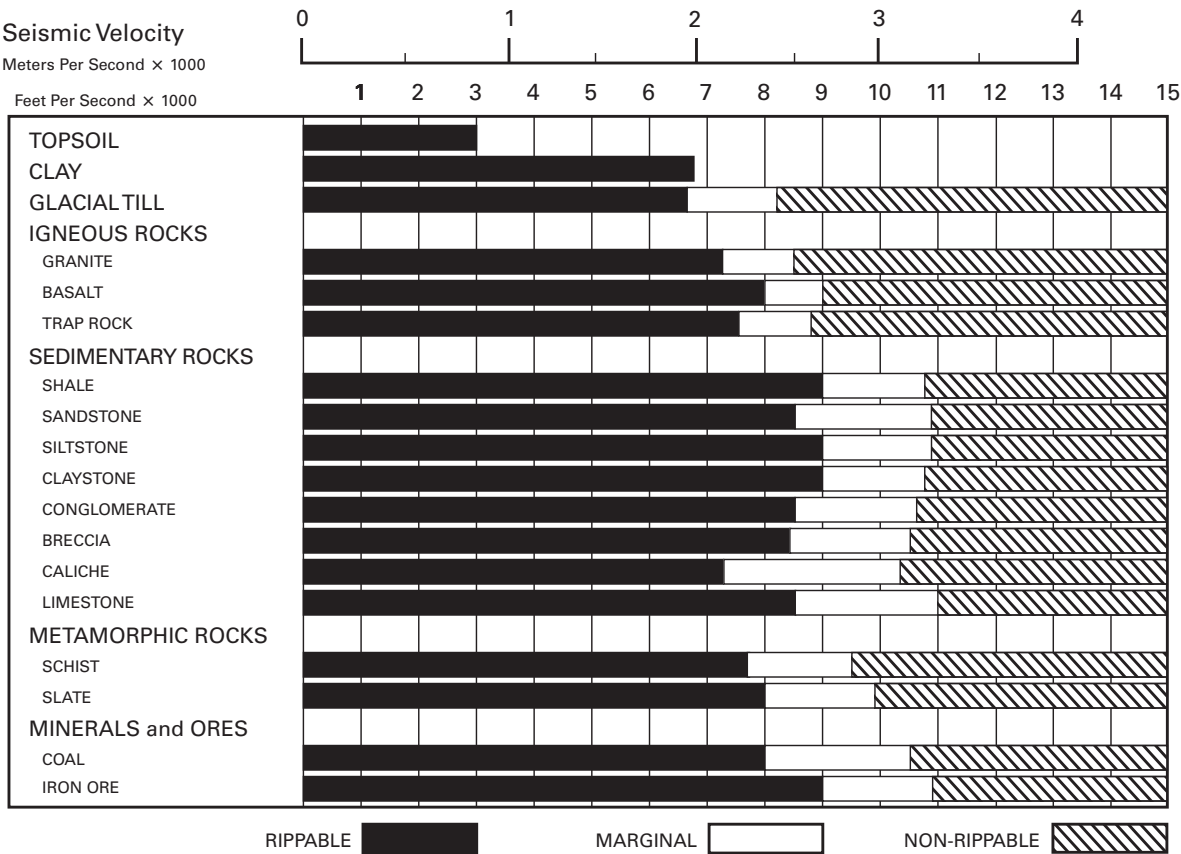
● Multi- or Single Shank No. 9 Ripper

● Estimated by Seismic Wave Velocities



D10T2

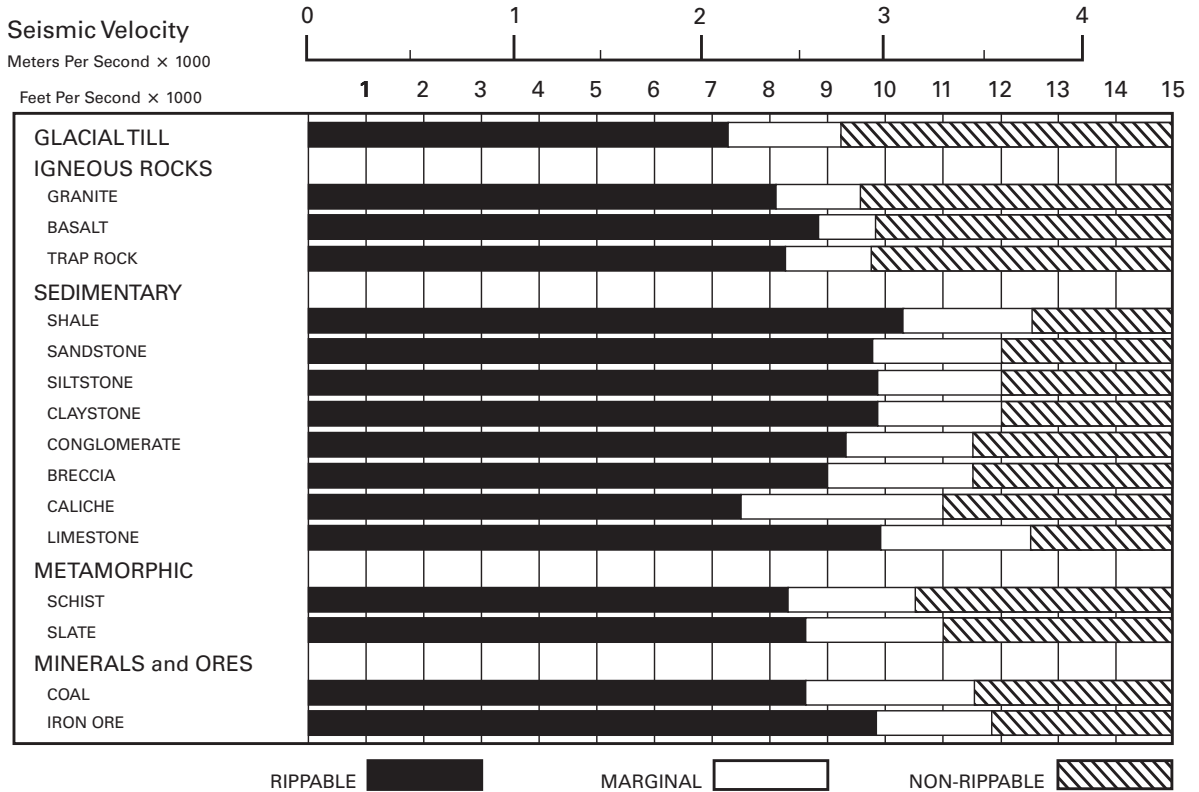
- Multi- or Single Shank No. 10 Ripper
- Estimated by Seismic Wave Velocities



# D11

● Multi- or Single Shank No. 11 Ripper

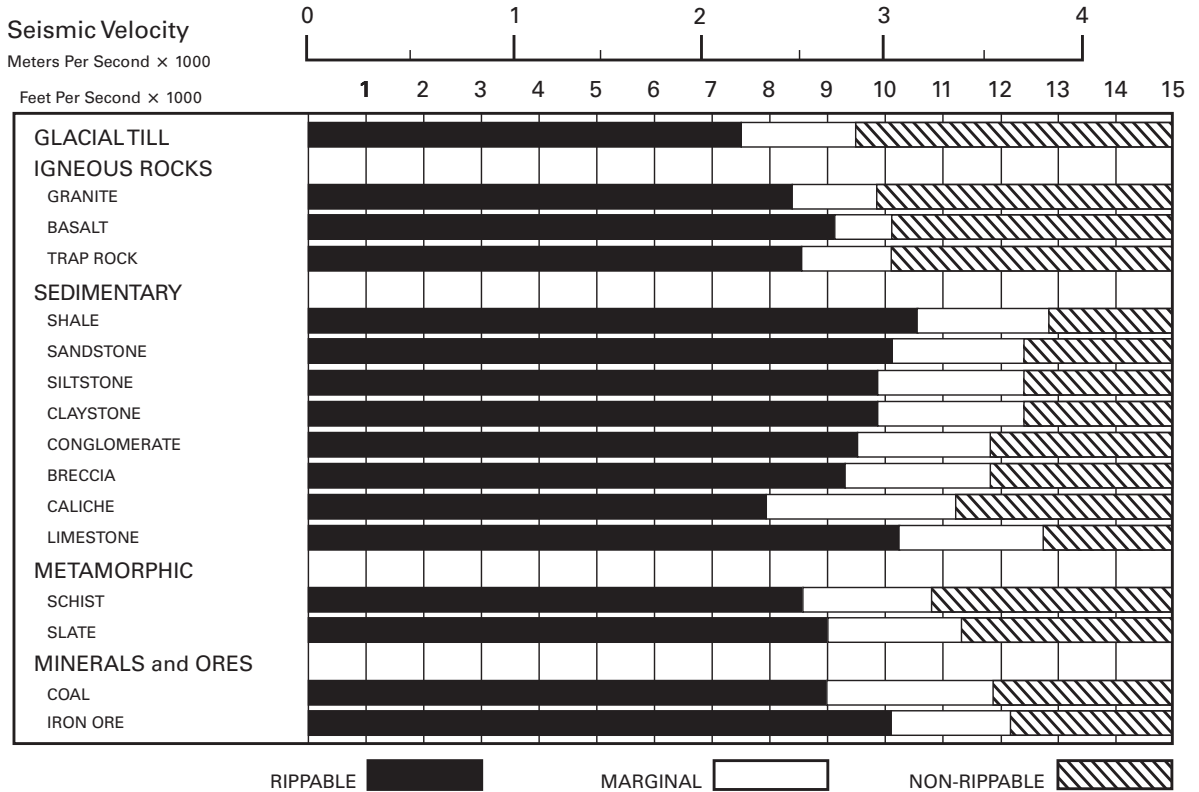
● Estimated by Seismic Wave Velocities



**D11 CD**

● Single Shank No. 11 Ripper

● Estimated by Seismic Wave Velocities



**APPENDIX C**  
**LABORATORY TESTING**

## **APPENDIX C - LABORATORY TESTING**

### **INTRODUCTION**

The laboratory analysis performed for the site consisted of limited testing of the principal soil types sampled during the field investigation to evaluate index properties of subsurface materials. Laboratory tests were performed on selected driven ring or bulk soil samples to estimate engineering characteristics of the various earth materials encountered. Testing was performed in general accordance with ASTM Standards for Soil Testing, latest revision. Soil descriptions and the field and laboratory test results were used to assign parameters to the various materials at the site. Testing procedures are presented below, and results of the laboratory testing program are presented in this appendix, and the test pit and boring logs included in Appendix A.

### **Laboratory Moisture and Dry Unit Weight Determinations**

Moisture content and dry unit weight determinations were performed on select driven ring samples collected to evaluate the natural water content and dry unit weights of the various soils encountered in accordance with ASTM D7263. In addition, moisture contents were determined on select collected bulk samples in accordance with ASTM D2216. The results are presented in Table C-1 – Summary of Laboratory Test Results, and the respective boring logs in Appendix A.

### **Grain Size Distribution**

Grain size distributions were determined for twenty-three selected soil samples in accordance with standard test method ASTM D422. In addition, five tests were performed to determine the amount of material in soils finer than the No. 200 Sieve in accordance with ASTM test method D1140. The results are presented in Table C-1 and in Figures C-1a through C-1s – Gradation Curves or Grain Size Distribution Curve.

### **Atterberg Limits Tests**

Atterberg limits were determined for sixteen selected soil samples. The liquid and plastic limits were determined in accordance with standard test method ASTM D4318. The results are presented in Table C-1 and in Figure C-2 – Plasticity Chart.

### **Direct Shear Tests**

Multistage direct shear tests were performed on thirteen representative driven ring samples to evaluate the shear strength of earth materials. Tests were performed in accordance with standard test method ASTM D3080. The results are presented in Table C-1 and in Figures C-3a and C-3m – Direct Shear.

### **Consolidation Test**

Eight one-dimensional consolidation tests were performed to determine how relatively undisturbed samples performed under increased loading over time. The tests were performed in accordance with ASTM D2435, and test results are presented on Figures C-4a through C-4h – Consolidation.

### **Maximum Unit Weight/Optimum Moisture Content Tests**

Maximum unit weight and optimum moisture content tests were performed on three selected samples of the near surface onsite materials to assess their compaction characteristics. The tests were performed in accordance with ASTM D1557, and the results are presented in Table C-1 and in Figures C-4a through C-4c – Modified Proctor.

### **Soil Chemistry Tests/Corrosion Tests**

Soil corrosion suites were performed on four select bulk and ring samples to evaluate resistivity (ASTM G187), pH (ASTM D4972), sulfate (ASTM C1580), and chloride (WK93649). Results of the testing and an analysis of the corrosivity to reinforcement steel and concrete materials are summarized in the main report. Test results are also presented in Table C-1.

### **Expansion Index Tests**

Expansion Index tests were performed on five near surface bulk samples to evaluate the expansion potential of the site materials. Tests were performed in accordance with ASTM D4829, and the results are presented in Table C-1.

### **R-Value Tests**

R-value tests were performed on two selected soil samples of subgrade earth material. The tests were performed in accordance with standard test method ASTM D2844 and test results are presented on Table C-1.

**TABLE C-1**  
**SUMMARY OF LABORATORY TEST RESULTS**

| Boring | Depth   | USCS   | Moisture Content | In-Situ Moist Unit Weight | In-Situ Dry Unit Weight | Passing #200 Sieve | Atterberg Limits |     | Expansion Index | Peak Shear Strength |         | 'R' Value | Maximum Unit Weight / Optimum Moisture Content |              | Corrosion Potential |      |              |              |
|--------|---------|--------|------------------|---------------------------|-------------------------|--------------------|------------------|-----|-----------------|---------------------|---------|-----------|------------------------------------------------|--------------|---------------------|------|--------------|--------------|
| No.    | (feet)  | Symbol | (%)              | (pcf)                     | (pcf)                   | (%)                | (%)              | (%) | EI              | φ (deg)             | c (psf) | 'R'       | Unit Weight (pcf)                              | Moisture (%) | Resistivity (ohm)   | pH   | Chorides (%) | Sulfates (%) |
| TP-1   | 1-3     | SC     | 8.1              | --                        | --                      | 46.6               | 29               | 17  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| TP-3   | 0-1     | SC     | 6.0              | --                        | --                      | 33.7               | 32               | 19  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| TP-3   | 6-7     | SC     | 12.8             | --                        | --                      | 52.7               | 37               | 24  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| TP-3   | 8.5-9.5 | SC     | 18.9             | --                        | --                      | --                 | --               | --  | 79              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| TP-3   | 12-13   | SM     | 17.4             | --                        | --                      | 46.4               | 26               | 22  | 13              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| TP-4   | 6.5-7.5 | Tcv    | 9.3              | --                        | --                      | 24.4               | 34               | 27  | 11              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-1   | 3.5     | CL     | 9.3              | 101.4                     | 92.8                    | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-1   | 6.0     | CL     | 11.8             | 119.7                     | 107.1                   | --                 | --               | --  | --              | 28                  | 438     | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-1   | 8.5     | CL     | 16.1             | 121.8                     | 104.9                   | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-1   | 11.0    | CL     | 16.6             | 126.5                     | 108.5                   | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-1   | 13.5    | SC     | 16.7             | 123.9                     | 106.2                   | 38.8               | 34               | 20  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-1   | 16.0    | CL     | 25.5             | 123.7                     | 98.6                    | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-1   | 22.5    | Tcv    | 17.2             | 135.0                     | 115.2                   | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-2   | 0-5     | SC     | 9.7              | --                        | --                      | 43.4               | --               | --  | 35              | --                  | --      | --        | --                                             | --           | 1,400               | 7.19 | 0.0115       | 0.0040       |
| BH-2   | 3.5     | SM     | 15.9             | 100.9                     | 87.1                    | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-2   | 6.0     | SC     | 17.1             | 105.4                     | 90.0                    | --                 | --               | --  | --              | 29                  | 114     | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-2   | 8.5     | SC     | 27.5             | 117.8                     | 92.4                    | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-2   | 11.0    | SC     | 29.6             | 113.4                     | 87.5                    | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-2   | 13.5    | SC     | 26.9             | 122.7                     | 96.7                    | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-2   | 18.0    | Tcv    | 15.6             | 133.1                     | 115.1                   | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-2   | 20.0    | Tcv    | 14.1             | 107.3                     | 94.0                    | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-2   | 25.5    | Tcv    | 34.3             | 118.2                     | 88.0                    | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-3   | 3.5     | SC     | 14.0             | 116.9                     | 102.5                   | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-3   | 6.0     | CL     | 20.8             | 114.9                     | 95.1                    | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-3   | 8.5     | CL     | 25.0             | 119.3                     | 95.4                    | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-3   | 11.0    | CL     | 24.1             | 124.8                     | 100.6                   | 66.8               | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-3   | 13.5    | CL     | 27.6             | 119.2                     | 93.4                    | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-3   | 16.0    | GP-GC  | 20.8             | 125.4                     | 103.8                   | 16.7               | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-3   | 21.0    | ML     | 26.6             | 127.1                     | 100.4                   | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-3   | 26.0    | Tcv    | 25.7             | 124.9                     | 99.4                    | --                 | --               | --  | --              | --                  | --      | --        | --                                             | --           | --                  | --   | --           | --           |

**TABLE C-1**  
**SUMMARY OF LABORATORY TEST RESULTS**

| Boring | Depth  | USCS   | Moisture Content | In-Situ Moist Unit Weight | In-Situ Dry Unit Weight | Passing #200 Sieve | Atterberg Limits<br>LL PL |     | Expansion Index | Peak Shear Strength<br>$\phi$ (deg) c (psf) |         | 'R' Value | Maximum Unit Weight / Optimum Moisture Content |              | Corrosion Potential |      |              |              |
|--------|--------|--------|------------------|---------------------------|-------------------------|--------------------|---------------------------|-----|-----------------|---------------------------------------------|---------|-----------|------------------------------------------------|--------------|---------------------|------|--------------|--------------|
| No.    | (feet) | Symbol | (%)              | (pcf)                     | (pcf)                   | (%)                | (%)                       | (%) | EI              | $\phi$ (deg)                                | c (psf) | 'R'       | Unit Weight (pcf)                              | Moisture (%) | Resistivity (ohm)   | pH   | Chorides (%) | Sulfates (%) |
| BH-3   | 28.0   | Tcv    | 16.7             | 133.9                     | 114.7                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-4   | 0-5    | SC     | 8.5              | --                        | --                      | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-4   | 3.5    | SC     | 10.0             | 111.2                     | 101.1                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-4   | 6.0    | SC     | 7.3              | 110.3                     | 102.8                   | 39.2               | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-4   | 8.5    | SC     | 11.1             | 107.7                     | 96.9                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-4   | 11.0   | Tcv    | 10.3             | 116.1                     | 105.3                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-4   | 13.0   | Tcv    | 12.7             | 110.1                     | 97.7                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-5   | 3.5    | CL     | 16.8             | 106.3                     | 91.0                    | 50.4               | 31                        | 19  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-5   | 6.0    | CL     | 18.2             | 108.9                     | 92.1                    | --                 | --                        | --  | --              | 32                                          | 96      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-5   | 8.5    | CL     | 20.5             | 111.5                     | 92.5                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-5   | 11.0   | CL     | 24.0             | 112.6                     | 90.8                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-5   | 13.5   | SP     | 27.5             | 125.5                     | 98.4                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-5   | 16.0   | CL     | 24.6             | 126.1                     | 101.2                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-5   | 21.0   | GP-GC  | 9.5              | 123.5                     | 112.8                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-5   | 25.25  | Tcv    | 15.0             | 133.6                     | 116.2                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-6   | 0-5    | SC     | 14.2             | --                        | --                      | 38.2               | 39                        | 20  | --              | --                                          | --      | --        | 119.2                                          | 11.3         | 775                 | 7.85 | 0.0160       | 0.0290       |
| BH-6   | 3.5    | SC     | 17.3             | 110.4                     | 94.1                    | --                 | --                        | --  | --              | 29                                          | 90      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-6   | 6.0    | SC     | 17.3             | 112.8                     | 96.2                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-6   | 8.5    | CL     | 23.0             | 123.7                     | 100.6                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-6   | 11.0   | CL     | 21.4             | 124.2                     | 102.3                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-6   | 13.5   | CL     | 23.3             | 123.8                     | 100.4                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-6   | 16.0   | SC     | 26.4             | 122.1                     | 96.6                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-6   | 21.0   | GP-GC  | 26.6             | 114.8                     | 90.7                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-6   | 26.0   | GP-GC  | 17.8             | 130.6                     | 110.9                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-7   | 0-5    | SC     | 18.4             | --                        | --                      | 40.9               | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-7   | 3.5    | SC     | 18.7             | 118.3                     | 99.7                    | --                 | --                        | --  | --              | 28                                          | 222     | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-7   | 6.0    | CL     | 20.5             | 117.5                     | 97.5                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-7   | 8.5    | SC     | 18.9             | 127.3                     | 107.1                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-7   | 11.0   | SC     | 21.5             | 121.1                     | 99.7                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-7   | 13.5   | SP-SC  | 12.3             | 122.4                     | 109.0                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --           | --           |

**TABLE C-1  
SUMMARY OF LABORATORY TEST RESULTS**

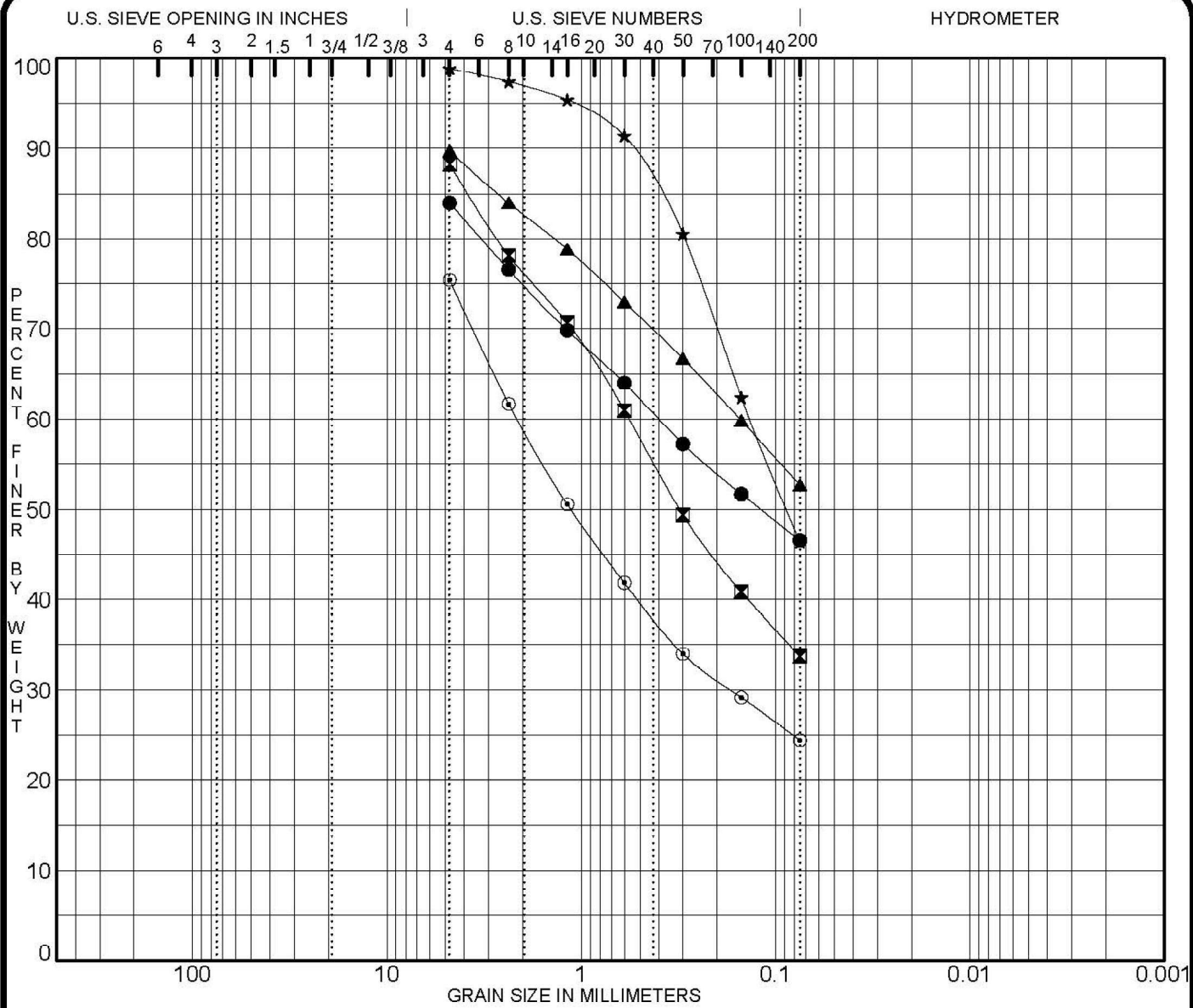
| Boring | Depth  | USCS   | Moisture Content | In-Situ Moist Unit Weight | In-Situ Dry Unit Weight | Passing #200 Sieve | Atterberg Limits<br>LL PL |     | Expansion Index | Peak Shear Strength<br>$\phi$ (deg) c (psf) |         | 'R' Value | Maximum Unit Weight / Optimum Moisture Content |              | Corrosion Potential |      |               |              |
|--------|--------|--------|------------------|---------------------------|-------------------------|--------------------|---------------------------|-----|-----------------|---------------------------------------------|---------|-----------|------------------------------------------------|--------------|---------------------|------|---------------|--------------|
| No.    | (feet) | Symbol | (%)              | (pcf)                     | (pcf)                   | (%)                | (%)                       | (%) | EI              | $\phi$ (deg)                                | c (psf) | 'R'       | Unit Weight (pcf)                              | Moisture (%) | Resistivity (ohm)   | pH   | Chlorides (%) | Sulfates (%) |
| BH-7   | 16.0   | SP-SC  | 21.8             | 126.4                     | 103.8                   | 13.3               | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-7   | 21.0   | GC     | 21.0             | 132.3                     | 109.3                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-7   | 26.0   | GP-GC  | 20.2             | 139.1                     | 115.7                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-8   | 0-5    | CL     | 14.7             | --                        | --                      | --                 | --                        | --  | 40              | --                                          | --      | --        | 118.0                                          | 12.4         | --                  | --   | --            | --           |
| BH-8   | 3.5    | CL     | 14.3             | 132.7                     | 116.1                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-8   | 6.0    | CL     | 16.5             | 132.3                     | 113.6                   | 42.5               | 38                        | 19  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-8   | 8.5    | SC     | 12.7             | 133.8                     | 118.7                   | --                 | --                        | --  | --              | 30                                          | 522     | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-8   | 11.0   | SC     | 19.0             | 130.2                     | 109.4                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-8   | 13.5   | SC     | 19.9             | 127.2                     | 106.1                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-8   | 16.0   | SC     | 13.9             | 127.3                     | 111.8                   | --                 | --                        | --  | --              | 36                                          | 546     | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-9   | 3.5    | CL     | 15.9             | 117.6                     | 101.5                   | --                 | 37                        | 20  | --              | 32                                          | 180     | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-9   | 8.5    | GC     | 10.1             | 123.8                     | 112.4                   | 18.3               | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-9   | 11.0   | SP     | 24.5             | 124.0                     | 99.6                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-9   | 13.5   | CL     | 11.2             | 124.7                     | 112.1                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-9   | 16.0   | SC     | 25.8             | 124.5                     | 99.0                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-9   | 21.0   | SP-SM  | 19.8             | 136.3                     | 113.8                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-9   | 25.0   | SP-SM  | 9.1              | 133.1                     | 122.0                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-9   | 30.5   | SP-SM  | 14.5             | 128.7                     | 112.4                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-10  | 3.5    | CL     | 19.0             | 118.9                     | 99.9                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-10  | 6.0    | CL     | 17.3             | 128.9                     | 109.9                   | --                 | --                        | --  | --              | 33                                          | 324     | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-10  | 11.0   | CL     | 20.5             | 127.1                     | 105.5                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-10  | 13.5   | CL     | 18.3             | 120.4                     | 101.8                   | 46.4               | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-10  | 16.0   | CL     | 21.5             | 125.6                     | 103.4                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-10  | 21.0   | SC     | 21.4             | 127.1                     | 104.7                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-10  | 26.0   | GP-GC  | 31.3             | 117.5                     | 89.5                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-10  | 35.0   | GP-GC  | 23.1             | 129.1                     | 104.9                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-11  | 0-5    | SC     | 19.4             | --                        | --                      | 47.8               | 41                        | 19  | --              | --                                          | --      | --        | 118.1                                          | 12.9         | 1,100               | 7.91 | 0.0095        | 0.0110       |
| BH-11  | 3.5    | SC     | 19.1             | 129.3                     | 108.6                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-11  | 6.0    | SC     | 13.2             | 129.4                     | 114.3                   | --                 | --                        | --  | --              | 25                                          | 792     | --        | --                                             | --           | --                  | --   | --            | --           |
| BH-11  | 8.5    | SC     | 13.7             | 129.6                     | 114.0                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | --   | --            | --           |

**TABLE C-1**  
**SUMMARY OF LABORATORY TEST RESULTS**

| Boring | Depth  | USCS   | Moisture Content | In-Situ Moist Unit Weight | In-Situ Dry Unit Weight | Passing #200 Sieve | Atterberg Limits<br>LL PL |     | Expansion Index | Peak Shear Strength<br>φ (deg) c (psf) |         | 'R' Value | Maximum Unit Weight / Optimum Moisture Content |              | Corrosion Potential |      |              |              |
|--------|--------|--------|------------------|---------------------------|-------------------------|--------------------|---------------------------|-----|-----------------|----------------------------------------|---------|-----------|------------------------------------------------|--------------|---------------------|------|--------------|--------------|
| No.    | (feet) | Symbol | (%)              | (pcf)                     | (pcf)                   | (%)                | (%)                       | (%) | EI              | φ (deg)                                | c (psf) | 'R'       | Unit Weight (pcf)                              | Moisture (%) | Resistivity (ohm)   | pH   | Chorides (%) | Sulfates (%) |
| BH-11  | 13.5   | SC     | 12.0             | 115.4                     | 103.0                   | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-11  | 16.0   | SC     | 10.7             | 116.9                     | 105.6                   | 15.6               | 31                        | 21  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-11  | 18.5   | SP-SC  | 17.6             | 120.4                     | 102.4                   | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-11  | 21.0   | CL     | 22.3             | 112.9                     | 92.3                    | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-11  | 26.0   | CL     | 33.6             | 115.4                     | 86.4                    | 56.8               | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-12  | 0-5    | SC     | 17.7             | --                        | --                      | 37.9               | 38                        | 20  | --              | --                                     | --      | 25        | --                                             | --           | 1,300               | 7.98 | 0.0120       | 0.0030       |
| BH-12  | 3.5    | SC     | 15.8             | 118.8                     | 102.6                   | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-12  | 8.5    | SP-SC  | 23.6             | 125.5                     | 101.5                   | --                 | --                        | --  | --              | 33                                     | 186     | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-12  | 11.0   | SP     | 20.0             | 131.9                     | 109.9                   | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-12  | 16.0   | SP     | 17.3             | 136.9                     | 116.7                   | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-12  | 20.0   | Tcv    | 13.5             | 144.1                     | 127.0                   | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-13  | 0-5    | CL     | 18.4             | --                        | --                      | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-13  | 3.5    | CL     | 17.6             | 124.4                     | 105.8                   | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-13  | 6.0    | SP-SC  | 14.4             | 119.0                     | 104.0                   | --                 | --                        | --  | --              | 42                                     | 414     | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-13  | 11.0   | SC     | 43.9             | 121.2                     | 84.2                    | 46.2               | 44                        | 24  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-13  | 13.5   | SC     | 25.8             | 126.6                     | 100.6                   | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-13  | 16.0   | CL     | 15.5             | 126.1                     | 109.2                   | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-13  | 20.0   | SC     | 14.9             | 138.3                     | 120.4                   | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-14  | 0-5    | SM     | 10.1             | --                        | --                      | 30.1               | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-14  | 3.5    | CL     | 8.2              | 99.8                      | 92.2                    | --                 | --                        | --  | --              | 34                                     | 36      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-14  | 6.0    | SM     | 12.4             | 104.4                     | 92.9                    | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-14  | 8.5    | ML     | 26.7             | 110.0                     | 86.8                    | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-14  | 11.0   | SP-SC  | 17.4             | 116.9                     | 99.6                    | 9.2                | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-14  | 16.0   | SC     | 26.8             | 123.1                     | 97.1                    | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-14  | 20.5   | Tcv    | 11.6             | 141.0                     | 126.3                   | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| BH-14  | 25.5   | Tcv    | 14.7             | 140.0                     | 122.1                   | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| P-1    | 0-5    | SC     | 13.5             | --                        | --                      | 30.1               | 42                        | 20  | --              | --                                     | --      | 24        | --                                             | --           | --                  | --   | --           | --           |
| P-1    | 3.5    | SC     | 25.0             | 118.6                     | 94.9                    | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| P-1    | 6.0    | SC     | 15.6             | 111.8                     | 96.7                    | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |
| P-1    | 8.5    | SP     | 22.7             | 108.5                     | 88.4                    | --                 | --                        | --  | --              | --                                     | --      | --        | --                                             | --           | --                  | --   | --           | --           |

**TABLE C-1  
SUMMARY OF LABORATORY TEST RESULTS**

| Boring | Depth  | USCS   | Moisture Content | In-Situ Moist Unit Weight | In-Situ Dry Unit Weight | Passing #200 Sieve | Atterberg Limits<br>LL PL |     | Expansion Index | Peak Shear Strength<br>$\phi$ (deg) c (psf) |         | 'R' Value | Maximum Unit Weight / Optimum Moisture Content |              | Corrosion Potential |    |               |              |
|--------|--------|--------|------------------|---------------------------|-------------------------|--------------------|---------------------------|-----|-----------------|---------------------------------------------|---------|-----------|------------------------------------------------|--------------|---------------------|----|---------------|--------------|
| No.    | (feet) | Symbol | (%)              | (pcf)                     | (pcf)                   | (%)                | (%)                       | (%) | EI              | $\phi$ (deg)                                | c (psf) | 'R'       | Unit Weight (pcf)                              | Moisture (%) | Resistivity (ohm)   | pH | Chlorides (%) | Sulfates (%) |
| P-1    | 11.0   | SC     | 23.3             | 119.0                     | 96.5                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | -- | --            | --           |
| P-2    | 0-5    | CL     | 13.4             | --                        | --                      | 38.9               | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | -- | --            | --           |
| P-2    | 3.5    | CL     | 18.1             | 130.5                     | 110.5                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | -- | --            | --           |
| P-2    | 6.0    | CL     | 17.1             | 131.7                     | 112.5                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | -- | --            | --           |
| P-2    | 8.5    | CL     | 15.2             | 111.3                     | 96.6                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | -- | --            | --           |
| P-2    | 11.0   | CL     | 18.1             | 117.2                     | 99.2                    | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | -- | --            | --           |
| P-3    | 3.5    | SC     | 17.6             | 127.8                     | 108.7                   | 37.2               | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | -- | --            | --           |
| P-3    | 7.5    | CL     | 23.5             | --                        | --                      | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | -- | --            | --           |
| P-4    | 0-5    | CL     | 12.8             | --                        | --                      | 48.2               | 39                        | 18  | --              | --                                          | --      | --        | --                                             | --           | --                  | -- | --            | --           |
| P-4    | 6.0    | CL     | 15.2             | 124.4                     | 108.0                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | -- | --            | --           |
| P-5    | 3.5    | SC     | 12.3             | 135.3                     | 120.5                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | -- | --            | --           |
| P-5    | 6.5    | GC     | 13.1             | 122.7                     | 108.5                   | --                 | --                        | --  | --              | --                                          | --      | --        | --                                             | --           | --                  | -- | --            | --           |



| COBBLES | GRAVEL |      | SAND   |        |      | SILT OR CLAY |
|---------|--------|------|--------|--------|------|--------------|
|         | coarse | fine | coarse | medium | fine |              |

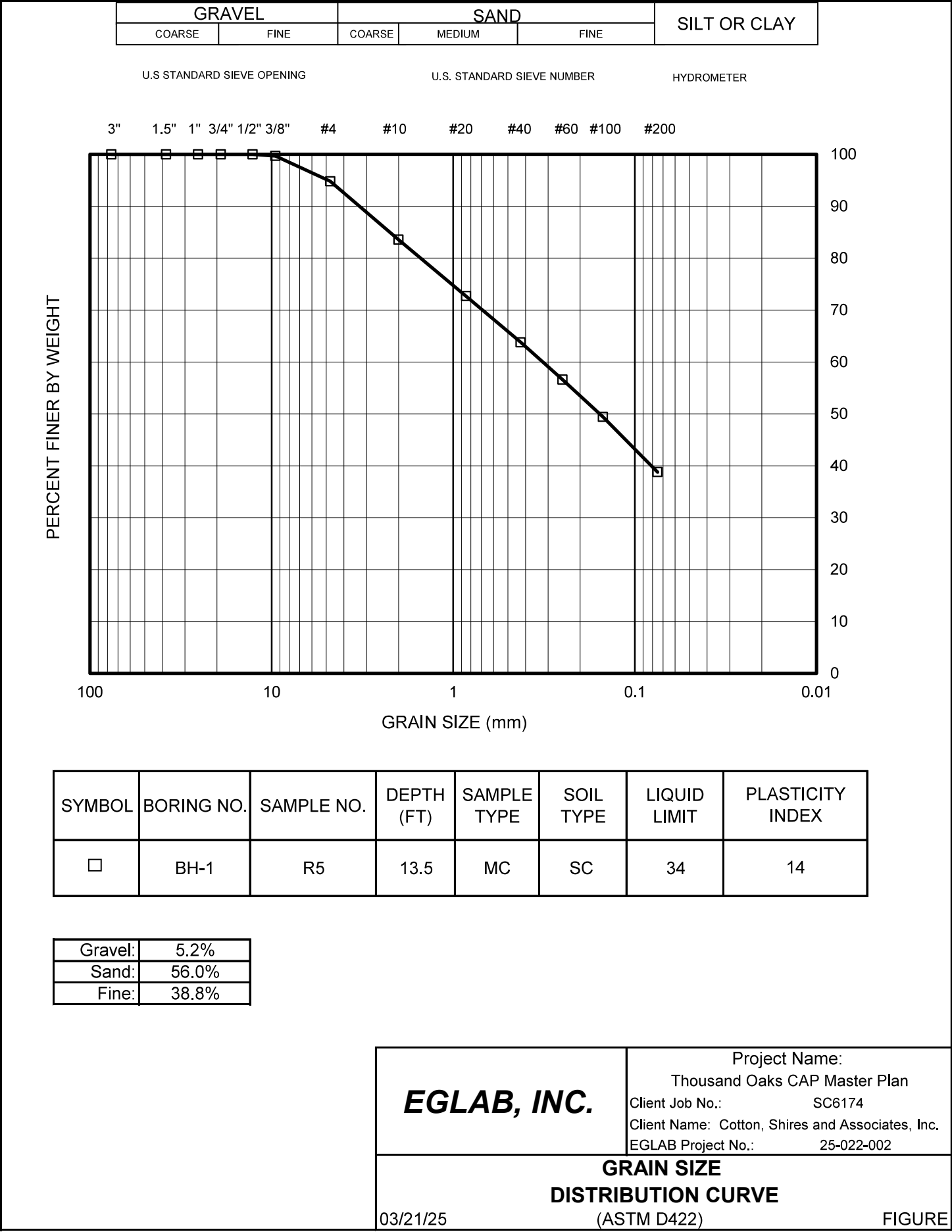
| Specimen Identification |      |      | USCS Classification |  | MC% | LL | PL | PI | Cc | Cu |
|-------------------------|------|------|---------------------|--|-----|----|----|----|----|----|
| ●                       | TP-1 | 1.0  | 1' - 3'             |  | 8   | 29 | 17 | 13 |    |    |
| ⊠                       | TP-3 | 0.0  | 0' - 1'             |  | 6   | 32 | 19 | 14 |    |    |
| ▲                       | TP-3 | 6.0  | 6' - 7'             |  | 13  | 37 | 24 | 13 |    |    |
| ★                       | TP-3 | 12.0 | 12' - 13'           |  | 17  | 26 | 22 | 4  |    |    |
| ⊙                       | TP-4 | 6.5  | 6.5' - 7'           |  | 9   | 34 | 27 | 8  |    |    |

| Specimen Identification |      |      | D100 | D60  | D30   | D10 | %Gravel | %Sand | %Silt | %Clay |
|-------------------------|------|------|------|------|-------|-----|---------|-------|-------|-------|
| ●                       | TP-1 | 1.0  | 4.75 | 0.40 |       |     | 16.0    | 37.4  | 46.6  |       |
| ⊠                       | TP-3 | 0.0  | 4.75 | 0.57 |       |     | 11.7    | 54.6  | 33.7  |       |
| ▲                       | TP-3 | 6.0  | 4.75 | 0.15 |       |     | 10.3    | 37.0  | 52.7  |       |
| ★                       | TP-3 | 12.0 | 4.75 | 0.14 |       |     | 1.2     | 52.4  | 46.4  |       |
| ⊙                       | TP-4 | 6.5  | 4.75 | 2.12 | 0.170 |     | 24.6    | 51.0  | 24.4  |       |

PROJECT - City of Thousand Oaks- CAP

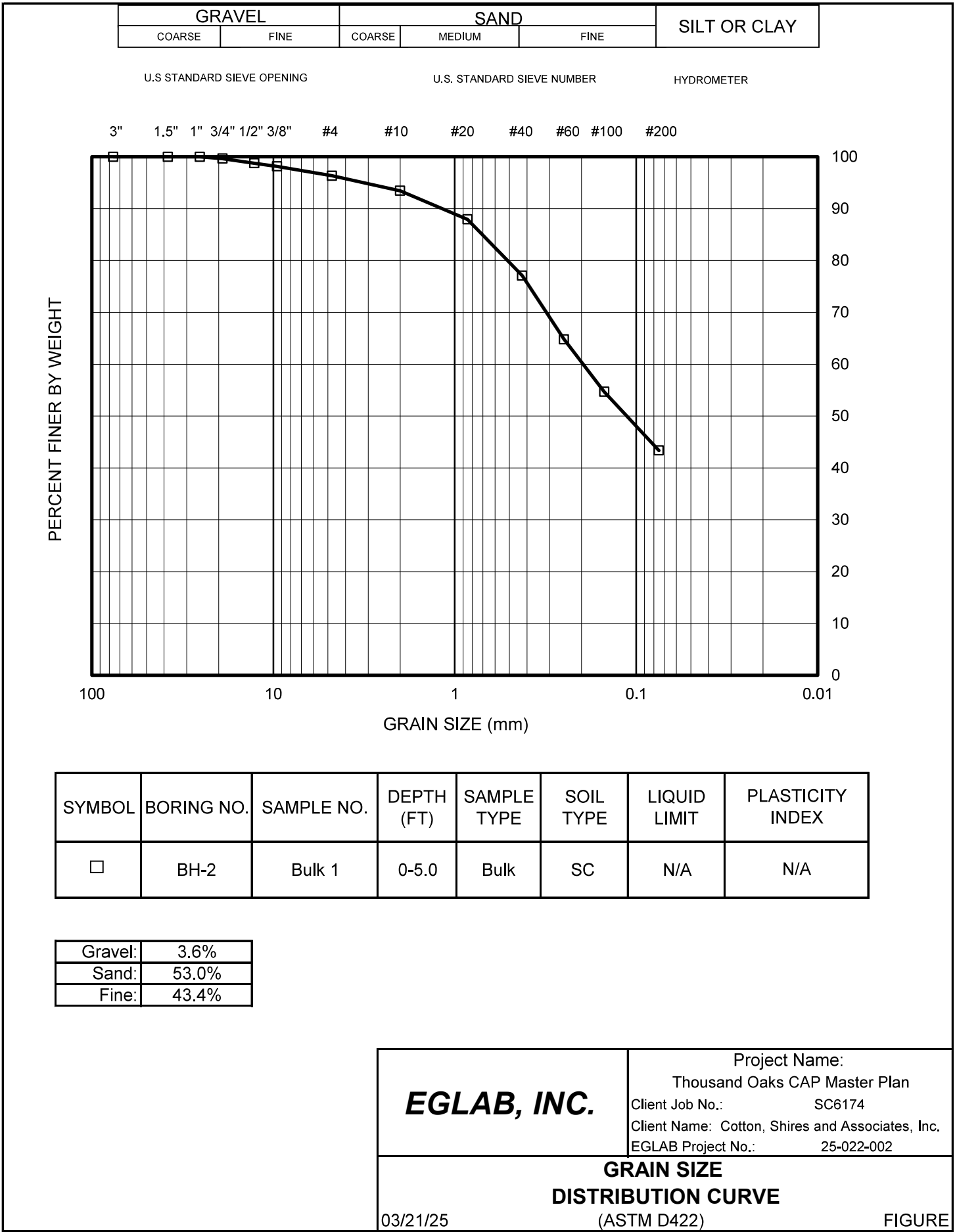
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Civic Arts Plaza Master Plan  
City of Thousand Oaks, California

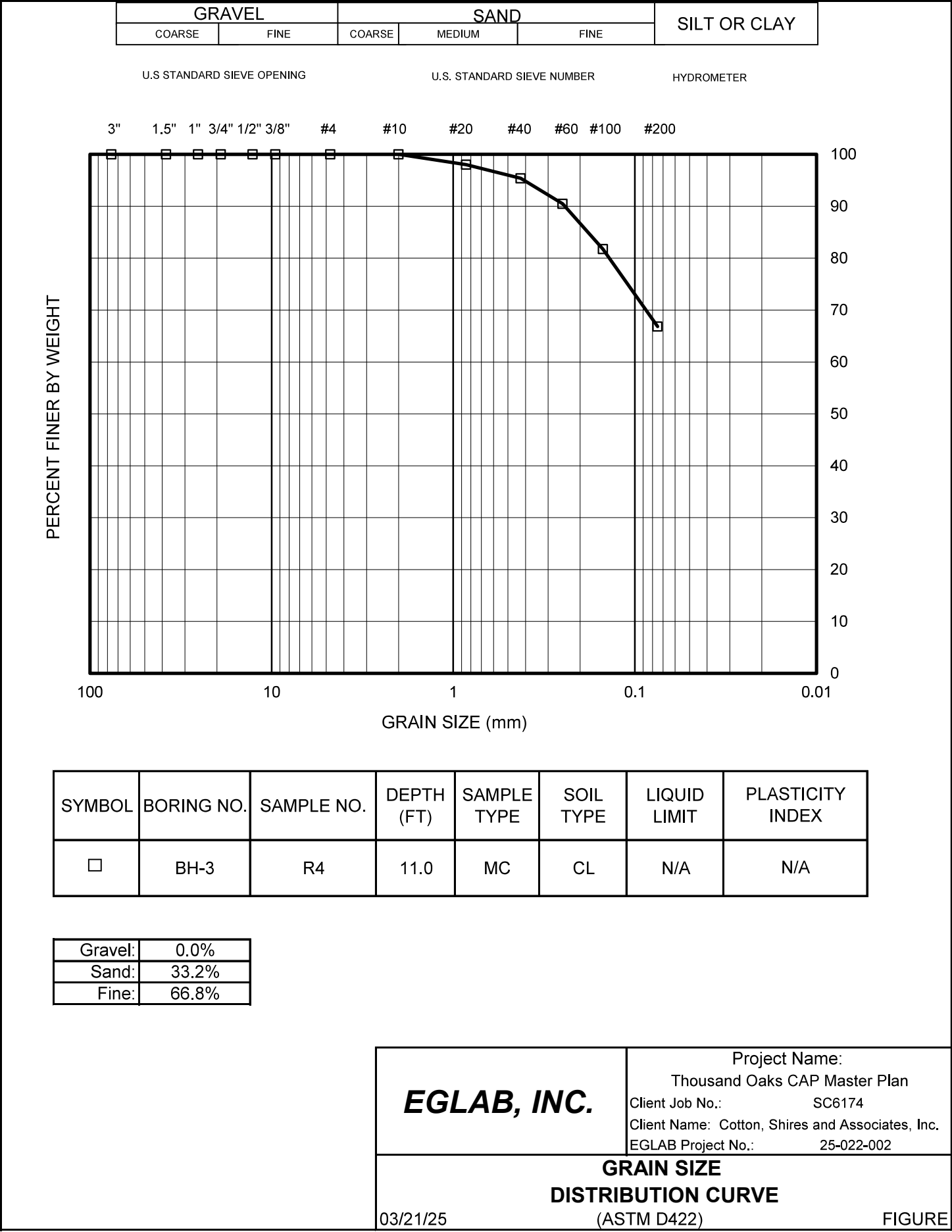
Figure C-1a

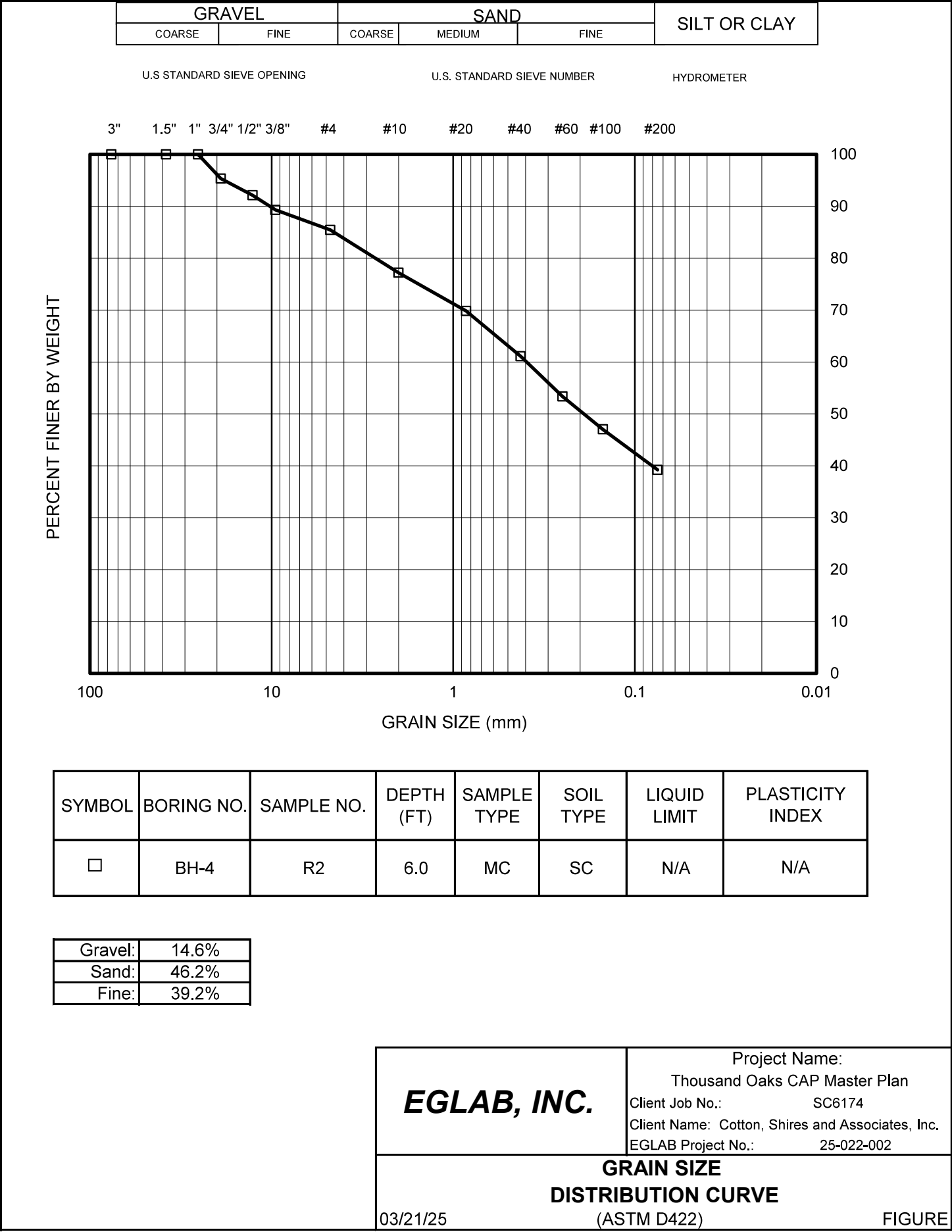


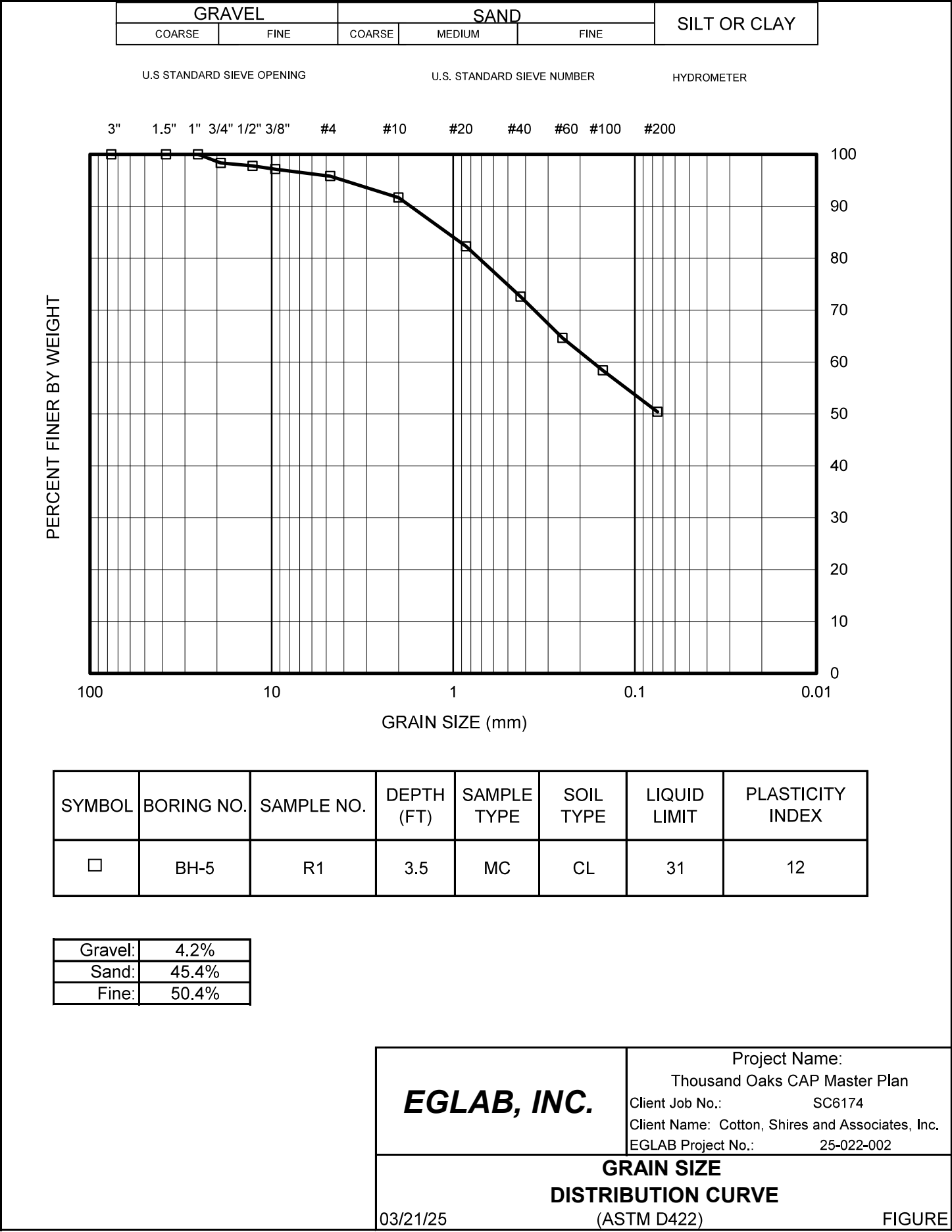
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City of Thousand Oaks, California

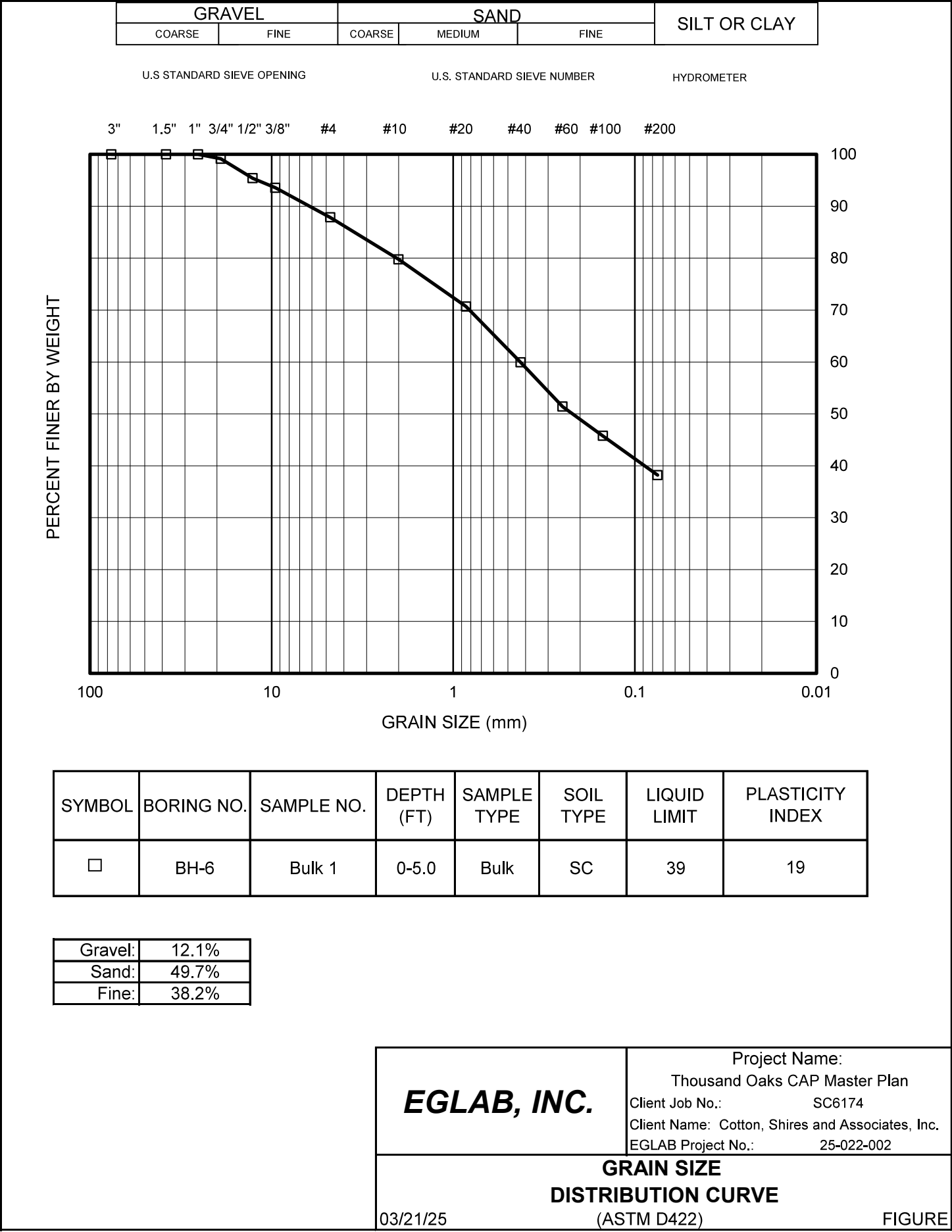
Figure C-1b

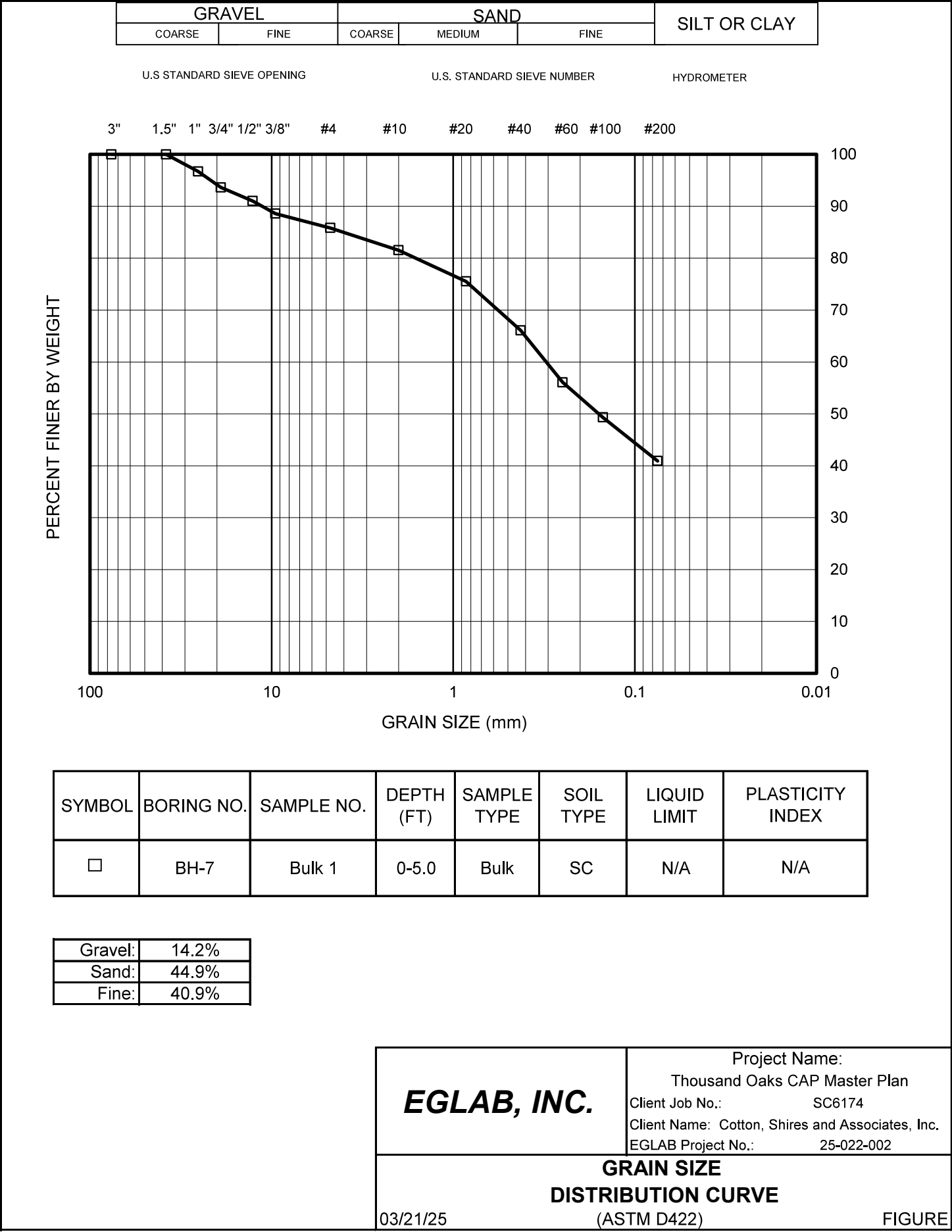


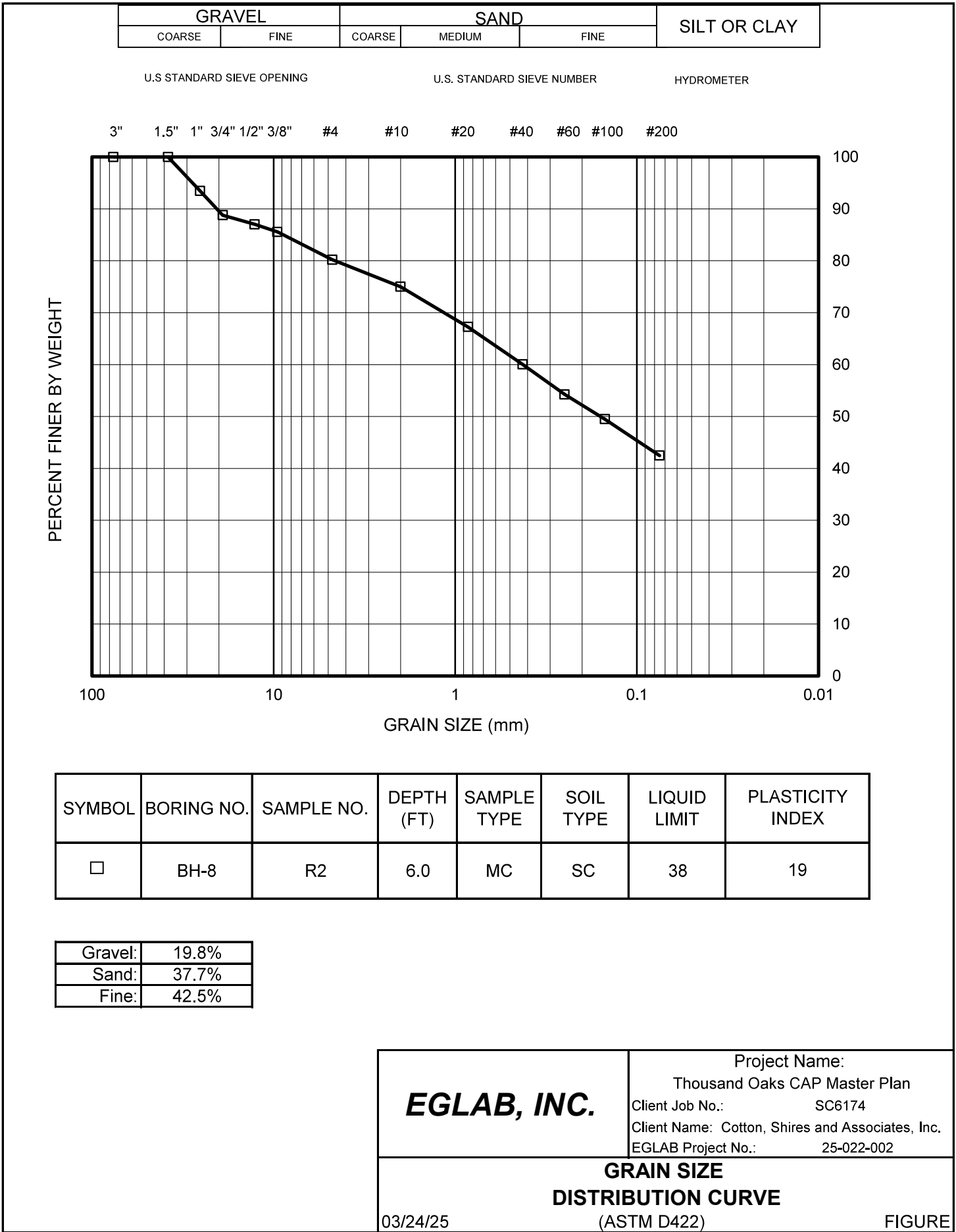




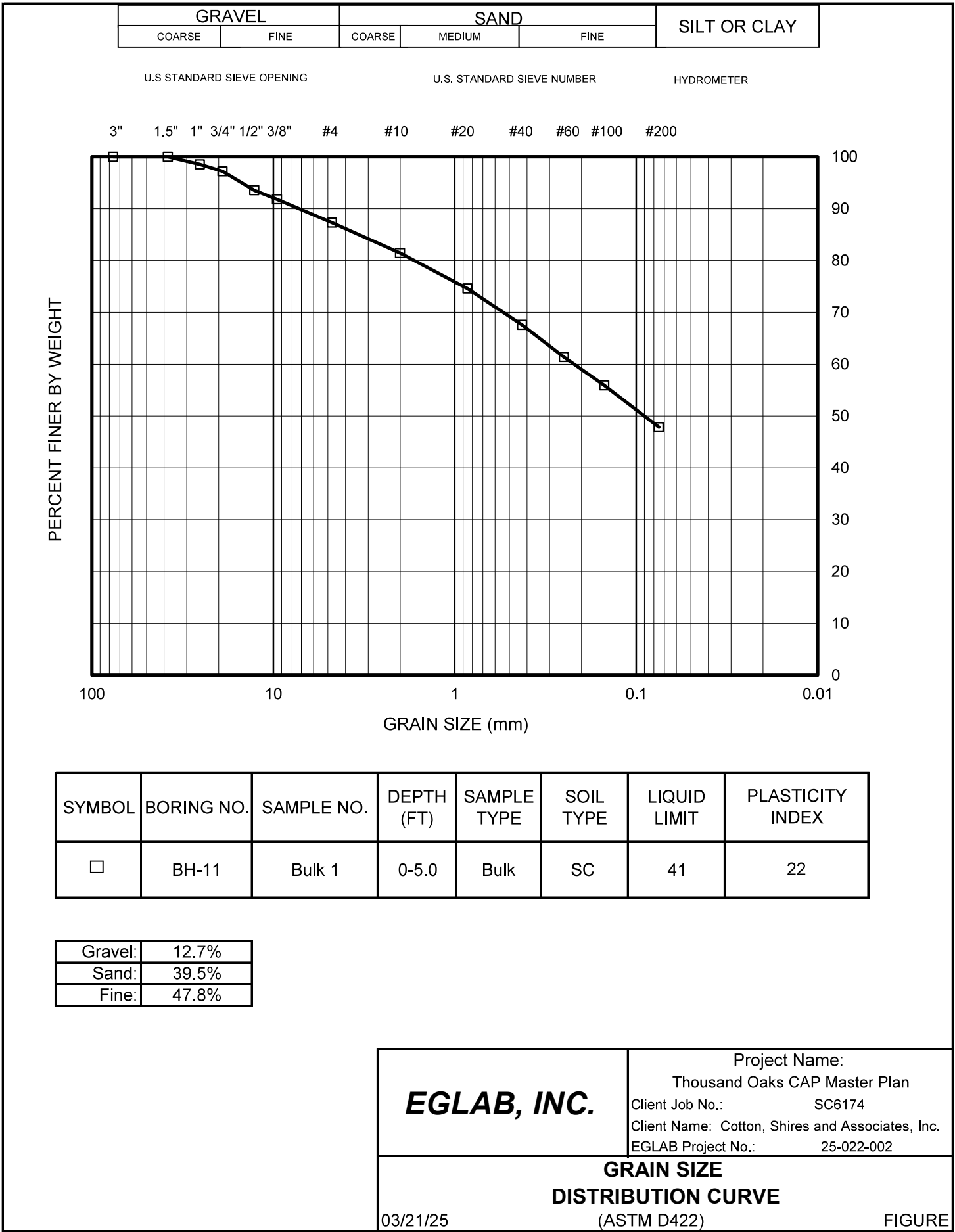


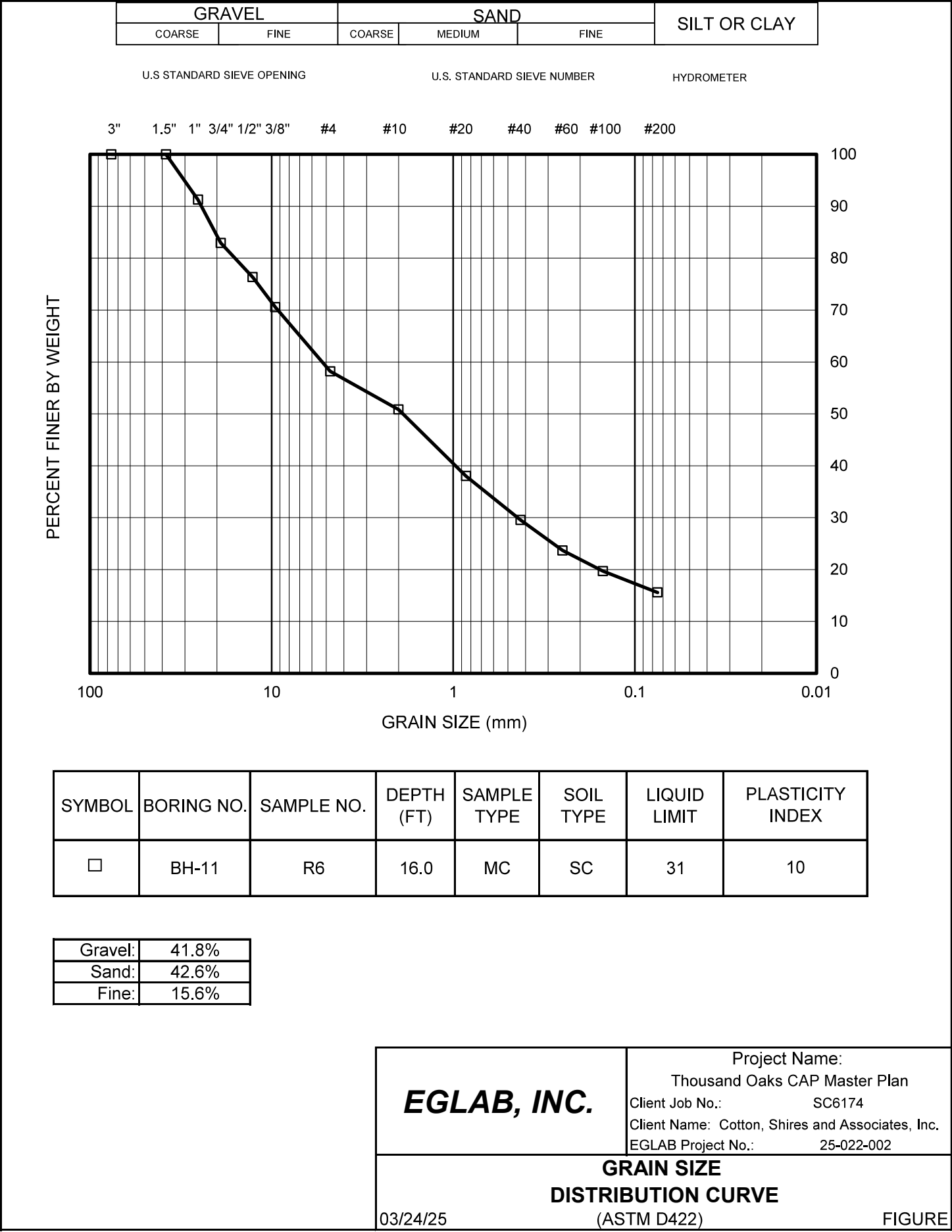


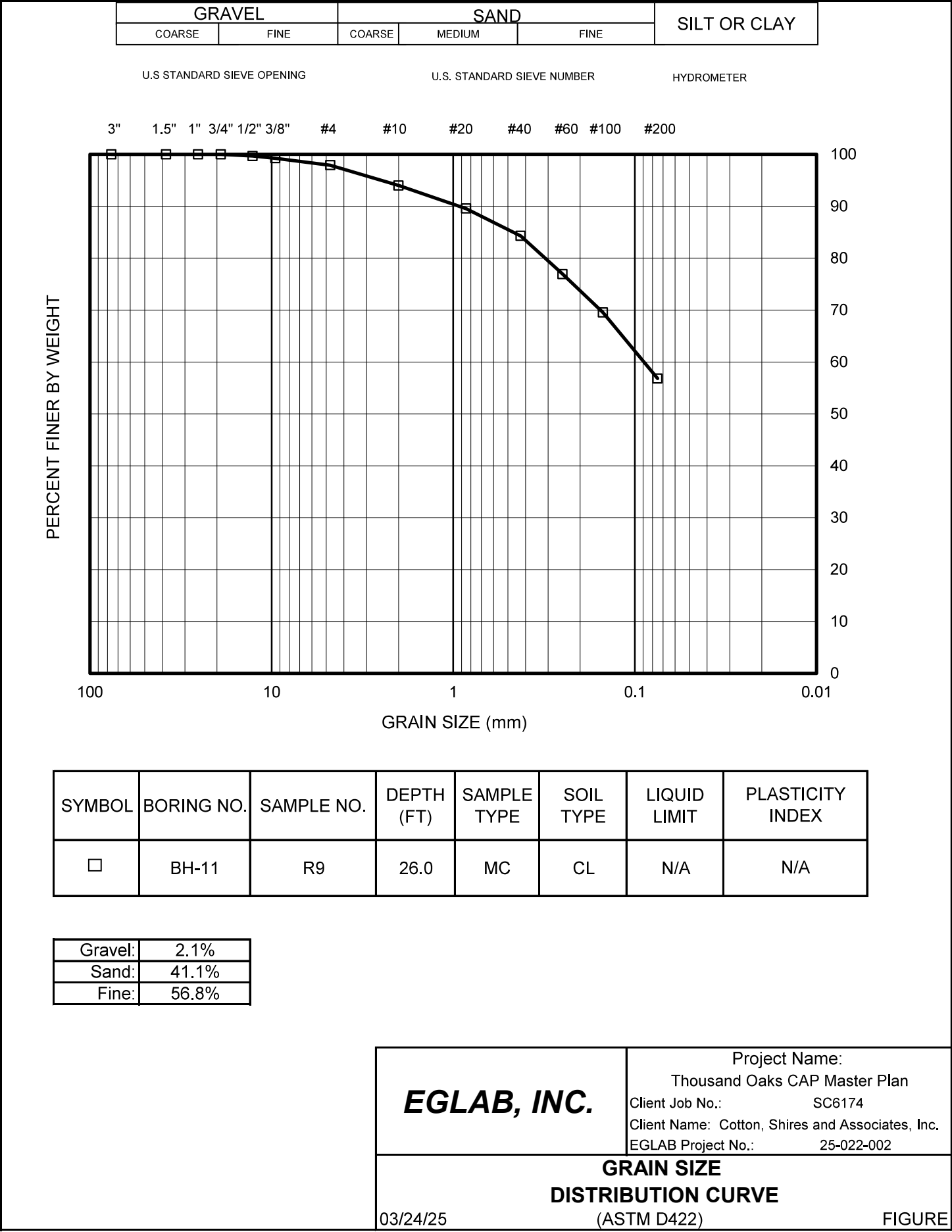


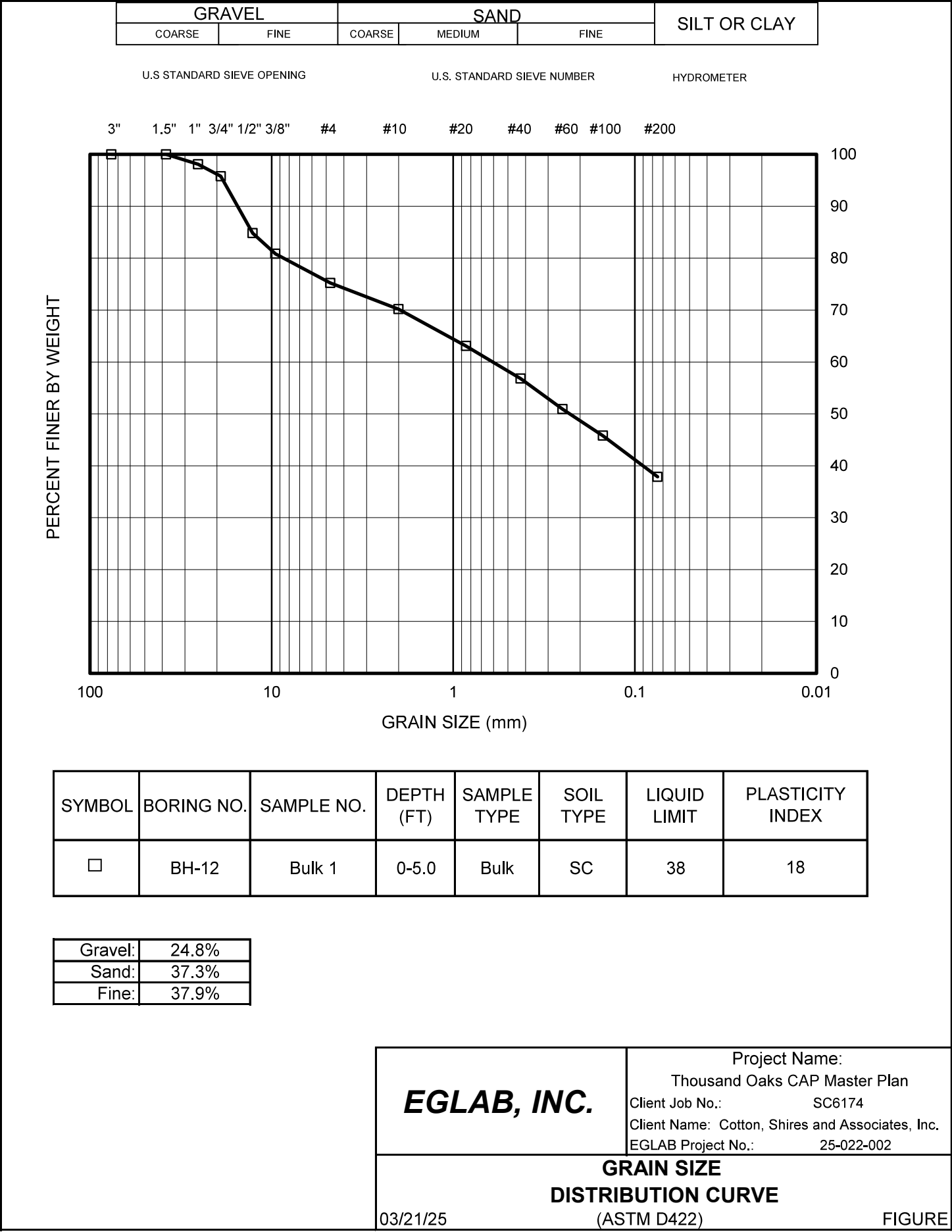


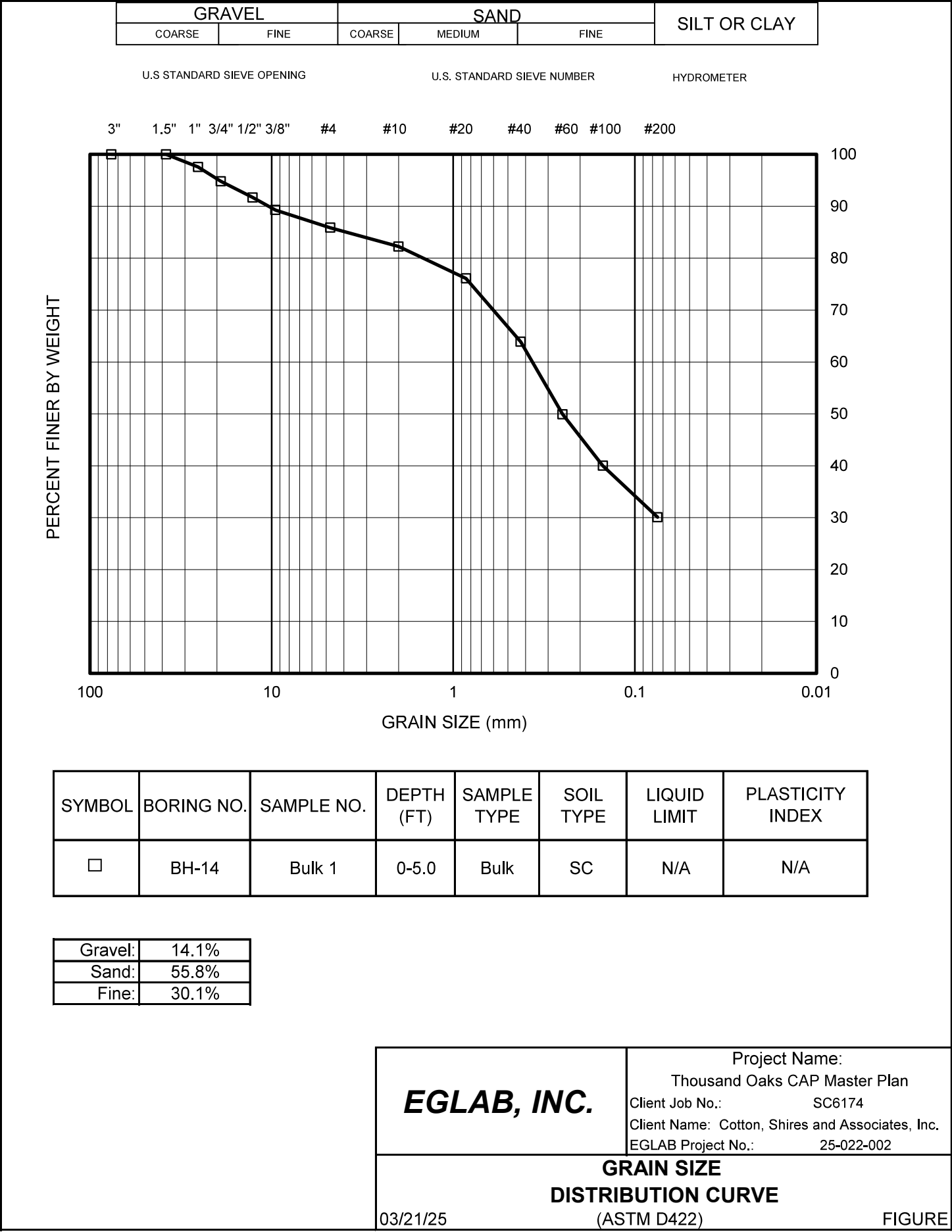


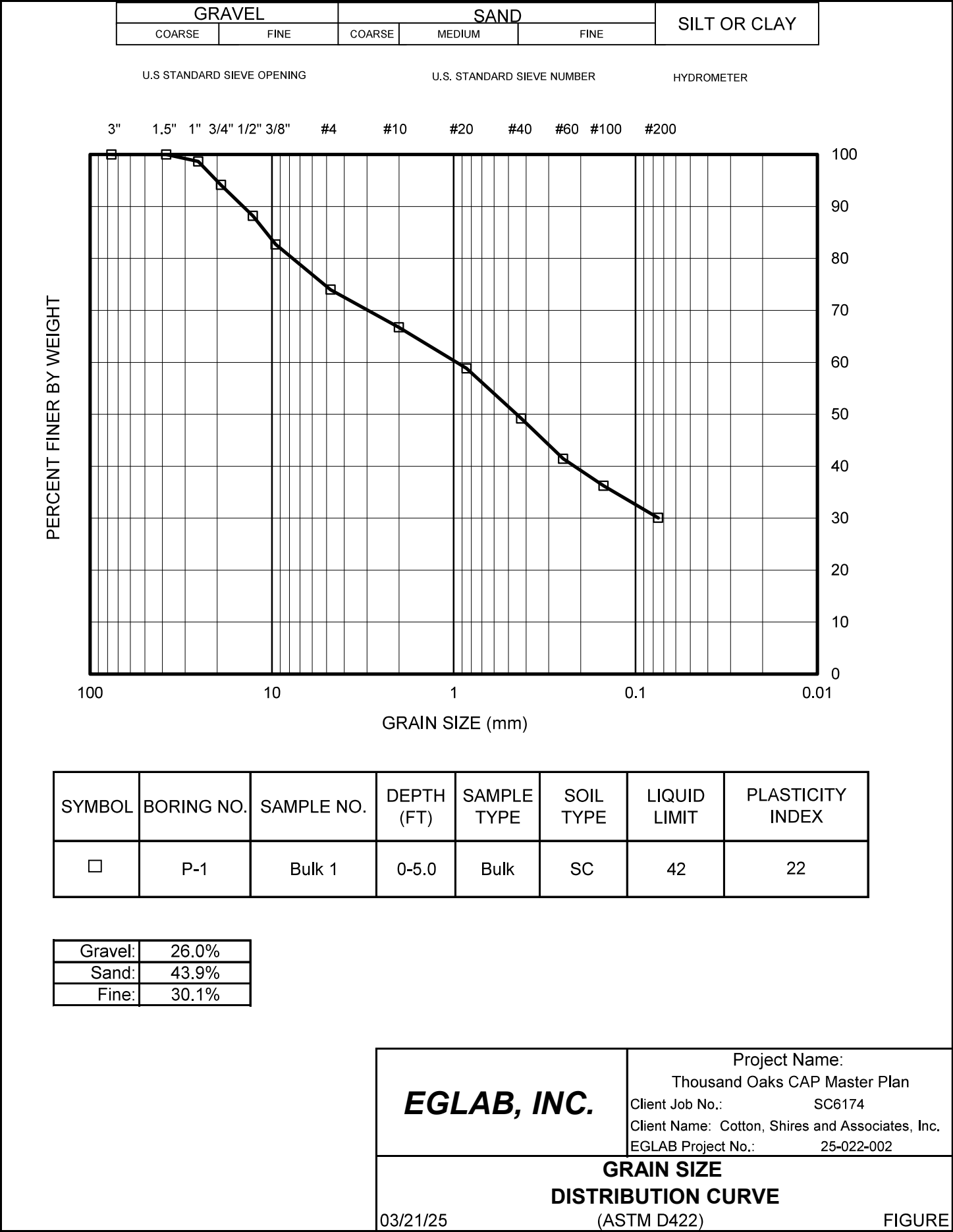


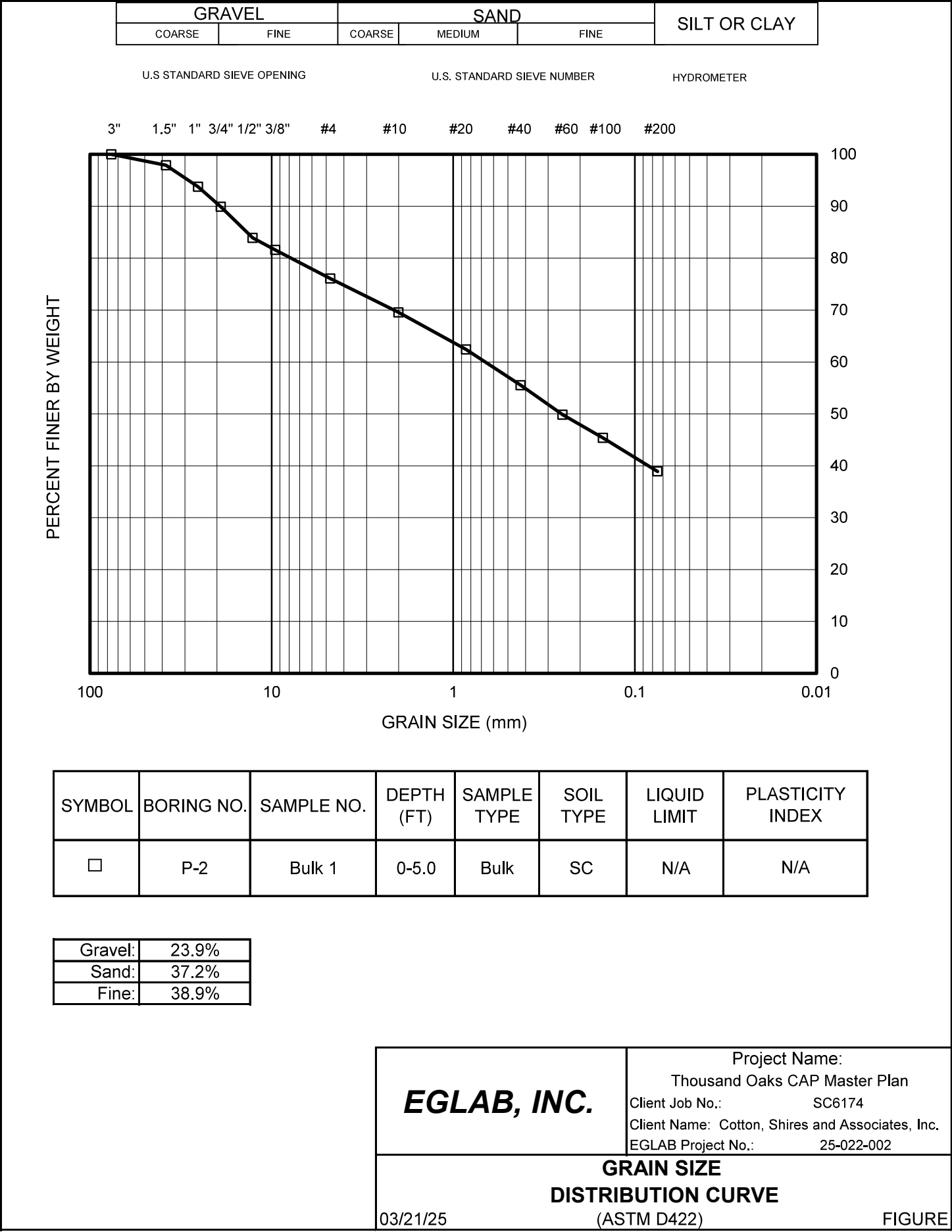


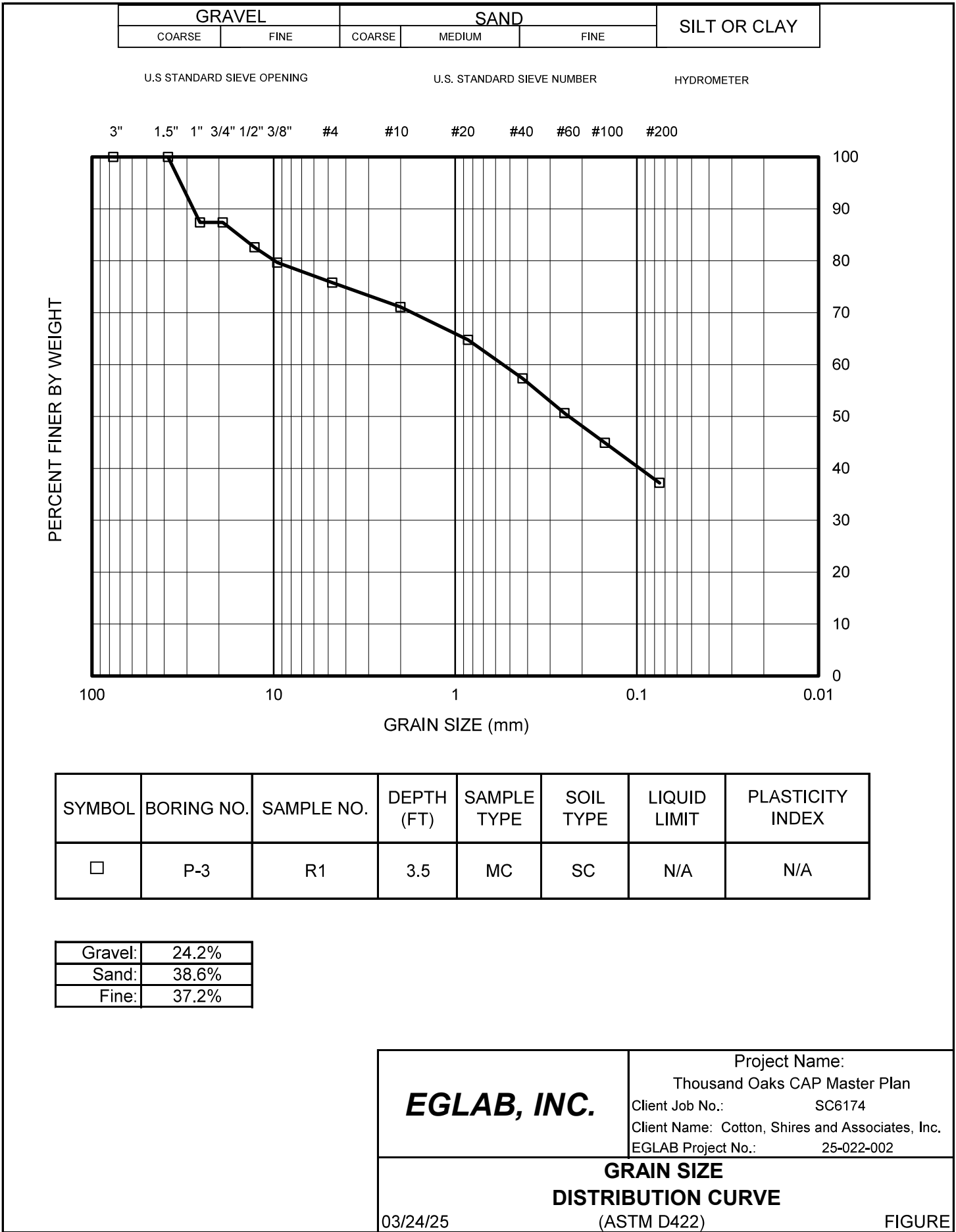


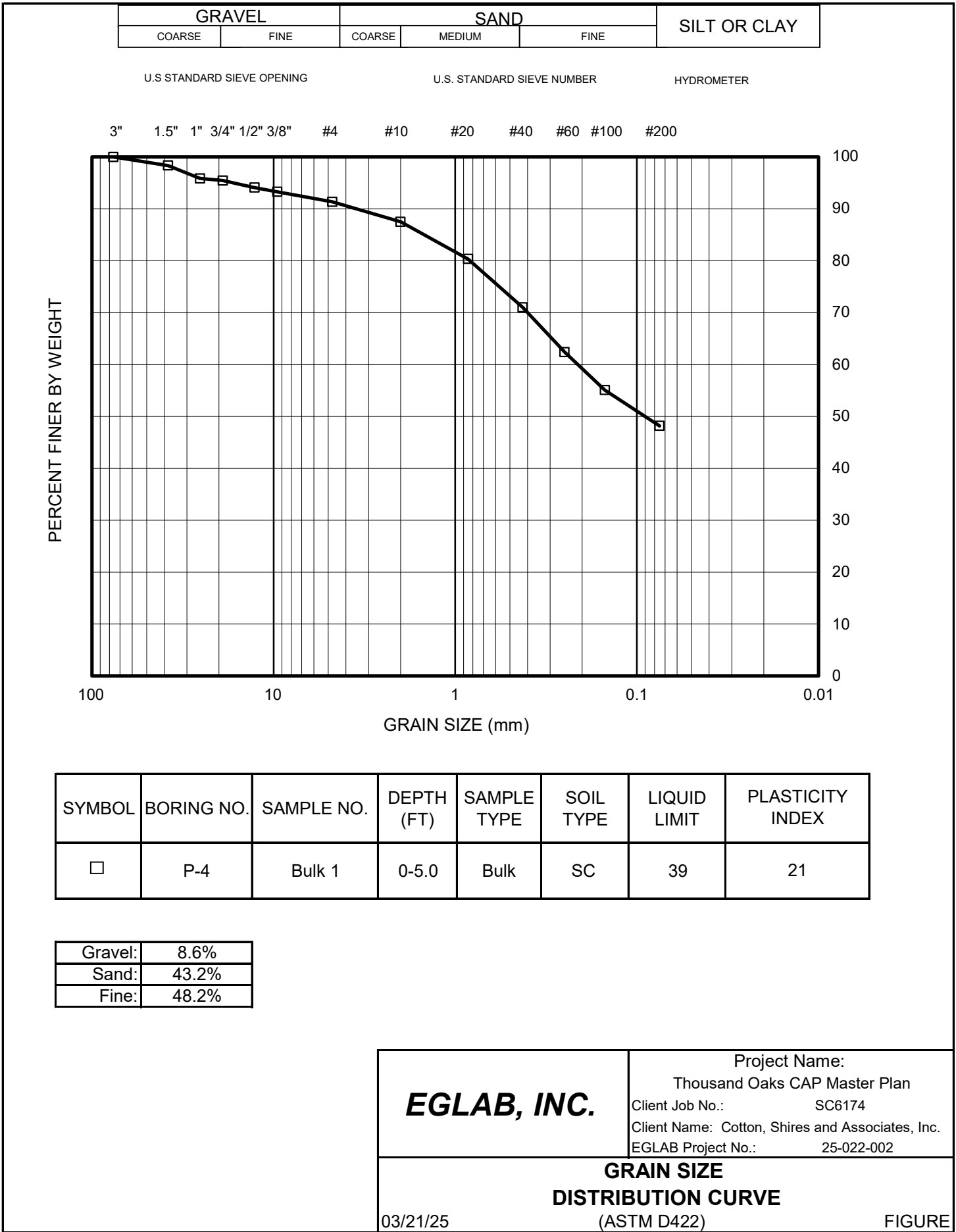


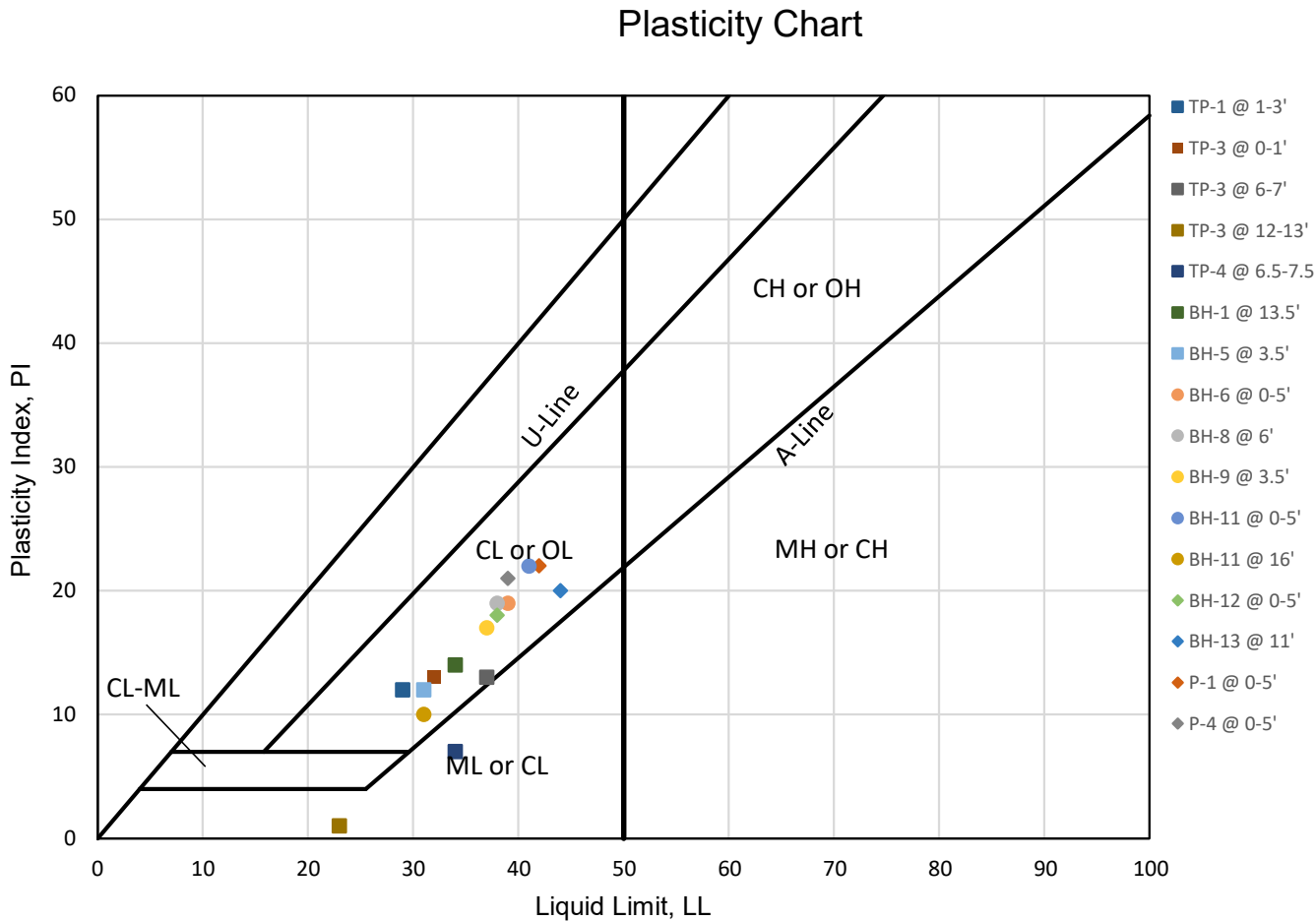




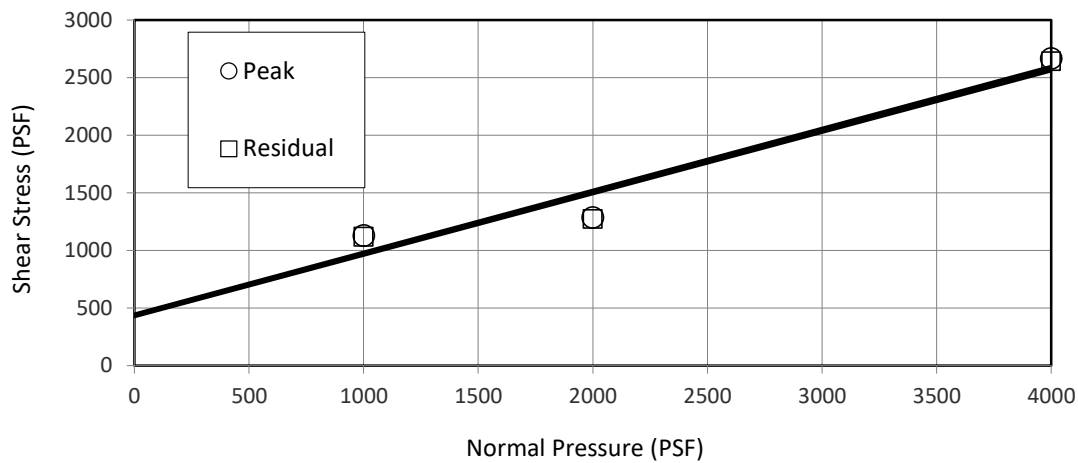
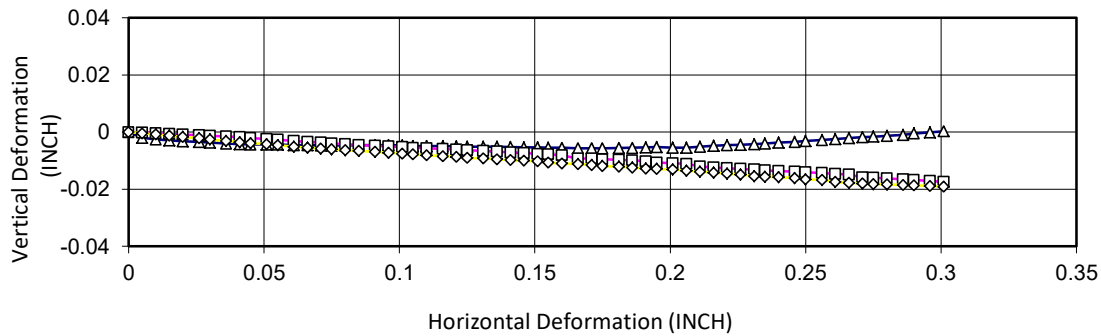
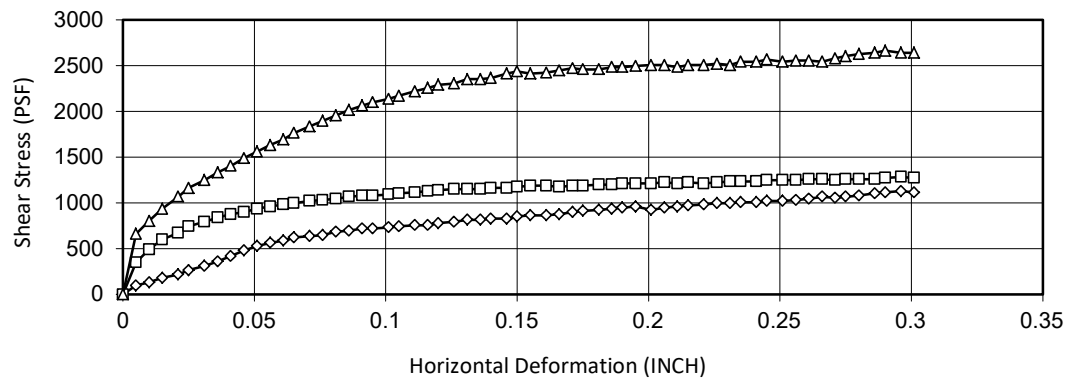








| Boring | Depth (ft) | LL | PL | PI | Boring | Depth (ft) | LL | PL | PI |
|--------|------------|----|----|----|--------|------------|----|----|----|
| TP-1   | 1-3        | 29 | 17 | 12 |        |            |    |    |    |
| TP-3   | 0-1        | 32 | 19 | 13 |        |            |    |    |    |
| TP-3   | 6-7        | 37 | 24 | 13 |        |            |    |    |    |
| TP-3   | 12-13      | 23 | 22 | 1  |        |            |    |    |    |
| TP-4   | 6.5-7.5    | 34 | 27 | 7  |        |            |    |    |    |
| BH-1   | 13.5       | 34 | 20 | 14 |        |            |    |    |    |
| BH-5   | 3.5        | 31 | 19 | 12 |        |            |    |    |    |
| BH-6   | 0-5        | 39 | 20 | 19 |        |            |    |    |    |
| BH-8   | 6          | 38 | 19 | 19 |        |            |    |    |    |
| BH-9   | 3.5        | 37 | 20 | 17 |        |            |    |    |    |
| BH-11  | 0-5        | 41 | 19 | 22 |        |            |    |    |    |
| BH-11  | 16         | 31 | 21 | 10 |        |            |    |    |    |
| BH-12  | 0-5        | 38 | 20 | 18 |        |            |    |    |    |
| BH-13  | 11         | 44 | 24 | 20 |        |            |    |    |    |
| P-1    | 0-5        | 42 | 20 | 22 |        |            |    |    |    |
| P-4    | 0-5        | 39 | 18 | 21 |        |            |    |    |    |



| Boring No. | Sample No. | Depth (ft) | Sample Type | Soil Type | Symbol | Cohesion (PSF) | Friction Angle |
|------------|------------|------------|-------------|-----------|--------|----------------|----------------|
| BH-1       | R2         | 6.0        | Ring        | CL        | ○      | 438            | 28             |
|            |            |            |             |           | □      | 432            | 28             |

| Normal Stress (psf) | Initial Moisture (%) | Final Moisture (%) |
|---------------------|----------------------|--------------------|
| 1000                | 11.8                 | 20.9               |
| 2000                | 11.8                 | 21.4               |
| 4000                | 11.8                 | 19.4               |

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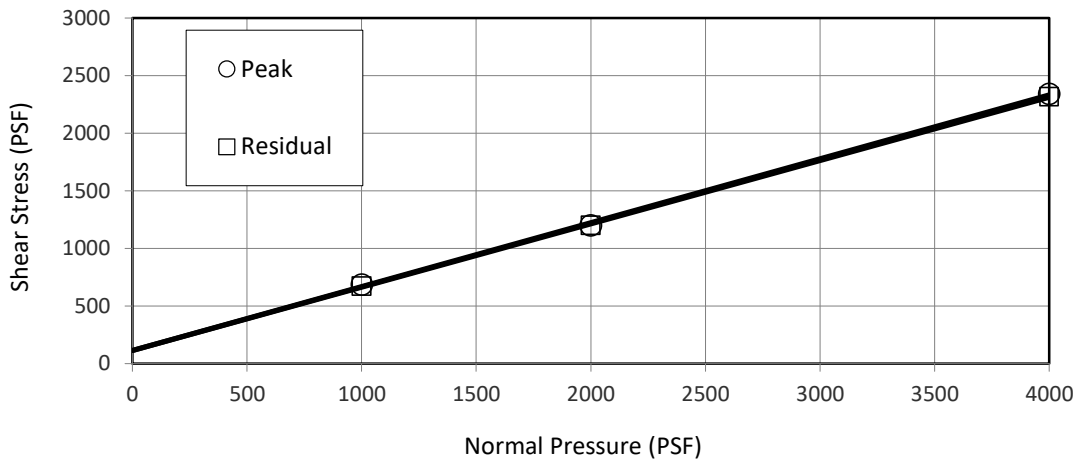
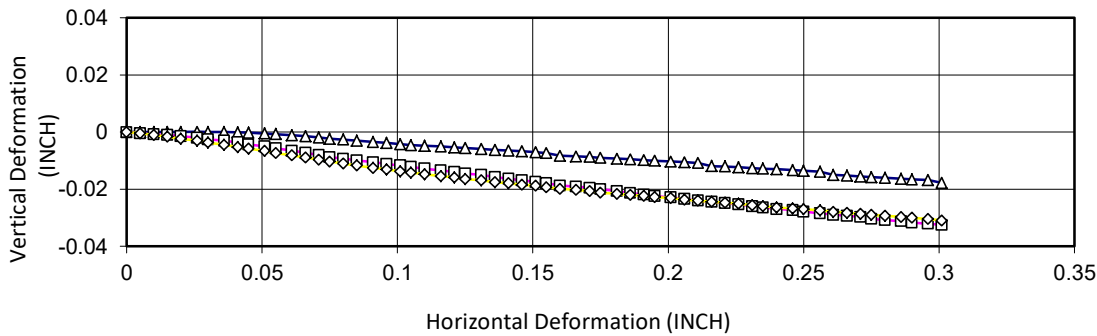
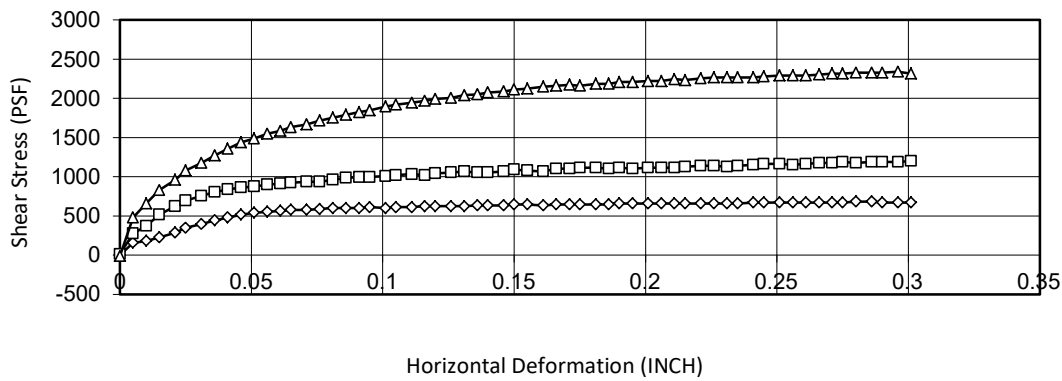
03/25

Project Name:  
Thousand Oaks CAP Master Plan  
Client: Cotton, Shires & Assoc., Inc.  
Project No.: SC6174  
EGLAB Project No.: 25-022-002

**DIRECT SHEAR**

(ASTM D3080)

Figure



| Boring No. | Sample No. | Depth (ft) | Sample Type | Soil Type | Symbol | Cohesion (PSF) | Friction Angle |
|------------|------------|------------|-------------|-----------|--------|----------------|----------------|
| BH-2       | R2         | 6.0        | Ring        | CL        | ○      | 114            | 29             |
|            |            |            |             |           | □      | 114            | 29             |

| Normal Stress (psf) | Initial Moisture (%) | Final Moisture (%) |
|---------------------|----------------------|--------------------|
| 1000                | 17.1                 | 31.6               |
| 2000                | 17.1                 | 30.1               |
| 4000                | 17.1                 | 29.8               |

**EGLAB, INC.**

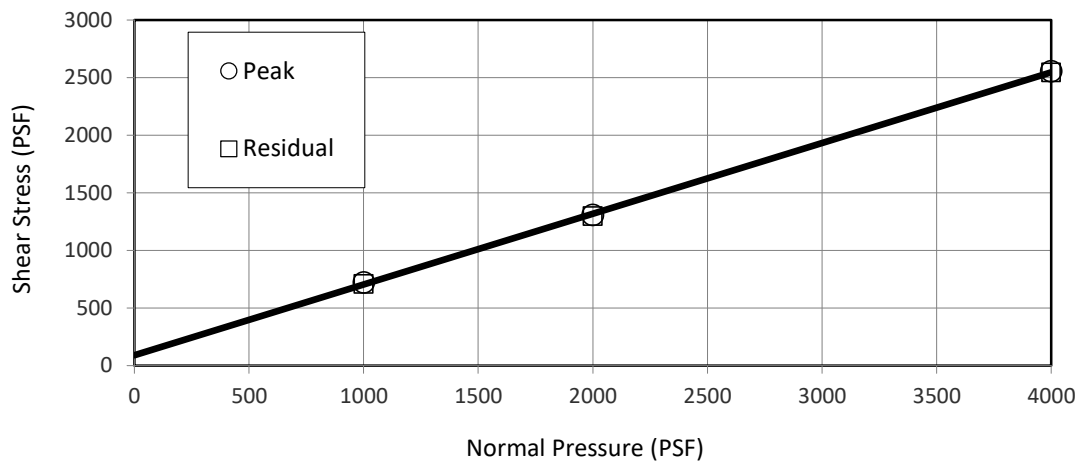
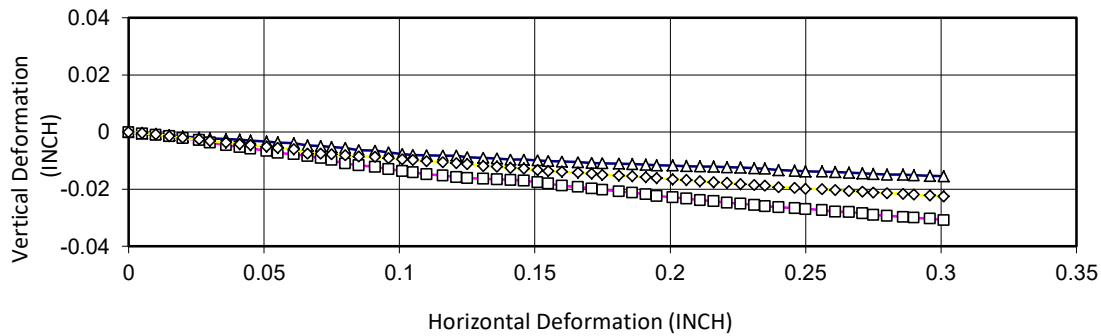
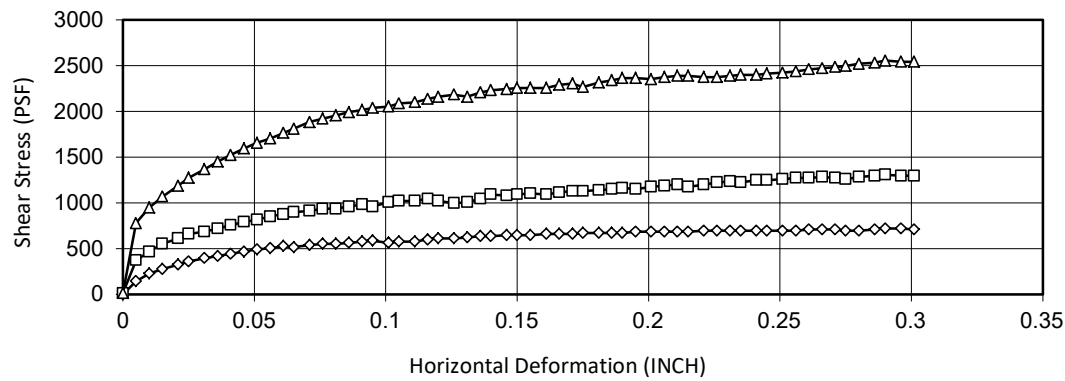
03/25

Project Name:  
Thousand Oaks CAP Master Plan  
Client: Cotton, Shires & Assoc., Inc.  
Project No.: SC6174  
EGLAB Project No.: 25-022-002

**DIRECT SHEAR**

(ASTM D3080)

Figure



| Boring No. | Sample No. | Depth (ft) | Sample Type | Soil Type | Symbol | Cohesion (PSF) | Friction Angle |
|------------|------------|------------|-------------|-----------|--------|----------------|----------------|
| BH-5       | R2         | 6.0        | Ring        | CL        | ○      | 96             | 32             |
|            |            |            |             |           | □      | 84             | 32             |

| Normal Stress (psf) | Initial Moisture (%) | Final Moisture (%) |
|---------------------|----------------------|--------------------|
| 1000                | 18.2                 | 28.1               |
| 2000                | 18.2                 | 26.8               |
| 4000                | 18.2                 | 26.1               |

**EGLAB, INC.**

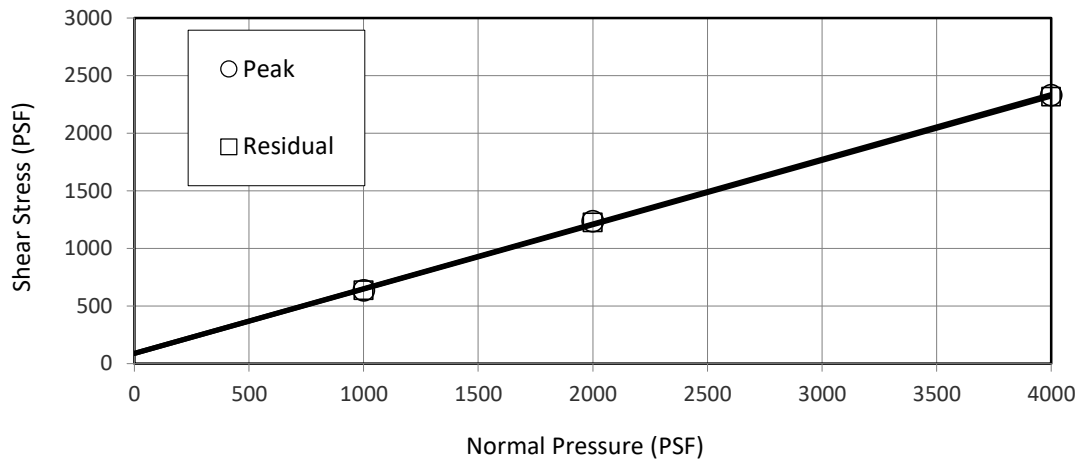
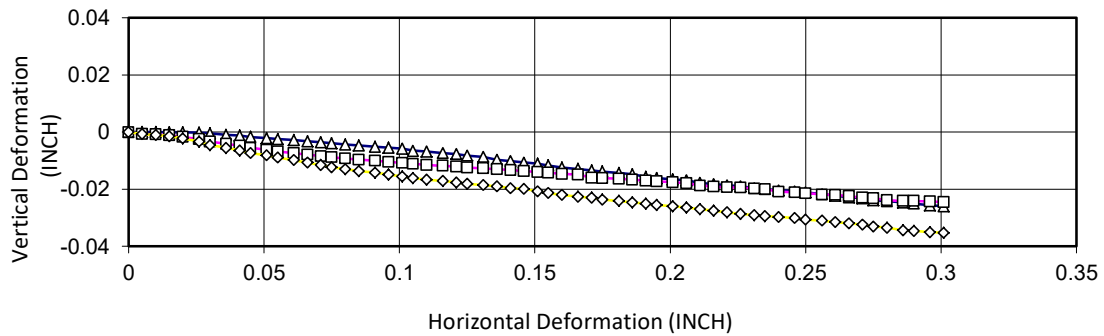
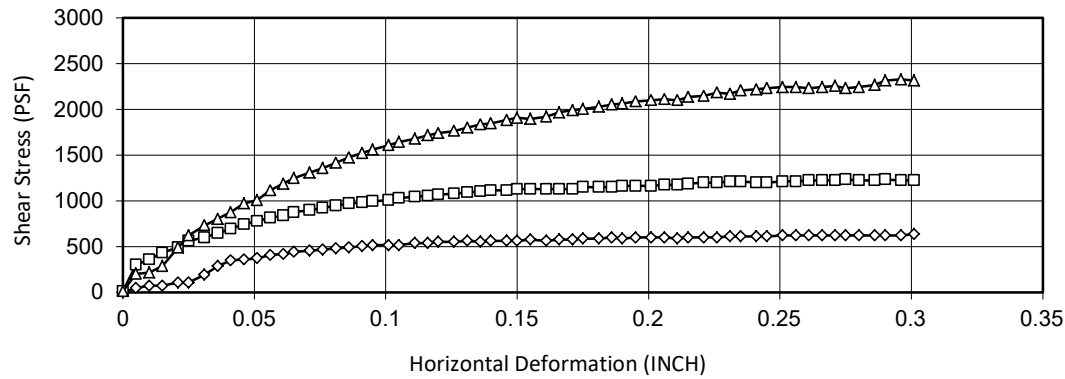
03/25

Project Name:  
Thousand Oaks CAP Master Plan  
Client: Cotton, Shires & Assoc., Inc.  
Project No.: SC6174  
EGLAB Project No.: 25-022-002

**DIRECT SHEAR**

(ASTM D3080)

Figure



| Boring No. | Sample No. | Depth (ft) | Sample Type | Soil Type | Symbol | Cohesion (PSF) | Friction Angle |
|------------|------------|------------|-------------|-----------|--------|----------------|----------------|
| BH-6       | R1         | 3.5        | Ring        | SC/CL     | ○      | 90             | 29             |
|            |            |            |             |           | □      | 90             | 29             |

| Normal Stress (psf) | Initial Moisture (%) | Final Moisture (%) |
|---------------------|----------------------|--------------------|
| 1000                | 17.3                 | 26.6               |
| 2000                | 17.3                 | 25.9               |
| 4000                | 17.3                 | 25.6               |

**EGLAB, INC.**

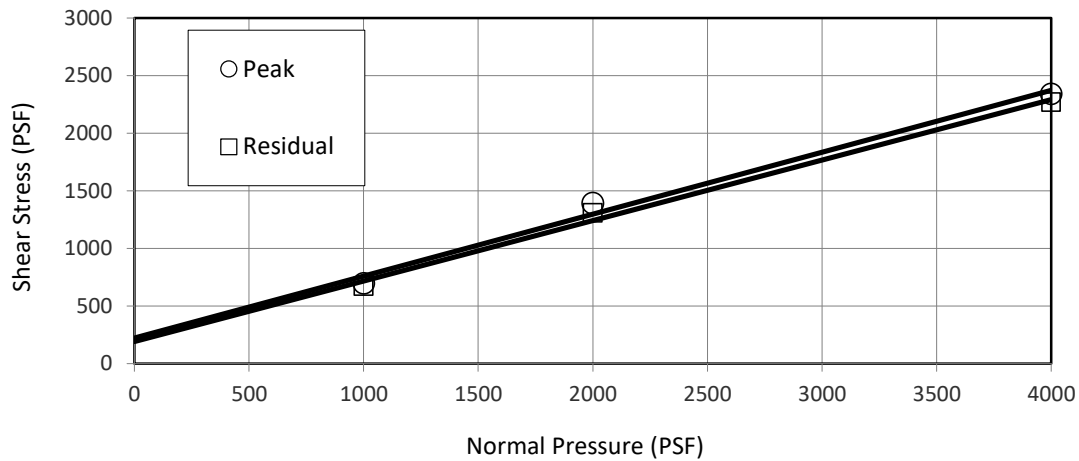
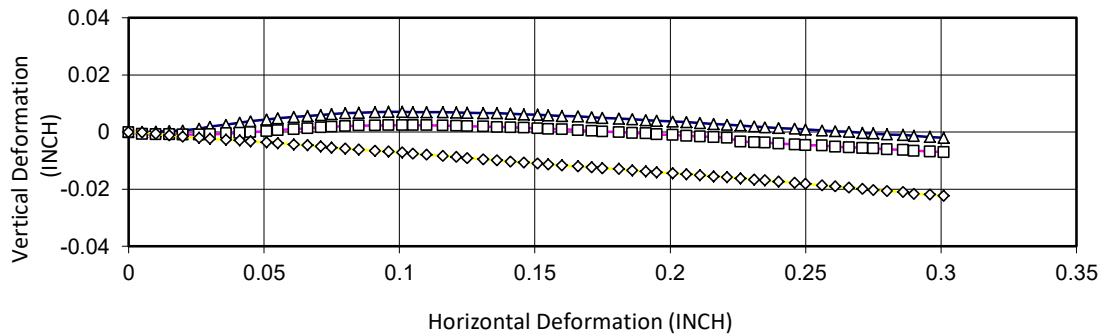
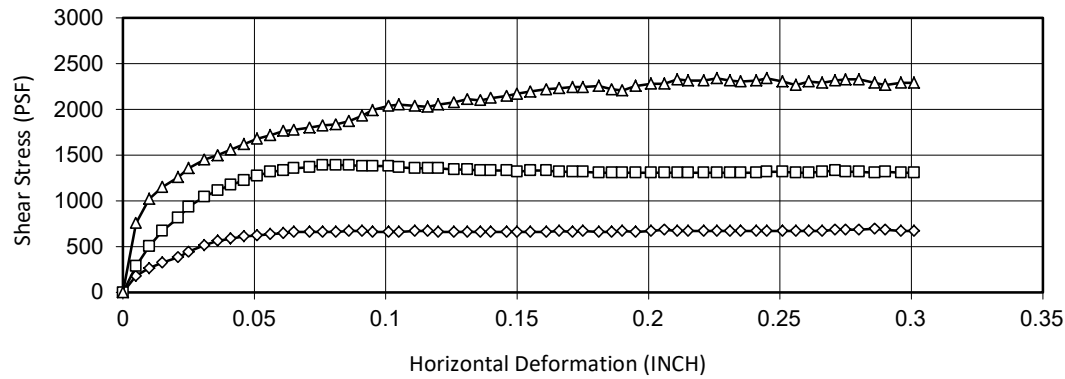
03/25

Project Name:  
Thousand Oaks CAP Master Plan  
Client: Cotton, Shires & Assoc., Inc.  
Project No.: SC6174  
EGLAB Project No.: 25-022-002

**DIRECT SHEAR**

(ASTM D3080)

Figure



| Boring No. | Sample No. | Depth (ft) | Sample Type | Soil Type | Symbol | Cohesion (PSF) | Friction Angle |
|------------|------------|------------|-------------|-----------|--------|----------------|----------------|
| BH-7       | R1         | 3.5        | Ring        | CL        | ○      | 222            | 28             |
|            |            |            |             |           | □      | 192            | 28             |

| Normal Stress (psf) | Initial Moisture (%) | Final Moisture (%) |
|---------------------|----------------------|--------------------|
| 1000                | 18.7                 | 26.4               |
| 2000                | 18.7                 | 24.6               |
| 4000                | 18.7                 | 25.1               |

**EGLAB, INC.**

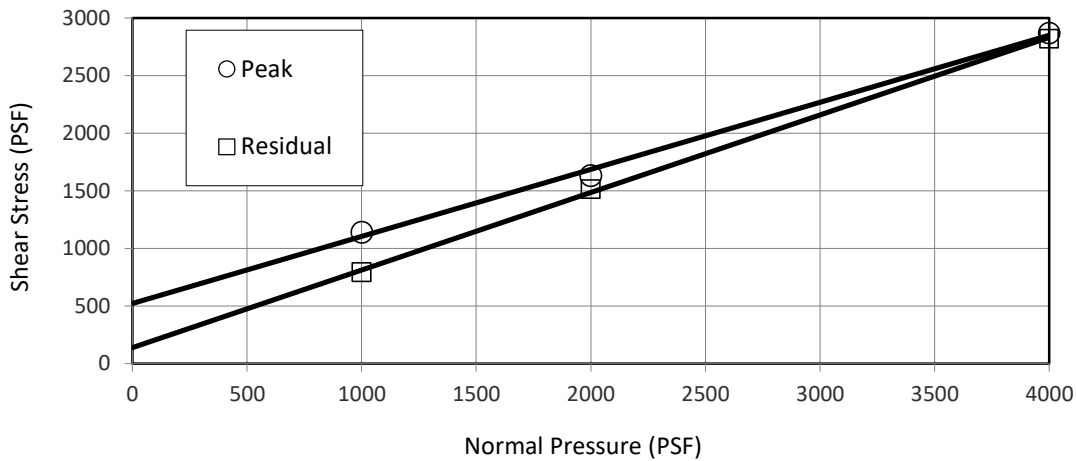
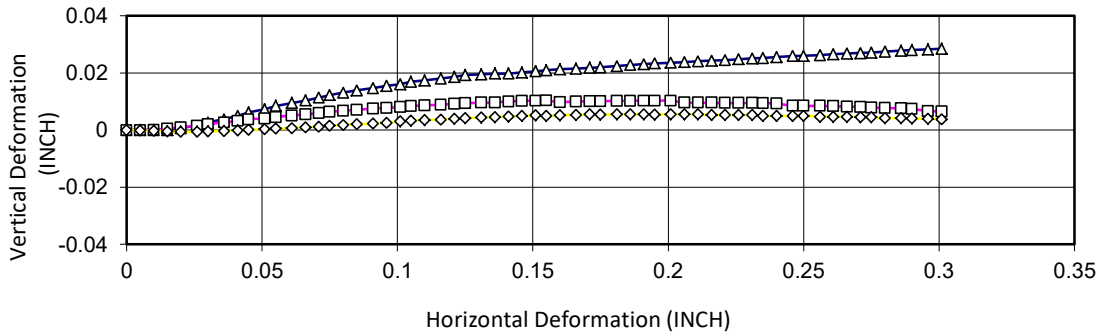
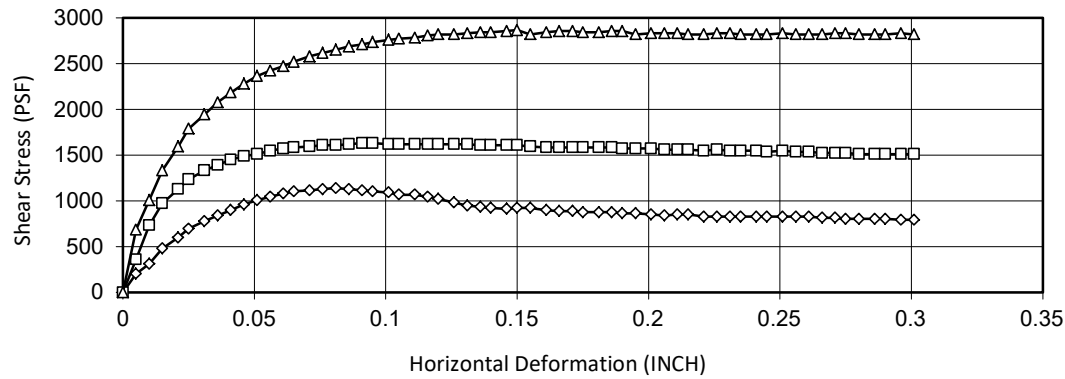
03/25

Project Name:  
Thousand Oaks CAP Master Plan  
Client: Cotton, Shires & Assoc., Inc.  
Project No.: SC6174  
EGLAB Project No.: 25-022-002

**DIRECT SHEAR**

(ASTM D3080)

Figure



| Boring No. | Sample No. | Depth (ft) | Sample Type | Soil Type | Symbol | Cohesion (PSF) | Friction Angle |
|------------|------------|------------|-------------|-----------|--------|----------------|----------------|
| BH-8       | R3         | 8.5        | Ring        | CL        | ○      | 522            | 30             |
|            |            |            |             |           | □      | 138            | 34             |

| Normal Stress (psf) | Initial Moisture (%) | Final Moisture (%) |
|---------------------|----------------------|--------------------|
| 1000                | 12.7                 | 21.3               |
| 2000                | 12.7                 | 20.3               |
| 4000                | 12.7                 | 20.9               |

**EGLAB, INC.**

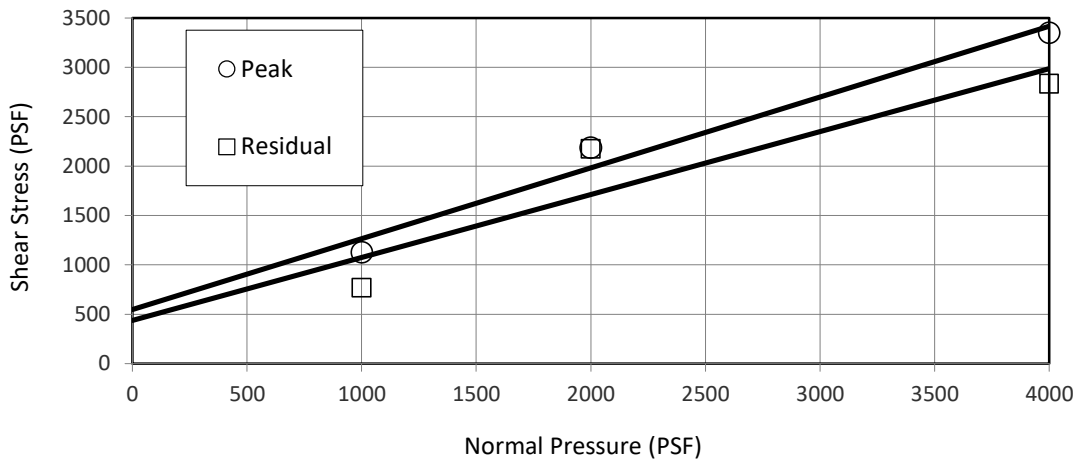
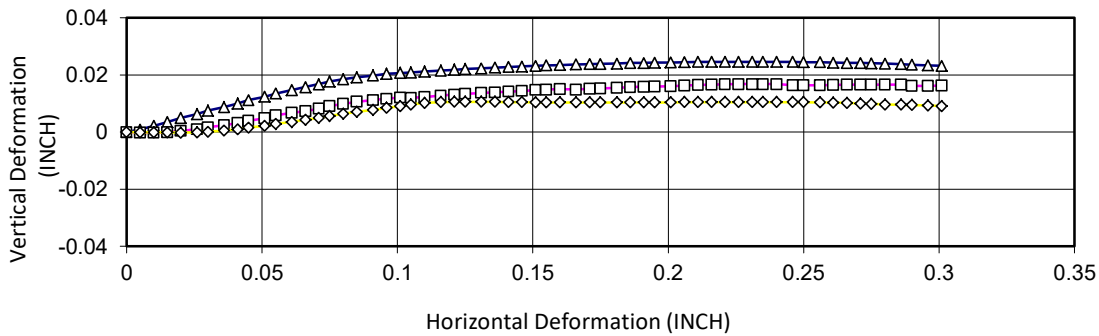
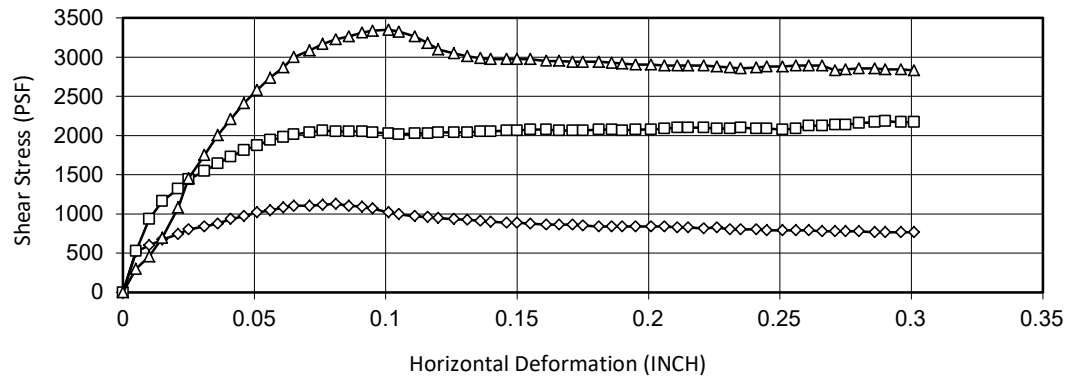
03/25

Project Name:  
Thousand Oaks CAP Master Plan  
Client: Cotton, Shires & Assoc., Inc.  
Project No.: SC6174  
EGLAB Project No.: 25-022-002

**DIRECT SHEAR**

(ASTM D3080)

Figure



| Boring No. | Sample No. | Depth (ft) | Sample Type | Soil Type | Symbol | Cohesion (PSF) | Friction Angle |
|------------|------------|------------|-------------|-----------|--------|----------------|----------------|
| BH-8       | R6         | 16.0       | Ring        | SC        | ○      | 546            | 36             |
|            |            |            |             |           | □      | 438            | 32             |

| Normal Stress (psf) | Initial Moisture (%) | Final Moisture (%) |
|---------------------|----------------------|--------------------|
| 1000                | 13.9                 | 27.4               |
| 2000                | 13.9                 | 24.8               |
| 4000                | 13.9                 | 25.6               |

**EGLAB, INC.**

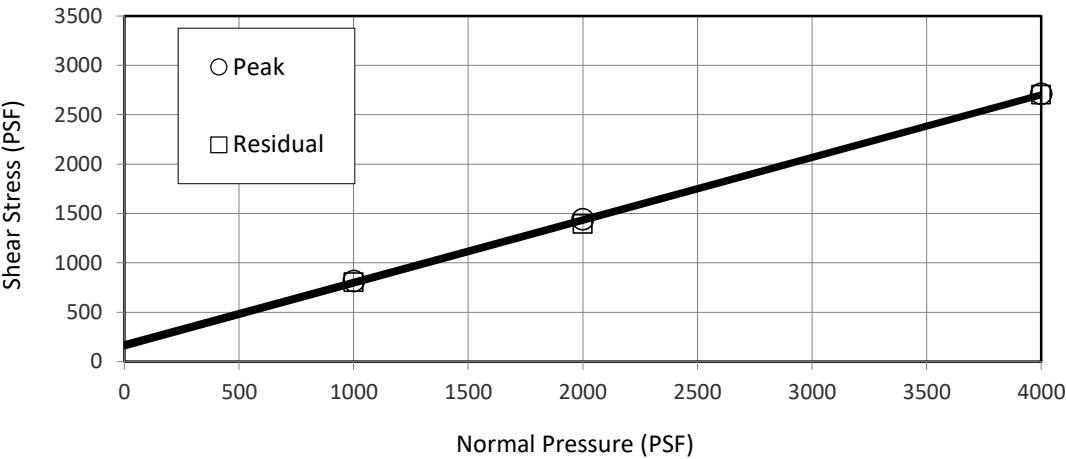
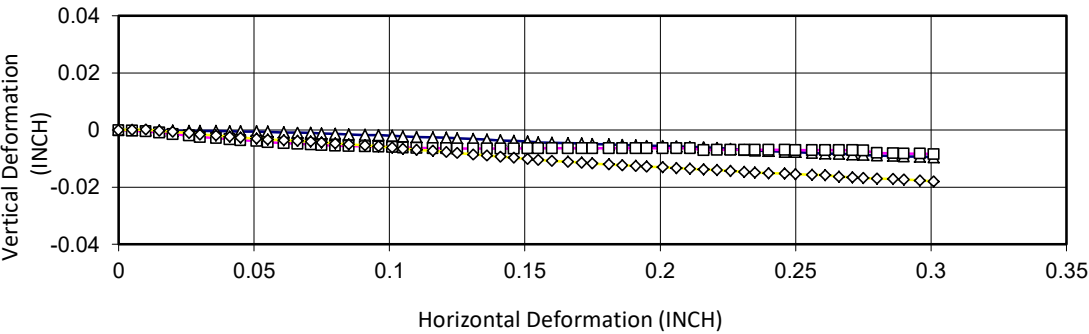
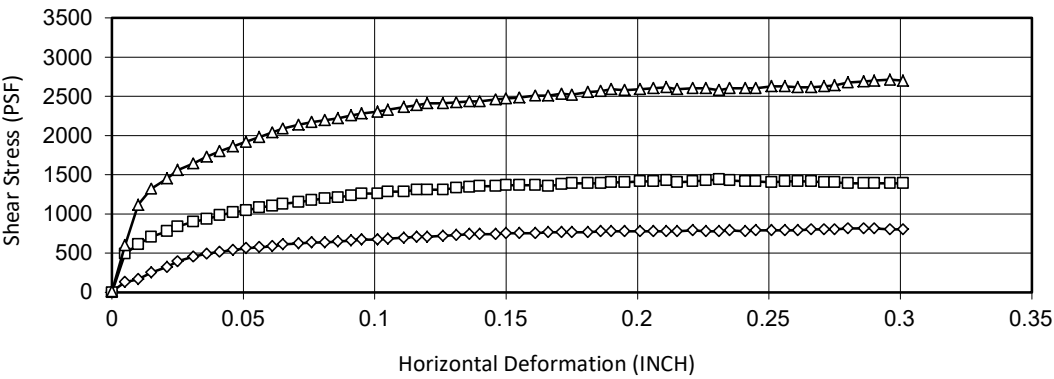
03/25

Project Name:  
Thousand Oaks CAP Master Plan  
Client: Cotton, Shires & Assoc., Inc.  
Project No.: SC6174  
EGLAB Project No.: 25-022-002

**DIRECT SHEAR**

(ASTM D3080)

Figure



| Boring No. | Sample No. | Depth (ft) | Sample Type | Soil Type | Symbol | Cohesion (PSF) | Friction Angle |
|------------|------------|------------|-------------|-----------|--------|----------------|----------------|
| BH-9       | R1         | 3.5        | Ring        | CL        | ○      | 180            | 32             |
|            |            |            |             |           | □      | 150            | 32             |

| Normal Stress (psf) | Initial Moisture (%) | Final Moisture (%) |
|---------------------|----------------------|--------------------|
| 1000                | 15.9                 | 24.6               |
| 2000                | 15.9                 | 22.8               |
| 4000                | 15.9                 | 22.4               |

**EGLAB, INC.**

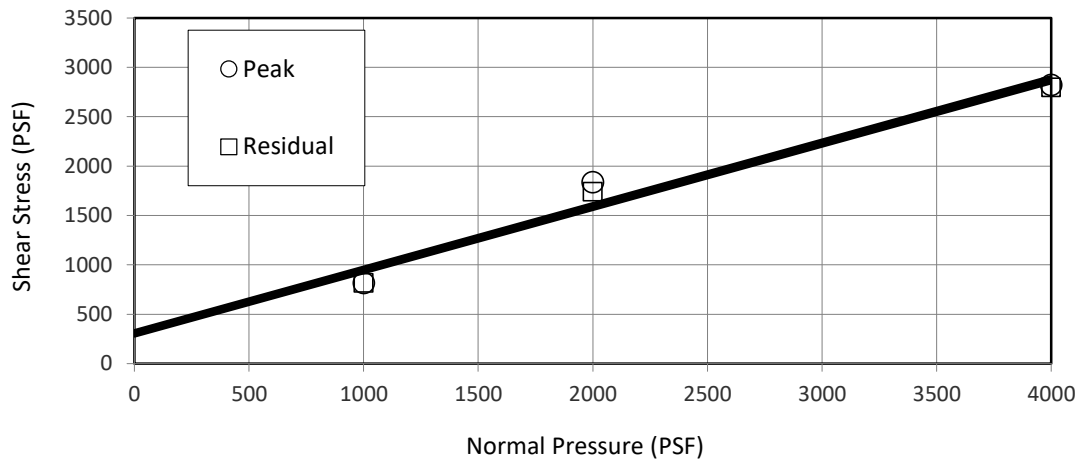
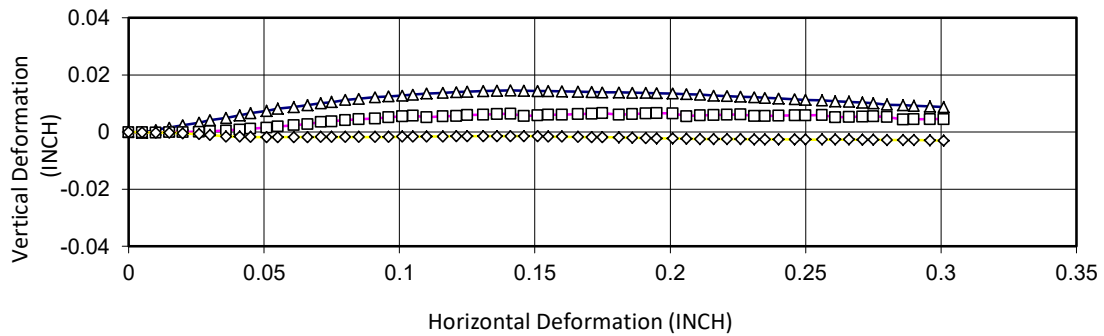
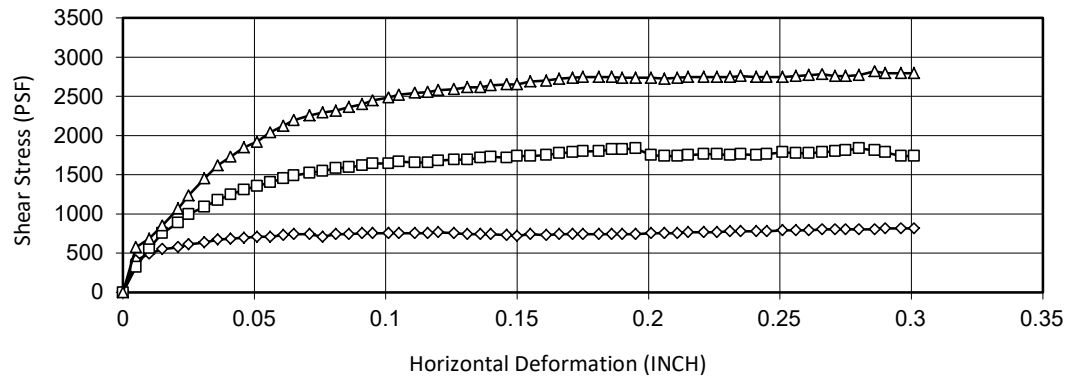
03/25

Project Name:  
Thousand Oaks CAP Master Plan  
Client: Cotton, Shires & Assoc., Inc.  
Project No.: SC6174  
EGLAB Project No.: 25-022-002

**DIRECT SHEAR**

(ASTM D3080)

Figure



| Boring No. | Sample No. | Depth (ft) | Sample Type | Soil Type | Symbol | Cohesion (PSF) | Friction Angle |
|------------|------------|------------|-------------|-----------|--------|----------------|----------------|
| BH-10      | R2         | 6.0        | Ring        | CL        | ○      | 324            | 33             |
|            |            |            |             |           | □      | 288            | 33             |

| Normal Stress (psf) | Initial Moisture (%) | Final Moisture (%) |
|---------------------|----------------------|--------------------|
| 1000                | 17.3                 | 22.9               |
| 2000                | 17.3                 | 21.9               |
| 4000                | 17.3                 | 20.4               |

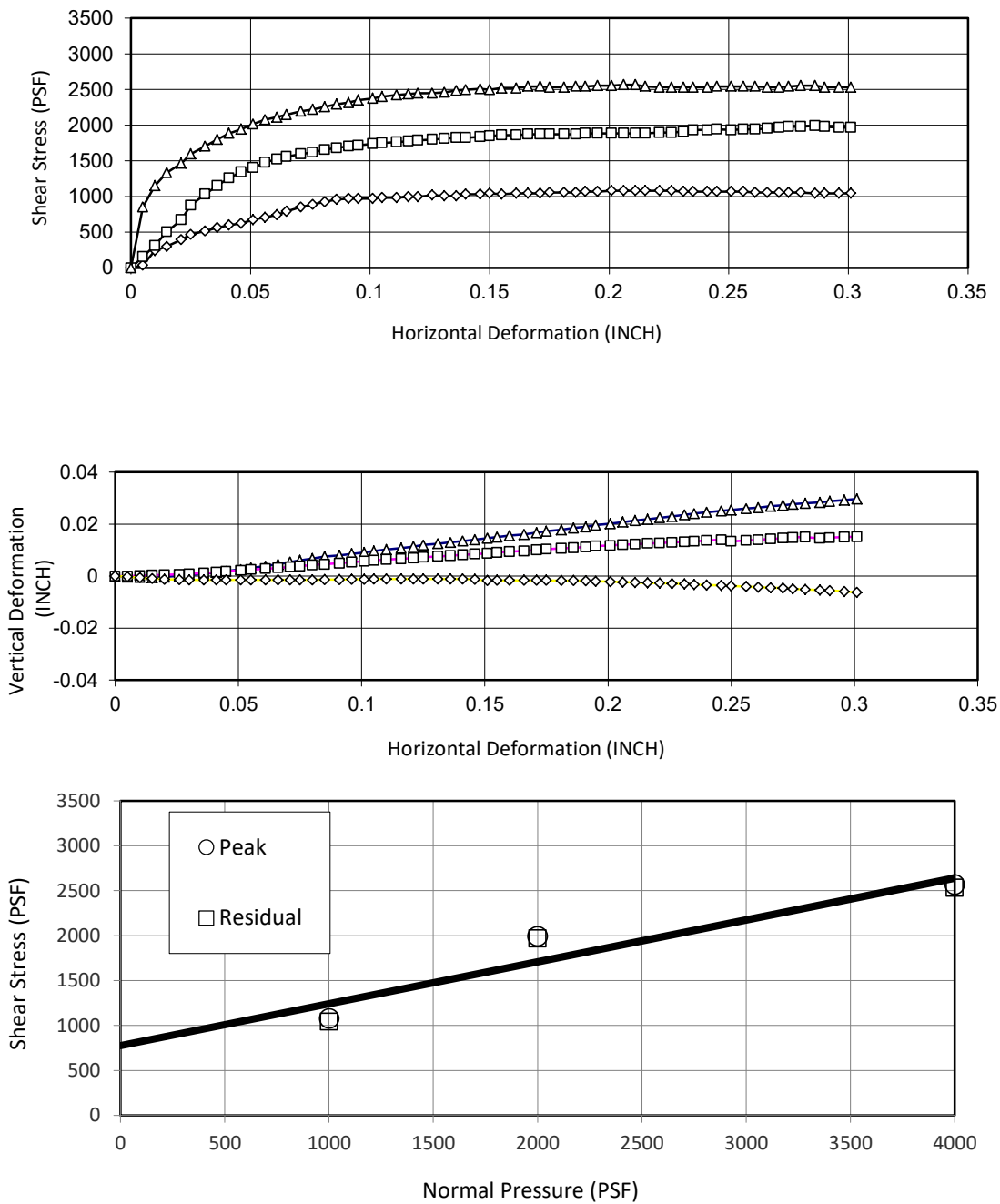
**EGLAB, INC.**

03/25 (ASTM D3080)

Project Name:  
Thousand Oaks CAP Master Plan  
Client: Cotton, Shires & Assoc., Inc.  
Project No.: SC6174  
EGLAB Project No.: 25-022-002

**DIRECT SHEAR**

Figure



| Boring No. | Sample No. | Depth (ft) | Sample Type | Soil Type | Symbol | Cohesion (PSF) | Friction Angle |
|------------|------------|------------|-------------|-----------|--------|----------------|----------------|
| BH-11      | R2         | 6.0        | Ring        | CL        | ○      | 792            | 25             |
|            |            |            |             |           | □      | 762            | 25             |

| Normal Stress (psf) | Initial Moisture (%) | Final Moisture (%) |
|---------------------|----------------------|--------------------|
| 1000                | 13.2                 | 21.4               |
| 2000                | 13.2                 | 21.8               |
| 4000                | 13.2                 | 20.5               |

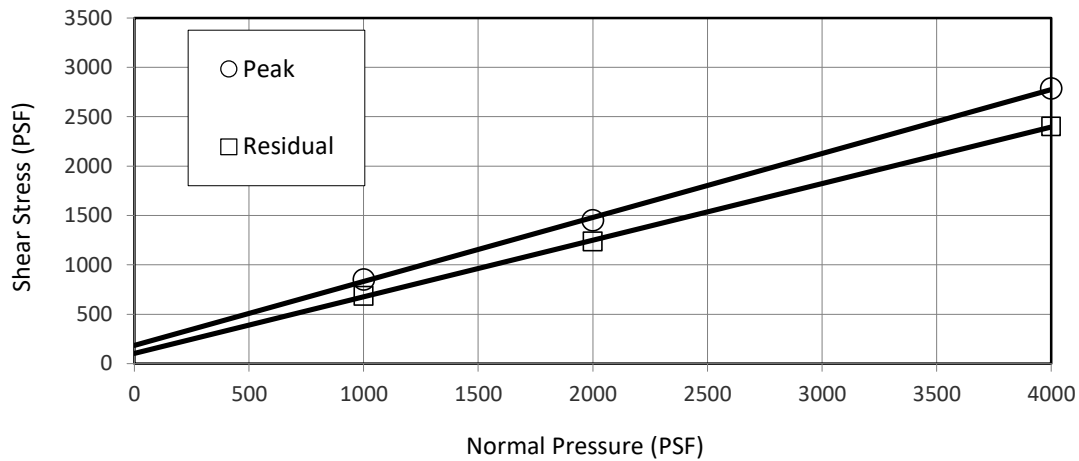
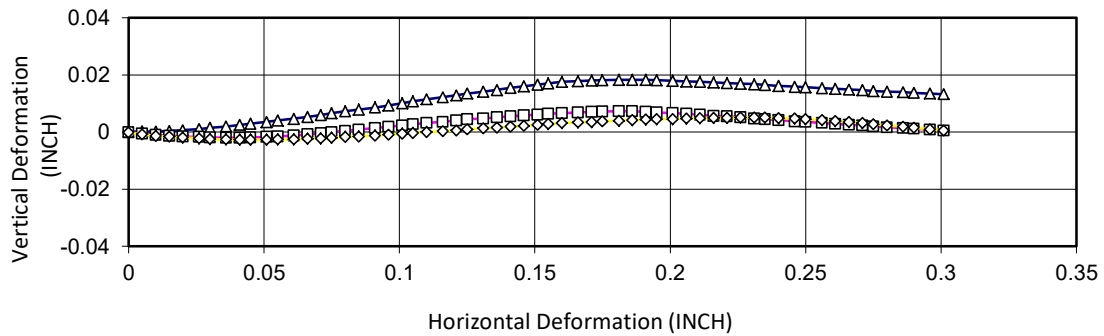
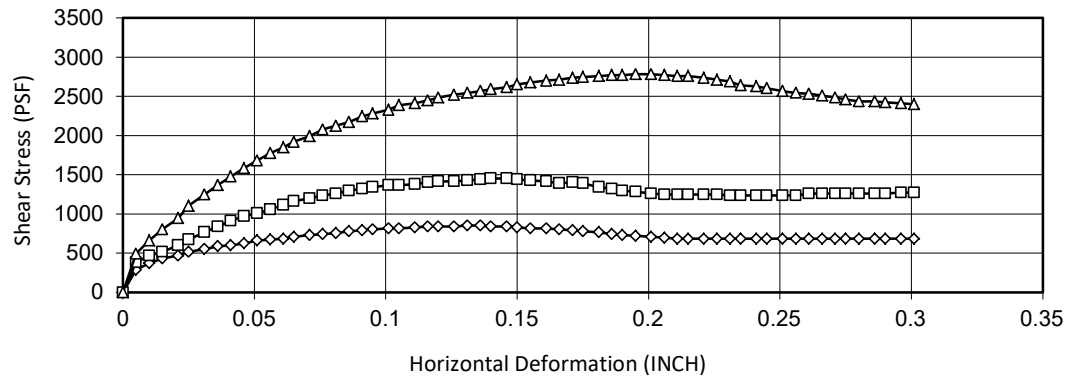
**EGLAB, INC.**

03/25

Project Name:  
Thousand Oaks CAP Master Plan  
Client: Cotton, Shires & Assoc., Inc.  
Project No.: SC6174  
EGLAB Project No.: 25-022-002

**DIRECT SHEAR**  
(ASTM D3080)

Figure



| Boring No. | Sample No. | Depth (ft) | Sample Type | Soil Type | Symbol | Cohesion (PSF) | Friction Angle |
|------------|------------|------------|-------------|-----------|--------|----------------|----------------|
| BH-12      | R3         | 8.5        | Ring        | SM        | ○      | 186            | 33             |
|            |            |            |             |           | □      | 102            | 30             |

| Normal Stress (psf) | Initial Moisture (%) | Final Moisture (%) |
|---------------------|----------------------|--------------------|
| 1000                | 23.6                 | 26.2               |
| 2000                | 23.6                 | 26.1               |
| 4000                | 23.6                 | 23.9               |

**EGLAB, INC.**

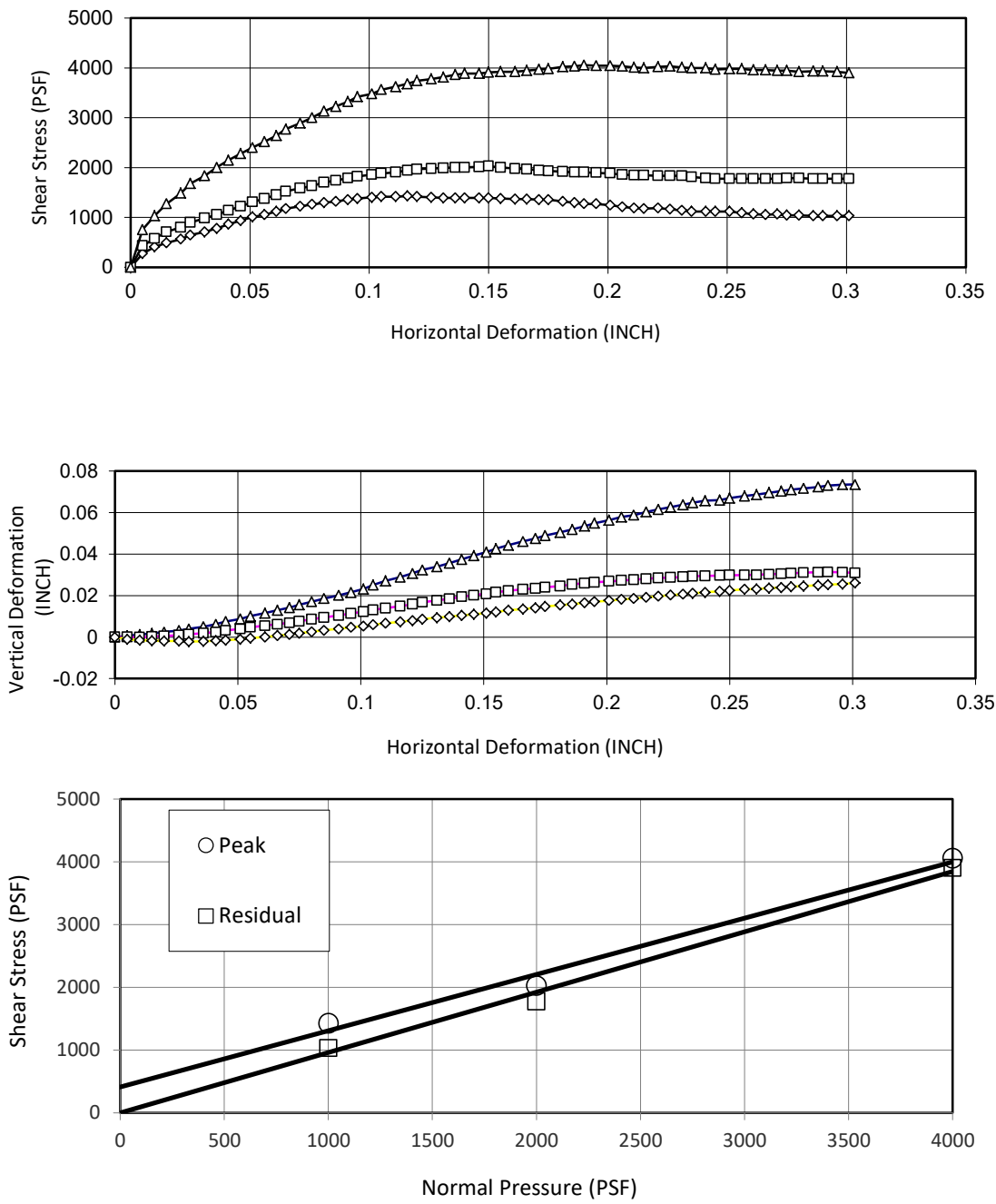
Project Name:  
Thousand Oaks CAP Master Plan  
Client: Cotton, Shires & Assoc., Inc.  
Project No.: SC6174  
EGLAB Project No.: 25-022-002

## DIRECT SHEAR

03/25

(ASTM D3080)

Figure



| Boring No. | Sample No. | Depth (ft) | Sample Type | Soil Type | Symbol | Cohesion (PSF) | Friction Angle |
|------------|------------|------------|-------------|-----------|--------|----------------|----------------|
| BH-13      | R2         | 6.0        | Ring        | SC        | ○      | 414            | 42             |
|            |            |            |             |           | □      | 0              | 44             |

| Normal Stress (psf) | Initial Moisture (%) | Final Moisture (%) |
|---------------------|----------------------|--------------------|
| 1000                | 14.4                 | 21.5               |
| 2000                | 14.4                 | 21.3               |
| 4000                | 14.4                 | 20.5               |

**EGLAB, INC.**

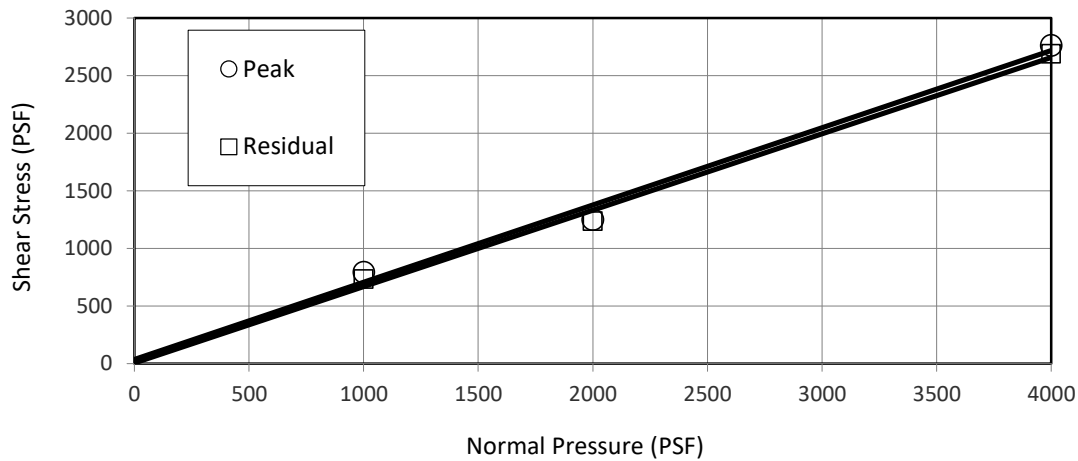
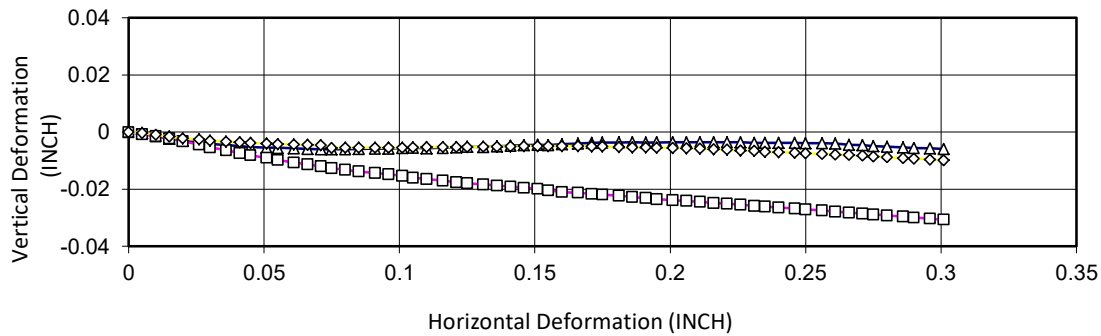
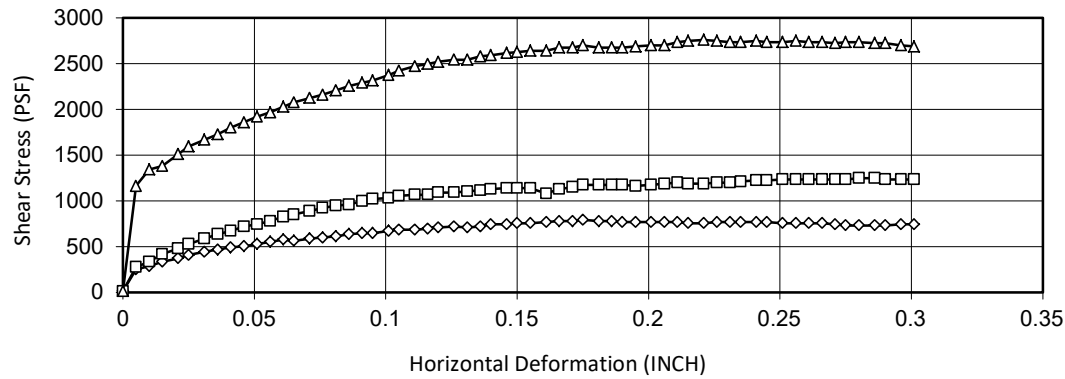
03/25

Project Name:  
Thousand Oaks CAP Master Plan  
Client: Cotton, Shires & Assoc., Inc.  
Project No.: SC6174  
EGLAB Project No.: 25-022-002

**DIRECT SHEAR**

(ASTM D3080)

Figure



| Boring No. | Sample No. | Depth (ft) | Sample Type | Soil Type | Symbol | Cohesion (PSF) | Friction Angle |
|------------|------------|------------|-------------|-----------|--------|----------------|----------------|
| BH-14      | R1         | 3.5        | Ring        | SM        | ○      | 36             | 34             |
|            |            |            |             |           | □      | 6              | 34             |

| Normal Stress (psf) | Initial Moisture (%) | Final Moisture (%) |
|---------------------|----------------------|--------------------|
| 1000                | 8.2                  | 28.0               |
| 2000                | 8.2                  | 27.2               |
| 4000                | 8.2                  | 26.9               |

**EGLAB, INC.**

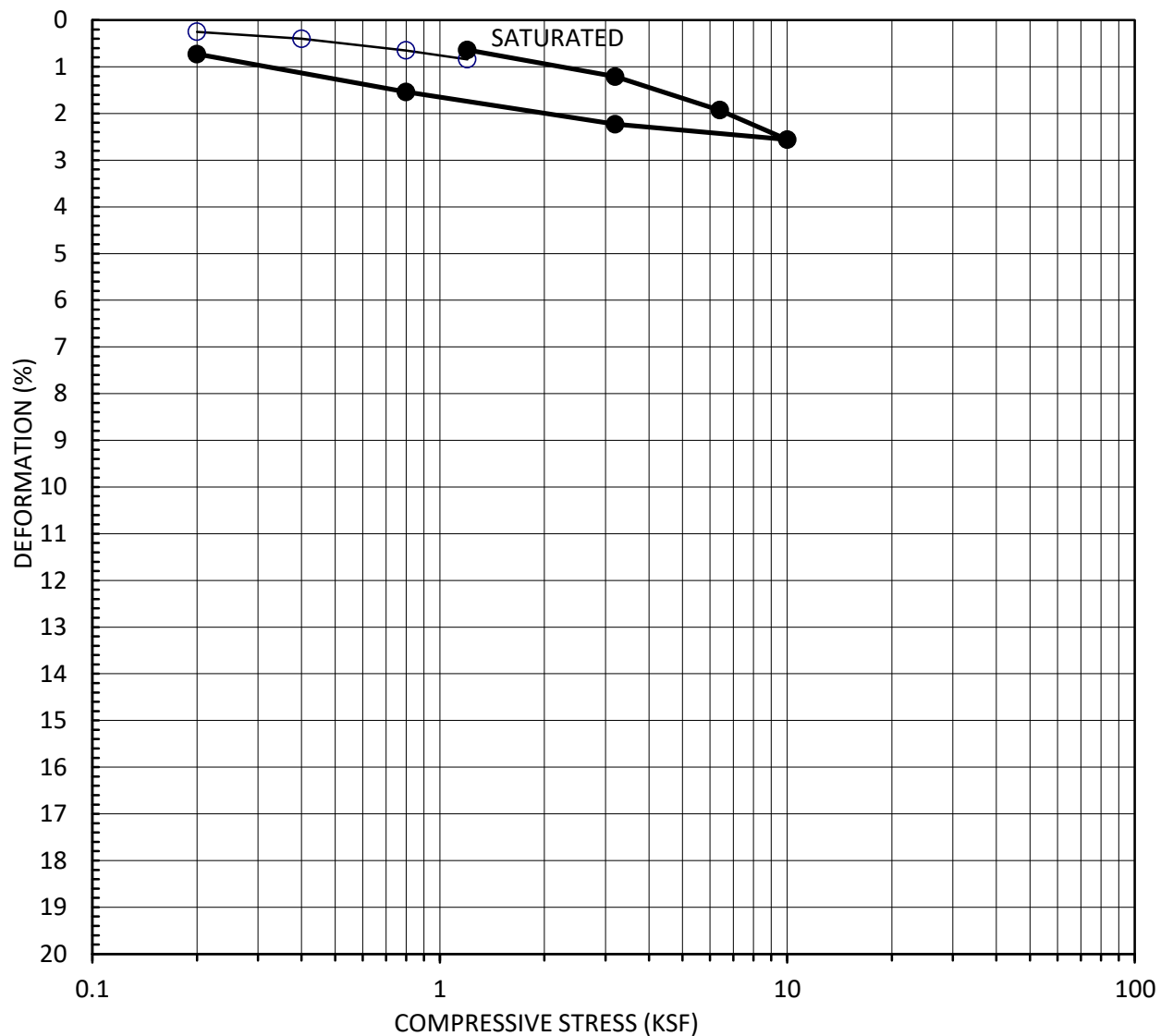
03/25

Project Name:  
Thousand Oaks CAP Master Plan  
Client: Cotton, Shires & Assoc., Inc.  
Project No.: SC6174  
EGLAB Project No.: 25-022-002

**DIRECT SHEAR**

(ASTM D3080)

Figure



| Symbol | Boring No. | Sample No. | Depth (Ft.) | Soil Type | Init. Moisture Content (%) | Init. Dry Density (PCF) | Init. Void Ratio |
|--------|------------|------------|-------------|-----------|----------------------------|-------------------------|------------------|
| ○      | BH-1       | R4         | 11.0        | CL        | 16.6                       | 108.9                   | 0.547            |

Project Name:

Thousand Oaks CAP Master Plan

Client: Cotton, Shires & Associates, Inc.

Project No.: SC6174

EGLAB Project No.: 25-022-002

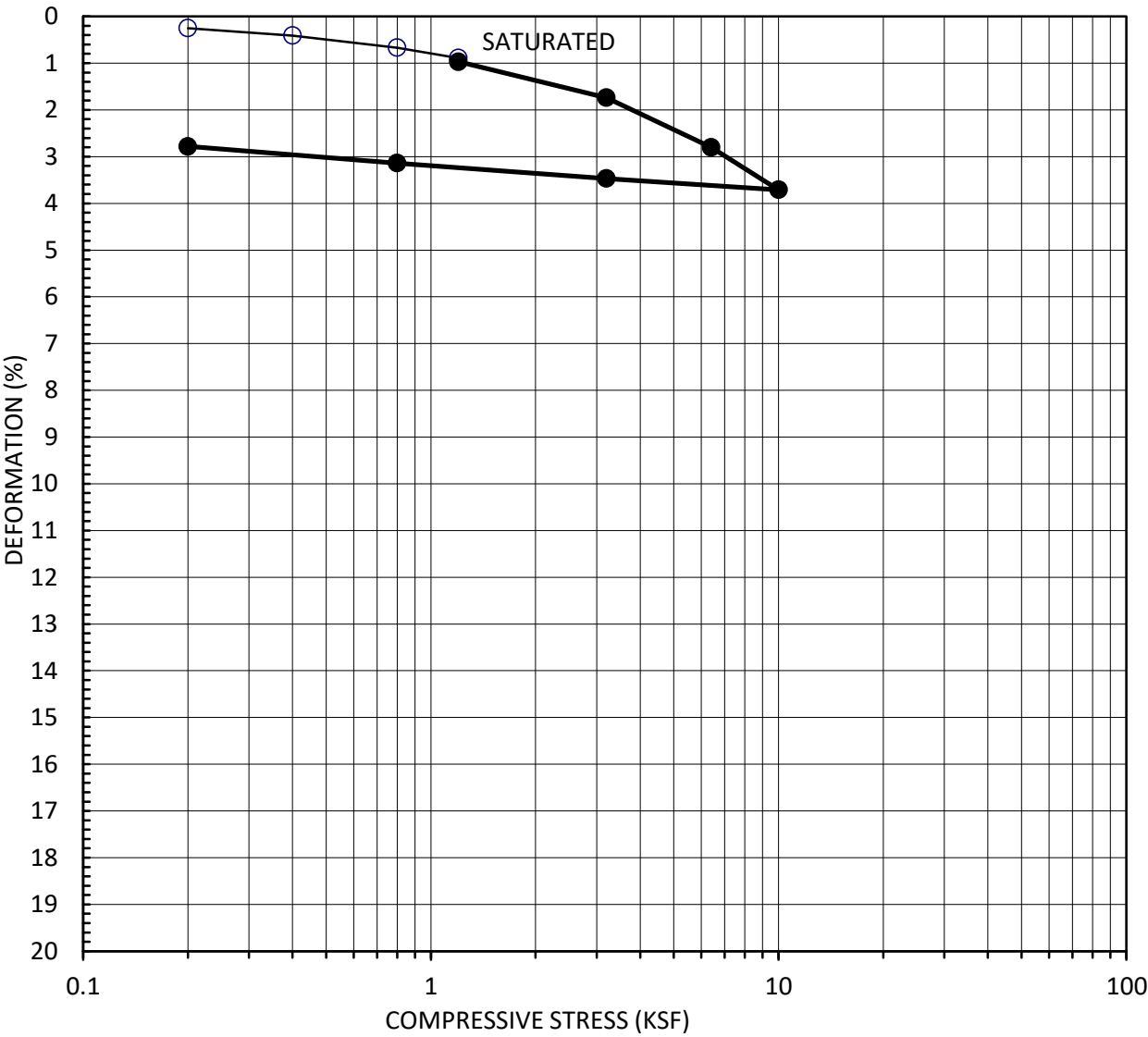
**EGLAB, INC.**

## CONSOLIDATION

03/25

(ASTM D2435)

Figure



| Symbol | Boring No. | Sample No. | Depth (Ft.) | Soil Type | Init. Moisture Content (%) | Init. Dry Density (PCF) | Init. Void Ratio |
|--------|------------|------------|-------------|-----------|----------------------------|-------------------------|------------------|
| ○      | BH-3       | R1         | 3.5         | CL        | 14.0                       | 103.3                   | 0.631            |

**EGLAB, INC.**

03/25

Project Name:  
Thousand Oaks CAP Master Plan

Client: Cotton, Shires & Associates, Inc.

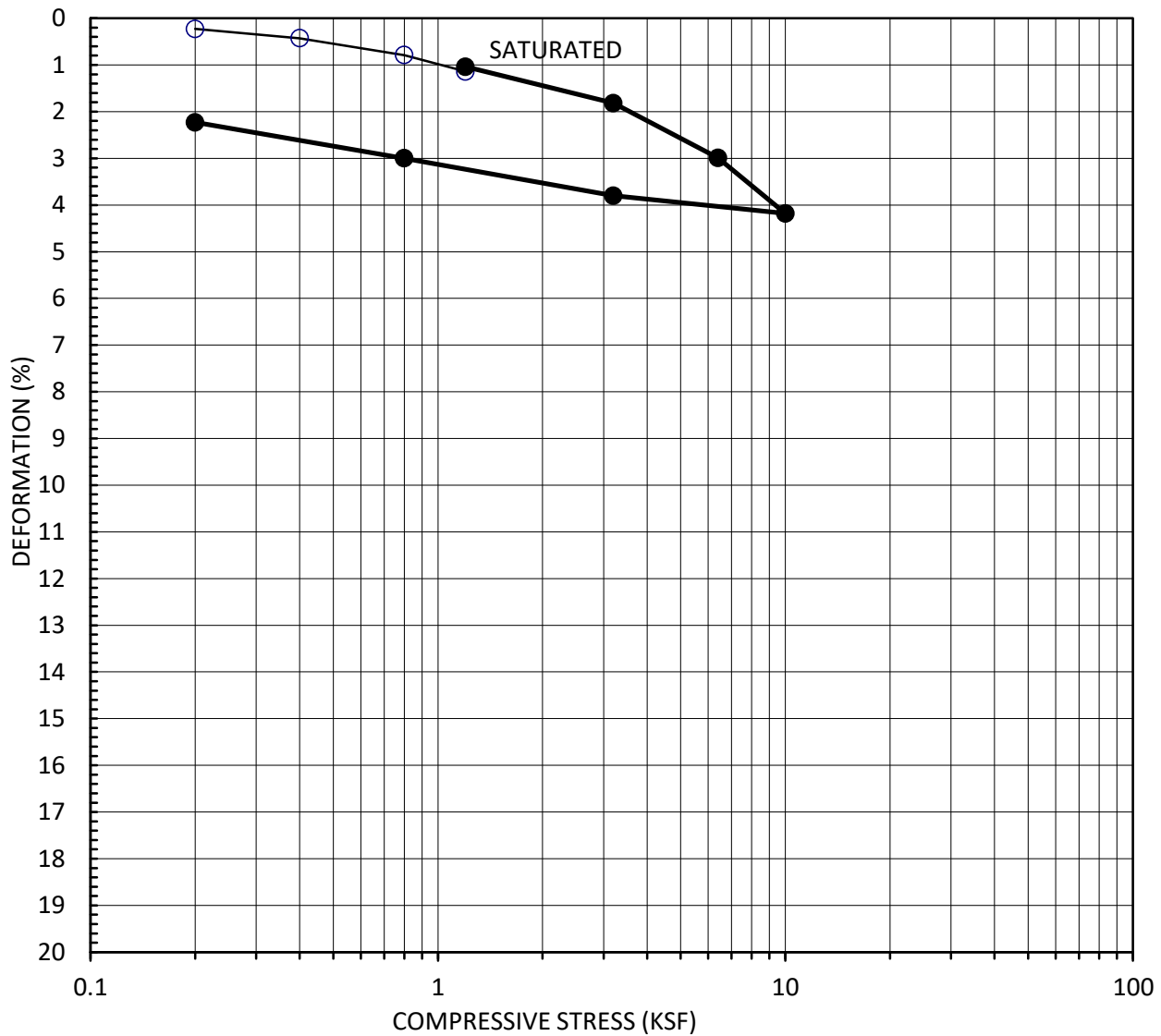
Project No.: SC6174

EGLAB Project No.: 25-022-002

CONSOLIDATION

(ASTM D2435)

Figure



| Symbol | Boring No. | Sample No. | Depth (Ft.) | Soil Type | Init. Moisture Content (%) | Init. Dry Density (PCF) | Init. Void Ratio |
|--------|------------|------------|-------------|-----------|----------------------------|-------------------------|------------------|
| ○      | BH-5       | R4         | 11.0        | SC        | 24.0                       | 92.5                    | 0.821            |

Project Name:

Thousand Oaks CAP Master Plan

Client: Cotton, Shires & Associates, Inc.

Project No.: SC6174

EGLAB Project No.: 25-022-002

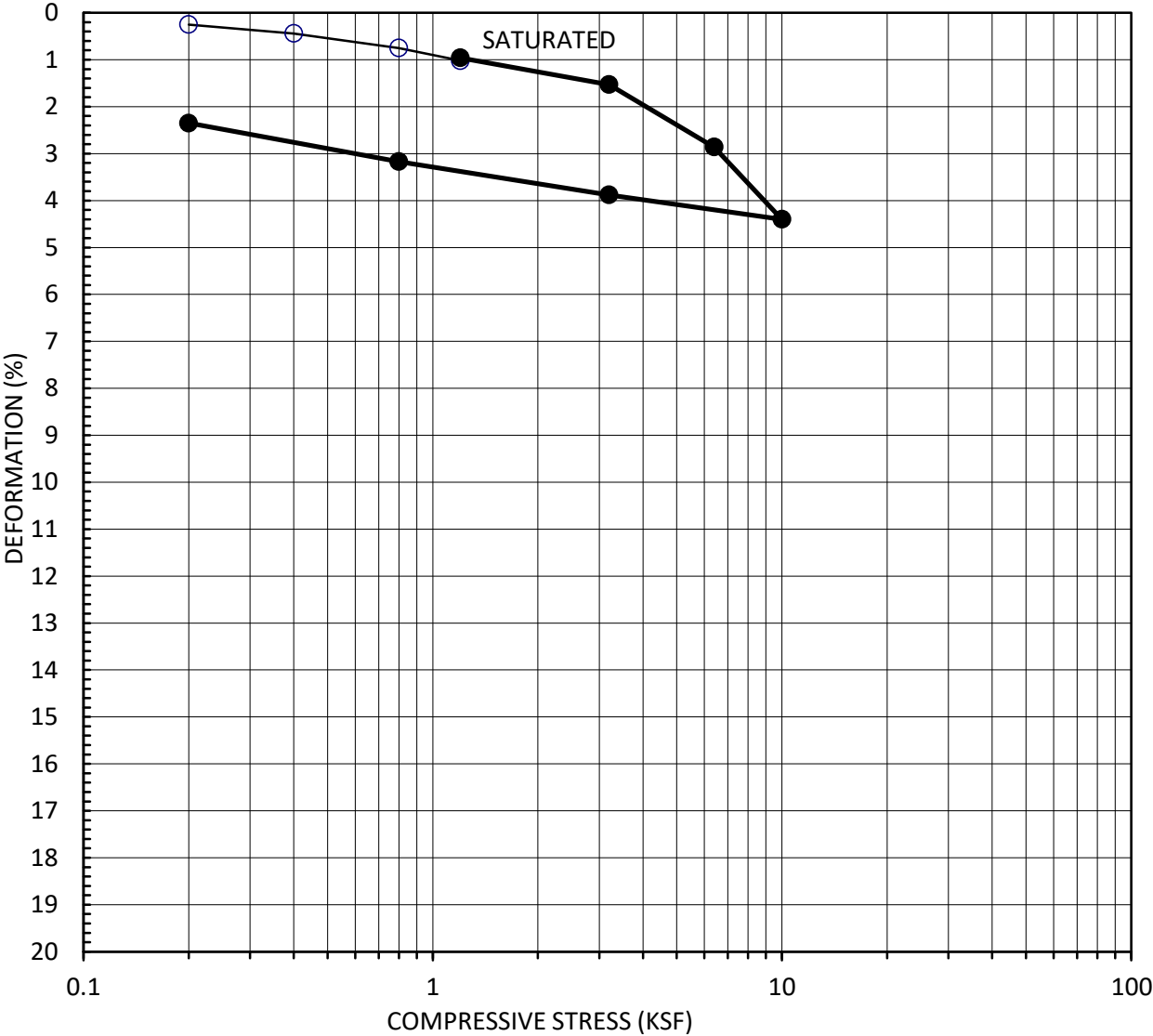
**EGLAB, INC.**

## CONSOLIDATION

03/25

(ASTM D2435)

Figure



| Symbol | Boring No. | Sample No. | Depth (Ft.) | Soil Type | Init. Moisture Content (%) | Init. Dry Density (PCF) | Init. Void Ratio |
|--------|------------|------------|-------------|-----------|----------------------------|-------------------------|------------------|
| ○      | BH-7       | R2         | 6.0         | CL        | 20.5                       | 98.5                    | 0.710            |

**EGLAB, INC.**

03/25

(ASTM D2435)

Project Name:

Thousand Oaks CAP Master Plan

Client:

Cotton, Shires & Assocites, Inc.

Project No.:

SC6174

EGLAB Project No.:

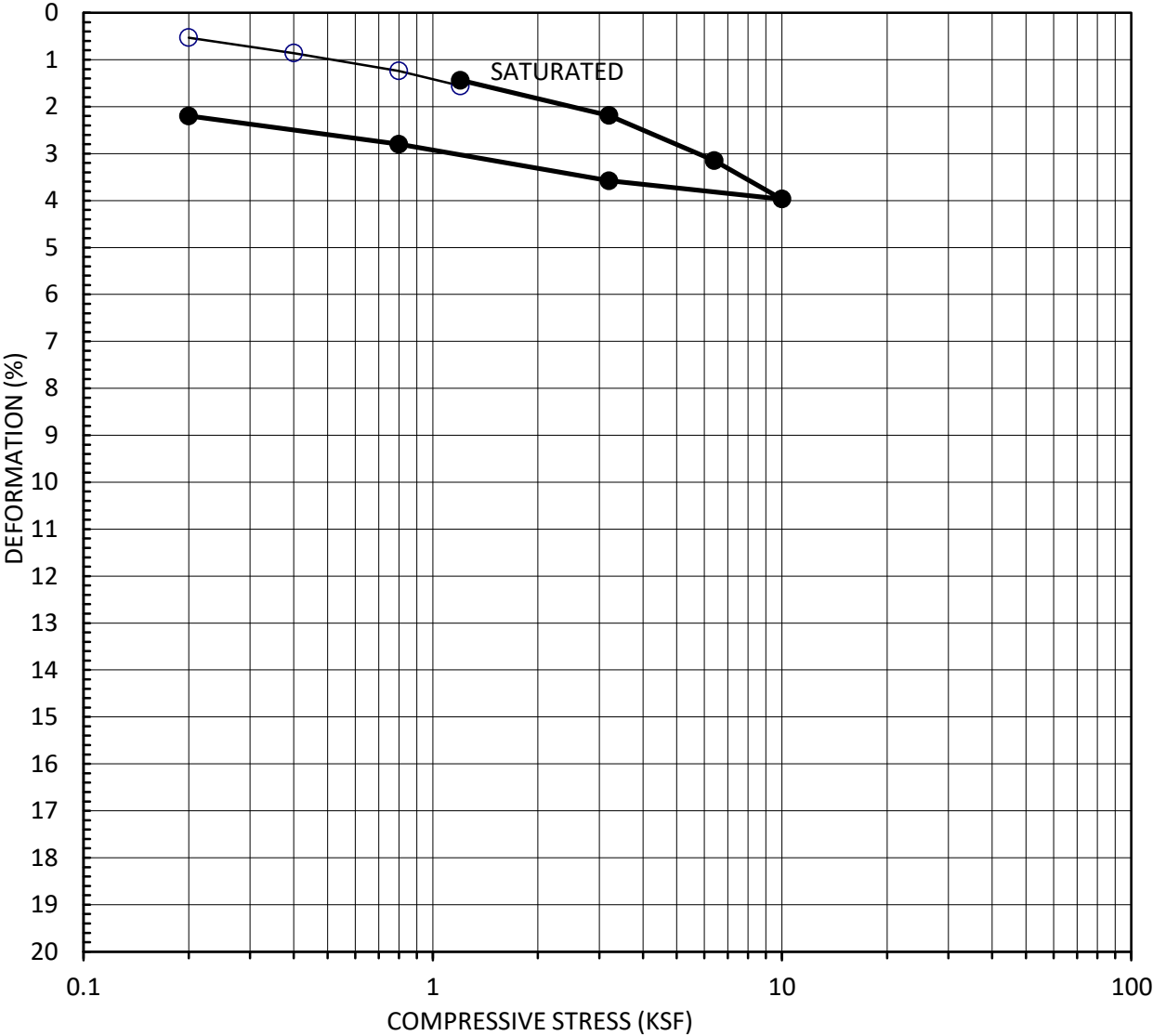
25-022-002

**CONSOLIDATION**

Figure

Civic Arts Plaza Master Plan  
City of Thousand Oaks, California

Figure C-4d



| Symbol | Boring No. | Sample No. | Depth (Ft.) | Soil Type | Init. Moisture Content (%) | Init. Dry Density (PCF) | Init. Void Ratio |
|--------|------------|------------|-------------|-----------|----------------------------|-------------------------|------------------|
| ○      | BH-9       | R4         | 11.0        | CL        | 24.5                       | 99.8                    | 0.689            |

**EGLAB, INC.**

03/25

Project Name:  
Thousand Oaks CAP Master Plan

Client: Cotton, Shires & Associates, Inc.

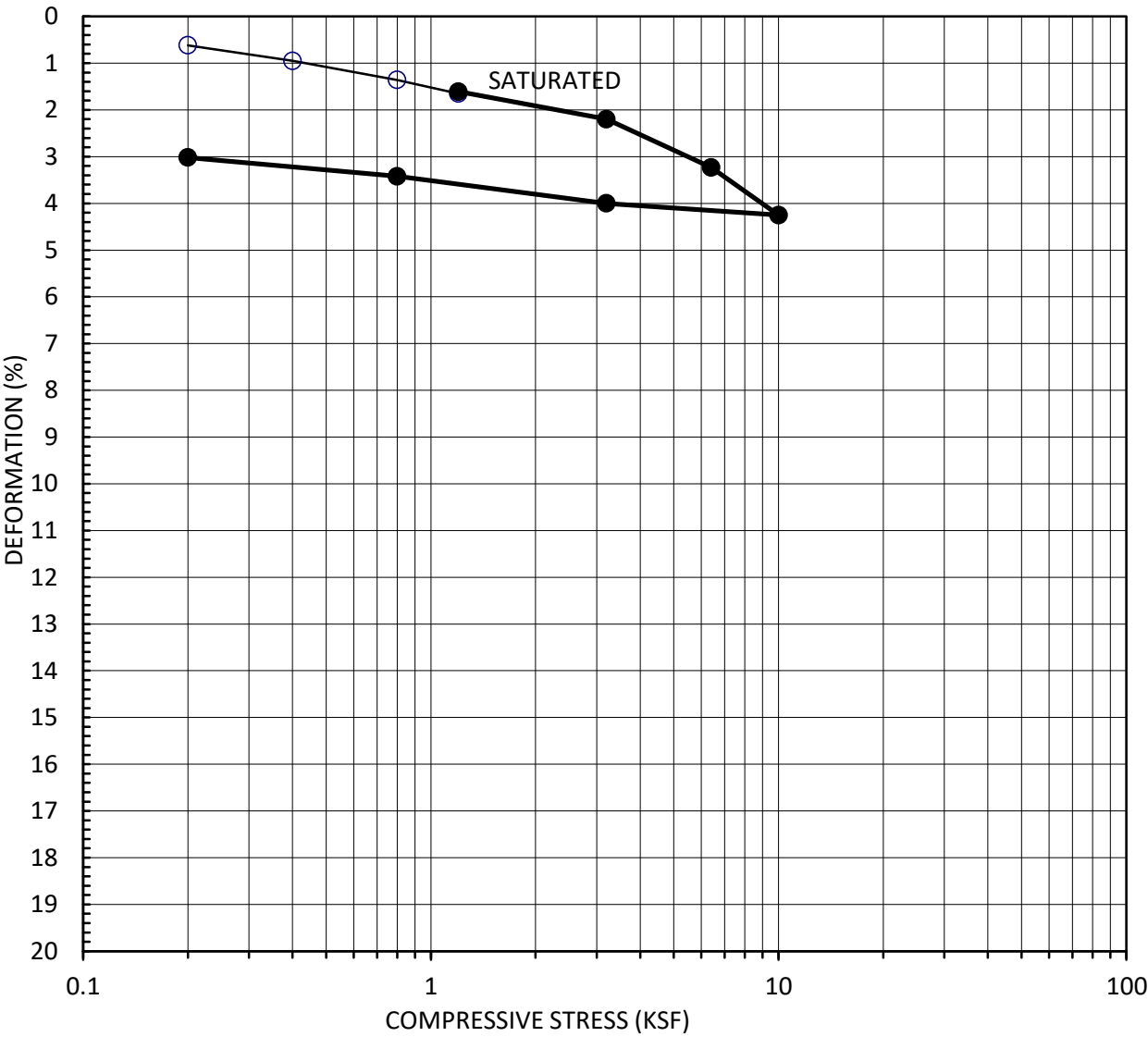
Project No.: SC6174

EGLAB Project No.: 25-022-002

CONSOLIDATION

(ASTM D2435)

Figure



| Symbol | Boring No. | Sample No. | Depth (Ft.) | Soil Type | Init. Moisture Content (%) | Init. Dry Density (PCF) | Init. Void Ratio |
|--------|------------|------------|-------------|-----------|----------------------------|-------------------------|------------------|
| ○      | BH-10      | R4         | 11.0        | CL        | 20.5                       | 106.2                   | 0.587            |

**EGLAB, INC.**

03/25

Project Name:  
Thousand Oaks CAP Master Plan

Client: Cotton, Shires & Associates, Inc.

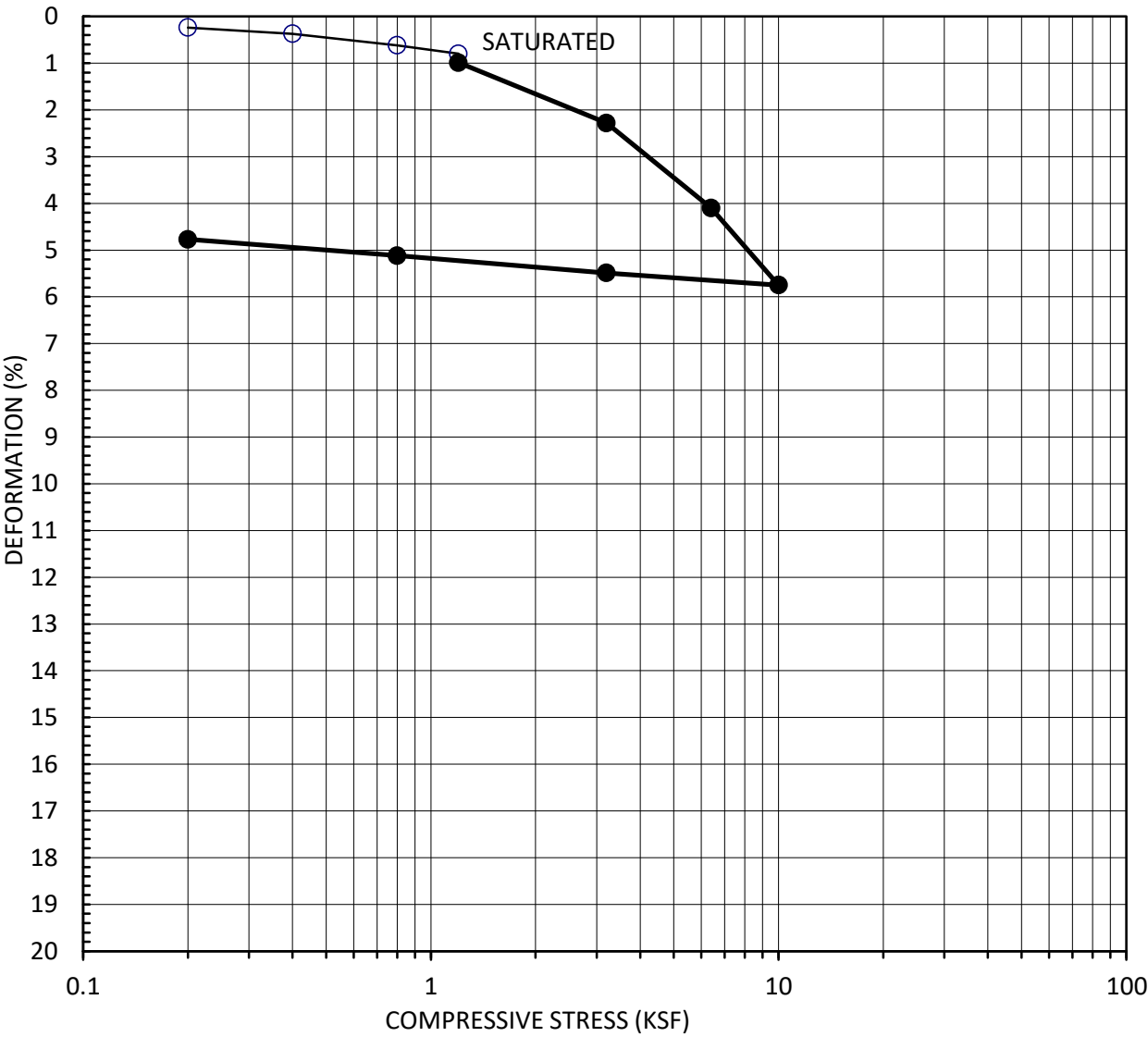
Project No.: SC6174

EGLAB Project No.: 25-022-002

**CONSOLIDATION**

(ASTM D2435)

Figure



| Symbol | Boring No. | Sample No. | Depth (Ft.) | Soil Type | Init. Moisture Content (%) | Init. Dry Density (PCF) | Init. Void Ratio |
|--------|------------|------------|-------------|-----------|----------------------------|-------------------------|------------------|
| ○      | BH-11      | R5         | 13.5        | SC        | 12.0                       | 103.4                   | 0.629            |

EGLAB, INC.

03/25

Project Name:  
Thousand Oaks CAP Master Plan

Client: Cotton, Shires & Assocites, Inc.

Project No.: SC6174

EGLAB Project No.: 25-022-002

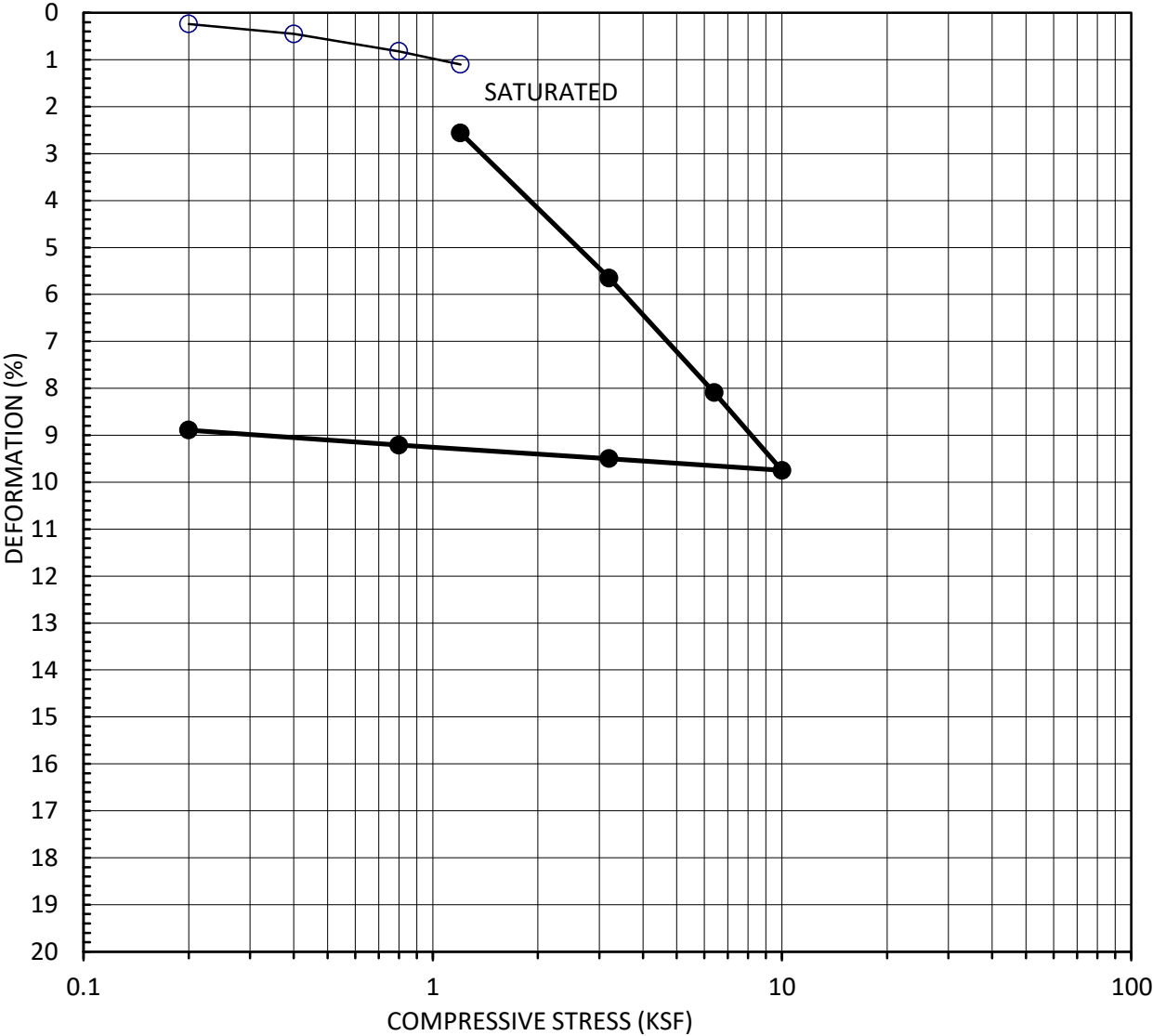
CONSOLIDATION

(ASTM D2435)

Figure

Civic Arts Plaza Master Plan  
City of Thousand Oaks, California

Figure C-4g



| Symbol | Boring No. | Sample No. | Depth (Ft.) | Soil Type | Init. Moisture Content (%) | Init. Dry Density (PCF) | Init. Void Ratio |
|--------|------------|------------|-------------|-----------|----------------------------|-------------------------|------------------|
| ○      | BH-14      | R2         | 6.0         | SC-SM     | 12.4                       | 94.6                    | 0.781            |

**EGLAB, INC.**

03/25

Project Name:  
Thousand Oaks CAP Master Plan

Client: Cotton, Shires & Assocites, Inc.

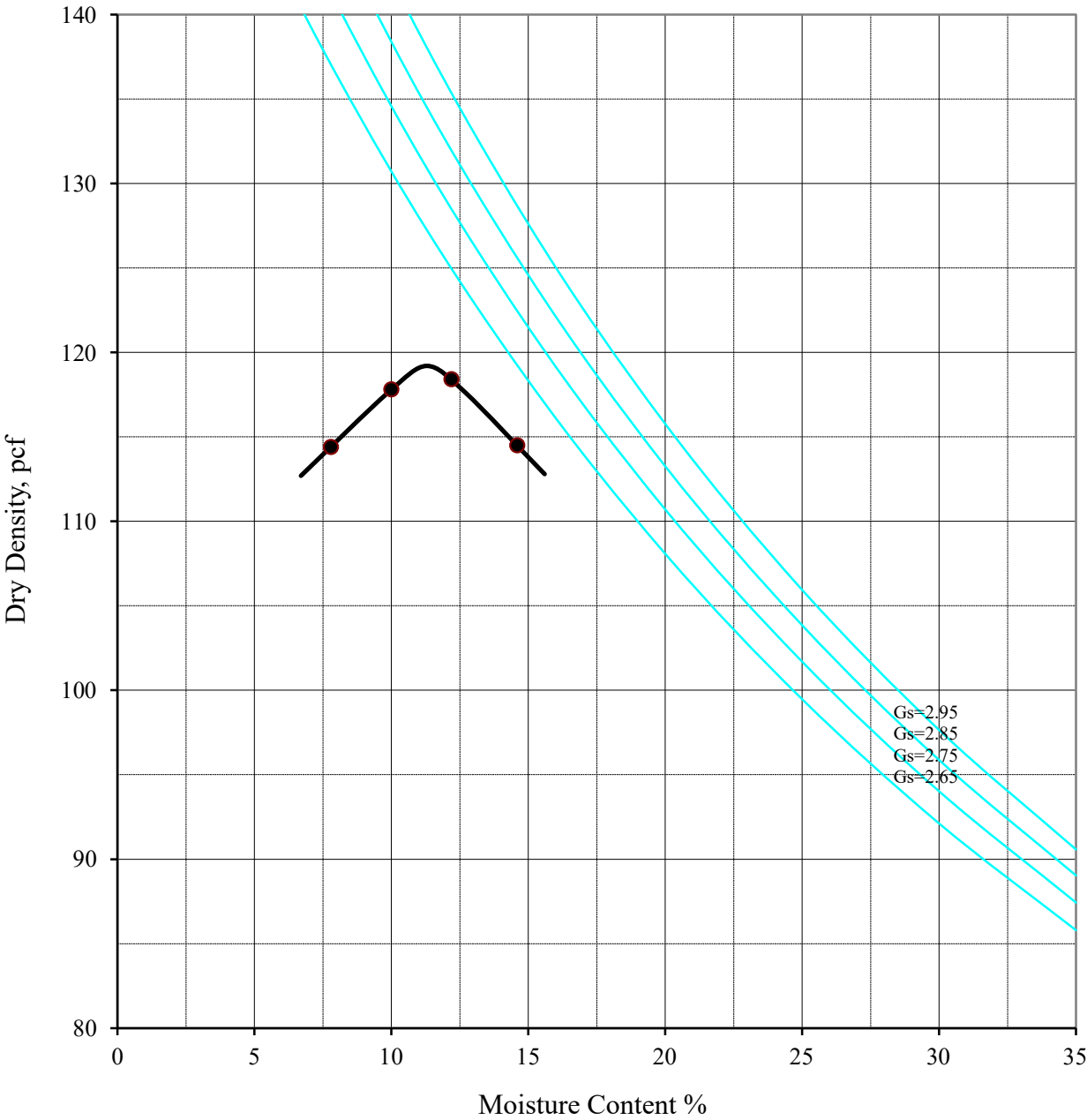
Project No.: SC6174

EGLAB Project No.: 25-022-002

CONSOLIDATION

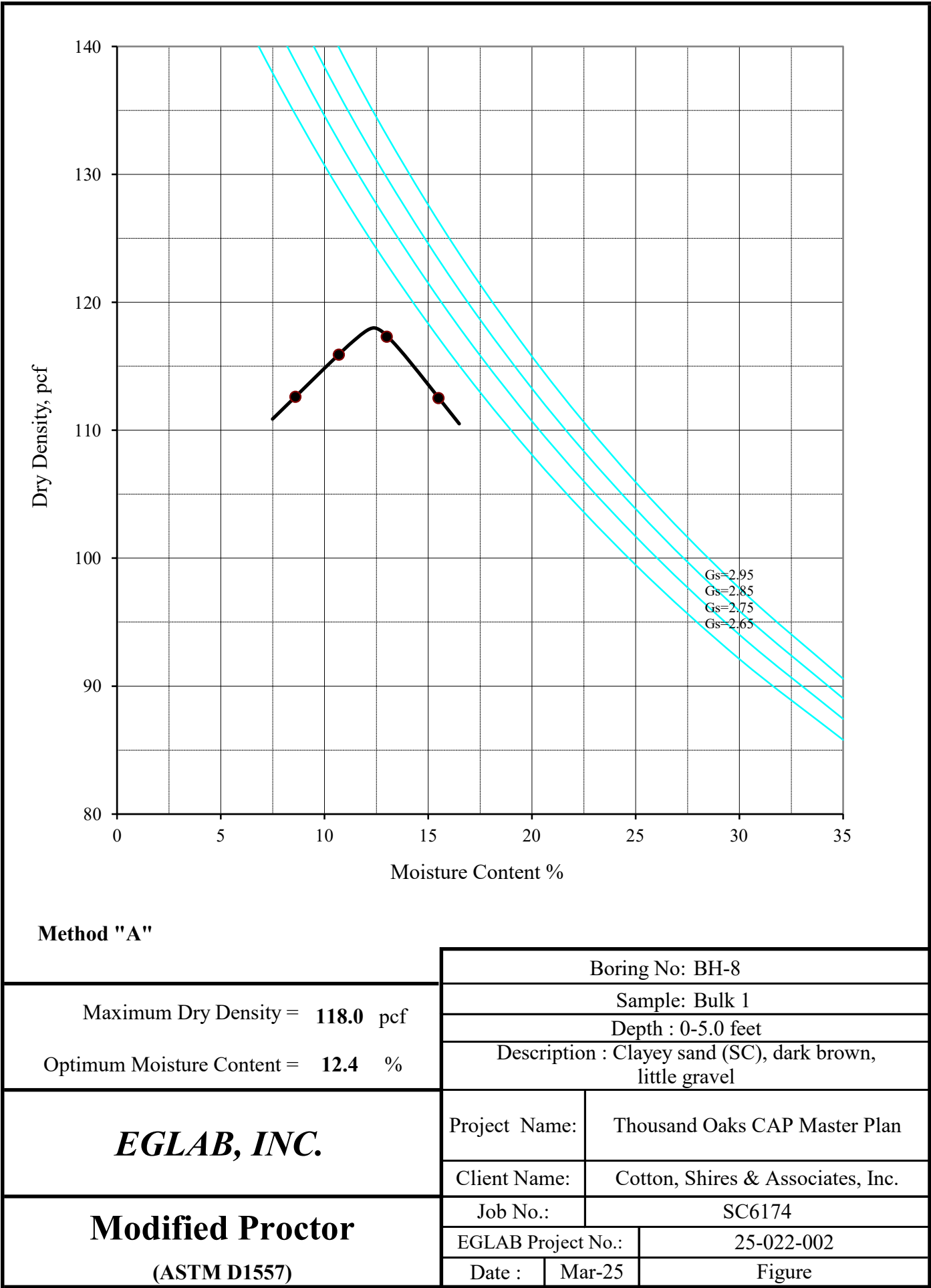
(ASTM D2435)

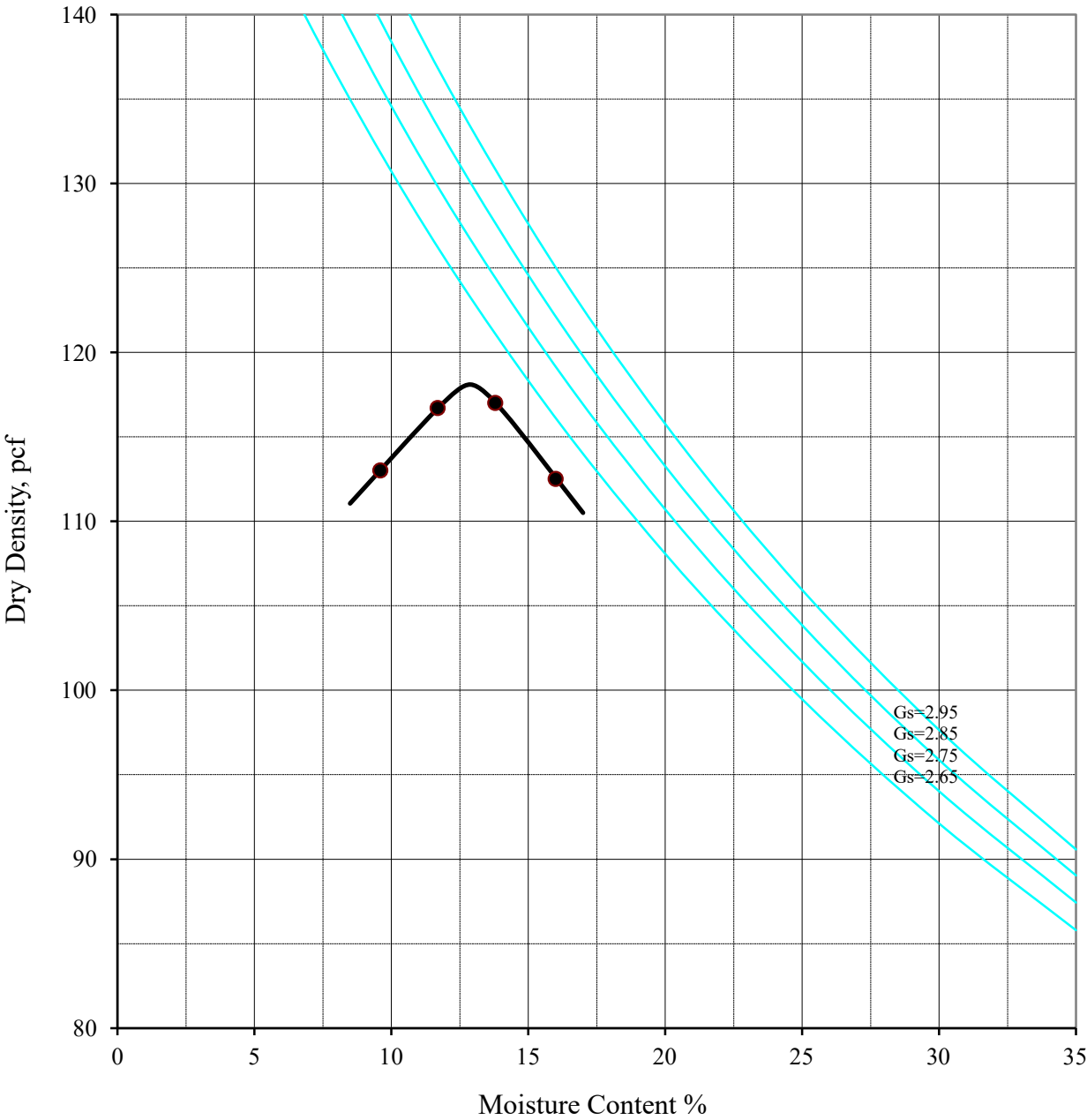
Figure



Method "A"

|                                                                                         |                                                           |                                   |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------------|
| <div>Maximum Dry Density = 119.2 pcf</div> <div>Optimum Moisture Content = 11.3 %</div> | Boring No: BH-6                                           |                                   |
|                                                                                         | Sample: Bulk 1                                            |                                   |
|                                                                                         | Depth : 0-5.0 feet                                        |                                   |
|                                                                                         | Description : Clayey sand (SC), dark brown, little gravel |                                   |
| <i>EGLAB, INC.</i>                                                                      | Project Name:                                             | Thousand Oaks CAP Master Plan     |
|                                                                                         | Client Name:                                              | Cotton, Shires & Associates, Inc. |
| Modified Proctor<br>(ASTM D1557)                                                        | Job No.:                                                  | SC6174                            |
|                                                                                         | EGLAB Project No.:                                        | 25-022-002                        |
|                                                                                         | Date :                                                    | Mar-25                            |
|                                                                                         |                                                           | Figure                            |





Method "A"

Maximum Dry Density = 118.1 pcf

Optimum Moisture Content = 12.9 %

EGLAB, INC.

Modified Proctor  
(ASTM D1557)

Boring No: BH-11

Sample: Bulk 1

Depth : 0-5.0 feet

Description : Clayey sand (SC), dark brown,  
little gravel

Project Name:

Thousand Oaks CAP Master Plan

Client Name:

Cotton, Shires & Associates, Inc.

Job No.:

SC6174

EGLAB Project No.:

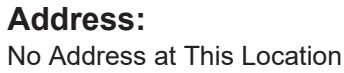
25-022-002

Date :

Mar-25

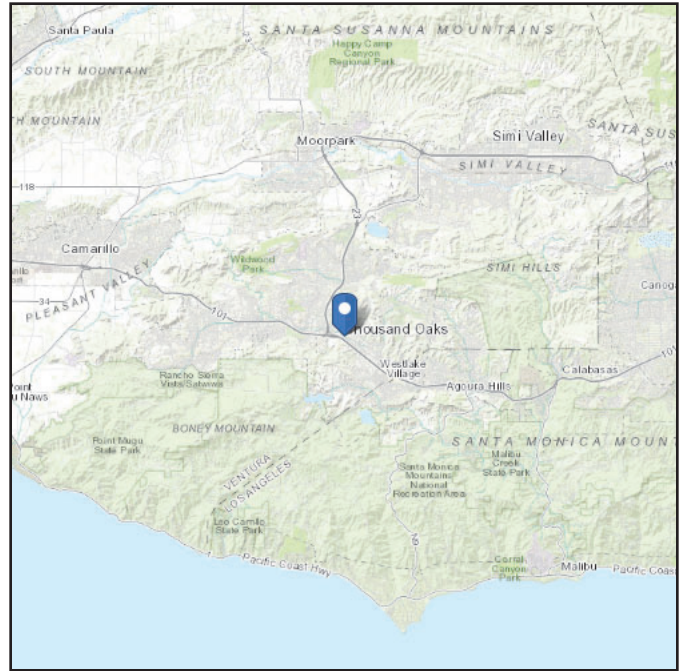
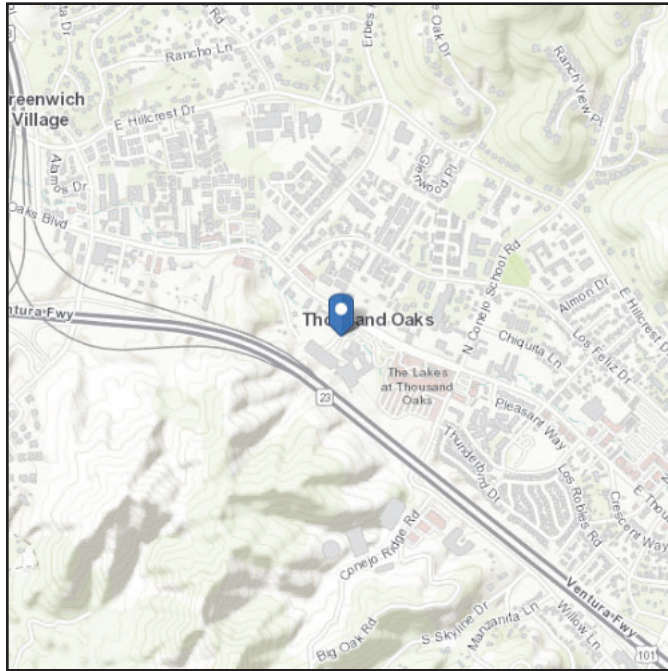
Figure

**APPENDIX D**  
**SEISMIC DESIGN PARAMETERS**



**Standard:** ASCE/SEI 7-22  
**Risk Category:** IV  
**Soil Class:** CD

**Latitude:** 34.175467  
**Longitude:** -118.849036  
**Elevation:** 827.2497687160862 ft  
(NAVD 88)

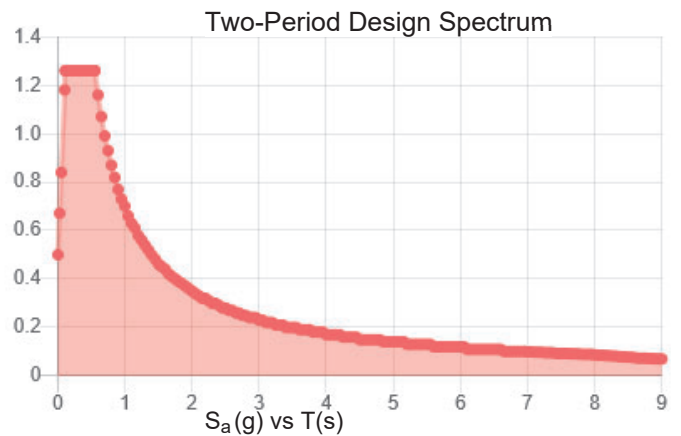
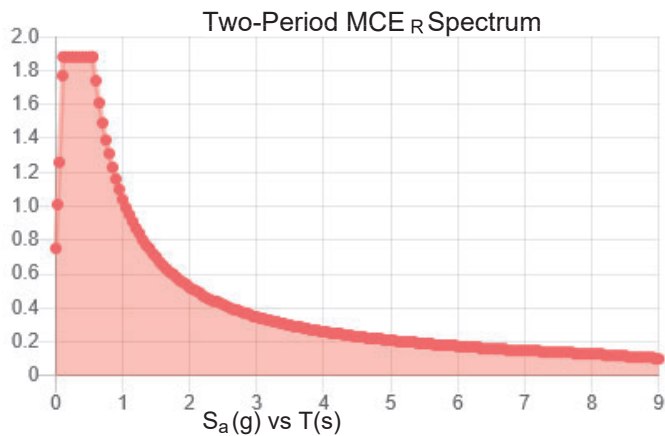
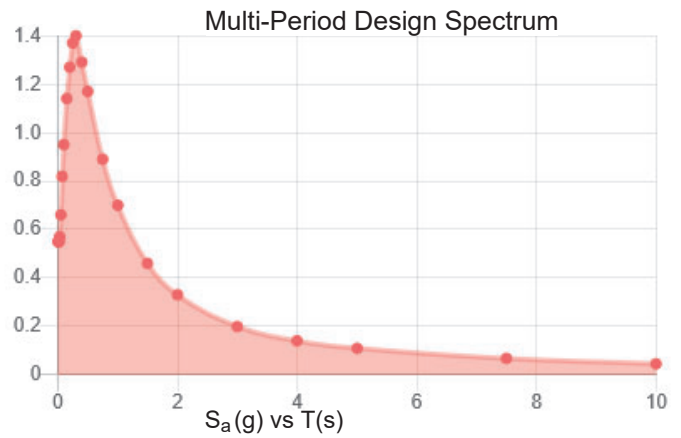
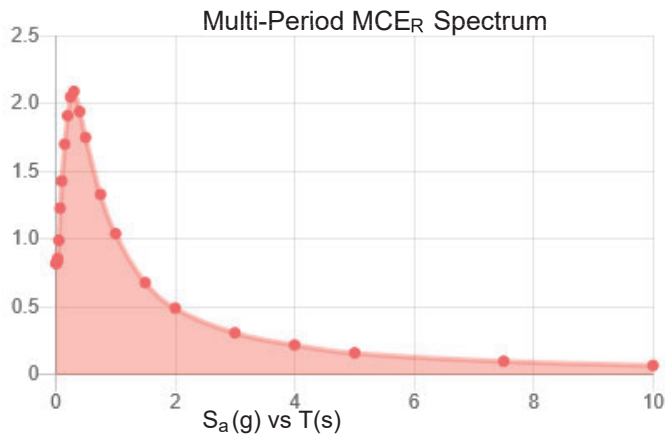


**Site Soil Class:** CD

**Results:**

|                    |      |                    |      |
|--------------------|------|--------------------|------|
| PGA <sub>M</sub> : | 0.69 | T <sub>L</sub> :   | 8    |
| S <sub>MS</sub> :  | 1.88 | S <sub>S</sub> :   | 1.67 |
| S <sub>M1</sub> :  | 1.04 | S <sub>1</sub> :   | 0.52 |
| S <sub>DS</sub> :  | 1.26 | V <sub>S30</sub> : | 365  |
| S <sub>D1</sub> :  | 0.7  |                    |      |

**Seismic Design Category: D**



MCE<sub>R</sub> Vertical Response Spectrum  
Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum  
Vertical ground motion data has not yet been made available by USGS.

# Unified Hazard Tool



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

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

## ^ Input

### Edition

Dynamic: Conterminous U.S. 2014 (...)

### Spectral Period

Peak Ground Acceleration

### Latitude

Decimal degrees

34.175467

### Time Horizon

Return period in years

2475

### Longitude

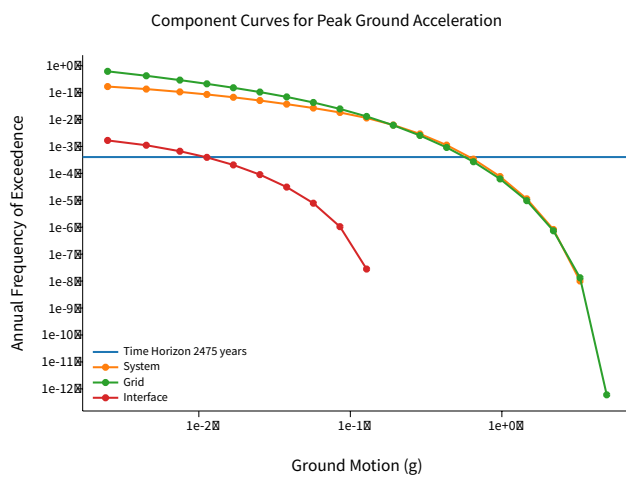
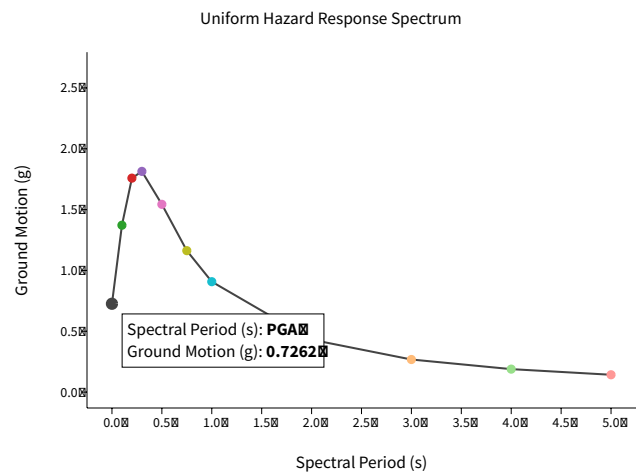
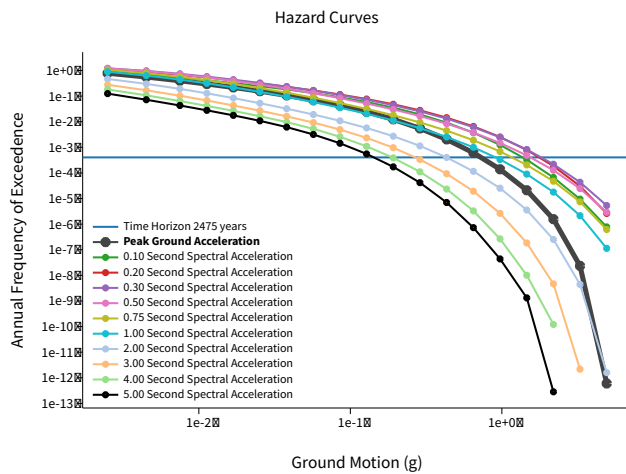
Decimal degrees, negative values for western longitudes

-118.849036

### Site Class

360 m/s (C/D boundary)

## ^ Hazard Curve

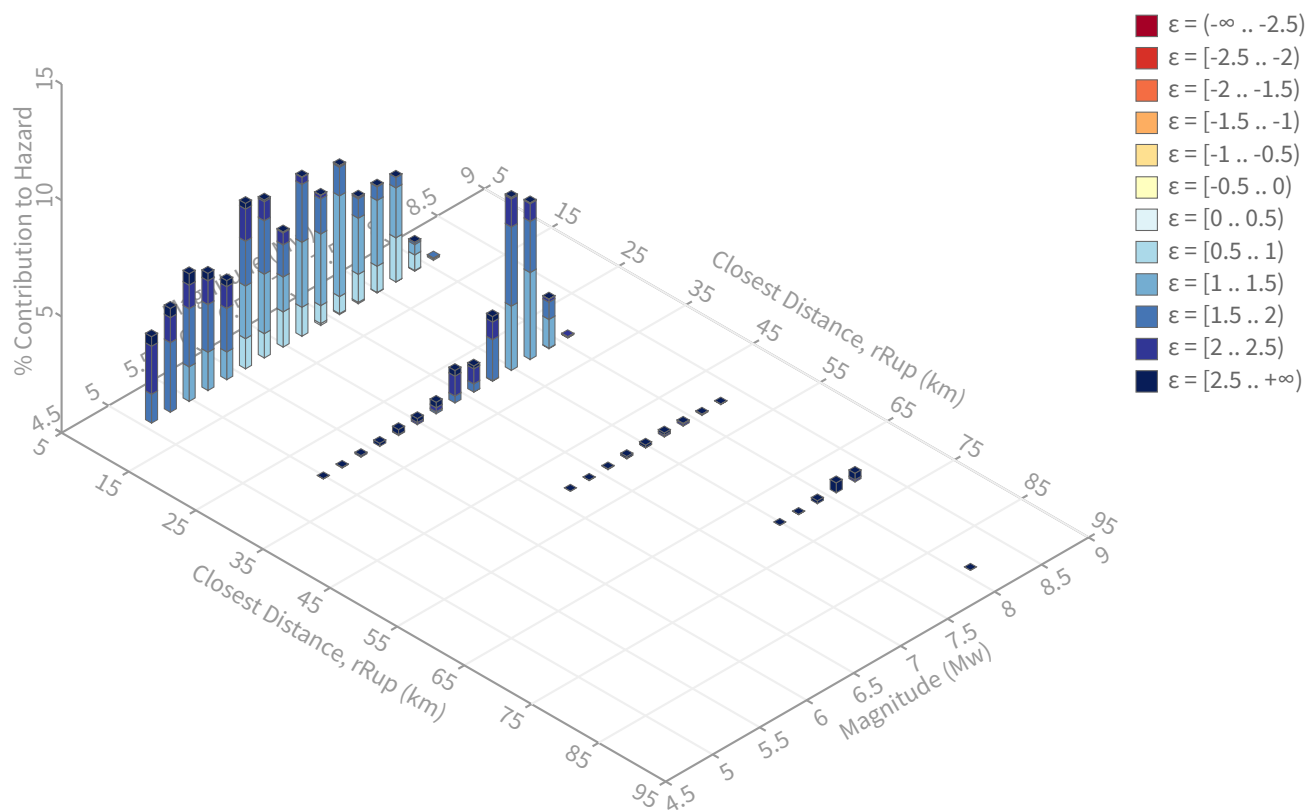


[View Raw Data](#)

## ^ Deaggregation

### Component

Total



## Summary statistics for, Deaggregation: Total

### Deaggregation targets

---

**Return period:** 2475 yrs

**Exceedance rate:** 0.0004040404 yr<sup>-1</sup>

**PGA ground motion:** 0.72615791 g

### Recovered targets

---

**Return period:** 2949.0044 yrs

**Exceedance rate:** 0.00033909749 yr<sup>-1</sup>

### Totals

---

**Binned:** 100 %

**Residual:** 0 %

**Trace:** 0.04 %

### Mean (over all sources)

---

**m:** 6.71

**r:** 13.83 km

**ε<sub>0</sub>:** 1.58 σ

### Mode (largest m-r bin)

---

**m:** 7.52

**r:** 22.28 km

**ε<sub>0</sub>:** 1.68 σ

**Contribution:** 7.43 %

### Mode (largest m-r-ε<sub>0</sub> bin)

---

**m:** 7.08

**r:** 10.53 km

**ε<sub>0</sub>:** 1.25 σ

**Contribution:** 4.33 %

### Discretization

---

**r:** min = 0.0, max = 1000.0, Δ = 20.0 km

**m:** min = 4.4, max = 9.4, Δ = 0.2

**ε:** min = -3.0, max = 3.0, Δ = 0.5 σ

### Epsilon keys

---

**ε0:** [-∞ .. -2.5)

**ε1:** [-2.5 .. -2.0)

**ε2:** [-2.0 .. -1.5)

**ε3:** [-1.5 .. -1.0)

**ε4:** [-1.0 .. -0.5)

**ε5:** [-0.5 .. 0.0)

**ε6:** [0.0 .. 0.5)

**ε7:** [0.5 .. 1.0)

**ε8:** [1.0 .. 1.5)

**ε9:** [1.5 .. 2.0)

**ε10:** [2.0 .. 2.5)

**ε11:** [2.5 .. +∞]

## Deaggregation Contributors

| Source Set           | Source                              | Type   | r     | m    | $\epsilon_0$ | lon       | lat      | az     | %     |
|----------------------|-------------------------------------|--------|-------|------|--------------|-----------|----------|--------|-------|
| UC33brAvg_FM32       |                                     | System |       |      |              |           |          |        | 27.62 |
|                      | Simi-Santa Rosa [3]                 |        | 10.09 | 7.07 | 1.30         | 118.880°W | 34.260°N | 343.11 | 7.49  |
|                      | Oak Ridge (Onshore) [3]             |        | 21.11 | 7.53 | 1.60         | 118.919°W | 34.364°N | 343.03 | 6.27  |
|                      | Malibu Coast alt 2 [4]              |        | 14.59 | 7.54 | 1.11         | 118.872°W | 34.045°N | 188.13 | 3.45  |
|                      | Anacapa-Dume alt 2 [3]              |        | 16.90 | 7.37 | 1.43         | 118.788°W | 33.975°N | 165.82 | 2.48  |
| UC33brAvg_FM31       |                                     | System |       |      |              |           |          |        | 26.86 |
|                      | Simi-Santa Rosa [3]                 |        | 10.09 | 7.10 | 1.28         | 118.880°W | 34.260°N | 343.11 | 8.05  |
|                      | Oak Ridge (Onshore) [3]             |        | 21.11 | 7.61 | 1.53         | 118.919°W | 34.364°N | 343.03 | 6.65  |
|                      | Malibu Coast alt 1 [8]              |        | 14.66 | 7.15 | 1.53         | 118.872°W | 34.042°N | 188.04 | 2.57  |
|                      | Anacapa-Dume alt 1 [0]              |        | 17.16 | 7.44 | 1.25         | 118.794°W | 33.977°N | 167.08 | 1.97  |
| UC33brAvg_FM31 (opt) |                                     | Grid   |       |      |              |           |          |        | 22.81 |
|                      | PointSourceFinite: -118.849, 34.225 |        | 7.03  | 5.87 | 1.41         | 118.849°W | 34.225°N | 0.00   | 6.68  |
|                      | PointSourceFinite: -118.849, 34.225 |        | 7.03  | 5.87 | 1.41         | 118.849°W | 34.225°N | 0.00   | 6.68  |
|                      | PointSourceFinite: -118.849, 34.261 |        | 9.67  | 5.95 | 1.76         | 118.849°W | 34.261°N | 0.00   | 2.38  |
|                      | PointSourceFinite: -118.849, 34.261 |        | 9.67  | 5.95 | 1.76         | 118.849°W | 34.261°N | 0.00   | 2.38  |
| UC33brAvg_FM32 (opt) |                                     | Grid   |       |      |              |           |          |        | 22.70 |
|                      | PointSourceFinite: -118.849, 34.225 |        | 7.03  | 5.87 | 1.41         | 118.849°W | 34.225°N | 0.00   | 6.67  |
|                      | PointSourceFinite: -118.849, 34.225 |        | 7.03  | 5.87 | 1.41         | 118.849°W | 34.225°N | 0.00   | 6.67  |
|                      | PointSourceFinite: -118.849, 34.261 |        | 9.62  | 5.97 | 1.74         | 118.849°W | 34.261°N | 0.00   | 2.35  |
|                      | PointSourceFinite: -118.849, 34.261 |        | 9.62  | 5.97 | 1.74         | 118.849°W | 34.261°N | 0.00   | 2.35  |