

ALLAN E. SEWARD
ENGINEERING GEOLOGY, INC.
Geological And Geotechnical Consultants

GEOTECHNICAL REPORT
Review of Building Plan

Proposed Buildings C, D, E, and F
Paradise Canyon Elementary School
471 Knight Way
La Cañada, Los Angeles County, California

Exclusively Prepared for:

La Cañada Unified School District
4490 Cornishon Avenue
La Cañada, CA 91011

Job No.: 24-2775-6
Dated: June 19, 2024

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 - HS-6 thru HS-9
 - PB-1 and PB-2 (1/13/23)
- Hand-Auger Boring Logs
 - HA-1
 - HA-2 thru HA-6 (2/8/24)
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- Slope Stability Analyses Results Table D1
- Gross Slope Stability Analyses Computer Output

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- Recommended Earthwork Specifications
- Recommended Specifications for Placement of Trench Backfill
- Drainage and Erosion Control Recommendations
- Retaining Wall Drainage Details
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- Active Lateral Earth Pressures, Temporary Excavation Supported by Pile

Cross Sections 2-2', 3-3', 4-4', 6-6' and 7-7' (20-scale)

Cross Sections H-H', I-I' and J-J' (10-scale)¹

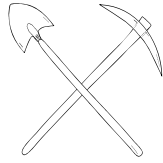
Geologic Map (Site Plan)

Plate I

Geotechnical Map (Civil Site Grading Plan)

Plate II

¹ Cross Sections H-H' and I-I' have three versions: Conventional Footing (illustrating temporary backcut); Soldier Pile Wall; and Temporary Excavation Supported by Soldier Pile.



ALLAN E. SEWARD
ENGINEERING GEOLOGY, INC.
Geological And Geotechnical Consultants

June 19, 2024

Job No.: 24-2775-6

La Cañada Unified School District
4490 Cornishon Avenue
La Cañada, California 91011

Attention: Mr. Harold Pierre
Program Manager
Linik Corp. Builders Management

Subject: **GEOLOGIC HAZARDS EVALUATION REPORT**
Review of Building Plan

Project: Proposed Buildings C, D, E, and F
Paradise Canyon Elementary School
471 Knight Way
La Cañada, Los Angeles County, California 91011

References: At the end of the text

Dear Mr. Pierre:

This report presents our professional opinions regarding the existing geologic and geotechnical conditions at the above-referenced site, their potential effects on the proposed development, and our geotechnical recommendations for design and construction.

1.0 SCOPE OF WORK

Our investigation included the following tasks:

1. Review of Civil Site Grading Plan, prepared by GGA Architecture and KPFF (received 4/29/24), illustrating selected option 2A for building footprint locations.
2. Review of our Geotechnical Report (for nearby buildings “N” and “P”), dated January 13, 2023 (see ref. 1).
3. Review of our Geologic Report, Fault Rupture Hazard Investigation, dated September 14, 2023 (see ref. 2).
4. Review of our Geologic Hazard Evaluation Report (for the conceptual site plan of proposed buildings at the vicinity of existing Classrooms D, E, and F), dated November 10, 2023 (see ref. 4).

5. Review of CGS Engineering Geology and Seismology Review Letter for the site, dated March 6, 2024.
6. Review of the published geologic reports and maps referenced at the end of this report.
7. Review of the Seismic Hazards Map and Report for the Pasadena Quadrangle.
8. Evaluation of groundwater conditions and historic groundwater levels based on Los Angeles County Flood Control District (LACFCD) water well data and published maps.
9. Review of the following aerial photographs:

Date	Flight	Frame	Scale	Agency
1/1/28	C-300	K246	1:18,000±	Fairchild
11/8/35	C-3758	1 & 2	1:7,800	Fairchild
1938	AXJ-1938	59-72	1:20,000	USDA
11/22/44	DDF-1944	7-30 & 7-31	1:10,000	Fairchild
1/5/60	C-23870	1945 & 1946	1:14,000	Fairchild
1994 – 2021	- Various Images	-	-	Google Earth Web Application

10. Performed general earthquake ground motion characterization utilizing the latest seismic ground-motion provisions of the 2022 California Building Code (CBC).
11. Assessment of potential ground rupture hazard at the site.
12. Preliminary evaluation of geotechnical parameters for the design of shallow footing foundations, slab-on-grade floors, and retaining walls, including allowable bearing pressure, equivalent fluid densities for calculation of active, passive, and at-rest pressures, soil-to-concrete friction factors, and coefficient of vertical subgrade reaction.
13. Preliminary assessment of recommended grading removal depths based on subsurface conditions and rough estimates of static settlements under assumed future building loads.
14. Preparation of Cross Sections 2-2', 3-3', 4-4', 6-6' and 7-7' at a scale of 1" = 20' and Cross Sections I-I', H-H' and J-J' at a scale of 1" = 10', illustrating anticipated geotechnical conditions with respect to proposed development.
15. Preparation of a Geologic Map (**Plate I**), and Geotechnical Map (**Plate II**) illustrating the location of our subsurface explorations, distribution of geologic units, and cross sections relative to the area of proposed new buildings. The site plan – limit of work received 4/29/2023 was used as the base map. We make no representation regarding the accuracy of these base maps.

16. Preparation of a Location Map, Geologic Map, drill hole logs, laboratory test reports, and seismicity figures for inclusion in this report.
17. Preparation of this Geotechnical report, which summarizes the results of our study and provides preliminary geotechnical recommendations for the design and construction of the proposed improvements.

The School District has decided on Option 2A for building footprints (out of the five previously proposed study options as shown on the Site Studies – Options 1A to 5A (Plate II) of our referenced report (see ref. 4). Confirmatory geotechnical investigation has been carried as part of this study.

2.0 SITE DESCRIPTION

The project site is located at 471 Knight Way within the City of La Cañada, Los Angeles County, at the northeast corner of the intersection with Gould Avenue (see **Location Map** following page 4). The site coordinates are 34.20888°N, 118.18777°W. The site is within a residential community and is bounded by Knight Way to the south, Gould Avenue to the west, and single-family homes to the north and east. The elementary school campus is occupied by several single-story administrative and classroom buildings on level pad areas with small retaining walls to accommodate grade changes in between some buildings. Blacktop and field areas occupy the east side and northwest corner of the campus. The site generally ascends from south to north, with topography ranging from a low of 1290 ft above mean sea level at the southeast corner of the campus to 1334 ft at the northwest corner.

3.0 PROPOSED DEVELOPMENT

The proposed development includes the construction of four new 1-story buildings (Buildings C, D, E and F), as shown on the attached Geologic Map (**Plate I**), and Geotechnical Map (**Plate II**). The buildings are expected to be supported on shallow footing foundations. The finish floor grades for the proposed buildings ranges from 1314.40 to 1316.80. Minor cut (up to 2 feet) and fill (up to 2 feet) are required. Retaining walls of up to 2 feet are proposed within the interior areas. The retaining wall located northwest of Building E is up to 6 feet in height (see **Plate II**). However, we understand that this wall is likely to be 8 ft in height. Also, this retaining wall may be constructed with a conventional foundation system or as a soldier pile wall system with wall elements spanning between cast-in-drill-hole (CIDH) piles. There is an existing retaining wall (to remain) along the northerly portion of the site. The approximate locations of the proposed new buildings are shown relative to the existing improvements on the attached Cross Sections.

4.0 FIELD INVESTIGATION, SAMPLING, AND LABORATORY TESTING

4.1 Subsurface Exploration

In 2022, this firm carried out subsurface exploration for other buildings in campus, which included the drilling, sampling, and logging of five (5) hollow-stem auger borings (HS-1 through HS-5, PB-1 and PB-2) to a maximum depth of 35.9 feet below the existing ground surface. The hollow stem borings were drilled by Choice Drilling Inc. on 6/25/22. This data was also utilized for the purposes of this report.

In 2023, five (5) hand-auger borings (HA-2 through HA-6), near Buildings H and J, were drilled, sampled, and logged to a maximum depth of 11 feet below the existing ground surface to better address this project. Hand-auger borings were excavated by Gold Construction, Inc., on 12/28/23.

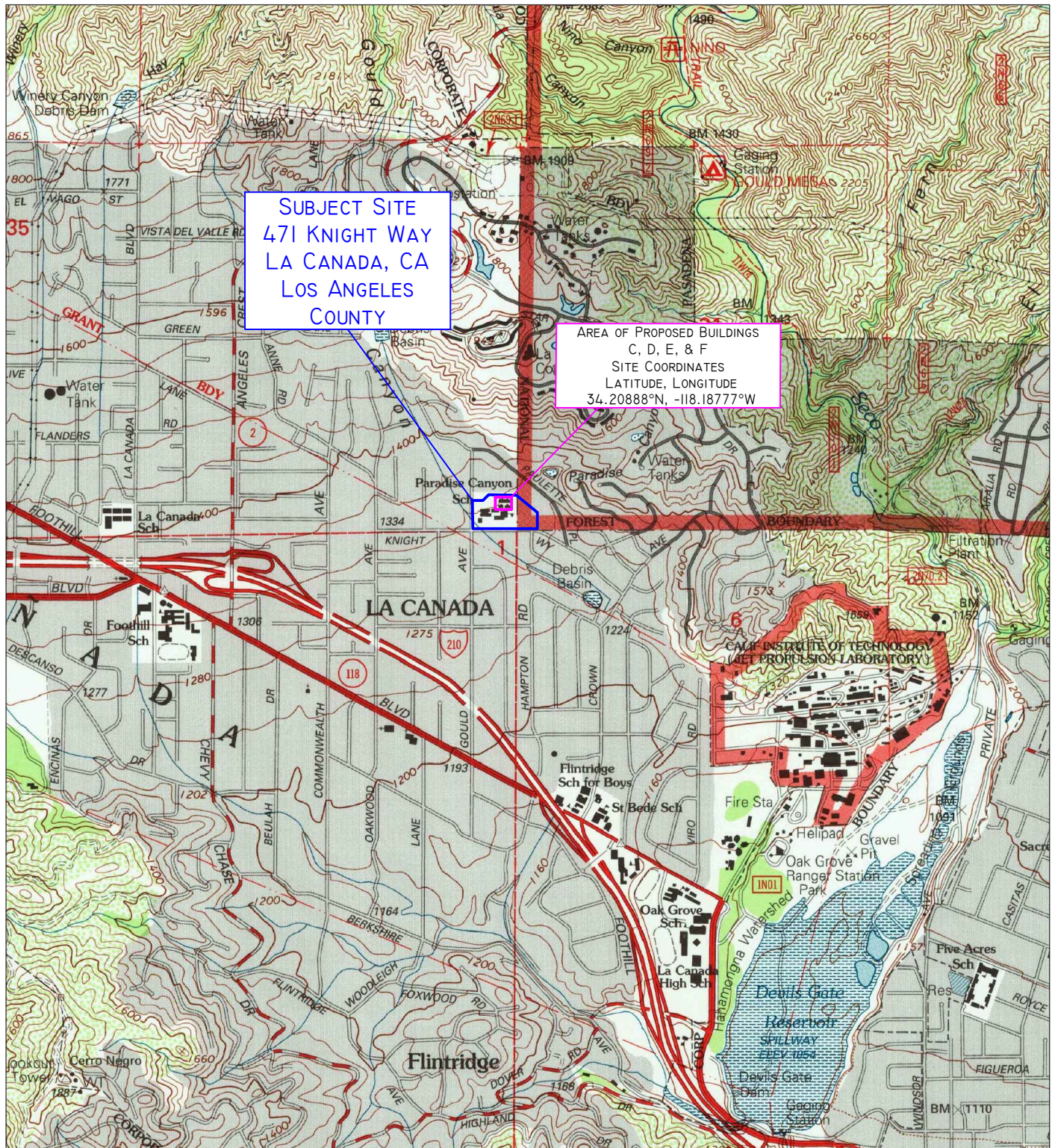
Subsurface exploration performed included the drilling, sampling, and logging of four (4) hollow-stem auger borings (HS-6 through HS-9) to a maximum depth of 36.5 feet. A hand-auger boring (HA-1) was excavated to a depth of 9 feet below the existing ground surface north of proposed Building F. Trench (T-1) was excavated to a depth of 4 feet below the existing ground surface, north of proposed Building E. HA-1 and T-1 was excavated by Gold Construction on 12/28/23. The borings were drilled by Choice Drilling Inc. on 1/4/24. These explorations were logged by a staff geologist with oversight by a Geotechnical Engineer and a Certified Engineering Geologist.

The trench and drill hole logs are included in **Appendix A** and represent our interpretation of field data prepared for each boring by our geologic/engineering staff at the time of exploration, along with refinements based on observations and laboratory test results. Unit boundaries shown in the graphic log column of our hollow-stem-auger drill hole logs are approximate and may represent gradual transitions. The subsurface locations are shown on the attached Geologic Map (**Plate I**), and Geotechnical Map (**Plate II**).

4.2 Sampling Procedures

California drive (relatively undisturbed) ring and Standard Penetration Test (SPT) samples were obtained in the exploratory drill holes at various depths (see logs in **Appendix A**). Recovered soil samples were sealed in plastic containers and brought to our laboratory for further classification and testing.

Bulk (disturbed) samples of the near-surface soils were obtained from cuttings developed during the excavation of the exploratory drill holes. The bulk samples were collected for classification and testing purposes and represent a mixture of soils within the noted depths.



SOURCE: USGS PASADENA 7.5-MINUTE QUADRANGLE,
 DATED 1995

APPROXIMATE SCALE: 1"=2,000'

NOTE: THIS IS NOT A SURVEY OF THE
 PROPERTY



ALLAN E. SEWARD
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LOCATION MAP

JOB No.: 24-2775-6

DATE: 6/19/24

4.3 Laboratory Testing

Soil samples were visually classified at the site in accordance with the Unified Soil Classification System (ASTM D2488). Thereafter, the samples were brought to our geotechnical laboratory, the visual soil classifications were checked, and the subsurface logs were reviewed in order to select soil samples for testing.

The laboratory testing program performed on samples of on-site soils included the following tests: moisture content, dry density, percent minus no. 200 sieve (i.e., percent fines), direct shear, modified Proctor compaction, hydro-compression, and corrosivity (sulfate content, chloride content, pH, and resistivity).

Based on laboratory test results the soil samples classifications were further refined per the Unified Soils Classification System (ASTM Standard Practice D2487). In-situ moisture content and dry density were used to evaluate the in-situ soil strength and selection of samples for additional testing. Amount of Material in Soils Finer than No. 200 Sieve was performed for classification purposes. Hydro-compression testing was performed for evaluation of settlement of soil from future fill and foundation loads. Direct shear testing was performed to develop appropriate soil strength parameters. Modified Proctor compaction was performed to assess the moisture-density relationship of compacted soil. Laboratory test methods and results of the testing are provided in **Appendix B** of this report.

5.0 GEOTECHNICAL CONDITIONS

5.1 Geologic Setting

The project site is located within the eastern Transverse Ranges geomorphic province of southern California in the westernmost portion of the San Gabriel Valley (see **Regional Geologic Map** following page 6). The Transverse Ranges are characterized by east-west trending ranges separated by alluviated, broadly synclinal valleys, narrow stream canyons, and prominent faults.

The San Gabriel Valley is a sediment filled, east-trending structural trough situated between the south flank of the pre-Tertiary, crystalline igneous bedrock of the San Gabriel Mountains to the north and Verdugo Hills and San Rafael Hills to the south. The subject site is underlain by sub-horizontal sedimentary deposits of Pleistocene age. These sediments have been classified as older alluvial fan deposits (Qof) consisting of fan gravel and sand derived from the San Gabriel Mountains (Smith, 1986; Crook et al., 1987; Dibblee, 1989).

The Sierra Madre fault zone is one of the largest structures in the western Transverse Ranges. The Sierra Madre fault zone consists of north-dipping thrust and reverse faults along the range front of the Santa Susana and San Gabriel Mountains. It is divided into four sections

based on major structural discontinuities (Treiman, 2000). These sections consist of the Santa Susana fault, the San Fernando fault, the Central Sierra Madre fault, and the Cucamonga fault. The section of the fault north of the school site is the Central Sierra Madre fault. This fault is listed as Sierra Madre fault zone, Sierra Madre B section (Class A) No. 105c at the U.S.G.S. Fault and Fold Data Base.

The Sierra Madre fault is shown on published geologic maps north of the school site by Crook (1987) and Dibblee (1989), although there are slight variations in location. The location of the Sierra Madre fault from these published references are shown on the Geologic Map (**Plate I**). In addition, the fault locations from the CGS preliminary A-P Zone map are shown. The Sierra Madre fault is mapped as concealed beneath the alluvial fan deposits approximately 121 ft (Dibblee, 1989) to 204 ft (Crook, 1987) northerly of the site. The CGS preliminary A-P Zone map indicates faults at 126 ft and 176 ft northerly of the site. It is opined that the CGS fault at 126 ft and the Dibblee fault are the same and the CGS fault at 175 ft and the Crook fault are the same. These minor differences between Dibblee/Crook fault locations and the CGS preliminary A-P Zone map is likely due to scaling of these reference maps into the project drawings.

5.2 Subsurface Soils

Details of the soil units observed at the site are discussed below and presented on our subsurface logs (**Appendix A**).

5.2.1 Artificial Fill (af)

Artificial fill (af) generated from past development activities was encountered in the borings up to depths of 5 to 9.5 feet below the existing ground surface. The artificial fill consists of a dull brown to orangish-brown, silty, fine- to coarse-grained sand and light-brown, poorly graded sand. The fill materials contained some scattered gravel and occasional granitic rock fragments. The fill is characterized as medium dense, and dry to damp. The measured dry density in the artificial fill ranged from about 105 pounds per cubic foot (pcf) to 123 pcf, with moisture contents ranging from 1.8 to 11.6 percent.

5.2.2 Alluvial Fan Deposits (Qal₃)

The artificial fill is underlain by alluvial fan deposits (Qal₃). This unit is designated as Qal₃ on the attached Geologic Map and logs. This unit correlates to Qal₃ of Crook et al. (1987), Qof of Dibblee (1989), Qo₄ of Smith (1986), Qof₁ on the 2014 Preliminary Geologic Map of the Los Angeles 30'x 60' Quadrangle, and Q3 of Burgette et al (2020). This unit is judged to be Pleistocene in age based on correlation with Burgette et al (2020).

At the project site these deposits were observed to generally consist of alternating layers of light-brown to dark-brown to orangish-brown, silty, fine- to coarse-grained sands, graded sands with varied silt and gravel content, and silty, clayey, fine- to medium grained sands. Isolated hard cobble- and boulder-sized clasts are known to exist in the older fan deposits. The exploratory borings encountered clasts consist of (weathered) granitic rock fragments. The fan deposits are characterized as medium dense to very dense, and dry to wet with depth. The measured dry density in the fan deposits ranged from about 93 pounds per cubic foot (pcf) to 133 pcf, with moisture contents ranging from 2.3 to 14.7 percent.

5.3 Ground Water

Based on the historically highest ground water contours included in the Seismic Hazard Zone Report for the Pasadena 7.5-Minute Quadrangle (Plate 1.2), the depth to historic high groundwater beneath the school campus is greater than 50 feet.

Review of Los Angeles County water well data indicates that no historic or active wells are located at the project site. The closest known active well (#4000A) is located approximately 0.9 miles southwest of the site at the vicinity of Beulah Drive and Descanso Drive. The well record indicates that the last reading was conducted on 10/17/2007 with a measured ground water depth of 78.5 feet and the highest measured ground water depth was 62.3 feet (elev. 1122.7') recorded on 4/6/1973.

Ground water was encountered on 1/4/24 in Boring HS-7 at 29 feet below the existing ground surface during the drilling and sampling. At the completion of the drill hole, which was drilled to 35 ft and then sampled with an SPT sampler, the depth of water was measured at a depth of 34 feet (i.e., ~1 ft of water in the hole). It is opined that the ground water is perched in a granular layer above a less permeable layer. Seasonal fluctuations in ground water levels or development of perched water conditions will occur in the alluvium due to precipitation, storm water, irrigation, and other factors not evident at the time of our study. Nevertheless, ground water is not anticipated to be encountered during construction or have an adverse impact to design.

5.4 Shear Strength

Direct Shear testing was performed on California drive ring samples of existing artificial fill soils and alluvial fan deposits and on soil samples remolded from a blend of on-site soils collected within the upper 8 feet at the project site, in HS-6 and HS-8. In addition, direct shear test results of the existing artificial fill and remolded samples from the previous investigations. Results of the testing are presented in **Appendix B** and were used to select the following design shear strength parameters for site materials.

Shear Strength Parameters

MATERIAL	MOIST UNIT WEIGHT, PCF	PEAK SHEAR STRENGTH		RESIDUAL SHEAR STRENGTH	
		PHI, DEGREES	COHESION, PSF	PHI, DEGREES	COHESION, PSF
Existing Artificial Fill (af)	120	31	150	31	150
Proposed Compacted Fill (Cf)	130	43	318	32	130
Alluvial Fan Deposits (Qal ₃)	120	32	861	31	84

5.5 Soil Compressibility

Compressibility of the existing artificial fill and fan deposits under assumed foundation loads was estimated based on in-situ dry density in conjunction with laboratory hydro-compression testing. Recommendations to limit settlement (total and differential) of footing foundations to tolerable values (resulting from static plus live loading) are provided in the Earthworks and Foundation Recommendations sections of this report.

In general, low plasticity soils that have an in-situ dry density of 108 pcf or less and in-situ moisture content of 8 percent or less are considered susceptible to hydro-compression. Based on measured in-situ dry densities and moisture contents, soil layers encountered in the hollow stem auger borings do not fit these criteria. However, samples with the lowest measured dry density were selected for testing. Test results show 1.7% settlement due to hydro-compression under future loading at the test depths (see **Appendix B** for lab test data).

Based on the laboratory test results in conjunction with assumed foundation loads, maximum allowable bearing capacity, and footing influence at depth, total settlement due to soil compressibility is not expected to exceed 1 inch, following recommended remedial removals (see **Removals** section of this report).

5.6 Expansion Potential of Soils

Soils encountered during the subsurface exploration were observed to consist predominantly of silty, fine- to medium-grained sands and poorly graded sands with silt. An Expansion Index value of 1.3 was measured on a mixture of soils from Boring HA-5 in the upper 7 ft.

Based on the observed material and lack of any fine-grained deposits with appreciable plasticity, and site-specific testing, in-situ soils at the site are regarded to have a **very low** expansion potential (per ASTM D4829 expansion potential classification).

5.7 Soil Corrosivity

The Geotechnical and Materials Engineering Division (GMED) of the Los Angeles County Department of Public Works regards soil at a site to be corrosive to concrete and/or steel if the measured resistivity is 1,000 ohm-cm or less, and/or if the sulfate concentration is 2,000

ppm (0.20%) or greater, and/or if the pH is 5.5 or less. Also, a soil with a chloride concentration greater than or equal to 500 ppm is considered deleterious to ferrous metals.

Soil resistivity, chloride content, soluble sulfate content, and pH were measured on a mixture of soils collected from Borings HS-6 and HS-8 at a depth of 0 to 8 feet to assess the potential corrosive effects on concrete and metals. Results of this testing, along with corrosion results from the previous investigations are presented in Table B1 (**Appendix B**) and are discussed below.

- The lowest measured resistivity value of the soil sample was 5,814 ohm-cm (which classifies as moderately corrosive to ferrous metals, per Los Angeles County Department of Public Works classification).
- The highest measured chloride content of the soil sample was 108 parts per million (ppm). Soils in this chloride content range have a negligible effect on concrete or ferrous metals.
- The highest measured sulfate content of the soil sample was 0.003 percent. Soils in this sulfate content range have a negligible effect on concrete per ACI 318 (Table 4.3.1).
- Based on the lowest measured pH value (7.2), acidity of site soils is low and not anticipated to increase soil corrosivity.

5.8 Oil Wells

Review of the Department of Conservation, Division of Oil and Gas and Geothermal Resources well finder web page indicates that oil wells are not present within the boundaries of the project site. The closest oil well is located approximately 7.3 miles to the southwest, in the vicinity of Victory Boulevard and West Alameda Ave.

6.0 SEISMICITY

6.1 Introduction

The site is located within the Transverse Ranges geomorphic province of southern California. The Transverse Ranges consist of a series of east-west trending mountains and intervening valleys, with similarly trending faults. Associated faults in the vicinity of the site include the Sierra Madre zone, Verdugo, Raymond, and Hollywood. Additionally, the southern California region is traversed by the active San Andreas fault, located about 23 miles northeast of the project site, which is a transform boundary between the Pacific Plate and the North American Plate. The San Andreas fault is part of a system of northwest-striking, right-lateral faults that are generally historically active, as evidenced by the June 28, 1992 Landers (M7.3) earthquake. Faults located in the vicinity of the project site are

shown on the appended Quaternary Fault Location Map, **Figure C1**. Moderate to major earthquakes generated on these nearby faults can be expected to cause strong ground shaking at the site.

The southern California region is seismically active and commonly experiences strong ground shaking resulting from earthquakes along active faults. Earthquakes along these faults are part of a continuous, naturally occurring process, which has contributed to the characteristic landscape of the region. Common geologic hazards associated with earthquakes are discussed below and include **Ground Rupture**, **Ground Motion**, and **Ground Failure**.

6.2 Ground Rupture

The Alquist-Priolo Earthquake Fault Zone Act (A-P Act) purpose is to prohibit structures for human occupancy over active faults. The State Mining and Geology Board defines an active fault for the A-P Act as a fault trace that has had surface displacement within Holocene time (about the last 11,700 years). The California Geological Survey (CGS) per the A-P Act defines Earthquake Fault Zones along known Holocene-active faults.

The Los Angeles County General Plan – Safety Element (Leighton, 1990) defines an active fault as having either suspected or proven to have experienced surface rupture during Holocene time and potentially active faults as having surface displacement within greater than Holocene time and less than 750,000 years.

Review of the Earthquake Zones of Required Investigation map for the Pasadena Quadrangle, provided digitally on the CGS EQZ web application, indicates that there are not any known active faults within the project site, per A-P Act criteria. The nearest Earthquake Fault Zone is delineated for the Sierra Madre fault zone located approximately 4.3 miles northwest of the project site. However, the 3/20/23 CGS Review of Modular Buildings “N” and “P” indicated that the Sierra Madre fault within the Pasadena Quadrangle will be placed within an A-P Zone and that the northern portion of the campus will be located within an Earthquake Fault Zone. The CGS provided a portion of the preliminary, work in-progress, A-P Zone map illustrating the potential location of the A-P Zone.

The Sierra Madre fault is a complex zone of thrust and reverse faults that extends for 125 km and demarcates the base of the San Gabriel Mountains. Surface fault rupture is generally evidenced by geomorphic expressions including scarps, truncated ridges, hanging drainages, and the abrupt mountain front. A segment of the Sierra Madre fault zone (Section B) is mapped trending northwest approximately 120 to 176 feet northerly of the site and is dipping 45 degrees to the northeast.

6.2.1 Site Specific Fault Assessment

Tentative AP Zone Boundary as provided by CGS is shown on the attached Geologic Map (**Plate I**). A Fault Rupture Hazard Investigation was carried out for the site (see ref. 2). The referenced report concluded that the alluvial fan deposits and a 100,000-year older paleosol are un-faulted. The observed un-faulted alluvial fan deposits are judged to be pre-Holocene in age (i.e., greater than 11,700 years old). Therefore, active faulting is not present at the school site.

6.3 Ground Motion

6.3.1 General

The project site is located in southern California, which is in a geologically and seismically active region where large magnitude, potentially destructive earthquakes are common. Therefore, it is reasonable to assume that moderate or large magnitude earthquakes along any of the numerous faults in the region are expected to produce strong ground shaking at the project site in the future.

The current standards for construction provided in the 2022 California Building Code are designed to safeguard against major failures and loss of life, but are not intended to limit damage, maintain functions or provide for easy repair. Per Structural Engineers Association of California (SEAOC), conformance to these recommendations does not constitute any kind of guarantee or assurance that significant structural damage will not occur in the event of a maximum level of earthquake ground motion. However, it is reasonable to expect that a well-planned and constructed structure will not collapse in a major earthquake and that protection of life is reasonably provided, but not with complete assurance.

Although research on earthquakes during the last fifty years has greatly enhanced the level of understanding of earthquake faulting in California, the record is much too short to constrain behavior of all faults in southern California and the attenuation characteristics of all areas relative to each future potential earthquake. Predicted accelerations should, therefore, be considered **rough estimates** rather than precise facts and ground motions from future earthquakes may exceed the predicted accelerations. Neither the **Time, Location, nor Magnitude** of an earthquake can be accurately predicted at this time.

6.3.2 Earthquake Magnitude

Earthquake **magnitude** is a quantitative measure of the strength of an earthquake or the strain energy released by it, as determined by seismographic or geologic observations. It does not vary with distance or the underlying earth material. This differs from **intensity**,

which is a qualitative measure of the effects a given earthquake has on people, structures, loose objects, and the ground at a specific location. Intensity generally increases with increasing magnitude and in areas underlain by unconsolidated materials and decreases with distance from the epicenter. Approximate locations of historic earthquakes are shown on the appended Earthquake Epicenter Location Map (**Figure C2**).

The table below presents the distance to nearby significant faults (closest distance to potential rupture surface) from the project site. The site-to-source distances were obtained from the USGS fault parameters online database (based on 2008 National Seismic Hazards Map). The characteristic earthquake magnitude for each fault was calculated using the magnitude-area relationships recommended in Model 2 of the 2007 Working Group for California Earthquake Probabilities (WGCEP) (USGS Open-File Report 2007-1437D).

Summary of Significant Faults

~DISTANCE (MILES)*	FAULT NAME	DIP DIRECTION	SLIP SENSE	MAGNITUDE
0.10	Sierra Madre	N	reverse	7.2
0.10	Sierra Madre Connected		reverse	7.3
4.04	Verdugo	NE	reverse	6.9
6.10	Raymond	N	strike slip	6.8
6.65	Hollywood	N	strike slip	6.7
7.80	Sierra Madre (San Fernando)	N	thrust	6.7
8.83	Santa Monica Connected alt 2		strike slip	7.3
9.13	Elysian Park (Upper)	NE	reverse	6.7
9.19	San Gabriel	N	strike slip	7.3
11.00	Clamshell-Sawpit	NW	reverse	6.7
12.93	Northridge	S	thrust	6.9
14.81	Puente Hills (LA)	N	thrust	7.0

6.3.3 Peak Ground Acceleration

The peak ground acceleration consistent with maximum considered earthquake geometric mean (MCE_G) ground motions was evaluated at the site for stiff soil conditions (Site Class D). The mapped MCE_G peak ground acceleration (ASCE 7-16, Figure 22-9) adjusted for Site Class effects (PGA_M) was determined using the OSHPD Seismic Design Maps web tool by the Structural Engineers Association of California (SEAOC). Based on this evaluation, a PGA_M of 0.90g would be produced by MCE_G ground motions. This mapped value incorporates a 2% probability of exceedance in 50 years (i.e., 2,475-year return period).

6.4 Ground Failure

Ground Failure is a general term describing seismically induced secondary permanent ground deformation caused by strong ground motion. This includes liquefaction, lateral spreading, seismic settlement of poorly consolidated materials (dynamic densification), differential materials response, slope failures, sympathetic movement on weak bedding planes or non-causative faults, shattered ridge effects and ground lurching.

6.4.1 Potential for Liquefaction and Associated Ground Failure

Review of the Earthquake Zones of Required Investigation map for the Pasadena Quadrangle indicates that the subject site is not located within an area of required investigation for liquefaction (see **Figure C3**). Based on dense soil conditions and depth to historic high groundwater, the potential for liquefaction and associated ground failure to adversely impact the proposed development can be ruled out.

6.4.2 Potential for Other Modes of Ground Failure

Earthquake-induced slope failures include activation and reactivation of landslides, rock falls, debris flows and surficial failures. Based on review of the California Seismic Hazard Zones Map for the Pasadena Quadrangle, the project site is not located in a zone of required investigation for seismic slope instability. There are no known landslides at or in the vicinity of the project site. Due to the generally level site conditions and distance from any significant sloping terrain, the potential for earthquake-induced slope failures to adversely impact the proposed development can be ruled out.

7.0 SLOPE STABILITY

Limit equilibrium analyses were performed to evaluate the stability of the following temporary excavations:

- Remedial grading temporary excavation. Stability analyses utilized Cross Section I-I' (Conventional Footing) to illustrate the most critical temporary excavation for remedial removals.
- Temporary excavations supported by soldier piles. Stability analyses utilizing Cross Sections H-H' and I-I' (Temporary Excavation Supported by Soldier Pile) to illustrate the most critical temporary excavation that will be supported by CIDH soldier piles.

For design purposes, the following groundwater conditions were applied:

- For permanent loading conditions: an assumed pore water pressure coefficient (u_0 of 0.15) was utilized where a future source of groundwater seepage could potentially exist, directly above the slope.

- For temporary loading conditions: Groundwater is not anticipated assuming construction is performed during the dry season; therefore, groundwater is not modeled.

The analyses included an evaluation of gross slope stability under static and seismic-loading conditions. Slope stability diagrams graphically illustrating the results of our analyses are attached for review. The critical failure surface under static loading conditions for the temporary excavation supported by CIDH soldier piles is plotted on Cross Sections H-H' and I-I' (Temporary Excavation Supported by Soldier Pile) in **Appendix E**.

The slope stability analyses used the 2D limit equilibrium software, Slide, by RocScience. This software utilizes robust search methods to locate critical slip surfaces and computes associated minimum factors of safety. The analyses used Spencer's complete equilibrium procedure to evaluate critical circular failure surfaces under static and seismic (pseudostatic) loading conditions.

Analysis for seismic slope stability was performed using the pseudostatic procedure. In this procedure, the seismic loading is introduced into the conventional limit equilibrium analysis as a static horizontal force equal to the soil weight multiplied by a seismic coefficient, k . The seismic coefficient is an empirical value which in no way models actual seismic forces. However, the pseudostatic procedure does provide some indication of slope stability or instability during seismic loading. A seismic coefficient value of $k = 0.15$ was selected for our analyses.

The *pile/micro pile* support types in Slide were used in the limit-equilibrium stability analyses for the design of temporary excavation supports. The applied *pile/micro pile* support force is entered as a pile shear strength and is oriented tangentially to the slip surface.

The results of the stability analyses are graphically illustrated in **Appendix D**. Based on the results, the analyzed temporary excavation slopes and temporary excavation support by soldier piles comply with the minimum factor of safety requirements for gross stability under temporary conditions ($FS \geq 1.25$). The Soldier Pile wall system with wall elements spanning between cast-in-drill-hole (CIDH) piles comply with the minimum factor of safety requirements for gross stability under static ($FS \geq 1.5$) and seismic ($FS \geq 1.15$) loading conditions, assuming our recommendations are implemented.

8.0 GENERAL CONCLUSIONS AND GRADING RECOMMENDATIONS

8.1 General

From the feasibility perspective, the locations of the proposed buildings as shown on the attached Geologic Map (**Plate I**) and Geotechnical Map (**Plate II**) are satisfactory from the standpoints of geology and soils, provided that the recommendations presented in this report are implemented in the design and construction phases of this project.

Based on our evaluation of the site and soil conditions the following conclusions and recommendations are made:

- Based upon our subsurface exploration, artificial fill, and older fan deposits underlie the existing improvements at the location of the proposed buildings.
- In order to provide competent and uniform foundation and slab support, existing site artificial fill soils should be removed and the older fan deposits over-excavated to at least 3 ft beneath the bottom of proposed footings and replaced as an engineered compacted fill.
- Shallow foundations may be used for support, provided they are bearing onto at least 3 feet of engineered compacted fill material.
- Footing excavations should be observed for competency and adequate embedment prior to placement of reinforcing steel or concrete.
- Grade low areas adjacent to future footings to cause water to drain away. The design should include eave gutters. All downspouts should discharge directly into pipe drains directed to the street. Other concentrated drainage should also be collected and discharged to the street in non-erosive devices.

8.2 Earthwork and Grading Recommendations

All earthworks shall be accomplished under the observation and testing of the Project Geotechnical Engineer, Engineering Geologist and/or their authorized representatives in accordance with the recommendations contained herein and the applicable California Building Code.

8.2.1 Site Preparation

The purpose of site preparation is to expose competent subgrades on which to support structures and/or place compacted engineered fill. Site preparation includes removal of vegetation, organic topsoil, and debris from the project site. Demolition will be required to remove the existing structures and pavements prior to the start of grading. It should be anticipated that the buried remnants of previous construction could also be encountered

anywhere on the site. Any loose or disturbed soils created by demolition should be removed. Buried utilities are located within and adjacent to the building area. Precautions should be taken to remove and relocate or protect existing utilities. All excavations created by demolition should be properly backfilled. The Geotechnical Engineer or his representative shall observe the excavated areas prior to placing compacted fill on them.

8.2.2 Removals for Buildings

Based on the boring locations relative to the proposed building locations and site topography, the buildings are underlain by about 5 to 9.5 feet of existing fill. Any existing fill should be considered uncertified and should be removed and replaced with properly compacted engineered fill. Additionally, in order to mitigate the potential compressibility of existing site soils and to provide a uniform bearing surface for footing foundations, the existing site soils should be removed to a depth of at least 3 feet beneath the bottom of the foundation, placed as a properly compacted engineered fill. Based on the prior building foundations, it is assumed that the bottom of the footing will be ~3.3 ft below the finished floor elevations. Based upon the preceding the removal depths are expected to be 5 to 10.5 ft below existing ground surface.

The attached Cross Sections illustrate the opined thickness of artificial fill based on the subsurface explorations. The depth of removal and recompaction below the proposed buildings is denoted by an elevation, which is illustrated on the Geotechnical Map (Plate II) and Cross Sections.

The removal bottom should extend laterally a horizontal distance equal to the depth of the removal beyond the building foundation footprint. In general, the lateral limits of the removals constrained by property lines or existing improvements may be reduced, but shall maintain a 1:1 (h:v) projection from bottom of footing down to the removal bottom (e.g., see Cross Section 2-2').

Removal areas shall be observed by the Geotechnical Engineer, or his authorized representative, prior to placement of compacted fill, to confirm the removal of all unsuitable materials. The exposed removal bottom should be proof-rolled with loaded equipment and any soft or yielding materials should be removed and recompacted. The exact depth and extent of necessary removals may be revised in the field during the grading operations, when observations and more location-specific evaluations can be performed.

8.2.3 Removals for Retaining Walls

Depth of removal and recompaction beneath retaining wall footings may vary depending on various parameters, including retained height, footing depth, and proximity to other structures and improvements. We understand that the retaining wall (up to 8 ft tall)

northwest of Building E will likely be supported on a conventional foundation system or as a soldier pile wall system with wall elements spanning between cast-in-drill-hole (CIDH) piles.

The following are general removal recommendations for the other retaining wall heights and locations shown on the Civil Site Grading Plan. The parameter “H” below refers to the height from the top of the footing to the top of the retained soil behind the retaining wall.

8.2.3.1 Retaining Walls: $H \leq 2$ ft with Level Backfill

Retaining walls, generally retaining less than 2 ft, that will be underlain by the artificial fill or compacted fill from the building removal and recompaction. No removal or recompaction is required below these retaining wall footings. However, at the bottom of the retaining wall footing excavation, the exposed sub-grade materials shall be ripped to a minimum depth of six inches, brought to optimum moisture content or up to 2 percent above, and thoroughly mixed to obtain a near-uniform moisture condition and uniform blend of materials, and then thoroughly compacted to at least 90% percent of the Maximum Dry Density, per the latest ASTM D1557 laboratory maximum density.

8.2.3.1 Retaining Walls: $2 < H \leq 4$ ft with Level Backfill and $H \leq 2$ with sloped backfill

The existing site soils at these locations shall be removed to a depth of at least 1 foot beneath the bottom of the foundation, and replaced as properly compacted engineered fill. The removal bottom should extend laterally a horizontal distance of 1 foot beyond the foundation footprint, which will maintain a 1:1 (h:v) projection from the bottom of the footing down to the removal bottom. Example, retaining wall (up to 4 ft tall) west and south of Building E (see Section J-J’).

8.2.3.2 Retaining Walls: $4 < H \leq 6$ ft with Level Backfill and $2 < H \leq 6$ with sloped backfill

The existing site soils at these locations shall be removed to a depth of at least 4 feet beneath the existing grade or 2 feet beneath the bottom of the foundation, whichever is greater, and replaced as properly compacted engineered fill. The removal bottom should extend laterally a horizontal distance of 2 feet beyond the foundation footprint, which will maintain a 1:1 (h:v) projection from the bottom of the footing down to the removal bottom.

8.2.3.3 8 ft Retaining Wall Northwest of Building E

If this retaining wall is constructed conventionally the footing excavation is anticipated to be embedded within dense alluvial fan deposits and removals are not anticipated below the retaining wall footing.

8.2.4 Preparation of Removal Bottom Areas

After the ground surface to receive fill has been exposed, it shall be ripped to a minimum depth of six inches, brought to optimum moisture content or above and thoroughly mixed to obtain a near uniform moisture condition and uniform blend of materials, and then thoroughly compacted to at least 90% percent of the Maximum Dry Density, per the latest ASTM D1557 laboratory maximum density.

8.2.5 Fill Materials

Onsite soils, excluding any debris or organic matter, may be used for compacted fill. Rocks with a maximum dimension larger than 8 inches may not be placed in the fill. Rocks with a maximum dimension between 4 inches and 8 inches shall not compose more than 25 percent of any fill lift.

8.2.6 Oversize Material

Oversized, irreducible rocks are likely present in the older fan deposits. Cobbly layers are expected to be encountered within the structural removals. Any large rock fragments over eight (8) inches in size will require the contractor to employ proper means and equipment to remove all large-size pieces and disposal off-site.

8.2.7 Placement and Compaction of Fill Materials

All fill materials should be placed in lifts not exceeding 8 inches prior to compaction, then aerated or water-conditioned to obtain Optimum Moisture Content or up to 2% above Optimum Moisture Content, then thoroughly mixed to produce a nearly uniform moisture content and uniform blend of materials, and then compacted to at least 90% percent of maximum dry density (MDD), in accordance with ASTM D1557. Additional recommendations for compaction of fill are provided in the “Recommended Earthwork Specifications” (**Appendix E**).

8.2.8 Construction of Fill Slopes

In general, fill slopes of any significance are not currently anticipated for this site. However, the following recommendations are provided should the situation arise during the design that requires construction of a fill slope. Fill slope inclination should not be steeper than 2:1 (h:v). The relative compaction requirement of the finished fill-slope faces depends on the construction method. A compaction of at least 90 percent of the MDD, per ASTM D1557, is for finished fill-slope faces constructed by over-building the slope, typically 2 ft vertically, and cutting back to the compacted fill material. If the fill-slope face is constructed basically on-grade then the outer 10 feet, measured horizontally from the slope face, shall be compacted to at least 92 percent of the MDD, per ASTM D1557.

8.2.9 Import Fill

All imported fill shall be observed, tested and accepted by the Geotechnical Engineer prior to use at the project site. Import soils to be used in the building pad areas should have an expansion index of less than 20 and corrosive characteristics that are equally or less detrimental than that of the existing onsite soils.

8.3 Proposed Fill Slopes

Based on site grades manufactured slopes, if any, are not anticipated to exceed 10 ft in height. Manufactured slope inclination should not be steeper than 2:1 (h:v). Manufactured slopes are considered grossly stable under static and pseudo static conditions based on a slope gradient of 2:1 and a maximum slope height of 10 ft.

8.4 Proposed Cut-Slopes

The cut slopes, if any, are not anticipated to exceed 10 ft in vertical height. Cut slope inclination should not be steeper than 2:1 (h:v). Cut slopes are considered grossly stable under static and pseudo-static conditions based on a slope gradient of 2:1 (h:v) and a maximum slope height of 10 ft.

8.5 Soil Shrinkage

Based on measured in-situ density values within the range of the recommended removal depths for the building pad and assuming that fill will be compacted to an average of about 92 percent of maximum dry density (per ASTM D1557), soil shrinkage when excavated, placed, and compacted as a controlled fill is estimated to be 12 to 18 percent. However, actual shrinkage (or bulking) quantities will depend on the degree of compaction achieved during earthwork operations. The supervising civil engineer should design pad grades with sufficient flexibility to accommodate a possible shrinkage or bulking of fill of up to 5 percent of the total grading volume.

8.6 Existing Utilities

Existing wet and dry utility pipes and areal drain pipes should be removed from beneath the footprint area of proposed structures and relocated.

8.7 Building Setbacks

The building setbacks from property lines should be in accordance with standards set by the City of La Canada.

8.8 Sewage Disposal

It is our understanding that sewage disposal will be via public sanitary sewer.

8.9 Drainage

Water should not be allowed to stand or pond on structural pads, parking areas, level-graded areas, or constructed slopes. Water that flows into these areas should be conducted to appropriate discharge locations via non-erodible drainage devices. Drainage devices should be inspected periodically and should be kept clear of debris. Drainage and erosion control should be designed in accordance with the standards outlined in the 2022 California Building Code.

Any modification of the grade of the building pad, parking areas, etc. after certification by the project Civil Engineer could adversely affect drainage at the site. Future landscaping, construction of walkways, planters and walls, etc. must never modify site drainage unless additional measures to enhance drainage (such as area drains, additional grading, etc.) are designed and constructed in compliance with applicable regulations.

8.10 Landscaping

All final grades should be sloped away from the building foundations to allow rapid removal of surface water runoff. No ponding of water should be allowed adjacent to the foundations. Plants and other landscaped vegetation requiring excessive watering should be avoided adjacent to the building foundations. Should landscaping be constructed, an effective water-tight barrier should be provided or drains to discharge water well away from the perimeter footing foundations.

9.0 FOUNDATION DESIGN RECOMMENDATIONS

9.1 Conventional Shallow Footing Foundations

Continuous shallow spread footings are considered adequate for the support of the proposed building structures based on the assumptions indicated below. We understand that footing design for the buildings should be in accordance with the minimum foundation requirements of the applicable California Building Code. Results of observations during earthworks for this project may warrant revisions to the recommendations herein.

9.1.1 Assumptions

The recommendations for the design of conventional footing foundations provided below are based on the following assumptions:

- The **expansion potential** of foundation subgrades is **very low**.
- Minimum continuous footing width = 12 inches (1-story) and 15 inches (2-story).
- Minimum individual column footing width = 24 inches.
- Minimum embedment of footing foundations beneath lowest adjacent final subgrade elevation: 12 inches.
- Bearing foundation material: Compacted engineered fill (Cef).
- Footings are not influenced by other footing loads.
- Removals beneath the proposed grade: per the Removals section of this report.

9.1.2 Vertical Bearing Capacity Parameters

- Allowable static vertical bearing pressure applied to the soil subgrade by footing foundations with the embedment and width recommended above: 2,000 psf.
- The maximum allowable foundation bearing pressure may be increased by 250 pounds per square foot for every additional foot of width of the foundation, to a maximum value of 2,500 pounds per square foot.
- No increase in allowable footing bearing pressure with depth.
- Increase in allowable bearing pressure for seismic loads and wind loads: one-third.

9.1.3 Footing Settlements

For conventional footing foundations designed as recommended herein, the static settlements is not expected to exceed 1 inch. Expected maximum differential settlement can be taken as ½-inch over a horizontal distance of 30 ft. Foundation settlement caused

by earthquake shaking is expected to be negligible.

9.1.4 Resistance to Lateral Loads

- Allowable lateral passive pressure (i.e., a factor of safety of 2.0) that can be developed against the side of footing foundations is 200 psf per foot of depth beneath the lowest adjacent soil subgrade, to a maximum value of 2,000 psf. If care is not taken to compact soil adjacent to footing foundations or if the soil surface adjacent to footing foundations is not protected against erosion, the passive resistance of soil provided by the upper foot of foundation embedment should be neglected.
- A one-third increase in allowable passive pressure may be used for short-term seismic and wind loads.
- The allowable frictional resistance (i.e., factor of safety of 2.0) that can be developed beneath the base of footing foundations may be calculated by multiplying the dead load by a friction coefficient of 0.3.
- The passive pressure and frictional resistance may be used concurrently without reduction.

9.1.5 Additional Foundation Recommendations

Additional recommendations for shallow foundations that should be incorporated into the design and construction of future structures, as applicable, are presented below.

- All continuous footing foundations shall be reinforced with at least four No. 4 steel bars (two placed near the top, and two placed near the bottom of the foundations) or by the requirements of the applicable structural design code for the design loadings, whichever is greater.
- Foundation excavations should be observed by a representative of the Geotechnical Engineer prior to placement of forms, reinforcement, or concrete, to confirm that the excavations are embedded into the recommended material.
- The footing excavations should be pre-moistened to optimum moisture content and free of all loose or sloughed material prior to placement of concrete. The footing area should not be allowed to desiccate prior to placing concrete.
- To reduce moisture intrusion beneath slabs on grade, utility trenches should be backfilled with lean concrete or concrete slurry at the foundation perimeters. The lean concrete plug shall be under the full width of the footing and may be extended along the trench a minimum of 24 inches in the direction of the slab.

- Material from utility trench excavations should not be spread on slab-on-grade areas unless it is compacted and tested.

9.2 Concrete Slab-on-Grade Floors

The following recommendations are included for concrete slab-on-grade floors should they be needed

9.2.1 General

Concrete slab-on-grade floors shall be supported on a fill subgrade compacted to at least 95 percent of Maximum Dry Density (per ASTM D1557) in the upper 12 inches. The design of the required slab thickness and reinforcement is under the purview of the structural engineer. The following are minimum recommendations for design of conventional slab-on-grade floors based on a very low expansion potential of the fill subgrade beneath the floor slabs.

- Slab-on-grade thickness: at least 5 inches
- Slab reinforcement: No. 4 Rebar at 16-inch each way.
- Slab underlayment: 2 inches of clean sand.
- Concrete used in floor slabs should satisfy the requirements presented in Chapter 19 of the California Building Code.

In order to minimize shrinkage cracking of concrete slab-on-grade, the slabs should be constructed using low-slump concrete and with crack control joints in both horizontal directions. In any case, concrete used in slabs-on-grade should satisfy the requirements of Chapter 19 of the California Building Code.

In order to reduce moisture intrusion from utility trenches beneath slabs on grade, utility trenches should be plugged with lean concrete or concrete slurry at foundation perimeters. The plug should extend under the full width of the footing foundation and should extend at least 24 inches along the utility trench in the direction of the slab.

Deflections, shears, and moments in concrete slabs-on-grade caused by applied vertical pressures up to 1,000 psf may be estimated using a coefficient of vertical subgrade reaction, k_v . The value k_v is defined as the pressure applied by a concrete slab to the subgrade divided by the resulting settlement of the subgrade and is a function of the subgrade soil type, soil stiffness, and dimensions of the loaded area. A k_v value of 120 pci may be used to represent the soil subgrade that supports slab-on-grade floors at the project site. This value should be adjusted based on the actual dimensions of a loaded area. The coefficient of vertical subgrade reaction for a loaded area of specific width, k_b , may be

determined using the following equation, where b equals the width of the loaded area in feet: $k_b = k_v [(b + 1) / 2b]$

9.2.2 Slab Underlayment

Slab underlayment to mitigate vapor transmission is not under the purview of the geotechnical engineer; however, the following specifications based on standard local practice may be incorporated into the design:

- The compacted granular material recommended to be placed and compacted over the soil subgrade to minimize effects of expansive soil pressures (i.e., 2 inches of clean sand for very low expansion potential) may act as a capillary break and should be overlain with a 10-mil vapor retarder (i.e., “Visqueen” vapor retarder or an approved equivalent) to prevent transmission of water vapor. The vapor retarder should then be overlain by an additional 2-inch-thick protective cushion of compacted, well-graded clean sand.
- Alternatively, the omission of the 2-inch protective sand cushion and placement of an engineered under-slab vapor barrier (e.g., Stego Wrap 15-mil Vapor Barrier) directly between the compacted granular material and concrete slab-on-grade is also acceptable, provided the barrier is installed in accordance with the manufacturer’s instructions.
- The selected membrane should be properly lapped and sealed at all seams and around all plumbing structures and other openings. Care should be taken to prevent sharp objects in the subgrade and/or structures from puncturing the membrane.

The suitability of proposed sand cushion materials should be evaluated in our laboratory before transporting them to the subject site.

9.3 Expansive Soil Considerations

Recommendations are provided in this report for mitigation of the effects of potential expansion of fill soils, including recommendations for footing embedment and reinforcement, slab thickness and reinforcement, and moisture conditioning of subgrades beneath footing foundations and slab-on-grade floors, as required. These recommendations depend on the expansion potential that characterizes the subgrade of the building pads. Based on the predominantly granular nature of site soils, the expansion potential when removed, mixed, and replaced as compacted fill is anticipated to be **very low** (per ASTM D4849 expansion potential classification).

Geotechnical observation of the soils exposed in the foundation excavation and slab subgrade should be performed and the Expansion Index measured (if warranted) in order to

confirm the applicability of minimum parameters presented herein for the design and construction of footing foundations and concrete slab-on-grade floors.

9.4 Soil Corrosivity Considerations

Based on the results of sulfate content testing, corrosivity of soils at the site to concrete is expected to be negligible. Therefore, Type I or II Portland cement may be used for concrete structures that will be in contact with site soils. Based on the results of resistivity testing site soils classify as moderately corrosive to metals.

The on-site soils when excavated, mixed and placed as a compacted fill are not anticipated to exhibit corrosive characteristics to concrete or ferrous metals. However, the following precautionary measures may be implemented to mitigate for corrosion potential:

- Steel and wire reinforcement in concrete structures cast against site soils should have at least 3 inches of concrete cover.
- Buried utilities made of ferrous metals should be protected with polyethylene extruded coating, or with tape over primer per AWWA Standard C209 or C203, or with hot-applied coal tar enamel, or as recommended by manufacturers of the utility conduits.
- Metallic pipes that penetrate concrete structures should be surrounded by plastic sleeves, rubber seals, boots, or other dielectric material in order to prevent contact between the pipe and the concrete structure.
- Below-grade ferrous metals should be electrically insulated from above-grade metals.

Additional corrosivity testing of soils from the subgrades of footings and floor slabs should be performed following site grading. A corrosion specialist should provide final recommendations for mitigation of potential corrosion of metals, as it does not fall under purview of geotechnical engineering.

10.0 RETAINING WALLS

The following recommendations may be used for the design and construction of retaining walls, as applicable.

10.1 Assumptions

Retaining walls should be founded on clean, non-deleterious, competent compacted fill. The earth materials exposed at the bottom of the proposed retaining wall footing should be observed by the Soils Engineer/Engineering Geologist or his representative. Recommendations for remedial removals beneath retaining wall footings are presented in the Removals section of this report. If the earth materials in the bottom of the foundation

excavation appear to be disturbed, they should be removed and replaced with compacted fill.

10.2 Footing Parameters for Conventional Shallow Footings

Footings that will support conventional retaining walls shall be designed as recommended above for conventional shallow footing foundations for the building, except where superseded below.

- Minimum footing depth: 24 inches below lowest adjacent soil subgrade.
- Minimum footing width: 24 inches.

10.3 Footing Parameters for Soldier Pile Wall

A Soldier Pile Wall system with cast-in-drilled-hole (CIDH) concrete friction piles with wall elements spanning between cast-in-drill-hole (CIDH) piles for the proposed retaining wall northwest of Building E, provided that the recommendations herein are incorporated into the design and construction. In addition, we understand that CIDH piles will also provide temporary stability for the near vertical excavation of the wall and during the remedial grading for Building E (see Cross Sections H-H' and I-I' Temporary Excavation Supported by Soldier Pile). At this time, structural plans and details have not been provided.

10.3.1 Assumptions

The recommendations for concrete friction piles are based on the following assumptions:

- Maximum excavation depth: 12.6 feet
- Pile type: Reinforced concrete, cast-in-drill-hole (CIDH) pile
- Minimum pile diameter: 24 inches
- Pile configuration: Single pile row, with center-to-center horizontal spacing as described herein.
- Pile head condition: Unrestrained against rotation in the direction perpendicular to the wall axis
- Minimum Pile Embedment into Competent Stratum (i.e., alluvial fan deposits) $\geq 3 \times$ pile diameter
- Estimate depth to alluvial fan deposits = ~ 7 ft below existing ground at the location of the wall
- Center-to-center pile spacing: $\geq 3 \times$ pile diameter

- Minimum Allowable Pile Shear Strength (kips) = 5 kips, based upon 6-ft center-to-center spacing
- Location of the Applied Shear = at elevation 1,314 (i.e., ~2 ft below the proposed grade elevation), at Cross Sections I-I' and H-H'.
- For cantilevered shoring up to 13 feet in height supporting a level backslope, a triangular distribution of lateral earth pressure of 38 pcf should be used per Section 10.4.
- For cantilevered shoring up to 13 feet in height supporting a 2:1 (h:v) gradient backslope, a triangular distribution of lateral earth pressure of 60 pcf should be used, per Section 10.4.
- We have assumed tie-backs or braced soldier piles are not required for this project. In the event the shoring engineer, may decide otherwise, this firm should be contacted to provide supplemental recommendations to address trapezoidal lateral earth distribution.
- Additional lateral earth pressure from surcharge pressure should be included as a uniform pressure acting on the upper 10 feet of the shoring wall and computed as the product of vertical surcharge pressure and the "Coefficient of Lateral Pressure" equal to 0.3 for the temporary condition. The temporary condition does not require inclusion of seismic force.
- The distribution of lateral loading on the soldier pile during the temporary excavation is illustrated on the attached detail, **Active Lateral Earth Pressures – Temporary Excavation Supported by Pile**. Cross Sections H-H' and I-I' (Temporary Excavation Supported by Soldier Pile) illustrate the assumptions used to determine the height of the temporary excavations to evaluate active loading conditions.

10.3.2 Vertical Bearing Capacity

The allowable vertical bearing capacity of CIDH piles embedded in alluvial fan deposits should be calculated using shaft friction, $f_{s,all}$ of **300 psf** for the portion of the pile embedded beneath the maximum excavation depth. This shaft friction value includes a safety factor of 2. End-bearing of the piles should be neglected.

$$f_{s,all} = k \cdot \sigma'_{vo} \cdot \tan(\delta) / FS$$

Where,

$$k = \text{lateral earth pressure coefficient} = 1.8 \cdot (1 - \sin \phi')$$

$$\phi' = \text{drained friction angle of competent subsurface materials}$$

- σ'_{vo} = average vertical effective stress in the upper 15 ft of embedment in the competent stratum (assuming pile tip is within this upper 15 ft). If deeper embedment depths are determined by the project structural engineer, this firm should be contacted to reevaluate our recommendations, (e.g., $f_{s,all}$).
- δ = soil-pile friction angle, taken as $0.75 \cdot \phi'$
- FS = factor of safety

The length of the CIDH piles should be determined by the project structural engineer to be greater than either the length calculated using the preceding allowable shaft friction value, the length selected to provide adequate resistance to lateral loading (see the following section of this report), or the length required to achieve minimum slope setback requirements, as the case maybe.

10.3.3 Excavation Considerations

For center-to-center CIDH pile spacings greater than three pile diameters (i.e., 6 ft), the contractor should provide all temporary bracing required to support the near vertical excavation until the permanent retaining elements that will span between the CIDH piles are installed.

10.3.4 Resistance to Lateral Loads

- The allowable lateral passive pressure (i.e., a factor of safety of 2), that can be developed against portions of CIDH piles embedded within alluvial fan deposits is 200 psf per foot of depth, up to a maximum of 2,000 psf.
- The adjusted pile width may be taken as 2 times the shaft diameter to account for soil arching when calculating passive resistance.
- A one-third increase in allowable passive pressure may be used for short-term seismic and wind loads.
- Passive resistance should be neglected for the portion of CIDH piles above the bottom of the temporary excavation (e.g., elevation 1,310 on Cross Section H-H' Temporary Excavation Supported by Soldier Pile).
- Passive resistance should be neglected for the portion of CIDH piles embedded in artificial fill, if any.
- Required embedment depth of CIDH pile into the competent strata can be evaluated in accordance with Section 1807.3 of the 2022 California Building Code.

10.4 Lateral Earth Pressures

Retaining walls should be designed to resist lateral (static) earth pressures equal to those exerted by an equivalent fluid with a density not less than the following for active (free-standing) and at-rest (restrained) conditions. A wall is considered restrained if it is prevented from movement greater than $0.002 \times H$ (H = height of the wall in feet) at the top of the wall.

Lateral Static Earth Pressure

BACKFILL SLOPE (HORIZONTAL TO VERTICAL)	EQUIVALENT FLUID DENSITY VALUE	
	FREE-STANDING CANTILEVER RETAINING WALLS (ACTIVE CONDITIONS)	RETAINING WALLS RESTRAINED AGAINST ROTATION (AT-REST CONDITIONS)
Level	38 pcf	58 pcf
2:1 max	60 pcf	80 pcf

These equivalent fluid density (EFD) values assume backfill consisting of compacted fill materials with low expansion potential and plasticity, and that drainage will be provided behind walls in order to prevent buildup of water pressure. If soil retained by walls is not drained, the walls should be designed to resist hydro-static water pressures in addition to the applicable active or at-rest soil pressures discussed above.

Additional lateral pressures due to surcharge loads from adjacent footings are not anticipated. Additional lateral pressures may be exerted against retaining walls by traffic loads. Potential traffic loads may be represented by a vertical surcharge load of 250 psf. Potential incidental pedestrian loads may be represented by a vertical surcharge load of 100 psf. A uniform lateral surcharge pressure against the retaining wall and base can be taken as one-third when this vertical surcharge pressure is applied within a 1:1 (h:v) projection up from the base of the wall. For surcharges applied beyond a 2:1 (h:v) projection from the base of the wall, the associated lateral surcharge pressure against retaining walls is considered negligible. The magnitude of lateral surcharge for applied surcharge loads between these two cases can be estimated using linear interpolation. Additional analyses can be performed to evaluate or confirm appropriate lateral surcharges, as needed, on a case-by-case basis.

Walls that will retain more than 6 feet of earth materials (typically taken as the difference between grade at the front and back of the wall) shall be designed to resist dynamic seismic lateral earth pressures. The total seismic earth pressure (P_{AE}) is equal to the sum of the static lateral earth pressure under active conditions (P_A) and a dynamic load increment (ΔP_{AE}) tabulated below. The dynamic load increment can be represented by an equivalent fluid with a density not less than the following:

Dynamic Load Increment

BACKFILL SLOPE (HORIZONTAL TO VERTICAL)	EQUIVALENT FLUID DENSITY VALUE	
	ACTIVE CONDITION (P _A)	SEISMIC INCREMENT (ΔP _{AE})
Level	38 pcf	26 pcf
2:1 max	60 pcf	43 pcf

Dynamic load increments are calculated as follows:

$$\text{Unrestrained wall with level backfill: } \Delta P_{AE} = 0.5\gamma H^2(0.42 PG_{AM}/g)$$

$$\text{Unrestrained wall with sloping backfill: } \Delta P_{AE} = 0.5\gamma H^2(0.70 PG_{AM}/g)$$

where γ is the moist unit weight of retained soil (120 pcf), H is the retained height, and PG_{AM} (0.51g) is the design peak ground acceleration (i.e., $S_{DS}/2.5$).

The equivalent fluid pressures provided for the dynamic load increment are in addition to the equivalent fluid density (EFD) values provided for active and at-rest conditions under static loading. The resultant seismic earth pressure acts at about $H/3$ from the base of the wall.

10.5 Retaining Wall Drainage

Retaining walls should be provided with a freeboard of at least 6 inches and a standard surface backdrain swale, if applicable (see **Retaining Wall Drainage Detail**). All drainage should flow to the toe of the adjacent slope using non-erodible devices. In order to reduce infiltration of surface water behind retaining walls, the surface backdrain swale should be paved or the surface of the backfill covered with at least 12 inches of low permeability fill for a horizontal distance equal at least to the height of the wall.

A backdrain system should be provided to prevent development of hydrostatic water pressures behind retaining walls. The referenced **Retaining Wall Drainage Detail** and **Alternate Wall Drainage Detail** show drainage recommendations with specifications for drainage materials behind the walls. If a drainage composite is selected for use in lieu of drainage rock it should consist of a high-strength core (compressive strength > 15,000 psi) and a high-flow (flow rate > 140 gpm/ft²) non-woven filter fabric. At locations where moisture migration through walls is undesirable, the side of the wall in contact with backfill soils should be waterproofed. The drainage composite shall be compatible with the waterproofing materials.

10.6 Retaining Wall Backfill

Retaining wall backfill to be confirmed by the Geotechnical Engineer, must be placed in accordance with our recommendations presented in this report and observed and tested by

our personnel during placement. Under no circumstances will retaining wall backfill be confirmed by this office if our recommendations concerning backfill placement are not followed, or if our personnel do not observe the installed backdrain and test the backfill during placement.

To prevent the buildup of lateral soil pressures in excess of the recommended design pressures, over-compaction of fill behind walls should be avoided by placement of wall backfill in lifts not exceeding 6 inches in thickness and by compacting each lift with hand-operated or self-propelled compaction equipment that weighs less than 1,000 pounds. Use of heavier equipment for compacting backfills should be limited to those areas at least 8 feet from the retaining walls. If these precautions cannot be maintained, then the respective retaining walls should either be redesigned to support the significantly higher lateral loads or the walls should be braced to support higher loads during placement and compaction of backfill.

11.0 DESIGN RESPONSE SPECTRUM

Based on site soil properties, the site is classified as Site Class D (stiff soil). The following spectral response parameters were determined using the OSHPD Seismic Design Maps web tool by the Structural Engineers Association of California (SEAOC). The parameters represent mapped values (adjusted for Site Class) with a 2% probability of exceedance in 50 years and corresponding risk-targeted ground motion (RTGM) with a 1% probability of collapse in 50 years

FACTOR	VALUE
Risk Category	III
Site Class	D – Stiff Soil
MCE_R ground motion (for 0.2 second period), S_s	1.916
MCE_R ground motion (for 1.0 second period), S_1	0.719
Site Coefficient, F_a	1.0
Site Coefficient, F_v	1.7*
Site-modified spectral acceleration value, S_{MS}	1.916
Site-modified spectral acceleration value, S_{M1}	1.833*
Design Spectral Response Acceleration at Short Period, S_{DS}	1.278
Design Spectral Response Acceleration 1-Second Period, S_{D1}	1.222*
Design Peak Ground Acceleration (PGA), $S_{DS}/2.5$	0.51g

* See requirements for site-specific ground motions in Section 11.4.8 of ASCE 7. These values of F_v shall only be used for

calculation of T_s , determination of Seismic Design Category, linear interpolation for intermediate values of S_1 , and when taking the exceptions under Items 1 and 2 of Section 11.4.8 for the calculation of SD_1 .

The values were obtained for site coordinates of 34.20888°N, and 118.18777°W. The preceding parameters should be used to calculate a response spectrum in accordance with Section 1613.3 of the 2022 California Building Code (CBC) and assume that planned structures will meet at least one of the exceptions noted in ASCE 7-16 Section 11.4.8. Further, the recommended value of the parameters S_{M1} and S_{D1} are already increased by 50 percent as required in ASCE7-16 Supplement 3, Section 11.4.8, item 1 exception.

The final selection of the appropriate seismic design coefficients should be made by the project structural engineer based on the local practices and ordinances, expected building response, and desired level of conservatism.

12.0 CONSTRUCTION CONSIDERATIONS

12.1 Temporary Excavations

Cross sections have been constructed to illustrate the remedial removal configurations. Cross section locations are shown on the attached Geotechnical Map (Plate II). Based on the remedial removal configuration shown on these cross sections, temporary excavations for the building removals up to 12 feet will be required. In addition, if the proposed retaining wall northwest of Building E is constructed with a conventional spread footing a temporary excavation up to 17 feet will be required (see Cross Section I-I', conventional footing).

Excavations deeper than 3.5 ft should conform to the State Construction Safety Orders of the State Division of Industrial Safety, CAL-OSHA. Temporary excavations in competent on-site soils up to 5 feet in height may be vertical. Temporary excavations greater than 5 ft in height shall be laid back to a gradient no steeper than 1.5:1 (h:v). The lower 3 ft of the sloping excavation may be vertical. At locations where the lateral limits of the excavation are constrained, slot cuts or temporary shoring may be used. Excavation walls in sands and dry soils must be kept moist at all times, but not saturated.

The horizontal distance of vertical surcharge loads from excavations should be at least 5 feet or half the excavation depth, whichever is greater. Some sloughing from granular soils may occur in excavations. Workers should be adequately protected from such sloughing, i.e., using movable shields/shoring. Surface drainage should be controlled along the top of excavation slopes.

During construction, the soil conditions should be regularly evaluated to confirm that conditions are as anticipated. The contractor shall be responsible for providing the "competent person" required by OSHA standards to evaluate soil conditions. Close

coordination between the competent person and the geotechnical engineer should be maintained to facilitate construction while providing safe excavations. The construction slopes should be visually observed during excavation operations and periodically thereafter in order to check for any cracks or other signs of instability. Prior to personnel entering the excavation, all loose material near the top of the excavation should be cleared. Observations of the excavation should be conducted following any significant rain or seismic event. If any signs of incipient failure are discovered, the conditions should be assessed immediately and appropriate safety measures implemented prior to anyone entering the excavation.

12.2 Temporary Slot Cut Excavations

Near-vertical excavations are not anticipated for the recommended grading removals. Nevertheless, near-vertical excavations may be required to achieve the recommended grading removals due to constraints from existing improvements or property line. In order to maintain temporary stability, it is recommended that removals in these areas be performed using an A-B-C slot cutting procedure. The Slot Cut Procedure is illustrated on a detail in **Appendix D** and described below:

- The area to be excavated should initially be excavated at an inclination no steeper than 1.5:1 (h:v) to a maximum height of 12 ft.
- Then, vertical cuts up to 9 feet in height should be excavated down to the required removal bottom at the locations of the “A” slots (this may result in up to a 3-ft high 1.5:1 slope at top of excavation). The width of the slots should not exceed 8 ft.
- Then, the “A” slots should be backfilled with compacted fill, in accordance with the grading recommendations/specifications provided in this report.
- Then, the “B” slots should be excavated and backfilled, as described above for the “A” slots.
- Then, the “C” slots should be excavated and backfilled, as described above for the “A” slots.

12.3 Temporary Shoring

Temporary shoring should be utilized to support portions of the temporary excavation that are not in conformance with our prior recommendations (e.g., removals for the northwest corner of Building E, see Cross Sections I-I' and H-H'). Shoring may consist of steel soldier piles that are placed in drilled holes and filled with concrete and designed in accordance with the following general design parameters:

- Drilled cast-in-place soldier piles should be spaced no closer than 3 diameters on center. The minimum diameter of the piles is 24 inches and the minimum embedment is at least three times pile diameter or 6 feet into the competent materials, whichever is greater, beneath the bottom of the excavation.
- For cantilevered shoring up to 13 feet in height supporting a level backslope, a triangular distribution of lateral earth pressure of 38 pcf should be used per Section 10.4 above.
- For cantilevered shoring up to 13 feet in height supporting a 2:1 (h:v) gradient backslope, a triangular distribution of lateral earth pressure of 60 pcf should be used, per Section 10.4 above.
- An allowable passive value of 200 psf per foot of depth (to a maximum of 2,000 psf) may be used in the anchoring stratum below the excavation bottom.
- For piles spaced greater than or equal to three times their diameter, the effective width of the pile may be taken as two times its diameter in passive resistance computations. In all cases of pile spacing, the structure should be considered as a continuous sheet pile structure in the active force computations. Active pressure should be considered as acting on the full height and depth of the pile shaft unless indicated as otherwise.
- Continuous lagging between soldier piles will be required. The lagging should be designed for full lateral earth pressures, limited to a maximum of 400 psf.
- Structural concrete should be used for that portion of a soldier pile, which is below the excavated level; lean mix concrete may be used above that level.
- Frictional resistance between the soldier piles and the retained earth may be used in resisting the downward component of the anchor load.
- Axial loads on soldier piles may be resisted by skin friction on the piles below the bottom plane of the excavation. The coefficient of friction between soldier piles and the retained earth may be taken as 0.30 assuming that uniform full shear load transfer will develop between the steel soldier beam and the lean-mix concrete and between the lean mix concrete and the retained earth.
- A civil or structural engineer experienced in shoring design shall prepare signed and sealed shoring plans by a California Registered Professional Engineer.
- We should review, from a geotechnical perspective only, the shoring plans, calculations and specifications before bidding.

12.4 Installation of CIDH Piles

12.4.1 General

Since the proposed piles are not designed for end bearing, some “slough” or loose soils in the bottom of the pile drill holes is acceptable, provided the actual depth of the drill holes (at the time that steel rebar cages are placed and concrete is cast) is at least equal to the specified pile depth(s). Care should be exercised to carefully position steel reinforcement cages and place concrete without disturbing the sidewalls of the pile drill holes.

Excavations for CIDH piles drilled in the predominantly granular site soils may be subject to caving. Casing or other means may be required to prevent caving. CIDH pile foundations may be constructed using the “dry method”, the “casing method”, or by other methods, selected by the contractor, such as the “slurry displacement” method, subject to acceptance by the structural engineer and the geotechnical engineer. The “dry method” consists of casting concrete directly in a dry, drilled hole, where no caving, squeezing, or sloughing of soils has occurred. The “casing method” may be used where soils with significant caving potential are present, when excessive water collects in a pile drill hole, or if other difficulties arise during construction of the pile foundation. The “slurry displacement” method employs drilling fluid along the full depth of the pile drill hole to minimize caving and slough of earth materials. Where the “slurry displacement” method is employed, concrete is cast in the pile drill hole by pumping or tremie methods so that the drilling fluid is displaced by concrete mix.

Casting of concrete in the drill hole for CIDH piles should be performed as follows:

- A tremie pipe should be lowered to the bottom of the CIDH drill hole and concrete should be cast into the hole until the height of concrete over the end of the tremie pipe is at least five ft.
- A height of five ft of concrete above the end of the tremie pipe should be maintained during casting as the tremie pipe is removed from the drill hole.

12.4.2 Dry Method

Pile excavations performed using the Dry Method usually are drilled without the use of water. However, if necessary, water may be used to facilitate removal of cuttings, unless this causes caving of the drill hole sidewalls. Any added water that may accumulate at the bottom of the pile drill hole should be removed from the hole prior to casting of concrete. Each pile drill hole should be completed in a continuous operation and the concrete should be placed without undue delay.

If caving conditions are encountered in a pile drill hole, no further drilling should be

allowed until the contractor selects a drilling method for preventing ground movement, subject to acceptance by the engineer. The contractor may elect to place casing in the pile drill hole by approved means, or advance the pile drill hole by stabilizing the drill hole using a fluid of appropriate density, or other appropriate means. The contractor should use appropriate means to clean the bottom of the pile drill hole so that loose material does not accumulate near the elevation of the pile tip. The pile drill hole should be protected with a platform to prevent the collar of the drill hole from caving during casting of concrete. Prior to casting the concrete in the pile drill hole, any water in the hole should be removed.

12.4.3 Casing Method

Approved casing, when employed, should have sufficient strength to withstand handling stresses and the external pressure of the caving soil. The outside diameter of the casing should not be less than the specified diameter of the drilled shaft. Preferably, casing should not be left in the ground. Where casing cannot be withdrawn, the shaft friction capacity may be reduced. The amount of shaft friction reduction should be assessed by the geotechnical engineer.

12.4.4 Protection of Structures and Holes Adjacent To Piles

representative of this firm should observe excavation operations adjacent to the existing hotel building and drilling and casting of the proposed CIDH piles. Displacement of the existing hotel structure should be monitored during grading operations.

If horizontal spacing between adjacent CIDH piles is less than five pile diameters, center-to-center, adjacent drilled shafts should be concreted simultaneously, or drilled and concreted alternately, allowing at least eight hours between concrete placement in one drilled pile and drilling of an adjacent pile. When the slurry method is used, the steel cage should be positioned and the concrete should be cast before proceeding to the next pile drill hole.

12.4.5 Quality and Casting of Concrete

Concrete placement should begin within four hours after completion of drilling. Concrete placement should be continuous without interruption, and should proceed at a sufficient rate that will prevent fresh concrete from being deposited on concrete that has already hardened sufficiently to form a cold joint or plane of weakness.

Ordinary Type I or Type II Portland Cement Concrete may be used for casting of the CIDH piles. The slump of the concrete mix used in a dry pile drill hole should be 4 to 8 inches. Concrete slump for pile holes drilled using the casing method should be 6 to 8

inches. If casing is required, it should be withdrawn as the concrete is being placed, maintaining a five-foot minimum head of concrete within the casing. This prevents reduction in the diameter of the drilled shaft due to earth pressure that acts against the fresh concrete, and prevents caving of materials in the drill hole sidewalls and mixing of these materials into the concrete. Concrete casting should continue in this manner until suitable concrete extends to the top of the excavation of forms.

12.4.6 Observation of Pile Construction

CIDH pile drilling operations should be performed in the presence of the geotechnical engineer or his representative, to confirm that suitable materials for lateral and vertical support of the piles are penetrated, that the dimensions of the installed piles meet the design dimensions, and that the installation has been performed as recommended herein. Accordingly, the geotechnical engineer or his representative must examine the pile drill holes prior to placement of steel reinforcement cages in the holes, and again prior to casting of concrete in the holes. The contractor should provide all aid and assistance required by the geotechnical engineer and his representative for field monitoring of the pile construction operations. If workers or inspectors are required to go into pile drill holes, the drill holes should be cased and ventilation should be provided in the borehole. All applicable safety regulations of OSHA and other regulatory authorities regarding working in excavations should also be implemented.

Drilled piles are accepted or rejected based on visual observation and testing during construction. The contractor should not allow or cause any of his work to be permanently enclosed or covered up until it has been observed, tested, and accepted by the engineer and all legally constituted authorities having jurisdiction.

12.5 Utility Trench Backfill

Utility trench backfill should be compacted at least to 90 percent of Maximum Dry Density (MDD), per ASTM Test Method D1557. Compaction shall be performed with a mechanical compaction device in accordance with specifications for trench backfill presented in **Appendix E**. If the excavated soils have dried, they should be moisture-conditioned to near Optimum Moisture Content before placement and compaction in trenches. Trench backfill within the building footprints must comply with all PCC floor slab compaction and moisture requirements.

Bedding material placed around utility conduits shall consist of clean gravel or sand with a Sand Equivalent (per ASTM D2419) of 30 or greater. Compaction of bedding material shall be in accordance with “Standard Specifications for Public Works Construction” (Greenbook) specifications. Jetting should not be employed for compaction of bedding

material at depths less than 4 feet beneath the subgrade of concrete slabs-on-grade, vehicle pavements, or other structures.

13.0 TENTATIVE PAVEMENT DESIGN AND ASSOCIATED GRADING

13.1 Asphalt Concrete Pavements

Design of asphalt concrete pavement sections depends primarily on support characteristics (strength) of soil beneath the pavement section and on cumulative traffic loads within the service life of the pavement. Strength of the pavement subgrade is represented by R-Value test data. Traffic loads within service life of a pavement are represented by a Traffic Index (TI) which is calculated based on anticipated traffic loads and on the projected number of load repetitions during the design life of the pavement. The design TI value should be decided by the Project Civil Engineer prior to construction.

Based on soil type and compaction characteristics of future subgrade soils, and on judgment regarding variability of site soils, a preliminary design R-Value of 30 was selected. Pavement sections are provided in the following table. These sections satisfy the minimum requirements of the CALTRANS flexible pavement design procedure for the design R-Value and a design service life of 20 years.

Flexible Pavement Sections

TRAFFIC INDEX (TI)	PAVEMENT SECTION (THICKNESS IN INCHES)	
	ASPHALT CONCRETE	BASE COURSE
4	3.0	4.5
5	3.0	5.5
6	4.0	7.0
7	4.5	8.5

The preceding pavement sections provide the minimum thickness of asphalt concrete permitted by the Caltrans design procedure. Alternate designs with greater asphalt thickness and smaller base course thickness can be provided upon request. Confirmatory R-Value testing should be performed during the finished grading of the project to determine whether or not any revision to pavement section recommendations above may be necessary.

13.2 PCC Vehicle Pavements

The design of PCC pavement and slab thicknesses and reinforcement is under the purview of a structural engineer. Deflections, shears, and moments in PCC pavements may be estimated using a coefficient of vertical subgrade reaction, k_v . The value k_v is defined as the pressure applied by the PCC slab divided by the resulting settlement of the subgrade and is

a function of the subgrade soil type, soil stiffness, base thickness, and base type. An effective k_v value of 120 pci may be used for design of PCC pavements that support vehicle loads.

Unless specifically designed by the project structural engineer, PCC vehicle pavements should be at least 6 inches thick and reinforced with No. 3 rebar placed 18 inches on center in each horizontal direction. PCC vehicle pavements should be supported on at least 6 inches of compacted base material.

PCC apron slabs planned for support of heavy vehicle loads in loading areas (i.e., trash enclosure) should be reinforced with No. 4 bars at 14-inch spacing in both horizontal directions. PCC apron slabs should be at least 8-inches thick and should be supported on at least 8 inches of compacted base material.

13.3 PCC Curb and Gutter

Based on the anticipated expansion potential of the compacted fills at the project site (i.e., very low), proposed PCC curbs and gutters may be cast directly on compacted soil subgrades.

13.4 Base Course

The base course beneath pavements should have an R-value of at least 78 and should comply with specifications for untreated crushed aggregate base (CAB), crushed miscellaneous base (CMB), or processed miscellaneous base (PMB), as defined in Section 200-2 of the current **Green Book** (Standard Specifications for Public Works Construction), or aggregate base (AB-Class 2) as defined in Section 605.3 of the current Caltrans Highway Design Manual.

13.5 Concrete Flatwork/Hardscape

Portland Cement Concrete sidewalks that will not support vehicular traffic should be at least 4 inches thick, and as a minimum, should be reinforced at mid-depth with 6x6-W1.4xW1.4 welded wire-fabric reinforcement.

Based on a very low expansion potential, PCC sidewalks may be cast directly on compacted soil subgrades. The moisture conditioned subgrade should not be allowed to desiccate prior to casting of concrete hardscape elements.

To help minimize shrinkage cracking, concrete flatwork should be constructed using uniformly cured, low-slump concrete, with crack control joints spaced at intervals not exceeding 8 ft.

13.6 Grading Recommendations for Pavement Construction

13.6.1 General

All grading shall be performed under the observation and testing of the Project Geotechnical Engineer and/or their authorized representatives in accordance with the recommendations contained herein and in accordance with the current Building Code requirements of the County of Los Angeles.

In order to provide suitable bearing support for the pavement section, all disturbed compacted fill soils (e.g., due to desiccation or over-saturation by rainfall, broken water lines, etc.) must be removed and replaced with a minimum 12 inches of fill compacted to the required density and moisture content before placement of PCC pavement.

13.6.2 Subgrade Preparation

The top 6 inches of the sub-grade materials shall be scarified and moisture conditioned to Optimum Moisture Content, or above, immediately prior to pavement construction. The moisture content shall be brought to the specified percentage by the addition of water, by the addition and blending of dry suitable material, or by the drying of existing material. The subgrade material shall then be compacted to a relative compaction of at least 95 percent of Maximum Dry Density, per ASTM 1557.

During processing of the top 6 inches of backfill in the pavement subgrade, all rocks larger than 3 inches in dimension shall be removed. If unsuitable material is found below the processing depth, it shall be removed and replaced as a compacted fill. After compaction and trimming, the subgrade shall be firm, hard, and unyielding.

13.6.3 Placement of Base Materials

Base material shall be watered as required to facilitate compaction and spread and compacted in horizontal lifts of approximately equal thickness. The maximum compacted thickness of any aggregate base lift shall not exceed 6 inches. Each lift of aggregate base material shall be compacted to at least 95 percent of Maximum Dry Density, per ASTM D1557.

14.0 LANDSLIDE, SETTLEMENT & SLIPPAGE STATEMENT

It is the finding of this firm that the proposed area for new buildings on the attached Geologic Map (**Plate I**), and Geotechnical Map (**Plate II**) submitted with this report, will be safe against hazards from landslide, settlement, and slippage, for the use intended, and will not affect the offsite property, provided that all our recommendations are incorporated in the Grading and Building Plans and implemented during construction.

15.0 PLAN REVIEW AND CONSTRUCTION OBSERVATIONS

Allan E. Seward Engineering Geology, Inc. (AESEGI) should be authorized to review project grading plans, foundation plans, and specifications for conformance with the recommendations provided in this report. Before the approval of the Grading Plans and Building Plans by the regulatory agency, this office is required to review and approve your plans by manual signatures and date.

AESEGI should also be authorized to perform on-site construction observation and testing to ascertain that conditions at the project site are consistent with the findings and conclusions presented in this report and that construction operations are performed in accordance with the recommendations presented in this report. If variations in subsurface soil conditions become evident during construction, the recommendations presented in this report may require revision.

The geotechnical and geological consultants of record should be authorized to perform the testing and observation recommended in this report, including the following tasks:

1. Observation and testing of all subgrade and fill bottoms (following excavation and prior to scarifying, recompaction, and fill placement).
2. Observation and testing of all fill placement and compaction.
3. Observation of foundation excavations to confirm embedment into competent bearing material (prior to the placement of forms or reinforcement into the excavations). Excavations must be free of all loose and slough material and must be neatly trimmed and water-conditioned prior to casting concrete in them.
4. Observation and testing of utility trenches beneath and adjacent to the proposed structures
5. Observation of slab-on-grade subgrades prior to casting of concrete and/or installation of slab underlayment materials. The slab subgrades must be tested to confirm that they have been maintained at the moisture content recommended herein.

Please notify AESEGI at least 48 hours in advance of any required observations, sampling, or testing, so that appropriate personnel can be made available.

16.0 GEOLOGIST/GEOTECHNICAL ENGINEER OF RECORD

This report has been prepared assuming that all required geologic and geotechnical field inspections and observations will be performed by Allan E. Seward Engineering Geology, Inc. If these tasks are performed by another party, that party must review this report, assume full responsibility for recommendations contained herein, and assume the title and responsibility of “Geologist/Geotechnical Engineer of Record” for the specific work.

A representative of the Geologist/Geotechnical Engineer of Record shall be present to observe all grading operations. All footing excavations shall be observed by a representative of the Geologist/Geotechnical Engineer of Record prior to placing steel or casting concrete in the excavations. A report that presents results of these observations and related testing shall be issued at the end of grading operations.

17.0 LIMITATIONS

This report has been prepared by Allan E. Seward Engineering Geology, Inc. for the exclusive use of the La Cañada Unified School District and their design consultants for the specific site discussed herein. This report should not be considered transferable. Prior to use by others, this firm must be notified, as additional work may be required to update this report.

In the event that any modification in the location or design of the proposed development, as discussed herein, are planned, the conclusions and recommendations contained in this report will require a written review by this firm with respect to the planned modifications.

The proposed development is located in southern California, a geologically and tectonically active region, where large magnitude, potentially destructive earthquakes are common. Therefore, ground motions from moderate or large magnitude earthquakes could affect the project site during the design life of the proposed structure(s). Typically, faulting is confined to the area adjacent to a known fault. However, absolute assurance against future fault displacement is not possible in tectonically active regions because new faults can form over time as the orientation and magnitude of deformational forces change in the earth's crust. Therefore, the location and magnitude of new ground surface ruptures during a seismic event cannot be anticipated.

In performing these professional services, this firm has used the degree of care and skill ordinarily exercised under similar circumstances by reputable engineering geologists and geotechnical engineers practicing in this or similar localities. The data presented in this report are based on the results of pertinent field and laboratory testing. It should be recognized that subsurface conditions can vary in time and laterally and with depth at a given site and that the conclusions and recommendations presented in this report are based on our interpretation of these data. Therefore, our **conclusions** and **recommendations** are **professional opinions** and are **not meant** to be a control of nature. We make no **warranty**, either **expressed** or **implied**.

This opportunity to be of continued service is appreciated. If you have any questions regarding this report, please contact us.

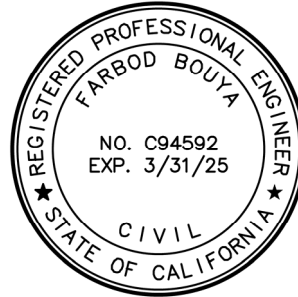
Respectfully submitted,



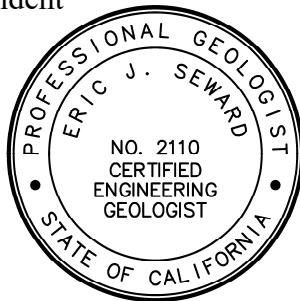
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Martin Neely, MS, GE 2937
Principal Geotechnical Engineer



The following attachments and appendices complete this report.

Location Map
Regional Geologic Map
References

following page 4
following page 6

APPENDIX A – Subsurface Logs

- Hollow-Stem Auger and Percolation Boring Logs
 - HS-1 thru HS-5 (11/10/23)
 - HS-6 thru HS-9
 - PB-1 and PB-2 (1/13/23)

- Hand-Auger Boring Logs
 HA-1
 HA-2 thru HA-6 (2/8/24)
- Trench Log (T-1)
- Key to Boring Log Symbols

APPENDIX B – Laboratory Testing

APPENDIX C – Seismicity

- Ground Motion and Response Spectra References
- Quaternary Fault Location Map
- Earthquake Epicenter Location Map
- Earthquake Zones of Required Investigation
- OSHPD Seismic Design Maps Output

Figure C1

Figure C2

Figure C3

APPENDIX D – Slope Stability Analyses

- Slope Stability Analyses Results
- Gross Slope Stability Analyses Computer Output

Table D1

APPENDIX E – General Specifications and Construction Details

- Recommended Earthwork Specifications
- Recommended Specifications for Placement of Trench Backfill
- Drainage and Erosion Control Recommendations
- Retaining Wall Drainage Details
- Slot Cut Procedure
- Active Lateral Earth Pressures, Temporary Excavation Supported by Pile

Cross Sections 2-2', 3-3', 4-4', 6-6' and 7-7' (20-scale)

Cross Sections H-H', I-I' and J-J' (10-scale)²

Geologic Map (Site Plan)

Plate I

Geotechnical Map (Civil Site Grading Plan)

Plate II

Distribution:

La Cañada Unified School District
(C/o Linik Corp. Builders Management)
Attn: Mr. Harold Pierre

(via email in PDF format)

GGA Architecture
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KPFF
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(via email in PDF format)

² Cross Sections H-H' and I-I' have three versions: Conventional Footing (illustrating temporary backcut); Soldier Pile Wall; and Temporary Excavation Supported by Soldier Pile.

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New Construction and Various Site Improvements for
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Paradise Canyon Elementary School
471 Knight Way
La Cañada, Los Angeles County, California 91011
Dated January 13, 2023 – JN: 23-2775-6
2. **GEOLOGIC REPORT**
Fault Rupture Hazard Investigation
New Construction and Various Site Improvements
Paradise Canyon Elementary School
471 Knight Way
La Cañada, Los Angeles County, California
Dated September 14, 2023 – JN: 23-2775-1
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Paradise Canyon Elementary School
471 Knight Way
La Cañada, California 91011
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4. **GEOLOGIC HAZARDS EVALUATION REPORT**
Review of Conceptual Site Plan
Proposed Buildings at Vicinity of Existing Classrooms D, E and F
Paradise Canyon Elementary School
471 Knight Way
La Cañada, Los Angeles County, California
Dated November 10, 2023 – JN: 23-2775-9
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Seismic Retrofit of Existing Buildings H and J
Paradise Canyon Elementary School
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Paradise Canyon Elementary School
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Appendix A

ALLAN E. SEWARD
ENGINEERING GEOLOGY

CLIENT: La Canada Unified School District		JOB NO.: 23-2775-9		DRILL HOLE LOG			
PROJECT: Proposed Buildings Paradise Canyon Elementary School		DATE: 11/10/23					
DRILLING COMPANY: Choice Drilling Inc.		LOGGED BY: CHS					
DRILLING METHOD: Hollow-stem auger		DRILLED: 6/25/22					
HAMMER TYPE: Automatic		HOLE DIA: 8"					
DRIVING WEIGHTS: 140 lbs		AVERAGE DROP: 18"		BORING NO. HS-1			
		ELEVATION: 1320.5'					

DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	LABORATORY TESTS			
						Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0				SP	PAVEMENT SECTION; (0 - 7") @ 0' 3-inch asphalt concrete over 4-inch base material ARTIFICIAL FILL; af (7" - 5')				
46				SP	@ 3' Poorly graded, coarse-grained SAND with silt; medium dense; dry; light brown	2.2	113	4	Swell/Consol
5					ALLUVIAL FAN DEPOSITS; Qal₃ (5 - 21.5') @ 6' Poorly graded, coarse-grained SAND; medium dense; damp; dark greenish brown				
10				SM	@ 9' Silty, fine- to coarse-grained SAND; medium dense; damp; medium brown	5.8	120	15	Sieve
36					@ 12' Silty, fine-grained SAND; dense				
15					@ 15' - medium dense; trace gravel	3.1	118		
20					@ 20' Silty, fine- to coarse-grained SAND; dense				
25					TOTAL DEPTH 21.5' (Elev. 1299') No Groundwater No Caving				
30									
35									

CLIENT: La Canada Unified School District		JOB NO.: 23-2775-9		DRILL HOLE LOG	
PROJECT: Proposed Buildings Paradise Canyon Elementary School		DATE: 11/10/23			
DRILLING COMPANY: Choice Drilling Inc.		LOGGED BY: CHS			
DRILLING METHOD: Hollow-stem auger		DRILLED: 6/25/22			
HAMMER TYPE: Automatic		HOLE DIA: 8"			
DRIVING WEIGHTS: 140 lbs		AVERAGE DROP: 18"		BORING NO. HS-2	
		ELEVATION: 1329'			

DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	LABORATORY TESTS			
						Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0				SM	PAVEMENT SECTION; (0 - 7") @ 0' 3-inch asphalt concrete over 4-inch base material ARTIFICIAL FILL; af (7" - 5')				
20					@ 3' Silty, fine- to coarse-grained SAND; medium dense; dry; roots; dull brown	2.6	115	16	Bulk Sample @ 1 - 6' Remold Shear Cor Curve=A
5					ALLUVIAL FAN DEPOSITS; Qal₃ (5 - 35.9') @ 6' Silty, fine- to coarse-grained SAND with trace gravel; medium dense; dry; greyish tan; root in sampler				
10		42		SP-SM	@ 9' - no gravel; light brown	2.6	116	8	Swell/Consol
15		26		SM	@ 12' Silty, fine- to medium-grained SAND; trace gravel				
20		83/10"			@ 15' - medium brown (rock lodged in sampler tip)	7.1	115		
25		50/Ref			@ 20' Silty, fine- to coarse-grained SAND; dense				
30		59			@ 25' - no recovery (rock lodged in sample ring)				
35		50/5"			@ 30' - very dense				
					@ 35' - moist; orangish brown				
TOTAL DEPTH 35.9' (Elev. 1293.1')									
No Groundwater									
No Caving									

CLIENT: La Canada Unified School District		JOB NO.: 23-2775-9		DRILL HOLE LOG			
PROJECT: Proposed Buildings Paradise Canyon Elementary School		DATE: 11/10/23					
DRILLING COMPANY: Choice Drilling Inc.		LOGGED BY: CHS					
DRILLING METHOD: Hollow-stem auger		DRILLED: 6/25/22					
HAMMER TYPE: Automatic		HOLE DIA: 8"					
DRIVING WEIGHTS: 140 lbs		AVERAGE DROP: 18"		BORING NO. HS-3			
		ELEVATION: 1327.5'					

DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	LABORATORY TESTS			
						Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0					PAVEMENT SECTION; (0 - 7") @ 0' 3-inch asphalt concrete over 4-inch base material ARTIFICIAL FILL; af (7" - 9')				
11				SM-SC	@ 3' Silty, clayey SAND; medium dense; damp; light brown; scattered gravel				
31					@ 6' - medium brown	4.1	123	32	Shear Test
22				SP-SM	ALLUVIAL FAN DEPOSITS; Qal₃ (9 - 21.4') @ 9' Poorly graded SAND with silt; medium dense; dry; light brown				
53				SM	@ 12' Silty SAND; medium dense; damp; light brown	3.5	118	14	Sieve
26					@ 15' - medium brown; scattered gravel				
70/11"					@ 20' - very dense; moist; dark orangish brown	4.6	131		
					TOTAL DEPTH 21.4' (Elev. 1306.1') No Groundwater No Caving				

CLIENT: La Canada Unified School District		JOB NO.: 23-2775-9		DRILL HOLE LOG			
PROJECT: Proposed Buildings Paradise Canyon Elementary School		DATE: 11/10/23					
DRILLING COMPANY: Choice Drilling Inc.		LOGGED BY: CHS					
DRILLING METHOD: Hollow-stem auger		DRILLED: 6/25/22					
HAMMER TYPE: Automatic		HOLE DIA: 8"					
DRIVING WEIGHTS: 140 lbs		AVERAGE DROP: 18"		BORING NO. HS-4			
		ELEVATION: 1313'					

DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	LABORATORY TESTS			
						Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0					PAVEMENT SECTION; (0 - 7") @ 0' 3-inch asphalt concrete over 4-inch base material ARTIFICIAL FILL; af (7" - 8')				
42				SM	@ 3' Silty, fine- to coarse-grained SAND; medium dense; dry; dull orangish brown; scattered gravel	2.3	123		
21					@ 6' Silty, fine-grained SAND				
62/11"				SW-SM	ALLUVIAL FAN DEPOSITS; Qal₃ (8 - 21.5') @ 9' Well-graded SAND with silt; very dense; damp; orangish brown	3.3	123	6	Sieve
63					@ 12' - scattered gravel				
30				SM-SC	@ 15' Silty, clayey SAND; medium dense; moist; dark brown	13.8	120		
34				SM	@ 20' Silty SAND; dense; moist; dark brown				
TOTAL DEPTH 21.5' (Elev. 1291.5') No Groundwater No Caving									

CLIENT: La Canada Unified School District				JOB NO.: 23-2775-9		DRILL HOLE LOG			
PROJECT: Proposed Buildings Paradise Canyon Elementary School				DATE: 11/10/23					
				LOGGED BY: CHS					
DRILLING COMPANY: Choice Drilling Inc.				DRILLED: 6/25/22					
DRILLING METHOD: Hollow-stem auger				HOLE DIA: 8"					
HAMMER TYPE: Automatic				AVERAGE DROP: 18"					
DRIVING WEIGHTS: 140 lbs				ELEVATION: 1312.5'		BORING NO. <u>HS-5</u>			
DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	LABORATORY TESTS			
						Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0					PAVEMENT SECTION; (0 - 7") @ 0' 3-inch asphalt concrete over 4-inch base material ARTIFICIAL FILL; af (7" - 5')				Bulk Sample @ 1 - 6'
18				SM	@ 3' Silty SAND; medium dense; dry; dull brown; scattered gravel				
5					ALLUVIAL FAN DEPOSITS; Qal₃ (5 - 36.5')				
20				SP-SM	@ 6' Poorly graded SAND with silt; medium dense; damp; light brown; scattered gravel	4.8	120		
10				SM	@ 9' Silty SAND; medium dense; damp; dull brown				
84/10"				SM-SC	@ 12' Silty, clayey, fine- to medium-grained SAND; very dense; moist; medium brown	10.4	129		
15				SP-SM	@ 15' Poorly graded SAND with silt and gravel; dense; dry; light brown				
20				SM-SC	@ 20' Silty, clayey SAND; medium dense; moist; medium brown	12.4	119		@ 20' Driller added water due to difficult drilling
25				SM	@ 25' Silty, fine- to medium-grained SAND; dense; moist; medium brown				
30				SP-SM	@ 30' Poorly graded SAND with silt; very dense; damp; dark orangish brown	5.6	112	9	Swell/Consol
35									
60									
TOTAL DEPTH 36.5' (Elev. 1276') No Groundwater No Caving									

CLIENT: La Canada Unified School District				JOB NO.: 24-2775-6		DRILL HOLE LOG			
PROJECT: Proposed Buildings C, D, E & F Paradise Canyon Elementary School				DATE: 6/19/24					
DRILLING COMPANY: Choice Drilling Inc.				LOGGED BY: CHS/KHI					
DRILLING METHOD: Hollow Stem Auger				DRILLED: 1/4/24					
HAMMER TYPE: Automatic				HOLE DIA: 8"					
DRIVING WEIGHTS: 140 lbs.				AVERAGE DROP: 30"					
				ELEVATION: 1,311.5'		BORING NO. HS-6			

CLIENT: La Canada Unified School District		JOB NO.: 24-2775-6		DRILL HOLE LOG					
PROJECT: Proposed Buildings C, D, E & F Paradise Canyon Elementary School		DATE: 6/19/24							
		LOGGED BY: CHS/KHI							
DRILLING COMPANY: Choice Drilling Inc.		DRILLED: 1/4/24							
DRILLING METHOD: Hollow Stem Auger		HOLE DIA: 8"							
HAMMER TYPE: Automatic		AVERAGE DROP: 30"							
DRIVING WEIGHTS: 140 lbs.		ELEVATION: 1,315.5'		BORING NO. HS-7					
DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0					ARTIFICIAL FILL; af (0 - 5')				
		25		SP-SM	@ 2' Poorly graded, medium- to coarse-grained SAND with silt; medium dense; damp; light-brown; 2" diameter granitic rock fragment	6.8	114		
5		24		SP	ALLUVIAL FAN DEPOSITS; Qal₃ (5 - 36.5')	6.3	106	4	0.1% Clpse Swell/Consol
					@ 5' Poorly graded, coarse-grained SAND; medium dense; damp; light-brown to tan				
		21			@ 8' - light-brown; fine- to medium-grained sands	4.0			
10		32		SC	@ 11' Clayey, fine- to coarse-grained SAND with gravel; medium dense; moist; light-brown to medium-brown	12.4	119	16	
15		10			@ 15' - loose; reddish-brown; fine-grained sands	16.3			
		21			@ 18' - medium dense; light reddish-brown	17.4	112	44	
20									
25		38			@ 25' - dense; light-brown; 1-2" diameter granitic gravel in ring sample	14.1	120		
30		54			@ 29' Perched groundwater encountered at 29'; at completion of drilling groundwater at 34'	13.5	121		
				SP	@ 31' Poorly graded, medium- to coarse-grained SAND; dense; moist; light-brown; sparse gravel sized granitic rock fragments				
35		41			@ 35' - no gravel	11.2			
TOTAL DEPTH 36.5' (Elev. 1,279') During drilling perched groundwater @ 29' and @ 34' at end No Caving									

CLIENT: La Canada Unified School District				JOB NO.: 24-2775-6		DRILL HOLE LOG BORING NO. HS-8			
PROJECT: Proposed Buildings C, D, E & F Paradise Canyon Elementary School				DATE: 6/19/24					
DRILLING COMPANY: Choice Drilling Inc.				LOGGED BY: CHS/KHI					
DRILLING METHOD: Hollow Stem Auger				DRILLED: 1/4/24					
HAMMER TYPE: Automatic				HOLE DIA: 8"					
DRIVING WEIGHTS: 140 lbs.				AVERAGE DROP: 30"					
				ELEVATION: 1,317'					

DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	LABORATORY TESTS			
						Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0					ASPHALT; (0 - 3") ARTIFICIAL FILL; af (3" - 6.5')				
18				SP	@ 2' Poorly graded, fine- to medium-grained SAND; medium dense; dry; tan				Bulk Sample @ 0 - 8' Cor
5		35				2.7	122		
89/11"				SM	ALLUVIAL FAN DEPOSITS; Qal₃ (6.5 - 26.5') @ 6.5' Silty, fine grained SAND; dense; damp; light-brown; sparse gravel sized granitic rock fragments; roots @ 8' - brown; medium-grained sands; no gravel	7.9	133		
10		35			@ 11' - moist; sparse gravel sized granitic rock fragments	8.9			
15		84			@ 15' - moist	9.5	131		
20		43		SP-SM	@ 20' Poorly graded SAND with silt; dense; damp; light-brown; sparse gravel sized granitic rock fragments	7.3			
25		68				10.4	117		
TOTAL DEPTH 26.5' (Elev. 1,290.5')									
No Groundwater									
No Caving									
30									
35									

CLIENT: La Canada Unified School District		JOB NO.: 24-2775-6		DRILL HOLE LOG BORING NO. HS-9			
PROJECT: Proposed Buildings C, D, E & F Paradise Canyon Elementary School		DATE: 6/19/24					
DRILLING COMPANY: Choice Drilling Inc.		LOGGED BY: CHS/KHI					
DRILLING METHOD: Hollow Stem Auger		DRILLED: 1/4/24					
HAMMER TYPE: Automatic		HOLE DIA: 8"					
DRIVING WEIGHTS: 140 lbs.		AVERAGE DROP: 30"					
		ELEVATION: 1,316'					

DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	LABORATORY TESTS			
						Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0					ARTIFICIAL FILL; af (0 - 9.5')				
34				SP-SM	@ 2' Poorly graded, medium- to coarse-grained SAND with silt; medium dense; damp; sparse granitic rock fragments; 2" diameter gravel in tip	5.9	117	10	
5					@ 5' - dense; damp; brown; sparse granitic rock fragments	3.8			
53					@ 8' - dense; damp	3.8	122		
10				SC-SM	ALLUVIAL FAN DEPOSITS; Qal₃ (9.5 - 26.5') @ 9.5' Silty, clayey fine-grained SAND; medium dense; moist; reddish-brown; sparse coarse-grained sands and granitic rock fragments @ 11' - 2" diameter gravel	14.7	119	44	Bulk Sample @10 - 20' Shear Test
15					@ 15' - more clay; medium-brown	11.8			
20					@ 20' - medium- to coarse-grained sands; less clay	14.4	120		
25				SP-SM	@ 25' Poorly graded, medium- to coarse-grained SAND with silt; very dense; moist; light brown; 2" granitic gravel in tip	8.1			
TOTAL DEPTH 26.5' (Elev. 1289.5')									
No Groundwater									
No Caving									
30									
35									

CLIENT: La Canada Unified School District		JOB NO.: 23-2775-9		DRILL HOLE LOG	
PROJECT: Proposed Buildings Paradise Canyon Elementary School		DATE: 11/10/23			
DRILLING COMPANY: Choice Drilling Inc.		LOGGED BY: CHS			
DRILLING METHOD: Hollow-stem auger		DRILLED: 6/25/22			
HAMMER TYPE: Automatic		HOLE DIA: 8"			
DRIVING WEIGHTS: 140 lbs		AVERAGE DROP: 18"		BORING NO. PB-1	
ELEVATION: 1326.5'					

DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	LABORATORY TESTS			
						Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0				SM	PAVEMENT SECTION; (0 - 7") ARTIFICIAL FILL; af (7" - 8') @ 0.6' Silty, fine- to coarse-grained SAND; dry; light brown @ 3' - layer with up to 6-inch nominal diameter cobbles @ 6' - damp ALLUVIAL FAN DEPOSITS; Qal₃ (8 - 11') @ 8' Silty, fine- to coarse-grained SAND; dry; medium brown				
5									
10									
15									
20									
25									
30									
35									
					TOTAL DEPTH 11' (Elev. 1315.5') No Groundwater				Infiltration test invert at 11 ft

CLIENT: La Canada Unified School District				JOB NO.: 23-2775-9		DRILL HOLE LOG			
PROJECT: Proposed Buildings Paradise Canyon Elementary School				DATE: 11/10/23					
DRILLING COMPANY: Choice Drilling Inc.				LOGGED BY: CHS					
DRILLING METHOD: Hollow-stem auger				DRILLED: 6/25/22					
HAMMER TYPE: Automatic				HOLE DIA: 8"					
DRIVING WEIGHTS: 140 lbs				AVERAGE DROP: 18"					
				ELEVATION: 1314.5'		BORING NO. PB-2			

DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	LABORATORY TESTS			
						Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0				SM	ARTIFICIAL FILL; af (0 - 8') @ 0' Silty SAND; moist; dark brown				
5					@ 6' sand grades coarser; damp; light brown				
10				SW-SM	ALLUVIAL FAN DEPOSITS; Qal₃ (8 - 10.5') @ 8' Well-graded SAND with silt; damp; orangish brown				
					TOTAL DEPTH 10.5' (Elev. 1304') No Groundwater				Infiltration test invert at 10.5 ft
15									
20									
25									
30									
35									

CLIENT: La Canada Unified School District		JOB NO.: 24-2775-6		DRILL HOLE LOG			
PROJECT: Proposed Buildings C, D, E & F Paradise Canyon Elementary School		DATE: 6/19/24					
DRILLING COMPANY: Gold Construction, Inc.		LOGGED BY: CHS/KHI					
DRILLING METHOD: Hand Auger		DRILLED: 12/28/23					
HAMMER TYPE: Donut		HOLE DIA: 3"					
DRIVING WEIGHTS: 48 lbs.		AVERAGE DROP: 18"					
		ELEVATION: 1,315.5'		BORING NO. HA-1			

DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	LABORATORY TESTS			
						Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0				SM	ARTIFICIAL FILL; af (0 - 5') @ 0' Silty SAND; loose; moist; dull orangish-brown				Medium Bulk Sample @ 0 - 5'
2.5		25			@ 1.5' - pin-hole voids; sparse roots @ 2' - orangish-brown	11.6	109		
5		50			@ 4' - gravel sized granitic rock fragments in auger cuttings	9.9	105		Shear Test
7.5		50		SM	ALLUVIAL FAN DEPOSITS; Qal₃ (5 - 9') @ 5' Silty, medium- to coarse-grained SAND; loose; moist; tannish-brown; roots; gravel sized granitic fragments	9.8	98	38	1.7% Clpse Swell/Consol
10		50		SP	@ 8' Poorly graded medium- to coarse-grained SAND; medium dense; moist; tannish-brown @ 9' - more silt	13.6	112		Medium Bulk Sample @ 7 - 8'
12.5					TOTAL DEPTH 9' (Elev. 1,306.5') No Groundwater No Caving				
15									
17.5									

CLIENT: La Canada Unified School District		JOB NO.: 24-2775-6		DRILL HOLE LOG	
PROJECT: Paradise Canyon Elementary Classrooms H & J 471 Knight Way, La Canada, CA 91011		DATE: 2/8/24			
DRILLING COMPANY: Gold Construction, Inc.		LOGGED BY: CHS/KHI			
DRILLING METHOD: Hand Auger		DRILLED: 12/28/23			
HAMMER TYPE: Donut		HOLE DIA: 3"			
DRIVING WEIGHTS: 48 lbs.		AVERAGE DROP: 18"		BORING NO. HA-2	
ELEVATION: 1,320.5'					

DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	LABORATORY TESTS			
						Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0				SM	ARTIFICIAL FILL; af (0 - 5.5') @ 0' Silty SAND; loose; damp to moist; dark-brown; sparse construction debris				Medium Bulk Sample @ 0 - 4'
2.5		25			@ 1.5' - medium dense; damp; less silt; brown	7.6	110	18	Shear Test
5		30			@ 3.5' - moist	10.9	109		Medium Bulk Sample @ 3 - 7'
7.5		40		SP	ALLUVIAL FAN DEPOSITS; Qal₃ (5.5 - 8.5') @ 5.5' Poorly graded, coarse-grained SAND; medium dense; damp; orangish-brown	3.9	112		
		30			@ 7.5' - gravel-sized granitic rock fragments in cuttings; no sample recovery				
		50			@ 8' - sample disturbed	6.5			
10					TOTAL DEPTH 8.5' (Elev. 1,312') No Groundwater No Caving				
12.5									
15									
17.5									

CLIENT: La Canada Unified School District				JOB NO.: 24-2775-6		DRILL HOLE LOG BORING NO. HA-3			
PROJECT: Paradise Canyon Elementary Classrooms H & J 471 Knight Way, La Canada, CA 91011				DATE: 2/8/24					
DRILLING COMPANY: Gold Construction, Inc.				LOGGED BY: CHS/KHI					
DRILLING METHOD: Hand Auger				DRILLED: 12/28/23					
HAMMER TYPE: Donut				HOLE DIA: 3"					
DRIVING WEIGHTS: 48 lbs.				AVERAGE DROP: 18"					
				ELEVATION: 1,318.5'					

DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	LABORATORY TESTS			
						Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0				SP-SM	ARTIFICIAL FILL; af (0 - 6.5') @ 0' Poorly graded SAND with silt; medium dense; damp; dark-brown to black				Bulk Sample @ 0 - 7'
40						4.1	108		
40					@ 3.5' - grayish dark-brown to dark-brown	4.8	110		
50						5.8	107		
7.5				SP	ALLUVIAL FAN DEPOSITS; Qal₃ (6.5 - 8') @ 6.5' Poorly graded, fine-grained SAND with gravel; dense; dry; light-brown; 1 to 2" diameter granitic rock fragments	2.0	122		
					TOTAL DEPTH 8' (Elev. 1,310.5')				
					No Groundwater				
					No Caving				
10									
12.5									
15									
17.5									

CLIENT: La Canada Unified School District				JOB NO.: 24-2775-6		DRILL HOLE LOG BORING NO. HA-4			
PROJECT: Paradise Canyon Elementary Classrooms H & J 471 Knight Way, La Canada, CA 91011				DATE: 2/8/24					
DRILLING COMPANY: Gold Construction, Inc.				LOGGED BY: CHS/KHI					
DRILLING METHOD: Hand Auger				DRILLED: 12/29/23					
HAMMER TYPE: Donut				HOLE DIA: 3"					
DRIVING WEIGHTS: 48 lbs				AVERAGE DROP: 18"					
				ELEVATION: 1,319'					

DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	LABORATORY TESTS			
						Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0				SM	ARTIFICIAL FILL; af (0 - 9.5') @ 0' Silty, medium-grained SAND; medium dense; moist; medium-brown to dark-brown; roots in the upper foot				Medium Bulk Sample @ 0 - 7'
30					@ 1.5' - some gravel	8.2	113		
50					@ 3.5' - fine- to medium-grained sand; damp	4.3	113	18	Shear Test
40					@ 5.5' - dry	3.2	108		
50					@ 7.5' - damp	4.4	112		
10				SP-SM	ALLUVIAL FAN DEPOSITS; Qal₃ (9.5 - 11') @ 9.5' Poorly graded, fine- to medium-grained SAND with silt; medium dense; moist; medium-brown to orangish-brown; some gravel; roots @ 10.5' - fine-grained sands	13.2	110		
12.5					TOTAL DEPTH 11' (Elev. 1,308') No Groundwater No Caving				
15									
17.5									

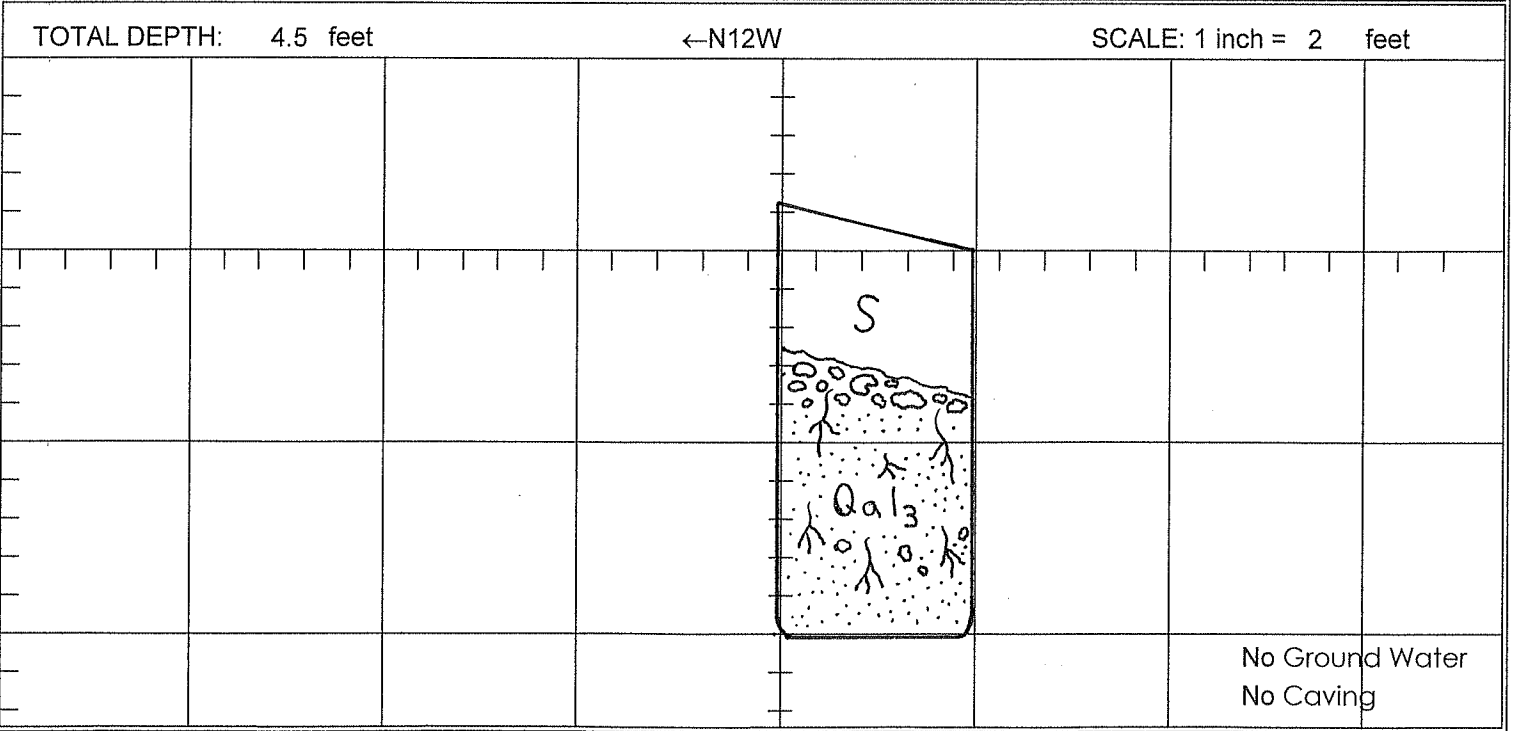
CLIENT: La Canada Unified School District				JOB NO.: 24-2775-6		DRILL HOLE LOG BORING NO. HA-5			
PROJECT: Paradise Canyon Elementary Classrooms H & J 471 Knight Way, La Canada, CA 91011				DATE: 2/8/24					
DRILLING COMPANY: Gold Construction, Inc.				LOGGED BY: CHS/KHI					
DRILLING METHOD: Hand Auger				DRILLED: 12/29/23					
HAMMER TYPE: Donut				HOLE DIA: 3"					
DRIVING WEIGHTS: 48 lbs				AVERAGE DROP: 18"					
				ELEVATION: 1,319.5'					
DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	LABORATORY TESTS			
						Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0				SM	ARTIFICIAL FILL; af (0 - 6.5') @ 0' Silty SAND with gravel; medium dense; moist; hair-like roots; dark-brown				Bulk Sample @ 0 - 7' EI, Cor
2.5		40			@ 2.5' - dense; rock fragment in 6th ring	8.5	120		
					@ 3' - pieces red clay brick in cuttings; auger refusal at 3 ft; moved boring over 1' north				
5		40		SP-SM	@ 4.5' Poorly graded SAND with silt; dense; moist; dark-brown	9.6	118		
					@ 6.5' No sample recovery; rock in tip				
7.5		50		SP	ALLUVIAL FAN DEPOSITS; Qal₃ (6.5 - 7.5') @ 7' Poorly graded, coarse-grained SAND with gravel; medium dense; damp; grayish-brown;	5.8	115		
					TOTAL DEPTH 7.5' (Elev. 1,312') No Groundwater Caving @ 6.5' cannot further auger				
10									
12.5									
15									
17.5									

CLIENT: La Canada Unified School District				JOB NO.: 24-2775-6		DRILL HOLE LOG BORING NO. HA-6			
PROJECT: Paradise Canyon Elementary Classrooms H & J 471 Knight Way, La Canada, CA 91011				DATE: 2/8/24					
DRILLING COMPANY: Gold Construction, Inc.				LOGGED BY: CHS/KHI					
DRILLING METHOD: Hand Auger				DRILLED: 12/29/23					
HAMMER TYPE: Donut				HOLE DIA: 3"					
DRIVING WEIGHTS: 48 lbs				AVERAGE DROP: 18"					
				ELEVATION: 1,315.5'					

DEPTH (feet)	SAMPLE TYPE	BLOWS / 12"	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	LABORATORY TESTS			
						Moisture Content (%)	Dry Density (pcf)	% Fines	Other Tests
0				SM	CLEAN SOIL; (0 - 2") @ 2" Plastic fabric ARTIFICIAL FILL; af (2" - 2.5') @ 2" Silty SAND; loose; moist; dark-brown @ 1.5' - dense	10.0	122		Bulk Sample @ 0 - 4'
2.5		20		SP	ALLUVIAL FAN DEPOSITS; Qal₃ (2.5 - 8') @ 2.5' Poorly graded, fine- to coarse-grained SAND; medium dense; damp; dark-brown; some gravel	7.2	104		
5		20		SP	@ 5' - very fine-grained sands	5.7	106		
				SC	@ 6' Sandy CLAY; firm; damp; dark-brown; hair-like roots				Swell/Consol
				SP-SM	@ 6.5' Poorly graded SAND with silt; medium dense; moist; brown				Bulk Sample @ 6 - 8'
7.5		60		SM	@ 7.5' - sample disturbed @ 8' auger refusal at 8.5'				
10					TOTAL DEPTH 8.5' (Elev. 1,307") No Groundwater No Caving				
12.5									
15									
17.5									

CLIENT: La Canada Unified School District	JOB NO: 24-2775-6	TRENCH LOG NO. T-1
PROJECT: Proposed Buildings C, D, E & F Paradise Canyon Elementary School	DATE: 6/19/24	
	LOGGED BY: CHS/KHI	
	EXCAVATED: 12/28/23	
EXCAVATION METHOD: Hand Excavated	ELEVATION: 1,327.75'	

DEPTH (feet)	SAMPLE TYPE	SAMPLE NUMBER	GRAPHIC LOG	USCS SYMBOL	DESCRIPTION	ATTITUDES	LABORATORY TESTS		
							Moisture Content (%)	Dry Density (pcf)	Other Tests
0				SM	SOIL; s (0 - 1.5') @ 0' Silty, medium-grained SAND; loose; damp; dark- brown; abundant roots and vegetation; bark; some 3 to 4" diameter cobbles				
2				SP	ALLUVIAL FAN DEPOSITS; Qal₃ (1.5 - 4.5') @ 1.5' Poorly graded, coarse-grained SAND with gravel; loose; dry; roots; light-brown to light orangish-brown; Large 10" diameter granitic boulder removed @ 2' - very loose		2.30	93.2	Bulk Sample @ 2 - 4'
4					@ 4' - loose; fine- to medium-grained sands; smaller roots		2.69	107.9	
6									
8									



SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	Well-graded gravels, gravel-sand mixtures, little or no fines
				GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	Silty gravels, gravel-sand-silt mixtures
				GC	Clayey gravels, gravel-sand-clay mixtures
	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	Well-graded sands, gravelly sands, little or no fines
				SP	Poorly-graded sands, gravelly sands, little or no fines
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	Silty sands, sand-silt mixtures
				SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	Inorganic silts and very fine sands, clayey silts with slight plasticity
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
				OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	Inorganic silts, micaceous or diatomaceous fine, sandy or silty soils, elastic silts
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic clays of medium to high plasticity, organic silts
			HIGHLY ORGANIC SOILS		

HS: Hollow-stem-auger boring
RW: Rotary-wash boring
B: Bucket-auger boring

SAMPLE TYPE

- STANDARD PENETRATION TEST
Split barrel sampler in accordance with ASTM D-1586 Test Method
- CALIFORNIA DRIVE
Split-barrel sampler in accordance with ASTM D-3550 Test Method
- DISTURBED CALIFORNIA DRIVE
- SHELBY TUBE
Thin-walled sampler in accordance with ASTM D-1587 Test Method
- BULK SAMPLE
- NO RECOVERY

GROUND WATER DATA

- GROUND WATER WHILE DRILLING
- GROUND WATER AFTER DRILLING

DENSITY OF GRANULAR SOILS	
DESCRIPTION	SPT BLOWS PER FOOT
Very Loose	< 4
Loose	4 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

STRENGTH OF COHESIVE SOILS	
CONSISTENCY	SPT BLOWS PER FOOT
Very Soft	< 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	> 30

SPLIT-BARREL SAMPLER DRIVING RECORD	
BLOW COUNT	DESCRIPTION
25	25 blows drove the sampler 12 inches, after initial 6 inches of seating
50/7"	50 blows drove the sampler 7 inches, after initial 6 inches of seating
Ref/3"	50 blows drove the sampler 3 inches during initial 6-inch seating interval

LABORATORY TESTING ABBREVIATIONS			
Plasticity Index	PI	Compaction Curve	Curve=A
Liquid Limit	LL	Consolidation / Collapse	Consol
Hydrometer	%-5 micron	Direct Shear /	Shear
Expansion Index	EI	Reshear / Remold	Test
Corrosivity Analysis	Cor		

Notes:

- (1) Dual USCS symbols, such as SP-SM, denote 5 to 12% of minor constituent.
- (2) Dual USCS symbols, such as SM/ML, denote borderline soil classifications.
- (3) Subsurface information from boring and test pit logs depict conditions only at the specific locations and dates indicated. Soil conditions and water levels at other locations may differ from conditions at these locations. Also, the conditions at these locations may change with time.
- (4) Blow counts on logs are the number of blows to drive the sampler with the weight and drop height indicated on each log.
- (5) Split-barrel sampler driving record applies only to hollow-stem-auger and rotary-wash borings.
- (6) These logs are subject to the limitations, conclusions, and recommendations in this report.



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Geological and Geotechnical Consultants

**USCS Soil Classification and
Key to Boring Log Symbols**

Appendix B

APPENDIX B

GEOTECHNICAL LABORATORY INVESTIGATION

1. General

- a. The laboratory investigation used current, accepted test procedures of the American Society of Testing and Materials (ASTM) and/or California Test Standards, wherever practical.
- b. Bulk samples, Standard Penetration Test (SPT) samples, and Modified California Drive ring samples were obtained during the field investigation. Laboratory sample identification is by project name and number, trench/boring number, and depth.

2. Geotechnical Index Parameter Tests

The following Geotechnical Index Parameters tests were performed on bulk samples, Standard Penetration Test (SPT) samples, and modified California ring samples of soil collected at the project site.

TEST TYPE	NUMBER OF TESTS PERFORMED	TESTING STANDARD
In-Situ Moisture Content	25	ASTM D2216
In-Situ Dry Density	25	ASTM D7263
Percent-Finer Than #200 Sieve	7	ASTM D1140
Particle-Size Analysis of Soils	3	ASTM D422

The purpose of each test type is briefly described below.

- a. In-Situ Moisture Content (ASTM D2216) and Dry Density (ASTM D7263) testing of soils provide an indication of the strength and compressibility of in-situ soils. These data aided in evaluation of soil consistency and in selection of samples for additional laboratory testing. Results of Moisture Content and Dry Density testing are recorded on the Trench and Drill Hole Logs in **Appendix A**.
- b. Percent Finer than #200 Sieve (ASTM D1140) testing aids in classification of soils in accordance with the Unified Soil Classification System (USCS). Results of Percent Finer than #200 Sieve testing are recorded on the Trench and Drill Hole Logs in **Appendix A** and on applicable test reports in this appendix.

APPENDIX B

3. Geotechnical Engineering Parameters Tests

The following Geotechnical Engineering Parameters Tests were performed on bulk samples and modified California ring samples of soil collected at the project site.

TEST TYPE	NUMBER OF TESTS PERFORMED	TESTING STANDARD
Modified Proctor	1	ASTM D1557
Collapse of Soils	2	ASTM D4546
Direct Shear	3	ASTM D3080

The Geotechnical Engineering Parameters testing is briefly described below.

- a. A modified Proctor (ASTM D1557) test was performed on a mixture of soils collected from Borings HS-6 and HS-8 to assess the laboratory moisture content vs. dry density relationship of future compacted fill materials generated from on-site soils. Results of the testing are presented in **Figure B1** within this Appendix.
- b. One-dimensional Collapse of Soils (ASTM D4546) testing was performed on California drive ring samples to assess the hydro-compression potential of alluvial soils when inundated with water under future loading conditions. The samples were incrementally loaded to normal pressures ranging from 200 to 8,000 psf in accordance with Procedure B. The “hydro-compression” was taken as the percent strain when inundated with water under an applied pressure approximately equal to the existing overburden pressure plus future applied foundation-bearing pressure at that depth. Results of collapse testing are presented on **Figures B2.1** and **B2.2** in this Appendix.
- c. Direct Shear (ASTM D3080) testing was performed on selected ring samples and on remolded test specimens using a displacement-controlled Direct Shear machine. The remolded sample was prepared using material passing the No. 4 sieve compacted to about 90% of Maximum Dry Density. Before testing, the samples were inundated and consolidated under normal pressures ranging from about 1,000 psf to 4,000 psf. Thereafter, the samples were sheared horizontally at a controlled displacement rate until the horizontal shear force reduced to a stable value. Results of the Direct Shear testing, including interpreted peak strength and residual shear strength parameters, are recorded in **Figures B3.1** through **B3.3** in this Appendix.

APPENDIX B

4. Corrosivity Tests

The following corrosivity tests were performed on a mixture of soils collected from Borings HS-6 and HS-8 at a depth ranging from 0 to 8 feet.

TEST TYPE	NUMBER OF TESTS	TESTING STANDARD
Sulfate-Content	1	California Test 417
Chloride-Content	1	California Test 422
Resistivity and pH	1	California Test 643

Soluble Sulfates Content, Chloride Content, Resistivity, and pH tests were performed to evaluate corrosivity of soils to concrete, ferrous metals, and non-ferrous metals. Results of the testing are presented in **Table B1**.

The following attachments complete this Appendix.

LABORATORY TEST RESULTS

Current Study

- Corrosivity Testing Summary Table B1
- Summary of Compaction (Modified Proctor) Test Results Table B2
- Compaction Report Figure B1
- Consolidation Test Reports Figures B2.1 to B2.2
- Direct Shear Test Reports Figures B3.1 to B3.3

Seismic Retrofit Assessment, 2/8/24

- Consolidation Test Reports Figure B1
- Direct Shear Test Reports Figures B2.1 & 2.2

Geologic Hazards Evaluation Report, 11/10/23

- Particle-Size Analysis Test Report Figure B1
- Compaction Report Figure B2
- Consolidation Test Reports Figures B3.1 to B3.3
- Direct Shear Test Reports Figures B4.1 & 4.2

Observation and Testing of Compacted (Fault) Trench Backfill, 9/28/23

- Compaction Report Figure A1

APPENDIX B

Table B1 – Summary of Corrosivity Test Results

LOCATION	USCS	RESISTIVITY		CHEMICAL ANALYSES			
		SATURATED (OHM-CM)	CORROSION CHARACTERISTIC ³	PH	CHLORIDE CL (PPM)	SULFATE SO ₄ (%)	CONCRETE EXPOSURE TO SULFATE ⁴
HS-6 and HS-8 blend at 0 – 8'	SM	5,814	Moderately Corrosive	7.2	84	0.001	Negligible
HA- 5 (0 – 7') (2024)	SM	9,666	Moderately Corrosive	8.15	108	0.003	Negligible
HS-2 and HS-5 blend at 1 – 6' (2022)	SM	> 10,000	Mildly Corrosive	8.41	90	< 0.001	Negligible

Table B2 – Summary of Compaction (Modified Proctor) Test Results

SOURCE	DEPTH (FT)	SOIL DESCRIPTION	USCS	% FINES	MAXIMUM DRY DENSITY (PCF) ⁵	OPTIMUM MOISTURE CONTENT ¹ (%)
HS-2 and HS-5 blend	1 - 6	Brown Silty Sand	SM	16	137.1	5.9
Fault Trench (9/28/23)	0 - 10	Yellowish-brown Silty Sand with gravel	SM	~25 (visual)	136.4	7.0
HS-6 and HS-8 blend	0 - 8	Silty Sand	SM	12.1	137.2	7.1

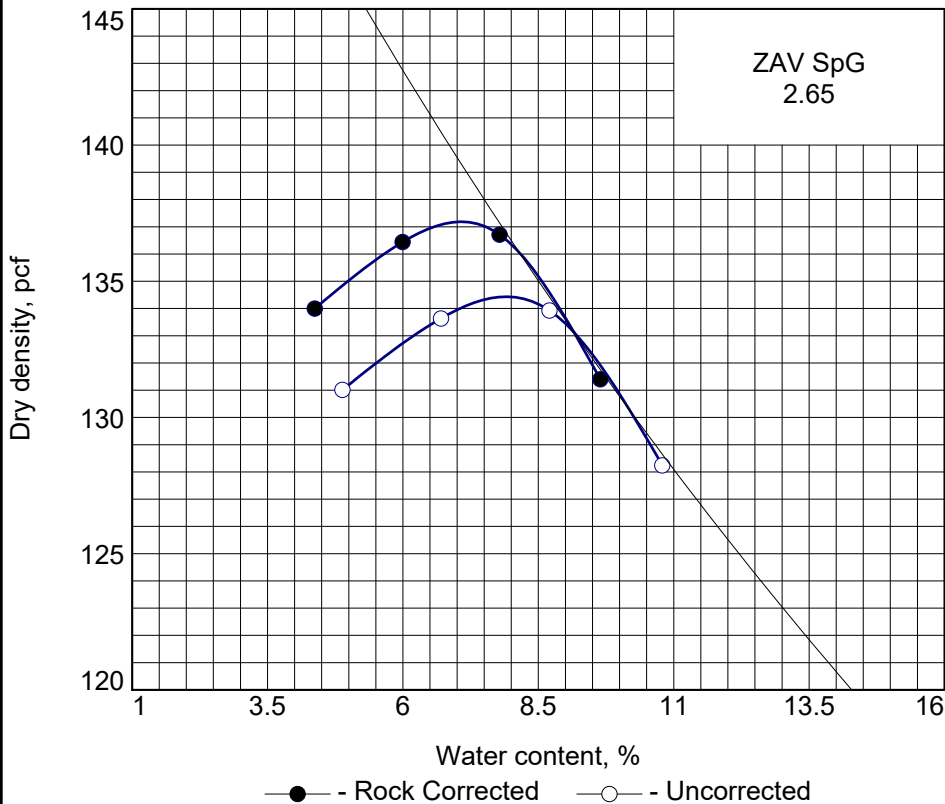
³ Per County of Los Angeles classification

⁴ Per ACI 318

⁵ Per ASTM Test Method D1557

COMPACTION TEST REPORT

Curve No.
C



Test Specification:

ASTM D 1557-12 Method A Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Preparation Method Moist
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Hammer Type: automatic
Layers five Blows/Layer 25
Mold Size 0.03333 cu. ft.

Test Performed on Material

Passing #4 Sieve

NM LL PI
Sp.G. (assumed): 2.65
%>#4 10.7 %<No.200 12.1
USCS SP-SM AASHTO

Date Sampled 1/4/24

Date Received 1/4/24

Date Tested 1/18/24

Tested By E. Parr

TESTING DATA	1	2	3	4	5	6
WM + WS	8.91	9.08	9.18	9.06		
WM	4.35	4.35	4.35	4.35		
WW + T #1	927.0	875.9	839.0	967.7		
WD + T #1	885.5	822.9	774.5	876.7		
TARE #1	34.4	32.2	33.4	33.9		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	4.4	6.0	7.8	9.6		
DRY DENSITY	134.0	136.4	136.7	131.4		

ROCK CORRECTED TEST RESULTS

Maximum dry density = 137.2 pcf

Optimum moisture = 7.1 %

Project No. 24-2775-6 Client: La Canada Unified School District

Project: Proposed Buildings C, D, E & F

Paradise Canyon Elementary School

Location: HS-6 @ 0-8' & HS-8 @ 0-8' Sample Number: C

ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.

Valencia, California

Material Description

dark-brown poorly-graded sand with silt

Remarks:

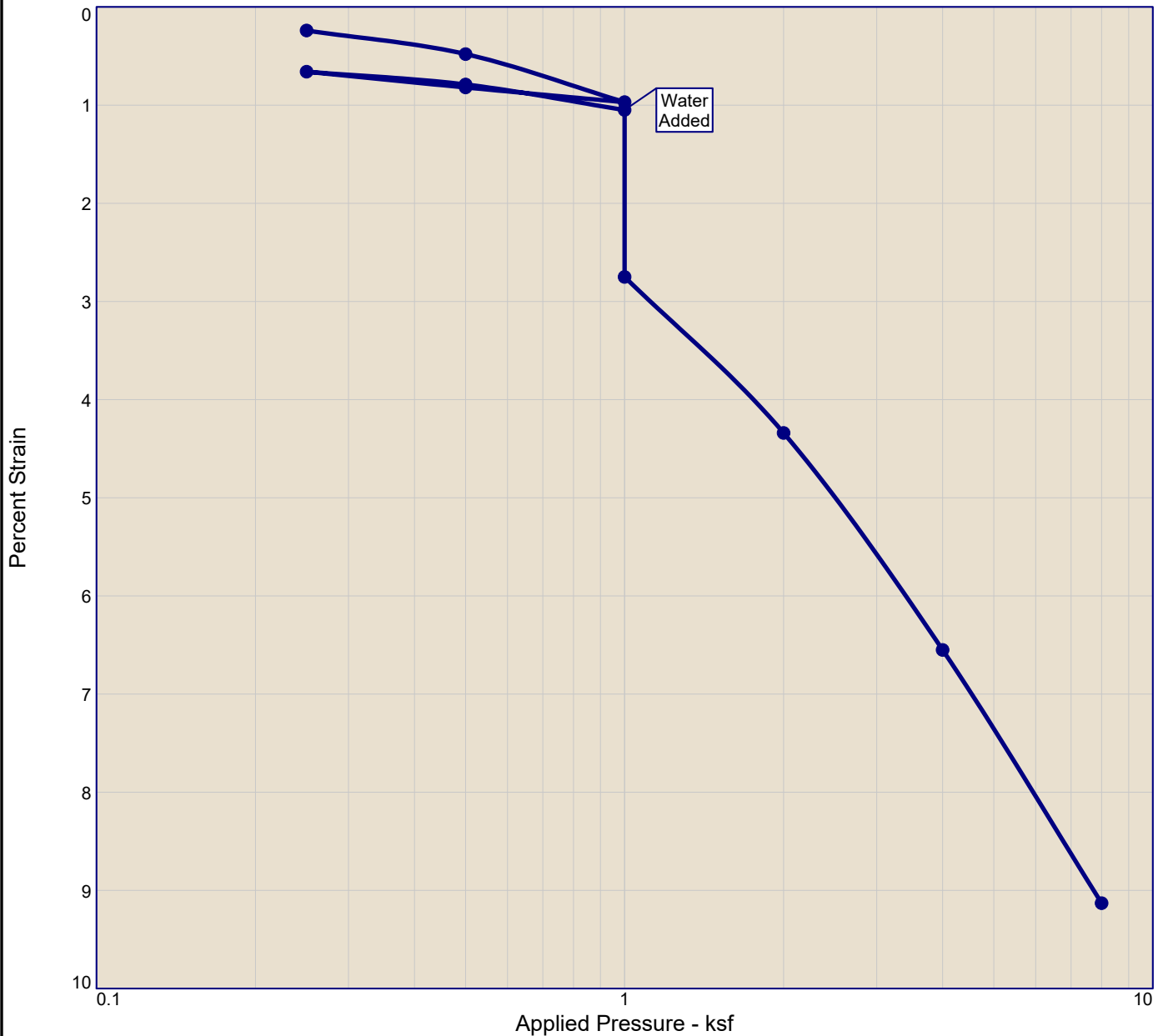
Blend of bulk samples from HS-6 and HS-8

Checked by: E. Seward

Title: Principal

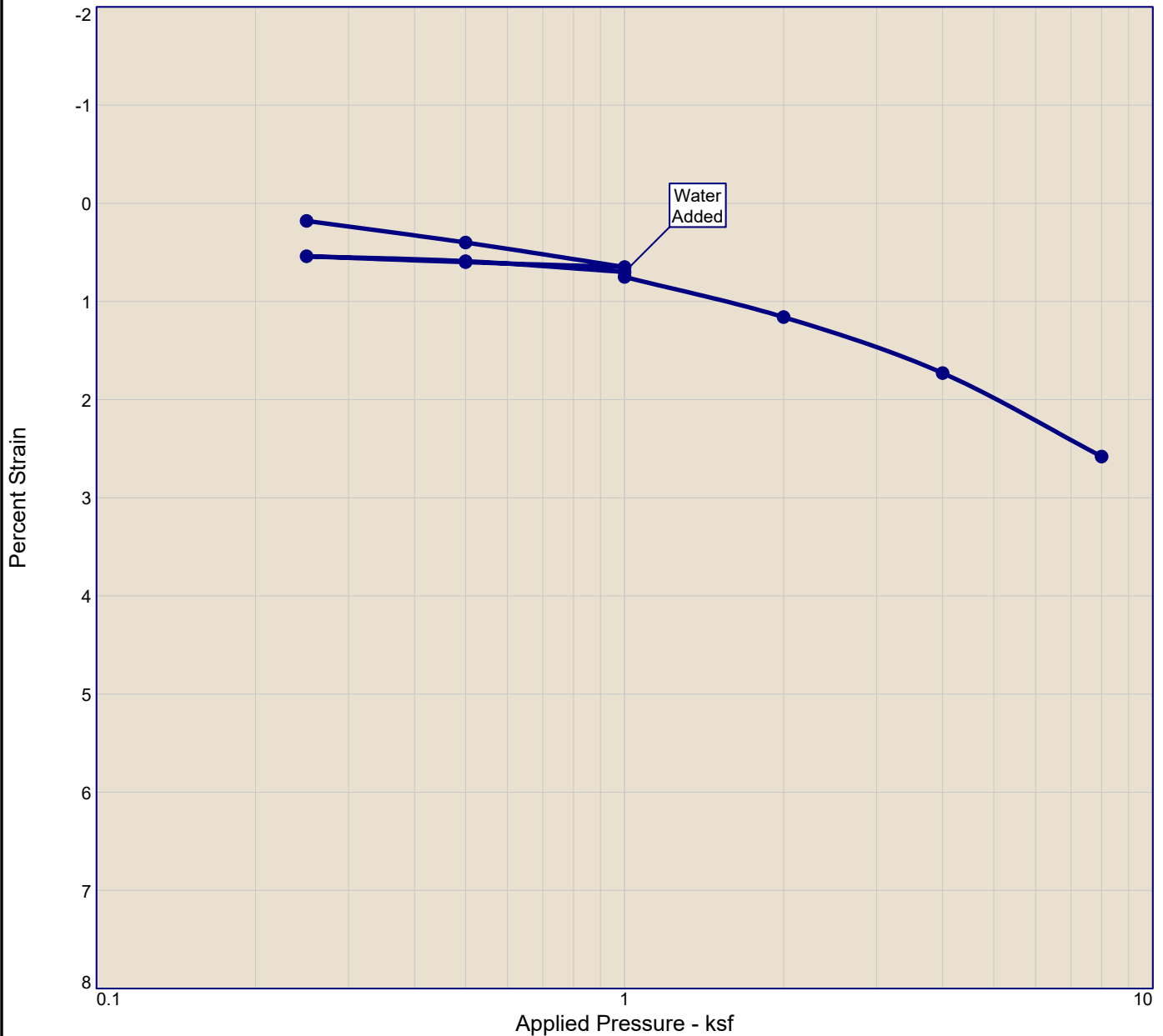
Figure B1

SWELL/CONSOLIDATION TEST REPORT

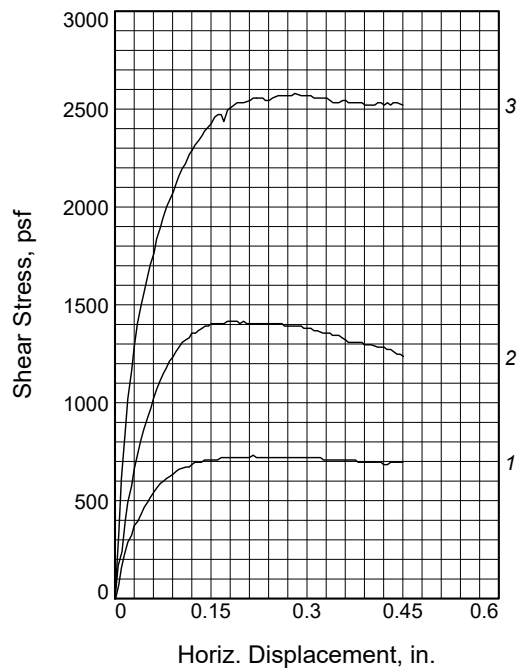
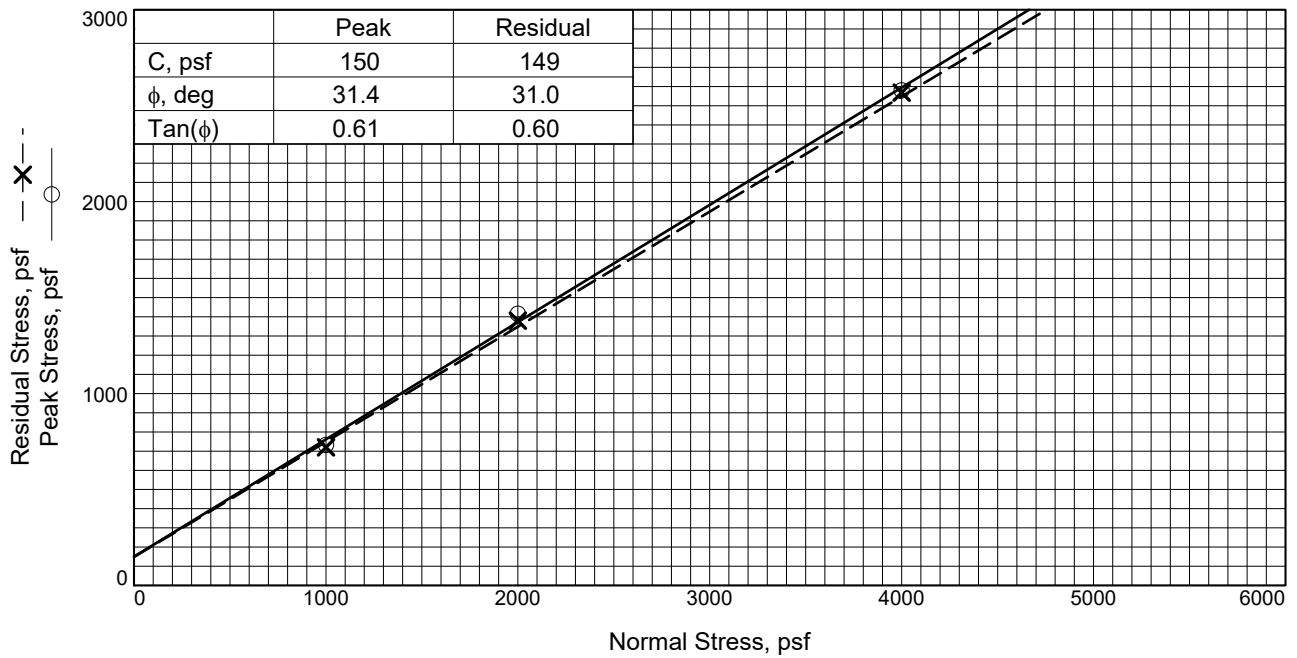


MATERIAL DESCRIPTION											USCS		AASHTO	
tannish brown silty sand														
LL	PI	Sp. Gr.	Overburden (ksf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P _c (ksf)	C _c	
				Init.	Final	Init.	Final	Init.	Final	Init.	Final			
		2.65	0.660	98.7	108.65	10.4 %	19.7	40.7 %	100.0	0.676	0.523	2.4	0.14	
Preparation Process: Tested directly in a ring from a ring lined sampler									D2435 Method		C _r	Swell Press. (ksf)	Clpse. %	
Condition of Test: Inundated with distilled water at 1,000 psf									D4546					
Project No. 24-2775-6 Client: La Canada Unified School District									Remarks: Alluvial Fan Deposits (Qal ₃) % Fines = 37.9					
Project: Proposed Buildings C, D, E & F Paradise Canyon Elementary School														
Source of Sample: HA-1 Depth: 5.5'									Checked By: M. Neely Title: Geotechnical Engineer					
ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.														
Valencia, California									Figure B2.1					

SWELL/CONSOLIDATION TEST REPORT



MATERIAL DESCRIPTION											USCS		AASHTO	
Light-brown poorly graded sand											SP			
LL	PI	Sp. Gr.	Overburden (ksf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P _c (ksf)	C _c	
				Init.	Final	Init.	Final	Init.	Final	Init.	Final			
		2.65	0.720	103.6	106.3	5.5 %	21.0	24.4 %	100.0	0.597	0.555	3.6	0.05	
Preparation Process: Tested directly in a ring from a ring lined sampler									D2435 Method		C _r	Swell Press. (ksf)	Clpse. %	
Condition of Test: Inundated with distilled water at 1,000 psf									D4546					
Project No. 24-2775-6 Client: La Canada Unified School District									Remarks: Alluvial Fan Deposits (Qal ₃) % Fines = 4.1					
Project: Proposed Buildings C, D, E & F Paradise Canyon Elementary School														
Source of Sample: HS-7 Depth: 5'									Checked By: M. Neely Title: Geotechnical Engineer					
ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.														
Valencia, California									Figure B2.2					



Sample No.		1	2	3
Initial	Water Content, %	10.4	10.4	10.6
	Dry Density, pcf	105.4	104.4	102.1
	Saturation, %	48.4	46.9	45.3
	Void Ratio	0.5699	0.5848	0.6205
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	20.8	19.7	19.2
	Dry Density, pcf	106.6	108.7	109.7
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5525	0.5214	0.5084
	Diameter, in.	2.42	2.42	2.42
	Height, in.	0.99	0.96	0.93
Normal Stress, psf		1000	2000	4000
Peak Stress, psf		732	1416	2580
Displacement, in.		0.22	0.18	0.28
Residual Stress, psf		720	1380	2568
Displacement, in.		0.30	0.30	0.30
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Modified California Drive
Description: orangish-brown, silty sand

Assumed Specific Gravity= 2.65

Remarks: Artificial Fill (af)

Client: La Canada Unified School District

Project: Proposed Buildings C, D, E & F
 Paradise Canyon Elementary School

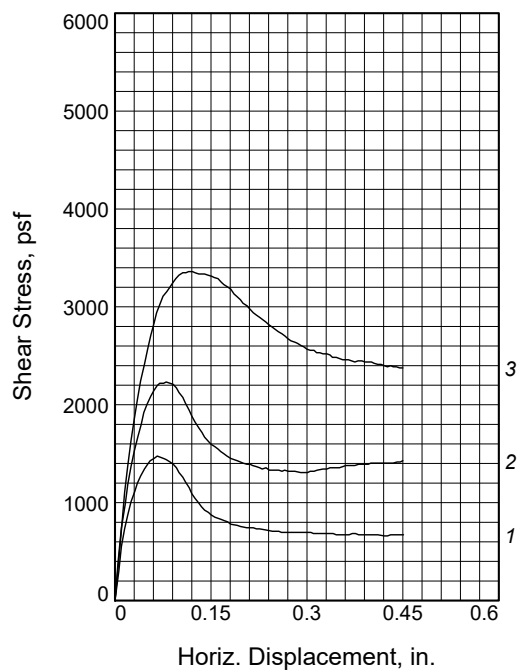
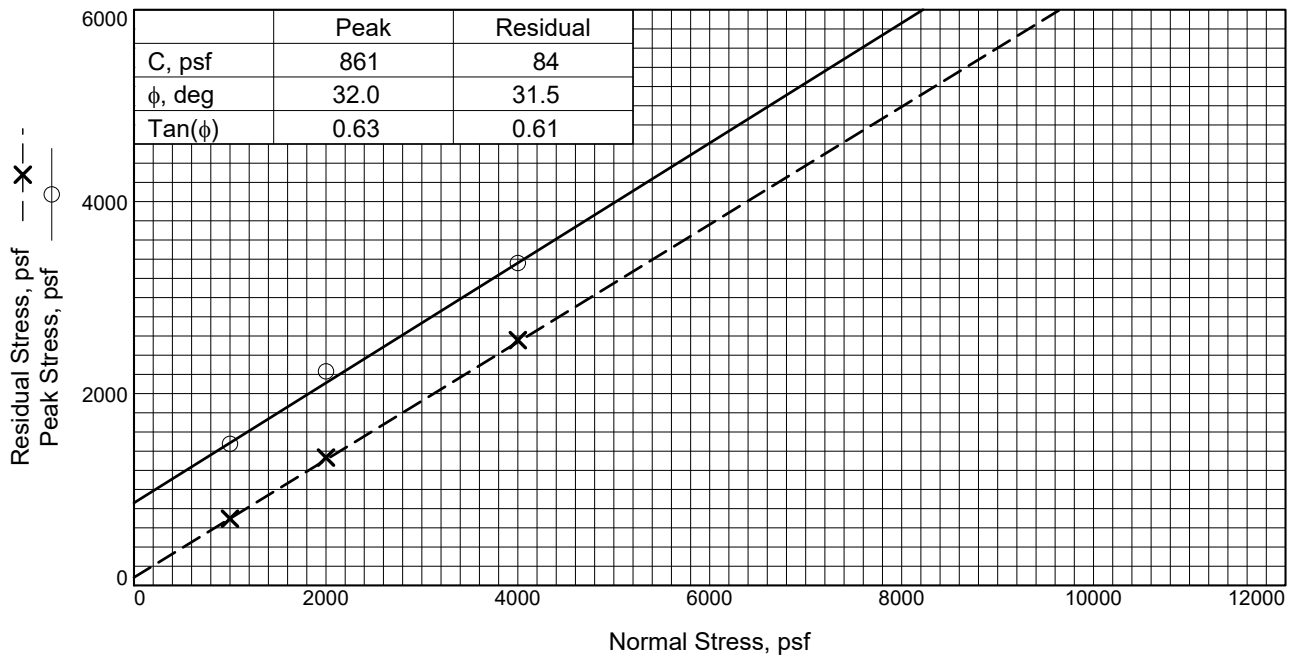
Source of Sample: HA-1 **Depth:** 3.5'

Proj. No.: 24-2775-6

Date Sampled: 1-4-24

DIRECT SHEAR TEST REPORT
 ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.
 Valencia, California

Figure B3.1



Sample No.		1	2	3
Initial	Water Content, %	14.3	14.4	14.8
	Dry Density, pcf	116.4	117.4	114.9
	Saturation, %	89.8	93.4	89.5
	Void Ratio	0.4215	0.4089	0.4393
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	15.7	14.9	15.7
	Dry Density, pcf	116.9	118.5	116.7
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.4150	0.3955	0.4174
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	0.99	0.98
Normal Stress, psf		1000	2000	4000
Peak Stress, psf		1476	2232	3360
Displacement, in.		0.07	0.08	0.12
Residual Stress, psf		696	1332	2556
Displacement, in.		0.26	0.24	0.30
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Modified California Drive
Description: reddish-brown, silty, clayey sand

Assumed Specific Gravity= 2.65
Remarks: Alluvial Fan Deposits (Qal₃)
 % Fines: 44.4

Figure B3.2

Client: La Canada Unified School District

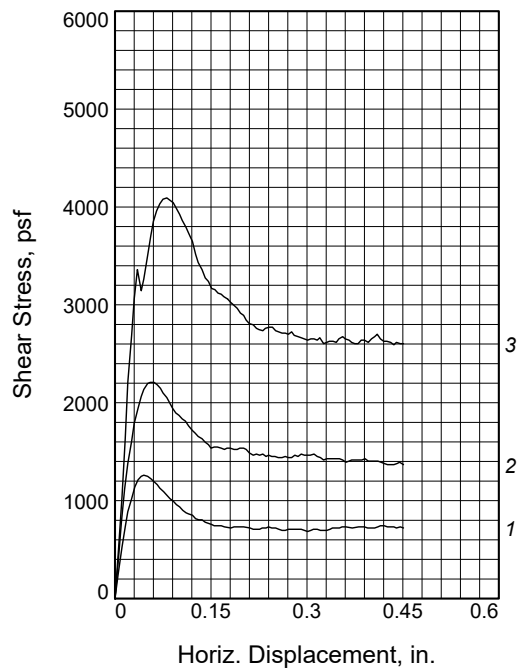
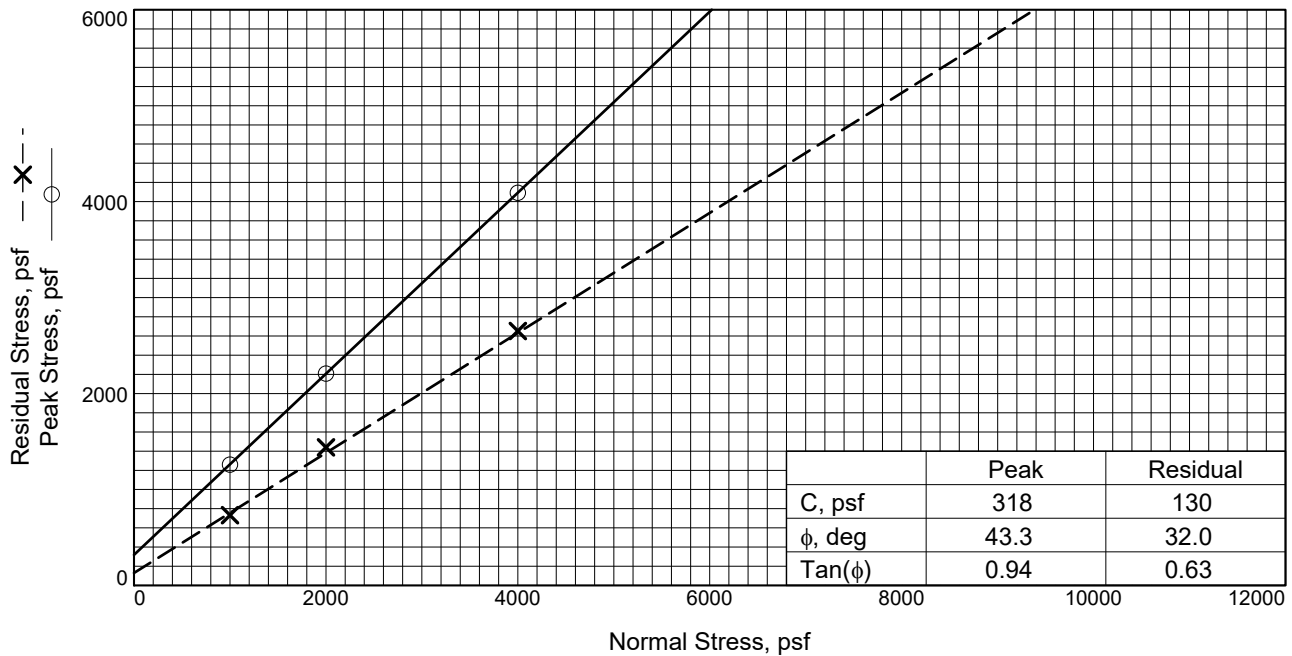
Project: Proposed Buildings C, D, E & F
 Paradise Canyon Elementary School

Source of Sample: HS-9 **Depth:** 11'

Proj. No.: 24-2775-6

Date Sampled: 1-4-24

DIRECT SHEAR TEST REPORT
 ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.
 Valencia, California



Sample No.		1	2	3
Initial	Water Content, %	8.0	8.0	7.9
	Dry Density, pcf	123.7	123.7	123.8
	Saturation, %	62.5	62.5	62.0
	Void Ratio	0.3376	0.3370	0.3361
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	12.3	12.3	12.1
	Dry Density, pcf	124.7	124.9	125.3
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.3261	0.3248	0.3202
	Diameter, in.	2.42	2.42	2.42
	Height, in.	0.99	0.99	0.99
Normal Stress, psf		1000	2000	4000
Peak Stress, psf		1260	2208	4092
Displacement, in.		0.05	0.06	0.08
Residual Stress, psf		732	1440	2652
Displacement, in.		0.19	0.26	0.31
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Remold

Description: dark-brown, poorly-graded sand with silt

Assumed Specific Gravity= 2.65

Remarks: Proposed Compacted Fill
Remolded to approx. 90% of MDD
% Fines = 12.1

Client: La Canada Unified School District

Project: Proposed Buildings C, D, E & F
Paradise Canyon Elementary School

Location: HS-6 @ 0-8' & HS-8 @ 0-8'

Sample Number: C

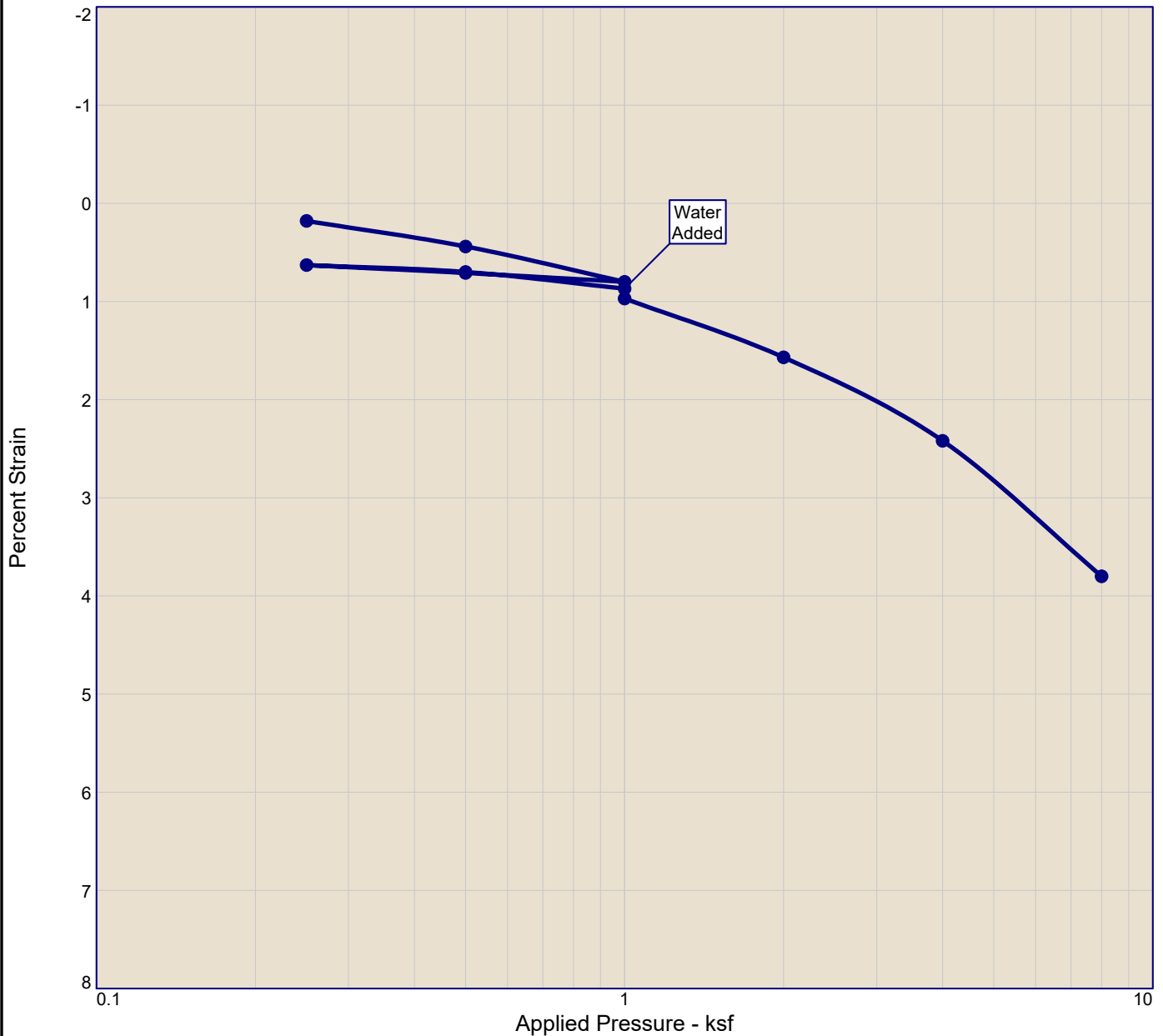
Proj. No.: 24-2775-6

Date Sampled: 1/4/24

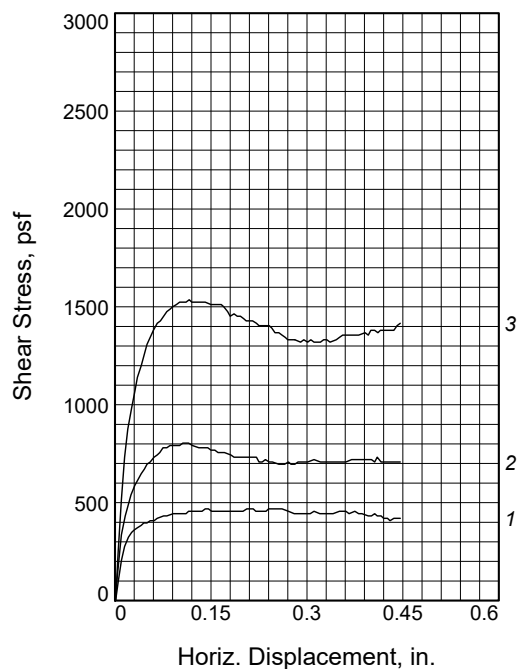
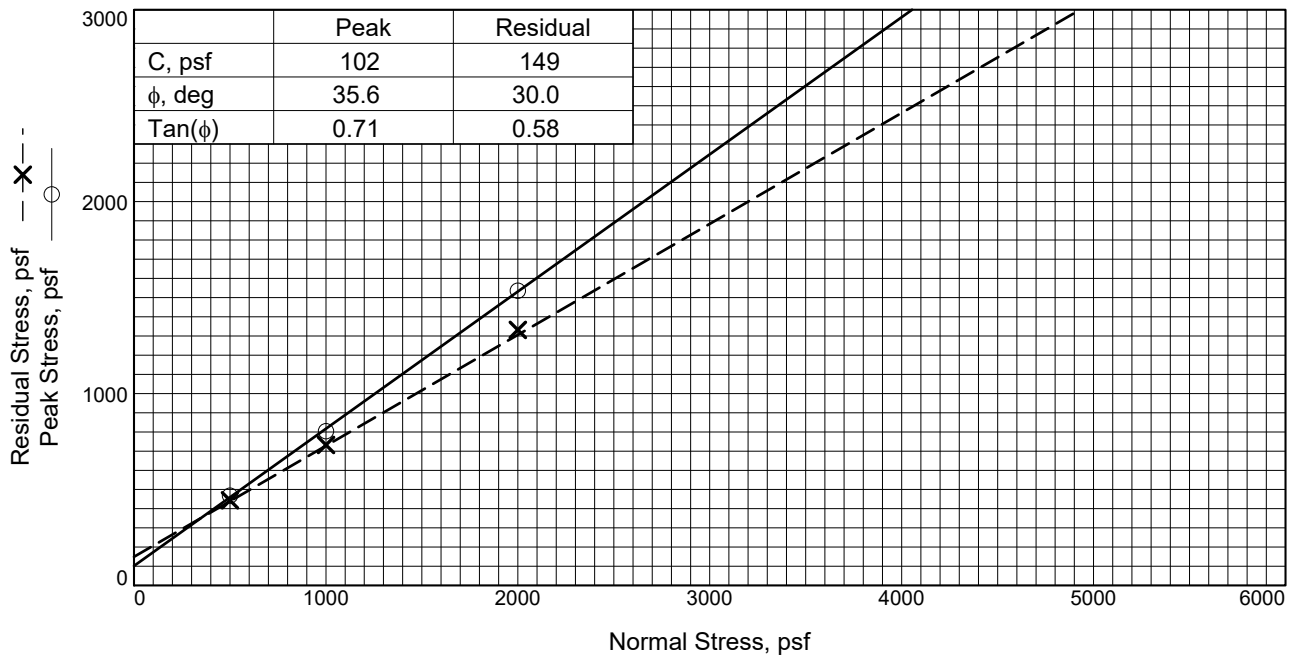
DIRECT SHEAR TEST REPORT
ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.
Valencia, California

Figure B3.3

SWELL/CONSOLIDATION TEST REPORT



MATERIAL DESCRIPTION											USCS		AASHTO	
dark brown poorly graded sand											SP			
LL	PI	Sp. Gr.	Overburden (ksf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P _C (ksf)	C _C	
				Init.	Final	Init.	Final	Init.	Final	Init.	Final			
		2.65	0.660	91.3	93.1	14.0 %	28.1	45.6 %	100.0	0.813	0.744	3.7	0.08	
Preparation Process: Tested directly in a ring from a ring lined sampler									D2435 Method		C _r	Swell Press. (ksf)	Clpse. %	
Condition of Test: Inundated with distilled water at 1,000 psf									D4546					
Project No. 24-2775-6 Client: La Canada Unified School District Project: Paradise Canyon Elementary Classrooms H & J 471 Knight Way, La Canada, CA 91011 Source of Sample: HA-6 Depth: 5.5'									Remarks: Alluvial Fan Deposits (Qal ₃)					
ALLAN E. SEWARD ENGINEERING GEOLOGY, INC. Valencia, California									Checked By: M. Neely Title: Geotechnical Engineer Figure B1					



Sample No.		1	2	3
Initial	Water Content, %	8.1	8.9	8.7
	Dry Density, pcf	112.9	113.2	114.8
	Saturation, %	46.1	51.3	52.5
	Void Ratio	0.4648	0.4611	0.4414
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	17.2	17.0	15.9
	Dry Density, pcf	113.6	114.1	116.5
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.4563	0.4495	0.4206
	Diameter, in.	2.42	2.42	2.42
	Height, in.	0.99	0.99	0.99
Normal Stress, psf		500	1000	2000
Peak Stress, psf		468	804	1536
Displacement, in.		0.14	0.11	0.12
Residual Stress, psf		444	732	1332
Displacement, in.		0.28	0.20	0.31
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Modified California Drive
Description: dark brown silty sand (USCS: SM)

Assumed Specific Gravity= 2.65

Remarks: Artificial Fill (af)

% Fines = 18.1

Client: La Canada Unified School District

Project: Paradise Canyon Elementary Classrooms H & J
 471 Knight Way, La Canada, CA 91011

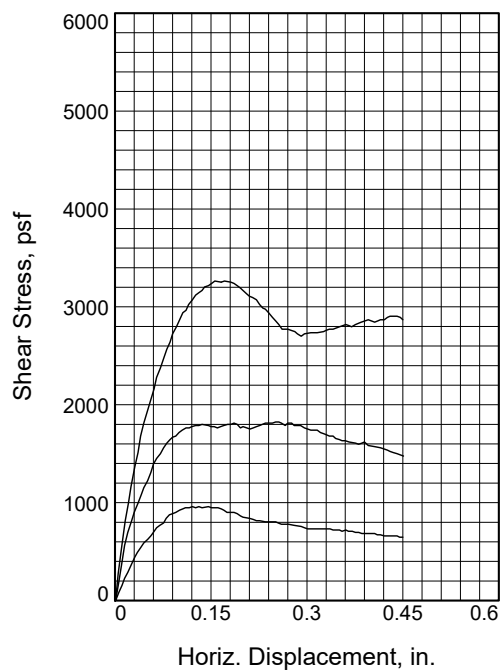
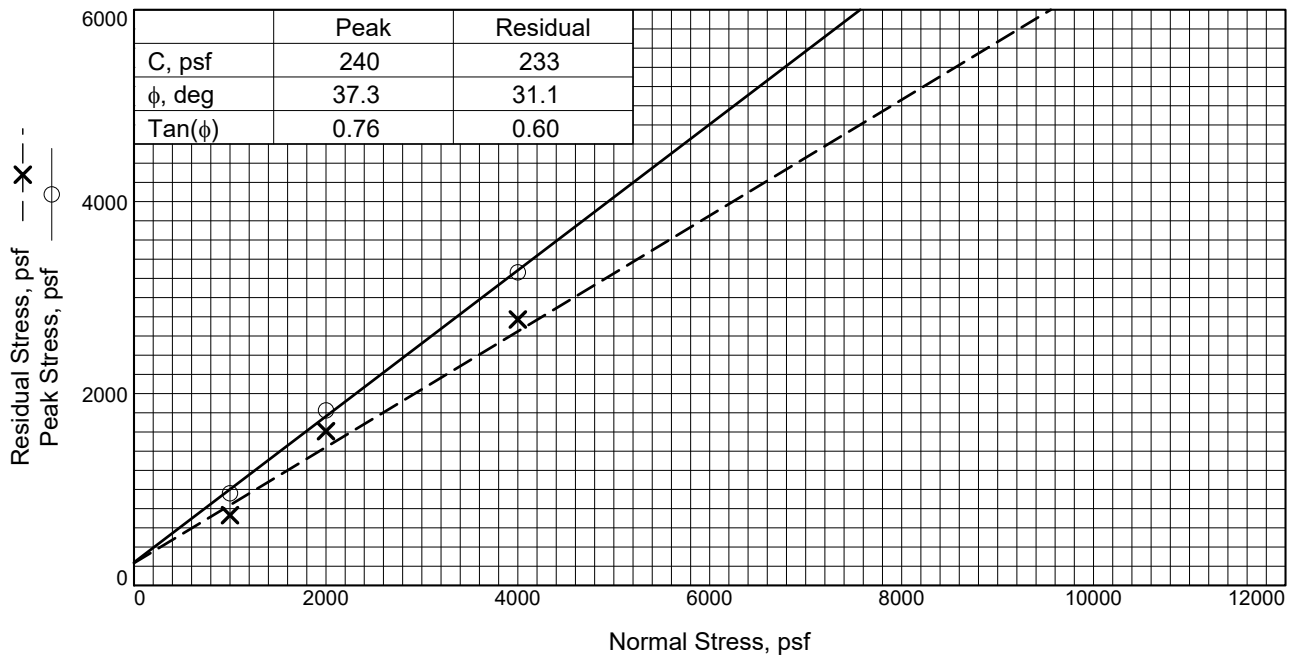
Source of Sample: HA-2 **Depth:** 1.5'

Proj. No.: 24-2775-6

Date Sampled: 12/28/23

DIRECT SHEAR TEST REPORT
 ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.
 Valencia, California

Figure B2.1



Sample No.		1	2	3
Initial	Water Content, %	4.7	6.2	4.7
	Dry Density, pcf	111.7	112.8	108.2
	Saturation, %	26.0	35.1	23.6
	Void Ratio	0.4815	0.4667	0.5288
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	17.8	16.8	17.8
	Dry Density, pcf	112.4	114.5	112.5
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.4713	0.4453	0.4710
	Diameter, in.	2.42	2.42	2.42
	Height, in.	0.99	0.99	0.96
Normal Stress, psf		1000	2000	4000
Peak Stress, psf		960	1824	3264
Displacement, in.		0.12	0.25	0.16
Residual Stress, psf		732	1608	2772
Displacement, in.		0.30	0.38	0.26
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Modified California Drive
Description: dark brown silty SAND (USCS: SM)

Assumed Specific Gravity= 2.65

Remarks: Artificial Fill (af)

% Fines = 17.6%

Client: La Canada Unified School District

Project: Paradise Canyon Elementary Classrooms H & J
 471 Knight Way, La Canada, CA 91011

Source of Sample: HA-4 **Depth:** 3.5'

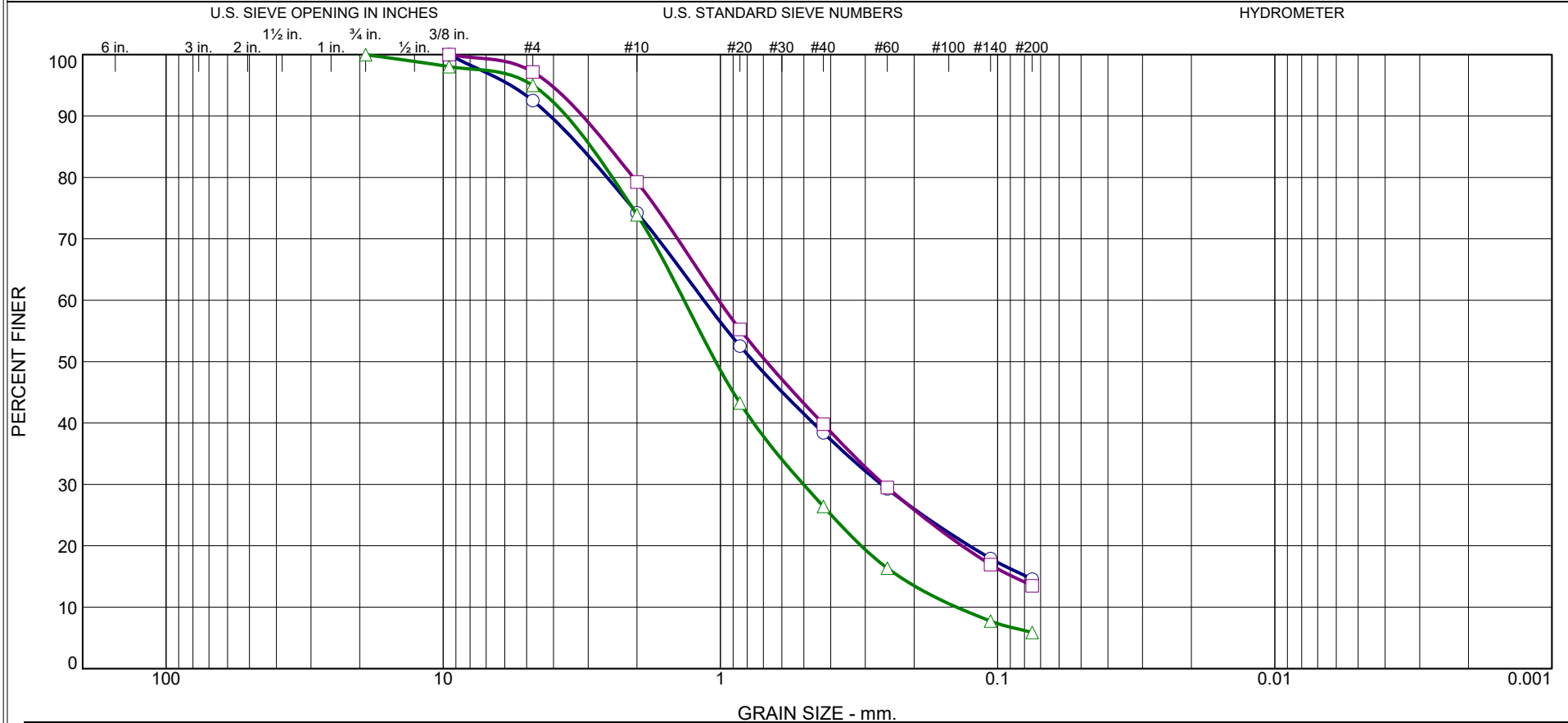
Proj. No.: 24-2775-6

Date Sampled:

DIRECT SHEAR TEST REPORT
 ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.
 Valencia, California

Figure B2.2

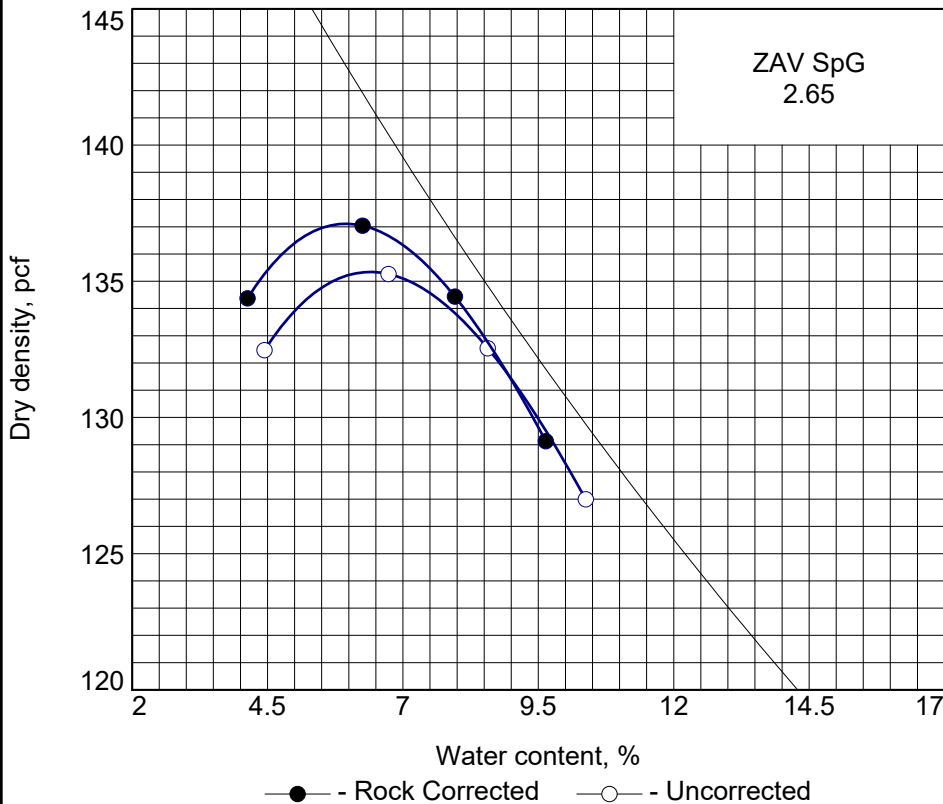
Particle Size Distribution Test Report



COMPACTION TEST REPORT

Curve No.

A



Test Specification:

ASTM D 1557-12 Method A Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Preparation Method Moist
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Hammer Type: automatic
Layers five Blows/Layer 25
Mold Size 0.03333 cu. ft.

Test Performed on Material

Passing #4 Sieve

NM LL PI
Sp.G. (assumed): 2.65
%>#4 7.1 %<No.200 16.0
USCS SM AASHTO

Date Sampled 6/25/22

Date Received 6/25/22

Date Tested 6/28/22

Tested By E. Parr

TESTING DATA	1	2	3	4	5	6
WM + WS	8.97	9.17	9.15	9.03		
WM	4.36	4.36	4.36	4.36		
WW + T #1	872.7	936.5	808.8	826.2		
WD + T #1	836.8	879.3	748.6	751.5		
TARE #1	30.0	29.7	47.1	31.9		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	4.1	6.3	8.0	9.6		
DRY DENSITY	134.4	137.0	134.4	129.1		

ROCK CORRECTED TEST RESULTS

Maximum dry density = 137.1 pcf

Optimum moisture = 5.9 %

Project No. 23-2775-9 Client: La Canada Unified School District

Project: Proposed Buildings

Paradise Canyon Elementary School

Source of Sample: HS-2 Depth: 1-6'

ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.

Valencia, California

Material Description

Brown, silty SAND

Remarks:

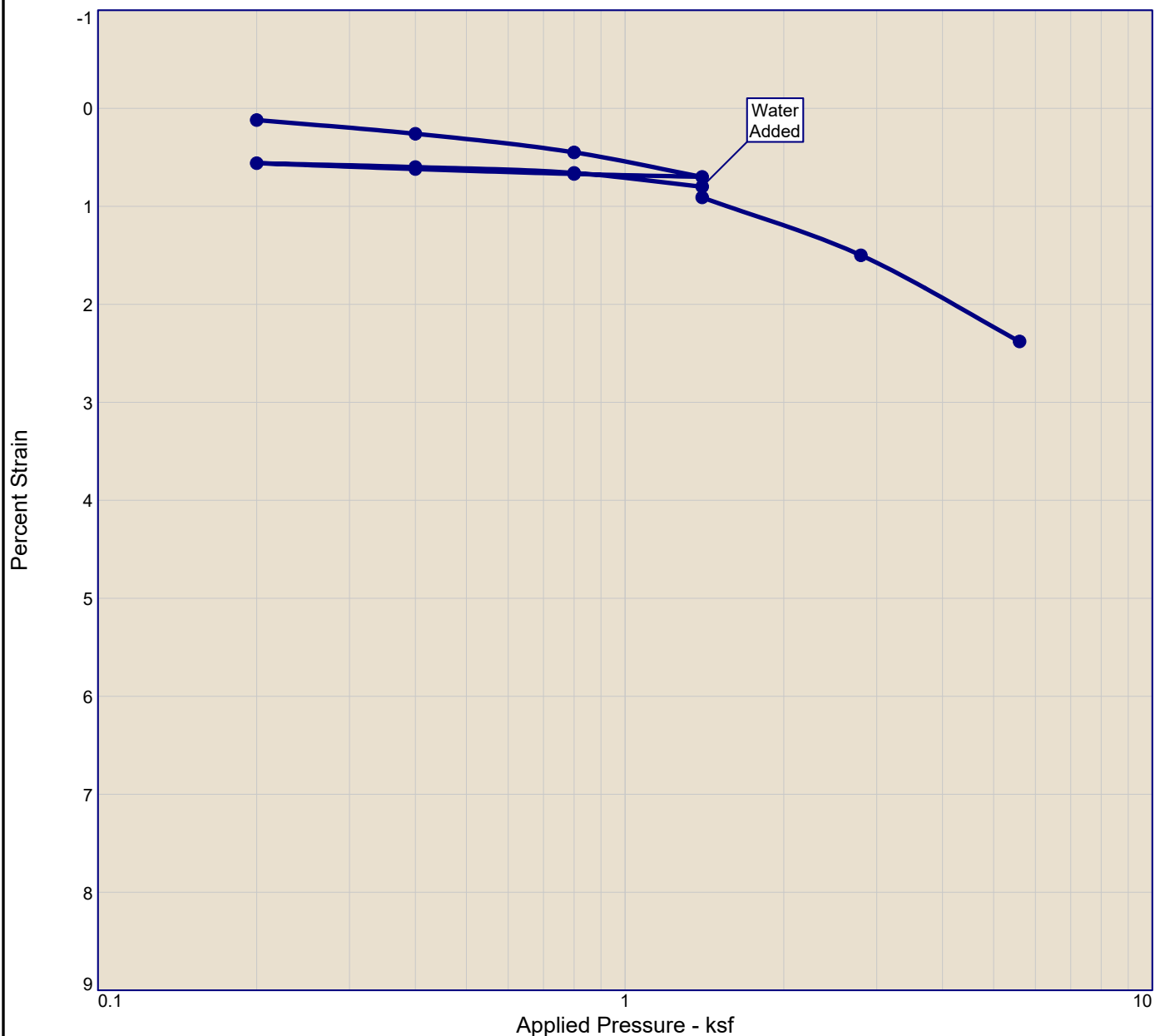
50/50 mix HS-2 @ 1-6' and HS-5 @ 1-6'

Checked by: M. Neely

Title: Geotechnical Engineer

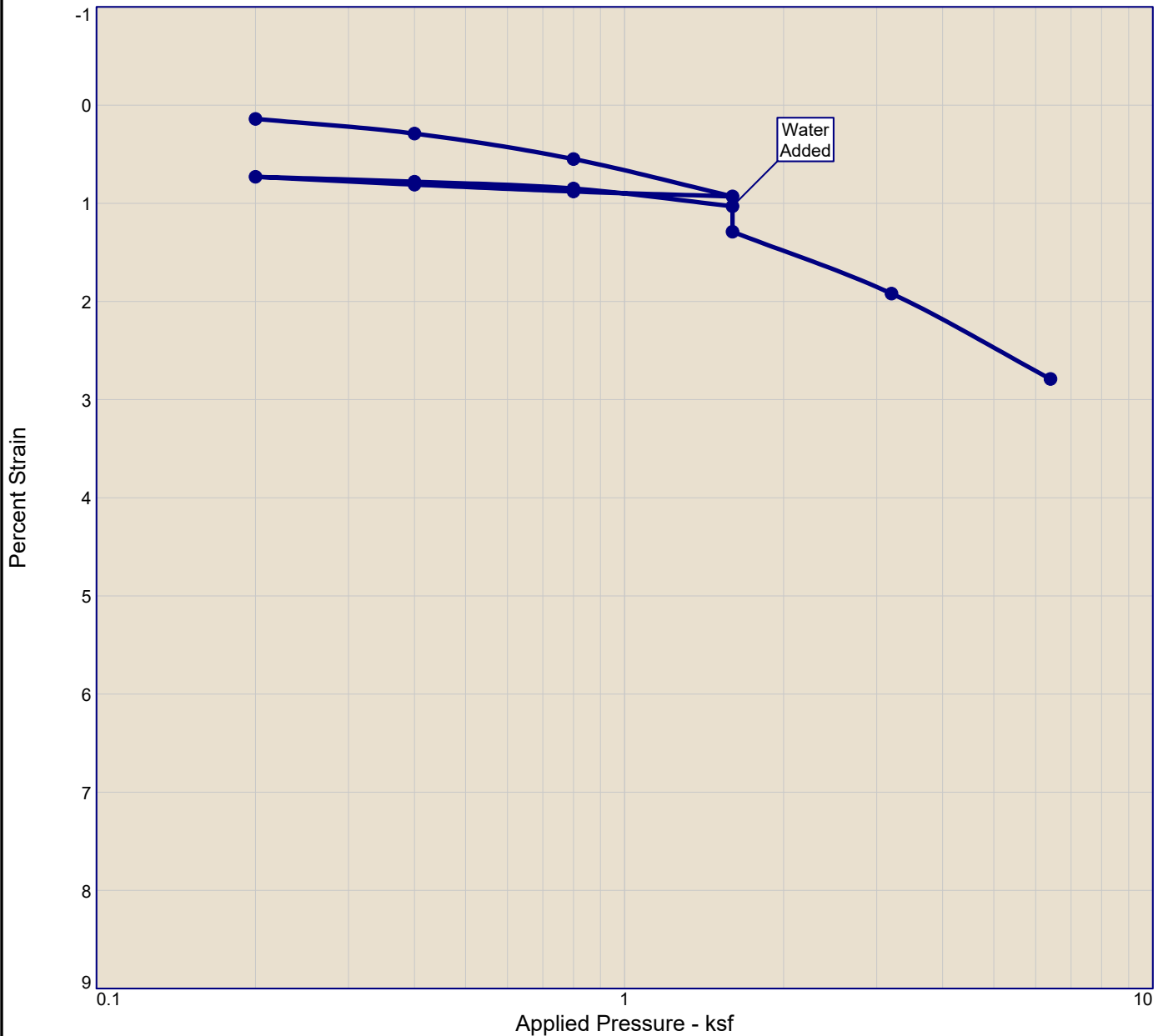
Figure B2

SWELL/CONSOLIDATION TEST REPORT



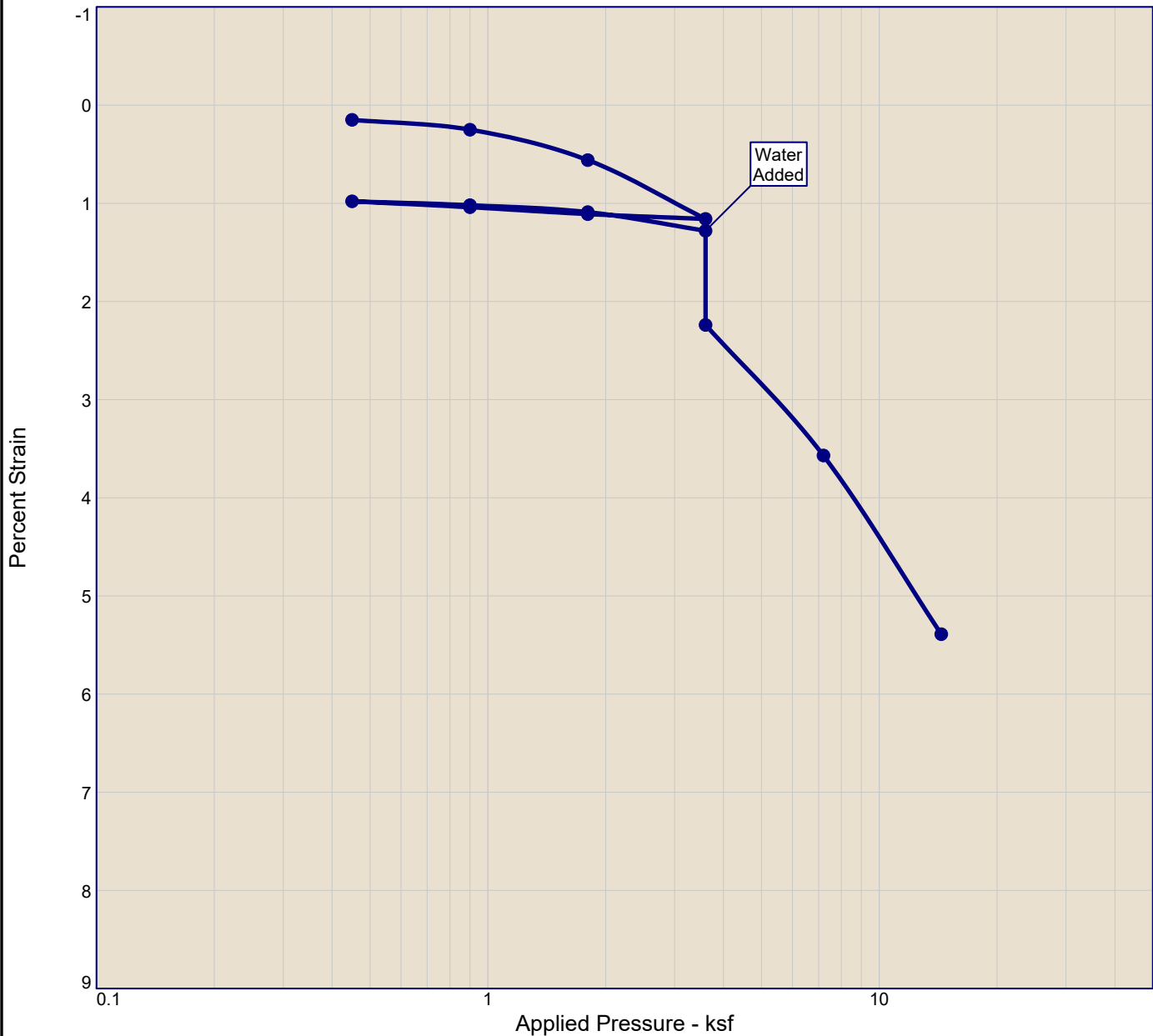
MATERIAL DESCRIPTION											USCS		AASHTO	
Poorly-graded sand											SP			
LL	PI	Sp. Gr.	Overburden (ksf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P _C (ksf)	C _C	
				Init.	Final	Init.	Final	Init.	Final	Init.	Final			
		2.65	0.36	107.4	110.0	3.4 %	19.0	16.5 %	100.0	0.540	0.503	2.9	0.05	
Preparation Process: Tested directly in a ring from a ring lined sampler									D2435 Method		C _r	Swell Press. (ksf)	Clpse. %	
Condition of Test: Method B; Inundated with distilled water at 1,400 psf									D4546					
Project No. 23-2775-9 Client: La Canada Unified School District									Remarks: Artificial fill (af) % Fines = 3.8					
Project: Proposed Buildings Paradise Canyon Elementary School														
Source of Sample: HS-1 Depth: 3'									Checked By: M. Neely Title: Geotechnical Engineer					
ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.														
Valencia, California									Figure B3.1					

SWELL/CONSOLIDATION TEST REPORT

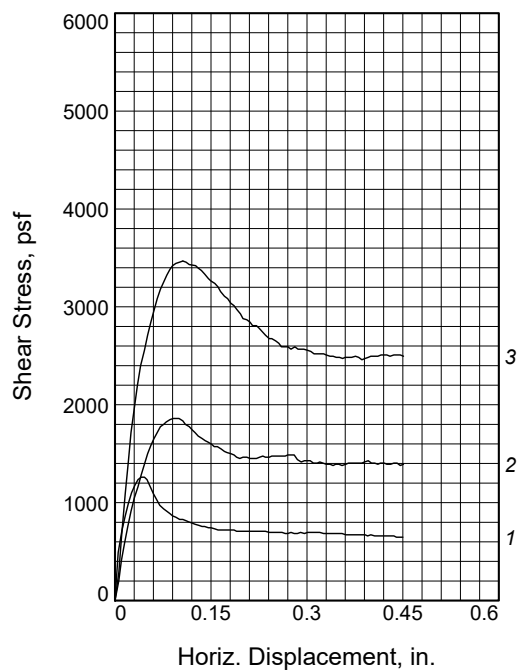
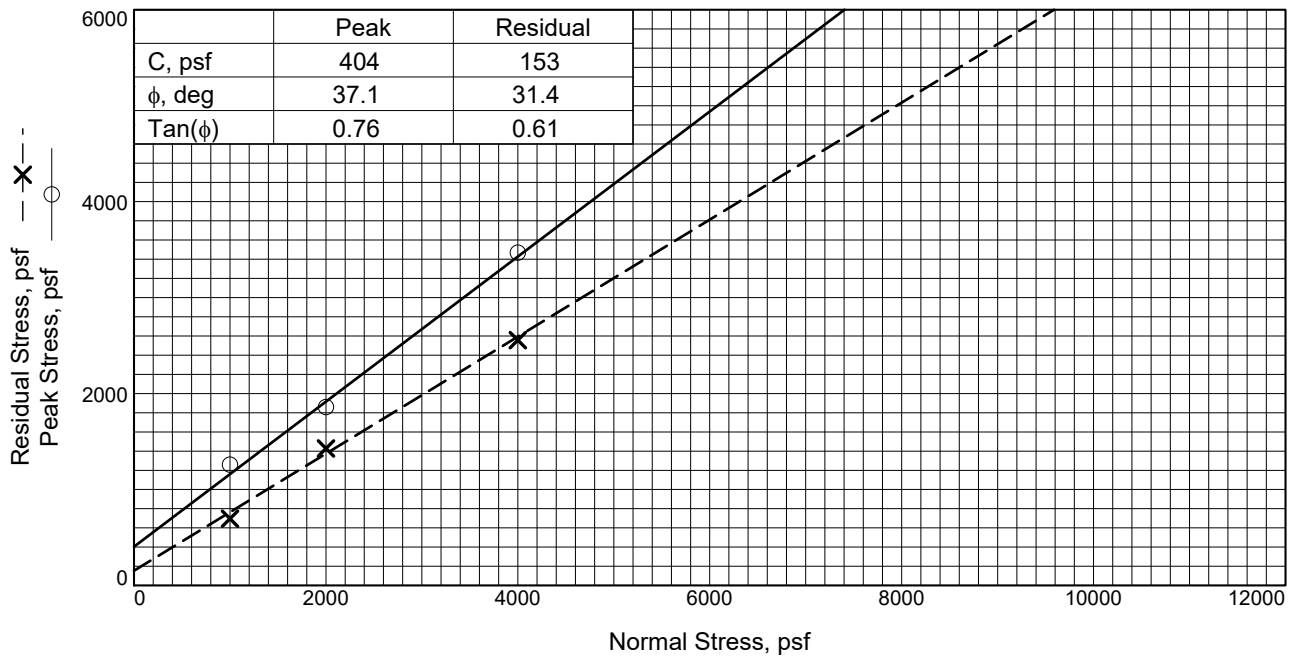


MATERIAL DESCRIPTION											USCS		AASHTO	
Poorly graded sand with silt											SP-SM			
LL	PI	Sp. Gr.	Overburden (ksf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P _c (ksf)	C _c	
				Init.	Final	Init.	Final	Init.	Final	Init.	Final			
		2.65	1.08	110.7	113.9	4.2 %	17.1	22.7 %	100.0	0.495	0.453	3.3	0.04	
Preparation Process: Tested directly in a ring from a ring lined sampler									D2435 Method		C _r	Swell Press. (ksf)	Clpse. %	
Condition of Test: Method B; Inundated with distilled water at 1,600 psf									D4546					
Project No. 23-2775-9 Client: La Canada Unified School District									Remarks: Alluvium (Qal) % Fines = 7.9					
Project: Proposed Buildings Paradise Canyon Elementary School														
Source of Sample: HS-2 Depth: 9'									Checked By: M. Neely Title: Geotechnical Engineer					
ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.														
Valencia, California									Figure B3.2					

SWELL/CONSOLIDATION TEST REPORT



MATERIAL DESCRIPTION											USCS	AASHTO	
Poorly graded sand with silt											SP-SM		
LL	PI	Sp. Gr.	Overburden (ksf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P _C (ksf)	C _C
				Init.	Final	Init.	Final	Init.	Final	Init.	Final		
		2.65	3.6	107.2	113.3	3.9 %	17.4	18.9 %	100.0	0.543	0.460	7.4	0.09
Preparation Process: Tested directly in a ring from a ring lined sampler									D2435 Method	C _r	Swell Press. (ksf)	Clpse. %	
Condition of Test: Method B; Inundated with distilled water at 3,600 psf									D4546				
Project No. 23-2775-9 Client: La Canada Unified School District									Remarks: Alluvium (Qal) % Fines = 9.0				
Project: Proposed Buildings Paradise Canyon Elementary School													
Source of Sample: HS-5 Depth: 30'									Checked By: M. Neely Title: Geotechnical Engineer				
ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.													
Valencia, California									Figure B3.3				



Sample No.		1	2	3
Initial	Water Content, %	9.5	7.1	5.4
	Dry Density, pcf	119.5	114.0	115.2
	Saturation, %	65.7	41.7	32.7
	Void Ratio	0.3847	0.4506	0.4365
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	14.3	16.2	14.9
	Dry Density, pcf	119.9	115.7	118.6
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.3797	0.4293	0.3950
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	0.99	0.97
Normal Stress, psf		1000	2000	4000
Peak Stress, psf		1260	1860	3468
Displacement, in.		0.04	0.09	0.11
Residual Stress, psf		696	1428	2556
Displacement, in.		0.30	0.30	0.30
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Modified California Drive

Description: Medium-brown, silty, clayey sand with scattered gravel

Assumed Specific Gravity= 2.65

Remarks: Artificial Fill (af)

% Fines = 31.8

Client: La Canada Unified School District

Project: Proposed Buildings

Paradise Canyon Elementary School

Source of Sample: HS-3

Depth: 6'

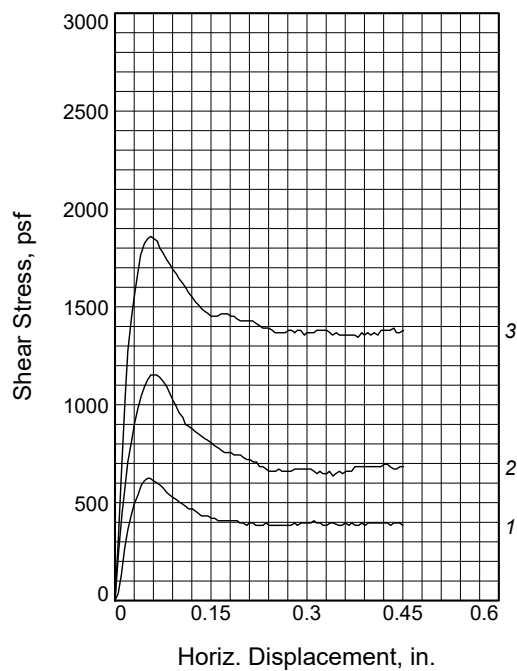
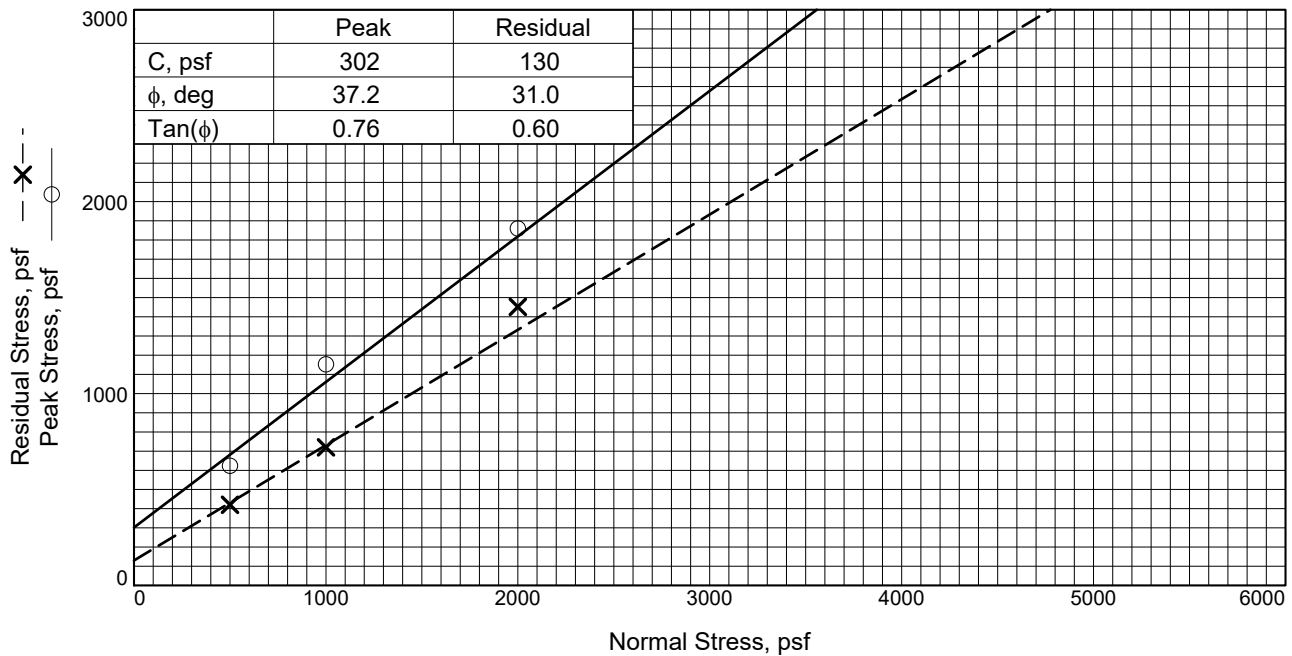
Proj. No.: 23-2775-9

Date Sampled: 6/25/22

DIRECT SHEAR TEST REPORT

ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.
Valencia, California

Figure B4.1



Sample No.		1	2	3
Initial	Water Content, %	6.8	6.9	6.9
	Dry Density, pcf	124.5	124.4	124.4
	Saturation, %	54.6	55.6	55.8
	Void Ratio	0.3292	0.3298	0.3293
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	12.0	12.1	12.0
	Dry Density, pcf	125.5	125.2	125.5
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.3185	0.3209	0.3183
	Diameter, in.	2.42	2.42	2.42
	Height, in.	0.99	0.99	0.99
Normal Stress, psf		500	1000	2000
Peak Stress, psf		624	1152	1860
Displacement, in.		0.05	0.06	0.06
Residual Stress, psf		420	720	1452
Displacement, in.		0.15	0.21	0.15
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Remold

Description: Medium-brown, silty sand

Assumed Specific Gravity= 2.65

Remarks: Future compacted fill

% Fines = 16.0

Client: La Canada Unified School District

Project: Proposed Buildings

Paradise Canyon Elementary School

Location: Mixture of HS-2 & HS-5 at 1-6'

Sample Number: A

Proj. No.: 23-2775-9

Date Sampled: 6/25/22

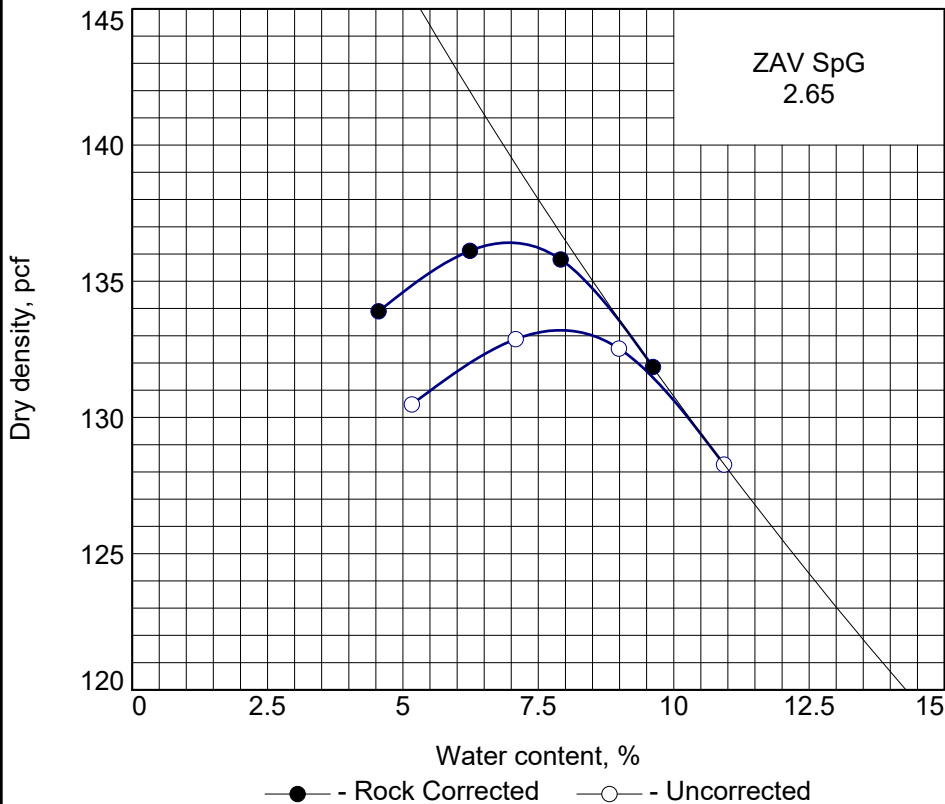
DIRECT SHEAR TEST REPORT

ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.
Valencia, California

Figure B4.2

COMPACTION TEST REPORT

Curve No.
B



Test Specification:

ASTM D 1557-12 Method A Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Preparation Method Dry
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Hammer Type: automatic
Layers five **Blows/Layer** 25
Mold Size 0.03333 cu. ft.

Test Performed on Material

Passing #4 **Sieve**

NM **LL** **PI**

Sp.G. (assumed): 2.65

%>#4 12.1 **%<No.200**

USCS SM **AASHTO**

Date Sampled 7/7/23

Date Received 7/7/23

Date Tested 7/7/23

Tested By E. Parr

TESTING DATA	1	2	3	4	5	6
WM + WS	8.91	9.08	9.15	9.08		
WM	4.35	4.35	4.35	4.35		
WW + T #1	815.5	962.1	918.0	918.5		
WD + T #1	777.0	900.6	845.0	832.3		
TARE #1	32.0	32.0	31.9	43.5		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	4.6	6.2	7.9	9.6		
DRY DENSITY	133.9	136.1	135.8	131.9		

ROCK CORRECTED TEST RESULTS

Maximum dry density = 136.4 pcf

Optimum moisture = 7.0 %

Project No. 23-2775-2 **Client:** LaCanada Unified School District

Project: Fault Trench Backfill

Paradise Canyon Elementary School

○ **Sample Number:** S-1 (B)

ALLAN E. SEWARD ENGINEERING GEOLOGY, INC.

Valencia, California

Material Description

yellowish-brown, silty SAND with gravel

Remarks:

Soil stockpile from fault excavation

Checked by: E. Seward

Title: Principal

Figure A1

Appendix C

ALLAN E. SEWARD
ENGINEERING GEOLOGY

APPENDIX C

GROUND MOTION AND RESPONSE SPECTRA REFERENCES

American Society of Civil Engineers, 2016, Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE/SEI 7-16), provisions and commentary.

Structural Engineers Association of California (SEAOC), OSHPD Seismic Design Maps web application,
<https://seismicmaps.org/>

U.S. Geological Survey, Quaternary Faults and Folds in the U.S., Google Earth .kmz file,
<https://www.usgs.gov/natural-hazards/earthquake-hazards/google-earth-kml-files>



EXPLANATION

- Historic (< 150 years), well constrained location
- - - Historic (< 150 years), moderately constrained location
- ... Historic (< 150 years), inferred location
- Latest Quaternary (<15,000 years), well constrained location
- - - Latest Quaternary (<15,000 years), moderately constrained location
- ... Latest Quaternary (<15,000 years), inferred location
- Late Quaternary (< 130,000 years), well constrained location
- - - Late Quaternary (< 130,000 years), moderately constrained location
- ... Late Quaternary (< 130,000 years), inferred location

APPROXIMATE LOCATION OF SUBJECT SITE



SOURCE; U.S. GEOLOGICAL SURVEY
INTERACTIVE FAULT MAP - QUATERNARY
FAULTS



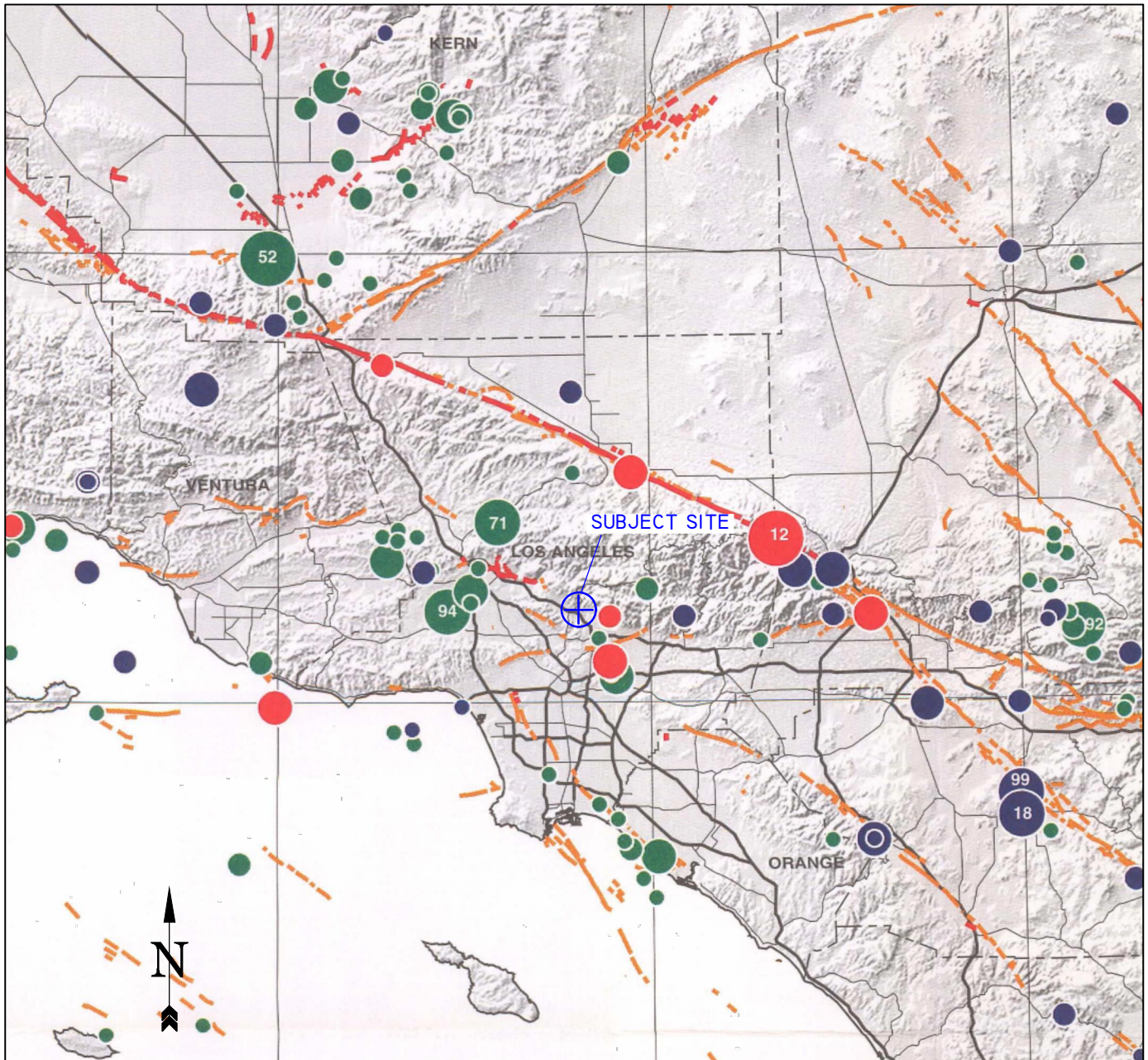
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Geological And Geotechnical Consultants

QUATERNARY FAULT LOCATION MAP

JOB No.: 24-2775-6

DATE: 6/19/24

FIGURE: CI



EPICENTER MAP LEGEND

Period	1800 - 1868	1869 - 1931	1932 - 1999
≥ 7.0			
6.5 - 6.9			
6.0 - 6.4			
5.5 - 5.9			
5.0 - 5.4			

Historical Faulting	
Holocene Faulting	
Highways (Major)	
Highways (Minor)	

Lakes	
65	Last two digits of M ≥ 6.5 earthquake year

0 15 MI 30 MI
20 KM 48 KM

APPROXIMATE SCALE

SOURCE; CALIFORNIA GEOLOGIC SURVEY, EPICENTERS AND AREAS DAMAGED BY $M \geq 5$ CALIFORNIA EARTHQUAKES, 1800-1999 BY T. TOPPOZADA, D. BRANUM, M. PETERSON, C. HALLSTROM, C. CRAMER, M. REICHLER, 2000



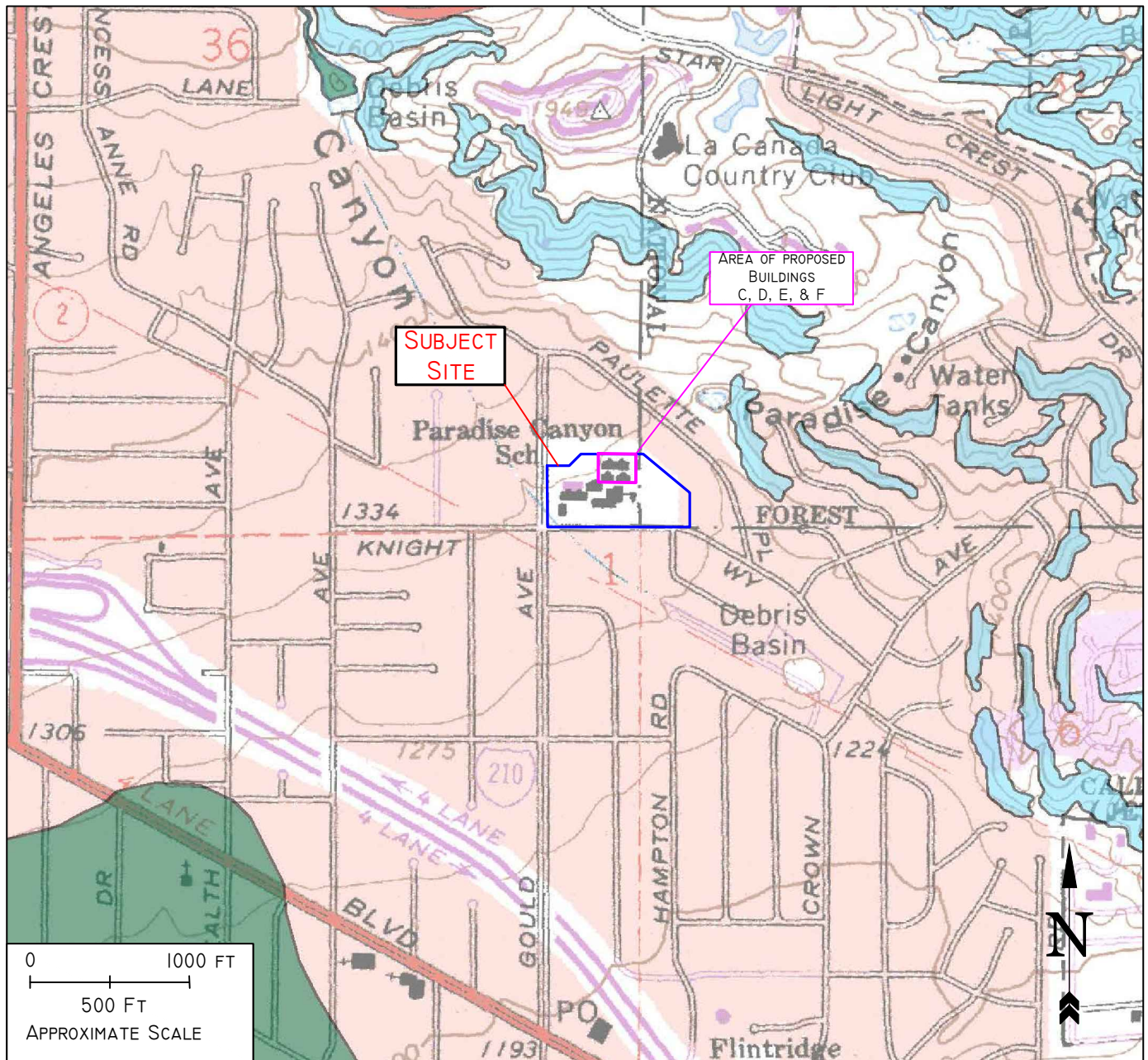
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EQ EPICENTER LOCATION MAP

JOB No.: 24-2775-6

DATE: 6/19/24

FIGURE: C2



SOURCE; CALIFORNIA GEOLOGIC SURVEY

PASADENA QUADRANGLE

SEISMIC HAZARD ZONES

Delivered in compliance with
Chapter 7.8 Division 2 of the California Public Resources Code
(Seismic Hazards Mapping Act)

OFFICIAL MAP

Released: March 25, 1999

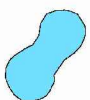
MAP EXPLANATION

SEISMIC HAZARD ZONES



Liquefaction Zones

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



Earthquake-Induced Landslide Zones

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



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EARTHQUAKE ZONES OF REQUIRED INVESTIGATION

JOB No.: 24-2775-6

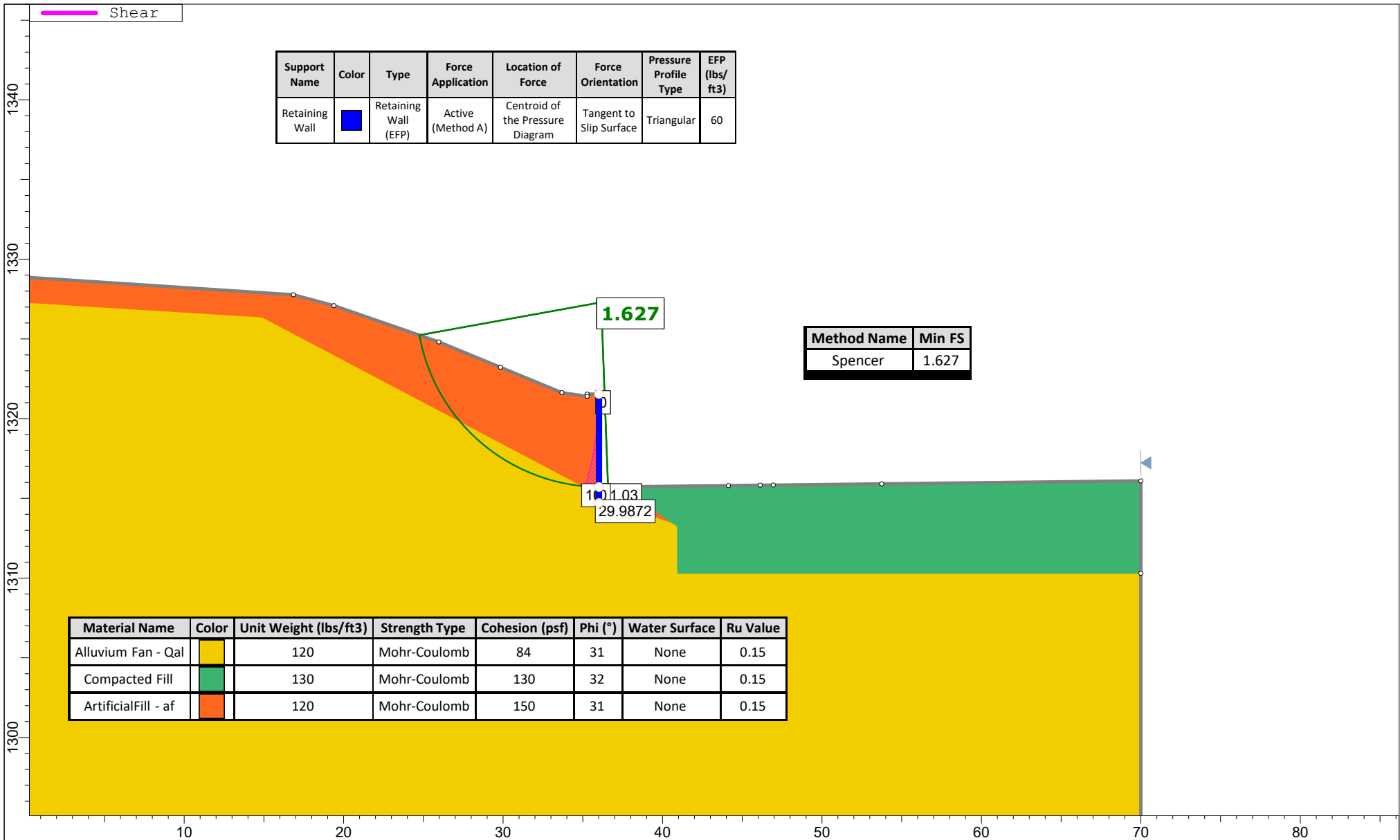
DATE: 6/19/24

FIGURE: C3

Appendix D

APPENDIX D

CROSS SECTION	FILE NAME	SLOPE CONDITION	ANALYZED PLANE	SEARCH TYPE	METHOD	FACTOR OF SAFETY			COMMENTS	RUN No.
						Temp.	Static	Seismic		
H-H'	Hs1a Hps1a	Retaining wall	Circular	Auto-refine	Spencer	--	1.63	1.23	Min FS (circular)	1 2
H-H'	Hs2a	Temporary excavation w/ soldier pile	Circular	Auto-refine	Spencer	1.28	--	--	Evaluation of full depth shored excavation (H=11.3') w/ soldier pile at 6-ft spacing. Req'd pile support force of 3 kips	3
I-I'	Is1aw lps1aw	Retaining wall	Circular	Auto-refine	Spencer	--	1.52	1.28	Min FS (circular)	4 5
I-I'	Is2a	Temporary excavation w/ soldier pile	Circular	Auto-refine	Spencer	1.27	--	--	Evaluation of full depth shored excavation (H=12.6') w/ soldier pile at 6-ft spacing. Req'd pile support force of 5 kips	6
I-I'	Is1a	Temporary excavation for retaining wall w/ conventional ftg	Circular	Auto-refine	Spencer	1.47	--	--	Temporary min FS (circular)	7



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SLIDEINTERPRET 9.034

Analysis Description				Cross Section H-H' Retaining Wall, Perm. Static			
Client		La Canada Unified School District			Drawn By		F. Bouya
Project		Proposed Buildings C, D, E & F Retaining Wall			File Name		Hs1a.slmd
					Scale		1:100
Project No.:		24-2775-6		Date:		6/19/2024	
				Run Number		Run No. 1	

Slide2 Analysis Information

Hs1a

Project Summary

File Name:	Hs1a.slmd
Slide2 Modeler Version:	9.034
Compute Time:	00h:00m:02.450s
Project Title:	Proposed Buildings C, D, E & F
Analysis:	Cross Section H-H' Retaining Wall, Perm. Static
Author:	F. Bouya
Date Created:	6/19/2024
Comments	
La Canada Unified School District Retaining Wall 24-2775-6	

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
Spencer	
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes
Eliminate vertical segments in non-circular search	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

Alluvium Fan - Qal

Color	
Strength Type	Mohr-Coulomb
Unit Weight	120 lbs/ft3
Cohesion	84 psf
Phi	31 °
Water Surface	None
Ru Value	0.15

Compacted Fill

Color	
Strength Type	Mohr-Coulomb
Unit Weight	130 lbs/ft3
Cohesion	130 psf
Phi	32 °
Water Surface	None
Ru Value	0.15

Artificial Fill - af

Color	
Strength Type	Mohr-Coulomb
Unit Weight	120 lbs/ft3
Cohesion	150 psf
Phi	31 °
Water Surface	None
Ru Value	0.15

Support

Retaining Wall

Color	
Type	Retaining Wall (EFP)
Force Application	Active (Method A)
Force Orientation	Tangent to Slip Surface
Pressure Profile Type	Triangular
EFP	60 lbs/ft3
Location of Force	Centroid of the Pressure Diagram

Global Minimums

Method: spencer

FS		1.626580
Center:	36.154, 1327.299	
Radius:	11.590	
Left Slip Surface Endpoint:	24.748, 1325.239	
Right Slip Surface Endpoint:	36.584, 1315.716	
Resisting Moment:	55677.3 lb-ft	
Driving Moment:	34229.7 lb-ft	
Resisting Horizontal Force:	3887.32 lb	
Driving Horizontal Force:	2389.88 lb	
Active Support Moment:	-3.80812e-07 lb-ft	
Active Horizontal Support Force:	-3.28538e-08 lb	
Maximum Single Support Force:	3.28578e-08 lb	
Total Support Force:	3.28578e-08 lb	
Total Slice Area:	55.9446 ft2	
Surface Horizontal Width:	11.8357 ft	
Surface Average Height:	4.72679 ft	

Global Minimum Support Data

Method: spencer

Number of Supports: 2						
Retaining Wall						
Support Type: Retaining Wall (EFP)						
Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
36.0137, 1321.54	5.8339	Not Effective	Not Effective	Not Effective	Not Effective	0
36.0137, 1315.71	0.999787	3.30947e-05	0.999754	3.30947e-05	0.999754	3.28578e-08

Valid and Invalid Surfaces

Method: spencer

Number of Valid Surfaces:	13967
Number of Invalid Surfaces:	0

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.62658

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.238208	13.7164	-77.1213	ArtificialFi ll - af	150	31	60.0434	97.6654	-78.4623	8.63721	-87.0995	184.15	175.513
2	0.238208	37.0685	-72.5184	ArtificialFi ll - af	150	31	74.001	120.368	-25.973	23.3421	-49.3151	208.991	185.649
3	0.238208	54.3626	-68.9208	ArtificialFi ll - af	150	31	86.3936	140.526	18.465	34.2322	-15.7672	242.601	208.369
4	0.238208	68.438	-65.8445	ArtificialFi ll - af	150	31	97.9676	159.352	58.66	43.0955	15.5645	277.102	234.006
5	0.238208	80.3926	-63.1039	ArtificialFi ll - af	150	31	108.938	177.197	95.8859	50.6233	45.2626	310.651	260.028
6	0.238208	90.6276	-60.6027	ArtificialFi ll - af	150	31	119.315	194.075	130.421	57.0682	73.3526	342.193	285.125
7	0.238208	99.3713	-58.2831	ArtificialFi ll - af	150	31	129.074	209.949	162.345	62.5742	99.7713	371.196	308.622
8	0.238208	107.136	-56.1072	ArtificialFi ll - af	150	31	138.409	225.132	192.505	67.4633	125.041	398.534	331.071
9	0.238208	114.085	-54.0484	ArtificialFi ll - af	150	31	147.359	239.692	221.111	71.8395	149.272	424.295	352.455
10	0.238208	120.338	-52.0872	ArtificialFi ll - af	150	31	155.956	253.675	248.321	75.7771	172.544	448.563	372.786
11	0.238208	125.985	-50.209	ArtificialFi ll - af	150	31	164.224	267.123	274.259	79.3327	194.926	471.429	392.096
12	0.234668	129.112	-48.415	Alhaviu m Fan - Qal	84	31	138.393	225.107	317.37	82.5288	234.841	473.328	390.799
13	0.234668	133.612	-46.6954	Alhaviu m Fan - Qal	84	31	145.548	236.746	339.616	85.4049	254.211	494.043	408.638
14	0.234668	137.695	-45.0289	Alhaviu m Fan - Qal	84	31	152.451	247.974	360.913	88.0152	272.898	513.519	425.503
15	0.234668	141.399	-43.4098	Alhaviu m Fan - Qal	84	31	159.113	258.81	381.314	90.3824	290.932	531.831	441.449
16	0.234668	144.753	-41.8328	Alhaviu m Fan - Qal	84	31	165.542	269.267	400.863	92.5261	308.337	549.045	456.519
17	0.234668	147.782	-40.2938	Alhaviu m Fan - Qal	84	31	171.747	279.36	419.596	94.4626	325.133	565.216	470.754
18	0.234668	150.51	-38.7892	Alhaviu m Fan - Qal	84	31	177.735	289.1	437.549	96.206	341.343	580.396	484.19
19	0.234668	152.954	-37.3157	Alhaviu m Fan - Qal	84	31	183.512	298.497	454.75	97.7685	356.981	594.628	496.86
20	0.234668	155.132	-35.8706	Alhaviu m Fan - Qal	84	31	189.084	307.561	471.227	99.1607	372.066	607.953	508.793
21	0.234668	157.059	-34.4514	Alhaviu m Fan - Qal	84	31	194.457	316.3	487.007	100.392	386.615	620.41	520.018
22	0.234668	158.746	-33.0559	Alhaviu m Fan - Qal	84	31	199.635	324.722	502.099	101.471	400.628	632.02	530.549
23	0.234668	160.206	-31.6822	Alhaviu m Fan - Qal	84	31	204.622	332.834	516.533	102.404	414.129	642.822	540.418
24	0.234668	161.449	-30.3286	Alhaviu m Fan - Qal	84	31	209.422	340.641	530.32	103.198	427.122	652.836	549.638
25	0.234668	162.483	-28.9934	Alhaviu m Fan - Qal	84	31	214.037	348.148	543.477	103.859	439.618	662.087	558.228
26	0.234668	163.317	-27.6753	Alhaviu m Fan - Qal	84	31	218.471	355.36	556.012	104.393	451.619	670.592	566.199
27	0.234668	163.959	-26.3729	Alhaviu m Fan - Qal	84	31	222.726	362.281	567.941	104.803	463.138	678.371	573.568
28	0.234668	164.414	-25.085	Alhaviu m Fan - Qal	84	31	226.804	368.915	579.271	105.094	474.177	685.441	580.347
29	0.234668	164.689	-23.8106	Alhaviu m Fan - Qal	84	31	230.707	375.263	590.013	105.27	484.743	691.817	586.547
30	0.234668	164.79	-22.5485	Alhaviu m Fan - Qal	84	31	234.437	381.33	600.173	105.334	494.839	697.512	592.178
31	0.234668	164.72	-21.2979	Alhaviu m Fan - Qal	84	31	237.993	387.115	609.757	105.289	504.468	702.536	597.247
32	0.234668	164.485	-20.0578	Alhaviu m Fan - Qal	84	31	241.379	392.622	618.773	105.139	513.634	706.904	601.765
33	0.234668	164.088	-18.8275	Alhaviu m Fan - Qal	84	31	244.593	397.85	627.22	104.885	522.335	710.618	605.733
34	0.234668	163.534	-17.6061	Alhaviu m Fan - Qal	84	31	247.637	402.801	635.105	104.531	530.574	713.689	609.158
35	0.234668	162.825	-16.393	Alhaviu m Fan - Qal	84	31	250.51	407.474	642.431	104.078	538.353	716.126	612.048
36	0.234668	161.964	-15.1873	Alhaviu m Fan - Qal	84	31	253.212	411.869	649.193	103.528	545.665	717.929	614.401
37	0.234668	160.954	-13.9885	Alhaviu m Fan - Qal	84	31	255.742	415.985	655.397	102.882	552.515	719.106	616.224
38	0.234668	159.803	-12.796	Alhaviu m Fan - Qal	84	31	258.107	419.832	661.063	102.147	558.916	719.685	617.538
39	0.234668	159.507	-11.609	Alhaviu m Fan - Qal	84	31	261.595	425.505	670.318	101.957	568.361	724.058	622.101
40	0.234668	159.811	-10.4271	Alhaviu m Fan - Qal	84	31	265.934	432.563	682.257	102.151	580.106	731.195	629.044
41	0.234668	159.975	-9.2496	Alhaviu m Fan - Qal	84	31	270.175	439.461	693.845	102.256	591.589	737.844	635.588
42	0.234668	160	-8.07608	Alhaviu m Fan - Qal	84	31	274.319	446.201	705.076	102.272	602.804	744.001	641.729
43	0.234668	159.886	-6.90595	Alhaviu m Fan - Qal	84	31	278.364	452.782	715.953	102.2	613.753	749.668	647.468
44	0.243713	165.782	-5.71626	ArtificialFi ll - af	150	31	327.036	531.95	737.705	102.035	635.67	770.441	668.406
45	0.243713	167.099	-4.50659	ArtificialFi ll - af	150	31	333.853	543.038	756.971	102.846	654.125	783.284	680.438
46	0.243713	170.078	-3.29893	ArtificialFi ll - af	150	31	343.223	558.28	784.171	104.679	679.492	803.954	699.275
47	0.243713	170.414	-2.09273	ArtificialFi ll - af	150	31	349.108	567.852	800.309	104.886	695.423	813.065	708.179
48	0.243713	112.707	-0.887459	ArtificialFi ll - af	150	31	270.272	439.619	551.377	69.3684	482.009	555.564	486.195
49	0.243713	0.087036	0.317417	ArtificialFi ll - af	150	31	106.578	173.358	38.9281	0.0535687	38.8745	38.3376	38.284
50	0.243713	0.0540032	1.52243	ArtificialFi ll - af	150	31	104.278	169.617	32.6814	0.0332377	32.6482	29.9099	29.8767

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.62658

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	24.7482	1325.24	0	0	0
2	24.9864	1324.2	-96.036	-34.0278	19.5104
3	25.2246	1323.44	-133.292	-47.2285	19.5104
4	25.4628	1322.82	-142.441	-50.4703	19.5105
5	25.701	1322.29	-134.6	-47.6918	19.5104
6	25.9392	1321.82	-115.496	-40.9231	19.5105
7	26.1775	1321.4	-88.7502	-31.4463	19.5104
8	26.4157	1321.01	-56.894	-20.1589	19.5104
9	26.6539	1320.66	-21.5738	-7.64409	19.5104
10	26.8921	1320.33	15.9802	5.66215	19.5104
11	27.1303	1320.02	54.8139	19.4218	19.5104
12	27.3685	1319.74	94.1677	33.3658	19.5104
13	27.6032	1319.47	145.651	51.6074	19.5104
14	27.8378	1319.23	196.086	69.4777	19.5104
15	28.0725	1318.99	245.124	86.853	19.5104
16	28.3072	1318.77	292.468	103.628	19.5104
17	28.5418	1318.56	337.861	119.712	19.5104
18	28.7765	1318.36	381.081	135.026	19.5104
19	29.0112	1318.17	421.935	149.502	19.5105
20	29.2458	1317.99	460.252	163.078	19.5104
21	29.4805	1317.82	495.883	175.703	19.5104
22	29.7152	1317.66	528.695	187.329	19.5104
23	29.9498	1317.51	558.571	197.915	19.5104
24	30.1845	1317.36	585.408	207.424	19.5104
25	30.4192	1317.23	609.115	215.824	19.5105
26	30.6538	1317.1	629.609	223.085	19.5104
27	30.8885	1316.97	646.819	229.183	19.5104
28	31.1232	1316.86	660.681	234.095	19.5104
29	31.3578	1316.75	671.141	237.801	19.5104
30	31.5925	1316.64	678.148	240.284	19.5104
31	31.8272	1316.55	681.663	241.529	19.5104
32	32.0619	1316.45	681.647	241.524	19.5105
33	32.2965	1316.37	678.072	240.257	19.5104
34	32.5312	1316.29	670.913	237.72	19.5104
35	32.7659	1316.21	660.15	233.966	19.5104
36	33.0005	1316.15	645.768	228.811	19.5104
37	33.2352	1316.08	627.757	222.429	19.5104
38	33.4699	1316.02	606.112	214.76	19.5105
39	33.7045	1315.97	580.832	205.802	19.5104
40	33.9392	1315.92	551.816	195.521	19.5104
41	34.1739	1315.88	518.91	183.869	19.5104
42	34.4085	1315.84	482.103	170.82	19.5104
43	34.6432	1315.81	441.267	156.351	19.5104
44	34.8779	1315.78	396.353	140.437	19.5104
45	35.1216	1315.75	334.721	118.599	19.5104
46	35.3653	1315.74	267.972	94.9488	19.5104
47	35.609	1315.72	195.417	69.2409	19.5104
48	35.8527	1315.71	117.541	41.6474	19.5104
49	36.0964	1315.71	53.8142	19.0676	19.5104
50	36.3401	1315.71	27.8111	9.85412	19.5104
51	36.5839	1315.72	0	0	0

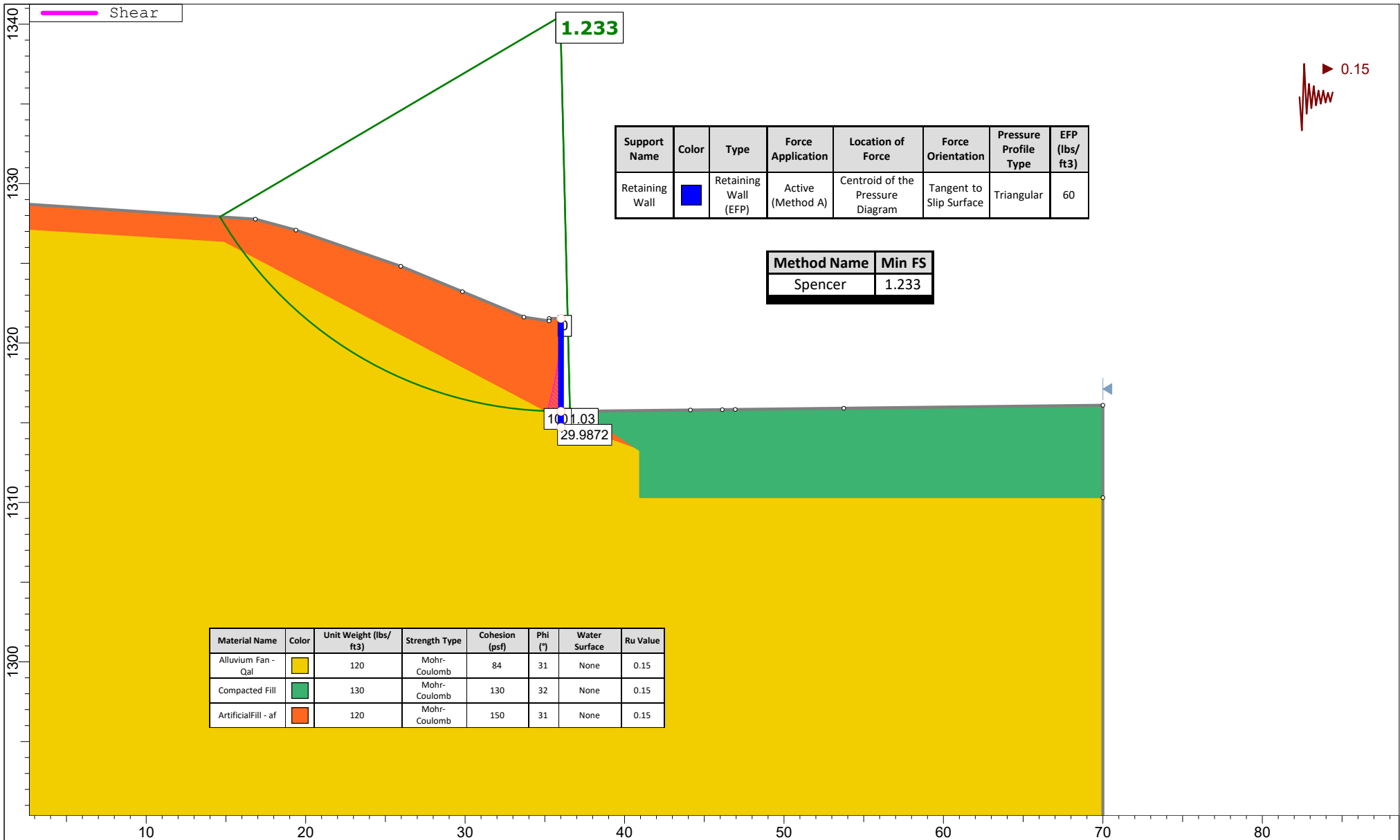
Discharge Sections

Entity Information

Group 1

Shared Entities

Type	Coordinates (x,y)
External Boundary	0, 1290
	70, 1290
	70, 1310.3
	70, 1316.1
	53.7467, 1315.91
	46.9416, 1315.83
	46.1299, 1315.83
	44.1299, 1315.8
	37.2296, 1315.72
	36.0137, 1315.71
	36.0137, 1321.54
	35.2723, 1321.54
	35.2723, 1321.39
	33.6864, 1321.63
	29.8296, 1323.22
	25.9728, 1324.82
	19.3847, 1327.09
	16.8468, 1327.77
	0, 1328.88
	-1.77636e-15, 1327.25
Material Boundary	37.2296, 1315.72
	40.6214, 1313.46
	40.9374, 1313.25
	40.9374, 1310.3
	70, 1310.3
Material Boundary	-1.77636e-15, 1327.25
	14.872, 1326.33
	36.3547, 1315
	40.6214, 1313.46



ALLAN E. SEWARD
ENGINEERING GEOLOGY, INC.
 Geological And Geotechnical Consultants

SLIDEINTERPRET 9.034

Analysis Description				Cross Section H-H' Retaining Wall, Pseudo Static			
Client		La Canada Unified School District			Drawn By		F. Bouya
Project		Proposed Buildings C, D, E & F Retaining Wall			File Name		Hps1a.slmd
					Scale		1:100
Project No.:		24-2775-6		Date:		6/19/2024	Run Number
							Run No. 2

Slide2 Analysis Information

Hps1a

Project Summary

File Name:	Hps1a.slmd
Slide2 Modeler Version:	9.034
Compute Time:	00h:00m:02.339s
Project Title:	Proposed Buildings C, D, E & F
Analysis:	Cross Section H-H' Retaining Wall, Pseudo Static
Author:	F. Bouya
Date Created:	6/19/2024
Comments	
La Canada Unified School District Retaining Wall 24-2775-6	

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
Spencer	
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes
Eliminate vertical segments in non-circular search	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.15

Materials

Alluvium Fan - Qal

Color	
Strength Type	Mohr-Coulomb
Unit Weight	120 lbs/ft3
Cohesion	84 psf
Phi	31 °
Water Surface	None
Ru Value	0.15

Compacted Fill

Color	
Strength Type	Mohr-Coulomb
Unit Weight	130 lbs/ft3
Cohesion	130 psf
Phi	32 °
Water Surface	None
Ru Value	0.15

Artificial Fill - af

Color	
Strength Type	Mohr-Coulomb
Unit Weight	120 lbs/ft3
Cohesion	150 psf
Phi	31 °
Water Surface	None
Ru Value	0.15

Support

Retaining Wall

Color	
Type	Retaining Wall (EFP)
Force Application	Active (Method A)
Force Orientation	Tangent to Slip Surface
Pressure Profile Type	Triangular
EFP	60 lbs/ft3
Location of Force	Centroid of the Pressure Diagram

Global Minimums

Method: spencer

FS	1.233480
Center:	35.972, 1340.480
Radius:	24.771
Left Slip Surface Endpoint:	14.621, 1327.920
Right Slip Surface Endpoint:	36.578, 1315.716
Resisting Moment:	217963 lb-ft
Driving Moment:	176706 lb-ft
Resisting Horizontal Force:	7871.54 lb
Driving Horizontal Force:	6381.59 lb
Active Support Moment:	-1.74987e-05 lb-ft
Active Horizontal Support Force:	-7.06444e-07 lb
Maximum Single Support Force:	7.06444e-07 lb
Total Support Force:	7.06444e-07 lb
Total Slice Area:	119.707 ft2
Surface Horizontal Width:	21.9569 ft
Surface Average Height:	5.45191 ft

Global Minimum Support Data

Method: spencer

Number of Supports: 2						
Retaining Wall						
Support Type: Retaining Wall (EFP)						
Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
36.0137, 1321.54	5.8339	Not Effective	Not Effective	Not Effective	Not Effective	0
36.0137, 1315.71	0.999787	0.000153454	0.999634	0.000153454	0.999634	7.06444e-07

Valid and Invalid Surfaces

Method: spencer

Number of Valid Surfaces:	13064
Number of Invalid Surfaces:	0

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.23348

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.496756	23.1319	-58.4349	ArtificialFI II - af	150	31	109.511	135.08	-17.8468	6.9849	-24.8317	160.404	153.419
2	0.496756	67.4983	-56.3018	ArtificialFI II - af	150	31	120.356	148.457	17.813	20.3817	-2.56874	198.291	177.909
3	0.496756	108.356	-54.2821	ArtificialFI II - af	150	31	132.422	163.34	54.9214	32.7191	22.2023	239.085	206.366
4	0.438622	127.273	-52.4653	Alluvium Fan - Qal	84	31	96.9931	119.639	102.838	43.5247	59.3133	229.084	185.559
5	0.438622	154.709	-50.8295	Alluvium Fan - Qal	84	31	108.412	133.725	135.663	52.9075	82.7556	268.73	215.822
6	0.438622	177.121	-49.2493	Alluvium Fan - Qal	84	31	119.123	146.936	165.316	60.572	104.744	303.561	242.989
7	0.438622	196.979	-47.7181	Alluvium Fan - Qal	84	31	129.66	159.933	193.737	67.3629	126.374	336.322	268.959
8	0.438622	215.49	-46.2308	Alluvium Fan - Qal	84	31	140.306	173.064	221.922	73.6935	148.228	368.389	294.695
9	0.438622	232.764	-44.7828	Alluvium Fan - Qal	84	31	151.025	186.286	249.834	79.6008	170.233	399.718	320.117
10	0.438622	248.892	-43.3702	Alluvium Fan - Qal	84	31	161.791	199.566	277.45	85.1163	192.334	430.289	345.173
11	0.438622	263.704	-41.9899	Alluvium Fan - Qal	84	31	172.483	212.754	304.465	90.1816	214.284	459.714	369.533
12	0.438622	276.223	-40.6389	Alluvium Fan - Qal	84	31	182.631	225.272	329.58	94.4628	235.117	486.329	391.866
13	0.438622	287.62	-39.3147	Alluvium Fan - Qal	84	31	192.652	237.632	354.047	98.3604	255.687	511.813	413.453
14	0.438622	298.133	-38.0151	Alluvium Fan - Qal	84	31	202.611	249.916	378.086	101.956	276.13	536.469	434.513
15	0.438622	307.809	-36.7382	Alluvium Fan - Qal	84	31	212.501	262.116	401.701	105.265	296.436	560.315	455.05
16	0.438622	316.69	-35.4823	Alluvium Fan - Qal	84	31	222.321	274.228	424.894	108.302	316.592	583.37	475.068
17	0.438622	324.814	-34.2456	Alluvium Fan - Qal	84	31	232.063	286.245	447.673	111.08	336.593	605.653	494.573
18	0.438622	332.213	-33.0269	Alluvium Fan - Qal	84	31	241.727	298.165	470.042	113.61	356.432	627.182	513.572
19	0.438622	338.917	-31.8248	Alluvium Fan - Qal	84	31	251.308	309.983	492.002	115.903	376.099	647.971	532.068
20	0.438622	344.955	-30.6382	Alluvium Fan - Qal	84	31	260.805	321.698	513.564	117.968	395.596	668.039	550.071
21	0.438622	350.351	-29.466	Alluvium Fan - Qal	84	31	270.216	333.306	534.727	119.813	414.914	687.397	567.584
22	0.438622	355.127	-28.3072	Alluvium Fan - Qal	84	31	279.538	344.805	555.499	121.446	434.053	706.06	584.614
23	0.438622	359.303	-27.1608	Alluvium Fan - Qal	84	31	288.772	356.194	575.881	122.875	453.006	724.04	601.165
24	0.438622	362.899	-26.0262	Alluvium Fan - Qal	84	31	297.912	367.469	595.876	124.104	471.772	741.346	617.242
25	0.438622	365.931	-24.9024	Alluvium Fan - Qal	84	31	306.96	378.629	615.486	125.141	490.345	757.988	632.847
26	0.438622	368.204	-23.7887	Alluvium Fan - Qal	84	31	315.775	389.502	634.358	125.919	508.439	773.558	647.639
27	0.438622	368.764	-22.6845	Alluvium Fan - Qal	84	31	323.696	399.272	650.81	126.11	524.7	786.112	660.002
28	0.438622	368.621	-21.5892	Alluvium Fan - Qal	84	31	331.338	408.699	666.45	126.061	540.389	797.564	671.503
29	0.438622	367.969	-20.502	Alluvium Fan - Qal	84	31	338.816	417.923	681.58	125.838	555.742	808.272	682.434
30	0.438622	366.819	-19.4226	Alluvium Fan - Qal	84	31	346.125	426.938	696.192	125.445	570.747	818.235	692.79
31	0.438622	365.182	-18.3502	Alluvium Fan - Qal	84	31	353.257	435.736	710.272	124.885	585.387	827.444	702.559
32	0.438622	363.067	-17.2845	Alluvium Fan - Qal	84	31	360.206	444.307	723.813	124.162	599.651	835.898	711.736
33	0.438622	360.481	-16.2249	Alluvium Fan - Qal	84	31	366.963	452.641	736.799	123.278	613.521	843.584	720.306
34	0.438622	357.434	-15.171	Alluvium Fan - Qal	84	31	373.518	460.727	749.215	122.236	626.979	850.494	728.258
35	0.438622	353.932	-14.1223	Alluvium Fan - Qal	84	31	379.863	468.554	761.043	121.038	640.005	856.616	735.578
36	0.438622	349.982	-13.0785	Alluvium Fan - Qal	84	31	385.985	476.105	772.26	119.687	652.573	861.928	742.241
37	0.438622	345.589	-12.039	Alluvium Fan - Qal	84	31	391.872	483.366	782.841	118.185	664.656	866.415	748.23
38	0.438622	340.76	-11.0035	Alluvium Fan - Qal	84	31	397.509	490.32	792.762	116.533	676.229	870.056	753.523
39	0.438622	335.498	-9.97171	Alluvium Fan - Qal	84	31	402.881	496.946	801.991	114.734	687.257	872.825	758.091
40	0.438622	329.807	-8.94313	Alluvium Fan - Qal	84	31	407.97	503.223	810.492	112.788	697.704	874.693	761.905
41	0.438622	323.693	-7.91745	Alluvium Fan - Qal	84	31	412.755	509.125	818.225	110.697	707.528	875.627	764.93
42	0.438622	317.158	-6.89432	Alluvium Fan - Qal	84	31	417.215	514.626	825.144	108.462	716.682	875.591	767.129
43	0.438622	310.205	-5.8734	Alluvium Fan - Qal	84	31	421.323	519.694	831.202	106.084	725.118	874.544	768.46
44	0.438622	305.487	-4.85435	Alluvium Fan - Qal	84	31	427.93	527.843	843.15	104.47	738.68	879.493	775.023
45	0.438622	303.795	-3.83683	Alluvium Fan - Qal	84	31	438.162	540.464	863.576	103.892	759.684	892.962	789.07
46	0.438622	301.706	-2.82052	Alluvium Fan - Qal	84	31	448.412	553.107	883.903	103.178	780.725	905.995	802.817
47	0.401487	275.894	-1.84806	ArtificialFI II - af	150	31	540.215	666.345	962.42	103.077	859.343	979.85	876.773
48	0.401487	280.922	-0.919105	ArtificialFI II - af	150	31	560.937	691.905	1006.84	104.956	901.881	1015.84	910.88
49	0.401487	166.94	0.0096106 3	ArtificialFI II - af	150	31	417.911	515.485	670.64	62.3705	608.269	670.569	608.199
50	0.401487	0.0479129	0.938328	ArtificialFI II - af	150	31	202.109	249.298	165.277	0.0179008	165.259	161.967	161.949

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.23348

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	14.6213	1327.92	0	0	0
2	15.1181	1327.11	-65.3281	-47.8619	36.228
3	15.6148	1326.37	-101.686	-74.4991	36.2279
4	16.1116	1325.68	-113.232	-82.9582	36.228
5	16.5502	1325.1	-77.948	-57.1077	36.2279
6	16.9888	1324.57	-29.2282	-21.4137	36.2279
7	17.4275	1324.06	29.272	21.4458	36.2279
8	17.8661	1323.57	95.4294	69.9153	36.228
9	18.3047	1323.12	167.863	122.983	36.228
10	18.7433	1322.68	245.329	179.737	36.2279
11	19.182	1322.27	326.703	239.355	36.2279
12	19.6206	1321.87	410.85	301.005	36.228
13	20.0592	1321.5	496.299	363.608	36.228
14	20.4978	1321.14	582.164	426.516	36.228
15	20.9364	1320.79	667.704	489.186	36.228
16	21.3751	1320.47	752.238	551.119	36.228
17	21.8137	1320.15	835.133	611.851	36.228
18	22.2523	1319.86	915.803	670.953	36.228
19	22.6909	1319.57	993.698	728.022	36.228
20	23.1295	1319.3	1068.31	782.682	36.2278
21	23.5682	1319.04	1139.14	834.582	36.2281
22	24.0068	1318.79	1205.76	883.387	36.228
23	24.4454	1318.55	1267.72	928.784	36.228
24	24.884	1318.33	1324.63	970.477	36.228
25	25.3227	1318.11	1376.1	1008.18	36.2278
26	25.7613	1317.91	1421.76	1041.63	36.2278
27	26.1999	1317.72	1461.22	1070.55	36.228
28	26.6385	1317.53	1493.96	1094.53	36.2279
29	27.0771	1317.36	1519.68	1113.38	36.228
30	27.5158	1317.2	1538.14	1126.9	36.2279
31	27.9544	1317.04	1549.11	1134.94	36.228
32	28.393	1316.9	1552.37	1137.32	36.2278
33	28.8316	1316.76	1547.72	1133.92	36.228
34	29.2702	1316.63	1534.97	1124.58	36.228
35	29.7089	1316.51	1513.96	1109.19	36.2281
36	30.1475	1316.4	1484.52	1087.62	36.228
37	30.5861	1316.3	1446.51	1059.77	36.228
38	31.0247	1316.21	1399.8	1025.54	36.2277
39	31.4634	1316.12	1344.27	984.865	36.228
40	31.902	1316.05	1279.84	937.658	36.2279
41	32.3406	1315.98	1206.41	883.866	36.2281
42	32.7792	1315.92	1123.95	823.446	36.2278
43	33.2178	1315.86	1032.39	756.37	36.228
44	33.6565	1315.82	931.736	682.626	36.228
45	34.0951	1315.78	821.381	601.776	36.228
46	34.5337	1315.75	700.282	513.054	36.228
47	34.9723	1315.73	568.073	416.193	36.228
48	35.3738	1315.72	405.166	296.84	36.2279
49	35.7753	1315.71	228.715	167.566	36.228
50	36.1768	1315.71	86.0258	63.0258	36.2279
51	36.5783	1315.72	0	0	0

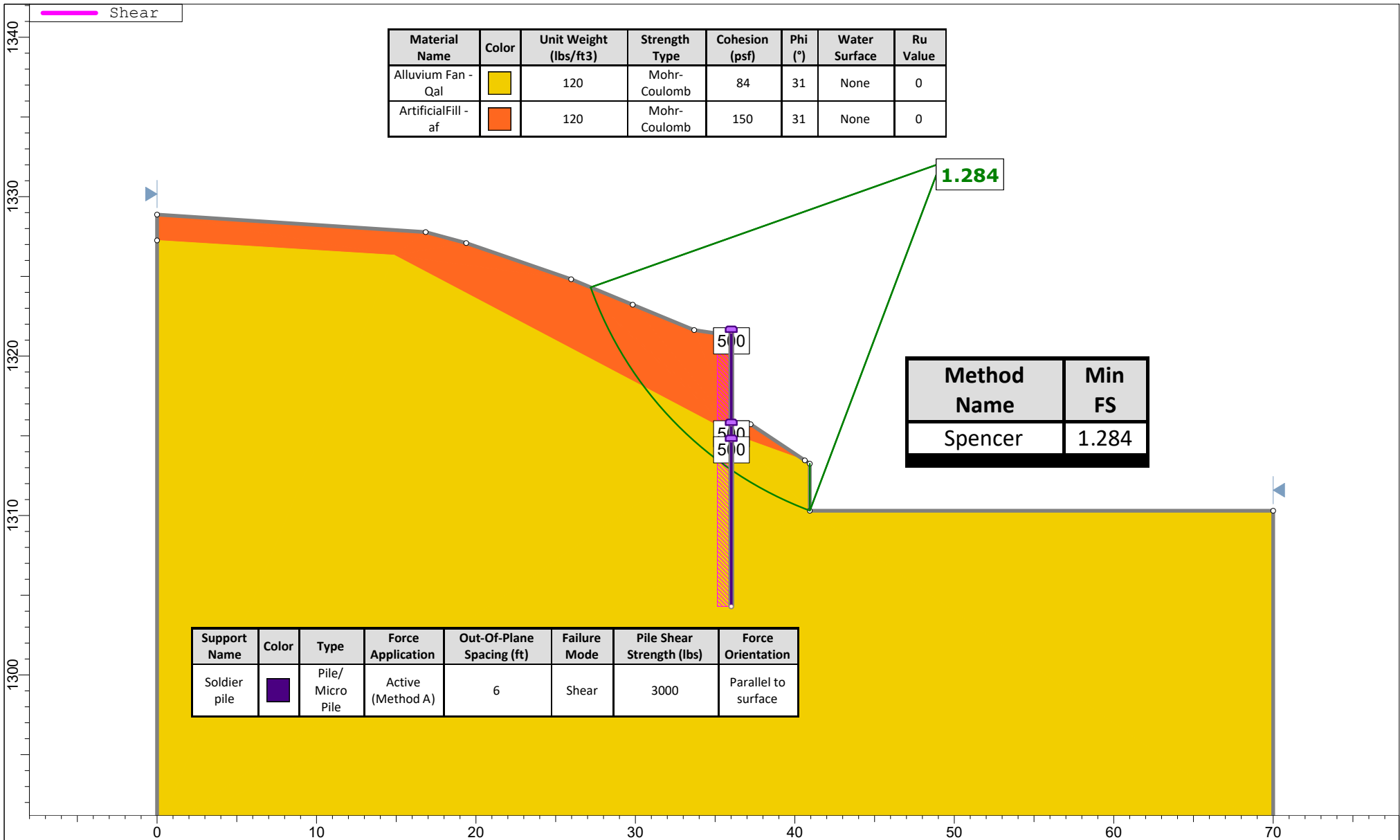
Discharge Sections

Entity Information

Group 1

Shared Entities

Type	Coordinates (x,y)
External Boundary	0, 1290
	70, 1290
	70, 1310.3
	70, 1316.1
	53.7467, 1315.91
	46.9416, 1315.83
	46.1299, 1315.83
	44.1299, 1315.8
	37.2296, 1315.72
	36.0137, 1315.71
	36.0137, 1321.54
	35.2723, 1321.54
	35.2723, 1321.39
	33.6864, 1321.63
	29.8296, 1323.22
	25.9728, 1324.82
	19.3847, 1327.09
	16.8468, 1327.77
	0, 1328.88
	-1.77636e-15, 1327.25
Material Boundary	37.2296, 1315.72
	40.6214, 1313.46
	40.9374, 1313.25
	40.9374, 1310.3
Material Boundary	70, 1310.3
	-1.77636e-15, 1327.25
	14.872, 1326.33
	36.3547, 1315
Material Boundary	40.6214, 1313.46



ALLAN E. SEWARD
ENGINEERING GEOLOGY, INC.
 Geological And Geotechnical Consultants

SLIDEINTERPRET 9.034

Analysis Description				Cross Section H-H', Temp with Soldier Pile (Static)			
Client		La Cañada Unified School District			Drawn By		F. Bouya
Project		Proposed Buildings C, D, E, and F Soldier Pile Wall			File Name		Hs2a.slmd
					Scale		1:100
Project No.:		24-2775-6		Date:		6/19/2024	Run Number
							Run No. 3

Slide2 Analysis Information

Hs2a

Project Summary

File Name:	Hs2a.slmd
Slide2 Modeler Version:	9.034
Compute Time:	00h:00m:02.628s
Project Title:	Proposed Buildings C, D, E, and F
Analysis:	Cross Section H-H', Temp with Soldier Pile (Static)
Author:	F. Bouya
Company:	Company
Date Created:	6/17/2024, 3:37:45 PM
Comments	
La Cañada Unified School District	
Soldier Pile Wall	
24-2775-6	

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
Spencer	
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes
Eliminate vertical segments in non-circular search	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

Alluvium Fan - Qal	
Color	
Strength Type	Mohr-Coulomb
Unit Weight	120 lbs/ft3
Cohesion	84 psf
Phi	31 °
Water Surface	None
Ru Value	0

ArtificialFill - af	
Color	
Strength Type	Mohr-Coulomb
Unit Weight	120 lbs/ft3
Cohesion	150 psf
Phi	31 °
Water Surface	None
Ru Value	0

Support

Soldier pile	
Color	
Type	Pile/Micro Pile
Force Application	Active (Method A)
Force Orientation	Parallel to surface
Out-Of-Plane Spacing	6 ft
Failure Mode	Shear
Pile Shear Strength	3000 lbs

Global Minimums

Method: spencer

FS		1.284370
Center:	49.142, 1332.093	
Radius:	23.285	
Left Slip Surface Endpoint:	27.196, 1324.311	
Right Slip Surface Endpoint:	40.937, 1310.301	
Left Slope Intercept:	27.196 1324.311	
Right Slope Intercept:	40.937 1313.246	
Resisting Moment:	129864 lb-ft	
Driving Moment:	101111 lb-ft	
Resisting Horizontal Force:	4002.47 lb	
Driving Horizontal Force:	3116.28 lb	
Active Support Moment:	-11642.1 lb-ft	
Active Horizontal Support Force:	-411.092 lb	
Maximum Single Support Force:	500 lb	
Total Support Force:	500 lb	
Total Slice Area:	62.8142 ft2	
Surface Horizontal Width:	13.7415 ft	
Surface Average Height:	4.57112 ft	

Global Minimum Support Data

Method: spencer

Number of Supports: 3						
Soldier pile						
Support Type: Pile/Micro Pile						
Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
36.0137, 1321.54	5.8339	Not Effective	Not Effective	Not Effective	Not Effective	0
36.0137, 1315.71	0.999787	Not Effective	Not Effective	Not Effective	Not Effective	0
36.014, 1314.71	10.41	1.84854	8.56146	1.84854	8.56146	500

Valid and Invalid Surfaces

Method: spencer

Number of Valid Surfaces:	10676
Number of Invalid Surfaces:	0

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.28437

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.28086	10.6982	-69.4916	ArtificialFi ll - af	150	31	102.984	132.27	-29.5079	0	-29.5079	245.813	245.813
2	0.28086	30.9236	-67.5985	ArtificialFi ll - af	150	31	111.447	143.139	-11.419	0	-11.419	258.951	258.951
3	0.28086	49.0503	-65.8472	ArtificialFi ll - af	150	31	120.801	155.153	8.57557	0	8.57557	277.963	277.963
4	0.28086	65.4892	-64.2085	ArtificialFi ll - af	150	31	130.776	167.965	29.8987	0	29.8987	300.524	300.524
5	0.28086	80.5284	-62.6618	ArtificialFi ll - af	150	31	141.188	181.338	52.1551	0	52.1551	325.255	325.255
6	0.28086	94.3798	-61.1922	ArtificialFi ll - af	150	31	151.905	195.102	75.0626	0	75.0626	351.288	351.288
7	0.28086	107.204	-59.7884	ArtificialFi ll - af	150	31	162.83	209.133	98.4146	0	98.4146	378.054	378.054
8	0.28086	119.129	-58.4414	ArtificialFi ll - af	150	31	173.889	223.338	122.055	0	122.055	405.166	405.166
9	0.28086	130.253	-57.1442	ArtificialFi ll - af	150	31	185.028	237.644	145.864	0	145.864	432.358	432.358
10	0.28086	140.659	-55.8911	ArtificialFi ll - af	150	31	196.201	251.995	169.748	0	169.748	459.439	459.439
11	0.28086	150.417	-54.6772	ArtificialFi ll - af	150	31	207.376	266.347	193.633	0	193.633	486.273	486.273
12	0.28086	159.581	-53.4986	ArtificialFi ll - af	150	31	218.523	280.664	217.46	0	217.46	512.762	512.762
13	0.272927	163.34	-52.3678	Alhaviu m Fan - Qal	84	31	184.024	236.355	253.562	0	253.562	492.244	492.244
14	0.272927	171.019	-51.281	Alhaviu m Fan - Qal	84	31	194.529	249.847	276.016	0	276.016	518.663	518.663
15	0.272927	178.27	-50.2193	Alhaviu m Fan - Qal	84	31	204.953	263.236	298.299	0	298.299	544.461	544.461
16	0.272927	185.12	-49.1808	Alhaviu m Fan - Qal	84	31	215.286	276.507	320.386	0	320.386	569.629	569.629
17	0.272927	191.594	-48.1637	Alhaviu m Fan - Qal	84	31	225.518	289.648	342.255	0	342.255	594.162	594.162
18	0.272927	197.715	-47.1664	Alhaviu m Fan - Qal	84	31	235.64	302.649	363.894	0	363.894	618.062	618.062
19	0.272927	203.502	-46.1874	Alhaviu m Fan - Qal	84	31	245.646	315.5	385.281	0	385.281	641.326	641.326
20	0.272927	208.973	-45.2256	Alhaviu m Fan - Qal	84	31	255.529	328.194	406.407	0	406.407	663.956	663.956
21	0.272927	214.144	-44.2798	Alhaviu m Fan - Qal	84	31	265.286	340.725	427.262	0	427.262	685.961	685.961
22	0.272927	219.029	-43.349	Alhaviu m Fan - Qal	84	31	274.91	353.086	447.834	0	447.834	707.341	707.341
23	0.272927	223.642	-42.4323	Alhaviu m Fan - Qal	84	31	284.399	365.273	468.116	0	468.116	728.102	728.102
24	0.272927	228.374	-41.5288	Alhaviu m Fan - Qal	84	31	294.137	377.781	488.935	0	488.935	749.429	749.429
25	0.272927	234.618	-40.6378	Alhaviu m Fan - Qal	84	31	305.583	392.482	513.401	0	513.401	775.667	775.667
26	0.272927	240.844	-39.7585	Alhaviu m Fan - Qal	84	31	317.206	407.41	538.245	0	538.245	802.141	802.141
27	0.272927	246.838	-38.8902	Alhaviu m Fan - Qal	84	31	328.774	422.268	562.972	0	562.972	828.167	828.167
28	0.272927	252.61	-38.0325	Alhaviu m Fan - Qal	84	31	340.286	437.053	587.579	0	587.579	853.751	853.751
29	0.272927	258.168	-37.1847	Alhaviu m Fan - Qal	84	31	351.736	451.759	612.055	0	612.055	878.889	878.889
30	0.272927	267.591	-36.3463	Alhaviu m Fan - Qal	84	31	367.765	472.346	646.317	0	646.317	916.926	916.926
31	0.272927	275.218	-35.5169	Alhaviu m Fan - Qal	84	31	382.034	490.673	676.819	0	676.819	949.491	949.491
32	0.272927	273.817	-34.6959	Alhaviu m Fan - Qal	84	31	336.467	432.148	579.416	0	579.416	812.361	812.361
33	0.272927	96.5856	-33.883	Alhaviu m Fan - Qal	84	31	179.242	230.213	243.339	0	243.339	363.707	363.707
34	0.272927	102.6	-33.0778	Alhaviu m Fan - Qal	84	31	188.672	242.325	263.497	0	263.497	386.387	386.387
35	0.272927	108.437	-32.2799	Alhaviu m Fan - Qal	84	31	198.099	254.433	283.648	0	283.648	408.784	408.784
36	0.272927	114.099	-31.489	Alhaviu m Fan - Qal	84	31	207.519	266.531	303.782	0	303.782	430.895	430.895
37	0.272927	118.553	-30.7046	Alhaviu m Fan - Qal	84	31	215.604	276.915	321.063	0	321.063	449.103	449.103
38	0.272927	118.329	-29.9266	Alhaviu m Fan - Qal	84	31	217.813	279.752	325.785	0	325.785	451.168	451.168
39	0.272927	117.421	-29.1547	Alhaviu m Fan - Qal	84	31	219.114	281.423	328.567	0	328.567	450.798	450.798
40	0.272927	116.356	-28.3885	Alhaviu m Fan - Qal	84	31	220.169	282.779	330.824	0	330.824	449.812	449.812
41	0.272927	115.137	-27.6278	Alhaviu m Fan - Qal	84	31	220.977	283.816	332.552	0	332.552	448.212	448.212
42	0.272927	113.768	-26.8724	Alhaviu m Fan - Qal	84	31	221.534	284.532	333.742	0	333.742	445.999	445.999
43	0.272927	112.25	-26.1219	Alhaviu m Fan - Qal	84	31	221.838	284.922	334.389	0	334.389	443.172	443.172
44	0.272927	110.588	-25.3763	Alhaviu m Fan - Qal	84	31	221.885	284.982	334.492	0	334.492	439.738	439.738
45	0.272927	108.784	-24.6352	Alhaviu m Fan - Qal	84	31	221.673	284.71	334.038	0	334.038	435.693	435.693
46	0.272927	106.841	-23.8985	Alhaviu m Fan - Qal	84	31	221.198	284.1	333.023	0	333.023	431.037	431.037
47	0.272927	104.76	-23.166	Alhaviu m Fan - Qal	84	31	220.458	283.149	331.44	0	331.44	425.774	425.774
48	0.272927	102.544	-22.4375	Alhaviu m Fan - Qal	84	31	219.448	281.853	329.283	0	329.283	419.901	419.901
49	0.272927	100.196	-21.7128	Alhaviu m Fan - Qal	84	31	218.168	280.208	326.544	0	326.544	413.42	413.42
50	0.272927	97.7166	-20.9917	Alhaviu m Fan - Qal	84	31	216.648	278.256	323.296	0	323.296	406.423	406.423

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.28437					
Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	27.1958	1324.31	0	0	0
2	27.4767	1323.56	-51.0307	-27.3955	28.2288
3	27.7576	1322.88	-90.0582	-48.3473	28.2289
4	28.0384	1322.25	-118.557	-63.6466	28.2289
5	28.3193	1321.67	-137.846	-74.0019	28.2289
6	28.6001	1321.13	-149.098	-80.0423	28.2288
7	28.881	1320.62	-153.352	-82.3263	28.2289
8	29.1619	1320.14	-151.536	-81.3515	28.229
9	29.4427	1319.68	-144.478	-77.5625	28.229
10	29.7236	1319.24	-132.923	-71.3587	28.2288
11	30.0044	1318.83	-117.54	-63.1007	28.2289
12	30.2853	1318.43	-98.9386	-53.1147	28.2289
13	30.5662	1318.05	-77.6716	-41.6976	28.2289
14	30.8391	1317.7	-38.052	-20.428	28.2289
15	31.112	1317.36	2.91323	1.56395	28.2289
16	31.3849	1317.03	44.8553	24.0803	28.2289
17	31.6579	1316.71	87.4331	46.938	28.2289
18	31.9308	1316.41	130.331	69.9673	28.2288
19	32.2037	1316.12	173.254	93.0107	28.2289
20	32.4767	1315.83	215.931	115.922	28.229
21	32.7496	1315.56	258.107	138.563	28.2288
22	33.0225	1315.29	299.544	160.809	28.2289
23	33.2954	1315.03	340.021	182.539	28.229
24	33.5684	1314.78	379.33	203.641	28.2289
25	33.8413	1314.54	417.37	224.063	28.2289
26	34.1142	1314.31	454.371	243.926	28.2288
27	34.3871	1314.08	490.159	263.139	28.2289
28	34.6601	1313.86	524.519	281.585	28.2289
29	34.933	1313.65	557.244	299.154	28.2289
30	35.2059	1313.44	588.136	315.738	28.2289
31	35.4789	1313.24	617.733	331.627	28.2289
32	35.7518	1313.04	645.488	346.527	28.2289
33	36.0247	1312.85	252.207	135.396	28.2289
34	36.2976	1312.67	247.971	133.122	28.2289
35	36.5706	1312.49	243.407	130.672	28.2289
36	36.8435	1312.32	238.536	127.949	28.2288
37	37.1164	1312.15	232.581	124.86	28.2289
38	37.3893	1311.99	225.877	121.261	28.2289
39	37.6623	1311.83	217.717	116.88	28.2288
40	37.9352	1311.68	208.042	111.686	28.2288
41	38.2081	1311.53	196.852	105.679	28.2289
42	38.481	1311.39	184.151	98.8604	28.2289
43	38.754	1311.25	169.948	91.2358	28.2289
44	39.0269	1311.12	154.26	82.8138	28.2289
45	39.2998	1310.99	137.108	73.6059	28.229
46	39.5728	1310.86	118.52	63.6268	28.2289
47	39.8457	1310.74	98.5275	52.894	28.2289
48	40.1186	1310.63	77.1696	41.4281	28.2289
49	40.3915	1310.51	54.49	29.2527	28.2289
50	40.6645	1310.41	30.5381	16.3942	28.2289
51	40.9374	1310.3	0	0	0

Discharge Sections

Entity Information

◆ Group 1

Shared Entities	
Type	Coordinates (x,y)
External Boundary	0, 1290
	70, 1290
	70, 1310.3
	40.9374, 1310.3
	40.9374, 1313.25
	40.6214, 1313.46
	37.2296, 1315.72
	36.0137, 1315.71
	36.0137, 1321.54
	35.2723, 1321.54
	35.2723, 1321.39
	33.6864, 1321.63
	29.8296, 1323.22
	25.9728, 1324.82
	19.3847, 1327.09
	16.8468, 1327.77
	0, 1328.88
	-1.77636e-15, 1327.25
	-1.77636e-15, 1327.25
	14.872, 1326.33
Material Boundary	36.3547, 1315
	40.6214, 1313.46

Slide2 Analysis Information

Is1aw

Project Summary

File Name:	Is1aw.slm
Slide2 Modeler Version:	9.034
Compute Time:	00h:00m:02.577s
Project Title:	Proposed Buildings C, D, E & F
Analysis:	Cross Section I-I' Retaining Wall, Perm. Static
Author:	F. Bouya
Date Created:	6/19/2024
Comments	
La Canada Unified School District Retaining Wall 24-2775-6	

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
Spencer	
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes
Eliminate vertical segments in non-circular search	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

Alluvium Fan - Qal

Color	
Strength Type	Mohr-Coulomb
Unit Weight	120 lbs/ft3
Cohesion	84 psf
Phi	31 °
Water Surface	None
Ru Value	0.15

Artificial Fill - af

Color	
Strength Type	Mohr-Coulomb
Unit Weight	120 lbs/ft3
Cohesion	150 psf
Phi	31 °
Water Surface	None
Ru Value	0.15

Compacted Fill - Cf

Color	
Strength Type	Mohr-Coulomb
Unit Weight	130 lbs/ft3
Cohesion	130 psf
Phi	32 °
Water Surface	None
Ru Value	0.15

Support

Retaining Wall

Color	
Type	Retaining Wall (EFP)
Force Application	Active (Method A)
Force Orientation	Tangent to Slip Surface
Pressure Profile Type	Triangular
EFP	60 lbs/ft3
Location of Force	Centroid of the Pressure Diagram

Global Minimums

Method: spencer

FS		1.522420
Center:	46.232, 1325.823	
Radius:	10.227	
Left Slip Surface Endpoint:	36.005, 1325.823	
Right Slip Surface Endpoint:	47.349, 1315.657	
Resisting Moment:	51389.5 lb-ft	
Driving Moment:	33755.2 lb-ft	
Resisting Horizontal Force:	3930.46 lb	
Driving Horizontal Force:	2581.72 lb	
Active Support Moment:	-0.0025475 lb-ft	
Active Horizontal Support Force:	-0.000247023 lb	
Maximum Single Support Force:	0.00024913 lb	
Total Support Force:	0.00024913 lb	
Total Slice Area:	53.3108 ft2	
Surface Horizontal Width:	11.3442 ft	
Surface Average Height:	4.69939 ft	

Global Minimum Support Data

Method: spencer

Number of Supports: 3						
Retaining Wall						
Support Type: Retaining Wall (EFP)						
Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
44.841, 1322.91	0.485559	Not Effective	Not Effective	Not Effective	Not Effective	0
44.841, 1322.43	6.73511	Not Effective	Not Effective	Not Effective	Not Effective	0
44.8409, 1315.69	1.05772	0.00288173	1.05484	0.00288173	1.05484	0.00024913

Valid and Invalid Surfaces

Method: spencer

Number of Valid Surfaces:	13239
Number of Invalid Surfaces:	0

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.52242

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.22531	27.6911	-83.9755	Artificial Fill - af	150	31	98.3124	149.673	17.8908	18.4353	-0.544498	949.44	931.005
2	0.22531	65.9389	-75.4397	Artificial Fill - af	150	31	87.3595	132.998	15.6025	43.8988	-28.2963	351.937	308.038
3	0.22531	84.167	-70.9905	Artificial Fill - af	150	31	94.1463	143.33	44.9338	56.0342	-11.1004	318.207	262.173
4	0.22531	97.9891	-67.4093	Artificial Fill - af	150	31	103.781	157.998	78.5473	65.2362	13.3111	327.979	262.743
5	0.22531	109.302	-64.3101	Artificial Fill - af	150	31	114.465	174.263	113.148	72.7676	40.3805	351.095	278.328
6	0.22531	118.911	-61.53	Artificial Fill - af	150	31	125.552	191.142	147.637	79.1648	68.4722	379.163	299.998
7	0.22531	127.253	-58.9811	Artificial Fill - af	150	31	136.75	208.191	181.566	84.7189	96.8467	408.986	324.268
8	0.22531	134.6	-56.6094	Artificial Fill - af	150	31	147.913	225.185	214.739	89.61	125.129	439.141	349.531
9	0.22531	141.133	-54.3789	Artificial Fill - af	150	31	158.958	242.001	247.074	93.959	153.115	468.931	374.972
10	0.22531	146.98	-52.2639	Artificial Fill - af	150	31	169.841	258.569	278.539	97.8518	180.688	498.002	400.15
11	0.22531	152.238	-50.2457	Artificial Fill - af	150	31	180.534	274.849	309.136	101.352	207.784	526.172	424.82
12	0.22531	156.98	-48.3097	Artificial Fill - af	150	31	191.025	290.821	338.875	104.509	234.366	553.351	448.842
13	0.22531	161.263	-46.4448	Artificial Fill - af	150	31	201.305	306.47	367.772	107.361	260.411	579.494	472.133
14	0.22531	165.135	-44.6418	Artificial Fill - af	150	31	211.369	321.793	395.85	109.939	285.911	604.593	494.654
15	0.22531	168.633	-42.8932	Artificial Fill - af	150	31	221.218	336.787	423.134	112.268	310.866	628.654	516.386
16	0.22531	171.789	-41.193	Artificial Fill - af	150	31	230.852	351.453	449.644	114.369	335.275	651.689	537.32
17	0.22531	174.629	-39.5359	Artificial Fill - af	150	31	240.271	365.793	475.401	116.26	359.141	673.718	557.458
18	0.22531	177.177	-37.9175	Artificial Fill - af	150	31	249.479	379.812	500.429	117.955	382.474	694.765	576.81
19	0.22531	179.45	-36.334	Artificial Fill - af	150	31	258.479	393.513	524.743	119.469	405.274	714.85	595.381
20	0.22531	181.466	-34.782	Artificial Fill - af	150	31	267.271	406.899	548.363	120.811	427.552	733.997	613.186
21	0.22531	183.239	-33.2588	Artificial Fill - af	150	31	275.861	419.976	571.305	121.992	449.313	752.228	630.236
22	0.22531	184.783	-31.7617	Artificial Fill - af	150	31	284.249	432.746	593.587	123.019	470.568	769.565	646.546
23	0.22531	186.108	-30.2885	Artificial Fill - af	150	31	292.438	445.214	615.221	123.902	491.319	786.03	662.128
24	0.22531	187.225	-28.8371	Artificial Fill - af	150	31	300.432	457.384	636.217	124.645	511.572	801.634	676.989
25	0.22531	188.141	-27.4057	Artificial Fill - af	150	31	308.232	469.258	656.59	125.255	531.335	816.401	691.146
26	0.22531	188.866	-25.9926	Artificial Fill - af	150	31	315.839	480.839	676.347	125.738	550.609	830.341	704.603
27	0.22531	189.406	-24.5963	Artificial Fill - af	150	31	323.256	492.131	695.497	126.097	569.4	843.47	717.373
28	0.22531	189.767	-23.2154	Artificial Fill - af	150	31	330.484	503.136	714.054	126.337	587.717	855.805	729.468
29	0.22531	189.955	-21.8487	Artificial Fill - af	150	31	337.525	513.855	732.019	126.462	605.557	867.352	740.89
30	0.22531	189.975	-20.4949	Artificial Fill - af	150	31	344.379	524.29	749.401	126.476	622.925	878.124	751.648
31	0.22531	189.832	-19.153	Artificial Fill - af	150	31	351.049	534.444	766.203	126.381	639.822	888.128	761.747
32	0.22531	189.529	-17.8219	Artificial Fill - af	150	31	357.533	544.316	782.433	126.179	656.254	897.375	771.196
33	0.22531	189.071	-16.5007	Artificial Fill - af	150	31	363.834	553.908	798.089	125.874	672.215	905.866	779.992
34	0.22531	188.461	-15.1884	Artificial Fill - af	150	31	369.95	563.219	813.18	125.468	687.712	913.613	788.145
35	0.22531	189.653	-13.8843	Artificial Fill - af	150	31	378.662	576.483	836.047	126.261	709.786	929.646	803.385
36	0.22531	191.222	-12.5875	Artificial Fill - af	150	31	388.083	590.825	860.964	127.306	733.658	947.622	820.316
37	0.22531	192.511	-11.2972	Artificial Fill - af	150	31	397.28	604.827	885.126	128.164	756.962	964.49	836.326
38	0.22531	193.657	-10.0127	Artificial Fill - af	150	31	406.452	618.79	909.125	128.927	780.198	980.887	851.96
39	0.22531	194.663	-8.73323	Artificial Fill - af	150	31	415.6	632.717	932.974	129.597	803.377	996.816	867.219
40	0.22531	42.9291	-7.45816	Artificial Fill - af	150	31	181.672	276.581	239.246	28.5801	210.666	263.029	234.449
41	0.22531	0.915852	-6.1868	Artificial Fill - af	150	31	115.818	176.323	44.4187	0.609728	43.809	56.9735	56.3638
42	0.22531	1.41789	-4.91848	Artificial Fill - af	150	31	117.748	179.262	49.6434	0.943959	48.6995	59.7763	58.8323
43	0.22531	1.78418	-3.65259	Artificial Fill - af	150	31	119.518	181.957	54.3729	1.18782	53.1851	62.0025	60.8147
44	0.22531	2.01541	-2.38847	Artificial Fill - af	150	31	121.119	184.393	58.5821	1.34176	57.2403	63.634	62.2923
45	0.22531	2.11205	-1.12552	Artificial Fill - af	150	31	122.539	186.555	62.244	1.40609	60.8379	64.6515	63.2454
46	0.22531	2.07435	0.136888	Artificial Fill - af	150	31	123.767	188.425	65.3303	1.381	63.9493	65.0346	63.6536
47	0.22531	1.90242	1.39936	Artificial Fill - af	150	31	124.79	189.983	67.8099	1.26653	66.5434	64.7615	63.495
48	0.22531	1.59612	2.66251	Artificial Fill - af	150	31	125.597	191.211	69.6496	1.06261	68.587	63.8089	62.7463
49	0.22531	1.16365	3.92696	Artificial Fill - af	150	31	126.189	192.112	70.8616	0.774698	70.0869	62.1993	61.4246
50	0.304006	0.658443	5.415	Compacted Fill - Cf	130	32	110.987	168.969	62.6882	0.324884	62.3633	52.1675	51.8427

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.52242

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	36.0046	1325.82	0	0	0
2	36.2299	1323.69	15.9925	8.75593	28.7008
3	36.4552	1322.82	9.79783	5.36432	28.7007
4	36.6806	1322.17	17.9226	9.81267	28.7008
5	36.9059	1321.62	37.0201	20.2685	28.7007
6	37.1312	1321.16	64.1652	35.1305	28.7007
7	37.3565	1320.74	97.1524	53.191	28.7007
8	37.5818	1320.37	134.302	73.5303	28.7007
9	37.8071	1320.02	174.3	95.4296	28.7008
10	38.0324	1319.71	216.098	118.314	28.7008
11	38.2577	1319.42	258.835	141.712	28.7007
12	38.483	1319.15	301.798	165.235	28.7008
13	38.7083	1318.89	344.382	188.549	28.7007
14	38.9337	1318.66	386.07	211.374	28.7008
15	39.159	1318.44	426.416	233.463	28.7007
16	39.3843	1318.23	465.028	254.603	28.7007
17	39.6096	1318.03	501.56	274.605	28.7008
18	39.8349	1317.84	535.708	292.301	28.7008
19	40.0602	1317.67	567.196	310.54	28.7007
20	40.2855	1317.5	595.778	326.189	28.7007
21	40.5108	1317.35	621.232	340.125	28.7007
22	40.7361	1317.2	643.354	352.237	28.7008
23	40.9614	1317.06	661.959	362.424	28.7008
24	41.1868	1316.93	676.879	370.592	28.7008
25	41.4121	1316.8	687.956	376.657	28.7008
26	41.6374	1316.69	695.048	380.54	28.7008
27	41.8627	1316.58	698.02	382.167	28.7008
28	42.088	1316.47	696.749	381.471	28.7008
29	42.3133	1316.38	691.119	378.389	28.7008
30	42.5386	1316.29	681.024	372.861	28.7007
31	42.7639	1316.2	666.363	364.834	28.7007
32	42.9892	1316.12	647.041	354.256	28.7008
33	43.2145	1316.05	622.972	341.078	28.7008
34	43.4398	1315.98	594.071	325.255	28.7008
35	43.6652	1315.92	560.263	306.744	28.7007
36	43.8905	1315.87	521.309	285.417	28.7007
37	44.1158	1315.82	476.982	261.148	28.7007
38	44.3411	1315.77	427.101	233.838	28.7007
39	44.5664	1315.73	371.474	203.382	28.7007
40	44.7917	1315.7	309.907	169.675	28.7008
41	45.017	1315.67	275.935	151.075	28.7008
42	45.2423	1315.64	250.864	137.349	28.7009
43	45.4676	1315.62	225.235	123.317	28.7009
44	45.6929	1315.61	199.026	108.967	28.7008
45	45.9183	1315.6	172.223	94.2924	28.7008
46	46.1436	1315.6	144.825	79.2919	28.7008
47	46.3689	1315.6	116.839	63.9694	28.7007
48	46.5942	1315.6	88.2835	48.3353	28.7007
49	46.8195	1315.61	59.1893	32.4062	28.7007
50	47.0448	1315.63	29.5953	16.2035	28.7008
51	47.3488	1315.66	0	0	0

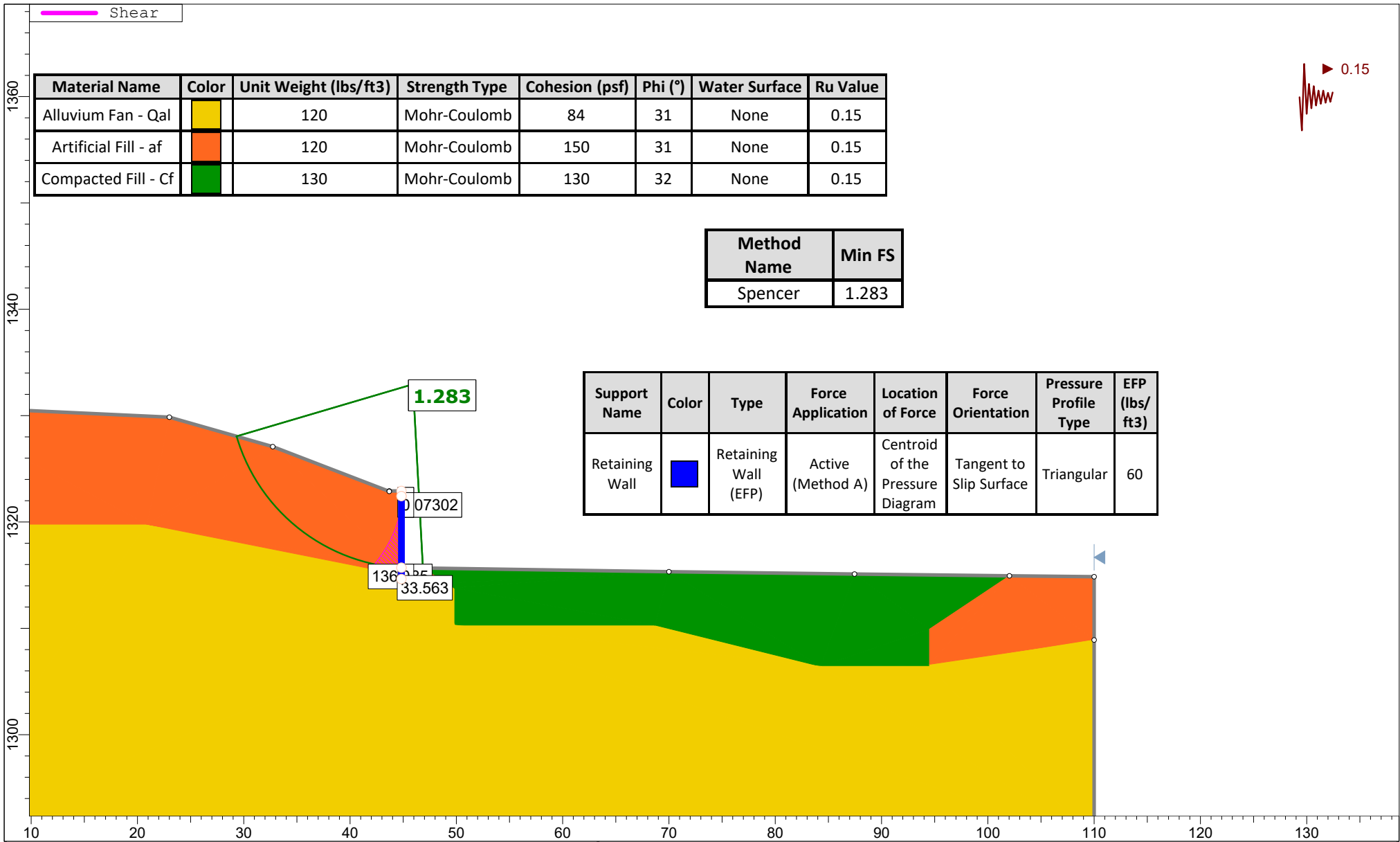
Discharge Sections

Entity Information

- ◆

Group 1
- Shared Entities

Type	Coordinates (x,y)
External Boundary	44.8409, 1315.69
	44.841, 1322.43
	44.841, 1322.91
	43.6939, 1322.91
	43.6939, 1322.87
	32.7317, 1327.08
	23.0013, 1329.85
	0, 1330.92
	0, 1319.79
	0, 1290
	110, 1290
	110, 1308.9
	110, 1314.85
	102.037, 1314.94
	87.4644, 1315.1
	70, 1315.32
	46.9937, 1315.66
Material Boundary	45.0165, 1315
	49.1171, 1314.25
Material Boundary	46.9937, 1315.66
	49.1171, 1314.25
	49.7864, 1313.8
	49.7864, 1310.3
	68.7009, 1310.3
	84.2785, 1306.42
	94.5124, 1306.42
	94.5124, 1306.61
	94.5124, 1309.92
Material Boundary	102.037, 1314.94
	0, 1319.79
	20.8946, 1319.79
Material Boundary	45.0165, 1315
	94.5124, 1306.61
Material Boundary	110, 1308.9



Slide2 Analysis Information

Ips1aw

Project Summary

File Name:	Ips1aw.slm2
Slide2 Modeler Version:	9.034
Compute Time:	00h:00m:02.751s
Project Title:	Proposed Buildings C, D, E & F
Analysis:	Cross Section I-I' Retaining Wall, Perm. Pseudo Static
Author:	F. Bouya
Date Created:	6/19/2024

Comments
La Canada Unified School District Retaining Wall 24-2775-6

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes
Eliminate vertical segments in non-circular search	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No
Seismic Load Coefficient (Horizontal):	0.15

Materials

Alluvium Fan - Qal	
Color	
Strength Type	Mohr-Coulomb
Unit Weight	120 lbs/ft3
Cohesion	84 psf
Phi	31 °
Water Surface	None
Ru Value	0.15
Artificial Fill - af	
Color	
Strength Type	Mohr-Coulomb
Unit Weight	120 lbs/ft3
Cohesion	150 psf
Phi	31 °
Water Surface	None
Ru Value	0.15
Compacted Fill - Cf	
Color	
Strength Type	Mohr-Coulomb
Unit Weight	130 lbs/ft3
Cohesion	130 psf
Phi	32 °
Water Surface	None
Ru Value	0.15

Support

Retaining Wall	
Color	
Type	Retaining Wall (EFP)
Force Application	Active (Method A)
Force Orientation	Tangent to Slip Surface
Pressure Profile Type	Triangular
EFP	60 lbs/ft3
Location of Force	Centroid of the Pressure Diagram

Global Minimums

Method: spencer

FS		1.282840
Center:	45.922, 1332.948	
Radius:	17.310	
Left Slip Surface Endpoint:	29.319, 1328.052	
Right Slip Surface Endpoint:	46.861, 1315.664	
Resisting Moment:	141733 lb-ft	
Driving Moment:	110484 lb-ft	
Resisting Horizontal Force:	6969.17 lb	
Driving Horizontal Force:	5432.61 lb	
Active Support Moment:	-0.228415 lb-ft	
Active Horizontal Support Force:	-0.0131802 lb	
Maximum Single Support Force:	0.0132018 lb	
Total Support Force:	0.0132018 lb	
Total Slice Area:	97.0518 ft2	
Surface Horizontal Width:	17.5419 ft	
Surface Average Height:	5.53258 ft	

Global Minimum Support Data

Method: spencer

Number of Supports: 3						
Retaining Wall						
Support Type: Retaining Wall (EFP)						
Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
44.841, 1322.91	0.485559	Not Effective	Not Effective	Not Effective	Not Effective	0
44.841, 1322.43	6.73511	Not Effective	Not Effective	Not Effective	Not Effective	0
44.8409, 1315.69	1.05772	0.0209776	1.03674	0.0209776	1.03674	0.0132018

Valid and Invalid Surfaces

Method: spencer

Number of Valid Surfaces:	13381
Number of Invalid Surfaces:	0

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.28284

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.350838	20.2499	-71.7176	Artificial Fill - af	150	31	104.009	133.427	-18.9251	8.65782	-27.5829	295.892	287.234
2	0.350838	56.9504	-68.296	Artificial Fill - af	150	31	100.744	129.238	-10.2049	24.3491	-34.554	242.901	218.552
3	0.350838	87.379	-65.3342	Artificial Fill - af	150	31	110.028	141.148	22.6271	37.3587	-14.7316	262.222	224.863
4	0.350838	113.548	-62.6776	Artificial Fill - af	150	31	119.795	153.678	54.6679	48.5473	6.12058	286.544	237.997
5	0.350838	136.553	-60.2425	Artificial Fill - af	150	31	129.826	166.547	85.9208	58.3828	27.538	313.001	254.618
6	0.350838	157.071	-57.9775	Artificial Fill - af	150	31	140.088	179.71	116.601	67.1554	49.4455	340.592	273.437
7	0.350838	175.558	-55.848	Artificial Fill - af	150	31	150.537	193.115	146.815	75.0596	71.7558	368.724	293.665
8	0.350838	192.339	-53.8298	Artificial Fill - af	150	31	161.141	206.719	176.63	82.2341	94.3956	397.042	314.808
9	0.350838	207.653	-51.9048	Artificial Fill - af	150	31	171.875	220.488	206.093	88.7816	117.312	425.331	336.549
10	0.350838	221.631	-50.0591	Artificial Fill - af	150	31	182.7	234.375	235.182	94.7578	140.424	453.373	358.615
11	0.350838	233.449	-48.2821	Artificial Fill - af	150	31	193.262	247.924	262.783	99.8106	162.972	479.558	379.748
12	0.350838	243.86	-46.565	Artificial Fill - af	150	31	203.721	261.341	289.563	104.262	185.301	504.728	400.466
13	0.350838	253.347	-44.9006	Artificial Fill - af	150	31	214.2	274.784	315.994	108.318	207.676	529.452	421.134
14	0.350838	261.989	-43.2832	Artificial Fill - af	150	31	224.697	288.25	342.101	112.013	230.088	553.72	441.707
15	0.350838	269.853	-41.7078	Artificial Fill - af	150	31	235.21	301.737	367.908	115.375	252.533	577.53	462.155
16	0.350838	276.997	-40.1701	Artificial Fill - af	150	31	245.74	315.245	393.443	118.43	275.013	600.889	482.459
17	0.350838	283.468	-38.6665	Artificial Fill - af	150	31	256.287	328.775	418.727	121.196	297.531	623.806	502.61
18	0.350838	289.309	-37.1939	Artificial Fill - af	150	31	266.853	342.33	443.783	123.694	320.089	646.292	522.598
19	0.350838	294.558	-35.7496	Artificial Fill - af	150	31	277.442	355.914	468.637	125.938	342.699	668.363	542.425
20	0.350838	299.245	-34.3309	Artificial Fill - af	150	31	288.057	369.531	493.303	127.942	365.361	690.03	562.088
21	0.350838	303.4	-32.9359	Artificial Fill - af	150	31	298.703	383.188	517.809	129.718	388.091	711.315	581.597
22	0.350838	307.049	-31.5626	Artificial Fill - af	150	31	309.385	396.891	542.174	131.278	410.896	732.23	600.952
23	0.350838	310.212	-30.2092	Artificial Fill - af	150	31	320.109	410.648	566.422	132.631	433.791	752.799	620.168
24	0.350838	312.912	-28.8742	Artificial Fill - af	150	31	330.881	424.468	590.575	133.785	456.79	773.038	639.253
25	0.350838	315.166	-27.5562	Artificial Fill - af	150	31	341.711	438.36	614.659	134.749	479.91	792.968	658.219
26	0.350838	316.989	-26.2538	Artificial Fill - af	150	31	352.605	452.336	638.7	135.528	503.172	812.615	677.087
27	0.350838	318.397	-24.9659	Artificial Fill - af	150	31	363.575	466.408	662.72	136.13	526.59	831.994	695.864
28	0.350838	319.404	-23.6913	Artificial Fill - af	150	31	374.63	480.59	686.753	136.56	550.193	851.136	714.576
29	0.350838	320.02	-22.429	Artificial Fill - af	150	31	385.782	494.897	710.83	136.824	574.006	870.066	733.242
30	0.350838	320.257	-21.1781	Artificial Fill - af	150	31	397.047	509.348	734.982	136.925	598.057	888.812	751.887
31	0.350838	320.124	-19.9377	Artificial Fill - af	150	31	408.438	523.961	759.243	136.869	622.374	907.4	770.531
32	0.350838	319.631	-18.707	Artificial Fill - af	150	31	419.972	538.757	783.66	136.658	647.002	925.87	789.212
33	0.350838	318.785	-17.4852	Artificial Fill - af	150	31	431.669	553.762	808.271	136.296	671.975	944.253	807.957
34	0.350838	317.595	-16.2715	Artificial Fill - af	150	31	443.549	569.003	833.125	135.787	697.338	962.589	826.802
35	0.350838	316.065	-15.0653	Artificial Fill - af	150	31	455.637	584.51	858.279	135.133	723.146	980.923	845.79
36	0.350838	314.204	-13.8659	Artificial Fill - af	150	31	467.961	600.319	883.794	134.337	749.457	999.307	864.97
37	0.350838	312.014	-12.6727	Artificial Fill - af	150	31	480.551	616.47	909.736	133.401	776.335	1017.79	884.392
38	0.350838	309.503	-11.485	Artificial Fill - af	150	31	493.443	633.008	936.188	132.327	803.861	1036.45	904.119
39	0.350838	306.673	-10.3023	Artificial Fill - af	150	31	506.677	649.985	963.233	131.118	832.115	1055.33	924.215
40	0.350838	303.529	-9.12408	Artificial Fill - af	150	31	520.3	667.462	990.973	129.773	861.2	1074.54	944.763
41	0.350838	300.127	-7.9497	Artificial Fill - af	150	31	534.431	685.59	1019.69	128.319	891.371	1094.32	966.002
42	0.350838	301.195	-6.77867	Artificial Fill - af	150	31	555.098	712.102	1064.27	128.776	935.493	1130.25	1001.47
43	0.350838	302.799	-5.61048	Artificial Fill - af	150	31	577.992	741.471	1113.83	129.461	984.371	1170.61	1041.15
44	0.350838	304.098	-4.44463	Artificial Fill - af	150	31	602.257	772.599	1166.19	130.017	1036.18	1213.01	1082.99
45	0.350838	74.6736	-3.28062	Artificial Fill - af	150	31	295.977	379.691	414.196	31.9266	382.269	431.161	399.235
46	0.350838	1.52272	-2.11797	Artificial Fill - af	150	31	195.614	250.942	168.647	0.651036	167.996	175.882	175.231
47	0.350838	1.70026	-0.956183	Artificial Fill - af	150	31	201.463	258.445	181.209	0.726945	180.482	184.572	183.845
48	0.350838	1.57824	0.205206	Artificial Fill - af	150	31	207.381	266.037	193.792	0.674773	193.117	193.049	192.374
49	0.350838	1.15676	1.36668	Artificial Fill - af	150	31	213.381	273.734	206.422	0.494569	205.927	201.331	200.837
50	0.350838	0.435572	2.52872	Artificial Fill - af	150	31	222.257	285.12	225.063	0.186228	224.877	215.248	215.061

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.28284

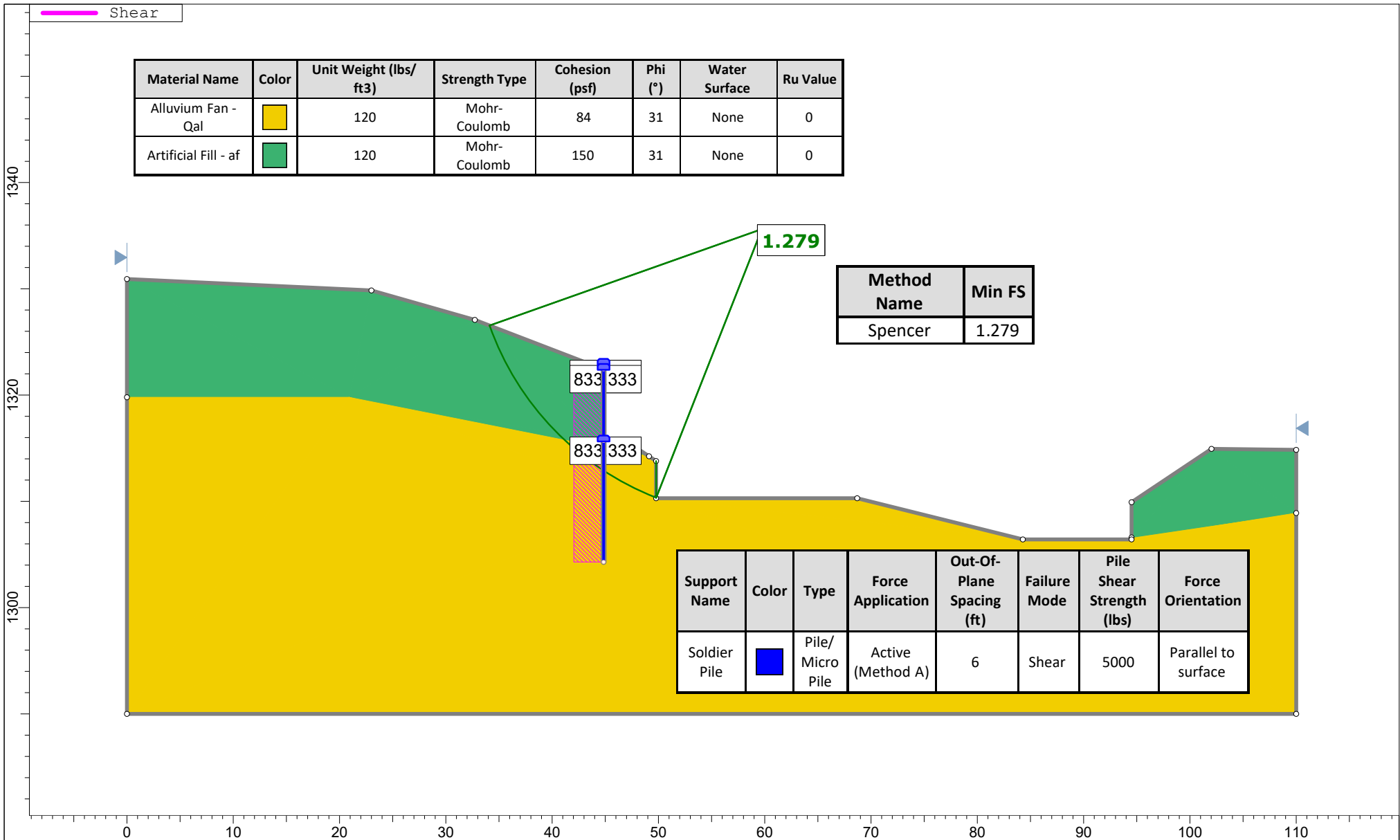
Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	29.3191	1328.05	0	0	0
2	29.6699	1326.99	-53.5719	-48.8447	42.3573
3	30.0208	1326.11	-89.3903	-81.5025	42.3573
4	30.3716	1325.34	-97.6222	-89.008	42.3573
5	30.7225	1324.67	-85.52	-77.9737	42.3573
6	31.0733	1324.05	-57.8871	-52.7792	42.3573
7	31.4241	1323.49	-18.095	-16.4983	42.3573
8	31.775	1322.97	31.3216	28.5578	42.3573
9	32.1258	1322.49	88.3652	80.5678	42.3573
10	32.4766	1322.05	151.406	138.046	42.3573
11	32.8275	1321.63	219.053	199.723	42.3572
12	33.1783	1321.23	289.637	264.079	42.3573
13	33.5292	1320.86	361.996	330.054	42.3574
14	33.88	1320.51	435.282	396.873	42.3573
15	34.2308	1320.18	508.736	463.845	42.3573
16	34.5817	1319.87	581.678	530.351	42.3573
17	34.9325	1319.57	653.485	595.822	42.3573
18	35.2833	1319.29	723.589	659.739	42.3573
19	35.6342	1319.03	791.46	721.621	42.3573
20	35.985	1318.77	856.607	781.02	42.3573
21	36.3359	1318.54	918.569	837.514	42.3573
22	36.6867	1318.31	976.906	890.704	42.3573
23	37.0375	1318.09	1031.2	940.21	42.3574
24	37.3884	1317.89	1081.06	985.67	42.3574
25	37.7392	1317.69	1126.1	1026.73	42.3572
26	38.09	1317.51	1165.95	1063.06	42.3571
27	38.4409	1317.34	1200.23	1094.33	42.3575
28	38.7917	1317.18	1228.61	1120.2	42.3574
29	39.1426	1317.02	1250.73	1140.37	42.3574
30	39.4934	1316.88	1266.24	1154.51	42.3574
31	39.8442	1316.74	1274.8	1162.31	42.3573
32	40.1951	1316.61	1276.06	1163.46	42.3573
33	40.5459	1316.49	1269.67	1157.63	42.3572
34	40.8967	1316.38	1255.28	1144.51	42.3572
35	41.2476	1316.28	1232.53	1123.77	42.3573
36	41.5984	1316.19	1201.04	1095.06	42.3573
37	41.9493	1316.1	1160.43	1058.03	42.3572
38	42.3001	1316.02	1110.3	1012.33	42.3574
39	42.6509	1315.95	1050.24	957.564	42.3572
40	43.0018	1315.89	979.797	893.339	42.3573
41	43.3526	1315.83	898.512	819.227	42.3573
42	43.7034	1315.78	805.877	734.766	42.3573
43	44.0543	1315.74	700.571	638.753	42.3573
44	44.4051	1315.7	581.475	530.165	42.3573
45	44.756	1315.68	447.47	407.985	42.3573
46	45.1068	1315.66	363.084	331.046	42.3574
47	45.4576	1315.64	296.83	270.638	42.3573
48	45.8085	1315.64	227.423	207.355	42.3573
49	46.1593	1315.64	154.615	140.972	42.3574
50	46.5101	1315.65	78.1533	71.257	42.3573
51	46.861	1315.66	0	0	0

Discharge Sections

Entity Information

- ◆ Group 1
- Shared Entities

Type	Coordinates (x,y)
External Boundary	44.8409, 1315.69
	44.841, 1322.43
	44.841, 1322.91
	43.6939, 1322.91
	43.6939, 1322.87
	32.7317, 1327.08
	23.0013, 1329.85
	0, 1330.92
	0, 1319.79
	0, 1290
	110, 1290
	110, 1308.9
	110, 1314.85
	102.037, 1314.94
	87.4644, 1315.1
	70, 1315.32
	46.9937, 1315.66
Material Boundary	45.0165, 1315
	49.1171, 1314.25
Material Boundary	46.9937, 1315.66
	49.1171, 1314.25
	49.7864, 1313.8
	49.7864, 1310.3
	68.7009, 1310.3
	84.2785, 1306.42
	94.5124, 1306.42
	94.5124, 1306.61
	94.5124, 1309.92
Material Boundary	102.037, 1314.94
	0, 1319.79
	20.8946, 1319.79
Material Boundary	45.0165, 1315
	94.5124, 1306.61
Material Boundary	110, 1308.9



ALLAN E. SEWARD
ENGINEERING GEOLOGY, INC.
 Geological And Geotechnical Consultants

SLIDEINTERPRET 9.034

Analysis Description				Cross Section I-I' Soldier Pile, Temp. Static			
Client		La Canada Unified School District		Drawn By		F. Bouya	
Project		Proposed Buildings C, D, E & F Soldier Pile		File Name		Is2a.slmd	
				Scale		1:150	
Project No.:		24-2775-6		Date:		6/19/2024	
				Run Number		Run No. 6	

Slide2 Analysis Information

Is2a

Project Summary

File Name:	Is2a.slmd
Slide2 Modeler Version:	9.034
Compute Time:	00h:00m:02.330s
Project Title:	Proposed Buildings C, D, E & F
Analysis:	Cross Section I-I' Soldier Pile, Temp. Static
Author:	F. Bouya
Date Created:	6/19/2024

Comments

La Canada Unified School District
Soldier Pile
24-2775-6

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
	Spencer
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes
Eliminate vertical segments in non-circular search	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

Alluvium Fan - Qal

Color	
Strength Type	Mohr-Coulomb
Unit Weight	120 lbs/ft3
Cohesion	84 psf
Phi	31 °
Water Surface	None
Ru Value	0

Artificial Fill - af

Color	
Strength Type	Mohr-Coulomb
Unit Weight	120 lbs/ft3
Cohesion	150 psf
Phi	31 °
Water Surface	None
Ru Value	0

Support

Soldier Pile

Color	
Type	Pile/Micro Pile
Force Application	Active (Method A)
Force Orientation	Parallel to surface
Out-Of-Plane Spacing	6 ft
Failure Mode	Shear
Pile Shear Strength	5000 lbs

Global Minimums

Method: spencer

FS		1.278930
Center:	59.728, 1335.617	
Radius:	27.170	
Left Slip Surface Endpoint:	34.116, 1326.548	
Right Slip Surface Endpoint:	49.786, 1310.331	
Left Slope Intercept:	34.116 1326.548	
Right Slope Intercept:	49.786 1313.800	
Resisting Moment:	203480 lb-ft	
Driving Moment:	159101 lb-ft	
Resisting Horizontal Force:	5354.68 lb	
Driving Horizontal Force:	4186.83 lb	
Active Support Moment:	-22641.4 lb-ft	
Active Horizontal Support Force:	-697.209 lb	
Maximum Single Support Force:	833.333 lb	
Total Support Force:	833.333 lb	
Total Slice Area:	86.0388 ft2	
Surface Horizontal Width:	15.6702 ft	
Surface Average Height:	5.49058 ft	

Global Minimum Support Data

Method: spencer

Number of Supports: 3						
Soldier Pile						
Support Type: Pile/Micro Pile						
Start (x, y)	Length (ft)	L Inside SS (ft)	L Outside SS (ft)	Li (ft)	Lo (ft)	Force (lb)
44.841, 1322.91	0.485559	Not Effective	Not Effective	Not Effective	Not Effective	0
44.841, 1322.43	6.73511	Not Effective	Not Effective	Not Effective	Not Effective	0
44.8409, 1315.69	11.3937	2.80477	8.58895	2.80477	8.58895	833.333

Valid and Invalid Surfaces

Method: spencer

Number of Valid Surfaces:	13341
Number of Invalid Surfaces:	0

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.27893

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	0.30718	13.0275	-69.5734	Artificial Fill - af	150	31	103.787	132.736	-28.7323	0	-28.7323	249.945	249.945
2	0.30718	37.746	-67.7885	Artificial Fill - af	150	31	112.997	144.516	-9.12771	0	-9.12771	267.605	267.605
3	0.30718	60.0574	-66.1312	Artificial Fill - af	150	31	123.172	157.529	12.53	0	12.53	290.894	290.894
4	0.30718	80.4141	-64.5763	Artificial Fill - af	150	31	134.042	171.43	35.6657	0	35.6657	317.657	317.657
5	0.30718	99.1383	-63.1058	Artificial Fill - af	150	31	145.417	185.978	59.8769	0	59.8769	346.581	346.581
6	0.30718	116.469	-61.7065	Artificial Fill - af	150	31	157.159	200.995	84.8707	0	84.8707	376.826	376.826
7	0.30718	132.592	-60.368	Artificial Fill - af	150	31	169.166	216.352	110.428	0	110.428	407.829	407.829
8	0.30718	147.649	-59.0826	Artificial Fill - af	150	31	181.36	231.947	136.383	0	136.383	439.206	439.206
9	0.30718	161.759	-57.8436	Artificial Fill - af	150	31	193.68	247.703	162.605	0	162.605	470.684	470.684
10	0.30718	175.018	-56.646	Artificial Fill - af	150	31	206.077	263.558	188.991	0	188.991	502.07	502.07
11	0.30718	187.503	-55.4853	Artificial Fill - af	150	31	218.512	279.462	215.461	0	215.461	533.224	533.224
12	0.30718	199.283	-54.3578	Artificial Fill - af	150	31	230.956	295.376	241.947	0	241.947	564.041	564.041
13	0.30718	210.415	-53.2605	Artificial Fill - af	150	31	243.381	311.267	268.393	0	268.393	594.444	594.444
14	0.30718	220.947	-52.1907	Artificial Fill - af	150	31	255.766	327.107	294.754	0	294.754	624.376	624.376
15	0.30718	230.923	-51.1461	Artificial Fill - af	150	31	268.094	342.874	320.995	0	320.995	653.796	653.796
16	0.30718	240.379	-50.1246	Artificial Fill - af	150	31	280.351	358.549	347.085	0	347.085	682.673	682.673
17	0.30718	249.349	-49.1245	Artificial Fill - af	150	31	292.523	374.117	372.995	0	372.995	710.985	710.985
18	0.30718	257.862	-48.1442	Artificial Fill - af	150	31	304.602	389.564	398.702	0	398.702	738.712	738.712
19	0.30718	265.943	-47.1822	Artificial Fill - af	150	31	316.576	404.878	424.187	0	424.187	765.845	765.845
20	0.30718	273.616	-46.2374	Artificial Fill - af	150	31	328.438	420.049	449.437	0	449.437	792.377	792.377
21	0.30718	280.901	-45.3086	Artificial Fill - af	150	31	340.181	435.068	474.434	0	474.434	818.299	818.299
22	0.30718	287.819	-44.3948	Artificial Fill - af	150	31	351.801	449.929	499.165	0	499.165	843.612	843.612
23	0.30718	294.385	-43.495	Artificial Fill - af	150	31	363.291	464.624	523.623	0	523.623	868.314	868.314
24	0.318707	312.011	-42.5921	Alhaviium Fan - Qal	84	31	327.034	418.253	556.29	0	556.29	856.93	856.93
25	0.318707	318.359	-41.6857	Alhaviium Fan - Qal	84	31	338.438	432.839	580.565	0	580.565	881.951	881.951
26	0.318707	324.364	-40.7918	Alhaviium Fan - Qal	84	31	349.689	447.228	604.514	0	604.514	906.27	906.27
27	0.318707	330.04	-39.9099	Alhaviium Fan - Qal	84	31	360.784	461.417	628.128	0	628.128	929.895	929.895
28	0.318707	335.398	-39.0391	Alhaviium Fan - Qal	84	31	371.719	475.403	651.403	0	651.403	952.836	952.836
29	0.318707	340.451	-38.179	Alhaviium Fan - Qal	84	31	382.492	489.18	674.334	0	674.334	975.098	975.098
30	0.318707	345.21	-37.3289	Alhaviium Fan - Qal	84	31	393.099	502.746	696.912	0	696.912	996.687	996.687
31	0.318707	349.916	-36.4883	Alhaviium Fan - Qal	84	31	403.765	516.387	719.613	0	719.613	1018.26	1018.26
32	0.318707	358.489	-35.6568	Alhaviium Fan - Qal	84	31	418.373	535.07	750.706	0	750.706	1050.86	1050.86
33	0.318707	367.103	-34.8338	Alhaviium Fan - Qal	84	31	433.263	554.113	782.399	0	782.399	1083.9	1083.9
34	0.318707	375.457	-34.019	Alhaviium Fan - Qal	84	31	448.132	573.129	814.046	0	814.046	1116.53	1116.53
35	0.318707	240.676	-33.2119	Alhaviium Fan - Qal	84	31	319.496	408.613	540.248	0	540.248	749.415	749.415
36	0.318707	115.083	-32.4122	Alhaviium Fan - Qal	84	31	185.988	237.865	256.074	0	256.074	374.161	374.161
37	0.318707	122.524	-31.6195	Alhaviium Fan - Qal	84	31	196.129	250.835	277.659	0	277.659	398.411	398.411
38	0.318707	129.733	-30.8335	Alhaviium Fan - Qal	84	31	206.251	263.78	299.204	0	299.204	422.317	422.317
39	0.318707	136.717	-30.0539	Alhaviium Fan - Qal	84	31	216.349	276.695	320.699	0	320.699	445.879	445.879
40	0.318707	143.48	-29.2804	Alhaviium Fan - Qal	84	31	226.419	289.574	342.132	0	342.132	469.091	469.091
41	0.318707	150.027	-28.5127	Alhaviium Fan - Qal	84	31	236.455	302.41	363.494	0	363.494	491.947	491.947
42	0.318707	154.053	-27.7506	Alhaviium Fan - Qal	84	31	243.794	311.795	379.115	0	379.115	507.384	507.384
43	0.318707	152.462	-26.9937	Alhaviium Fan - Qal	84	31	244.699	312.953	381.04	0	381.04	505.687	505.687
44	0.318707	150.445	-26.242	Alhaviium Fan - Qal	84	31	245.05	313.402	381.789	0	381.789	502.592	502.592
45	0.318707	148.23	-25.495	Alhaviium Fan - Qal	84	31	245.102	313.468	381.899	0	381.899	498.781	498.781
46	0.318707	145.82	-24.7527	Alhaviium Fan - Qal	84	31	244.849	313.145	381.36	0	381.36	494.251	494.251
47	0.318707	143.219	-24.0148	Alhaviium Fan - Qal	84	31	244.29	312.43	380.171	0	380.171	489.011	489.011
48	0.318707	140.431	-23.281	Alhaviium Fan - Qal	84	31	243.42	311.317	378.32	0	378.32	483.058	483.058
49	0.318707	137.458	-22.5513	Alhaviium Fan - Qal	84	31	242.235	309.801	375.795	0	375.795	476.387	476.387
50	0.318707	134.304	-21.8255	Alhaviium Fan - Qal	84	31	240.781	307.942	372.703	0	372.703	469.133	469.133

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.27893

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	34.1162	1326.55	0	0	0
2	34.4234	1325.72	-55.636	-30.1734	28.4726
3	34.7305	1324.97	-97.2743	-52.7554	28.4726
4	35.0377	1324.28	-126.478	-68.5939	28.4727
5	35.3449	1323.63	-144.678	-78.464	28.4725
6	35.6521	1323.02	-153.162	-83.0651	28.4725
7	35.9593	1322.45	-153.091	-83.027	28.4726
8	36.2664	1321.91	-145.512	-78.9166	28.4726
9	36.5736	1321.4	-131.369	-71.246	28.4725
10	36.8808	1320.91	-111.516	-60.4791	28.4726
11	37.188	1320.45	-86.7315	-47.0377	28.4726
12	37.4952	1320	-57.7248	-31.3063	28.4726
13	37.8023	1319.57	-25.1452	-13.6372	28.4727
14	38.1095	1319.16	10.4111	5.64635	28.4727
15	38.4167	1318.76	48.395	26.2464	28.4726
16	38.7239	1318.38	88.2992	47.8879	28.4726
17	39.0311	1318.01	129.654	70.3161	28.4726
18	39.3382	1317.66	172.023	93.2945	28.4726
19	39.6454	1317.32	215.002	116.603	28.4725
20	39.9526	1316.98	258.211	140.037	28.4726
21	40.2598	1316.66	301.298	163.405	28.4726
22	40.567	1316.35	343.932	186.527	28.4726
23	40.8741	1316.05	385.804	209.236	28.4726
24	41.1813	1315.76	426.623	231.373	28.4726
25	41.5	1315.47	485.196	263.14	28.4726
26	41.8187	1315.18	541.917	293.901	28.4726
27	42.1374	1314.91	596.526	323.518	28.4726
28	42.4562	1314.64	648.782	351.858	28.4726
29	42.7749	1314.38	698.456	378.798	28.4726
30	43.0936	1314.13	745.332	404.221	28.4726
31	43.4123	1313.89	789.208	428.017	28.4726
32	43.731	1313.66	829.934	450.104	28.4726
33	44.0497	1313.43	868.01	470.754	28.4726
34	44.3684	1313.2	903.208	489.843	28.4726
35	44.6871	1312.99	935.255	507.223	28.4726
36	45.0058	1312.78	248.764	134.914	28.4726
37	45.3245	1312.58	241.202	130.813	28.4727
38	45.6432	1312.38	233.067	126.401	28.4726
39	45.9619	1312.19	224.138	121.558	28.4725
40	46.2806	1312.01	214.204	116.17	28.4725
41	46.5993	1311.83	203.057	110.125	28.4725
42	46.9181	1311.66	190.498	103.314	28.4726
43	47.2368	1311.49	176.234	95.5782	28.4726
44	47.5555	1311.33	159.97	86.7575	28.4726
45	47.8742	1311.17	141.717	76.8585	28.4727
46	48.1929	1311.02	121.506	65.897	28.4725
47	48.5116	1310.87	99.3721	53.8931	28.4726
48	48.8303	1310.73	75.3608	40.8709	28.4726
49	49.149	1310.59	49.5243	26.8588	28.4726
50	49.4677	1310.46	21.9222	11.8892	28.4726
51	49.7864	1310.33	0	0	0

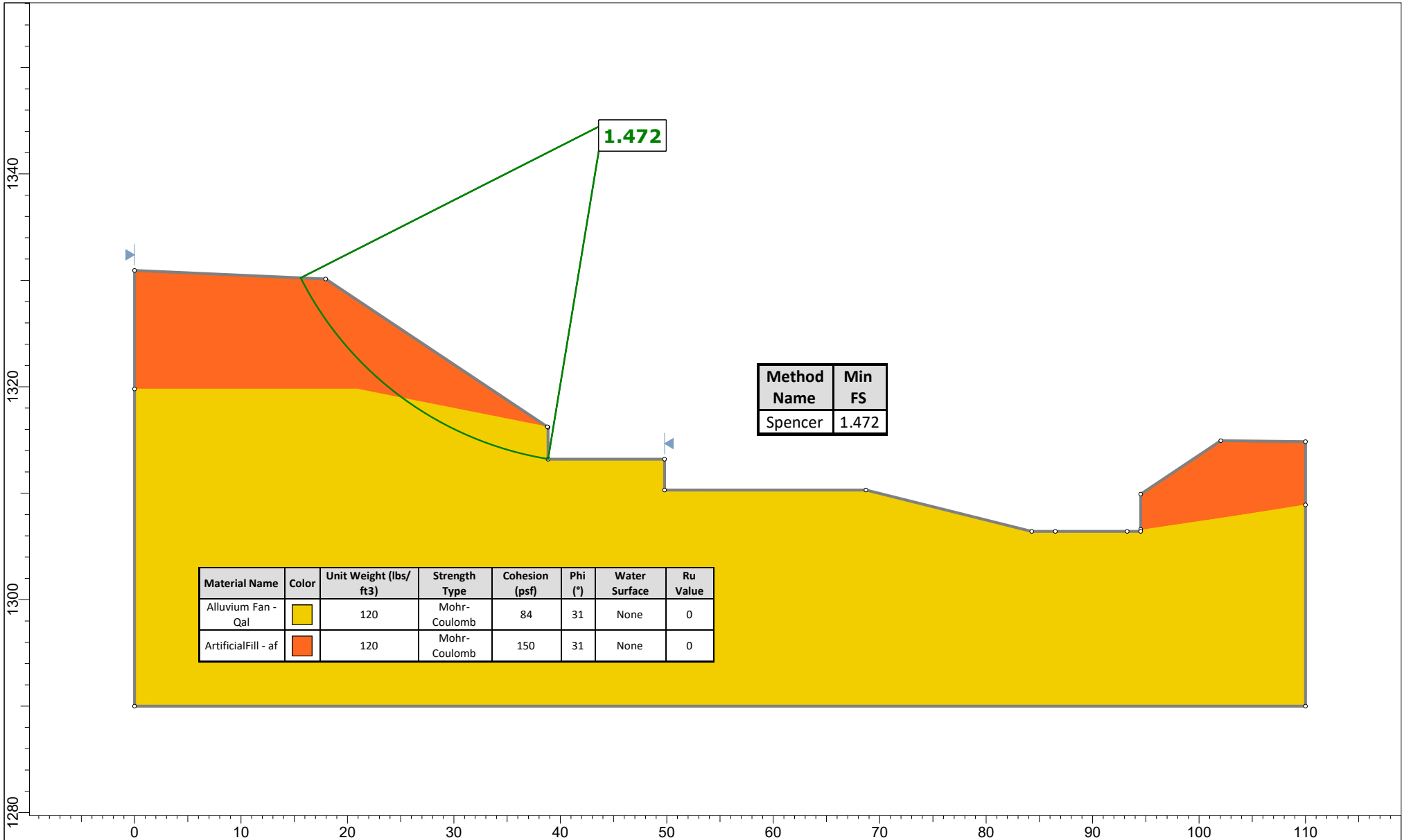
Discharge Sections

Entity Information

- ◆

Group 1
- Shared Entities

Type	Coordinates (x,y)
External Boundary	0, 1290
	110, 1290
	110, 1308.9
	110, 1314.85
	102.037, 1314.94
	94.5124, 1309.92
	94.5124, 1306.61
	94.5124, 1306.42
	84.2785, 1306.42
	68.7009, 1310.3
	49.7864, 1310.3
	49.7864, 1313.8
	49.1171, 1314.25
	46.9937, 1315.66
	44.8409, 1315.69
	44.841, 1322.43
	44.841, 1322.91
	43.6939, 1322.91
	43.6939, 1322.87
	32.7317, 1327.08
	23.0013, 1329.85
Material Boundary	0, 1330.92
	0, 1319.79
Material Boundary	45.0165, 1315
	49.1171, 1314.25
Material Boundary	0, 1319.79
	20.8946, 1319.79
	45.0165, 1315
Material Boundary	94.5124, 1306.61
	110, 1308.9



ALLAN E. SEWARD
ENGINEERING GEOLOGY, INC.
 Geological And Geotechnical Consultants

SLIDEINTERPRET 9.034

Analysis Description				Cross Section I-I' Temp Exca for Wall w/ Conv. Ftg			
Client		La Canada Unified School District			Drawn By		F. Bouya
Project		Proposed Buildings C, D, E & F Excavated Slope			File Name		Is1a.slmd
					Scale		1:150
Project No.:		24-2775-6		Date:		6/19/2024	Run Number
							Run No. 7

Slide2 Analysis Information

Is1a

Project Summary

File Name:	Is1a.slmd
Slide2 Modeler Version:	9.034
Compute Time:	00h:00m:01.957s
Project Title:	Proposed Buildings C, D, E & F
Analysis:	Cross Section I-I' Temp Exca for Wall w/ Conv. Ftg
Author:	F. Bouya
Date Created:	6/19/2024
Comments	
La Canada Unified School District	
Excavated Slope	
24-2775-6	

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right

Analysis Options

Slices Type:	Vertical
Analysis Methods Used	
Spencer	
Number of slices:	50
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes
Eliminate vertical segments in non-circular search	Yes

Groundwater Analysis

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Advanced Groundwater Method:	None

Random Numbers

Pseudo-random Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Surface Options

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Materials

Alluvium Fan - Qal	
Color	
Strength Type	Mohr-Coulomb
Unit Weight	120 lbs/ft3
Cohesion	84 psf
Phi	31 °
Water Surface	None
Ru Value	0
ArtificialFill - af	
Color	
Strength Type	Mohr-Coulomb
Unit Weight	120 lbs/ft3
Cohesion	150 psf
Phi	31 °
Water Surface	None
Ru Value	0

Global Minimums

Method: spencer		
FS		1.472080
Center:	44.017, 1344.643	
Radius:	31.864	
Left Slip Surface Endpoint:	15.600, 1330.229	
Right Slip Surface Endpoint:	38.842, 1313.202	
Resisting Moment:	341164 lb-ft	
Driving Moment:	231756 lb-ft	
Resisting Horizontal Force:	8679.09 lb	
Driving Horizontal Force:	5895.79 lb	
Total Slice Area:	116.952 ft2	
Surface Horizontal Width:	23.2421 ft	
Surface Average Height:	5.03192 ft	

Global Minimum Support Data

No Supports Present

Valid and Invalid Surfaces

Method: spencer	
Number of Valid Surfaces:	9936
Number of Invalid Surfaces:	0

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.47208														
Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]	
1	0.456384	23.1691	-62.2235	ArtificialFi ll - af	150	31	83.5202	122.948	-45.0214	0	-45.0214	113.547	113.547	
2	0.456384	67.878	-60.5095	ArtificialFi ll - af	150	31	103.143	151.835	3.05384	0	3.05384	185.429	185.429	
3	0.456384	109.562	-58.8819	ArtificialFi ll - af	150	31	122.587	180.458	50.6906	0	50.6906	253.761	253.761	
4	0.456384	148.636	-57.3278	ArtificialFi ll - af	150	31	141.869	208.843	97.9316	0	97.9316	319.152	319.152	
5	0.456384	185.423	-55.837	ArtificialFi ll - af	150	31	161.003	237.01	144.808	0	144.808	382.046	382.046	
6	0.456384	214.681	-54.4014	ArtificialFi ll - af	150	31	177.54	261.353	185.323	0	185.323	433.321	433.321	
7	0.456384	232.265	-53.0144	ArtificialFi ll - af	150	31	189.289	278.649	214.109	0	214.109	465.436	465.436	
8	0.456384	248.002	-51.6707	ArtificialFi ll - af	150	31	200.461	295.095	241.479	0	241.479	495.04	495.04	
9	0.456384	262.235	-50.3658	ArtificialFi ll - af	150	31	211.16	310.844	267.69	0	267.69	522.628	522.628	
10	0.456384	275.085	-49.0959	ArtificialFi ll - af	150	31	221.398	325.916	292.774	0	292.774	548.326	548.326	
11	0.456384	286.658	-47.8577	ArtificialFi ll - af	150	31	231.189	340.329	316.761	0	316.761	572.244	572.244	
12	0.456384	297.043	-46.6484	ArtificialFi ll - af	150	31	240.541	354.096	339.673	0	339.673	594.469	594.469	
13	0.456384	306.32	-45.4656	ArtificialFi ll - af	150	31	249.463	367.229	361.53	0	361.53	615.08	615.08	
14	0.456384	314.558	-44.3071	ArtificialFi ll - af	150	31	257.961	379.739	382.35	0	382.35	634.146	634.146	
15	0.456384	321.817	-43.1711	ArtificialFi ll - af	150	31	266.041	391.633	402.145	0	402.145	651.721	651.721	
16	0.456384	328.152	-42.0558	ArtificialFi ll - af	150	31	273.707	402.918	420.927	0	420.927	667.857	667.857	
17	0.456384	333.612	-40.9598	ArtificialFi ll - af	150	31	280.963	413.6	438.705	0	438.705	682.597	682.597	
18	0.456384	338.24	-39.8818	ArtificialFi ll - af	150	31	287.813	423.684	455.486	0	455.486	695.979	695.979	
19	0.456384	342.075	-38.8204	ArtificialFi ll - af	150	31	294.258	433.172	471.278	0	471.278	708.041	708.041	
20	0.456384	345.152	-37.7746	ArtificialFi ll - af	150	31	300.302	442.068	486.082	0	486.082	718.807	718.807	
21	0.456384	347.504	-36.7434	ArtificialFi ll - af	150	31	305.943	450.373	499.905	0	499.905	728.308	728.308	
22	0.470967	360.332	-35.7098	Alluvium Fan - Qal	84	31	269.468	396.679	520.385	0	520.385	714.088	714.088	
23	0.470967	361.361	-34.6735	Alluvium Fan - Qal	84	31	274.133	403.546	531.814	0	531.814	721.445	721.445	
24	0.470967	361.681	-33.6499	Alluvium Fan - Qal	84	31	278.373	409.787	542.201	0	542.201	727.502	727.502	
25	0.470967	361.319	-32.6384	Alluvium Fan - Qal	84	31	282.186	415.401	551.544	0	551.544	732.276	732.276	
26	0.470967	360.297	-31.6382	Alluvium Fan - Qal	84	31	285.572	420.385	559.837	0	559.837	735.785	735.785	
27	0.470967	358.638	-30.6487	Alluvium Fan - Qal	84	31	288.526	424.734	567.075	0	567.075	738.04	738.04	
28	0.470967	356.361	-29.6691	Alluvium Fan - Qal	84	31	291.047	428.444	573.251	0	573.251	739.054	739.054	
29	0.470967	353.484	-28.6991	Alluvium Fan - Qal	84	31	293.13	431.511	578.355	0	578.355	738.833	738.833	
30	0.470967	350.023	-27.7379	Alluvium Fan - Qal	84	31	294.772	433.928	582.377	0	582.377	737.384	737.384	
31	0.470967	345.995	-26.7852	Alluvium Fan - Qal	84	31	295.968	435.689	585.309	0	585.309	734.717	734.717	
32	0.470967	341.414	-25.8403	Alluvium Fan - Qal	84	31	296.714	436.787	587.136	0	587.136	730.831	730.831	
33	0.470967	336.293	-24.903	Alluvium Fan - Qal	84	31	297.004	437.214	587.847	0	587.847	725.731	725.731	
34	0.470967	330.645	-23.9728	Alluvium Fan - Qal	84	31	296.832	436.961	587.426	0	587.426	719.415	719.415	
35	0.470967	324.48	-23.0492	Alluvium Fan - Qal	84	31	296.192	436.019	585.859	0	585.859	711.885	711.885	
36	0.470967	317.811	-22.1319	Alluvium Fan - Qal	84	31	295.078	434.378	583.126	0	583.126	703.136	703.136	
37	0.470967	310.646	-21.2205	Alluvium Fan - Qal	84	31	293.481	432.027	579.214	0	579.214	693.169	693.169	
38	0.470967	302.996	-20.3148	Alluvium Fan - Qal	84	31	291.392	428.953	574.099	0	574.099	681.974	681.974	
39	0.470967	294.868	-19.4143	Alluvium Fan - Qal	84	31	288.805	425.144	567.76	0	567.76	669.545	669.545	
40	0.470967	286.272	-18.5187	Alluvium Fan - Qal	84	31	285.709	420.587	560.176	0	560.176	655.877	655.877	
41	0.470967	277.214	-17.6279	Alluvium Fan - Qal	84	31	282.095	415.267	551.321	0	551.321	640.958	640.958	
42	0.470967	267.701	-16.7414	Alluvium Fan - Qal	84	31	277.952	409.168	541.17	0	541.17	624.778	624.778	
43	0.470967	257.74	-15.859	Alluvium Fan - Qal	84	31	273.268	402.273	529.695	0	529.695	607.326	607.326	
44	0.470967	247.337	-14.9805	Alluvium Fan - Qal	84	31	268.032	394.564	516.866	0	516.866	588.587	588.587	
45	0.470967	236.498	-14.1056	Alluvium Fan - Qal	84	31	262.23	386.023	502.652	0	502.652	568.546	568.546	
46	0.470967	225.227	-13.234	Alluvium Fan - Qal	84	31	255.849	376.63	487.018	0	487.018	547.187	547.187	
47	0.470967	213.53	-12.3655	Alluvium Fan - Qal	84	31	248.873	366.361	469.928	0	469.928	524.49	524.49	
48	0.470967	201.411	-11.4999	Alluvium Fan - Qal	84	31	241.288	355.195	451.344	0	451.344	500.435	500.435	
49	0.470967	188.873	-10.6369	Alluvium Fan - Qal	84	31	233.076	343.107	431.226	0	431.226	475.001	475.001	
50	0.470967	175.779	-9.77642	Alluvium Fan - Qal	84	31	223.743	329.368	408.362	0	408.362	446.914	446.914	

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.47208

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	15.5997	1330.23	0	0	
2	16.0561	1329.36	-77.2024	-37.7041	26.03
3	16.5124	1328.56	-121.904	-59.5354	26.0299
4	16.9688	1327.8	-139.638	-68.1965	26.03
5	17.4252	1327.09	-134.82	-65.8434	26.03
6	17.8816	1326.41	-111.063	-54.2412	26.0301
7	18.338	1325.78	-74.1063	-36.192	26.0299
8	18.7944	1325.17	-30.9247	-15.103	26.03
9	19.2508	1324.59	16.8072	8.20829	26.0299
10	19.7071	1324.04	67.7448	33.0852	26.03
11	20.1635	1323.52	120.732	58.9632	26.03
12	20.6199	1323.01	174.768	85.3532	26.03
13	21.0763	1322.53	228.98	111.829	26.0299
14	21.5327	1322.06	282.604	138.018	26.0299
15	21.9891	1321.62	334.971	163.593	26.0299
16	22.4454	1321.19	385.488	188.265	26.03
17	22.9018	1320.78	433.637	211.779	26.0299
18	23.3582	1320.38	478.957	233.913	26.03
19	23.8146	1320	521.043	254.467	26.03
20	24.271	1319.63	559.541	273.269	26.03
21	24.7274	1319.28	594.137	290.165	26.03
22	25.1837	1318.94	624.559	305.022	26.0299
23	25.6547	1318.6	673.572	328.959	26.03
24	26.1257	1318.28	717.47	350.398	26.03
25	26.5966	1317.96	756.087	369.258	26.03
26	27.0676	1317.66	789.292	385.475	26.03
27	27.5386	1317.37	816.982	398.998	26.03
28	28.0095	1317.09	839.081	409.79	26.0299
29	28.4805	1316.82	855.539	417.828	26.03
30	28.9515	1316.57	866.333	423.1	26.03
31	29.4224	1316.32	871.464	425.605	26.0299
32	29.8934	1316.08	870.954	425.356	26.0299
33	30.3644	1315.85	864.851	422.376	26.03
34	30.8353	1315.63	853.226	416.699	26.03
35	31.3063	1315.42	836.17	408.369	26.03
36	31.7773	1315.22	813.798	397.443	26.03
37	32.2482	1315.03	786.247	383.987	26.0299
38	32.7192	1314.85	753.676	368.08	26.0299
39	33.1902	1314.67	716.265	349.809	26.0299
40	33.6612	1314.51	674.218	329.275	26.03
41	34.1321	1314.35	627.763	306.587	26.03
42	34.6031	1314.2	577.149	281.868	26.03
43	35.0741	1314.06	522.651	255.252	26.0299
44	35.545	1313.93	464.566	226.885	26.03
45	36.016	1313.8	403.22	196.925	26.03
46	36.487	1313.68	338.962	165.542	26.0299
47	36.9579	1313.57	272.169	132.922	26.03
48	37.4289	1313.47	203.248	99.262	26.0299
49	37.8999	1313.37	132.631	64.7746	26.0301
50	38.3708	1313.28	60.7869	29.6871	26.03
51	38.8418	1313.2	0	0	0

Discharge Sections

Entity Information

- ◆

Group 1

Shared Entities

Type	Coordinates (x,y)
External Boundary	0, 1290
	110, 1290
	110, 1308.9
	110, 1314.85
	102.037, 1314.94
	94.5124, 1309.92
	94.5124, 1306.61
	94.5124, 1306.42
	93.25, 1306.42
	86.5, 1306.42
	84.2785, 1306.42
	68.7009, 1310.3
	49.7864, 1310.3
	49.7857, 1313.2
	38.8418, 1313.2
	38.841, 1316.2
	38.7822, 1316.24
	17.9542, 1330.12
	0, 1330.92
	0, 1319.79
Material Boundary	94.5124, 1306.61
	110, 1308.9
Material Boundary	0, 1319.79
	20.8946, 1319.79
	38.7822, 1316.24

Appendix E

APPENDIX E

RECOMMENDED EARTHWORK SPECIFICATIONS

The following specifications are recommended to provide a basis for quality control during the placement of compacted fill or backfill, as applicable. If there may be any perceived discrepancy between the recommendations in this Appendix, and those provided in the main text of the report, the more stringent requirement governs.

1. Areas on which compacted fill will be placed shall be observed by Allan E. Seward Engineering Geology, Inc. (AESEGI) prior to the placement of fill.
2. All drainage devices shall be properly installed and observed by AESEGI and/or the owner's representative(s) prior to placement of backfill.
3. Fill soils shall consist of imported soils or on-site soils which are free of organics, cobbles, and deleterious material, provided that each material is approved by AESEGI. AESEGI shall evaluate and/or test the import material for its conformance with the report recommendations prior to its delivery to the site. The contractor shall notify AESEGI at least 72 hours prior to importing material to the site.
4. The thickness of the controlled lifts in which Fill is placed shall be compatible with the type of compaction equipment used. The fill materials shall be brought to Optimum Moisture Content or above, thoroughly mixed during spreading to obtain a near uniform water content and a uniform blend of materials, and then placed in lifts with a pre-compaction thickness not exceeding 8 inches. Each lift shall be compacted to the specified percentage of Maximum Dry Density determined in accordance with ASTM Test Method D1557. Density testing shall be performed by AESEGI to verify relative compaction. The contractor shall provide proper access and level areas for testing.
5. Rocks or rock fragments less than eight (8) inches in the largest dimension may be utilized in the fill, provided they are not placed in concentrated pockets. However, rocks larger than four (4) inches in dimension shall not be placed within three (3) ft of finish grade.
6. Rocks greater than eight (8) inches in largest dimension shall be taken offsite, or placed in areas designated by the Geotechnical Engineer to be suitable for rock disposal.
7. Where space limitations do not allow for conventional fill compaction operations, special backfill materials and procedures may be required. Pea gravel or other select fill can be used in areas of limited space. A sand and Portland Cement slurry (2 sacks per cubic-yard of slurry mix) shall be used in limited space areas for shallow backfill near final pad grade, and pea gravel shall be placed in deeper backfill near drainage systems.

APPENDIX E

8. AESEGI shall observe the placement of fill and conduct in-place field density tests on the compacted fill in order to check adequacy of in-situ water content and relative compaction. Where measured in-situ density of compacted fill soil is lower than the required relative compaction, the soil shall be water-conditioned and recompacted until adequate relative compaction is achieved.
9. The Contractor shall achieve with the specified relative compaction out to the finish slope face of fill slopes, buttresses, and stabilization fills, as set forth in the specifications for compacted fill. This may be achieved either by overbuilding the slope and cutting back as necessary, by direct compaction of the slope face with suitable equipment, or by other procedures which produce the required result.
10. Any abandoned underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines, or others not discovered prior to grading are to be removed or treated to the satisfaction of the Geotechnical Engineer and/or the controlling agency for the project.
11. The Contractor shall have suitable and sufficient equipment during a particular operation to handle the volume of fill being placed. When necessary, fill placement equipment shall be shut down temporarily in order to permit proper compaction of fill, correction of deficient areas, or to facilitate required field testing.
12. The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications.
13. Final reports shall be submitted after completion of earthwork and after the Geotechnical Engineer and Engineering Geologist have finished their observations of the work. No additional excavation or filling shall be performed without prior notification to the Geotechnical Engineer and/or Engineering Geologist.
14. Whenever the words “supervision”, “inspection”, or “control” are used, they shall mean observation of the work and/or testing of the compacted fill by AESEGI to assess whether substantial compliance with plans, specifications and design concepts has been achieved. However, these words do not refer to direction by AESEGI of the actual work of the Contractor or the Contractor’s workers.

APPENDIX E

RECOMMENDED SPECIFICATIONS FOR PLACEMENT OF TRENCH BACKFILL

1. Trench excavations in which backfill will be placed shall be free of trash, debris or other deleterious materials prior to backfill placement, and shall be observed by a representative of Allan E. Seward Engineering Geology, Inc. (AESEGI).
2. Except as stipulated herein, soils obtained from the excavation may be used as backfill if they are free of organics and other deleterious materials.
3. Rocks generated by trench excavation operations that do not exceed three (3) inches in largest dimension may be used as trench backfill material. However, material larger than 1-½ inches in dimension may not be placed within 12 inches of the top of pipes. No more than 30 percent of the backfill volume shall contain particles larger than 1-½ inches in dimension, and particles larger than 1-½ inches in dimension shall be well mixed with finer soil.
4. Clean aggregates with a Sand Equivalent (SE) greater than or equal to 30 (as determined by ASTM Standard Test Method D2419) or other soils authorized by the Geotechnical Engineer or his representative in the field, may be used for bedding and shading material in pipe trenches.
5. Trench backfill other than bedding and shading shall be compacted by mechanical methods as tamping sheepsfoot, vibrating or pneumatic rollers, or other mechanical tampers to achieve the specified density. The backfill materials shall be brought to Optimum Moisture Content or above, thoroughly mixed during spreading to obtain a near uniform water content and uniform blend of materials, and then placed in horizontal lifts with a pre-compaction thickness not exceeding 8 inches. Trench backfills shall be compacted to the specified percentage of Maximum Dry Density determined in accordance with ASTM Test Method D1557.
6. The Contractor shall select the equipment and procedure for achieving the specified density without damage to the pipe, the adjacent ground, existing improvements, or completed work.
7. Observations and field tests shall be performed during construction by AESEGI to confirm that the required degree of compaction has been achieved. Where achieved compaction is less than that specified value, the water content shall be adjusted as necessary and additional compactive effort shall be made until the specified compaction is achieved. Field density tests may be omitted at the discretion of the Geotechnical Engineer or his

APPENDIX E

representative in the field.

8. Whenever, in the opinion of AESEGI or the Owner's Representative(s), an unstable condition is being created either by cutting or filling, the work shall not proceed until an investigation has been made and the excavation plan has been revised, if deemed necessary.
9. Fill material shall not be placed, spread, or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests by AESEGI indicate the water content and density of the fill materials and of the fill surface over which they are to be compacted satisfy the requirements of the specifications.
10. Whenever the words "supervision", "inspection", or "control" are used, they shall mean observation of the work and/or testing of the compacted fill by AESEGI to assess whether substantial compliance with plans, specifications and design concepts has been achieved.

APPENDIX E

DRAINAGE AND EROSION CONTROL RECOMMENDATIONS

Slopes and pads for this project shall be designed to direct surficial runoff away from structures and to reduce water-induced surficial erosion/sloughing. Permanent erosion control measures shall be initiated immediately following completion of grading. All constructed slopes will undergo some erosion when subjected to sustained water influx. To maintain appropriate long-term drainage and erosion control, the following points shall be incorporated in slope protection, landscaping, irrigation, and modifications to slopes, pads and structures:

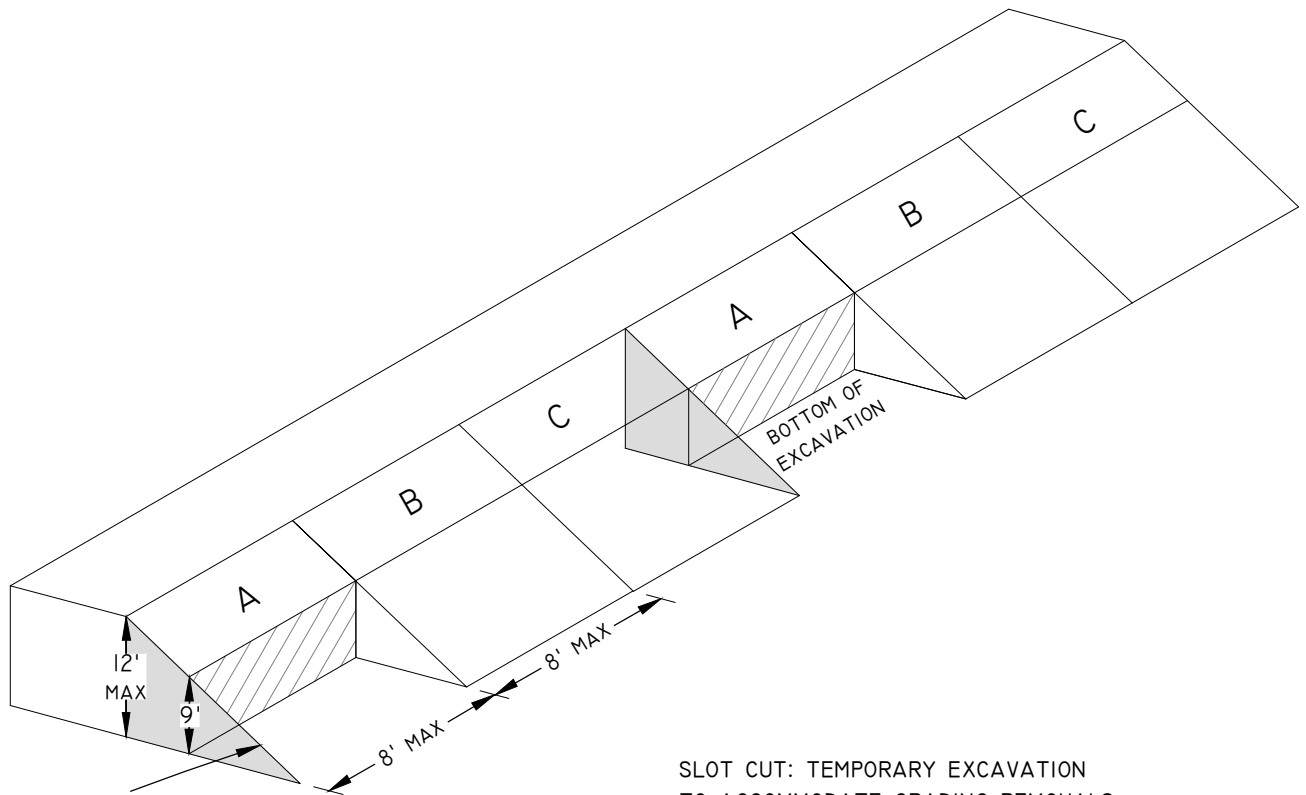
1. All interceptor ditches, drainage terraces, down-drains and any other drainage devices shall be maintained and kept clear of debris. A qualified Engineer should review any proposed additions or revisions to these systems in order to evaluate their impact on slope erosion.
2. Retaining walls shall have adequate freeboard to provide a catchment area for minor slope erosion. Periodic inspection, and if necessary, cleanout of deposited soil and debris shall be performed, particularly during and after periods of rainfall.
3. The future developers shall be made aware of the **potential problems**, which may develop **when drainage is altered** by landscaping and/or by construction of retaining walls and paved walkways. Pondered water, water directed over slope faces, leaking irrigation systems, **over-watering**, or other conditions which could lead to excessive soil moisture, **must be avoided**.
4. Surficial slope soils may be subject to water-induced mass erosion. Therefore, a suitable proportion of slope planting shall have root systems which will extend well below three feet. We suggest consideration of drought-resistant shrubs and low trees for this purpose. Intervening areas can then be planted with lightweight surface plants with shallower root systems. All plants shall be lightweight and require low moisture. Any loose slough generated during planting of shrubs, trees, and other surface plants shall be removed from slope faces.
5. Construction delays, climate/weather conditions, and plant growth rates may necessitate additional short-term, non-plant erosion control measures such as matting, netting, plastic sheets, deep (5-ft) staking, etc.
6. Significant erosion can be initiated by seemingly insignificant events such as rodent burrowing, human trespass (footprints, etc.), small concentrations of uncontrolled surface/subsurface water, or poor compaction of utility trench backfill on slopes.
7. High and/or fluctuating water content in slope materials is a major factor in slope erosion

APPENDIX E

and/or slope failures. Therefore, all possible precautions shall be taken to maintain moderate and uniform soil moisture in soil and rock slopes. Slope irrigation systems shall be properly operated and maintained and irrigation system controls shall be placed under strict control.

EROSION CONTROL REFERENCES

1. "Slope Protection for Residential Developments", National Academy of Sciences, Washington D.C. (1969).
2. "Guide for Erosion and Debris Control in Hillside Areas", Department of Building and Safety, City of Los Angeles. (1970).
3. "Slope Stability Report", Orange County Department of Building and Safety (1973).
4. "Guides for Erosion and Sediment Control", Soil Conservation Service, Davis, California, U.S. Department of Agriculture (1977).
5. "Rain-Care and Protection of Hillside Homes", brochure undated, published by Building and Safety Division, Los Angeles County Engineer.
6. "Guidelines for Erosion and Sediment Control Planning and Implementation: Office of Research and Monitoring", U.S. Environmental Protection Agency (1972).
7. "Resource Conservation Glossary", Soil Conservation Society of America (1970).
8. "Standards and Specifications for Soil Erosion and Sediment Control Developing Areas", Soil Conservation Service, U.S. Department of Agriculture (1975).
9. "Homeowners Guide for Debris and Erosion Control", Los Angeles County Flood Control District (undated).
10. "Grading Guidelines (8 pages, stapled sheets)", Building and Safety Division, Department of County Engineer, County of Los Angeles (undated, but probably about 1977).
11. "Biotechnical Slope Protection and Erosion Control", Donald H. Gray and Andrew T. Leiser, Robert E. Krieger Publishing Company, Malabuv, Florida, 1989.



TEMPORARY SLOPE BETWEEN
SLOT CUTS (NO STEEPER THAN 1.5:1)

SLOT CUT: TEMPORARY EXCAVATION
TO ACCOMMODATE GRADING REMOVALS

*EXCAVATED SLOTS SHOULD BE CONTINUOUSLY
OBSERVED BY A REPRESENTATIVE OF AESEGI

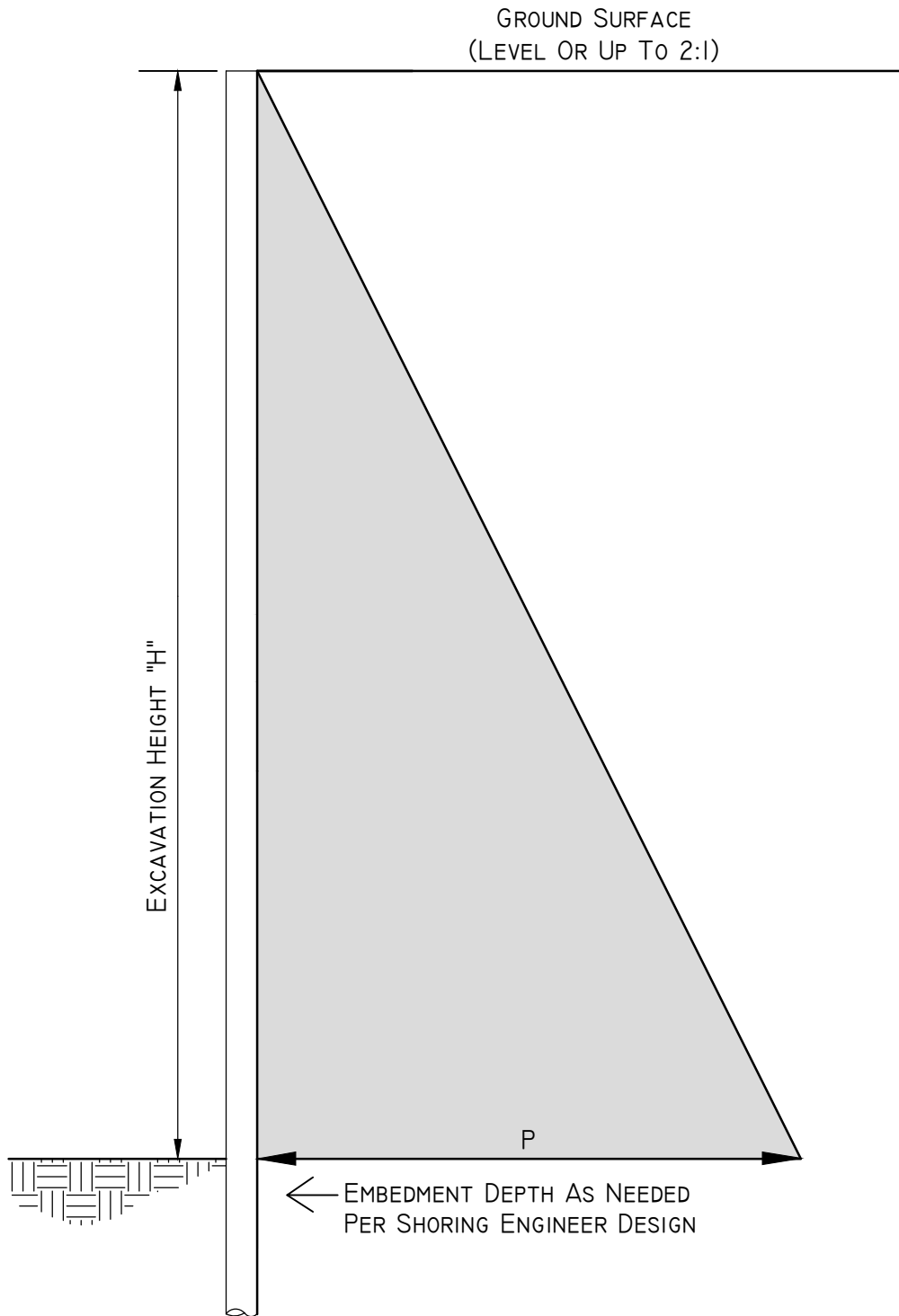
A-B-C SLOT CUTTING SEQUENCE

1. THE AREA TO BE OVER-EXCAVATED SHOULD INITIALLY BE EXCAVATED AT AN INCLINATION NO STEEPER THAN 1.5:1 (H:V).
2. THEN, VERTICAL CUTS UP TO 9 FT IN HEIGHT SHOULD BE EXCAVATED DOWN TO THE REQUIRED REMOVAL BOTTOM AT THE LOCATIONS OF THE "A" SLOTS. THE WIDTH OF THE SLOTS SHOULD NOT EXCEED 8 FT. THE TOTAL EXCAVATION HEIGHT (9 FT. VERTICAL PLUS 1.5:1 SLOPE) SHOULD NOT EXCEED 12 FT.
3. THEN, THE "A" SLOTS SHOULD BE BACKFILLED WITH COMPACTED FILL, IN ACCORDANCE WITH THE GRADING RECOMMENDATIONS / SPECIFICATIONS PROVIDED IN THE REPORT.
4. THEN, THE "B" SLOTS SHOULD BE EXCAVATED AND BACKFILLED AS DESCRIBED ABOVE IN STEPS 2 AND 3.
5. THEN, THE "C" SLOTS SHOULD BE EXCAVATED AND BACKFILLED AS DESCRIBED ABOVE IN STEPS 2 AND 3.



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SLOT CUTTING PROCEDURE



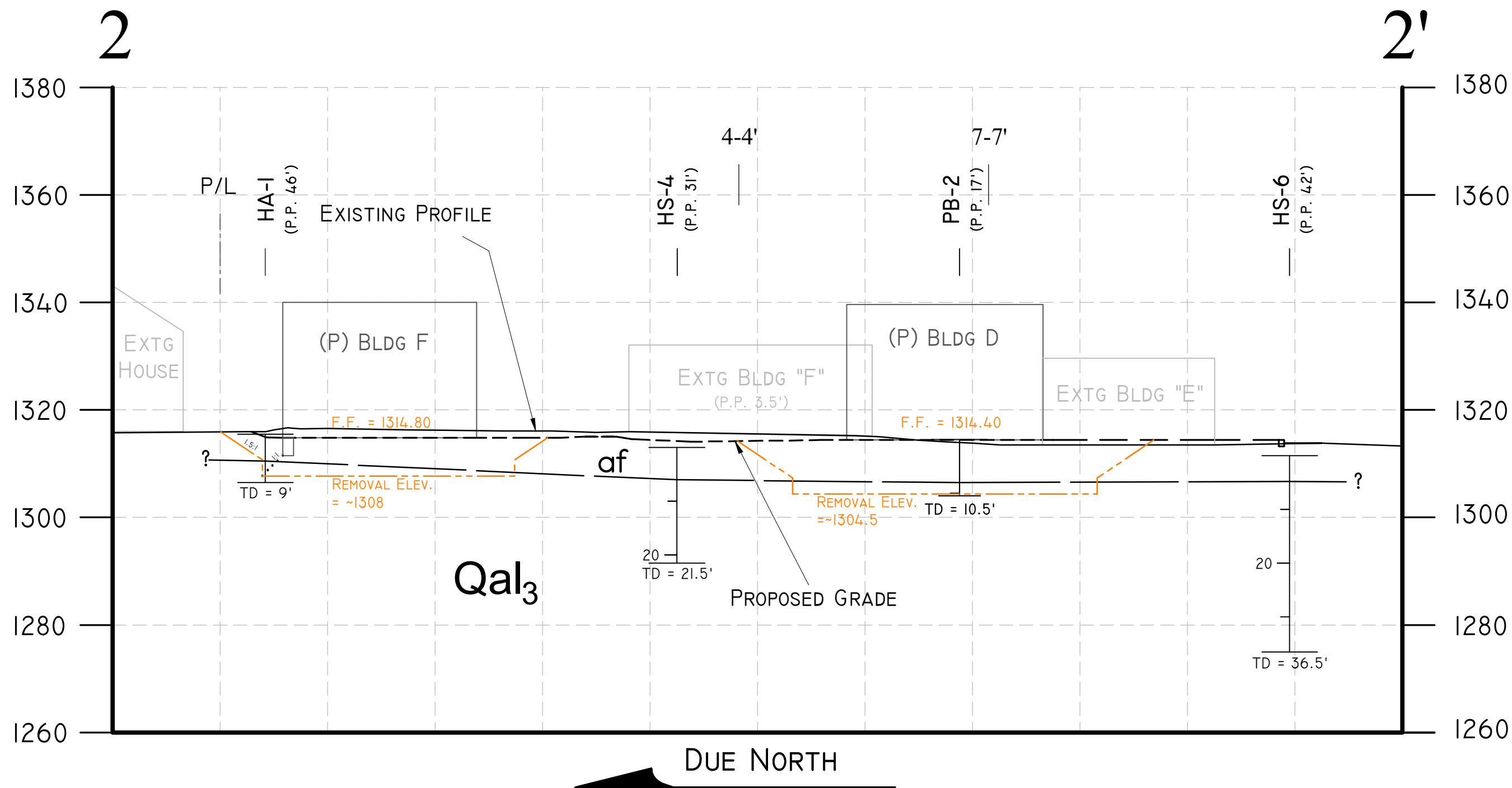
$P = \text{MIN. } 38H \text{ (LEVEL GROUND SURFACE)}$
 $\text{OR } 60H \text{ (2:1 GROUND SURFACE) FOR}$
 ACTIVE PRESSURES

* NO SURCHARGE



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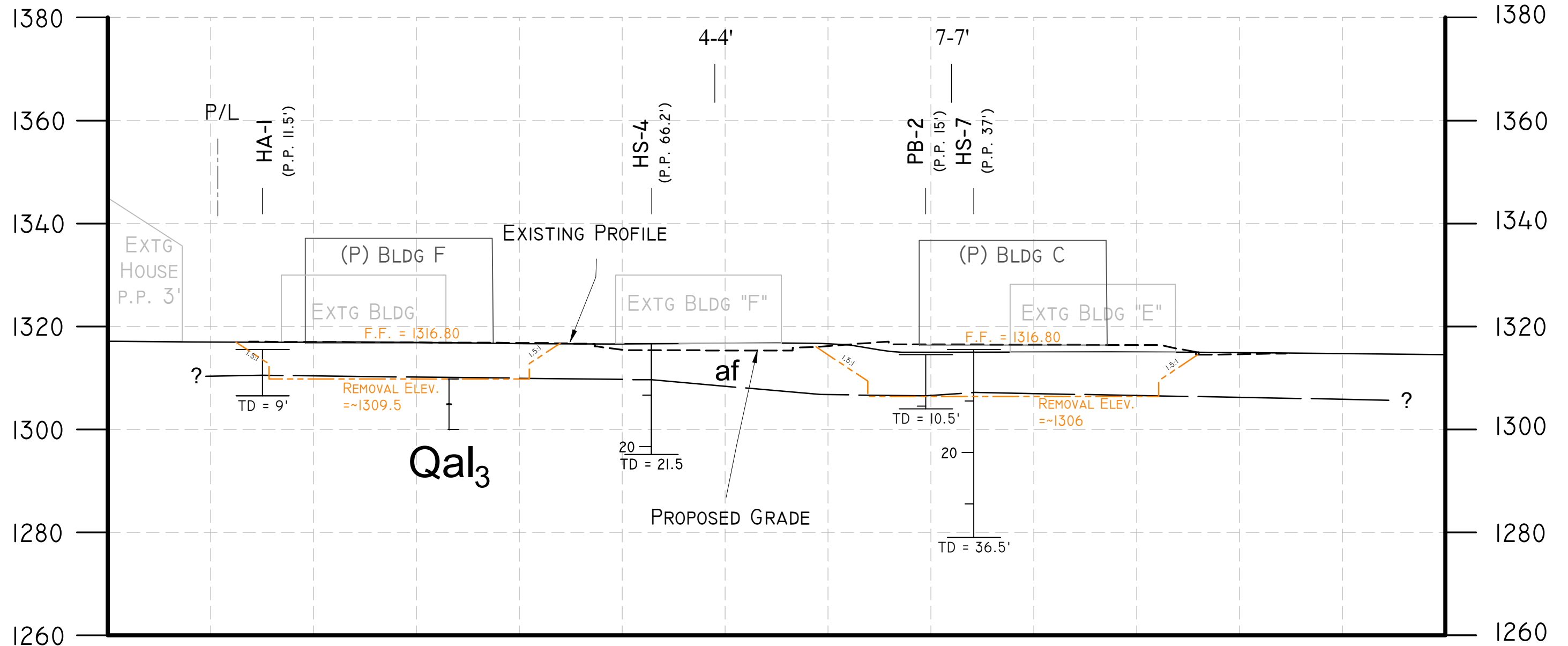
ACTIVE LATERAL EARTH PRESSURES
TEMPORARY EXCAVATION SUPPORTED BY PILE



		ALLAN E. SEWARD ENGINEERING GEOLOGY, INC. Geological and Geotechnical Consultants
CROSS SECTION 2-2'		
JOB No.: 24-2775-6		
DATE: 6/19/24	SCALE: 1"=20' (H=V)	

3

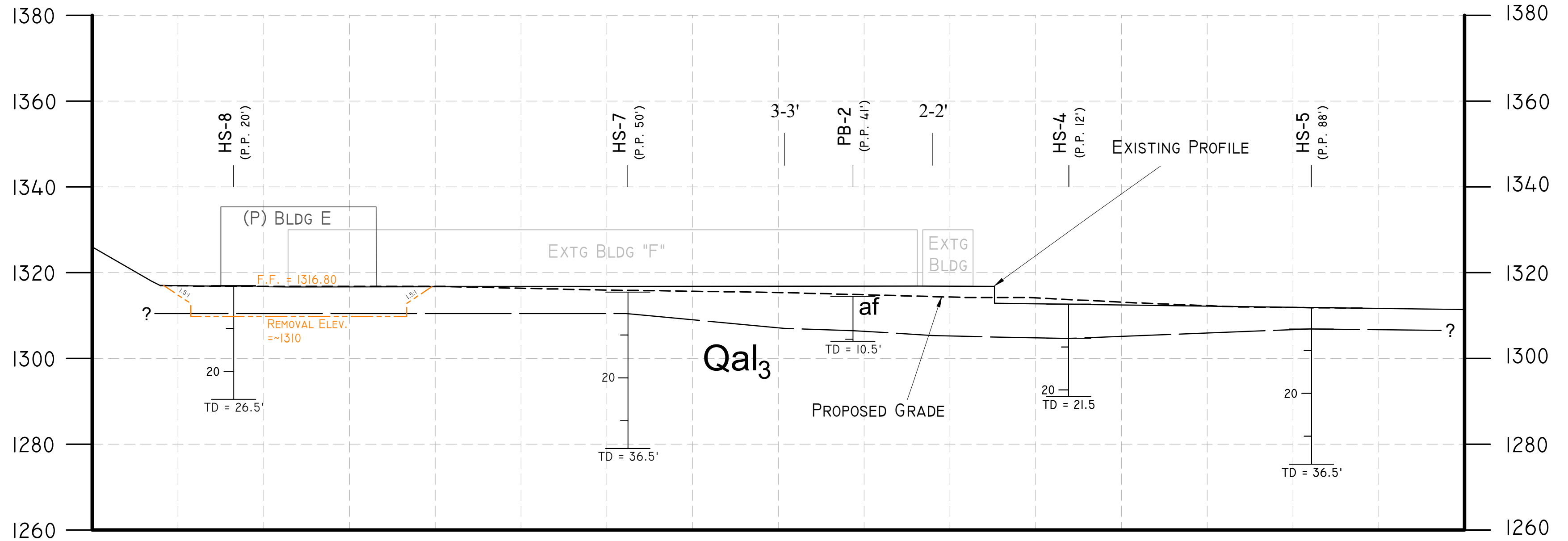
3'



 ALLAN E. SEWARD ENGINEERING GEOLOGY, INC. Geological and Geotechnical Consultants	
CROSS SECTION 3-3'	
JOB No.: 24-2775-6	
DATE: 6/19/24	SCALE: 1"=20' (H=V)

4

4'

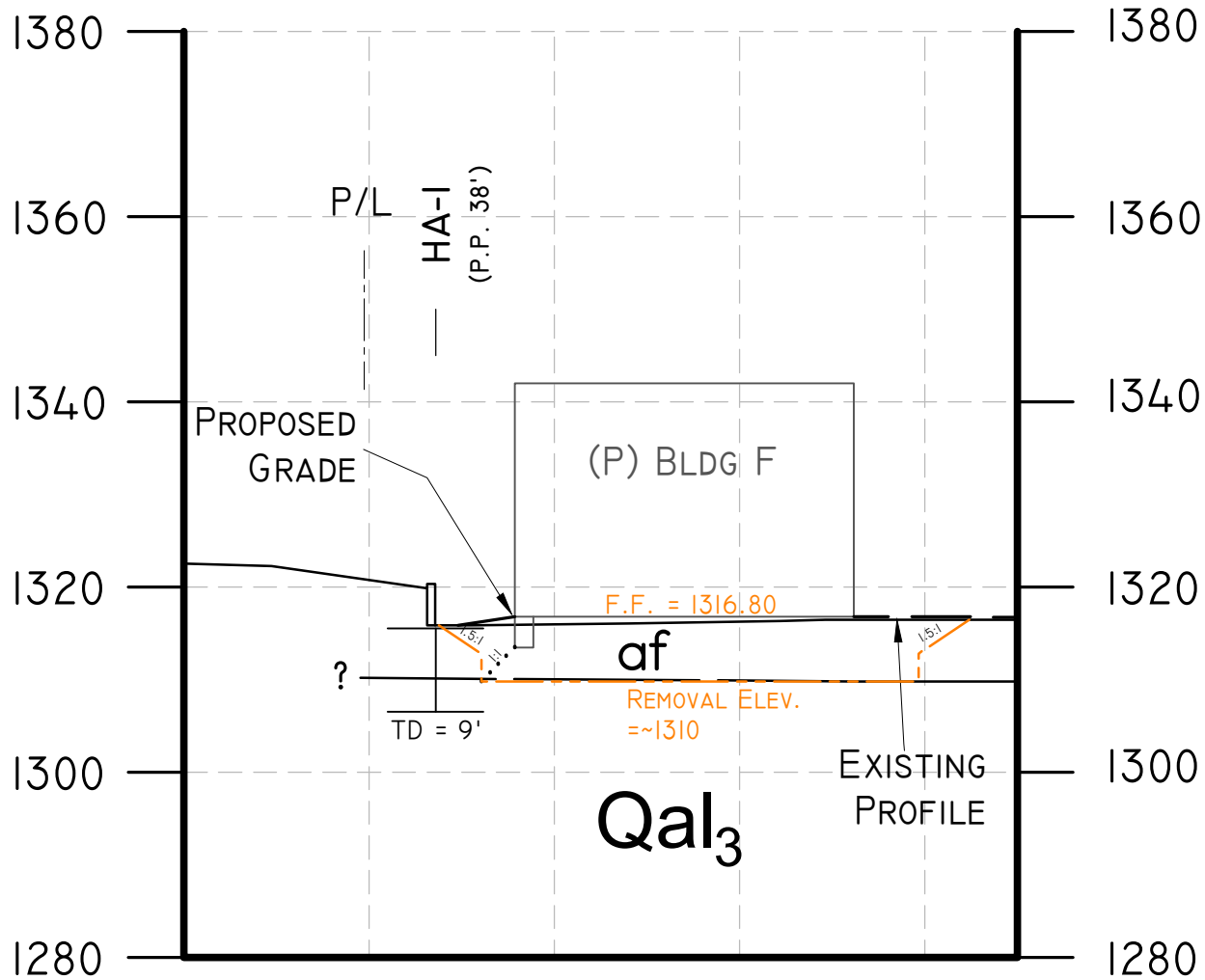


DUE WEST

 ALLAN E. SEWARD ENGINEERING GEOLOGY, INC. Geological and Geotechnical Consultants	
CROSS SECTION 4-4'	
JOB No.: 24-2775-6	
DATE: 6/19/24	SCALE: 1"=20' (H=V)

6

6'



DUE NORTH



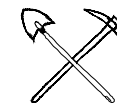
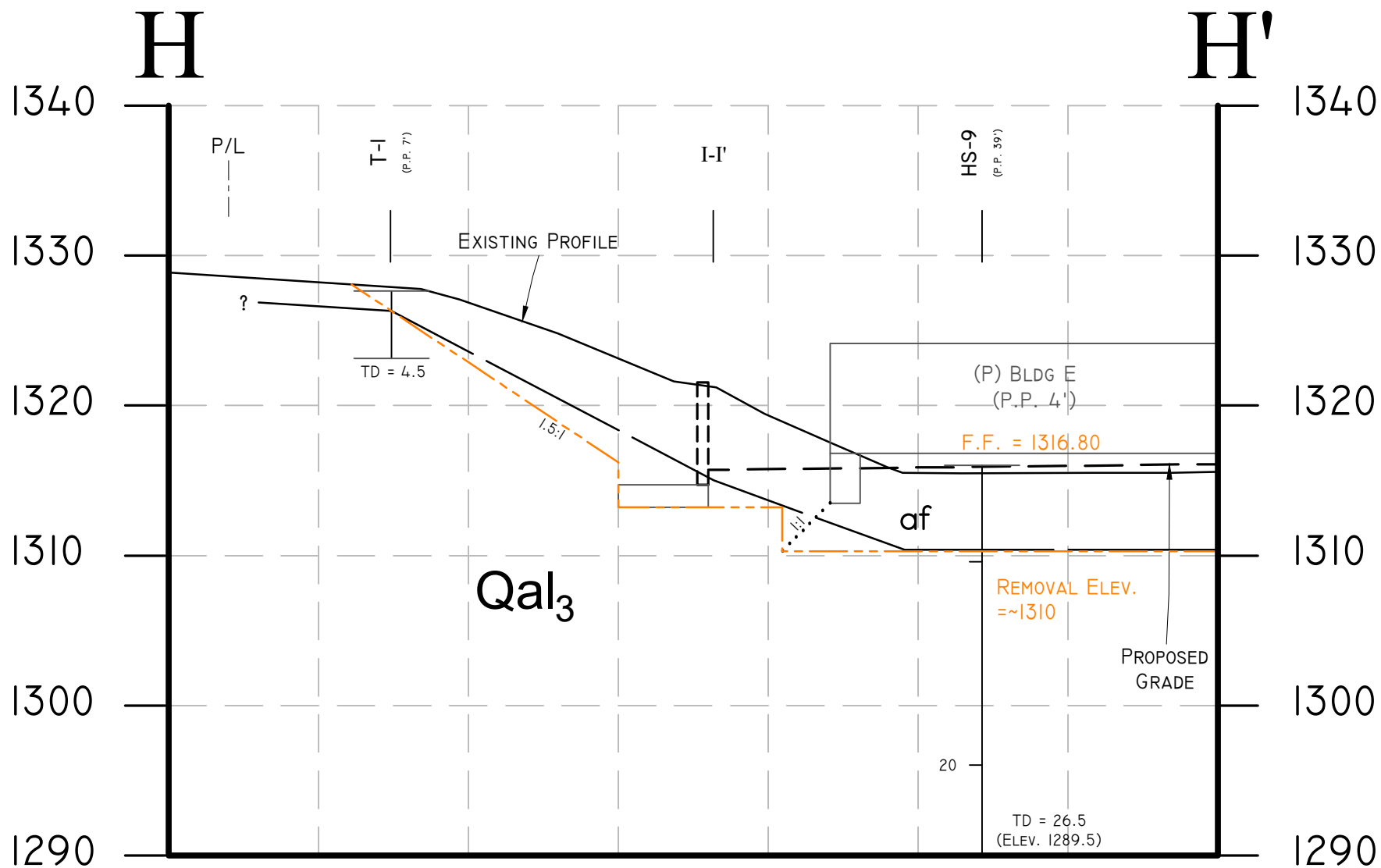
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CROSS SECTION 6-6'

JOB No.: 24-2775-6

DATE: 6/19/24

SCALE: 1"=20' (H=V)



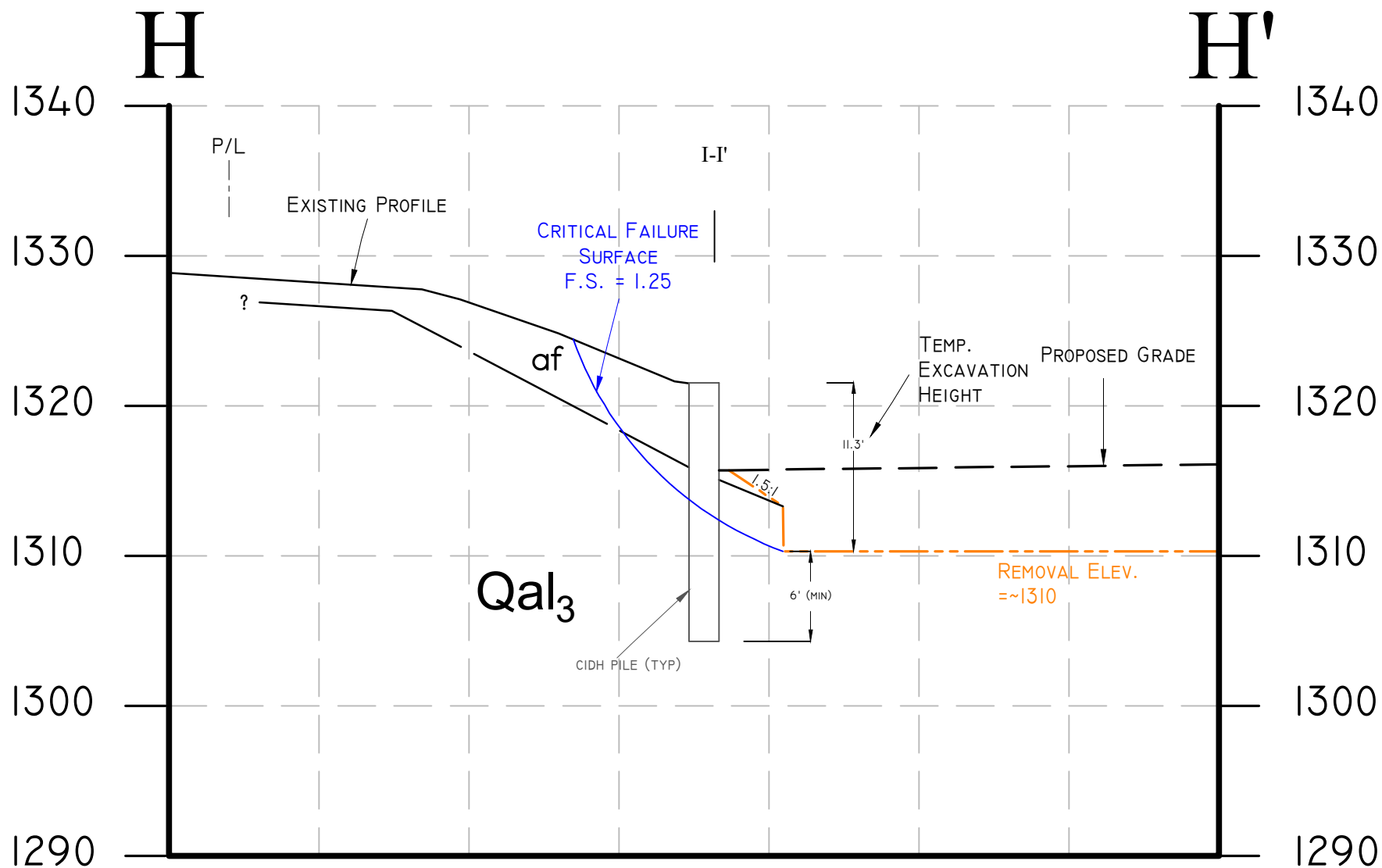
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CROSS SECTION H-H'
(CONVENTIONAL FOOTING)

JOB No.: 24-2775-6

DATE: 6/19/24

SCALE: 1"=10' (H:V)



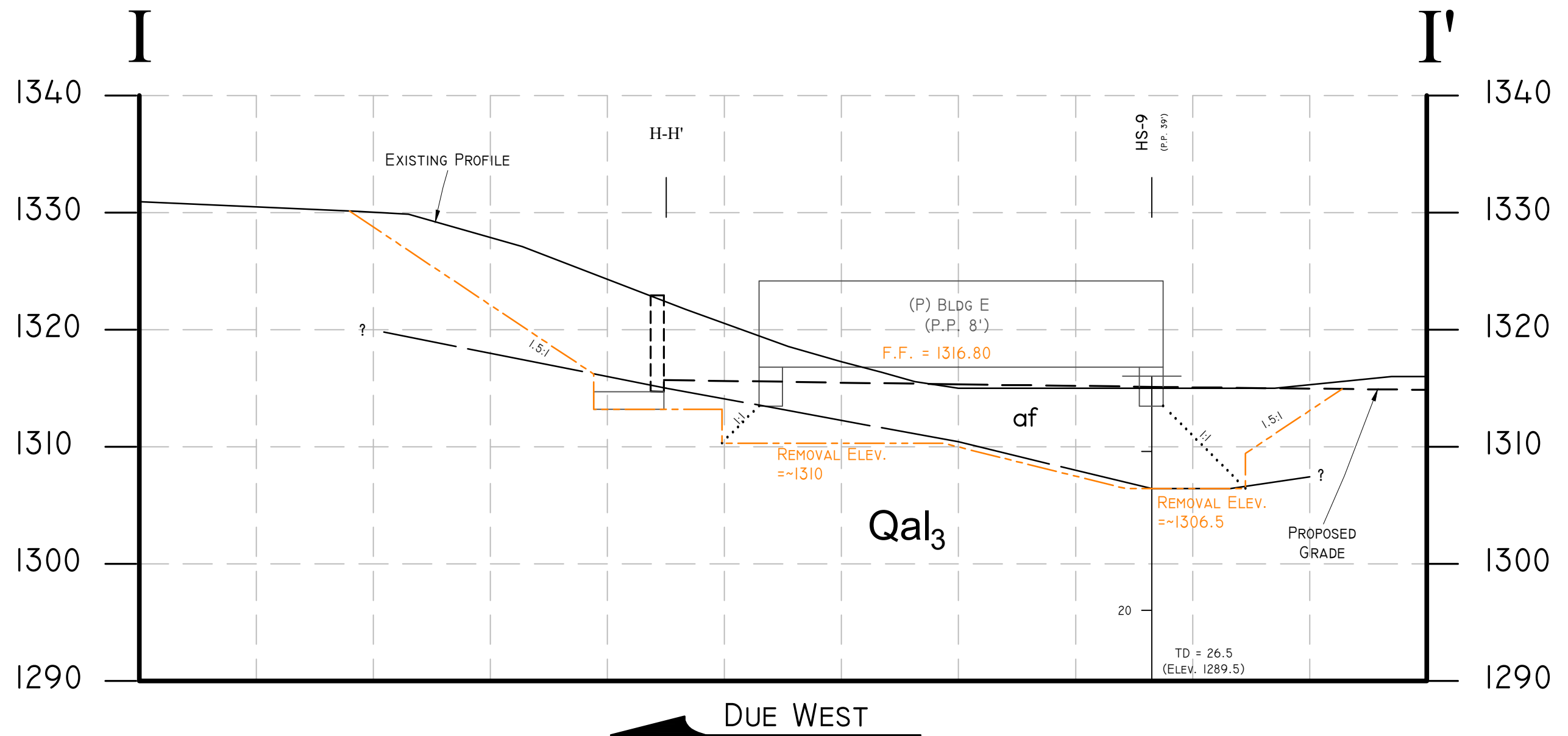
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CROSS SECTION H-H'
(TEMPORARY EXCAVATION SUPPORTED BY PILE)

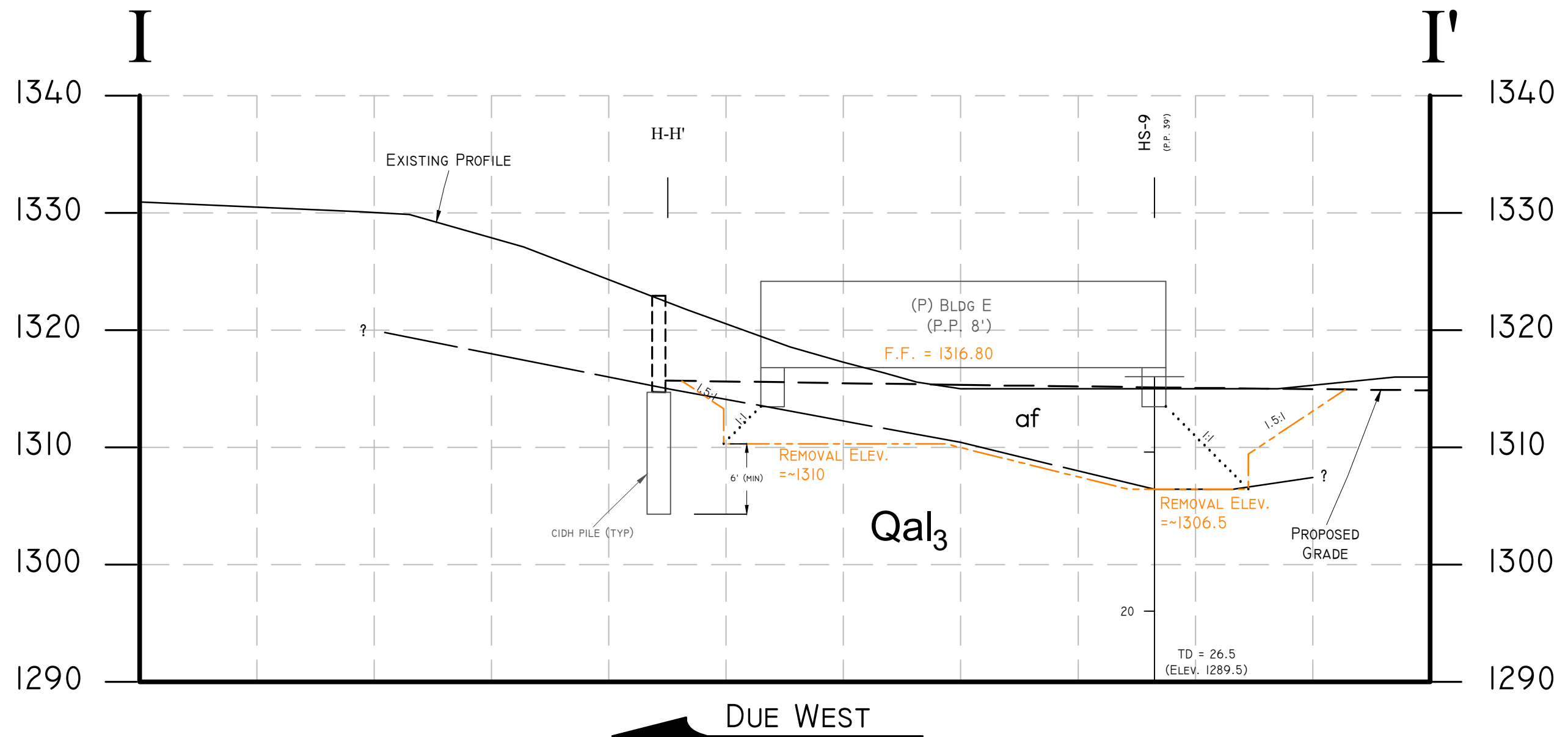
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DATE: 6/19/24

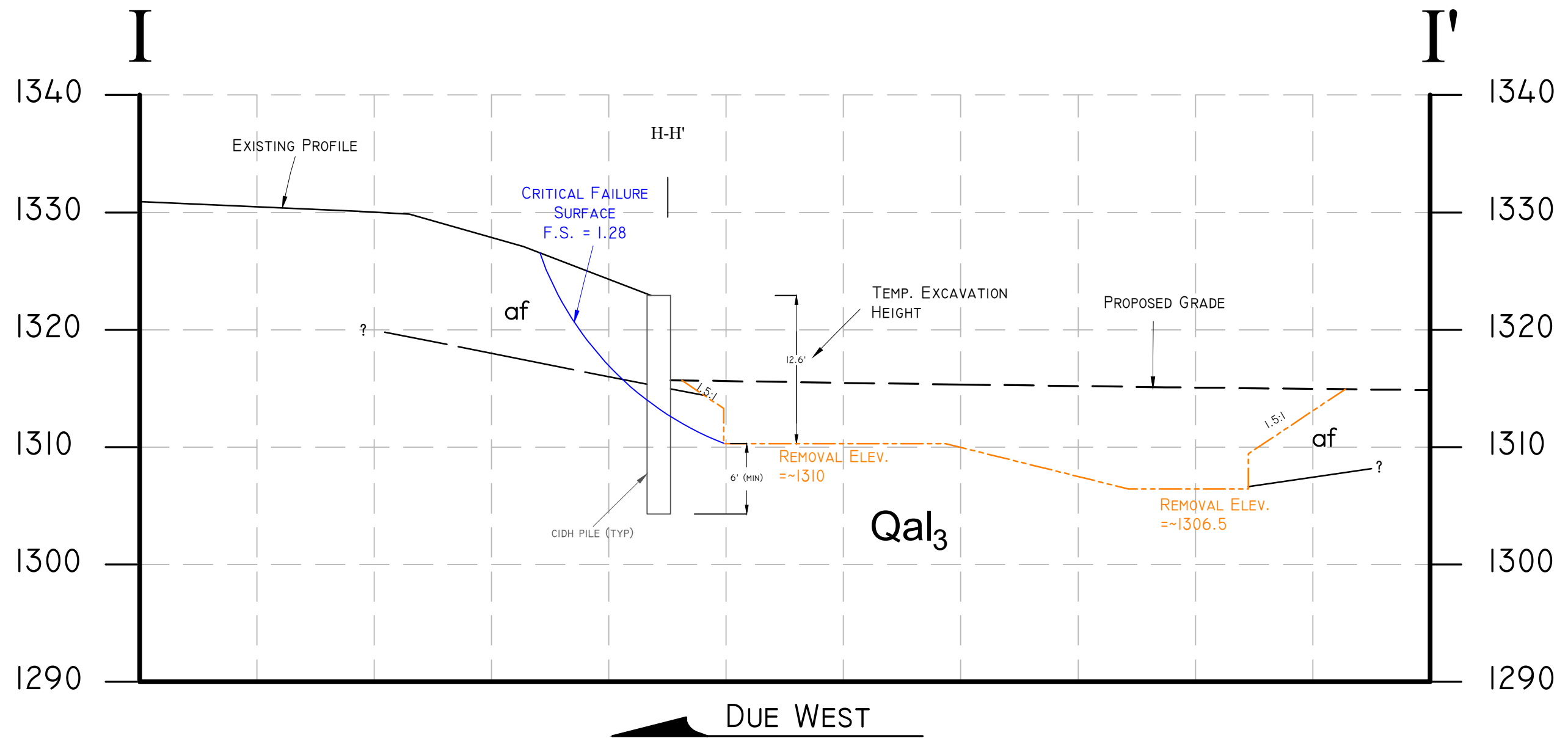
SCALE: 1"=10' (H:V)



	
ALLAN E. SEWARD ENGINEERING GEOLOGY, INC. Geological and Geotechnical Consultants	
CROSS SECTION I-I' (CONVENTIONAL FOOTING)	
JOB No.: 24-2775-6	
DATE: 6/19/24	SCALE: 1"=10' (H:V)



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CROSS SECTION I-I' (SOLDIER PILE WALL)	
JOB No.: 24-2775-6	
DATE: 6/19/24	SCALE: 1"=10' (H:V)



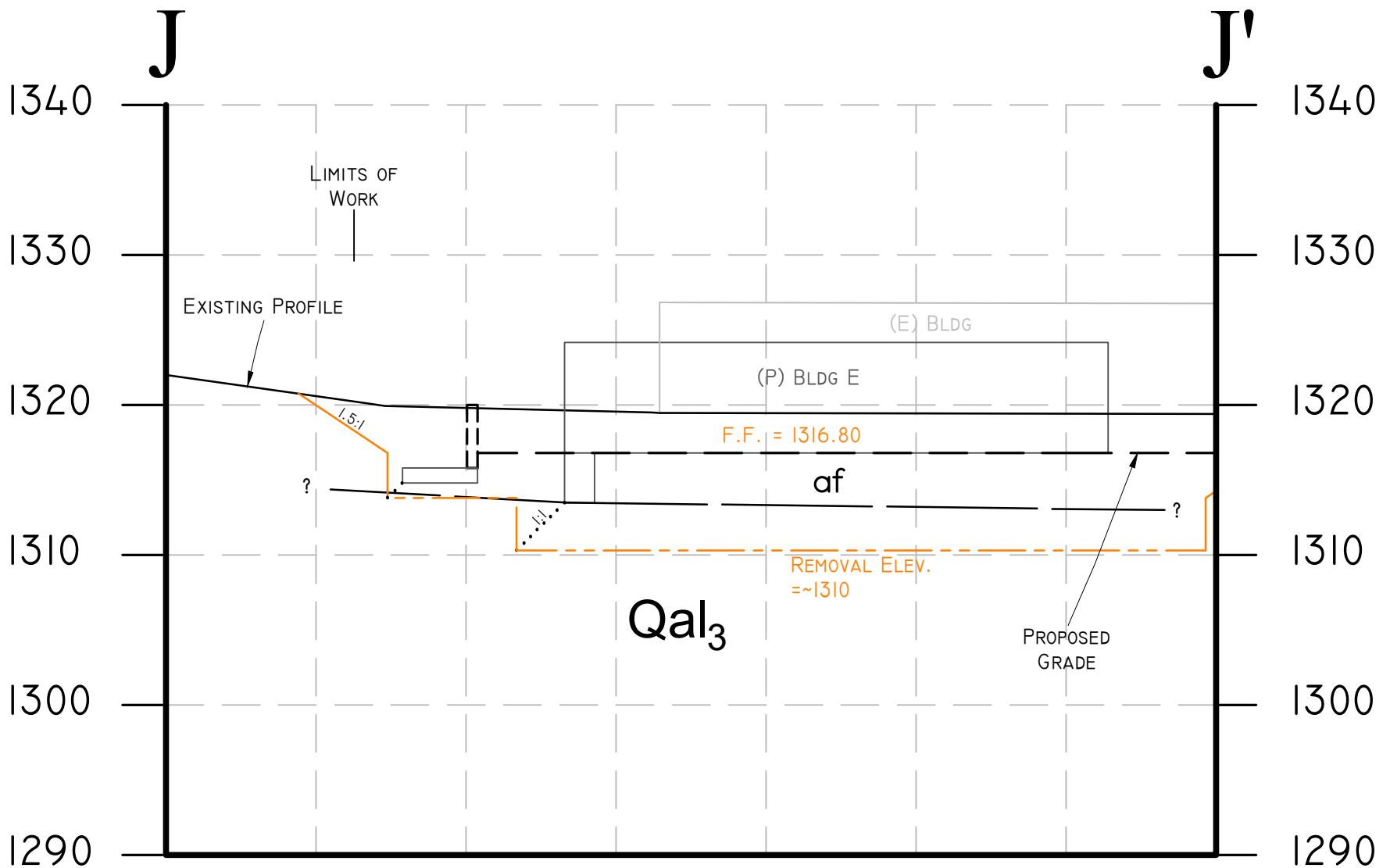
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CROSS SECTION I-I'
(TEMPORARY EXCAVATION SUPPORTED BY PILE)

JOB No.: 24-2775-6

DATE: 6/19/24

SCALE: 1"=10' (H:V)



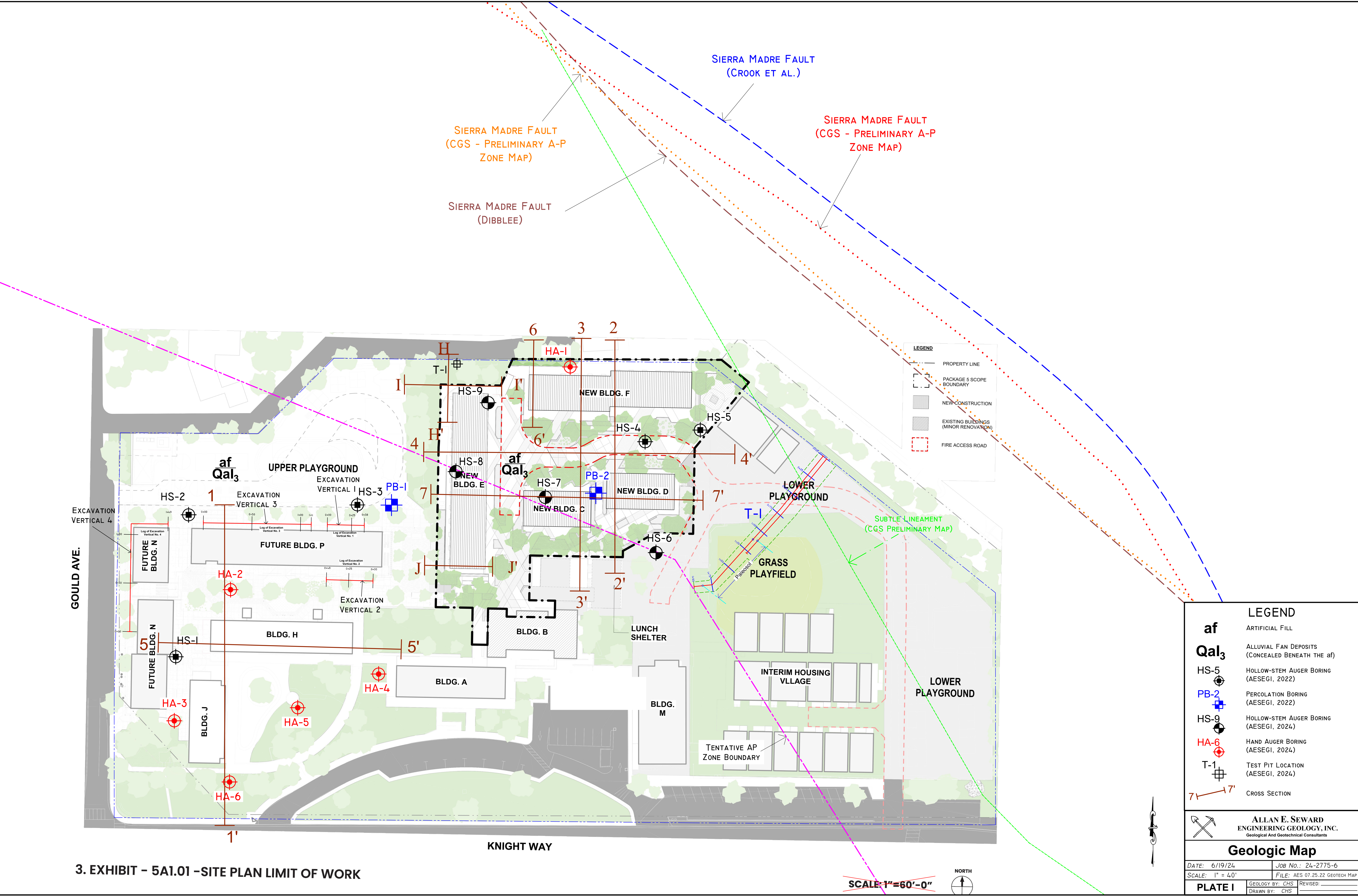
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CROSS SECTION J-J'

JOB No.: 24-2775-6

DATE: 6/19/24

SCALE: 1"=10' (H:V)



3. EXHIBIT - 5A1.01 - SITE PLAN LIMIT OF WORK

SCALE: 1" = 60'-0"



LEGEND

af
Qal₃
HS-5
PB-2
HS-9
HA-6
T-1
7' 1' 7'

ARTIFICIAL FILL
ALLUVIAL FAN DEPOSITS
(CONCEALED BENEATH THE af)
HOLLOW-STEM AUGER BORING
(AESEGI, 2022)
PERCOLATION BORING
(AESEGI, 2022)
HOLLOW-STEM AUGER BORING
(AESEGI, 2024)
HAND AUGER BORING
(AESEGI, 2024)
TEST PIT LOCATION
(AESEGI, 2024)
CROSS SECTION

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Geologic Map

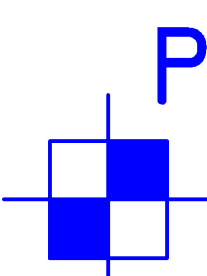
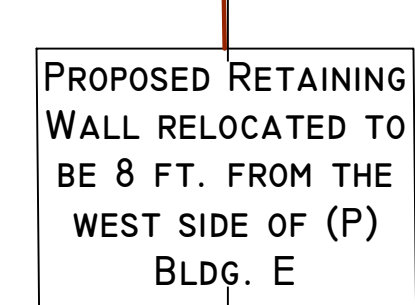
DATE: 6/19/24
SCALE: 1" = 40'
GEOLOGY BY: CHS
DRAWN BY: CHS

JOB No.: 24-2775-6
FILE: AES 07.25.22 GEOTECH MAP
REVISED: _____

PLATE I

1310'

CROSS SECTION

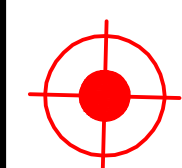
APPROXIMATE RECOMMENDED
REMOVAL ELEVATION

HS-3

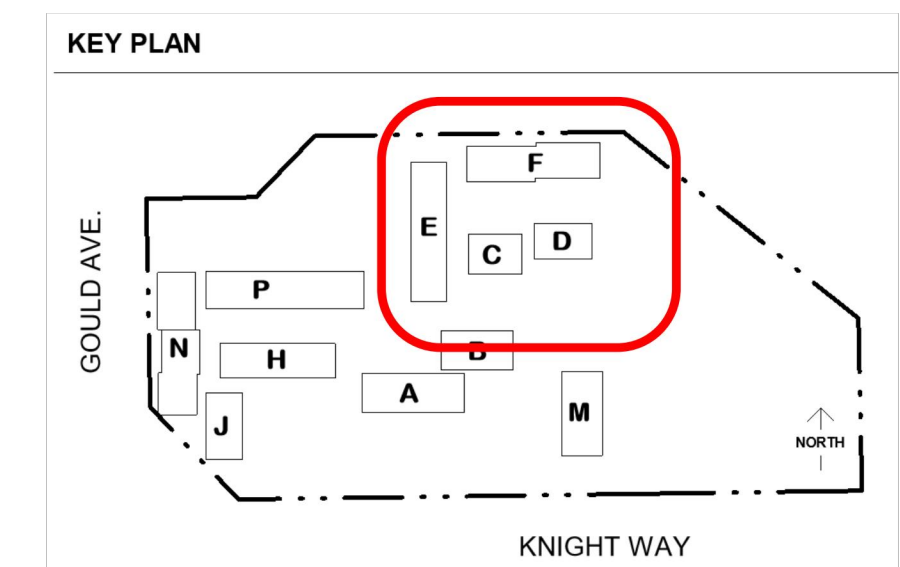
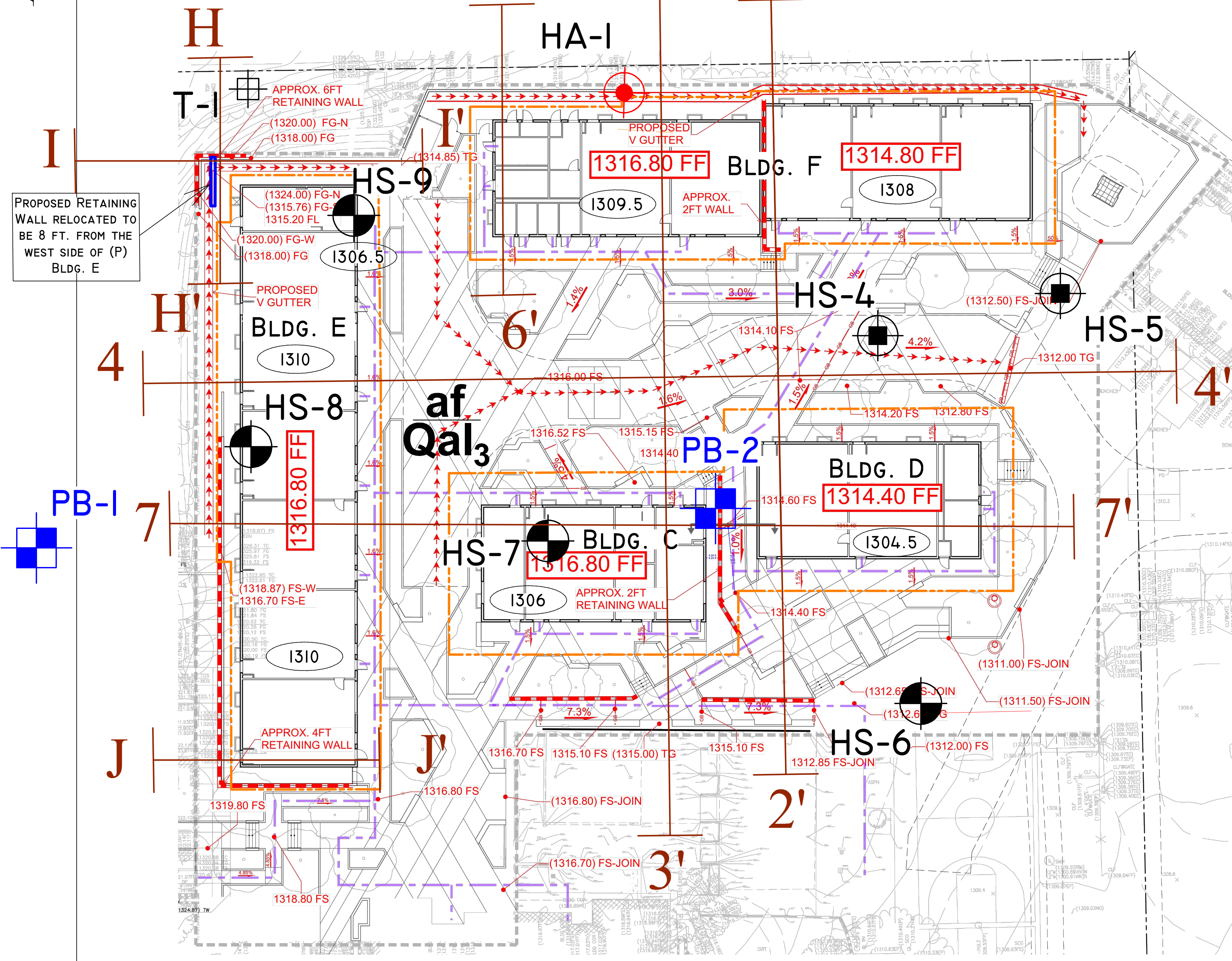
PE



HA-4



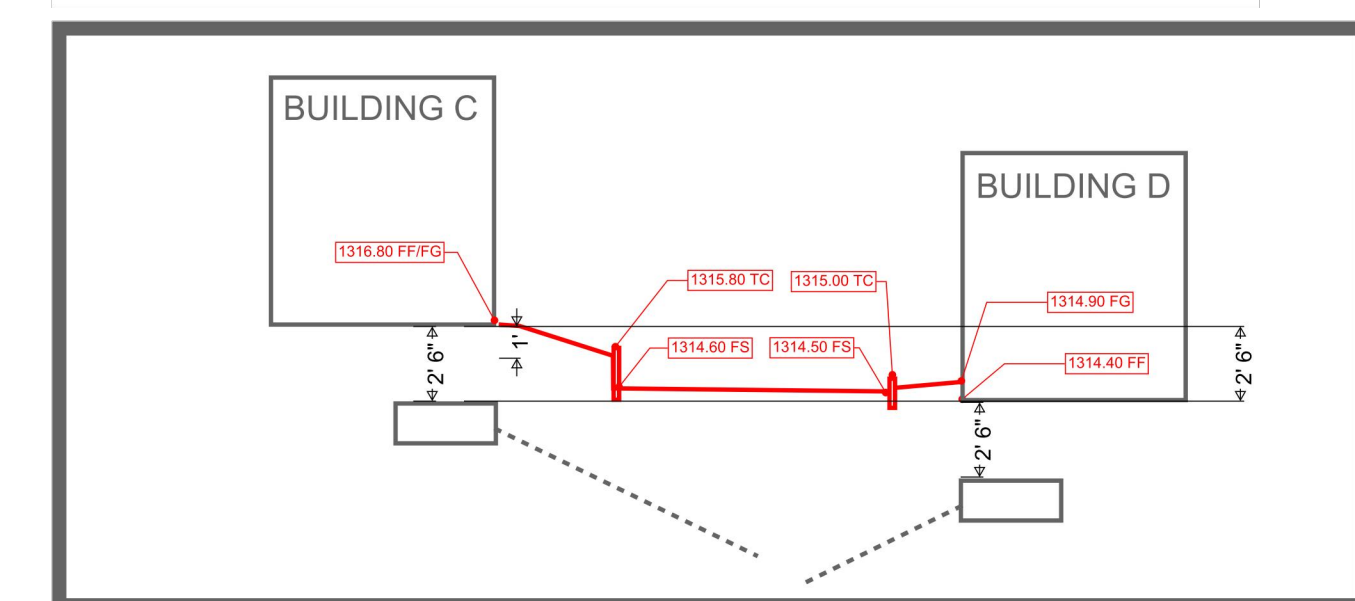
HA-5



	LIMIT OF WORK
	PROPERTY LINE
	FLOW LINE
	GRADE BREAK
	RIDGE LINE
	EARTHEN SWALE
	SAWCUT AND JOIN
	GRADE SLOPE (HORIZONTAL:VERTICAL)
	LIMITS OF GRADING
	GRADING BENCH
	PROPOSED MAJOR CONTOUR
	PROPOSED MINOR CONTOUR
	RETAINING WALL/SITE WALL (REFER TO STRUCTURAL PLANS FOR DETAILS)
	PLANTER WALL BRICK INFILL
	ACCESSIBLE PATH OF TRAVEL
	TRENCH DRAIN

FF - FINISH FLOOR
FG - FINISH GRADE
FS - FINISH SURFACE
TG - TOP OF GRATE

CUTSECTION THROUGH BUILDING C AND BUILDING D



kpff



GGA | Architecture+



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Geotechnical Map

DATE: 6/19/24

JOB No.: 24-2775-6

SCALE: 1" = 20'

FILE: AES 24.04.26 GEOTECH MAP

PLATE II

GEOLOGY BY: CHS

REVISÉ: _____