GEOTECHNICAL DESIGN AND GEOLOGICAL HAZARDS EVALUATION REPORT
CHILD DEVELOPMENT CENTER
MERRITT COLLEGE
12500 CAMPUS DRIVE
OAKLAND, CALIFORNIA

Prepared for

Peralta Community College District
333 E 8th Street
Oakland, California 94606

Prepared by

Terraphase Engineering Inc.
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December 22, 2019

Project Number 0034.005.0003

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terraphase engineering

December 22, 2019

Atheria Smith
Facilities Planning and Development Manager
Peralta Community College
333 E 8th Street
Oakland, California 94606

Subject: **Geotechnical Design and Geological Hazards Evaluation Report, Proposed Child Development Center, Merritt College, 12500 Campus Drive, Oakland, California**

Dear Ms. Smith:

Terraphase Engineering Inc. (Terraphase) is pleased to present the attached Geotechnical Design Report for the Merritt College Child Development Center, to be located at 12500 Campus Drive, in Oakland ("the Site"). Design recommendations for building foundations and site grading are presented, along with other pertinent findings and conclusions. This version of the report was revised to reference the requirements of the 2019 California Building Code.

Terraphase observed and logged five (5) hand auger borings at the Site to assess the subsurface soil conditions. The results of our assessment indicate that, with proper preparation, the Site will be suitable to support the proposed development, provided that the Site is prepared in accordance with the recommendations contained within the attached report.

We appreciate the opportunity to provide this service for the Peralta Community College District, and look forward to being of further assistance as the project proceeds. If you have any questions concerning the contents of the attached report, please feel free to call Jeff Raines at (510) 645-1853 at any time.

Sincerely,

Christopher Alger C.E.G. (1564)
Principal Geologist

Jeff Raines, P.E. (C51120), GE (2762)
Principal Geotechnical Engineer

Attachment

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ACRONYMS AND ABBREVIATIONS

ASCE	American Society of Civil Engineers
ASTM	ASTM International
bgs	below ground surface
CDF	controlled density fill
CGS	California Geological Survey
DHS	Department of Health Services
DSA	Department of the State Architect
DTSC	Department of Toxic Substances Control
FEMA	Federal Emergency Management Agency
Fugro	Fugro Consultants, Inc.
g	the acceleration of gravity at the earth's surface
Jensen-Van Lienden	Jensen-Van Lienden Associates, Inc.
m/s	meters per second
MRC	maximum rotated component
pcf	pounds per cubic foot
ppm	parts per million
psi	pounds per square inch
the Site	the proposed Merritt College Child Development Center to be located at 12500 Campus Drive in Oakland, California
Terraphase	Terraphase Engineering Inc.
UBC	Uniform Building Code
USGS	United States Geological Survey
Woodward-Clyde	Woodward-Clyde-Sherard and Associates

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1.0 INTRODUCTION

Terraphase Engineering Inc. (Terraphase) has prepared this report to present the results of our geotechnical engineering and design study for the proposed Merritt College Child Development Center to be located at 12500 Campus Drive in Oakland, California ("the Site"; Figure 1). This Geotechnical Design Report is based on the proposal prepared for the Peralta Community College District by Terraphase, dated July 23, 2019.

Woodward-Clyde-Sherard and Associates (Woodward-Clyde) performed extensive investigations (1960, 1962) of the subsurface at the campus in the early 1960s. They installed 16 borings to depths up to 100 feet below ground surface (bgs).

This report was prepared in general accordance with the California Department of the State Architect (DSA) requirements for the design of a public school. DSA consults with the California Geological Survey (CGS) to assess whether the geotechnical work performed for a client site is sufficient. The CGS requirements for the geotechnical reports for client sites are presented in CGS Special Publication 48 (CGS 2019). The project is to be constructed under the 2019 edition of the California Building Code and ASCE 7 (2016).

1.1 Project Description

The Site is located at 37.7891° north latitude and 122.164° west longitude. The proposed project consists of a two-story classroom building with an approximately 8,500-square-foot footprint. We understand that the site will be leveled with three to four feet of engineered fill. We estimate that building loads are approximately 1,200 pounds per foot for wall loads and 12 kips for internal columns. These estimates were used to select appropriate foundation types for the structure and should not be used for structural design. Grading of the Site will consist of importing fill to raise the site by up to 4 feet. Additional details of the project are not known at this time.

1.2 Scope of Study

Based on our understanding of the client development, the following scope of services was formulated and completed:

- Terraphase observed and logged five (5) hand auger borings – all of the hand auger borings encountered bedrock within 20 inches of the ground surface.
- A soil sample was collected from one of the borings for analysis for asbestos as the Site is located in an area known to contain naturally occurring asbestos.

The following engineering analyses were performed to develop geotechnical engineering criteria for the proposed project:

- allowable bearing capacity of shallow foundation systems
- settlement of the proposed shallow foundation systems
- allowable passive resistance and base friction to resist wind and seismic lateral loads

- a site-specific seismic hazard study was conducted

Recommendations were developed for:

- site preparation and grading
- allowable soil-bearing pressures for shallow foundation systems
- design of slabs-on-grade
- allowable passive soil resistance and base friction
- pavement design and construction

This report summarizes our study results and presents our design and construction recommendations and design criteria, as well as the subsurface data on which they are based.

2.0 BACKGROUND

2.1 Geology

Three different geologic formations are present at the Site: Leona Rhyolite, Knoxville Shale, and Franciscan Serpentine (Figure 4). These rocks are arranged in parallel bands, elongated northwest to southeast from one end of the property to the other. The rhyolite, a bluish-gray, hard, somewhat fractured, fine-grained crystalline volcanic rock, forms the high ridge on the southwest and the chain of low knobs along the axis of the property. Figure 4 shows the Site to be located near the boundary between the Leona Rhyolite and the Knoxville Formation. The surficial bedrock at the Site was found to be Leona Rhyolite.

To either side of the central band of rhyolite lies shale, an olive-gray sedimentary rock that is firm but minutely stratified and fractured. Minor siltstones, sandstones, and conglomerates are interbedded within the shale. Ages of erosion have cut valleys in the soft shale and left high hills where lies the hard resistant rhyolite. Serpentine, a blue-green, fine-grained intrusive rock occurs as thin tabular bodies within the shale near the eastern extremity of the campus (away from the Site; Figure 4). Much of this rock is distinctly platey and weak, or highly sheared and greasy, but, locally, there are large masses of hard crystalline serpentine rock enclosed by sheared serpentine.

2.2 Hydrogeology

Neither Woodward Clyde (1960) nor Jensen-Van Lienden Associates, Inc. (Jensen-Van Lienden; 2009) encountered free groundwater in their borings installed on campus. Woodward-Clyde (1960, 1962) installed sixteen (16) borings to depths up to 100 feet across the campus. They reported that some of the shear zones in the shale bedrock were wet. Jensen-Van Lienden (2009) installed 11 borings to depths between 2.5 feet and 17.5 feet, where each of the borings reached refusal, without encountering groundwater. Department of Water Resources (http://wdl.water.ca.gov/waterdatalibrary/) and United States Geological Survey (USGS) (https://waterdata.usgs.gov/nwis/uv?referred_module=gw&search_criteria=lat_long_bounding_box&search_criteria=site_tp_cd&submitted_form=introduction) databases did not locate a groundwater well in the vicinity of the Site. The Regional Water Quality Control Board database (https://www.waterboards.ca.gov/water_issues/programs/gama/online_tools.html) also failed to locate a water supply well near the Site.

3.0 SUBSURFACE EXPLORATION AND LABORATORY TESTING

3.1 Subsurface Exploration

On July 30, 2019, Gregg Drilling & Testing, Inc. used an air knife, pry bar, and hand auger at five locations at the Site. Figure 2 illustrates the approximate locations of subsurface probes, designated HA-1 through HA-5 The purpose of the work was to clear the boring locations to five (5) feet prior to mobilizing a drill rig to the Site. The subsurface locations were selected based on the architectural site plan provided by the project architect. At four of the locations, refusal was met at 6 inches bgs. At the fifth location, refusal was met at 20 inches. Given the shallow depth of bedrock, the drilling was canceled.

3.2 Laboratory Testing

A soil sample collected from the air knife borings was submitted to Micro Analytical Laboratories of Berkeley, California, for analysis of asbestos by Air Resources Board Method 435 (polarized light microscopy). No asbestos was detected in the sample.

4.0 SITE AND SUBSURFACE CONDITIONS

4.1 Site Description

The Site is located at 12500 Campus Drive in Oakland, California. The Site slopes from the southeast to the northwest about 4 feet across the building footprint. The Site is level in the southwest to northeast direction.

4.2 Subsurface Conditions

Bedrock was encountered at 6 inches in the two locations inside the building footprint (Figure 2) and between 6 inches and 20 inches at three other locations near the building footprint. The site was classified as Site Class B based on the USGS shear wave velocity study (https://earthquaek.usgs.gov/data/vs30/us/) where the measured shear wave velocity in the upper 30 meters (VS30) was found to be 788 meters per second (m/s). However a shear wave velocity of 760 m/s (boundary between Site Classes B and C) was used in the site specific seismic hazard assessment and the NGA WEST2 parameter for "shear wave velocity measured" was set to false.

4.3 Groundwater

Woodward-Clyde (1960 and 1962) reported free water in bedrock fractures in the Knoxville Formation shale.

4.4 Site Seismicity

A review of available earthquake hazard maps (CGS 2003 and Figure 5) indicates that the Site is not located within an Earthquake Special Studies Zone. The nearest such zone is 0.67 mile southeast of the Site and is associated with the Hayward Fault. While ground rupture at the Site is unlikely, strong ground shaking will likely occur at the Site during the useful economic life of the proposed structure.

A site-specific earthquake ground motion study, appended to this report in Appendix B, was conducted for the Site in accordance with the 2019 California Building Code (State of California 2018) and ASCE 7 (ASCE 2016). The expected peak ground acceleration for the Maximum Considered Earthquake at the Site is 1.18g, where "g" is the acceleration of gravity at the earth's surface. The 2014 NGA WEST2 ground motion predictors were used in the site specific seismic hazard assessment. A shear wave velocity of 760 m/s, the boundary between Site Classes B and C was used in the site specific seismic hazard assessment.

Mapped ASCE 7 (ASCE 2016) seismic design parameters (S_S, S_1, S_{DS} and S_{D1}) are shown in Appendix B based from the ASCE Hazard Tool - https://asce7hazardtool.online/. While there is a measurement of shear wave velocity in the top 30 meters (VS_{30}) for the campus, please see Appendix B, in accordance with the CBC Section 1613A.2.2, the mapped base seismic parameters were based on F_a and F_v of 1.0 (i.e., assuming no measurement of shear wave velocity) for use in the site specific seismic hazard assessment. The Seismic Design Category is E.

4.5 Seismic Environment

Regionally active faults within 100 kilometers of the Site that are capable of producing significant ground shaking at the Site are shown on Figure 6 and presented in Table 1. Table 1 is based on results from the software program, EZ-Frisk™ v8.0 (beta) (Fugro 2019).

Table 1: Known Active Earthquake Faults within 100 Kilometers of the Site
Merritt College Child Development Center, Oakland, California

Source	Distance (Kilometers)	Magnitude	Mechanism	Angle	To	Lies
Hayward-Rodgers Creek	1.66	7.334	Strike Slip	90	--	NE
Calaveras	13.98	7.025	Strike Slip	90	--	W
Mount Diablo Thrust	16.74	6.7	Reverse	38	NE	SW
Green Valley Connected	20.01	6.8	Strike Slip	90	--	SW
Northern San Andreas	30.25	8.05	Strike Slip	90	--	NE
Greenville Connected	30.92	7	Strike Slip	90	--	W
Greenville Connected U	30.92	7	Strike Slip	90	--	W
California Gridded Deep	34.89	7.2	Intraslab	90	--	S
San Gregorio Connected	38.12	7.5	Strike Slip	90	--	E
Great Valley 5, Pittsburg Kirby Hills	38.98	6.7	Strike Slip	90	--	SW
Monte Vista-Shannon	39.8	6.501	Reverse	45	SW	N
West Napa	42.3	6.7	Strike Slip	90	--	S
Great Valley 7	52.09	6.9	Reverse	15	SW	W
Great Valley 4b, Gordon Valley	52.1	6.8	Reverse	20	W	S
Point Reyes	61.21	6.9	Reverse	50	NE	E
Hunting Creek-Berryessa	73.84	7.1	Strike Slip	90	--	S
Great Valley 4a, Trout Creek	77.88	6.6	Reverse	20	SW	S
Zayante-Vergeles	79.63	7	Strike Slip	90	--	N
Nonextensional Gridded	86.62	10	SS|R	90	--	S
San Andreas Creeping Section Gridded	86.84	6	Strike Slip	90	--	NW
Great Valley 8	91	6.8	Reverse	15	W	NW
Great Valley 3, Mysterious Ridge	95.8	7.1	Reverse	20	SW	S
Monterey Bay-Tularcitos	96.52	7.3	Strike Slip	90	--	N

Source	Distance (Kilometers)	Magnitude	Mechanism	Angle	To	Lies
Ortigalita	96.86	7.1	Strike Slip	90	--	NW
Maacama-Garberville	98.9	7.4	Strike Slip	90	--	SE

Source: EZ FRISK Version 7.65 Build 004

4.6 Historical Seismicity

The known earthquakes of note to affect the San Francisco Bay Area are shown on Figure 7 and presented in Table 2 below.

**Table 2: Historical Earthquakes in the Bay Area with Magnitudes Greater than 5.0
Merritt College Child Development Center, Oakland, California**

Location	Date	Depth	Magnitude
South Napa	2014-08-24 10:20:44 (UTC)	11.1 km	6.0
San Francisco Bay area, California	2007-10-31 03:04:54 (UTC)	9.7 km	5.5
Loma Prieta (not shown on figure)	1989-10-18 00:04:15 (UTC)	17.2 km	6.9
San Francisco Bay area, California	1988-06-13 01:45:36 (UTC)	9.1 km	5.3
Northern California	1986-03-31 11:55:39 (UTC)	8.5 km	5.7
Northern California	1984-04-24 21:15:18 (UTC)	8.2 km	6.2
San Francisco Bay area, California	1980-01-27 02:33:35 (UTC)	14.2 km	5.4
San Francisco Bay area, California	1980-01-24 19:01:01 (UTC)	6.5 km	5.1
San Francisco Bay area, California	1980-01-24 19:00:09 (UTC)	11.0 km	5.8
San Francisco Bay area, California	1957-03-22 19:44:21 (UTC)	–	5.3
San Francisco Bay area, California	1955-10-24 04:10:44 (UTC)	–	5.4
San Francisco Bay area, California	1955-09-05 02:01:18 (UTC)	–	5.5
San Francisco Bay area, California	1911-07-01 22:00:03 (UTC)	–	6.6
The 1906 San Francisco Earthquake	1906-04-18 13:12:26 (UTC)	11.7 km	7.9
San Francisco Bay area, California	1903-08-03 06:49:00 (UTC)	–	5.8
San Francisco Bay area, California	1903-06-11 13:12:00 (UTC)	–	5.8
Northern California	1902-05-19 18:31:00 (UTC)	–	5.4
San Francisco Bay area, California	1889-05-19 11:10:00 (UTC)	–	6.0
San Francisco Bay area, California	1868-10-21 15:53:00 (UTC)	–	6.8

Alameda County	1864-03-05 16:49:00 (UTC)	–	6.1
San Francisco Bay area, California	1858-11-26 08:35:00 (UTC)	–	6.1
San Francisco Bay area, California	1836-06-10 15:30:00 (UTC)	–	6.8

5.0 GEOLOGICAL HAZARDS

5.1 Landslides

The Site itself is relatively flat and hence not subject to landsliding. The bedrock nob 75 feet behind the proposed structure has a slope of 3 horizontal to 1 vertical and does not pose a landslide hazard to the proposed buidling. The CGS does not map the area as being in a zone subject to seismically induced landsliding (Figure 5).

5.2 Liquefaction

The Site is underlain by bedrock which is not subject to liquefaction or seismic shakedown settlement.

5.3 Ground Rupture Potential

As shown on Figure 5, the Site is not within an earthquake fault zone. Hence, the likelihood of a ground-crossing fault at the Site is low.

5.4 Flooding

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map indicates that the Site is not located within a 100-year flood zone (FEMA 2009). The Site has been mapped in "Zone X," which represents "Areas of minimal flooding."

There are no reservoirs located uphill from the Site, so dam inundation is not an applicable hazard for the Site.

5.5 Expansive Clay and Collapse Potential

There is essentially no soil on the Site. As the plans call for using fill to level the building pad, the structure will be founded on imported engineered fill. The requirements for imported fill are presented in Section 7.2 below. The requirements on the geotechnical properties of imported fill will assure that expansive clays or soils with collapse potential are not imported to the Site.

5.6 Naturally Occurring Asbestos

There are large areas of serpentinite bedrock in the Site's vicinity, but the bedrock at the Site is Leona Rhyolite underlain at some depth by Knoxville Formation shales and sandstones. A sample of site soil was collected and analyzed in a laboratory for asbestos by polarized light microscopy. No asbestos was detected in the sample. The laboratory report is appended to this report in Appendix A.

5.7 Other Hazards

Certain other potential geological hazards, including tsunamis, seiches, naturally occurring radon, and oil and gas fields, do not appear to pose significant risks at the Site, for the reasons discussed briefly below.

- **Tsunamis and Seiches.** Tsunamis do not pose an appreciable risk at this inland location. Seiches do not pose an appreciable risk given the absence of nearby surface water bodies.
- **Naturally Occurring Radon.** The California Department of Health Services (DHS) maintains a database of radon measurements in California, based on zip code. No elevated radon results (greater than or equal to 4.0 picoCuries per liter) have been reported in 47 measurements from the 94619 (Oakland) zip code, which includes the Site.
- **Oil and Gas Fields.** The Site is not located within an oil or gas field, as recognized by the California Department of Oil, Gas, and Geothermal Resources (DOGGR 2019).
- **Volcanos.** While the Site contains large amounts of Pleistocene-age (11,700 to 1,800,000 years before the present) igneous rock (Leona Rhyolite; USGS 1968), it is unlikely that there will be a new eruption within the useful economic lifetime of the proposed building.

5.8 Conditional Geotechnical Topics

The proposed structure will not have a basement or deep foundations. There are no nearby structures that might be affected by the new structure.

6.0 FOUNDATIONS

Conventional spread footing foundations or slab-on-grade foundations are suitable for support of the proposed building loads. Foundation design recommendations are presented in Section 7.5.

6.1 Settlement Estimates (Including Seismic Shakedown)

Settlement was estimated for a foundation supported on engineered fill, as defined in Section 7.2. Up to 4 feet of fill will be placed on the Site. As this fill will be compacted, settlement under it from a two-story structure should be zero. We recommend that the structure be designed to accommodate up to ¼ inch of differential settlement over 25 feet, however.

7.0 DESIGN RECOMMENDATIONS

7.1 Site Preparation and Grading

The Site should be cleared and grubbed to remove surficial organic materials. Clearing is to include the removal of accumulated surface debris and vegetation, if any. Soil containing more than 2% organic material should be segregated for use as the topsoil in any landscaped areas, with the approval of the project owner. Soils containing more than 2% organic materials should not be used as fill within the building footprint or hardscape.

Rootballs of any trees within the building footprint should be completely removed and the resulting excavation backfilled in accordance with the recommendations presented below.

7.2 Fill Recommendations

Imported fill materials should be approved by the engineer before being brought to the Site. Imported fill shall be certified as clean from the source (not from former industrial sites or similar locations; not chemically affected). Any imported fill should be characterized in accordance with Department of Toxic Substances Control guidance (DTSC 2001).

Imported fill should be nonexpansive, with between 5% and 25% finer than a No. 200 sieve and meet the following requirements: minimum R-Value of 35 (California Department of Transportation [Caltrans] 301), maximum expansion index of 25 (Uniform Building Code [UBC] 18-2), and maximum plasticity index of the fine fraction of 12 (ASTM International [ASTM] D4318). The soil should be compacted in lifts no greater than 8 inches loose to a minimum of 90% of the soil's maximum dry density as determined using the methodology of ASTM D1557 (Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort). A representative of the geotechnical engineer should observe site grading, including stripping, scarifying, and placing and compacting of fill and backfill.

Imported fill should not have chloride concentrations in excess of 400 parts per million (ppm), sulfate concentrations in excess of 1,500 ppm, and the pH should not be less than 6.

Controlled density fill (CDF), if used, shall be composed of cementitious materials, aggregate, water, and an air-entraining admixture, as follows:

1. Cementitious materials shall be Portland cement in combination with fly ash.
2. Admixture shall be an air-entraining agent.
3. Aggregate Content: CDF mixture shall contain no aggregate larger than 3/8 inch. Amount passing a No. 200 sieve shall not exceed 12 percent. No plastic fines shall be present.
4. Air Content: Total calculated air content of the sample, prepared in accordance with ASTM C231, shall not exceed 30 percent.

5. Strength: At 28 days, CDF shall have an unconfined compressive strength of from 50 pounds per square inch (psi) to a maximum of 150 psi.

7.3 Trench Excavation and Backfilling

Trenches should be excavated as required by the plans and specifications, using appropriate equipment. Where necessary, trenches should be sloped or shored by the contractor, in accordance with the governing safety standards to provide a safe work site. The contractor shall be responsible for any temporary slopes and trenches excavated at the Site and for design of shoring, should it be required.

Trenches should be backfilled with compacted fill, in accordance with the stricter of the recommendations contained in this section or in accordance with local requirements. Fill material should be placed in lifts no greater than 8 inches in loose thickness and compacted by mechanical means. Trench backfill should be compacted to at least 90% of the soil's maximum dry density (ASTM D1557) except where located within a pavement section where the upper 18 inches of the trench backfill below subgrade level will require compaction to at least 95% (ASTM D1557) of the soil's maximum dry density.

7.4 Excavations Adjacent to Buildings

Trenches and other excavations located adjacent to existing foundations should be located such that an imaginary line drawn at a 45-degree angle from the bottom of the outer edge of the spread footing does not intersect the trench.

Trenches and other excavations that will pass close to a future spread footing or slab-on-grade foundation should be backfilled with clean fill compacted to at least 95% relative compaction or with flowable fill prior to construction of the foundation or slab.

Trenches to be excavated parallel to an existing slab-on-grade foundation should be located such that an imaginary line drawn at a 45-degree angle from the bottom of the outer edge of the slab does not intersect the trench. If this is not possible, the trench can be installed in 5-foot-long sections with each section backfilled with clean fill compacted to at least 95% relative compaction or with flowable fill prior to excavation of the next segment of the trench.

For other trench/foundation layouts, please consult with the engineer.

7.5 Spread or Continuous Footings

Spread or continuous footings should bear on engineered fill or the native bedrock. The surficial soil beneath the building footprint should be excavated to the top of bedrock and be recompacted in place to 90% of the native soil's maximum dry density (ASTM D1557). Continuous and isolated spread footings should have minimum widths of 18 inches and 24 inches, respectively, and should extend at least 18 inches below the lowest exterior grade or to the top of bedrock. The following are recommended allowable bearing pressures for foundation elements:

Table 3: Allowable Bearing Pressures for Spread or Continuous Footings
Merritt College Child Development Center, Oakland, California

Loading Condition	Allowable Bearing Pressure
Dead Loads	3,000 psf
Dead plus Live Loads	4,000 psf
All Loads, including Wind or Seismic	5,300 psf

Note: psf = pounds per square foot

The minimum size footings listed above will likely govern rather than the allowable bearing pressures as the minimum footing size will likely have more than enough capacity to support the building loads.

Footing concrete should be poured neat against engineered fill or bedrock. Any disturbed or softened material encountered at the bottom of the footing excavations should be removed to expose firm bearing material. Footing excavations should be kept moist before concrete placement.

Continuous footings should be reinforced with a minimum of at least two (2) #4 bars top and bottom in the longitudinal direction unless otherwise determined by the structural engineer. Isolated spread footings should be reinforced with a minimum of two (2) #4 bars in each direction. Reinforcement should be spaced 12 inches on center in each direction unless otherwise determined by the structural engineer.

Before issuing the construction bids, the geotechnical engineer should review the foundation plans and prepare a review letter. In addition, the geotechnical engineer should observe foundation operations.

7.6 Concrete Slabs-on-Grade

Slab-on-grade floors should be supported on a minimum of 4 inches of clean gravel or crushed rock. We recommend that moisture-sensitive foundations in direct contact with the subsurface (mechanical rooms, elevator shafts, lobbies, and commercial and residential units on the ground floor) be underlain by a moisture barrier. A typical moisture barrier should include a capillary moisture break consisting of at least four (4) inches of clean, free-draining gravel or crushed rock (1/2 to 3/4 inch gradation) overlain by a moisture-proof membrane of at least 10 mils thick (15-mil Stego, Grace FlorPrufe, or equivalent). The vapor retarder should be covered with two (2) inches of sand to aid in curing the concrete and to protect the vapor retarder during slab construction unless the structural engineer recommends placing the concrete directly on the vapor barrier. Water should not be allowed to accumulate in the capillary break or sand prior to casting of the slab.

The vapor retarder should meet the requirements for Class C vapor retarders as given in ASTM Standard E1745-97. The vapor retarder should be installed in general accordance with the methodology documented in ASTM Standard E1643-98. These requirements include overlapping seams by at least six (6) inches, taping seams, and sealing penetration through the vapor retarder. The particle size of the gravel/crushed rock and sand should meet the gradation requirements presented in the following table.

Material for support of slabs should conform to the following gradation specification:

Table 4: Subslab Foundation Materials
Merritt College Child Development Center, Oakland, California

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

The sand overlying the membrane should be moist at the time concrete is placed. There should be no free liquid in the sand. If the sand has been placed and there is a possibility for precipitation, the sand should be covered with Visqueen and measures be made available to collect the precipitation and remove it from the Visqueen.

The concrete water:cement ratio should be 0.45 or less. Mid-range plasticizers may be used to increase concrete workability and facilitate pumping and placement. All slabs should be poured at a maximum slump of less than 5 inches. Excessive water content is the major cause of concrete cracking.

The project structural engineer should design the reinforcement and joints of any slabs proposed for the Site. The following recommendations are minimums. Slabs-on-grade should be a minimum of 4 inches thick and should be reinforced with at least No. 4 reinforcing bars placed at 18 inches on-center both ways at or slightly above the center of the structural section. Reinforcing bars should have a minimum clear cover of 1.5 inches, and hot bars should be cooled prior to placement of concrete. The aforementioned reinforcement may be used for anticipated uniform floor loads not exceeding 100 psf. If floor loads greater than 100 psf are anticipated, the slab should be evaluated by a structural engineer.

We recommend a maximum control joint spacing of about 2 feet in each direction for each inch of concrete thickness and a construction joint spacing of 10 to 12 feet, though the structural engineer should make the final decision on construction joints. Construction joints that abut the foundations should include a felt strip, or approved equivalent, that extends the full depth of the exterior slab. This will help to reduce the potential for permanent vertical offset between the slabs due to friction between the concrete edges. We recommend that exterior slabs be isolated from adjacent foundations.

7.7 Lateral Loads

Resistance to lateral loads from wind or seismic forces would be obtained from passive resistance on the vertical faces of footings. We recommend an equivalent fluid pressure of 400 pounds per cubic foot (pcf) be used for a passive resistance value acting on faces of embedded foundation members. The top foot of soil resistance, but not the weight of the top foot of soil, should be neglected in these calculations. The friction on the bottoms of footings and nonstructural slabs-on-grade also may be included in the design. A friction coefficient of 0.35 can be used for calculating base friction for footings. Where a vapor barrier is used between slab-on-grade and soil, a friction coefficient of 0.20 is recommended. These friction coefficient values do not include a factor of safety.

Backfill against structures should be compacted to a minimum of 90% relative compaction (ASTM D1557).

7.8 Pavement Design

Pavements for this project are expected to consist of parking and play areas. We have assumed that traffic loading will consist of light-duty pavement for light auto traffic, parking. We have assumed a Traffic Index of 4 for pavement design calculations.

The table below presents recommended pavement sections for the assumed Traffic Index based on the Caltrans Flexible Pavement Design Method. If imported fill is required in pavement areas, it should have an R-Value that is equal to or greater than that of the existing soils.

We recommend the following pavement design sections based on our experience with similar projects.

Table 5: Flexible Pavement Section
Merritt College Child Development Center, Oakland, California

Recommended Pavement Designs (R-Value =35)		
Traffic Index	**Pavement Component**	**Minimum Thickness (inches)**
4	asphalt concrete	3
	aggregate base	4

Note: While the Traffic Index is 4, the calculation, per Caltrans requirements, is based on a Traffic Index of 5.

Aggregate Base is to be Caltrans Type 2. Asphalt concrete shall meet the current requirements of the Caltrans District Engineer for the Oakland area.

To prepare for pavement construction, the exposed subgrade, if it is native soil, should be scarified to a depth of 6 inches and be compacted to at least 95% relative compaction (ASTM D1557). Engineered fill does not require additional preparation as long as it has not been allowed to dry out and form desiccation cracks more than 1/8 inch wide

Aggregate base should be compacted in one lift to a minimum of 95% relative compaction (ASTM D1557).

Concrete slabs-on-grade should be used for trash-collection areas and other locations that may experience heavy wheel or impact loads. The slab thickness should be designed to accommodate the anticipated vehicle loading and the subgrade modulus of 100 pounds per cubic inch divided by the width of the slab in feet. The concrete pavement should be supported on a minimum of 6 inches of Caltrans Class 2 aggregate base rock compacted to at least 95% relative compaction (ASTM D1557) over 6 inches of recompacted subgrade, also compacted to at least 95% relative compaction (ASTM D1557).

7.9 Site Drainage

All exterior surface areas should be sloped a minimum of 2% away from the buildings to facilitate drainage. In hardscape areas, drainage gradients should be maintained to carry surface water to area drains or off the Site. Surface-water ponding should not be allowed anywhere on the Site during or after construction. If planter areas will be created between buildings and walkways, drainage inlets should be placed and the ground surface sloped to collect and drain surface water. A representative of the geotechnical engineer should review the site-drainage plans and conduct a final drainage review.

7.10 Soil Corrosivity

The imported fill requirements in Section 7.2 require that the imported soil not be corrosive.

7.11 Exterior Flatwork

It is recommended that exterior concrete flatwork be a minimum of 4 inches thick and reinforced with reinforcing bars. Exterior flatwork should be underlain by at least 4 inches of aggregate base rock conforming to Caltrans Class 2 standards that is compacted to a minimum of 92% relative compaction (ASTM D1557). The exterior flatwork should be poured separately from building foundations so that they act independently of the walls and foundations. Soils below exterior flatwork should scarified to a depth of 6 inches and be compacted to a minimum of 90% relative compaction (ASTM D1557).

8.0 DESIGN REVIEW AND CONSTRUCTION MONITORING

Terraphase recommends that the geotechnical aspects of the project be reviewed by Terraphase during the design process. The scope of services may include:

- assisting the design team in providing specific recommendations for special cases
- reviewing the foundation design and evaluating the overall applicability of our recommendations
- reviewing the geotechnical portions of the project for possible cost savings through alternative approaches
- reviewing the proposed construction techniques to evaluate whether they satisfy the intent of our recommendations
- reviewing and stamping drawings

Terraphase recommends that foundation construction and earthwork performed during construction be monitored by a qualified representative from our office, including:

- site preparation (stripping and grading)
- placement of compacted fill and backfill
- all foundation excavations
- construction of slab, roadway, and/or parking-area subgrade

Terraphase's representative should be present to observe the soil conditions encountered during construction to evaluate the applicability of the recommendations presented in this report to the soil conditions encountered and to recommend appropriate changes in design or construction procedures, if conditions differ from those described herein.

9.0 LIMITATIONS

The opinions and recommendations presented in this report are based upon the scope of services, information obtained through the performance of the services, and the schedule as agreed upon by Terraphase and the party for whom this report was originally prepared. This report is an instrument of professional service and was prepared in accordance with the generally accepted standards and level of skill and care under similar conditions and circumstances established by the geotechnical consulting industry. No representation, warranty, or guarantee, express or implied, is intended or given. To the extent that Terraphase relied upon any information prepared by other parties not under contract to Terraphase, Terraphase makes no representation as to the accuracy or completeness of such information. This report is expressly for the sole and exclusive use of the party for whom this report was originally prepared for a particular purpose and only in its entirely. Only the party for whom this report was originally prepared and/or other specifically named parties have the right to make use of and rely upon this report. Reuse of this report or any portion thereof for other than its intended purpose, or if modified, or if used by third parties, shall be at the user's sole risk.

Furthermore, nothing contained in this report shall relieve any other party of its responsibility to abide by contract documents and applicable laws, codes, regulations, or standards.

Review

In the event that any change in the nature, design, or location of the proposed structure(s) is planned, the conclusions and recommendations in this report shall not be considered valid nor relied upon unless the changes are reviewed and the conclusions and recommendations of this report are modified or verified in writing.

Terraphase should be provided the opportunity for a general review of final design plans and specifications to assess that our recommendations have been properly interpreted and included in the design and construction documents.

Construction

To verify conditions presented in this report and modify recommendations based on field conditions encountered in the field, Terraphase should be retained to provide geotechnical engineering services during the construction phase of the project. This is to observe compliance with design concepts, specifications, and recommendations contained in this report, and to verify and refine our recommendations as necessary in the event that subsurface conditions differ from those anticipated prior to the start of construction.

10.0 REFERENCES

American Society of Civil Engineers (ASCE). 2016. 2016 Edition of ASCE 7: Minimum Design Loads for Building and Other Structures.

Boore, D.M., and AtkinsonG. M. 2008. Ground-Motion Prediction Equations for the Average Horizontal Component of PGA, PGV, and 5%-Damped PSA at Spectral Periods between 0.01 s and 10.0 s, Earthquake Spectra, Volume 24, No. 1, pages 99–138, February 2008.

Bowles, J. 1982. Foundation Analysis and Design, 3rd Edition. McGraw Hill Book Company, New York, NY.

California Department of Transportation (Caltrans). 2003. Corrosion Guidelines. September – available at http://www.dot.ca.gov/hq/esc/ttsb/corrosion/CorrGuidelinesSept03.pdf.

______. 2004. Highway Manual, Section 600, Pavement Structural Section. December 24.

California Geological Survey (CGS). 2003. Earthquake Zones of Required Investigation, Oakland East Quadrangle. February 14.

______. 2019. Note 48, Checklist for the Review of Engineering Geology and Seismology Reports for California Public Clients, Hospitals, and Essential Services Buildings. November.

Campbell, Kenneth and Yousef Bozorgnia. 2008. NGA Ground Motion Model for the Geometric Mean Horizontal Component of PGA, PGV, PGD, and 5% Damped Linear Elastic Response Spectra for Periods Ranging from 0.01 to 10 S., Earthquake Spectra, Volume 24, No. 1 pages 139-171, February 2008.

Chiou, Brian S.-J. and Robert R. Youngs. 2008 A NGA Model for the Average Horizontal Component of Peak Ground Motion and Response Spectra, Earthquake Spectra, Volume 24, No. 1, pages 173–215, February.

Coduto, D.P. 2001. Foundation Design, Principles and Practices, 2nd Edition, Prentice Hall, Upper Saddle River, New Jersey.

Department of Toxic Substances Control (DTSC). 2001. Information Advisory, Clean Imported Fill Material. October.

Division of Oil Gas and Geothermal Resources. 2019. Well Finder: https://maps.conservation.ca.gov/doggr/wellfinder/#openModal/-122.08795/37.79427/11

Federal Emergency Management Agency (FEMA). 2009. Alameda County, California and Incorporated Areas. Panel 95 of 725. Map 06001C0095G. August 3.

Fugro Consultants, Inc. (Fugro). 2019. EZ-FRISK 7.65 Build 004.

Jensen-Van Lienden Associates, Inc. (Jensen-Van Lienden). 2009. Geotechnical Study, Proposed New Allied Health Building, Merritt College Campus, 12500 Campus Drive, Oakland, CA. October 26.

Radbruch, Dorothy H. 1969. Areal and Engineering Geology of the Oakland East Quadrangle, California. GQ-769.

State of California. 2015. 2016 California Building Code.

U.S. Geological Survey (USGS). 1968. Upper Cretaceous and Lower Tertiary Rocks, Berkeley and San Leandro Hills, California. Geological Survey Bulletin 1251-J. J.E. Case.

______. 2012. Oakland East, California 7.5-Minute Series Topographic Quadrangle.

Woodward-Clyde-Sherard and Associates (Woodward-Clyde). 1960. Preliminary Soil Investigation of a Possible Site, Proposed Oakland City College, Hillcrest Estates Area, Oakland, California. March 11.

______. 1962. Soil Investigation for the Proposed Oakland City College, Near Redwood Road and Skyline Boulevard Oakland , California. May 11.

Willenbrock, J.H., Manbeck, H.B., and Suchar, M.G. 1998. Residential Building Design and Construction, Prentice-Hall, Inc., New Jersey.

FIGURES

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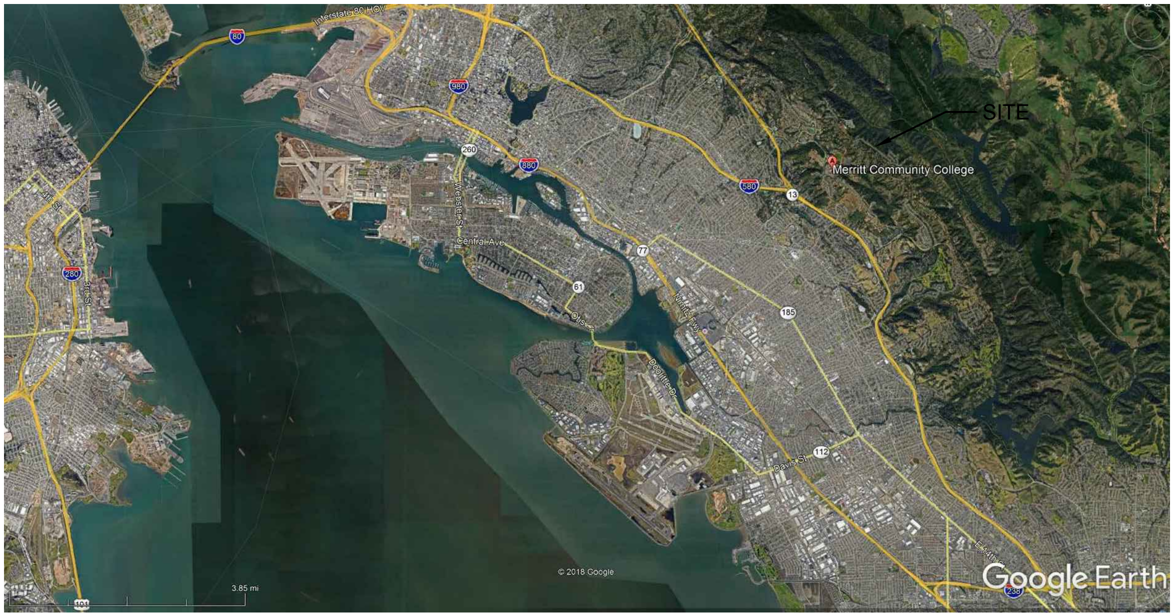
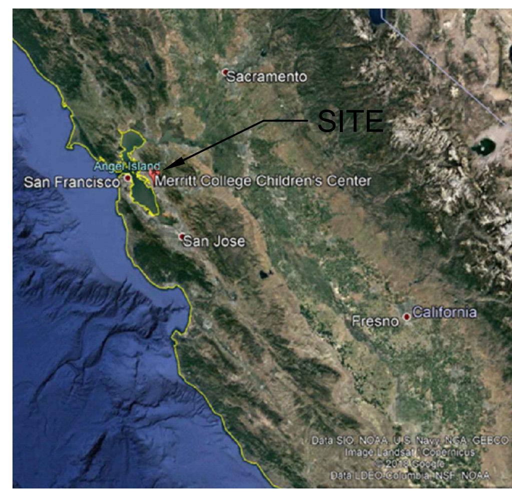


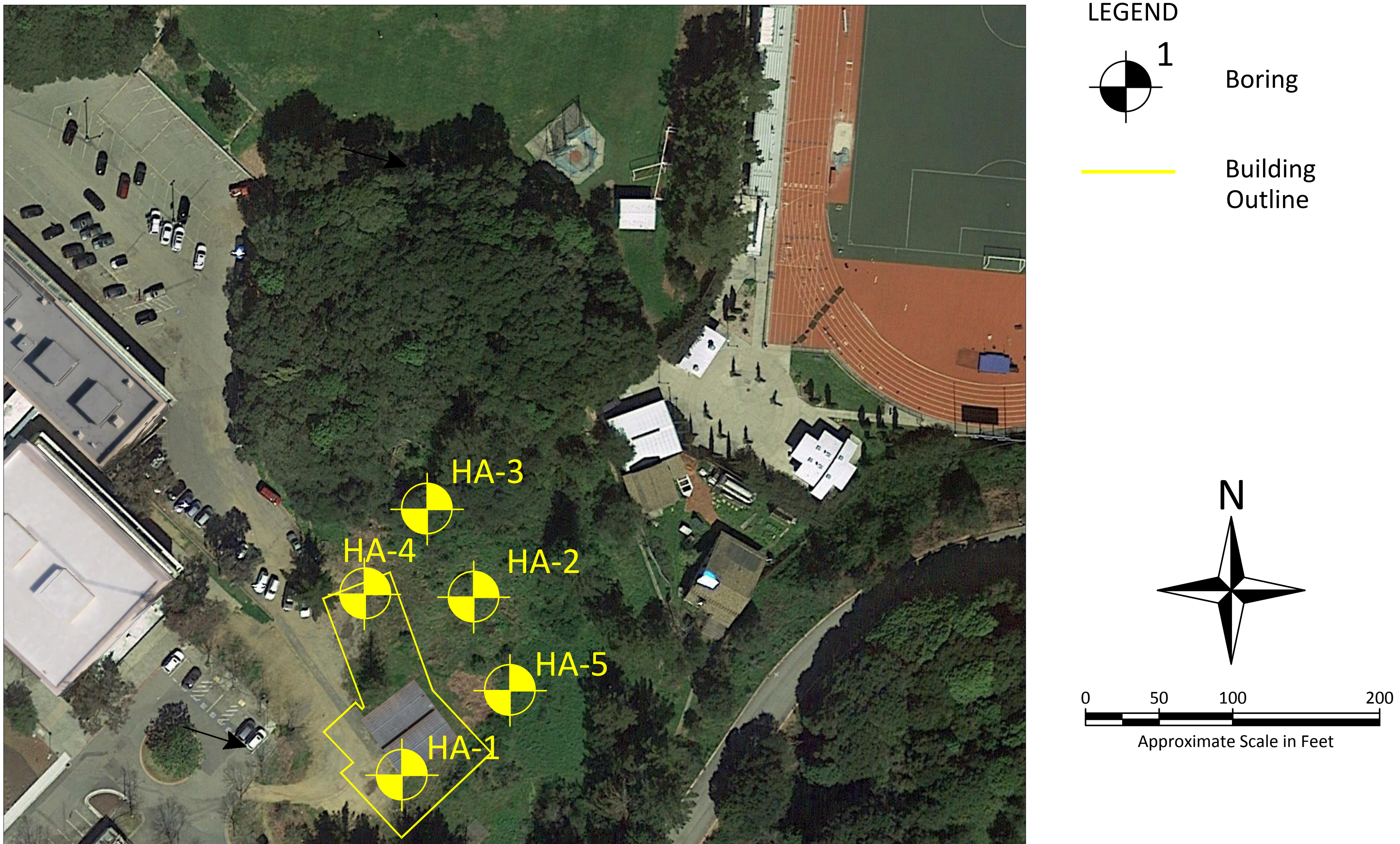


N

0 0.75 1.5 3
Approximate Scale in Miles

SAFETY FIRST	CLIENT: Peralta Community College District	**SITE LOCATION**
terraphase engineering	PROJECT: Merritt College Child Learning Center	
	PROJECT NUMBER: 0034.005.0003	**FIGURE 1**

Source: Google Earth



SAFETY FIRST	CLIENT: Peralta Community College District	Boring Locations
terraphase engineering	PROJECT: Child Development Center	
	PROJECT NUMBER: 0034.001.0001	FIGURE 2

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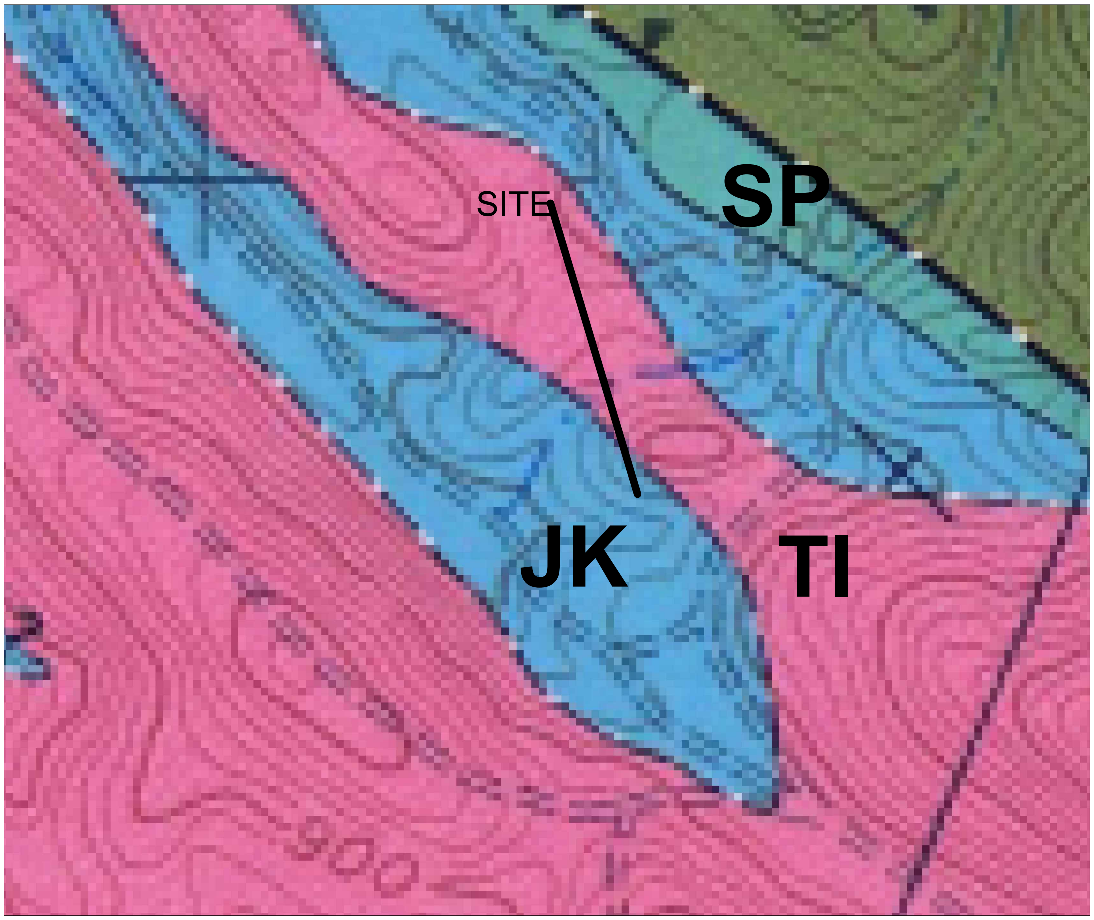
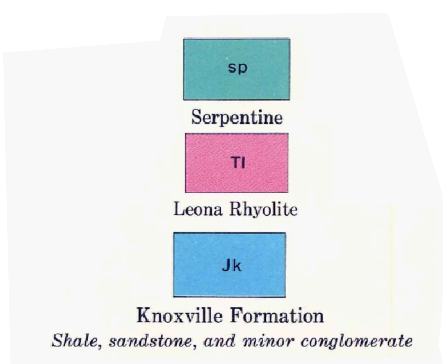
N

0 187.5 375 750
Approximate Scale in Feet

SOURCE: USGS TNM

SAFETY FIRST	CLIENT: Peralta Community College District	REGIONAL TOPOGRAPHY
terraphase engineering	PROJECT: Merritt College Child Learning Center	
	PROJECT NUMBER: 0034.005.0003	FIGURE 3





Source: Radbruch, 1969

SAFETY FIRST	CLIENT: PERALTA COMMUNITY COLLEGE DISTR		**GEOLOGICAL MAP**
terraphase engineering	PROJECT: CHILD DEVELOPMENT CENTER		
Source: USGS	PROJECT NUMBER: 0035.005.0003	DATE: 9-4-19	**FIGURE 4**

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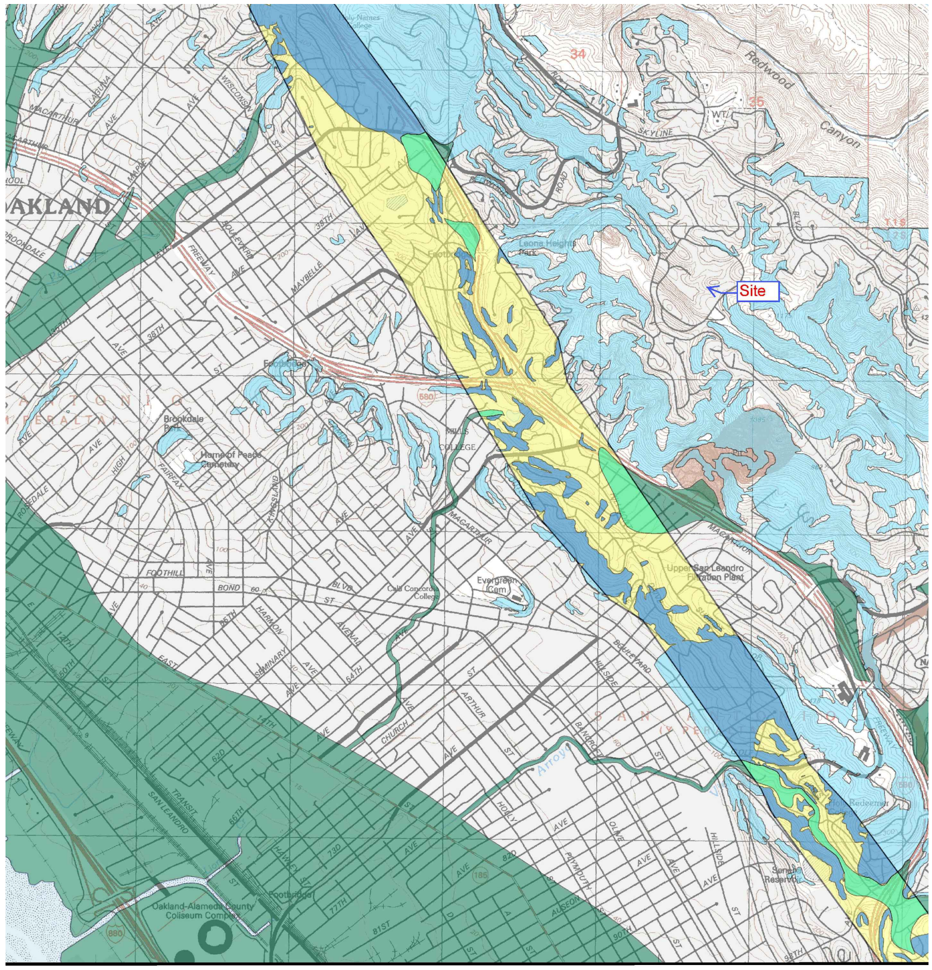

(SAN LEANDRO)

Map Preparation by: Kate Thomas and

1 0.5 0 1 2 Miles

1,000 500 0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000 Feet

1 0.5 0 1 2 Kilometers

1,000 500 0 1,000 2,000 Meters

Contour Interval 20 Feet

MAP EXPLANATION

EARTHQUAKE FAULT ZONES

Earthquake Fault Zones
Zone boundaries are delineated by straight-line segments; the boundaries define the zone encompassing active faults that constitute a potential hazard to structures from surface faulting or fault creep such that avoidance as described in Public Resources Code Section 2621.5(a) would be required.

Active Fault Traces
Faults considered to have been active during Holocene time and to have potential for surface rupture: Solid Line in Black or Red where Accurately Located; Long Dash in Black or Solid Line in Purple where Approximately Located; Short Dash in Black or Solid Line in Orange where Inferred; Dotted Line in Black or Solid Line in Rose where Concealed; Query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by fault creep.

1906 C ? ?

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.

OVERLAPPING EARTHQUAKE FAULT AND SEISMIC HAZARD ZONES

Overlap of Earthquake Fault Zone and Liquefaction Zone
Areas that are covered by both Earthquake Fault Zone and Liquefaction Zone.

Overlap of Earthquake Fault Zone and Earthquake-Induced Landslide Zone
Areas that are covered by both Earthquake Fault Zone and Earthquake-Induced Landslide Zone.

Note: Mitigation methods differ for each zone –
AP Act only allows avoidance; Seismic Hazard Mapping Act allows mitigation by engineering/geotechnical design as well as avoidance.

Source: California Geological Survey

SAFETY FIRST	CLIENT: PERALTA COMMUNITY COLLEGE DISTR		SEISMIC HAZARD ZONE MAP
terraphase engineering	PROJECT: CHILD DEVELOPMENT CENTER		
	PROJECT NUMBER: 0035.005.0003	DATE: 9-4-19	FIGURE 5

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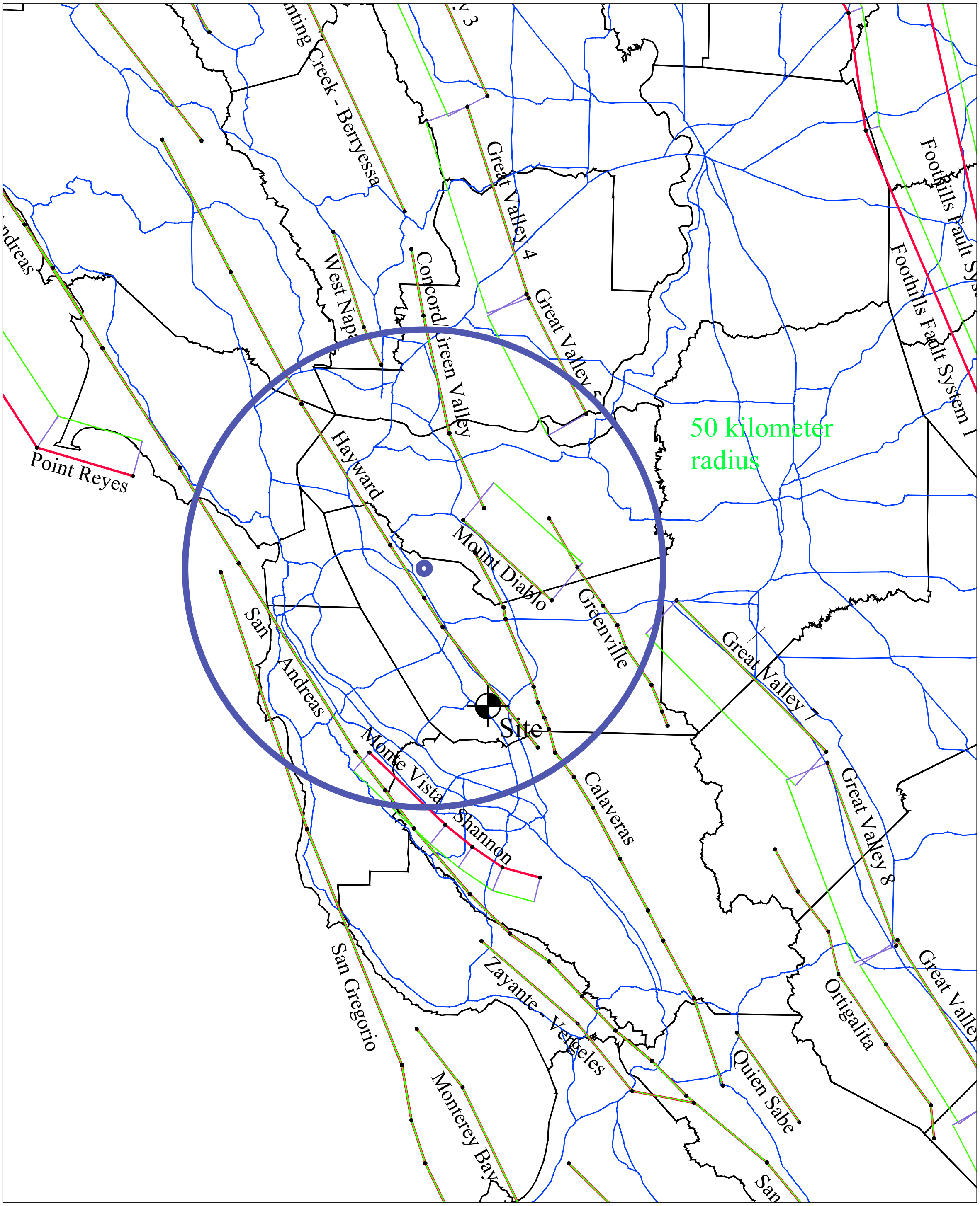

County Line — Major Road

Fault Bend — Fault Trace — Fault Plane Bottom Projected to Surface

Source: Cao et al, 2003

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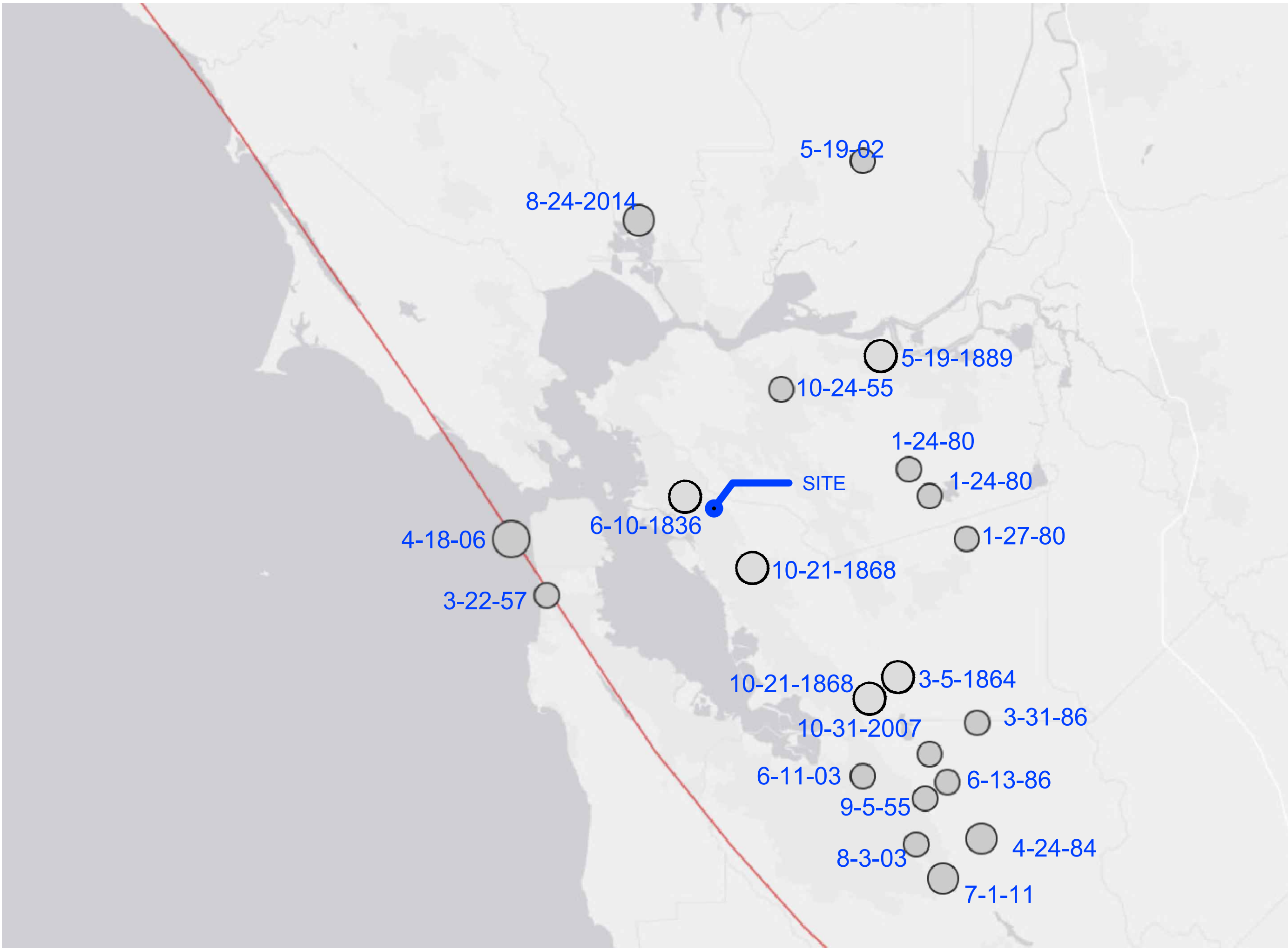
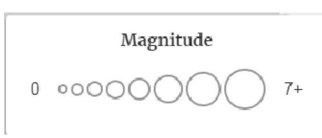
SAFETY FIRST	CLIENT: Peralta Community College District	EARTHQUAKE FAULT MAP
terraphase engineering	PROJECT: Child Development Center	
	PROJECT NUMBER: 0034.005.0001	FIGURE 6



Source:
https://earthquake.usgs.gov/earthquakes/search/



SAFETY FIRST	CLIENT: Peralta Community College District	**Historical Earthquakes**
terraphase engineering	PROJECT: Merritt College Child Learning Center	
	PROJECT NUMBER: 0034.005.0003	**Figure 7**

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APPENDIX A
RESULTS OF ASBESTOS TESTING

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MICRO ANALYTICAL LABORATORIES, INC.

BULK ASBESTOS ANALYSIS - PLM ARB 435

1225
Jeff Raines
Terraphase Engineering, Inc.
1404 Franklin St, Ste 600
Oakland, CA 94612

PROJECT:
PROJECT NO. 0034.005.0002

Micro Log In	**260766**
Total Samples	1
Date Sampled	08/08/2019
Date Received	08/12/2019
Date Analyzed	08/14/2019

SAMPLE INFORMATION	ASBESTOS INFORMATION QUANTITY (AREA %) / TYPES / LAYERS / DISTINCT SAMPLES	DOMINANT OTHER MATERIALS
Client #: 1 Micro #: 260766-01 Analyst: JM BULK Asb. / Total Pts.: 0 / 400 Matrix Removed: 0% Sensitivity: 0.250%	ND	1 % CELLULOSE 1 % FIBROUS GLASS Matrix Type: ROCK FRAGMENTS, CLAY, MISCELLANEOUS PARTICLES

Technical Supervisor: Gamini Ranatunga, Ph.D. 8/14/2019 Date Reported

Analyses use Polarized Light Microscopy (PLM), Micro Analytical SOP PLM-101,Rev.1/4/2013 for building materials (based on EPA-600/R93-116 (1993)), and California ARB 435 (1991) for applicable soil, rock, or aggregate samples. NOTES: Weight % cannot be determined by PLM estimation or point counts. Asbestos fibers with diameter below ~1 µm may not be detected by PLM. The absence of asbestos in dust or debris (including wipe or microvacuum), and in some compact materials, including floor tiles, cannot be conclusively established by PLM, and should be confirmed by Transmission Electron Microscopy (TEM). Only dominant non-asbestos materials are indicated. This report must not be interpreted as a conclusive identification of non-asbestos (fibrous or not). Quantities of non-asbestos fibers are estimated, not point counted. Preparation (all samples): grinding, milling; teasing bundles apart; drying, if needed, by hotplate. Acid dissolution, ashing, or other matrix reduction techniques may be applied to some samples; residue asbestos % is corrected for amount of matrix removed. Various sample interferences may prevent detection of small asbestos fibers, and hinder determination of some optical properties. Notes are made if point counting is used; otherwise, asbestos is quantified by calibrated visual estimation. Detection limit is material dependent. Detection of asbestos traces (<<1%) may not be reliable or reproducible by PLM. Lower quantitation limit (reporting limit) of PLM estimation is 1%. The Cal-OSHA definition of asbestos-containing construction material is 0.1% asbestos by weight; however, reliable determination of asbestos weight percent at this level cannot be done by PLM, and TEM is recommended. Sample heterogeneity is indicated by listing more than one distinct layer or material on the report. Composite asbestos percentages on multilayered samples are applicable only to layered wall systems (wallboard, joint compound, and related materials); compositing is based on clients' descriptions of a material as "joint compound". Clients are solely responsible for identification and description of bulk materials listed on field forms. Laboratory sample descriptions may differ from descriptions given by the client. Quality Control (QC): all results have been determined to be within acceptance limits prior to reporting. Samples that were reanalyzed are denoted by two sets of analyst initials. Unless otherwise stated in this report, all samples were received in acceptable condition for analysis. This report must not be used to claim product endorsement by NIST or any U.S. Government agency. This report shall not be reproduced except in full, without the approval of Micro Analytical Laboratories, Inc., and pertains only to the samples analyzed. ND = NO ASBESTOS DETECTED.

1225

terraphase engineering

260766
3-5days

TECHNICAL MEMORANDUM

To:
Micor Analytical Laboratories, Inc.
5900 Hollis Street, Suite M
Emeryville, CA 94608

From:
Jeff Raines, Terraphase

Date:
August 8, 2019

Project Number:
0034.005.0002

Subject: Request for CARB 435 Analysis

---

1 Bulk Sample for analysis for asbestos by CARB 435

Standard turnaround

Please report to:

Jeff Raines

510.645.1853

Jeff.raines@terraphase.com

re. by: Kao Saelel
8/12/2019 125pm

APPENDIX B
SITE-SPECIFIC SEISMIC HAZARD ASSESSMENT

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B-1 Site-Specific Seismic Hazard

B-1.1 Introduction

Because the mapped seismic parameters were far apart for Site Class B and Site Class C, a site-specific seismic hazard assessment was prepared for the Site using the shear wave velocity of the B/C boundary (760 meters per second [m/s]). The Seismic Design Category is E.

B-1.2 Soil Class

The USGS conducted a downhole seismic shear wave test in rhyolite on the Merritt College Campus (Figure B-1). Their result was 787 meters per second (m/s) which is the low end of Site Class B. For the analysis, a shear wave velocity of 760 m/s was used.

To assess how sensitive the results were to the choice of shear wave velocity, an analysis was made using 520 m/s. At that shear wave velocity, the spectral acceleration at 0.2g (where "g" is the acceleration of gravity at the Earth's surface), the likely fundamental period of a two-story building, was lower by less than 1%.

B-1.3 Methodology

A site-specific seismic risk assessment was performed for the Site in accordance with ASCE-7 (2016). EZ-Frisk version8.0 (beta) (Fugro 2019) was used to perform the probabilistic and deterministic seismic hazard assessments. The following ground motion predictors were used:

- Abrahamson-et al (2014) NGA West 2
- Boore-et al (2014) NGA West 2
- Campbell-Bozorgnia (2014) NGA West 2
- Chiou-Youngs (2014) NGA West 2
- Idriss (2014) NGA West 2

The first four ground motion predictors were weighted 22% in the analysis while Idriss (2014) was weighed 12%.

The maximum rotated component, 5% damping was determined using the methodology of Huang, Whittaker, and Luco (2008). The probabilistic result was modified using the mapped values of C_1 and C_r.

The design earthquake spectra was developed using the methodology of ASCE-7 (2016) Section 21. The probabilistic ground motion was developed based on the methodology of ASCE 7 (2010) Section 21.2.1.1.

The California fault database identified as “USGS08 California– 2014 Rates Excluded” was used in the analysis. We understand EZFRISK obtained this database directly from USGS and models the faults with multiple segments. Each segment is characterized with multiple magnitudes, occurrence or slip rates and weights.

B-1.4 Result

In accordance with ASCE-7 Section 21.4:

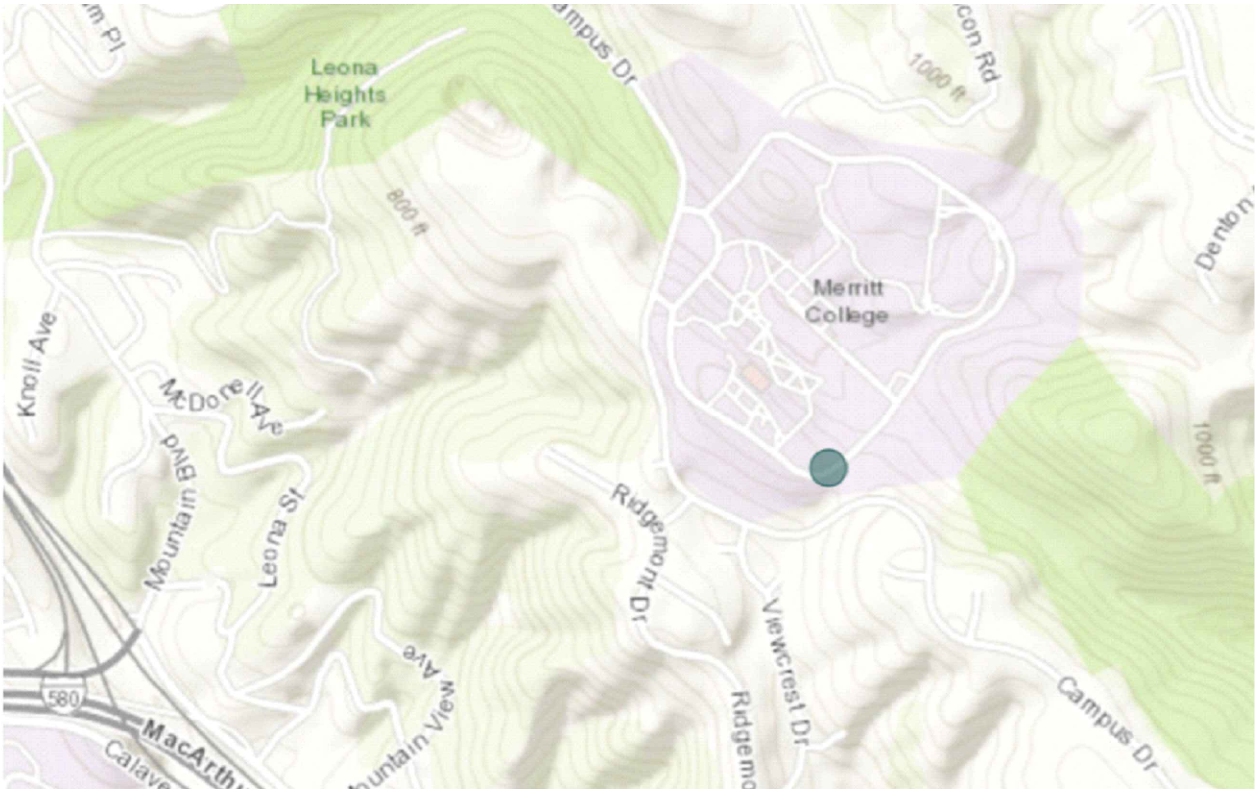
S_{DS} = 1.62g

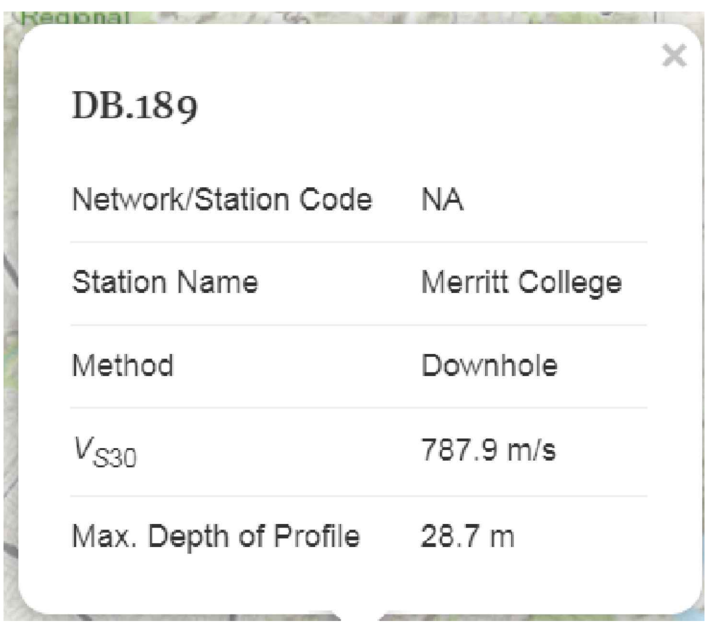
S_{D1} = 0.62g

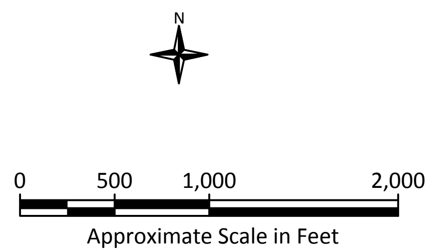
Where g is the acceleration of gravity at the Earth’s surface.

The calculations, output, and backup materials for the design response spectra are presented below. The results are presented in Table B-1 and shown on Figure B-1.

Deterministic spectral accelerations due to the Hayward Fault, located 1.66 kilometers from the Site, dominated the results.







Source:https://earthquake.usgs.gov/data/vs30/us/

SAFETY FIRST	CLIENT: PERALTA COMMUNITY COLLEGE DISTR		**SHEAR WAVE VELOCITY**
terraphase engineering Source: USGS	PROJECT: CHILD DEVELOPMENT CENTER		
	PROJECT NUMBER: 0035.005.0003	DATE: 9-4-19	**FIGURE B-1**

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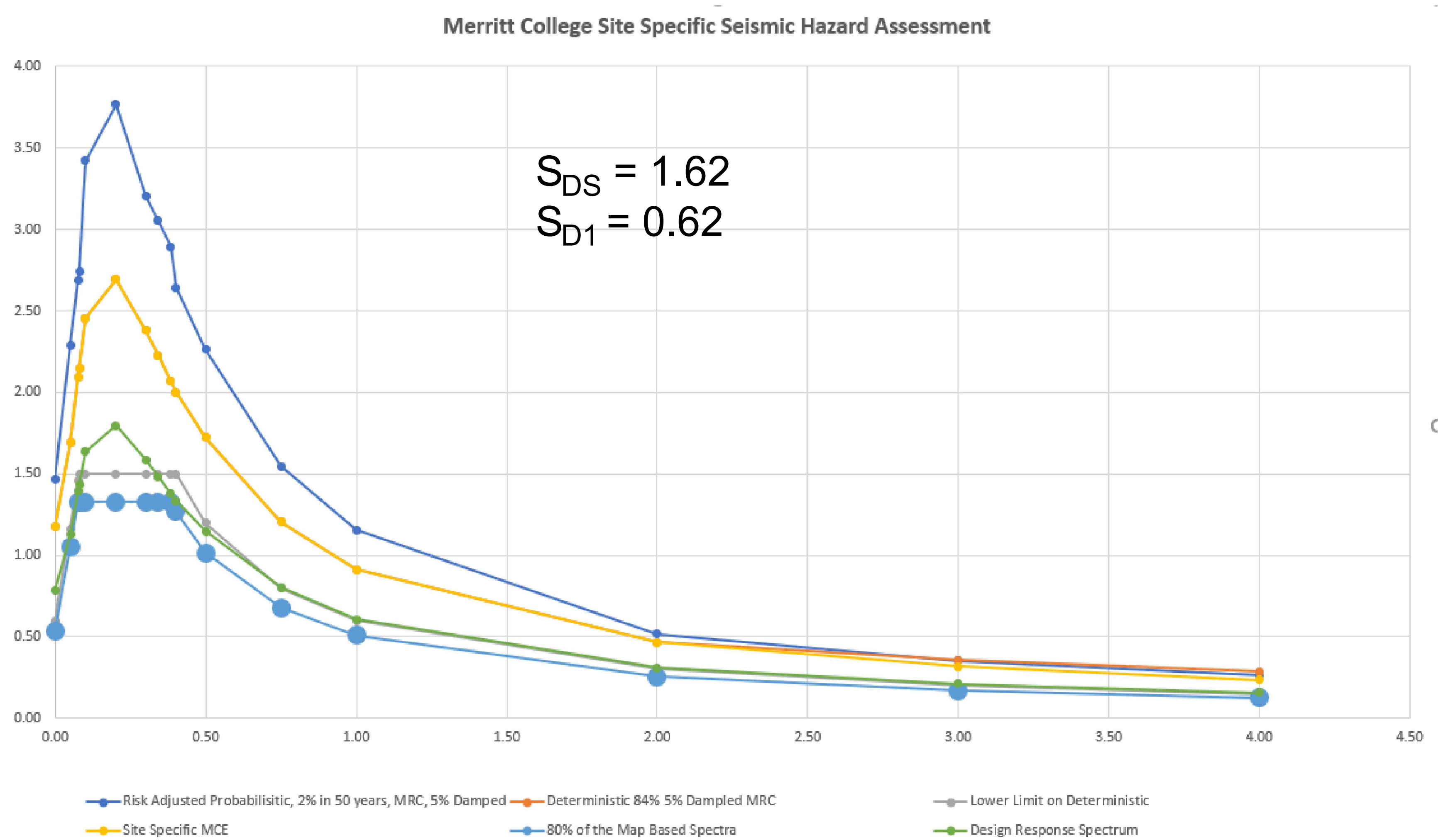


SAFETY FIRST	CLIENT: Peralta Community College District	**Site Specific Seismic Hazard Assessment**
terraphase engineering	PROJECT: Merritt College Child Learning Center	
	PROJECT NUMBER: 0034.005.0003	**Figure B-2**

	Uniform Hazard (2% in 50 years Probabilistic Spectrum)	C_R (Risk Coefficient)	Probabilistic MCE_R Response acceleration	Deterministic MCE_R Response acceleration	Deterministic Lower Limit	S_{aM} (Site-specific MCE_R spectral response acceleration)	Map Based General Response Spectrum	80% of Map Based General Response Spectrum	Design Response Spectrum
Source	Column 2 EZ-FRISK output	USGS Mapping tool; CRS=0.911, CR1=0.9	Per ASCE 21.2.1.1 Method 1; 2% in 50year spectrum*C_R	EZ-FRISK	Per ASCE 21.2.2; Figure 21.2-1 using Ss as 1.5 and S1 as 0.6; Fa=1.0 Fv=1.0 see CBC 1613A.2.2; (Site Class B)	Per ASCE 7 21.2.3 the lower of the probabilistic ground motions and deterministic ground motions	USGS Mapping Tool design response spectrum; S_{D1}=0.63, S_{DS}=1.66 (Fa=1.0, Fv=1.0)	=Map based general response * 0.8	ASCE 7 21.3; S_a=2/3S_{aM}
0.000	1.46	0.911	1.33	1.18	0.60	1.18	0.664	0.53	0.78
0.050	2.29	0.911	2.09	1.69	1.16	1.69	1.316	1.05	1.13
0.076	2.69	0.911	2.45	2.09	1.46	2.09	1.660	1.33	1.40
0.080	2.75	0.911	2.50	2.15	1.50	2.15	1.660	1.33	1.43
0.100	3.42	0.911	3.12	2.45	1.50	2.45	1.660	1.33	1.64
0.200	3.77	0.911	3.43	2.70	1.50	2.70	1.660	1.33	1.80
0.300	3.21	0.910	2.92	2.38	1.50	2.38	1.660	1.33	1.59
0.340	3.06	0.909	2.78	2.23	1.50	2.23	1.660	1.33	1.49
0.382	2.89	0.908	2.63	2.07	1.50	2.07	1.660	1.33	1.38
0.400	2.64	0.908	2.40	2.00	1.50	2.00	1.587	1.27	1.33
0.500	2.26	0.907	2.05	1.72	1.20	1.72	1.269	1.02	1.15
0.750	1.55	0.903	1.40	1.21	0.80	1.21	0.846	0.68	0.80
1.000	1.15	0.900	1.04	0.91	0.60	0.91	0.635	0.51	0.61
2.000	0.52	0.900	0.46	0.47	0.30	0.46	0.317	0.25	0.31
3.000	0.35	0.900	0.32	0.36	0.20	0.32	0.212	0.17	0.21
4.000	0.26	0.900	0.24	0.29	0.15	0.24	0.159	0.13	0.16

Seismic Design Category E

Highlighted cells are EZFrisk output, non-highlighted cells are linearly interpolated

Fa	1
Fv	1
Ss	2.491
S1	0.952
S_DS	1.66
S_D1	0.63
PGA	0.938
Ie	1.25
T_o = 0.2*(S_D1/S_DS)	0.0764
T_S = S_D1/S_DS	0.3822

```
*********************************************
*****              EZ-FRISK             *****
***** SEISMIC HAZARD ANALYSIS DEFINITION *****
*****       FUGRO CONSULTANTS, INC.      *****
*****        WALNUT CREEK, CA  USA       *****
*********************************************
```

PROGRAM VERSION
  EZ-FRISK 8.00 beta Build 000

ANALYSIS TITLE:
  Seismic Hazard Analysis Merritt College Child Development Center

ANALYSIS TYPE:
  Single Site Analysis

SITE COORDINATES
  Latitude 37.7891
  Longitude -122.164

INTENSITY TYPE: Spectral Response @ 5% Damping

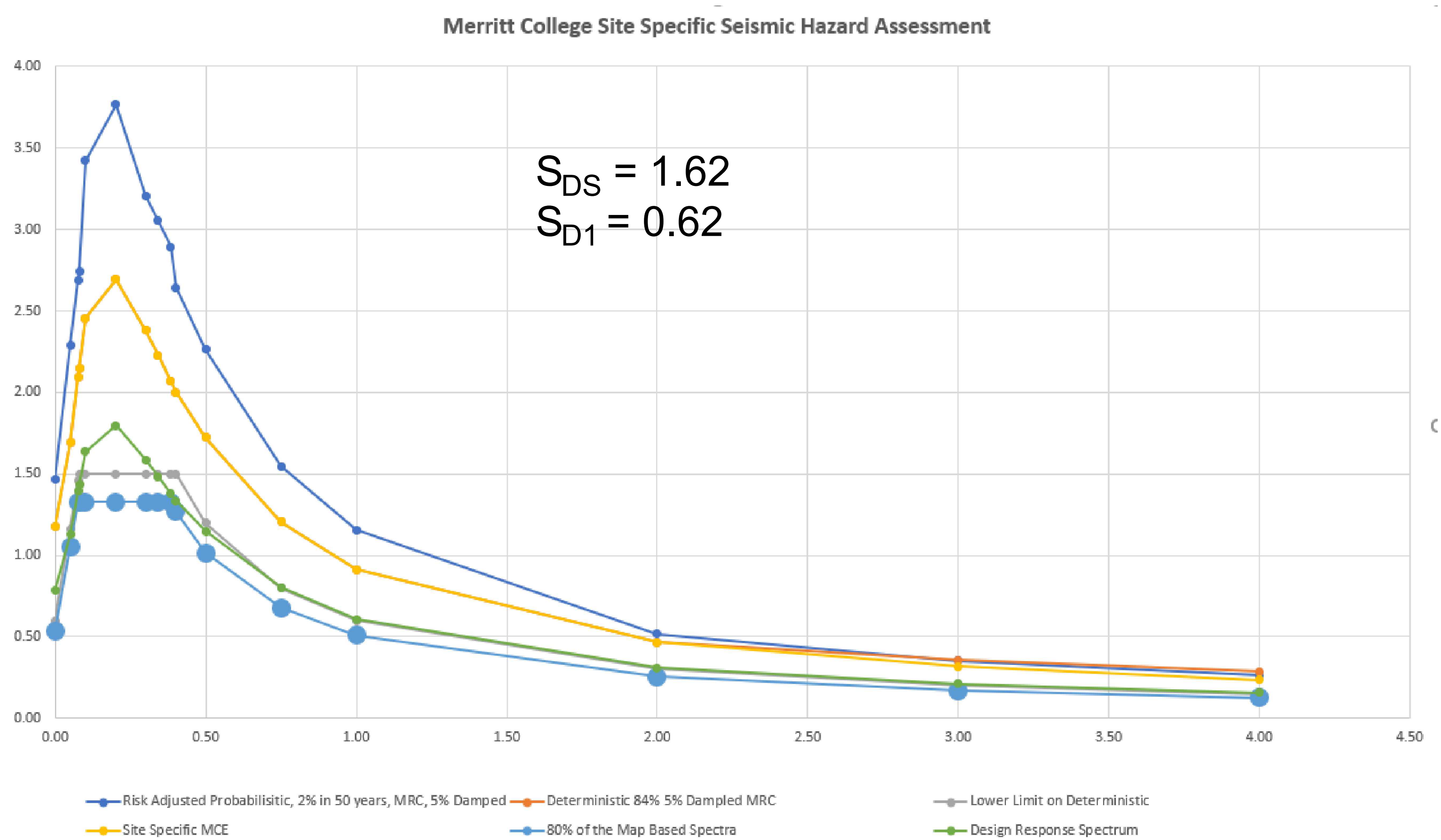
HAZARD DEAGGREGATION
  Status: OFF

SOIL AMPLIFICATION
  Method: Do not use soil amplification

ATTENUATION EQUATION SITE PARAMETERS
  Depth[Vs=1000m/s] (m): -1
  Estimate Z1 from Vs30 for CY NGA: 1
  Regional Code: Default
  Vs30 (m/s): 760
  Vs30 Is Measured: 0
  Z25 (km): 3

AMPLITUDES - Acceleration (g)
  0.0001
  0.001
  0.01
  0.02
  0.05
  0.07

J:\CADD FILES\0034 Peralta\Merritt College\FIGURES_2.dwg Drawn by:__jr__; Checked by:__ca__



SAFETY FIRST	CLIENT: Peralta Community College District	**Site Specific Seismic Hazard Assessment**
terraphase engineering	PROJECT: Merritt College Child Learning Center	
	PROJECT NUMBER: 0034.005.0003	**Figure B-2**

```
  0.077
  0.1
  0.2
  0.3
  0.34
  0.383
  0.4
  0.5
  0.7
  1
  2
  3

PERIODS (s)
  PGA
  0.05
  0.1
  0.2
  0.3
  0.4
  0.5
  0.75
  1
  2
  3
  4

DETERMINISTIC FRACTILES
  0.5
  0.84

PLOTTING PARAMETERS
  Period at which to plot PGA: 0.005

CALCULATIONAL PARAMETERS
  Fault Seismic Sources -
    Maximum inclusion distance           :   300 km
    Down dip integration increment       :   1 km
    Horizontal integration increment     :   1 km
    Number rupture length per earthquake :   1
  Subduction Interface Seismic Sources -
    Maximum inclusion distance           :   1000 km
    Down dip integration increment       :   5 km
    Horizontal integration increment     :   20 km
    Number rupture length per earthquake :   1
```

```
Subduction Slab Seismic Sources -
  Maximum inclusion distance           :   300 km
  Down dip integration increment       :   5 km
  Horizontal integration increment     :   20 km
  Number rupture length per earthquake :   1
Area Seismic Sources -
  Maximum inclusion distance           :   200 km
  Vertical integration increment       :   3 km
  Number of rupture azimuths           :   3
  Minimum epicentral distance step     :   0.5 km
  Maximum epicentral distance step     :   10 km
Gridded Seismic Sources -
  Maximum inclusion distance            :   300 km
  Default number of rupture azimuths    :   20
  Maximum distance for default azimuths :   40 km
  Minimum distance for one azimuth      :   150
  Use binned calcuations if possible    :   true
  Bins per decade in distance (km)      :   20
All Seismic Sources -
  Magnitude integration step           :   0.1 M
  Apply magnitude scaling              :   NO
  Include near-source directivity      :   YES
    Method    :  Huang, Whittaker, and Luco (2008)
    Component :  Maximum
    Hypocenter integration increment  :   5 km
```

ATTENUATION EQUATIONS

```
Name: Abrahamson-et al (2014) NGA West 2 USGS 2014
Database: C:\Program Files (x86)\EZ-FRISK 8.00\Files\standard.bin-attendb
Base: Abrahamson-et al 2014 NGA West 2
Truncation Type: USGS 2008 NSHM Truncation
Truncation Value: 3
Magnitude Scale: Moment Magnitude
Distance Type: Distance To Rupture

Name: Atkinson-Boore (2003) Cascadia Subduction USGS 2008
Database: C:\Program Files (x86)\EZ-FRISK 8.00\Files\standard.bin-attendb
Base: Atkinson-Boore 2003-3
Truncation Type: USGS 2008 NSHM Truncation
Truncation Value: 3
Magnitude Scale: Moment Magnitude
Distance Type: Distance To Rupture
```

Name: Atkinson-Boore (2003) Worldwide Subduction USGS 2008
Database: C:\Program Files (x86)\EZ-FRISK 8.00\Files\standard.bin-attendb
Base: Atkinson-Boore 2003-3
Truncation Type: USGS 2008 NSHM Truncation
Truncation Value: 3
Magnitude Scale: Moment Magnitude
Distance Type: Distance To Rupture

Name: BCHydro (2012) USGS 2014
Database: C:\Program Files (x86)\EZ-FRISK 8.00\Files\standard.bin-attendb
Base: BCHydro 2012
Truncation Type: USGS 2008 NSHM Truncation
Truncation Value: 3
Magnitude Scale: Moment Magnitude
Distance Type: Distance To Rupture

Name: Boore-et al (2014) NGA West 2 USGS 2014
Database: C:\Program Files (x86)\EZ-FRISK 8.00\Files\standard.bin-attendb
Base: Boore-et al 2014 NGA West 2
Truncation Type: USGS 2008 NSHM Truncation
Truncation Value: 3
Magnitude Scale: Moment Magnitude
Distance Type: Horizontal Distance To Rupture

Name: Campbell-Bozorgnia (2014) NGA West 2 USGS 2014
Database: C:\Program Files (x86)\EZ-FRISK 8.00\Files\standard.bin-attendb
Base: Campbell-Bozorgnia 2014 NGA West 2
Truncation Type: USGS 2008 NSHM Truncation
Truncation Value: 3
Magnitude Scale: Moment Magnitude
Distance Type: Distance To Rupture

Name: Chiou-Youngs (2014) NGA West 2 USGS 2014
Database: C:\Program Files (x86)\EZ-FRISK 8.00\Files\standard.bin-attendb
Base: Chiou-Youngs 2014 NGA West 2
Truncation Type: USGS 2008 NSHM Truncation
Truncation Value: 3
Magnitude Scale: Moment Magnitude
Distance Type: Distance To Rupture

Name: Idriss (2014) NGA West 2 USGS 2014
Database: C:\Program Files (x86)\EZ-FRISK 8.00\Files\standard.bin-attendb
Base: Idriss 2014 NGA West 2
Truncation Type: USGS 2008 NSHM Truncation
Truncation Value: 3

Magnitude Scale: Moment Magnitude
Distance Type: Distance To Rupture

Name: Zhao et al (2006) USGS 2008
Database: C:\Program Files (x86)\EZ-FRISK 8.00\Files\standard.bin-attendb
Base: Zhao et al 2006 Japan
Truncation Type: Trunc Sigma*Value
Truncation Value: 3
Magnitude Scale: Moment Magnitude
Distance Type: Distance To Rupture

SEISMIC SOURCE SUMMARY TABLE

Source	Region	Closest Distance	Deterministic Magnitude	Fault Mechanism	Dip Angle	Dips To	Site Lies
Bartlett Springs	USGS 2008 California - 2014 Rates Excluded	130.64	7.3000	Strike Slip	90.0000	--	S
Calaveras	USGS 2008 California - 2014 Rates Excluded	13.98	7.0250	Strike Slip	90.0000	--	W
Collayomi	USGS 2008 California - 2014 Rates Excluded	118.91	6.7000	Strike Slip	90.0000	--	S
Great Valley 5, Pittsburg Kirby Hills	USGS 2008 California - 2014 Rates Excluded	38.98	6.7000	Strike Slip	90.0000	--	SW
Green Valley Connected	USGS 2008 California - 2014 Rates Excluded	20.01	6.8000	Strike Slip	90.0000	--	SW
Greenville Connected	USGS 2008 California - 2014 Rates Excluded	30.92	7.0000	Strike Slip	90.0000	--	W
Greenville Connected U	USGS 2008 California - 2014 Rates Excluded	30.92	7.0000	Strike Slip	90.0000	--	W
Hayward-Rodgers Creek	USGS 2008 California - 2014 Rates Excluded	1.66	7.3340	Strike Slip	90.0000	--	NE
Hosgri	USGS 2008 California - 2014 Rates Excluded	186.28	7.3000	Strike Slip	80.0000	NE	N
Hunting Creek-Berryessa	USGS 2008 California - 2014 Rates Excluded	73.84	7.1000	Strike Slip	90.0000	--	S
Maacama-Garberville	USGS 2008 California - 2014 Rates Excluded	98.90	7.4000	Strike Slip	90.0000	--	SE
Monterey Bay-Tularcitos	USGS 2008 California - 2014 Rates Excluded	96.52	7.3000	Strike Slip	90.0000	--	N
Northern San Andreas	USGS 2008 California - 2014 Rates Excluded	30.25	8.0500	Strike Slip	90.0000	--	NE
Ortigalita	USGS 2008 California - 2014 Rates Excluded	96.86	7.1000	Strike Slip	90.0000	--	NW
Quien Sabe	USGS 2008 California - 2014 Rates Excluded	119.15	6.6000	Strike Slip	90.0000	--	NW
Rinconada	USGS 2008 California - 2014 Rates Excluded	128.93	7.5000	Strike Slip	90.0000	--	N
SAF - creeping segment	USGS 2008 California - 2014 Rates Excluded	124.81	6.7000	Strike Slip	90.0000	--	NW
San Andreas Creeping Section Gridded	USGS 2008 California - 2014 Rates Excluded	86.84	6.0000	Strike Slip	90.0000	--	NW
San Gregorio Connected	USGS 2008 California - 2014 Rates Excluded	38.12	7.5000	Strike Slip	90.0000	--	E
Shear 1 Gridded	USGS 2008 California - 2014 Rates Excluded	125.48	7.6000	Strike Slip	90.0000	--	SW
West Napa	USGS 2008 California - 2014 Rates Excluded	42.30	6.7000	Strike Slip	90.0000	--	S
Zayante-Vergeles	USGS 2008 California - 2014 Rates Excluded	79.63	7.0000	Strike Slip	90.0000	--	N
Shallow - Extensional Gridded	USGS 2014 WUS Gridded Source	0.00	8.0000	N|SS	90.0000	--	Above
California Gridded	USGS 2008 California - 2014 Rates Excluded	0.00	7.0000	SS|R	90.0000	--	Above
Shallow - Nonextensional Gridded	USGS 2014 WUS Gridded Source	86.62	8.0000	SS|R	90.0000	--	S
Great Valley 1	USGS 2008 California - 2014 Rates Excluded	166.79	6.8000	Reverse	15.0000	W	S
Great Valley 10	USGS 2008 California - 2014 Rates Excluded	163.15	6.5010	Reverse	15.0000	SW	NW
Great Valley 11	USGS 2008 California - 2014 Rates Excluded	184.96	6.6000	Reverse	15.0000	SW	NW

Great Valley 2	USGS 2008 California - 2014 Rates Excluded	145.07	6.5010 Reverse	15.0000 W	S
Great Valley 3, Mysterious Ridge	USGS 2008 California - 2014 Rates Excluded	95.80	7.1000 Reverse	20.0000 SW	S
Great Valley 4a, Trout Creek	USGS 2008 California - 2014 Rates Excluded	77.88	6.6000 Reverse	20.0000 SW	S
Great Valley 4b, Gordon Valley	USGS 2008 California - 2014 Rates Excluded	52.10	6.8000 Reverse	20.0000 W	S
Great Valley 7	USGS 2008 California - 2014 Rates Excluded	52.09	6.9000 Reverse	15.0000 SW	W
Great Valley 8	USGS 2008 California - 2014 Rates Excluded	91.00	6.8000 Reverse	15.0000 W	NW
Great Valley 9	USGS 2008 California - 2014 Rates Excluded	126.15	6.8000 Reverse	15.0000 SW	NW
Monte Vista-Shannon	USGS 2008 California - 2014 Rates Excluded	39.80	6.5010 Reverse	45.0000 SW	N
Mount Diablo Thrust	USGS 2008 California - 2014 Rates Excluded	16.74	6.7000 Reverse	38.0000 NE	SW
Point Reyes	USGS 2008 California - 2014 Rates Excluded	61.21	6.9000 Reverse	50.0000 NE	E
California Gridded Deep	USGS 2008 California - 2014 Rates Excluded	34.89	7.2000 Intraslab	90.0000 --	S
Deep - California Gridded	USGS 2014 WUS Gridded Source	23.45	8.0000 Intraslab	90.0000 --	S
Deep - Pacific NW Gridded	USGS 2014 WUS Gridded Source	23.45	8.0000 Intraslab	90.0000 --	S

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MAGNITUDE CONVERSIONS

This analysis does not require any magnitude conversions.
Note: Your analysis may indirectly use magnitude conversions that are not listed here.

Echo File Creation Time: 11:48:23 Wednesday, December 11, 2019

PROBABILISTIC RESULT

ANNUAL FREQUENCY OF EXCEEDANCE: 4.041e-004
RETURN PERIOD: 2474.9
PROBABILITY OF EXCEEDENCE: 2.0% IN 50.0 YEARS
Column 1: Spectral Period
Column 2: Acceleration (g) for: Mean
Column 3: Acceleration (g) for: Abrahamson-et al (2014) NGA West 2 USGS 2014
Column 4: Acceleration (g) for: Boore-et al (2014) NGA West 2 USGS 2014
Column 5: Acceleration (g) for: Campbell-Bozorgnia (2014) NGA West 2 USGS 2014
Column 6: Acceleration (g) for: Chiou-Youngs (2014) NGA West 2 USGS 2014
Column 7: Acceleration (g) for: Idriss (2014) NGA West 2 USGS 2014
Column 8: Acceleration (g) for: Atkinson-Boore (2003) Cascadia Subduction USGS 2008
Column 9: Acceleration (g) for: Atkinson-Boore (2003) Worldwide Subduction USGS 2008
Column 10: Acceleration (g) for: Zhao et al (2006) USGS 2008
Column 11: Acceleration (g) for: BCHydro (2012) USGS 2014

1	2	3	4	5	6	7	8	9	10	11
PGA	1.463e+000	1.653e+000	1.323e+000	1.389e+000	1.348e+000	1.658e+000	3.340e-003	5.712e-003	7.109e-003	6.892e-003
0.05	2.288e+000	2.113e+000	2.214e+000	2.633e+000	2.221e+000	2.112e+000	4.349e-003	9.438e-003	1.033e-002	7.666e-003

0.1	* 3.423e+000	* 3.374e+000	* 3.421e+000	* 3.474e+000	* 3.478e+000	* 3.313e+000	5.379e-003	1.136e-002	1.791e-002	1.280e-002
0.2	* 3.767e+000	* 4.431e+000	* 3.481e+000	* 3.223e+000	* 3.940e+000	* 3.681e+000	9.591e-003	1.244e-002	1.820e-002	1.276e-002
0.3	* 3.206e+000	* 3.202e+000	* 3.032e+000	2.887e+000	* 3.688e+000	* 3.189e+000	8.545e-003	1.005e-002	1.371e-002	1.055e-002
0.4	2.641e+000	2.342e+000	2.552e+000	2.510e+000	* 3.108e+000	2.630e+000	7.901e-003	8.254e-003	1.207e-002	9.164e-003
0.5	2.264e+000	1.854e+000	2.224e+000	2.165e+000	2.676e+000	2.299e+000	6.426e-003	6.455e-003	1.041e-002	6.894e-003
0.75	1.548e+000	1.146e+000	1.567e+000	1.651e+000	1.857e+000	1.317e+000	4.463e-003	4.191e-003	6.910e-003	4.271e-003
1	1.154e+000	8.476e-001	1.166e+000	1.286e+000	1.285e+000	1.012e+000	3.486e-003	3.138e-003	4.834e-003	3.103e-003
2	5.165e-001	3.981e-001	4.832e-001	6.007e-001	5.594e-001	4.832e-001	1.881e-003	1.419e-003	2.284e-003	1.300e-003
3	3.523e-001	2.566e-001	3.244e-001	4.196e-001	3.290e-001	4.289e-001	1.082e-003	9.793e-004	1.415e-003	7.783e-004
4	2.612e-001	2.066e-001	2.535e-001	2.982e-001	2.184e-001	3.462e-001	8.125e-004	6.858e-004	1.022e-003	4.797e-004

Warning: Values marked with the character '*' are extrapolated values and should be considered suspect. (NOTE ADDED BY Terraphase: Probabilistic didn't govern)

DETERMINISTIC RESULT

Deterministic Spectra Results using EZ-FRISK 8.00 beta Build 000

Largest Amplitudes of Ground Motions Considering All Sources Calculated using Weighted Mean of Attenuation Equations
Amplitude Units: Acceleration (g)

Fractile: 0.5

Period	Amplitude	Magnitude	Closest Distance (km)	Region	Controlling Source
PGA	6.468e-001	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
0.05	9.091e-001	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
0.1	1.286e+000	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
0.2	1.412e+000	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
0.3	1.243e+000	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
0.4	1.036e+000	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
0.5	8.804e-001	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
0.75	6.007e-001	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
1	4.498e-001	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
2	2.229e-001	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
3	1.660e-001	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
4	1.318e-001	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek

Fractile: 0.84

Period	Amplitude	Magnitude	Closest Distance (km)	Region	Controlling Source
PGA	1.176e+000	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
0.05	1.691e+000	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
0.1	2.453e+000	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
0.2	2.695e+000	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
0.3	2.379e+000	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
0.4	2.000e+000	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek

0.5	1.721e+000	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
0.75	1.205e+000	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
1	9.124e-001	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
2	4.670e-001	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
3	3.566e-001	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek
4	2.860e-001	7.33 Mw	1.66	USGS 2008 California - 2014 Rates Excluded	Hayward-Rodgers Creek