
Appendix 1-I
Preliminary Geotechnical Assessment – Geosyntec Consultants

2 September 2025

VIA EMAIL

Ronelle Candia
Dudek
605 Third Street
Encinitas, CA 92024

**Subject: Avocado Site Location
 Ventura Compressor Station Modernization Project
 Seismic Design Desktop Review
 Ventura, California**

Dear Ms. Candia

Geosyntec Consultants, Inc. (Geosyntec) is pleased to submit this letter report to Dudek presenting a summary of a desktop review completed for the Southern California Gas Company's (SoCalGas') proposed Ventura Compressor Station Modernization Project (Project) in Ventura, California to address comments from the California Public Utilities Commission's (CPUC) Data Request #1 dated 1/17/25 related to item DR 1.6. This letter report provides a summary of the desktop review, a discussion of the findings, an estimated site-class designation, and a preliminary seismic design category for the potential Avocado site location identified by Dudek.

BACKGROUND

The objective of the desktop review is to evaluate anticipated subsurface conditions, geologic hazards, and estimate the seismic design category for the potential Avocado site in response to requests made by the CPUC for the Proponent's Environmental Assessment (PEA). Based on discussions with Dudek, Geosyntec was requested to prepare a written summary detailing the following preliminary information related to the Soils and Geology component of the PEA, specifically the following bullets for the potential site of interest.

- Normal geologic information - soil types, depth to bedrock, depth to groundwater, etc.
- Landslide potential
- Rockfall hazards
- Fault crossing proximity
- Liquefaction potential
- Seismic design category

METHODOLOGY

Geosyntec performed a PEA-level desktop review to evaluate the anticipated subsurface conditions at the Avocado site location provided to Geosyntec via GoogleEarth™ file on 22 May 2025. The desktop review included reviewing publicly available aerial imagery, published geologic maps of the

immediate site area, geologic literature, accessing the California Department of Transportation's (CalTrans) GeoDOG database, and utilizing the American Society of Civil Engineers (ASCE) Vs₃₀ Hazard Tool and California Geological Survey (CGS) Map Sheet 48.

We understand the purpose of this desktop evaluation is for preliminary constructability and project planning purposes and should be re-evaluated using site-specific information once design and associated project components are further developed.

SITE AND GEOLOGIC CONDITIONS

Regional Geology

The Avocado site is situated within the western margin of the Ventura Basin in the Transverse Ranges geomorphic province, which extends approximately 320-miles east from Point Arguello and San Miguel Island to the Pinto Mountains of the Mojave Desert. The Transverse Ranges province is characterized by a series of east-west-trending mountain ranges and valleys that are oblique to the predominant northwest-southeast structural fabric of southern California. This atypical orientation is the result of a restraining bend in the San Andreas fault system that has rotated and compressed the region into its current configuration. The compression has resulted in folding, thrust and reverse faulting, and rapid regional uplift with a similar east-west trend.

The Ventura Basin consists of an elongated sedimentary trough that developed within an east-west trending syncline, with its fold axis roughly parallel to the Santa Clara River. Locally, the basin is situated between the Red Mountain fault zone (RMFZ) to the north and the Oak Ridge fault to the south and extends from eastern Piru to Ventura before continuing offshore beneath the Santa Barbara Channel. Sedimentation within the basin began in the early Miocene (22 million years ago [mya]) during crustal stretching and consists of a thick sequence of marine and non-marine sediments and bedrock including shale, sandstone, and conglomerate. The onshore portion of the basin was later uplifted during the Pleistocene to its present configuration. A regional geologic map and the approximate limits of the Avocado site is presented in Figure 1.

Seismic Setting

Faults in California are generally classified as "Holocene-active," "Pre-Holocene active," and "age-undetermined." The division of these major groups is based on criteria by the CGS for the Alquist-Priolo Earthquake Fault Zoning Program [CGS, 2018]. By definition, a Holocene-active fault is one that has experienced displacement within the Holocene (last 11,700 years). A Pre-Holocene fault has evidence of displacement prior to the last 11,700 years, and an age-undetermined fault has either not been studied, or the results were inconclusive regarding the age of displacement.

The Ventura Basin lies within a seismically complex region of the Transverse Ranges and is bordered by the Red Mountain fault zone (RMFZ) and Oak Ridge fault. The RMFZ extends northwest in a series of en-echelon side-stepping reverse faults and continues offshore, paralleling the Mission Ridge and Santa Ynez fault zones, and the offshore Pitas Point fault. The Pitas Point and RMFZ onshore-offshore system is characterized by high rates of Pliocene-Quaternary fault slip and may be capable of generating frequent large earthquakes [Sorlien et al., 2000]. The Oak Ridge fault delineates the

southern boundary of the Ventura Basin, extends onshore from the Santa Barbara Channel, and trends northeast to the Santa Susana Mountains. The Oak Ridge fault is the longest south-dipping reverse/thrust fault in the western Transverse Ranges, which contrasts the region's predominantly north-dipping reverse faults [Yeats, 1988]. The RMFZ and Oakridge fault have absorbed significant strain during the clockwise rotation and crustal shortening in the Transverse Ranges throughout the Miocene [Sorlien et al., 2000], making them potential sources of seismic hazards in the Ventura Basin.

The RMFZ (South Strand) and Ventura fault are the closest major Holocene-active faults to the potential Avocado site, with the mapped trace of the Ventura fault extending across the southern extent of the site access road. The RMFZ is a well-constrained series of reverse faults that trend south from Ojai Valley, continue northwest subparallel to the Pacific Ocean coastline, and extend offshore south of Carpinteria. Estimated slip rates on the RMFZ are between 1.0 millimeters per year (mm/yr) and 5.0 mm/yr [Treiman, 2006]. According to the Uniform California Rupture Forecast, Version 3 [UCERF3, Field et al., 2015], the RMFZ (South Strand) has a mean 30-year probability of an earthquake equal to or greater than 6.7 moment magnitude (**M**) (30 Year **M**≥6.7 probability) of 3.00 percent, a mean 30 Year **M**≥7.0 probability of 2.42 percent, and a mean 30 Year **M**≥7.5 probability of 0.13 percent. The mean 30 Year **M**≥8.0 probability was not recorded. The onshore Ventura fault is a well-constrained, north-dipping, reverse fault that extends approximately 8.1 miles east from the Pacific Ocean along the southern base of Ventura's foothills. Recent studies indicate the Ventura fault has a slip rate between 0.2 mm/yr and 1.0 mm/yr and is likely an extension of the offshore Pitas Point fault [Perry and Bryant, 2017]. According to UCERF3, the Ventura fault has a mean **M**≥6.7 probability of 1.42 percent, a mean 30 Year **M**≥7.0 probability of 1.40 percent, a mean 30 Year **M**≥7.5 probability of 0.97 percent, and a mean 30 Year **M**≥8.0 probability of <0.01 percent.

Other Holocene-active faults closest to the potential Avocado site of interest include the Javon Canyon fault to the northwest and the Faults near Oakview and Meiners Oaks to the north. Regional Holocene-active faults in the vicinity of the potential sites of interest include the Northridge blind thrust to the east and the San Andreas fault zone to the north. The closest pre-Holocene fault to the potential site includes a moderately constrained unnamed fault, which extends approximately 2.3 miles west from the foothills of northern Ventura and into the foothills to the west. These faults, with their respective distances from the sites and UCERF3 participation probabilities, are presented in Table 1 on the following page. The locations of regional faults are shown on Figure 2.

Table 1. Summary of Nearby Faults

Fault Name	Distance and Direction from Avocado Site ¹	Mean 30 Year Participation Probability (%) ²			
		M _≥ 6.7	M _≥ 7.0	M _≥ 7.5	M _≥ 8.0
Unnamed fault in California	0.7 miles NE	NR	NR	NR	NR
Ventura-Pitas Point	1.5 miles S	1.42	1.40	0.97	<0.01
Red Mountain fault zone (South Strand)	4.8 miles NW	3.00	2.42	0.13	NR
Javon Canyon	4.8 miles NW	NR	NR	NR	NR
Sisar	5.5 miles N	0.60	0.60	0.53	<0.01
Faults near Oakview and Meiners Oaks	6.6 miles N	NR	NR	NR	NR
San Cayetano	11.7 miles NE	1.69	1.58	0.82	<0.01
Santa Ynez	13.2 miles N	1.37	1.30	0.54	NR
Mission Ridge fault system (Mission Ridge section)	19.0 miles NW	0.64	0.59	0.49	NR
Pine Mountain	19.4 miles NE	0.42	0.24	0.04	NR
Oak Ridge (Bardsdale section)	21.3 miles E	1.90	1.54	1.05	<0.01
Big Pine fault zone	24.6 miles N	0.32	0.15	0.05	NR
Northridge	35.2 miles NE	0.85	0.79	0.50	<0.01
San Gabriel fault zone	36.0 miles NE	0.59	0.57	0.52	0.03
San Andreas fault zone	37.9 miles NE	17.03	16.97	16.82	6.61

Notes:

- Distances from site noted are the closest distance to the surface trace or inferred projection of the fault as measured from mapped traces in the USGS Quaternary Fault and Fold Database of the United States (USGS, 2017).
- As reported by the “According to the Uniform California Earthquake Rupture Forecast”, Version 3 (UCERF3, Field et al., 2015). “NR” = Not Reported

Surface Conditions

The potential Avocado site is located in the foothills approximately 1.5 miles north of U.S. Route 101 and 0.5 miles west of Highway 33/Stanley Ave. Based on aerial imagery, the site is situated on moderately steep terrain and bordered by agricultural crops to the south and east. This site is underlain by Holocene-age terrace and alluvial deposits of consolidated clay, sand, gravel and cobble with some boulder-sized material. The Pleistocene-age Pico Formation and Santa Barbara claystone are mapped on the northern slope adjacent to the site with an approximate structural orientation of N85°W and bedding dip of 33 to 36 degrees to the southwest [Tan et al., 2003].

GEOLOGIC HAZARDS

Fault Ground Rupture

Seismically induced fault surface rupture occurs as the result of differential movement across a fault that propagates to the ground surface. The potential for fault surface rupture is generally considered to be significant along “Holocene active” faults and to a lesser degree along “Pre-Holocene active” faults [CGS, 2018]. A review of published geologic maps did not identify the presence of an active fault crossing or projecting towards the potential Avocado site [CDMG, 1998]. However, as presented in Figure 2, the mapped trace of the active Ventura fault extends across the southern extent of the proposed site access road.

Strong Ground Shaking

The potential site is located in a seismically active region and will likely experience moderate to severe ground shaking due to a large magnitude earthquake that occurs on a local or regional active fault during the proposed compressor station's expected lifespan. Therefore, seismically induced ground shaking resulting from an earthquake on a nearby active fault, such as the RMFZ, or a regional fault like the Santa Ynez or San Andreas fault zones, is considered to be the major geologic hazard affecting the Project.

Landslide and Rockfall

Landslides within the Ventura area are abundant due to rapid uplift and deformation of sedimentary formational deposits that range greatly in consistency from unconsolidated to well indurated. Specific formational units such as the Santa Barbara and Pico Formations are typically more prone to landsliding following periods of above average rainfall or seismic shaking from near or more distant seismic sources.

According to the California Geological Survey (CGS; Figure 3) Earthquake Zones of Required Investigation, Ventura Quadrangle map [CGS, 2003], the Avocado site is located within a mapped landslide hazard zone and the site is underlain by the landslide prone Pico Formation, which consists of weakly cemented sandstone, siltstone, and mudstone. Based on our review of the available geologic maps and GoogleEarth™ aerial imagery, no mapped landslides have been identified within the immediate site area (Figure 4); however, given the moderately steep terrain and anticipated subsurface conditions, the risk of slope instability associated with landslides and seismically induced landsliding is considered high.

Rockfall hazards are typically associated with unstable rock outcrops on steep terrain that undergo climatic or biological changes, which include pore pressure, freeze-thaw cycles, root growth, and weathering. Topography within the Project's mapped buffer zone (Figure 5) does not include slopes that exceed 60 degrees, therefore, rockfall hazards are considered low.

Liquefaction

Seismically induced liquefaction is a phenomenon where saturated soils lose a significant portion of their strength and gain some mobility due to seismic shaking or other large cyclic loading. The material types most susceptible to liquefaction are loose to medium-dense granular soils and low plasticity fine-grained soils. A rapid increase in groundwater pressures (excess pore water pressure) leads to the loss of soil strength. Signs of soil liquefaction may include a loss of bearing capacity beneath foundations, surface settlements, tilting in level ground, and instabilities in sloping areas. Soil liquefaction can also result in increased lateral and uplift pressures on buried structures, e.g., lightweight or unrestrained buried structures may float upward to the ground surface during a liquefaction event. Other factors, such as soil mineralogy, void ratio, and age, contribute to liquefaction susceptibility. Generally, the older or denser a deposit, the less susceptible it is to liquefaction.

According to the CGS Earthquake Zones of Required Investigation, Ventura Quadrangle [CGS, 2003], the potential Avocado site is not located within a mapped liquefaction zone, and anticipated depth to groundwater is estimated to be greater than 40-feet (Figure 6); therefore, the liquefaction potential is considered low.

SITE CLASS ESTIMATION

Site class designations categorize the soil and rock conditions at sites evaluated through geotechnical field investigations. These investigations generally include, but are not limited to, standard penetration tests (SPTs), geotechnical lab testing, and geophysical surveys (i.e., shear wave velocity [V_{s30}]). Where site-specific data are not available to a depth of 100 feet (30 meters), soil properties are estimated based on assumed subsurface geologic conditions.

Based on Geosyntec's desktop review and project understanding, site-specific geotechnical investigations or geotechnical subsurface data is not currently available at the potential Avocado site. Due to limited subsurface data at the potential site of interest, site class designations were estimated based on topographical and geomorphological features, the averaged V_{s30} data calculated with CGS Map Sheet 48, and the professional experience of Geosyntec. V_{s30} results are compared with Table 20.3-1 ASCE 7-16 [ASCE, 2016] and used to estimate the site classification. Depth to bedrock estimates are presented on Figure 7.

Averaged V_{s30} data obtained from CGS Map Sheet 48 (~1,260 feet per second [ft/s], Figure 8) indicates subsurface materials at Avocado border Site Class D and Site Class C classifications (1,200 ft/s). However, due to the topography at the site and anticipated proximity to the mapped Santa Barbara claystone and Pico Formation, it is Geosyntec's professional opinion that soft sedimentary rock is relatively shallow in this region and result in V_{s30} values representative of soft rock. Therefore, Site Class C is estimated for the Avocado site.

SEISMIC DESIGN CATEGORY

Based on the values presented in Table 2 on the following page, the S_1 value was reported at greater than 0.75 for the proposed Avocado site location. In accordance with ASCE 7-16, Section 11.4.8, and 2022 CBC Section 1613.2.5, the Seismic Design Category was estimated as E for Type III risk

structures, and F for Type IV risk structures. Geosyntec recommends these estimations be re-evaluated as part of detailed project design with a site-specific geotechnical investigation.

The seismic ground motion values listed in Table 2 were derived in accordance with the ASCE 7-16 Standard¹ and the 2022 California Building Code (CBC)². Using the estimated site class and the project location, the following site coefficients and parameters were calculated using the ASCE 7 Hazard Tool³ online application:

Table 2: Seismic Ground Motions and Seismic Design Category

PARAMETER	Avocado
Estimated Site Class	C
Latitude, Longitude	34.304639; -119.311127
Mapped Spectral Response Acceleration Parameter, S_1	0.763
Design Spectral Response Acceleration, Parameter S_{DS}	1.619
Design Spectral Response Acceleration, Parameter S_{D1}	0.712
Peak Ground Acceleration PGA_M	1.065
Seismic Design Category (Note 2) Risk Category III Risk Category IV	E F

Notes:

- 1) Requires site specific ground motion hazard analysis.
- 2) In accordance with CBC, sites with $S_1 > 0.75$ will be designated as SDC E and F for Type III and IV structures, respectively.

LIMITATIONS

The desktop review for the identified project site was based on publicly available information. The recommendations made herein are based on the assumption that soil conditions do not deviate appreciably from those identified in the available referenced documents. This desktop review has been prepared in accordance with current practices and the standard of care exercised by scientists and

¹ American Society of Civil Engineers (ASCE), 2016. "Minimum Design Loads and Associated Criteria for Buildings and Other Structures" ASCE Standard 7-16

² California Building Code, 2022. Title 24, Part 2, Volume 2.

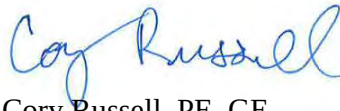
³ ASCE Hazard Tool, 2025. <https://ascehazardtool.org>. Accessed 19 March 2025

engineers performing similar tasks in this area. The conclusions contained in this report are based solely on the analysis of the conditions observed by Geosyntec personnel. We cannot make any assurances concerning the completeness of the data presented to us.

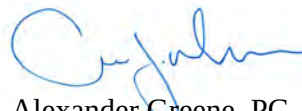
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California, including Ventura County, is an area of high seismic risk. It is generally considered economically unfeasible for construction-related excavations to resist earthquake loadings without damage. Proposed structures designed in accordance with the recommendations presented in this report could experience limited distress/damage if subjected to strong earthquake shaking.

Sincerely,



Cory Russell, PE, GE
Senior Geotechnical Engineer



Alexander Greene, PG, CEG
Senior Principal Engineering Geologist



FIGURES

- Figure 1 – Regional Geologic Map
- Figure 2 – Regional Fault Map
- Figure 3 – Earthquake Fault and Seismic Hazard Zones
- Figure 4 – Landslides
- Figure 5 – Rockfall Map
- Figure 6 – Depth to Groundwater
- Figure 7 – Depth to Bedrock
- Figure 8 – Avocado Site V_{S30} Map Sheet

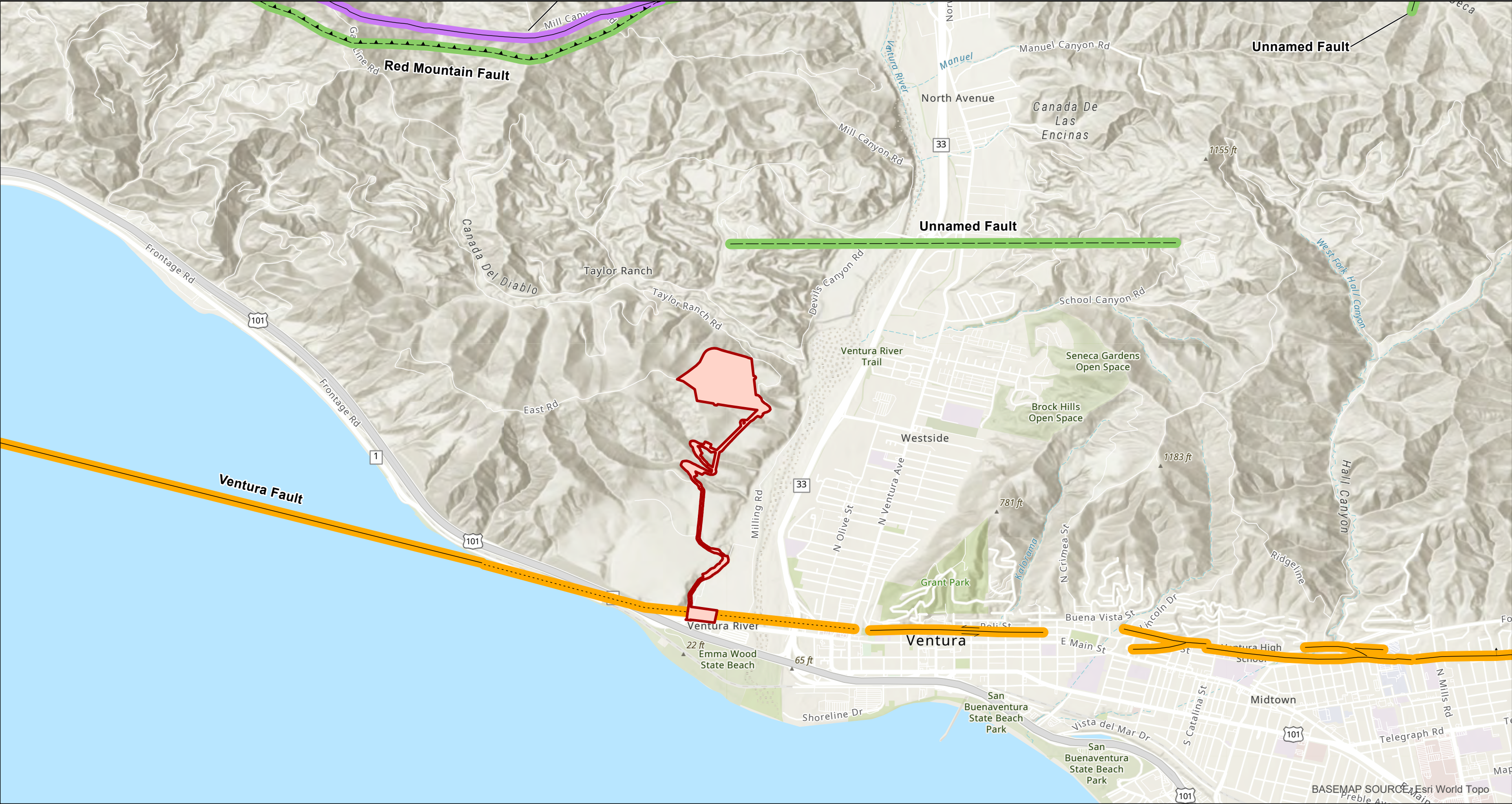
ATTACHMENTS

- Attachment A – ASCE 7 Hazard Tool Output

REFERENCES

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- California Division of Mines and Geology (CDMG), 1998. "Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada." Prepared for International Conference of Building Officials to be used with 1997 UBC, February.
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- CGS Map Sheet 48: Shear-wave Velocity in Upper 30m of Surficial Geology (VS30). <https://gis.data.cnra.ca.gov/datasets/cadoc::cgs-map-sheet-48-shear-wave-velocity-in-upper-30m-of-surficial-geology-vs30/explore>. Accessed 19 March 2025.
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- Yeats, R. S., 1988, Oak Ridge Fault, Ventura Basin, California; Slip Rates and Late Quaternary History, U.S. Geological Survey Open-File Report 89-343.

FIGURES



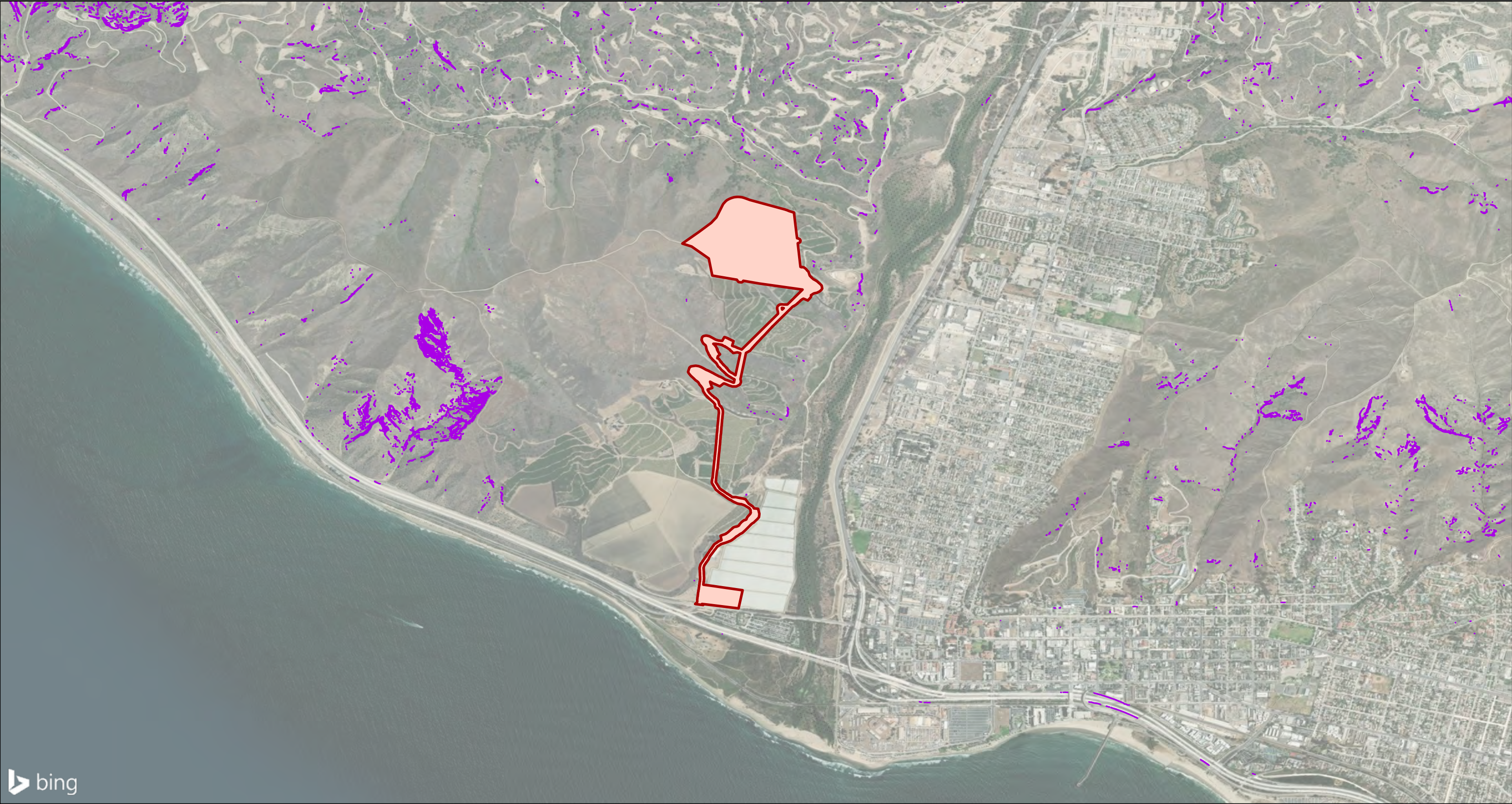
Holocene displacement (< 15,000 years) - Mapped Fault Location - Dashed were Approximated - Concealed Late Quaternary displacement (< 750,000 years) - Mapped Fault Location - Dashed were Approximated - Concealed	Quaternary & unspecified displacement (< 1,600,000 years) - undifferentiated Quaternary Well Constrained - undifferentiated Quaternary Moderately Constrained - undifferentiated Quaternary Inferred - Site Boundary SOURCE: - Faults: Fault Activity Map of California, CGS (California Geological Survey) Jennings and Bryant, 2010	Additional Fault Symbols: - Bar and ball on downthrown side (relative or apparent) - Arrows along fault indicate relative or apparent direction of lateral movement - Arrow on fault indicates direction of dip - Low angle fault (barbs on upper plate). Fault surface generally dips less than 45 degrees but locally may have been subsequently steepened. On offshore faults, barbs simply indicate a reverse fault regardless of steepness of dip.	Regional Fault Map Avocado Site Ventura Compressor Station Modernization Project Ventura, California Geosyntec consultants San Diego September 2025	Figure 2
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bing SOURCE: Seismic hazard datasets were compiled and published by the California Geologic Survey in 2023.	Earthquake Fault and Seismic Hazard Zones Avocado Site Ventura Compressor Station Modernization Project Ventura, California	
	Geosyntec consultants San Diego September 2025	Figure 3



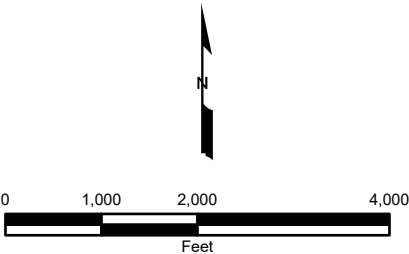
? Landslide (Source/Scarp-Questionable) XX Landslide (Source/Scarp) ■ Landslide (Deposit) ■ Site Boundary		Landslides Avocado Site Ventura Compressor Station Modernization Project Ventura, California	
SOURCE: Landslide datasets were compiled and published by the California Geologic Survey.		Geosyntec consultants	
San Diego		September 2025	
		Figure 4	



bing

-  Area with Slope Greater than 60 Degrees
-  Site Boundary

SOURCE: Slope areas created from UGSG elevation data.



Rockfall Hazards

Avocado Site
Ventura Compressor Station
Modernization Project
Ventura, California

Geosyntec
consultants

Figure
5

San Diego

September 2025

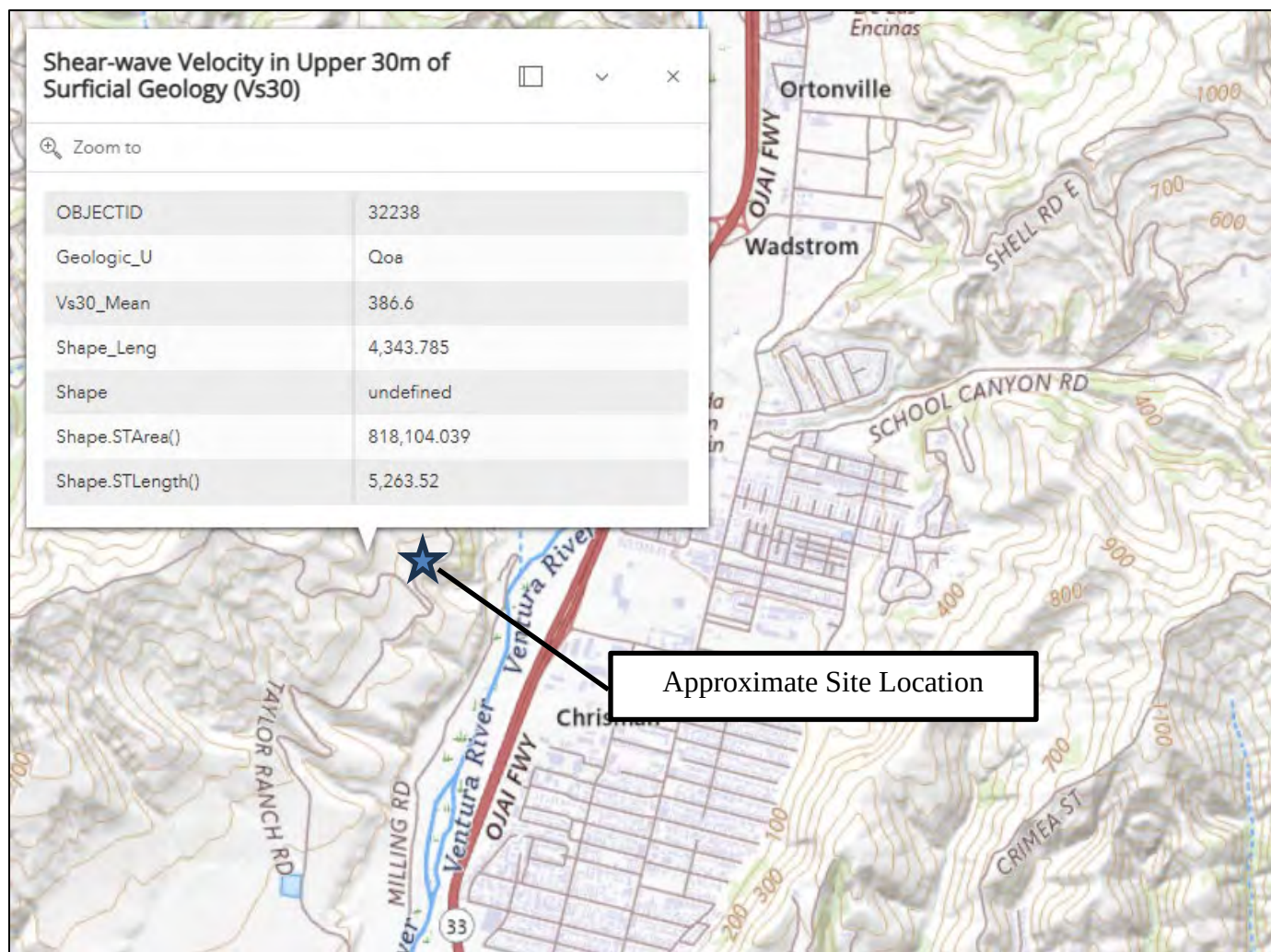


FIGURE 8 – AVOCADO SITE V_{s30} MAP SHEET

ATTACHMENT A

ASCE 7 Hazard Tool Output

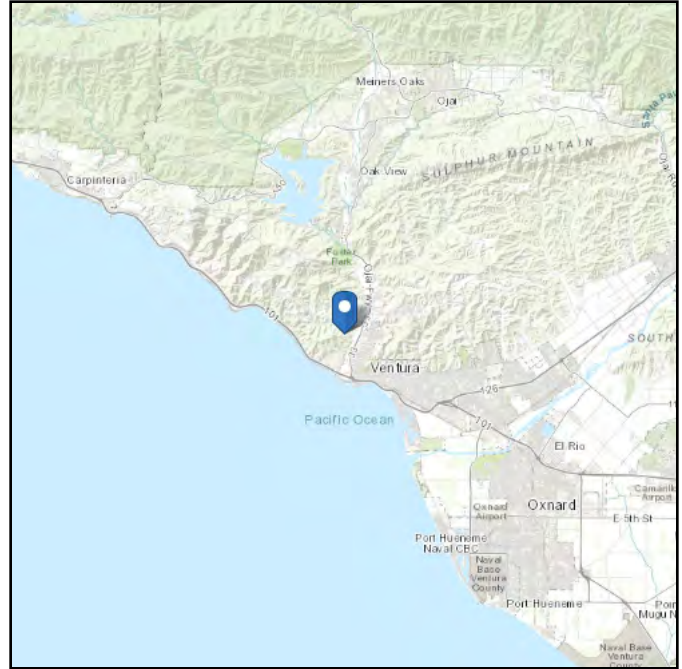
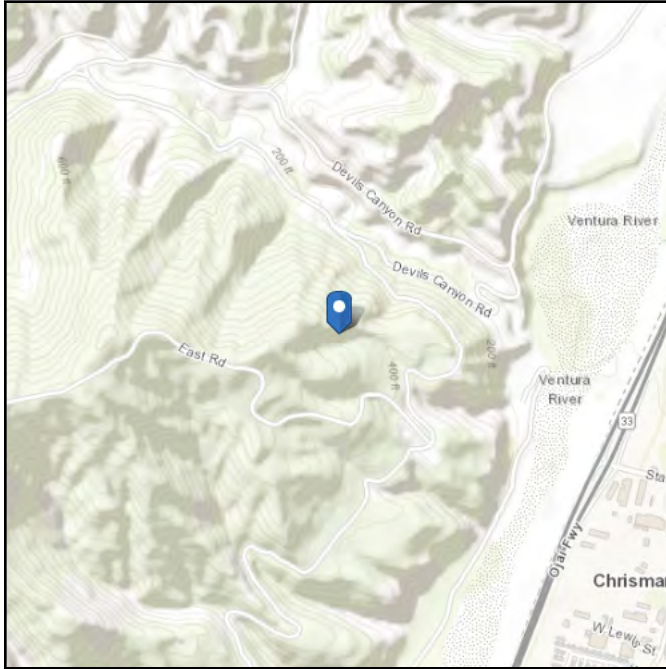


ASCE Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: III
Soil Class: C - Very Dense
Soil and Soft Rock

Latitude: 34.304639
Longitude: -119.311127
Elevation: 535.1629954093361 ft
(NAVD 88)

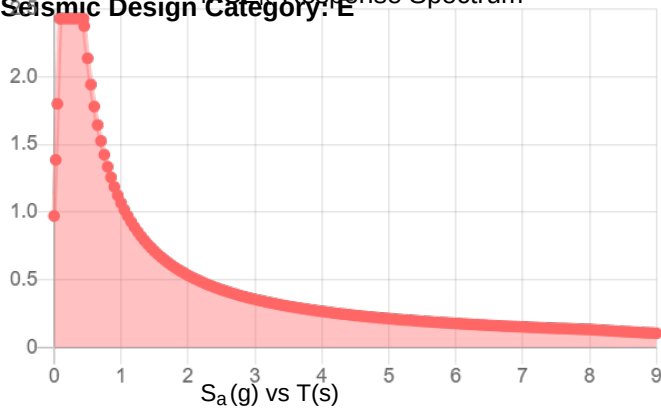


Site Soil Class: C - Very Dense Soil and Soft Rock

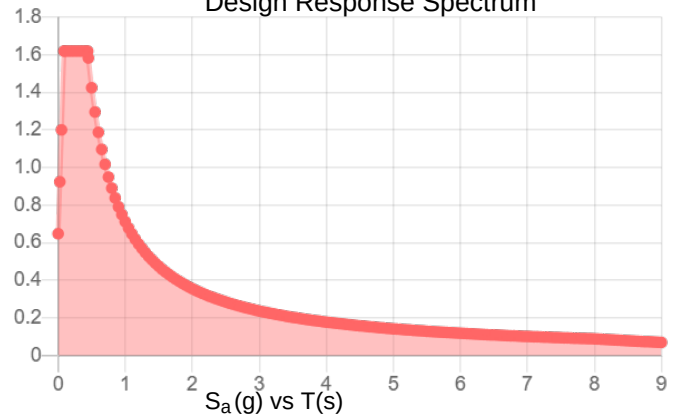
Results:

S_S :	2.024	S_{D1} :	0.712
S_1 :	0.763	T_L :	8
F_a :	1.2	PGA :	0.888
F_v :	1.4	PGA _M :	1.065
S_{MS} :	2.429	F_{PGA} :	1.2
S_{M1} :	1.068	I_e :	1.25
S_{DS} :	1.619	C_v :	1.3

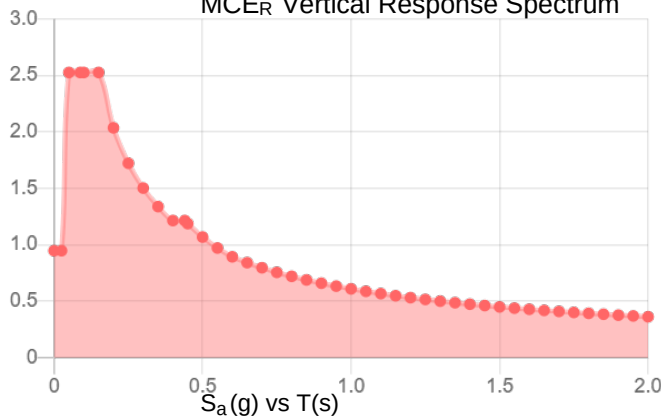
Seismic Design Category: E
MCE_R Response Spectrum



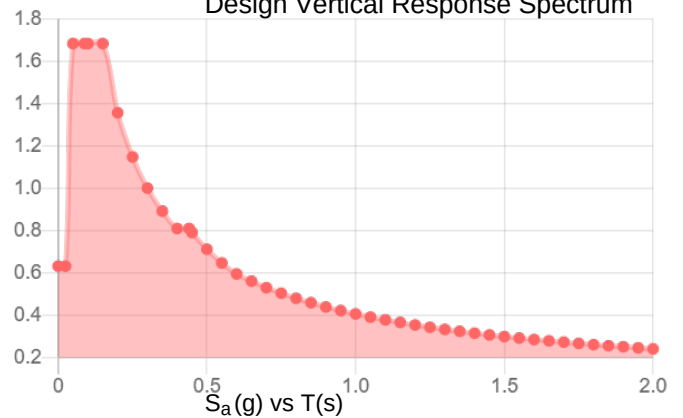
Design Response Spectrum



MCE_R Vertical Response Spectrum



Design Vertical Response Spectrum



Data Accessed: Thu Mar 20 2025

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-16 and ASCE/SEI 7-16 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-16 Ch. 21 are available from USGS.

The ASCE Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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