GEOTECHNICAL ENGINEERING
& GEOLOGY UPDATE REPORT

VERIZON CELLULAR FACILITY
MOUNT BALDY RESORT
LAX-277

AT

801 SAN ANTONIO CREEK ROAD
MT. BALDY, CALIFORNIA 91759

FOR

VERIZON WIRELESS
C/O SPECTRUM SERVICES, INC.
4405 EAST AIRPORT DRIVE, SUITE 100
ONTARIO, CALIFORNIA 91761

PROJECT NO: VS-4195-06

JANUARY 9, 2015

GEOTECHNICAL SOLUTIONS, INC.
GEOTECHNICAL & ENVIRONMENTAL
ENGINEERING

Geotechnical Solutions, Inc.
Geotechnical, Structural & Environmental Engineering

January 9, 2015

Project No: VS-4195-06

Spectrum Services, Inc.
4405 East Airport Drive Suite 100
Ontario, California 91761

Attention: Mr. Garrett Hawthorne

Re: Update Geotechnical & Geology Report
Verizon Wireless – Mt. Baldy Resort - LAX-277
801 San Antonio Creek Road
Mt. Baldy, California 91759

Gentlemen:

As requested, we have performed a study to update our previous geotechnical engineering & Geology report for Verizon Wireless - Mt. Baldy Resort LAX-277 located at 801 San Antonio Creek Road, Mt. Baldy, California. This update became necessary because the report needs to comply with the Current California Building Code (2013 CBC), which reflects changes on seismic and other parameters.

For the report user's convenience, all applicable contents of the previous reports are also included in this update; therefore this is a self-standing report. The accompanying engineering report presents the results of our previous subsurface exploration, laboratory testing and our conclusions and recommendations for the geotechnical engineering aspects of the project design.

The project development consists of (12) Verizon Wireless panel antennas at a 38 feet centerline, and (2) Verizon Wireless GPS antenna mounted on a new 45-foot high steel monopine, equipment shelter block building, 30 KW generator pad, and 8-feet high chain link fence enclosure within a 30' x 30' Verizon lease area.

The closest known active fault capable of producing a major earthquake is the Cucamonga fault, which is located about 3.8 miles (6.1 km) away from the site.

The site does not lie within or near an Alquist-Priolo Earthquake Fault Zone as designated by the California Geological Survey (CGS). The potential for direct surface fault rupture at the site is considered unlikely.

The investigation was made in accordance with generally accepted geotechnical engineering principles and procedures and included such field and laboratory tests considered necessary under the circumstances. In the opinion of the undersigned, the accompanying report has been substantiated by mathematical and other data and presents fairly the design information requested by your organization.

Respectfully submitted,

Geotechnical Solutions, Inc.

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Principal Geotechnical Engineer

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Distribution: (3+pdf) Addressee

TABLE OF CONTENTS

Introduction

The primary objectives of this study were to explore the site conditions beneath the project site and evaluate the existing earth materials relative to foundation support and lateral pressure design factors.

In general, the study objectives were met by a visual reconnaissance of the site and vicinity, review of available tentative development plans, exploratory test pit, seismic evaluations, geologic hazards and engineering analysis. The general scope and objectives of the study were established in collaboration with the client.

Proposed Construction

The project will consist of installation of (12) Verizon Wireless panel antennas at a 38 feet centerline, 4' parabolic antenna, and (2) Verizon Wireless GPS antenna mounted on a new 45-foot high steel monopine, equipment shelter block building, equipment cabinets, and 30 KW generator pad within a 30' x 30' Verizon Wireless lease area.

The design vertical load of the monopine will not exceed 60 kips, and horizontal shear force will vary in relation to the height of the monopine and transient loads.

Site Description

The project site is located in an unincorporated area within San Bernardino County, south of Mount Baldy Road, California. More specifically it is located at 801 San Antonio Creek Road, Mount Baldy, San Bernardino County, California within APN No. 0353-151-18 as shown on the Vicinity Map (Plate A) and Plot Plan and Boring Location Map (Plate B).

Geologic Setting and Site Condition

The site is situated in the eastern Gabriel Mountains within Transverse Ranges province. The Transverse Ranges geomorphic province is so named because of the conspicuous

east-west alignment of the mountain ranges which is in contract to the majority of the mountain ranges in North America which trend north-south. The province extends from point Arguello and San Miguel Island (Channel Islands) on the west, about 320 miles to the Joshua Tree National Monument area on the east where it merges with the Mojave and Colorado deserts geomorphic provinces. The province reaches its maximum width (60 miles) along the Ventura-Los Angeles County line. Its most narrow width (40 miles) is at its western most end. The northern boundary from Ventura County east to the Cajon Pass is formed by the San Andreas Fault system. The Peninsular Ranges geomorphic province forms the southernmost boundary.

The province is characterized by major mountain ranges with intervening alluviated, broadly synclinal valleys and narrow stream canyons. The province subdivides into several individual ranges and geologic features. The major subdivisions of interest are the Santa Ynez Mountains, Central Ventura County Mountains, Santa Monica Mountains, Ventura/Soledad Basin, Ridge Basin, San Gabriel Mountains, Los Angeles Basin, San Bernardino Mountains, and the Eastern Boundary Ranges.

Locally, the site is located on a mildly sloping (northward) hilltop, northeast of Mt. Baldy Village which is an unincorporated community in San Bernardino County, California. The site is about 160 feet from the top of the road cut facing San Antonio Creek and Mt. Baldy road. Based on the published geologic maps (Plates E and F) the site is underlain by flood/landslide debris which consist of cobble to boulder size rock clasts in sand and silt matrix which overlies gneiss bedrock (see Plate G). The road cut is approximately 75 feet tall, near vertical and expose both landslide debris and bedrock outcrops. The landslide materials appear to be highly permeable, and could reactivate and move down-hill during an event of severe rain fall and saturation and therefore are not considered a suitable base for structural foundation support. The tower foundation should be founded into bedrock and also designed adequately to neglect passive bearing for rock debris materials. It should be noted due to hardness nature of metamorphic bedrocks below

landslide debris, drilling difficulties should be expected and special handling could be required during caisson excavation. The site access currently is via a narrow trail and not accessible for an exploratory drilling rig. Based on our estimation from the outcrop exposures in the road cut, the thickness of landslide debris could be up to 20- to 25- feet beneath the site.

Surface Water and Site Surface Drainage

Surface water on this site is the likely result of precipitation or surface run-off from surrounding sites. Overall site drainage is in a northerly direction. Provisions for surface drainage will need to be accounted for by the project civil engineer.

Groundwater

No evidence of near surface groundwater was observed during the field study. No springs or perennial stream flow in local drainages exist based on topographic maps. No well closed to the vicinity was found. The project site is situated at an elevation of 4501 feet above mean sea level. We believe that the groundwater is estimated to be very deep at the project site.

Groundwater is not anticipated to affect the site adversely. However, these observations reflect site conditions at the time of the investigation and do not preclude changes in local groundwater conditions, localized seepage due to variations in rainfall, heavy irrigation, damaged structure (pipes, etc.), or altered site drainage pattern(s).

Geologic Hazards

The most significant geologic hazard impacting the site is the presence of landslide debris beneath the site. This issue was addressed on pages 2 and 3 of this report.

The site is not located near any impounded bodies of water therefore seiches are not considered a potential hazard to the project.

The site is not within a designated subsidence or liquefaction zone. It is our opinion that the potential for the subsidence or liquefaction within the site is unlikely due to lack of shallow ground water and presence of dense cobbly materials and bedrock.

Faulting and Seismicity

The project site is located in the highly seismic Southern California region within the influence of several fault systems that are considered to be active or potentially active. An active fault is defined by the State of California as a "sufficiently active and well defined fault" that has exhibited surface displacement within the Holocene time (about the last 11,000 years). A potentially active fault is defined by the State as a fault with a history of movement within Pleistocene time (between 11,000 and 1.6 million years ago).

These active and potentially active faults are capable of producing potentially damaging seismic shaking at the site. It is anticipated that the project site will periodically experience ground acceleration as the result of small to moderate magnitude earthquakes. Other active faults without surface expression (blind faults) or other potentially active seismic sources are not currently zoned and may be capable of generating an earthquake. Based on our review of geologic maps for the site and vicinity, no State of California designated Earthquake Fault Zone (Alquist-Priolo) is shown to be located on the site. The potential for direct surface fault rupture are considered very low.

Revised version of the 2008 U.S.G.S. National Seismic Hazard Mapping Project (NSHMP) PSHA Interactive Deaggregation for the spectral period of 0 second (PGA) is used. The Peak Horizontal Ground Acceleration for 10% probability of exceedance in 50 years i.e. return period of 475 years, 10% probability of exceedance in 100 years i.e. return period of 949 years, and 2% probability of exceedance in 50 years i.e. return period of 2,475 years, are 0.7190g, 0.9204g and 1.2309g respectively.

No faults have been mapped projecting towards or through the site area. The site does not lie within an Alquist-Priolo Earthquake Fault Zone as designated by the California

Geological Survey (CGS). The potential for direct surface fault rupture are considered unlikely.

In addition to possible very high ground motions at the site from local large earthquakes, other secondary effects were considered which include: induced liquefaction, induced flooding, subsidence and landsliding. Due to the geographic/topographic position, lack of near surface groundwater, the potential for any of the secondary effects mentioned above are low at the subject property.

Exploration

The field investigation consisted of subsurface exploration by means of one hand-dug test pit to a depth of 3 feet. Approximate test pit location is shown on Plate B. A continuous record of the soils encountered during excavation was made by the field geologist and are presented on Plate I, Log of Test Hole.

Soils Condition

The site is underlain by flood/landslide debris which consists of cobble to boulder size rock clasts in sand and silt matrix, generally light brown to brownish gray, dense to very dense, medium to coarse grained sand, damp to slightly moist. Based on our estimation from the outcrop exposures in the road cut, gneiss bedrock may be encountered at a depth from 20- to 25-feet. A more detailed soil profile is shown on Plate I, Log of Test Pit Hole.

Laboratory Testing

Laboratory testing was programmed following a review of field investigation data and after considering the various foundations, floor slabs, and grading elements to be evaluated. In general, this includes physical testing to establish foundation-bearing characteristics, and classification tests.

A. Moisture and Density

In situ moisture content was determined for the bulk sample obtained during test pit excavation operation. Test result is tabulated on Plate I, Log of Test Pit.

B. Mechanical Analysis

The texture composition of a selected typical sample determined by the hydrometer test method was as follows:

Test Pit No.	Depth (Feet)	Percent Sand	Percent Silt	Percent Clay
TP-1	1-3	92	8	2

C. Expansion

Expansion characteristic was determined by the Expansion Index test of a typical bulk sample considered to be generally representative of the near subgrade soils. Test results are as follows:

Test Pit No.	Moisture (%)	Dry Density (pcf)	Expansion Index
TP-1	7.5	120.0	0

The soil underneath the project site is classified as non-expansive to very low expansive.

D. Chemical Analysis

Chemical sulfate analysis was performed on a representative sample by the CAL 417-A method. A soluble sulfate of 136 parts per million was indicated, which is negligible, however we recommend to use Type II Portland cement for the foundation elements in contact with the underlying soil.

Design Values

Representative values were selected from the test data and other sources for design and is tabulated below:

Field Density	120 pcf
Expansion Index	0
Modulus of Subgrade Reaction (K)	100 pci

Seismic Factors

The following are the geotechnical parameters for earthquake design data in accordance with California Building Code (CBC), 2013:

NO.	PARAMETERS	VALUES	REFERENCE
1	0.2-Second Mapped Spectral Response Accelerations, $\mathbf{S_s}$ for Site Class B	**2.142g**	USGS eqhazmaps
2	1-Second Mapped Spectral Response Accelerations, $\mathbf{S_1}$ for Site Class B	**0.759g**	USGS eqhazmaps
3	Site Class	**D**	Table 1613.5.2
4	Site Coefficient, $\mathbf{F_a}$	**1.0**	Table 1613.5.3 (1)
5	Site Coefficient, $\mathbf{F_v}$	**1.5**	Table 1613.5.3 (2)
6	Maximum Considered Earthquake Spectral Acceleration for Short Period, $\mathbf{S_{MS}}$	**2.142g**	Equation 16-37
7	Maximum Considered Earthquake Spectral Acceleration for 1-Second Period, $\mathbf{S_{M1}}$	**1.138g**	Equation 16-38
8	5 % Damped Design Spectral Response Accelerations at Short Period, $\mathbf{S_{DS}}$	**1.428g**	Equation 16-39

9	5 % Damped Design Spectral Response Accelerations at 1-Second Period, S_{D1}	**0.759g**	Equation 16-40

Other seismic parameters are as follows:

Closest Fault Distance	3.8 miles (6.1 km)
Fault Name	Cucamonga Fault
Earthquake Magnitude	6.9 M_w
Slip Rate (mm/year)	5.0
Largest Maximum-Earthquake Site Acceleration	0.58g

PSHA Deaggregation

The following are the results of U.S.G.S. National Seismic Hazard Mapping Project, 2008, Interactive PSHA Deaggregation:

Peak Horizontal Ground Acceleration for 10% probability of exceedance in 50 years i.e. return period of 475 years 0.7190g

Peak Horizontal Ground Acceleration for 10% probability of exceedance in 100 years i.e. return period of 949 years 0.9204g

Peak Horizontal Ground Acceleration for 2% probability of exceedance in 50 years i.e. return period of 2,475 years 1.2309g

The PSHA Deaggregation plots are presented in Appendix B.

Liquefaction Potential

Soils susceptible to liquefaction are generally saturated loose to medium dense sands and non-plastic silt deposits below the water table. It is our opinion that the potential for liquefaction at the site is low, due to the lack of shallow groundwater, presence of dense to very dense cobbly to boulder size materials overlying gneiss bedrock.

Other Geologic/ Seismic Hazards

Based on the materials encountered at this site, the existing topographic conditions, we do not expect seismic slope instability and debris flows to be a concern. Also, due to the absence of the site's proximity from any large bodies of impounded water (existing drainage pond is at lower elevation), we believe that seiches should not be considered a potential hazard to the project.

Since there is no liquefaction, the site does not appear to be susceptible to seismically induced lateral spreading.

Tsunamis are seismic sea waves generated predominantly by vertical displacement of the ocean floor during an earthquake. Due to inland location of the site, tsunamis do not pose a seismic risk hazard to the site.

Relatively dry soils (e.g., soils above the groundwater table) with low density or softer consistency tend to undergo a certain degree of compaction during a seismic event. Earthquake shaking often induces significant cyclic shear strain in a soil mass that responds to the vibration by undergoing volumetric changes.

Volumetric changes in dry soils take place primarily through changes in the void ratio (usually contraction in loose or normally consolidated, soft soils, and dilation in dense or overconsolidated, stiff soils) and secondarily through particle reorientation. Such volumetric changes are generally non-recoverable. The dynamic settlement for dry soils was found to be less than ¼".

Hydroconsolidation or soil collapse, typically occurs in recently deposited, Holocene (less than 10,000 years old) soils that were deposited in an arid or semi-arid environment. Soils prone to collapse are commonly associated with man-made fill, wind-laid sands and silts, and alluvial fan and mudflow sediments deposited during flash floods. When saturated, collapsible soils undergo a rearrangement of their grains and the water removes the cohesive or cementing material and settlement results.

Based on the type of existing soil materials and non-expansive to very low expansive material, hydroconsolidation of the soils should not pose any significant safety hazard to the proposed development.

Conclusions and Recommendations

It is concluded that the site will be suitable for the proposed construction described in this report, provided that the design and construction are properly executed. Our recommendations are based on site conditions encountered during the test pit excavation, laboratory tests, and experience with similar sites, and are in accordance with generally accepted geotechnical engineering practices.

It is unlikely that development of this unmanned wireless facility at the subject property will be prone to geologic hazards like landslide, subsidence and liquefaction. However, there is a possibility that landslide may occur in case of heavy rainfall near Mt. Baldy Road and top 20 feet of subgrade soil could be affected. However, the proposed development will not have an adverse affect on adjoining properties and vice versa.

Followings are more specific recommendations:

Equipment Shelter Support

Proposed equipment shelter and enclosure wall may be supported by a minimum of 12-inch deep and 12 inches wide continuous footings bearing into the newly compacted subgrade soil or natural firm material. A 12-inch deep continuous footing resting on

newly compacted subgrade soil or natural soil may be designed for an allowable bearing value of 1,500 pounds per square foot. The estimated total settlement will be less than one-half of an inch and differential settlement will be negligible.

Recommended bearing values are for dead plus live loads and may be increased one-third for combined dead, live, and seismic forces.

All continuous footings shall be incorporated with 2#5 bars at the top and 2#5 bars at the bottom. It is recommended to over excavate and re-compact the equipments pad area to a depth of 12 inches below finish subgrade and recompact.

Floor Slab for Equipment Shelter and Generator Pad

Based on test results, the underlying surface soils are very low expansive; therefore, special measures will not be required for expansion potential. The subgrade for slab on grade should be kept moist (optimum moisture) at top 12 inches and the slab be incorporated with reinforcement of #3 bars 16 inches center to center each way. The slab thickness should be 4 inches minimum and shall be placed over approved subgrade. However, the structural engineer should design the thickness of the slab.

Caisson Foundation

Proposed 45-foot high steel monopine may be supported by cast in place concrete caissons bearing into the bedrock material.

The lateral forces will be the controlling element in this case depending on the height of the monopine and wind load. Therefore, it is recommended that the minimum pier diameter should be 36 inches and should be extended at least 5 feet into the bedrock; hence the depth may be 25- to 30-feet below the ground surface, subject to field verification. Difficult drilling condition may be encountered in the field.

The pier may be designed for an allowable end bearing of 4,000 pounds per square foot or for an average frictional resistance of 200 pounds per square foot. Most probably, end bearing will provide adequate foundation support for the monopine.

For lateral support a passive capacity of 150 pounds per square foot per foot to a maximum of 2,000 psf may be used for the top 20 feet depth and a passive capacity of 400 psf per foot may be used for bedrock to a maximum of 5,000 psf.

It is recommended that concrete be placed immediately after drilling. The concrete for the pier should be placed through tremmie or other directional devices. Pier drilling operations should be subject to observation by this office to confirm the conditions encountered are consistent with the conclusions and recommendations of this report and/or to make any appropriate modifications, if necessary.

At the time of construction, the contractor will use the bigger diameter rig (at least 4 feet diameter) for caisson drilling and caving may occur, therefore necessary measures should be considered to prevent the drilled shaft from caving. Also, difficult drilling may be encountered during construction due to the presence of cobbles, boulders and gneiss bedrock.

Lateral Passive Pressure

Horizontal forces of shallow footings (continuous) may be resisted by the combined effect of friction resistance of 0.4 times the dead load and a passive pressure of 150 pounds per square foot per foot of depth (for top 20 feet and 400 psf per foot beyond 20 feet depth). The weight of the pier may be neglected. If combining friction and passive resistance, the friction component shall be reduced by 1/3. The allowable bearing capacity and the allowable resistance of horizontal forces may be increased 1/3 for earthquakes and other transient forces.

Active Earth Pressure

Recommended active lateral soil pressure values for design of drained retaining wall are as follows:

Surface Slope of Retained Material (Horizontal:Vertical)	Equivalent Fluid Weight (pcf) (Native Backfill)
Level	35
2 : 1	45

A pipe and gravel drain (4" perforated PVC embedded in at least three cubic feet of filter gravel per lineal foot of pipe, both wrapped with geofabric) should be provided on the retained side located near the top of the footing base on the outside face. While all backfill should be compacted to the required degree, care should be taken when working close to the walls to prevent excessive pressure.

At-Rest Earth Pressure

Retaining walls (basement walls, underground vault, if applicable) should be designed for at-rest conditions. The recommended earth pressure for at-rest conditions is an equivalent fluid density of 60 pounds per cubic foot without surcharge loading.

Seismic Force (if applicable)

Lateral forces on retaining walls due to earthquake movements in accordance with Section 1803A.5.12 of the 2013 CBC for active and at-rest conditions may be calculated as follows:

Seismic active Force = 10 H^2 pounds/ft of wall (Inverted triangular distribution, acting at 0.6H from bottom).

Seismic at-rest Force = 20 H^2 pounds/ft of wall (Rectangular Distribution, acting at 0.6H from bottom).

Where, H = Height of the retaining wall in feet

Field Resistivity

Resistivity tests were performed at the field using NILSSON Model 400 Soil Resistance Meter by driving 4 test rods 12 inches deep into the ground in a straight line with a uniform distance of 5 and 10 feet in the same line. Test results and the field engineer's report are enclosed in Appendix C.

Corrosivity

A major factor in determining soil corrosivity is electrical Resistivity. The electrical resistivity of a soil is a measure of its resistance to the flow of electrical current. Corrosion of buried metal is an electrochemical process in which the amount of metal loss due to corrosion is directly proportional to the flow of electrical current (DC) from the metal into the soil. Corrosion currents, following Ohm's Law, are inversely proportional to soil resistivity. Lower electrical resistivity result from higher moisture and chemical contents and indicate corrosive soil. Other soil characteristics that can influence corrosivity toward metals are pH, chemical content, soil types and site drainage.

Based on the test results the soils are classified as moderately to mildly corrosive to ferrous metals and non-corrosive to Portland cement concrete; nevertheless, it is recommended to use Type II Portland cement for all concrete elements in contact with soil. Ferrous metals and pipes shall be properly coated or wrapped.

Grading Procedures

Minor grading may be required for the proposed development. Followings are the general recommendations related to the grading, if any.

a. After the site clearing, the equipment shelter and generator pad areas should be excavated 12 inches below lowest grade; moisture conditioned and compacted, subject to inspection.

b. On-site material is acceptable for backfill if moisture conditioned and over size rocks over 6-inches are removed. If required, import fill should consist of clean, granular, non-expansive soils free from vegetation, debris or rocks larger than three inches in size. The Expansion Index value should not exceed a maximum of 20.

c. All recompacted native and import soil should be spread, watered or aerated, mixed and compacted by mechanical means of approximately six-inch thick lifts.

d. The minimum degree of compaction obtained should be at least 90 percent of the ASTM D-1557 Laboratory test standard.

e. Backfill placed in narrow, restricted areas such as along utility trenches, may be placed in 12 to 18 inch thick lifts, provided; the minimum required degree of compaction is obtained.

f. Observation and testing of all compaction should be under the direction of the Geotechnical Engineer. The Engineer should be notified at least two days in advance of the start of the grading.

Recommendations for Construction

Surveying. The contractor shall set necessary stakes to verify lines and grades as shown on the plan. The owner or his representative shall monitor the work to verify that the depth of footing embedment is correct.

Caisson Drilling. Drilling operation of the pier and footing excavations should be observed by a representative of Geotechnical Solutions, Inc.

Footing and Utility Excavations: All footing trenches for the proposed structure should be observed by a representative of this firm to verify that they were excavated into competent bearing soils per the recommendations of this report as well as to the minimum depths recommended. These observations should be performed prior to the placement of forms or reinforcement. The excavations should be trimmed neat, level and square. All loose, sloughed or moisture softened soil should be removed prior to placing concrete.

Site Drainage: The site should be sloped to direct water away from all structures. All roof and pad drainage shall be conducted to appropriate drainage systems via non-erosive devices. All drainage systems should be maintained in good working condition.

Changed Conditions: Changed conditions not found during field investigation should be brought to the attention of the soil engineer. As a result of the changed conditions, further recommendations will be provided by the soil engineer.

Additional Services

This report is based on the assumption that an adequate program of monitoring and testing will be performed by Geotechnical Solutions, Inc. during construction to check compliance with recommendations given in this report. The recommended tests and observations include, but are not necessarily limited to the following:

(a) Review of the plans during the design phase of the project.

(b) Observation and testing during site preparation, and foundation construction.

(c) Consultation as required during design and construction.

Limitations

This report is issued with the understanding that it is the responsibility of the owner or his representative to see that the information and recommendations contained herein are called to the attention of the other members of the design team for the project and that the applicable information is incorporated into the plans, and that the necessary steps are

taken to see that the contractors and the subcontractors carry out such recommendations. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether due to natural processes or due to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated, wholly or in part, by changes outside of our control. The validity of the recommendations of this report assumes that Geotechnical Solutions, Inc. will be retained to provide these services.

Geotechnical Solutions, Inc.

References

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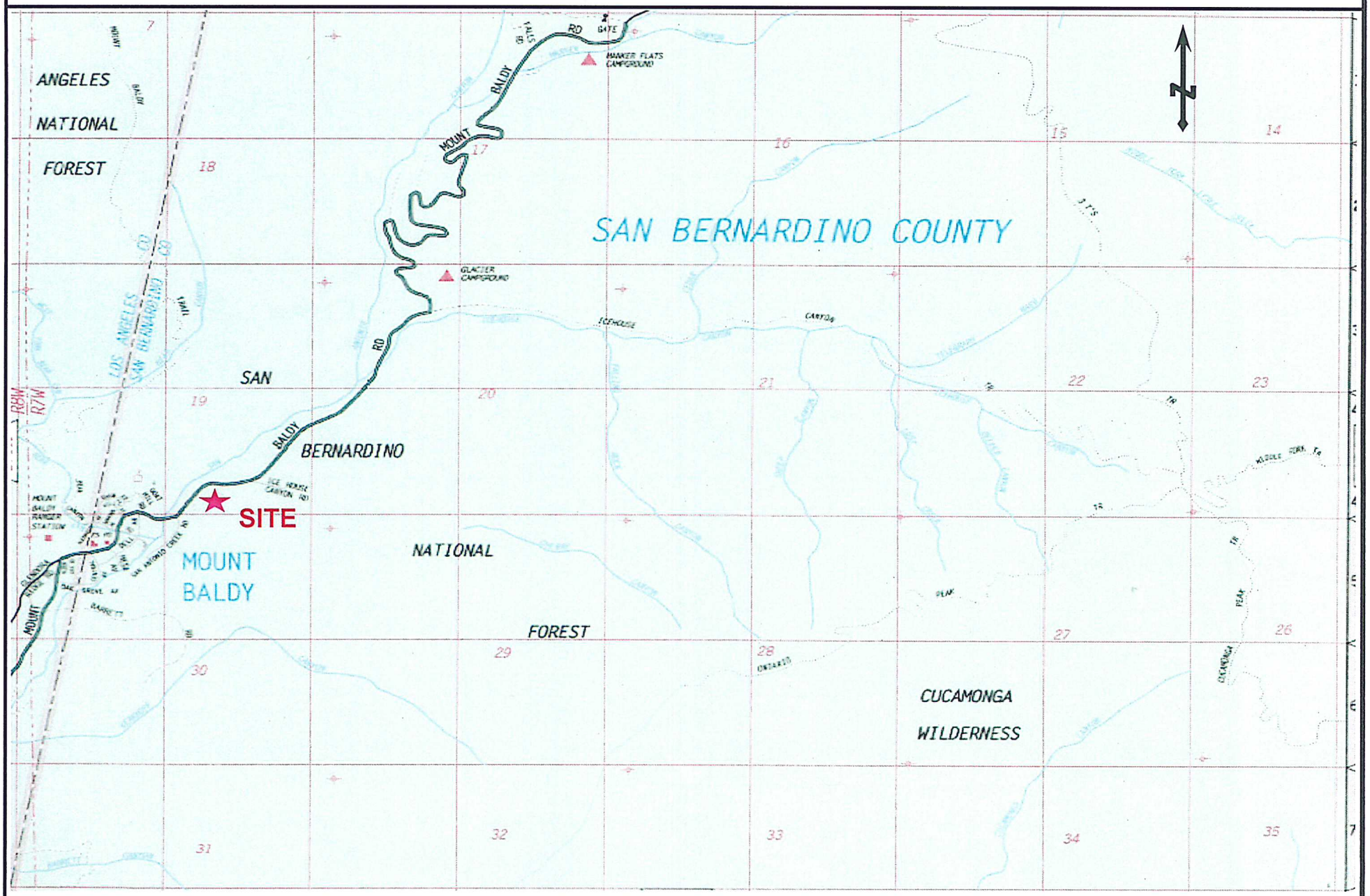
U.S.G.S., Geologic hazards Science Center, 2008 PSHA Interactive Deaggregation web Site

APPENDIX A

Plates

- Vicinity Map
- Plot Plan & Test Boring
- Topographic Map
- Google Map
- Geology Map
- Landslide Debris Map
- View from Mt. Baldy
- Fault Zone Map
- Test Pit Log
- Direct Shear Test
- Consolidation Tests

VICINITY MAP

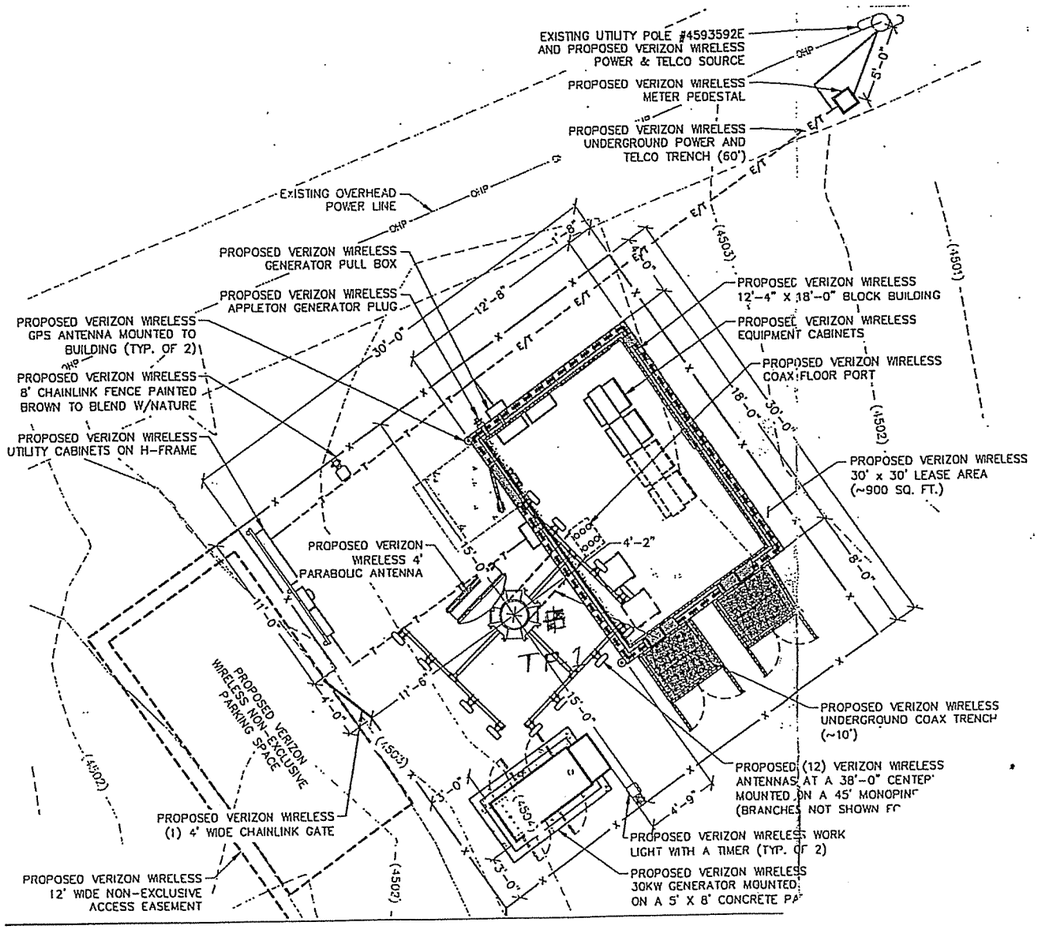


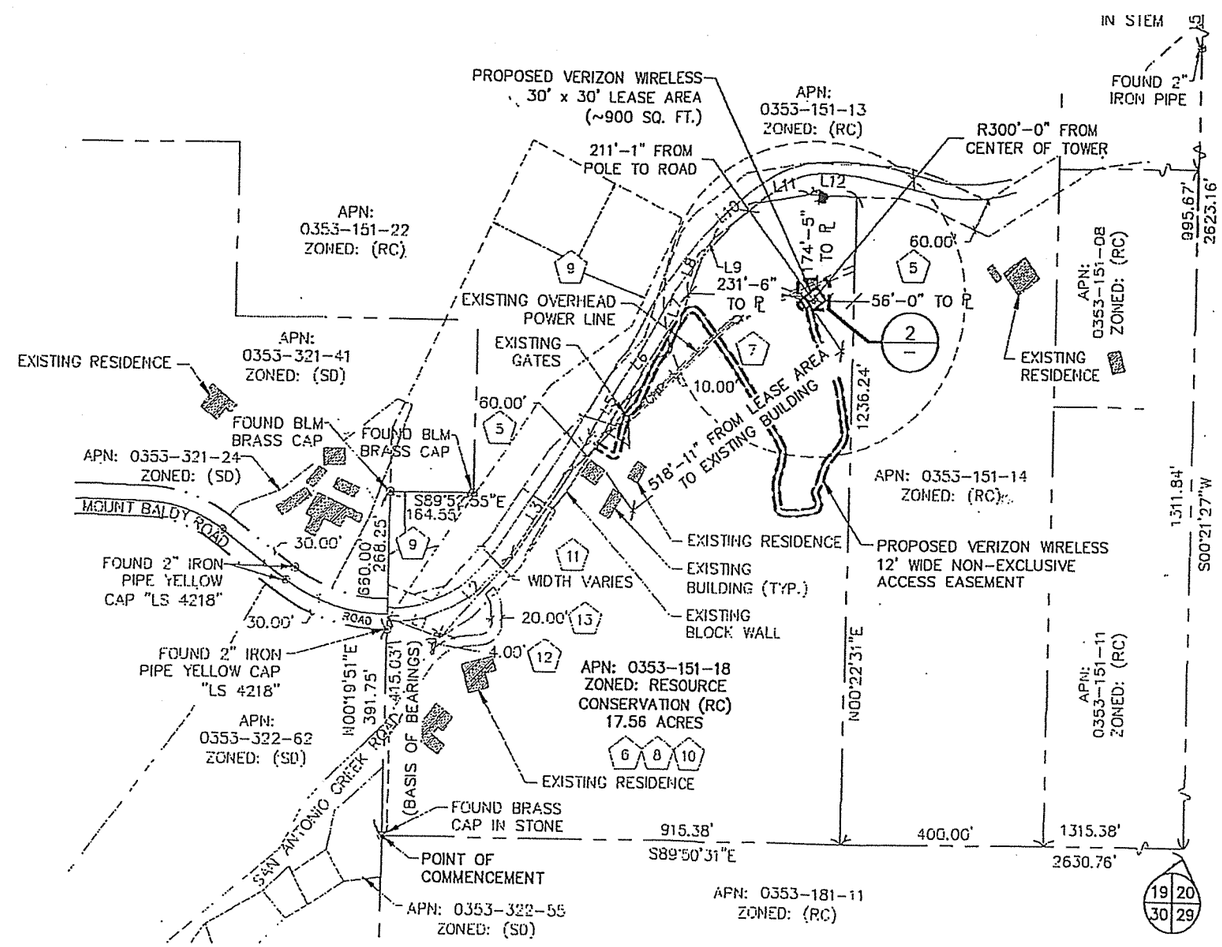
VERIZON WIRELESS - Mount Baldy LAX-277	Project No.	VS-4195-06
801 San Antonio Creek Road, Mt. Baldy, California	Plate:	A

Geotechnical Solutions, Inc.

PLOT PLAN & BORING LOCATION MAP

ENLARGED PLAN
SCALE: 1" = 10'





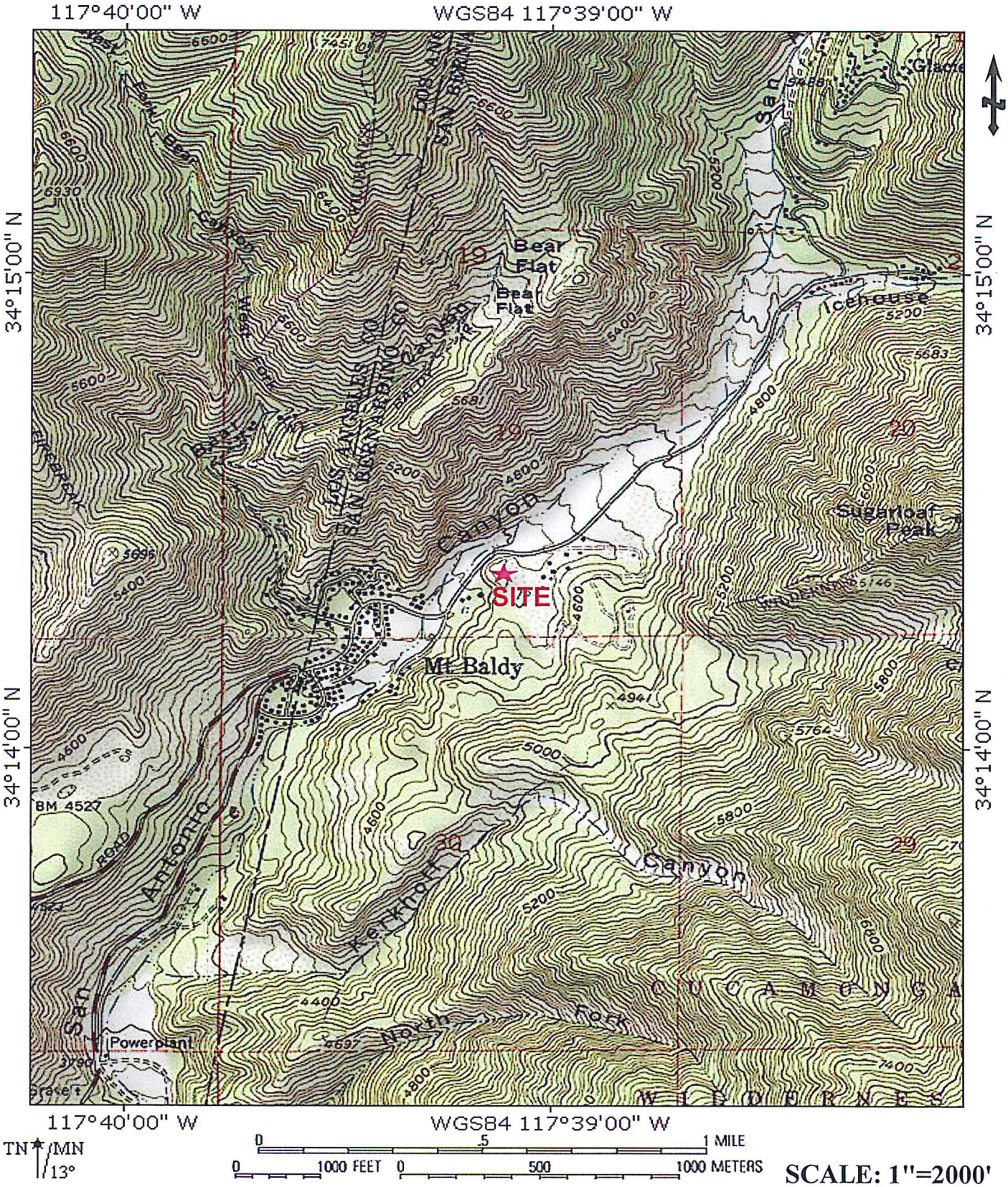
Test Pit
TP-1

Scale: 1" = 300'

VERIZON WIRELESS - Mount Baldy LAX-277	Project No.	VS-4195-06
801 San Antonio Creek Road, Mt. Baldy, California	Plate:	B

Geotechnical Solutions, Inc.

TOPOGRAPHIC MAP



SCALE: 1"=2000'

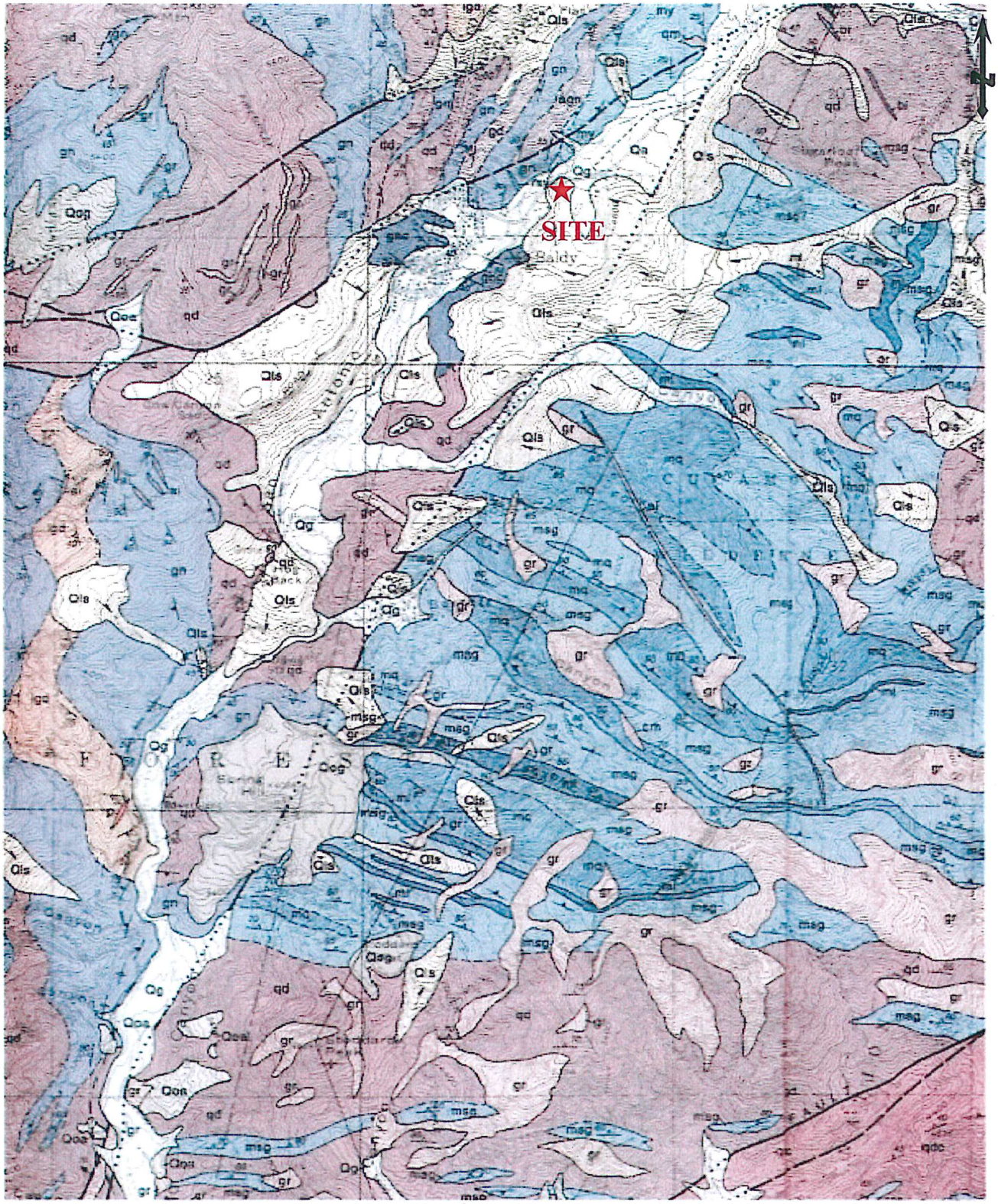
VERIZON WIRELESS - Mount Baldy LAX-277	Project No.	VS-4195-06
801 San Antonio Creek Road, Mt. Baldy, California	Plate:	C

Geotechnical Solutions, Inc.

GOOGLE MAP

VERIZON WIRELESS - Mount Baldy LAX-277	Project No.	VS-4195-06
801 San Antonio Creek Road, Mt. Baldy, California	Plate:	D
Geotechnical Solutions, Inc.		

GEOLOGY MAP

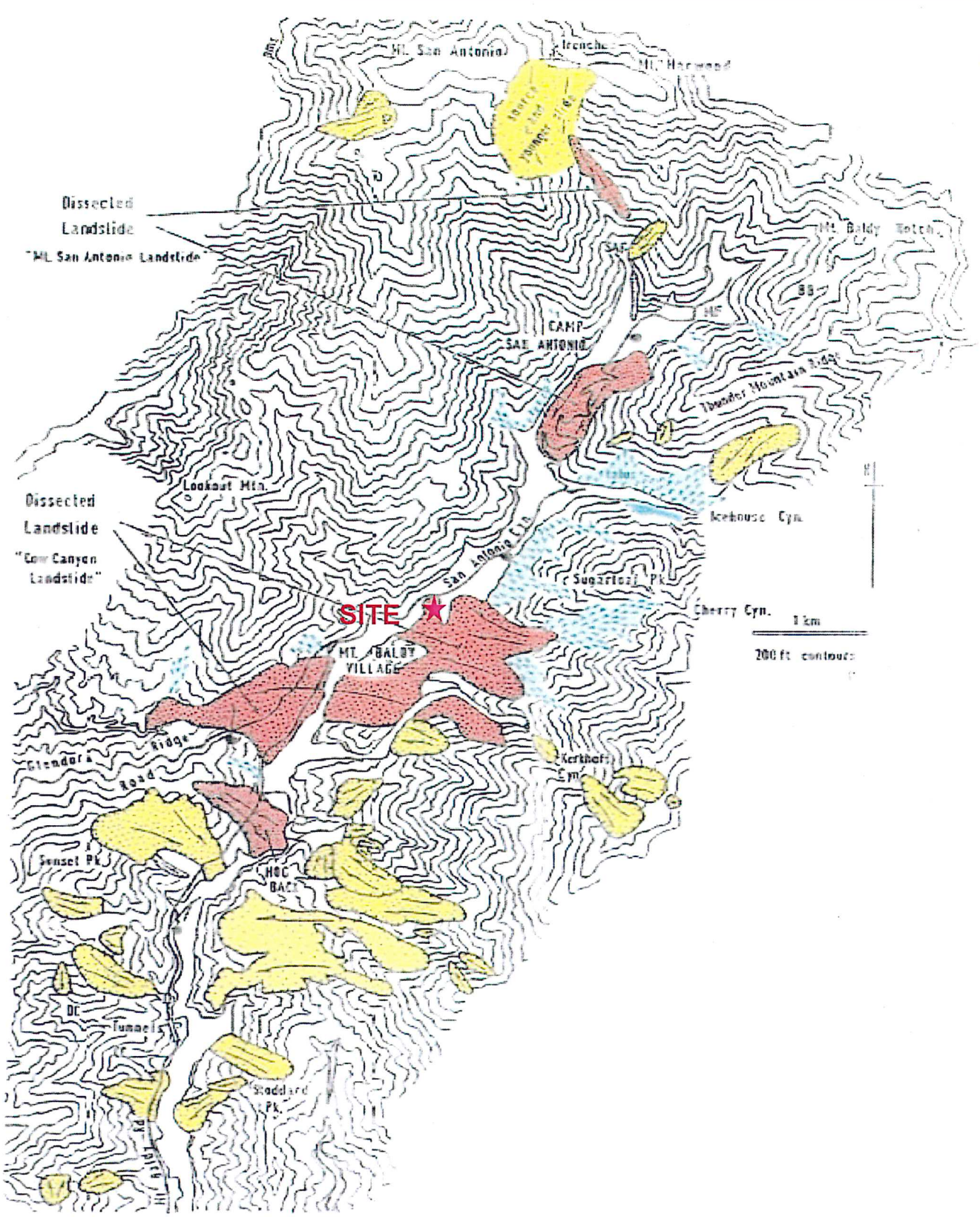


Geologic Map of the San Antonio Canyon in the vicinity of Mt. Baldy Village. From Dibblee, 2002.

VERIZON WIRELESS - Mount Baldy LAX-277	Project No.	VS-4195-06
801 San Antonio Creek Road, Mt. Baldy, California	Plate:	E

Geotechnical Solutions, Inc.

Landslide and Debris Map

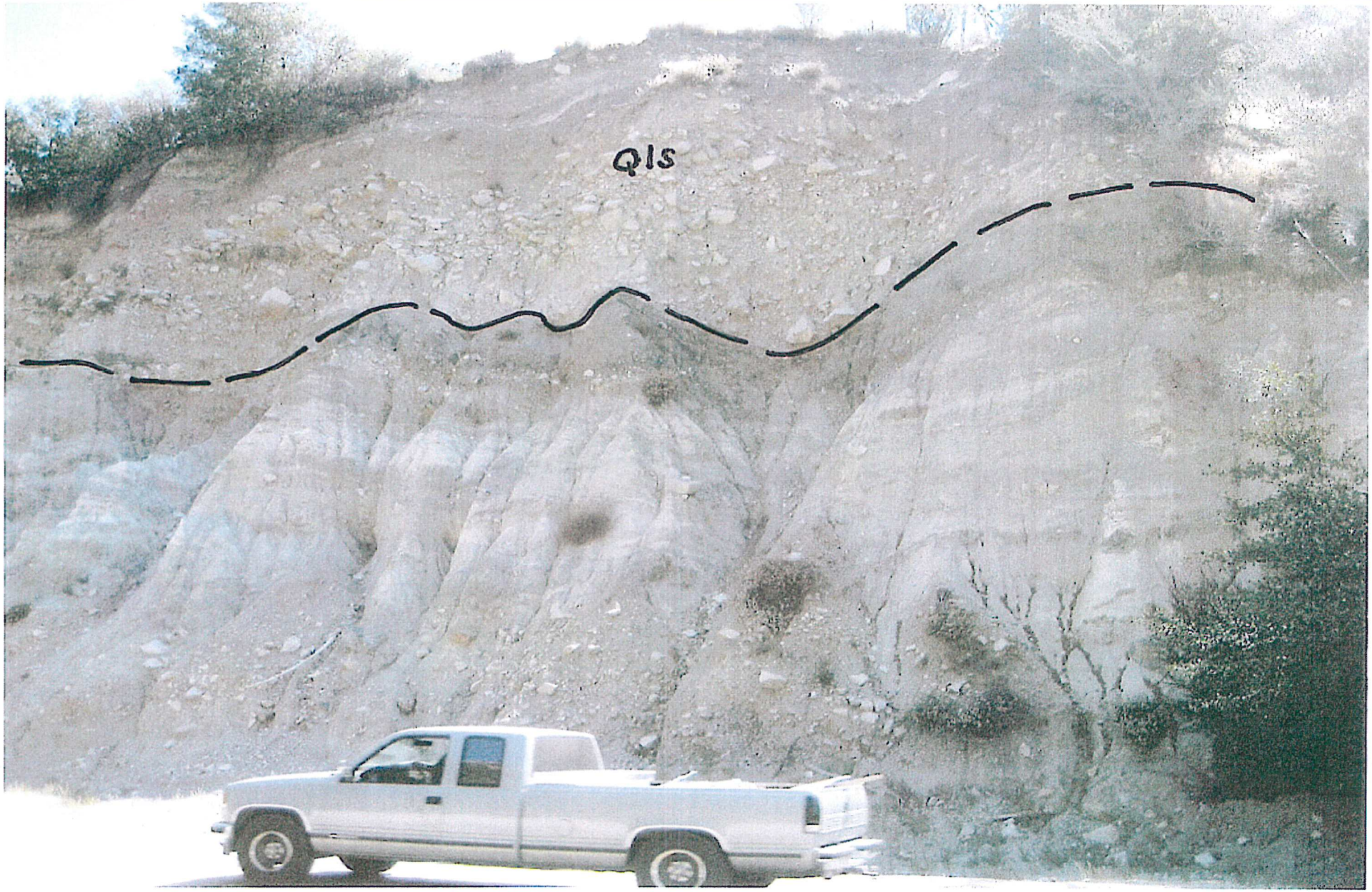


Landslides and Debris Flows in the San Antonio Canyon (from Hazlett, 2001)

VERIZON WIRELESS - Mount Baldy LAX-277	Project No.	VS-4195-06
801 San Antonio Creek Road, Mt. Baldy, California	Plate:	F

Geotechnical Solutions, Inc.

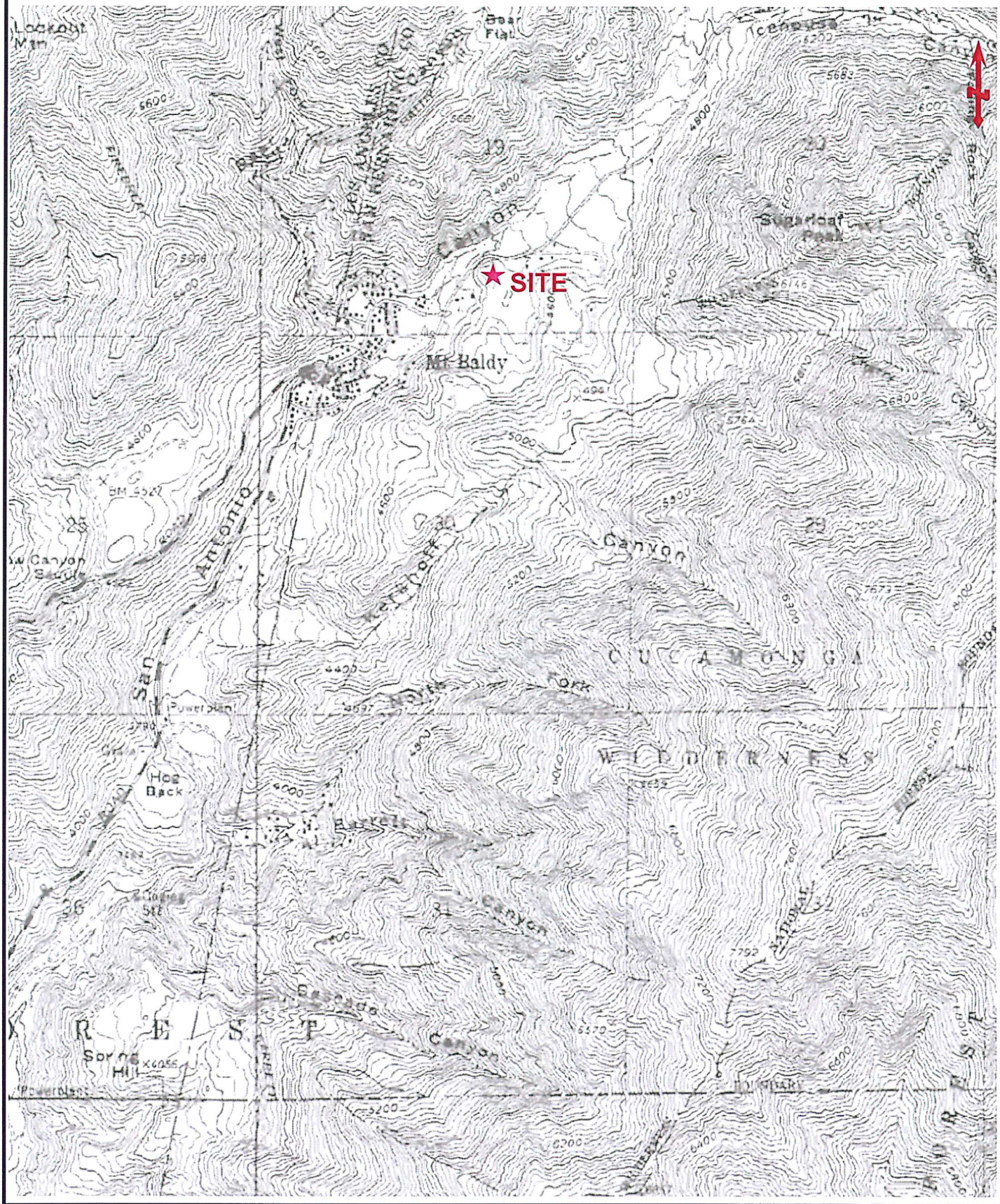
VIEW FROM MOUNT BALDY ROAD TOWARDS SOUTHERLY DIRECTION



VERIZON WIRELESS - Mount Baldy LAX-277	Project No.	VS-4195-06
801 San Antonio Creek Road, Mt. Baldy, California	Plate:	G

Geotechnical Solutions, Inc.

FAULT ZONE MAP



VERIZON WIRELESS - Mount Baldy LAX-277	Project No.	VS-4195-06
801 San Antonio Creek Road, Mt. Baldy, California	Plate:	H

Geotechnical Solutions, Inc.

TEST PIT LOG : TP-1

DATE EXCAVATED 9/19/2012

EQUIPMENT

PIT DIMENSIONS: Length Width SURFACE ELEVATION 4501'

DEPTH (Feet)	UNDIST. SAMPLE	BULK SAMPLE	ATTITUDE	CLASSIFICATION AND DESCRIPTION	MOISTURE & DENSITY	CONSISTENCY	COLOR
1				Cobbly, Gravelly Sand with little silt damp to slightly moist cobbles up to 8 inches in diameter, angular to subangular	5.00%	medium dense to dense to very dense	light brown to brownish gray
2							
3							
4				End of Excavation 3 feet 3" No Groundwater encountered Backfill w/cuttings			
5							
6							
7							
8							
9							
10							

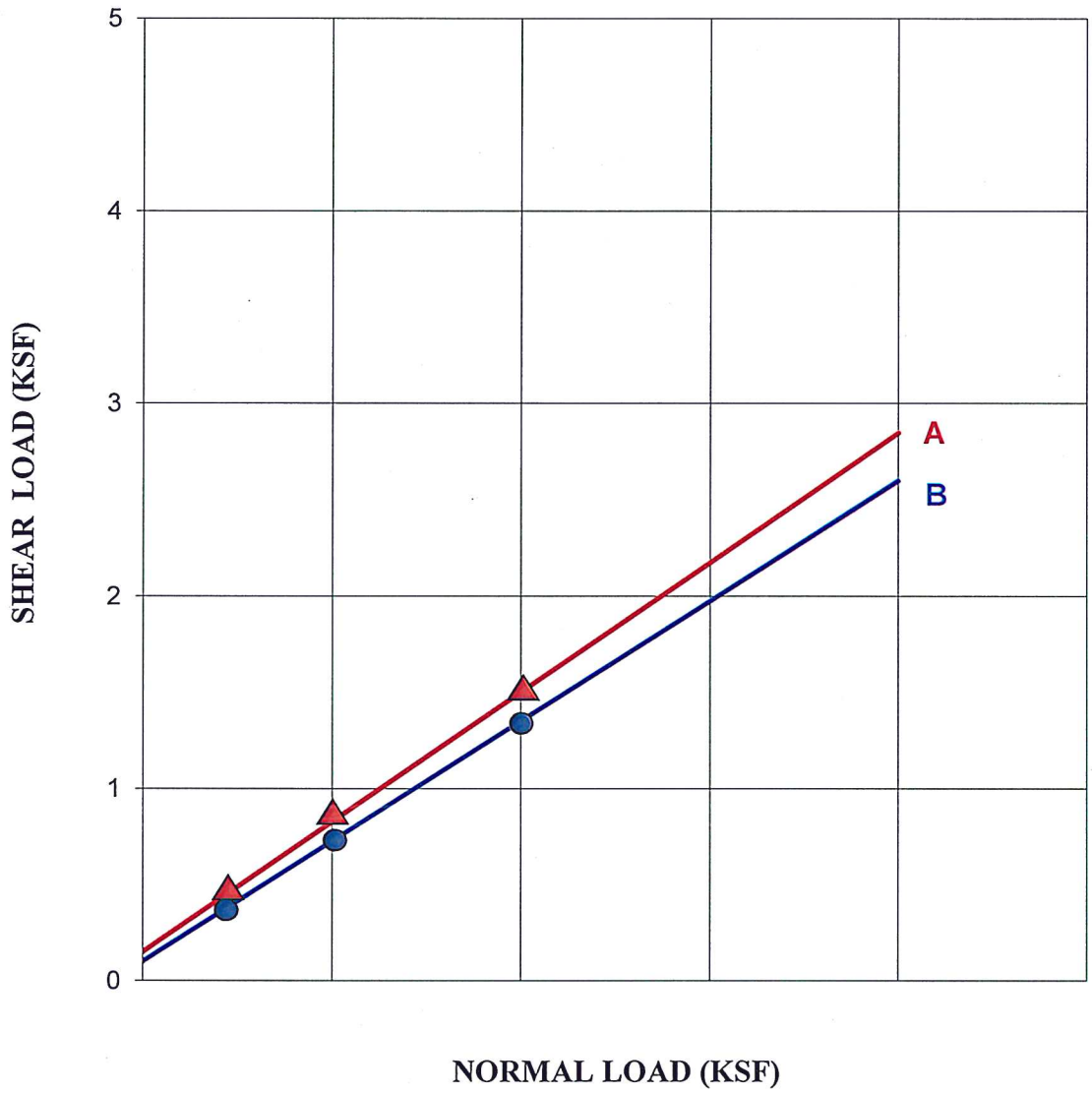
VERIZON WIRELESS - MOUNT BALDY LAX-277

801 San Antonio Creek Road, Mt. Baldy, California

Project No.	VS-4195-06
Plate:	I

Geotechnical Solutions, Inc.

DIRECT SHEAR

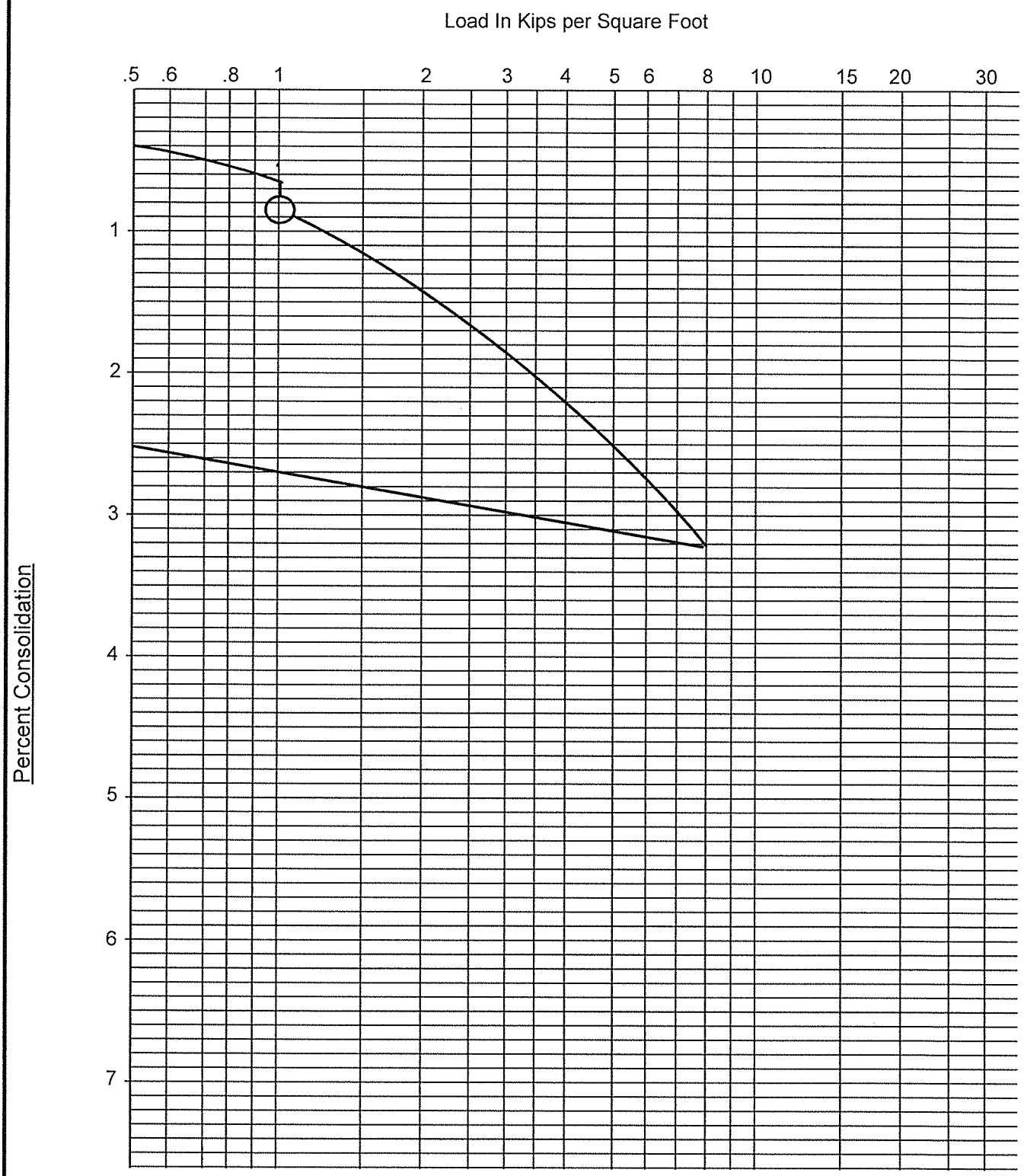


SYMBOL	LOCATION	DEPTH (FT)	TEST CONDITION		COHESION (PSF)	FRICTION (DEG)
A	Test Pit TP-1	2'	Saturated - Drained	Peak	150	34
B	Test Pit TP-1	2'	Saturated - Drained	Ultimate	100	32

VERIZON WIRELESS - Mount Baldy LAX-277	Project No.	VS-4195-06
801 San Antonio Creek Road, Mt. Baldy, California	Plate:	J

Geotechnical Solutions, Inc.

CONSOLIDATION



○ After water added to the sample

Test Pit TP-1 @ 2'

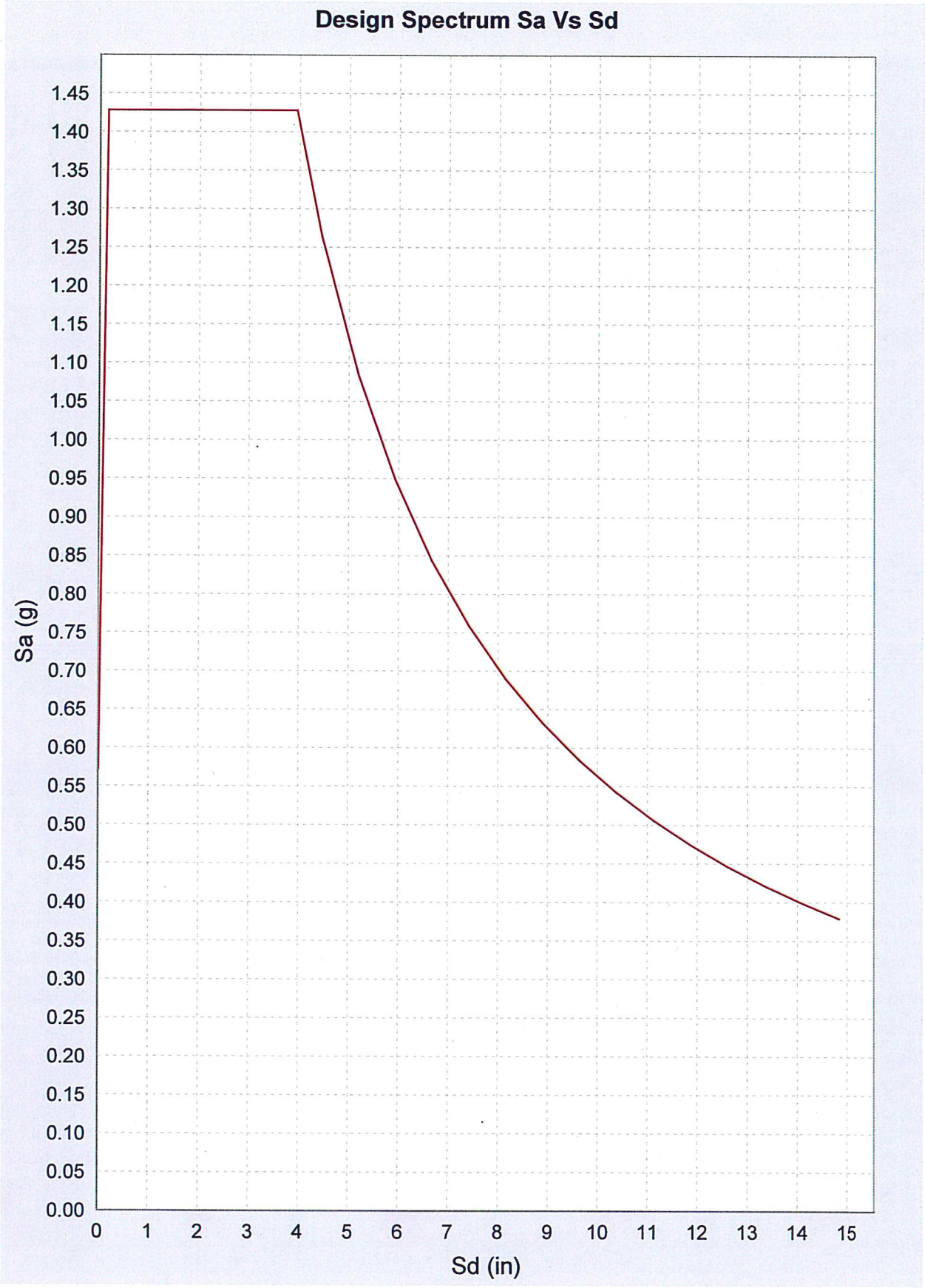
VERIZON WIRELESS - Mount Baldy LAX-277	Project No.	VS-4195-06
801 San Antonio Creek Road, Mt. Baldy, California	Plate:	K

Geotechnical Solutions, Inc.

APPENDIX B

Seismic Data

- CBC 2013 Seismic Design Provisions
- PSHA Deaggregation Results


Design Spectrum Sa Vs Sd
Sa (g)
1.45
1.40
1.35
1.30
1.25
1.20
1.15
1.10
1.05
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Sd (in)

NEHRP Seismic Design Provisions
Verizon Wireless – Mt. Baldy LAX-277
VS-4195-06

Conterminous 48 States

Latitude = 34.2397

Longitude = -117.6521

Spectral Response Accelerations Ss and S1
Ss and S1 = Mapped Spectral Acceleration Values
Site Class B - Fa = 1.0, Fv = 1.0

Data are based on a 0.01 deg grid spacing

Period (sec)	Sa (g)
0.2	2.142 (Ss, Site Class B)
1.0	0.759 (S1, Site Class B)

Spectral Response Accelerations SMs and SM1
SMs = Fa x Ss and SM1 = Fv x S1
Site Class D - Fa = 1.0, Fv = 1.5

Period (sec)	Sa (g)
0.2	2.142 (SMs, Site Class D)
1.0	1.138 (SM1, Site Class D)

Design Spectral Response Accelerations SDs and SD1
SDs = 2/3 x SMs and SD1 = 2/3 x SM1
Site Class D - Fa = 1.0, Fv = 1.5

Period (sec)	Sa (g)
0.2	1.428 (SDs, Site Class D)
1.0	0.759 (SD1, Site Class D)

MCE Response Spectrum for Site Class B
Ss and S1 = Mapped Spectral Acceleration Values
Site Class B - Fa = 1.0, Fv = 1.0

Period (sec)	Sa (g)	Sd (inches)
0.000	0.857	0.000
0.071	2.142	0.105
0.200	2.142	0.837
0.354	2.142	2.626
0.400	1.897	2.965
0.500	1.518	3.707
0.600	1.265	4.448
0.700	1.084	5.189
0.800	0.949	5.931
0.900	0.843	6.672
1.000	0.759	7.414
1.100	0.690	8.155
1.200	0.632	8.896
1.300	0.584	9.638
1.400	0.542	10.379
1.500	0.506	11.120
1.600	0.474	11.862
1.700	0.446	12.603
1.800	0.422	13.344
1.900	0.399	14.086
2.000	0.379	14.827

Site Modified Response Spectrum for Site Class D
SMs = FaSs and SM1 = FvS1
Site Class D - Fa = 1.0, Fv = 1.5

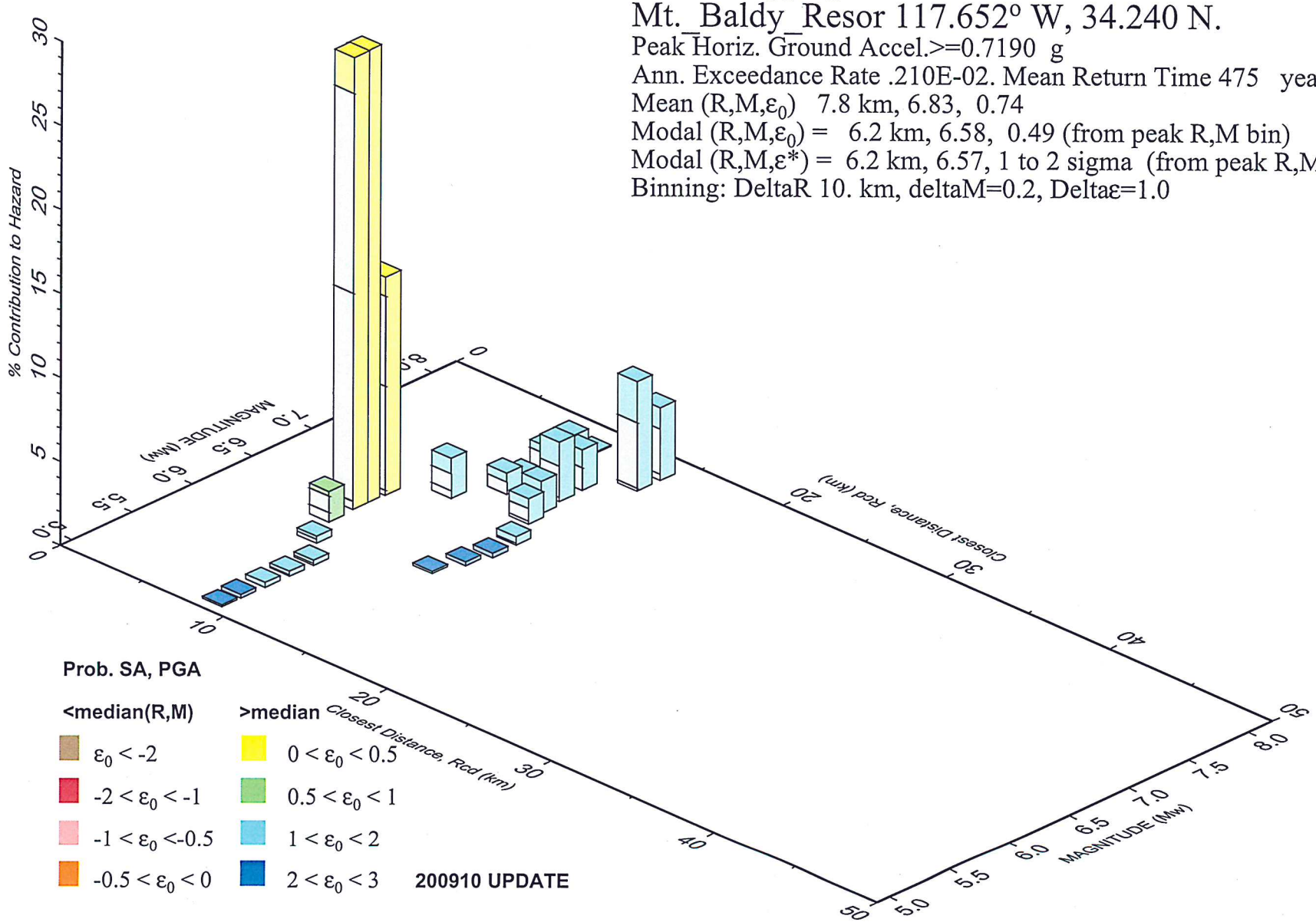
Period (sec)	Sa (g)	Sd (inches)
0.000	0.857	0.000
0.106	2.142	0.236
0.200	2.142	0.837
0.531	2.142	5.908
0.600	1.897	6.672
0.700	1.626	7.784
0.800	1.423	8.896
0.900	1.265	10.008
1.000	1.138	11.120
1.100	1.035	12.232
1.200	0.949	13.344
1.300	0.876	14.456
1.400	0.813	15.568
1.500	0.759	16.680
1.600	0.711	17.792
1.700	0.670	18.905
1.800	0.632	20.017
1.900	0.599	21.129
2.000	0.569	22.241

Design Response Spectrum for Site Class D
SDs = 2/3 x SMs and SD1 = 2/3 x SM1
Site Class D - Fa = 1.0, Fv = 1.5

Period (sec)	Sa (g)	Sd (inches)
0.000	0.571	0.000
0.106	1.428	0.158
0.200	1.428	0.558
0.531	1.428	3.939
0.600	1.265	4.448
0.700	1.084	5.189
0.800	0.949	5.931
0.900	0.843	6.672
1.000	0.759	7.414
1.100	0.690	8.155
1.200	0.632	8.896
1.300	0.584	9.638
1.400	0.542	10.379
1.500	0.506	11.120
1.600	0.474	11.862
1.700	0.446	12.603
1.800	0.422	13.344
1.900	0.399	14.086
2.000	0.379	14.827

PSH Deaggregation on NEHRP BC rock
Mt._Baldy_Resor 117.652° W, 34.240 N.

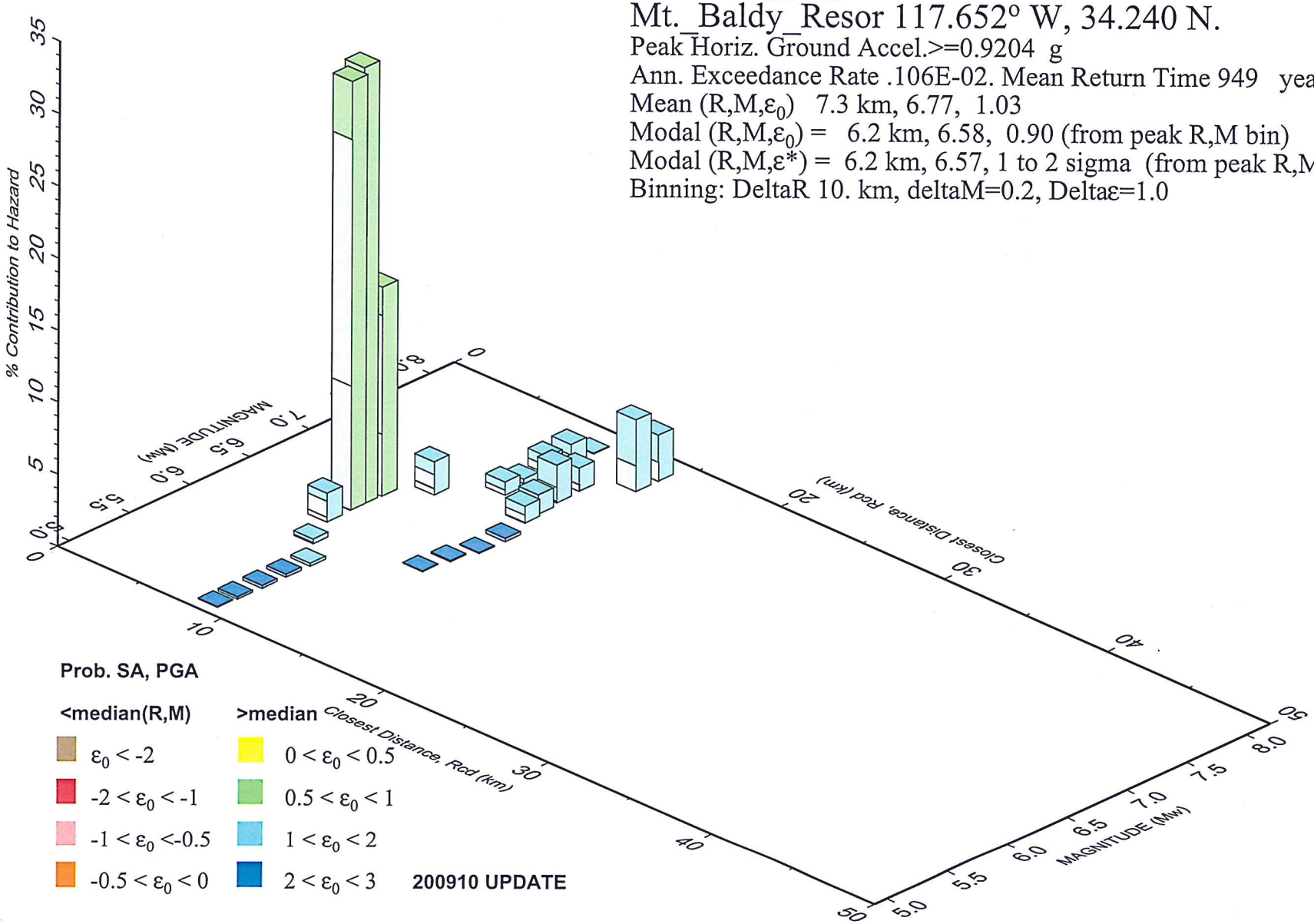
Peak Horiz. Ground Accel.>=0.7190 g
Ann. Exceedance Rate .210E-02. Mean Return Time 475 years
Mean (R,M,ε_0) 7.8 km, 6.83, 0.74
Modal (R,M,ε_0) = 6.2 km, 6.58, 0.49 (from peak R,M bin)
Modal (R,M,ε*) = 6.2 km, 6.57, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0



GMT 2014 Oct 17 22:25:11 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on rock with average vs= 760. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

PSH Deaggregation on NEHRP BC rock
Mt._Baldy_Resor 117.652° W, 34.240 N.

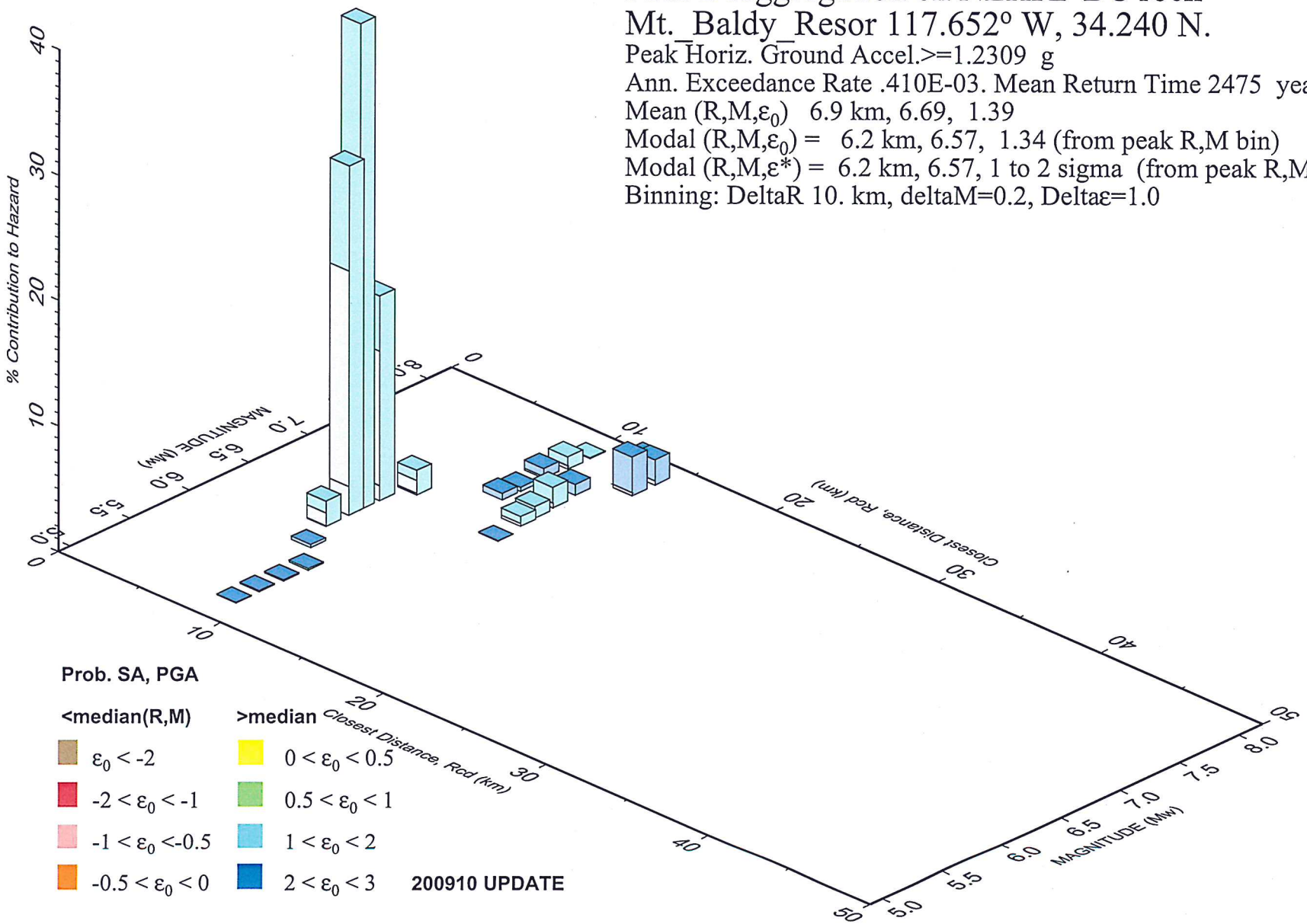
Peak Horiz. Ground Accel.>=0.9204 g
Ann. Exceedance Rate .106E-02. Mean Return Time 949 years
Mean (R,M,ε_0) 7.3 km, 6.77, 1.03
Modal (R,M,ε_0) = 6.2 km, 6.58, 0.90 (from peak R,M bin)
Modal (R,M,ε*) = 6.2 km, 6.57, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0



GMT 2014 Oct 17 22:27:47 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on rock with average vs= 760. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

PSH Deaggregation on NEHRP BC rock
Mt._Baldy_Resor 117.652° W, 34.240 N.

Peak Horiz. Ground Accel.>=1.2309 g
Ann. Exceedance Rate .410E-03. Mean Return Time 2475 years
Mean (R,M,ε_0) 6.9 km, 6.69, 1.39
Modal (R,M,ε_0) = 6.2 km, 6.57, 1.34 (from peak R,M bin)
Modal (R,M,ε*) = 6.2 km, 6.57, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0



GMT 2014 Oct 17 22:29:09 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on rock with average vs= 760. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

APPENDIX C

Field Resistivity Test

Test Report

Site Name: Verizon Wireless – Mount Baldy LAX-277

Site Address: 801 San Antonio Creek Road, Mt. Baldy, California 91759

Report Prepared by: **Geotechnical Solutions, Inc.**

Give two or three sentences description of the soil as seen at the site:

Fine to coarse Sand, cobbly, boulders

Soil Condition: ☐ Wet ☐ Damp ☒ Dry

Choose one and only one of the following descriptions that best describe the earth conditions:

☐ Good clay earth ☒Sandy soil

☐ Solid rock ☐ High-Rise site

If high-rise site was checked, verify the location of the main water line entering the building and give the following information:

☐ The line was located and verified as copper and is ____ inches in circumference.

☐ The line was located and verified as iron and is ____ inches in circumference.

☐ I was unable to locate the water main and recommend further engineering study for the grounding of this site.

Provide the following information:

Date of Resistivity test: 09-19-2012

Weather for the seven days preceding the test: Sunny and moderately warm
(The last three days must have been clear and sunny.)

Model number of test instrument: NILSON MODEL 400

Serial number of test instrument: 4-7368

Project Name: Verizon Wireless – Mt. Baldy LAX-277

Date: 09-19-2012

Project No: VS-4195-06

Site Address: 801 San Antonio Creek Road, Mt. Baldy, California 91759

RESISTIVITY DATA

A= (ft)	5	10	20	30	40
Formula = (Ohm-cm)	957.5*R	1915*R	3830*R	5745*R	7660*R
Area 1 Measured R	2.8	1.7			
Area 1 Calc	2,681 Ohm-cm	3,255 Ohm-cm			
Area 2 Measured R					
Area 2 Calc					
Area 3 Measured R					
Area 3 Calc					
Area 4 Measured R					
Area 4 Calc					

385 N. Arrowhead Ave, First Floor, San Bernardino, CA 92415 | Phone: 909.387.8311 Fax: 909.387.3223
www.SBCounty.gov

SAN BERNARDINO COUNTY

Land Use Services Department
Building and Safety

Tom Hudson
Director

April 16, 2015

Verizon Wireless
15505 Sand Canyon Avenue, Building D
Irvine, California 92618

RE: REVIEW OF GEOLOGIC AND GEOTECHNICAL INVESTIGATION REPORT, PROPOSED WIRELESS COMMUNICATIONS FACILITY, MT. BALDY, COUNTY REVIEW NO. 1766

The following report prepared by Geotechnical Solutions, Inc., dated January 29, 2015, was submitted for review:

> *Geotechnical Engineering & Geology Update Report, Verizon Cellular Facility, Mount Baldy Resort, LAX-277, 801 San Antonio Creek Road, Mt. Baldy, California 91759, Project No. VS-4195-06*

The report is signed and sealed by Fred Aflakian, California Professional Geologist and Certified Engineering Geologist, Dharma R. Shakya, California Professional Engineer and Certified Geotechnical Engineer and Abraham S. Baha, California Professional Engineer.

Although the title of the report suggests it is an update, the report is intended to supersede any previous reports and was submitted as a standalone report.

The report indicates that the parcel will be developed with a 45-foot high monopine tower, an equipment shelter and a generator pad. It is also our understanding that an existing access road will be improved and extended as part of the project.

The geotechnical field investigation included a hand-dug excavation approximately 3 feet deep. Cobbly and gravelly sand was exposed. Sampling for laboratory analysis was conducted at a depth of 2 feet. The report states that the testing was conducted to "*establish foundation-bearing characteristics*".

Based upon the three-foot deep excavation as well as observations of the adjacent road cut along Mt. Baldy Road, the report concludes that the tower can be supported by cast-in-place concrete caissons bearing into gneissic bedrock estimated at a depth of 20 to 25 feet beneath the tower site.

The site is located within the Geologic Hazard Overlay District designated by the County of San Bernardino to include areas known to have a potential for slope instability. In addition, the entire site is located upon a large mapped landslide referred to in the geologic literature as the Cow Canyon landslide. Any development proposed within the boundaries of a mapped landslide requires careful analysis.

The report acknowledges that the site is underlain by landslide materials and states that these materials "*are not considered a suitable base for structural foundation support*". The report estimates that non-landslide competent bedrock underlies the site at a depth of 20 to 25 feet based upon observation of the road cut. However, the Cow Canyon landslide plane is likely beneath the elevation of the roadway and likely not exposed in the road cut. In the July 6, 2002 report entitled "*Evaluation of Supplementary Groundwater Sources Near Mt. Baldy Trout Ponds*" for the San Antonio Canyon Mutual Water Services Company, Dr. Jonathan Nourse of the Department of Geological Sciences at California State Polytechnic University suggests the Cow Canyon landslide plane could well be over one hundred feet in depth in the immediate vicinity of the tower site.

The report concludes "*It is unlikely that development of this unmanned wireless facility at the subject property will be prone to geologic hazards like landslide ... However, there is a possibility that landslide may occur in case of heavy rainfall near Mt. Baldy Road and top 20 feet of subgrade soil could be affected.*" The report also states "*the most significant geologic hazard impacting the site is the presence of landslide debris beneath the site*" and "*landslide materials appear to be highly permeable, and could reactivate and move downhill during an event of severe rain fall and saturation*".

In addition, the report states that there is a potential for "*very high ground motions at the site from local large earthquakes*" but also indicates "*we do not expect seismic slope instability*".

These statements are vague, contradictory and unsubstantiated. A more detailed stability analysis is warranted.

The report indicates that there was no evidence of shallow groundwater or springs and estimates groundwater "*to be very deep at the project site*". However, there is apparently a developed spring along the proposed access alignment referred to as the Trout Pond Spring in Dr. Nourse's 2002 report for the San Antonio Canyon Mutual Water Services Company. Dr. Nourse also states that the spring discharges from "*a porous and highly permeable zone within the Cow Canyon landslide deposits*." There is some indication that this water is utilized for domestic purposes locally. Groundwater conditions should be reevaluated at the project site in light of this information.

The following conditions apply:

- Samples from a three foot hole do not characterize foundation conditions. As is typically required, an exploratory boring extending to a minimum depth equivalent to the base of proposed caissons must be completed, logged, sampled and tested.

- The geologic portion of the report must better characterize and evaluate the onsite landslide including anticipated depth, age, stability and hydrogeology.

- A static and dynamic slope stability analysis must be conducted for the adjacent road cut if complete failure of the cut slope could potentially impact the site.

- Grading for the access roadway must be addressed, including whether cut or fill slopes are proposed as well as whether the project will impact the spring and whether any specific recommendations are necessary to ensure the spring is not impacted by grading or grading-related erosion.

Sincerely,

WESSLY A. REEDER, County Geologist
PG 4270 EG 1447
Building and Safety Division
Land Use Services Department
909.387.4111

WAR:mp

cc: Geotechnical Solutions, Inc.
Geology File
APN File

Geotechnical Solutions, Inc.
Geotechnical, Structural & Environmental Engineering

May 15, 2015

Project No: VS-4195-06

Verizon Wireless
Spectrum Services, Inc.
4405 East Airport Drive Suite 100
Ontario, California 91761

Attention: Mr. Garrett Hawthorne

Re: **Responses to San Bernardino County Review Comments**
County Geologic Report No. 2377
Geotechnical Engineering & Geology Update Report
Verizon Wireless - Mt. Baldy
801 San Antonio Creek Road
Mt. Baldy, California 91759

Gentlemen:

This letter report is prepared in response to San Bernardino County, Land Use Services Department, Building & Safety Review comments dated April 16, 2015 and will serve as an addendum to our original Geotechnical Engineering Report dated January 9, 2015. For the user convenience, the San Bernardino County comments are written and responded as follows:

San Bernardino County Comment No. 1:

Samples from a three foot hole do not characterize foundation conditions. As is typically required, an exploratory boring extending to a minimum depth equivalent to the base of proposed caissons must be completed, logged, sampled and tested.

Response to San Bernardino County Comment No. 1:

The proposed foundation is no longer a caisson type foundation. Pad type foundation is now proposed. As such, it is our opinion that previous exploration is sufficient for the currently proposed foundation. Based on the review of the site aerial photos and report by Dr. Jonathan A. Nourse, it is our current opinion that the site is underlain by more than 100 feet of landslide materials. The landslide debris consist of cobbly and gravelly sand with large boulder size metamorphic bedrock inclusions in the upper 40 feet of the site based on the exposure on the roadcut along San Antonio Creek Road which would make conventional deep drilling at the proposed site very difficult.

San Bernardino County Comment No. 2:

The geologic portion of the report must better characterize and evaluate the onsite landslide including anticipated depth, age, stability and hydrogeology.

Response to San Bernardino Comment No. 2:

Based on further review of available geotechnical maps, site aerial photos and reports (including the referenced report by Dr. Jonathan A. Nourse), it is our opinion that the landslide (Cow Canyon) is relatively deep seated and over 100 feet deep at the proposed monopine location.

It is now our opinion that the road cut along San Antonio Creek Road exposes landslide material throughout the entire section. The slide has been buttressed at the toe by San Antonio Creek. Based on the landslide geomorphology and the fact that the san Antonio creek alluvium has been mapped by others as resting on landslide debris it is likely that the landslide is a relatively old landslide. Existing seepage/springs near the subject site are at least 70 feet below the proposed monopine elevation. Since no deep foundations are being proposed the foundation should not adversely impact the existing hydro-geologic regime for the area.

San Bernardino County Comment No. 3:

A static and dynamic slope stability analyses must be conducted for the adjacent road cut if complete failure of the cut slope could potentially impact the site.

Response to San Bernardino Comment No. 3:

It is our opinion that complete failure of road cut is unlikely as lower portion of cut consists of relatively dense fine grained materials which are not exhibiting surficial failure characteristics. Also, the landslide is buttressed by San Antonio Creek alluvium. If failure of the road cut were to occur it is most likely that it would involve the upper 40 feet of materials which consist of cobbles and boulders in sandy matrix.

If these materials were to fail, it is likely that it would fail back to a 1:1 to 1.5:1 angle which would impact an area 20 to 40 feet to the north from the top of the slope (The slope angle currently is approximately 1/2:1).

The distance from the top of the slope to the existing power lines on the north is approximately 75 feet and the proposed monopine is located further 25 feet towards north.

Given the distance from the top of the road cut to the proposed monopine we do not think the monopine will be impacted by slope failure in the road cut.

San Bernardino County Comment No. 4:

Grading for the access road must be addressed, including whether cut or fill slopes are proposed as well as whether the project will impact the spring and whether any specific recommnedations are necessary to ensure the spring is not impacted by grading or grading-related erosion.

Response to San Bernardino Comment No. 4:

Based on our review of the site plan and verbal discussion with the project civil engineer,

no grading is being proposed along the existing access road. Rather, the existing road is being utilized "as-is".

Any possible grading to widen the road along the side of the hill should be avoided as this could adversely impact the existing springs and hydro-geologic regime in this area.

Additional/Revised Recommendations

Since it is going to be very difficult to drill because of presence of cobbles and boulder, we recommend mat foundation support for the proposed 45-foot high steel monopine.

The semi-rigid mat foundation should be at least 6-feet or more below the finish grade and may be designed for an allowable bearing capacity of 2,000 pounds per square foot. This basic allowable bearing value is for dead load plus live load and may be increased by one-third for short duration loading, such as wind or seismic forces. Modulus of subgrade reaction, k value may be taken as 100 pci for subgrade soil.

For lateral support, an average passive capacity of 300 pounds per square foot per foot to a maximum of 4,500 psf may be used for mat footing.

Minimum thickness of mat footing should be 36 inches. The bottom of excavation at 6 feet below the finish grade should be compacted to 90 % of the maximum density as per ASTM D-1557 laboratory Standard, certified by the Geotechnical Engineer of record prior to pouring concrete. Other aspects of the design, including reinforcement and the thickness of the mat should be determined by the project structural engineer. The mat may be buried and should be backfilled with selected on-site material compacted to 90 percent. The fill materials should not have rocks larger than 3 inches in diameter.

All other recommendations of our geotechnical engineering report dated January 9, 2015 are still valid and applicable.

Remarks

We trust the responses presented herein adequately address the information requested in the review comments. Should you have any questions or require additional information, please do not hesitate to call us.

This office will be available for further assistance and services.

Respectfully Submitted,

Geotechnical Solutions, Inc

Dharma Shakya, PhD, PE, GE
Principal Geotechnical Engineer

Fred Aflakian, CEG #2051
Engineering Geologist
Exp. Date 02/28/16

Abraham S. Baha, P.E., MASCE
Sr. Principal

Appendix A: Review sheets (3) pages, San Bernardino County, dated April 16, 2015.

Distributions: (3+pdf) Addressee

References:

San Bernardino County, Land Use Services Department, Building & Safety, 2015, "Review Comments on Geotechnical Engineering & Geology Update Report, Verizon Wireless Facility, Mt. Baldy Resort Located at 801 San Antonio Creek Road, Mt. Baldy, California, Project No. VS-4195-06, dated January 9", County Review No. 1766 dated April 16.

Geotechnical Solutions, Inc., 2015, "Geotechnical Engineering & Geology Update Report for Verizon Wireless Cellular Facility, Mt. Baldy Resort, LAX-277, Located at 801 San Antonio Creek Road, Mt. Baldy, California", Project No.: VS-4195-06, dated January 9.

Dr. Jonathan A. Nourse, 2002, "Evaluation of Supplementary Groundwater Sources Near Mt. Baldy Trout Ponds", dated July 6.

Appendix A

San Bernardino County Review Sheets

385 N. Arrowhead Ave, First Floor, San Bernardino, CA 92415 | Phone: 909.387.8311 Fax: 909.387.3223
www.SBCounty.gov

SAN BERNARDINO COUNTY

Land Use Services Department
Building and Safety

Tom Hudson
Director

April 16, 2015

Verizon Wireless
15505 Sand Canyon Avenue, Building D
Irvine, California 92618

RE: REVIEW OF GEOLOGIC AND GEOTECHNICAL INVESTIGATION REPORT, PROPOSED WIRELESS COMMUNICATIONS FACILITY, MT. BALDY, COUNTY REVIEW NO. 1766

The following report prepared by Geotechnical Solutions, Inc., dated January 29, 2015, was submitted for review:

> *Geotechnical Engineering & Geology Update Report, Verizon Cellular Facility, Mount Baldy Resort, LAX-277, 801 San Antonio Creek Road, Mt. Baldy, California 91759, Project No. VS-4195-06*

The report is signed and sealed by Fred Aflakian, California Professional Geologist and Certified Engineering Geologist, Dharma R. Shakya, California Professional Engineer and Certified Geotechnical Engineer and Abraham S. Baha, California Professional Engineer.

Although the title of the report suggests it is an update, the report is intended to supersede any previous reports and was submitted as a standalone report.

The report indicates that the parcel will be developed with a 45-foot high monopine tower, an equipment shelter and a generator pad. It is also our understanding that an existing access road will be improved and extended as part of the project.

The geotechnical field investigation included a hand-dug excavation approximately 3 feet deep. Cobbly and gravelly sand was exposed. Sampling for laboratory analysis was conducted at a depth of 2 feet. The report states that the testing was conducted to "*establish foundation-bearing characteristics*".

Based upon the three-foot deep excavation as well as observations of the adjacent road cut along Mt. Baldy Road, the report concludes that the tower can be supported by cast-in-place concrete caissons bearing into gneissic bedrock estimated at a depth of 20 to 25 feet beneath the tower site.

The site is located within the Geologic Hazard Overlay District designated by the County of San Bernardino to include areas known to have a potential for slope instability. In addition, the entire site is located upon a large mapped landslide referred to in the geologic literature as the Cow Canyon landslide. Any development proposed within the boundaries of a mapped landslide requires careful analysis.

The report acknowledges that the site is underlain by landslide materials and states that these materials "*are not considered a suitable base for structural foundation support*". The report estimates that non-landslide competent bedrock underlies the site at a depth of 20 to 25 feet based upon observation of the road cut. However, the Cow Canyon landslide plane is likely beneath the elevation of the roadway and likely not exposed in the road cut. In the July 6, 2002 report entitled "*Evaluation of Supplementary Groundwater Sources Near Mt. Baldy Trout Ponds*" for the San Antonio Canyon Mutual Water Services Company, Dr. Jonathan Nourse of the Department of Geological Sciences at California State Polytechnic University suggests the Cow Canyon landslide plane could well be over one hundred feet in depth in the immediate vicinity of the tower site.

The report concludes "*It is unlikely that development of this unmanned wireless facility at the subject property will be prone to geologic hazards like landslide ... However, there is a possibility that landslide may occur in case of heavy rainfall near Mt. Baldy Road and top 20 feet of subgrade soil could be affected.*" The report also states "*the most significant geologic hazard impacting the site is the presence of landslide debris beneath the site*" and "*landslide materials appear to be highly permeable, and could reactivate and move downhill during an event of severe rain fall and saturation*".

In addition, the report states that there is a potential for "*very high ground motions at the site from local large earthquakes*" but also indicates "*we do not expect seismic slope instability*".

These statements are vague, contradictory and unsubstantiated. A more detailed stability analysis is warranted.

The report indicates that there was no evidence of shallow groundwater or springs and estimates groundwater "*to be very deep at the project site*". However, there is apparently a developed spring along the proposed access alignment referred to as the Trout Pond Spring in Dr. Nourse's 2002 report for the San Antonio Canyon Mutual Water Services Company. Dr. Nourse also states that the spring discharges from "*a porous and highly permeable zone within the Cow Canyon landslide deposits.*" There is some indication that this water is utilized for domestic purposes locally. Groundwater conditions should be reevaluated at the project site in light of this information.

The following conditions apply:

- Samples from a three foot hole do not characterize foundation conditions. As is typically required, an exploratory boring extending to a minimum depth equivalent to the base of proposed caissons must be completed, logged, sampled and tested.

- The geologic portion of the report must better characterize and evaluate the onsite landslide including anticipated depth, age, stability and hydrogeology.

- A static and dynamic slope stability analysis must be conducted for the adjacent road cut if complete failure of the cut slope could potentially impact the site.

- Grading for the access roadway must be addressed, including whether cut or fill slopes are proposed as well as whether the project will impact the spring and whether any specific recommendations are necessary to ensure the spring is not impacted by grading or grading-related erosion.

Sincerely,

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Geology File
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SAN BERNARDINO COUNTY

Land Use Services Department
Building and Safety

Tom Hudson
Director

May 20, 2015

Verizon Wireless
15505 Sand Canyon Avenue, Building D
Irvine, CA 92618

RE: REVIEW OF RESPONSE REPORT, GEOLOGIC AND GEOTECHNICAL INVESTIGATION, PROPOSED WIRELESS COMMUNICATIONS FACILITY, MT. BALDY, COUNTY REVIEW NO. 1766.1

The following report prepared by Geotechnical Solutions, Inc., dated May 15, 2015, was submitted for review:

> *Responses to County of San Bernardino Review Comments, County Geology Report No. 2377 [sic] Geotechnical Engineering & Geology Update Report, Verizon Wireless - Mount Baldy, 801 San Antonio Creek Road, Mt. Baldy, California 91759, Project No. VS-4195-06*

The report is signed and sealed by Fred Aflakian, California Professional Geologist and Certified Engineering Geologist, Dharma R. Shakya, California Professional Engineer and Certified Geotechnical Engineer and Abraham S. Baha, California Professional Engineer.

The report was submitted in response to our review of the January 29, 2015 geologic and geotechnical investigation report (County Review No. 1766 dated April 16, 2015).

The previous report indicated that the parcel will be developed with a 45-foot high monopine tower, an equipment shelter and a generator pad. It was also our understanding that an existing access road would be improved and extended as part of the project.

As a result of additional analysis, the report concludes that the site is likely underlain by more than 100 feet of landslide materials. The report further indicates that the landslide materials are part of the Cow Canyon landslide, which is relatively old and is currently buttressed. Gross instability of the landslide is therefore, not expected.

The response report indicates that failure of the adjacent steep road cut, which exposes landslide materials is unlikely. However, should road cut failure occur, the report notes that the proposed tower will be 100 feet from the top of the cut slope and states "*Given the distance from the top of the road cut to the proposed monopine we do not think the monopine will be impacted by slope failure in the road cut*."

The response report also outlines several significant changes in the proposed scope of development that have occurred since the last report. The previous report recommended that the tower be supported by cast-in-place concrete caissons extending to a minimum depth of 20 to 25 feet. As a result of the anticipated presence of cobbles and boulders in the subsurface, the response report recommends that the tower be supported by a semi-rigid mat foundation a minimum thickness of 36 inches placed a minimum depth of 6 feet below grade.

In addition, it was our understanding that the existing access road was to be improved and extended as part of this project. Our previous review requested that the consultant evaluate proposed road grading and any possible impacts with respect to erosion and effect on the adjacent natural spring, which is apparently utilized as a local water supply. However, the response report indicates that no grading is being proposed along the existing access road and recommends "*Any possible grading to widen the road along the side of the hill should be avoided as this could adversely impact the existing springs and hydro-geologic regime in this area*."

The response report adequately addresses the areas of concern outlined in our previous review and is approved this date. Should changes to the proposed tower location or tower foundation occur or if road grading is proposed, additional evaluation may be necessary.

The following conditions apply:

- The Project Geotechnical Engineer (Geotechnical Solutions, Inc.) must review and sign foundation plans. Alternatively, the Geotechnical Engineer may submit a written review of the plans but must indicate whether the plans appear to incorporate the geotechnical recommendations for site development as outlined in the preliminary geotechnical report.

- The Project Geotechnical Engineer must inspect and approve footing excavations prior to pouring of concrete.

Sincerely,

WESSLY A. REEDER, County Geologist
PG 4270 EG 1447
Building and Safety Division
Land Use Services Department

WAR:mp

cc: Geotechnical Solutions, Inc.
Geology File
APN File