GEOLOGIC HAZARDS ASSESSMENT
for
ROCKLIN FIRE STATION 23
Pacific Street
Rocklin, California
Placer County APN: 010-230-004

Prepared by:
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Prepared for:
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Project No. E16379.000
March 2017

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Project No. E16379.000
8 March 2017

Attention: Mr. Timothy Peel

Subject: **ROCKLIN FIRE STATION NO. 23**
Pacific Street, Rocklin, Placer County, California
GEOLOGIC HAZARDS ASSESSMENT

Report References:
1. Phase I Environmental Site Assessment for Kesti Property, prepared by Brusca Associates, Inc., dated 12 May 2014 (Project No. 142-002).
2. Site Plan for Rocklin Fire Station No. 23, prepared by Calpo Hom & Dong, (Project No. C16114.00).
3. Geotechnical Engineering Report, prepared by MatriScope Engineering Laboratories, Inc., dated 8 March 2017 (MEL File No. 2677-01)

Dear Mr. Peel:

With your authorization, Youngdahl Consulting Group, Inc. (Youngdahl) has completed the attached Geologic Hazards Assessment for the proposed Rocklin Fire Station No. 23. We understand that the proposed project will include the construction of a new fire station, security fencing, and access road.

This assessment is designed to address the specific items listed in the California Geological Survey (CGS) Note 48 Checklist (CGS, 2013) and to be used in conjunction with the Geotechnical Engineering Report prepared by MatriScope Engineering Laboratories, Inc. (Report Reference No. 3). If you have questions or require any additional updates, please do not hesitate contacting us at (916) 933-0633.

Very truly yours,
Youngdahl Consulting Group, Inc.

Dennis S. Eck
Staff Geologist

Reviewed by

David C. Sederquist, C.E.G., C.H.G.
Senior Engineering Geologist/Hydrogeologist

CERTIFIED ENGINEERING GEOLOGIST
DAVID C. SEDERQUIST
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EXPIRATION DATE
9-30-18
STATE OF CALIFORNIA

Distribution: 1 PDF to Client

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GEOLOGIC HAZARDS ASSESSMENT
ROCKLIN FIRE STATION NO. 23
Pacific Street, Rocklin, California

1.0 EXECUTIVE SUMMARY

The proposed Rocklin Fire Station No. 23 site is located along Pacific Street northeast from the intersection of Pacific Street and Ruhkala Road in Rocklin, California (Figure 1). The terrain generally consists of short grasses, oak and pine trees, and mounds of quarrying spoils and unknown fill materials. Adjacent properties include Pacific Street to the west, a veterinary clinic to the south, Quarry Park to the south and east, and remnant quarry buildings and debris to the north. The proposed construction includes a new fire station building, security fencing and an access road. The geotechnical conditions are discussed in the Geotechnical Engineering Study (Report Reference 3) prepared by Matriscope Engineering Laboratories, Inc. (Matriscope). This Geologic Hazards Study was prepared by Youngdahl Consulting Group, Inc., addressing the California Geologic Survey (CGS) Note 48 Checklist for 2013. The existing site features and geology are shown on Figure 3. Significant findings of this report are presented below:

- The nearest active fault was identified as the Dunnigan Hills Fault, approximately 38 miles west of the site.
- Historically, the largest earthquake within 100km of the site that occurred in the past 200 years was the 6.6 magnitude earthquake approximately 3½ miles north of Vacaville, CA in 1892.
- According to the November 2001 Federal Emergency Management Agency (FEMA) Flood Map for Placer County, California (Map No. 06061C0477 G), the areas of proposed construction are outside of the 500-year floodplain

2.0 INTRODUCTION

This report presents the results of our analysis of geologic hazards for the proposed Fire Station site located along Pacific Street in Rocklin, California (Figure 1). This report is being produced concurrently with the Geotechnical Report by Matriscope Engineering Laboratories, Inc. for the new Rocklin Fire Station No. 23 (Report Reference 3). The scope of this study includes the following:

- A review of past geologic hazard studies and local fault studies.
- A review of the Geotechnical Engineering Report boring logs.
- The addressing of items listed on the checklist of Note 48 published by the California Geological Survey.
- Engineering geology analysis of geological hazards for the planned facility location.
- Preparation of this report.

3.0 PROJECT DESCRIPTION

The preliminary project design includes the construction of a new fire station, security fencing, and an access road connecting to Pacific Street, and other site improvements. Grading plans were not available at the time of this report.

4.0 SITE LOCATION AND DESCRIPTION

The site was visited on 16 February 2017 by a representative of our firm. The site is at Latitude/Longitude coordinates 38.78786° N, 121.23647° W, which have been plotted and are presented on a topographic map (Figure 1). The site slopes gradually towards the south and is covered by short, seasonal grasses with a moderate covering of oak and pine trees. Boulders and outcrops consisting of granitoid rock are visible throughout the site. The northeast half of the site has hummocky terrain, likely from past dumping of quarried rock, and contains several mounds of fill material and rock piles. Metal railroad debris and remnant railroad tracks were observed near the center of the site. Quarry Park occupies the south and east adjacent areas

from the site and dilapidated structures and mining debris were observed to the north. A veterinary hospital is located to the southwest, and Pacific Street is to the west. Remnant rock quarries exist to the northeast, east, and southeast from the site.

5.0 ENGINEERING GEOLOGY

The geology of the site is based on observations of boring logs and a review of published literature.

5.1 Regional Geology

The site is located within the Great Valley geomorphic province of California. This province is underlain by Cretaceous, Tertiary and Quaternary Age sediments which may exceed 6,500 feet in thickness in the south Sacramento County area (Harwood & Helley, 1987). Erosion of the Sierra Nevada to the east and Coast Ranges to the west supply the valley with sediment, with the western edge of the valley containing the thickest sedimentary strata.

According to the 1:100,000 scale Preliminary Geologic Map of the Sacramento Quadrangle map (Gutierrez, 2011, Loyd, 1984), the subject site is underlain by the Rocklin Pluton (Map Unit Kr). The Rocklin Pluton is a lower Cretaceous quartz-diorite intrusive body that intruded into the Penryn Pluton (Upper Jurassic) and metamorphic rocks near Rocklin, California (Swanson, 1978; Olmsted, 1971). To the south and west it is covered by Cenozoic deposits of the eastern Sacramento Valley. Cross section A within the California Department of Water Resources Bulletin No. 118-3 (1974) indicated materials overlying the plutonic rock include Tuff-breccia and Mehrten Formation in the area northeast of Highway 65 near Clover Valley.

The California Department of Agriculture Natural Resources Conservation Service's Web Soil Survey provides information and data on site soils. The site is underlain by two soil units shown in the table below.

Soil Type	Soil Description
Cometa-Ramona sandy loams, *1 to 5 percent slopes* *Map Unit Symbol 142*	Parent material is alluvium derived from granite. The soil is well drained and has a very high runoff class. A typical profile includes sandy loam and clay to 60 inches. This unit is considered farmland of statewide importance.
Pits and Dumps *Map Unit Symbol 173*	A typical profile of this unit is variable.

5.2 Site Subsurface Geology

A representative from Matriscope advanced two borings and one hand-dug test pit at strategic locations around the proposed fire station site to depths between 2½ and 15½ feet. Within boring B-1, Silty CLAY (Fill) was encountered from the surface to approximately 8 feet and poorly graded fine SAND from a depth of 8 feet to 15½ feet, where refusal was met. Boring B-2 was advanced to a depth of 10½ feet and encountered poorly graded fine SAND throughout, with the top 3 feet characterized as fill material. A railroad tie was also encountered at a depth of 2 feet within boring B-2. A third location, TP-3, was hand-excavated to a depth of 2½ feet and encountered poorly graded fine SAND.

Perched groundwater was encountered ½ inch before refusal was met in all locations. Refusal was met at the bedrock (granitoid rock) horizon. Subsurface water is likely also present in fractures and joints within the underlying granitoid rock. Groundwater elevations are highly seasonal and may vary significantly. Also, shallow groundwater flow directions are typically closely tied to surface topography with ground water flowing at right angles to elevation contours.

A nearby underground storage tank (UST) site, discovered through the California State Water Resources Control Board's Geotracker website, had 6 monitoring wells installed purposed for contamination characterization, but also to obtain groundwater depth data on a semi-annual basis. This UST site, named the Palmer Property, is at 5250 Pacific Street – approximately 530 feet north of the subject site. Within the most recent monitoring report, dated 3 February 2012, depth to water ranged from 4.74 to 9.69 feet below ground surface (bgs).

5.3 Faulting

The Sierra Nevada, like most of California, is a seismically active region. The level of seismicity is due to complex regional tectonic processes that include movement along major crustal plates and uplift in the Sierra Nevada mountain range. The Foothills Fault system is composed of numerous faults residing within the basement rocks (Bedrock Series) of the foothills of the western Sierra Nevada. Together they make up a major regional geologic feature and were formed during the Mesozoic Era (225 to 65 million years ago) in response to the building and deformation of the Sierra Nevada geologic province. But the current relative risk of earthquakes in this region is considered to be lower than in most other areas of California because most faults in the Foothills have very slow slip rates and this region is not considered to be as seismically active.

No active faulting or coseismic deformation is present on or near the site. According to the Fault Activity Map of California and Adjacent Areas (Jennings, 2010), and based on field evidence, no active faults are located within the general proximity of the subject property. No evidence of recent shear movement, such as soil off-set, springs, seeps, sag ponds or other indications of recent ground rupture were observed on the project site during our study. The closest active fault is the Dunnigan Hills Fault, situated approximately 38 miles to the west.

6.0 SEISMOLOGY & CALCULATION OF EARTHQUAKE GROUND MOTION

6.1 Evaluation of Historical Seismicity

The Foothills Fault System is Figure 6 shows mapped faults near the project site. Figure 5 shows historical epicenters above an estimated moment magnitude of 5.5 in California. Inspection of Figure 5 shows that the closest source of historical seismicity to the site in the past 200 years was the 6.6 magnitude approximately 3½ miles north of Vacaville, California earthquake in 1892.

6.2 Calculation of Earthquake Ground Motion

Earthquake ground motion is discussed in Report Reference 3.

7.0 LIQUEFACTION, SURFACE RUPTURE POTENTIAL, AND SEISMIC SETTLEMENT

Liquefaction is the sudden loss of soil shear strength and sudden increase in porewater pressure cause by shear strains, as could result from an earthquake. Research has shown that saturated, loose to medium-dense sands with a silt content less than about 25 percent and located with the top 40 feet are most susceptible to liquefaction and surface rupturing/lateral spreading.

Due to the absence of permanently elevated groundwater table, the relatively low seismicity of the area, and the shallow depths to bedrock, the potential for seismically induced damage due to liquefaction, surface ruptures, and settlement is considered negligible. For the above-mentioned reasons, mitigation for these potential hazards is not required for the development of this project.

8.0 SLOPE STABILITY ANALYSIS

The topography of the site slopes gently towards the south and has few fill mounds that are a maximum of approximately 8 feet in height. The site has insufficient relief to be prone to landslides or slope failures; therefore, for other than artificially constructed conditions (excavations), landslides or slope failures are highly unlikely.

9.0 OTHER GEOLOGIC HAZARDS

9.1 Hazardous Materials

The Report Reference 1 Phase I Environmental Site Assessment (ESA) conducted historical research regarding potential contamination by hazardous materials release and attempts to identify any recognized environmental conditions in connection with the site. Review of this assessment has revealed that past quarrying operations had taken place on and in the vicinity of the site, but no significant quantities of hazardous materials were involved. It was concluded that no recognized environmental conditions were discovered in connection with the subject site.

Review of the California Department of Conservation Division of Oil, Gas and Geothermal Resources Well Finder (accessed 15 Feb 2017) indicates that the site is not located on or near a source of natural gas or oil.

9.2 Volcanic Eruption

The subject site does not lie in a volcanic hazards zone.

9.3 Flooding

According to the November 2001 Federal Emergency Management Agency (FEMA) Flood Map for Placer County, California (Map No. 06061C0477 G), the areas of proposed construction are outside of the 500-year floodplain.

9.4 Tsunami and Sieche Inundation

There are no nearby major bodies of water capable of inundating the site with a tsunami or a seiche.

9.5 Radon-222 Gas

The California Department of Health Services, California Indoor Radon Levels sorted by zip code was last updated in February 2016. The number of tests does not necessarily represent the number of houses tested. A single house may have had several tests conducted. The table contains both long-term and short-term indoor radon measurements. The California Department of Health Services recommends that you take action to reduce radon levels in your house if they are 4pCi/L or greater. Of the 116 tests conducted for Zip Code 95677, 5 tests were equal to or greater than 4pCi/L.

According to EPA publication 402-R-93-025, entitled EPA's Map of Radon Zones, California, dated September 1993, Placer County is shown to be in Zone 2. Zone 2 has a predicted average indoor radon screening level of between 2 and 4 pCi/l and is considered moderate potential.

9.6 Naturally Occurring Asbestos

The subject site is not underlain by serpentinite, ultramafic rock, or mafic rock. According to the Department of Conservation California Geological Survey's *Relative Likelihood for the Presence of Naturally Occurring Asbestos in Placer County, California (2006),* the site is not in or near an identified area identified as having a potential to contain naturally occurring asbestos.

9.7 Hydrocollapse

A principal cause of hydrocollapse has been identified as the saturation of previously unsaturated alluvium. This can be caused by excessive irrigation or other inflows of water. Groundwater was limited to perched water on the bedrock horizon. The subsurface investigations and geology review did not find sufficiently thick alluvium or other conditions conducive to the hydrocollapse of soils.

9.8 Regional Subsidence

Regional subsidence is most often caused by either mining, petroleum extraction or by excessive groundwater extraction. No petroleum extraction has been done, or is in progress in the vicinity of the site.

The subject site is underlain by granitoid rock not in an area of mapped land subsidence. We were unable to identify any additional sources of information indicating that regional subsidence is a problem in the area. Based on our review of the subsurface geology described in the California Department of Water Resources Bulletin 118-3 and previous mining and quarrying operations as described in the Reference 1 Phase I ESA, we are of the opinion that the project area is not subject to significant land subsidence.

9.9 Clays and Cyclic Softening

Some clay materials were encountered during the geotechnical investigation for this site. It is Youngdahl's opinion that these clay layers are not extensive enough to cause conditions conducive for clays subject to cyclic softening.

10.0 RECOMMENDATIONS

It is Youngdahl's opinion that this project is not located within an area of significant geologic hazards, and no special mitigation measures need to be taken.

11.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. This report has been prepared for the exclusive use of the MatriScope Engineering Laboratories, Inc., their clients, and their subcontractors for specific application to the proposed Fire Station No. 23. Youngdahl Consulting Group, Inc. has endeavored to comply with generally accepted engineering geology practice common to the local area. Youngdahl Consulting Group, Inc. makes no other warranty, express or implied.

2. As of the present date, the findings of this report are valid for the property studied. With the passage of time, changes in the conditions of a property can occur whether they be due to natural processes or to the works of man on this or adjacent properties. Legislation or the broadening of knowledge may result in changes in applicable standards. Changes outside of our control may cause this report to be invalid, wholly or partially. Therefore, this report should not be relied upon after a period of three years without our review nor should it be used or is it applicable for any properties other than those studied.

3. Do not apply any of this report's conclusions or recommendations if the nature, design, or location of the facilities is changed. If changes are contemplated, Youngdahl Consulting Group, Inc. must review them to assess their impact on this report's applicability. Also note that Youngdahl Consulting Group, Inc. is not responsible for any claims, damages, or liability associated with any other party's interpretation of this report's subsurface data or reuse of this report's subsurface data or engineering analyses without the express written authorization of Youngdahl Consulting Group, Inc.

12.0 REFERENCES

Geologic References

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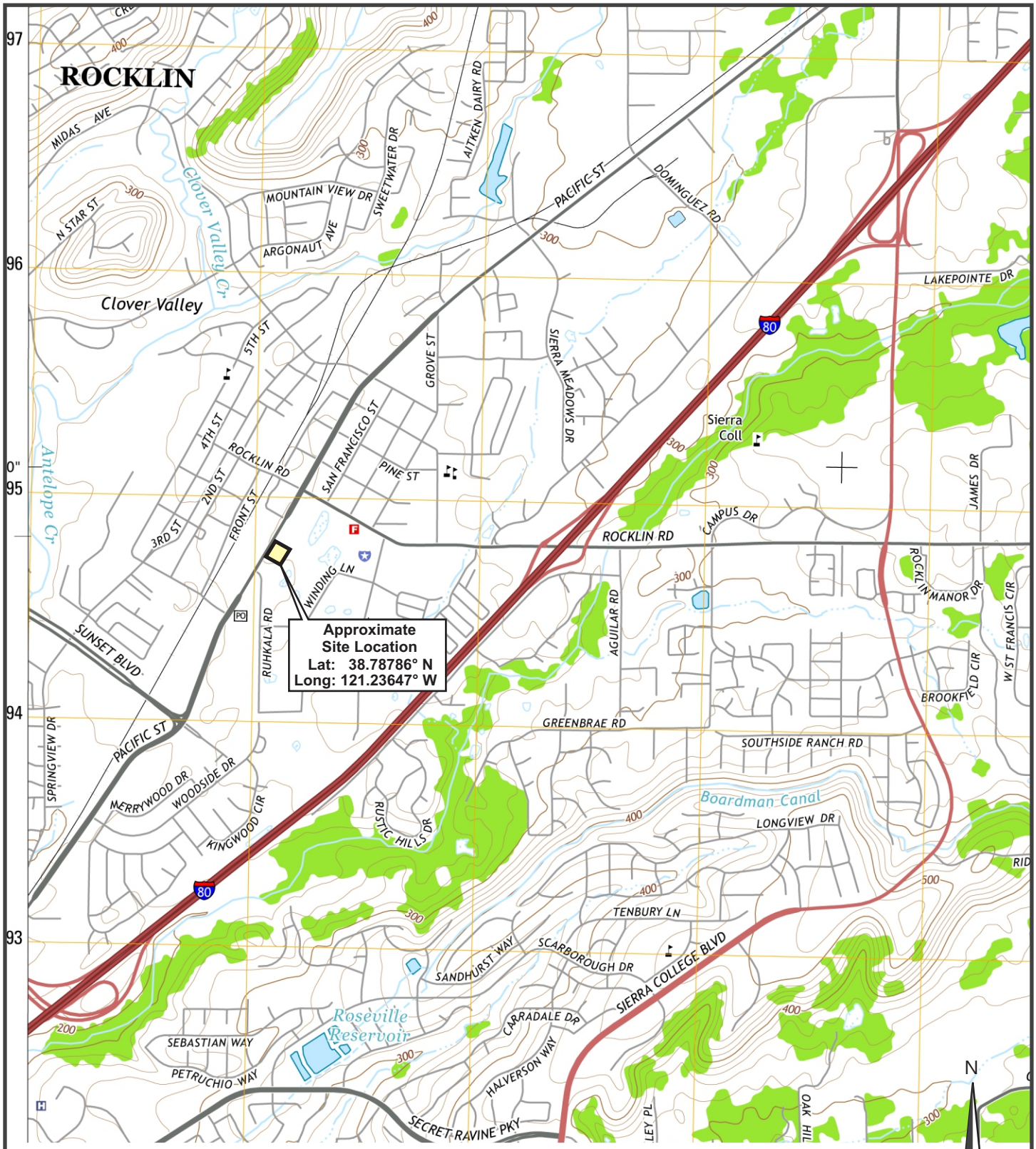
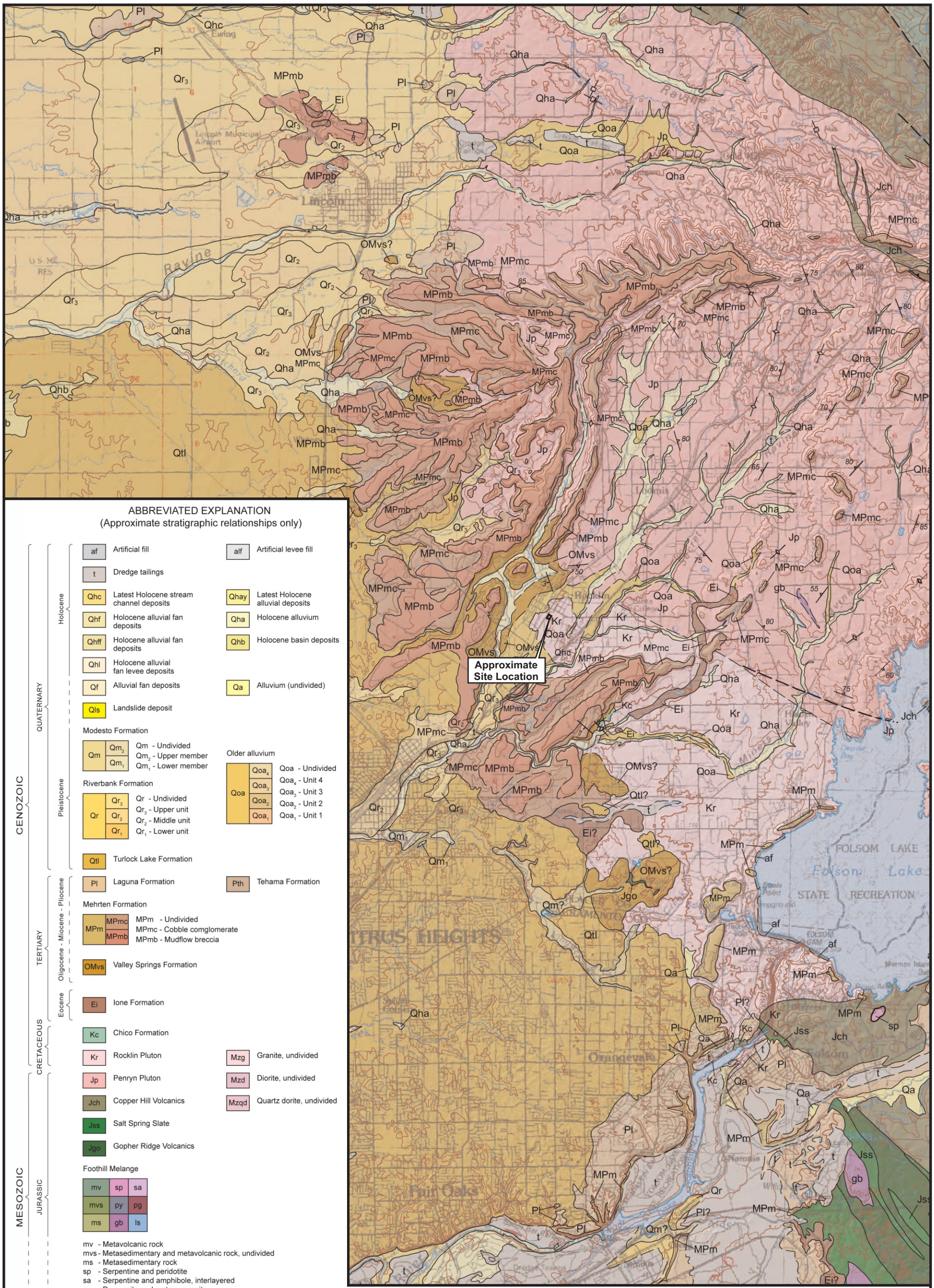
FIGURES



Scale: 1:24,000

BASE MAP REFERENCE: U.S.G.S. 7.5 Minute Topographic Series, Clarksville Quadrangle, Dated 2015

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS TESTING	Project No.: E16379.000 **March 2017**	**VICINITY MAP** **Rocklin Fire Station 23 GHA** Rocklin, California	**FIGURE 1**



ABBREVIATED EXPLANATION
(Approximate stratigraphic relationships only)

CENOZOIC

QUATERNARY

Holocene

- af — Artificial fill
- alf — Artificial levee fill
- t — Dredge tailings
- Qhc — Latest Holocene stream channel deposits
- Qhay — Latest Holocene alluvial deposits
- Qhf — Holocene alluvial fan deposits
- Qha — Holocene alluvium
- Qhff — Holocene alluvial fan deposits
- Qhb — Holocene basin deposits
- Qhl — Holocene alluvial fan levee deposits
- Qf — Alluvial fan deposits
- Qa — Alluvium (undivided)
- Qls — Landslide deposit

Modesto Formation

- Qm — Undivided
- Qm_2 — Upper member
- Qm_1 — Lower member

Riverbank Formation

- Qr — Undivided
- Qr_3 — Upper unit
- Qr_2 — Middle unit
- Qr_1 — Lower unit

Older alluvium

- Qoa — Undivided
- Qoa_4 — Unit 4
- Qoa_3 — Unit 3
- Qoa_2 — Unit 2
- Qoa_1 — Unit 1

Pleistocene

- Qtl — Turlock Lake Formation

TERTIARY

Pliocene - Miocene - Oligocene

- Pl — Laguna Formation
- Pth — Tehama Formation

Mehrten Formation

- MPm — Undivided
- MPmc — Cobble comglomerate
- MPmb — Mudflow breccia

- OMvs — Valley Springs Formation

Eocene

- Ei — Ione Formation

CRETACEOUS

- Kc — Chico Formation
- Kr — Rocklin Pluton
- Jp — Penryn Pluton
- Jch — Copper Hill Volcanics
- Jss — Salt Spring Slate
- Jgo — Gopher Ridge Volcanics

MESOZOIC

JURASSIC

Foothill Melange

mv	sp	sa
mvs	py	pg
ms	gb	ls

- mv - Metavolcanic rock
- mvs - Metasedimentary and metavolcanic rock, undivided
- ms - Metasedimentary rock
- sp - Serpentine and peridotite
- sa - Serpentine and amphibole, interlayered
- py - Pyroxenite and metapyroxenite
- pg - Pyroxenite and gabbro
- gb - Gabbro and metagabbro
- ls - Limestone

N

REFERENCE: *Preliminary Geological Map of the Sacramento Quadrangle, California, California Department of Conservation, Carlos I. Gutierrez, Dated 2011*

SCALE 1:100,000

2 0 2 4 6 Miles

2 0 2 4 6 Kilometers

Contour Interval: 20 meters (approximately 66 feet)
Supplementary Contour Interval: 10 meters (approximately 33 feet)

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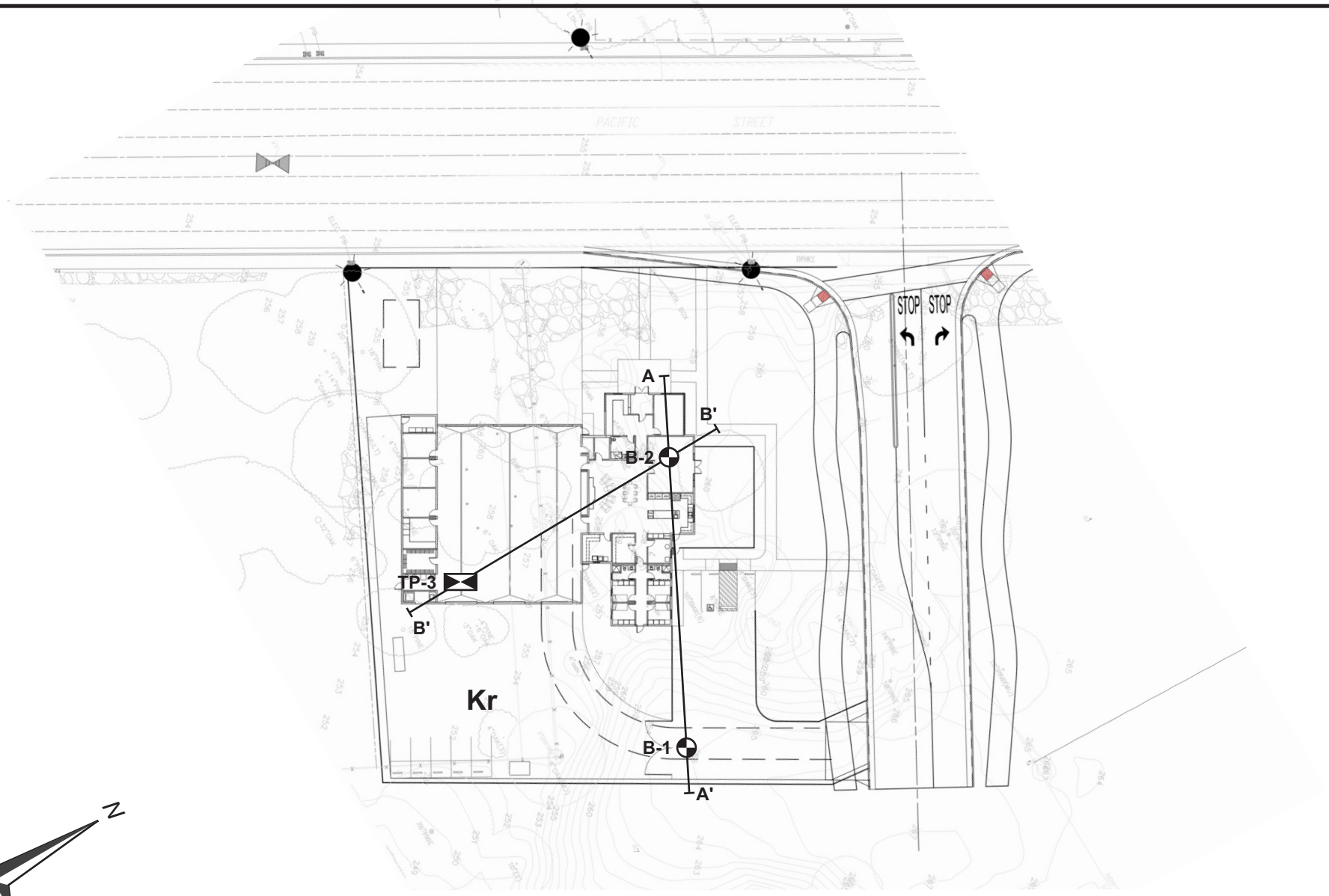
REGIONAL GEOLOGY MAP

Rocklin Fire Station 23 GHA
Rocklin, California

FIGURE 2



N

TP-1 = Approximate Test Pit Locations

Kr = Rocklin Pluton

B-1 = Approximate Boring Location

BASE MAP REFERENCE: *Site Plan Provided by Client*

No Scale

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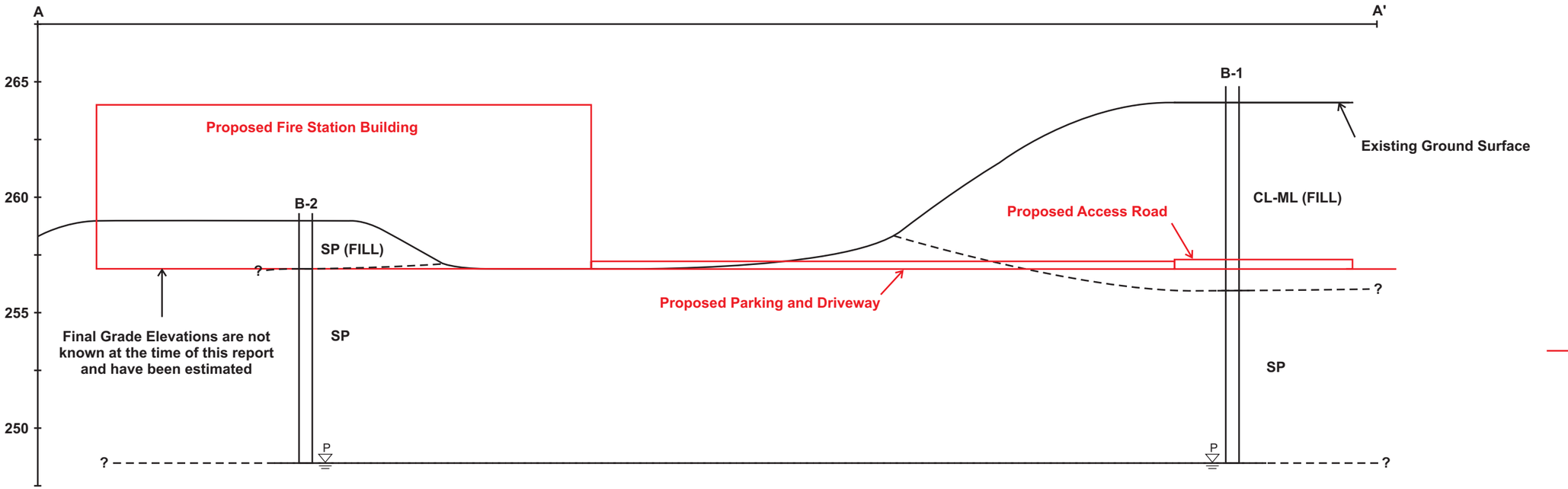
SITE GEOLOGY

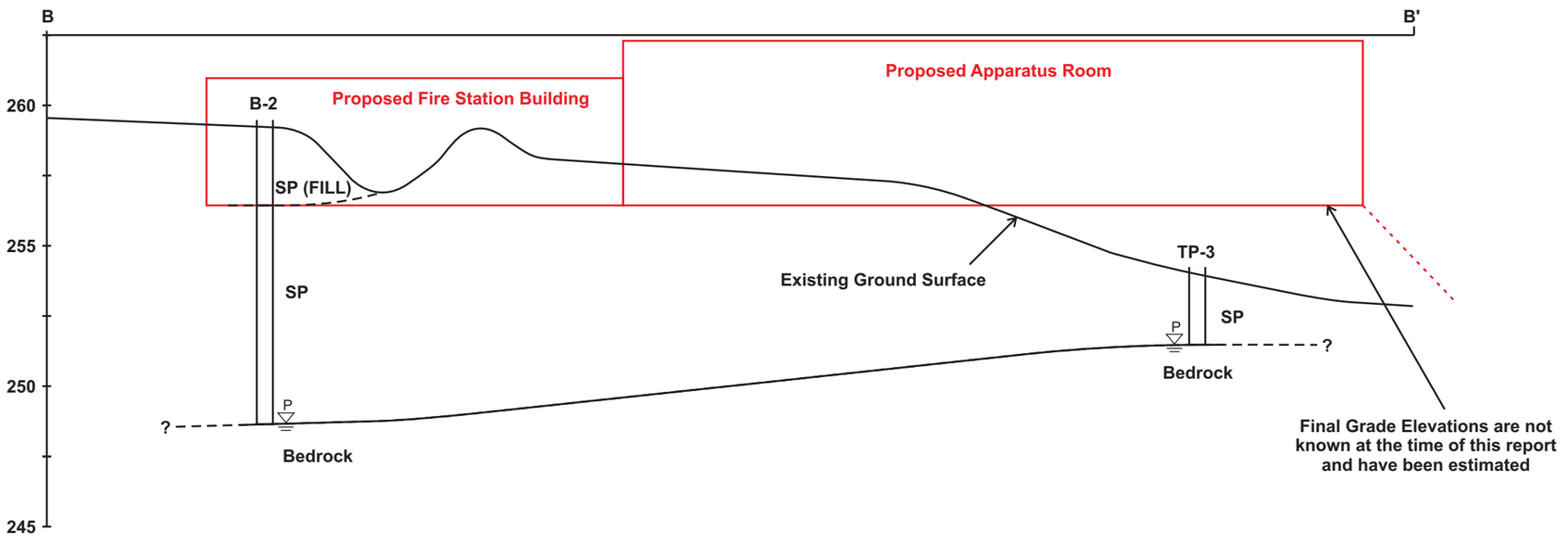
Rocklin Fire Station 2 GHA
Rocklin, California

FIGURE
3

Cross Section A



Cross Section B



0 25 50 100

Approximate Scale: 1" = 16' Horizontal
1" = 5' Vertical

UNIFIED SOIL CLASSIFICATION SYSTEMS

MAJOR DIVISION			SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS Over 50% > #200 sieve	GRAVELS Over 50% > #4 sieve	Clean GRAVELS With Little Or No Fines	GW	Well graded **GRAVELS, GRAVEL-SAND** mixtures
			GP	Poorly graded **GRAVELS, GRAVEL-SAND** mixtures
		GRAVELS With Over 12% Fines	GM	Silty **GRAVELS**, poorly graded **GRAVEL-SAND-SILT** mixtures
			GC	Clayey **GRAVELS**, poorly graded **GRAVEL-SAND-CLAY** mixtures
	SANDS Over 50% < #4 sieve	Clean **SANDS** With Little Or No Fines	SW	Well graded **SANDS**, gravelly **SANDS**
			SP	Poorly graded **SANDS**, gravelly **SANDS**
		SANDS With Over 12% Fines	SM	Silty **SANDS**, poorly graded **SAND-SILT** mixtures
			SC	Clayey **SANDS**, poorly graded **SAND-CLAY** mixtures
FINE GRAINED SOILS Over 50% < #200 sieve	SILTS & CLAYS Liquid Limit < 50		ML	Inorganic **SILTS**, silty or clayey fine **SANDS**, or clayey **SILTS** with plasticity
			CL	Inorganic **CLAYS** of low to medium plasticity, gravelly, sandy, or silty **CLAYS**, lean **CLAYS**
			OL	Organic **CLAYS** and organic silty **CLAYS** of low plasticity
	SILTS & CLAYS Liquid Limit > 50		MH	Inorganic **SILTS**, micaceous or diamacious fine sandy or silty soils, elastic **SILTS**
			CH	Inorganic **CLAYS** of high plasticity, fat **CLAYS**
			OH	Organic **CLAYS** of medium to high plasticity, organic **SILTS**
HIGHLY ORGANIC CLAYS			PT	PEAT & other highly organic soils

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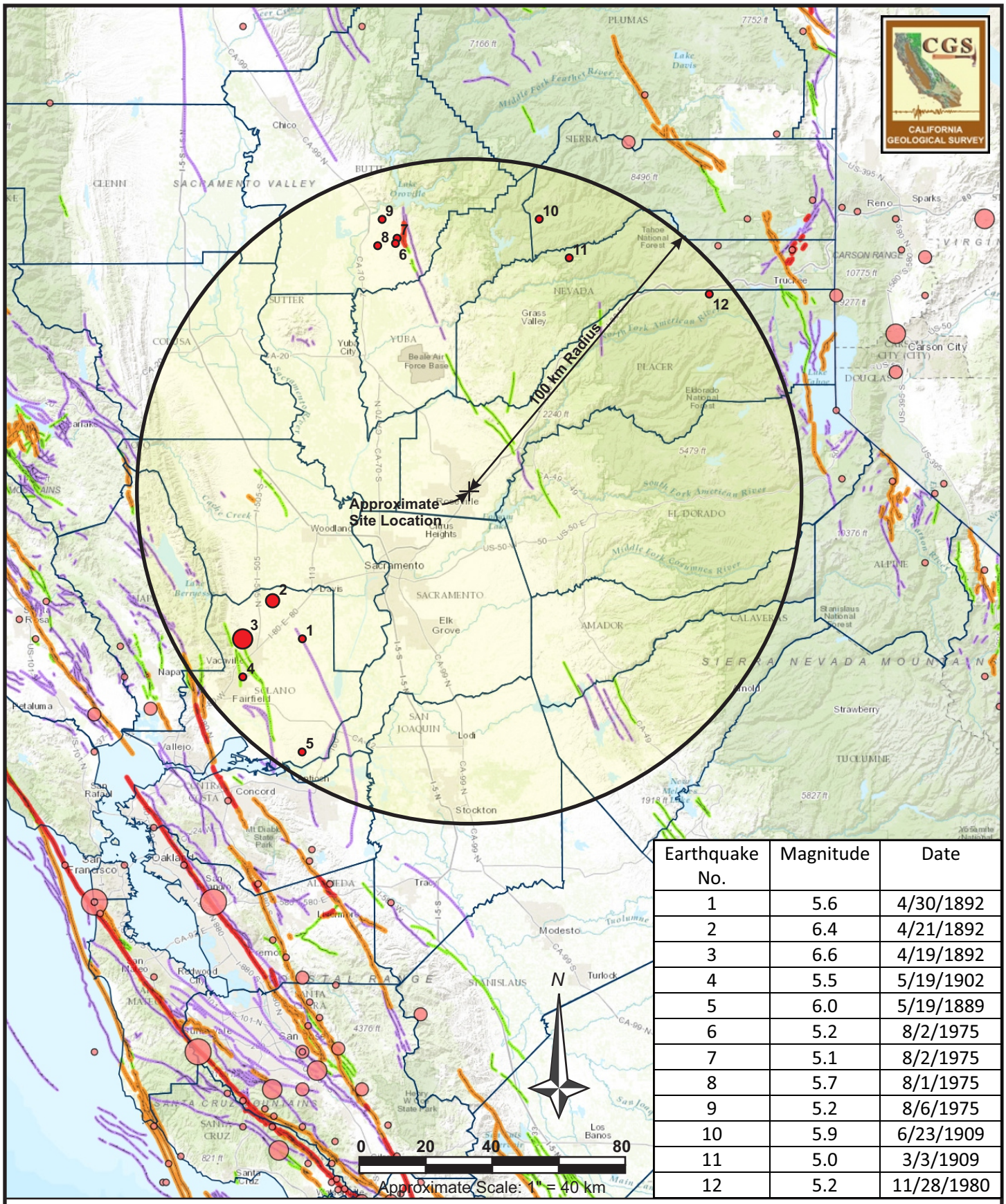
CROSS SECTION

Rocklin Fire Station 23 GHA
Rocklin, California

FIGURE 4



Earthquake No.	Magnitude	Date
1	5.6	4/30/1892
2	6.4	4/21/1892
3	6.6	4/19/1892
4	5.5	5/19/1902
5	6.0	5/19/1889
6	5.2	8/2/1975
7	5.1	8/2/1975
8	5.7	8/1/1975
9	5.2	8/6/1975
10	5.9	6/23/1909
11	5.0	3/3/1909
12	5.2	11/28/1980

BASE MAP REFERENCE: Esri, HERE, DeLorme, FAO, NOAA, USGS, EPA | California Geological Survey, C.W. Jennings, W.A. Bryant

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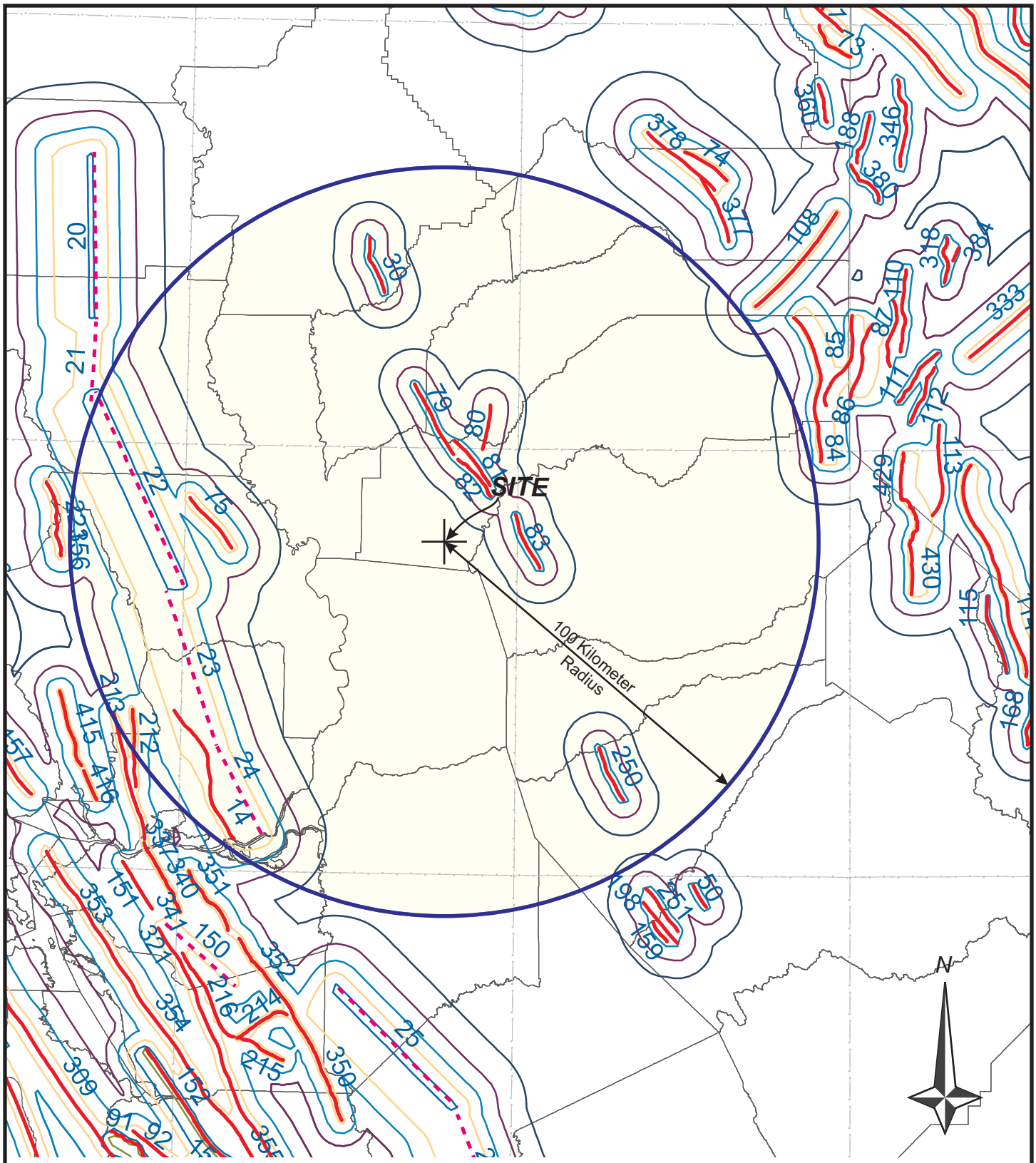
HISTORICAL SEISMICITY

Rocklin Fire Station 23 GHA
Rocklin, California

FIGURE 5



BASE MAP REF: *2007 Caltrans Deterministic PGA Map, Fault Identification Numbers (FID) Shown. September 2007, Martha Merriam, Tom Shantz, GIS by Ke Zhou, Fault Map Legend Follows On Figure 7*

0 25 50 100

Scale: Kilometers

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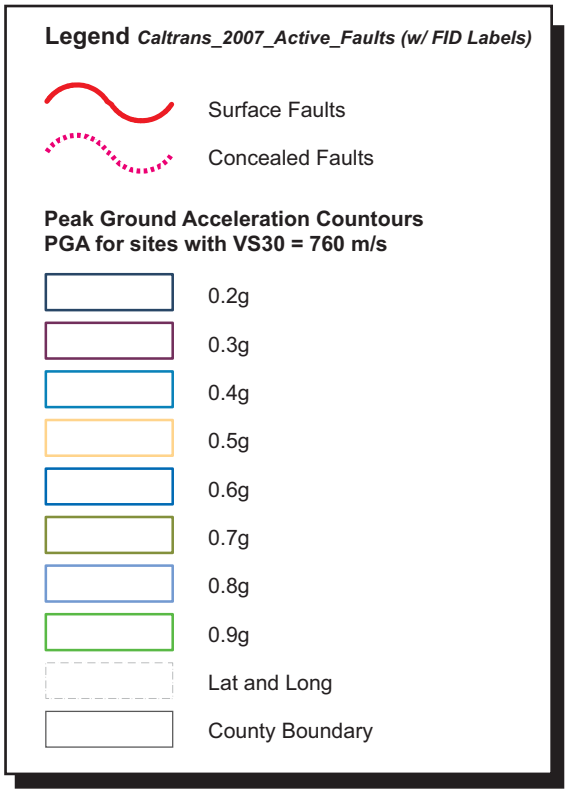
FAULT MAP

Rocklin Fire Station 23 GHA
Rocklin, California

FIGURE 6



Fault Name	CalTrans Fault ID Number
Vaca fault zone	14
Great Valley fault 3	22
Great Valley fault 4	23
Great Valley fault 5	24
Bear Mountains fault zone (Swain Ravine fault zone section)	30
Dunnigan Hills fault	75
Bear Mountains fault zone (Spenceville fault section)	79
Bear Mountains fault zone (Highway 49 section)	80
Bear Mountains fault zone (Dewitt fault section)	81
Bear Mountains fault zone (Deadman fault section)	82
Bear Mountains fault zone (Rescue fault section)	83
Cordelia fault	212
Green Valley fault	213
Hunting Creek-Berryessa fault zone (Hunting Creek section)	221
Bear Mountains fault zone (Poorman Gulch fault section)	250
Hunting Creek-Berryessa fault zone (Berryessa section)	356

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FAULT MAP LEGEND

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FIGURE 7