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Filer:	Patty Paul
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8.15 Geologic Hazards and Resources

8.15.1 Introduction

This section evaluates the effect of geologic hazards and resources that might be encountered on the project site. The objective of this analysis is to evaluate the potential for impacts from the construction or operation of the project. This section presents a summary of the relevant LORS, existing site conditions, and expected direct, indirect, and cumulative impacts due to construction, operation, and maintenance of the project. Proposed mitigation measures and the effectiveness and monitoring plans are also described. Permits that are required and permitting agencies are identified.

8.15.2 Laws, Ordinances, Regulations, and Standards

The LORS that apply to geologic hazards and resources are summarized in Table 8.15-1.

TABLE 8.15-1
Laws, Ordinances, Regulations, and Standards

Jurisdiction	Authority	Administering Agency	Compliance
State/Local	Uniform Building Code (UBC), 1997. Appendix Chapter 16, Division 4	Sacramento County Planning Department	Acceptable design criteria for structures with respect to seismic design and load bearing capacity

8.15.3 Affected Environment

The proposed CPP site is a 30-acre parcel approximately 25 miles southeast of Sacramento, California, adjacent to the former Rancho Seco Plant. The project site and linears are located along the eastern flank of the Great Valley geomorphic province and near the western edge of the Sierra Nevada geomorphic province. The Great (Central) Valley province is an area of low alluvial plains and fans approximately 400 miles long. The Valley is a northwest-southeast trending structural basin that extends along the center of the state from the Klamath Range in the north to the Tehachapi Mountains in the south (Norris and Webb, 1990). The Sierra Nevada is characterized as a north-northwest trending mountain range which slopes gently to the west to the Central Valley that comprises Jurassic to Cretaceous plutonic (chiefly granitic) rocks (Norris and Webb, 1990). The proposed generating facility site is relatively flat (approximate elevation 200 feet) and is underlain by Quaternary and Tertiary alluvial deposits that originated from the erosion of the Sierra Nevada. Although the mountainous areas to the east and west are seismically active, the Central Valley is considered generally seismically stable and is designated as a California Uniform Building Code Seismic Zone 3 (Sacramento County, 1993).

8.15.3.1 Regional Geology

The Project site lies in the southeastern corner of Sacramento County near the boundary of the Central Valley and Sierra Nevada provinces of California. The area is primarily on the

edge of a structural trough overlying bedrock formations of the Sierra Nevada. This "trough" has been filled with marine, lacustrine, and alluvial deposits of Cretaceous, Tertiary, and Quaternary age. Deposits up to 30,000 feet thick are common in the Central Valley, primarily in the southern part of the valley. These deposits dip uniformly from each side of the valley toward its axis. In the project site area, the thickness of the Quaternary alluvial sediments is relatively thin, whereas the Tertiary sedimentary deposits are more prominent. Each of these units thickens westerly toward the center of the valley from the project site.

8.15.3.2 Local Geology

The local geology is composed of flood basin alluvial deposits of recent quaternary age underlain by Tertiary continental deposits. Figure 8.15-1 shows the stratigraphy, geology, and geomorphic features within a 2-mile radius of the CPP site. The stratigraphy and structure of the local area are discussed subsequently.

Stratigraphy

Several rock types are present beneath the CPP site. These are discussed here and are based on descriptions from the Geologic Map of California, Sacramento Sheets (Wagner et al., 1981) and (Bechtel Corporation, 1965). A generalized geologic cross-section illustrating the stratigraphy beneath the project site is shown on Figure 8.15-2.

Quaternary Basin Deposits

Recent sand, gravel, and silt in stream channels and beneath flood plains.

Quaternary Alluvium

Modesto-Riverbank Formation. Comprises sand, silt, and gravel. Derived from crystalline basement.

Tertiary Continental

Laguna Formation. Fluviatile sand, silt, and some gravel. Local clay deposits. Semiconsolidated alluvial deposits.

Tertiary Continental

Mehrten Formation. Fluviatile sandstone, siltstone, conglomerate, and breccia of mudflow origin. Dominated by andesitic detritus.

Tertiary Continental

Valley Springs Formation. Pumice, fine siliceous ash, and clay derived mainly from rhyolitic ejecta. Also contains sedimentary rocks (sandstone, siltstone, and conglomerate).

Tertiary Continental

Ione Formation. Light-color clay and clayey (kaolinite) sandstone. Also contains shale and lignite deposits in lower horizons.

Pre-Cretaceous Basement Deposits

Contains metamorphic, sedimentary, and volcanics that are folded and intruded by granitic and associated plutonic rocks.

Structure

The basement complex, which consists of metamorphic, sedimentary, and igneous rocks, slopes gently westward from the Sierra Nevada under the younger rocks that compose the valley fill. A major cycle of crustal deformation occurred during the Mesozoic and Tertiary times, causing the progressive uplift of the Sierra Nevada and the downwarping of the area that is the Central Valley.

Above the basement complex, there is little rock structure to the Central Valley.

8.15.3.3 Regional Seismicity

Although seismic activity occurs to the east in the Sierra Nevada and to the west in the Coast Ranges, the Central Valley of California is considered generally seismically stable (Sacramento County, 1993). The site does not lie in an Alquist-Priolo Earthquake Zone (Division of Mines and Geology, 1999).

In 1975, a Richter magnitude 6 earthquake occurred along the Foothill fault system near the City of Oroville, approximately 85 miles north of the project site. The earthquake occurred along a fault that had been previously unrecognized (Bechtel Corporation, 1981).

Major Faults

No known active (within Holocene times [11,000 years]) faults lie within 30 miles of the project site. The nearest faults are those associated with the Foothill faults system. These faults (Prairie Creek, Bear Mountain, and Forest Hill – Melones) have been inactive since the Jurassic Period (140 million years ago) (Environmental Geotechnical Consultants [EGC], 1993) (Figure 8.15-3). Although believed to be inactive, these faults have been evaluated and have maximum credible earthquake (MCE) potential of Richter magnitude 6.5 for the Prairie Creek and Bear Mountain and Magnitude 7 for the Forest Hill-Melones fault (Mualchin, 1996).

The nearest known active faults are those located well west of the site and include the San Andreas, Calaveras, and the Hayward – all of which have MCEs greater than Richter Magnitude 7.5 (Mualchin, 1996)). However, given the distance of these faults from the project site, 65+ miles, the effect of an earthquake along these faults to the project site would likely be minimal (EGC, 1993).

8.15.3.4 Geologic Hazards

The following subsections discuss potential geologic hazards that might occur in the project area, based on a review of the substantial work that has been done at the site, primarily in preparation for the Rancho Seco Plant.

Surface Fault Rupture

No faults were found to cross either the CPP site or any of the linear facility corridors (Bechtel Corporation, 1981 and EGC, 1993).

Seismic Shaking

The most significant geologic hazard at the CPP site is strong ground-shaking due to an earthquake. Mualchin (1996) estimated that the ground-shaking of a magnitude 7 earthquake along the Foothills Fault System could produce peak ground gravity (g) acceleration of up to 0.2 g in the vicinity of the CPP.

Liquefaction

During strong ground-shaking, loose, saturated, cohesionless soils can experience a temporary loss of shear strength. This phenomenon is known as liquefaction. Liquefaction of soils is dependent on grain size distribution, relative density of the soils, degree of saturation, and intensity and duration of the earthquake. The potential hazard associated with liquefaction is seismically induced settlement. The depth to groundwater at the project site is relatively deep, approximately 150 feet, and the soil types are generally consolidated; therefore, the likelihood that liquefaction would occur is considered very low.

Slope Stability and Mass Wasting

Slope instability and mass wasting depend on steepness of the slope, underlying geology, surface soil strength, and moisture in the soil. Significant excavating, grading, or fill work during construction might introduce slope stability hazards at either the CPP site or along linear facility routes. Because the CPP site itself is relatively flat and no significant excavation is planned during site construction, the potential for direct impact from landslides at the site is considered low.

Subsidence

Subsidence can be caused by natural phenomena during tectonic movement, consolidation, hydrocompaction, or rapid sedimentation. Sacramento County has experienced regional subsidence, but primarily on the western side of the county. This subsidence has resulted from long-term withdrawal of groundwater, causing compaction of fine-grain sediments in the aquifer system. The potential for subsidence as a hazard that could affect the project site is low.

Expansive Soils

Expansive soils shrink and swell with wetting and drying. The shrink-swell capacity of expansive soils can result in differential movement beneath foundations. Expansive soils account for approximately one-third of the soil types mapped in the county (Sacramento County, 1993). Site-specific borings advanced in the vicinity of project site have identified primarily sands, silts, and clays, with minor amounts of gravel and are generally medium dense to very dense (EGC, 1993). Borings advanced for Bechtel prior to the construction of the Rancho Seco Plant reported the presence of primarily coarse-grain material as well as consolidated sediments (Boyles Brothers Drilling Company, 1967). Based on these, the likelihood of expansive soils to be present at the site is low. As mentioned in Section 8.2, expansive soils (montmorillonite clay) are identified along the proposed gas linear route.

8.15.3.5 Geologic Resources of Recreational, Commercial, or Scientific Value

Geologic resources of recreational, commercial, or scientific value in the project vicinity that could be affected comprise aggregate and gas reserves. Geologic resources of value were identified in the Sacramento County Plan (Sacramento County, 1993). These include aggregate and natural gas resources.

Aggregate Resources

There are several aggregate resources in the county. None of which are currently mined in the project vicinity. The project would not affect this resource.

Natural Gas

Natural gas production occurs in the county primarily in the southwestern part of the Delta (Sacramento County, 1993) and greater than 20 miles from the site. The project will have no affect on this resource.

There are no known geologic resources that provide a significant scientific value in the vicinity of the site.

8.15.4 Environmental Consequences

8.15.4.1 Generating Facility

Geologic Hazards

Ground-shaking presents the most significant geologic hazard to the proposed CPP and linear facilities. Table 8.15-2 summarizes geologic hazards associated with the CPP site and linear facilities. Mitigation measures proposed in Section 8.15.3 would be implemented in the design of the facilities to reduce risk associated with these hazards.

TABLE 8.15-2
Summary of Potential Geologic Hazards

Project Component	Area of Potential Concern	Geologic Hazards of Potential Concern
Proposed Generating Facility Site (up to 30 acres)	Entire site	Seismic ground-shaking
Off-site Natural Gas Pipelines	Entire route	Seismic ground-shaking, expansive soils

Geologic Conditions and Topography

Construction will require minor grading and excavation, thereby altering the terrain of the CPP site. Impacts to the geologic conditions involve changes in drainage, cuts, and fills. Since the site is generally level, site grading is not expected to impact the geologic environment adversely.

8.15.4.2 Linear Facilities

Linear facilities associated with the CPP site include a natural gas line, which is discussed below. The geologic hazards associated with the linear facility are summarized in Table 8.15-2.

Natural Gas Supply Line

Seismically induced ground-shaking presents a possible hazard to the proposed natural gas pipeline route. With implementation of the mitigation measures proposed in Section 8.15.3, the hazards will be reduced to acceptable levels. Expansive soils are identified along the proposed gas linear (see Section 8.2). If encountered during construction, it is recommended that this material not be used as backfill.

8.15.4.3 Geologic Resources of Recreational, Commercial, and Scientific Value

The project site is relatively flat and primarily composed of alluvial sediments and consolidated outcroppings of little recreational value. Aggregate deposits and natural gas

production are two of the main resources of Sacramento County but are not presently mined in the vicinity of the project site. Construction and operation of the CPP site would not affect these resources. Also, there are no known geologic resources that provide a significant scientific value in the vicinity of the site. Therefore, the CPP project would not affect these resources.

8.15.5 Mitigation Measures

The following subsections describe mitigation measures that could be used to reduce impacts from geologic hazards.

8.15.5.1 Surface Faulting Rupture

No active faults were noted to cross the CPP site or any of the linear facility corridors (Wagner, et. al., 1981). Therefore, no mitigation measures are required to reduce the hazard from surface faulting rupture.

8.15.5.2 Ground-Shaking

The CPP generating facility and linear facility will need to be designed and constructed to withstand strong earthquake shaking as specified in the 1997 Uniform Building Code (UBC) for Seismic Zone 3 in accordance with the County of Sacramento.

8.15.5.3 Liquefaction

The soil types present at the CPP site and the relatively deep depth to water are not conducive to liquefaction; as a result, no mitigation measures would be required.

8.15.5.4 Subsidence

Subsidence has occurred regionally in the county, primarily in the southwestern part. It is not likely to have occurred in the project vicinity, and as a result, no mitigation measures would be required.

8.15.5.5 Expansive Soils

Expansive soils are identified throughout Sacramento County. Expansive soils can be mitigated by either removing the soil and backfilling with non-expansive soil, instituting a chemical stabilization of the soil, or by constructing a foundation treatment that resists uplift of the expansive soil. A site-specific soils investigation would be conducted during facility planning and construction to confirm that mitigation measures are not required for expansive soils at the site.

8.15.6 Involved Agencies and Agency Contacts

No permits are required for compliance with geological LORS. Therefore, no specific agencies for geologic resources are identified. However, the planning department of Sacramento County is responsible for enforcing compliance to building standards.

8.15.7 Permits Required and Permit Schedule

Compliance of building construction to UBC standards is covered under engineering and construction permits for the project. There are no other permit requirement that specifically addresses geologic resources and hazards.

8.15.8 References

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Wagner, D. L., C. W. Jennings, T. L. Bedrossian, and E. J. Bortugno. 1981. Geologic Map of California – Sacramento Sheet. Regional Geologic Map Series. 1:250,000 scale.

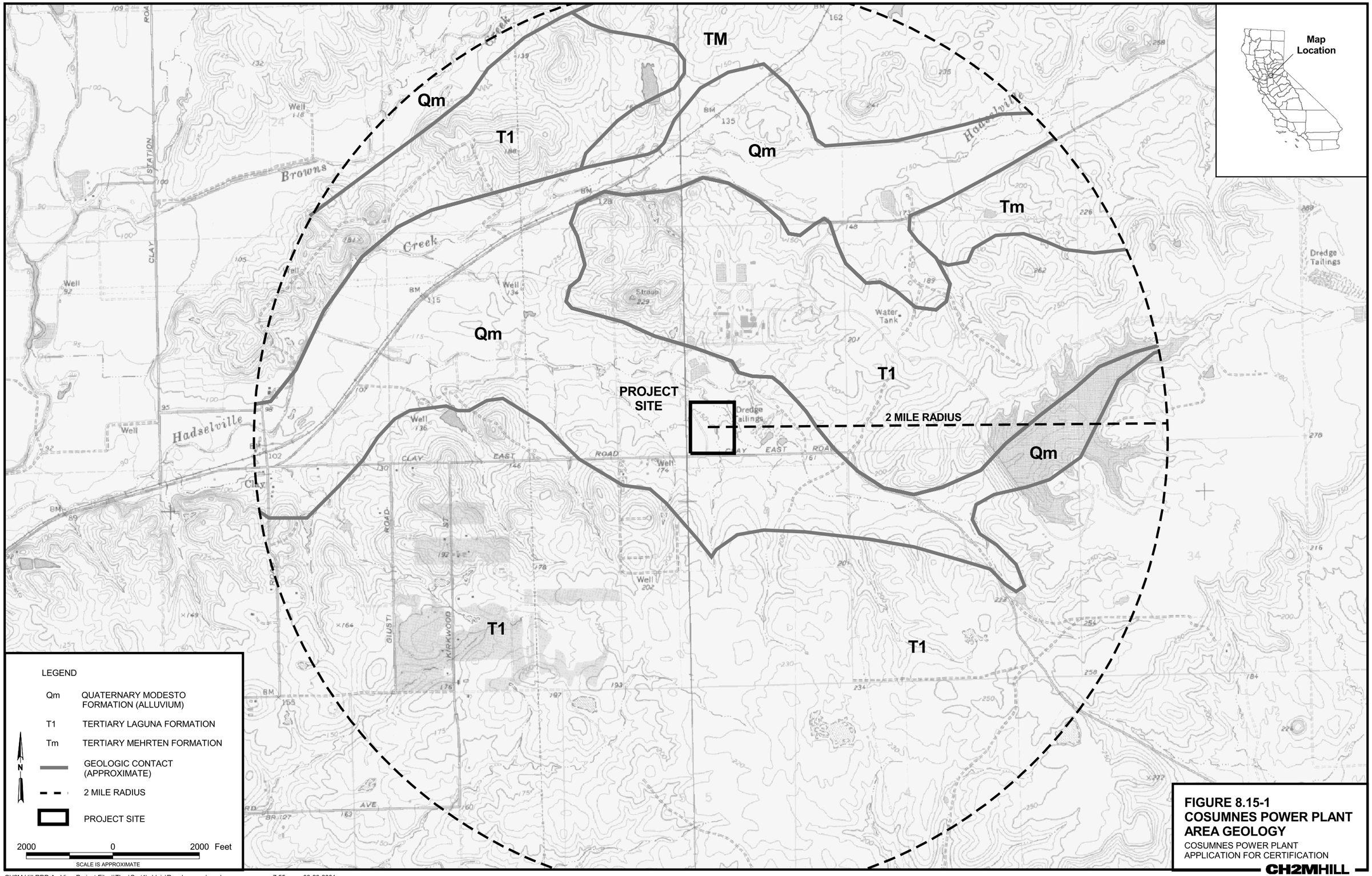

FIGURE 8.15-1
COSUMNES POWER PLANT AREA GEOLOGY
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION

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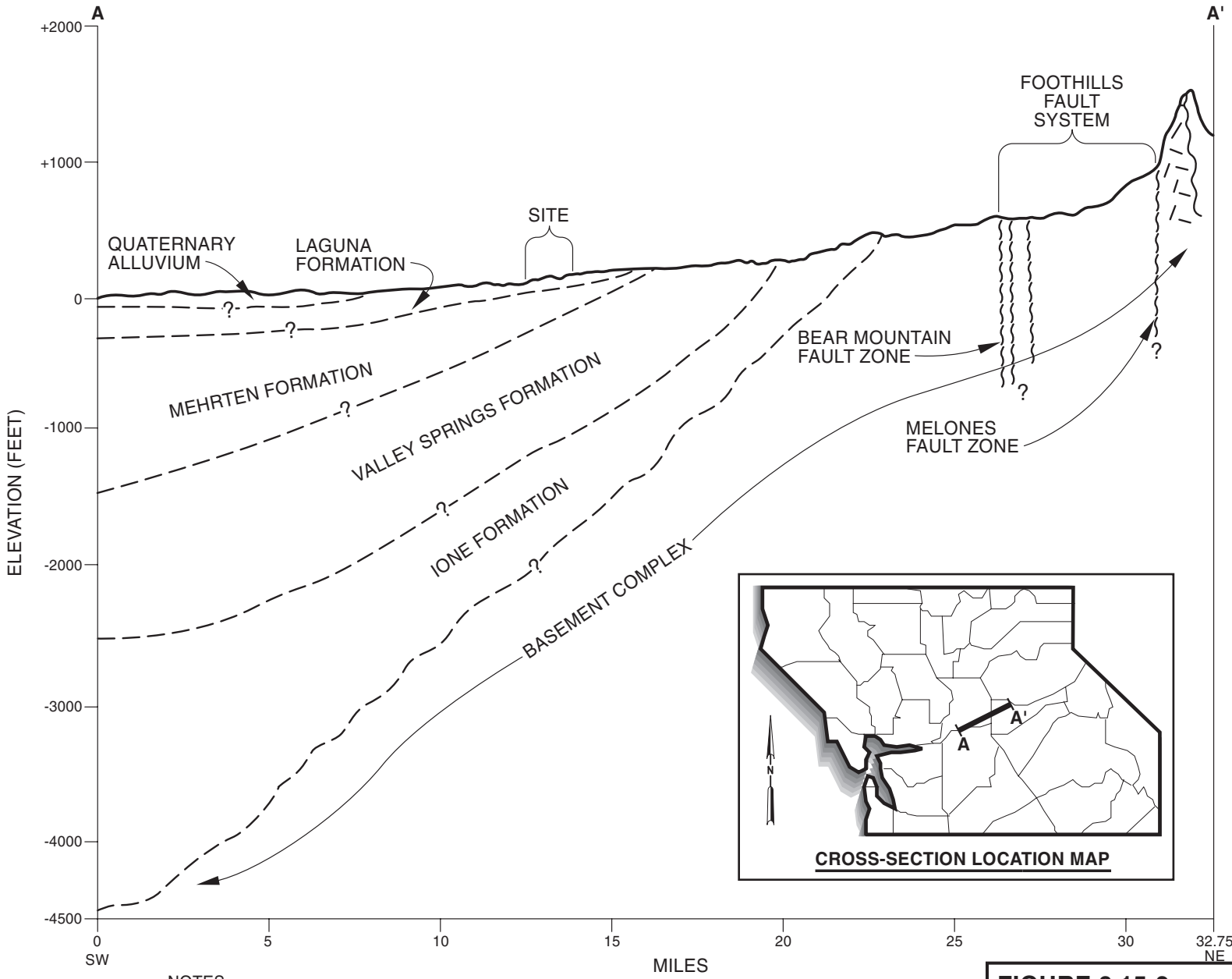

NOTES:

1. DERIVED FROM AAPG CENOZOIC CORRELATION SECTIONS 1(1951) AND 15(1967) AND USGS MAP 0M-215-BASEMENT CONTOURS.
2. CONTACT LINES ARE APPROXIMATE.
3. EXAGGERATED SCALE - V=1 : H=26 (±).

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FIGURE 8.15-2
GENERALIZED GEOLOGIC CROSS-SECTION
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION

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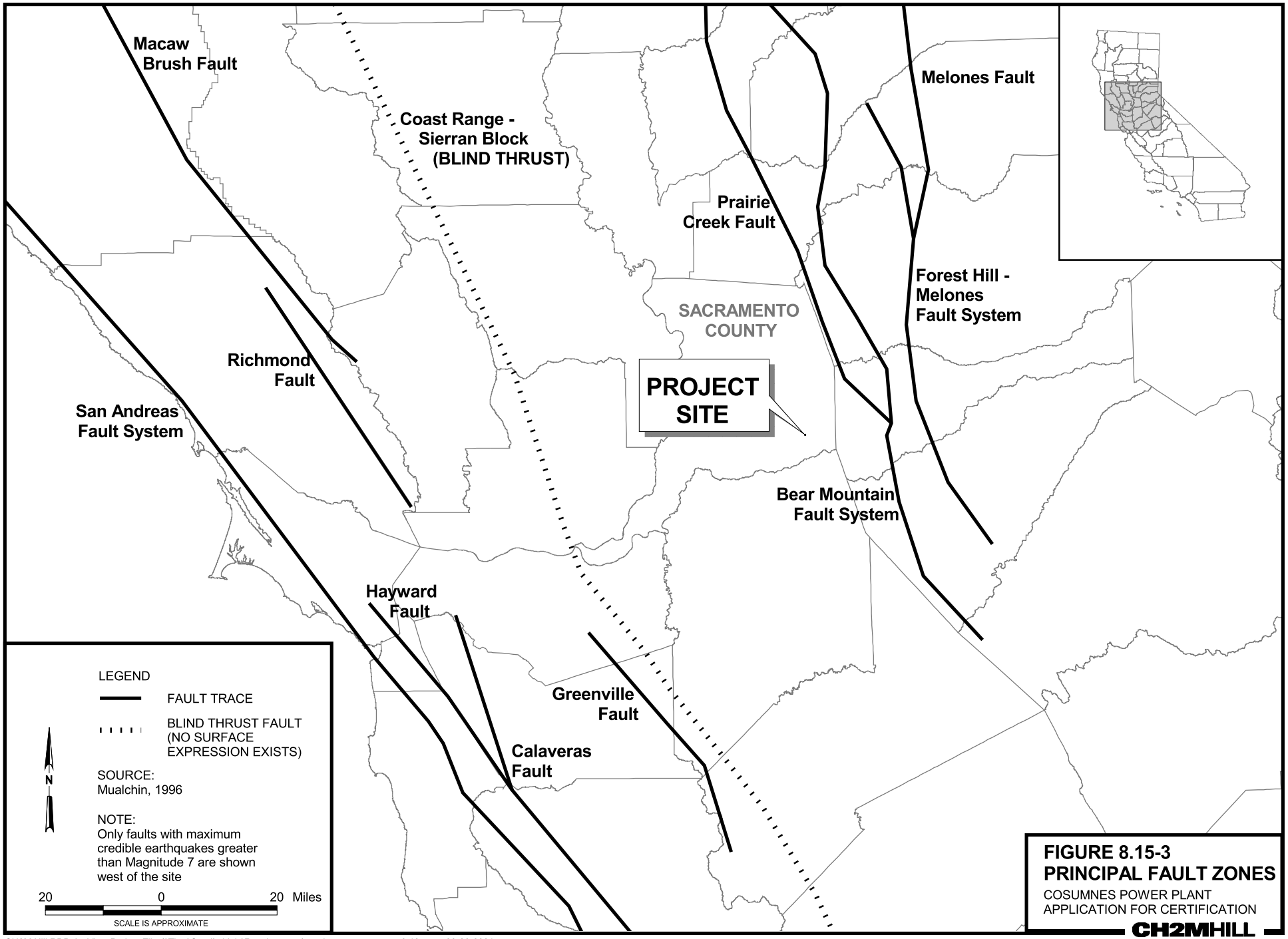

FIGURE 8.15-3
PRINCIPAL FAULT ZONES
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION

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