3.5 GEOLOGY AND SOILS

This section addresses potential impacts of the Proposed Project on geology and soils. The geologic conditions in the area of the Proposed Project have been assessed through review of existing publicly-available data and reports, aerial photographs, and field reconnaissance. Documents and maps from the California Geological Survey, U.S. Geological Survey, Kern County and other public sources were reviewed and evaluated as part of this assessment. Potential impacts related to geology and soils are evaluated based on the CEQA thresholds of significance described in Section 3.5.2, below.

3.5.1 Environmental Setting

The Proposed Project is located in the northeast corner of Kern County within the southwest part of the Indian Wells Valley. The valley is bounded by mountain ranges consisting of igneous and metamorphic rocks, including the Sierra Nevada range on the west, the Coso Range on the north, the Argus Range on the east, and the El Paso Mountains on the south (Figure 3.5-1). China Lake is a perennial saline lake present in the eastern part of the Valley. Within the valley, surface elevations range from 2150 feet above mean sea level (msl) at China Lake to over 3,000 feet msl in the southwest corner of the basin.

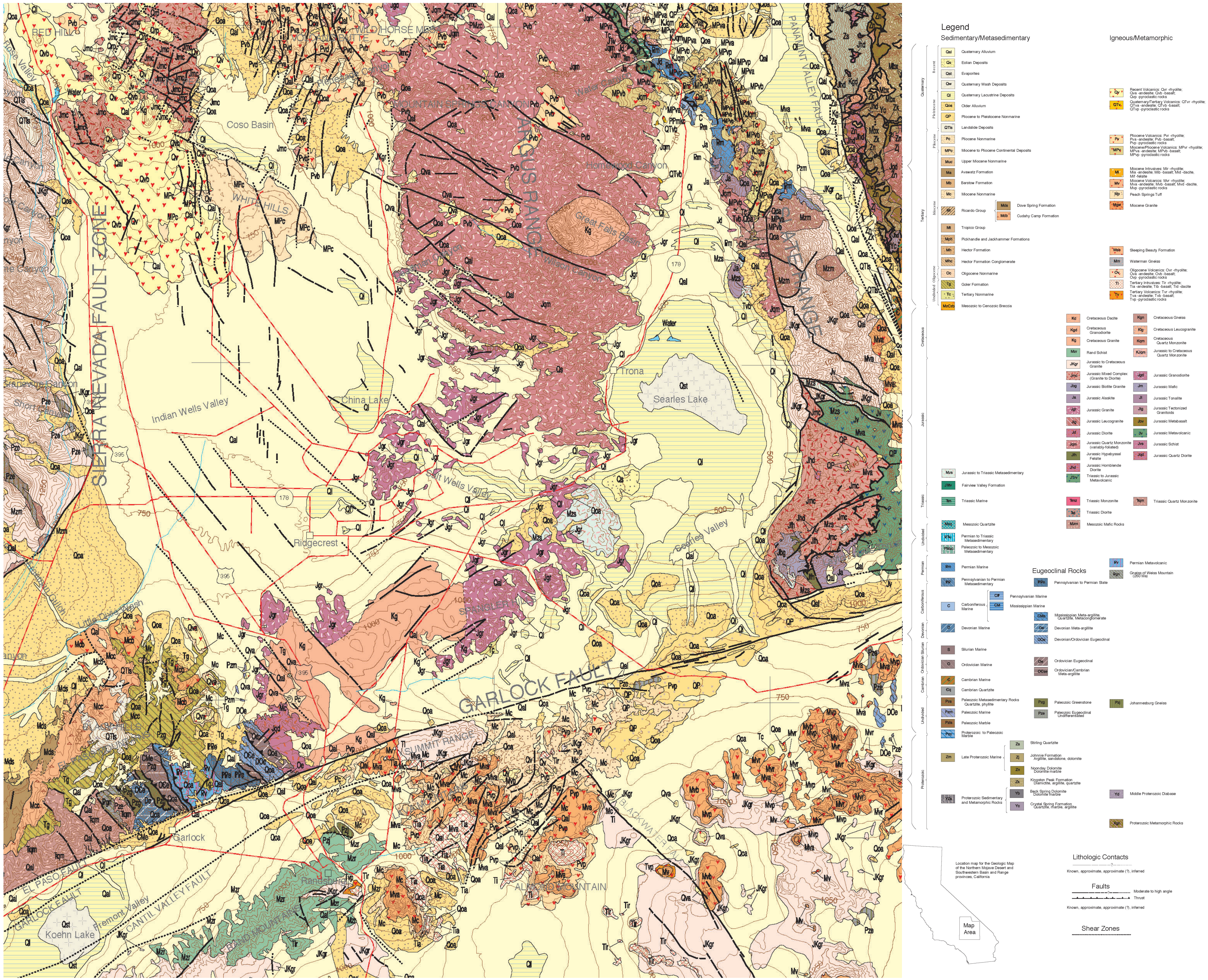
The Indian Wells Valley is in the southwest corner of the Basin and Range Physiographic Province (TTEMI 2003). The valley is also considered to be at the boundary of the Basin and Range and the Mojave Desert Provinces. In general, the Indian Wells Valley consists of a structural basin that has been filled with alluvial sediments that were eroded from the surrounding mountains. Erosion of the surrounding mountains and deposition of sediments occurred primarily in the Miocene through Pleistocene epochs (TTEMI 2003). The Miocene epoch began approximately 23 million years ago and the Pleistocene epoch ended approximately 10,000 years ago (Geological Society of America 2009).

Sedimentation and fill of the valley occurred primarily due to the rise of the Sierra Nevada range on the west, with a corresponding down drop of the valley floor along the Sierra Nevada frontal fault (TTEMI 2003). Especially during the Pleistocene epoch, the climate was much wetter than it currently is, and substantial rainfall and glacial runoff resulted in erosion of the uplands and the formation of the alluvial valley. Due to the faulting along the edge of the Sierra Nevada range, the thickest sediments occur near the west side of the Indian Wells Valley, with maximum sediment thicknesses on the order of 7,000 feet (TTEMI 2003). The average sediment thickness, however, is approximately 2,000 feet. The sediments were derived from debris flows, alluvial fans, deltas, and ancient lakes (TTEMI 2003). Figure 3.5-2 is a block diagram showing the relationship of the Sierra Nevada with the various sediments deposited in the basin. Due to the wetter climate at that time, a large lake, or several large lakes, occupied much of the valley during part of the Pleistocene (TTEMI 2003). As a result, thick lacustrine (lake) deposits consisting of organic clays formed in parts of the valley. As discussed in Section 3.8 of this EIR, these clays may be over 1,000 feet thick in the northwestern part of Indian Wells Valley, but are not present in the south and southwest parts of the valley, including the area of the Proposed Project.

Typical for the Basin and Range Province, Indian Wells Valley formed due to faulting and the related rise of the adjacent mountain ranges. The main faulting occurred along the Sierra Nevada frontal fault, which is still active and located near the base of the mountains to the west of State Highway 14 (Figure 3.5-1). Active faulting is also present along the Little Lake and Airport fault zones, which trend from the north end of the valley toward the southeast through the City of Ridgecrest (Figures 3.5-3 and 3.5-4) (ESA Associates 2009). According to the California Geological Survey (2007), the Proposed Project is located in the Inyokern South U.S. Geological Survey quadrangle. There are no active faults identified within the Inyokern South quadrangle (California Geological Survey 2007).

Based on drilling logs (U.S. Bureau of Reclamation 1993), direct field observations conducted for preparation of this EIR, and other documentation (Kern County Planning Department 2007b), the soils in the area of the Proposed Project consist of hard silty sandy soils with gravel and rock fragments on relatively flat slopes. The lack of clayey soils in the area of the Proposed Project indicates that there is little potential liquefaction or subsidence to occur as a result of seismic activity or groundwater withdrawal. The relatively flat slopes provide little or no potential for landslides to occur in the area of the Proposed Project. These conditions are documented by the Kern County Planning Department (Kern County Planning Department 2007b, Figure 12 of Chapter 4).

Figure 3.5-1
Surface Geology of the Indian Wells Valley and Surrounding Areas



Source: Walker et al. 2002

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Location: N:\2010\2010-132 IWVWD EIR\MAPS\Soils_and_Geology\Geology\SurfaceGeology-IndianWellsValley.mxd (aaguirre, 10/20/2011)

Map Date: 10/20/2011

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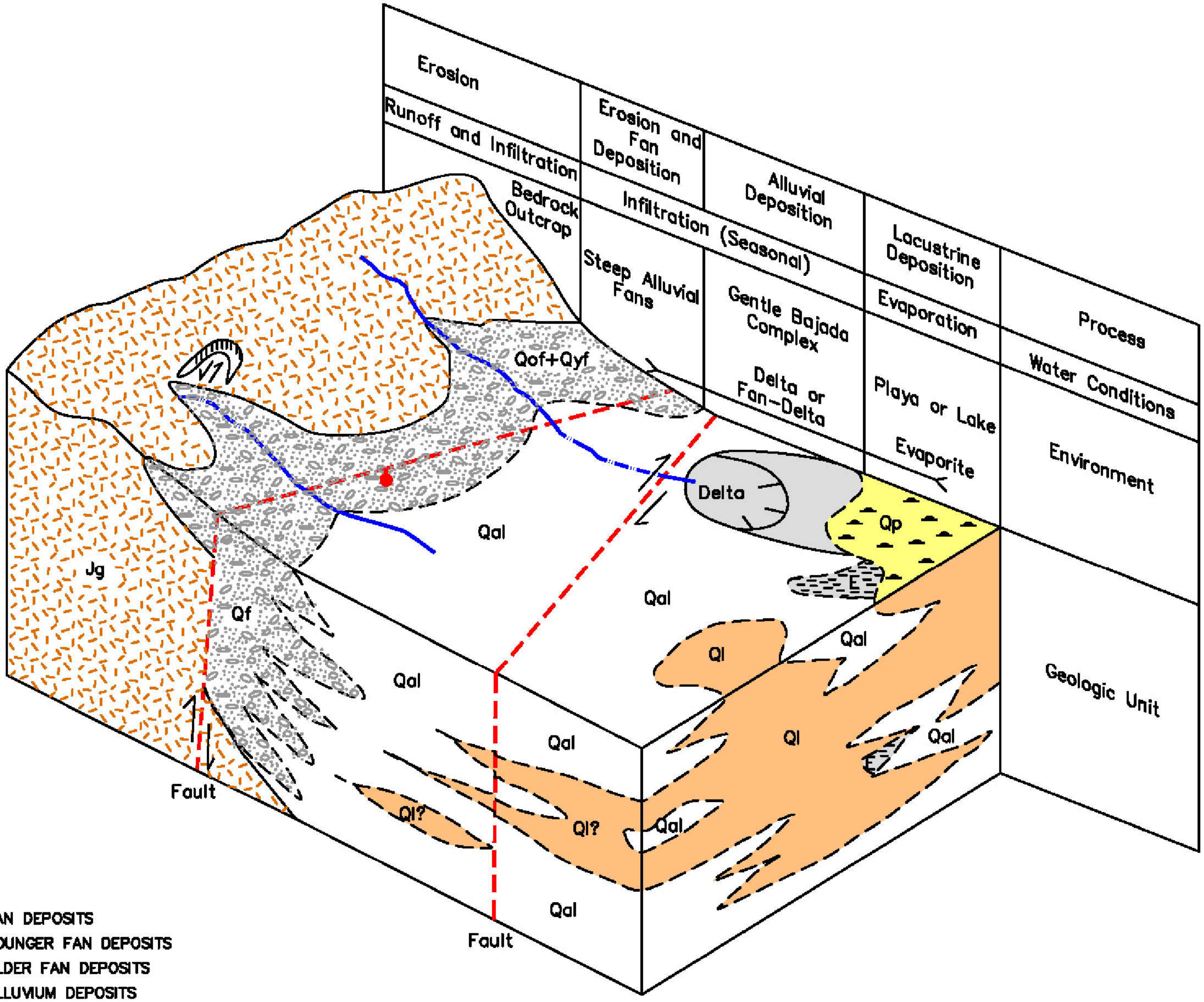

Notes:

Qf	QUATERNARY FAN DEPOSITS
Qyf	QUATERNARY YOUNGER FAN DEPOSITS
Qof	QUATERNARY OLDER FAN DEPOSITS
Qal	QUATERNARY ALLUVIUM DEPOSITS
Ql	QUATERNARY LACUSTRINE DEPOSITS
Qp	QUATERNARY PLAYA DEPOSITS
Jg	JURASSIC GRANODIORITE
E	EVAPORITE

Location: N:\2010\2010-132 IWVWD EIR\MAPS\Soils_and_Geology\Geology\ConceptualizationOfDepositionalEnvironments-IndianWellsValley.mxd *(aaguirre, 9/27/2011)*

Date: 9/27/2011
Source: TTEMI 2003

Figure 3.5-2 Conceptualization of Depositional Environments in the Indian Wells Valley

2010-132 Indian Wells Valley Water District EIR

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3.5.2 Thresholds of Significance

According to Appendix G of the CEQA Guidelines, a project would have a significant impact with respect to geology and soils if it would:

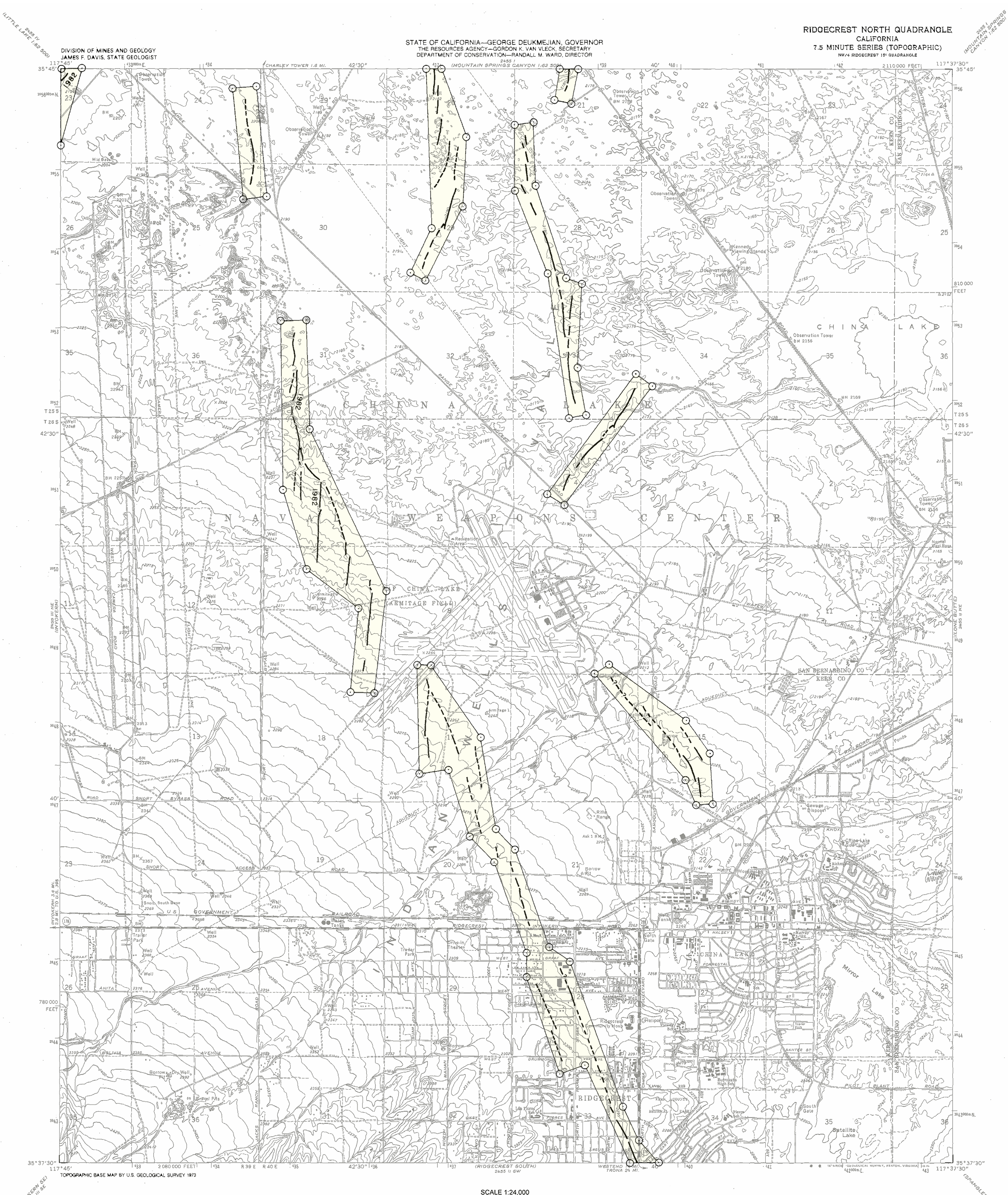
- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault;
  - Strong seismic ground shaking;
  - Seismic-related ground failure, including liquefaction;
  - Landslides;
- Result in substantial soil erosion or the loss of topsoil;
- Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse;
- Be located on expansive soil, creating substantial risks to life or property.
- Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

3.5.3 Environmental Impacts

3.5.3.1 Criteria Determined to Have No Impact or a Less than Significant Impact

The following were determined to have No Impact in the Initial Study (Appendix A) and were not evaluated further in this EIR:

- Seismic-related ground failure, including liquefaction.
- Landslides.
- Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.



SCALE 1:24,000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

REFERENCES USED TO COMPILE FAULT DATA

Ridgecrest North Quadrangle

Roquemore, G.R., and Zellmer, J.T., 1987, Naval Weapons Center active fault map series, Naval Weapons Center publication NWCTP 6828, 18 p., 14 maps, scale 1:24,000.

Wills, C.J. 1986, Little Lake and Airport Lake fault zones, Inyo and Kern Counties, California: Division of Mines and Geology Fault Evaluation Report FER-199 (unpublished).

For additional information on faults in this map area, the rationale used for zoning, and additional references consulted, refer to unpublished Fault Evaluation Reports on file at regional offices of DMG.

MAP EXPLANATION

Active Faults

1906 C — Faults considered to have been active during Holocene time and to have a relatively high potential for surface rupture; solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed; query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by creep or possible creep.

Special Studies Zone Boundaries

These are delineated as straight-line segments that connect encircled turning points so as to define special studies zone segments.

Seaward projection of zone boundary.

STATE OF CALIFORNIA
SPECIAL STUDIES ZONES
Delineated in compliance with
Chapter 7.5, Division 2 of the California Public Resources Code
(Alquist-Priolo Special Studies Zones Act)

Ridgecrest North Quadrangle

OFFICIAL MAP

Effective: January 1, 1990

James F. Davis State Geologist

IMPORTANT – PLEASE NOTE

1) *This map may not show all faults that have the potential for surface fault rupture, either within the special studies zones or outside their boundaries.*
2) Faults shown are the basis for establishing the boundaries of the special studies zones.
3) The identification and location of these faults are based on the best available data. However, the quality of data used is varied. Traces have been drawn as accurately as possible at this map scale.
4) Fault information on this map is not sufficent to serve as a substitute for the geologic site investigations (special studies) required under Chapter 7.5 of Division 2 of the California Public Resources Code.

Location: N:\2010\2010-132 IWVWD EIR\MAPS\Soils_and_Geology\Geology\RC North Fault Map.mxd (aaguirre, 9/27/2011)

Map Date: 9/27/2011

Figure 3.5-3 Ridgecrest North Fault Map

2010-132 Indian Wells Valley Water District EIR

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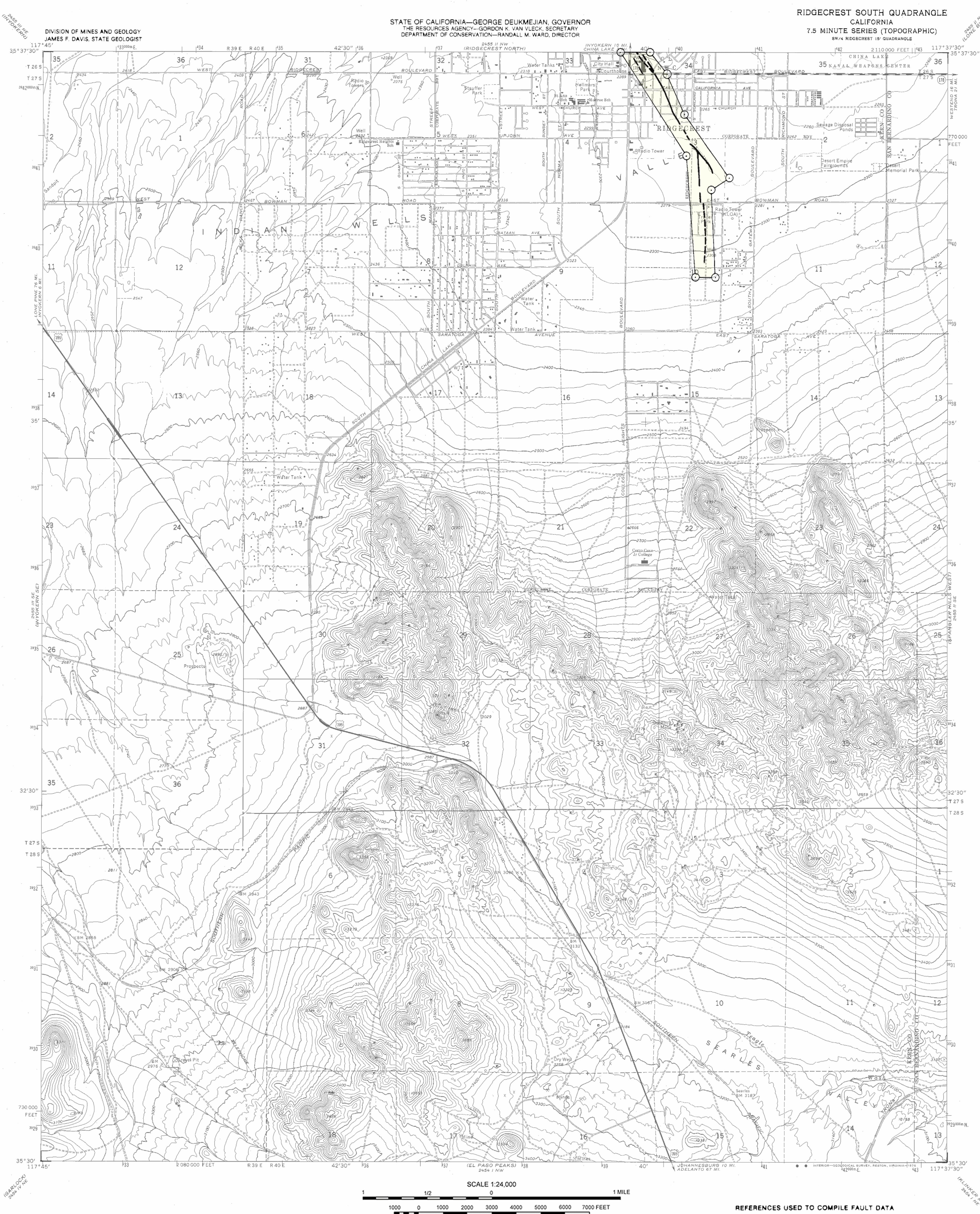

MAP EXPLANATION

Active Faults

Faults considered to have been active during Holocene time and to have a relatively high potential for surface rupture; solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed; query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by creep or possible creep.

Special Studies Zone Boundaries

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Seaward projection of zone boundary.

STATE OF CALIFORNIA
SPECIAL STUDIES ZONES

Delineated in compliance with
Chapter 7.5, Division 2 of the California Public Resources Code
(Alquist-Priolo Special Studies Zones Act)

Ridgecrest South Quadrangle

OFFICIAL MAP

Effective: January 1, 1990

James F. Davis State Geologist

REFERENCES USED TO COMPILE FAULT DATA

Ridgecrest South Quadrangle

Roquemore, G.R., and Zellmer, J.T., 1987, Naval Weapons Center active fault map series, Naval Weapons Center publication NWCTP 6826, 16 p., 14 maps, scale 1:24,000.

Wills, C.J. 1988, Little Lake and Airport Lake fault zones, Inyo and Kern Counties, California: Division of Mines and Geology Fault Evaluation Report FER-199 (unpublished).

For additional information on faults in this map area, the rationale used for zoning, and additional references consulted, refer to unpublished Fault Evaluation Reports on file at regional offices of DMG.

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4) Fault information on this map is not sufficent to serve as a substitute for the geologic site investigations (special studies) required under Chapter 7.5 of Division 2 of the California Public Resources Code.

Location: N:\2010\2010-132 IWVWD EIR\MAPS\Soils_and_Geology\Geology\RC South Fault Map.mxd (aaguirre, 9/28/2011)

Map Date: 9/28/2011

Figure 3.5-4 Ridgecrest South Fault Map

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- Be located on expansive soil, creating substantial risks to life or property.
- Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

The following were determined to have a Less Than Significant Impact in the Initial Study and were not evaluated further in this EIR:

- Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault.
- Strong seismic ground shaking.

3.5.3.2 Criteria Determined to Have a Less Than Significant Impact with Mitigation Incorporated

The following was determined to have a Less Than Significant Impact with Mitigation Incorporated in the Initial Study and is discussed further here:

- Result in substantial soil erosion or the loss of topsoil.

The Proposed Project includes several activities that have the potential to cause erosion and remove topsoil from disturbed areas during the construction of well 35. These activities include grading of drill sites, excavation of percolation ponds, excavation of pipeline trenches, stockpiling of excavated soils, and other actions. Disturbed soils, modified surface grades, soil stockpiles, and other disturbed areas have the potential to result in soil erosion or the loss of topsoil during a major rainfall event. Unprotected soils may also be lost during major wind storms and similar events. As discussed in Section 3.2 Air Quality, the best management practices from EKAPCD's Rule 402 would be applied. This is a potentially significant impact, which would be reduced to a less than significant impact with mitigation.

3.5.4 Mitigation Measures

G-1: Proper construction, soil management, and storm water protection practices will prevent soil erosion and the loss of topsoil. Construction specifications will identify areas where soil excavation, grading, stockpiling, backfilling, or other disturbance may occur. The construction specifications will identify appropriate construction and soil management practices, such as stockpiling soils adjacent to the construction area, minimizing areas of disturbance, and appropriate slopes for excavations and backfill. The construction specifications will also identify the proper methods for protection of disturbed or exposed soils to prevent erosion.

Prevention of soil erosion and loss of topsoil due to rainfall and storm water will be addressed through the preparation of a Storm Water Pollution Prevention Plan (SWPPP). IWVWD will file a Notice of Intent to comply with the general storm water permit for construction activities with the State Water Resources Control Board. The SWPPP will subsequently be prepared to identify site activities and conditions that may result in erosion or loss of topsoil due to storm water runoff. Appropriate best management practices (BMPs) for protection of disturbed areas and stockpiled soil will be identified. The SWPPP will also identify the applicable monitoring parameters and frequencies to be implemented in the case of storm events that occur during the construction period. The SWPPP will be submitted to the Lahontan Regional Water Quality Control Board and a copy must be maintained onsite during construction. The construction specifications will also include best management practices to prevent wind erosion, as specified by EKAPCD's Rule 402.

The construction specifications will also address proper backfilling, compaction, and restoration requirements to prevent erosion of restored areas after construction is completed.

3.5.5 Residual Impacts After Mitigation

Impacts to geology and soils will be less than significant after incorporation of mitigation. There will be no residual impacts.