4.6 GEOLOGY, SOILS, AND SEISMICITY

SETTING

The project site is located on the western side of the central portion of the San Joaquin Valley in the Great Valley Geomorphic Province of Central California. **The project location is near the Coast Range - Sierran Block Boundary (CR-SBB) Zone, a significant regional geological boundary which separates basement rock of the Coast Range structural block to the west from the Sierran block underlying the Great Valley to the east.** Regional geologic mapping (Reiche 1950; Clark 1955; Atwater, 1982; Page, 1986; **Sowers et al, 1993**) indicates that the project site is underlain by non-marine sediments. Most of these sediments were deposited by streams (alluvial deposits) draining the uplands area east of the project site.

Subsurface investigations at the site indicate that the majority of the near-surface sediments consists of silt and clay. Groundwater was encountered at depths varying from 5 to 16 feet below the ground surface at most of the locations of on-site investigations. Thin layers of sand and gravel deposits were encountered at shallow depths in the southern portion of the site (Earth Systems Consultants, 1990). These deposits were apparently saturated and medium dense to dense. Sandy silt and sand deposits at depths below the groundwater table were reported from data collected from borings made in the northern portion of the site (Kleinfelder and Associates, 1989). Subsequent drilling and sampling near these locations did not corroborate the presence of these deposits (Earth Systems Consultants, 1990) which may indicate that the silty sands are of limited extent. The saturated fine-grain deposits may be subject to liquefaction. If liquefaction were to occur, it would be localized in nature and would not occur on a regional level (Earth Systems Consultants, 1990).

The youngest alluvial sediments are the deposits along the present stream channels. Recent sediments have been mapped along Old River and are described as floodplain and flood basin deposits (Atwater, 1982; Page, 1986). The upper ten feet of these deposits include clays with high water content, low density, and thin layers of organics (Earth Systems Consultants, 1990).

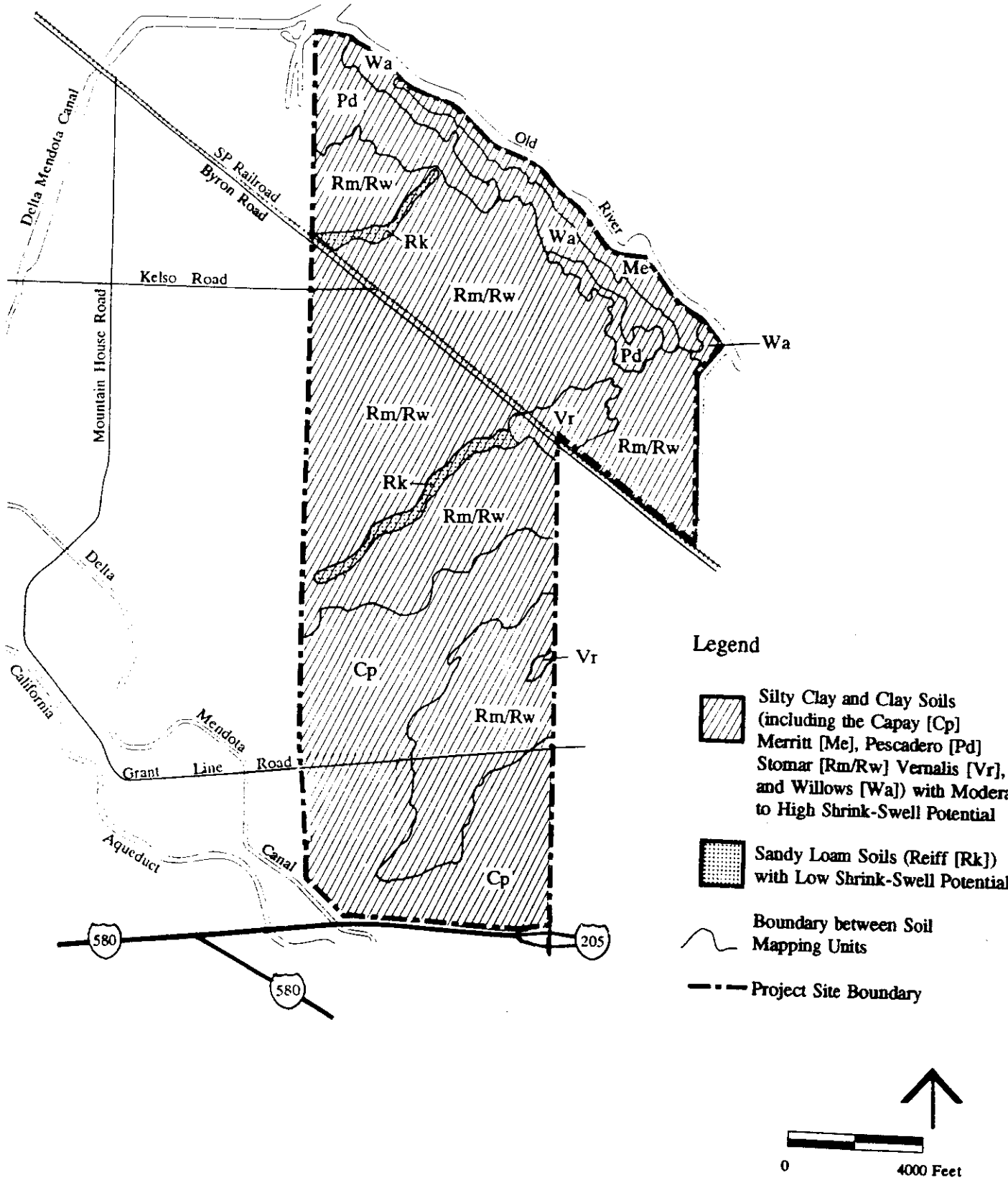
The gentle hill slopes in the southwestern portion of the site do not show evidence of significant landsliding. The project site is located outside areas of southwest San Joaquin County identified as susceptible to landsliding (San Joaquin County, 1973). Swales filled with slope-derived sediments (colluvium) have been identified in this area (Nilsen, 1975). While failure of similar geomorphic features during high precipitation periods (creating mud flows or landslides) is possible even on gentle slopes, evidence of such failures has not been mapped within or immediately adjacent to the project site.

Soils

The U.S. Soil Conservation Service (SCS) has mapped seven distinctive soil types at the site (U.S. Department of Agriculture, 1988) (Figure 4.6-1). Six of these soil types have similar characteristics.

SITE SOILS

Figure 4.6-1



Source: U.S. Department of Agriculture, SCS, 1990.

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These surface soils, which include the Capay (Cp), Merritt (Me), Pescadero (Pd), Stomar (Rm/Rw), Vernalis (Vr), and Willows (Wa) soils, are predominantly silty clay and clays developed on the gently sloping alluvial fan sediments. The soils are characterized as being deeply developed and moderately well drained, with low permeability and moderately-high to high shrink-swell potential. These soil types at the project site are considered by SCS to be Class I or II soils which have few limitations for agricultural use. The seventh soil type, Reiff mapping unit (Rk), is a sandy loam with low shrink-swell potential.

Soils that have characteristics reflecting development within the hydrological and ecological environment of wetlands are referred to as hydric soils. Although wetlands have been identified within the project site, none of the mapped soil units in the project site are classified as hydric soils (U.S. Department of Agriculture, 1986). Hydric soils, if present at the site, may be localized in extent and would not be identified by SCS mapping techniques.

The northern portion of the project site is close to the Delta lowlands region of the Sacramento-San Joaquin Delta. Within the Delta lowlands, soils are high in organic content and in some cases include peat deposits. Historic drainage of the organic soils has allowed oxidation of the organic material, resulting in land surface subsidence. The mapped soils within the project site do not have high organic content.

Seismicity

The project site is located within a seismically-active region of west-central California. The seismicity of this region is primarily related to the San Andreas Fault system. The San Andreas Fault system contains several major faults and fault zones including the San Andreas Fault Zone and the San Gregorio-Hosgri Fault Zone, west of San Francisco Bay, and the Hayward, Calaveras, Concord, and Greenville faults in the East Bay hills and the Diablo Range. Relatively lower seismic activity characterizes the eastern flank of the Coast Ranges and the area within the San Joaquin Valley. The faults in this area have less well defined surface expression and the seismic risk posed by these faults has not been clearly identified. A description of seismicity and associated terminology is summarized in Appendix G.

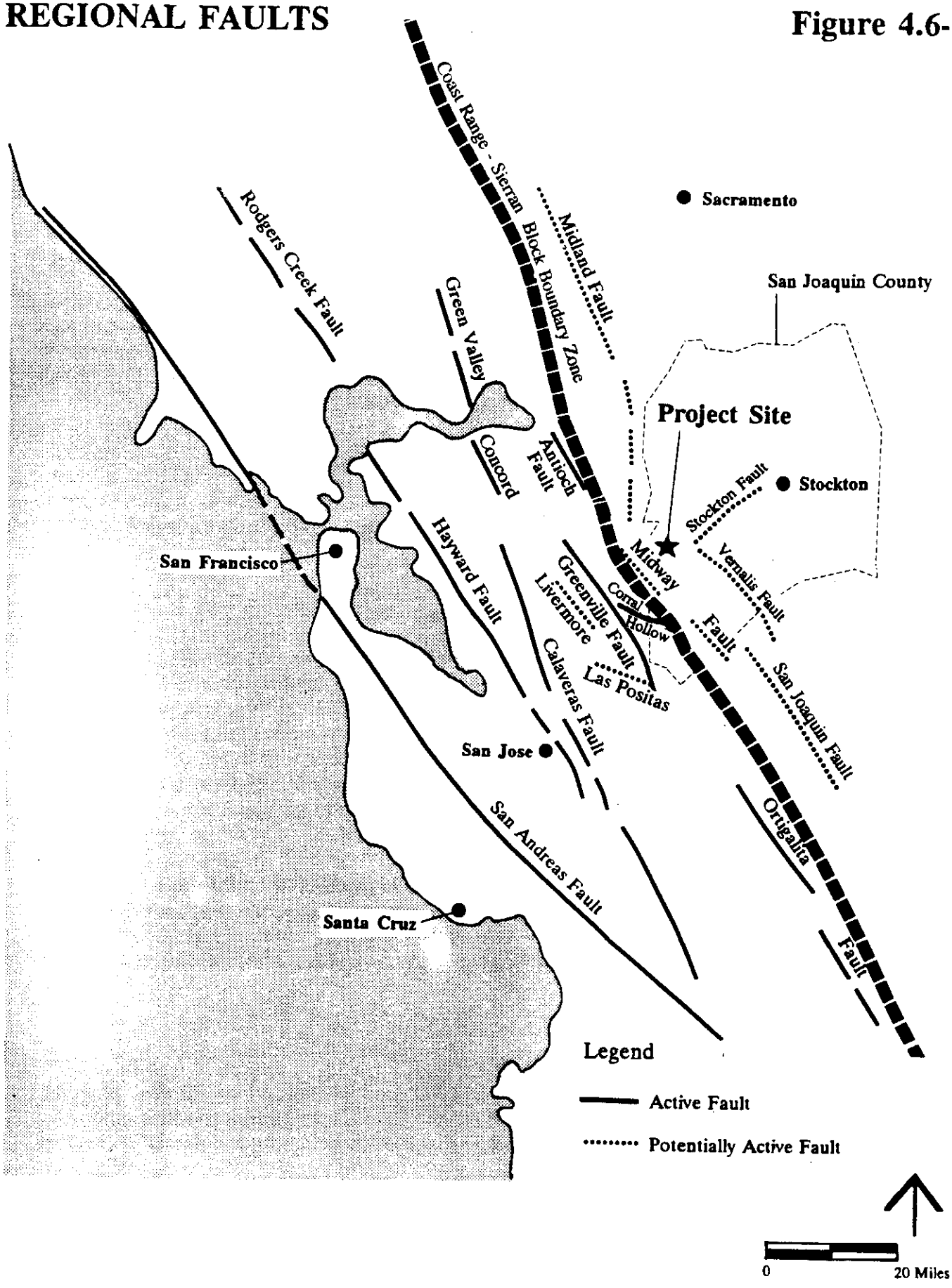
The active and potentially active faults located within about 50 miles of the boundaries of the project site are shown in Figure 4.6-2. These faults and their seismic potential are listed in Table 4.6-1, which presents estimates of the magnitude of the largest expected earthquake generated by each of the faults (Wesnousky, 1986; Mualchin and Jones, 1992). No active faults have been identified within the project site.

Liquefaction

The project site is underlain by young alluvial deposits. Some of these deposits consist of silty sands, particularly along Mountain House Creek and Old River. Where loose and well-sorted sands are saturated by high groundwater conditions, soils may be prone to liquefaction during seismic shaking. The distribution of soils susceptible to liquefaction has not been identified at the project site.

REGIONAL FAULTS

Figure 4.6-2



Source: CDMG, 1975

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BASELINE

TABLE 4.6-1

MAJOR FAULTS POTENTIALLY AFFECTING THE PROJECT SITE

Fault	Distance from Project (miles)	Maximum Credible Earthquake[1] (MW)[3]		Recurrence Interval[2] (years)	Years of Historic Damaging Earthquakes	Expected Maximum Peak Ground Acceleration at Site during MCE (g)[4]	Expected Ground Shaking Intensity at the Site (MMI)
Active:							
~~Antioch~~	~~16~~	~~6.6~~	~~(6.75)~~	~~N/A~~	~~1889?, 1965~~	~~0.17~~	~~VIII~~
Calaveras	21	6.3	(7.5)	150	1861	0.19	VIII
Coast Range-Sierran Block Boundary Zone	0	--	(7)	NA	1892, 1983	0.63	IX
Corral Hollow	7	6.5		N/A	None known	0.28	VIII
Green Valley-Concord	27	6.9	(6.75)	424	1955	0.12	VII
Greenville	8	6.8	(7.25)	3,585	1980	0.50	IX
Hayward	27	7.1	(7.5)	264-556	1836, 1868	0.16	VIII
Ortigalita	35	6.7	(7.0)[5]	10,000		0.08	VII
San Andreas (North Coast Segment)	46	7.8	(8.0)	300	1833, 1906	0.18	VIII
Potentially Active:							
Antioch	16	6.6	(6.75)	N/A	1889?, 1965	0.17	VIII
Las Positas	12	N/A	4.3	872	None known	0.07	VII
Livermore	13	N/A	6.2	N/A	None known	0.13	VII
Midland	10	N/A	7.0[5]	N/A	1889?	0.37	IX
Midway	2	6.3	N/A	2,651	None known	0.38	IX
San Joaquin	5	N/A	6.6	1,083	None known	0.37	IX

Notes: MW = Moment Magnitude
MMI= Modified Mercalli Intensity Scale; see Appendix G

1 The maximum credible earthquake (MCE) is the largest earthquake expected under the present geologic framework. The sources for MCE estimates are Wesnousky (1986) and (shown in parenthesis) Mualchin and Jones (1992), unless otherwise noted.

2 Recurrence interval, or repeat time, is the estimated interval of time between maximum credible earthquakes. The sources for recurrence intervals are summarized in Wesnousky (1986).

3 The estimated magnitude of future earthquakes can be made using the Moment Magnitude method. The magnitude of potential earthquakes on such faults is made by calculations based on the earth materials in the area of the fault and measurement or estimation of the length of the fault and previous displacement along the fault.

4 Expected maximum peak ground accelerations are estimated by distance-magnitude relationships developed by Mualchin and Jones (1992).

5 Source of estimated magnitude: Greenfelder, 1974.

IMPACTS AND MITIGATION MEASURES

Under CEQA, exposure of people or structures to major geologic hazards is considered a significant adverse impact. For the purpose of this DEIR, significant geologic hazards would pertain to soil and/or seismic conditions so unfavorable that they could not be overcome by reasonable design, construction, and maintenance practices; in addition, exposing an increased number of people to risk of injury would constitute a significant impact.

The potential geologic hazards associated with the proposed project were evaluated based on the Preliminary Geotechnical Study (Earth Systems Consultants, 1990), various documents, and a site visit. Since the site is relatively flat, slope stability is not considered a significant potential impact.

MASTER PLAN

The proposed project contains objectives, policies, and implementation measures to address adverse soil conditions and seismic hazards at the project site (Objectives 4 and 5 in the Potential Site Hazards section of Public Health and Safety in Appendix C). Impacts of adverse soil conditions on proposed facilities at the site would be addressed in preliminary soil reports required by the adoption of the provisions of the State Subdivision Map Act by the San Joaquin County Development Title. Objective 1 in Development Standards (Appendix C) addresses erosion and sedimentation impacts associated with grading.

Deep excavations for foundations, trenches for utility lines, and other topographic alterations (for landscape and/or levees) could increase erosion hazards. The project includes major modification of the Mountain House Creek channel, which would require significant excavation. Eroded soils could enter surface water systems, causing a reduction in water quality. Sedimentation in storm drains could adversely affect storm drain capacity. Potential impacts of grading and excavation are addressed in the Draft Master Plan by compliance with the State permitting requirements for control of runoff during construction activities, development of Storm Water Pollution Prevention Plans for each construction project, and control of discharges of sediment to drainage channels.

The Draft Master Plan specifies that preliminary soils reports (required by the San Joaquin Development Title) for all subdivisions of land within the project site which would provide recommendations for appropriate structural design values for construction on those soils. The preliminary soils reports for the subdivisions within the project site should specifically address the potential presence of low-density clay and high shrink swell soils and liquefaction potential. If these conditions are identified, the preliminary report should specify recommendations for structural design values.

If ground settlement is not considered in foundation design and building load calculations, structural damage may occur in the future. Settlement can also cause warping and cracking of roads and sidewalks and rupture of utility lines.

The Draft Master Plan specifies that preliminary soils reports prepared for subdivisions of land within the project site identify areas of low density clays; adequate foundation designs for structures constructed within areas underlain by low density clay soils; the extent of low density clay; and other appropriate land uses for areas where suitable building foundations cannot be designed.

The existing levees along Old River and Wicklund Road on the project site are constructed of unengineered fill. These flood control structures were not designed to withstand forces caused by strong ground shaking. Expected moderate to strong ground shaking could cause levee failure and flooding of a portion of the project site.

Objective 1 and associated Policies and Implementations under Flood Protection in Storm Drainage and Flood Protection (Appendix C) propose to protect people and property in the Mountain House community from flood hazards, including flooding caused by levee failure and the 100-year flood event, by implementation of a Flood Protection Plan. The Plan would include the construction of a second set of levees landward of the existing levees prior to development in the 100-year flood hazard zone; the levees would be designed to minimally meet the requirements of the National Flood Insurance Program (NFIP). Failure of the existing levee prior to construction of the new levee system would result in flooding of agricultural land in the designated 100-year flood hazard zone and would not expose people or structures to hazards. Construction in the current 100-year flood plain would not occur until levees had been constructed. Implementation of these requirements would reduce the potential for levee failure to a less-than-significant level.

Impact M4.6-1

Strong ground shaking during an earthquake could cause structural damage to improvements and injuries to residents of the proposed project.

Structural damage at the site during an earthquake on regional faults may include damage to buildings and infrastructure (roads, bridges, and utilities). A disrupted infrastructure could inhibit disaster relief efforts, cause water and power supply shortages, and limit communications and transportation. This would be an unavoidable adverse impact that cannot be mitigated to a less-than-significant level.

Several California laws are designed to minimize the potential adverse effects of an earthquake. These include the Hospital Seismic Safety Act of 1972, Essential Services Buildings Seismic Safety Act of 1986 (concerning construction of buildings for police, fire, emergency services), and the Field Act of 1933 (concerning construction of schools). In addition, the Uniform Building Code (UBC) provides construction guidelines for residential, commercial, and industrial buildings. UBC has divided the United States into zones based on seismic risk. Zone 1 is likely to experience the least amount of ground shaking; Zone 4 the most. The site is located in seismic Zone 3, and is adjacent to Zone 4 in Alameda County and southern San Joaquin County. Implementation of the above mentioned laws would significantly reduce the earthquake hazards associated with building collapse and infrastructure disruption. However, the potential for associated hazards such as injuries related

to falling objects, fire, and repairable structural damage remain a significant unavoidable adverse impact.

The residual impacts associated with seismic hazards can be reduced through effective distribution of appropriate information on earthquake preparedness. The Draft Master Plan proposes that the Community Services District develop and implement a community earthquake preparedness plan to promote public awareness and education on earthquake hazards.

Mitigation Measure M4.6-1

The preparation and distribution of a Community Earthquake Preparedness Plan, proposed in the Draft Master Plan, would reduce this impact. This remains an unavoidable adverse impact. Implementation a) under Objective 5 of Potential Site Hazards (Appendix C) should be amended to ensure that the Plan be prepared prior to submittal of the first Development Permit. No further mitigation is possible.

SPECIFIC PLAN I

Specific Plan I does not specifically address impacts associated with adverse soil conditions or seismic hazards within the Plan subareas. The provisions of the Draft Master Plan require that a preliminary soils report be prepared prior to the approval of the final map for any subdivision of land within the Mountain House community. This requirement would apply to any and all development projects proposed within the area covered by Specific Plan I. Seismic hazards would be mitigated by existing requirements of the ~~1991~~ **1994 (or more current)** Uniform Building Code and recommendations for special conditions, such as liquefaction hazards, presented in the required preliminary soils report. Specific Plan I defers to the Draft Master Plan for objectives, policies, and implementations in addressing flood protection. The Master Plan, as amended by Mitigation Measure M4.6-1, would provide mitigation of the seismic hazards to the extent possible. No further significant impacts have been identified.