5.8 SOILS AND GEOLOGY

The following discussion summarizes information from the geologic study prepared by Kleinfelder in March 2003 for the Specific Plan (Appendix I), U.S. Geological Survey Maps, the Rancho San Juan ADC Feasibility Study, the Greater Salinas Area Plan and the Monterey County General Plan.

5.8.1 EXISTING CONDITIONS

The Salinas area, situated at the north end of the Salinas River Valley, lies within the Coast Ranges Geomorphic Province, a discontinuous series of northwest-southeast trending mountain ranges, ridges, and intervening valleys characterized by complex folding and faulting. Regional geomorphic features within the Salinas and Monterey areas are the result of a complex geologic history of uplift and folding ultimately caused by the interaction between the North American and Pacific tectonic plates.

5.8.1.1 Specific Plan

Topography of the Specific Plan area consists of gently rolling hills in the northern and northwestern portion and generally flat areas in the southern and eastern areas. Elevations range from about 120 feet to approximately 300 feet above mean sea level.

The project site is located in the Salinas Valley, which consists primarily of unconsolidated Quaternary deposits (less than two million years old). These deposits were derived from the Salinas River, its tributaries, basin and tidal flat sediments, and eolian or dune sediments. Underlying the Quaternary Age sediments is a layer of mostly marine Pliocene to Pleistocene Age sediments. The basement rock is composed of high grade metamorphic rock and Cretaceous granitic rock. The project site is underlain by Quaternary Age alluvium, eolian, and alluvial fan deposits.

Soils

Soil phases, described in detail below, are mapped on Figure 5.8-1. Due to the scale and mapping limitations of the SCS base map, small occurrences of some soil types are not shown, although they may be scattered over the entire area.

Arnold Series

The Arnold Series consists of excessively drained soils formed on hills and uplands in old marine sand dunes or in materials weathered from soft sandstone. The elevation range of this soil series is from 100 to 200 feet. In a representative profile, the surface layer, or horizon, is loamy sand to a depth of approximately eight inches underlain by loamy fine sand to a depth of about 48 inches. Beneath these soil horizons lies bedrock parent material consisting of soft sandstone.

The specific soil type within the Arnold Series that occurs on the property is Arnold Loamy Sand (AkF). This type occurs on 15 to 50 percent slopes. This soil is a moderately steep to steep upland soil having a soil profile representative of the series. Runoff is rapid and the erosion hazard is high. Due to the often steep slopes and high erosion hazard, this soil is generally unsuitable for development of structures or roads. This soil has high erosion hazard in cases where a close growing plant cover is not maintained.

Arroyo Seco Series

The Arroyo Seco Series consists of well-drained soils that formed in granitic alluvium on alluvial fans and plains. The series occurs on slopes up to nine percent from elevations between 100 and 3,000 feet. In a representative soil profile, the surface layer is gravelly sand loam 29 inches thick underlain by gravelly sandy loam and very gravelly coarse sandy loam to a depth of approximately 42 inches.

Arroyo Seco gravelly loam, is the specific Arroyo Series soil found on the property. It occurs on slopes up to 2 percent. This soil occurs on nearly level areas of alluvial fans. It has a profile similar to soils representative of the series, but has a sharp, angular gravel constituent. This soil exhibits slow runoff and retains a slight erosion hazard.

Chualar Series

Three soil types within the Chualar Series occur on the property.

Chualar loam (CbA) occurs on 0 to 2 percent slopes. This soil occurs on alluvial fans and terraces and has the profile described as representative of the series. It exhibits very slow runoff and is accompanied by a minimal to slight erosion hazard.

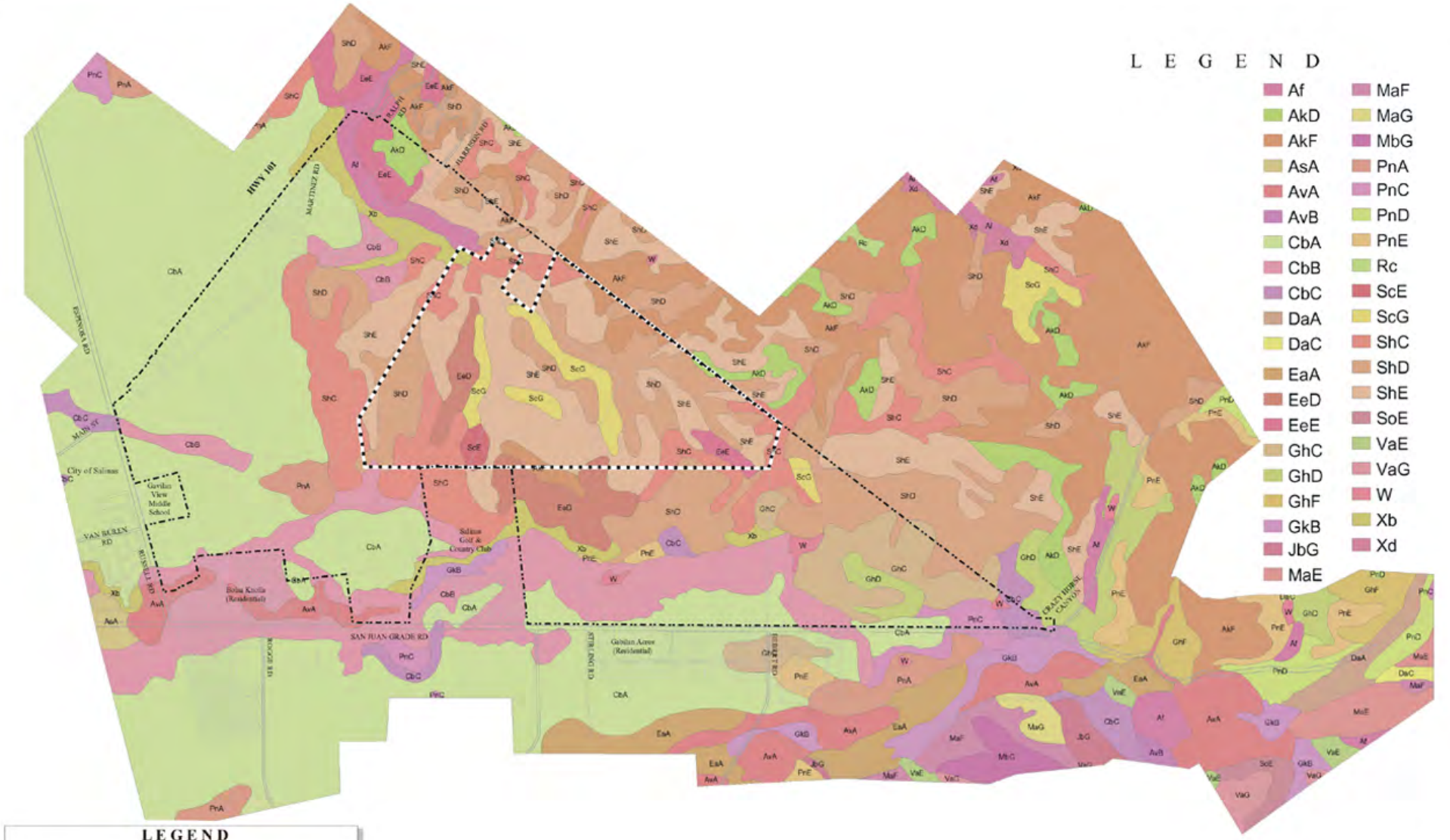
Chualar loam (CbB) occurs on 2 to 5 percent slopes. This soil occurs on gently sloping alluvial fans and terraces. The surface layer is loam or very fine gravelly loam from 16 to 24 inches thick with a subsoil from 10 to 20 inches thick. In some places, this soil is underlain by granite and shale cobblestones, commonly at a depth of more than 40 inches. This soil exhibits slow runoff and has a slight erosion hazard. Permeability is moderately rapid to moderately slow.

Chualar loam (CbC) occurs on 5 to 9 percent slopes. This is a moderately sloping soil occurring on fans and some terraces. The Chualar Loam, 5 to 9 percent slope phase, has a soil profile representative of the series. This soil exhibits medium runoff and a moderate erosion hazard.

Elkhorn Variant

The Elkhorn variant consists of soils on marine terraces and dune-like hills. The typical profile of these soils exhibits a fine sandy loam to a depth of about 12 inches, fine sandy loam and clay loam to about 25 inches, and weakly consolidated loamy fine sand to a depth of 60 inches.

The Elkhorn Series soils occurring on the property are described below.



LEGEND

HYH Boundary

Revised ADC Boundary

N

Not to Scale

Source: *ProjectDesign Consultants, 4/29/2004*

Soils Map

Figure 5.8-1

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Elkhorn fine sandy loam (EeD) is a thin surface variant which occurs on 5 to 15 percent slopes. This is a moderately sloping to strongly sloping soil on marine terraces. It has a soil profile generally representative of the variant, but with a depth to weakly consolidated sandy sediments or soft sandstone of 30 to 50 inches. This soil percolates and has a moderate erosion hazard.

Elkhorn fine sandy loam (EeE) is a thin surface variant which is found on 15 to 30 percent slope. This soil occurs on moderately steep hills and marine terraces and has a profile representative of the series. A capacity for runoff and existence of a high erosion hazard are typical of this soil, and landslides are common in some areas, especially when the soil is saturated for extended periods.

Gloria Series

The Gloria series consists of well drained and moderately well drained soils formed in granitic alluvium on benches, terraces and alluvial fans. These soils occur at elevations between 100 and 2,000 feet and have slopes ranging from two to 50 percent. The typical soil profile exhibits sandy loam to a depth of approximately seven inches thick. The substratum is typically hardpan to a depth of more than 60 inches.

The soil types within this series are described below.

Gloria sandy loam (GhC) is found on 2 to 9 percent slopes. This is a gently sloping to a moderately sloping soil having a profile representative of the series. This soil is moderately well drained and has a slight to moderate erosion hazard.

Gloria sandy loam (GhD) is found on 9 to 15 percent slopes. This soil exhibits characteristics similar to those of GhC, but it occurs on steeper slopes.

Placentia Series

The Placentia series consists of well drained soils that formed in alluvium derived from granitic and schistose rocks on old alluvial fans and terraces. Typically, this series has a surface layer of sandy loam to a depth of about 13 inches, a subsoil of clay loam and sandy clay loam to a depth of about, 58 inches, and a gravelly sandy loam that extends to a depth of more than 68 inches.

The soil types within this series are described below.

Placentia sandy loam (PnA) occurs on 0 to 2 percent slopes. This gently to moderately sloping soil has formed on old alluvial fans and terraces and has a soil profile representative of the series. This soil exhibits slow to moderate runoff and poses a slight erosion hazard.

Placentia sandy loam (PnC) is found on 2 to 9 percent slopes. This soil exhibits characteristics of the Placentia sandy loam, 0 to 2 percent slope phase, but because it occurs in slightly steeper areas, it has a higher propensity to erode.

Placentia sandy loam (PnE) occurs on 15 to 30 percent slopes. This soil exhibits characteristics similar to the above two soil phases, but has a high erosion hazard because it occurs on steeper slopes.

San Andreas Series

The San Andreas Series consists of well drained sandy loam, 15 to 30 percent slopes. This is a moderately steep soil on lower hillsides and has a soil profile representative of the series, but with a depth to parent material of 30 to 40 inches. It exhibits rapid runoff and a moderate erosion hazard.

The soil types within this series are described below.

San Andreas fine sandy loam (ScE) occurs on 30 percent slopes. This is a moderately steep soil on lower hillsides and has a soil profile representative of the series, but with a depth to parent material of 30 to 40 inches. It exhibits rapid runoff and a moderate erosion hazard.

San Andreas fine sandy loam (ScG) occurs on 30 to 75 percent slopes. This soil exhibits the tendencies of the San Andreas fine sandy loam, 15 to 30 percent slope phase, but because it occurs on steeper slopes, it has a higher erosion hazard.

Santa Ynez Series

The Santa Ynez soil consists of moderately well-drained soils that formed in alluvium derived from sandstone and granitic rock. This soil has a fine sandy loam surface layer to about 18 inches and is underlain by clay loam to approximately 43 inches. The substratum is sandy loam.

The soil types within this series are described below.

Santa Ynez fine sandy loam (ScH) occurs on 2 to 9 percent slopes. This soil phase is present on moderately sloping terraces and has a soil profile typical of the series, but with a thicker, fine sandy loam surface layer. Runoff is slow to moderate, producing a slight to moderate erosion hazard.

Santa Ynez fine sandy loam (ShD) is found on 5 to 15 percent slopes. This is a strongly sloping soil that occurs on terraces and low hills and has a soil profile representative of the series. This soil has a medium runoff tendency and a moderate erosion hazard.

Santa Ynez fine sandy loam (ShE) is found on 15 to 30 percent slopes. This soil phase is on hilly terrain on dissected terraces. It has a soil profile representative of the series and exhibits characteristics of the other Santa Ynez soils. Because of its steep slopes, this soil exhibits rapid runoff tendencies and a high erosion hazard potential.

Xerothents sandy (Xb). These are well drained, strongly sloping to steep soils on banks and escarpments in elevation between different levels on alluvial fans or terraces. These soils are sands, loamy sands, sandy loams, and loams, and are characteristically high in sand and coarse

sand, but low in silt and clay. These soils exhibit moderately rapid runoff, with the erosion hazard varying considerably over short distances.

Slopes

Approximately 23 acres of the project site contains slopes over 30 percent as shown in Figure 5.3-3. However, areas having slopes over 30 percent are generally not considered suitable for development because of problems related to soil stability, erosion and runoff velocity.

Geologic Hazards

In general, there are three types of hazards associated with the property: seismic, slope stability and expansive soils.

Seismic Hazards

Seismic Conditions

The project site is located within the Salinian Block, a geologic tectonic unit bounded by the San Andreas Fault zone on the east and the Sur-Nacimiento fault zone offshore to the west. The Salinian Block is composed of a number of smaller fault-bounded blocks. These faults, along with the San Andreas Fault, have dominated the tectonic history of western California since the mid-Miocene time, approximately 12 to 15 million years ago.

Only a few of the fault traces present a seismic hazard to the project area. These include the San Andreas Fault, the Zayante- Vergeles Fault, the Pineate Fault, the Gavilan Fault, the Monterey Bay Fault zone, and the King City Fault zone (see Figure 5.8-2). These faults are considered active if movements have occurred within the last 10,000 years, or potentially active if movements have occurred within the last two to three million years.

The San Andreas Fault Zone is active and represents the major seismic hazard in northern California. The main trace of the San Andreas Fault runs northwest-southeast and extends over 700 miles from the Gulf of California through the Coast Ranges to Point Arena where the fault enters the Pacific Ocean. The San Andreas Fault lies about seven miles northeast of the project site at its closest point.

The two segments of the San Andreas Fault zone that could affect the project site are the San Jose to San Juan Bautista and the San Juan Bautista to Bear Valley segments. It is believed that no earthquakes exceeding Richter magnitude 6.5 have ever occurred in the San Juan Bautista to Bear Valley segment, the closest to the project site. The probable size of an earthquake on the San Jose to San Juan Bautista segment would likely have a Richter Magnitude of 6.5 to 7.0.

The Zayante-Vergeles Fault zone lies west of the San Andreas Fault and extends 51 miles from the Watsonville lowlands to the Santa Cruz Mountains. This fault is considered potentially active and capable of generating a 7.4 magnitude earthquake.

The Pineate Fault is a northwest/southeast-trending fault that lies north of the Zayante-Vergeles Fault. At its closest point, the Pineate Fault is five miles north of the project site. The Pineate Fault is considered to be inactive or potentially active.

The Gavilan Fault runs 19 miles along the Gavilan Range and is approximately two miles from the project site at its closest point. This fault is considered to be potentially active.

The Monterey Bay Fault Zone is 6 to 9 miles wide and approximately 25 miles long. The fault zone trends northwest/southeast and intersects the coast in the vicinity of Seaside and Fort Ord. The Tularcitos and King City Faults are the two faults within the Monterey Bay Fault Zone considered capable of generating up to 7.0 magnitude earthquakes.

Potential Seismic Effects

Seismic hazards may result from the following: surface rupture, seismic shaking (or ground shaking), and ground failure. Surface rupture occurs when fault movement breaks the ground surface. Ground rupture tends to occur along lines of previous faulting. The potential for ground rupture to occur is considered to be low as there is no evidence of active or potentially active faults on the project site.

Structural damage due to ground shaking is caused by the transmission of earthquake vibrations from the ground into a structure. Variables that determine the extent of damage are: the characteristics of underlying earth materials, design of the structure, quality of materials and workmanship used in construction, location and magnitude of the earthquake, and duration and intensity of the shaking. The most destructive effects of an earthquake are usually seen where the ground is unstable and structures are poorly designed and constructed.

The project site includes areas of steep and low slopes subject to seismically induced landslides and liquefaction. Liquefaction is the process in which a loose, saturated, sandy soil loses internal strength as a result of increased pore water pressure. These soils transform from a solid to a liquid state as a result of reduced, effective stresses within the soil mass. This phenomenon is typically induced by strong ground shaking associated with earthquakes. Liquefaction potential varies across the project site, based on ground water depth and soil profile.

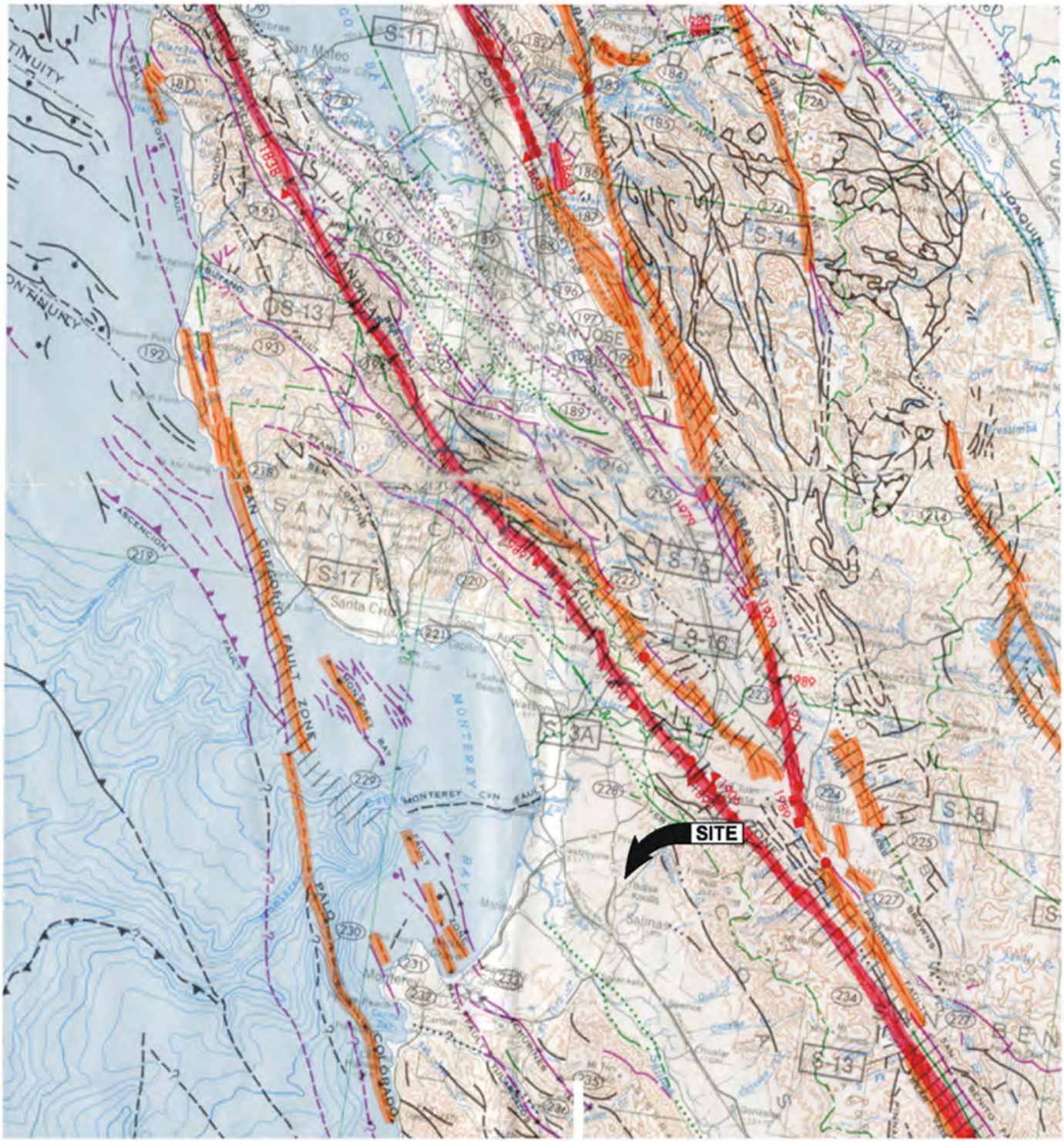
Slope Stability

Due to the relatively flat topography, the potential for landslides is considered low.

Soil Constraints

The primary constraint is associated with loose, near-surface soils in the western portions of the site. These soils are considered unsuitable to support buildings and pavement in their present condition.

Moderately to expansive soils occur over the majority of the property.



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Source: *Charles W. Jennings, 1994*

1 inch = 12 miles

Fault Map — Figure 5.8-2

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5.8.1.2 HYH Property Project

Soils

The HYH Property contains the following soil types (please see descriptions above): AkF; EeD; EeE; ScG; ShC; ShD; and ShE.

Slopes

The HYH Property contains little flat land, as shown on Figure 5.8-2. The flattest land occurs in the western and southern portions of the site. Approximately 552 acres contain slopes under 20 percent. Slopes of 20 to 30 percent cover approximately 99 acres and are largely located in the central and eastern portions of the property. Over 78 percent of the slopes 30 percent or greater are located within the HYH Property. The HYH Property contains approximately 18 acres of slopes over 30 percent, which are primarily within the central and eastern portions of the site.

Geologic Hazards

Geologic hazards would be the same as those described for the Specific Plan.

5.8.2 THRESHOLDS OF SIGNIFICANCE

Soil and geology impacts would be significant if the proposed project:

- Exposes persons or property to geologic hazards such as ground shaking, liquefaction, landslides land subsidence or erosion; and/or
- Exposes soils susceptible to erosion, deposition, sedimentation and siltation or involves structures located on expansive soils.

5.8.3 POTENTIAL IMPACTS

5.8.3.1 Alternative 2

The project site could be affected by a moderate to major earthquake with it epicenter located on one of the active faults in the Salinas area. At present, it is not possible to predict when or where movement will occur on these faults. It may be assumed, however, that movement along one or more of these faults would result in a moderate to major earthquake during the anticipated life of the project.

Seismic Impacts

In the event of an earthquake, seismic risk to a structure would depend upon the distance of the structure from the epicenter and source fault, the characteristics of the earthquake, the geologic, groundwater and soil conditions underlying the structure and its vicinity, and the nature of the construction. A Richter Magnitude earthquake of 7.4 on the Zayante-Vergeles fault would cause strong ground motion, which in turn could damage structures onsite.

Ground failures, such as liquefaction and landslides, are related to soil, bedrock and ground water conditions. The presence of springs and the sandy nature of some of the project site soils results in the potential for these low to moderate secondary seismic hazards to occur. The potential increases in the rainy season with wetter soil conditions.

Preliminary estimates of ground response characteristics at this site indicate that high peak accelerations can be expected during a moderate or major earthquake. These events could cause severe ground shaking onsite. The duration of shaking and the frequency component of the vibrational waves depends on the magnitude and location of the earthquake. In order to further reduce potential project impacts, detailed ground failure/liquefaction investigations are recommended.

Soil Impacts

Based on a preliminary analysis of onsite soil conditions, soils pose moderate to high constraints for development purposes, as shown in Figure 5.8-2. Moderate constraint areas impose special considerations on the siting and design of building foundations. The Specific Plan area contains few slopes over 30 percent and therefore, significant development constraints are not anticipated due to unstable soil conditions. High constraint areas are generally developable, but would require extensive site preparation such as soil excavation or extensive maintenance.

The expansive characteristics of onsite soils were analyzed in terms of shrink-swell capacity. Although results indicate that shrink-swell capacity was low for all of the soil types in the project area, the shrink-swell tendencies of some onsite soils were found to adversely affect their engineering properties and could result in a potential significant impact to future development.

5.8.3.2 Alternative 4E

Potential impacts would be the same as those described for Alternative 2.

5.8.3.3 HYH Property Project

Potential impacts would be the same as those described for Alternative 2.

5.8.4 MITIGATION MEASURES

The following section contains a summary statement for each significant soils and geology impact related to the significance thresholds and identified in the previous discussion including a determination as to whether the significant impact is direct or indirect. Immediately following each impact statement are one or more mitigation measures which would reduce the impact. Lastly, a conclusion is indicated which indicates whether the mitigation measures would reduce the impact to below a level of significance.

5.8.4.1 Alternative 2

Impact 5.8-1: Seismic shaking and expansive soil risk to future structures. (Direct)

Implementation of Alternative 2 could result in a potentially significant impact to future development due to the shrink-swell tendencies of some onsite soils, which were found to adversely affect their engineering properties. After mitigation this impact would be lessened to below a level of significance. In addition, high peak accelerations can be expected during a moderate or major earthquake. These events could cause severe ground shaking onsite. The duration of shaking and the frequency component of the vibrational waves depend on the magnitude and location of the earthquake. Implementation of the following mitigation measures would reduce soils and geology impacts associated with implementing the Specific Plan to less than significant.

Mitigation Measure 5.8-1a: Prior to approval of a tentative tract map, a qualified soils engineer shall prepare a detailed analysis of specific characteristics and capabilities of underlying soils and shall identify potential geologic hazards. The report shall recommend appropriate measures for the design of proposed structures to minimize property damage and safety hazards related to ground shaking and unstable or expansive soils to below a level of significance.

Mitigation Measure 5.8-1b: Prior to the issuance of a building or grading permit, detailed ground failure/liquefaction investigations shall be conducted by a licensed geological analyst as part of the soil studies required for Final Tract Maps to identify remedial grading or contour measures, as appropriate.

Level of Significance of Impact 5.8-1 After Mitigation: Less than significant.

5.8.4.2 Alternative 4E

Significant impacts related to geologic hazards would be the same as Impact 5.8-1. With implementation of Mitigation Measures 5.8-1a through 5.8-1b, geologic impacts would be less than significant.

5.8.4.3 HYH Property Project

Impact 5.8-2: Seismic shaking and expansive soil risk to future structures. (Direct)

Implementation of the HYH Property project could result in a potentially significant impact to future development due to the shrink-swell tendencies of some onsite soils, which were found to adversely affect their engineering properties. After mitigation this impact would be lessened to below a level of significance. In addition, high peak accelerations can be expected during a moderate or major earthquake. These events could cause severe ground shaking onsite. The duration of shaking and the frequency component of the vibrational waves depends on the magnitude and location of the earthquake. Implementation of mitigation measures 5.8-1a and 5.8-1b would reduce soils and geology impacts associated with implementing the HYH Property project to less than significant.

Level of Significance of Impact 5.8-2 After Mitigation: Less than significant.