4.1 GEOTECHNICAL AND SOIL RESOURCES

4.1.1 *INTRODUCTION*

Information and analysis presented in this section is based on a summary of a geotechnical engineering report prepared by Leighton & Associates in August of 1980. Refer to ***Appendix 4.1*** *of this EIR for a copy of this report. The study involved drilling, mapping, sampling, and logging of test borings to evaluate on-site soils and groundwater conditions. Laboratory testing of soil samples obtained from the subsurface exploration was conducted to determine their physical and engineering properties. This section addresses the soils and geological conditions of the site and the impacts resulting from the proposed grading. The discussion focuses on the grading required to support the proposed development. Topics to be addressed include geotechnical hazards, including ground shaking from seismic activity, and other potential hazards including direct impacts from faults, subsidence, liquefaction and expansive soils.*

4.1.2 EXISTING CONDITIONS

a. Regional Geologic Setting

The subject site is located on the northern edge of the San Jose Hills along the eastern margin of the Los Angeles Basin. The San Jose Hills are comprised of sedimentary bedrock of the Puente and Topanga Formations, and are underlain by volcanic basement rock.

b. Topography and Soils

Figure 4.1-1 illustrates the existing topographic conditions of the subject site. As shown, topography on the project site ranges from a low of 625 feet in the southwestern portion to a high of 735 feet in the northeastern section near Valley Center Avenue. Fill slopes up to 5 feet in height are present along the northerly boundary. This material is the result of road construction and is restricted to the area immediately adjacent to the roadbed. The overall slope angle in the northerly portion is 10 to 20 degrees with angles of 30± degrees between terraces. There are two very gently sloping terraces in the east central and west central portions of the site. The southerly portion of the site encompasses slopes of 15 to 30 degrees (occasionally steeper) along Walnut Creek.

Sedimentary bedrock of the Puente Formation underlies the area. These rocks consist of well bedded, diatomaceous siltstone. The siltstone is unconformable, overlain in some areas by recent alluvium, older alluvium and/or terrace deposits. Older alluvium, generally 2 to 4 feet thick, consisting of silty sand overlies bedrock on the gently sloping terraces in the west central and east central sections of the site. Trace deposits of sandy gravel and boulders overlie the bedrock in the northern section of the site. Groundwater was not encountered during the soil study.

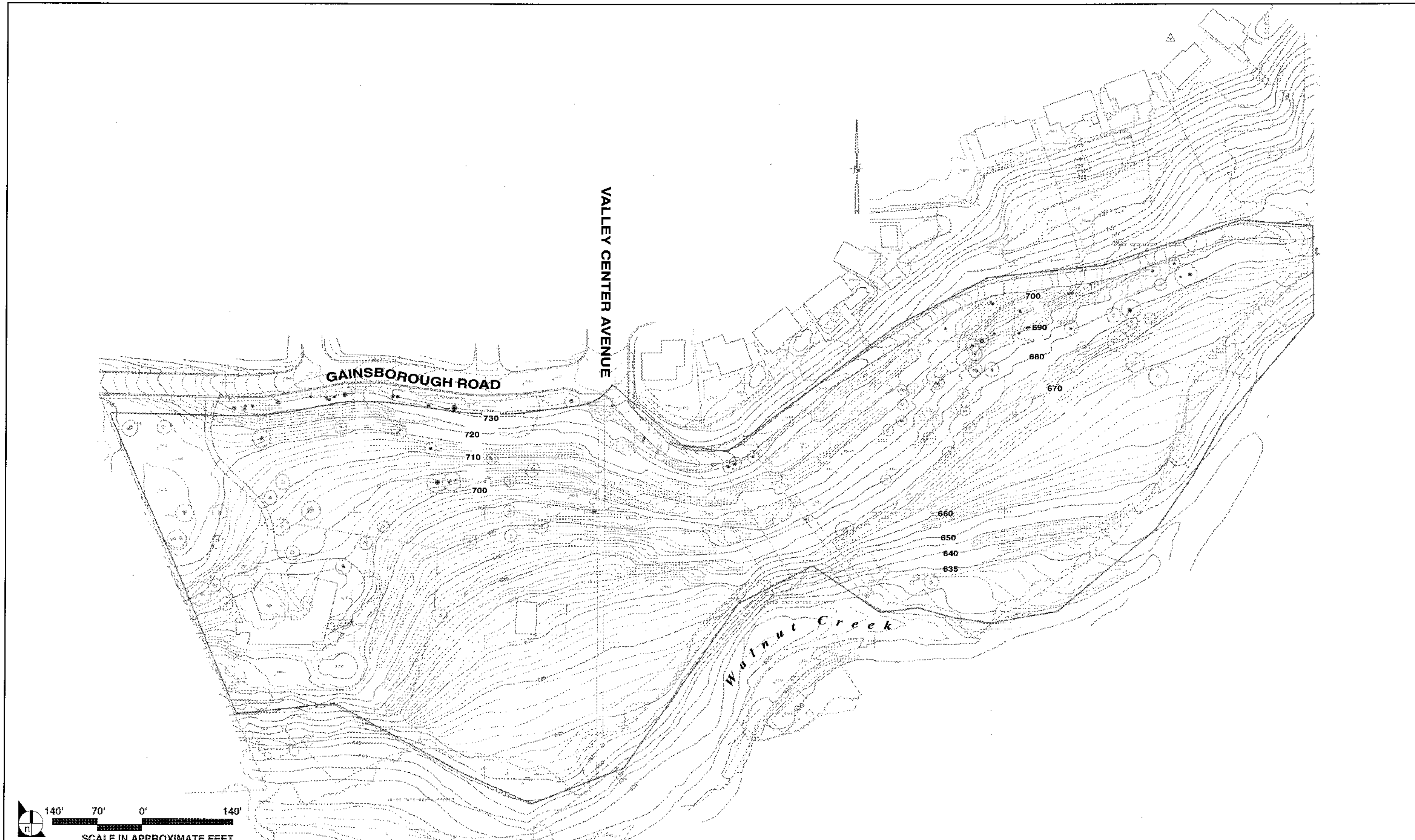
While no landslides are evident at the site, thin soil failures are present south of the existing residence on the steep slope above Walnut Creek and is the area of Boring 1 at the narrow central part of the property (see Geotechnical Map found in **Appendix** 4.1).

c. Seismic Hazards

1. Ground Shaking

Ground shaking is typically the main cause of structural damage and personal injury from earthquake events in southern California. The severity of an earthquake can be expressed in terms of both *intensity* and *magnitude*. However, the two terms are quite different, and they are often confused. Intensity is based on the observed effects of ground shaking on people, buildings, and natural features. It varies from place to place within the disturbed region depending on the location of the observer with respect to the earthquake epicenter. The intensity of ground shaking at a specific site is a function of distance from the fault, magnitude of the earthquake, and local geology. **Table 4.1-1** provides a comparison of the two scales.

The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and finally—total destruction. Although numerous intensity scales have been developed over the last several hundred years to evaluate the effects of earthquakes, the one currently used in the United States is the Modified Mercalli (MM) Intensity Scale. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects. The lower numbers of the intensity scale generally deal with the manner in which people feel the earthquake. The higher numbers of the intensity scale generally deal with the manner in which people feel the earthquake. The higher numbers of the scale are based on observed structural damage. For example, persons would feel an earthquake with an intensity of III quite noticeably indoors, especially on upper floors of buildings. Many people would not recognize it as an earthquake. On the other hand, an earthquake of X intensity would destroy some well-built wooden structures, while most masonry and frame structures would also be destroyed with foundations.



SOURCE: Giron Engineering, February 2001.

FIGURE **4.1-1**

On–Site Topography

Table 4.1-1
Magnitude and Intensity

Magnitude	Intensity	Description
1.0 - 3.0	I.	Not felt except by a very few under especially favorable conditions.
3.0 - 3.9	II - III	II. Felt only by a few persons at rest, especially on upper floors of buildings.
		III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
4.0 - 4.9	IV - V	IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
		V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
5.0-5.9	V-VI	VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
		VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
6.0 - 6.9	VII - IX	VIII. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned.
		IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
7.0 and higher	VIII or higher	X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
		XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
		XII. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Magnitude is related to the amount of seismic energy released at the hypocenter of the earthquake. It is based on the amplitude of the earthquake waves recorded on instruments, which have a common calibration. The magnitude or strength of earth movement associated with seismic activity is typically quantified using the Richter scale. This scale is a measure of the strength of an earthquake or strain energy released by it, as determined by seismographic observations. This is a logarithmic value originally defined by Charles Richter (1935). An increase of one unit of magnitude (for example, from 4.6 to 5.6) represents a 10-fold increase in wave amplitude on a seismogram or approximately a 30-fold increase in the energy released. In other words, a magnitude 6.7 earthquake releases over 900 times (30 times 30) the energy of a 4.7 earthquake.

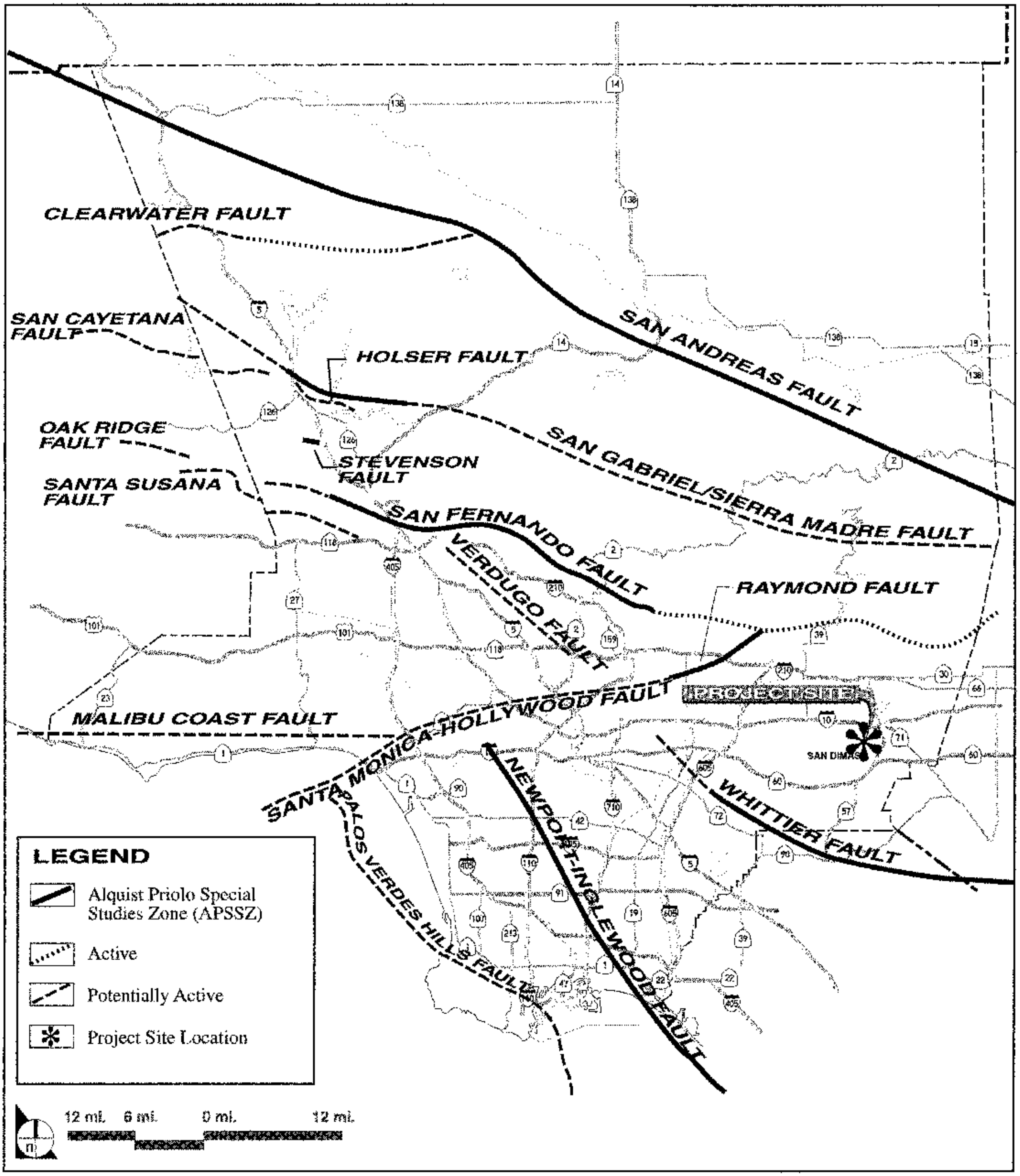
The principal seismic hazard in San Dimas is the Sierra Madre Fault Zone, which runs along the foot of the San Gabriel Mountains. Located approximately 2-1/2 to 3 miles north of the project site, it is considered an active fault. The strongest maximum quake generated by this fault system was 6.4 (Richter scale) in 1971; maximum probable magnitude is projected at 6.5 – 7 (Richter scale).

There is no evidence of active faulting on the property. However, the Walnut Creek Fault, considered potentially active with resultant strong ground shaking, but low probability of ground rupture, trends in a northwest to northeast direction through the project area. The San Dimas Public and Seismic Safety Element states that the exact location of the fault could not be shown because of the soil cover. The suspected alignment shown on the geotechnical land use capability map is generally aligned with the northern boundary of Walnut Creek. It could cross some of the southern sections of the property planned for development. Although close to the site, the Walnut Creek fault has a low potential for seismic activity and is not considered as important in terms of earthquake-generating potential compared to the Sierra Madre Fault Zone.

The principal potential seismic hazard, which could affect the site, is ground shaking resulting from an earthquake along any of several active faults and fault systems in southern California. The major seismically active faults of most significance to the proposed development include the San Andreas, San Jacinto, Sierra Madre-Cucamonga, Whittier-Elsinore and Newport-Inglewood fault zones. A summary of these active faults and their seismic parameters are illustrated on **Figure 4.1-2** and presented in **Table 4.1-2.**

2. *Liquefaction*

Liquefaction refers to an unstable ground condition in which ground shaking works cohesionless, water saturated soil particles (generally fine grained sands) into a tighter packing, thus creating excess pore space. Liquefaction typically occurs in earthquake prone areas where the groundwater level is less than 50 feet below the ground surface, and where the soils are composed of young alluvium. The potential for liquefaction does not exist at this project site.



SOURCE: Impact Sciences, 1997: Allan E. Seward, Engineering Geology 1997.

FIGURE 4.1-2

Regional and Local Faults

Table 4.1-2
Summary of Active Faults & Seismic Activity

Potential Causative Fault	Distance From Fault To Site (Miles)	Maximum Credible Earthquake Richter Magnitude Note 1	Maximum Probable Earthquake (Functional Basis Earthquake)			
			Richter Magnitude	Peak/ Horizontal Ground Acceleration (Gravity)	Predominant Period at Site	Duration of Strong Shaking at Site
San Andreas	21.0	8.5	7.5	0.35/0.23*	0.35	37
San Jacinto	19.5	8.0	7.2	0.37/0.25*	0.35	34
Sierra Madre-Cucamonga	3.5	7.5	6.1	0.63/0.42*	0.35	30
Whittier-Elsinore	10.5	7.7	6.7	0.42/0.28*	0.35	31
Newport-Inglewood	27.5	7.5	6.5	0.24/0.16*	0.35	30

*Source: Leighton and Associates, See **Appendix 4.1**.*

3. *Lateral Spreading*

According to the geotechnical land use capability map of the San Dimas *General Plan*, the project site is in an area of older alluvium underlain by steam terrace deposits. Geotechnical considerations to be investigated prior to development are local expansive soils and potential for settlement of ground under large loads.

4.1.3 IMPACT ANALYSIS

a. Thresholds of Significance

Appendix G of the State CEQA *Guidelines* defines a significant geologic problem as one that will cause:

1. Exposure of people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving seismic related ground rupture, shaking, ground failure or landslides.
2. Located on a geologic unit or soil that is unstable or that would become unstable as a result of the project.

b. Seismic Hazards

In order to develop the project, the site will be graded to establish drainage patterns, create building pads and roadway bed, and trenched for utilities. A total of 20,305 cubic yards of soil will be moved in a balanced operation. The primary geotechnical hazards associated with development of the property are described below.

1. *Ground Shaking*

The proposed project would be subject to ground shaking in the event of an earthquake along any of major faults in the vicinity. Strong ground shaking can result in serious damage to structures, personal injuries, including loss of life, damage to property, and economic and social dislocations. The proposed project would result in the construction and occupancy of residential uses, and therefore has the inherent potential to subject persons to ground shaking-related hazards. However, recommendations and specifications of the geotechnical engineering study would guide the design and construction of the proposed project, and are intended to mitigate seismic impacts. In addition, the project would be required to conform to the latest edition of the Uniform Building Code (UBC), which includes design measures to mitigate against seismic hazards. UBC and City of San Dimas building standards would be enforced through review of plans and inspection of structures during construction. By incorporating recommendations of the geotechnical engineering study and complying with the UBC and City of San Dimas standards, project impacts related to ground shaking would be less than significant. Recommendations of the geotechnical engineering study related to grading and construction are also intended to mitigate seismic hazards, and are identified as mitigation measures later in this section.

2. *Liquefaction, Settlement & Lateral Spreading*

Richard Mills Associates, Inc., of Ontario California conducted a soil investigation of this site in 1978. The complete report is on file at the City of San Dimas offices and is incorporated herein by reference. The soils study found that generally the soils would have adequate bearing capacity for the intended use when properly compacted. However, the upper layers of soils are loose and compressible and will have to be pre-compacted at depths below normal footing lines. Assuming compliance with these recommendations, the occurrence of potential secondary seismic hazards, such as liquefaction and seismically induced settlement, affecting the subsoils of the site is considered to be nil. These hazards occur where alluvial or low-density soils are underlain by a shallow water table. These conditions do not exist at this project site.

4.1.4 CUMULATIVE PROJECT IMPACTS

Many geologic hazards such as unstable soils, ground shaking, liquefaction, and lateral spreading are site specific in nature and do not contribute to cumulative impacts. A potential geologic impact of the project that can be cumulative in nature is land subsidence. However, the proposed project would not involve activities (i.e., permanent extraction of groundwater or oil resources) that would be capable of causing regional land subsidence, and therefore would not contribute to any cumulative impacts of that nature. From a geotechnical point of view, Tentative Tract 52717 can be safely developed as proposed, provided the recommendations presented below are implemented during preparation of the grading plan, rough grading and residential construction. Considering the above, the proposed project would not result in any cumulatively significant geologic impacts.

4.1.5 MITIGATION MEASURES

a. Legal/Regulatory Requirements

4.1-1 All structures shall be designed in accordance with the Uniform Building Code (UBC) and applicable City codes to ensure safety in the event of an earthquake.

4.1-2 Grading shall comply with the provisions outlined in Section 18.504.110 of Specific Plan No. 4 and at a minimum shall conform to Chapter 33 of the Uniform Building Code.

b. Measures Recommended by this EIR

4.1-3 All recommendations contained in the site specific geotechnical study shall be implemented during project design and construction.

4.1.6 UNAVOIDABLE SIGNIFICANT IMPACTS

With inclusion of all mitigation measures, no unavoidable significant geologic-related impacts would result from the proposed project.