4.9 Geology and Geotechnical Hazards

SUMMARY

The project site is within a relatively flat alluvial plain comprised of deep sediment. Although the project region has experienced relatively little seismic activity, ground motion experienced in the neighboring San Francisco Bay Area suggests that the County could be affected by seismic activity at sometime in the future. Based on a preliminary soil investigation, on-site soils are considered to have a low to moderate potential for expansion and are not considered to be liquefaction-sensitive. The soils are also considered capable of supporting concentrated loads with very little settlement. Potential impacts related to geotechnical hazards would be addressed through standard engineering measures, as recommended by a site-specific geotechnical study.

INTRODUCTION

The following analysis was prepared based on information obtained from a variety of sources. Information specific to the project site was obtained primarily from the Preliminary Soils Investigation, for the Lent Ranch property, prepared by Raney Geotechnical in September 1996. Other documents utilized in this analysis are listed below:

- Phase I Environmental Site Assessment, Lent Ranch Property, Elk Grove, California, Dames & Moore, Inc., October 1996;
- Sacramento County General Plan Update Environmental Impact Report, Sacramento County Department of Review and Assessment, February 1992;
- Sacramento County General Plan Safety Element, County of Sacramento Planning and Community Development Department, December 1993.
- United States Department of Agriculture, Soil Conservation Service, Soil Survey of Sacramento County, California, June 1991.
- Geologic Hazards Report Lent Ranch Marketplace, Kammerer Road and West Stockton Boulevard, Elk Grove, Sacramento County, California, Wallace-Kuhl & Associates, Inc., August 14, 2000.

EXISTING CONDITIONS

Regional Geology and Soils

The majority of Sacramento County lies within the Great Valley geomorphic province (areas with similar geologic origin and erosional/depositional history). The Great Valley province is a relatively flat alluvial plain comprised of deep sediment. It is bounded on the north by the Klamath and Cascade mountain ranges, on the east by the Sierra Nevada Mountains, and on the west by the California Coast Mountain

Range. The Valley has been filled with sediment derived from both marine and continental sources. Older sediments are mainly from marine sources associated with an ancient sea that occupied the Sacramento Valley floor. As the sea receded approximately 10 to 15 million years ago, tectonic activity created uplifting that was subsequently followed by glaciation and volcanism, all of which contributed additional layers of sediment on the Valley floor.[1]

The deepest layer of rock underlying the Valley is Mesozoic intrusive igneous rock extending from the Sierra Nevada Mountains. Overlying the igneous rock are siltstone, claystone, and sandstone sedimentary rocks at least 10,000 feet thick. The upper 3,000 feet of soil consists of fluvial deposited sediments eroded from the mountains to the north and east. This layer is comprised of silty clay and sand deposits with layers of gravel.[2]

Faults and Groundshaking

Faults

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. **Table 4.9-1** 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 the earthquake is felt by people. The higher numbers of the scale are based on observed structural damage. For example, an earthquake with an intensity of III would be felt quite noticeably by persons 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.

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1 County of Sacramento Planning and Community Development Department, Sacramento County General Plan Safety Element, December 1993.

2 Sacramento County Department of Review and Assessment, Sacramento County General Plan Update Environmental Impact Report, February 1992.

Table 4.9-1
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.
		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, 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

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.

No known active faults or Alquist-Priolo earthquake hazard zones (formerly known as special study zones) occur in Sacramento County, although several inactive subsurface faults are identified in the Delta.[3] **Table 4.9-2, Faults in Vicinity of Sacramento County**, identifies known faults in the vicinity of Sacramento County and the maximum magnitude associated with each fault.

Table 4.9-2
Faults in Vicinity of Sacramento County

Name	Approximate Distance from Project Area (Miles)	Maximum Magnitude (MW)
Foothills Fault System	21	6.5
Great Valley Fault (segment 5)*	27	6.5
Great Valley Fault (segment 4)*	29	6.6
Greenville Fault	41	6.9
Concord –Green Valley Fault	42	6.9
Hunting Creek – Barryessa Fault	45	6.9
West Napa Fault	49	6.5
Calaveras Fault	50	6.8
Rodgers Creek Fault	56	7.0
Hayward Fault	59	7.1
Bartlett Springs Fault	72	7.1
Maacama Fault (south)	73	6.9
Collayomi Fault	76	6.5
Ortigalita Fault	76	6.9
San Andreas Fault (1906)	76	7.9
San Gregorio Fault	78	7.3
Monte Vista - Shannon Fault	80	6.8
Mohawk Valley-Honey Lake Fault Zone	82	7.3
Point Reyes Fault	82	6.8
Genoa	87	6.9
Sargent	91	6.8
Zayante-Vergeles	94	6.8

- Nine segments of the Great Valley Fault are located 27 to 91 miles west of the site and have maximum magnitudes of 6.4 to 6.8

Source: Wallace-Kuhl Associates, August 14, 2000.

According to the *Fault Activity Map of California*, the nearest faults to the site with Historic displacement (activity within the last 200 years) are the Concord, Hayward, and Cleveland Hill faults, located approximately 42 miles southwest, 59 miles southwest, and 72 miles north of the site, respectively. Portions of the Greenville and Calaveras fault zones also have been rated as being active within the last 200 years and those portions are located approximately 46 and 53 miles southwest of the site, respectively; however, the major portion of these faults are indicated to be of Holocene activity (activity

3 Ibid.

within the last 10,000 years). Other Holocene faults within 100 miles of the site are the Dunnigan Hills (Zamora) (37 miles northwest), Green Valley (42 miles southwest), Hunting Creek (45 miles west), Healdsburg-Rodgers Creek (56 miles southwest), and West Napa (49 miles southwest). Distances from faults are measured from the center of the property.

The closest fault to the site shown on the *Fault Activity Map* is the south end of a queried trace of the northwest-southeast trending pre-Quaternary Willows fault zone, located approximately 10 miles north of the site.

The Great Valley Fault is not indicated on the *Fault Activity Map*, but is considered to be a factor in determining seismic risk potential. In the north Central Valley, the width of the zone extends from the eastern flanks of the Coast Ranges as far easterly as Dunnigan. This zone of potential faulting is not well understood, but is believed to be connected to the Vacaville-Winters earthquakes of 1892 and the Coalinga earthquake of 1983. Earthquake activity within the Great Valley fault zone often occurs on "blind thrusts" in reference to their lack of surface expression and the direction of fault offset.

The *Seismic Safety Element of the General Plan for the County of Sacramento* (1985) shows two faults influential to Sacramento County: the Midland fault zone, located approximately 20 miles west, and the Bear Mountains fault zone, located approximately 21 miles east of the site; these faults are mapped as pre-Quaternary (older than 1.6 million years) and late-Quaternary (activity within the last 700,000 years). The *Seismic Safety Element* also shows two short traces of a "Linda Creek fault" at the north edge of Sacramento County; however, these traces are not depicted on any current California Department of Conservation, Division of Mines and Geology or USGS references that we reviewed.

The Midland fault zone is considered to be a deep pre-Oligocene subsurface feature extending nearly 50 miles along the west side of the Sacramento Valley. This fault has been approximately located only from exploration work for natural gas reserves. Subsurface data indicate that there has been no appreciable movement on the Midland fault in the last 24 to 36 million years, and no evidence of surface expression has been found.

The Bear Mountains fault is the westerly-most fault within the Foothills fault zone, which consists of numerous northwesterly trending faults along the western edge of the Sierra Nevada range. The Foothills fault zone is generally bounded by the Bear Mountains and the Melones fault zones (Wagner, 1981). The closest segment of the Bear Mountain fault is approximately 21 miles northeast of the site; the closest segment of the Melones fault zone is 30 miles east of the planned Lent Ranch Marketplace. Faults within this belt are mapped as pre-Quaternary with some segments mapped as having late-Quaternary displacement (Jennings, 1994). The closest segment of the Foothills fault system with late-Quaternary displacement is located approximately 34 miles northeast of the site (the Rescue lineament of the Bear Mountains fault zone)

Historic Groundshaking

Data pertinent to the greatest historical earthquakes that has affected the project site was obtained from the EQSEARCH computer program database. The EQSEARCH database was developed by extracting records of events greater than magnitude 4.0 from the Department of Mining and Geology (DMG) Comprehensive Computerized Earthquake Catalog, supplemented by records from the USGS, University of California, Berkeley, the California Institute of Technology, and the University of Nevada at Reno. A list of historic epicenters within 100 miles of the site is contained with the Wallace-Kuhl report in **Appendix 4.9** of this EIR.

Based on the EQSEARCH, the most intense earthquake ground shaking in the vicinity of the project site resulted from the M_g 8.25 San Francisco earthquake of April 18, 1906, with an epicenter located approximately 77 miles southwest of the site. In addition, the Vacaville-Winters events of April 19 and 21, 1892 are estimated to have produced a local intensity roughly equivalent to the 1906 San Francisco event. The larger Vacaville-Winters earthquakes were of magnitude 6.4 and 6.2, with epicenters located approximately 34 and 30 miles northwest of the project site.

Geologic Hazards

The following is a general description of the types of geologic hazards that can occur. An evaluation of the potential for such hazards to occur at the project site is presented later in this section.

Liquefaction

Liquefaction refers to an unstable ground condition in which water-saturated soils are transformed from a solid to semi-liquid state due to a sudden shock or strain. It is most likely to occur in low-lying areas of poorly consolidated to unconsolidated water-saturated sediments or similar deposits of artificial fill. Areas underlain with alluvial deposits containing silt or sand are highly susceptible during seismic events.

Subsidence

Subsidence is the gradual settling of the earth's surface with little or no horizontal motion. Land within Sacramento County is subject to five types of subsidence: 1) compaction of unconsolidated soils by seismic activity; 2) compaction by heavy structures; 3) erosion of peat soils; 4) oxidation of peat; and 5) groundwater withdrawal.

Expansive Soils

Expansive soils are primarily comprised of clays, which increase in volume when water is absorbed and shrink when dry. Expansive soils are of concern since building foundations may rise during the rainy season and fall during dry periods in response to the clay's action. If movement varies under different parts of the building, structural portions of the building may distort.

On-Site Characteristics

Soils

The Sacramento County Soil Survey, prepared by the United States Department of Agriculture, Natural Resource Conservation Service, classifies on-site soils within the San Joaquin soil group. Soils within this group were formed in alluvium derived from granitic rock and are suited to irrigated hay, pasture and other irrigated crops. Specific soil types found on-site are identified below; a detailed description of their characteristics is presented in **Section 4.1, Agricultural Resources**.

- Galt clay – This is a moderately well drained soil found on low terraces. The surface layer is typically grayish brown clay with a fine texture surface layer.
- San Joaquin silt loam – This soil type is moderately well drained with a surface layer of silt loam. The subsoil is a claypan with a slow permeability.
- San Joqauin-Durixeralfs complex – This soil unit is a mix of 55 percent San Joaquin soil and 35 percent Durixeralfs soils. The San Joaquin soil is found in areas that are relatively undisturbed, while Durixeralfs are in cut areas from which most or the entire surface layer has been removed. This soil unit contains a strong silt loam that is moderately well drained. Below the silt loam is a reddish clay loam underlain by hardpan.

To determine site specific soil and subsurface conditions, Raney Geotechnical conducted surface sampling and ten soil borings distributed throughout the property. Boring and sampling locations are identified in Plate 1 of the preliminary soil investigation contained in **Appendix 4.9** of this Draft EIR. Soil sampling indicates that near surface soils are dominated by silts and lean clays with a stiff consistency. Sandy soils incise the hard silts and stiff clay at depth. Within one to three feet of ground surface, soil consistency is very hard and poorly drained.

Faults and Groundshaking

No active or potentially active faults pass through the project site based on published geologic maps. In addition, the project site is not located within an Alquist-Priolo Fault Study Zone, and Wallace-Kuhl & Associates, Inc observed no surface evidence of faulting on the project site.

The project site itself lies on the boundaries of seismic zones I and II as defined by the California Department of Mines and Geology on the Preliminary Map of Maximum Expectable Earthquake Intensity in California. A seismic zone I is an area that can expect to experience ground motion of low severity; seismic zone II is an area with potential ground motion of moderate severity.

The proposed project site has experienced ground shaking equivalent to Modified Mercalli Intensity Zone VIII. Uses and people in this zone can experience slight damage in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse; and extensive damage in poorly built structures. Ground shaking of this intensity could cause panel walls to be thrown out of frame structures. In addition, such movement could cause chimneys, factory stacks, columns, monuments, and walls to fall. Heavy furniture may be overturned, and persons driving automobiles may be disturbed.

Geologic Hazards

Based on the results of the preliminary soil investigation, on-site soils are considered to have a low to moderate potential for expansion and are considered capable of supporting concentrated loads with very little settlement. With regard to liquefaction, monitoring well data obtained during preparation of the soil investigation indicates that the groundwater table in the vicinity of the project site is at a depth of more than 100 feet below the ground surface. Free groundwater was not encountered during soil borings, which extended to a depth of 30 feet below ground surface. Thus, site soils are not considered to be liquefaction sensitive.

PROJECT IMPACTS

Thresholds of Significance

According to Appendix G of the CEQA *Guidelines* (Environmental Checklist Form), a project could have a significant effect on the environment when it would:

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury or death involving:

   i) 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 or other substantial evidence of a known fault. Refer to Division of Mines and Geology Special Publication 42;

   ii) Strong seismic ground shaking;

   iii) Seismic-related ground failure, including liquefaction;

   iv) Landslides;

b) Result in substantial soil erosion or the loss of topsoil;

c) 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;

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property; or

e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

Based on the analysis in the Initial Study, some potential impacts were determined to be less than significant, and thus were not analyzed in this EIR. Those impacts included the potential for landslides (because the site is relatively flat), and the capability of the soils for supporting septic tanks (because no septic system is proposed).

Analysis

On-Site Development

Fault Rupture

There are no known faults crossing through the project site. The site is not located in an Alquist-Priolo earthquake hazard zone. As such, ground rupture due to faulting is considered to be unlikely. No significant impacts are expected to occur.

Groundshaking

Maximum Probable Earthquake

The Maximum Probable Earthquake (MPE) is defined in Section 1631A.2 of the 1997 edition of the Uniform Building Code (UBC) as "having a 10-percent probability of being exceeded in 50 years." This probability of exceedance also can be expressed as the 475-year event. Criteria for determining the MPE include: the regional seismicity and known past seismic activity; the types of faults considered; the seismic recurrence factor for the area and for faults located within a 100 kilometer (63 mile) radius; and, the computed probability of seismic activity associated with the faults located within the 100 kilometer radius.

Wallace-Kuhl analyzed the probability of earthquake activity surrounding the site utilizing the FRISKSP computer model and assuming the cumulative effect of fault activity within a 100-mile (160 km) radius of the project site. From a statistical viewpoint, the site has a 10 percent probability of exceeding 0.17gravity (g)[4] horizontal ground acceleration in 50 years.

People at the site would experience earth movement equivalent to VIII on the Modified Mercalli Scale based on a ground acceleration of 0.17g. This equates to a magnitude 6.0-6.9 on the Richter scale. Damage would be slight in specially designed structures, but considerable damage may occur in ordinary buildings. The intensity of such earth movement could cause falling chimneys, factory stacks, column monuments, and walls. Heavy furniture would also be overturned if not properly strapped.

Upper Bound Earthquake

The Upper Bound Earthquake (UBE) is defined in the California Building Code (CBC) Section 1631A.2.6 "…as the motion having a 10-percent probability of being exceeded in a 100-year period <u>or</u> maximum level of motion which may ever be expected at the building site within the known geologic framework." This probability of exceedance also can be expressed as a 950-year event. Criteria for determining the UBE event include the seismic history of the vicinity, the geologic province in which the faults under consideration are located, fault lengths, faulting mechanisms and regional geologic structure.

Wallace-Kuhl assumed a magnitude 6.5-earthquake occurring on the Foothills Fault system would produce the maximum level of motion possible at the project site. The horizontal ground acceleration

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4 Gravity is a constant 32 feet per second.

component associated with a 6.5 magnitude event occurring approximately 21 miles (34 km) east of the site, using published attenuation relationships, would be approximately 0.17g. This equates to VIII-IX on the Mercalli scale.

Furthermore, the probability of earthquake activity affecting the site indicates a 10-percent probability of exceeding 0.19g horizontal ground acceleration in 100 years. This is approximately equal to the maximum possible ground motion that could be generated at the project site.

10,000-Year Earthquake

The 10,000-year earthquake event is an event that has a 10 percent probability of being exceeded in 1054 years. In other words, it is the event that has a 90 percent probability of <u>not</u> being exceeded in 1054 years. The maximum horizontal ground acceleration associated with the 10,000-year event was determined using the same methods described above for the UBE and MPE events. Statistically, the site has a 10 percent probability of exceeding a peak horizontal ground acceleration of 0.3g

To put this in perspective, it would be necessary to have an earthquake magnitude of 7.5 on the Foothills Fault zone to produce this level of ground motion. This is not considered to be realistic magnitude for this fault zone. Similarly, 0.3g horizontal ground acceleration would be generated by a theoretical (but unrealistic) 9.7 magnitude earthquake on the San Andreas Fault zone (at its nearest point to the site). However, the San Andreas Fault zone is only considered capable of producing a maximum 7.9 moment magnitude earthquake.

In the unlikely event such an earthquake were to occur, people at the site would experience severe movement equivalent to an intensity of IX on the Modified Mercalli Scale based on a ground acceleration of 0.3g. Damage would be considerable in specially designed structures, with well-designed frame structures thrown out of plumb. Damage would be great in substantial buildings, with partial collapse. Buildings would also shift off foundations.

Conclusion

The proposed project site, as with virtually all sites within the State of California, would be subjected to ground shaking from earthquakes. Based upon the seismologic and geologic conditions surrounding the site, the maximum level of ground motion that could ever be experienced at the project site would occur as the result of a 6.5 magnitude earthquake on the Foothills Fault zone or Great Valley fault, as discussed under the upper bound earthquake, above. Nonetheless, the design of the proposed structures in conformance with the 1997 edition of the UBC, Seismic Zone 3, should be sufficient to prevent significant damage from ground shaking during seismic events resulting from movement on any of the faults or fault systems discussed within this EIR. The purpose of this Code is to provide minimum standards to preserve the public peace, health and safety by regulating the design, construction, quality of materials, use, occupancy, location and maintenance of all buildings, structures, grading and certain equipment. Standards address foundation design, shear wall strength, among others. As a result, the effects resulting from ground shaking would be reduced to a minimum and is considered to be less than significant.

Liquefaction

The potential for soil liquefaction under earthquake shaking is considered minimal due to the depth to the groundwater beneath the site and the nature of on-site soils. As proposed, the structures on site would be supported by deep foundations and soils on the project site would be properly compacted and all debris would be removed. Therefore, no significant impacts are expected.

Short Term Construction Impacts (Erosion)

Impact 4.9-1 Grading and Earthwork necessary to construct the project could result in wind and water driven erosion of soils. This is considered a significant impact.

The site grading and construction phases of the project would involve earth movement and the use of heavy machinery. Unless preventive control measures are implemented, short-term wind- and water-driven erosion of soils from the project site could occur during grading and construction, which is considered a significant impact if not properly mitigated.

Under the requirements of the Clean Water Act amendments of 1972, the project construction contractor would be required to file a notice of intent under the State's NPDES General Construction Permit (CAS00002). The Project applicant would be required to adhere to conditions under the NPDES permit set forth by the Regional Water Quality Control Board (RWQCB), and prepare and submit a Storm Water Pollution Prevention Plan (SWPPP) to be administered throughout all phases of grading and project construction. The SWPPP would incorporate Best Management Practices (BMPs) to ensure that potential water quality impacts during construction phases are minimized. BMPs that would be implemented during site grading and construction are listed as mitigation measures in **Section 4.7, Hydrology and Water Quality**, of this EIR. Implementation of those measures would reduce potential erosion and sedimentation impacts to below a level considered significant.

In addition, the SWPPP would require that if any spills of materials known to be water pollutants or hazardous materials do occur, the proper agencies would be contacted immediately (if necessary) and appropriate clean-up of the spill would take place as soon as possible. The NPDES construction permit application approval conditions set forth by the RWQCB would dictate the actual measures and requirements of the project SWPPP and any other provisions deemed necessary.

Finally, the project is subject to the City Land Grading and Erosion Control Ordinance. This ordinance establishes administrative procedures, minimum standards for review, and implementation and enforcement procedures for controlling erosion, sedimentation, disruption of existing drainage and related environmental damage caused by land clearing activities, grading, filling, and land excavation. The ordinance applies to all projects that will disturb 350 cubic yards or more of soil.

Soil Stability

The soils beneath the site exhibit significant strength and are considered capable of supporting relatively heavy concentrated loads with very little settlement. Near-surface soils are capable of supporting light loads and pavements if they are remedially reworked. Through proper design methods articulated in the geotechnical feasibility report, potential impacts related to soil stability would be reduced to a less-than-significant level.

Expansive Soils

The site is located in an area with a low to moderate shrink-swell potential. When structures are located on expansive soils, foundations have the tendency to rise during the wet season, and sink during the dry season. Movements can vary under the structures, which in turn create new stresses on various sections of the foundation and connected utilities. These variations in ground settlement can lead to structural failure and damage to infrastructure. As proposed, the structures on site would be supported by properly designed foundations and soils on the project site would be properly compacted and treated (chemically stabilized) to minimize the shrink-swell potential. Therefore, with the implementation of standard UBC requirements as specified in the City Building Code and the preparation of soils reports and incorporation of recommendations as required by the City, potential impacts would be reduced to a less than significant level.

Off-Site Infrastructure

Seismic Hazards

As with all locations within the State of California, the infrastructure alignments are on land that would be subjected to ground shaking from earthquakes. Based upon local and regional seismologic and geologic conditions surrounding the site, the maximum level of ground motion that could ever be experienced in the area would occur as the result of a 6.5 magnitude earthquake on the Foothills Fault zone or Great Valley fault, as discussed under the upper bound earthquake, above. Nonetheless, the design of all infrastructure in conformance with the 1997 edition of the UBC, Seismic Zone 3, would be sufficient to prevent significant damage from ground shaking during seismic events resulting from movement on any of the faults or fault systems discussed within this EIR.

Short Term Construction Impacts

Impact 4.9-2 **Trenching and grading for installation of off-site infrastructure could result in wind and water driven erosion of soils. This is considered a significant impact.**

All off-site construction activity will be subject to the same Storm Water Pollution Prevention Plan and City Land Grading and Erosion Control Ordinance required for development of the project site. Implementation of the Best Management Practices during construction will mitigate short-term wind and water driven soil erosion.

PROJECT MITIGATION MEASURES

See **Section 4.7, Hydrology and Water Quality**, for mitigation to reduce potential impacts associated with erosion.

CONSISTENCY WITH GENERAL PLAN POLICIES

Table 4.9-3 identifies the General Plan Conservation Element policies that are directly applicable to the proposed project, and presents an evaluation of the consistency of the project with these statements. The final authority for interpretation of these policy statements, and determination of the project's consistency rests with the City Council.

Table 4.9-3
General Plan Policy Consistency - Geology and Geotechnical Hazards

General Plan Policies	Consistency with General Plan	Analysis
Policy CO-14: Roads and structures shall be designed to minimize grading on slopes above 20 percent.	Not Applicable	The Project site is basically flat and there are no slopes above 20 percent.

CUMULATIVE IMPACTS

Geotechnical impacts tend to be site specific rather than cumulative in nature and each development site would be subject to, at a minimum, uniform site development and construction standards relative to seismic and other geologic conditions that are prevalent within the region. Because the development of each site would have to be consistent with requirements of the City and the Uniform Building Code as they pertain to protection against known geologic hazards, impacts of cumulative development would be less than significant given known geologic considerations.

Impacts regarding surficial deposits, namely erosion and sediment deposition, can be cumulative in nature within a watershed. Buildout of approved and planned uses such as the East Franklin Specific Plan, Laguna Ridge Specific Plan area, South Point planning area, and the Grant Line interchange improvements has the potential to impact water quality. However, with implementation of Best Management Practices required by the NPDES permit and City Land Grading and Erosion Control Ordinance for each development project, cumulative erosion within the watershed will not exceed natural levels and significant cumulative impacts related to erosion will not occur.

CUMULATIVE MITIGATION MEASURES

No impacts are expected to occur related to cumulative development; therefore, cumulative mitigation is not required.

UNAVOIDABLE SIGNIFICANT IMPACTS

Project and cumulative impacts would be less than significant.