APPENDIX F

Preliminary Geotechnical Evaluation

PRELIMINARY GEOTECHNICAL EVALUATION
PROPOSED COMMERCIAL SHOPPING CENTER
NORTHWEST CORNER OF
60TH STREET WEST AND AVENUE K
APN 3203-018-006
LANCASTER, CALIFORNIA

PREPARED FOR:

ESA Community Development
707 Wilshire Boulevard, Suite 1450
Los Angeles, California 90017

PREPARED BY:

Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
475 Goddard, Suite 200
Irvine, California 92618

June 26, 2007
Project No. 207103001

June 26, 2007
Project No. 207103001

Ms. Deborah H. Kirtman
ESA Community Development
707 Wilshire Boulevard, Suite 1450
Los Angeles, California 90017

Subject: Preliminary Geotechnical Evaluation
Proposed Commercial Shopping Center
Northwest Corner of 60th Street West and Avenue K
APN 3203-018-006
Lancaster, California

Dear Ms. Kirtman:

In accordance with your request and authorization, please find enclosed the results of our preliminary geotechnical evaluation for a proposed commercial shopping center at the northwest corner of 60th Street West and Avenue K in Lancaster, California. Our study was conducted in accordance with the scope of services presented in our subconsulting services agreement dated March 15, 2007. We understand that the results of this study will be utilized in the preparation of an Environmental Impact Report (EIR) for the proposed project.

We appreciate the opportunity to provide geotechnical consulting services to you.

Sincerely,
NINYO & MOORE

Original Document Signed By:

Michael E. Rogers, C.E.G.
Senior Project Geologist

Original Document Signed By:

Carol A. Price, C.E.G.
Principal Geologist

Original Document Signed By:

Jalal Vakili, Ph.D., P.E.
Principal Engineer

MER/CAP/JV/emp

Distribution: (3) Addressee

TABLE OF CONTENTS

Page

1. INTRODUCTION 1
2. SCOPE OF SERVICES 1
3. PROJECT DESCRIPTION 2
4. SITE DESCRIPTION 2
5. GEOLOGY 3
  5.1. Regional Geology 3
  5.2. Local Geology 4
  5.3. Groundwater 4
6. FAULTING AND SEISMICITY 5
  6.1. San Andreas Fault Zone 7
  6.2. San Gabriel Fault Zone 7
  6.3. Garlock (West) Fault Zone 7
  6.4. Sierra Madre Fault 8
  6.5. Santa Susana Fault 8
  6.6. Northridge (East Oak Ridge) Fault 8
  6.7. Clamshell-Sawpit Fault 9
  6.8. Puente Hill Blind Thrust Fault 9
  6.9. Newport Inglewood (Los Angeles Basin) Fault 9
  6.10. White Wolf Fault 10
  6.11. Whittier Fault (Elsinore Fault Zone) 10
7. METHODOLOGY FOR GEOLOGIC IMPACT AND HAZARD ANALYSES 10
8. THRESHOLDS OF SIGNIFICANCE 11
9. POTENTIAL GEOLOGIC AND SEISMIC IMPACTS/HAZARDS 12
  9.1. Surface Fault Rupture 12
  9.2. Seismic Ground Shaking 12
  9.3. Liquefaction 13
  9.4. Landslides and/or Mudflows 14
  9.5. Soil Erosion 14
  9.6. Subsidence 14
  9.7. Compressible/Collapsible Soils 15
  9.8. Expansive Soils 15
  9.9. Corrosive Soils 16
  9.10. Groundwater 16
  9.11. Distinctive Geologic or Topographic Features 17
  9.12. Excavations 17
  9.13. Dam Inundation 18
  9.14. Seiches and Tsunamis 18

9.15. Mineral Resources 19

10. MITIGATION OF POTENTIAL GEOLOGIC IMPACTS/HAZARDS 19
10.1. Seismic Ground Shaking 19
10.2. Soil Erosion 20
10.3. Compressible/Collapsible Soils 20
10.4. Corrosive Soils 20
10.5. Excavations 21

11. LIMITATIONS 21

12. SELECTED REFERENCES 23

Tables

Table 1 – Principal Regional Active Faults 6
Table 2 – Summary of Potential Geologic Impacts/Hazards 11

Figures

Figure 1 – Site Location Map
Figure 2 – Geologic Map
Figure 3 – Fault Location Map

1. INTRODUCTION

In accordance with your request and authorization, we have performed a preliminary geotechnical evaluation for a proposed commercial development located at the northwest corner of 60th Street West and Avenue K in Lancaster, California (Assessor's Parcel Number [APN] 3203-018-006). The City of Lancaster has proposed General Plan Amendment 05-01 for a proposed 140,000-square-foot commercial shopping center located on this approximately 17-acre site and has requested an Environmental Impact Report (EIR) for the planned development. In accordance with the California Environmental Quality Act (CEQA), the EIR will include geotechnical evaluation of the impacts associated with potential geologic and seismic hazards.

Our geotechnical evaluation was based on review of readily available published geotechnical literature pertinent to the project site and site reconnaissance to develop preliminary conclusions regarding the proposed project's impact on the geologic environment and the potential geologic hazards that may affect the project. Where appropriate, measures to mitigate potential geologic hazards, as noted in this report, have been provided.

2. SCOPE OF SERVICES

Ninyo & Moore's scope of services has included review of background materials and geologic reconnaissance of the study area. Specifically, we have performed the following tasks:

- Review of readily available geologic maps, seismic data, published literature, aerial photographs, in-house information, and geotechnical aspects of the City of Lancaster General Plan.
- Geotechnical site reconnaissance by a representative from Ninyo & Moore conducted on May 16, 2007, to observe and document the existing surface conditions at the project site.
- Assessment of the general geologic conditions and seismic hazards affecting the area and evaluation of their potential impacts on the project.
- Compilation and analysis of existing geotechnical data pertaining to the site.
- Preparation of this report presenting the results of our study, as well as our conclusions and recommendations relative to the geotechnical aspects of the project's conceptual design and construction to be included in the EIR.

3. PROJECT DESCRIPTION

The City of Lancaster has proposed General Plan Amendment 05-01 for development of a commercial project located at the northwest corner of 60th Street West and Avenue K. Development of the approximately 17-acre site is proposed to consist of a 140,000-square-foot commercial shopping center and three fast food restaurant pads. In addition to these planned building pads, we anticipate that the project will also include construction of underground utilities, pavements, and associated hardscape improvements.

4. SITE DESCRIPTION

The site of the proposed project is located in a relatively level portion of the Antelope Valley approximately 5 miles west of State Highway 14 on the west side of the City of Lancaster. The property is situated in the western corner of the Mojave Desert on an alluvial fan/flood plain north of the Sierra Pelona Mountains. Topography of the site is relatively level and slopes gently down to the northwest, varying from an approximate elevation of 2,388 feet relative to mean sea level (MSL) near the southeast corner of the site to approximate elevation 2,375 MSL near the northwest corner of the site.

The project site is a rectangular parcel of approximately 17 acres bounded by Avenue K to the south, 60th Street West to the east, and residential developments on the north and south (Figure 1). The site was formerly a nine-hole golf course (Meadowlark Golf Course) and now consists primarily of vacant land with four abandoned buildings, a shed, and a water tank located in the southeast part of the site. Based on information from the Los Angeles County's Assessor's office, two of the structures located close to West Avenue K are wood-framed, single-family residences that were built in the 1940s. Two additional wood-framed buildings, reportedly built in the 1960s, are located north of the single-family residences along 60th Street West. These buildings were reportedly used as a golf pro-shop and equipment storage building as part of the site's former golf course. Evidence of the former golf course is limited to the abandoned structures and a dry, concrete-lined pond located in the northern part of the site.

No surface water was observed on the project site. Vegetation on the site consists of grasses, a few bushes, and scattered trees. Piles of dumped soil and construction debris were observed on the site.

5. GEOLOGY

5.1. Regional Geology

The proposed project site is located within the western corner of the Mojave Desert Geomorphic Province. The Mojave Desert Geomorphic Province is characterized by mountain ranges and hills of moderate relief that are partially buried and separated by broad alluviated basins like the Antelope Valley. The western part of the province in the project vicinity forms a wedge-shaped block bounded by the San Andreas fault zone on the southwest and the Garlock fault zone on the northeast; the province extends eastward to the Colorado River. The Antelope Valley comprises this wedge-shaped corner of the province, surrounded by the uplifted Tehachapi Mountain range to the north/northwest and the uplifted Liebre Mountains, Sierra Pelona, and San Gabriel Mountains to the south/southwest (City of Lancaster, 2007).

The geology of the region consists of older, pre-Tertiary age crystalline basement rocks comprising granite, quartz monzonite, gabbro, schist, gneiss, and other igneous and metamorphic rocks. Younger Tertiary age volcanic and sedimentary formations of marine and non-marine origin overlie the basement rocks. These formations contain units of sandstone, siltstone, shale, conglomerate, and undifferentiated pyroclastic and intrusive volcanic rocks. Younger Quaternary age alluvial sediments overlie the bedrock in the Antelope Valley area, deposited as a result of uplift and erosion of the surrounding mountains. The alluvial sediments in the Antelope Valley may exceed depths of 2,000 feet in some areas (City of Lancaster, 2007).

5.2. Local Geology

Regional geologic mapping indicates that the near-surface earth materials underlying the project area consist primarily of sand, silt, and gravel soils from alluvial deposits in the Antelope Valley. More detailed surficial mapping by the California Geological Survey (CGS, 2005) indicates that the project site is covered by two different alluvial units: Q4c, the predominant unit which covers much of the southern and western portions of the site, and Q6c, which is mapped for the eastern/northeastern part of the site (Figure 2).

The Q4c unit is described as late-Pleistocene alluvial fan deposits that are unconsolidated, uplifted, and slightly dissected. Alluvial fan deposits are typically comprised of sand and gravel sediments. These coarse materials are further described as having moderately developed soils with distinct soil horizons and clay accumulations. The Q6c unit is described as late-Pleistocene to Holocene alluvial fan and wash sediments that are unconsolidated, mainly medium-grained sands. Soils developed on the Q6c alluvial materials are described as weakly developed (CGS, 2005).

Fill soils are present on the project site, related to grading for the previous development and from dumping of materials on the site. Mounded areas of irregular topography for the former golf course indicate that fill soils are present, in addition to piles of dumped soil and construction debris that were observed during our site reconnaissance. Surface soils observed at the site consist of light brown, gravelly sand to silty sand.

5.3. Groundwater

According to the City of Lancaster's 2007 General Plan, the site is located within the Antelope Valley Groundwater Basin. The general plan reports the depth to groundwater at 100 feet or more below the ground surface in the general site vicinity. The historic high groundwater level in the vicinity of the site is reported by the CGS to be at a depth of approximately 175 feet (CGS, 2005).

Groundwater levels may be influenced by seasonal variations, precipitation, irrigation, soil/rock types, groundwater pumping, and other factors and are subject to fluctuations. Shallow perched conditions may be present in places.

6. FAULTING AND SEISMICITY

The proposed commercial site is located in a seismically active area, as is the majority of southern California. The numerous faults in southern California include active, potentially active, and inactive faults. As defined by the CGS, active faults are faults that have ruptured within Holocene time, or within approximately the last 11,000 years. Potentially active faults are those that show evidence of movement during Quaternary time (approximately the last 1.6 million years), but for which evidence of Holocene movement has not been established. Inactive faults have not moved in the last approximately 1.6 million years.

Based on our background review and site reconnaissance, the ground surface in the vicinity of the proposed commercial site is not transected by known active or potentially active faults. The site is not located within a State of California Seismic Hazard Zone (CGS, 2005) or Earthquake Fault Zone (Alquist-Priolo Special Studies Zone, Hart and Bryant, 1997). However, the site is located in a seismically active area, as is the majority of southern California, and the potential for strong ground motion at the site is considered significant. Figure 3 shows the approximate site location relative to the major faults in the region.

Based on our document review, the active San Andreas fault is located approximately 5 miles southwest of the site. Known active faults within approximately 30 miles of the project site include the San Andreas, San Gabriel, Garlock, Sierra Madre, Santa Susana, and Northridge (Table 1). These and other principal nearby active faults are discussed in further detail in the following sections. Based on the proximity and number of known active and potentially active faults within the general region, it is reasonable to expect a strong ground motion seismic event during the lifetime of structures for the proposed project.

Table 1 lists selected principal known active faults that may affect the subject site, the maximum moment magnitude (M_{max}) as published by the CGS (2003), the type of fault as defined in Table 16A-U of the California Building Code (CBC, 2001), and significant historic earthquakes that have occurred on the fault. The approximate fault to site distance was calculated by the computer program FRISKSP (Blake, 2001).

Table 1 – Principal Regional Active Faults

Fault	Approximate Fault to Site Distance miles (km)[1]	Maximum Moment Magnitude (M_{max})[2]	Fault Type[2]	Significant Historic Earthquakes[3]
San Andreas – 1857 Rupture	4.9 (7.8)	7.4	A	M7.9 Fort Tejon, 1/9/1857
San Gabriel	23.3 (37.5)	7.2	B	-
Garlock (West)	25.9 (41.6)	7.3	B	-
Sierra Madre	27.7 (44.5)	7.2	B	-
Santa Susana	28.3 (45.5)	6.7	B	M6.6 San Fernando, 2/9/71
Northridge (East Oak Ridge)	28.7 (46.2)	7.0	B	M6.7 Northridge, 1/17/94
Clamshell – Sawpit	36.0 (57.9)	6.5	B	M5.8 Sierra Madre, 6/28/91
Puente Hills Blind Thrust	42.5 (68.4)	7.1	B	-
Newport-Inglewood (Los Angeles Basin)	44.3 (71.3)	7.1	B	M6.4 Long Beach, 3/10/1933
White Wolf	45.8 (73.6)	7.3	B	M7.5 Kern County, 7/21/52
Whittier (Elsinore Fault Zone)	49.0 (78.8)	6.8	A	M5, 5/15/1910

Notes:
[1] Blake, 2001.
[2] Cao, et al., 2003.
[3] Southern California Earthquake Center (SCEC), 2004.

In general, potential hazards associated with seismic activity include strong ground motion, ground surface rupture, seismically induced liquefaction, and landsliding. These hazards are discussed in Section 9.

6.1. San Andreas Fault Zone

The San Andreas fault zone has long been recognized as the dominant seismotectonic feature in California. This right-lateral, strike-slip fault is over 700 miles long and strikes northwest through the state from the Gulf of California to north of San Francisco. Two of California's three largest historic earthquakes, the 1906 San Francisco earthquake and the 1857 Forth Tejon earthquake, occurred along the San Andreas fault. The segment of the San Andreas fault that ruptured during the 1857 earthquake is located approximately 5 miles southwest of the project site. Ground surface offset as much as 30 feet was recorded across the fault due to the 1857 earthquake. The slip rate of the fault is estimated to be 30 millimeters (mm) per year. The fault is considered capable of producing earthquakes in excess of M_{max} 7.4, and the average frequency of earthquakes along this segment of the San Andreas fault is approximately 140 years (Southern California Earthquake Center [SCEC], 2004).

6.2. San Gabriel Fault Zone

Segments of the San Gabriel fault zone are described as potentially active, and a portion of the fault between Castaic and Saugus is described as active (Jennings, 1994). This right-lateral, strike-slip fault is considered capable of producing a M_{max} 7.2 earthquake. The San Gabriel fault has a total length of approximately 87 miles, and the slip rate of the fault is estimated to be 1 mm per year. The San Gabriel fault zone is located approximately 23 miles southwest of the project site.

6.3. Garlock (West) Fault Zone

The Garlock (West) fault zone is a prominent fault feature in southern California and strikes northeast across the northern part of the Mojave Desert province. Although this fault has not produced large earthquakes historically, geomorphic and stratigraphic evidence indicates that it has done so in the past. The Garlock (West) fault is considered capable of generating about a M_{max} 7.3 earthquake. A portion of the Garlock fault zone ruptured due to 1952 Kern County Earthquake that occurred on the White Wolf Fault (SCEC, 2004). A total of about 30 to 40 miles of left-lateral strike slip has been documented across the Garlock (West) fault, and the slip rate is estimated to be 6 mm per year. The Garlock (West) fault is located approximately 26 miles northwest of the project site.

6.4. Sierra Madre Fault

The Sierra Madre fault zone is composed of a series of active reverse faults. The approximately 35-mile-long fault zone is located approximately between the cities of Sunland and Azuza along the foothills of the San Gabriel Mountains. The Sierra Madre fault is considered capable of generating about a M_{max} 7.2 earthquake. The slip rate of the fault is estimated to be 2 mm per year. The Sierra Madre fault is located approximately 28 miles south of the project site.

6.5. Santa Susana Fault

The Santa Susana fault is a thrust fault approximately 23 miles long located near the communities of Piru, Sylmar, and San Fernando. A short segment of the fault ruptured slightly during the 1971 San Fernando earthquake (SCEC, 2004). The Santa Susana fault is considered capable of generating about a M_{max} 6.7 earthquake. The slip rate of the fault is estimated to be 5 mm per year. The Santa Susana fault is located approximately 28 miles southwest of the project site.

6.6. Northridge (East Oak Ridge) Fault

The Northridge (East Oak Ridge) fault is an active reverse thrust fault located on Oak Ridge near the communities of Santa Paula and Fillmore, northwest of the community of Northridge. This fault was associated with the 1994 M 6.7 Northridge earthquake. The Northridge (East Oak Ridge) fault is considered capable of generating about a M_{max} 7.0 earthquake. The fault is approximately 56 miles long, and the slip rate of the fault is estimated to be 1.5 mm per year. The Northridge (East Oak Ridge) fault is located approximately 29 miles southwest of the project site.

6.7. Clamshell-Sawpit Fault

The Clamshell-Sawpit fault is a reverse fault located near the communities of Sierra Madre and Monrovia. The 1991 M 5.8 Sierra Madre earthquake probably originated on the Clamshell-Sawpit fault (SCEC, 2004). The fault is approximately 11 miles long, and the slip rate of the fault is estimated to be 0.5 mm per year. The Clamshell-Sawpit fault is considered capable of generating about a M_{max} 6.5 earthquake. The Clamshell-Sawpit fault is located approximately 36 miles southeast of the project site.

6.8. Puente Hill Blind Thrust Fault

The Puente Hills Blind Thrust (PHT) is an active reverse thrust fault that does not reach the surface (blind) and extends for more than 25 miles in the northern Los Angeles Basin from downtown Los Angeles east to northern Orange County. The fault consists of three distinct segments. From west to east, the segments are known as the Los Angeles, Santa Fe Springs, and Coyote Hills segments. Studies have indicated that the PHT generated the 1987 Whittier Narrows earthquake which occurred on the Santa Fe Springs segment of this fault system. Although not presently designated an Earthquake Fault Zone due to the lack of a well-defined surface trace, this fault is considered active (Shaw, 2002) and capable of generating moderate (M 6.5-6.6) earthquakes every approximately 400 to 1,320 years for single-segment earthquakes and strong earthquakes (M 7.1) every approximately 780 to 2,600 years for multi-segment earthquakes (Shaw, 2002). The slip rate of the fault is estimated to be 0.7 mm per year. The PHT is located approximately 42 miles south/southeast of the project site.

6.9. Newport Inglewood (Los Angeles Basin) Fault

The Newport-Inglewood fault zone is a major tectonic structure in the Los Angeles Basin area and consists of a series of northwest-trending, right-lateral, strike-slip fault segments that extend from the southern edge of the Santa Monica Mountains southeast to offshore from Newport Beach. The Newport-Inglewood fault zone was the source of the 1933 Long Beach earthquake with a measured magnitude of M_w 6.4. The Newport-Inglewood fault is considered capable of generating about a M_{max} 7.1 earthquake. The fault is approximately 46 miles in length and has a slip rate of approximately 1 mm per year. The project site is located approximately 44 miles from the northwestern end of the Newport-Inglewood fault.

6.10. White Wolf Fault

The White Wolf fault is a left-lateral reverse fault located northwest of the project site near the community of Tehachapi. The White Wolf fault was the source of one of the largest earthquakes in Southern California history, the 1952 M 7.5 Kern County earthquake (SCEC, 2004). The White Wolf fault is considered capable of generating about a M_{max} 7.5 earthquake. The fault is approximately 37 miles in length and has an estimated slip rate of 2 mm per year. The White Wolf fault is located approximately 46 miles northwest of the project site.

6.11. Whittier Fault (Elsinore Fault Zone)

The Whittier fault is a right-lateral, strike-slip fault zone that extends approximately 24 miles from Whittier Narrows in Los Angeles County, southeast to Santa Ana Canyon where it merges with the Elsinore fault zone. The Whittier fault zone is considered capable of generating a M_{max} 6.8 earthquake and has a slip rate of approximately 2.5 mm per year. The Whittier fault is located approximately 49 miles southeast of the project site.

7. METHODOLOGY FOR GEOLOGIC IMPACT AND HAZARD ANALYSES

The proposed project has been evaluated with respect to its potential impacts on the geologic environment, as outlined by the CEQA. Additionally, the impacts of potential geologic hazards on the proposed project have been evaluated. Potential project impacts and geologic hazards are based on our geologic and seismic review of readily available published geotechnical literature pertinent to the proposed project. These include, but are not limited to, the safety elements of the general plans for the County of Los Angeles, aerial photographs, State of California Earthquake Fault Zone Maps (Alquist-Priolo Special Studies Zone Maps), State of California Seismic Hazards Zones Maps, geologic and topographic maps, and other publications by the CGS and United States Geological Survey (USGS).

8. THRESHOLDS OF SIGNIFICANCE

According to Appendix G of the CEQA guidelines (2005), a project is considered to have a geologic impact if its implementation would result in or expose people/structures to potential substantial adverse effects, including the risk of loss, injury, or death involving hazards involving one or more of the geologic conditions presented in Table 2 below. Table 2 also presents the impact potential as defined by CEQA associated with each of the geologic conditions discussed in the following sections.

Table 2 – Summary of Potential Geologic Impacts/Hazards

Geologic Condition	Impact Potential[1]			
	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
Surface Fault Rupture				x
Seismic Ground Shaking	x			
Seismic Ground Failure, Including Liquefaction				x
Landslides or Mudflows				x
Soil Erosion or Loss of Topsoil		x		
Subsidence			x	
Compressible/Collapsible Soil		x		
Expansive Soil			x	
Corrosive Soil		x		
Shallow Groundwater			x	
Distinctive Geologic or Physical Feature				x
Excavations		x		
Dam Inundation				x
Seiches and Tsunamis				x
Loss of Mineral Resources				x

[1]Reference: CERES, 2005, Appendix G – Environmental Checklist Form, Final Text, dated October 26. Website: http://ceres.ca.gov/topic/envlaw/ceqa/guidelines/appendices.html

9. POTENTIAL GEOLOGIC AND SEISMIC IMPACTS/HAZARDS

Based on our review of geologic and seismic background information, and geotechnical site reconnaissance, the proposed project is not anticipated to have a significant impact on the geologic environment. However, the proposed project may be subjected to potential impacts from geologic and seismic hazards. Potential impacts on the proposed project based on our geologic and seismic review are provided in the following sections.

9.1. Surface Fault Rupture

Surface fault rupture is the offset or rupturing of the ground surface by relative displacement across a fault during an earthquake. The San Andreas fault zone is the closest active earthquake fault to the site and is located approximately 5 miles southwest of the site. Based on current published fault studies and geologic maps, as well as site reconnaissance, the proposed project site is not crossed or underlain by a known active fault and, therefore, would not likely result in, or expose people to, significant impacts related to ground surface rupture.

9.2. Seismic Ground Shaking

The seismic hazard likely to impact the project is ground shaking during an earthquake on one of the nearby or distant active faults. The level of ground shaking at a given location depends on many factors, including the size and type of earthquake, distance from the earthquake, and subsurface geologic conditions. The size and type of construction also affects how a particular structure performs during ground shaking.

Our evaluation of the ground shaking hazard included review of a probabilistic seismic hazard assessment that consisted of statewide estimates of peak horizontal ground accelerations conducted for California (Peterson, et al., 1996). In addition, for the purposes of evaluating seismically induced geotechnical hazards at the site, a site-specific probabilistic seismic hazard analysis was performed to evaluate anticipated peak ground accelerations (PGAs) using the computer program FRISKSP developed by Blake (2001). FRISKSP calculates the probability of occurrence of various ground accelerations at a site over a period of time and the probability of exceeding expected ground accelerations within the lifetime of the proposed structure from the significant earthquakes within a specific radius of search. For this project site, a search radius of 62 miles (100 kilometers) was selected.

The published guidelines of CGS (2004) define a PGA with a 10 percent probability of exceedance in 50 years as the Design Basis Earthquake (PGA_{DBE}) ground motion, and this value is typically used for residential and commercial structures. In evaluating the seismic hazards associated with the project site, we have considered a PGA that has a 10 percent probability of being exceeded in 50 years and used an attenuation relation for deep soil conditions present at the site. The PGA for the site was calculated as 0.75g (i.e., 75 percent of the acceleration due to gravity). This estimate of ground motion does not include near-source factors that may be applicable in the design of the proposed building structures. The requirements of the governing jurisdictions and the 2001 CBC should be considered in project design. The potential impacts due to ground shaking are significant, and the anticipated ground acceleration should be considered during the design and construction of the proposed project.

9.3. Liquefaction

Liquefaction is a phenomenon in which soil loses its shear strength for short periods of time during an earthquake. Ground shaking of sufficient duration results in the loss of grain-to-grain contact, due to a rapid increase in pore water pressure, causing the soil to behave as a fluid for short periods of time. The effects of liquefaction may include excessive total and/or differential settlement of structures founded on the liquefying soils. To be susceptible to liquefaction, a soil is typically cohesionless, with a grain-size distribution of a specified range (generally sand and silt), loose to medium dense, below the groundwater table, and subjected to a sufficient magnitude and duration of ground shaking.

According to Seismic Hazards Zones Maps published by the State of California (CGS, 2005), the site is not mapped within an area considered susceptible to liquefaction. Additionally, shallow groundwater, which is a component of liquefaction susceptibility, is reported to be deeper than 100 feet below the ground surface. Therefore, the proposed project would not result in, or expose people to, significant impacts related to potential earthquake-induced liquefaction.

9.4. Landslides and/or Mudflows

Landslides, slope failures, and mudflows of earth materials predominately occur where slopes are too steep and/or the earth materials too weak to support themselves. Landslides may also occur by seismic ground shaking, particularly where high groundwater is present.

There are no significant slopes within the boundaries of the proposed project site nor do we anticipate significant slopes proposed for project implementation. Therefore, the proposed project would not result in, or expose people to, significant impacts related to on- or off-site landslides or mudflows.

9.5. Soil Erosion

Soil erosion refers to the process by which soil or earth material is loosened or dissolved and removed from its original location. Erosion can occur by many different processes and may occur at the project site where bare soil is exposed to moving water or wind. Construction of the proposed project would result in ground surface disruption during excavation, grading, and trenching that would create the potential for erosion to occur. However, the erosion potential when the site is developed will be relatively minor due to the anticipated covering of bare areas with structures, pavements, and associated hardscape and landscaped areas. Surface drainage provisions would also reduce the potential for soil erosion at the site. Potential soil erosion is considered to have a less than significant impact during construction with mitigation incorporation.

9.6. Subsidence

According to the City of Lancaster General Plan (2007), portions of Lancaster are characterized by soils which exhibit subsidence. Areas of Lancaster that have experienced subsidence have developed sinkholes and/or ground fissures. Fissures are typically associated with faults or groundwater withdrawal, which results in the cracking of the ground surface. The General Plan has described areas of known fissuring and sinkholes. The project site is not located in an area of known ground fissures or sinkholes indicated in the City's plan. Therefore, potential subsidence of the project site is considered to have a less than significant impact.

9.7. Compressible/Collapsible Soils

The alluvial deposits underlying the site are generally described as unconsolidated (CGS, 2005), reflecting a depositional history without substantial loading. Soil collapse is the phenomenon where the soils underlying a site settle or compress, resulting in a lower ground-surface elevation. Collapsible soils are distinguished by their potential to undergo a significant decrease in volume upon increase in moisture content, with or without an increase in external loads. Portions of the project site may contain existing fill soils associated with previous development of the golf course, existing structures and utilities, and dumped materials. The degree of compaction, material types, and underlying ground conditions of existing fill soils at the site are unknown. Undocumented or poorly compacted fill may be present in these areas.

Compressible natural soils and undocumented fills pose the risk of adverse settlement under static loads imposed by new fill or structures. Differential settlement of soils can cause damage to project improvements, including foundations, structures, pavements, and other hardscape features. Since it is anticipated that grading for development of the project site will incorporate mitigation measures for these conditions, including removal and recompaction of loose fill soil, potential compressible/collapsible soils at the project site are considered to have a less than significant impact.

9.8. Expansive Soils

Expansive soils generally result from specific clay minerals that have the capacity to shrink or swell in response to changes in moisture content. The ability of clayey soil to change volume can result in uplift or cracking to foundation elements or other rigid structures such as slabs-on-grade, rigid pavements, sidewalks, or other slabs or hardscape founded on these soils. Geologic references reviewed indicate that much of the alluvial deposits at the project site consist of coarse, sandy materials (CGS, 2005). According to the City of Lancaster's 2007 General Plan, the project site is located in an area of low shrink-swell potential. Therefore, the potential for expansive soils at the project site is considered to have a less than significant impact.

9.9. Corrosive Soils

The project site is located in a geologic environment that could potentially contain soil conditions that are corrosive to concrete and metals. Corrosive soil conditions may exacerbate the corrosion hazard to pipelines, foundations, and other buried improvements. Assessment of the potential for corrosive soils would be evaluated during the design phase of the project. Therefore, potential soil corrosivity is considered to have a less than significant impact during construction with mitigation incorporation.

9.10. Groundwater

Based on our background review, the historic high groundwater table at the site is 100 feet or more below the ground surface. Subsurface construction activities for the proposed project are anticipated to consist of relatively shallow excavations for building pads, foundations, and utilities. Based on the anticipated depth of these construction activities and reported depths to groundwater, shallow groundwater is considered to have less than a significant impact on the proposed project.

Groundwater levels may be influenced by seasonal variations, precipitation, irrigation, soil/rock types, groundwater pumping, and other factors and are subject to fluctuations. Shallow perched conditions or seepage may be present in places. Further study, including subsurface exploration, should be performed during the design phase to evaluate the presence of groundwater, seepage, and/or perched groundwater at the site and the potential impacts on design and construction of project improvements.

9.11. Distinctive Geologic or Topographic Features

This potential geologic impact refers to the proposed project's potential to cover or modify one or more distinct prominent geologic or topographic features. Rock exposures or other prominent geologic features were not observed on the surface at the site and are not anticipated at shallow depth. The existing topography of the project site is comprised of gently sloping to relatively flat natural gradients and artificial features associated with development of the former golf course and subsequent dumping of materials. Prominent topographic features were not observed at the site. The proposed construction will result in minor grading and trenching activities, but will be matched with surrounding street gradients, and is not anticipated to significantly alter the existing topography. Therefore, the proposed project would not result in significant impacts related to the alteration or modification of prominent geologic or topographic features.

9.12. Excavations

Earthwork associated with construction of the proposed project is anticipated to include excavations for the creation of building pads, parking areas, and trench excavations for utility lines. Potential deeper excavations may be anticipated for deeper foundation work for structures, if needed. Based on our background review and site reconnaissance, we anticipate that the materials encountered in excavations will be comprised predominantly of poorly consolidated sandy soils with various amounts of gravel and finer grained soils. We anticipate that excavations within the alluvial materials at the project site will be feasible with conventional grading equipment. However, areas of cemented soils are present in some areas of the Antelope Valley (City of Lancaster, 2007) and could present excavation difficulty if encountered at the project site. The excavatability of materials at the site would result in a less than significant impact to the proposed project.

Excavations for proposed project improvements adjacent to existing streets, sidewalks, or structures will need to be performed with care to reduce the potential for differential movement of existing improvements located near the excavations. With appropriate mitigation incorporation during construction, excavations at the project site would result in a less than significant impact to surrounding improvements.

We anticipate that the project site will be fenced during construction operations, such that the public will not be exposed to the impacts of excavations. Construction personnel may be exposed to the impacts of excavations, and appropriate mitigative safety measures would result in a less than significant impact to site personnel. Since excavations will be filled following construction, the proposed project would not result or expose people to impacts related to excavations after construction of the project.

9.13. Dam Inundation

According to the County of Los Angeles Department of Regional Planning (1990), the proposed project site is not located within a potential dam failure inundation area. Therefore, the proposed project would not result or expose people to impacts related to dam failure inundation.

9.14. Seiches and Tsunamis

A seiche is the seismically induced sloshing of water in a large enclosed basin, such as a lake, reservoir, or bay. There are no known reservoirs or lakes within approximately 10 miles of the site, thus, the potential for damage from seiches to the proposed project is considered low. Therefore, the proposed project would not result in, or expose people to, significant impacts related to seiches.

Tsunamis are open-sea tidal waves generated by earthquakes. Tsunami damage is typically confined to low-lying coastal areas. Water surge caused by tsunamis is measured by distance of run-up on the shore. The project site is not mapped within the area considered to be susceptible to tsunami inundation (County of Los Angeles, Department of Regional Planning, 1990). Therefore, the proposed project would not result in, or expose people to, significant impacts related to tsunamis.

9.15. Mineral Resources

The CGS and the State Mining and Geology Board (SMGB) classify the regional significance of mineral resources in accordance with the California Surface Mining and Reclamation Act of 1975 (SMARA). The SMGB uses a classification system that divides land into four Mineral Resource Zones (MRZ) that have been designated based on quality and significance of mineral resources (CDMG, 1983). According to the State of California (CDMG, 1994), the project site is located in an area classified as MRZ-3, which is defined as "...areas of known or inferred mineral occurrence." Due to the abundance of similar mineralogical materials in the City of Lancaster and surrounding region around the proposed project site, the potential of the project to result in the loss of availability of a known mineral resource is not considered a significant impact.

10. MITIGATION OF POTENTIAL GEOLOGIC IMPACTS/HAZARDS

The potential geologic and seismic hazards described above can be reduced to less than significant levels by employing sound engineering practice in the design and construction of the new facilities. This practice includes the performance of site-specific geotechnical and seismic hazards analyses prior to the construction of the structures at the site. Typical measures to mitigate potential hazards that may be encountered during the construction of the improvements are described in the following sections.

10.1. Seismic Ground Shaking

Mitigation measures to reduce the potential impacts of seismic ground shaking will be achieved through project design and construction. During the design phase, site-specific geotechnical evaluations will be performed to obtain detailed subsurface soil and geologic data, including evaluation of the site-specific ground motion anticipated for the site. Structural elements will then be designed to resist or accommodate appropriate site-specific ground motions and conform to the current Uniform Building Code (UBC) seismic design standards.

10.2. Soil Erosion

The project site is relatively flat, and implementation of the project is not anticipated to significantly change the existing topography or accelerate existing erosional processes. Construction of the proposed project is anticipated to create the potential for soil erosion during excavation, grading, and trenching activities. However, with the implementation of appropriate procedures during construction, soil erosion can be limited to within the site boundaries. Examples of these procedures would include surface drainage measures for erosion due to water, such as the use of sandbags and plastic sheeting, and wetting of soil surfaces to mitigate wind-related erosion.

10.3. Compressible/Collapsible Soils

During the design phase of the project, a site-specific geotechnical evaluation will be performed to evaluate the presence of compressible/collapsible soils at the site. The settlement potential of the materials will be evaluated in areas of proposed structures. If the settlement potential exceeds acceptable tolerances for the structure, then remedial measures will be incorporated into the design and construction. Examples of possible mitigation measures include surcharging, overexcavation and recompaction, compaction grouting, allowing for a settlement period after or during construction, and specialized foundation design.

10.4. Corrosive Soils

The project site is located in a geologic environment that could potentially contain soil conditions that are corrosive to concrete and metals. The degree of potential corrosivity of soils will be evaluated by site-specific analysis during design of the project. Typical mitigation measures for corrosive soil include epoxy and metallic protective coatings, the use of alternative (corrosion resistant) materials, and selection of the type of cement and water/cement ratio. Concrete resistant to sulfate exposure and corrosion protection for metals will be used where appropriate for underground structures in areas where corrosive groundwater or soil could potentially cause deterioration. Specific measures to mitigate the potential effects of corrosive soils will be developed in the design phase.

10.5. Excavations

The proposed project is not anticipated to have deep excavations along the property lines that would affect surrounding improvements. However, some excavation along the site boundary may occur, and protection of surrounding improvements may be appropriate. The potential for damage to surrounding improvements and structures resulting from excavation operations could be monitored for movement with a variety of instrumentation. If, during the course of construction, the instrumentation detects ground movement that exceeds a predetermined value, the work would stop and the contractor's methods would be reviewed and changes would be made, as appropriate. Typical monitoring methods include installation of ground survey points around the outside of the excavation to monitor settlement and/or placing monitoring points on nearby structures to monitor performance of the structures.

Difficult construction excavation is not anticipated at the site due to the presence of poorly consolidated alluvial soils at the site. However, areas of cemented soils may be present at the site and could present excavation difficulty if encountered. To further evaluate the potential for hard excavation during construction, subsurface evaluation should be performed during the design phase. During the design phase of the project, site-specific geotechnical evaluations should be performed to assess the excavatability of the earth units. This may include drilling of exploratory borings and/or test pits to evaluate ground conditions for excavation capability.

11. LIMITATIONS

The geotechnical analyses presented in this report have been conducted in accordance with current engineering practice and the standard of care exercised by reputable geotechnical consultants performing similar tasks in this area. No other warranty, implied or expressed, is made regarding the conclusions, recommendations, and professional opinions expressed in this report. Our preliminary conclusions and recommendations are based on a review of aerial photographs and readily available geotechnical literature, and an analysis of the observed conditions. Variations may exist and conditions not observed or described in this report may be encountered.

The purpose of this study was to evaluate geologic and geotechnical conditions at the site using readily available data and to provide a preliminary geotechnical report which can be utilized in the preparation of planning and environmental impact documents for the project. A more detailed geologic evaluation, including subsurface exploration and laboratory testing, should be performed prior to design and construction of the proposed improvements.

12. SELECTED REFERENCES

Blake, T.F., 2001, FRISKSP (Version 4.00), A Computer Program for the Probabilistic Estimation of Peak Acceleration and Uniform Hazard Spectra Using 3-D Faults as Earthquake Sources.

Bonilla, M.G., 1970, Surface Faulting and Related Effects in Wiegel, R.L., Editor, Earthquake Engineering: Prentice Hall, p. 47-74.

California Department of Conservation, Division of Mines and Geology, 1983, Guidelines for Classification and Designation of Mineral Lands, Special Publication 51.

California Department of Conservation, Division of Mines and Geology, 1994, Update of Mineral Land Classification of Portland Cement Concrete Aggregate in Ventura, Los Angeles, and Orange Counties, California, Part II – Los Angeles County, Miller R.V., Open File Report 94-14.

California Department of Conservation, Division of Mines and Geology, 1997a, Fault-Rupture Hazard Zones in California: Special Publication 42.

California Department of Conservation, Division of Mines and Geology, 1997b, Guidelines for Evaluating and Mitigating Seismic Hazards in California: Special Publication 117, 74 pp.

California Department of Conservation, Division of Mines and Geology, 1998, Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada: International Conference of Building Officials, dated February.

California Department of Conservation, Division of Mines and Geology, 2000, Guidelines for Evaluating the Hazard of Surface Fault Rupture: Division of Mines and Geology Note 49.

California Environmental Resources Evaluation System (CERES), 2005a, The California Environmental Quality Act, Title 14; California Code of Regulations, Chapter 3; Guidelines for Implementation of the California Environmental Quality Act, Article 9; Contents of Environmental Impact Reports, Final Text dated May 25, Website: http://ceres.ca.gov/topic/env_law/ceqa/guidelines/art9.html.

California Environmental Resources Evaluation System (CERES), 2005b, The California Environmental Quality Act, CEQA Guidelines Appendices, Appendix G – Environmental Checklist Form, Final Text dated May 25, Website: http://ceres.ca.gov/topic/env_law/ceqa/guidelines/appendices.html.

California Geological Survey, 2005a, Probabilistic Seismic Hazards Mapping Ground Motion Page, Acceleration with 10 Percent Probabilistic of Exceedance in 50 Years: Website: http://www.consrv.ca.gov/cgs/rghm/pshamap/pshamap.asp.

California Geological Survey, 2005b, Seismic Hazard Zone Report For The Lancaster West 7.5-Minute Quadrangle, Los Angeles County, California: Seismic Hazard Zone Report 095.

California Geological Survey, 2005c, Seismic Hazard Zones Official Map, Lancaster West 7.5-Minute Quadrangle, Los Angeles County, California, Seismic Hazard Zone Report 95, dated February 11.

Cao, Tianqing, Bryant, William A., Rowshandel, Badie, Branum, David, and Wills, Christopher J., 2003, The Revised 2002 California Probabilistic Seismic Hazard Maps, Adapted by California Geological Survey (CGS), dated June.

City of Lancaster, 2006, Request for Proposals to Prepare an Environmental Impact Report for General Plan Amendment 05-01 in the City of Lancaster, dated November 17.

City of Lancaster, 2007, Public Review Draft, 2007 General Plan, Earth Resources Section 2.0, Lancaster, California, http://www.lancaster2030.info/gp_basics.asp, dated April.

County of Los Angeles Department of Regional Planning, 1990, Los Angeles County Safety Element, Scale 1 inch = 2 miles.

Dibblee, Thomas W., Jr., 1967, Aerial Geology of the Western Mojave Desert, California, Geological Survey Professional Paper 522, Scale 1:125,000.

Google Earth, 2006, http://earth.google.com.

Hart, E.W., and Bryant, W.A., 1997, Fault-Rupture Hazard Zones in California, Alquist-Priolo Special Studies Zone Act of 1972 with Index to Special Studies Zones Maps: California Division of Mines and Geology, Special Publication 42.

Jennings, C.W., and Strand, R.G., 1969, Geologic Map of California: Los Angeles Sheet, California Division of Mines and Geology, Scale 1:250,000.

Jennings, C.W., 1994, Fault Activity Map of California and Adjacent Areas: California Division of Mines and Geology, California Geologic Data Map Series, Map No. 6, Scale 1:750,000.

Ninyo & Moore, In-house and Proprietary Data.

Norris, R.M., and Webb, R.W., 1990, Geology of California: John Wiley & Sons, 541 pp.

Peterson, M.D., Bryant, W.A., Cramer, C.H., Cao, T., Reichle, M.S., 1996, Probabilistic Seismic Hazard Assessment for the State of California: California Department of Conservation Division of Mines and Geology Open File Report 96-08, and United States Department of the Interior United States Geological Survey Open File Report 96-706.

Shaw, J.H., Plesch A., Dolan, J.F., Pratt, T.L., Fiore, P., 2002, Puente Hills Blind-Thrust System, Los Angeles, California, Journal: Bulletin of the Seismological Society of America, Vol. 92, No. 8, pp. 2946-2960.

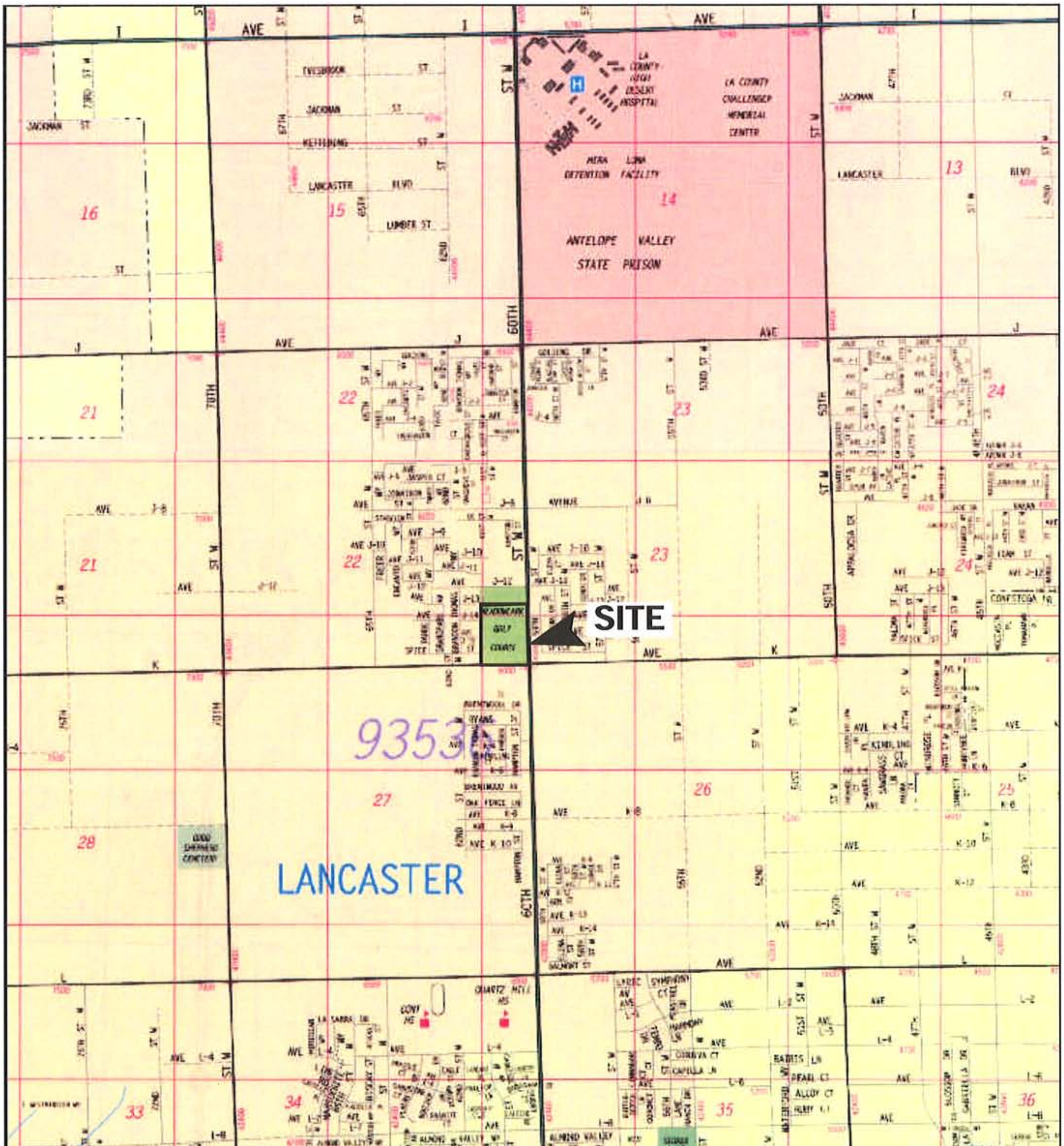
Seed, H.B., and Idriss, I.M., 1982, Ground Motions and Soil Liquefaction During Earthquakes, Volume 5 of Engineering Monographs on Earthquake Criteria, Structural Design, and Strong Motion Records: Berkeley, Earthquake Engineering Research Institute.

Southern California Earthquake Center, 2004, Index of Faults of California: http://www.data.scec.org/fault_index/.

TerraServer, 2007, Aerial Photograph of Project Site, Lancaster, California, United States, dated May 31, 1994, http://www.terraserver.microsoft.com/default.aspx.

United States Geological Survey, 1958 (Photorevised 1974), Lancaster West, California Quadrangle Map, 7.5 Minute Series: Scale 1:24,000.

United States Geological Survey, 1997 (2002rev), National Seismic Hazard Mapping Project, http://geohazards.cr.usgs.gov.eq.



REFERENCE: 2007 THOMAS GUIDE FOR LOS ANGELES/ORANGE COUNTIES, STREET GUIDE AND DIRECTORY

APPROXIMATE SCALE IN FEET

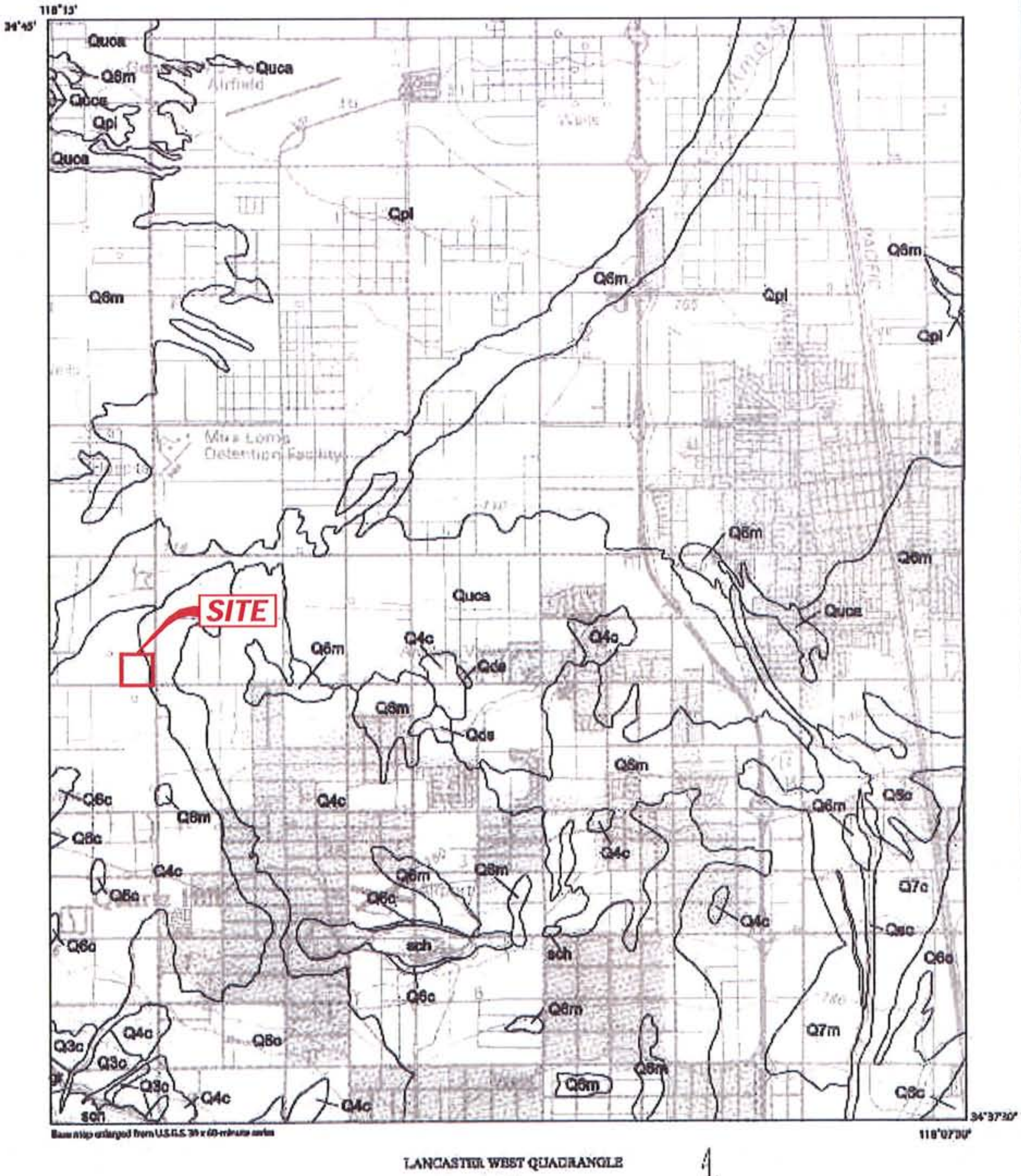
0 2400 4800

N

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

207103-A1.DWG

Ninyo & Moore		SITE LOCATION MAP	FIGURE
PROJECT NO.	DATE	PROPOSED COMMERCIAL SHOPPING CENTER 60th STREET WEST & AVENUE K LANCASTER, CALIFORNIA	1
207103001	6/07		



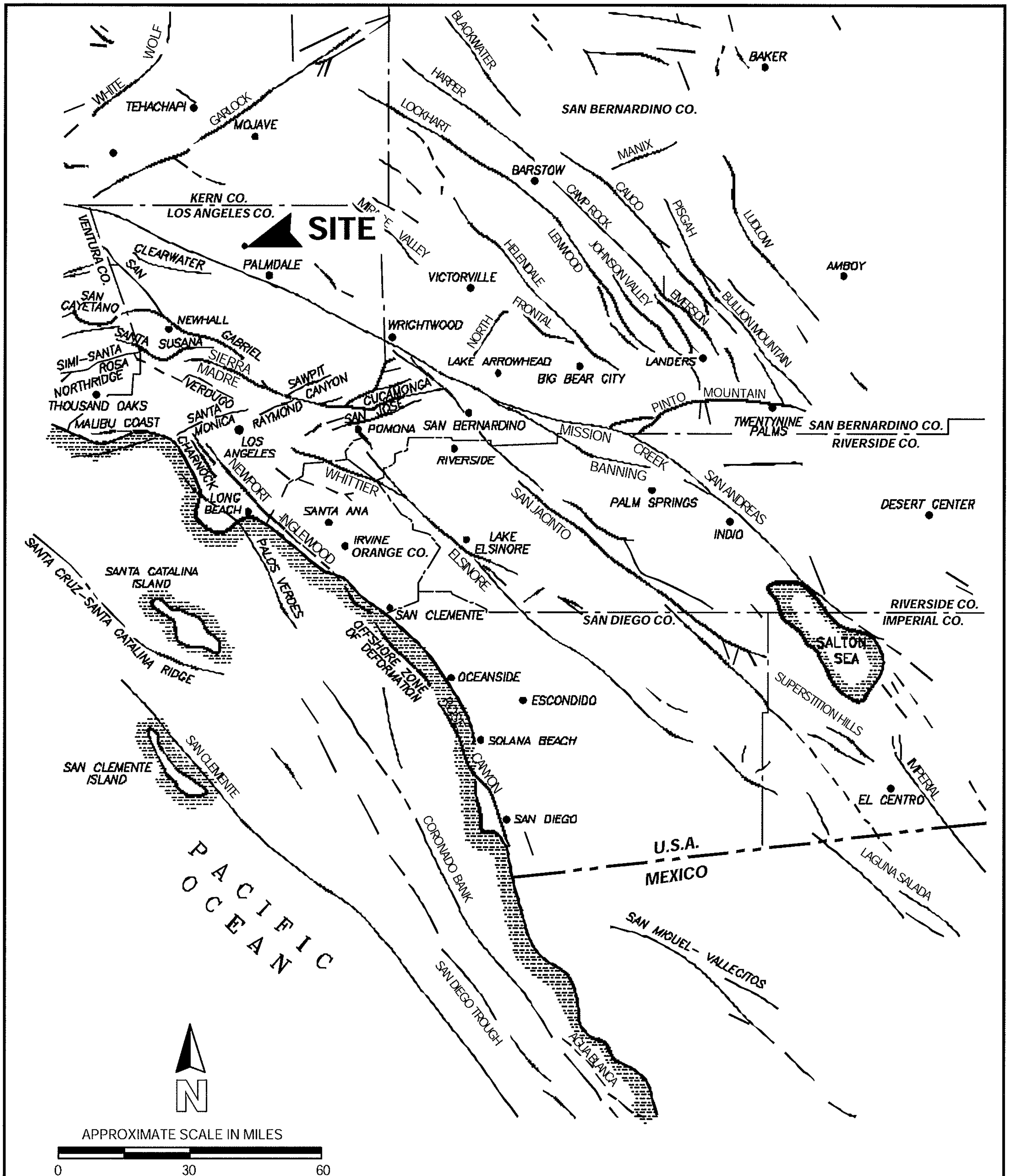
See "Bedrock and Surficial Geology" in Section 1 of report for descriptions of units.
B = Pre-Quaternary bedrock.

Q6c	LATE PLEISTOCENE AND HOLOCENE ALLUVIAL FAN AND WASH SEDIMENTS, UNCONSOLIDATED, MAINLY MEDIUM-GRAINED SEDIMENTS. SOILS ARE WEAKLY DEVELOPED.
Q4c	LATE PLEISTOCENE ALLUVIAL FAN MATERIALS; UNCONSOLIDATED, UPLIFTED AND SLIGHTLY DISSECTED. MODERATELY DEVELOPED SOIL HORIZONS.

REFERENCE: SEISMIC HAZARD ZONE REPORT 095, CALIFORNIA GEOLOGICAL SURVEY, 2005.

207103-A2.DWG

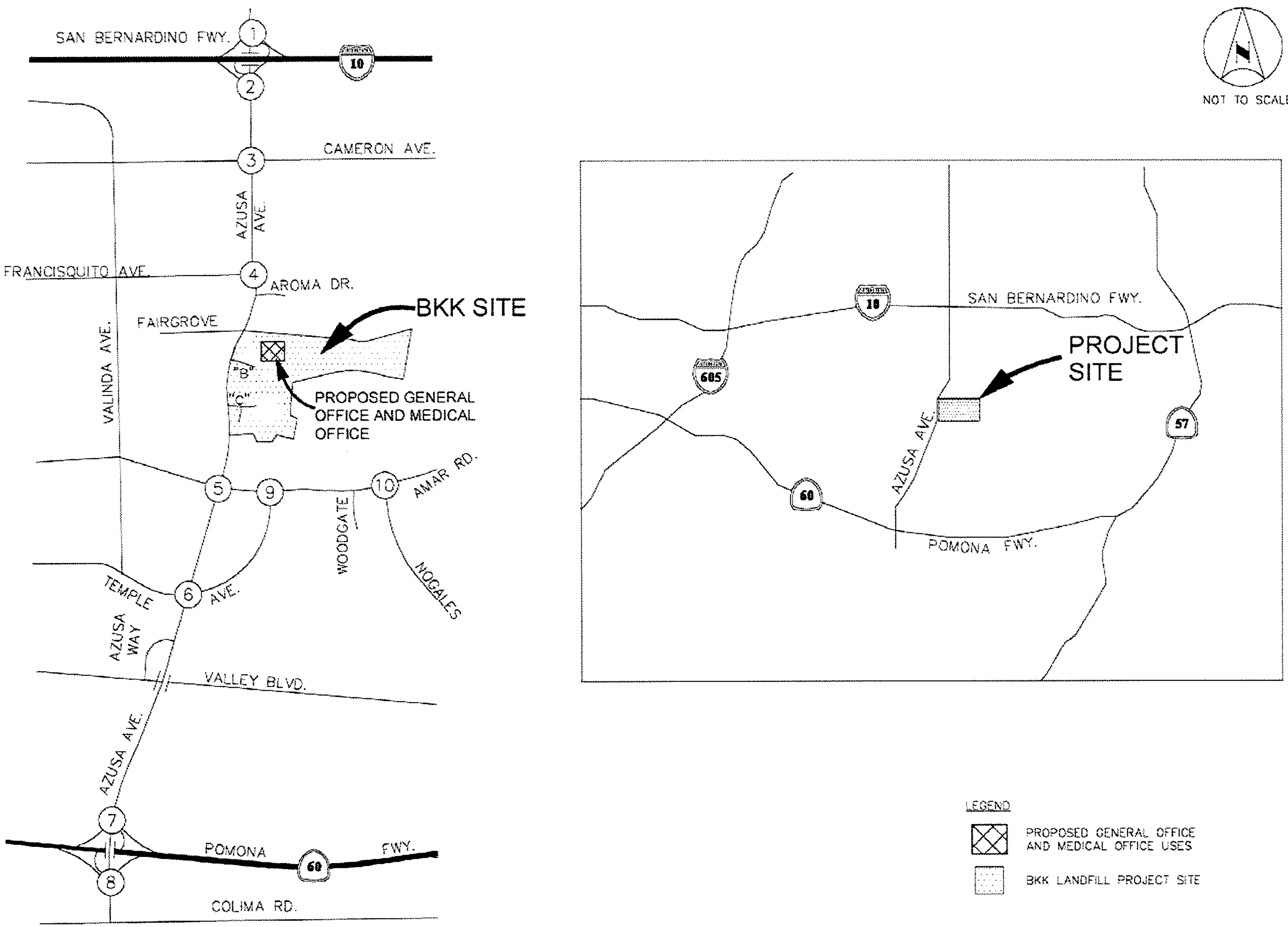
Ninyo & Moore		GEOLOGIC MAP	FIGURE
PROJECT NO.	DATE	PROPOSED COMMERCIAL SHOPPING CENTER 60th STREET WEST & AVENUE K LANCASTER, CALIFORNIA	2
207103001	6/07		



NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

207103-A3.DWG

Ninyo & Moore		FAULT LOCATION MAP	FIGURE
PROJECT NO.	DATE	PROPOSED COMMERCIAL SHOPPING CENTER 60th STREET WEST & AVENUE K LANCASTER, CALIFORNIA	3
207103001	6/07		



SOURCE: Kimley-Horn and Associates, Inc. 2007.

West Covina Corporate Center . 206458

Figure 1
Proposed Study Intersections