

Appendix D
Preliminary Geotechnical Evaluation

**PRELIMINARY GEOTECHNICAL EVALUATION
LAC+USC MEDICAL CENTER MASTER PLAN
1200 NORTH STATE STREET
LOS ANGELES, CALIFORNIA**

DRAFT

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June 13, 2014
Project No. 209126002

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Mr. Lee Lisecki
ICF International
601 W. Fifth Street, Suite 900
Los Angeles, California 90071

Subject: Preliminary Geotechnical Evaluation
LAC+USC Medical Center Master Plan
1200 North State Street
Los Angeles, California

Dear Mr. Lisecki:

In accordance with your request and authorization, Ninyo & Moore has performed a preliminary geotechnical evaluation for the LAC+USC Medical Center Master Plan project located at 1200 North State Street in Los Angeles, California. Our evaluation was conducted in general accordance with the scope of services presented in our proposal dated July 23, 2013. This report presents our findings and conclusions regarding the subject site. We understand that the results of this evaluation will be utilized in the preparation of an Environmental Impact Report for the project.

We appreciate the opportunity to provide geotechnical consulting services for this project.

Sincerely,
NINYO & MOORE

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TABLE OF CONTENTS

	<u>Page</u>
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. Site Geology	4
5.3. Groundwater	4
6. FAULTING AND SEISMICITY	5
6.1. Regional Seismicity	5
7. METHODOLOGY FOR GEOLOGIC IMPACT AND HAZARD ANALYSES	6
8. THRESHOLDS OF SIGNIFICANCE	7
9. CONCLUSIONS AND RECOMMENDATIONS FOR POTENTIAL GEOLOGIC AND SEISMIC IMPACTS/HAZARDS	8
9.1. Surface Fault Rupture	8
9.2. Seismic Ground Shaking	9
9.3. Liquefaction	10
9.4. Landslides	11
9.5. Soil Erosion	12
9.6. Subsidence	13
9.7. Compressible/Collapsible Soils	14
9.8. Expansive Soils	15
9.9. Corrosive Soils	16
9.10. Groundwater	17
10. LIMITATIONS	18
11. REFERENCES	19

Tables

Table 1 – Principal Regional Active Faults	6
Table 2 – Summary of Potential Geologic Impacts/Hazards	7

Figures

- Figure 1 – Site Location
- Figure 2 – Site Aerial
- Figure 3 – Regional Geology
- Figure 4 – Fault Locations
- Figure 5 – Seismic Hazard Zones

1. INTRODUCTION

In accordance with your request and authorization, we have performed a preliminary geotechnical evaluation for the LAC+USC Medical Center Master Plan project (project) located at 1200 North State Street in Los Angeles, California (Figure 1). We have performed a geotechnical evaluation of the site geologic conditions and the impacts associated with potential geologic and seismic hazards for inclusion in the Environmental Impact Report (EIR) for the project.

The purpose of our preliminary geotechnical evaluation was to assess the geologic conditions at the site and develop preliminary conclusions regarding potential geologic and seismic impacts associated with the project in accordance with the California Environmental Quality Act (CEQA). Where appropriate, recommendations to mitigate potential geologic hazards, as noted in this report, have been provided. Our geotechnical evaluation was based on review of readily available geologic and seismic data and published geotechnical literature pertinent to the project site, and site reconnaissance.

Ninyo & Moore conducted previous geotechnical evaluations at the site associated with repairs to the medical center following the 1994 Northridge earthquake (Ninyo & Moore, 1995).

2. SCOPE OF SERVICES

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

- Review of readily available topographic and geologic maps, published geotechnical literature, geologic and seismic data, soil data, groundwater data, aerial photographs, and in-house information related to our previous work at the site.
- Review of geotechnical aspects of project plans and documents pertaining to the site.
- Geotechnical site reconnaissance by a representative from Ninyo & Moore conducted on June 3, 2014, to observe and document the existing surface conditions at the project site.
- Compilation and analysis of existing geotechnical data pertaining to the site.

- Assessment of the general geologic conditions and seismic hazards affecting the area and evaluation of their potential impacts on the project.
- Preparation of this report presenting the results of our study, as well as our conclusions regarding the projects' geologic and seismic impacts, and recommendations to address the impacts to be included in the EIR.

3. PROJECT DESCRIPTION

Based on our understanding, the proposed project involves the development of a new long-term master plan to guide future medical campus development and delivery of health care services and health-related community programs. Future development under the master plan would include demolition of existing buildings, and renovation or construction of new medical, office and retail structures, open space areas, and parking areas (ICF International, 2014).

4. SITE DESCRIPTION

The project site is located north of Interstate 10 and east of Interstate 5 in the Lincoln Heights community of Los Angeles (Figure 1). Topography of the site slopes gently to moderately down toward the west and south, varying from an approximate elevation of 420 feet above mean sea level (MSL) near the east part of the project area to an approximate elevation of 320 feet above MSL in the west part of the project area.

The campus is approximately 75 acres and is bounded by Zonal Avenue to the north, Chicago Street to the east, Marengo Street to the south and North Mission Road to the west (Figure 2). The project site is improved with an inpatient hospital, outpatient clinics, research/development and education facilities, and community/public service areas. The site is also improved with paved roads and parking areas, landscaped areas, retaining walls and developed pedestrian open space.

5. GEOLOGY

5.1. Regional Geology

The project site is located within the Peninsular Ranges Geomorphic Province of southern California. This geomorphic province encompasses an area that extends approximately 125 miles from the Transverse Ranges and the Los Angeles Basin south to the Mexican border, and beyond another approximately 775 miles to the tip of Baja California. The Peninsular Ranges province varies in width from approximately 30 to 100 miles and is characterized by northwest-trending mountain range blocks separated by similarly trending northwest-trending faults (Norris and Webb, 1990).

The project is situated in the Los Angeles Basin, a region divided into four structural blocks that include uplifted zones and synclinal depressions. The structural blocks are generally bounded by fault systems. The project site is situated in the Central block, which is largely a synclinal depression bounded on the southwest by the Newport-Inglewood fault zone, on the northwest by the Santa Monica-Hollywood-Raymond Hill fault system, and on the northeast by the Whittier and Elysian Park fault system (Norris and Webb, 1990). Active northwest-trending fault zones in the Peninsular Ranges province include the San Jacinto fault zone, Elsinore fault zone (Whittier fault), and Newport-Inglewood fault zone. The predominant tectonic activity associated with these and other faults within this regional tectonic framework is right-lateral, strike-slip movement (Norris and Webb, 1990).

The predominant rock type that underlies the Peninsular Ranges province is a Cretaceous-age igneous rock (granitic rock) referred to as the Southern California batholith. Older Jurassic-age metavolcanic and metasedimentary rocks and older Paleozoic limestone, altered schist, and gneiss are present within the province. Cretaceous-age marine sedimentary rocks and younger Tertiary-age rocks comprised of volcanic, marine, and non-marine sediments overlie the older rocks (Norris and Webb, 1990). More recent Quaternary sediments, primarily of alluvial origin, comprise the low-lying valley and drainage areas within the region, including the area where the LAC+USC Medical Center Campus project site is located.

5.2. Site Geology

The project site is located on the north edge of the Los Angeles coastal plain at the base of hilly terrain that ascends to the north of the site. The medical center is situated approximately 1 mile east of the Los Angeles River on a gently sloping alluvial fan at the base of the nearby hills. Regional geologic maps indicate that the elevated northeastern portion of the site is underlain by Tertiary-age Puente Formation (Yerkes and Campbell, 2005) generally comprised of sandstone. The lower western and southern portions of the site are mapped as being underlain by young (Holocene) and older (late- to middle-Pleistocene) alluvial deposits generally comprised of silt, sand, and gravel. A regional geologic map of the site vicinity is shown on Figure 3.

Previous geotechnical evaluations performed at the site by Ninyo & Moore in 1995 encountered artificial fill soils in portions of the campus related to the original development of the medical center (Ninyo & Moore, 1995). The soils encountered in our previous explorations were generally comprised of silty clay and silty to clayey sand. Puente Formation generally comprised of interbedded sandstone and shale was observed in open space areas in the northeast corner of the site during our 2014 geologic reconnaissance.

The project site is not located in a City of Los Angeles Methane Zone or Methane Buffer Zone (Moore, 2002).

5.3. Groundwater

The site is located within the Central basin of the Los Angeles Coastal Groundwater Basin. Historic groundwater monitoring well data from the State of California Water Resources Control Board's GeoTracker website (State of California, 2014) were reviewed for wells located on adjacent properties that border the west, south, and east sides of the site. Based on the groundwater measurements in these wells from 2005 to 2013, groundwater levels at these locations have ranged from approximately 13 to 44 feet below the ground surface. Previous subsurface evaluation at the project site by Ninyo & Moore in 1995 encountered groundwater in borings ranging between approximately 21 and 58 feet below the ground surface (1995). The historic high groundwater in the site vicinity is approximately 20 feet

deep (California Department of Conservation, Division of Mines and Geology [CDMG], 1998).

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.

6. FAULTING AND SEISMICITY

6.1. Regional Seismicity

The project area 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 4 shows the approximate site location relative to the principal faults in the region. Blind thrust faults are low-angle faults at depths that do not break the surface and are, therefore, not shown on Figure 4. Although blind thrust faults do not have a surface trace, they can be capable of generating damaging earthquakes. The active Upper Elysian Park blind thrust fault is located approximately 0.4 mile north of the approximate center of the site, the active Raymond fault is located approximately 4.2 miles north of the approximate center of the site, and the active Hollywood fault is located approximately 4.3 miles northwest of the approximate center of the site. The site is not located within a State of California Earthquake Fault Zone (State of California, 1977).

Table 1 lists selected principal known active faults within approximately 50 miles of the project area and the maximum moment magnitude (M_{max}) as published by the California Geological Survey (CGS) (Cao, et al., 2003). The fault distances in Table 1 are measured from the approximate center of the project area.

Table 1 – Principal Regional Active Faults

Fault	Approximate Fault-to-Site Distance ¹ miles (kilometers)	Maximum Moment Magnitude ² (M_{max})
Upper Elysian Park Blind Thrust	0.4 (0.7)	6.4
Raymond	4.2 (6.8)	6.5
Hollywood	4.3 (6.9)	6.4
Puente Hills Blind Thrust	5.6 (8.9)	7.1
Verdugo	5.9 (9.5)	6.9
Newport-Inglewood (Los Angeles Basin)	9.6 (15.4)	7.1
Whittier	10.3 (16.5)	6.8
Sierra Madre	10.4 (16.7)	7.2
Santa Monica	11.6 (18.7)	6.6
Clamshell-Sawpit Canyon	14.6 (23.4)	6.5
Malibu Coast	18.2 (29.4)	6.7
San Gabriel	18.3 (29.4)	7.2
Palos Verdes	18.9 (30.1)	7.3
San Jose	19.0 (30.6)	6.4
Northridge (East Oak Ridge)	19.8 (31.8)	7.0
Anacapa-Dume	19.9 (31.9)	7.5
Santa Susana	24.5 (39.5)	6.7
Chino-Central Ave. (Elsinore)	26.7 (42.9)	6.7
Cucamonga	27.9 (44.9)	6.9
San Joaquin Hills	29.7 (47.8)	6.6
Notes:		
¹ USGS, 2008		
² Cao, et al., 2003		

7. METHODOLOGY FOR GEOLOGIC IMPACT AND HAZARD ANALYSES

As outlined by the CEQA, the proposed project has been evaluated with respect to potential geologic and seismic impacts associated with the project. Evaluation of impacts due to potential geologic and seismic hazards is based on our review of readily available published geotechnical literature and geologic and seismic data pertinent to the proposed project, and site reconnaissance. The references and data reviewed include, but are not limited to, the following:

- Geologic maps and fault maps from the CGS and United States Geological Survey (USGS).
- Topographic maps from the USGS.
- State of California Earthquake Fault Zone Maps.

- State of California Seismic Hazards Zones Reports and Maps.
- Previous geotechnical evaluation performed by Ninyo & Moore.
- Aerial photographs.
- Seismic data from the CGS and USGS.
- Geotechnical publications by the CGS and USGS.
- Safety Element of the Los Angeles City General Plan.

8. THRESHOLDS OF SIGNIFICANCE

According to Appendix G of the CEQA guidelines (California Environmental Resources Evaluation System [CERES], 2005a, 2005b), 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. 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
Earthquake Fault Rupture			X	
Strong Seismic Ground Shaking		X		
Seismically Related Ground Failure, Including Liquefaction		X		
Landslides			X	
Substantial Soil Erosion			X	
Subsidence				X
Compressible/Collapsible Soils		X		
Expansive Soils		X		
Corrosive Soils		X		
Shallow Groundwater		X		
Note: 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. CONCLUSIONS AND RECOMMENDATIONS FOR POTENTIAL GEOLOGIC AND SEISMIC IMPACTS/HAZARDS

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

The potential geologic and seismic hazards described below may be addressed by employing sound engineering practice in the design and construction of future development in the project area. This practice includes the implementation of appropriate geotechnical recommendations prior to the design and construction of the facilities in the project area. Typical methods to reduce potential hazards that may be encountered during the construction of future improvements are described in the following sections. Where appropriate, recommendations to mitigate potential geologic hazards are provided. Prior to design of future improvements, detailed subsurface geotechnical evaluation should be performed to address the site-specific conditions at the locations of the planned improvements and to provide detailed recommendations for design and construction.

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. Based on our review of referenced geologic and fault hazard data and site reconnaissance, the project site is not transected by known active or potentially active faults. The active Upper Elysian Park blind thrust fault is located approximately 0.4 mile north of the approximate center of the site, the active Raymond fault is located approximately 4.2 miles north of the approximate center of the site, and the active Hollywood fault is located approximately 4.3 miles northwest of the approximate center of the site. Therefore, the potential for surface rupture is relatively low. However, lurching or cracking of the ground surface as a result of nearby seismic events is possible.

9.2. Seismic Ground Shaking

Earthquake events from one of the regional active or potentially active faults near the project area could result in strong ground shaking which could affect the project area. 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 type of construction also affects how particular structures and improvements perform during ground shaking.

In order to evaluate the level of ground shaking that might be anticipated in the project area, site-specific analysis was performed. The 2013 California Building Code recommends that the design of structures be based on spectral response accelerations in the direction of maximum horizontal response (5 percent damped) having a 1 percent probability of collapse in 50 years. Such spectral response accelerations represent the Risk-Targeted Maximum Considered Earthquake (MCE_R) ground motion. The horizontal peak ground acceleration (PGA) that corresponds to the MCE_R for the site was calculated as 1.02g using the USGS (USGS, 2014) seismic design tool (web-based). The mapped and design PGA were estimated to be 0.97g and 0.68g, respectively, using the USGS (2014) calculator and the American Society of Civil Engineers 7-10 Standard. These estimates of ground motion do not include near-source factors that may be applicable to the design of structures on site.

These potential levels of ground shaking could have high impacts on future improvements in the project area without appropriate design mitigation, and should be considered during the detailed design phase of the project. Mitigation of the potential impacts of seismic ground shaking can be achieved through project structural design. Structural elements of future improvements can be designed to resist or accommodate appropriate site-specific ground motions and to conform to the current seismic design standards. Appropriate structural design and mitigation techniques would reduce the impacts related to seismic ground shaking to low levels.

9.3. Liquefaction

Liquefaction is the phenomenon in which loosely deposited granular soils located below the water table undergo rapid loss of shear strength due to excess pore pressure generation when subjected to strong earthquake-induced ground shaking. Ground shaking of sufficient duration results in the loss of grain-to-grain contact due to rapid rise in pore water pressure causing the soil to behave as a fluid for a short period of time. Liquefaction is known generally to occur in saturated or near-saturated cohesionless soils at depths shallower than 50 feet bgs. Factors known to influence liquefaction potential include composition and thickness of soil layers, grain size, relative density, groundwater level, degree of saturation, and both intensity and duration of ground shaking. The potential damaging effects of liquefaction include differential settlement, loss of ground support for foundations, ground cracking, heaving and cracking of slabs due to sand boiling, buckling of deep foundations due to liquefaction-induced ground settlement.

According to Seismic Hazard Zones Maps published by the State of California (CDMG, 1999), a portion of the project area in the western part of the site is located within an area considered susceptible to liquefaction (Figure 5). Other areas of the site not indicated on the State map could also be subject to liquefaction. This would be evaluated with site-specific subsurface evaluation. Based on the geologic mapping of Puente Formation sandstone under the elevated northeast part of the site, that portion of the site would not be subject to liquefaction. Liquefaction and its associated manifestations could cause damage to future project improvements if not mitigated during detailed project design, and could have a potentially high impact on the project. The potential damaging effects of liquefaction include differential settlement, loss of ground support for foundations, ground cracking, heaving and cracking of pavement due to sand boiling, buckling of deep foundations due to liquefaction-induced ground settlement.

Assessment of the liquefaction potential would be evaluated prior to detailed design and construction of project improvements and incorporated into the design, as appropriate. Structural design and mitigation techniques would be developed to reduce the impacts

related to liquefaction to low levels. Therefore, the potential impacts due to liquefaction are considered to be minimal with incorporation of techniques such as structural design, in-situ ground modification, or supporting foundations with piles at depths designed specifically for liquefaction.

To evaluate the potential liquefaction hazard for the proposed project, subsurface evaluation could be performed. Site-specific geotechnical evaluations to assess the liquefaction and dynamic settlement characteristics of the on-site soils would include drilling of exploratory borings, evaluation of groundwater depths, and laboratory testing of soils.

Methods for construction in areas with potential liquefaction hazard may include in-situ ground modification, removal of liquefiable layers and replacement with compacted fill, or support of project improvements with piles at depths designed specifically for liquefaction. Pile foundations can be designed for liquefaction hazard by supporting the piles in dense soil or bedrock below the liquefiable zone or other appropriate methods as evaluated during the site-specific evaluation. Additional recommendations for mitigation of liquefaction may include densification by installation of stone columns, vibration, deep dynamic compaction, and/or compaction grouting.

9.4. Landslides

Landslides, slope failures, and mudflows of earth materials generally occur where slopes are steep and/or the earth materials are too weak to support themselves. Earthquake-induced landslides may also occur due to seismic ground shaking. Landslides are not shown at the site on the geologic maps reviewed. The project site has been extensively developed and is primarily covered with pavements, hardscape and structures. The site includes some graded slopes associated with landscaping and pedestrian areas. The northeast corner of the site contains a slope that ascends approximately 60 feet toward the edge of the property. This slope is landscaped and is lined with a series of concrete drainage swales to route water runoff away from the slope face.

Accordingly, the potential for future landslides or mudflows to affect developments within the project areas is relatively low, and significant impacts related to landslides or mudflows within the project area are not anticipated. Slopes created for future developments within the project area should also be designed to reduce the potential for 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 varying processes and may occur in the project area where bare soil is exposed to wind or moving water (both rainfall and surface runoff). The processes of erosion are generally a function of material type, terrain steepness, rainfall or irrigation levels, surface drainage conditions, and general land uses.

Based on our review of geologic references, previous site exploration and site reconnaissance, the materials exposed at the surface of the project site include silty clay and silty to clayey sand soils, and interbedded sandstone and shale rock formation. Sandy soils typically have low cohesion, and have a relatively higher potential for erosion from surface runoff when exposed in cut slopes or utilized near the face of fill embankments. Surface soils with higher amounts of clay tend to be less erodible as the clay acts as a binder to hold the soil particles together.

Future construction at the project site would result in ground surface disruption during excavation, grading, and trenching that would create the potential for erosion to occur. However, a Storm Water Pollution Prevention Program (SWPPP) incorporating Best Management Practices (BMPs) for erosion control would be prepared prior to the start of construction in accordance with governing agencies. In addition, the topographic gradients at the project site are relatively gentle. During long-term operation of future developments at the project site, surface drainage provisions, as appropriate, would reduce the potential for soil erosion at the site. Therefore, potential soil erosion would be reduced with incorporation of appropriate BMPs.

With the implementation of BMPs incorporated in the project SWPPP during future construction, water- and wind-related soil erosion can be limited and managed within construction site boundaries. Examples of these procedures could include surface drainage measures for erosion due to water, such as the use of erosion prevention mats or geofabrics, silt fencing, sandbags and plastic sheeting, and temporary drainage devices. Positive surface drainage should be accommodated at project construction sites to allow surface runoff to flow away from site improvements or areas susceptible to erosion. To reduce wind-related erosion, wetting of soil surfaces and/or covering exposed ground areas and soil stockpiles could be considered during construction operations, as appropriate. The use of soil tackifiers may be considered to reduce the potential for water- and wind-related soil erosion.

During long-term operation of future developments in the project area, soil erosion can be mitigated through site drainage design and maintenance practices. Design procedures can be performed to reduce soil erosion such as appropriate surface drainage design of roadways and facilities to provide for positive surface runoff. Design would address reducing concentrated run-off conditions that could cause erosion and affect the stability of project improvements.

9.6. Subsidence

Subsidence is characterized as a sinking of the ground surface relative to surrounding areas, and can generally occur where deep soil deposits are present. Subsidence in areas of deep soil deposits is typically associated with regional groundwater withdrawal or other fluid withdrawal from the ground such as oil and natural gas. Subsidence can result in the development of ground cracks and damage to subsurface vaults, pipelines and other improvements.

The City of Los Angeles and County of Los Angeles references do not indicate mapped areas of subsidence. The Safety Element of the Los Angeles City General Plan (1996) includes information regarding the City's program to preclude potential subsidence within the City. Subsurface extraction activities within the City of Los Angeles are regulated by the Oil Drilling District procedures, which contain provisions for monitoring and imposing

measures to preclude subsidence related to oil and gas extraction. Therefore, the potential for subsidence in the Project area is relatively low.

9.7. Compressible/Collapsible Soils

Compressible soils are generally comprised of soils that undergo consolidation when exposed to new loading, such as fill or foundation loads. Soil collapse is a phenomenon where the soils undergo a significant decrease in volume upon increase in moisture content, with or without an increase in external loads. Buildings, structures and other improvements may be subject to excessive settlement-related distress when compressible soils or collapsible soils are present.

Based on our background review, the project area is underlain by fill soils, alluvial sediments, and sedimentary rock formations. The alluvial deposits underlying the site are generally unconsolidated, based on the young nature of the deposits, reflecting a depositional history without substantial loading, and may be subject to collapse. Older, undocumented fill soils are considered potentially compressible/collapsible. Due to the presence of potentially compressible/collapsible soils at the site, there is a potential for differential settlement to cause damage to project improvements. The potential impacts of settlement are significant without appropriate mitigation during detailed project design and construction.

Since future development within the project area will involve construction of new improvements that would be loaded upon the existing soils, potential settlement and/or collapsible soils will be a consideration in the detailed design and construction of project improvements. Assessment of the potential for soils prone to settlement would be evaluated prior to detailed design and construction of project improvements and mitigation techniques would be developed, as appropriate, to reduce the impacts related to settlement to low levels.

To evaluate the potential for settlement to affect future project components, surface reconnaissance and subsurface evaluation would be performed. During the detailed design phase of the project, site-specific geotechnical evaluations would be performed to assess the

settlement potential of the on-site natural soils and undocumented fill. This may include detailed surface reconnaissance to evaluate site conditions, and drilling of exploratory borings or test pits and laboratory testing of soils, where appropriate, to evaluate site conditions.

Examples of possible mitigation measures for soils with the potential for settlement include removal of the compressible/collapsible soil layers and replacement with compacted fill; surcharging to induce settlement prior to construction of improvements; allowing for a settlement period after or during construction of new fills; and specialized foundation design, including the use of deep foundation systems to support structures. Varieties of in-situ soil improvement techniques are also available, such as dynamic compaction (heavy tamping) or compaction grouting.

9.8. Expansive Soils

Expansive soils include clay minerals that are characterized by their ability to undergo significant volume change (shrink or swell) due to variations in moisture content. Sandy soils are generally not expansive. Changes in soil moisture content can result from rainfall, irrigation, pipeline leakage, surface drainage, perched groundwater, drought, or other factors.

Volumetric change of expansive soil may cause excessive cracking and heaving of structures with shallow foundations, concrete slabs-on-grade, or pavements supported on these materials. Based on our background review and site reconnaissance, the near-surface soils in the project site are predominantly comprised of sandy, coarse-grained materials. These soils typically have a low expansion potential. However, clayey soils may be present in areas not observed. Constructing project improvements on soils known to be potentially expansive could have a significant impact on future improvements.

Detailed assessment of the potential for expansive soils would be evaluated during the design phase of the project and mitigation techniques would be developed, as appropriate, to reduce the impacts related to expansive soils to low levels. Therefore, the potential impacts

due to expansive soils would be reduced to low levels with incorporation of techniques such as overexcavation and replacement with non-expansive soil, soil treatment, moisture management, and/or specific structural design for expansive soil conditions developed during design of the project.

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 buried conduits, foundations, and other buried concrete or metal improvements. Corrosive soil could cause premature deterioration of these underground structures or foundations. Constructing future project improvements on corrosive soils could have a substantial impact to the project. Assessment of the potential for corrosive soils would be evaluated during the detailed design phase of the project through soil testing procedures, and mitigation techniques would be developed, as appropriate, to reduce the impacts related to corrosive soils to low levels.

To evaluate the potential for corrosive soils to affect future project improvements, subsurface evaluation including laboratory testing would be performed. Evaluation of the corrosive soil potential can be accomplished by testing and analysis of soils at foundation design depths. The laboratory tests conducted on the soils prior to construction and improvement plan preparation would include corrosivity tests to evaluate the corrosivity of the subsurface soils. Review of these data by a corrosion engineer would result in corrosion protection measures suitable to the project elements. Evaluation of the potential corrosive soils hazard would be performed prior to detailed design and construction so that, in the event the hazard exists, mitigation techniques can be implemented. To avoid site-specific subsurface evaluation, corrosion protection measures can be included in the initial design for the proposed project improvements.

Mitigation of corrosive soil conditions may involve the use of concrete resistant to sulfate exposure. Corrosion protection for metals may be needed for underground foundations or structures in areas where corrosive groundwater or soil could potentially cause deterioration.

Typical mitigation techniques include epoxy and metallic protective coatings, the use of alternative (corrosion resistant) materials, and selection of the appropriate type of cement and water/cement ratio. Specific measures to reduce the potential effects of corrosive soils would be developed in the detailed design phase.

9.10. Groundwater

Based on our background review and previous site exploration, groundwater levels in the vicinity of the project site may vary from approximately 13 to 58 feet below the ground surface. The depth to historic high groundwater is approximately 20 feet. Future improvements in the project area are anticipated to consist of excavations and site grading for new medical, office and retail structures, pedestrian areas, landscaping, open space areas, and parking area improvements. Based on the reported depth of groundwater in the project area and the anticipated depth of these construction activities, groundwater could have a significant impact on excavations for future project improvements. In addition, areas of shallower perched groundwater may be encountered during excavations. Groundwater levels may be influenced by seasonal variations, precipitation, irrigation, soil/rock types, groundwater pumping, and other factors and are subject to fluctuations.

Wet or saturated soil conditions encountered in excavations during construction for the project can cause instability of the excavations, and present a constraint to the construction of foundations. Excavations for foundations in areas with shallow perched groundwater may need to be cased/shored and/or dewatered to maintain stability of the excavations and provide access for construction. Saturated soils encountered in excavations below the groundwater can be difficult for the contractor to handle.

Shallow groundwater can also impact ground stability, and foundation design of proposed improvements, as well as the methods and costs of construction. If not adequately monitored by the contractor, dewatering of excavations could induce consolidation of the underlying soils, which could cause differential settlement of existing structures and improvements located near the excavation. The amount of consolidation due to dewatering would depend on many factors, including the areal extent and depth of dewatering, soil type, soil density,

and the methods used by the dewatering contractor. Excavations for underground structures would need to be performed with care to reduce the potential for lateral deflection of excavation sidewalls and/or shoring, which could also cause differential movement of structures located near the excavation.

Further study, including subsurface exploration, would be performed during the detailed design phase of future improvements 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. Assessment of the potential for shallow groundwater would be evaluated during the design phase of the project and mitigation techniques would be developed, as appropriate, to reduce the impacts related to shallow groundwater to low levels. Therefore, the potential impacts due to groundwater would be reduced with incorporation of techniques such as construction dewatering.

10. LIMITATIONS

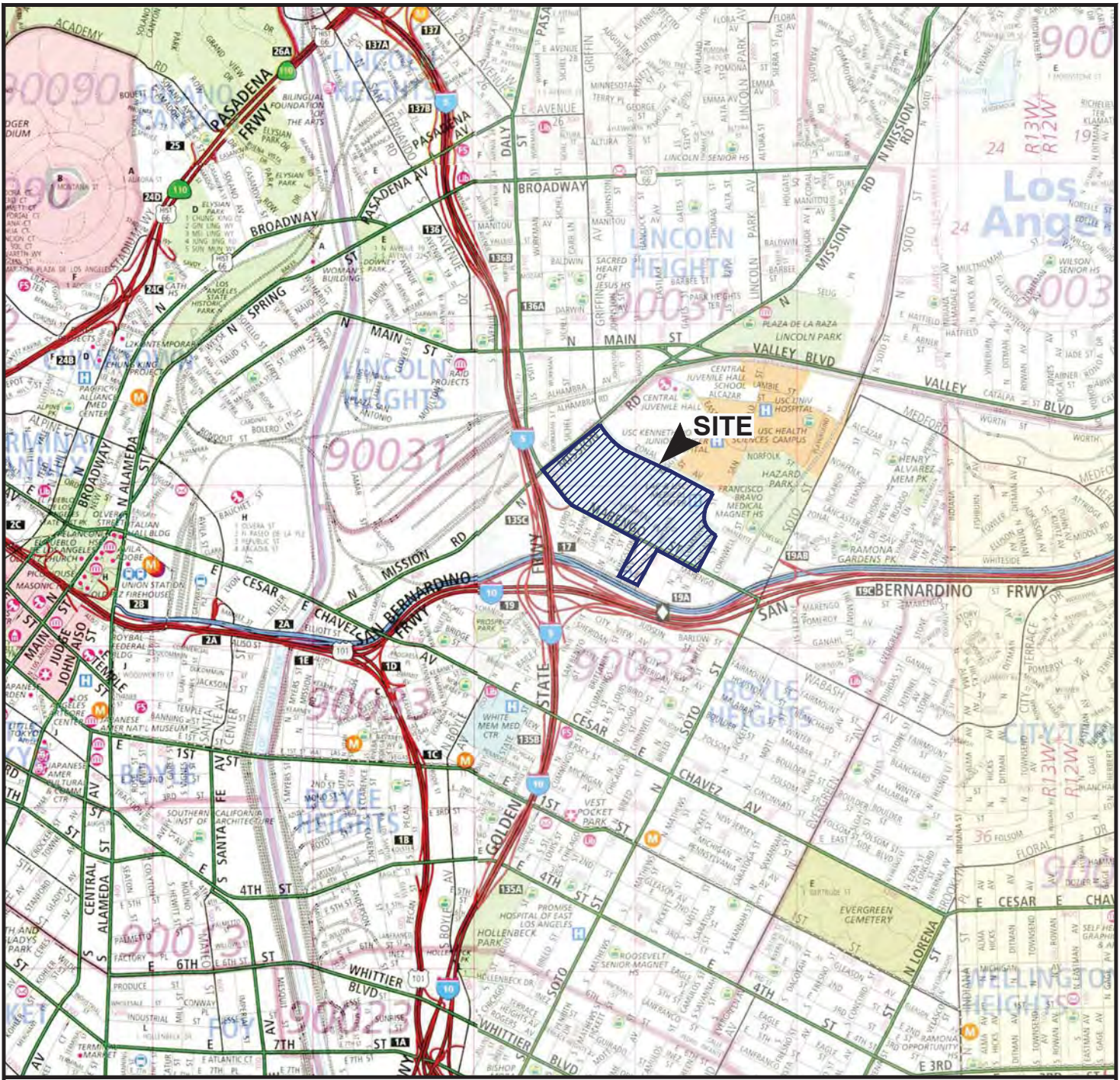
The purpose of this study was to evaluate geotechnical conditions and potential geologic and seismic hazards at the site using readily available geotechnical data, site reconnaissance, and to provide a preliminary geotechnical report which can be utilized in the preparation of an EIR for the project.

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 readily available geotechnical literature, geologic and seismic data, and an analysis of the observed conditions. Variations may exist and conditions not observed or described in this report may be encountered.

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SCALE IN FEET



NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.
Map © Rand McNally, R.L.07-S-129



SITE LOCATION

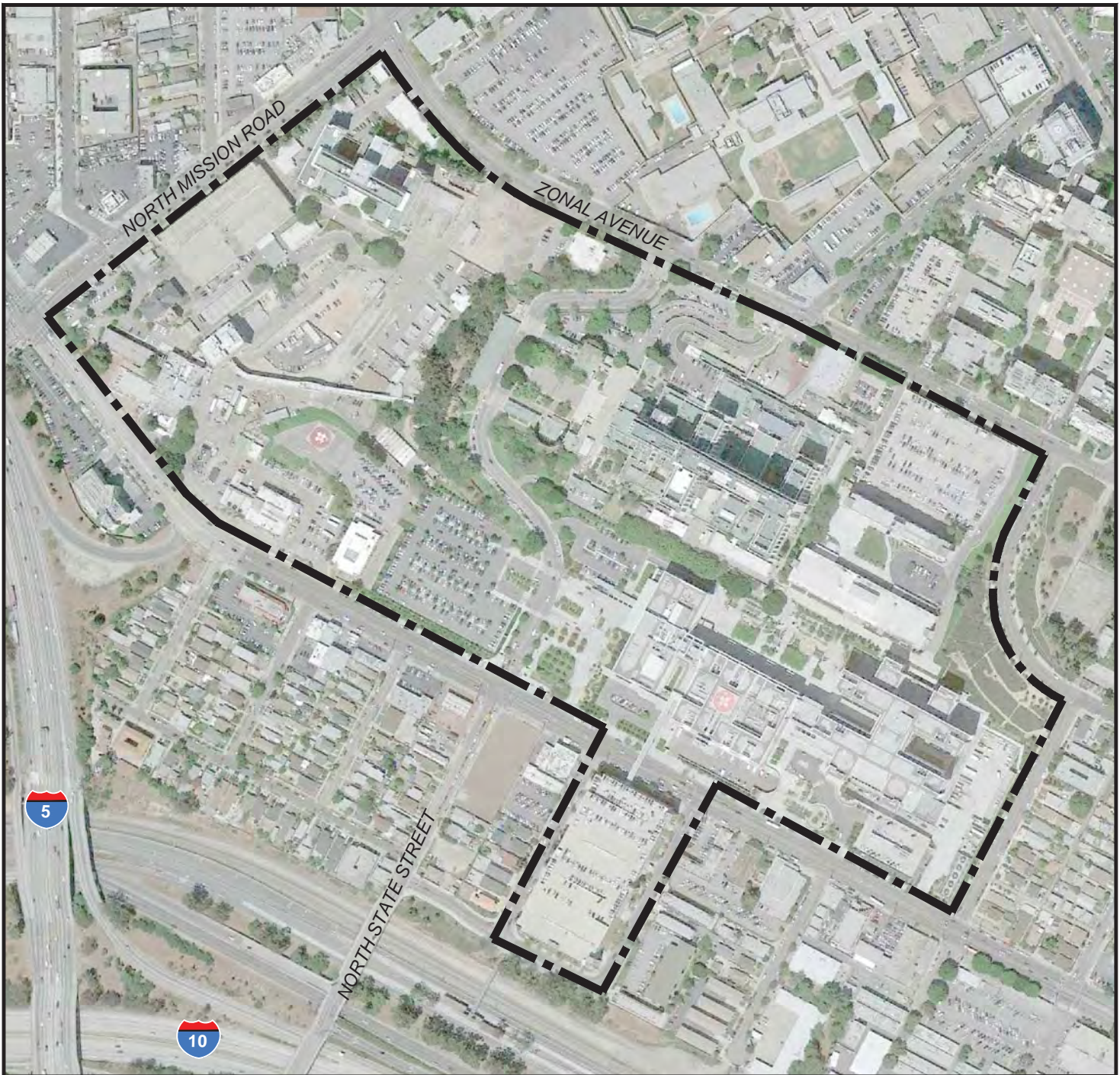
FIGURE

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1

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REFERENCE: GOOGLE EARTH IMAGERY, 2014.



SCALE IN FEET



NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

LEGEND

SITE BOUNDARY



SITE AERIAL

FIGURE

2

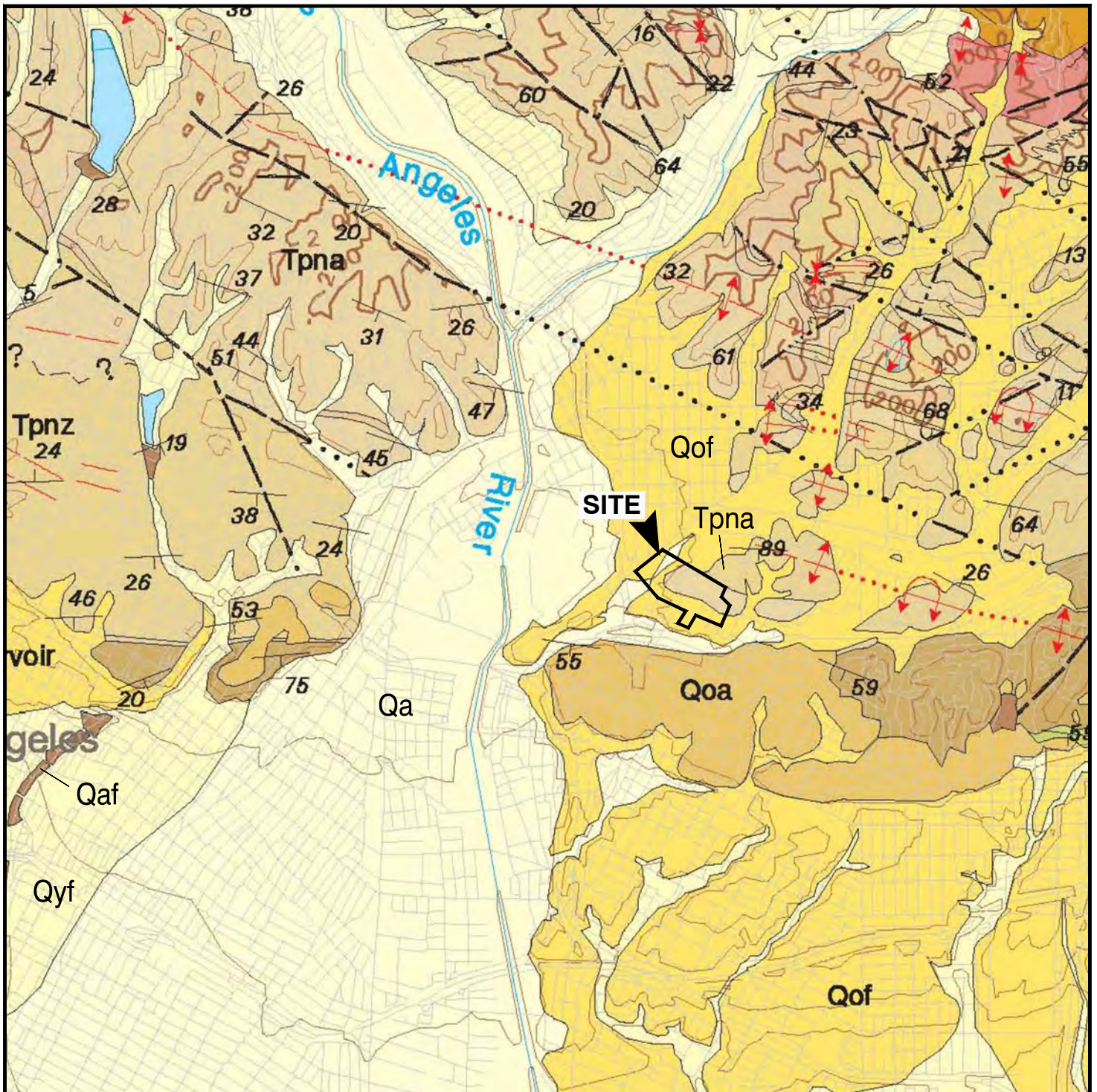
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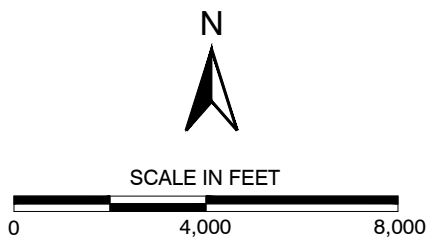
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







6/14



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LEGEND

	Qa	ALLUVIAL DEPOSITS		Tpna	PUEANTE FORMATION SANDSTONE
	Qoa	OLD ALLUVIAL DEPOSITS			GEOLOGIC CONTACT
	Qof	OLD ALLUVIAL FAN DEPOSITS			FAULT; DOTTED WHERE CONCEALED
	Tpnz	PUEANTE FORMATION		89	STRIKE AND DIP OF BEDDING

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore

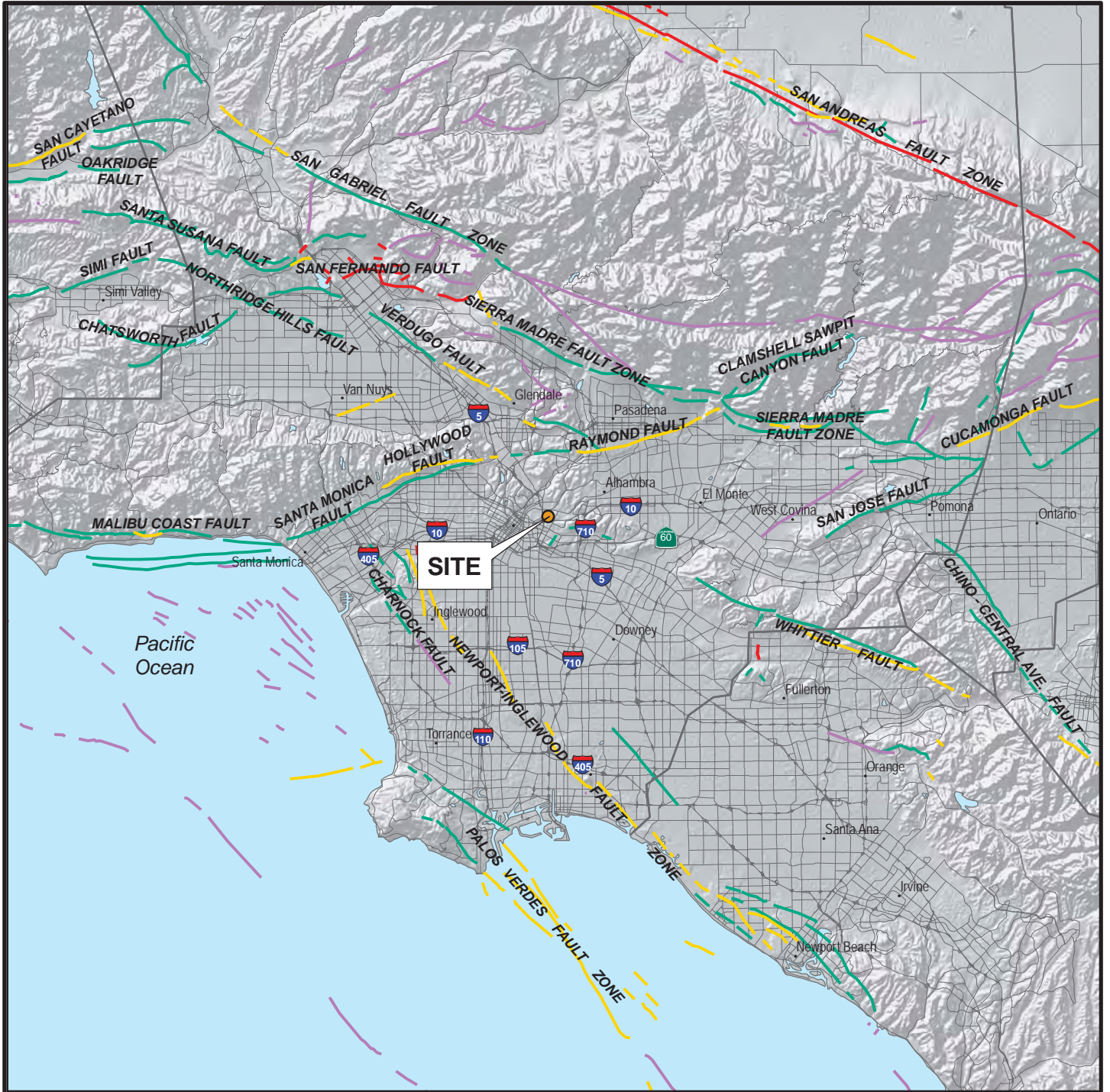
REGIONAL GEOLOGY

FIGURE

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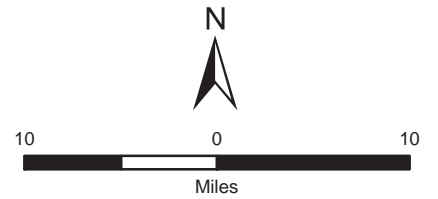
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3



GIS DATA SOURCE: CALIFORNIA GEOLOGICAL SURVEY (CGS); ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE (ESRI)
 REFERENCE: JENNINGS, 2010, FAULT ACTIVITY MAP OF CALIFORNIA AND ADJACENT AREAS

LEGEND	
FAULT ACTIVITY:	
— HISTORICALLY ACTIVE	— LATE QUATERNARY
— HOLOCENE ACTIVE	— QUATERNARY
— COUNTY BOUNDARIES	



NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE

Ninyo & Moore

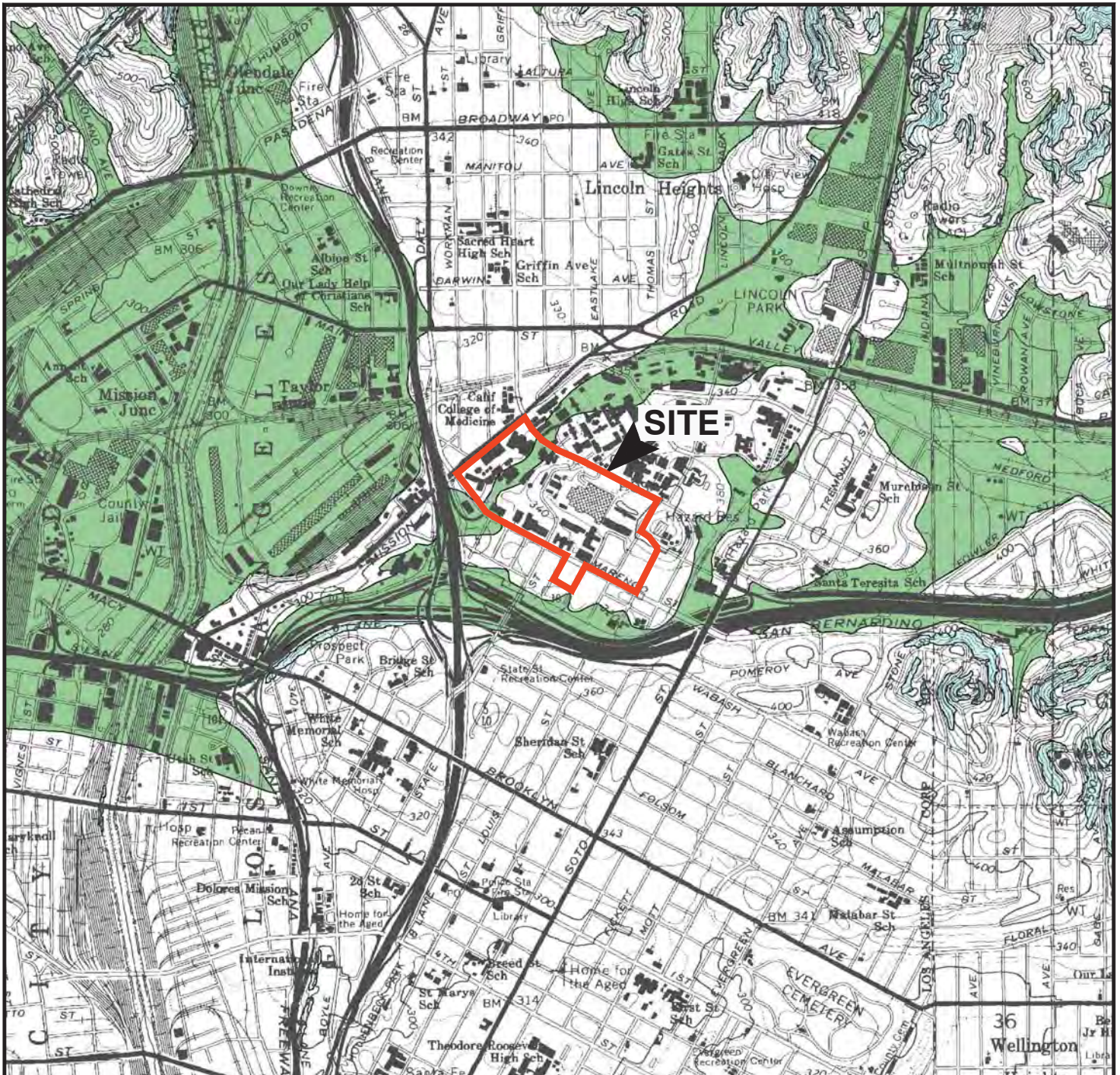
FAULT LOCATIONS

FIGURE

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4



REFERENCE: CALIFORNIA DEPARTMENT OF CONSERVATION, DIVISION OF MINES AND GEOLOGY, STATE OF CALIFORNIA, 1999, SEISMIC HAZARD ZONES MAP OFFICIAL REVISED MAP LOS ANGELES QUADRANGLE, 7.5-MINUTE SERIES: SCALE 1:24,000.

LEGEND

EARTHQUAKE-INDUCED LANDSLIDES
 Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

LIQUEFACTION:
 Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

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NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.



SEISMIC HAZARD ZONES

FIGURE

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5