Appendix H
GEOLOGY AND SOILS ANALYSIS

GEOLOGY, SOILS AND SEISMICITY TECHNICAL REPORT

for
Henry Mayo Newhall Memorial Hospital Master Plan
Santa Clarita, California

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Henry Mayo Newhall Memorial Hospital EIR
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GEOLOGY, SOILS AND SEISMICITY EIR
for
Henry Mayo Newhall Memorial Hospital, California

1.0 INTRODUCTION

The scope of work was performed as part of the geology, soils and seismicity portion of the Henry Mayo Newhall Memorial Hospital (HMNMH) EIR. The scope included compilation and review of published geologic and seismic hazards maps, geotechnical reports prepared by Leighton & Associates (1986, 1987, 1989, 1990) for the existing Skilled Nursing Facility and Diagnostic and Treatment Center and adjacent parking lots, and combined geotechnical; and geologic hazards and seismic reports prepared by URS Corporation (URS)(2002, 2003) for the proposed addition to the northwest corner of the HMNMH and helipad. A list of the reports, maps and other relevant data reviewed for this study are presented in the References section at the end of this report.

As with all new construction for "critical structures," requirements for geotechnical and geologic/ seismic hazard studies are provided in Title 24 of the California Code of Regulations. As such, studies of these types are reviewed by the Office of the State Architect and California State Geologist's office.

The results of the EIR-level evaluation for this study as well as pertinent impacts and mitigating measures are provided in the following report.

2.0 EXISTING CONDITIONS

2.1 GEOLOGIC SETTING

The HMNMH project area is situated in the southeasternmost portion of the East Ventura Basin, a former structural basin, which is part of the western Transverse Ranges Province of southern California. This structural basin is filled with more than 10,000 feet of both marine and non-marine sediments that were deposited in Tertiary (beginning about 65 million years ago) through Quaternary time (1.6 million years ago to the present), with periods of erosion and non-deposition. The East Ventura Basin is bounded on the north and northeast by the San Gabriel fault and on the south and east by the Oat Mountain/Santa Susana and Weldon Canyon thrust faults, each of which are considered seismically active. Tectonic activity during the last

5 million years (+/-) has produced a series of large amplitude, east-west trending anticlines and synclines within the bedrock, portions of which have been exploited for oil and gas. The project area lies outside known oilfields.

The HMNMH project area is situated on the margin of an alluvial flood plain near the mouth of Pico Canyon and its confluence with the South Fork of the Santa Clara River. This area is represented by a relatively broad flat valley that is filled with young (Holocene age) alluvium, as shown on Figure 1- Geologic Map. According to published geologic maps (Dibblee, 1996) and geotechnical consultants' reports URS (2002), older (Pleistocene age) alluvium underlies the younger alluvium at depths ranging from 20 to 75 feet below ground surface. These same Pleistocene alluvial deposits are exposed in the topographically elevated terrace along the north side of the project area, and are underlain by non-marine sedimentary fluviatile deposits (i.e. sandstone and conglomerate with minor siltstone) of the Saugus formation. The depth to the Saugus formation is not well known, but is considered by Woodward-Clyde Consultants (1982, *in* URS, 2002) and Dibblee (1996) to be about 200 to 400 feet below ground surface, respectively.

There are no documented mineral deposits or significant paleontological (i.e. fossil) sites within the project area.

Site Conditions

The HMNMH project site comprises an area of approximately 29 acres and is occupied by various medical office buildings consisting of the main hospital, pavilion, and an ambulatory care center. Paved parking lots surround these various buildings. Aside from the varying heights of the medical campus, the overall site has little to no topographic relief and lies at an elevation of about 1225 feet (+/- several feet) above mean sea level.

Since the original development of the medical campus, the uppermost 2 to 10 feet of the native alluvial soils has been excavated and replaced with compacted fill for support of the parking areas and medical buildings. Based on a review of recent aerial photographs, it appears that most, if not all, of the native near- surface soils has been removed within the limits of the project area. The only exposed remaining natural soils in the vicinity of the project area are found on the slopes along the southern flanks of the elevated terrace/ older alluvial deposits that border the northern margin of the site.

The only potential geologic hazards and geotechnical constraints to the proposed development include the following:

- Collapsible artificial fill and isolated areas of Holocene age alluvial soils;
- Seismically-induced moderate to strong ground shaking; and
- Corrosive clayey soils at deeper foundation levels.

Although the project area is located within a highly seismically active portion of the state, there are no documented active or potentially active faults transecting or projecting towards the project area. Moreover, there are no documented landslides within or adjacent to the project area.

2.2 GEOLOGIC MATERIALS

The subsurface geologic materials that would likely have an influence on the proposed expansion/ development of the HMNMH are the artificial fill soils that have been placed beneath the existing buildings and parking areas (younger Holocene age, and possibly older Pleistocene age alluvial sediments).

Artificial fill

Artificial fill soils within the project area are reported to vary from about 2 to 10 feet thick. There are essentially two types of artificial fill soils within the project site. These include engineered fill soils, which support the existing buildings and the parking areas (e.g. Leighton & Associates 1986, 1987, 1989 a, b, 1990); and approximately 2 to 5 feet of artificial fills soils beneath other portions of the site that are likely to be loose, porous and contain varying amounts of organic debris/ trash. Where these "non-engineered" type of soils are encountered, they are expected to be compressible and therefore subject to long-term consolidation. If not removed and/or replaced with compacted fill beneath proposed buildings, the foundations and/or structural elements could experience moderate to significant distress.

Younger Alluvium (Geologic Map Symbol Qa)

Younger alluvial sediments are those that have been deposited by the intermittent stream flows and periods of severe flooding during the Holocene (last 11,000 years). Two Leighton & Associates (1986) exploratory borings were drilled within the northern portion of the G&L Reality Corp Parcel. Alluvial sediments to the depths explored (i.e. 40 feet below ground surface) consisted of layers and lenses of gravelly silty sand that was moist and medium dense, and overlain by up to 10 feet of artificial fill.

The majority of the subsurface explorations within the alluvial sediments occurred in the central and north-central portion of the project site, in the vicinity of the main hospital and hospital pavilion, and the parking area to the north and south. Here, Leighton and Associates (1989) and URS (2002, 2003), identified what appears to be a southerly-to easterly-thickening, 10- to 25-foot-thick (+/-) upper layer of alluvium consisting of layers and lenses of poorly to well graded sand, silty sand, and sand with gravel that is moist and medium dense to dense. Below this upper sandy/gravelly layer is a 10-to-20-foot-thick, southerly- to easterly- thinning layer of lean clay and sandy lean clay that is moist and very stiff to hard. Below this clay layer, URS (2002) reports the alluvium consists of very dense sand, sand with silt and silty sand to depths of 51.5 feet. Saugus formation bedrock was not encountered in the deeper borings.

To my knowledge, although there have been no exploratory borings drilled within the vicinity of the ambulatory care facility and adjacent medical building, the character of the alluvial deposits in this area is very likely to be similar to that described above within the central and north central part of the project area. However, neither the vertical or lateral extent of any artificial fill soils is known within this portion of the project area.

Based on the geotechnical information reviewed, the physical character of the alluvial soils is not considered to present any significant geotechnical constraints for development of the new medical campus. The alluvial soils are not considered by Leighton & Associates (1989) or URS (2002, 2003) to be subject to collapse/settlement upon wetting and/or placement of structural loads (i.e. embankment/ fill soils for buildings).

Older (Pleistocene) Alluvium (Geologic Map Symbol Qog)

Older Pleistocene age alluvial deposits are only exposed on the southerly-facing natural slope adjacent to the northern perimeter of the project area (refer to Figure 1- Geologic Map). According to geologic mapping by Dibblee (1996), these sediments represent an ancient alluvial fan deposit consisting of gravel and sand. No "weak" clay layers are known to occur within these coarse-grained deposits. It is unknown whether any of the exploration borings by Leighton & Associates (1986) or URS (2002, 2003) encountered these older deposits. The sedimentary layering within these deposits strikes northwest-southeast and, in all likelihood, dips to the northeast at very shallow angles (less than 7 degrees).

2.3 GROUNDWATER

The project site lies just beyond the southern margin of the Eastern Groundwater Basin within the Upper Santa Clara River Valley Hydrologic Area (Santa Clarita Water Purveyors, 2002; *in URS, 2002*). The alluvium and Saugus formation bedrock forms the Eastern Groundwater basin aquifer. The Santa Clarita Valley Water Purveyors (2002; *in URS, 2002*) report that groundwater levels in the alluvium can fluctuate rapidly in response to changes in recharge or groundwater extraction/ pumping due the high permeability of these deposits. According to the California Geological Survey (formally known as California Division of Mines and Geology), the depth to historic high groundwater in the vicinity of the project area is about 70 feet below ground surface. Although the current depth to groundwater is not known beneath the site, it is assumed to be greater than 70 feet.

There is no evidence of past or present groundwater use in the project area. No evidence of springs or seeps has been observed along the base of the alluvial terrace deposits northerly of the site.

2.4 MINERAL RESOURCES

There are no economic metallic or non-metallic ore deposits within or directly adjacent to the project area. Although the project area is essentially surrounded by either existing or abandoned oil producing areas, there are no known producing oil wells within several miles of the project area.

3.0 GEOLOGIC HAZARDS/CONSTRAINTS

General

The project is situated within an area underlain, for the most part, by dense alluvial soils that are not considered subject to static or seismically-induced settlement and are regarded as relatively safe from damage by ground shaking resulting from seismic activity. The risk from damage resulting from earthquake-induced liquefaction, lateral spread, landslides, seiches, and tsunami is considered remote.

The primary geologic hazards/constraints identified during this study are those associated with collapsible fill soils, possibly seismically-induced settlement within isolated pockets of loose Holocene alluvium, and strong seismically-induced ground shaking.

3.1 FAULTING AND SEISMICITY

The project area is situated within a highly seismically active area of Southern California referred to as the Ventura Basin/ Western Transverse Ranges fold-and-thrust belt (Duebendofer and Meyer, 2002). Hazards associated with earthquakes include primary hazards, such as ground shaking and surface rupture, and secondary hazards, such as liquefaction, seismically-induced settlement, landsliding, tsunamis, and seiches. However, because there is no evidence of active faults within or projecting towards the project site, the likelihood of ground surface rupture or significant ground deformation is considered very low. Given the depth to groundwater and dense nature of the alluvial sediments, the likelihood of liquefaction occurring within the site is also considered low.

In accordance with the California Geological Survey, a fault is defined as a fracture in the crust of the earth along which rocks on one side have moved relative to those on the other side. Most faults are the result of repeated displacements over a long period of time. An inactive fault is a fault which has not experienced earthquake activity within the last three million years. In comparison, an active fault is one that has experienced earthquake activity in the past 11,000 years. A fault that has moved within the last two to three million years, but has not been proven by direct evidence to have moved within the last 11,000 years, is considered potentially active. No active or potentially active faults are located within or project towards the project area.

The Alquist-Priolo Act of 1972 (now the Alquist-Priolo Earthquake Fault Zoning Act, Public Resources Code 2621-2624, Division 2 Chapter 7.5) regulates development near active faults to in order to mitigate the hazard of surface fault-rupture. Under the Act, the State Geologist is required to delineate "special study zones" along known active faults in California." The Act also requires that, prior to approval of a project, a geologic study be conducted to define and delineate any hazards from surface rupture. A geologist registered by the State of California, within or retained by the lead agency for the project, must prepare this geologic report.
A 50-foot setback from any known trace of an active fault is required. The project area is not currently known to be located within an Alquist-Priolo Earthquake Fault Zone, according to the California Geological Survey. The closest Earthquake Fault Zone to the site is a segment of the San Gabriel fault zone located about 1.75 miles northeast of the project site.

Ground shaking accompanying earthquakes on nearby faults can be expected to be felt within the site. However, the intensity of ground shaking would depend upon the magnitude of the earthquake, the distance to the epicenter, and the geology of the area between the epicenter and the property.

The Modified Mercalli Intensity (MMI) scale was developed in 1931 and measures the intensity of an earthquake's effects in a given locality, and is perhaps much more meaningful to the layman because it is based on actual observations of earthquake effects at specific places. On the MMI scale, values range from I to XII. The most commonly used adaptation covers the range of intensity from the conditions of: "I –not felt except by very few, favorably situate," to "XII – damage total, lines of sight disturbed, objects thrown into the air." While an earthquake has only one magnitude, it can have many intensities, which decrease with distance from the epicenter. In the case of the 1994 Northridge earthquake, the Santa Clarita/ Newhall area experienced MMI's between VII and VIII (Dewey, et. al., 1995).

Ground motions, on the other hand, are often measured in percentage of gravity (percent g), where g = 32 feet per second per second (980 cm/sec^2) on the earth. Maximum ground motions, referred to as the Peak Ground Acceleration (PGA), at the project site were determined by URS (2002) on the basis of the 1998 California Building Code (CBC) procedures (California Building Standards Commission, 1998; *in URS, 2002*). This "deterministic" approach used the closest distance to known faults and fault type (i.e. strike-slip, thrust, or combination of the two). Although the CBC method provides generalized results for seismic design, the requirements of California Geological Survey Note 48 state that a "Probabilistic Seismic Hazard Analysis (PSHA) must be performed for certain types of buildings, such as hospitals. URS (2002) performed a PSHA for the addition to the northwest corner of the HMNMH in 2002. This analysis produced PGA values of 0.86 g that corresponds to a 475-year return period (*e.g. Design Basis Earthquake*), and 1.03 g corresponding to a 949-year return period (*e.g. Upper Bound Earthquake)*. For comparative purposes, ground motion from the Northridge earthquake, in which the epicenter was about 12 miles south of the project site, produced a PGA (i.e. horizontal component) of 1.03g at the Los Angeles County fire station in Newhall, approximately 1.25 miles from the site. Although the PGA values produced by URS (2002) are applicable for this EIR-level evaluation, an updated PSHA will likely be required for the build out of the HMNMH.

A listing of active faults considered capable of producing strong ground motion at the site, their closest distances to the property, and the maximum expected earthquake along each fault is presented in Table 1. Also presented are generalized evaluations of maximum ground shaking at the project site for the maximum earthquakes, and generalized predictions of the likelihood of such events occurring.

TABLE 1

SUMMARY OF FAULTS AND GENERALIZED EARTHQUAKE INFORMATION FOR HENRY MAYO NEWHALL MEMORIAL HOSPITAL PROJECT SITE

Name	Miles from Site	Maximum Magnitude (M)	Expected Level of Ground Shaking	Likelihood
Northridge (E Oak Ridge)	3.5*	6.9	High	High
Santa Susana	6	6.6	High	High
Holser	1.5	6.5	High	Moderate
San Gabriel	1.5	7.0	High	Moderate
Sierra Madre	17.5	6.7	Moderate	High
Simi-Santa Rosa	8.5	6.7	Moderate	Moderate
Northridge Hills	9.3	6.6	Moderate	Moderate
San Andreas (Mojave)	19	7.1	Moderate	High
Oak Ridge (onshore)	9.3	6.9	Moderate	High
San Cayetano	11.5	6.8	Moderate	Moderate
Newport-Inglewood	27.5	6.9	Low	High

* This fault is a blind thrust fault that has no surface projection. The closest distance to a projection of the rupture area along the subsurface trace of the fault is estimated to be about 9 miles, according to URS (2002).

The greatest amount of ground shaking at the site would be expected to accompany large earthquakes on the Northridge/ E. Oak Ridge, Santa Susana, Holser, and San Gabriel faults. Earthquake magnitudes in the range of M6.5 to M7.0 could produce Modified Mercalli Intensities in the range of VIII to XI within the property, and maximum horizontal ground acceleration on the order of 1.0g. As stated above, damage from ground rupture on-site is extremely unlikely because no known active faults cross the property.

Secondary earthquake hazards include liquefaction, ground lurching, lateral spreading, seismically-induced settlement, earthquake-induced landsliding/ rock fall, tsunamis, and seiches.

Liquefaction

Seismic ground shaking of relatively loose, granular soils that are saturated or submerged can cause the soils to liquefy and temporarily behave as a dense fluid. Liquifaction is caused by a sudden temporary increase in pore water pressure due to seismic densification or other displacement of submerged granular soils. Liquefaction more often occurs in earthquake-prone areas underlain by young (i.e. Holocene age) alluvium where the groundwater table is higher than 50 feet below ground surface.

The CGS has designated certain areas within California as potential liquefaction hazard zones. However, the project site is not designated as being within a zone having the potential for earthquake-induced liquefaction and therefore the CGS does not consider the site as being a high risk. Although Holocene age alluvium is present beneath the entire site, groundwater levels are deeper than 50 feet and, therefore, are not susceptible to liquefaction. The liquefaction potential is considered nil.

Lateral Spreading

Lateral spreading involves the lateral displacement of surficial blocks of sediment as a result of liquefaction in a subsurface layer. Because the liquefaction potential within the project area is unlikely, the likelihood of lateral spread is considered to be remote.

Ground Lurching

Lurching is a phenomenon in which loose to poorly consolidated deposits move laterally as a response to strong ground shaking during an earthquake. Lurching is typically associated with soil deposits on or adjacent to steep slopes. Lurching that occurred in the Santa Monica and

Santa Susana mountains during the 1994 Northridge earthquake usually was attributable to the outer two to eight feet of loose fill soils, which spilled over the edges of graded pads cut into bedrock. Graded and compacted housing pads did not experience lurching during this very damaging earthquake.

Certain soils have been observed to move in a wave-like manner in response to intense seismic ground shaking, forming ridges or cracks on the ground surface. Areas underlain by thick accumulations of alluvium appear to be more susceptible to ground lurching than bedrock. Under strong seismic ground motion conditions, lurching can be expected within loose, cohesionless soils, or in clay-rich soils with high moisture content. Generally, only lightly-loaded structures such as pavement, fences, pipelines and walkways are damaged by ground lurching; more heavily loaded structures appear to resist such deformation. Ground lurching may occur where deposits of loose alluvium exist on the project site. If alluvial soils prove to be loose (i.e. poorly consolidated), ground lurching may affect lightly-loaded structures built on these materials.

Lurching can also affect graded pads that are underlain by steep contacts of dissimilar bearing materials at depth, such as compacted fill caps that have been placed over a transition from very dense older alluvium, or bedrock, to Holocene age alluvium. Given the local geologic conditions and latest proposed layout for the build-out of the HMNMH, no structures would overlie a transition between Holocene age alluvium and older alluvium or Saugus formation bedrock. Therefore, the likelihood of lurching affecting the project area is considered low.

Seismically-Induced Ground Settlement

Strong ground shaking can cause settlement by allowing sediment particles to become more tightly packed, thereby reducing pore space. Unconsolidated, loosely packed alluvial deposits are especially susceptible to this phenomenon. Poorly compacted artificial fills may also experience seismically-induced settlement. Based on the subsurface data obtained from the exploratory borings drilled by Leighton & Associates (1986) and URS (2002, 2003), the Holocene age alluvial soils are, for the most part, dense to very dense and therefore are not prone to seismically-induced settlement. However, because relatively loose alluvial soils were encountered in only one of the 19 exploratory borings drilled beneath the addition to the northwest corner of the HMNMH by URS (2002{i.e. Boring #B-3}), the possibility of other isolated pockets of alluvium that may be subject to seismic settlement cannot be ruled out completely. In addition, portions of the site that are mantled with non-engineered (i.e. loose) fill soils may likely be subject to seismically-induced settlement and/ or development of ground cracking.

Seismically-Induced Landsliding

Because the project area is situated on a relatively flat alluvial plain and lacks any significant slopes, the hazard from slope instability, from both landslides and debris flows, is considered negligible. The CGS has designated the slopes to the north of the project site as having the potential for landslide movement during a seismic event. However, because the slope has apparently been developed as part of the housing development above the site and the toe of the slope lies more than 100 feet from any of the proposed buildings, it is considered unlikely that future landslide activity on these slopes, if any, would impact the proposed development.

Flooding

Flood hazards include storm-induced flooding and those caused by earthquakes, namely tsunami and dam failure. According to the Flood and Inundation Hazard Map from the Los Angeles General Plan Safety Element (County of Los Angeles, 1990; *in URS, 2002*), the project site does not lie within either a 100-year or 500-year flood area, or within a dam inundation area. Moreover, the Flood Insurance Rate Map for the City of Santa Clarita (Valencia) {Federal Emergency Management Agency, 1989; *in URS, 2002*} delineates the site as being in "Zone C," which is defined as an area of minimal flooding. Therefore, the likelihood for flood inundation at the site is considered minimal.

Tsunamis

A tsunami is a seismic sea-wave caused by sea-bottom deformations that are associated with earthquakes beneath the ocean floor. The hazard from tsunamis is considered nil, given the large distance from the Pacific Ocean.

Seiching

Seiching involves an enclosed body of water oscillating due to groundshaking, usually following an earthquake. Lakes and water towers are typical bodies of water affected by seiching. Given that there are no large open bodies of water or reservoirs upgradient of the project area, the potential for seiching is nil.

Other Geologic/Geotechnical Hazards

Subsidence

The extraction of groundwater or oil from sedimentary source rocks can cause the permanent collapse of pore space that was previously occupied by the removed fluid. The compaction of subsurface sediments resulting from fluid withdrawal could cause the ground surface overlying the fluid reservoir to subside. If sufficiently great, the subsidence can cause significant damage to nearby engineered structures. Because significant quantities of water or oil are not being extracted beneath or in close proximity to the project site, subsidence is not anticipated to pose a significant hazard to the project, barring such extractions in the future.

Expansive Soils

Expansive soils are clay-rich soils that can undergo a significant increase in volume with increased water content and a significant decrease in volume with a decrease in water content. Significant changes in moisture content within moderately to highly expansive soil can produce cracking, differential heave, and other adverse impacts to structures constructed on such soils. As identified by Leighton & Associates (1986) and URS (2002), the alluvial soils underlying the area at two likely foundation elevations consist primarily of granular soils and the deeper clays that have high moisture content (i.e. 20 to 30 percent) and a high degree of saturation. These soils are reported to exhibit "low" expansion potential and, therefore, the potential for expansive soils to impact new buildings is considered low. However, it has been pointed out by URS (2002) that clay soils exposed at the deeper subgrade level should not be allowed to dry out.

Corrosive Soils

Corrosive soils contain chemical constituents that can react with construction materials, such as concrete and ferrous metals, that may cause damage to foundations and buried pipelines. One such constituent is water-soluble sulfate which if in high enough concentration, can react with and damage concrete. Electrical resistivity, chloride content and pH level are indicators of the soil's tendency to corrode ferrous metals. Testing conducted by URS (2002) during their preliminary geotechnical investigation for the proposed addition to the northwest corner of the HMNMH indicates the upper sandy soils could be considered as having "mild" to "little" corrosion potential. However, the deeper clayey soils, based primarily on the resistivity tests, would be classified as being moderately to severely corrosive to metallic pipes. According to URS (2002), because the amount of sulfates in both the sandy and clayey soils was below the detection limit, the exposure to sulfate attack is considered mild. As such, no particular recommendations for cement type or water ratio were necessary to provide sulfate resistance.

Soil Erosion

Soil erosion is most prevalent in unconsolidated alluvium and surficial soils, which are prone to downcutting, sheetflow, and slumping and bank failure during and after heavy rainstorms. Given that the project site is essentially flat and does not possess site conditions conducive to erosion, the potential for soil erosion is nil.

4.0 THRESHOLDS OF SIGNIFICANCE

Earth resource and/or topographic impacts resulting from the proposed project could be considered significant if any of the following occur:

- exposure of people or property to substantial geological hazards, such as flooding due to dam or reservoir failure, landslides, mudslides, ground failure or similar hazards; or soil and/or seismic conditions so unfavorable that they could not be overcome by design using reasonable construction and/or maintenance practices;
- location of a structure within a mapped hazard area or within a structural setback zone;
- location of a structure within an Alquist-Priolo Fault-Rupture Hazard Zone, or within a known active fault zone, or an area characterized by surface rupture that might be related to a fault;
- triggering or acceleration of geologic processes, such as landslides or erosion that could result in slope or dam embankment failures;
- substantial irreversible disturbance of the soil materials at the site or adjacent sites, such that their use is compromised;
- modification of the surface soils such that abnormal amounts of windborne or waterborne soils are removed from the site;
- earthquake-induced ground shaking capable of causing ground rupture, liquifaction, soil settlement, landsliding and/or rock falls resulting in substantial damage to people and/or property;
- deformation of foundations by expansive soils (those characterized by shrink/swell potential) or collapsible soils; and

- modification of the on-site topography (i.e. grading) in a manner that results in decreased stability for adjacent residential enclaves.

5.0 IMPACTS

The level of geotechnical and landform information contained herein is adequate to analyze the potential project effects on earth resources and landforms, and to determine appropriate mitigation measures for the proposed development. In accordance with CEQA case law, these later additional refinements are not a deferral of mitigation. Rather, it is a design refinement, consistent with the commitment to mitigation included in this EIR.

Essentially, there are very few short- and long-term impacts to the current physical/geological setting that can generally be expected from grading and development activities associated with the proposed development.

5.1 EFFECTS FOUND NOT TO BE SIGNIFICANT

Based on the results of the information reviewed for this study, landsliding/debris flows, slope instability, ground surface rupture associated with active faulting, seismically-induced flooding, liquefaction, lateral spread, lurching, subsidence, and expansive soils are not considered to represent significant impacts due to low potential within the project site.

5.2 POTENTIALLY SIGNIFICANT IMPACTS

The most significant potential impacts to the project are those resulting from strong seismically-induced ground motion, possible earthquake-induced subsidence associated with isolated pockets of loose alluvial soils and non-engineered fill soils, and clayey soils at deeper foundation depths that are severely corrosive to metallic pipes.

5.2.1 Strong Seismically-Induced Ground Motion

Potential adverse impacts to new structures due to strong, seismically-induced vibratory ground motion can be reduced to a less-than-significant level with proper seismic design.

5.2.2 Settlement/Subsidence-Prone Soils

Non-engineered fill soils and isolated pockets of the alluvium are subject to varying amounts of settlement/ subsidence resulting from strong seismically-induced ground shaking. The impact to structures having footings or other structural elements founded in these soils could be significant unless mitigated. Typical mitigation concepts would include complete removal and replacement of these soils with engineered fill, performing insitu densification, or supporting all future structures that are underlain by these unsuitable soils on piles and grade beams. It is anticipated that the future geotechnical engineering studies to be performed for the proposed buildings will further evaluate the nature and extent of these types of soils.

5.2.3 Corrosive Soils

Clayey, alluvial soils that exist at deeper foundation levels on the site are considered severely corrosive to metallic pipes. It is anticipated that the future geotechnical engineering studies to be performed for the proposed buildings will further evaluate the nature and extent of these types of soils. At a minimum, buried metal piping should be protected with suitable coatings, wrappings, or seals; and a corrosion engineer should be consulted during future, site-specific geotechnical studies.

5.3 CONSTRUCTION RELATED IMPACTS

Grading activities associated with the development and construction of new buildings and associated parking areas would create very little change to the current topography. The greatest changes to existing topography would occur from construction of the taller building(s). Only by avoidance can impacts to topography related to the taller building(s) be mitigated and/or reduced to a less-than-significant level.

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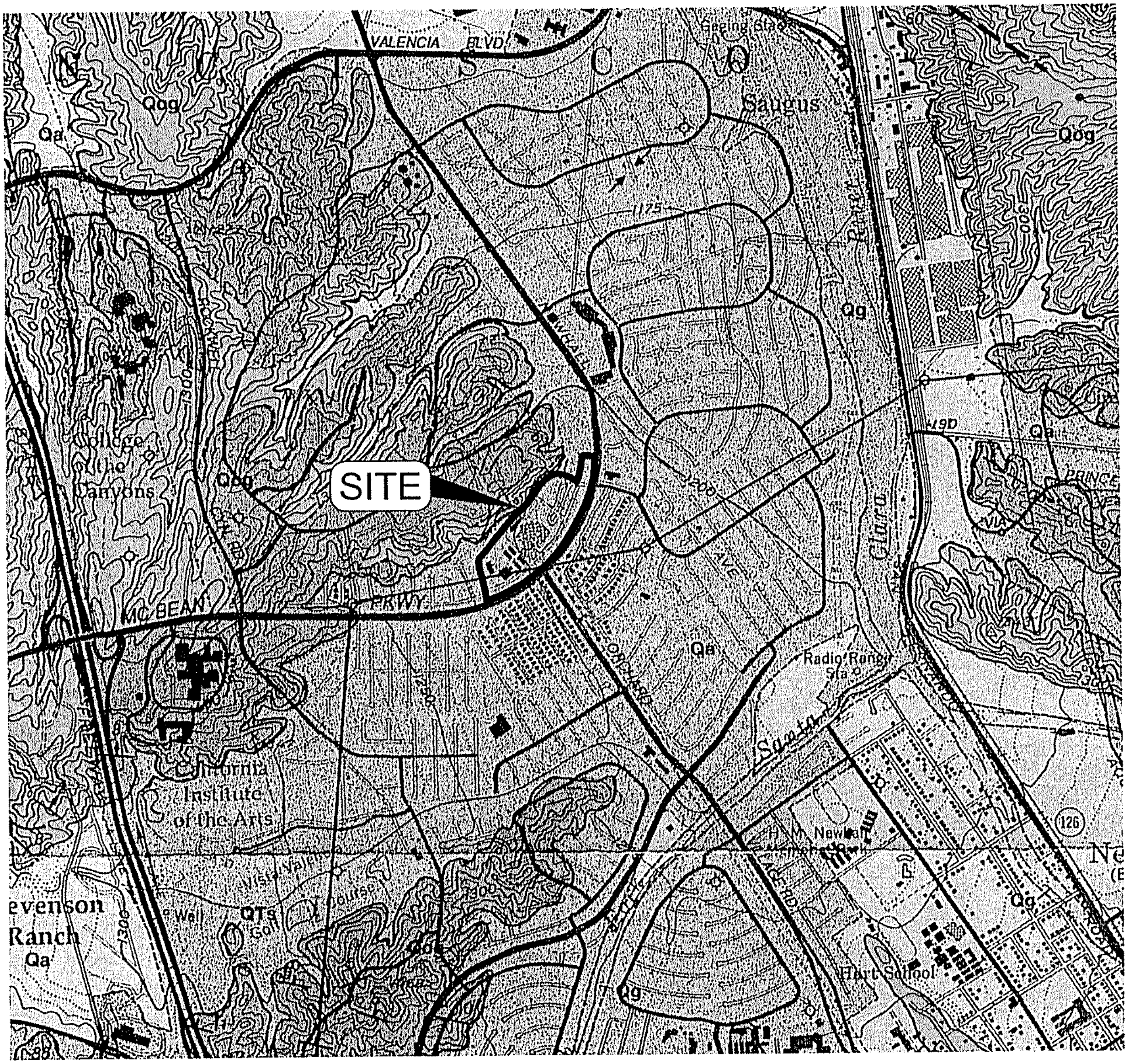


NEWHALL QUADRANGLE (DF-56)
LEGEND

af
Qa Qg

SURFICIAL SEDIMENTS

af *artificial cut and fill; includes areas of grading and/or development (updated from Treiman 1986, 1987a)*
Qg *gravel and sand of major stream channels*
Qa *alluvial gravel, sand and clay of valley areas*

Qls

LANDSLIDE DEBRIS

Qoa
Qog

OLDER DISSECTED SURFICIAL SEDIMENTS

unconsolidated alluvial sediments deposited by streams; late Pleistocene age
Qoa *low terrace remnants of alluvial gravel and sand*
Qog *alluvial fan and high terrace deposits of gravel and sand; detritus of mostly crystalline basement rocks and some of Tertiary rocks; assigned to Pacoima Formation (of Oakeshott 1958) by Treiman 1986, 1987a*

Holocene
?
Pleistocene

MAP SYMBOLS - NEWHALL

FORMATION CONTACT *dashed where inferred or indefinite*

MEMBER CONTACT *between units of a formation*

CONTACT BETWEEN SURFICIAL SEDIMENTS *located only approximately in places*

FAULT: *Dashed where indefinite or inferred, dotted where concealed, queried where existence is doubtful. Parallel arrows indicate inferred relative lateral movement. Relative vertical movement is shown by U/D (U=upthrown side, D=downthrown side). Short arrow indicates dip of fault plane. Sawteeth are on upper plate of low angle thrust fault.* U D 25 ?

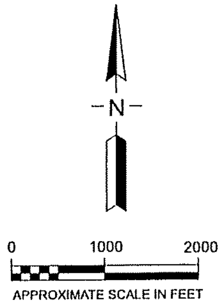
FOLD: **ANTICLINE** **SYNCLINE**

arrow on axial trace of fold indicates direction of plunge; dotted where concealed by surficial sediments

STRIKE AND DIP OF STRATIFIED ROCKS 18 *inclined* 20 *inclined (approximate)* 80 *overturned* *vertical*

metamorphic foliation or igneous flow banding 75 *inclined* *approximate* *vertical*

Direction of landslide movement
Sandstone marker bed or unit
Conglomerate marker bed or unit
Shale or mudstone unit (in cross-section)
Abandoned exploratory oil or gas wells; located approximately in places
Oil wells; may include some idle, converted or abandoned wells



SOURCE: GEOLOGIC MAP OF THE NEWHALL QUADRANGLE, DIBBLEE (1996)

D. Scott Magorien, C.E.G.1290
Consulting Engineering Geologist

GEOLOGIC MAP
HENRY MAYO NEWHALL MEMORIAL HOSPITAL EIR
Newhall, California

Figure by	Project No.
AY	9960
Date	Figure
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