# Appendix E:
# GEOLOGY AND SOILS

LOR GEOTECHNICAL GROUP, INC.
Soil Engineering ▲ Geology ▲ Environmental

# GEOTECHNICAL EVALUATION STUDY
# PROPOSED EARVIN "MAGIC" JOHNSON RECREATION AREA
# STATE MASTER PLAN/UJIMA VILLAGE MASTER PLAN
# WILLOWBROOK, LOS ANGELES COUNTY, CALIFORNIA

**PROJECT NO. 63084.1**
**DRAFT JULY 24, 2014**

Prepared For:

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Attention: Mr. Juan Villalobos

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Attention: Mr. Juan Villalobos

Subject: Geotechnical Evaluation, Proposed Earvin "Magic" Johnson Recreation Area State Master Plan/Ujima Village Master Plan, City of Willowbrook, Los Angeles County, California.

LOR Geotechnical Group, Inc. is pleased to present this report summarizing our Geotechnical Feasibility Study for the proposed Earvin "Magic" Johnson Recreation Area State Master Plan/Ujima Village Master Plan, located in the unincorporated Willowbrook area of Los Angeles County, California. This report was based upon a scope of services generally outlined in our proposal dated April 25th, 2014, and other written and verbal communications. Our report summarizes earlier reports compiled for the site and services the geologic, soils and geotechnical findings, conclusions and recommendations as related to future proposed development.

Non-structural fill soils ranging from less than 1 foot and up to about 10 feet in thickness cover virtually all of the proposed development area. Because the majority of the fill soils were not graded to create areas suitable for the construction of structural improvements, they will require complete removal from all structural and/or proposed fill areas. Minor to moderate amounts of removals within the native soils present beneath the fill soils, on the order of approximately two feet, may also be required.

A supplemental geotechnical investigation is recommended upon development of tentative site development plans and prior to site grading. This investigation will allow for the sampling of representative soils and laboratory testing to confirm the information contained herein and the development of additional, site specific, geotechnical recommendations

**LOR Geotechnical Group, Inc.**

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## INTRODUCTION

During June and July of 2014, a Geotechnical Evaluation was performed by LOR Geotechnical Group, Inc. for the proposed Earvin "Magic" Johnson Recreation Area State Master Plan/Ujima Village Master Plan, located in the unincorporated Willowbrook area of Los Angeles County, California. The main purpose of our study was to provide a geotechnical evaluation of the existing conditions and assess. Assess the general geologic and geotechnical conditions affecting the area and their potential impact on the project. To aid in the preparation of this report, we conducted a site reconnaissance to note the existing site conditions as they apply to geotechnical considerations. Findings, conclusions and recommendations as presented within previously published geotechnical reports were updated and/or modified, as necessary, to reflect the existing site conditions and to incorporate current applicable CBC criteria.

In order to provide a technical evaluation of the geologic setting of the site and to assess geotechnical conditions affecting the area and evaluate their potential ? the scope of our services included:

- Review of available geotechnical literature, reports, maps, and agency information pertinent to the study area;
- Interpretation of stereo aerial photograph pairs of the site and surrounding region dated 1952 through 1999;
- Geologic field reconnaissance to verify the areal distribution of earth units and significance of surficial features as compiled from documents, literature, aerial photographs and reviewed reports;
- Preliminary geotechnical recommendations for future site grading and foundation design; and
- Preparation of this report summarizing our findings, and providing conclusions and recommendations for site development.

The approximate location of the site is shown on the attached Index Map, Enclosure A-1, within Appendix A.

To orient our investigation at the site, an image of the site as presented on Google Earth was utilized and a copy of this image is presented as our Site Map (Enclosure A-2).

## PROJECT CONSIDERATIONS

We understand that the Department of Parks and Recreation intends to develop an Amendment to the State Master Plan for the Earvin "Magic" Johnson Recreation Area that reflects a future expanded area which includes the adjoining Ujima Village Apartments (UVA) and Ujima Housing Corporation (UHC) properties. However, at the time of preparation of this report, no specific development plans or grading plans were available for our review.

## SITE HISTORY AND DESCRIPTION

The area of the site was first utilized as a petroleum tank farm in the 1920's and these operations continued into the 1960's. The tank farm included twenty-two, 80,000 barrel steel above ground storage tanks; two concrete-lined crude oil reservoirs with a combined capacity of 1.8 million barrels; a pipeline pumping station and an absorption plant. Removals of the tank farm related improvements was initiated in the early 1960's and were completed by 1965. The above mentioned UVA and UHC developments were completed in the early 1970's. During the early 1980's, the park was constructed to its approximate present day configuration. There have been several dozen reports prepared which address various aspects of potential environmental concerns related to past and currently proposed site development and some of these are identified within our concurrently prepared Hazardous Materials Analysis report (LOR, 2014). In addition, a soil investigation and report addendum for the park site were previously prepared by R. T. Frankian & Associates (1979 and 1979a). However, we understand that there are no reports available that address geotechnical observation and/or compaction testing during grading operations that possibly took place as related to construction of the park site or the UVA or UHC properties.

The irregularly shaped site is located south of E. 120$^{th}$ Street and north of El Segundo Boulevard between S. Avalon Boulevard and Clovis Avenue (See Index Map, Enclosure A-1). The existing park includes two lakes, widespread grass lawn areas with scattered trees, paved parking areas, two restrooms, soccer fields and typical park

amenities including picnic tables, barbecues, drinking fountains and lighting fixtures. The UVA property was recently cleared of its structures with the foundations, roads and landscaping left in place. The UHC site is currently vacant and in a state of disrepair.

The surface of the site consists of relatively flat ground along the perimeter with gentle hills and mounds located mainly in the central portions. These elevated areas, which range from a few feet to a maximum of about 10 feet in height, are assumed to have been largely created through the placement of soil materials at these locations during excavation and grading that took place to create the two onsite lakes.

Single family residential homes are located in the north-west portion of the site and along eastern portion of the site down S. Central Avenue from E. 120$^{th}$ Street to El Segundo Boulevard. Commercial development is located along the major roads on to the west and south of the property.

## REVIEW OF PREVIOUS GEOTECHNIAL REPORTS

Our geotechnical evaluation consisted of a review of available relevant geotechnical reports and geologic maps as summarized below:

- ***R.T. Frankian & Associates, 1979*** This report served as a soils investigation for the Willowbrook Park in the Willowbrook District in the County of Los Angeles, California. The field investigation work for this report consisted of the excavation, logging and backfilling of 21 exploratory test pits and 20 test borings.

- The report indicates that terrain, at the time of investigation, generally sloped gently and irregularly from east to west, with a maximum difference in surface elevation of about 25ft. The surficial conditions of the site at the time generally consisted of heavy to sparse grass weeds covering the site. Standing water was noted to be present locally at the site although locations were not identified. Also, no ground water encountered with any of their exploratory borings which extended to maximum depths of 34 feet.

- Fill soils ranging from 0.5 to 8.5 feet were encountered within the majority of the excavations made during site investigation. The fill soils were clayey and

silty fine sand to fine sandy clay. The upper naturally-deposited older alluvial soils consisted of silty and clayey fine sand, clayey silt, and silty clay. These soils were generally moist and firm or dense and the silts and clays were generally underlain by clayey fine sand at depths of 5 to 12 feet. Occasional layers of clean or nearly clean sand were found and occurred at a depth of about 12 feet. The surficial soils were generally characterized as slightly expansive.

- ***R.T. Frankian & Associates, 1979a*** The above report was followed up by an addendum letter which provides alternative recommendations regarding the side slopes and bottoms for construction of the then proposed recreational lakes.

## GEOLOGIC CONDITIONS

### Regional Geologic Setting

The site is located on the Los Angeles coastal plain. This plain is a lowland that gently slopes seaward. It is underlain by as much as about 30,000 feet of sediments that rest on granitic and metamorphic basement rocks. The plain is bounded by the Santa Monica Mountains and San Joaquin Hills to the south, and the Palos Verde Hills and Pacific Ocean shoreline to the west. The dominate structural feature of the Los Angeles coastal plain is the northwest trending Newport-Inglewood fault zone.

The nearest known active earthquake fault is the Newport-Inglewood-Rose Canyon Fault which is located approximately 0.7 miles (1.2 kilometers) to the southwest. Other significant faults in the region include the Palos Verdes Fault approximately located 10 miles (16.1 kilometers) to the southwest, the Los Alamitos Fault approximately located 9.2 miles (15 kilometers) to the southeast, the Elsinore Fault approximately located 13.4 miles (21.5 kilometers) to the east and the Sierra Madre Fault Zone approximately located 21 miles (33.2 kilometers) to the north.

### Site Geologic Conditions

A recent geologic map of the region (Saucedo et al, 2003) shows the site as being underlain by old alluvial flood plain deposits. A copy of a portion of this map is included as Enclosure A-3 in Appendix A with a map explanation given on Enclosure A-4.

Data from our research and site reconnaissance indicate that the site is underlain by fill soils that were derived mainly from onsite grading while alluvial sediments are present at depth. Because virtually all of the site has been modified to some extent in the past, no areas of natural ground remain exposed at the surface. Based upon our review of the referenced geotechnical report and site reconnaissance, existing fill thicknesses across the site range from less than one foot to an anticipated maximum thickness of about 10 to 15 feet. As described above, the onsite soils consist mainly of fine-grained clayey sand to sandy clay soils that are soft to very firm and have low expansion potential.

Agronomy

Soil contamination was found at the north-westerly portion of the site just north of the lake in a 360 foot by 570 foot section. However, the agronomic report is outdated and in order to address agronomic concerns regarding current shallow soil conditions soil samples have to be obtained.

Groundwater Hydrology

Shallow groundwater was found at a depth of approximately 40 to 45 feet below the ground surface and deep ground water was found at approximate depths of 110 to 129 feet based on the Site Assessment Report for the Former Athens Tank Farm, Willowbrook, County of Los Angeles, Kleinfelder, 2010. Based on the information presented in the assessment localized perched groundwater may exist.

Surface Runoff

The current configuration of the site as a park allows for the directing of water along graded swales and valleys to collection devices and/or to one of the two onsite lakes. Overall drainage is toward the south.

Mass Movement

The site lies on a relatively flat surface. The occurrence of mass movement failures, such as landslides, rockfalls, or debris flows within such areas is generally not considered common and no evidence of mass movement was observed on the site.

Faulting

No active or potentially active faults are known to exist at the subject site. In addition, the subject site does not lie within a current State of California Earthquake Fault Zone (Hart and Bryant, 1997).

As previously mentioned, the closest known active fault is the Newport-Inglewood-Rose Canyon Fault which is located approximately 0.7 miles (1.2 kilometers) to the southwest. Other significant faults in the region include the Palos Verdes Fault approximately located 10 miles (16.1 kilometers) to the southwest, the Los Alamitos Fault approximately located 9.2 miles (15 kilometers) to the southeast, the Elsinore Fault approximately located 13.4 miles (21.5 kilometers) to the east and the Sierra Madre Fault Zone approximately located 21 miles (33.2 kilometers) to the north.

Historical Seismicity

In order to obtain a general perspective of the historical seismicity of the site and surrounding region a search was conducted for seismic events at and around the area within various radii. This search was conducted utilizing the historical seismic search program by EPI Software, Inc. This program conducts a search of a user selected cataloged seismic events database, within a specified radius and selected magnitudes, and then plots the events onto an overlay map of known faults. For this investigation the database of seismic events utilized by the EPI program was obtained from the Southern California Seismic Network (SCSN) available from the Southern California Earthquake Center. At the time of our search, the data base contained data from January 1, 1932 through December, 2010.

In our first search, the general seismicity of the region was analyzed by selecting an epicenter map listing all events of magnitude 4.0 and greater, recorded since 1932, within a 100 kilometer (62 mile) radius of the site, in accordance with guidelines of the California Division of Mines and Geology. This map illustrates the regional seismic history of moderate to large events. As depicted on Enclosure A-5 within Appendix A, the site lies within a relatively active region associated with the Newport-Inglewood- Rose Canyon Fault Zone trending southeast to northwest, and other faults within the area of the Los Angeles Basin. Of these events, the closest was a magnitude 4.0 located approximately 1.1 kilometers (0.5 miles) to the west of the site.

In the second search, the micro seismicity of the area lying within a 15 kilometer (9.3 mile) radius of the site was examined by selecting an epicenter map listing events on the order of 0.0 and greater since 1978. In addition, only the "A" events, or most accurate events were selected. Caltech indicates the accuracy of the "A" events to be approximately 1 km. The result of this search is a map that presents the seismic history around the area of the site with much greater detail, not permitted on the larger map. The reason for limiting the events to the last 35 years on the detail map is to enhance the accuracy of the map. Events recorded prior the mid 1970's are generally considered to be less accurate due to advancements in technology. As depicted on this map, Enclosure A-6 within Appendix A, numerous, widespread events have occurred, mainly in clusters to the northwest and southeast of the site.

In summary, the historical seismicity of the site entails numerous small to medium magnitude earthquake events occurring around the subject site, predominately associated with the presence of the Newport-Inglewood fault. Any future developments at the subject site should anticipate that moderate to large seismic events could occur within or very near the site.

Secondary Seismic Hazards

Other secondary seismic hazards generally associated with severe ground shaking during an earthquake include liquefaction, seiches and tsunamis, earthquake induced flooding, landsliding and rockfalls, and seismic-induced settlement.

Liquefaction: The potential for liquefaction generally occurs during strong ground shaking within loose, geologic young, granular sediments where the depth to groundwater is usually less than 50 feet. As previously discussed, the depth to static groundwater is approximately 40 feet below the ground surface. However, the site is underlain by relatively dense/stiff deposits of older alluvium soils and these materials are less susceptible to liquefaction. In addition, the Inglewood Quadrangle Seismic Hazards Map prepared by the California Division of Mines and Geology, 1991, shows the area of the site as being located outside of the area that may be susceptible to liquefaction. Therefore, the potential for liquefaction occurring at the site is considered to be very low to low.

Seiches/Tsunamis: The potential for the site to be affected by a seiche or tsunami (earthquake generated wave) is considered nil due to the absence of any large open bodies of water near the site. The two small, onsite lakes could produce waves as the result of a large, nearby earthquake, however, the impacts would likely be slight.

Flooding (Water Storage Facility Failure): The potential for flooding to occur at the site as the result of water storage facility failure is considered to be nil as there are no known large water storage facilities in close proximity above the site that could rupture and cause flooding.

Seismically-Induced Landsliding: Due to the low relief of the site and surrounding region, the potential for landslides to occur at the site is considered nil.

Rockfalls: No large, exposed, loose or unrooted boulders are present above the site that could affect the integrity of the site.

Seismically-Induced Settlement: Settlement generally occurs within areas of loose, granular soils with relatively low density. Since the site is underlain by relatively dense/stiff, older alluvial materials, the potential for settlement is considered low. In addition, the earthwork operations recommended within this report to be conducted during the development of the site will mitigate any near surface loose soil conditions.

## SOILS AND SEISMIC DESIGN CRITERIA (California Building Code)

Section 1613 of Chapter 16 of the 2013 California Building Code (CBC) contains the procedures and definitions for the calculations of the earthquake loads on structures and non structural components that are permanently attached to structures and their supports and attachments. It should be noted that the classification of use and occupancy of all proposed structures at the site, and thus design requirements, shall be the responsibility of the structural engineer and the building official.

### CBC Earthquake Design Summary

The following earthquake design criteria have been formulated for the site utilizing the source referenced above. However, these values should be reviewed and the final design should be performed by a qualified structural engineer familiar with the region.

| CBC 2013 SEISMIC DESIGN SUMMARY<br>Site Location (WGS 84) 33.9198, -118.2579 Occupancy Category II | |
|---|---|
| Site Class Definition (Table 1613.2) | D |
| $S_S$ Mapped Spectral Acceleration at 0.2s Period (Figure 1613.5(3)) | 1.7 |
| $S_1$ Mapped Spectral Acceleration at 1.0s Period (Figure 1613.5(4)) | 0.6 |
| $F_A$ Short Period Site Coefficient at 0.2s Period (Table 1613.5.3(1)) | 1.0 |
| $F_V$ Long period Site Coefficient at 1.0s Period (Table 1613.5.3(2)) | 1.5 |
| $S_{MS}$ Adjusted Spectral Response Acceleration at 0.2s Period (eq. 16-37) | 1.7 |
| $S_{M1}$ Adjusted Spectral Response Acceleration at 1.0s Period (eq. 16-38) | 0.9 |
| $S_{DS}$ Design Spectral Response Acceleration at 0.2s Period (eq. 16-39) | 1.1 |
| $S_{D1}$ Design Spectral Response Acceleration at 1.0s Perod (eq. 16-40) | 0.6 |
| Seismic Design Category, Short Period | D |
| Seismic Design Category, Long Period | D |

## CONCLUSIONS

### General

This feasibility study provides a broad overview of the geotechnical and geologic factors which are expected to influence future site planning and development. On the basis of our review of available data, it is the opinion of LOR Geotechnical Group, Inc. that proposed park/recreation area expansion is feasible from a geotechnical standpoint, provided the recommendations presented in this report and subsequent reports are incorporated into design and implemented during grading and construction. Supplemental investigation to include subsurface borings, sampling and laboratory testing, is recommended once development plans have been made available in order to confirm the findings of this and previous geotechnical reports and to make modifications to these reports, as necessary.

Foundation Support

In order to provide adequate support for any proposed structural improvements, we recommend that a compacted fill mat be constructed beneath footings and slabs. The compacted fill mat will provide a dense, high-strength soil layer to uniformly distribute the anticipated foundation loads over the underlying soils. The construction of this compacted fill mat should include the removal of any existing non-structural fill material as well as the removal of any upper, loose/soft to medium dense/stiff underlying natural earth materials.

Conventional foundation systems, utilizing either individual spread footings and/or continuous wall footings, will provide adequate support for the anticipated downward and lateral loads when utilized in conjunction with the recommended fill mat. These recommendations are tentatively made based upon our knowledge of the site conditions and anticipated development and may require modification as based upon the findings of any subsequent geotechnical investigation work and upon review of development plans, as they become available.

Geologic Mitigations

No special geologic mitigations are anticipated at this time, other than the geotechnical mitigations contained within.

Seismicity

Seismic ground rupture is generally considered most likely to occur along pre-existing active faults. Because no known faults project through or toward the site, the potential for seismic rupture is considered nil. However, due to the site's close proximity to the Newport-Inglewood and other nearby fault zones, described above, it is reasonable to expect a strong ground motion seismic event to occur during the lifetime of any proposed development on the site. Large earthquakes could occur on other faults in the general area, but because of their lesser anticipated magnitude and/or greater distance, they are considered less significant than the Newport-Inglewood fault zone from a ground motion standpoint.

The effects of ground shaking anticipated at the subject site should be mitigated by the seismic design requirements and procedures outlined in Chapter 16 of the California Building Code. However, it should be noted that the current building code requires the minimum design to allow a structure to remain standing after a seismic

event, in order to allow for safe evacuation. A structure built to code may still sustain damage which might ultimately result in the demolishing of the structure (Larson and Slosson 1992).

## RECOMMENDATIONS

Recommendations provided here are general and reflect professional opinions based on the geotechnical evaluation conducted in this report. These recommendations are to be regarded as general minimum guidelines to assist in the planning phase of the proposed Earvin "Magic" Johnson Regional Park State Master Plan Amendment/Ujima Village Master Plan Project. Any proposed improvements or new construction should first have a site specific geotechnical investigation conducted in order to adequately identify the engineering characteristics of the underlying earth materials.

### Geologic Recommendations

Geotechnical review of grading and site development plans should be conducted as planning and development of the project advances to further address existing and potential geologic and geotechnical conditions, as necessary.

### General Site Grading

It is imperative that no clearing and/or grading operations be performed without the presence of a qualified geotechnical engineer. An on-site, pre-job meeting with the developer, the contractor, and soil engineer should occur prior to all grading related operations. Operations undertaken at the site without the geotechnical engineer present may result in exclusions of affected areas from the final compaction report for the project.

Grading of the subject site should be performed in accordance with the following recommendations as well as applicable portions of the California Building Code, and/or applicable local ordinances.

All areas to be graded should be stripped of significant vegetation and other deleterious materials. In areas of existing grass, the grass and upper approximately 3 inches of topsoil must be removed. The remaining soil, when blended for use as engineered fill, should have an organic content of no more than 3 percent.

All existing non-structural fill soils should be completely removed from all proposed structural areas. Subsequent to removal of deleterious items to the satisfaction of the soils engineer, the fill soils may then be placed as compacted fill. Irrigation and drain lines, as well as their associated trench backfill materials, should also be removed during site clearing and grading.

It is our recommendation that all existing fills under any proposed flatwork and paved areas also be removed and replaced with engineered compacted fill. If this is not done, premature structural distress (settlement) of the flatwork and pavement may occur.

Cavities created by removal of subsurface obstructions should be thoroughly cleaned of loose soil, organic matter and other deleterious materials, shaped to provide access for construction equipment, and backfilled as recommended in the following Engineered Compacted Fill section of this report.

Initial Site Preparation

All fill soil material and all loose alluvial materials should be removed from areas to receive engineered compacted fill. The data developed during this study and the previous subsurface investigation indicate that removals ranging from approximately 3 to 12 feet will be required in most areas. This range is based upon complete removal of any existing non-structural fills and removal of the upper two feet of native soil materials present beneath the fill soils. Within areas that were graded as cut during the grading operations which created the existing park and apartment areas, lesser removals may be possible if competent natural soils are exposed at shallow depth beneath the existing fill soils. The removal depths stated may be modified as based upon the findings of subsequent geotechnical studies and the actual depths of removals will need to be verified during the grading operation by observation and/or in-place density testing. Removals should expose native materials with a relative in-situ compaction of at least 82 percent (ASTM D 1557) and/or an in-situ saturation of at least 85 percent. Areas of proposed non-structural fill should also be cleared of any fill soils and processed to a minimum depth of 12 inches prior to fill placement.

It is our recommendation that all existing fills under any proposed flatwork and paved areas be removed and replaced with engineered compacted fill. If this is not done, premature structural distress (settlement) of the flatwork and pavement may occur. Any undocumented fills encountered during grading should be completely removed and cleaned of significant deleterious materials. These may then be reused as compacted fill.

Preparation of Fill Areas

Prior to placing fill, the surfaces of all areas to receive fill should be scarified to a depth of at least 12 inches. The scarified soil should be brought to near optimum moisture content and recompacted to a relative compaction of at least 90 percent (ASTM D 1557).

Preparation of Foundation Areas

All footings should rest upon at least 24 inches of properly compacted fill material. In areas where the required fill thickness is not accomplished by the recommended removals or by site rough grading, the footing areas should be further subexcavated to a depth of at least 24 inches below the proposed footing base grade, with the subexcavation extending at least 5 feet beyond the footing lines. Where removal and/or over-excavation depths exceed 5 feet, subexcavation should extend beyond the footing lines a minimum distance equal to the depth of the removal and/or over-excavation. The bottom of all excavations should then be scarified to a depth of at least 12 inches, brought to near optimum moisture content, and recompacted to at least 90 percent relative compaction (ASTM D 1557) prior to refilling the excavation to grade as properly compacted fill. These recommendations are subject to revision pending the completion of supplemental geotechnical investigation and/or review of proposed development plans.

Proposed building areas should be graded such that the minimum fill thickness is greater than or equal to one-third of the maximum fill thickness around the building area.

Engineered Compacted Fill

The on-site soils should provide adequate quality fill material, provided they are free from organic matter and other deleterious materials. Unless approved by the geotechnical engineer, rock or similar irreducible material with a maximum dimension greater than 12 inches should not be buried or placed in fills. Rocks or other irreducible material greater than 12 inches in diameter should be disposed of within designated rock disposal areas approved by the soils engineer and/or local governing agency.

Import fill should be inorganic, non-expansive granular soils free from rocks or lumps greater than 6 inches in maximum dimension. Sources for import fill should be approved by the geotechnical engineer prior to their use.

Fill should be spread in maximum 8-inch uniform, loose lifts, each lift brought to near optimum moisture content, and compacted to a relative compaction of at least 90 percent in accordance with ASTM D 1557.

Based upon the estimated compaction of the near surface soils and the relative compaction anticipated for compacted fill soil, we tentatively estimate a compaction shrinkage of approximately 10 percent. In addition, we would anticipate subsidence of approximately 0.10 feet. These values are for estimating purposes only, and are exclusive of losses due to stripping or the removal of subsurface obstructions. These values will vary due to differing conditions within the project boundaries and the limitations of this study and previous investigation work. Anticipated shrinkage and subsidence values should be monitored and refined during grading. If percentages vary, provisions should be made to revise final grades or adjust quantities of borrow or export.

Short-Term Excavations

Following the California Occupational and Safety Health Act (CAL-OSHA) requirements, excavations deeper than 5 feet should be sloped or shored. All excavations and shoring should conform to CAL-OSHA requirements.

Short-term excavation greater than 5 feet deep shall conform to Title 8 of the California Code of Regulations, Construction Safety Orders, Section 1504 and 1539 through 1547. Based on our review of the referenced reports and previous site

grading operations, it appears that Type C soils are the predominant type of soil on the project and all short-term excavation should be based on this type of soil. Deviation from the standard short-term slopes are permitted using option 4, Design by a Registered Professional Engineer (Section 1541.1).

Slope Construction

Preliminary data indicates that cut and fill slopes should be constructed no steeper than two horizontal to one vertical. Fill slopes should be overfilled during construction and then cut back to expose fully compacted soil. A suitable alternative would be to compact the slopes during construction, then roll the final slopes to provide dense, erosion-resistant surfaces.

Slope Protection

Since the native materials are susceptible to erosion by running water, measures should be provided to prevent surface water from flowing over slope faces. Slopes at the project should be planted with a deep rooted ground cover as soon as possible after completion. The use of succulent ground covers such as iceplant or sedum is not recommended. If watering is necessary to sustain plant growth on slopes, then the watering operation should be monitored to assure proper operation of the irrigation system and to prevent over watering.

Soil Expansiveness

The upper materials encountered during previous subsurface investigation were classified and are considered to have a very low to low expansion potential, in accordance with Uniform Building Code, Standard 18-2. Therefore, specialized construction procedures to specifically resist expansive soil activity are not anticipated at this time. In order to verify this observation, additional evaluation of on-site soils for their expansion potential should be conducted during the grading operations. Any imported soils should also be evaluated and/or tested for expansion potential prior to importation to the site.

Foundation Design

If the site is prepared as recommended, the proposed structural improvements may be safely founded on conventional shallow foundations, utilizing either individual

spread footings and/or continuous wall footings, bearing on a minimum of 24 inches of engineered compacted fill.

The above recommendations are subject to revision pending supplemental geotechnical investigation and/or review of development plans. Soil bearing pressure for the proposed structures may be provided at that time.

Settlement

Total settlement of individual foundations will vary depending on the width of the foundation and the actual load supported. Maximum settlement of shallow foundations designed and constructed in accordance with the preceding recommendations and anticipated conditions are estimated to be on the order of 0.5 inch. Differential settlements between adjacent footings should be about one-half of the total settlement. Settlement of all foundations is expected to occur rapidly, primarily as a result of elastic compression of supporting soils as the loads are applied, and should be essentially completed shortly after initial application of the loads.

The given settlement estimates are preliminary. More precise settlement analysis should be conducted upon the performance of a further geotechnical investigation and review of data available at that time.

Slabs-On-Grade

To provide adequate support, concrete slabs-on-grade should bear on a minimum of 12 inches of compacted soil. The final pad surfaces should be rolled to provide smooth, dense surfaces upon which to place the concrete.

Slabs to receive moisture-sensitive coverings should be provided with a moisture vapor barrier. This barrier may consist of an impermeable membrane. Two inches of sand over the membrane will reduce punctures and aid in obtaining a satisfactory concrete cure. The sand should be moistened just prior to placing of concrete.

The slabs should be protected from rapid and excessive moisture loss which could result in slab curling. Careful attention should be given to slab curing procedures, as the site area is subject to large temperature extremes, humidity, and strong winds.

Wall Pressures

The design of footings for retaining wall structures should be performed in accordance with the recommendations described earlier under Preparation of Foundation Design Areas and Foundation Design. As previously mentioned, additional data should be developed based upon the findings determined through supplemental investigation and laboratory test results.

Pavement Design

Pavement design should be based upon the results of subsequent soil sampling and testing. Preliminary data indicates that the onsite soils have good R-value quality (greater than 50). For design purposes, the city of Rancho Cucamonga pavement design guidelines should be followed.

Sulfate Protection

Recommendations for concrete elements to be in contact with the onsite soils should be provided as based upon the results of the future onsite investigations.

Supplemental Geotechnical Investigation and Plan Reviews

This feasibility study was conducted prior to the issuance of any site development or grading plans. Once these plans become available, we should review the plans in order to better define onsite geotechnical considerations. Supplemental geotechnical investigation will allow for subsurface investigation, sampling and laboratory testing of the soils present within representative and/or key areas and help to identify any areas of geologic or geotechnical concern.

Construction Monitoring

During construction, sufficient and timely geotechnical observation and testing should be provided to correlate the findings of this study and the previous subsurface investigation with the actual subsurface conditions exposed. Items requiring observation and testing include, but are not necessarily limited to, the following:

1. Site preparation-stripping and removals.

2. Excavations, including approval of the bottom of excavations prior to filling.

3. Scarifying and recompacting prior to fill placement.

4. Subgrade preparation for pavements and slabs-on-grade.

5. Placement of engineered compacted fill and backfill, including approval of fill materials and the performance of sufficient density tests to evaluate the degree of compaction being achieved.

6. Foundation excavations.

We reiterate that supplemental geotechnical investigation should be conducted and the project plans and specifications should be reviewed prior to construction to confirm that the intent of the recommendations presented herein have been incorporated into the design.

## TIME LIMITATIONS

The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they be due to natural processes or the work of man on this or adjacent properties. In addition, changes in the Standards-of-Practice and/or Governmental Codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a significant amount of time without a review by LOR Geotechnical Group, Inc. verifying the suitability of the conclusions and recommendations.

## LIMITATIONS

This report contains geotechnical conclusions and recommendations developed solely for use by RBF Consulting Inc. and its designates for the purposes described earlier. It may not contain sufficient information for other uses or the purposes of other parties. The contents should not be extrapolated to other areas or used for other facilities without consulting LOR Geotechnical Group, Inc.

The recommendations are based on interpretations of the subsurface conditions concluded from information gained from subsurface explorations, and a surficial site reconnaissance. The interpretations may differ from actual subsurface conditions, which can vary horizontally and vertically across the site. Due to possible subsurface variations, all aspects of field construction addressed in this report should be observed and tested by the project geotechnical consultant.

If parties other than LOR Geotechnical Group, Inc. provide construction monitoring services, they must be notified that they will be required to assume responsibility for the geotechnical phase of the project being completed by concurring with the recommendations provided in this report or by providing alternative recommendations.

The report was prepared using generally accepted geotechnical engineering practices under the direction of a state licensed geotechnical engineer. No warranty, expressed or implied, is made as to conclusions and professional advice included in this report. Any persons using this report for bidding or construction purposes should perform such independent investigations as deemed necessary to satisfy themselves as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on this project.

**CLOSURE**

It has been a pleasure to assist you with this project. We look forward to being of further assistance to you as construction begins. Should conditions be encountered during construction that appear to be different than indicated by this report, please contact this office immediately in order that we might evaluate their effect.

Should you have any questions regarding this report, please do not hesitate to contact us as your convenience.

Respectfully submitted,
**LOR Geotechnical Group, Inc.**

Robert M Markoff, CEG 2073
Engineering Geologist

John P. Leuer, GE 2030
President

RMM:JPL:ejt

Distribution: Addressee (4)

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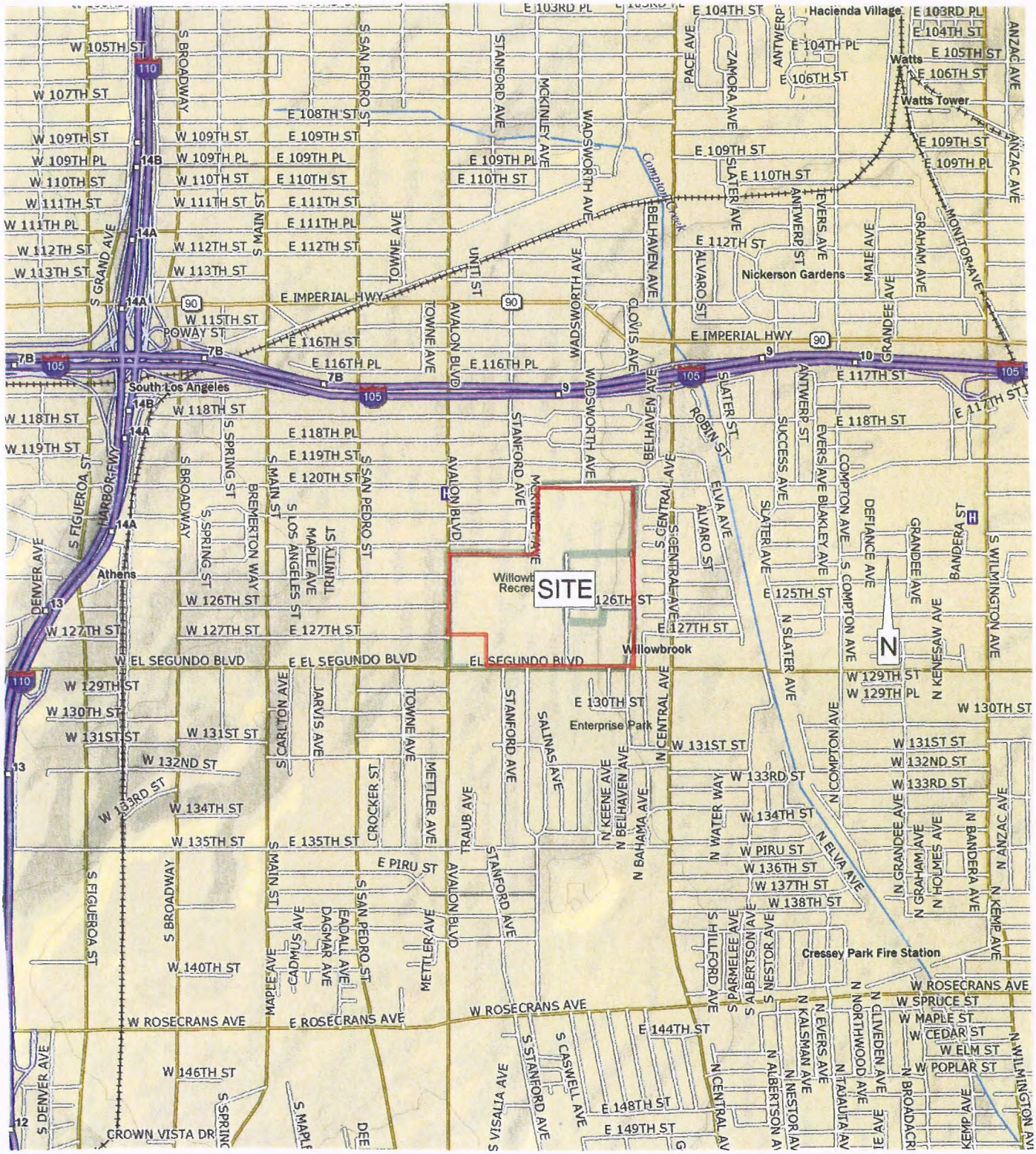
Ziony, J.I., and Jones, L.M., 1989, Map Showing the Quaternary Faults and 1978-1984 Seismicity of the Los Angeles Region, California: U.S. Geological Survey Miscellaneous Field Studies Map, MF-1964, Scale 1:250,000.

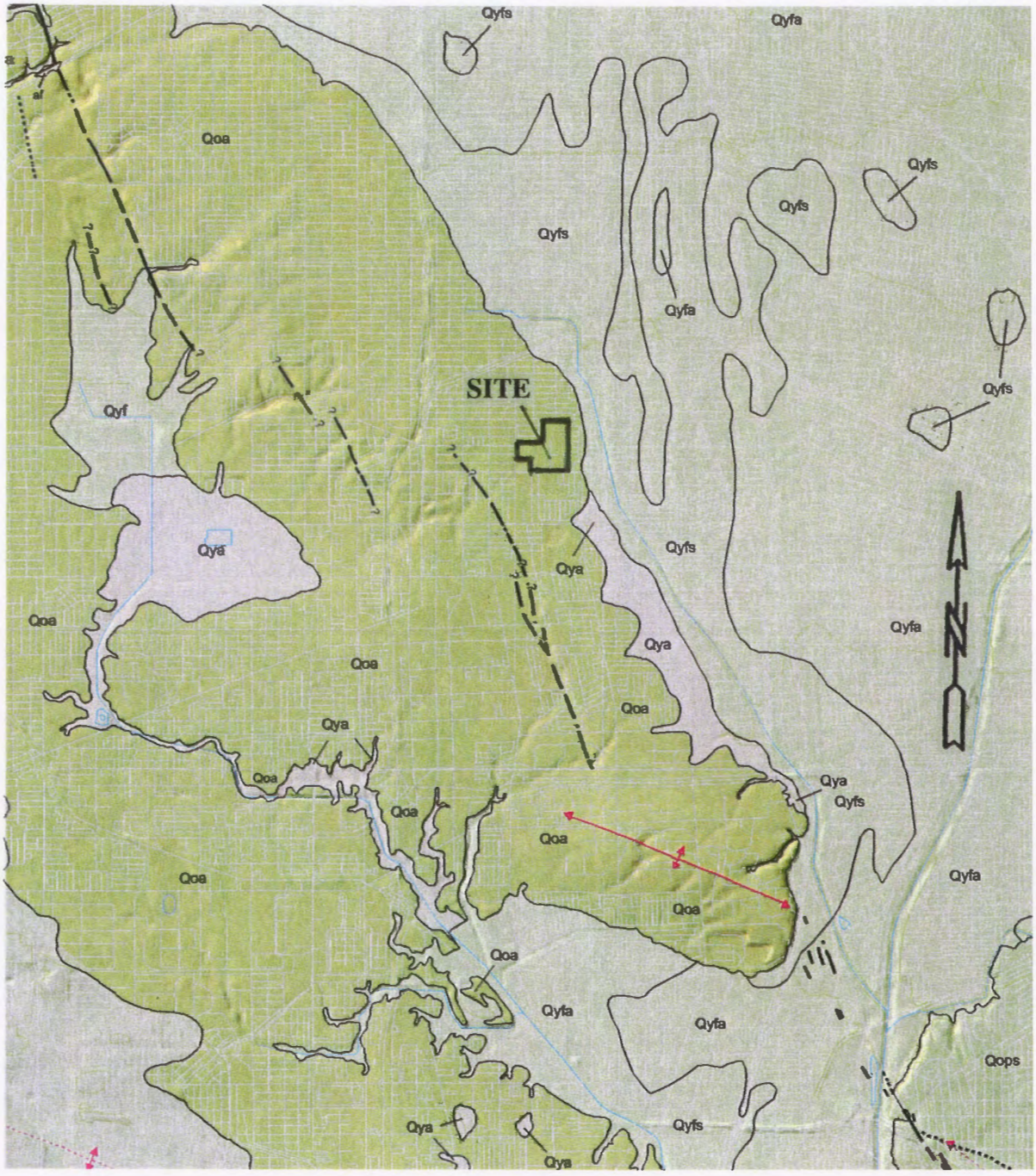



# INDEX MAP

| | | | |
|---|---|---|---|
| PROJECT: | EARVIN "MAGIC" JOHNSON RECREATION AREA | PROJECT NO.: | 63084.1 |
| CLIENT: | RBF CONSULTING | ENCLOSURE: | A-1 |
| **LOR Geotechnical Group, Inc.** | | DATE: | JULY, 2014 |
| | | SCALE: | 1" = 2,000' |


# SITE MAP

| | | | |
|---|---|---|---|
| PROJECT: | EARVIN "MAGIC" JOHNSON RECREATION AREA | PROJECT NO.: | 63084.1 |
| CLIENT: | RBF CONSULTING | ENCLOSURE: | A-2 |
| **LOR Geotechnical Group, Inc.** | | DATE: | JULY, 2014 |
| | | SCALE: | AS SHOWN |




# REGIONAL GEOLOGIC MAP (Saucedo, et al, 2003)

| | | | |
|---|---|---|---|
| PROJECT: | EARVIN "MAGIC" JOHNSON RECREATION AREA | PROJECT NO.: | 63084.1 |
| CLIENT: | RBF CONSULTING | ENCLOSURE: | A-3 |
| **LOR Geotechnical Group, Inc.** | | DATE: | JULY, 2014 |
| | | SCALE: | |

## PARTIAL LEGEND

| | |
|---|---|
| Qyf | Young alluvial fan and valley deposits, undivided<br>a = sand, s = silt, c = clay |
| Qyf2 | Young alluvial fan deposits, unit 2 |
| Qyf1 | Young alluvial fan deposits, unit 1 |
| Qya | Young alluvial flood plain deposits, unit 1 |
| Qye | Young eolian deposits |
| Qype | Young paralic estuarine deposits |
| Qof | Old alluvial fan and valley deposits, undivided<br>a = sand, s = silt, c = clay |
| Qoa | Old alluvial flood plain deposits, undivided |

## MAP SYMBOLS

Contact - accuracy of location ranges from well located to inferred. All offshore contacts are considered approximately located.

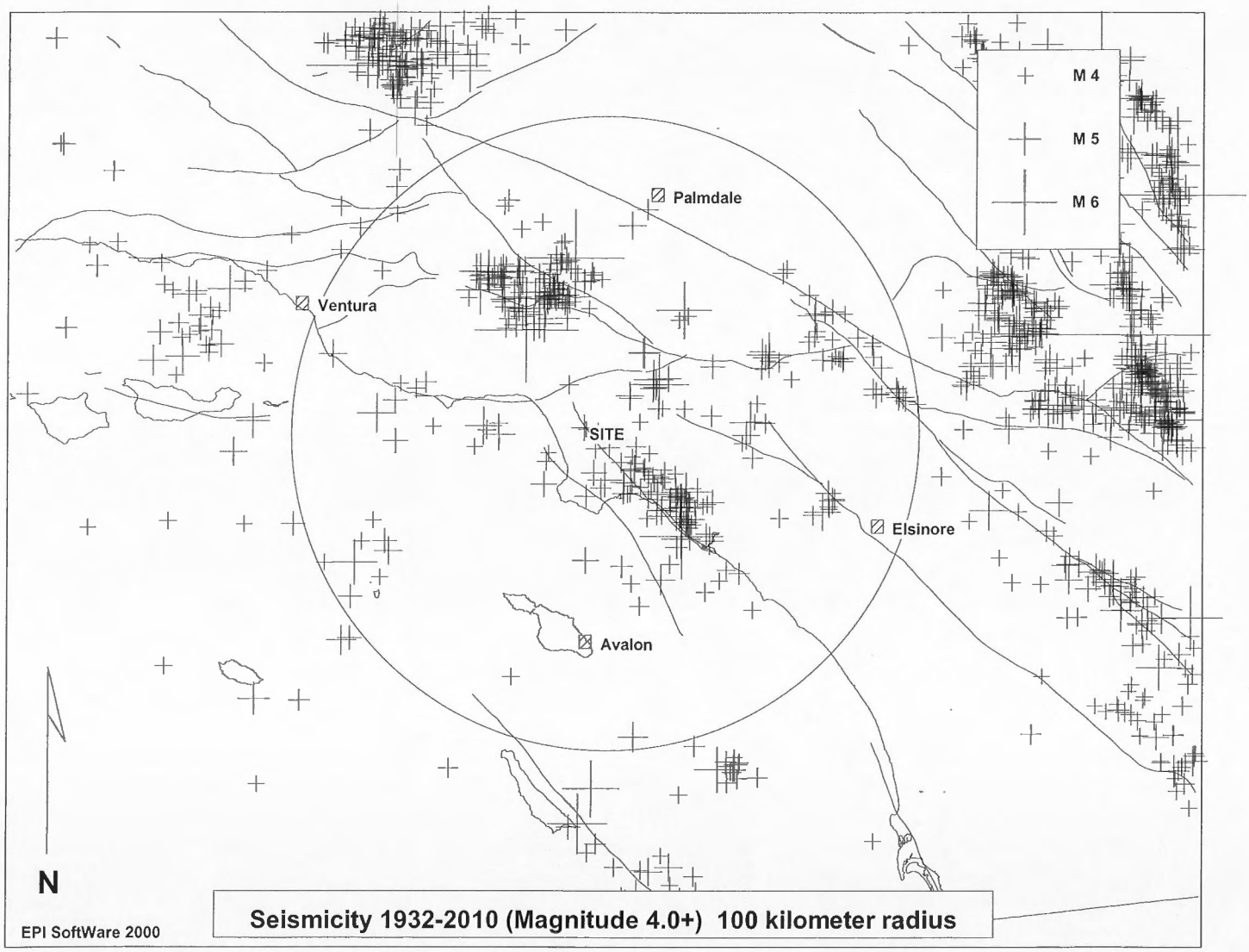
U
D

Fault - solid where well located; dashed where approximately located or inferred; dotted where concealed; queried where continuation or existence is uncertain. Where age was determined in offshore area, age symbol is shown astride fault and relative offset is shown by U, upthrown side; D, downthrown side (relative or apparent). Age of faults are indicated as follows:

- cuts strata of Holocene age
- cuts strata of Pleistocene age
- cuts strata of Quaternary age
- cuts strata of Pliocene age
- cuts Miocene or older strata

# DESCRIPTION OF UNITS

| | | | |
|---|---|---|---|
| PROJECT: | EARVIN "MAGIC' JOHNSON RECREATION AREA | PROJECT NO.: | 63084.1 |
| CLIENT: | RBF CONSULTING | ENCLOSURE: | A-4 |
| LOR Geotechnical Group, Inc. | | DATE: | JULY, 2014 |
| | | SCALE: | N/A |




SITE LOCATION: 33.9198 LAT. -118.2579 LONG.

MINIMUM LOCATION QUALITY: C

TOTAL # OF EVENTS ON PLOT: 1135

TOTAL # OF EVENTS WITHIN SEARCH RADIUS: 355

0 50 100
KILOMETERS

MAGNITUDE DISTRIBUTION OF SEARCH RADIUS EVENTS:

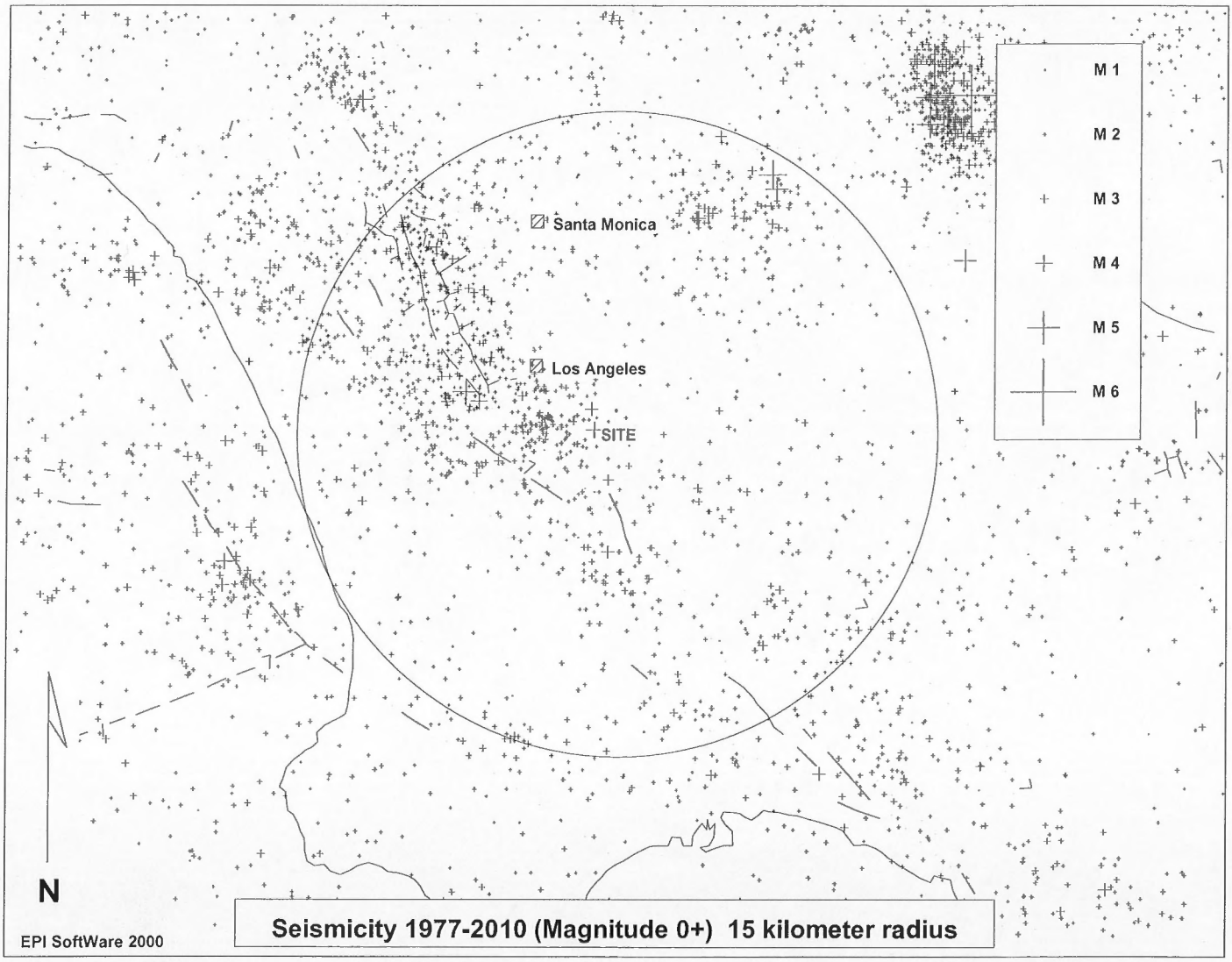
4.0- 4.9 : 324
5.0- 5.9 : 28
6.0- 6.9 : 3
7.0- 7.9 : 0
8.0- 8.9 : 0

CLOSEST EVENT: 4.0 ON SUNDAY, OCTOBER 28, 2001 LOCATED APPROX. 1.1 KILOMETERS WEST OF THE SITE

LARGEST 5 EVENTS:

6.7 ON MONDAY, JANUARY 17, 1994 LOCATED APPROX. 41 KILOMETERS NORTHWEST OF THE SITE
6.6 ON TUESDAY, FEBRUARY 09, 1971 LOCATED APPROX. 56 KILOMETERS NORTH OF THE SITE
6.4 ON SATURDAY, MARCH 11, 1933 LOCATED APPROX. 40 KILOMETERS SOUTHEAST OF THE SITE
5.9 ON MONDAY, JANUARY 17, 1994 LOCATED APPROX. 45 KILOMETERS NORTHWEST OF THE SITE
5.9 ON THURSDAY, OCTOBER 01, 1987 LOCATED APPROX. 22 KILOMETERS NORTHEAST OF THE SITE

Enclosure A-5




SITE LOCATION: 33.9198 LAT. -118.2579 LONG.

MINIMUM LOCATION QUALITY: A

TOTAL # OF EVENTS ON PLOT: 3591

TOTAL # OF EVENTS WITHIN SEARCH RADIUS: 1372

0 7 15
KILOMETERS

MAGNITUDE DISTRIBUTION OF SEARCH RADIUS EVENTS:

0.0- .9 : 38
1.0- 1.9 : 836
2.0- 2.9 : 463
3.0- 3.9 : 30
4.0- 4.9 : 5
5.0- 5.9 : 0
6.0- 6.9 : 0
7.0- 7.9 : 0
8.0- 8.9 : 0

CLOSEST EVENT: 1.4 ON TUESDAY, DECEMBER 05, 1995 LOCATED APPROX. .1 KILOMETER OF THE SITE

LARGEST 5 EVENTS:

4.8 ON MONDAY, JUNE 12, 1989 LOCATED APPROX. 13 KILOMETERS NORTHEAST OF THE SITE
4.7 ON MONDAY, MAY 18, 2009 LOCATED APPROX. 7 KILOMETERS WEST OF THE SITE
4.5 ON MONDAY, JUNE 12, 1989 LOCATED APPROX. 13 KILOMETERS NORTHEAST OF THE SITE
4.0 ON TUESDAY, MAY 19, 2009 LOCATED APPROX. 6 KILOMETERS WEST OF THE SITE
4.0 ON SUNDAY, OCTOBER 28, 2001 LOCATED APPROX. 1 KILOMETERS WEST OF THE SITE

Enclosure A-6

LOR GEOTECHNICAL GROUP, INC.
Soil Engineering ▲ Geology ▲ Environmental

# GEOTECHNICAL EVALUATION STUDY
# PROPOSED EARVIN "MAGIC" JOHNSON RECREATION AREA
# STATE MASTER PLAN/UJIMA VILLAGE MASTER PLAN
# WILLOWBROOK, LOS ANGELES COUNTY, CALIFORNIA

**PROJECT NO. 63084.1**
**DRAFT JULY 24, 2014**

Prepared For:

RBF Consulting, Inc.
3300 East Guasti Road, Suite 100
Ontario, California 91761

Attention: Mr. Juan Villalobos

6121 Quail Valley Court ▲ Riverside, CA 92507 ▲ (951) 653-1760 ▲ (951) 653-1741 (Fax) ▲ www.lorgeo.com
19-438 Ruppert Street ▲ P.O. Box 580799 ▲ N. Palm Springs, CA 92258 ▲ (760) 329-2727 ▲ (760) 329-2626 (Fax)

DRAFT July 24, 2014

RBF Consulting, Inc.
3300 East Guasti Road, Suite 100
Ontario, California 91761

Project No. 63084.1

Attention: Mr. Juan Villalobos

Subject: Geotechnical Evaluation, Proposed Earvin "Magic" Johnson Recreation Area State Master Plan/Ujima Village Master Plan, City of Willowbrook, Los Angeles County, California.

LOR Geotechnical Group, Inc. is pleased to present this report summarizing our Geotechnical Feasibility Study for the proposed Earvin "Magic" Johnson Recreation Area State Master Plan/Ujima Village Master Plan, located in the unincorporated Willowbrook area of Los Angeles County, California. This report was based upon a scope of services generally outlined in our proposal dated April 25th, 2014, and other written and verbal communications. Our report summarizes earlier reports compiled for the site and services the geologic, soils and geotechnical findings, conclusions and recommendations as related to future proposed development.

Non-structural fill soils ranging from less than 1 foot and up to about 10 feet in thickness cover virtually all of the proposed development area. Because the majority of the fill soils were not graded to create areas suitable for the construction of structural improvements, they will require complete removal from all structural and/or proposed fill areas. Minor to moderate amounts of removals within the native soils present beneath the fill soils, on the order of approximately two feet, may also be required.

A supplemental geotechnical investigation is recommended upon development of tentative site development plans and prior to site grading. This investigation will allow for the sampling of representative soils and laboratory testing to confirm the information contained herein and the development of additional, site specific, geotechnical recommendations

**LOR Geotechnical Group, Inc.**

# Table of Contents

# Table of Contents

## INTRODUCTION

During June and July of 2014, a Geotechnical Evaluation was performed by LOR Geotechnical Group, Inc. for the proposed Earvin "Magic" Johnson Recreation Area State Master Plan/Ujima Village Master Plan, located in the unincorporated Willowbrook area of Los Angeles County, California. The main purpose of our study was to provide a geotechnical evaluation of the existing conditions and assess. Assess the general geologic and geotechnical conditions affecting the area and their potential impact on the project. To aid in the preparation of this report, we conducted a site reconnaissance to note the existing site conditions as they apply to geotechnical considerations. Findings, conclusions and recommendations as presented within previously published geotechnical reports were updated and/or modified, as necessary, to reflect the existing site conditions and to incorporate current applicable CBC criteria.

In order to provide a technical evaluation of the geologic setting of the site and to assess geotechnical conditions affecting the area and evaluate their potential ? the scope of our services included:

- Review of available geotechnical literature, reports, maps, and agency information pertinent to the study area;
- Interpretation of stereo aerial photograph pairs of the site and surrounding region dated 1952 through 1999;
- Geologic field reconnaissance to verify the areal distribution of earth units and significance of surficial features as compiled from documents, literature, aerial photographs and reviewed reports;
- Preliminary geotechnical recommendations for future site grading and foundation design; and
- Preparation of this report summarizing our findings, and providing conclusions and recommendations for site development.

The approximate location of the site is shown on the attached Index Map, Enclosure A-1, within Appendix A.

To orient our investigation at the site, an image of the site as presented on Google Earth was utilized and a copy of this image is presented as our Site Map (Enclosure A-2).

## PROJECT CONSIDERATIONS

We understand that the Department of Parks and Recreation intends to develop an Amendment to the State Master Plan for the Earvin "Magic" Johnson Recreation Area that reflects a future expanded area which includes the adjoining Ujima Village Apartments (UVA) and Ujima Housing Corporation (UHC) properties. However, at the time of preparation of this report, no specific development plans or grading plans were available for our review.

## SITE HISTORY AND DESCRIPTION

The area of the site was first utilized as a petroleum tank farm in the 1920's and these operations continued into the 1960's. The tank farm included twenty-two, 80,000 barrel steel above ground storage tanks; two concrete-lined crude oil reservoirs with a combined capacity of 1.8 million barrels; a pipeline pumping station and an absorption plant. Removals of the tank farm related improvements was initiated in the early 1960's and were completed by 1965. The above mentioned UVA and UHC developments were completed in the early 1970's. During the early 1980's, the park was constructed to its approximate present day configuration. There have been several dozen reports prepared which address various aspects of potential environmental concerns related to past and currently proposed site development and some of these are identified within our concurrently prepared Hazardous Materials Analysis report (LOR, 2014). In addition, a soil investigation and report addendum for the park site were previously prepared by R. T. Frankian & Associates (1979 and 1979a). However, we understand that there are no reports available that address geotechnical observation and/or compaction testing during grading operations that possibly took place as related to construction of the park site or the UVA or UHC properties.

The irregularly shaped site is located south of E. 120$^{th}$ Street and north of El Segundo Boulevard between S. Avalon Boulevard and Clovis Avenue (See Index Map, Enclosure A-1). The existing park includes two lakes, widespread grass lawn areas with scattered trees, paved parking areas, two restrooms, soccer fields and typical park

amenities including picnic tables, barbecues, drinking fountains and lighting fixtures. The UVA property was recently cleared of its structures with the foundations, roads and landscaping left in place. The UHC site is currently vacant and in a state of disrepair.

The surface of the site consists of relatively flat ground along the perimeter with gentle hills and mounds located mainly in the central portions. These elevated areas, which range from a few feet to a maximum of about 10 feet in height, are assumed to have been largely created through the placement of soil materials at these locations during excavation and grading that took place to create the two onsite lakes.

Single family residential homes are located in the north-west portion of the site and along eastern portion of the site down S. Central Avenue from E. 120$^{th}$ Street to El Segundo Boulevard. Commercial development is located along the major roads on to the west and south of the property.

## REVIEW OF PREVIOUS GEOTECHNIAL REPORTS

Our geotechnical evaluation consisted of a review of available relevant geotechnical reports and geologic maps as summarized below:

- ***R.T. Frankian & Associates, 1979*** This report served as a soils investigation for the Willowbrook Park in the Willowbrook District in the County of Los Angeles, California. The field investigation work for this report consisted of the excavation, logging and backfilling of 21 exploratory test pits and 20 test borings.

- The report indicates that terrain, at the time of investigation, generally sloped gently and irregularly from east to west, with a maximum difference in surface elevation of about 25ft. The surficial conditions of the site at the time generally consisted of heavy to sparse grass weeds covering the site. Standing water was noted to be present locally at the site although locations were not identified. Also, no ground water encountered with any of their exploratory borings which extended to maximum depths of 34 feet.

- Fill soils ranging from 0.5 to 8.5 feet were encountered within the majority of the excavations made during site investigation. The fill soils were clayey and

silty fine sand to fine sandy clay. The upper naturally-deposited older alluvial soils consisted of silty and clayey fine sand, clayey silt, and silty clay. These soils were generally moist and firm or dense and the silts and clays were generally underlain by clayey fine sand at depths of 5 to 12 feet. Occasional layers of clean or nearly clean sand were found and occurred at a depth of about 12 feet. The surficial soils were generally characterized as slightly expansive.

- ***R.T. Frankian & Associates, 1979a*** The above report was followed up by an addendum letter which provides alternative recommendations regarding the side slopes and bottoms for construction of the then proposed recreational lakes.

## GEOLOGIC CONDITIONS

### Regional Geologic Setting

The site is located on the Los Angeles coastal plain. This plain is a lowland that gently slopes seaward. It is underlain by as much as about 30,000 feet of sediments that rest on granitic and metamorphic basement rocks. The plain is bounded by the Santa Monica Mountains and San Joaquin Hills to the south, and the Palos Verde Hills and Pacific Ocean shoreline to the west. The dominate structural feature of the Los Angeles coastal plain is the northwest trending Newport-Inglewood fault zone.

The nearest known active earthquake fault is the Newport-Inglewood-Rose Canyon Fault which is located approximately 0.7 miles (1.2 kilometers) to the southwest. Other significant faults in the region include the Palos Verdes Fault approximately located 10 miles (16.1 kilometers) to the southwest, the Los Alamitos Fault approximately located 9.2 miles (15 kilometers) to the southeast, the Elsinore Fault approximately located 13.4 miles (21.5 kilometers) to the east and the Sierra Madre Fault Zone approximately located 21 miles (33.2 kilometers) to the north.

### Site Geologic Conditions

A recent geologic map of the region (Saucedo et al, 2003) shows the site as being underlain by old alluvial flood plain deposits. A copy of a portion of this map is included as Enclosure A-3 in Appendix A with a map explanation given on Enclosure A-4.

Data from our research and site reconnaissance indicate that the site is underlain by fill soils that were derived mainly from onsite grading while alluvial sediments are present at depth. Because virtually all of the site has been modified to some extent in the past, no areas of natural ground remain exposed at the surface. Based upon our review of the referenced geotechnical report and site reconnaissance, existing fill thicknesses across the site range from less than one foot to an anticipated maximum thickness of about 10 to 15 feet. As described above, the onsite soils consist mainly of fine-grained clayey sand to sandy clay soils that are soft to very firm and have low expansion potential.

Agronomy

Soil contamination was found at the north-westerly portion of the site just north of the lake in a 360 foot by 570 foot section. However, the agronomic report is outdated and in order to address agronomic concerns regarding current shallow soil conditions soil samples have to be obtained.

Groundwater Hydrology

Shallow groundwater was found at a depth of approximately 40 to 45 feet below the ground surface and deep ground water was found at approximate depths of 110 to 129 feet based on the Site Assessment Report for the Former Athens Tank Farm, Willowbrook, County of Los Angeles, Kleinfelder, 2010. Based on the information presented in the assessment localized perched groundwater may exist.

Surface Runoff

The current configuration of the site as a park allows for the directing of water along graded swales and valleys to collection devices and/or to one of the two onsite lakes. Overall drainage is toward the south.

Mass Movement

The site lies on a relatively flat surface. The occurrence of mass movement failures, such as landslides, rockfalls, or debris flows within such areas is generally not considered common and no evidence of mass movement was observed on the site.

Faulting

No active or potentially active faults are known to exist at the subject site. In addition, the subject site does not lie within a current State of California Earthquake Fault Zone (Hart and Bryant, 1997).

As previously mentioned, the closest known active fault is the Newport-Inglewood-Rose Canyon Fault which is located approximately 0.7 miles (1.2 kilometers) to the southwest. Other significant faults in the region include the Palos Verdes Fault approximately located 10 miles (16.1 kilometers) to the southwest, the Los Alamitos Fault approximately located 9.2 miles (15 kilometers) to the southeast, the Elsinore Fault approximately located 13.4 miles (21.5 kilometers) to the east and the Sierra Madre Fault Zone approximately located 21 miles (33.2 kilometers) to the north.

Historical Seismicity

In order to obtain a general perspective of the historical seismicity of the site and surrounding region a search was conducted for seismic events at and around the area within various radii. This search was conducted utilizing the historical seismic search program by EPI Software, Inc. This program conducts a search of a user selected cataloged seismic events database, within a specified radius and selected magnitudes, and then plots the events onto an overlay map of known faults. For this investigation the database of seismic events utilized by the EPI program was obtained from the Southern California Seismic Network (SCSN) available from the Southern California Earthquake Center. At the time of our search, the data base contained data from January 1, 1932 through December, 2010.

In our first search, the general seismicity of the region was analyzed by selecting an epicenter map listing all events of magnitude 4.0 and greater, recorded since 1932, within a 100 kilometer (62 mile) radius of the site, in accordance with guidelines of the California Division of Mines and Geology. This map illustrates the regional seismic history of moderate to large events. As depicted on Enclosure A-5 within Appendix A, the site lies within a relatively active region associated with the Newport-Inglewood- Rose Canyon Fault Zone trending southeast to northwest, and other faults within the area of the Los Angeles Basin. Of these events, the closest was a magnitude 4.0 located approximately 1.1 kilometers (0.5 miles) to the west of the site.

In the second search, the micro seismicity of the area lying within a 15 kilometer (9.3 mile) radius of the site was examined by selecting an epicenter map listing events on the order of 0.0 and greater since 1978. In addition, only the "A" events, or most accurate events were selected. Caltech indicates the accuracy of the "A" events to be approximately 1 km. The result of this search is a map that presents the seismic history around the area of the site with much greater detail, not permitted on the larger map. The reason for limiting the events to the last 35 years on the detail map is to enhance the accuracy of the map. Events recorded prior the mid 1970's are generally considered to be less accurate due to advancements in technology. As depicted on this map, Enclosure A-6 within Appendix A, numerous, widespread events have occurred, mainly in clusters to the northwest and southeast of the site.

In summary, the historical seismicity of the site entails numerous small to medium magnitude earthquake events occurring around the subject site, predominately associated with the presence of the Newport-Inglewood fault. Any future developments at the subject site should anticipate that moderate to large seismic events could occur within or very near the site.

Secondary Seismic Hazards

Other secondary seismic hazards generally associated with severe ground shaking during an earthquake include liquefaction, seiches and tsunamis, earthquake induced flooding, landsliding and rockfalls, and seismic-induced settlement.

Liquefaction: The potential for liquefaction generally occurs during strong ground shaking within loose, geologic young, granular sediments where the depth to groundwater is usually less than 50 feet. As previously discussed, the depth to static groundwater is approximately 40 feet below the ground surface. However, the site is underlain by relatively dense/stiff deposits of older alluvium soils and these materials are less susceptible to liquefaction. In addition, the Inglewood Quadrangle Seismic Hazards Map prepared by the California Division of Mines and Geology, 1991, shows the area of the site as being located outside of the area that may be susceptible to liquefaction. Therefore, the potential for liquefaction occurring at the site is considered to be very low to low.

Seiches/Tsunamis: The potential for the site to be affected by a seiche or tsunami (earthquake generated wave) is considered nil due to the absence of any large open bodies of water near the site. The two small, onsite lakes could produce waves as the result of a large, nearby earthquake, however, the impacts would likely be slight.

Flooding (Water Storage Facility Failure): The potential for flooding to occur at the site as the result of water storage facility failure is considered to be nil as there are no known large water storage facilities in close proximity above the site that could rupture and cause flooding.

Seismically-Induced Landsliding: Due to the low relief of the site and surrounding region, the potential for landslides to occur at the site is considered nil.

Rockfalls: No large, exposed, loose or unrooted boulders are present above the site that could affect the integrity of the site.

Seismically-Induced Settlement: Settlement generally occurs within areas of loose, granular soils with relatively low density. Since the site is underlain by relatively dense/stiff, older alluvial materials, the potential for settlement is considered low. In addition, the earthwork operations recommended within this report to be conducted during the development of the site will mitigate any near surface loose soil conditions.

## SOILS AND SEISMIC DESIGN CRITERIA (California Building Code)

Section 1613 of Chapter 16 of the 2013 California Building Code (CBC) contains the procedures and definitions for the calculations of the earthquake loads on structures and non structural components that are permanently attached to structures and their supports and attachments. It should be noted that the classification of use and occupancy of all proposed structures at the site, and thus design requirements, shall be the responsibility of the structural engineer and the building official.

### CBC Earthquake Design Summary

The following earthquake design criteria have been formulated for the site utilizing the source referenced above. However, these values should be reviewed and the final design should be performed by a qualified structural engineer familiar with the region.

| CBC 2013 SEISMIC DESIGN SUMMARY<br>Site Location (WGS 84) 33.9198, -118.2579 Occupancy Category II | |
|---|---|
| Site Class Definition (Table 1613.2) | D |
| $S_S$ Mapped Spectral Acceleration at 0.2s Period (Figure 1613.5(3)) | 1.7 |
| $S_1$ Mapped Spectral Acceleration at 1.0s Period (Figure 1613.5(4)) | 0.6 |
| $F_A$ Short Period Site Coefficient at 0.2s Period (Table 1613.5.3(1)) | 1.0 |
| $F_V$ Long period Site Coefficient at 1.0s Period (Table 1613.5.3(2)) | 1.5 |
| $S_{MS}$ Adjusted Spectral Response Acceleration at 0.2s Period (eq. 16-37) | 1.7 |
| $S_{M1}$ Adjusted Spectral Response Acceleration at 1.0s Period (eq. 16-38) | 0.9 |
| $S_{DS}$ Design Spectral Response Acceleration at 0.2s Period (eq. 16-39) | 1.1 |
| $S_{D1}$ Design Spectral Response Acceleration at 1.0s Perod (eq. 16-40) | 0.6 |
| Seismic Design Category, Short Period | D |
| Seismic Design Category, Long Period | D |

## CONCLUSIONS

### General

This feasibility study provides a broad overview of the geotechnical and geologic factors which are expected to influence future site planning and development. On the basis of our review of available data, it is the opinion of LOR Geotechnical Group, Inc. that proposed park/recreation area expansion is feasible from a geotechnical standpoint, provided the recommendations presented in this report and subsequent reports are incorporated into design and implemented during grading and construction. Supplemental investigation to include subsurface borings, sampling and laboratory testing, is recommended once development plans have been made available in order to confirm the findings of this and previous geotechnical reports and to make modifications to these reports, as necessary.

Foundation Support

In order to provide adequate support for any proposed structural improvements, we recommend that a compacted fill mat be constructed beneath footings and slabs. The compacted fill mat will provide a dense, high-strength soil layer to uniformly distribute the anticipated foundation loads over the underlying soils. The construction of this compacted fill mat should include the removal of any existing non-structural fill material as well as the removal of any upper, loose/soft to medium dense/stiff underlying natural earth materials.

Conventional foundation systems, utilizing either individual spread footings and/or continuous wall footings, will provide adequate support for the anticipated downward and lateral loads when utilized in conjunction with the recommended fill mat. These recommendations are tentatively made based upon our knowledge of the site conditions and anticipated development and may require modification as based upon the findings of any subsequent geotechnical investigation work and upon review of development plans, as they become available.

Geologic Mitigations

No special geologic mitigations are anticipated at this time, other than the geotechnical mitigations contained within.

Seismicity

Seismic ground rupture is generally considered most likely to occur along pre-existing active faults. Because no known faults project through or toward the site, the potential for seismic rupture is considered nil. However, due to the site's close proximity to the Newport-Inglewood and other nearby fault zones, described above, it is reasonable to expect a strong ground motion seismic event to occur during the lifetime of any proposed development on the site. Large earthquakes could occur on other faults in the general area, but because of their lesser anticipated magnitude and/or greater distance, they are considered less significant than the Newport-Inglewood fault zone from a ground motion standpoint.

The effects of ground shaking anticipated at the subject site should be mitigated by the seismic design requirements and procedures outlined in Chapter 16 of the California Building Code. However, it should be noted that the current building code requires the minimum design to allow a structure to remain standing after a seismic

event, in order to allow for safe evacuation. A structure built to code may still sustain damage which might ultimately result in the demolishing of the structure (Larson and Slosson 1992).

## RECOMMENDATIONS

Recommendations provided here are general and reflect professional opinions based on the geotechnical evaluation conducted in this report. These recommendations are to be regarded as general minimum guidelines to assist in the planning phase of the proposed Earvin "Magic" Johnson Regional Park State Master Plan Amendment/Ujima Village Master Plan Project. Any proposed improvements or new construction should first have a site specific geotechnical investigation conducted in order to adequately identify the engineering characteristics of the underlying earth materials.

### Geologic Recommendations

Geotechnical review of grading and site development plans should be conducted as planning and development of the project advances to further address existing and potential geologic and geotechnical conditions, as necessary.

### General Site Grading

It is imperative that no clearing and/or grading operations be performed without the presence of a qualified geotechnical engineer. An on-site, pre-job meeting with the developer, the contractor, and soil engineer should occur prior to all grading related operations. Operations undertaken at the site without the geotechnical engineer present may result in exclusions of affected areas from the final compaction report for the project.

Grading of the subject site should be performed in accordance with the following recommendations as well as applicable portions of the California Building Code, and/or applicable local ordinances.

All areas to be graded should be stripped of significant vegetation and other deleterious materials. In areas of existing grass, the grass and upper approximately 3 inches of topsoil must be removed. The remaining soil, when blended for use as engineered fill, should have an organic content of no more than 3 percent.

All existing non-structural fill soils should be completely removed from all proposed structural areas. Subsequent to removal of deleterious items to the satisfaction of the soils engineer, the fill soils may then be placed as compacted fill. Irrigation and drain lines, as well as their associated trench backfill materials, should also be removed during site clearing and grading.

It is our recommendation that all existing fills under any proposed flatwork and paved areas also be removed and replaced with engineered compacted fill. If this is not done, premature structural distress (settlement) of the flatwork and pavement may occur.

Cavities created by removal of subsurface obstructions should be thoroughly cleaned of loose soil, organic matter and other deleterious materials, shaped to provide access for construction equipment, and backfilled as recommended in the following Engineered Compacted Fill section of this report.

Initial Site Preparation

All fill soil material and all loose alluvial materials should be removed from areas to receive engineered compacted fill. The data developed during this study and the previous subsurface investigation indicate that removals ranging from approximately 3 to 12 feet will be required in most areas. This range is based upon complete removal of any existing non-structural fills and removal of the upper two feet of native soil materials present beneath the fill soils. Within areas that were graded as cut during the grading operations which created the existing park and apartment areas, lesser removals may be possible if competent natural soils are exposed at shallow depth beneath the existing fill soils. The removal depths stated may be modified as based upon the findings of subsequent geotechnical studies and the actual depths of removals will need to be verified during the grading operation by observation and/or in-place density testing. Removals should expose native materials with a relative in-situ compaction of at least 82 percent (ASTM D 1557) and/or an in-situ saturation of at least 85 percent. Areas of proposed non-structural fill should also be cleared of any fill soils and processed to a minimum depth of 12 inches prior to fill placement.

It is our recommendation that all existing fills under any proposed flatwork and paved areas be removed and replaced with engineered compacted fill. If this is not done, premature structural distress (settlement) of the flatwork and pavement may occur. Any undocumented fills encountered during grading should be completely removed and cleaned of significant deleterious materials. These may then be reused as compacted fill.

Preparation of Fill Areas

Prior to placing fill, the surfaces of all areas to receive fill should be scarified to a depth of at least 12 inches. The scarified soil should be brought to near optimum moisture content and recompacted to a relative compaction of at least 90 percent (ASTM D 1557).

Preparation of Foundation Areas

All footings should rest upon at least 24 inches of properly compacted fill material. In areas where the required fill thickness is not accomplished by the recommended removals or by site rough grading, the footing areas should be further subexcavated to a depth of at least 24 inches below the proposed footing base grade, with the subexcavation extending at least 5 feet beyond the footing lines. Where removal and/or over-excavation depths exceed 5 feet, subexcavation should extend beyond the footing lines a minimum distance equal to the depth of the removal and/or over-excavation. The bottom of all excavations should then be scarified to a depth of at least 12 inches, brought to near optimum moisture content, and recompacted to at least 90 percent relative compaction (ASTM D 1557) prior to refilling the excavation to grade as properly compacted fill. These recommendations are subject to revision pending the completion of supplemental geotechnical investigation and/or review of proposed development plans.

Proposed building areas should be graded such that the minimum fill thickness is greater than or equal to one-third of the maximum fill thickness around the building area.

Engineered Compacted Fill

The on-site soils should provide adequate quality fill material, provided they are free from organic matter and other deleterious materials. Unless approved by the geotechnical engineer, rock or similar irreducible material with a maximum dimension greater than 12 inches should not be buried or placed in fills. Rocks or other irreducible material greater than 12 inches in diameter should be disposed of within designated rock disposal areas approved by the soils engineer and/or local governing agency.

Import fill should be inorganic, non-expansive granular soils free from rocks or lumps greater than 6 inches in maximum dimension. Sources for import fill should be approved by the geotechnical engineer prior to their use.

Fill should be spread in maximum 8-inch uniform, loose lifts, each lift brought to near optimum moisture content, and compacted to a relative compaction of at least 90 percent in accordance with ASTM D 1557.

Based upon the estimated compaction of the near surface soils and the relative compaction anticipated for compacted fill soil, we tentatively estimate a compaction shrinkage of approximately 10 percent. In addition, we would anticipate subsidence of approximately 0.10 feet. These values are for estimating purposes only, and are exclusive of losses due to stripping or the removal of subsurface obstructions. These values will vary due to differing conditions within the project boundaries and the limitations of this study and previous investigation work. Anticipated shrinkage and subsidence values should be monitored and refined during grading. If percentages vary, provisions should be made to revise final grades or adjust quantities of borrow or export.

Short-Term Excavations

Following the California Occupational and Safety Health Act (CAL-OSHA) requirements, excavations deeper than 5 feet should be sloped or shored. All excavations and shoring should conform to CAL-OSHA requirements.

Short-term excavation greater than 5 feet deep shall conform to Title 8 of the California Code of Regulations, Construction Safety Orders, Section 1504 and 1539 through 1547. Based on our review of the referenced reports and previous site

grading operations, it appears that Type C soils are the predominant type of soil on the project and all short-term excavation should be based on this type of soil. Deviation from the standard short-term slopes are permitted using option 4, Design by a Registered Professional Engineer (Section 1541.1).

Slope Construction

Preliminary data indicates that cut and fill slopes should be constructed no steeper than two horizontal to one vertical. Fill slopes should be overfilled during construction and then cut back to expose fully compacted soil. A suitable alternative would be to compact the slopes during construction, then roll the final slopes to provide dense, erosion-resistant surfaces.

Slope Protection

Since the native materials are susceptible to erosion by running water, measures should be provided to prevent surface water from flowing over slope faces. Slopes at the project should be planted with a deep rooted ground cover as soon as possible after completion. The use of succulent ground covers such as iceplant or sedum is not recommended. If watering is necessary to sustain plant growth on slopes, then the watering operation should be monitored to assure proper operation of the irrigation system and to prevent over watering.

Soil Expansiveness

The upper materials encountered during previous subsurface investigation were classified and are considered to have a very low to low expansion potential, in accordance with Uniform Building Code, Standard 18-2. Therefore, specialized construction procedures to specifically resist expansive soil activity are not anticipated at this time. In order to verify this observation, additional evaluation of on-site soils for their expansion potential should be conducted during the grading operations. Any imported soils should also be evaluated and/or tested for expansion potential prior to importation to the site.

Foundation Design

If the site is prepared as recommended, the proposed structural improvements may be safely founded on conventional shallow foundations, utilizing either individual

spread footings and/or continuous wall footings, bearing on a minimum of 24 inches of engineered compacted fill.

The above recommendations are subject to revision pending supplemental geotechnical investigation and/or review of development plans. Soil bearing pressure for the proposed structures may be provided at that time.

Settlement

Total settlement of individual foundations will vary depending on the width of the foundation and the actual load supported. Maximum settlement of shallow foundations designed and constructed in accordance with the preceding recommendations and anticipated conditions are estimated to be on the order of 0.5 inch. Differential settlements between adjacent footings should be about one-half of the total settlement. Settlement of all foundations is expected to occur rapidly, primarily as a result of elastic compression of supporting soils as the loads are applied, and should be essentially completed shortly after initial application of the loads.

The given settlement estimates are preliminary. More precise settlement analysis should be conducted upon the performance of a further geotechnical investigation and review of data available at that time.

Slabs-On-Grade

To provide adequate support, concrete slabs-on-grade should bear on a minimum of 12 inches of compacted soil. The final pad surfaces should be rolled to provide smooth, dense surfaces upon which to place the concrete.

Slabs to receive moisture-sensitive coverings should be provided with a moisture vapor barrier. This barrier may consist of an impermeable membrane. Two inches of sand over the membrane will reduce punctures and aid in obtaining a satisfactory concrete cure. The sand should be moistened just prior to placing of concrete.

The slabs should be protected from rapid and excessive moisture loss which could result in slab curling. Careful attention should be given to slab curing procedures, as the site area is subject to large temperature extremes, humidity, and strong winds.

Wall Pressures

The design of footings for retaining wall structures should be performed in accordance with the recommendations described earlier under Preparation of Foundation Design Areas and Foundation Design. As previously mentioned, additional data should be developed based upon the findings determined through supplemental investigation and laboratory test results.

Pavement Design

Pavement design should be based upon the results of subsequent soil sampling and testing. Preliminary data indicates that the onsite soils have good R-value quality (greater than 50). For design purposes, the city of Rancho Cucamonga pavement design guidelines should be followed.

Sulfate Protection

Recommendations for concrete elements to be in contact with the onsite soils should be provided as based upon the results of the future onsite investigations.

Supplemental Geotechnical Investigation and Plan Reviews

This feasibility study was conducted prior to the issuance of any site development or grading plans. Once these plans become available, we should review the plans in order to better define onsite geotechnical considerations. Supplemental geotechnical investigation will allow for subsurface investigation, sampling and laboratory testing of the soils present within representative and/or key areas and help to identify any areas of geologic or geotechnical concern.

Construction Monitoring

During construction, sufficient and timely geotechnical observation and testing should be provided to correlate the findings of this study and the previous subsurface investigation with the actual subsurface conditions exposed. Items requiring observation and testing include, but are not necessarily limited to, the following:

1. Site preparation-stripping and removals.

2. Excavations, including approval of the bottom of excavations prior to filling.

3. Scarifying and recompacting prior to fill placement.

4. Subgrade preparation for pavements and slabs-on-grade.

5. Placement of engineered compacted fill and backfill, including approval of fill materials and the performance of sufficient density tests to evaluate the degree of compaction being achieved.

6. Foundation excavations.

We reiterate that supplemental geotechnical investigation should be conducted and the project plans and specifications should be reviewed prior to construction to confirm that the intent of the recommendations presented herein have been incorporated into the design.

## TIME LIMITATIONS

The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they be due to natural processes or the work of man on this or adjacent properties. In addition, changes in the Standards-of-Practice and/or Governmental Codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a significant amount of time without a review by LOR Geotechnical Group, Inc. verifying the suitability of the conclusions and recommendations.

## LIMITATIONS

This report contains geotechnical conclusions and recommendations developed solely for use by RBF Consulting Inc. and its designates for the purposes described earlier. It may not contain sufficient information for other uses or the purposes of other parties. The contents should not be extrapolated to other areas or used for other facilities without consulting LOR Geotechnical Group, Inc.

The recommendations are based on interpretations of the subsurface conditions concluded from information gained from subsurface explorations, and a surficial site reconnaissance. The interpretations may differ from actual subsurface conditions, which can vary horizontally and vertically across the site. Due to possible subsurface variations, all aspects of field construction addressed in this report should be observed and tested by the project geotechnical consultant.

If parties other than LOR Geotechnical Group, Inc. provide construction monitoring services, they must be notified that they will be required to assume responsibility for the geotechnical phase of the project being completed by concurring with the recommendations provided in this report or by providing alternative recommendations.

The report was prepared using generally accepted geotechnical engineering practices under the direction of a state licensed geotechnical engineer. No warranty, expressed or implied, is made as to conclusions and professional advice included in this report. Any persons using this report for bidding or construction purposes should perform such independent investigations as deemed necessary to satisfy themselves as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on this project.

**CLOSURE**

It has been a pleasure to assist you with this project. We look forward to being of further assistance to you as construction begins. Should conditions be encountered during construction that appear to be different than indicated by this report, please contact this office immediately in order that we might evaluate their effect.

Should you have any questions regarding this report, please do not hesitate to contact us as your convenience.

Respectfully submitted,
**LOR Geotechnical Group, Inc.**

Robert M Markoff, CEG 2073
Engineering Geologist

John P. Leuer, GE 2030
President

RMM:JPL:ejt

Distribution: Addressee (4)

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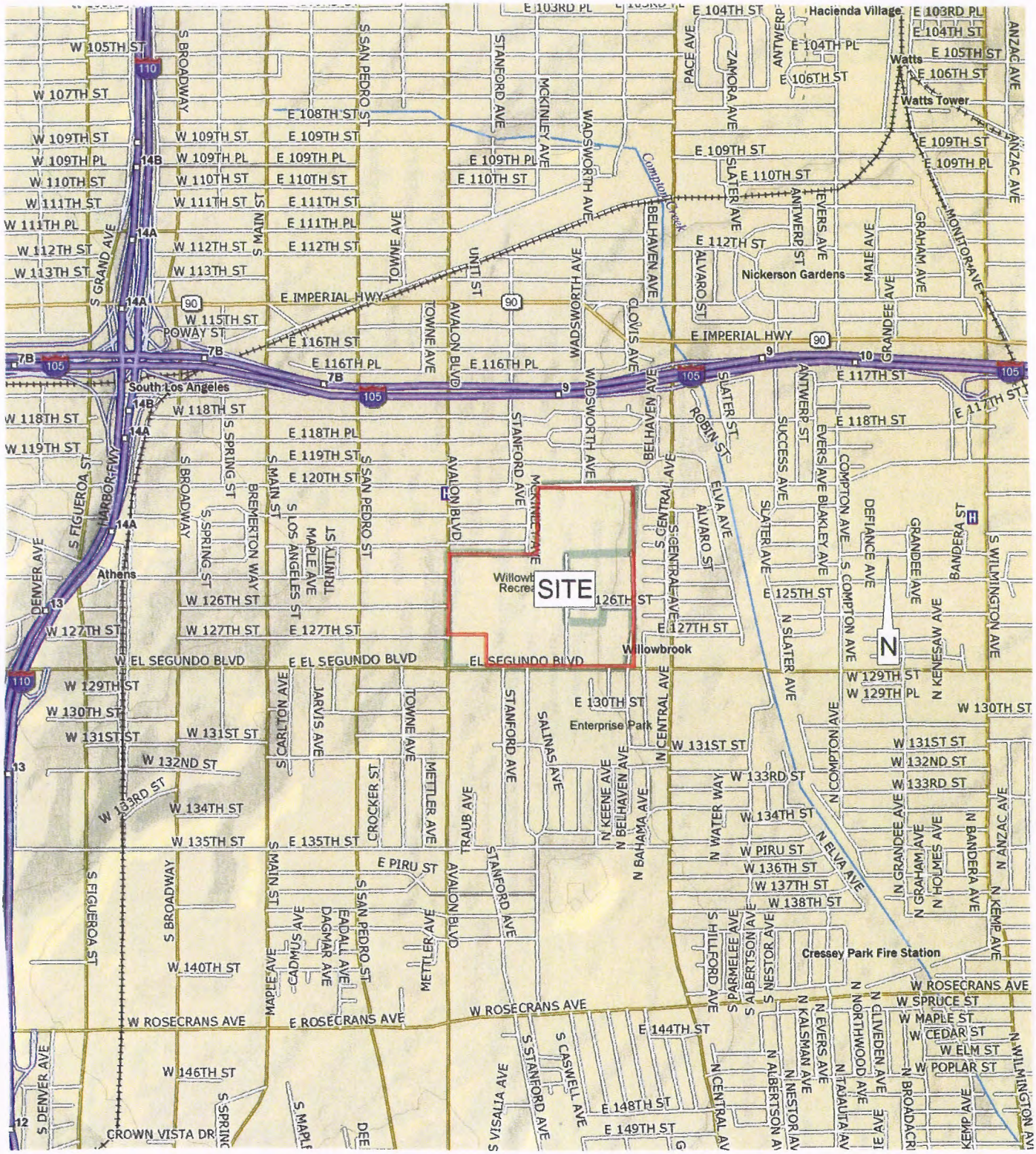
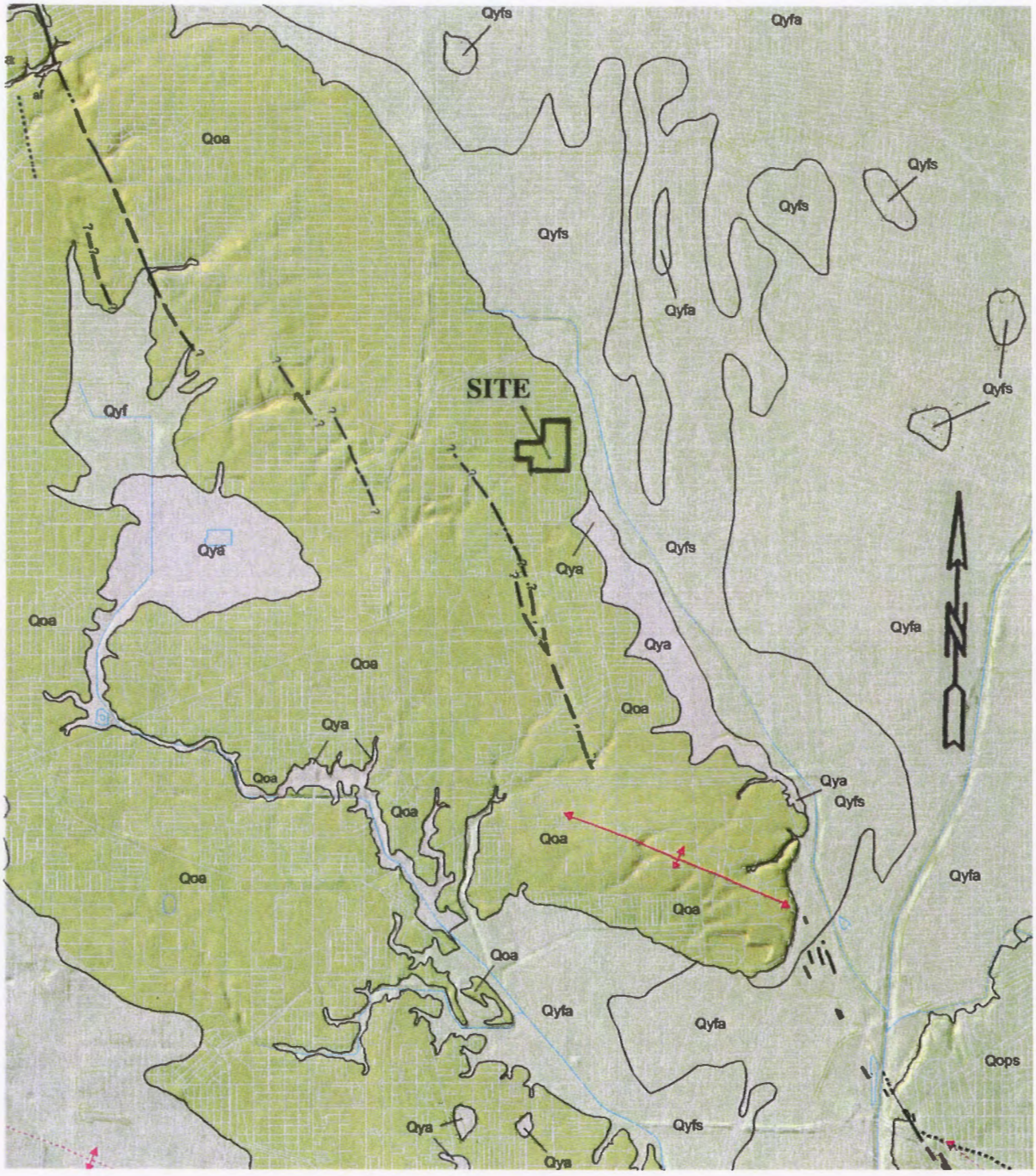



# INDEX MAP

| | | | |
|---|---|---|---|
| PROJECT: | EARVIN "MAGIC" JOHNSON RECREATION AREA | PROJECT NO.: | 63084.1 |
| CLIENT: | RBF CONSULTING | ENCLOSURE: | A-1 |
| **LOR Geotechnical Group, Inc.** | | DATE: | JULY, 2014 |
| | | SCALE: | 1" = 2,000' |


# SITE MAP

| | | | |
|---|---|---|---|
| PROJECT: | EARVIN "MAGIC" JOHNSON RECREATION AREA | PROJECT NO.: | 63084.1 |
| CLIENT: | RBF CONSULTING | ENCLOSURE: | A-2 |
| **LOR Geotechnical Group, Inc.** | | DATE: | JULY, 2014 |
| | | SCALE: | AS SHOWN |




# REGIONAL GEOLOGIC MAP (Saucedo, et al, 2003)

| | | | |
|---|---|---|---|
| PROJECT: | EARVIN "MAGIC" JOHNSON RECREATION AREA | PROJECT NO.: | 63084.1 |
| CLIENT: | RBF CONSULTING | ENCLOSURE: | A-3 |
| **LOR Geotechnical Group, Inc.** | | DATE: | JULY, 2014 |
| | | SCALE: | |

## PARTIAL LEGEND

| | |
|---|---|
| Qyf | Young alluvial fan and valley deposits, undivided<br>a = sand, s = silt, c = clay |
| Qyf2 | Young alluvial fan deposits, unit 2 |
| Qyf1 | Young alluvial fan deposits, unit 1 |
| Qya | Young alluvial flood plain deposits, unit 1 |
| Qye | Young eolian deposits |
| Qype | Young paralic estuarine deposits |
| Qof | Old alluvial fan and valley deposits, undivided<br>a = sand, s = silt, c = clay |
| Qoa | Old alluvial flood plain deposits, undivided |

## MAP SYMBOLS

Contact - accuracy of location ranges from well located to inferred. All offshore contacts are considered approximately located.

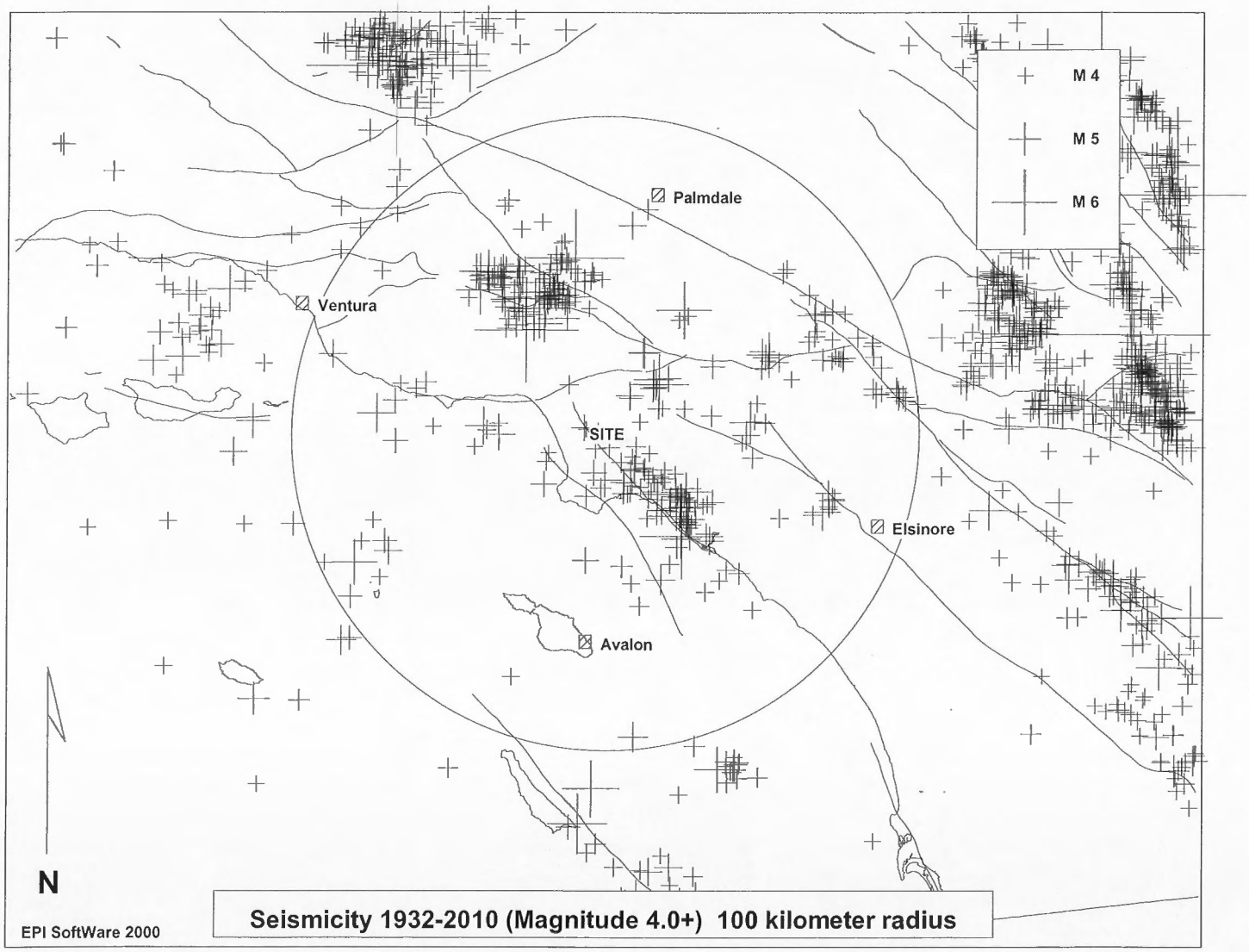
U
D

Fault - solid where well located; dashed where approximately located or inferred; dotted where concealed; queried where continuation or existence is uncertain. Where age was determined in offshore area, age symbol is shown astride fault and relative offset is shown by U, upthrown side; D, downthrown side (relative or apparent). Age of faults are indicated as follows:

- cuts strata of Holocene age
- cuts strata of Pleistocene age
- cuts strata of Quaternary age
- cuts strata of Pliocene age
- cuts Miocene or older strata

# DESCRIPTION OF UNITS

| | | | |
|---|---|---|---|
| PROJECT: | EARVIN "MAGIC' JOHNSON RECREATION AREA | PROJECT NO.: | 63084.1 |
| CLIENT: | RBF CONSULTING | ENCLOSURE: | A-4 |
| LOR Geotechnical Group, Inc. | | DATE: | JULY, 2014 |
| | | SCALE: | N/A |




SITE LOCATION: 33.9198 LAT. -118.2579 LONG.

MINIMUM LOCATION QUALITY: C

TOTAL # OF EVENTS ON PLOT: 1135

TOTAL # OF EVENTS WITHIN SEARCH RADIUS: 355

0 50 100
KILOMETERS

MAGNITUDE DISTRIBUTION OF SEARCH RADIUS EVENTS:

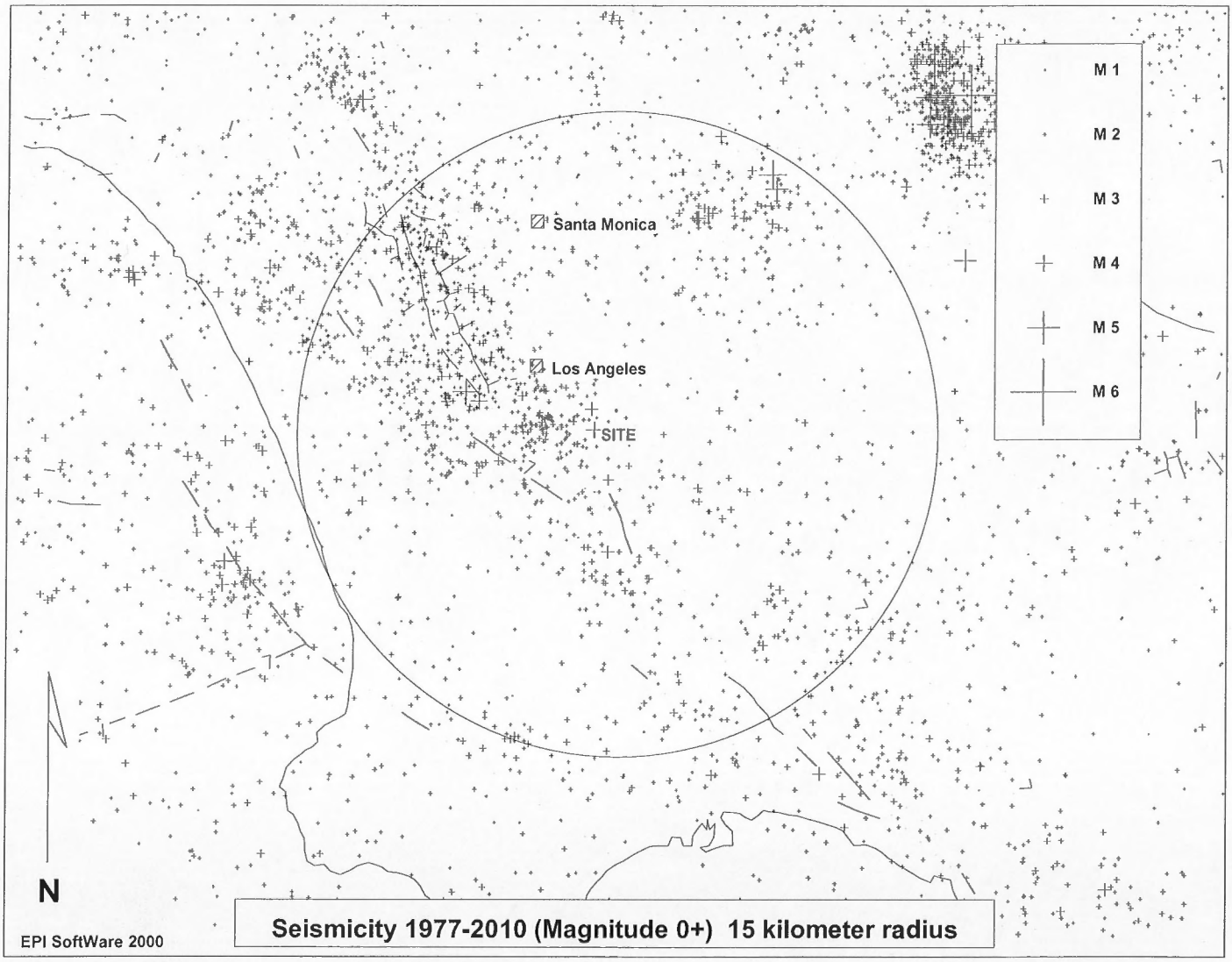
4.0- 4.9 : 324
5.0- 5.9 : 28
6.0- 6.9 : 3
7.0- 7.9 : 0
8.0- 8.9 : 0

CLOSEST EVENT: 4.0 ON SUNDAY, OCTOBER 28, 2001 LOCATED APPROX. 1.1 KILOMETERS WEST OF THE SITE

LARGEST 5 EVENTS:

6.7 ON MONDAY, JANUARY 17, 1994 LOCATED APPROX. 41 KILOMETERS NORTHWEST OF THE SITE
6.6 ON TUESDAY, FEBRUARY 09, 1971 LOCATED APPROX. 56 KILOMETERS NORTH OF THE SITE
6.4 ON SATURDAY, MARCH 11, 1933 LOCATED APPROX. 40 KILOMETERS SOUTHEAST OF THE SITE
5.9 ON MONDAY, JANUARY 17, 1994 LOCATED APPROX. 45 KILOMETERS NORTHWEST OF THE SITE
5.9 ON THURSDAY, OCTOBER 01, 1987 LOCATED APPROX. 22 KILOMETERS NORTHEAST OF THE SITE

Enclosure A-5




SITE LOCATION: 33.9198 LAT. -118.2579 LONG.

MINIMUM LOCATION QUALITY: A

TOTAL # OF EVENTS ON PLOT: 3591

TOTAL # OF EVENTS WITHIN SEARCH RADIUS: 1372

0 7 15
KILOMETERS

MAGNITUDE DISTRIBUTION OF SEARCH RADIUS EVENTS:

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7.0- 7.9 : 0
8.0- 8.9 : 0

CLOSEST EVENT: 1.4 ON TUESDAY, DECEMBER 05, 1995 LOCATED APPROX. .1 KILOMETER OF THE SITE

LARGEST 5 EVENTS:

4.8 ON MONDAY, JUNE 12, 1989 LOCATED APPROX. 13 KILOMETERS NORTHEAST OF THE SITE
4.7 ON MONDAY, MAY 18, 2009 LOCATED APPROX. 7 KILOMETERS WEST OF THE SITE
4.5 ON MONDAY, JUNE 12, 1989 LOCATED APPROX. 13 KILOMETERS NORTHEAST OF THE SITE
4.0 ON TUESDAY, MAY 19, 2009 LOCATED APPROX. 6 KILOMETERS WEST OF THE SITE
4.0 ON SUNDAY, OCTOBER 28, 2001 LOCATED APPROX. 1 KILOMETERS WEST OF THE SITE

Enclosure A-6