GEOTECHNICAL INVESTIGATION
PROPOSED RANCHO MIRAGE DOG PARK
SEC KEY LARGO AVENUE & VIA VAIL
RANCHO MIRAGE, CALIFORNIA

-Prepared By-

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March 16, 2015

Project No. 544-15032
15-03-110

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Attn: Mr. Stephen Crevoiserat

Subject: Geotechnical Investigation

Project: Proposed Rancho Mirage Dog Park
SEC Key Largo Avenue & Via Vail
Rancho Mirage, California

Sladden Engineering is pleased to present the results of the geotechnical investigation performed for the proposed Rancho Mirage Dog park to be located on the southeast corner of Key Largo Avenue and Via Vail in the City of Rancho Mirage, California. Our services were completed in accordance with our proposal for geotechnical engineering services dated December 15, 2014 and your authorization to proceed with the work. The purpose of our investigation was to explore the subsurface conditions at the site in order to provide recommendations for foundation design and site preparation. Evaluation of environmental issues and hazardous wastes was not included within the scope of services provided.

The opinions, recommendations and design criteria presented in this report are based on our field exploration program, laboratory testing and engineering analyses. Based on the results of our investigation, it is our professional opinion that the proposed project should be feasible from a geotechnical perspective provided that the recommendations presented in this report are implemented in design and carried out through construction.

We appreciate the opportunity to provide service to you on this project. If you have any questions regarding this report, please contact the undersigned.

Respectfully submitted,
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INTRODUCTION

This report presents the results of the geotechnical investigation performed by Sladden Engineering (Sladden) for the proposed dog park to be located on the southeast corner of Key Largo Avenue and Via Vail in the City of Rancho Mirage, California. The site is located at approximately 33.7997 degrees north latitude and 116.3954 degrees west longitude. The approximate location of the site is indicated on the Site Location Map (Figure 1).

Our investigation was conducted in order to evaluate the engineering properties of the subsurface materials, to evaluate their *in-situ* characteristics, and to provide engineering recommendations and design criteria for site preparation, foundation design and the design of various site improvements. This study also includes a review of published and unpublished geotechnical and geological literature regarding seismicity at and near the subject site.

PROJECT DESCRIPTION

Based on our preliminary conversations, it is our understanding that the proposed project will consist of constructing a new dog park on the site. Sladden anticipates that the proposed project will include a new restroom, paved parking, turf areas, shade structures, underground utilities and various associated site improvements. For our analyses we expect that the proposed structures associated with the dog park will consist of relatively lightweight wood-frame, steel-frame or reinforced masonry structures supported on conventional shallow spread foundations and concrete slabs on grade.

Grading plans were not available at the time of this report. However, Sladden expects that grading will be limited to minor cuts and fills to attain the desired grades. This does not include over-excavation and re-compaction of the loose surface soil and the primary foundation bearing soil. Upon completion of project grading plans, Sladden should be retained in order to ensure that the recommendations presented within in this report are incorporated into the design of the proposed project.

Structural foundation loads were not available at the time of this report. Based on our experience with relatively lightweight structures, we expect that isolated column loads will be less than 20 kips and continuous wall loads will be less than 2.0 kips per linear foot. If these assumed loads vary significantly from the actual loads, we should be consulted to verify the applicability of the recommendations provided.

SCOPE OF SERVICES

The purpose of our investigation was to determine specific engineering characteristics of the surface and near surface soil in order to develop foundation design criteria and recommendations for site preparation. Exploration of the site was achieved by drilling four (4) exploratory boreholes to depths of approximately 21 and 51 feet below the existing ground surface (bgs). Specifically, our site characterization consisted of the following tasks:

- Site reconnaissance to assess the existing surface conditions on and adjacent to the site.
- Advancing four (4) exploratory boreholes to depths of approximately 21 and 51 feet bgs in order to characterize the subsurface soil conditions. Representative samples of the soil were classified in the field and retained for laboratory testing and engineering analyses.
- Performing laboratory testing on selected samples to evaluate their engineering characteristics.
- Reviewing geologic literature and discussing geologic hazards.
- Performing engineering analyses to develop recommendations for foundation design and site preparation.
- The preparation of this report summarizing our work at the site.

SITE CONDITIONS

The site is located on the southeast corner of Key Largo Avenue and Via Vail in the City of Rancho Mirage, California. The subject site is currently undeveloped and remains in a basically native desert condition. Scattered native vegetation is located throughout the site and the surface soil consists of eolian (wind blown) sand. Generally, surface gradients descend gently to the east across the site. The subject parcel is bounded by native desert land to the south and east, Key Largo Avenue to the west and Via Vail (if projected) to the north.

Based on our review of the USGS (2012), the site is situated at an approximate elevation of 310 feet above mean sea level (MSL).

No natural ponding of water or surface seeps were observed at or near the site during our investigation conducted on February 26, 2015. Site drainage appears to be controlled via sheet flow and surface infiltration. Regional drainage is provided by the Whitewater River that is located approximately 4 miles south of the project site.

GEOLOGIC SETTING

The project site is located within the Colorado Desert Physiographic Province (also referred to as the Salton Trough) that is characterized as a northwest-southeast trending structural depression extending from the Gulf of California to the Banning Pass. The Salton Trough is dominated by several northwest trending faults, most notably the San Andreas Fault system. The Salton Trough is bounded by the Santa Rosa – San Jacinto Mountains on the southwest, the San Bernardino Mountains on the north, the Little San Bernardino - Chocolate – Orocopia Mountains on the east, and extends through the Imperial Valley into the Gulf of California on the south.

A relatively thick sequence (20,000 feet) of sediment has been deposited in the Coachella Valley portion of the Salton Trough from Miocene to present times. These sediments are predominately terrestrial in nature with some lacustrian (lake) and minor marine deposits. The major contributor of these sediments has been the Colorado River. The mountains surrounding the Coachella Valley are composed primarily of Precambrian metamorphic and Mesozoic "granitic" rock.

The Salton Trough is an internally draining area with no readily available outlet to Gulf of California and with portions well below sea level (-253' msl). The region is intermittently blocked from the Gulf of California by the damming effects of the Colorado River delta (current elevation +30'msl). Between about 300AD and 1600 AD (to 1700) the Salton Trough has been inundated by the River's water, forming ancient Lake Cahuilla (max. elevation +58' msl). Since that time the floor of the Trough has been repeatedly flooded with other "fresh" water lakes (1849, 1861, and 1891), the most recent and historically long lived being the current Salton Sea (1905). The sole outlet for these waters is evaporation, leaving behind vast amounts of terrestrial sediment materials and evaporite minerals.

The site has been mapped by Rogers (1965) to be immediately underlain by Quaternary-age dune sand (Qs). The regional geologic setting for the site vicinity is presented on the Regional Geologic Map (Figure 2).

SUBSURFACE CONDITIONS

The subsurface conditions at the site were investigated by drilling four (4) exploratory boreholes to depths of approximately 21 and 51 feet bgs. The approximate locations of the boreholes are illustrated on the Borehole Location Plan (Figure 3). The boreholes were advanced using a truck-mounted Mobile B-61 drill-rig equipped with 8-inch outside diameter hollow stem augers. A representative of Sladden was on-site to log the materials encountered.

During our field investigation a thin mantel of disturbed soil was encountered to a maximum depth of approximately one (1) to two (2) foot bgs. Underlying the disturbed surface soil and extending to the maximum depths explored, native eolian (wind blown sand deposits) were encountered. The native soil throughout the site consists primarily of fine- to coarse-grained sand with scattered micacious laminations. The native soil was found to be dry to slightly moist, loose to dense, fine- to coarse-grained and grayish brown in in-situ color. The final logs represent our interpretation of the contents of the field logs, and the results of the laboratory observations and tests of the field samples. The final logs are included in Appendix A of this report. The stratification lines represent the approximate boundaries between soil types although the transitions may be gradual.

Groundwater was not encountered to a maximum explored depth of 51 feet bgs during our field investigation. As such, it is our opinion that groundwater should not be a factor during construction of the proposed project.

SEISMICITY AND FAULTING

The southwestern United States is a tectonically active and structurally complex region, dominated by northwest trending dextral faults. The faults of the region are often part of complex fault systems, composed of numerous subparallel faults which splay or step from main fault traces. Strong seismic shaking could be produced by any of these faults during the design life of the proposed project.

We consider the most significant geologic hazard to the project to be the potential for moderate to strong seismic shaking that is likely to occur during the design life of the project. The proposed project is located in the highly seismic Southern California region within the influence of several fault systems that are considered to be active or potentially active. An active fault is defined by the State of California as a "sufficiently active and well defined fault" that has exhibited surface displacement within the Holocene epoch (about the last 11,000 years). A potentially active fault is defined by the State as a fault with a history of movement within Pleistocene time (between 11,000 and 1.6 million years ago).

As previously stated, the site has been subjected to strong seismic shaking related to active faults that traverse through the region. Some of the more significant seismic events near the subject site within recent times include: M6.0 North Palm Springs (1986), M6.1 Joshua Tree (1992), M7.3 Landers (1992), M6.2 Big Bear (1992) and M7.1 Hector Mine (1999).

Table 1 lists the closest known potentially active faults that was generated in part using the EQFAULT computer program (Blake, 2000), as modified using the fault parameters from The Revised 2002 California Probabilistic Seismic Hazard Maps (Cao et al, 2003). This table does not identify the probability of reactivation or the on-site effects from earthquakes occurring on any of the other faults in the region.

TABLE 1
CLOSEST KNOWN ACTIVE FAULTS

Fault Name	Distance (Km)	Maximum Event
San Andreas - Coachella	7.0	*7.2
San Andreas - Southern	7.0	*7.2
San Andreas - San Bernardino	15.7	*7.5
Burnt Mountain	16.3	6.5
Eureka Peak	19.5	6.4
Pinto Mountain	34.6	7.2
San Jacinto - Anza	35.9	7.2
San Jacinto - Coyote Creek	39.5	6.8
Landers	40.4	7.3
Emerson So. – Copper Mountain	44.4	7.0
North Frontal Fault Zone (East)	46.6	6.7
San Jacinto – San Jacinto Valley	48.7	6.9

* 8.1 for multiple segment rupture

2013 CBC SEISMIC DESIGN PARAMETERS

Sladden has reviewed the 2013 California Building Code (CBC) and summarized the current seismic design parameters for the proposed structures. The seismic design category for a structure may be determined in accordance with Section 1613 of the 2013 CBC or ASCE7. According to the 2013 CBC, Site Class D may be used to estimate design seismic loading for the proposed structures. The 2013 CBC Seismic Design Parameters are summarized below. The project Design Map Reports are included within Appendix C.

Risk Category (Table 1.5-1): I/II/III
Site Class (Table 1613.3.2): D
S_s (Figure 1613.3.1): 1.909g
S_1 (Figure 1613.3.1): 0.917g
F_a (Table 1613.3.3(1)): 1.0
F_v (Table 1613.5.3(2)): 1.5
S_{ms} (Equation 16-37 {F_a X S_s}): 1.909
S_{m1} (Equation 16-38 {F_v X S_1}): 1.375
S_{DS} (Equation 16-39 {2/3 X S_{ms}}): 1.273g
S_{D1} (Equation 16-40 {2/3 X S_{m1}}): 0.917g
Seismic Design Category: E

GEOLOGIC HAZARDS

The subject site is located in an active seismic zone and will likely experience strong seismic shaking during the design life of the proposed project. In general, the intensity of ground shaking will depend on several factors including: the distance to the earthquake focus, the earthquake magnitude, the response characteristics of the underlying materials, and the quality and type of construction. Geologic hazards and their relationship to the site are discussed below.

I. Surface Rupture. Surface rupture is expected to occur along preexisting, known active fault traces. However, surface rupture could potentially splay or step from known active faults or rupture along unidentified traces. Based on our review of Rogers (1965), Jennings (1994), CDOC (2015) and RCLIS (2015), known faults are not mapped on or projecting towards the site. In addition, no signs of active surface faulting were observed during our review of non-stereo digitized photographs of the site and site vicinity (Google, 2015; Terra Server 2002). Finally, no signs of active surface fault rupture or secondary seismic effects (lateral spreading, lurching etc.) were identified on-site during our field investigation. Therefore, it is our opinion that risks associated with primary surface ground rupture should be considered "low".

II. Ground Shaking. The site has been subjected to past ground shaking by faults that traverse through the region. Strong seismic shaking from nearby active faults is expected to produce strong seismic shaking during the design life of the proposed project. A probabilistic approach was employed to the estimate the peak ground acceleration (a_{max}) that could be experienced at the site. Based on the USGS Interactive Deaggregation (USGS, 2008) and shear wave velocity (Vs30) of 360 m/s (USGS, 2015a), the site could be subjected to ground motions on the order of 0.55g (USGS, 2015b). The peak ground acceleration at the site is judged to have a 475 year return period and a 10 percent chance of exceedence in 50 years.

III. Liquefaction/Dry Sand Settlement. The project site is situated within a County of Riverside designated "moderate" liquefaction potential zone (RCLIS, 2015). Liquefaction is the process in which loose, saturated granular soil loses strength as a result of cyclic loading. The strength loss is a result of a decrease in granular sand volume and a positive increase in pore pressures. Generally, liquefaction can occur if all of the following conditions apply: liquefaction-susceptible soil, groundwater within a depth of 50 feet or less, and strong seismic shaking. Based on our review of groundwater maps of the site vicinity (>50 feet bgs; Tyley, 1975), and our experience in the project vicinity, risks associated with liquefaction and liquefaction related hazards should be considered negligible.

IV. Tsunamis and Seiches. Because the site is situated at an inland location, and is not immediately adjacent to any impounded bodies of water, risk associated with tsunamis and seiches are considered negligible.

V. Slope Failure, Landsliding, Rock Falls. No signs of slope instability in the form of landslides, rock falls, earthflows or slumps were observed at or near the subject site. The site is situated on relatively flat ground and not immediately adjacent to any slopes or hillsides. As such, risks associated with slope instability should be considered negligible.

VI. Expansive Soil. Generally, the site soil consists of sand (SP) and silty sand (SM). Based on the results of our laboratory testing (EI=0), the materials underlying the site are considered to have a "very low" expansion potential. However, the expansion potential of the surface soil should be reevaluated after remedial grading.

VII. Settlement. Settlement resulting from the anticipated foundation loads should be minimal provided that the recommendations included in this report are considered in foundation design and construction. The estimated ultimate settlement is calculated to be approximately one-inch when using the recommended bearing pressures. As a practical matter, differential settlement between footings can be assumed as one-half of the total settlement.

VIII. Subsidence. Land subsidence can occur in valleys where aquifer systems have been subjected to extensive groundwater pumping, such that groundwater pumping exceeds groundwater recharge. Generally, pore water reduction can result in a rearrangement of skeletal grains and could result in elastic (recoverable) or inelastic (unrecoverable) deformation of an aquifer system.

Although recent investigations have documented significant subsidence within the Coachella Valley area (USGS, 2007), no fissures or other surficial evidence of subsidence were observed at the subject site. With the exception of isolated tension zones typically manifested on the ground surface as fissures and/or ground cracks, subsidence related to groundwater depletion is generally areal in nature with very little differential settlement over short distances such as across individual buildings.

The Coachella Valley Water District has publically acknowledged regional subsidence throughout the southern portion of the Coachella Valley and has indicated a commitment to groundwater replenishment programs that are intended to limit future subsidence. At this time, subsidence is considered a regional problem requiring regional mitigation not specific to the project vicinity.

IX. Ground Fissures. No surface features indicative of ground fissuring were identified on the site during our field investigation. Accordingly, risks associated with ground fissuring is considered low.

X. Debris Flows. Debris flows are viscous flows consisting of poorly sorted mixtures of sediment and water and are generally initiated on slopes steeper than approximately six horizontal to one vertical (6H:1V). Based on the flat nature of the site and the composition of the surface soil, we judge that risks associated with debris flows should be considered remote.

XI. Flooding and Erosion. No signs of flooding or erosion were observed during our field investigation. However, flooding and erosion should be evaluated and mitigated by the project design Civil Engineer.

CONCLUSIONS

Based on the results of our investigation, it is our professional opinion that the project should be feasible from a geotechnical perspective provided that the recommendations provided in this report are incorporated in the design and carried out through construction. The main geotechnical concern is the presence of loose native surface soil throughout the subject site.

We recommend that remedial grading within the proposed building areas include over-excavation and re-compaction of all loose native soil encountered during grading. Specific recommendations for site preparation are presented in the Earthwork and Grading section of this report.

Caving did occur to varying degrees within each of our exploratory bores and the surface soil may be susceptible to caving within deeper excavations. All excavations should be constructed in accordance with the normal CalOSHA excavation criteria. On the basis of our observations of the materials encountered, we anticipate that the subsoil will conform to that described by CalOSHA as Type B or C. Soil conditions should be verified in the field by a "Competent person" employed by the Contractor.

The following recommendations present more detailed design criteria that have been developed on the basis of our field and laboratory investigation.

EARTHWORK AND GRADING

All earthwork including excavation, backfill and preparation of the subgrade soil, should be performed in accordance with the geotechnical recommendations presented in this report and portions of the local regulatory requirements, as applicable. All earthwork should be performed under the observation and testing of a qualified soil engineer. The following geotechnical engineering recommendations for the proposed project are based on observations from the field investigation program, laboratory testing and geotechnical engineering analyses.

a. Stripping. Areas to be graded should be cleared of any vegetation, associated root systems, and debris. All areas scheduled to receive fill should be cleared of old fill and any irreducible matter. The strippings should be removed off site, or stockpiled for later use in landscape areas. Voids left by obstructions should be properly backfilled in accordance with the compaction recommendations of this report.

b. Preparation of the Building Areas: All undocumented artificial fill soil should be removed to competent native soil. In order to provide for firm and uniform foundation bearing conditions, the surface soil should be overexcavated and recompacted. Overexcavation should extend to a minimum depth of 2 feet below existing grade or 2 feet below the bottom of the footings, whichever is deeper. Once adequate removals have been verified, the exposed native soil should be moisture conditioned to within two percent of optimum moisture content and compacted to at least 90 percent relative compaction. The previously removed material may then be placed as compacted engineered fill as outlined below.

c. Fill Placement and Compaction: Soil to be used as engineered fill should be free of organic material, debris, and other deleterious substances, and should not contain irreducible matter greater than three inches in maximum dimension. All fill materials should be placed in thin lifts, not exceeding six inches in a loose condition. If import fill is required, the material should be of a low to non-expansive nature and should meet the following criteria:

Plastic Index	Less than 12
Liquid Limit	Less than 35
Percent Soil Passing #200 Sieve	Between 15% and 35%
Maximum Aggregate Size	3 inches

The subgrade and all fill should be compacted with acceptable compaction equipment, to at least 90 percent relative compaction. The bottom of the exposed subgrade should be observed by a representative of Sladden Engineering prior to fill placement. Compaction testing should be performed on all lifts in order to verify proper placement of the fill materials. Table 2 provides a summary of the excavation and compaction recommendations.

Table 2
SUMMARY OF RECOMMENDATIONS

*Remedial Grading	Excavation and recompaction within the building envelope and extending laterally for 5 feet beyond the building limits and to a minimum of 2 feet below existing grade or 2 feet below the bottom of the footings, whichever is deeper
Native / Import Engineered Fill	Place in thin lifts not exceeding 6 inches in the loose condition and compact to a minimum of 90 percent relative compaction within 2 percent of the optimum moisture content.

*Actual depth may vary and should be determined by a representative of Sladden Engineering in the field during construction.

d. Shrinkage and Subsidence. Volumetric shrinkage of the material that is excavated and replaced as controlled compacted fill should be anticipated. We estimate that this shrinkage should be between 10 and 15 percent. Subsidence of the surfaces that are scarified and compacted should be less than 1 tenth of a foot. This will vary depending upon the type of equipment used, the moisture content of the soil at the time of grading and the actual degree of compaction attained.

CONVENTIONAL SHALLOW SPREAD FOOTINGS

Conventional spread footings are expected to provide adequate support for the proposed structures. All footings should be founded upon properly compacted engineered fill and should have a minimum embedment depth of 12 inches measured from the lowest adjacent finished grade. Continuous and isolated footings should have minimum widths of 12 inches and 24 inches, respectively. Continuous and isolated footings supported upon properly compacted soil may be designed using allowable (net) bearing pressures of 1800 and 2000 pounds per square foot (psf), respectively. Allowable increases of 250 psf for each additional 1 foot in width and 250 psf for each additional 6 inches in depth may be utilized, if desired. The maximum allowable bearing pressure should be 2500 psf. The allowable bearing pressure applies to combined dead and sustained live loads.

The allowable bearing pressures may be increased by one-third when considering transient live loads, including seismic and wind forces. All footings should be reinforced in accordance with the project structural engineer's recommendations.

Based on the recommended allowable bearing pressures, the total static settlement of the shallow footings is anticipated to be less than one-inch, provided foundation preparations conform to the recommendations described in this report. Static differential settlement is anticipated to be approximately one-half of the total settlement for similarly loaded footings spaced up to approximately 50 feet apart.

Lateral load resistance for the spread footings will be developed by passive pressure against the sides of the footings below grade and by friction acting at the base of the footings. An allowable passive pressure of 300 psf per foot of depth may be used for design purposes. An allowable coefficient of friction 0.45 may be used for dead and sustained live loads to compute the frictional resistance of the footing placed directly on compacted fill. Under seismic and wind loading conditions, the passive pressure and frictional resistance may be increased by one-third.

All footing excavations should be observed by a representative of the project geotechnical consultant to verify adequate embedment depths prior to placement of forms, steel reinforcement or concrete. The excavations should be trimmed neat, level and square. All loose, disturbed, sloughed or moisture-softened soils and/or any construction debris should be removed prior to concrete placement. Excavated soil generated from footing and/or utility trenches should not be stockpiled within the building envelopes or in areas of exterior concrete flatwork.

SLABS-ON-GRADE

In order to provide uniform and adequate support, concrete slabs-on-grade must be placed on properly compacted engineered fill as outlined in the previous sections of this report. The slab subgrades should remain near optimum moisture content and should not be permitted to dry. Prior to concrete placement, slab subgrade should be firm and unyielding. Disturbed soil should be removed and replaced with engineered fill soil compacted to a minimum of 90 percent relative compaction.

Slab thickness and reinforcement should be determined by the structural engineer. We recommend a minimum slab thickness of 4.0 inches. All slab reinforcement should be supported on concrete chairs to ensure that reinforcement is placed at slab mid-height.

Slabs with moisture sensitive surfaces should be underlain with a moisture vapor retarder consisting of a polyvinyl chloride membrane such as 10-mil visqueen, or equivalent. All laps within the membrane should be sealed and at least 2 inches of clean sand should be placed over the membrane to promote uniform curing of the concrete. To reduce the potential for punctures, the membrane should be placed on a pad surface that has been graded smooth without any sharp protrusions. If a smooth surface can not be achieved by grading, consideration should be given to placing a 1-inch thick leveling course of sand across the pad surface prior to placement of the membrane.

PRELIMINARY PAVEMENT DESIGN

Asphalt concrete pavements should be designed in accordance with Topic 608 of the Caltrans Highway Design Manual based on R-Value and Traffic Index. An R-Value of 60 was assumed to develop the following preliminary pavement sections. On-site and any imported soil should be tested for R-Value after grading. The actual R-Value of subgrade soil should be consistent with the pavement design.

For Pavement design, a Traffic Index (TI) of 5.0 was used for the light duty pavements. We assumed Asphalt Concrete (AC) over Class II Aggregate Base (AB). The preliminary flexible pavement design is as follows:

RECOMMENDED ASPHALT PAVEMENT SECTION LAYER THICKNESS

Pavement Material	Recommended Thickness
	TI=5.0
Asphalt Concrete Surface Course	3.0 inches
Class II Aggregate Base Course	4.0 inches
Compacted Subgrade Soil	12.0 inches

Asphalt concrete should conform to Sections 39 of the latest edition of the CalTrans Standard Specifications. Class II aggregate base should conform to Section 26 of the Caltrans Standard Specifications, latest edition. The aggregate base course should be compacted to at least 95 percent of the maximum dry density as determined by ASTM Method D 1557 or to the dry density revealed by the R-value test data, whichever is greater

CORROSION SERIES

The soluble sulfate concentrations of the surface soil were determined to be 20 parts per million (ppm). The soil is considered to have a "negligible" corrosive potential with respect to concrete. The use of Type V cement and special sulfate resistant concrete mixes should not be necessary. However, the soluble sulfate concentration should be reevaluated after the grading and compaction work is completed. Soluble sulfate content of the surface soil should be reevaluated after grading and appropriate concrete mix designs should be established based upon post-grading test results.

The pH levels of the surface soil was 8.5. Based on soluble chloride concentration testing (50 ppm) the soil is considered "low" corrosive with respect to normal grade steel. The minimum resistivity of the surface soil was found to be 3500 ohm-cm that suggests the site soil is considered to be "moderate" corrosive with respect to ferrous metal installations. A corrosion expert should be consulted regarding appropriate corrosion protection measures.

UTILITY TRENCH BACKFILL

All utility trench backfill should be compacted to a minimum relative compaction of 90 percent. Trench backfill materials should be placed in lifts no greater than six inches in their loose state, moisture conditioned (or air-dried) as necessary to achieve near optimum moisture conditions, and then mechanically compacted in place to a minimum relative compaction of 90 percent. A representative of the project soil engineer should test the backfill to verify adequate compaction.

EXTERIOR CONCRETE FLATWORK

To minimize cracking of concrete flatwork, the subgrade soil below concrete flatwork areas should first be compacted to a minimum relative compaction of 90 percent. A representative of the project geotechnical consultant should observe and verify the density and moisture content of the soil prior to concrete placement.

DRAINAGE

All final grades should be provided with positive gradients away from foundations to provide rapid removal of surface water runoff to an adequate discharge point. No water should be allowed to be pond on or immediately adjacent to foundation elements. In order to reduce water infiltration into the subgrade soil, surface water should be directed away from building foundations to an adequate discharge point. Subgrade drainage should be evaluated upon completion of the precise grading plans and in the field during grading.

LIMITATIONS

The findings and recommendations presented in this report are based upon an interpolation of the soil conditions between the exploratory bore locations and extrapolation of these conditions throughout the proposed building areas. Should conditions encountered during grading appear different than those indicated in this report, this office should be notified.

The use of this report by other parties or for other projects is not authorized. The recommendations of this report are contingent upon monitoring of the grading operation by a representative of Sladden Engineering. All recommendations are considered to be tentative pending our review of the grading operation and additional testing, if indicated. If others are employed to perform any soil testing, this office should be notified prior to such testing in order to coordinate any required site visits by our representative and to assure indemnification of Sladden Engineering.

We recommend that a pre-job conference be held on the site prior to the initiation of site grading. The purpose of this meeting will be to assure a complete understanding of the recommendations presented in this report as they apply to the actual grading performed.

ADDITIONAL SERVICES

Once completed, final project plans and specifications should be reviewed by use prior to construction to confirm that the full intent of the recommendations presented herein have been applied to design and construction. Following review of plans and specifications, observation should be performed by the Soil Engineer during construction to document that foundation elements are founded on/or penetrate into the recommended soil, and that suitable backfill soil is placed upon competent materials and properly compacted at the recommended moisture content.

Tests and observations should be performed during grading by the Soil Engineer or his representative in order to verify that the grading is being performed in accordance with the project specifications. Field density testing shall be performed in accordance with acceptable ASTM test methods. The minimum acceptable degree of compaction should be 90 percent for engineered fil soil and 95 percent for Class II aggregate base as obtained by the ASTM D1557-91 test method. Where testing indicates insufficient density, additional compactive effort shall be applied until retesting indicates satisfactory compaction.

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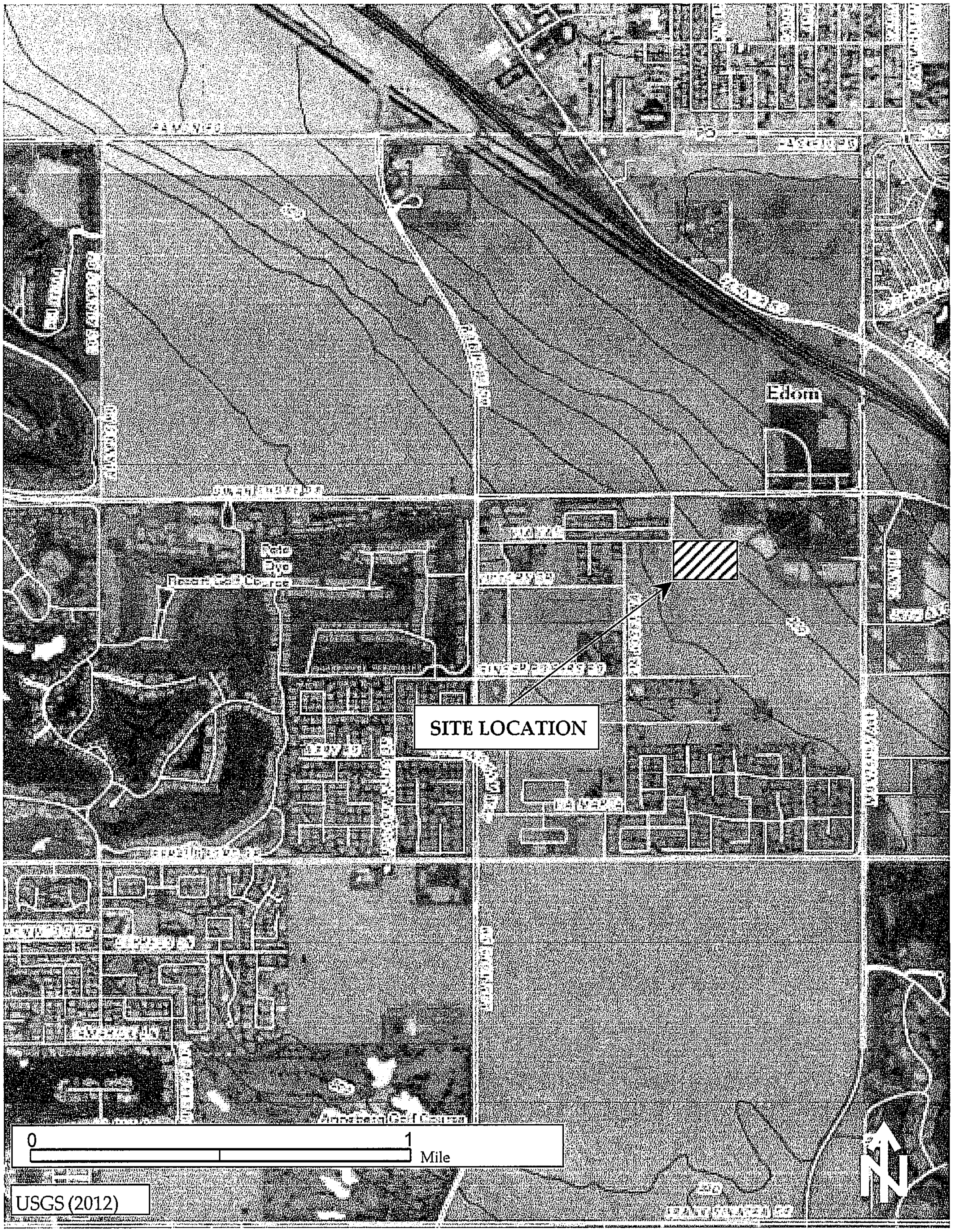
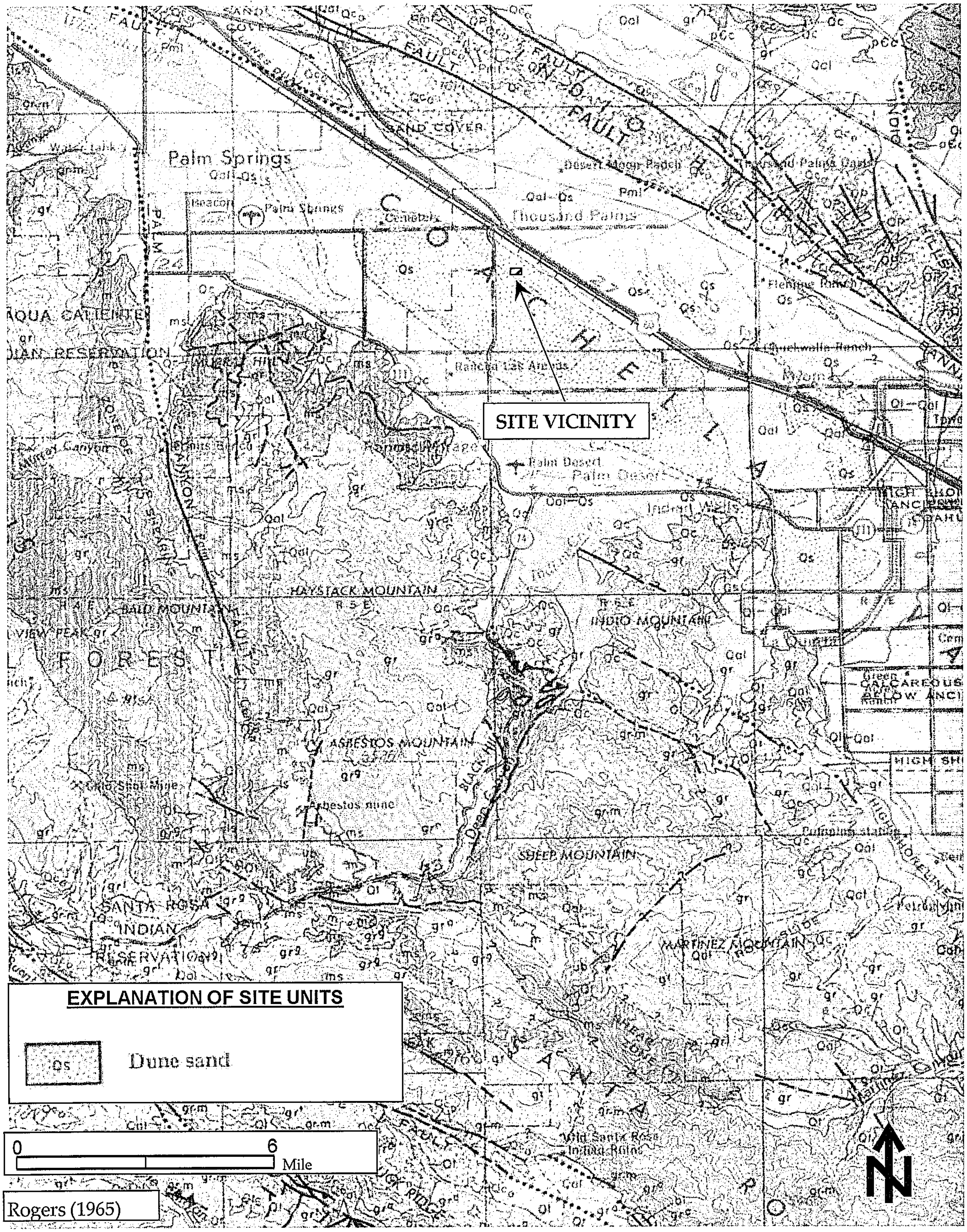
FIGURES

SITE LOCATION MAP
REGIONAL GEOLOGIC MAP
BOREHOLE LOCATION PLAN



Sladden Engineering	SITE LOCATION MAP		FIGURE
	Project Number:	544-15032	1
	Report Number:	15-03-110	
	Date:	March 16, 2015	



Sladden Engineering

REGIONAL GEOLOGIC MAP

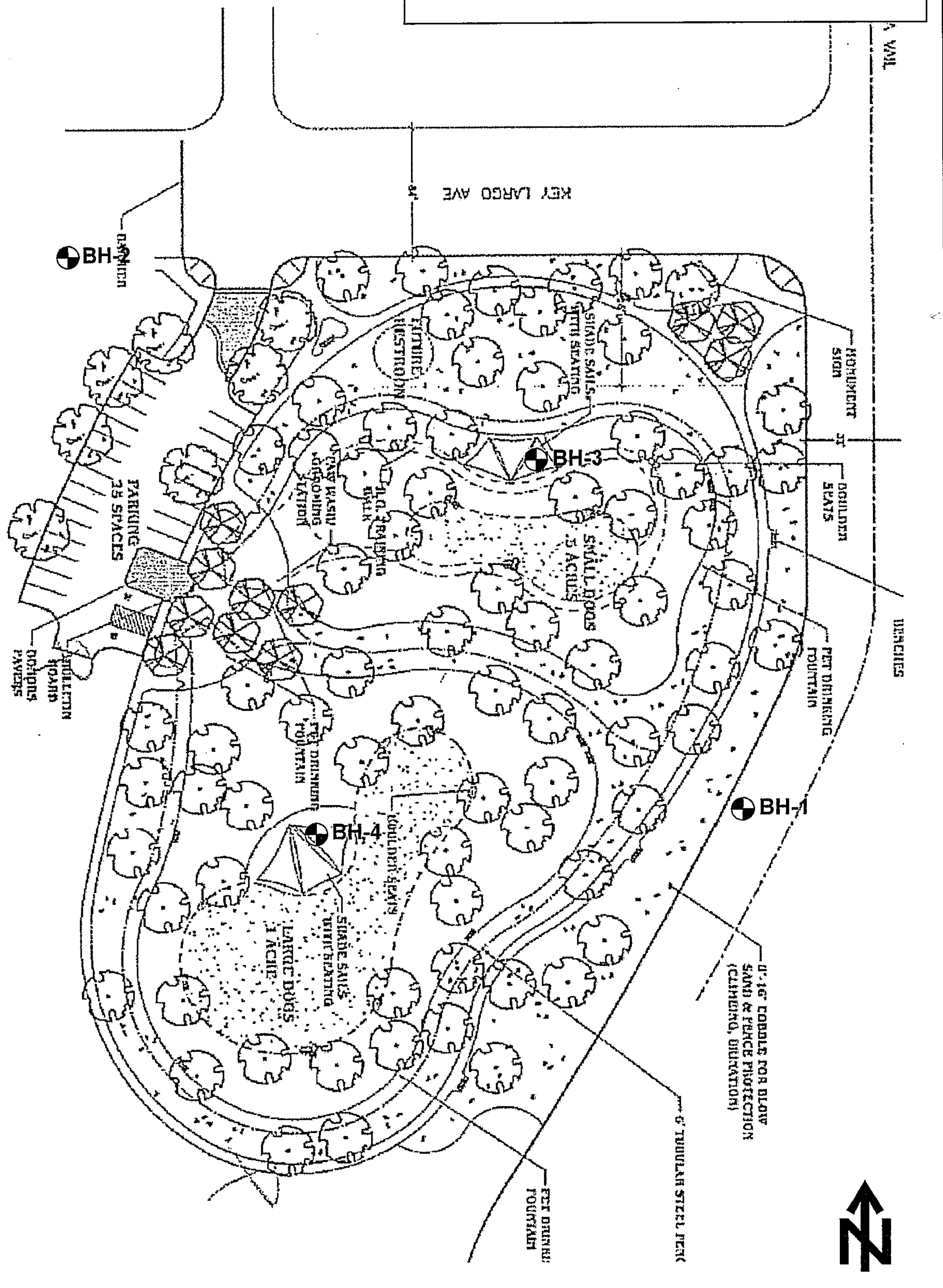
Project Number:	544-15032
Report Number:	15-03-110
Date:	March 16, 2015

FIGURE

2

LEGEND

BH-4 — Approximate Borehole Location



Sladden Engineering

BOREHOLE LOCATION PLAN

Project Number:	544-15032
Report Number:	15-03-110
Date:	March 16, 2015

FIGURE

3

APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

For our field investigation four (4) exploratory bores were excavated utilizing a truck-mounted drill rig equipped with 8 inch (O.D.) hollow-stem augers (mobile B-61). Continuous logs of the materials encountered were made by a representative of Sladden Engineering. Materials encountered in the boreholes were classified in accordance with the Unified Soil Classification System which is presented in this appendix.

Representative undisturbed samples were obtained within our borings by driving a thin-walled steel penetration sampler (California split spoon sampler) or a Standard Penetration Test (SPT) sampler with a 140 pound automatic-trip hammer dropping approximately 30 inches (ASTM D1586). The number of blows required to drive the samplers 18 inches was recorded in 6-inch increments and blowcounts are indicated on the boring logs.

The California samplers are 3.0 inches in diameter, carrying brass sample rings having inner diameters of 2.5 inches. The standard penetration samplers are 2.0 inches in diameter with an inner diameter of 1.5 inches. Undisturbed samples were removed from the sampler and placed in moisture sealed containers in order to preserve the natural soil moisture content. Bulk samples were obtained from the excavation spoils and samples were then transported to our laboratory for further observations and testing.

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS MORE THAN HALF IS LARGER THAN No.200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN No.4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVEL-SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, POORLY-GRADED GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN No.4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN HALF IS SMALLER THAN No.200 SIEVE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS & VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, CLEAN CLAYS
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS: LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

EXPLANATION OF BORE LOG SYMBOLS

California Split-spoon Sample

Unrecovered Sample

Standard Penetration Test Sample

Groundwater depth

Note: The stratification lines on the borelogs represent the approximate boundaries between the soil types; the transitions may be gradational.

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	2/26/2015
Elevation:	301 Ft (MSL)	Boring No:	BH-1

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–1		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Disturbed).
	7/12/12	1	0	3.1	0.7	105.9	2		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
	4/5/6			2.4	0.8	110.0	5		Sand (SP); grayish brown, dry to slightly moist, loose, fine to coarse grained (Qs).
	5/10/10			2.9	1.8		10		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
	13/18/39			3.5	1.6	110.6	15		Sand (SP); grayish brown, dry to slightly moist, dense, fine to coarse grained (Qs).
	11/14/17			3.7	2.1		20		Sand (SP); grayish brown, dry to slightly moist, dense, fine to coarse grained (Qs).
	19/26/37			1.6	1.4	110.6	25		Sand (SP); grayish brown, dry to slightly moist, dense, fine to coarse grained (Qs).

Terminated at ~ 26.5 Feet bgs.
No Bedrock Encountered.
No Groundwater or Seepage Encountered.

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Completion Notes:

PROPOSED RANCHO MIRAGE DOG PARK
RANCHO MIRAGE, CALIFORNIA

Project No: 544-14308
Report No: 15-03-110

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	2/26/2015
Elevation:	314 Ft (MSL)	Boring No:	BH-2

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–2		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Disturbed).
	11/13/18			3.3	0.4	112.0	2		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
	10/11/11			5.0	0.6	111.0	5		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
	5/5/6			5.4	1.6		10		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
	9/12/14			1.8	1.4	109.3	15		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
	7/10/11			2.3	1.0		20		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
	12/17/20			2.4	0.4	111.0	25		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
							28		Terminated at ~ 26.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Depth scale (Feet): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Completion Notes:

PROPOSED RANCHO MIRAGE DOG PARK
RANCHO MIRAGE, CALIFORNIA

Project No:	544-14308	Page	2
Report No:	15-03-110		

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	2/26/2015
Elevation:	309 Ft (MSL)	Boring No:	BH-3

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
									Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Disturbed).
	5/5/9			5.4	0.7	113.7	2		Sand (SP); grayish brown, dry to slightly moist, loose, fine to coarse grained (Qs).
	13/25/27			8.2	1.2	120.0	6		Sand (SP); grayish brown, dry to slightly moist, dense, fine to coarse grained (Qs).
	4/7/7			4.5	1.1		10		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
	6/10/10			3.0	1.7	112.9	15		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
	6/6/7			4.1	2.3		20		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
	10/12/13			2.6	2.0	108.8	25		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
	12/17/20			3.9	3.2		30		Sand (SP); grayish brown, dry to slightly moist, dense, fine to coarse grained (Qs).
	20/29/37			3.8	4.0	107.0	35		Sand (SP); grayish brown, slightly moist, dense, fine to coarse grained (Qs).
	11/18/21			5.4	3.7		40		Sand (SP); grayish brown, slightly moist, dense, fine to coarse grained (Qs).
	17/22/30			7.9	3.3	108.3	45		Sand (SP); grayish brown, slightly moist, dense, fine to coarse grained (Qs).
	17/22/29			4.9	5.5		50		Sand (SP); grayish brown, slightly moist to moist, very dense, fine to coarse grained (Qs).

Completion Notes:
Terminated at ~ 51.5 Feet bgs.
No Bedrock Encountered.
No Groundwater or Seepage Encountered.

PROPOSED RANCHO MIRAGE DOG PARK
RANCHO MIRAGE, CALIFORNIA

Project No: 544-14308
Report No: 15-03-110

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	2/26/2015
Elevation:	306 Ft (MSL)	Boring No:	BH-4

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–2		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Disturbed).
■	5/6/9			3.9	1.5		5		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
■	7/9/9			3.3	1.7	110.6	10		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
■	8/9/12			4.1	2.6		15		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
■	12/15/16			3.1	1.8	113.4	20		Sand (SP); grayish brown, dry to slightly moist, medium dense, fine to coarse grained (Qs).
							22–24		Terminated at ~ 21.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Depth scale (Feet): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Completion Notes:

PROPOSED RANCHO MIRAGE DOG PARK
RANCHO MIRAGE, CALIFORNIA

Project No:	544-14308	Page	4
Report No:	15-03-110		

APPENDIX B

LABORATORY TESTING

APPENDIX B

LABORATORY TESTING

Representative bulk and relatively undisturbed soil samples were obtained in the field and returned to our laboratory for additional observations and testing. Laboratory testing was generally performed in two phases. The first phase consisted of testing in order to determine the compaction of the existing natural soil and the general engineering classifications of the soils underlying the site. This testing was performed in order to estimate the engineering characteristics of the soil and to serve as a basis for selecting samples for the second phase of testing. The second phase consisted of soil mechanics testing. This testing including consolidation, shear strength and expansion testing was performed in order to provide a means of developing specific design recommendations based on the mechanical properties of the soil.

CLASSIFICATION AND COMPACTION TESTING

Unit Weight and Moisture Content Determinations: Each undisturbed sample was weighed and measured in order to determine its unit weight. A small portion of each sample was then subjected to testing in order to determine its moisture content. This was used in order to determine the dry density of the soil in its natural condition. The results of this testing are shown on the Boring Logs.

Maximum Density-Optimum Moisture Determinations: Representative soil types were selected for maximum density determinations. This testing was performed in accordance with the ASTM Standard D1557-91, Test Method A. Graphic representations of the results of this testing are presented in this appendix. The maximum densities are compared to the field densities of the soil in order to determine the existing relative compaction to the soil.

Classification Testing: Soil samples were selected for classification testing. This testing consists of mechanical grain size analyses. This provides information for developing classifications for the soil in accordance with the Unified Soil Classification System which is presented in the preceding appendix. This classification system categorizes the soil into groups having similar engineering characteristics. The results of this testing is very useful in detecting variations in the soil and in selecting samples for further testing.

SOIL MECHANIC'S TESTING

Expansion Testing: One (1) bulk sample was selected for Expansion testing. Expansion testing was performed in accordance with the UBC Standard 18-2. This testing consists of remolding 4-inch diameter by 1-inch thick test specimens to a moisture content and dry density corresponding to approximately 50 percent saturation. The samples are subjected to a surcharge of 144 pounds per square foot and allowed to reach equilibrium. At that point the specimens are inundated with distilled water. The linear expansion is then measured until complete.

Direct Shear Testing: One (1) bulk sample was selected for Direct Shear testing. This test measures the shear strength of the soil under various normal pressures and is used to develop parameters for foundation design and lateral design. Tests were performed using a recompacted test specimen that was saturated prior to tests. Tests were performed using a strain controlled test apparatus with normal pressures ranging from 800 to 2300 pounds per square foot.

Consolidation/Hydro-Collapse Testing: One (1) relatively undisturbed sample was selected for consolidation testing. For this test, a one-inch thick test specimen was subjected to vertical loads varying from 575 psf to 11520 psf applied progressively. The consolidation at each load increment was recorded prior to placement of each subsequent load.

Corrosion Series Testing: The soluble sulfate concentrations of the surface soil were determined in accordance with California Test Method Number (CA) 417. The pH and Minimum Resistivity were determined in accordance with CA 643. The soluble chloride concentrations were determined in accordance with CA 422.

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Maximum Density/Optimum Moisture

ASTM D698/D1557

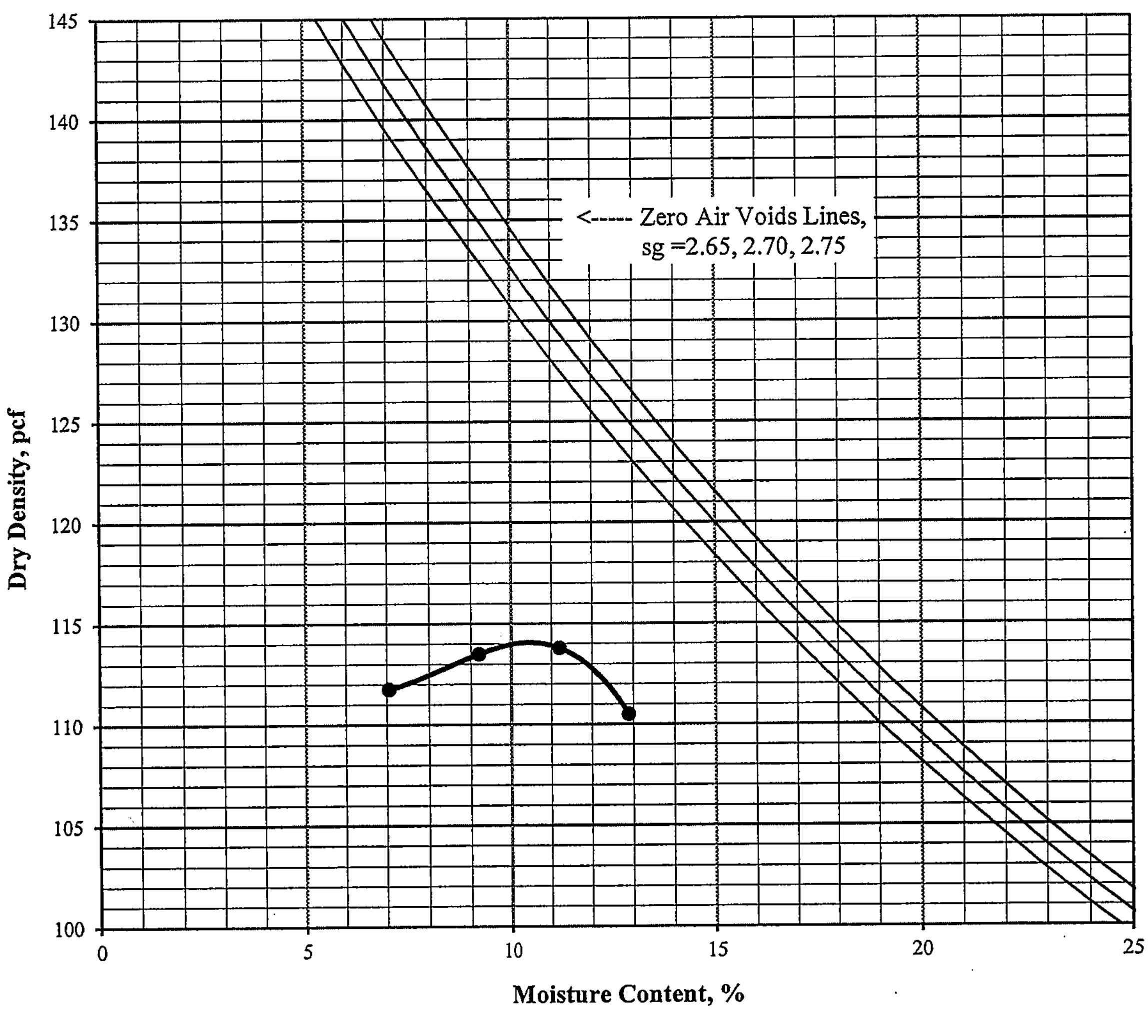
March 16, 2015

Project Number:	544-15032
Project Name:	Rancho Mirage Dog Park
Lab ID Number:	LN6-15115
Sample Location:	BH-2 Bulk 1 @ 0-5'
Description:	Gray Brown Sand w/Silt (SP-SM)

ASTM D-1557 A
Rammer Type: Machine

Maximum Density: **114 pcf**
Optimum Moisture: **10.5%**

Sieve Size	% Retained
3/4"	
3/8"	
#4	0.5



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Expansion Index

ASTM D 4829

March 16, 2015

Job Number: 544-15032

Job Name: Rancho Mirage Dog Park

Lab ID Number: LN6-15115

Sample ID: BH-2 Bulk 1 @ 0-5'

Soil Description: Gray Brown Sand w/Silt (SP-SM)

Wt of Soil + Ring:	570.0
Weight of Ring:	195.1
Wt of Wet Soil:	374.9
Percent Moisture:	9.7%
Sample Height, in	0.95
Wet Density, pcf:	119.6
Dry Denstiy, pcf:	109.0

% Saturation:	48.0

Expansion **Rack # 4**

Date/Time	3/13/2015	2:00 PM
Initial Reading	0.0000	
Final Reading	0.0000	

Expansion Index **0**

(Final - Initial) x 1000

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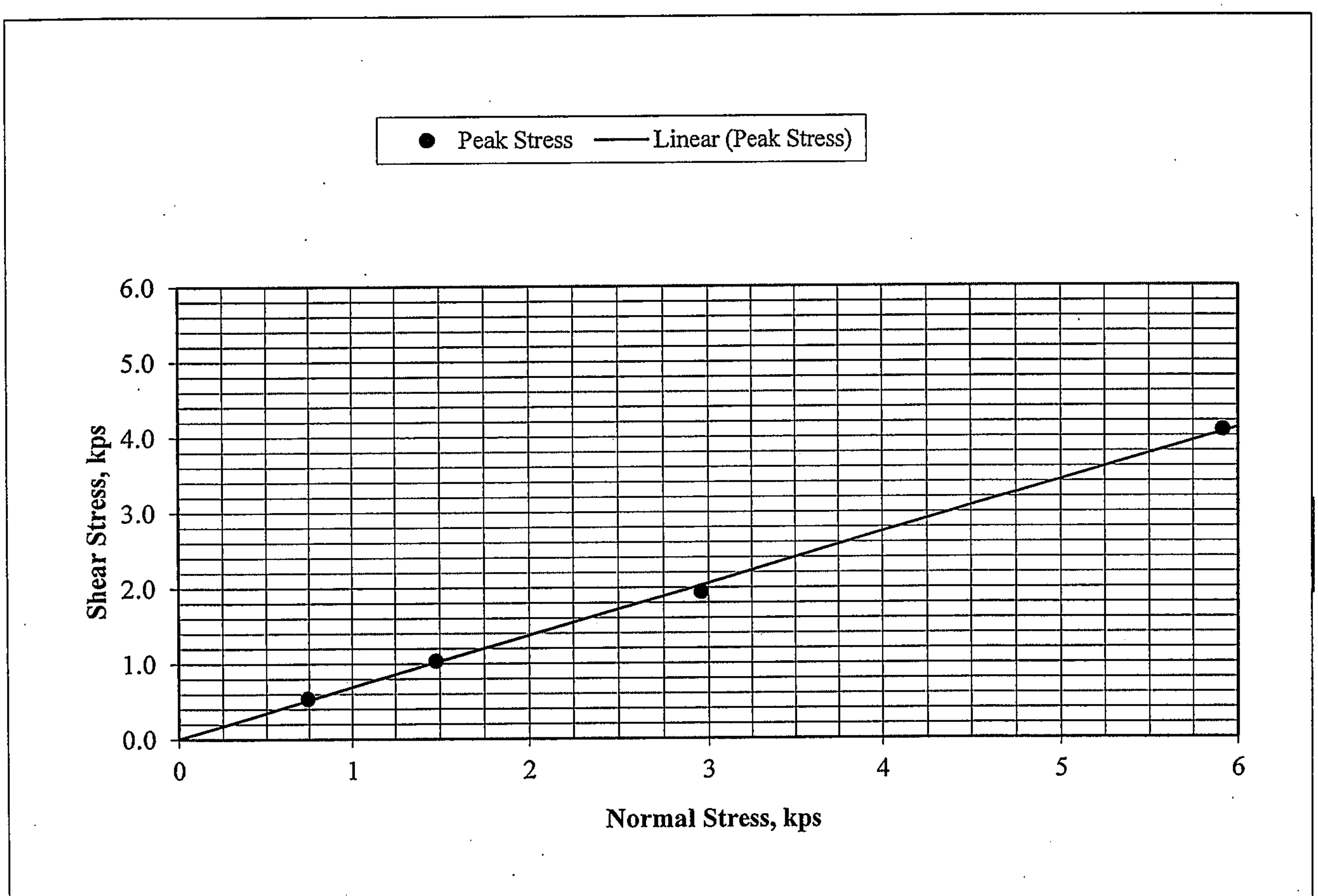
Direct Shear ASTM D 3080-04
(modified for unconsolidated condition)

Job Number: 544-15032
Job Name Rancho Mirage Dog Park
Lab ID No. LN6-15115
Sample ID BH-2 Bulk 1 @ 0-5'
Classification Gray Brown Sand w/Silt (SP-SM)
Sample Type Remolded @ 90% of Maximum Density

March 16, 2015
Initial Dry Density: 102.5 pcf
Initial Mosture Content: 10.5 %
Peak Friction Angle (Ø): 34°
Cohesion (c): 0 psf

Test Results	1	2	3	4	Average
Moisture Content, %	18.3	18.3	18.3	18.3	18.3
Saturation, %	76.7	76.7	76.7	76.7	76.7
Normal Stress, kps	0.739	1.479	2.958	5.916	
Peak Stress, kps	0.540	1.036	1.942	4.079	



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Gradation

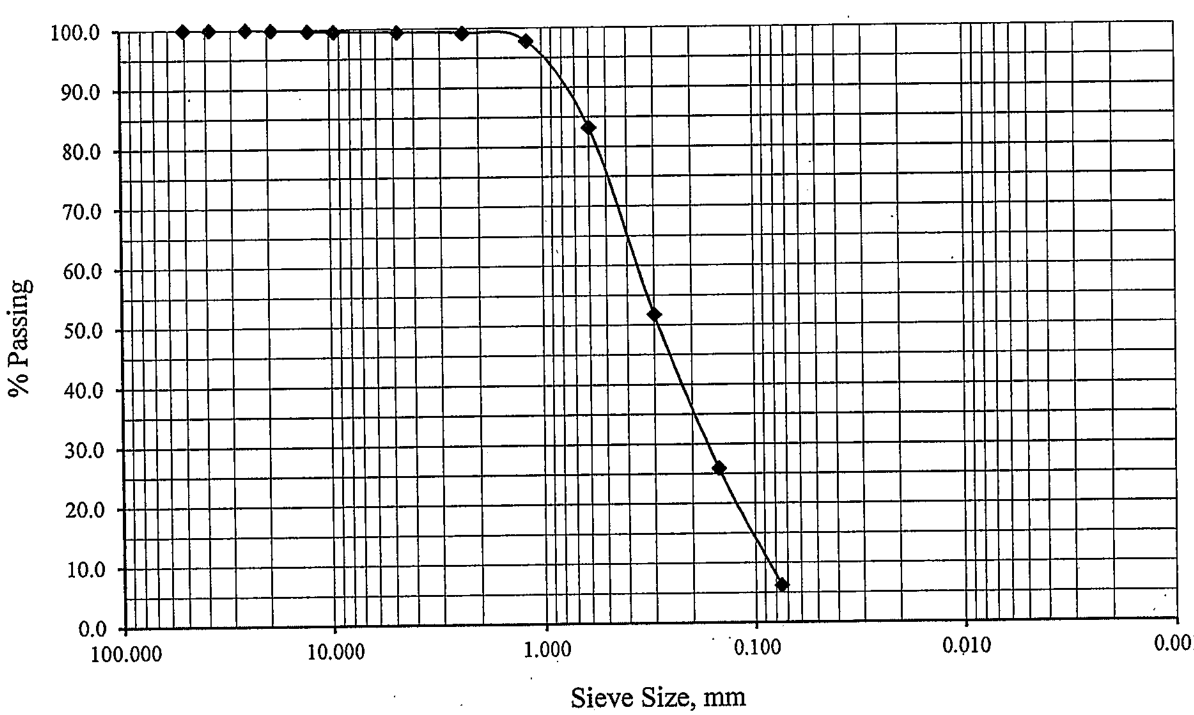
ASTM C117 & C136

March 16, 2015

Project Number: 544-15032
Project Name: Rancho Mirage Dog Park
Lab ID Number: LN6-15115
Sample ID: BH-2 Bulk 1 @ 0-5'

Soil Classification: SP-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
2"	50.8	100.0
1 1/2"	38.1	100.0
1"	25.4	100.0
3/4"	19.1	99.9
1/2"	12.7	99.7
3/8"	9.53	99.6
#4	4.75	99.5
#8	2.36	99.3
#16	1.18	97.8
#30	0.60	83.2
#50	0.30	51.8
#100	0.15	25.9
#200	0.075	6.2



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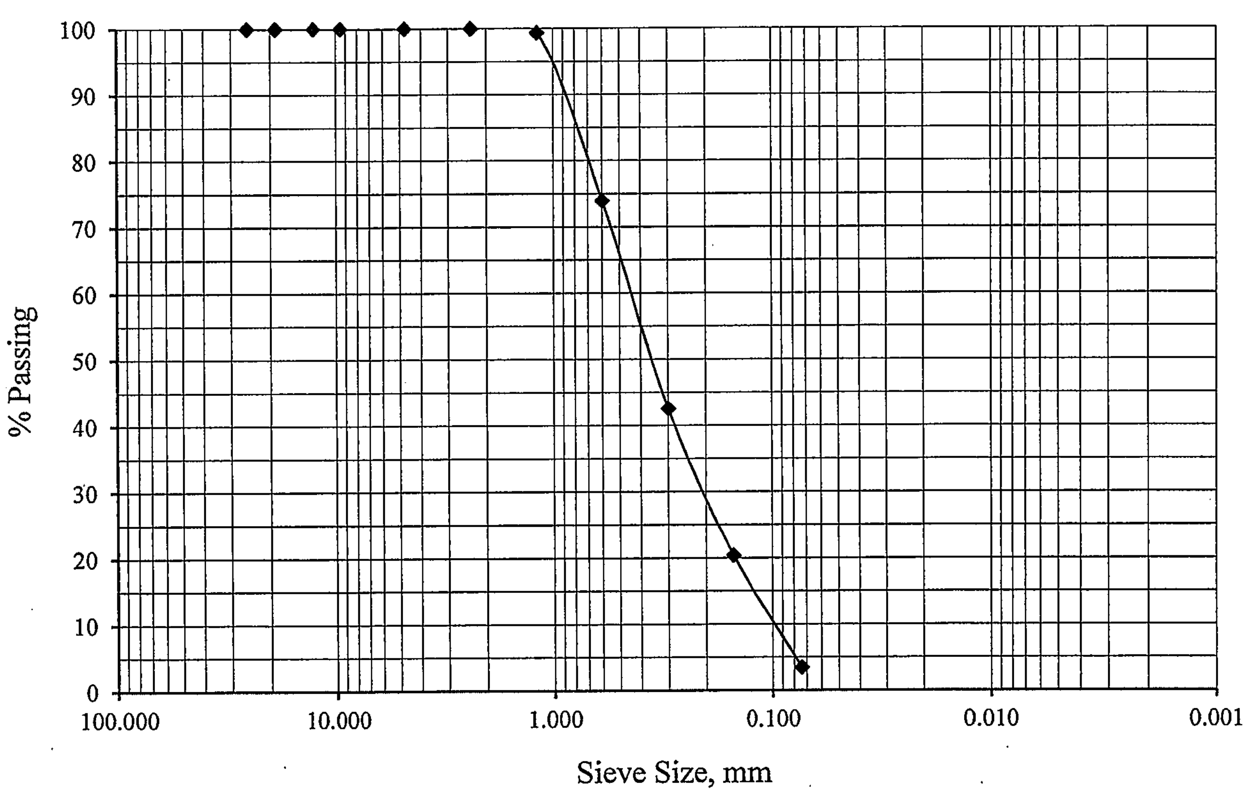
Gradation

ASTM C117 & C136

Project Number: 544-15032 March 16, 2015
Project Name: Rancho Mirage Dog Park
Lab ID Number: LN6-15115
Sample ID: BH-1 R-4 @ 15' Soil Classification: SP

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	100.0
#16	1.18	99.4
#30	0.60	74.0
#50	0.30	42.6
#100	0.15	20.4
#200	0.074	3.5



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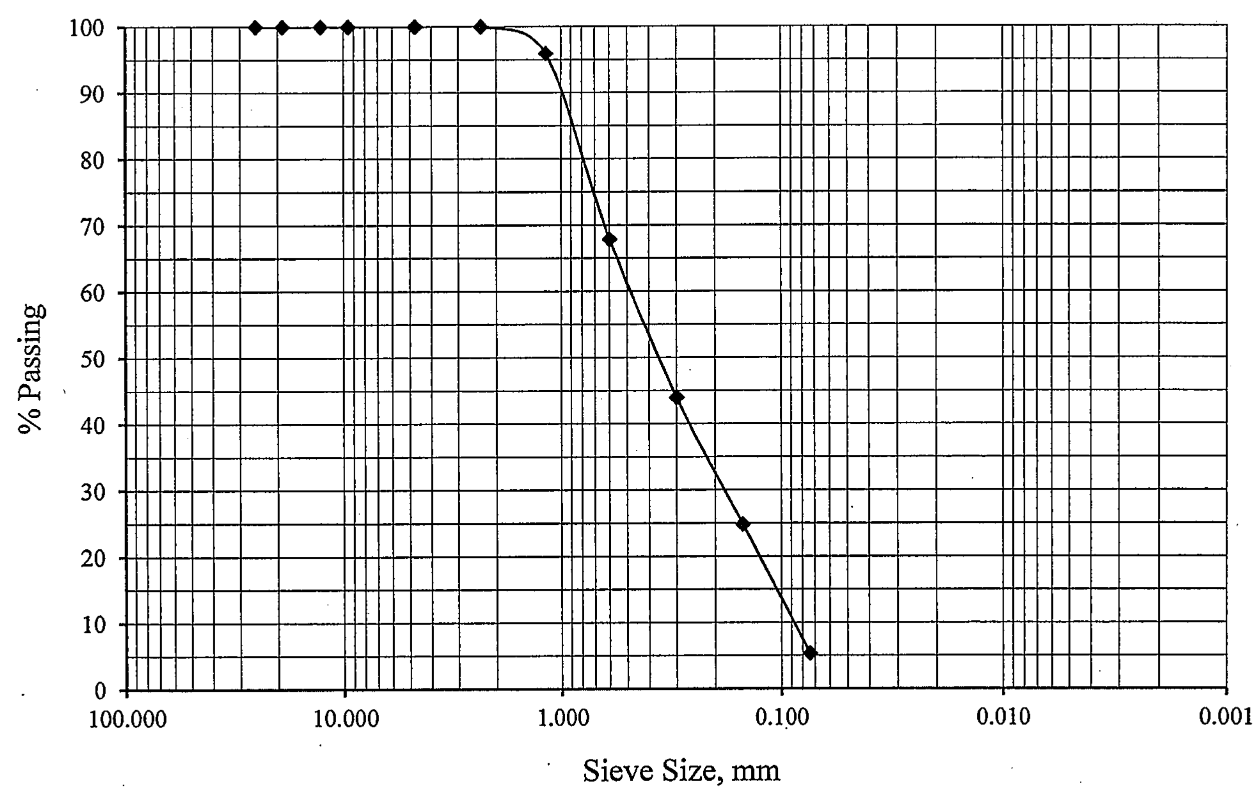
Gradation

ASTM C117 & C136

Project Number: 544-15032 March 16, 2015
Project Name: Rancho Mirage Dog Park
Lab ID Number: LN6-15115
Sample ID: BH-2 S-2 @ 10' Soil Classification: SP-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	100.0
#16	1.18	95.9
#30	0.60	67.9
#50	0.30	44.0
#100	0.15	24.8
#200	0.074	5.4



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Gradation

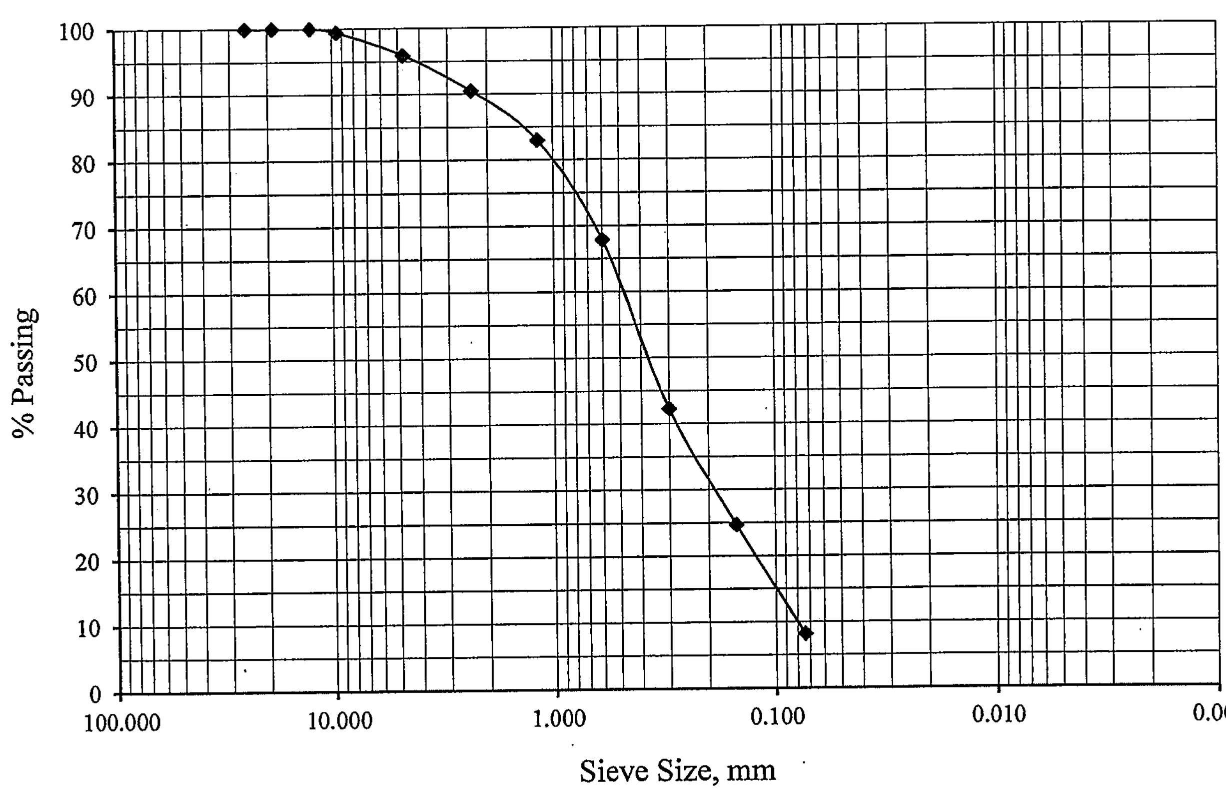
ASTM C117 & C136

March 16, 2015

Project Number: 544-15032
Project Name: Rancho Mirage Dog Park
Lab ID Number: LN6-15115
Sample ID: BH-3 R-2 @ 5'

Soil Classification: SP-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	99.4
#4	4.75	95.9
#8	2.36	90.5
#16	1.18	83.0
#30	0.60	67.9
#50	0.30	42.3
#100	0.15	24.7
#200	0.074	8.2



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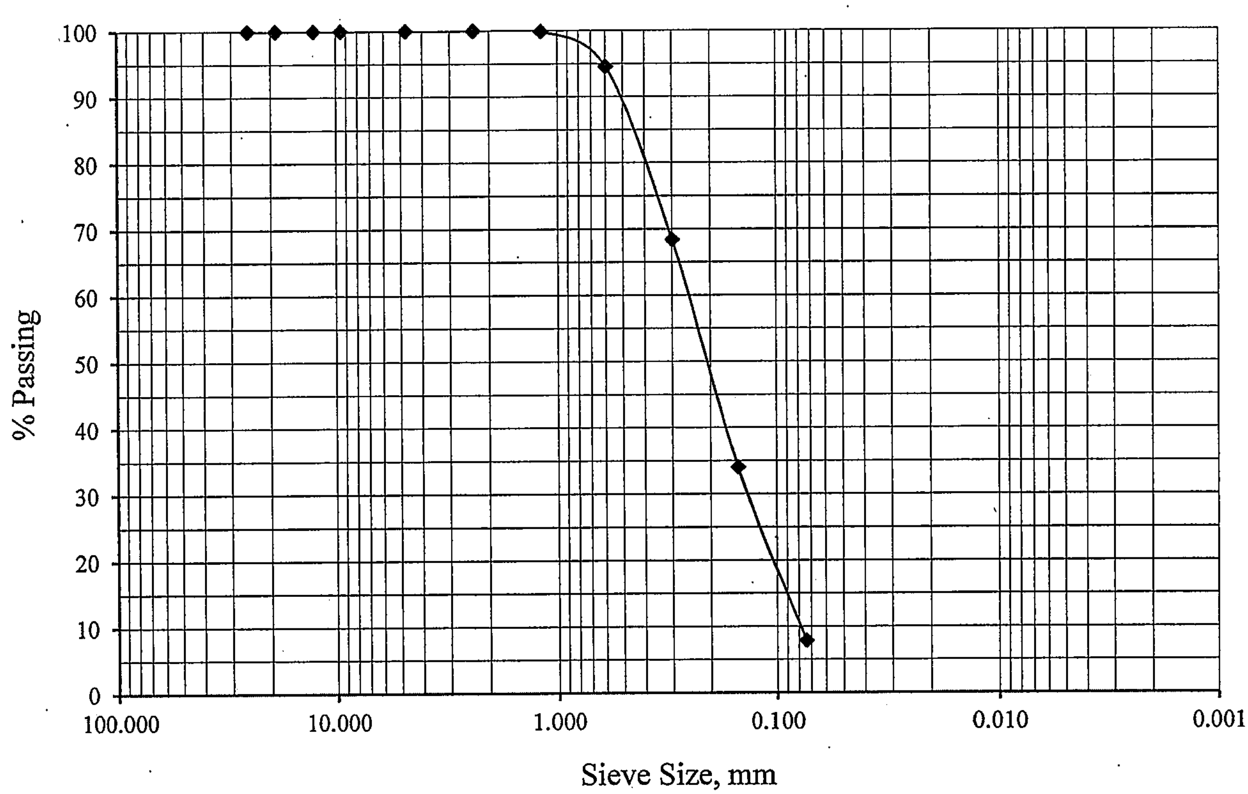
Gradation

ASTM C117 & C136

Project Number: 544-15032 March 16, 2015
Project Name: Rancho Mirage Dog Park
Lab ID Number: LN6-15115
Sample ID: BH-3 R-10 @ 45' Soil Classification: SP-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	100.0
#16	1.18	99.9
#30	0.60	94.6
#50	0.30	68.4
#100	0.15	34.1
#200	0.074	7.9



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One Dimensional Consolidation

ASTM D2435 & D5333

Job Number: 544-15032

March 16, 2015

Job Name: Rancho Mirage Dog Park

Lab ID Number: LN6-15115

Sample ID: BH-3 R-2 @ 5'

Soil Description: Brown Sand w/Silt (SP-SM)

Initial Dry Density, pcf: 115.9

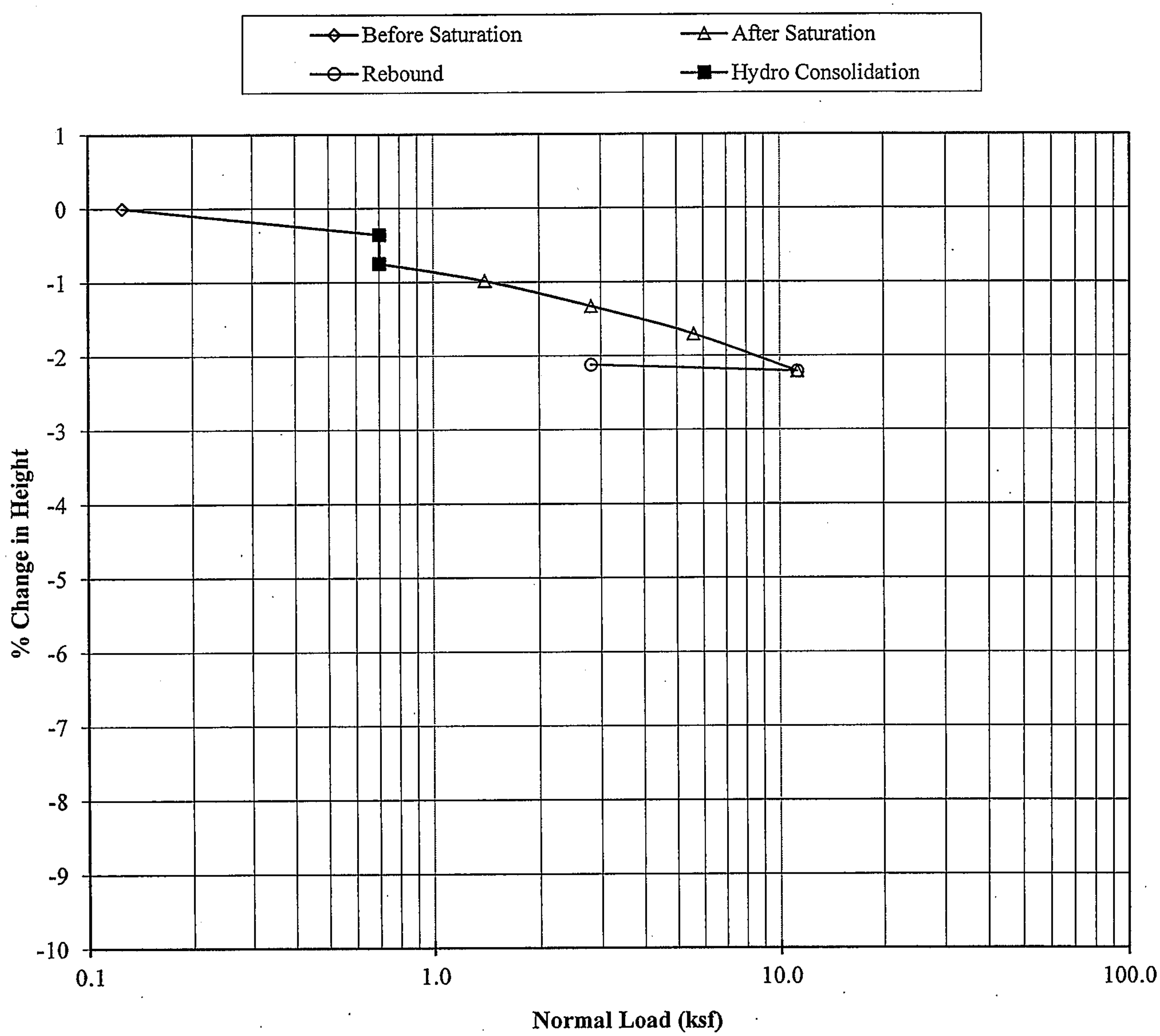
Initial Moisture, %: 1.2

Initial Void Ratio: 0.439

Specific Gravity: 2.67

Hydrocollapse: 0.4% @ 0.702 ksf

% Change in Height vs Normal Presssure Diagram



Sladden Engineering

6782 Stanton Ave., Suite C, Buena Park, CA 90621 (714) 523-0952 Fax (714) 523-1369
45090 Golf Center Pkwy, Suite F, Indio, CA 92201 (760) 863-0713 Fax (760) 863-0847
450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863

Date: March 16, 2015

Account No.: 544-15032

Customer: Nolte Vertical Five

Location: SEC Key Largo Avenue & Via Vail, Rancho Mirage

Analytical Report

Corrosion Series

	pH per CA 643	Soluble Sulfates per CA 417 ppm	Soluble Chloride per CA 422 ppm	Min. Resistivity per CA 643 ohm-cm
BH-2 @ 0-5'	8.5	20	50	3500

APPENDIX C

2013 SEISMIC DESIGN MAP AND REPORT
VS30 GRADIENT MAP
PSH DEAGGREGATION OUPUT

USGS Design Maps Summary Report

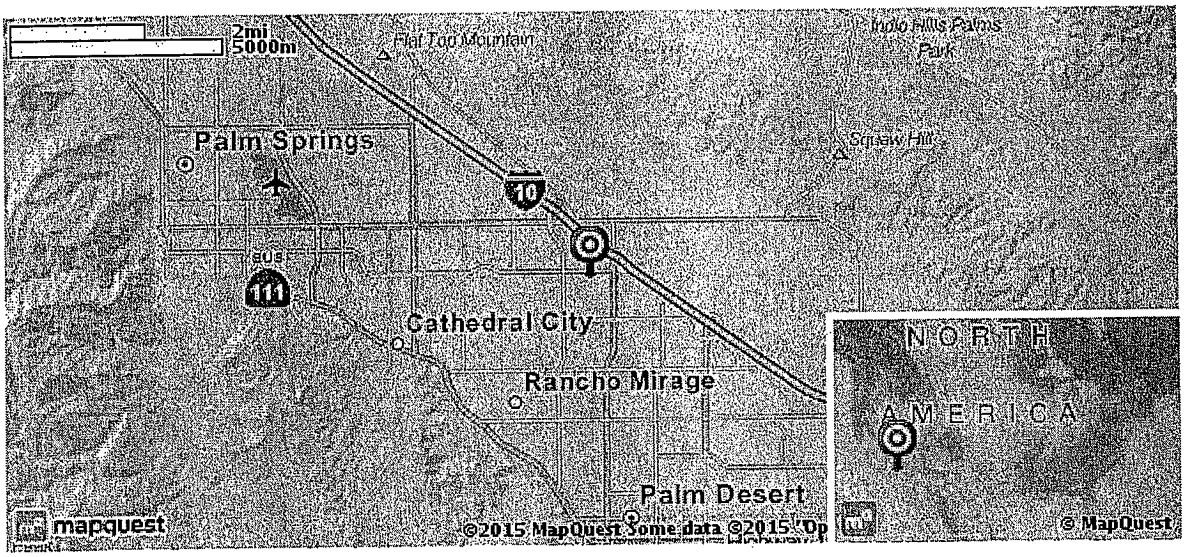
User–Specified Input

Building Code Reference Document ASCE 7-10 Standard
(which utilizes USGS hazard data available in 2008)

Site Coordinates 33.79929°N, 116.3965°W

Site Soil Classification Site Class D – "Stiff Soil"

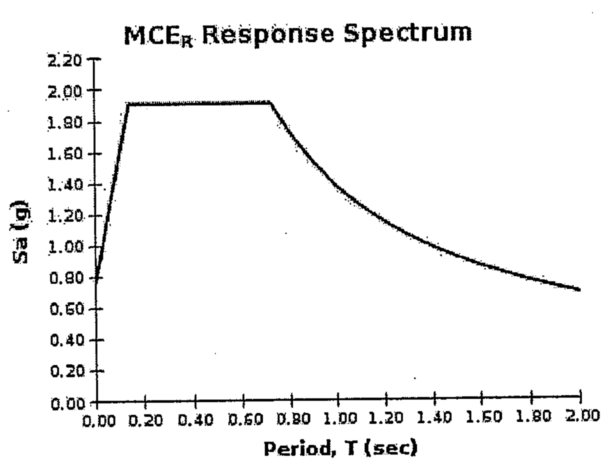
Risk Category I/II/III

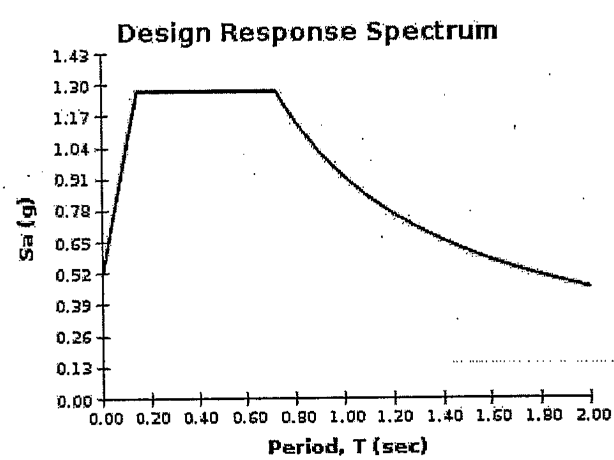


USGS–Provided Output

S_S =	1.909 g	S_{MS} =	1.909 g	S_{DS} =	1.273 g
S_1 =	0.917 g	S_{M1} =	1.375 g	S_{D1} =	0.917 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

USGS Design Maps Detailed Report

ASCE 7-10 Standard (33.79929°N, 116.3965°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1] $S_S = 1.909$ g

From Figure 22-2 [2] $S_1 = 0.917$ g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index $PI > 20$, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u < 500$ psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk–Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4–1: Site Coefficient F_a

Site Class	Mapped MCE R Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = D and S_S = 1.909 g, F_a = 1.000

Table 11.4–2: Site Coefficient F_V

Site Class	Mapped MCE R Spectral Response Acceleration Parameter at 1–s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.917 g, F_v = 1.500

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \leq S_{DS} < 0.33g$	B	B	C
$0.33g \leq S_{DS} < 0.50g$	C	C	D
$0.50g \leq S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 1.273 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \leq S_{D1} < 0.133g$	B	B	C
$0.133g \leq S_{D1} < 0.20g$	C	C	D
$0.20g \leq S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.917 g, Seismic Design Category = D

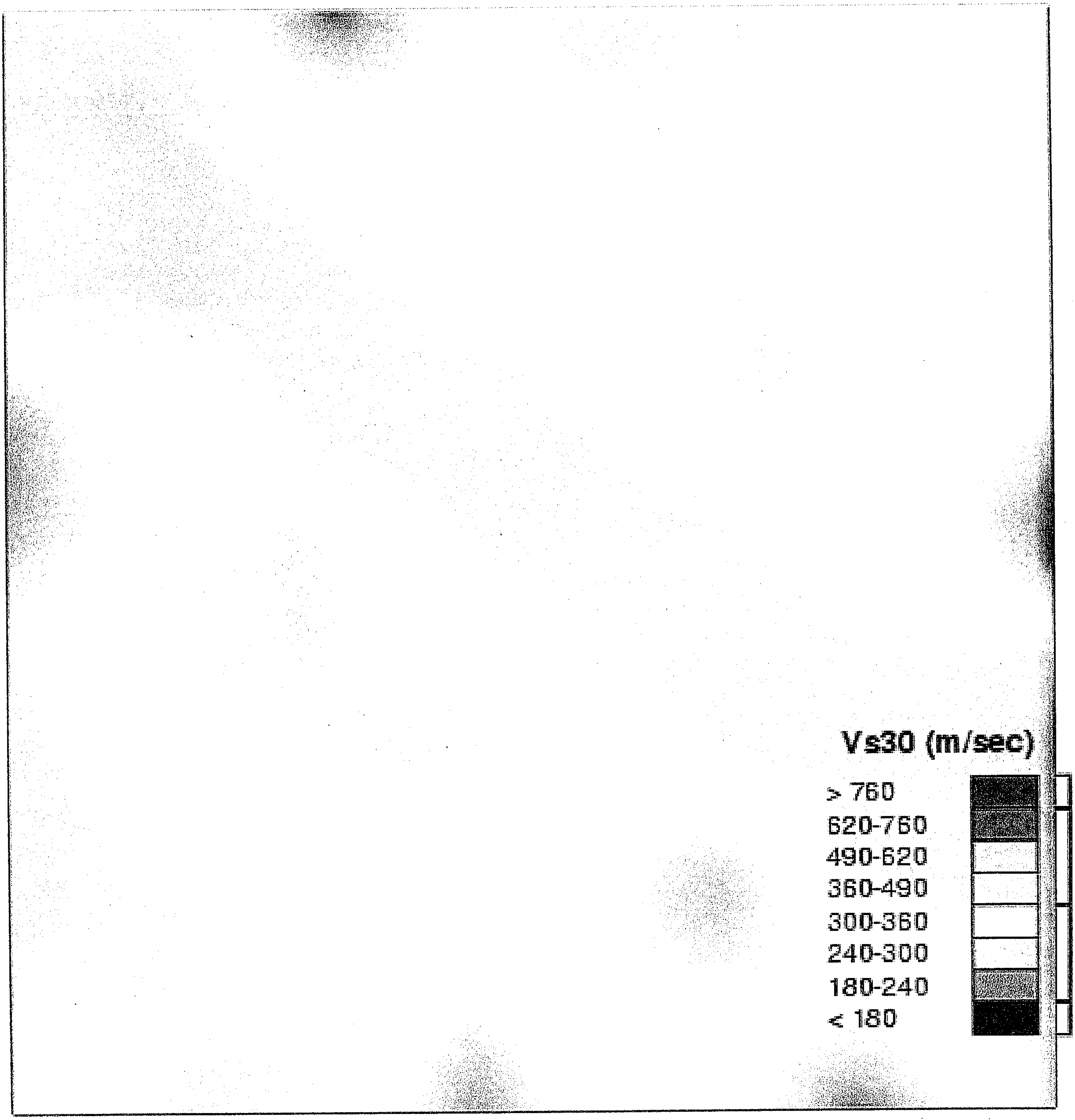
Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = E

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

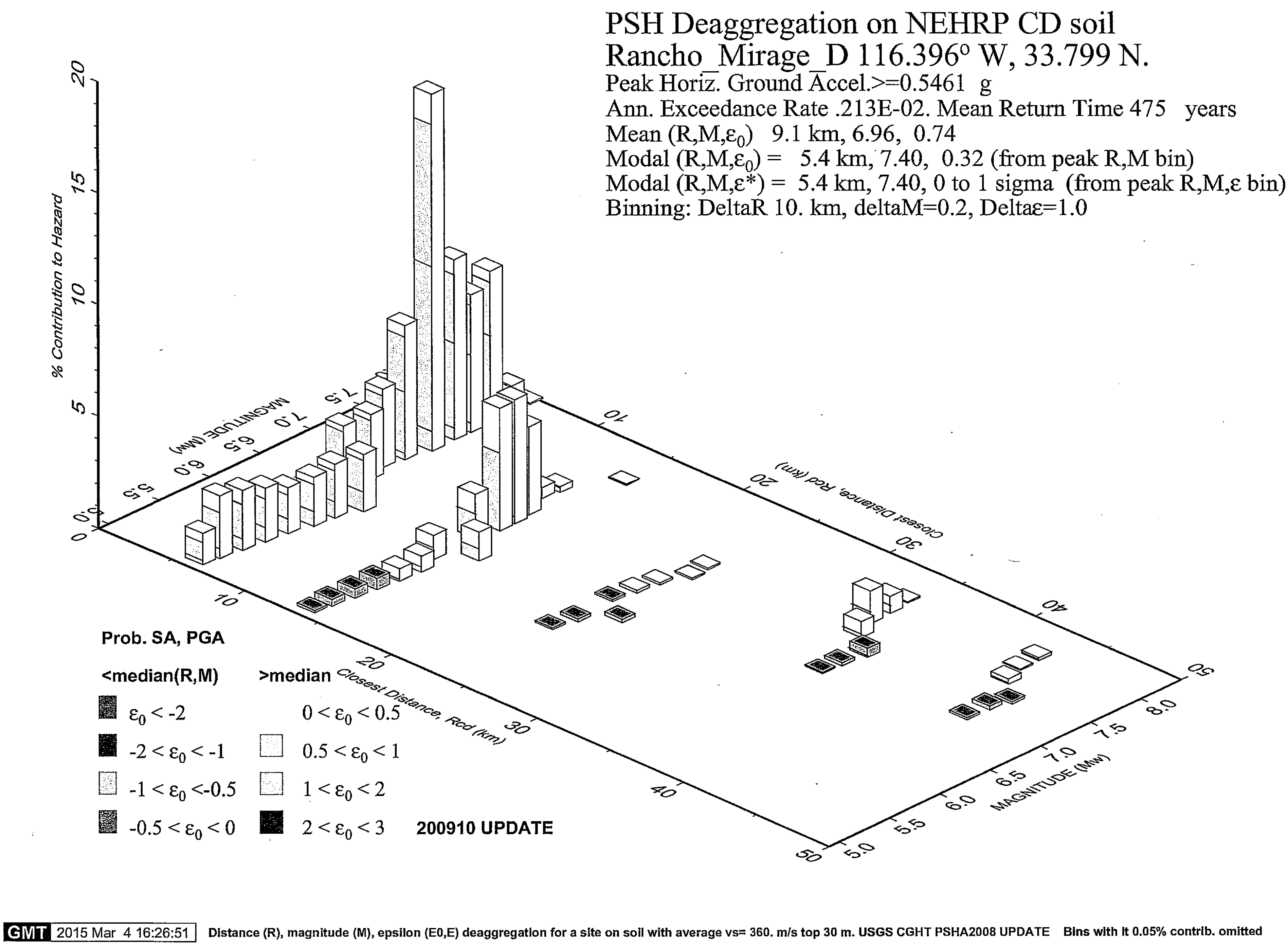
1. *Figure 22-1*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf



5 Mar 4 16:19:48

-116.420830	33.820835	368
-116.412498	33.820835	339
-116.404167	33.820835	243
-116.395836	33.820835	279
-116.387497	33.820835	342
-116.379166	33.820835	326
-116.370834	33.820835	307
-116.362503	33.820835	292
-116.420830	33.812500	402
-116.412498	33.812500	383
-116.404167	33.812500	355
-116.395836	33.812500	259
-116.387497	33.812500	270
-116.379166	33.812500	284
-116.370834	33.812500	281
-116.362503	33.812500	277
-116.420830	33.804165	248
-116.412498	33.804165	299
-116.404167	33.804165	382
-116.395836	33.804165	390
-116.387497	33.804165	336
-116.379166	33.804165	255
-116.370834	33.804165	253
-116.362503	33.804165	262
-116.420830	33.795834	245
-116.412498	33.795834	249
-116.404167	33.795834	243
-116.395836	33.795834	340
-116.387497	33.795834	391
-116.379166	33.795834	379
-116.370834	33.795834	298
-116.362503	33.795834	241
-116.420830	33.787498	331
-116.412498	33.787498	267
-116.404167	33.787498	251
-116.395836	33.787498	243
-116.387497	33.787498	266
-116.379166	33.787498	378
-116.370834	33.787498	402
-116.362503	33.787498	429
-116.420830	33.779167	355
-116.412498	33.779167	311
-116.404167	33.779167	278
-116.395836	33.779167	262
-116.387497	33.779167	263
-116.379166	33.779167	206
-116.370834	33.779167	341
-116.362503	33.779167	378
-116.420830	33.770832	303
-116.412498	33.770832	326
-116.404167	33.770832	318
-116.395836	33.770832	221

-116.387497 33.770832 267
-116.379166 33.770832 257
-116.370834 33.770832 236
-116.362503 33.770832 316


PSH Deaggregation on NEHRP CD soil
Rancho_Mirage_D 116.396° W, 33.799 N.
Peak Horiz. Ground Accel.>=0.5461 g
Ann. Exceedance Rate .213E-02. Mean Return Time 475 years
Mean (R,M,ε0) 9.1 km, 6.96, 0.74
Modal (R,M,ε0) = 5.4 km, 7.40, 0.32 (from peak R,M bin)
Modal (R,M,ε*) = 5.4 km, 7.40, 0 to 1 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0
% Contribution to Hazard
MAGNITUDE (Mw)
Closest Distance, Rcd (km)
Prob. SA, PGA
<median(R,M)
>median
ε0 < -2
-2 < ε0 < -1
-1 < ε0 <-0.5
-0.5 < ε0 < 0
0 < ε0 < 0.5
0.5 < ε0 < 1
1 < ε0 < 2
2 < ε0 < 3
200910 UPDATE
GMT 2015 Mar 4 16:26:51
Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 360. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

*** Deaggregation of Seismic Hazard at One Period of Spectral Accel. ***
*** Data from U.S.G.S. National Seismic Hazards Mapping Project, 2008 version ***
PSHA Deaggregation. %contributions. site: Rancho_Mirage_D long: 116.396 W., lat: 33.799 N.
Vs30(m/s)= 360.0 (some WUS atten. models use Site Class not Vs30).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 475 yrs. Exceedance PGA =0.5461 g. Weight * Computed_Rate_Ex 0.213E-02
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.01449
#This deaggregation corresponds to Mean Hazard w/all GMPEs

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
5.9	5.05	1.424	0.445	0.804	0.176	0.000	0.000	0.000
13.6	5.05	0.111	0.111	0.000	0.000	0.000	0.000	0.000
6.1	5.20	2.822	0.768	1.626	0.428	0.000	0.000	0.000
13.7	5.20	0.299	0.299	0.000	0.000	0.000	0.000	0.000
6.2	5.40	2.705	0.645	1.546	0.514	0.000	0.000	0.000
13.9	5.40	0.412	0.406	0.006	0.000	0.000	0.000	0.000
6.4	5.60	2.432	0.485	1.288	0.660	0.000	0.000	0.000
14.0	5.60	0.508	0.469	0.039	0.000	0.000	0.000	0.000
6.6	5.80	2.076	0.342	1.063	0.663	0.009	0.000	0.000
14.2	5.80	0.560	0.482	0.079	0.000	0.000	0.000	0.000
6.9	6.01	2.191	0.326	1.219	0.628	0.018	0.000	0.000
14.3	6.01	0.704	0.481	0.224	0.000	0.000	0.000	0.000
23.3	6.00	0.072	0.072	0.000	0.000	0.000	0.000	0.000
7.0	6.20	2.407	0.296	1.385	0.714	0.012	0.000	0.000
13.8	6.20	1.100	0.569	0.531	0.000	0.000	0.000	0.000
23.6	6.21	0.129	0.129	0.000	0.000	0.000	0.000	0.000
7.6	6.41	2.570	0.278	1.407	0.852	0.032	0.000	0.000
15.5	6.40	1.300	0.758	0.541	0.001	0.000	0.000	0.000
25.3	6.41	0.145	0.144	0.001	0.000	0.000		

0.000	0.000					
4.9	6.60	2.614	0.258	1.356	0.959	0.041
0.000	0.000					
13.6	6.64	2.006	0.911	1.096	0.000	0.000
0.000	0.000					
23.3	6.59	0.095	0.091	0.004	0.000	0.000
0.000	0.000					
5.4	6.80	2.842	0.282	1.480	1.045	0.035
0.000	0.000					
13.9	6.84	5.447	1.982	3.452	0.013	0.000
0.000	0.000					
23.6	6.80	0.123	0.109	0.014	0.000	0.000
0.000	0.000					
36.2	6.81	0.055	0.055	0.000	0.000	0.000
0.000	0.000					
4.9	6.99	3.437	0.305	1.547	1.495	0.090
0.000	0.000					
13.9	6.99	5.495	1.722	3.455	0.318	0.000
0.000	0.000					
23.7	7.00	0.093	0.069	0.024	0.000	0.000
0.000	0.000					
36.3	6.99	0.122	0.118	0.004	0.000	0.000
0.000	0.000					
44.8	7.00	0.098	0.098	0.000	0.000	0.000
0.000	0.000					
5.1	7.18	5.965	0.523	2.459	2.706	0.276
0.000	0.000					
13.7	7.16	3.917	0.924	2.417	0.576	0.000
0.000	0.000					
24.5	7.21	0.080	0.048	0.032	0.000	0.000
0.000	0.000					
36.6	7.20	0.407	0.332	0.075	0.000	0.000
0.000	0.000					
44.9	7.21	0.179	0.169	0.010	0.000	0.000
0.000	0.000					
5.4	7.40	16.002	1.371	6.416	7.362	0.852
0.000	0.000					
12.9	7.41	0.480	0.091	0.307	0.082	0.000
0.000	0.000					
24.3	7.40	0.065	0.035	0.030	0.000	0.000
0.000	0.000					
34.9	7.39	0.709	0.550	0.159	0.000	0.000
0.000	0.000					
45.2	7.39	0.117	0.104	0.013	0.000	0.000
0.000	0.000					
5.4	7.63	8.019	0.644	3.066	3.801	0.508
0.000	0.000					
13.1	7.56	0.253	0.043	0.162	0.048	0.000
0.000	0.000					
34.2	7.58	1.454	0.929	0.524	0.000	0.000
0.000	0.000					
43.6	7.59	0.231	0.179	0.051	0.000	0.000

0.000 0.000
5.4 7.78 6.162 0.470 2.251 3.013 0.427
0.000 0.000
34.1 7.79 0.746 0.392 0.354 0.000 0.000
0.000 0.000
43.0 7.79 0.058 0.044 0.015 0.000 0.000
0.000 0.000
5.4 7.97 6.816 0.499 2.412 3.396 0.509
0.000 0.000
14.9 7.95 0.054 0.007 0.031 0.015 0.000
0.000 0.000
33.9 7.99 0.067 0.030 0.037 0.000 0.000
0.000 0.000
42.9 7.99 0.137 0.085 0.052 0.000 0.000
0.000 0.000
5.4 8.19 1.214 0.084 0.412 0.619 0.099
0.000 0.000
5.4 8.37 0.065 0.004 0.020 0.036 0.004
0.000 0.000

Summary statistics for above PSHA PGA deaggregation, R=distance,
e=epsilon:
Contribution from this GMPE(%): 100.0
Mean src-site R= 9.1 km; M= 6.96; eps0= 0.74. Mean
calculated for all sources.
Modal src-site R= 5.4 km; M= 7.40; eps0= 0.32 from peak
(R,M) bin
MODE R*= 5.4km; M*= 7.40; EPS.INTERVAL: 0 to 1 sigma %
CONTRIB.= 7.362

Principal sources (faults, subduction, random seismicity having >
3% contribution)

Source Category: (mean values).	% contr.	R(km)	M	epsilon0
California A-faults	60.66	9.5	7.43	0.63
CA Compr. crustal gridded	25.31	8.4	5.84	0.99
San Gorgonio Zone gridded	12.03	6.9	7.01	0.59

Individual fault hazard details if its contribution to mean
hazard > 2%:

Fault ID	% contr.	Rcd(km)	M	epsilon0	Site-to-src azimuth(d)
S. S.Andr.;BG aPriori	2.44	5.4	7.06	0.50	28.0
S. S.Andr.;CO aPriori	3.06	13.9	6.98	1.32	95.1
S. S.Andr.;SSB+BG aPriori	4.96	5.4	7.31	0.37	28.0
S. S.Andr.;BG+CO aPriori	3.97	5.4	7.36	0.34	28.0
S. S.Andr.;NSB+SSB+BG aPriori	2.31	5.4	7.45	0.32	28.0
S. S.Andr.;SSB+BG+CO aPriori	2.38	5.4	7.51	0.29	

```
28.0
SSAndr.;NSB+SSB+BG+CO aPriori        2.45     5.4    7.61     0.26
28.0
SSAnd;SM+NSB+SSB+BG+CO aPriori       2.60     5.4    7.82     0.21
28.0
S. San Andreas;CO MoBal             10.59    13.9    6.95     1.34
95.1
S. San Andreas;BG+CO MoBal           2.47     5.4    7.35     0.34
28.0
S. San Andreas;SM+NSB+SSB+BG+CO      2.08     5.4    7.82     0.20
28.0
S. San Andreas Unsegmented A-flt     6.21     6.2    7.66     0.32
19.7
#*********End of deaggregation corresponding to Mean Hazard w/all
GMPEs  *********#

PSHA Deaggregation. %contributions. site: Rancho_Mirage_D long:
116.396 W., lat: 33.799 N.
 Vs30(m/s)= 360.0 (some WUS atten. models use Site Class not
Vs30).
NSHMP 2007-08  See USGS OFR 2008-1128. dM=0.2 below
Return period: 475   yrs. Exceedance PGA =0.5461   g. Weight *
Computed_Rate_Ex 0.807E-03
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.01744
#This deaggregation corresponds to Boore-Atkinson 2008
DIST(KM) MAG(MW) ALL_EPS EPSILON>2  1<EPS<2 0<EPS<1 -1<EPS<0 -2
<EPS<-1 EPS<-2
    5.1     5.05     0.438     0.225     0.213     0.000     0.000
0.000    0.000
    5.2     5.20     0.848     0.367     0.480     0.000     0.000
0.000    0.000
    5.3     5.40     0.789     0.293     0.495     0.000     0.000
0.000    0.000
    5.5     5.60     0.709     0.240     0.466     0.003     0.000
0.000    0.000
   13.8     5.61     0.032     0.032     0.000     0.000     0.000
0.000    0.000
    5.7     5.80     0.620     0.198     0.401     0.021     0.000
0.000    0.000
   14.2     5.81     0.061     0.061     0.000     0.000     0.000
0.000    0.000
    6.1     6.00     0.599     0.225     0.356     0.018     0.000
0.000    0.000
   14.5     6.01     0.109     0.109     0.000     0.000     0.000
0.000    0.000
    6.4     6.20     0.605     0.251     0.341     0.013     0.000
0.000    0.000
   14.4     6.21     0.217     0.212     0.005     0.000     0.000
0.000    0.000
   24.1     6.21     0.041     0.041     0.000     0.000     0.000
0.000    0.000
    7.1     6.40     0.613     0.258     0.340     0.015     0.000
```

0.000	0.000					
16.1	6.42	0.401	0.337	0.064	0.000	0.000
0.000	0.000					
25.6	6.41	0.058	0.058	0.000	0.000	0.000
0.000	0.000					
4.8	6.60	0.732	0.239	0.479	0.015	0.000
0.000	0.000					
14.1	6.64	0.940	0.538	0.402	0.000	0.000
0.000	0.000					
23.7	6.59	0.061	0.061	0.000	0.000	0.000
0.000	0.000					
34.8	6.62	0.029	0.029	0.000	0.000	0.000
0.000	0.000					
5.3	6.80	0.873	0.244	0.579	0.050	0.000
0.000	0.000					
14.0	6.83	2.496	0.905	1.592	0.000	0.000
0.000	0.000					
24.0	6.80	0.080	0.080	0.001	0.000	0.000
0.000	0.000					
36.3	6.81	0.053	0.053	0.000	0.000	0.000
0.000	0.000					
44.9	6.80	0.023	0.023	0.000	0.000	0.000
0.000	0.000					
4.9	6.99	1.164	0.203	0.741	0.220	0.000
0.000	0.000					
13.9	6.98	2.952	0.929	1.894	0.129	0.000
0.000	0.000					
24.0	7.00	0.059	0.052	0.006	0.000	0.000
0.000	0.000					
36.4	6.99	0.117	0.113	0.004	0.000	0.000
0.000	0.000					
44.8	7.00	0.097	0.097	0.000	0.000	0.000
0.000	0.000					
5.1	7.18	2.144	0.244	1.124	0.772	0.003
0.000	0.000					
13.8	7.15	1.801	0.472	1.118	0.211	0.000
0.000	0.000					
24.8	7.21	0.049	0.038	0.011	0.000	0.000
0.000	0.000					
36.6	7.20	0.368	0.294	0.075	0.000	0.000
0.000	0.000					
44.9	7.21	0.170	0.160	0.010	0.000	0.000
0.000	0.000					
5.4	7.40	5.891	0.549	2.718	2.519	0.105
0.000	0.000					
13.2	7.40	0.184	0.084	0.100	0.001	0.000
0.000	0.000					
24.4	7.40	0.038	0.027	0.011	0.000	0.000
0.000	0.000					
35.1	7.39	0.582	0.422	0.160	0.000	0.000
0.000	0.000					
45.3	7.39	0.107	0.094	0.013	0.000	0.000

0.000 0.000

5.4	7.63	2.953	0.253	1.294	1.308	0.098	
0.000	0.000						
13.4	7.56	0.098	0.038	0.058	0.002	0.000	
0.000	0.000						
24.6	7.57	0.022	0.014	0.009	0.000	0.000	
0.000	0.000						
34.1	7.58	1.106	0.654	0.452	0.000	0.000	
0.000	0.000						
43.6	7.59	0.195	0.144	0.051	0.000	0.000	
0.000	0.000						
5.4	7.78	2.349	0.168	0.936	1.139	0.106	
0.000	0.000						
15.0	7.81	0.022	0.003	0.014	0.005	0.000	
0.000	0.000						
34.1	7.79	0.521	0.238	0.283	0.000	0.000	
0.000	0.000						
43.0	7.79	0.046	0.032	0.014	0.000	0.000	
0.000	0.000						
5.4	7.97	2.602	0.175	0.991	1.292	0.145	
0.000	0.000						
15.1	7.95	0.025	0.003	0.016	0.006	0.000	
0.000	0.000						
33.9	7.99	0.044	0.016	0.028	0.000	0.000	
0.000	0.000						
42.9	7.98	0.098	0.056	0.042	0.000	0.000	
0.000	0.000						
5.4	8.19	0.475	0.030	0.172	0.242	0.031	
0.000	0.000						
5.4	8.39	0.019	0.001	0.007	0.010	0.001	
0.000	0.000						

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 37.9
Mean src-site R= 10.9 km; M= 7.08; eps0= 0.84. Mean calculated for all sources.
Modal src-site R= 5.4 km; M= 7.40; eps0= 0.42 from peak (R,M) bin
MODE R*= 5.4km; M*= 7.40; EPS.INTERVAL: 0 to 1 sigma % CONTRIB.= 2.718

Principal sources (faults, subduction, random seismicity having > 3% contribution)

Source Category: (mean values).	% contr.	R(km)	M	epsilon0
California A-faults	26.19	11.5	7.40	0.80
CA Compr. crustal gridded	6.45	7.4	5.82	0.92
San Gorgonio Zone gridded	4.02	7.9	7.02	0.72

Individual fault hazard details if its contribution to mean hazard > 2%:

Fault ID	% contr.	Rcd(km)	M	epsilon0

```
Site-to-src azimuth(d)
S. S.Andr.;BG aPriori                  0.92     5.4   7.06    0.57
28.0
S. S.Andr.;CO aPriori                  1.52    13.9   6.97    1.28
95.1
S. S.Andr.;SSB+BG aPriori              1.85     5.4   7.31    0.45
28.0
S. S.Andr.;BG+CO aPriori               1.47     5.4   7.36    0.44
28.0
S. S.Andr.;NSB+SSB+BG aPriori          0.87     5.4   7.45    0.41
28.0
S. S.Andr.;SSB+BG+CO aPriori           0.89     5.4   7.51    0.39
28.0
SSAndr.;NSB+SSB+BG+CO aPriori          0.92     5.4   7.61    0.37
28.0
SSAnd;SM+NSB+SSB+BG+CO aPriori         0.98     5.4   7.82    0.31
28.0
S. San Andreas;CO MoBal                5.30    13.9   6.95    1.30
95.1
S. San Andreas;BG+CO MoBal             0.92     5.4   7.35    0.44
28.0
S. San Andreas;SM+NSB+SSB+BG+CO        0.79     5.4   7.82    0.31
28.0
S. San Andreas Unsegmented A-flt       2.41     6.6   7.66    0.43
19.7
#*********End of deaggregation corresponding to Boore-Atkinson
2008       *********#

PSHA Deaggregation. %contributions. site: Rancho_Mirage_D long:
116.396 W., lat: 33.799 N.
 Vs30(m/s)= 360.0 (some WUS atten. models use Site Class not
Vs30).
NSHMP 2007-08  See USGS OFR 2008-1128. dM=0.2 below
Return period: 475   yrs. Exceedance PGA =0.5461   g. Weight *
Computed_Rate_Ex 0.297E-03
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.00140
#This deaggregation corresponds to Campbell-Bozorgnia 2008
DIST(KM) MAG(MW) ALL_EPS EPSILON>2  1<EPS<2 0<EPS<1 -1<EPS<0 -2
<EPS<-1 EPS<-2
    5.9    5.05    0.228     0.170     0.058     0.000     0.000
0.000    0.000
    6.2    5.20    0.533     0.390     0.144     0.000     0.000
0.000    0.000
   13.2    5.21    0.029     0.029     0.000     0.000     0.000
0.000    0.000
    6.5    5.40    0.623     0.379     0.244     0.000     0.000
0.000    0.000
   13.6    5.41    0.077     0.077     0.000     0.000     0.000
0.000    0.000
    6.7    5.60    0.602     0.305     0.298     0.000     0.000
0.000    0.000
   13.9    5.60    0.118     0.118     0.000     0.000     0.000
```

0.000	0.000					
6.8	5.80	0.498	0.234	0.264	0.000	0.000
0.000	0.000					
14.0	5.80	0.126	0.126	0.000	0.000	0.000
0.000	0.000					
7.1	6.01	0.520	0.262	0.258	0.000	0.000
0.000	0.000					
14.1	6.01	0.155	0.155	0.000	0.000	0.000
0.000	0.000					
22.9	6.01	0.009	0.009	0.000	0.000	0.000
0.000	0.000					
7.1	6.20	0.607	0.275	0.332	0.000	0.000
0.000	0.000					
13.4	6.20	0.242	0.219	0.023	0.000	0.000
0.000	0.000					
23.1	6.21	0.019	0.019	0.000	0.000	0.000
0.000	0.000					
7.6	6.41	0.695	0.267	0.424	0.004	0.000
0.000	0.000					
14.8	6.38	0.213	0.195	0.018	0.000	0.000
0.000	0.000					
24.8	6.41	0.021	0.021	0.000	0.000	0.000
0.000	0.000					
4.8	6.60	0.739	0.236	0.489	0.013	0.000
0.000	0.000					
12.4	6.61	0.233	0.209	0.025	0.000	0.000
0.000	0.000					
22.9	6.59	0.013	0.013	0.000	0.000	0.000
0.000	0.000					
5.3	6.80	0.691	0.238	0.444	0.010	0.000
0.000	0.000					
13.5	6.83	0.320	0.302	0.018	0.000	0.000
0.000	0.000					
22.9	6.80	0.015	0.015	0.000	0.000	0.000
0.000	0.000					
4.6	6.99	0.677	0.194	0.451	0.032	0.000
0.000	0.000					
13.6	7.00	0.293	0.234	0.059	0.000	0.000
0.000	0.000					
23.2	7.00	0.010	0.010	0.000	0.000	0.000
0.000	0.000					
4.8	7.18	0.885	0.218	0.535	0.132	0.000
0.000	0.000					
13.2	7.17	0.275	0.189	0.086	0.000	0.000
0.000	0.000					
24.1	7.21	0.008	0.008	0.000	0.000	0.000
0.000	0.000					
5.4	7.40	1.950	0.476	1.108	0.366	0.000
0.000	0.000					
12.5	7.41	0.079	0.054	0.025	0.000	0.000
0.000	0.000					
5.3	7.62	0.939	0.223	0.537	0.180	0.000

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0.000    0.000
   12.6     7.55     0.037     0.025     0.012     0.000     0.000
0.000    0.000
   34.1     7.59     0.007     0.007     0.000     0.000     0.000
0.000    0.000
    5.4     7.78     0.642     0.144     0.353     0.146     0.000
0.000    0.000
    5.4     7.97     0.687     0.150     0.378     0.159     0.000
0.000    0.000
    5.4     8.19     0.121     0.026     0.067     0.029     0.000
0.000    0.000

Summary statistics for above PSHA PGA  deaggregation, R=distance,
e=epsilon:
Contribution from this GMPE(%):   14.0
 Mean src-site R=    7.2 km; M= 6.72; eps0=   1.10. Mean
calculated for all sources.
Modal src-site R=    5.4 km; M= 7.40; eps0=   0.97 from peak
(R,M) bin
 MODE R*=   5.4km; M*= 7.40; EPS.INTERVAL: 0 to 1 sigma  %
CONTRIB.=  1.108

Principal sources (faults, subduction, random seismicity having >
3% contribution)
Source Category:                    % contr.  R(km)    M   epsilon0
(mean values).
California A-faults                    5.19     6.4   7.49    1.19
CA Compr. crustal gridded              5.81     8.2   5.90    1.17
Individual fault hazard details if its contribution to mean
hazard > 2%:
Fault ID                            % contr.   Rcd(km)  M   epsilon0
Site-to-src azimuth(d)
S. S.Andr.;BG aPriori                  0.28      5.4   7.06    1.18
28.0
S. S.Andr.;CO aPriori                  0.13     13.9   6.99    2.11
95.1
S. S.Andr.;SSB+BG aPriori              0.57      5.4   7.31    1.07
28.0
S. S.Andr.;BG+CO aPriori               0.44      5.4   7.35    1.06
28.0
S. S.Andr.;NSB+SSB+BG aPriori          0.26      5.4   7.45    1.06
28.0
S. S.Andr.;SSB+BG+CO aPriori           0.26      5.4   7.51    1.06
28.0
SSAndr.;NSB+SSB+BG+CO aPriori          0.26      5.4   7.61    1.05
28.0
SSAnd;SM+NSB+SSB+BG+CO aPriori         0.27      5.4   7.82    1.04
28.0
S. San Andreas;CO MoBal                0.44     13.9   6.97    2.14
95.1
S. San Andreas;BG+CO MoBal             0.28      5.4   7.35    1.07
28.0
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S. San Andreas;SM+NSB+SSB+BG+CO 0.21 5.4 7.82 1.04 28.0
S. San Andreas Unsegmented A-flt 0.61 5.5 7.66 1.09 19.7

#*********End of deaggregation corresponding to Campbell-Bozorgnia 2008 *********#

PSHA Deaggregation. %contributions. site: Rancho_Mirage_D long: 116.396 W., lat: 33.799 N.
Vs30(m/s)= 360.0 (some WUS atten. models use Site Class not Vs30).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 475 yrs. Exceedance PGA =0.5461 g. Weight * Computed_Rate_Ex 0.102E-02
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.02538
#This deaggregation corresponds to Chiou-Youngs 2008

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
6.4	5.05	0.759	0.420	0.339	0.000	0.000	0.000	0.000
13.6	5.05	0.107	0.107	0.000	0.000	0.000	0.000	0.000
6.5	5.20	1.441	0.721	0.719	0.000	0.000	0.000	0.000
13.8	5.20	0.268	0.268	0.000	0.000	0.000	0.000	0.000
6.7	5.40	1.293	0.581	0.712	0.000	0.000	0.000	0.000
14.0	5.40	0.324	0.324	0.000	0.000	0.000	0.000	0.000
6.9	5.60	1.120	0.461	0.651	0.008	0.000	0.000	0.000
14.1	5.60	0.358	0.356	0.002	0.000	0.000	0.000	0.000
7.0	5.80	0.958	0.339	0.591	0.029	0.000	0.000	0.000
14.2	5.80	0.373	0.357	0.017	0.000	0.000	0.000	0.000
22.9	5.81	0.033	0.033	0.000	0.000	0.000	0.000	0.000
7.3	6.01	1.071	0.324	0.723	0.024	0.000	0.000	0.000
14.3	6.01	0.441	0.391	0.050	0.000	0.000	0.000	0.000
23.3	6.00	0.047	0.047	0.000	0.000	0.000	0.000	0.000
7.3	6.20	1.195	0.296	0.880	0.019	0.000	0.000	0.000
13.7	6.20	0.641	0.445	0.197	0.000	0.000	0.000	0.000
23.4	6.21	0.069	0.069	0.000	0.000	0.000	0.000	0.000

7.8	6.41	1.263	0.278	0.944	0.041	0.000	0.000	0.000
15.2	6.40	0.647	0.480	0.167	0.000	0.000	0.000	0.000
25.1	6.41	0.066	0.066	0.000	0.000	0.000	0.000	0.000
4.9	6.60	1.143	0.243	0.815	0.084	0.000	0.000	0.000
13.6	6.64	0.873	0.507	0.366	0.000	0.000	0.000	0.000
5.4	6.80	1.265	0.247	0.877	0.142	0.000	0.000	0.000
13.9	6.85	2.550	0.995	1.555	0.000	0.000	0.000	0.000
22.8	6.80	0.028	0.028	0.000	0.000	0.000	0.000	0.000
4.9	6.99	1.609	0.202	0.949	0.437	0.021	0.000	0.000
13.9	7.00	2.329	0.755	1.430	0.144	0.000	0.000	0.000
5.1	7.18	2.936	0.244	1.272	1.237	0.182	0.000	0.000
13.7	7.16	1.841	0.455	1.123	0.263	0.000	0.000	0.000
36.2	7.21	0.038	0.038	0.000	0.000	0.000	0.000	0.000
5.4	7.40	8.161	0.550	2.979	3.959	0.674	0.000	0.000
12.8	7.41	0.216	0.083	0.131	0.002	0.000	0.000	0.000
34.7	7.41	0.146	0.145	0.001	0.000	0.000	0.000	0.000
5.4	7.63	4.094	0.256	1.443	2.033	0.363	0.000	0.000
13.0	7.56	0.118	0.039	0.075	0.004	0.000	0.000	0.000
34.1	7.60	0.319	0.254	0.065	0.000	0.000	0.000	0.000
43.4	7.60	0.034	0.034	0.000	0.000	0.000	0.000	0.000
5.4	7.78	3.203	0.165	0.987	1.729	0.321	0.000	0.000
14.7	7.81	0.024	0.003	0.014	0.007	0.000	0.000	0.000
34.1	7.80	0.220	0.149	0.071	0.000	0.000	0.000	0.000
5.4	7.97	3.526	0.175	1.043	1.945	0.364	0.000	0.000
14.8	7.95	0.028	0.003	0.016	0.009	0.000	0.000	0.000
42.9	7.99	0.038	0.028	0.010	0.000	0.000	0.000	0.000

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   5.4    8.19    0.618    0.029    0.173    0.348    0.067
0.000   0.000
   5.4    8.36    0.041    0.002    0.011    0.025    0.003
0.000   0.000

Summary statistics for above PSHA PGA  deaggregation, R=distance,
e=epsilon:
Contribution from this GMPE(%):   48.1
 Mean src-site R=    8.3 km; M= 6.94; eps0=   0.56. Mean
calculated for all sources.
Modal src-site R=    5.4 km; M= 7.40; eps0=   0.10 from peak
(R,M) bin
 MODE R*=    5.4km; M*= 7.40; EPS.INTERVAL: 0 to 1 sigma   %
CONTRIB.=  3.959

Principal sources (faults, subduction, random seismicity having >
3% contribution)
Source Category:                       % contr.  R(km)    M   epsilon0
(mean values).
California A-faults                     29.28     8.1   7.44    0.39
CA Compr. crustal gridded               13.05     9.0   5.82    0.95
San Gorgonio Zone gridded                5.14     6.6   7.02    0.38
Individual fault hazard details if its contribution to mean
hazard > 2%:
Fault ID                               % contr.   Rcd(km)  M    epsilon0
Site-to-src azimuth(d)
S. S.Andr.;BG aPriori                    1.25     5.4   7.06    0.29
28.0
S. S.Andr.;CO aPriori                    1.41    13.9   6.98    1.28
95.1
S. S.Andr.;SSB+BG aPriori                2.53     5.4   7.31    0.15
28.0
S. S.Andr.;BG+CO aPriori                 2.06     5.4   7.36    0.11
28.0
S. S.Andr.;NSB+SSB+BG aPriori            1.19     5.4   7.45    0.09
28.0
S. S.Andr.;SSB+BG+CO aPriori             1.23     5.4   7.51    0.06
28.0
SSAndr.;NSB+SSB+BG+CO aPriori            1.27     5.4   7.61    0.02
28.0
SSAnd;SM+NSB+SSB+BG+CO aPriori           1.35     5.4   7.82   -0.03
28.0
S. San Andreas;CO MoBal                  4.85    13.9   6.96    1.31
95.1
S. San Andreas;BG+CO MoBal               1.28     5.4   7.35    0.11
28.0
S. San Andreas;SM+NSB+SSB+BG+CO          1.08     5.4   7.82   -0.03
28.0
S. San Andreas Unsegmented A-flt         3.19     6.0   7.67    0.09
19.7
#*********End of deaggregation corresponding to Chiou-Youngs 2008
*********#
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******************** Southern California
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