GEOTECHNICAL INVESTIGATION
PROPOSED SOUTH SIDE COMMUNITY PARK
NWC JOSHUA LANE AND WARREN VISTA AVENUE
YUCCA VALLEY, CALIFORNIA

-Prepared By-

Sladden Engineering

45090 Golf Center Parkway, Suite F
Indio, California 92201
(760) 772-3893

Sladden Engineering

45090 Golf Center Parkway, Suite F, Indio, California 92201 (760) 863-0713 Fax (760) 863-0847
6782 Stanton Avenue, Suite A, Buena Park, CA 90621 (714) 523-0952 Fax (714) 523-1369
450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863
800 E. Florida Avenue, Hemet, CA 92543 (951) 766-8777 Fax (951) 766-8778

September 20, 2010

Project No. 644-10019
10-08-033

RHA Landscape Architects Planners, Inc.
6216 Brockton Avenue, Suite 212
Riverside, CA 92506

Attention: Mr. Doug Grove

Subject: Geotechnical Investigation

Project: Proposed 20 Acre South Side Community Park
Town Project No. 8518-409
Town of Yucca Valley
San Bernardino County, California

Sladden Engineering is pleased to present the results of our geotechnical investigation for the proposed South Side Community Park to be located at the northwest corner of Joshua Lane and Warren Vista Avenue in the Town of Yucca Valley, San Bernardino County, California. Our services were completed in accordance with our proposal for geotechnical engineering services and your signed 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 is feasible, provided the recommendations presented in this report are implemented in the 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,
SLADDEN ENGINEERING

Matthew J. Cohrt
Project Geologist

PROFESSIONAL GEOLOGIST
Matthew J. Cohrt
No. 8567
STATE OF CALIFORNIA

Brett L. Anderson
Principal Engineer

PROFESSIONAL ENGINEER
No. C 45389
Exp 9-30-2012
CIVIL
CALIFORNIA

SER/mcCopies:
6/Addressee

GEOTECHNICAL INVESTIGATION
PROPOSED SOUTH SIDE COMMUNITY PARK
NWC JOSHUA LANE AND WARREN VISTA AVENUE
YUCCA VALLEY, CALIFORNIA

September 20, 2010

TABLE OF CONTENTS

INTRODUCTION

This report presents the results of the geotechnical investigation performed by Sladden Engineering (Sladden) for the proposed South Side Community Park to be located on the northwest corner of Joshua Lane and Warren Vista Avenue in the Town of Yucca Valley, San Bernardino County, California. The site is situated on the northeast ¼ of Section 12, Township 1 South, Range 5 east (SBBM) at approximately 34.09965° north latitude and 116.40734° 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 the provided site plan, it is our understanding that the proposed project will consist of constructing a new community park on the currently undeveloped site. In addition, the project is anticipated to include a restroom facility, paved parking areas, exterior concrete flatwork, and various other improvements. For our analyses we expect that the proposed new restroom building will consist of relatively lightweight wood-framed or reinforced masonry structure supported on conventional shallow spread footings and concrete slabs-on-grade.

We expect that grading will be limited to minor cuts and fills in order to accomplish the desired pad elevations and to provide adequate gradients for site drainage. This does not include the removal and recompaction of foundation bearing soil within the building envelopes. Upon completion of precise grading plans, we should be retained in order to ensure that the recommendations presented within in this report are incorporated into the design of the proposed project. Sladden does not anticipate the use of import fill for the proposed project. If import fill is required, it should be of a low to non-expansive nature and approved by the Soil Engineer prior to use.

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, and if necessary, revise the recommendations of this report.

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 11 exploratory boreholes to depths between approximately 5.0 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.
- Advance 11 exploratory boreholes to depths between 5.0 and 51.5 feet in order to characterize the subsurface conditions. Representative samples of the soil was classified in the field and retained for laboratory testing and engineering analyses.
- Perform laboratory testing on selected samples to evaluate their engineering characteristics.
- Review geologic literature and discuss geologic hazards.
- Perform engineering analyses to develop recommendations for foundation design and site preparation.
- Preparation of this report summarizing our work at the site.

SITE CONDITIONS

The site is located on the northwest corner of Joshua Lane and Warren Vista Avenue in the Town of Yucca Valley, San Bernardino County, California. At the time of our investigation the site was undeveloped and covered with scattered trees and shrubs. The site is bounded by Joshua Lane to the south, Warren Vista Avenue to the east, and mostly undeveloped land to the immediate north and west. West Burnt Mountain wash transects the central portion of the site.

According to the USGS 7.5′ Yucca Valley South Quadrangle map (1989), the site is situated at an approximate elevation of 3,600 feet above mean sea level (MSL).

No ponding water or surface seeps were observed at or near the site during our investigation conducted on August 26, 2010. Site drainage appears to be controlled via sheet flow, surface infiltration and by the mapped "blue line" stream (West Burnt Mountain Wash) that transects the subject site (Figure 1).

GEOLOGIC SETTING

The site is located at the northernmost portion of the Eastern Transverse Ranges Physiographic Province of California (CGS, 2002). The Pinto Mountain fault, to the north of the site, generally forms the boundary between the Eastern Transverse Ranges and the Mojave Desert Physiographic provinces. The Eastern Transverse Ranges Physiographic Province consists of elevated masses of mainly Mesozoic plutonic rocks, Paleozoic metasedimentary rocks and Precambrian gneiss. These mountains are transected by roughly east-west trending, convergent (north-south compressional) deformational structures. The convergent deformational features of the Eastern Transverse Ranges are a result of north-south crustal shorting due to plate tectonic movement which locally folds and uplifts the Little San Bernardino Mountains and lowers the intervening valleys, along with propagation of thrust faults (including blind thrusts) and infilling of valley basins with sediments. The Eastern Transverse Ranges are considered to be one of the most rapidly rising orogenic regions on earth (CGS, 2002).

According to the CGS (2002), the Mojave Desert Physiographic Province, located to the north of the site, consists of a broad interior region of isolated mountain ranges separated by expanses of desert plains that include interior enclosed drainages and many playas that are controlled mainly by northwest-southeast trending faults. The Mojave Desert is characterized by a basin and range type of morphology. However, the topography in the Mojave Desert is much more subdued than that of the Basin and Range Physiographic Province to the east and north. The ranges of the Mojave Desert are shorter and lower and the basins are wider. The topography is gentler than the sharp horst and graben topography expressed within the Basin and Range Physiographic Province. The regional geologic setting is presented on the Regional Geologic Map (Figure 2).

SUBSURFACE CONDITIONS

The subsurface conditions at the site were investigated by drilling 11 exploratory boreholes. 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 (O.D.) hollow stem augers. A representative of Sladden was on-site to log the materials encountered and retrieve samples for laboratory testing and engineering analysis.

During our field investigation, alluvium consisting of poorly graded sand and silty sand was encountered to the maximum depths explored. In general, the alluvium appeared loose to very dense and dry to moist. Detailed descriptions of the subsurface materials encountered are included in Appendix A of this report.

Groundwater was not encountered during to the maximum explored depth of 51.5 feet bgs during our field investigation on August 26, 2010. Based on our field investigation and experience in the project area, it is our opinion that groundwater should not be a factor during construction of the proposed project. However, following periods of heavy or prolonged rainfall, perched groundwater may be encountered, but will likely dissipate rapidly.

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).

The site is partially situated within a Earthquake Fault Zone (EFZ) as designated by the State of California for the Burnt Mountain Fault (CDMG, 1993). However, it is our understanding that no habitable structures have been proposed for the portions of the site located within the EFZ.

Table 1 list the closest known potentially active faults which was generated using, 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
Burnt Mountain	< 2.0	6.5
Eureka Peak	2.3	6.4
Pinto Mountain	4.0	7.2
Landers	7.1	7.3
North Frontal Fault Zone (East)	17.3	6.7
Emerson So. - Copper Mountain	19.1	7.0
San Andreas - Coachella	20.5	7.5
San Andreas - Southern	20.5	7.2

2007 CBC SEISMIC DESIGN PARAMETERS

According to published maps (CDMG, 1993) the Burnt Mountain fault has been mapped trending through the western portion of the site. Based on its proximity, the Burnt Mountain fault is considered capable of producing the strongest level of seismic shaking. We assume that the design of the proposed construction will be in accordance with the 2007 California Building Code (CBC). Accordingly, the following 2007 CBC seismic design parameters have been developed for the site utilizing the Seismic Hazard Curves and Uniform Hazard Response Spectra Java application (USGS, 2009). The actual method of seismic design should be determined by the Structural Engineer.

Occupancy Category (Table 1604.5): II
Site Class (Table 1613.5.5): D
S_s (Figure 1613.5.1): 1.887g
S_1 (Figure 1613.5.1): 0.723g
F_a (Table 1613.5.3(1)): 1.0
F_v (Table 1613.5.3(2)): 1.5
S_{ms} (Equation 16-37 [F_a X S_s]): 1.887g
S_{m1} (Equation 16-38 [F_v X S_1]): 1.084g
S_{DS} (Equation 16-39 [2/3 X S_{ms}]): 1.258g
S_{D1} (Equation 16-40 [2/3 X S_{m1}]): 0.723g
Seismic Design Category: D

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. A previously stated the site is transected by the Burnt Mountain fault and is partially located within a State of California designated fault zone. Based on our review of the current site plan, it is our understanding that no habitable structures have been proposed within the fault zone. A Fault Hazard Evaluation report will prepared under separate cover at a later date for this project. In accordance with the current standards of practice, the report should be submitted to the appropriate reviewing agency for review and comment prior to construction.

II. Ground Shaking. The site has been subjected to past ground shaking by both local and regional faults that traverse through the region. Seismic shaking from nearby active faults is expected to produce high ground accelerations 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 Probabilistic Hazard Curves (USGS, 2009) the site could be subjected to ground accelerations on the order of 0.496g. 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. 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.

During our field investigation, no groundwater was encountered on-site to the maximum explored depth of 51.5 feet bgs. In addition, groundwater depths in the site vicinity have been recorded at depths exceeding 150 feet bgs (CDWR, 1968). Based on this information, it is Sladden's professional opinion that risks associated with liquefaction should be considered negligible.

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

VI. Expansive Soil. Generally, the soil at the site consists of sand which lacks significant concentrations of fine-grained constituents (silt and clay). Expansion Index testing of select samples was performed in order to evaluate expansive potential of the materials underlying the site. Based the results of our laboratory testing (EI=3), the materials underlying the site are considered to have a "very low" expansion potential and the risk of structural damage caused by volumetric changes in the subgrade soil is considered negligible.

VII. Settlement. Settlement resulting from the anticipated foundation loads should be tolerable 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 values. 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 (USGS, 2001).

Locally, no fissures or other surficial evidence of subsidence were observed at or near the subject site. However, site specific effects resulting from long term regional subsidence is beyond the scope of our investigation.

IX. Flooding and Erosion. No signs of flooding or erosion were observed during our field investigation. However, the site is transected by a ephemeral drainage that should be considered in design.

CONCLUSIONS

Based on the results of our investigation, it is our professional opinion that the project is feasible from a soil mechanic's standpoint provided the recommendations of this report are incorporated in the design and carried out through construction. The main geotechnical concern in the construction of the proposed project is the presence of potentially compressible surface soil.

Because of the somewhat loose and compressible condition of the near surface soil, remedial grading including overexcavation and recompaction is recommended for the proposed building and foundation areas. We recommend that remedial grading within the proposed building areas include overexcavation and recompaction of the primary foundation bearing soil. Specific recommendations for site preparation are presented in the Earthwork and Grading section of this report.

Groundwater was not encountered within our bores and groundwater is expected to be in excess of 150 feet below the existing ground surface in the vicinity of the site. As such, specific liquefaction analyses were not performed. Based upon the depth to groundwater, the potential for liquefaction and the related surficial affects of liquefaction impacting the site are considered negligible.

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 analysis.

a. Stripping. Areas to be graded should be cleared of any existing structures, vegetation, associated root systems and debris. All areas scheduled to receive fill should be cleared of old fills 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. In order to achieve a firm and unyielding bearing surface, we recommend overexcavation and recompaction throughout the building areas. All native low density near surface soil should be removed to a depth of approximately 4 feet below existing grade or 3 feet below the bottom of the footings, whichever is deeper. Remedial grading should extend laterally, a minimum of five feet beyond perimeter wall foundations. The exposed surface should then be scarified, moisture conditioned to within two percent of optimum moisture content, and compacted to at least 90 percent relative compaction. The competency of native soil encountered within the excavation bottoms should be generally evaluated based upon 85 percent relative compaction or 85 percent saturation. Testing of the native soil within the excavation bottoms should be performed during grading to verify adequacy.

c. 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 their loose state. 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 fills 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 ensure 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/or recompaction within the building envelopes and extending laterally for 5 feet beyond the building limits and to a minimum of 4 feet below existing grade or 3 feet below the footings, whichever is deeper.
Native / Import Engineered Fill	Place in thin lifts not exceeding 6 inches in the loose state, compact to a minimum of 90 percent relative compaction.
Asphalt Concrete	Compact the top 12 inches to at least 95 percent compaction within 2 percent of 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 could vary from 10 to 15 percent Subsidence of the surfaces that are scarified and compacted should be between 1 and 2 tenths 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.

FOUNDATION: CONVENTIONAL SPREAD FOOTINGS

Load bearing walls may be supported on continuous spread footings and interior columns may be supported on isolated pad footings. All footings should be founded upon properly 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 a minimum width of 18 inches and 24 inches respectively. Continuous and isolated footings placed on such materials may be designed using an allowable (net) bearing pressure 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 3000 psf. The maximum bearing value applies to combined dead and sustained live loads.

The allowable bearing pressure 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 allowable bearing pressures recommended above, total settlement of the shallow footings are anticipated to be less than one-inch, provided foundation preparations conform to the recommendations described in this report. Differential settlement is anticipated to be approximately half the total settlement for similarly loaded footings spaced up to approximately 40 feet apart.

Lateral load resistance for the spread footings will be developed by passive soils pressure against the sides of the footings below grade and by friction acting at the base of the concrete footings bearing on compacted fill. 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, 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 soils generated from footing and/or utility trenches should not be stockpiled within the building envelope or in areas of exterior concrete flatwork.

DRILLED PIERS

Drilled piers for light poles should have a minimum diameter of 12 inches and be spaced at least three pier diameters center to center. The piers will derive their support through skin friction.

The portion of the piers extending below a depth of two (2) feet below the finished ground surface (unless surrounded by concrete or asphalt) may be designed using an allowable skin friction of 650 pounds per square foot (psf). This value may be increased by one-third for short duration wind and seismic loads. End bearing should be neglected because of difficulty in cleaning out small diameter pier holes and the uncertainty of mobilizing skin friction and end bearing simultaneously. To resist uplift, a value equal to one-half the downward capacity of the pier should be used.

Lateral loads resulting from wind and earthquakes can be resisted by the pier through a combination of cantilever action and passive resistance of the soil surrounding the pier. A passive equivalent fluid pressure of 350 psf/ft acting on two pier diameters should be used. The upper three feet should be neglected for passive resistance.

SLABS-ON-GRADE

In order to reduce the risk cracking and settlement, concrete slabs-on-grade must be placed on properly compacted fill as outlined in the previous sections. The slab subgrades should remain near optimum moisture content and should not be permitted to dry. Prior to concrete pour, all slab subgrades should be firm and unyielding. Disturbed soils should be removed and then replaced and compacted to a minimum of 90 percent relative compaction.

Slab thickness and reinforcement should be determined by the structural engineer. 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 barrier 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. Design R-Value is assumed to be 50. On-site and any imported soil's should be tested for R-Value. Actual R-Value of subgrade soil should be consistent with the pavement design.

For Pavement design, Traffic Indices (TI) of 5.0 and 6.5 were used for the light duty and heavy duty pavements, respectively. We assumed Asphalt Concrete (AC) over Class II Aggregate Base (AB). The preliminary flexible pavement layer thickness is as follows:

RECOMMENDED ASPHALT PAVEMENT SECTION LAYER THICKNESS		
Pavement Material	Recommended Thickness	
	TI=5.0	TI=6.5
Asphalt Concrete Surface Course	3 inches	3 inches
Class II Aggregate Base Course	4 inches	6 inches
Compacted Subgrade Soil	12 inches	12 inches

Asphalt concrete should conform to Sections 203 and 302 of the latest edition of the Standard Specifications for Public Works Construction ("Greenbook").

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.

SOLUBLE SULFATES

Soluble sulfate concentrations were not detected (ND) during our laboratory analysis. The surface soil is generally considered non-corrosive with respect to concrete. The use of Type V and/or sulfate resistant mix design should not be necessary. However, the soil will need to be retested for its soluble sulfate concentration after 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.

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 geotechnical consultant should probe and test the backfills to verify adequate compaction.

EXTERIOR CONCRETE FLATWORK

To minimize cracking of concrete flatwork, the subgrade soils 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 soils, and the depth of moisture penetration prior to pouring concrete.

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 boring locations and extrapolation of these conditions throughout the proposed building area. 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 soils, and that suitable backfill soils are placed upon competent materials and properly compacted at the recommended moisture content.

During grading, tests and observations should be performed 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 subgrade soils 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.

REFERENCES

Blake, T., 2000, EQFAULT and EQSEARCH, Computer Programs for Deterministic and Probabilistic Prediction of Peak Horizontal Acceleration from Digitized California Faults.

California Building Code (CBC), (2007), California Building Standards Commission.

California Department of Water Resources (CDWR), 1968, Historical Data by Well-Map Interface, available at:http://wdl.water.ca.gov/gw/; State Well No. 01N06E31P0015.

California Division of Mines and Geology (CDMG), 1993, State of California Special Studies Zones, Yucca Valley South Quadrangle, 1:24000.

California Geological Survey, 2002, California Geomorphic Provinces: Note 36.

Cao T., Bryant, W.A., Rowshandel B., Branum D., Wills C.J., (2003), "The Revised 2002 California Probabilistic Seismic Hazard Maps".

Dibblee, T.W., (1967), Geologic Map of the Joshua Tree Quadrangle, San Bernardino and Riverside Counties, California; Miscellaneous Geologic Investigations Map I-516, 1:62,500.

Jennings, Charles W. (Compiler), 1994, Fault Activity Map of California and Adjacent Areas, California Division of Mines and Geology, Geologic Data Map No. 6.

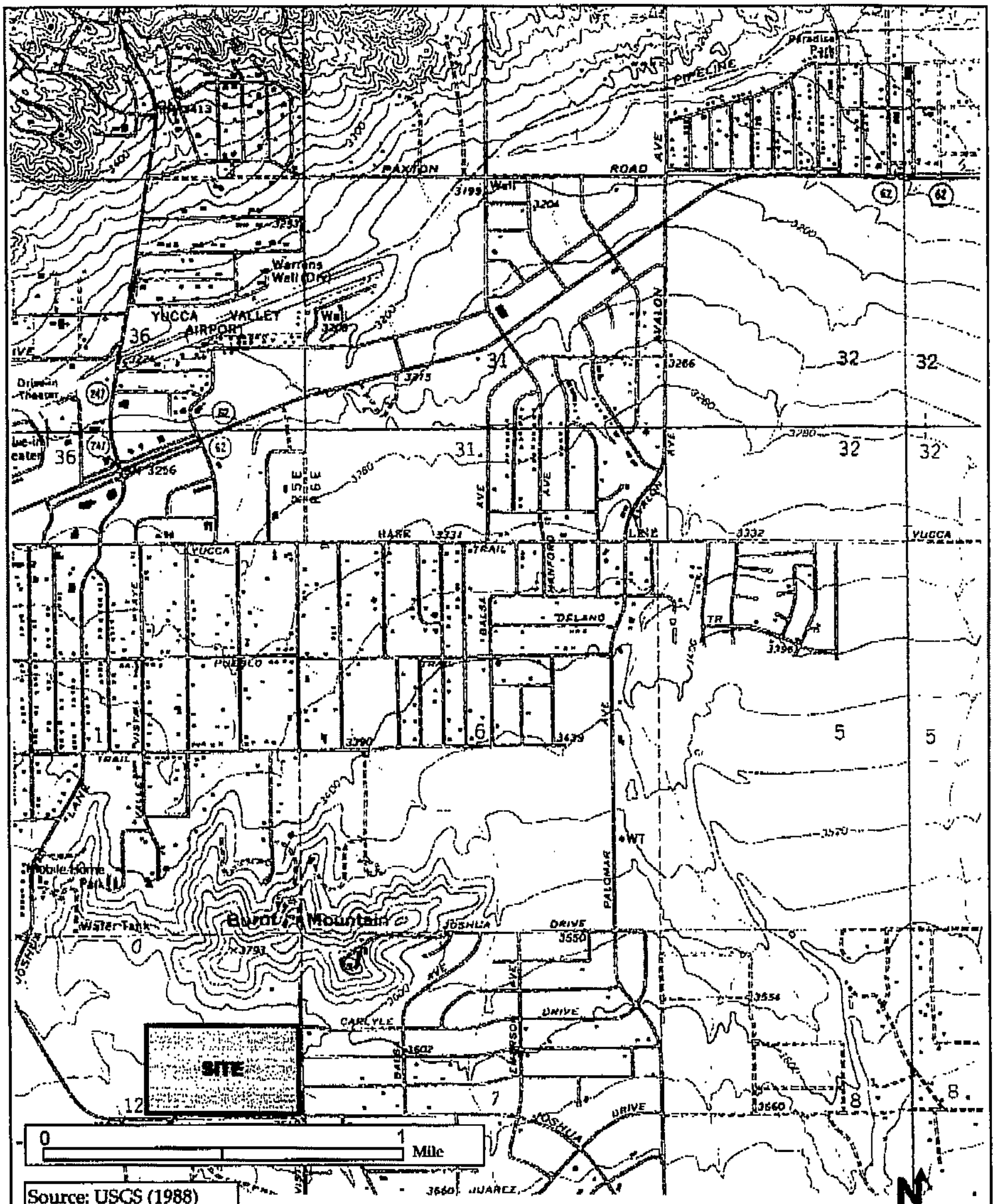
United States Geological Survey (USGS) (1989) Yucca Valley South 7.5 Minute Quadrangle Map, 1:24000.

United States Geological Survey (USGS) (2001), "Detection and Measurement of Land Subsidence Using Global Positioning System and Interferometric Synthetic Aperture Radar, Coachella Valley, California, 1996-98", Water-Resources Investigations Report 01-4193.

United States Geological Survey (USGS) (2009), "Seismic Hazard Curves and Uniform Response Spectra, Version 5.0.9"

FIGURES

SITE LOCATION MAP
REGIONAL GEOLOGIC MAP
BOREHOLE LOCATION PLAN



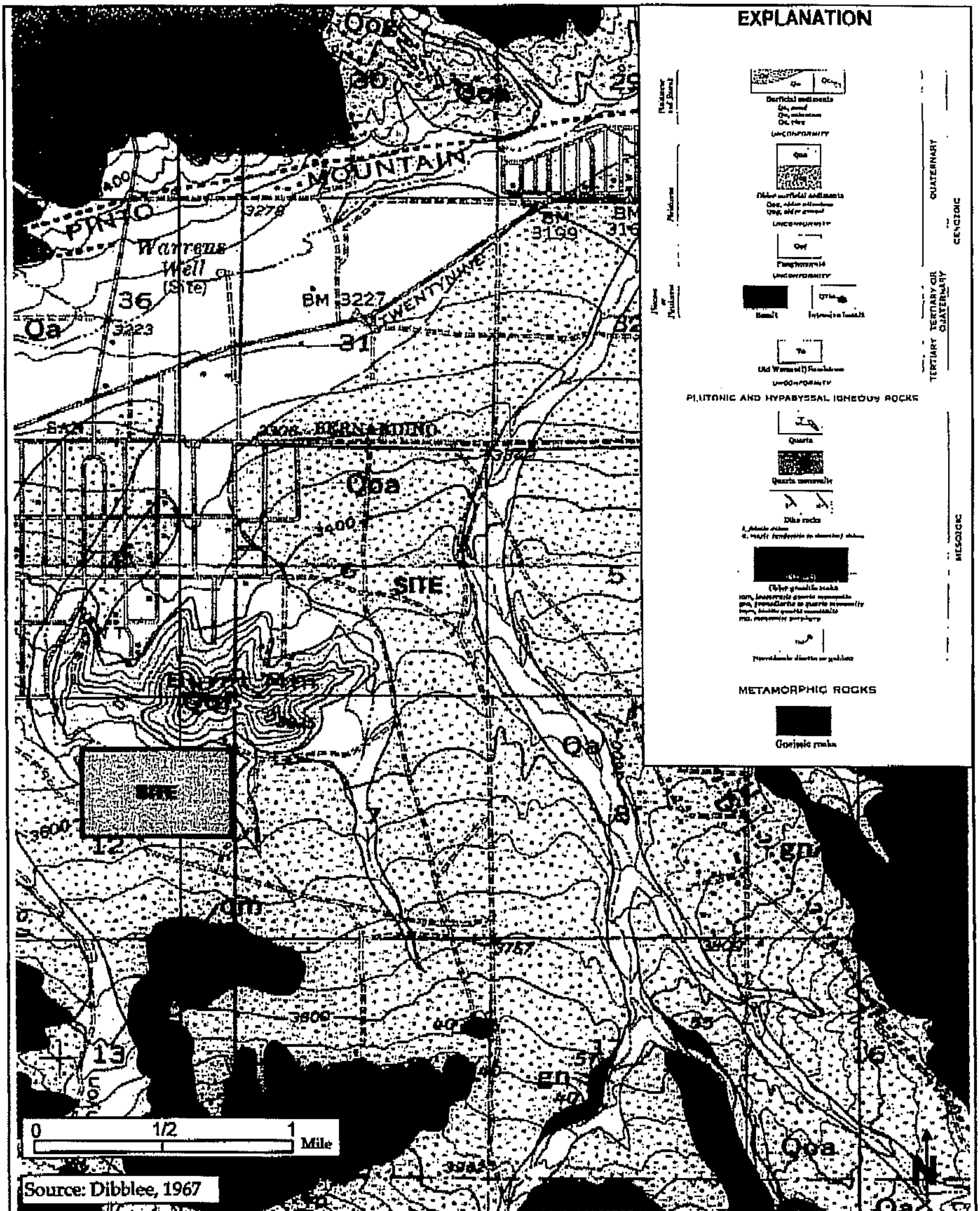
SITE LOCATION MAP

Sladden Engineering

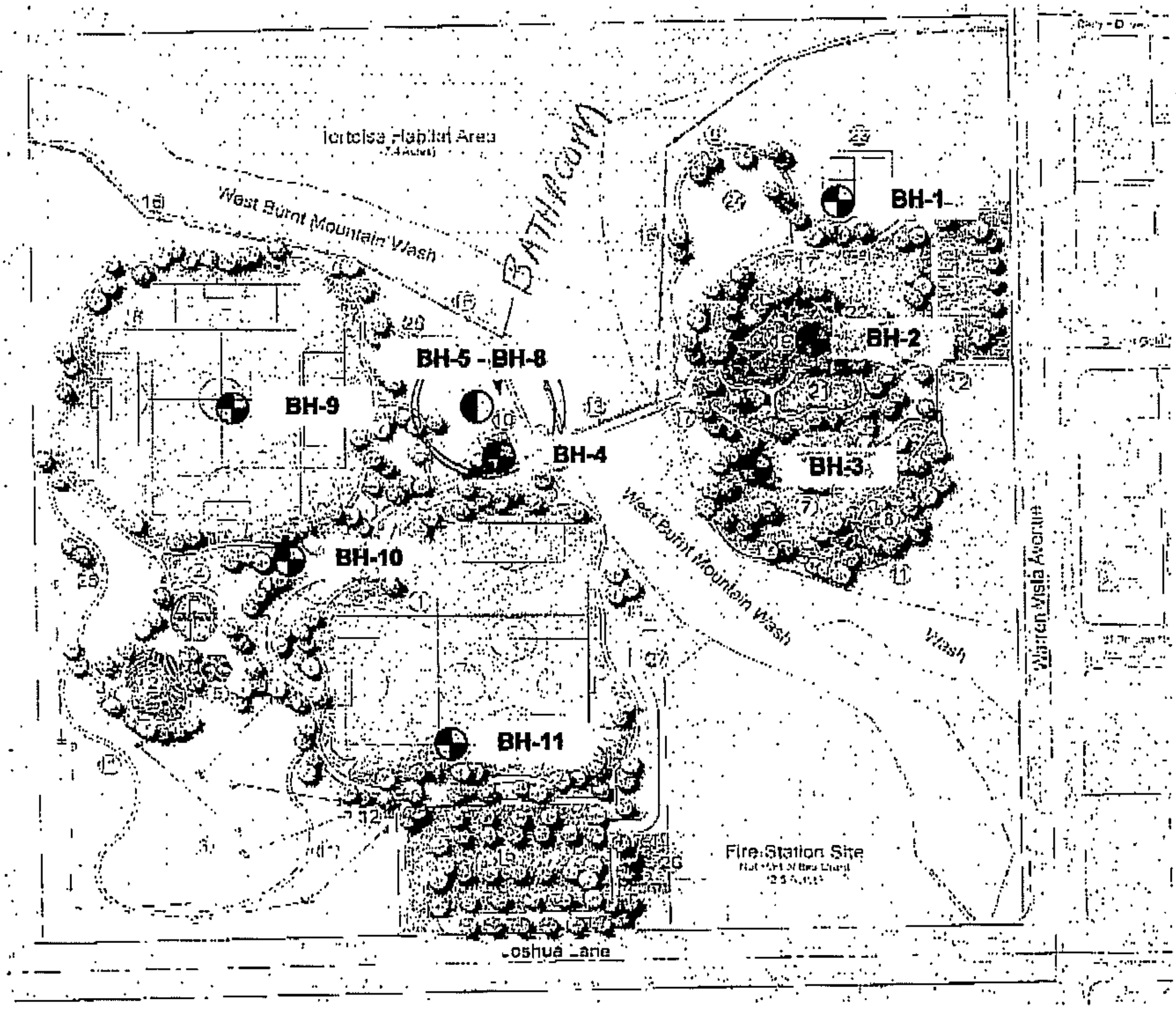
Project Number:	644-10019
Report Number:	10-08-033
Date:	September 20, 2010

FIGURE

1



Sladden Engineering	REGIONAL GEOLOGIC MAP		FIGURE
	Project Number:	644-10019	2
	Report Number:	10-08-033	
	Date:	September 20, 2010	



◐ **BH-5 - BH-8** Approximate Percolation test hole location and Designation

⊕ **BH-11** Approximate Borehole Location and Designation

N

Sladden Engineering	BOREHOLE LOCATION PLAN		FIGURE
	Project Number:	644-10019	3
	Report Number:	10-08-033	
	Date:	September 20, 2010	

APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

For our field investigation eleven exploratory borings were excavated on August 26, 2010 utilizing a truck mounted hollow stem auger rig (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 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 transition may be gradual.

SLADDEN ENGINEERING

BORE LOG

Drill rig:	Mobil B-61	Date Drilled:	8/26/2010
Elevation:	3,600 (MSL)	Boring No:	BH-1

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							0–2	▨	Silty Sand (SM); yellowish brown, dry to moist, fine- to coarse-grained (Alluvium).
■	14/20/21			25.8	6.0	132.5	6	▨	Silty Sand (SM); yellowish brown, moist, medium dense, fine- to coarse-grained (Alluvium).
■	3/6/12			14.4	4.0		11	▨	Silty Sand (SM); yellowish brown, moist, medium dense, fine- to coarse-grained with carbonate stringers (Alluvium).
■	16/50-5"			26.3	6.4	119.5	16	▨	Silty Sand (SM); yellowish brown, moist, very dense, fine- to coarse-grained (Alluvium).
■	18/21/21			13.1	2.8		20	▨	Silty Sand (SM); yellowish brown, moist, dense, fine- to coarse-grained (Alluvium).
							22		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:

SOUTH SIDE COMMUNITY PARK
JOSHUA LANE AND WARREN VISTA, YUCCA VALLEY

Project No:	644-10019	Page	1
Report No:	10-08-033		

SLADDEN ENGINEERING

BORE LOG

Drill rig:	Mobil B-61	Date Drilled:	8/26/2010
Elevation:	3,600 (MSL)	Boring No:	BH-2

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							0–4		Silty Sand (SM); yellowish brown, dry to moist, fine- to coarse-grained with gravel (Alluvium).
	6/6/7			19.6	3.5	118.6	5–6		Silty Sand (SM); yellowish brown, moist, loose, fine- to coarse-grained (Alluvium).
	2/2/2			22.2	4.4		10–14		Silty Sand (SM); yellowish brown, moist, very loose, fine- to coarse-grained (Alluvium).
	6/9/9			2.7	0.3		15–19		Sand (SP); yellowish brown, dry, medium dense, fine- to coarse-grained (Alluvium).
	18/26/30			24.6	5.1		20–21.5		Silty Sand (SM); light yellowish brown, moist, very dense, fine- to coarse-grained with gravel and carbonate stringers (Alluvium).
							22–50		Terminated at ~21.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

SOUTH SIDE COMMUNITY PARK
JOSHUA LANE AND WARREN VISTA, YUCCA VALLEY

Project No:	644-10019	Page	2
Report No:	10-08-033		

SLADDEN ENGINEERING

BORE LOG

Drill rig:	Mobil B-61	Date Drilled:	8/26/2010
Elevation:	3,600 (MSL)	Boring No:	BH-3

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							0–5		Silty Sand (SM); yellowish brown, dry to moist, fine- to coarse-grained with gravel (Alluvium).
■	4/5/4			6.4	1.0	112.9	5–10		Sand (SP); yellowish brown, dry, loose, fine- to coarse-grained with gravel (Alluvium).
■	3/3/4			23.3	8.1		10–15		Silty Sand (SM); yellowish brown, moist, loose, fine- to coarse-grained with gravel (Alluvium).
■	6/7/8			5.6	2.3	112.7	15–19		Sand (SP); yellowish brown, dry, loose, fine- to coarse-grained (Alluvium).
■	9/14/16			25.6	10.6		19–22		Silty Sand (SM); dark yellowish brown, moist, medium dense, fine- to coarse-grained (Alluvium).
							22–50		Terminated at ~21.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

SOUTH SIDE COMMUNITY PARK

JOSHUA LANE AND WARREN VISTA, YUCCA VALLEY

Project No:	644-10019	Page	3
Report No:	10-08-033		

SLADDEN ENGINEERING

BORE LOG

Drill rig:	Mobil B-61	Date Drilled:	8/26/2010
Elevation:	3,600 (MSL)	Boring No:	BH-4

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
		1	3				2, 4		Silty Sand (SM); yellowish brown, dry to moist, fine- to coarse-grained with gravel (Alluvium).
	5/6/9			8.5	2.7	113.0	6, 8		Sand (SP); yellowish brown, dry, loose, fine- to coarse-grained (Alluvium).
	4/8/9			9.9	3.3		10, 12, 14		Sand (SP); yellowish brown, dry, medium dense, fine- to coarse-grained (Alluvium).
	27/50-5"			17.8	6.7	130.7	16, 18		Silty Sand (SM); yellowish brown, moist, very dense, fine- to coarse-grained (Alluvium).
	13/17/17			6.6	1.8		20, 22, 24		Sand (SP); yellowish brown, dry, dense, fine- to coarse-grained (Alluvium).
	17/22/25			4.3	1.2	119.9	26, 28		Sand (SP); yellowish brown, dry, dense, fine- to coarse-grained with gravel (Alluvium).
	17/26/28			23.0	4.5		30, 32, 34		Silty Sand (SM); yellowish brown, moist, very dense, fine-grained (Alluvium).
	4/19/19			20.5	4.5		36, 38		Silty Sand (SM); yellowish brown, moist, dense, fine-grained (Alluvium).
	13/19/21			30.8	6.7		40, 42, 44		Silty Sand (SM); grayish brown, moist, dense, fine-grained (Alluvium).
	14/15/18			19.9	4.3		46, 48		Silty Sand (SM); yellowish brown, moist, dense, fine-grained (Alluvium).
	15/33/30			15.2	2.3		50		Silty Sand (SM); yellowish brown, dry, very dense, fine- to coarse-grained (Alluvium).

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

SOUTH SIDE COMMUNITY PARK
JOSHUA LANE AND WARREN VISTA, YUCCA VALLEY

Project No: 644-10019
Report No: 10-08-033

SLADDEN ENGINEERING

BORE LOG

Drill rig:	Mobil B-61	Date Drilled:	8/26/2010
Elevation:	3,600 (MSL)	Boring No:	BH-5

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							0–5	(SM)	Silty Sand (SM); yellowish brown, dry to moist, fine- to coarse-grained (Alluvium).
									Terminated at ~5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Piped to Facilitate Infiltration Testing.

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:

SOUTH SIDE COMMUNITY PARK
JOSHUA LANE AND WARREN VISTA, YUCCA VALLEY

Project No:	644-10019	Page	5
Report No:	10-08-033		

SLADDEN ENGINEERING

BORE LOG

Drill rig:	Mobil B-61	Date Drilled:	8/26/2010
Elevation:	3,600 (MSL)	Boring No:	BH-6

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2, 4		Silty Sand (SM); yellowish brown, dry to moist, fine- to coarse-grained (Alluvium).
							6, 8, 10		Terminated at ~5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Piped to Facilitate Infiltration Testing.
							12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50		

Completion Notes:

SOUTH SIDE COMMUNITY PARK
JOSHUA LANE AND WARREN VISTA, YUCCA VALLEY

Project No: 644-10019
Report No: 10-08-033

SLADDEN ENGINEERING

BORE LOG

Drill rig:	Mobil B-61	Date Drilled:	8/26/2010
Elevation:	3,600 (MSL)	Boring No:	BH-7

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							0–5		Silty Sand (SM); yellowish brown, dry to moist, fine- to coarse-grained (Alluvium).
									Terminated at ~5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Piped to Facilitate Infiltration Testing.

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:

SOUTH SIDE COMMUNITY PARK
JOSHUA LANE AND WARREN VISTA, YUCCA VALLEY

Project No: 644-10019
Report No: 10-08-033

SLADDEN ENGINEERING

BORE LOG

Drill rig:	Mobil B-61	Date Drilled:	8/26/2010
Elevation:	3,600 (MSL)	Boring No:	BH-8

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							0–5		Silty Sand (SM); yellowish brown, dry to moist, fine- to coarse-grained (Alluvium).
							5		Terminated at ~5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Piped to Facilitate Infiltration Testing.

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:

SOUTH SIDE COMMUNITY PARK
JOSHUA LANE AND WARREN VISTA, YUCCA VALLEY

Project No: 644-10019
Report No: 10-08-033

SLADDEN ENGINEERING

BORE LOG

Drill rig:	Mobil B-61	Date Drilled:	8/26/2010
Elevation:	3,600 (MSL)	Boring No:	BH-9

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							0–2		Silty Sand (SM); yellowish brown, dry to moist, fine- to coarse-grained (Alluvium).
■	3/3/4			17.7	4.5		5		Silty Sand (SM); yellowish brown, moist, loose, fine- to coarse-grained (Alluvium).
■	9/13/16						10		No Recovery
							12–50		Terminated at ~11.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

SOUTH SIDE COMMUNITY PARK
JOSHUA LANE AND WARREN VISTA, YUCCA VALLEY

Project No: 644-10019
Report No: 10-08-033

SLADDEN ENGINEERING

BORE LOG

Drill rig:	Mobil B-61	Date Drilled:	8/26/2010
Elevation:	3,600 (MSL)	Boring No:	BH-10

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							0–2		Silty Sand (SM); yellowish brown, moist, fine- to coarse-grained (Alluvium).
■	3/6/9			14.7	3.7		5		Silty Sand (SM); yellowish brown, moist, medium dense, fine- to coarse-grained (Alluvium).
■	6/9/12			22.0	3.9		10		Silty Sand (SM); yellowish brown, moist, medium dense, fine- to coarse-grained (Alluvium).
■	5/5/2			23.9	4.8		15		Silty Sand (SM); yellowish brown, moist, loose, fine- to coarse-grained (Alluvium).

Terminated at ~16.5 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:

SOUTH SIDE COMMUNITY PARK
JOSHUA LANE AND WARREN VISTA, YUCCA VALLEY

Project No:	644-10019	Page	10
Report No:	10-08-033		

SLADDEN ENGINEERING

BORE LOG

Drill rig:	Mobil B-61	Date Drilled:	8/26/2010
Elevation:	3,600 (MSL)	Boring No:	BH-11

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							0–4		Silty Sand (SM); yellowish brown, dry to moist, fine- to coarse-grained (Alluvium).
■	6/7/8			14.4	2.8		5–6		Silty Sand (SM); yellowish brown, moist, medium dense, fine- to coarse-grained (Alluvium).
■	10/12/15			13.6	2.7		10–11		Silty Sand (SM); yellowish brown, moist, medium dense, fine- to coarse-grained (Alluvium).
■	8/8/10			13.7	2.8		15–16		Silty Sand (SM); yellowish brown, moist, medium dense, fine- to coarse-grained (Alluvium).
							18–50		Terminated at ~16.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

SOUTH SIDE COMMUNITY PARK

JOSHUA LANE AND WARREN VISTA, YUCCA VALLEY

Project No: 644-10019

Report No: 10-08-033

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. The results of this testing are presented graphically 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. This is shown on the Boring Logs, and is useful in estimating the strength and compressibility of 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 soils 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 Tests: One (1) bulk sample was selected for Direct Shear Tests. 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 Tests: Two (2) relatively undisturbed samples were selected for consolidation testing. For this test one-inch thick test specimens are 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. The specimen was saturated at the 575 psf or 720 psf load increment.

Sladden Engineering

6782 Stanton Ave., Suite A, 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: September 10, 2010

Account No.: 644-10019

Customer: RHA Landscape Architects

Location: South Side Community Park, Yucca Valley

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-4 @ 0-5'	6.9	ND	30	5,400

Sladden Engineering
460 Egan Avenue, Beaumont CA 92223 (951) 845-7743 Fax (951) 845-8863

Maximum Density/Optimum Moisture

ASTM D698/D1557

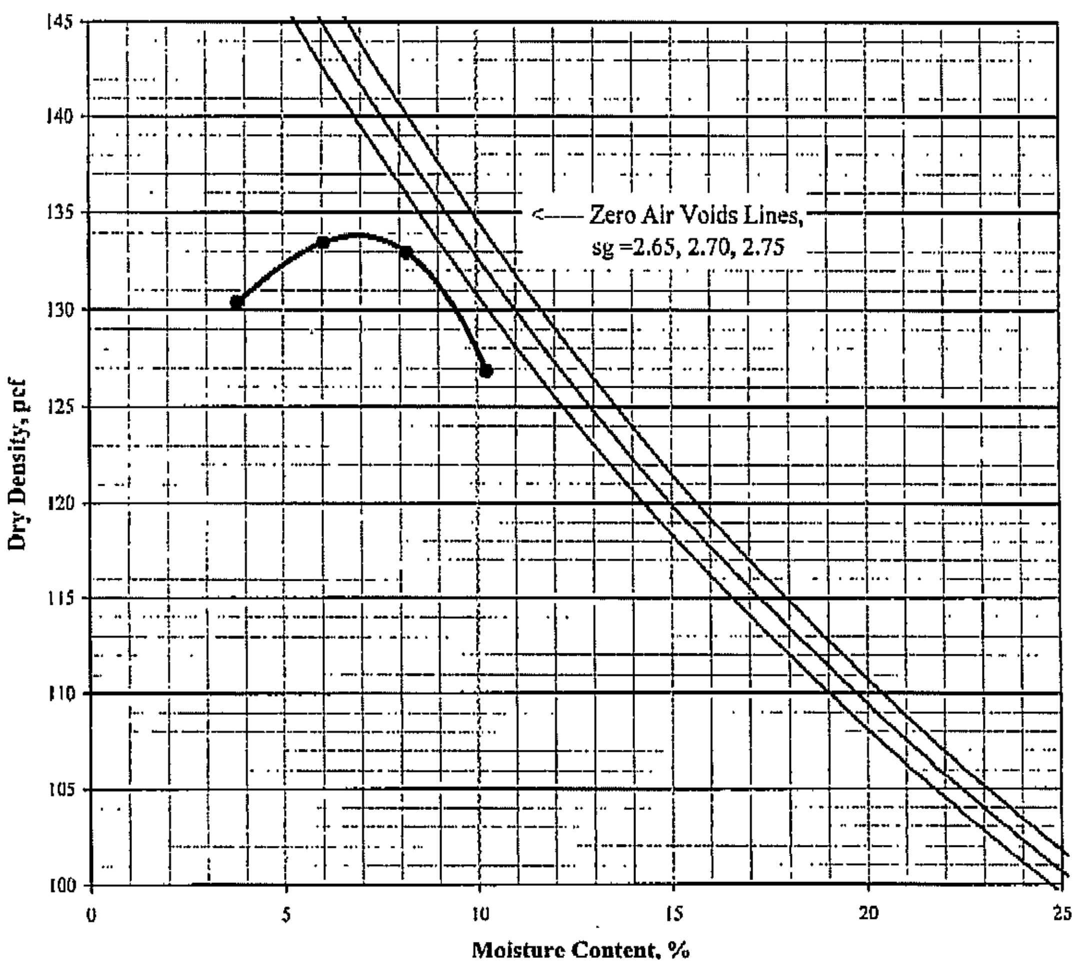
Project Number: 644-10019
Project Name: South Side Community Park
Lab ID Number: LN6-10339
Sample Location: BH-4 Bulk 1 @ 0-5'
Description: Brown Silty Sand (SM)

September 10, 2010

ASTM D-1557 A
Rammer Type: Machine

Maximum Density: **135 pcf**
Optimum Moisture: **6.5%**
Corrected for Oversize (ASTM D4718)

Sieve Size	% Retained
3/4"	
3/8"	
#4	5.7



Sladden Engineering

450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863

Expansion Index

ASTM D 4829

Job Number: 644-10019 September 10, 2010

Job Name: South Side Community Park

Lab ID Number: LN6-10339

Sample ID: BH-4 Bulk 1 @ 0-5'

Soil Description: Brown Silty Sand (SM)

Wt of Soil + Ring:	626.2
Weight of Ring:	192.7
Wt of Wet Soil:	433.5
Percent Moisture:	7.2%

Wet Density, pcf:	131.4
Dry Denstiy, pcf:	122.5

% Saturation:	51.8

Expansion **Rack # 1**

Date/Time	9/8/2010	3:25 PM
Initial Reading	0.0000	
Final Reading	0.0027	

Expansion Index 3

(Final - Initial) x 1000

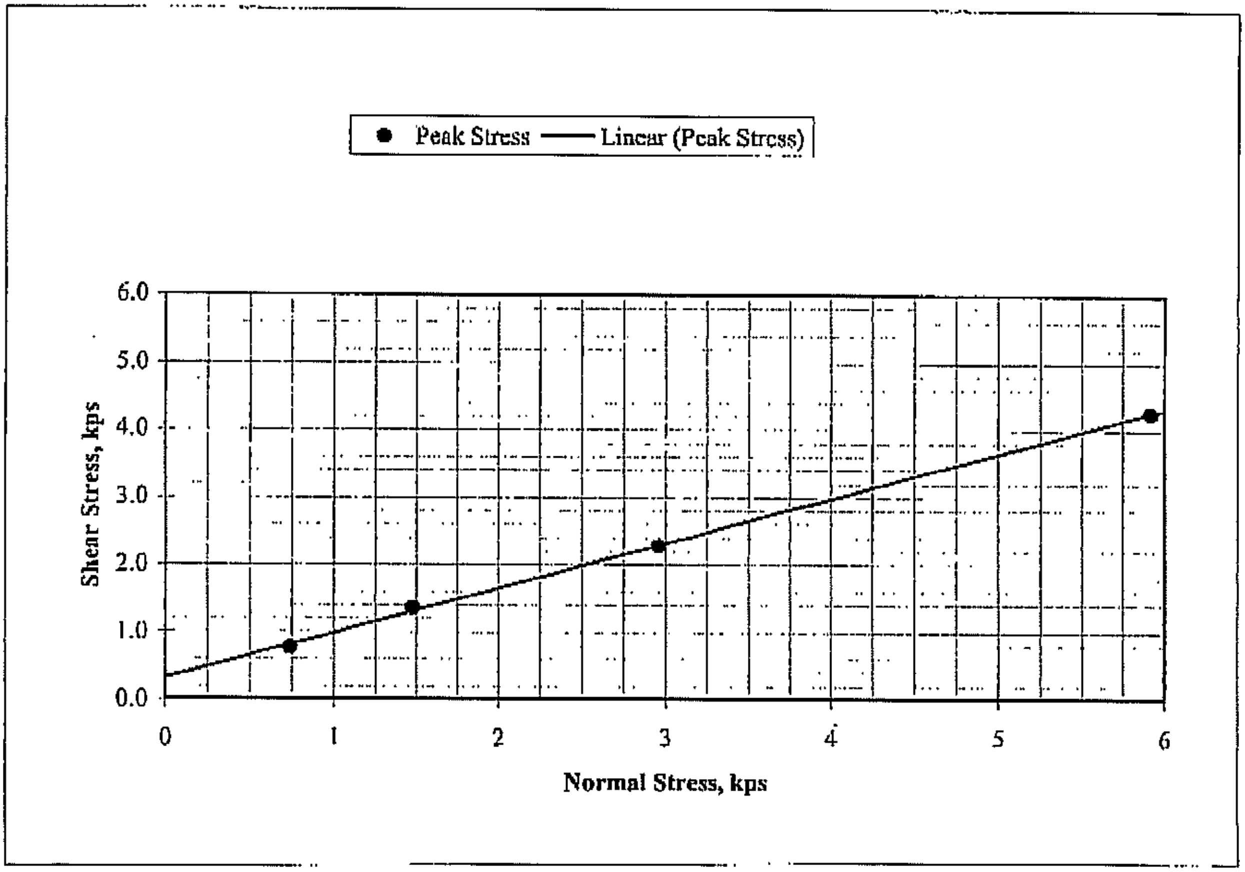
Sladden Engineering
450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863

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

Job Number: 644-10019
Job Name South Side Community Park
Lab ID No. LN6-10339
Sample ID BH-4 Bulk 1 @ 0-5'
Classification Brown Silty Sand (SM)
Sample Type Remolded @ 90% of Maximum Density

September 10, 2010
Initial Dry Density: 120.8 pcf
Initial Mosture Content: 7.1 %
Peak Friction Angle (Ø): 34°
Cohesion (c): 320 psf

Test Results	1	2	3	4	Average
Moisture Content, %	12.6	12.6	12.6	12.6	12.6
Saturation, %	86.3	86.3	86.3	86.3	86.3
Normal Stress, kps	0.739	1.479	2.958	5.916	
Peak Stress, kps	0.768	1.360	2.281	4.254	



Sladden Engineering

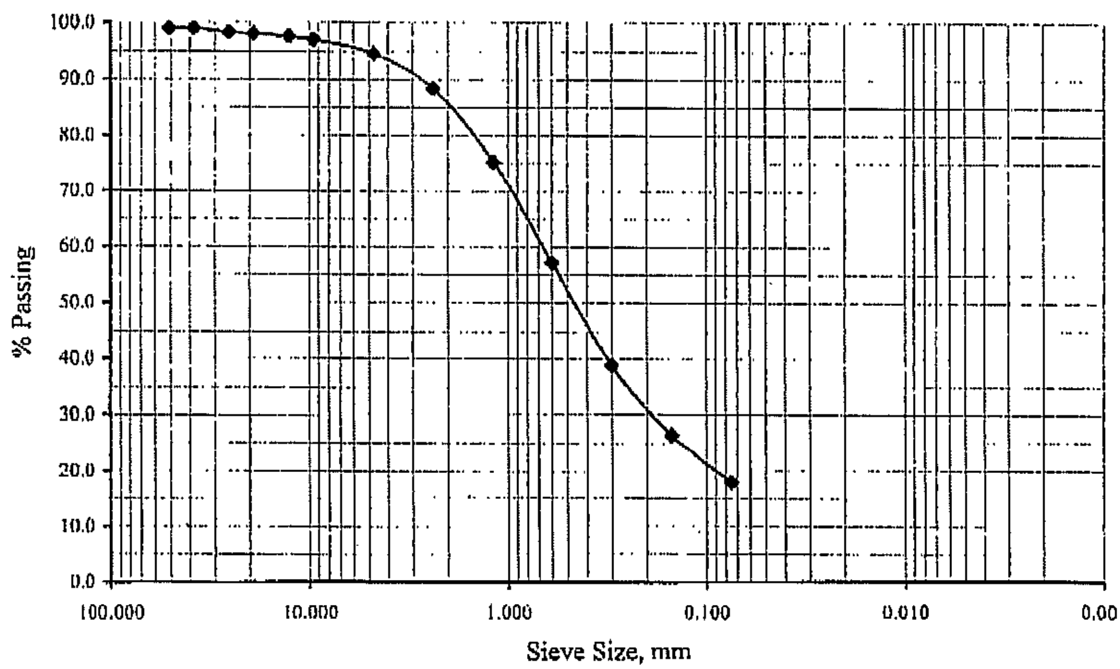
450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863

Gradation

ASTM C117 & C136

Project Number: 644-10019 September 10,2010
Project Name: South Side Community Park
Lab ID Number: LN6-10339
Sample ID: BH-4 Bulk 1 @ 0-5' Soil Classification: SM

Sieve Size, in	Sieve Size, mm	Percent Passing
2"	50.8	99.0
1 1/2"	38.1	99.0
1"	25.4	98.3
3/4"	19.1	98.1
1/2"	12.7	97.6
3/8"	9.53	97.0
#4	4.75	94.5
#8	2.36	88.3
#16	1.18	75.3
#30	0.60	57.1
#50	0.30	38.8
#100	0.15	26.4
#200	0.075	18.0



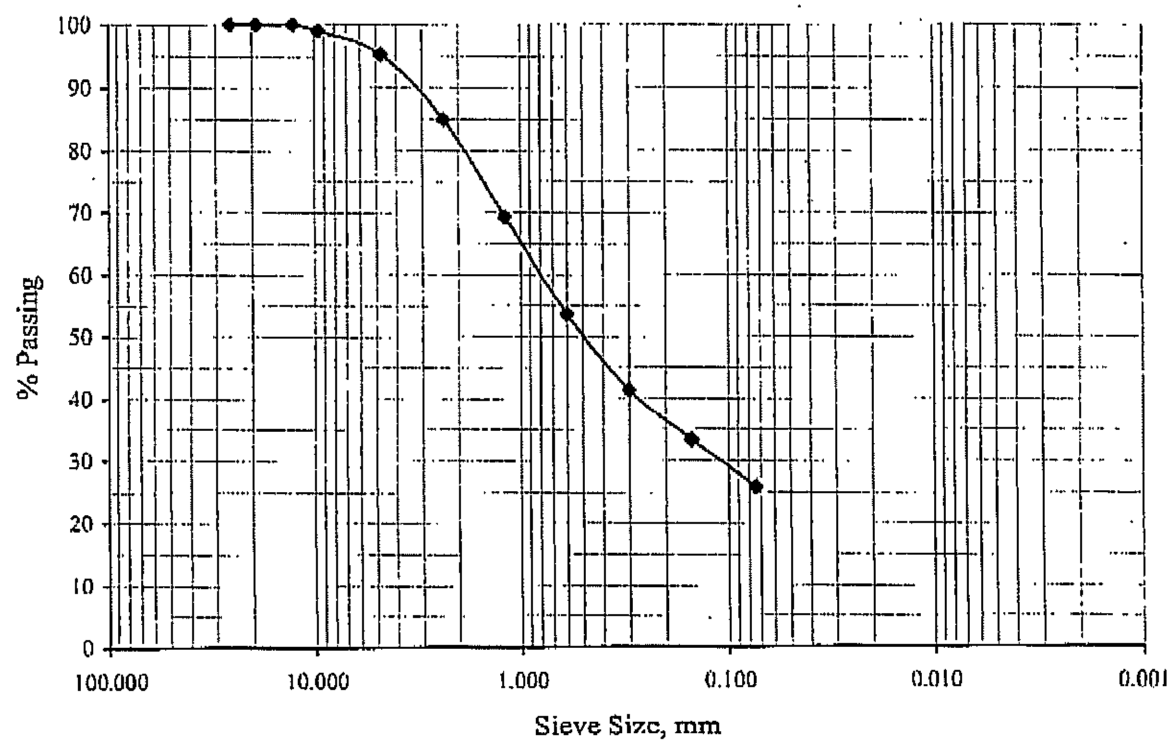
Sladden Engineering
450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863

Gradation

ASTM C117 & C136

Project Number: 644-10019 September 10, 2010
Project Name: South Side Community Park
Lab ID Number: LN6-10339
Sample ID: BH-1 R-1 @ 5' Soil Classification: 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	99.0
#4	4.75	95.4
#8	2.36	85.0
#16	1.18	69.3
#30	0.60	53.6
#50	0.30	41.3
#100	0.15	33.4
#200	0.074	25.8



Sladden Engineering

450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863

Gradation

ASTM C117 & C136

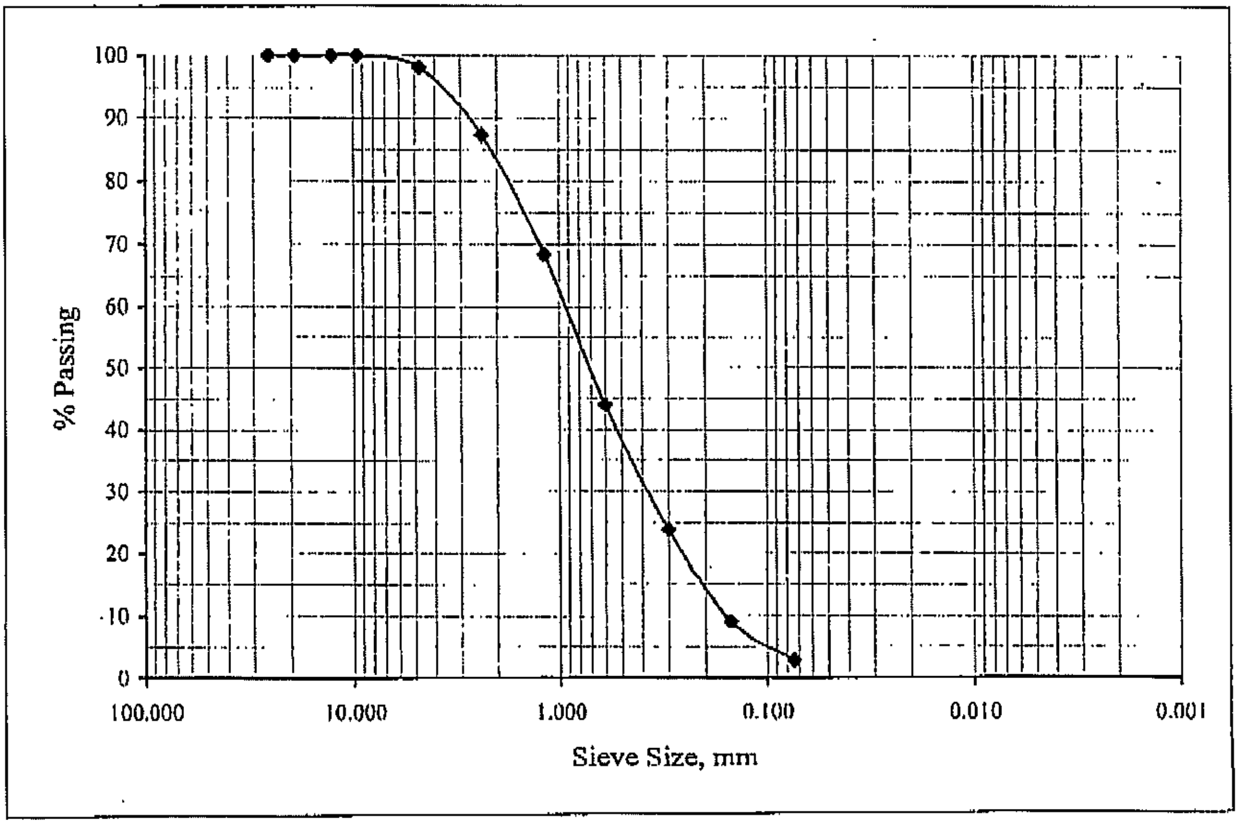
Project Number: 644-10019 September 10, 2010

Project Name: South Side Community Park

Lab ID Number: LN6-10339

Sample ID: BH-2 R-3 @ 15' 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	98.2
#8	2.36	87.4
#16	1.18	68.4
#30	0.60	44.0
#50	0.30	23.9
#100	0.15	9.0
#200	0.074	2.7



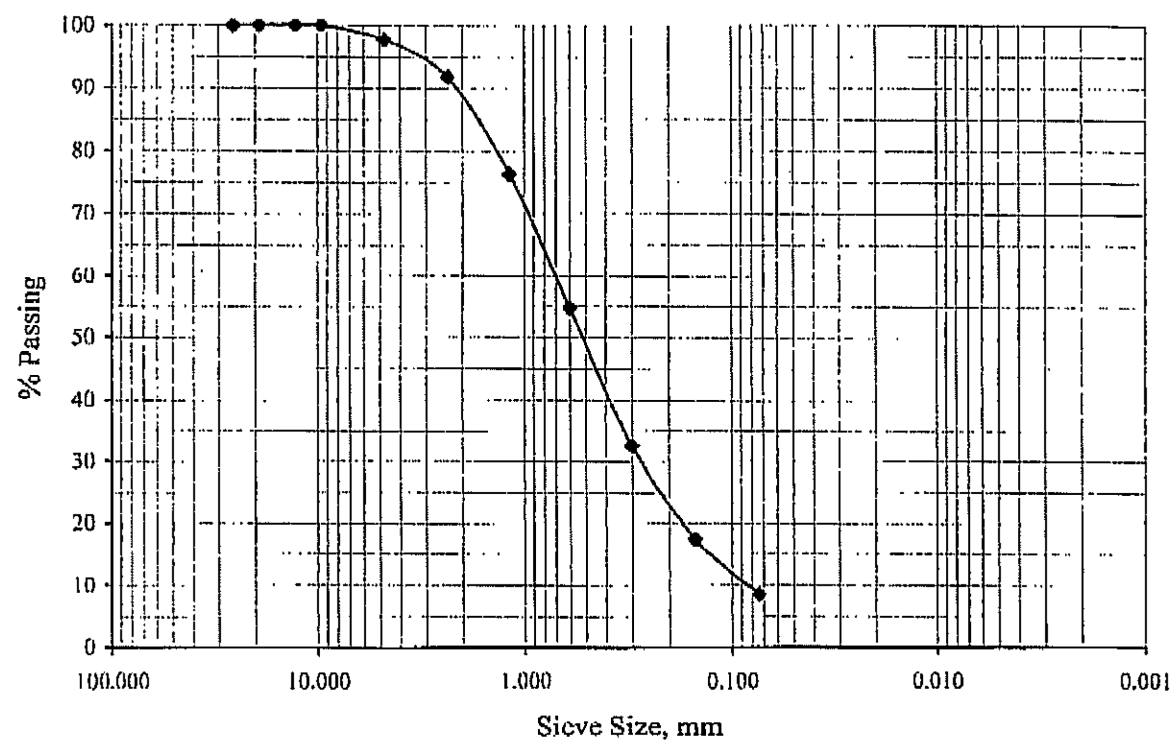
Sladden Engineering
450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863

Gradation

ASTM C117 & C136

Project Number: 644-10019 September 10, 2010
Project Name: South Side Community Park
Lab ID Number: LN6-10339
Sample ID: BH-4 R-1 @ 5' Soil Classification: SW-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	97.6
#8	2.36	91.7
#16	1.18	76.3
#30	0.60	54.7
#50	0.30	32.6
#100	0.15	17.5
#200	0.074	8.5



Sladden Engineering

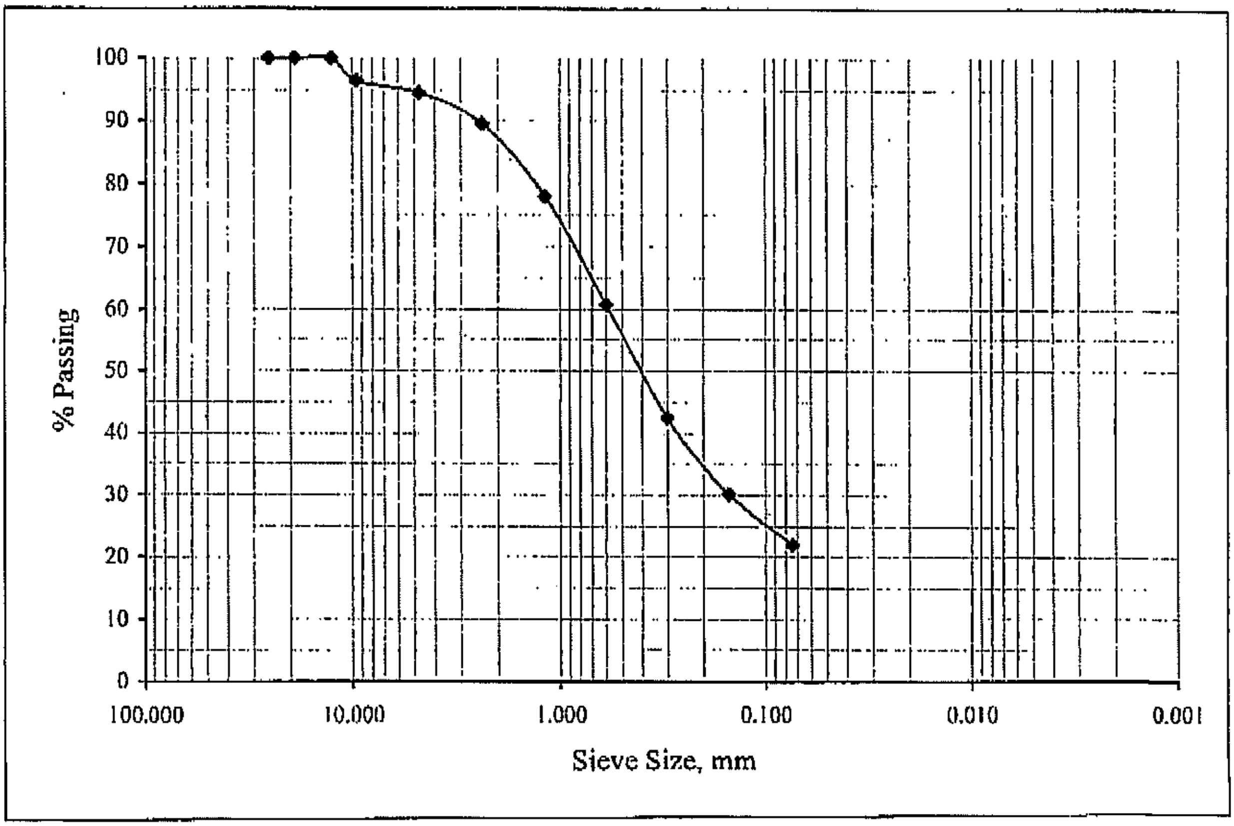
450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863

Gradation

ASTM C117 & C136

Project Number: 644-10019 September 10, 2010
Project Name: South Side Community Park
Lab ID Number: LN6-10339
Sample ID: BH-10 S-2 @ 10' Soil Classification: 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	96.4
#4	4.75	94.5
#8	2.36	89.6
#16	1.18	78.1
#30	0.60	60.8
#50	0.30	42.3
#100	0.15	30.1
#200	0.074	22.0



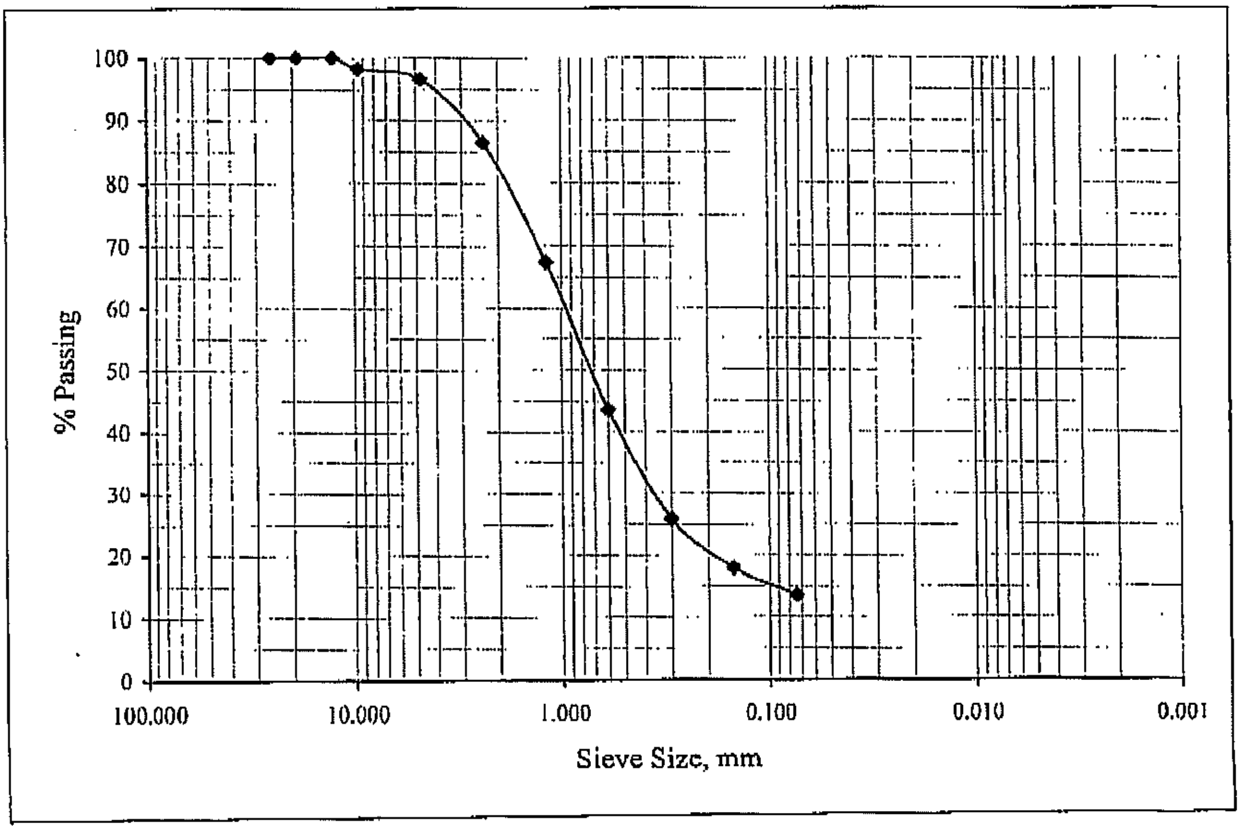
Sladden Engineering
450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863

Gradation

ASTM C117 & C136

Project Number: 644-10019 September 10, 2010
Project Name: South Side Community Park
Lab ID Number: LN6-10339
Sample ID: BH-11 S-2 @ 10' Soil Classification: 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	98.2
#4	4.75	96.6
#8	2.36	86.5
#16	1.18	67.4
#30	0.60	43.5
#50	0.30	25.8
#100	0.15	17.9
#200	0.074	13.6



Sladden Engineering
450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863

One Dimensional Consolidation

ASTM D2435 & D5333

Job Number: 644-10019 September 10, 2010
Job Name: South Side Community Park

Lab ID Number: LN6-10339
Sample ID: BH-4 R-1 @ 5'
Soil Description: Brown Sand w/Silt (SW-SM)

Initial Dry Density, pcf: 109.0
Initial Moisture, %: 2.7
Initial Void Ratio: 0.529
Specific Gravity: 2.67

Hydrocollapse: 0.6% @ 0.702 ksf

% Change in Height vs Normal Presssure Diagram