GEOTECHNICAL INVESTIGATION

PROPOSED JOSHUA TREE ESTATES

SEC EAST BROADWAY STREET & LAFERNEY AVENUE

APN 0605-051-01

JOSHUA TREE AREA

SAN BERNARDINO COUNTY, CALIFORNIA

-Prepared By-

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Project No. 544-22471
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Subject: Geotechnical Investigation

Project: Proposed Joshua Tree Estates
SEC East Broadway Street & Laferney Avenue
APN 0605-051-01
Joshua Tree Area
San Bernardino County, California

Sladden Engineering is pleased to present the results of the geotechnical investigation performed for the 32 lot residential development proposed for the subject parcel (APN 0605-051-01) located on the southeast corner of East Broadway Street and Laferney Avenue in the Joshua Tree area of San Bernardino County, California. Our services were completed in accordance with our proposal for geotechnical engineering services dated October 21, 2022 and your authorization to proceed with the work. The purpose of our investigation was to explore the subsurface conditions at the site to provide recommendations for foundation design and the design of the various site improvements. 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 32 lot residential subdivision proposed for the project site (APN 0605-051-01) located on the southeast corner of East Broadway Street and Laferney Avenue in the Joshua Tree area of San Bernardino County, California. The central portion of the site is located at approximately 34.1623 degrees north latitude and 116.2690 degrees west longitude. The approximate location of the site is indicated on the Site Location Map (Figure 1).

Our investigation was conducted 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

It is our understanding that the proposed project will consist of constructing a 32 lot residential development on the subject parcel. Each proposed residential lot will consist of approximately 2 acres. Concrete flatwork, landscape areas and various associated site improvements are also anticipated. Private on-site sewage disposal systems consisting of septic tanks and leach lines are proposed to serve each lot. For our analyses we expect that the proposed residential structures will consist of a relatively lightweight wood-frame structures supported on conventional shallow spread footings and concrete slabs on grade.

Sladden expects that grading will be limited to minor cuts and fills to accomplish the desired elevations and to provide adequate gradients for site drainage. This does not include the removal and re-compaction of the loose surface soil and primary foundation bearing soil within the proposed building pad areas. Upon completion of precise grading plans, Sladden should be retained in order to verify that the recommendations presented within in this report are properly 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 wood-frame 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 17 exploratory bores and 17 shallow percolation test holes to depths between approximately 5 and 26 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.
- Excavating 17 exploratory boreholes and 17 shallow percolation test holes to depths between approximately 5 and 26 feet bgs in order to characterize the surface 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 project site is located on the southeast corner of East Broadway Street and Laferney Avenue in the Joshua Tree area of San Bernardino County, California. The project site consists of a single parcel that is formally identified by the County of San Bernardino County as APN 0605-051-01. The parcel occupies approximately 80 acres of undeveloped land. Surface gradients descend to the northeast with elevations ranging from approximately 2,520 to 2,475 feet above mean sea level descending from southwest to northeast. A shallowly incised drainage course transects the site from approximately Lot 12 northeast to Lot 32. The site is near the elevation of the adjacent properties and roadways and is located at approximately 34.1623 degrees north latitude and 116.2690 degrees west longitude (Figure 1). The parcel is bounded by East Broadway Street to the north, Laferney Avenue to the west, Sunever Road to the east and undeveloped land to the immediate south.

Based on our review of the Joshua Tree North 7.5-Minute Quadrangle Map (USGS, 2018), the site is situated at elevations ranging from approximately 2,520 to 2,475 feet above mean sea level (MSL) from southwest to northeast, respectively.

No natural ponding of water or surface seeps were observed at or near the site during our investigations conducted on November 22, 2022 and December 15, 2022. Site drainage appears to be controlled via sheet flow, surface infiltration and through shallowly drainage courses transecting the site. No "blue line" streams are mapped on the property. The closest "blue line" stream is located approximately 2,000 feet to the northwest of the site.

GEOLOGIC SETTING

The site is located within the Transverse Ranges Geomorphic province. The Transverse Ranges are characterized by roughly east-west trending, convergent (north-south compressional) deformational structural features. The convergent deformational features of the Transverse Ranges are a result of north-south crustal shorting due to plate tectonics, locally folding and uplifting of the mountains and lowering of the intervening valleys, along with propagation of thrust faults (including blind thrusts) and in filling of the valley basins with sediments. The Transverse Ranges are considered to be one of the most rapidly rising orogenic regions on earth.

The site has been mapped by Dibblee (1967) to be immediately underlain by alluvium (Qa). 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 17 exploratory boreholes and 17 percolation test holes to depths between approximately 5 and 26 feet bgs. The approximate exploratory bore and test hole locations are illustrated on the Exploration Location Plan (Figure 3). The borehole were advanced using a truck mounted drill-rig (Mobile B-61) equipped with 8-inch outside diameter hollow stem augers. A representative of Sladden was on-site to log the materials encountered and retrieve samples for laboratory testing and engineering analyses.

During our field investigation, alluvium consisting of silty sand (SM) and sand (SW/SM) was encountered to a maximum explored depth of 26 feet bgs. Generally, the alluvial materials appeared yellowish brown to grayish brown, dry to slightly moist, loose to very dense, and fine- to coarse-grained with gravel.

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 during our field investigation. Information regarding the approximate depth to groundwater provided by the California Department of Water Resources online database indicates that the historic high depth to groundwater is in excess of 200 feet below the existing ground surface in the vicinity of the site. The following table provides a summary of the recorded groundwater depths in the project vicinity.

TABLE 1
GROUNDWATER DEPTHS

STATE WELL	LAT/LONG	DISTANCE (KM)	DATE	DEPTH (FT)
01N07E17Q001S	34.165/-116.2736	0.50	05/03/1994	Dry Well
01N07E16P001S	34.1656/-116.2578	1.10	04/20/1968	262.7
01N07E21Q001S	34.1506/ -116.2528	1.98	04/16/1947	286.9
01N07E20P002S	34.1524/-116.2738	1.20	05/11/2006	375
01N07E21J001S	34.1539/-116.25	2.00	04/25/1956	258.7
01N07E22E001S	34.1572/-116.2475	2.05	03/27/1958	259.08

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), M7.1 Hector Mine (1999) and 7.1 Ridgecrest (2019).

Table 2 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), Southern Earthquake Data Center (SCEDC, 2023) and the Quaternary Fault and Fold Database of the United States (USGS, 2023a). 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 2
CLOSEST KNOWN ACTIVE FAULTS

Fault Name	Distance (Km)	Maximum Event
Pinto Mountain	2.0	7.27*
Emerson So. Copper Mountain	5.1	7.0
Eureka Peak	12.2	6.7
Burnt Mountain	13.3	6.7
Landers	13.6	7.3
Pisgah – Bullion Mtn. – Mesquite Lk	18.9	7.3
Calico – Hidalgo	21.8	7.3
Johnson Valley (Northern)	23.8	6.7
North Frontal Fault Zone (East)	26.4	6.7
San Andreas – Southern	32.5	7.5
San Andreas – Coachella	32.5	7.5
San Andreas – San Bernardino	32.7	7.5

*USGS Earthquake Scenario Map (BSSC 2014)

SITE SPECIFIC GROUND MOTION PARAMETERS

Sladden has reviewed the 2023 California Building Code (CBC) and ASCE7-16 and developed site specific ground motion parameters for the subject site. The project site-specific ground motion parameters are summarized in the following table and included within Appendix C. The project Structural Engineer should verify that all design parameters provided are applicable for the subject project.

TABLE 3
GROUND MOTION PARAMETERS

Latitude / Longitude	34.1623/-116.2690
Risk Category	II
Site Class	D
Code Reference Documents	ASCE 7-16; Chapter 11 & 21

Description	Type	Map Based	Site-Specific
MCE_R Ground Motion (0.2 second period)	S_S	1.96	---
MCE_R Ground Motion (1.0 second period)	S_1	0.714	---
Site-Modified Spectral Acceleration Value	S_{MS}	1.96	**2.266**
Site-Modified Spectral Acceleration Value	S_{M1}	null	**1.788**
Numeric Seismic Design Value at 0.2 second SA	S_{DS}	1.307	**1.511**
Numeric Seismic Design Value at 1.0 second SA	S_{D1}	null	**1.192**
Site Amplification Factor at 0.2 second	F_a	1	**1**
Site Amplification Factor at 1.0 second	F_v	null	**2.5**
Site Peak Ground Acceleration	PGA_M	0.929	**0.858**

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 Dibblee (1967), Jennings (1994), and CDMG (1998), known faults are not mapped on or projecting towards the site. The subject parcel is not located in a State of California delineated fault zone (Figure 4). 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 Earth, 2023). Finally, no signs of active surface fault rupture or secondary seismic effects (lateral spreading, lurching etc.) were identified 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. The site modified peak ground acceleration is estimated to be 0.858g.

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.

Based on the depth to groundwater in the project vicinity, risks associated with liquefaction are 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 is considered "negligible".

V. Slope Failure, Land Sliding, 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 located on relatively level ground and not immediately adjacent to any hillsides. Based on our field observations of the site vicinity, risks associated with slope instability should be considered "negligible".

VI. Expansive Soil. Generally, the surface soil consists of silty sand (SM) and sand (SW/SM). Based on the results of our laboratory testing (EI=0), the materials underlying the site are considered to have a "negligible" expansion potential.

VII. Static Settlement. Static 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 ultimate static settlement is expected to be less than 1 inch when using the recommended allowable bearing pressures. As a practical matter, differential static 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.

Locally, no fissures or other surficial evidence of subsidence were observed at or near the subject site. The potential for subsidence related settlement is considered "negligible".

IX. 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) (Boggs, 2001). Based on the flat nature of the site and the composition of the surface soil, we judge that the risks associated with debris flows should be considered "negligible".

X. Flooding and Erosion. No signs of flooding or erosion were observed during our field investigation. Risks associated with 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 included in this report are incorporated into design and carried out through construction. The main geotechnical concern is the presence of loose and potentially compressible native surface soil throughout the project site.

We recommend remedial work within the proposed new building areas including over-excavation and re-compaction of the primary foundation bearing soil. Specific recommendations for foundation area 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. Based on our observations of the materials encountered, we anticipate that the subsoil will conform to that described by CalOSHA as Type 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 based on our field and laboratory investigation.

EARTHWORK AND GRADING

All earthwork including excavation, backfill and preparation of the primary foundation and/or slab bearing soil should be performed in accordance with the geotechnical recommendations presented in this report and portions of the local regulatory requirements, as applicable. All earth work 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. Site Clearing: Areas to be graded should be cleared of any existing vegetation, root systems and debris. All areas scheduled to receive fill should be cleared of old fills and any irreducible matter. The unsuitable materials should be removed off site. Voids left by obstructions should be properly backfilled in accordance with the compaction recommendations of this report.

b. Preparation of Building Areas: To provide firm and uniform foundation bearing conditions, we recommend over-excavation and re-compaction throughout the proposed building areas. All artificial fill soil and low density near surface native soil should be removed to a depth of approximately 3 feet below existing grade or 2 feet below the bottom of the footings, whichever is deeper. Remedial grading should extend laterally a minimum of five feet beyond the building perimeter. The native soil exposed by over-excavation should be scarified, moisture conditioned to near optimum moisture content and compacted to at least 90 percent relative compaction prior to fill placement. The previously removed soil may then be replaced as engineered fill as recommended below.

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 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 soil and all fill material should be compacted with acceptable compaction equipment to at least 90 percent relative compaction. The exposed subgrade soil 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 4 provides a summary of the excavation and compaction recommendations.

TABLE 4
SUMMARY OF RECOMMENDATIONS

*Remedial Grading	Over-excavation and re-compaction within the building envelopes and extending laterally 5 feet beyond the building limits and to a minimum depth of 3 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 a loose condition, 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 between 1 tenth 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.

CONVENTIONAL SHALLOW SPREAD FOOTINGS

Conventional shallow spread footings are expected to provide adequate support for the proposed residential structures. All footings should be founded upon properly compacted engineered fill soil and should have a minimum embedment depth of 12 inches measured from the lowest adjacent finished grade. Continuous and isolated pad footings should have minimum widths of 12 inches and 24 inches, respectively. Continuous and isolated pad footings supported upon properly compacted engineered fill soil may be designed using allowable bearing pressures of 1800 and 2000 pounds per square foot (psf), respectively. Allowable increases of 200 psf for each additional 1 foot of width and 250 psf for each additional 6 inches of depth may be used if desired. The maximum allowable bearing pressure should be 2500 psf. The allowable bearing pressures apply 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.

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

Lateral load resistance for the shallow 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 250 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 envelope or in areas of exterior concrete flatwork. All footings should be reinforced in accordance with the project Structural Engineer's recommendations.

SLABS-ON-GRADE

To provide uniform and adequate support, concrete slabs-on-grade must be placed on properly compacted engineered fill soil 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 subgrades should be firm and unyielding. Loose and/or 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 and minimum reinforcement of #3 bars at 24 inches on center in both directions. All slab reinforcement should be supported on concrete chairs to ensure that reinforcement is placed at slab mid-height. Final floor slab design and reinforcement should be determined by the Structural Engineer.

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 thin leveling course of sand across the pad surface prior to placement of the membrane.

RETAINING WALLS

Minor retaining walls may be required to accomplish the proposed construction. Cantilever retaining walls may be designed using "active" pressures. Active pressures may be estimated using an equivalent fluid weight of 35 pcf for gently sloping (less than 3H:1V) native backfill soil acting in a triangular pressure distribution with drained backfill conditions. For steeper slopes, an active equivalent fluid pressure of 55 pcf should be used. "At Rest" pressures should be utilized for restrained walls. At rest pressures may be estimated using an equivalent fluid weight of 55 pcf for native backfill soil with level drained backfill conditions. At rest pressures should be increased to 75 pcf for sloped backfill conditions.

We recommend that a back drain system be provided behind all retaining walls or that the walls be designed for full hydrostatic pressures. The back drains should consist of a heavy walled, four inch diameter, perforated pipe sloped to drain to outlets by gravity, and of clean, free-draining, three-quarter to one and one-half inch crushed rock or gravel. The crushed rock or gravel should extend to within one foot of the surface. The upper one foot should be backfilled with compacted, fine-grained soil to exclude surface water. A Mirafi 140N (or equivalent) filter cloth should be placed between the on-site native material and the drain rock.

We recommend that the ground surface behind retaining walls be sloped to drain. Under no circumstances should the surface water be diverted into back drains. Where migration of moisture through walls would be detrimental, the walls should be waterproofed.

CORROSION SERIES

The soluble sulfate concentrations of the surface soil were determined to be 80 parts per million (ppm). The soil is considered to have a "negligible- S0" corrosion potential with respect to concrete. The use of Type V cement and special sulfate resistant concrete mixes should not be necessary.

The pH levels of the surface soil was determined to be 8.7. Based on soluble chloride concentration testing (30 ppm) the soil is considered to have a "negligible - C0" corrosion potential with respect to normal grade steel. The minimum resistivity of the surface soil was found to be 7,900 ohm-cm, that suggests the site soil is considered to have a "low" corrosion potential with respect to ferrous metal installations. A corrosion expert should be consulted regarding appropriate corrosion protection measures for corrosion sensitive installations.

PRELIMINARY PAVEMENT DESIGN

Asphalt concrete pavements should be designed in accordance with Topic 610 of the Caltrans Highway Design Manual based on R-Value and Traffic Index. The R-Value of the near surface soil is expected to be in excess of 60. On-site soil and any imported soil should be tested after grading for R-Value prior to establishing final pavement design sections. For on-site pavement design, a Traffic Index (TI) of 6.5 was used in design. We recommend a pavement section of 3.0 inches of asphalt concrete (AC) over 4.0 inches of Class II Aggregate Base (AB).

Asphalt concrete should conform to applicable sections of the latest editions of the Standard Specifications for Public Works Construction (Greenbook) or Caltrans Standard Specifications. Aggregate base material should conform to Section 26 of the Caltrans Standard Specifications or Greenbook, latest edition. Subgrade should be compacted to at least 90 percent relative compaction and aggregate base material should be compacted to at least 95 percent of the maximum dry density as determined by ASTM Test Method D 1557.

UTILITY TRENCH BACKFILL

All utility trench backfill should be compacted to a minimum of 90 percent relative compaction. Trench backfill materials should be placed in lifts no greater than six inches in a loose condition, moisture conditioned (or air-dried) as necessary to achieve near optimum moisture content, and mechanically compacted in place to a minimum of 90 percent relative compaction. 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 of 90 percent relative compaction. 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. Site 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 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 extend into the properly compacted 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 fill soil and 95 percent for Class II aggregate base as obtained by ASTM Test Method D1557. Where testing indicates insufficient density, additional compactive effort shall be applied until retesting indicates satisfactory compaction.

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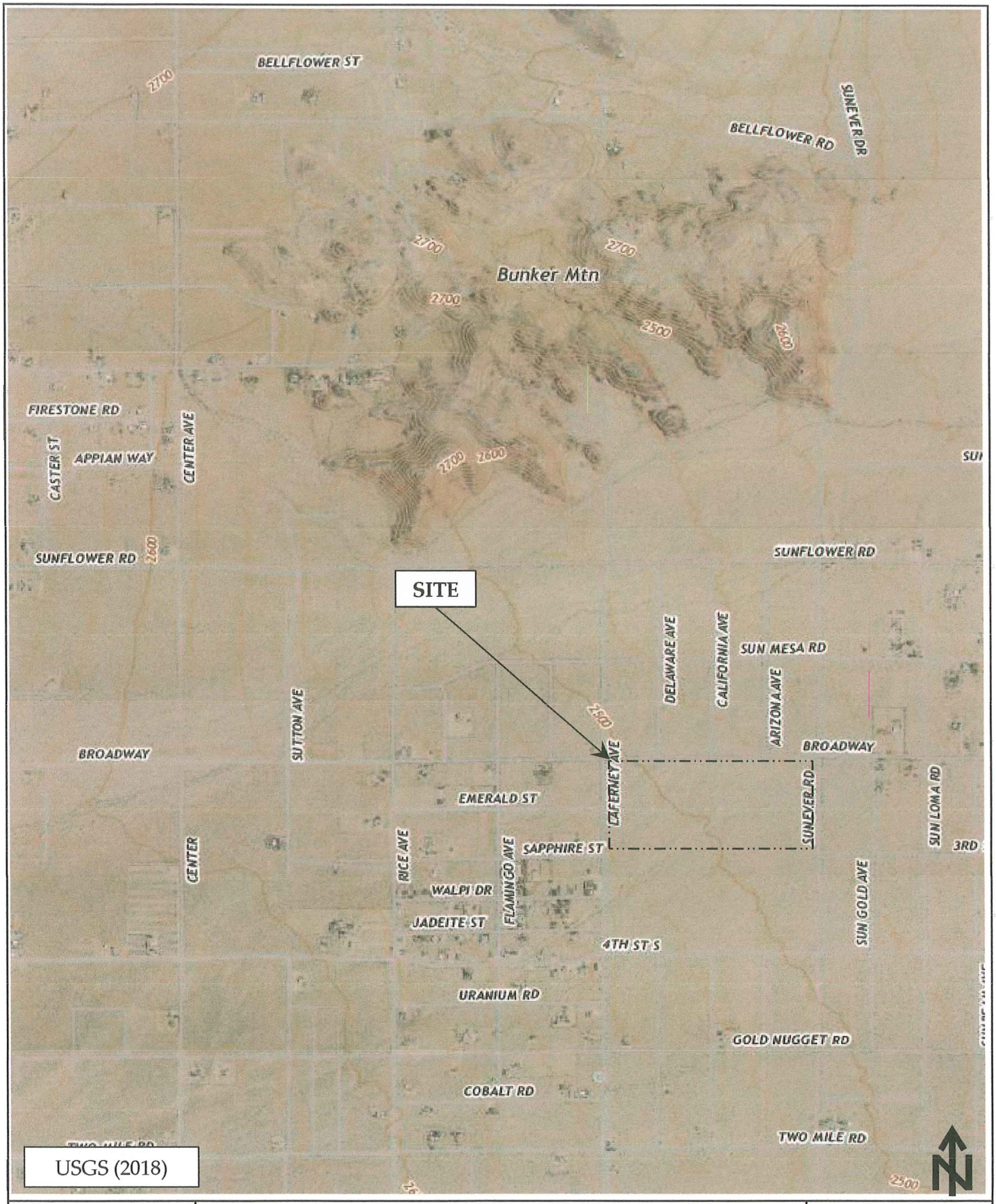
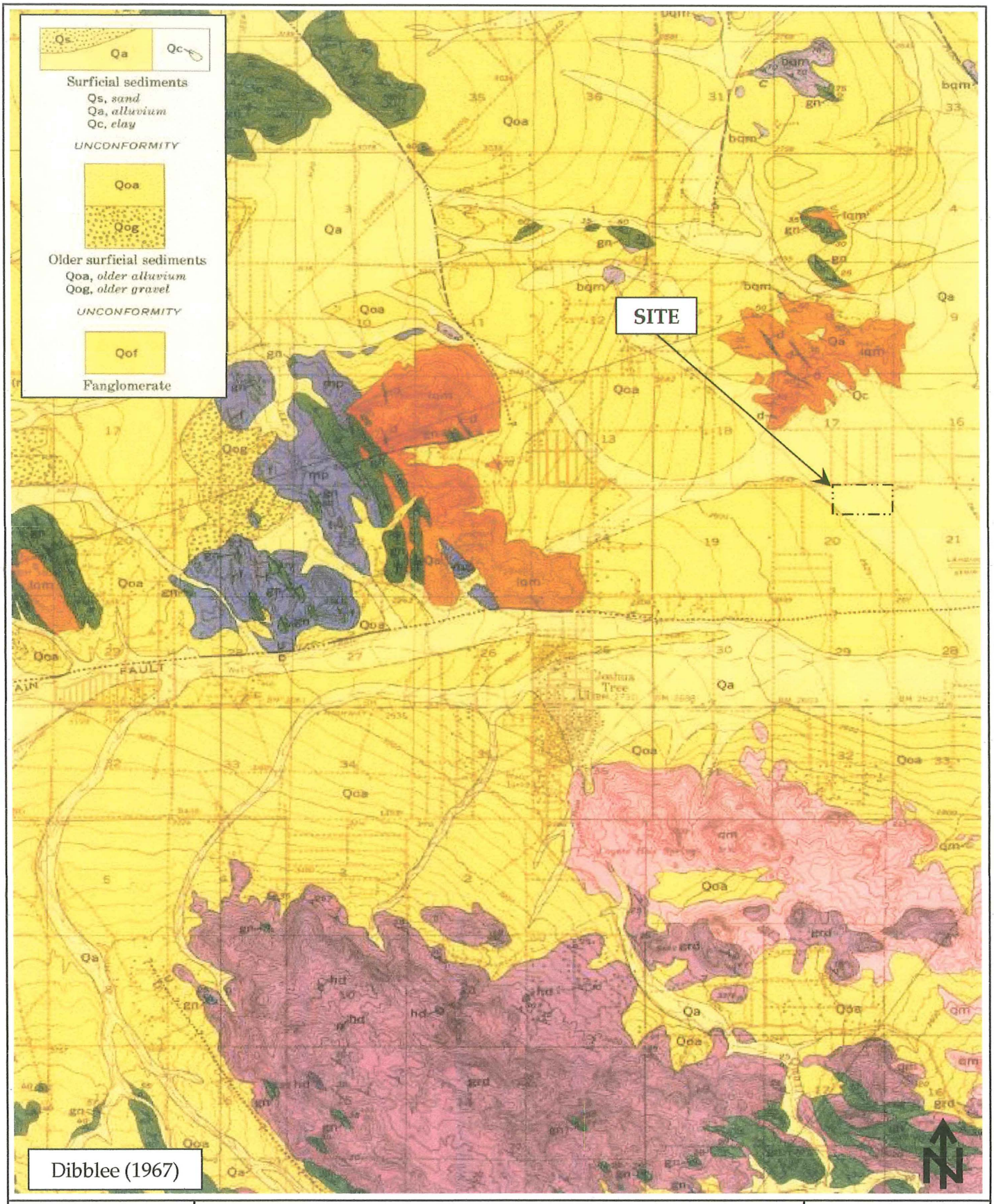
FIGURES

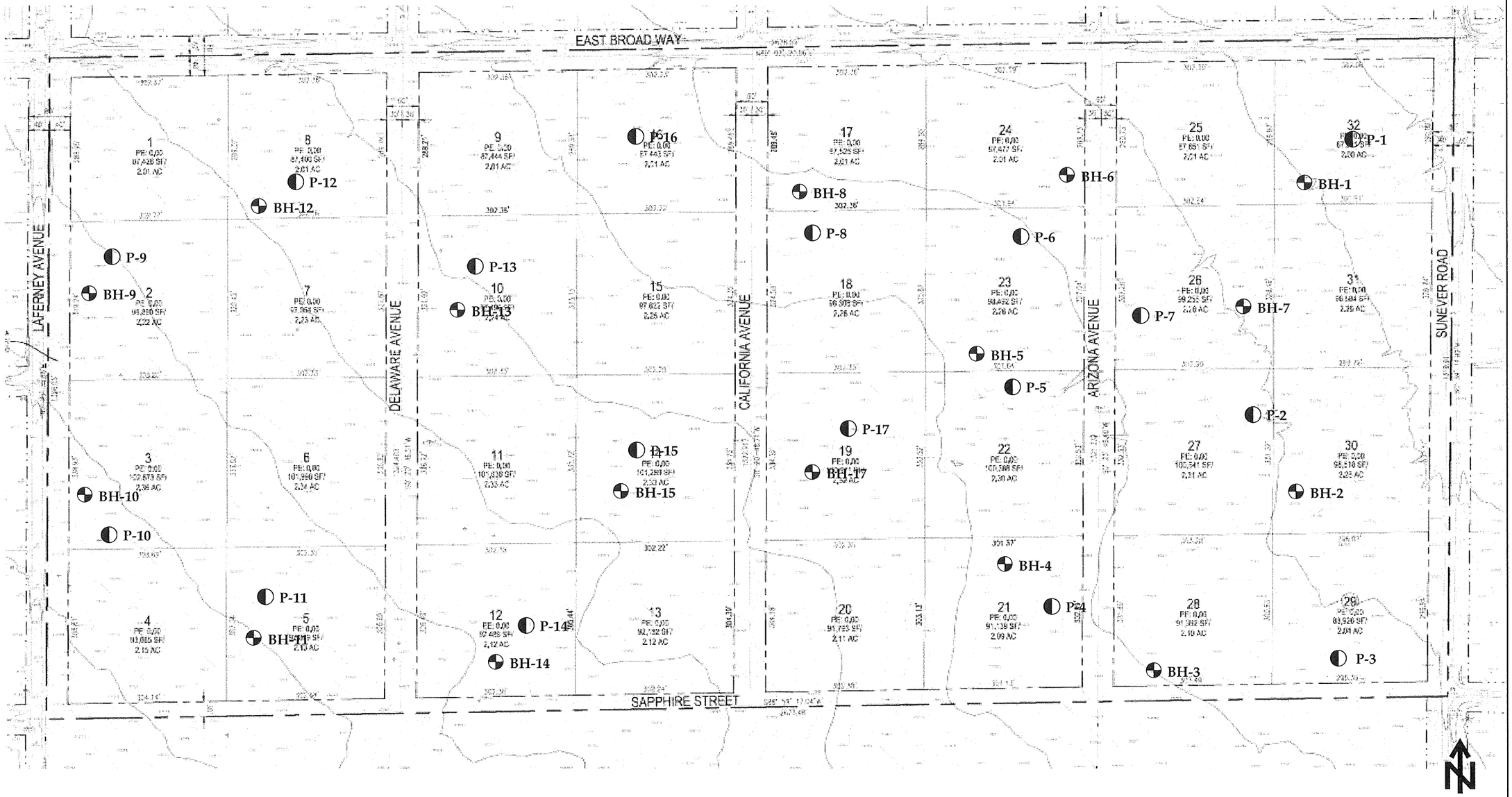
SITE LOCATION MAP
REGIONAL GEOLOGIC MAP
EXPLORATION LOCATION PLAN
FAULT ZONE MAP



Sladden Engineering	SITE LOCATION MAP	FIGURE 1
	Project Number: 544-22471	
	Report Number: 23-01-005	
	Date: January 5, 2023	



	REGIONAL GEOLOGIC MAP	FIGURE
Sladden Engineering		2
	Project Number:	544-22471
	Report Number:	23-01-005
	Date:	January 5, 2023



LEGEND

BH-17	Borehole Location
P-17	Percolation Test Location

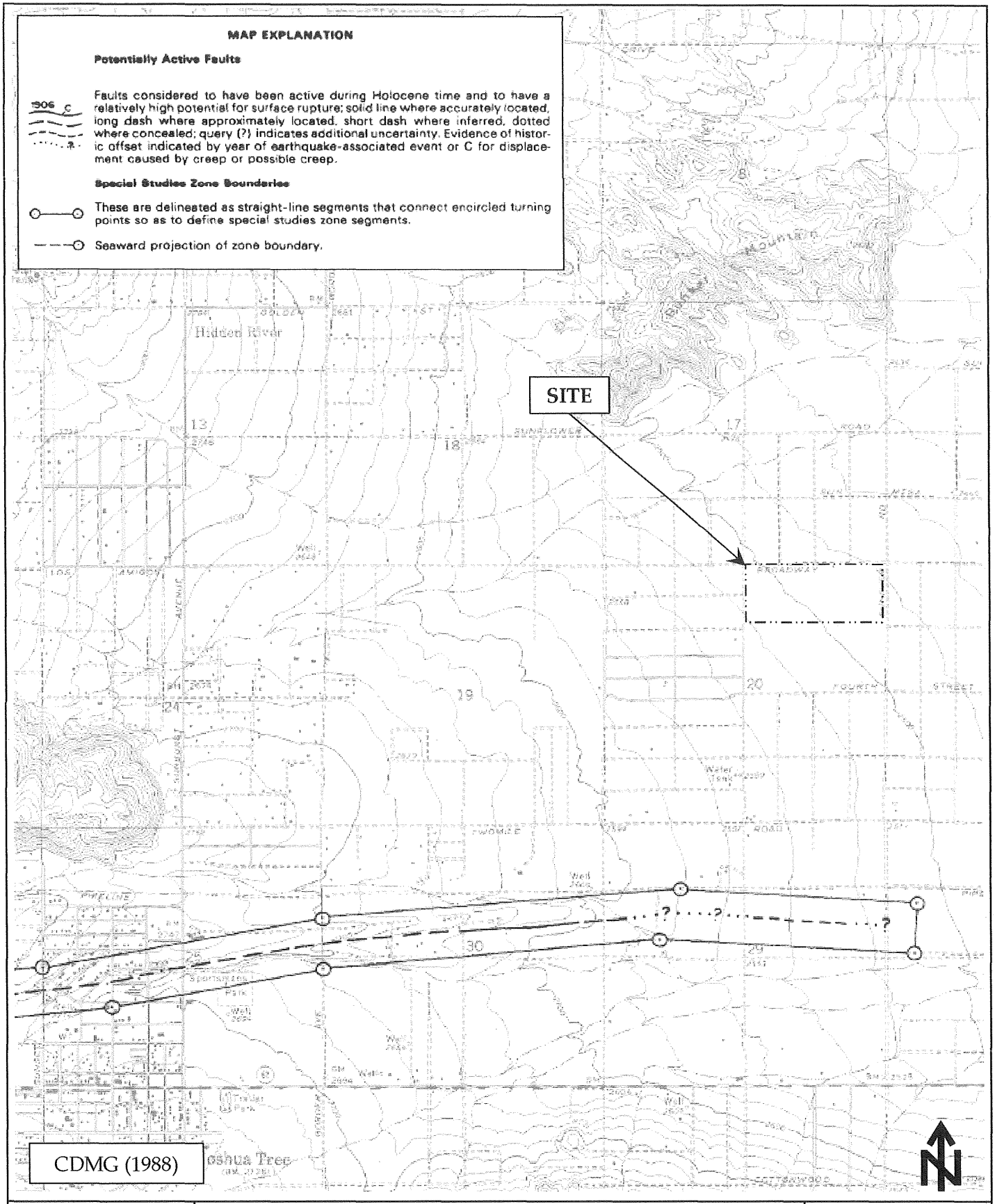
Sladden Engineering

EXPLORATION LOCATION PLAN

Project Number:	544-22471
Report Number:	23-01-005
Date:	January 5, 2023

FIGURE

3



FAULT ZONE MAP

FIGURE 4

Project Number:	544-22471
Report Number:	23-01-005
Date:	January 5, 2023

Sladden Engineering

APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

For our field investigation 17 exploratory bores and 17 percolation test holes were excavated on November 22, 2022 and December 15, 2022 utilizing a truck mounted drill-rig (Mobile B-61) equipped with 8-inch outside diameter (O.D.) hollow stem augers and a track-mounted excavator equipped with a 24-inch wide bucket and solid stem auger attachment. 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 that is presented in this appendix.

Representative undisturbed samples were obtained within our bores 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 gradual.

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-1

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
■	7 11 15	1	0	14.0	1.0	114.2	2		Silty Sand (SM); yellowish brown, dry, medium dense, fine- to coarse-grained with gravel (Qa).
■	10 12 13			14.8	1.2	108.1	6		Silty Sand (SM); yellowish brown, dry, medium dense, fine- to coarse-grained with gravel (Qa).
■	4 5 6			9.9	1.2		10		Sand (SW); yellowish brown, dry, medium dense, fine- to coarse-grained (Qa).
■	16 29 38			6.5	0.6	117.2	16		Sand (SW); yellowish brown, dry, dense, fine- to coarse-grained (Qa).
■	6 9 15			17.7	1.9		20		Silty Sand (SM); yellowish brown, dry, medium dense, fine- to coarse-grained with gravel (Qa).
■	27 43 55			3.2	0.5		26		Sand (SW); yellowish brown, dry, very dense, fine- to coarse-grained with calcium carbonate stringers (Qa).
							28		Terminated at ~26.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							50		

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-2

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM); yellowish brown, dry, fine- to coarse-grained with gravel (Qa).
	5 6 7			19.3	1.7		6		Silty Sand (SM); yellowish brown, dry, medium dense, fine- to coarse-grained (Qa).
	6 14 18			14.4	1.0	108.9	10		Silty Sand (SM); yellowish brown, dry, medium dense, fine- to coarse-grained with gravel (Qa).
	12 14 14			6.5	1.0		16		Sand (SW); yellowish brown, dry, medium dense, fine- to coarse-grained (Qa).
							18		Terminated at ~16.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							20		
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-3

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM); yellowish brown, dry, fine- to coarse-grained with gravel (Qa).
	6 7 8			2.4	0.3		6		Sand (SW); yellowish brown, dry, loose, fine- to coarse-grained with gravel (Qa).
	9 11 21			7.1	1.5		10		Sand (SW); yellowish brown, dry, dense, fine- to coarse-grained with gravel (Qa).
	12 26 34			5.6	0.9	115.9	16		Sand (SW); yellowish brown, dry, dense, fine- to coarse-grained with gravel (Qa).
	16 18 20			8.7	1.4		20		Sand (SW); yellowish brown, dry, dense, fine- to coarse-grained with gravel (Qa).
							22		Terminated at ~21.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-4

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM); yellowish brown, dry, fine- to coarse-grained with gravel (Qa).
	3 4 4			13.9	2.3		6		Silty Sand (SM); yellowish brown, dry, loose, fine- to coarse-grained with gravel (Qa).
	5 11 16			7.1	0.9	107.5	10		Sand (SW); yellowish brown, dry, medium dense, fine- to coarse-grained (Qa).
							12		Terminated at ~11.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-5

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM); yellowish brown, dry, fine- to coarse-grained with gravel (Qa).
	12 20 22			4.8	0.6		6		Sand (SW); yellowish brown to grayish brown, dry, medium dense, fine- to coarse-grained with gravel (Qa).
	5 6 8			9.5	1.0		10		Sand (SW); yellowish brown to grayish brown, dry, medium dense, fine- to coarse-grained with gravel (Qa).
	8 11 28			2.5	0.3		16		Sand (SW); yellowish brown, dry, medium dense, fine- to coarse-grained with gravel (Qa).
	9 11 14			5.6	0.8		20		Sand (SW); yellowish brown, dry, medium dense, fine- to coarse-grained with gravel (Qa).
	19 33 29			3.5	0.4		26		Sand (SW); yellowish brown, dry, medium dense, fine- to coarse-grained with gravel (Qa).
							28		Terminated at ~26.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-6

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							0–10		Silty Sand (SM); yellowish brown, dry, fine- to coarse-grained with gravel (Qa).
■	12 17 24			17.4	1.1	112.3	6		Silty Sand (SM); yellowish brown, dry, medium dense, fine- to coarse-grained with gravel (Qa).
■	7 9 12			6.9	0.9		10–14		Sand (SP); yellowish brown, dry, medium dense, fine- to coarse-grained (Qa).
■	12 16 21			4.0	0.4	115.0	16		Sand (SP); yellowish brown, dry, medium dense, fine- to coarse-grained (Qa).
							18–50		Terminated at ~16.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-7

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM); yellowish brown, dry, fine- to coarse-grained with gravel (Qa).
	5 6 8			8.4	0.8		6		Sand (SP); grayish brown, dry, medium dense, fine- to coarse-grained (Qa).
	10 14 17			14.2	1.0	121.0	10		Silty Sand (SM); yellowish brown, dry, medium dense, fine- to coarse-grained with gravel (Qa).
	10 16 18			5.6	0.6		16		Sand (SP); grayish brown to yellowish brown, dry, dense, fine- to coarse-grained with gravel (Qa).
	16 22 27			5.4	0.4	111.1	20		Sand (SP); grayish brown to yellowish brown, dry, dense, fine- to coarse-grained with gravel (Qa).
							22		Terminated at ~16.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-8

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM); yellowish brown, dry, fine- to coarse-grained with gravel (Qa).
	13 26 23			6.7	0.4	121.9	6		Sand (SP); yellowish brown to grayish brown, dry, dense, fine- to coarse-grained (Qa).
	4 8 9			10.1	1.0		10		Sand (SW); grayish brown, dry, medium dense, fine- to coarse-grained with gravel (Qa).
							12		
							14		Terminated at ~11.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							16		
							18		
							20		
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-9

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		
							8		Terminated at ~7.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							10		
							12		
							14		
							16		
							18		
							20		
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-10

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		
							8		Terminated at ~7.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							10		
							12		
							14		
							16		
							18		
							20		
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-11

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2, 4, 6, 8		Silty Sand (SM) to Sand (SP); yellowish brown, dry, fine- to coarse-grained with gravel (Qa).
							10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50		Terminated at ~8.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-12

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Sand (SP); grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		
							8		
							10		Terminated at ~8.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							12		
							14		
							16		
							18		
							20		
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-13

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2, 4, 6, 8		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50		Terminated at ~8.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-14

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained (Qa).
							4		
							6		
							8		
							10		Terminated at ~9.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							12		
							14		
							16		
							18		
							20		
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-15

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2, 4, 6, 8		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50		Terminated at ~8.5 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-16

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		
							8		Terminated at ~6.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							10		
							12		
							14		
							16		
							18		
							20		
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	BH-17

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		
							8		Terminated at ~7.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							10		
							12		
							14		
							16		
							18		
							20		
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-1

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							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 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-2

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							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 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-3

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							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 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-4

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							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 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-5

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							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 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-6

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							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 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-7

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							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 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	CME-75	Date Drilled:	11/22/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-8

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							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 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-9

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							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 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-10

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-11

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							8		
							10		
							12		
							14		
							16		
							18		
							20		
							22		
							24		
							26		
							28		
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							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-12

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							8		
							10		
							12		
							14		
							16		
							18		
							20		
							22		
							24		
							26		
							28		
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							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-13

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							8		
							10		
							12		
							14		
							16		
							18		
							20		
							22		
							24		
							26		
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							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471

Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-14

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							8		
							10		
							12		
							14		
							16		
							18		
							20		
							22		
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							28		
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							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-15

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							8		
							10		
							12		
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							18		
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							22		
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							26		
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							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-16

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							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 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

Sladden Engineering

BORE LOG

Equipment:	John Deere 30	Date Drilled:	12/15/2022
Elevation:	2,500 Ft. MSL	Boring No:	P-17

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM) to Sand (SP); yellowish brown to grayish brown, dry, fine- to coarse-grained with gravel (Qa).
							4		
							6		Terminated at ~5.0 Feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered. Cased to Facilitate Percolation Testing.
							8		
							10		
							12		
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							16		
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							32		
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							36		
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							40		
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							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED 32 LOT RESIDENTIAL DEVELOPMENT
EAST BROADWAY STREET, JOSHUA TREE AREA

Project No: 544-22471
Report No: 23-01-005

APPENDIX B

LABORATORY TESTING

APPENDIX B

LABORATORY TESTING

Representative bulk 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

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, 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.

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.

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

Maximum Density/Optimum Moisture

ASTM D698/D1557

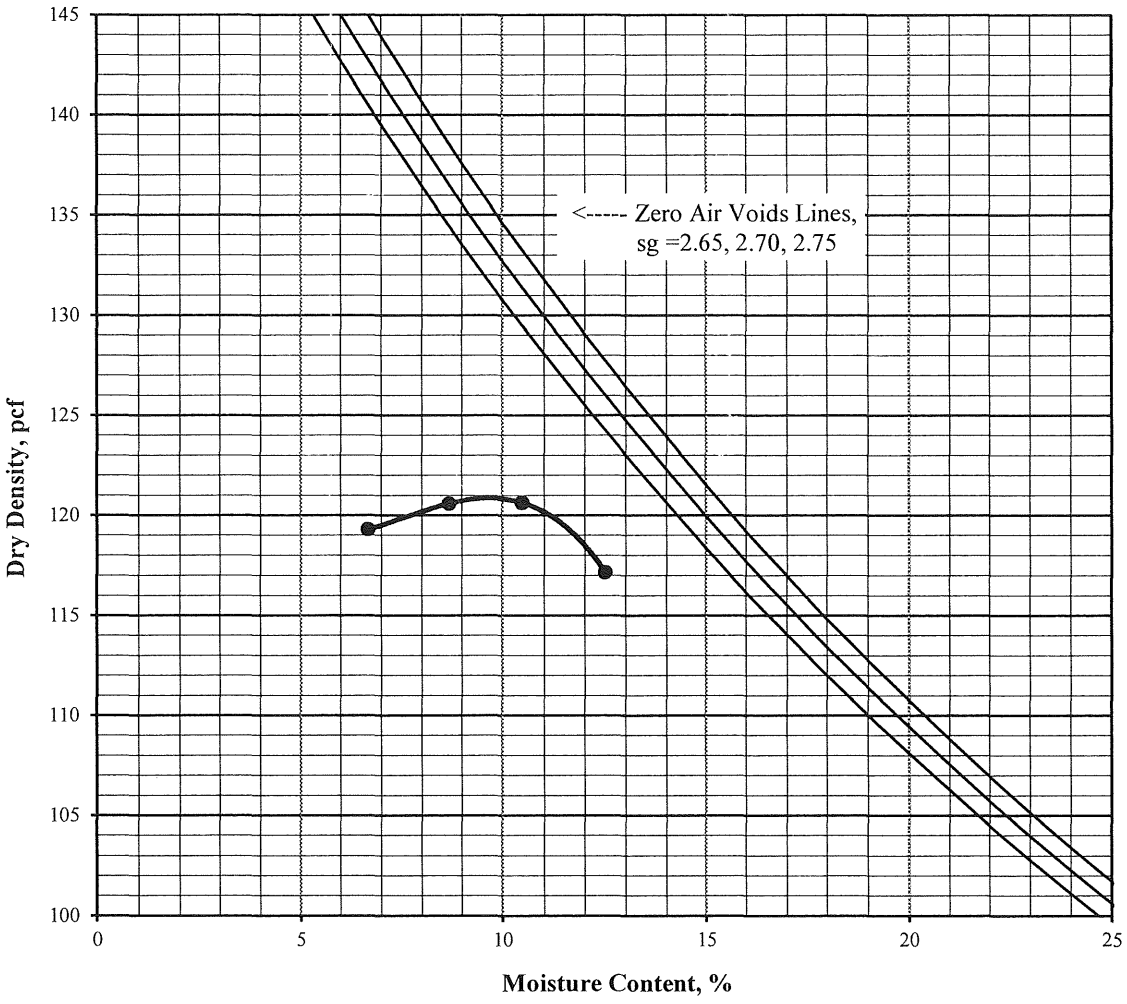
Project Number: 544-22471
Project Name: East Broadway
Lab ID Number: LN6-22566
Sample Location: BH-1 Bulk 1 @ 0-5'
Description: Brown Sand w/Silt (SW-SM)

December 30, 2022

ASTM D-1557 A
Rammer Type: Machine

Maximum Density: 121 pcf
Optimum Moisture: 10%

Sieve Size	% Retained
3/4"	
3/8"	
#4	1.6



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Expansion Index

ASTM D 4829

Job Number: 544-22471

Job Name: East Broadway

Lab ID Number: LN6-22566

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

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

December 30, 2022

Wt of Soil + Ring:	577.6
Weight of Ring:	188.6
Wt of Wet Soil:	389.0
Percent Moisture:	8.9%
Sample Height, in	0.95
Wet Density, pcf:	124.5
Dry Denstiy, pcf:	114.3

% Saturation:	50.7

Expansion **Rack # 3**

Date/Time	12/23/2022	10:50 AM
Initial Reading	0.0000	
Final Reading	0.0002	

Expansion Index **0**

(Final - Initial) x 1000

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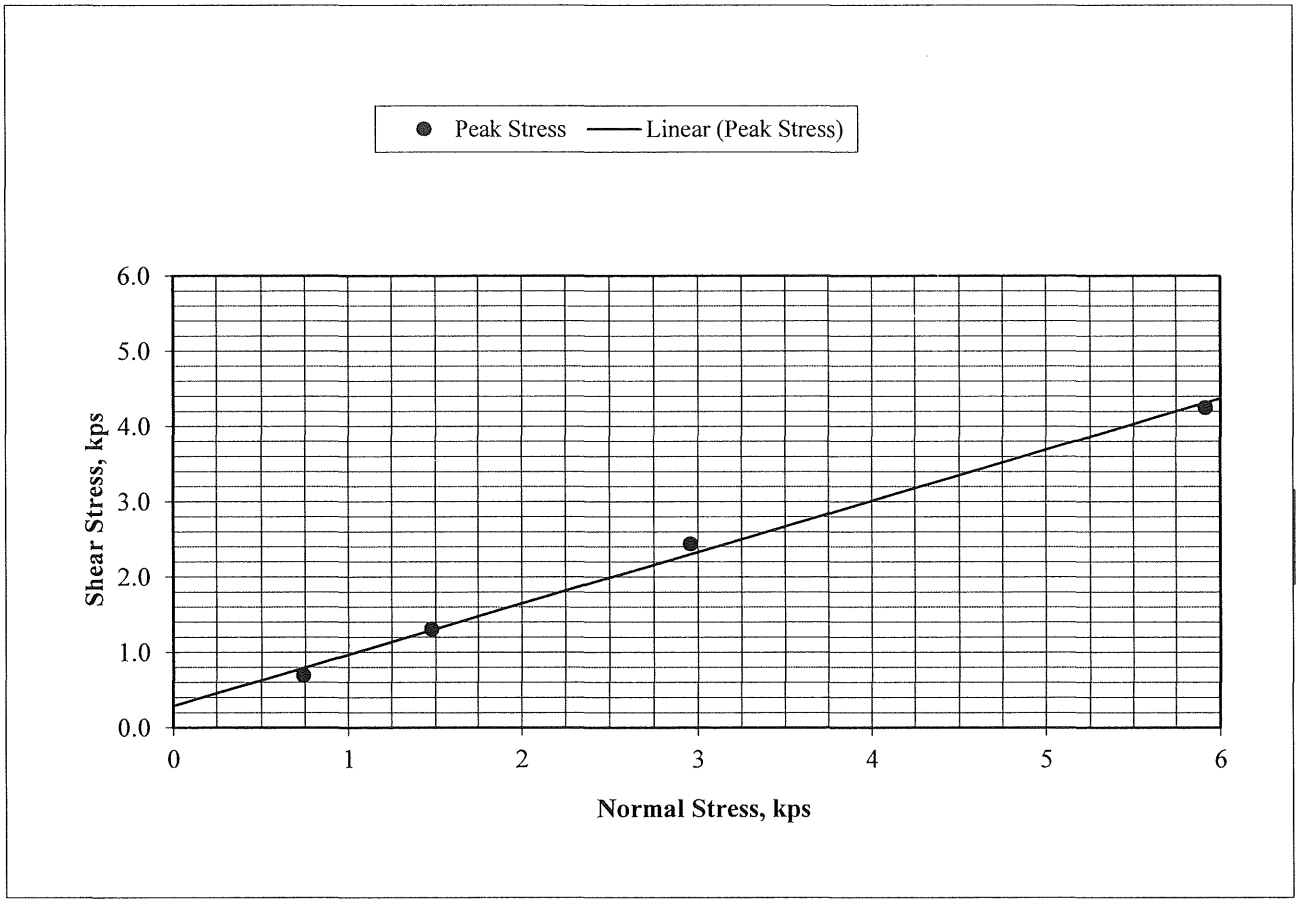
Direct Shear ASTM D 3080-04
(modified for unconsolidated condition)

Job Number:	544-22471		December 30, 2022
Job Name	East Broadway	Initial Dry Density:	109.0 pcf
Lab ID No.	LN6-22566	Initial Mosture Content:	10.1 %
Sample ID	BH-1 Bulk 1 @ 0-5'	Peak Friction Angle (Ø):	34°
Classification	Brown Sand w/Silt (SW-SM)	Cohesion (c):	290 psf
Sample Type	Remolded @ 90% of Maximum Density		

Test Results	1	2	3	4	Average
Moisture Content, %	14.6	14.6	14.6	14.6	14.6
Saturation, %	72.2	72.2	72.2	72.2	72.2
Normal Stress, kps	0.739	1.479	2.958	5.916	
Peak Stress, kps	0.698	1.308	2.442	4.251	



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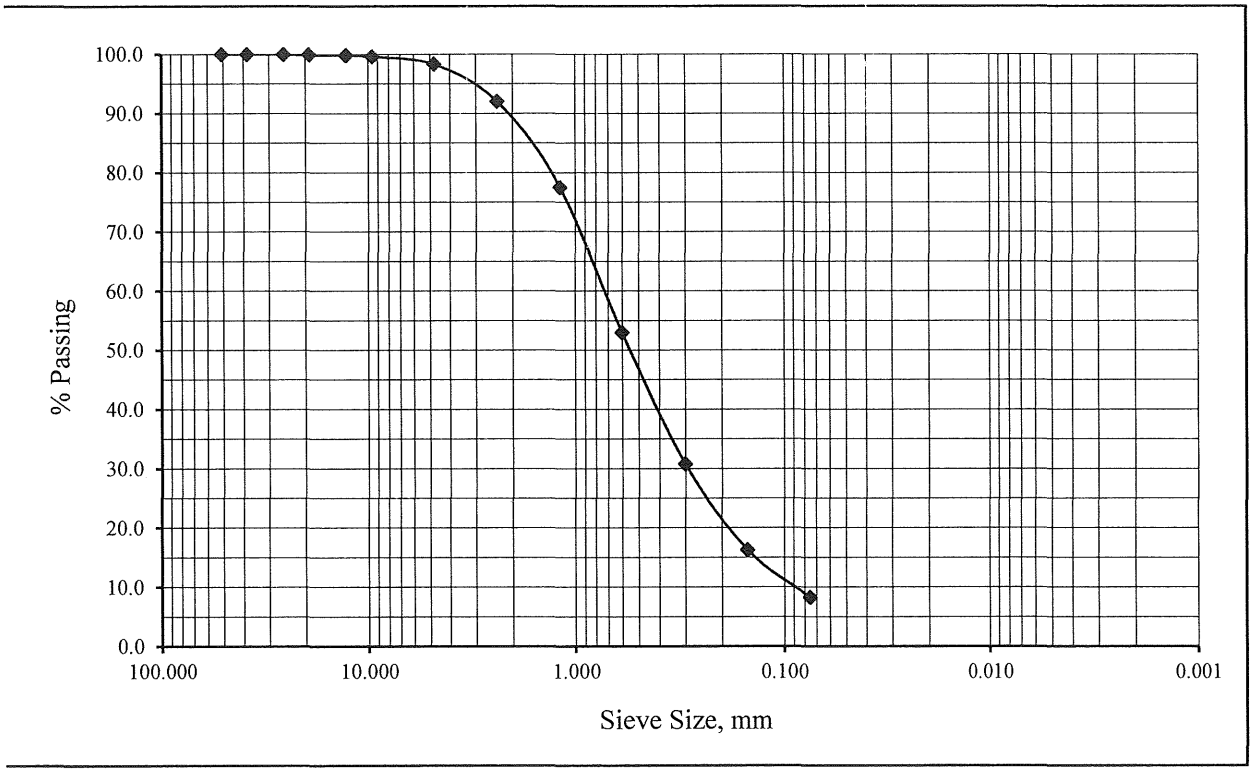
ASTM C117 & C136

Project Number: 544-22471 December 30, 2022
Project Name: East Broadway
Lab ID Number: LN6-22566
Sample ID: BH-1 Bulk 1 @ 0-5' Soil Classification: SW-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	99.8
3/8"	9.53	99.6
#4	4.75	98.4
#8	2.36	92.1
#16	1.18	77.5
#30	0.60	53.0
#50	0.30	30.8
#100	0.15	16.3
#200	0.075	8.3



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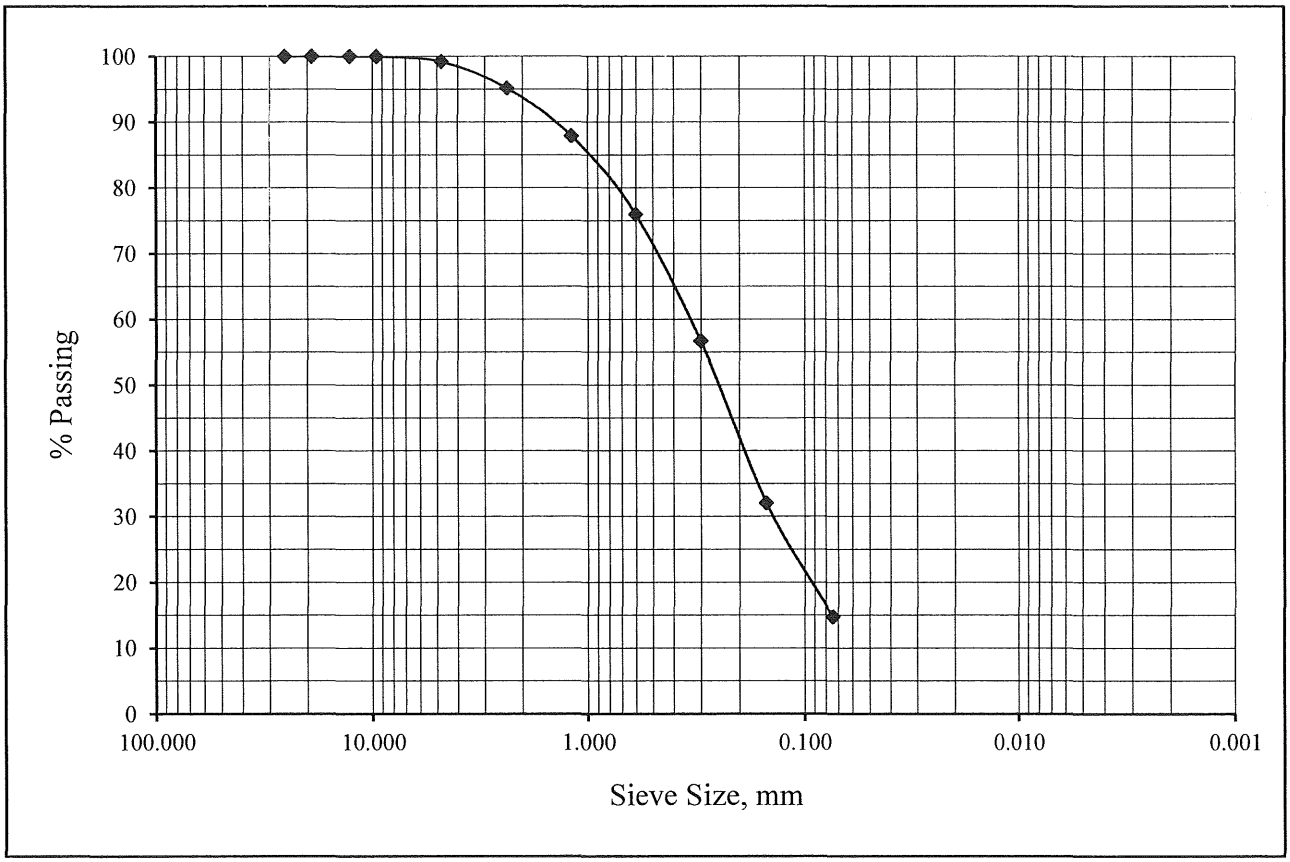
Gradation

ASTM C117 & C136

Project Number: 544-22471 December 30, 2022
Project Name: East Broadway
Lab ID Number: LN6-22566
Sample ID: BH-1 R-2 @ 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	100.0
#4	4.75	99.2
#8	2.36	95.2
#16	1.18	87.9
#30	0.60	76.0
#50	0.30	56.7
#100	0.15	32.1
#200	0.074	14.8



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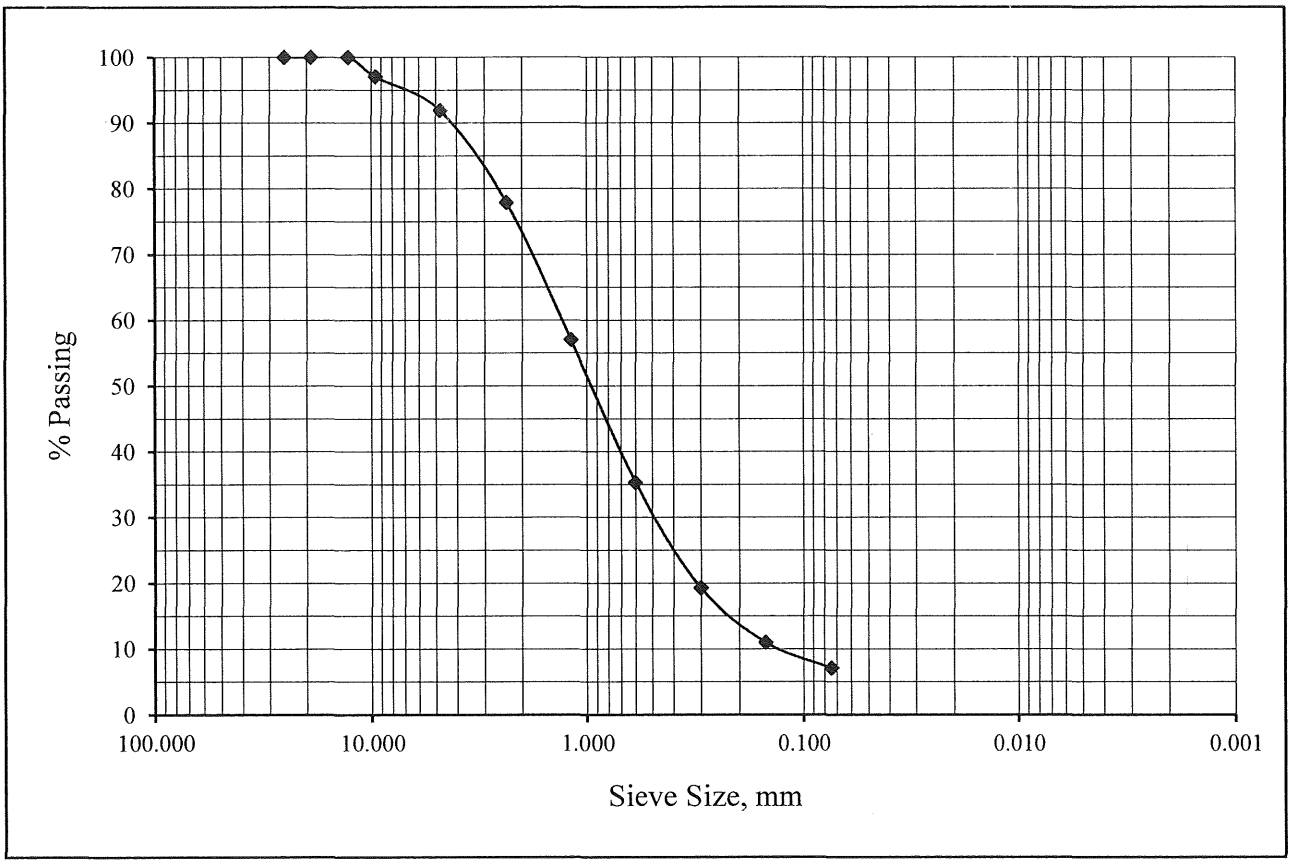
Gradation

ASTM C117 & C136

Project Number: 544-22471 December 30, 2022
Project Name: East Broadway
Lab ID Number: LN6-22566
Sample ID: BH-3 S-2 @ 10' 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	97.1
#4	4.75	91.9
#8	2.36	77.9
#16	1.18	57.0
#30	0.60	35.4
#50	0.30	19.3
#100	0.15	11.0
#200	0.074	7.1



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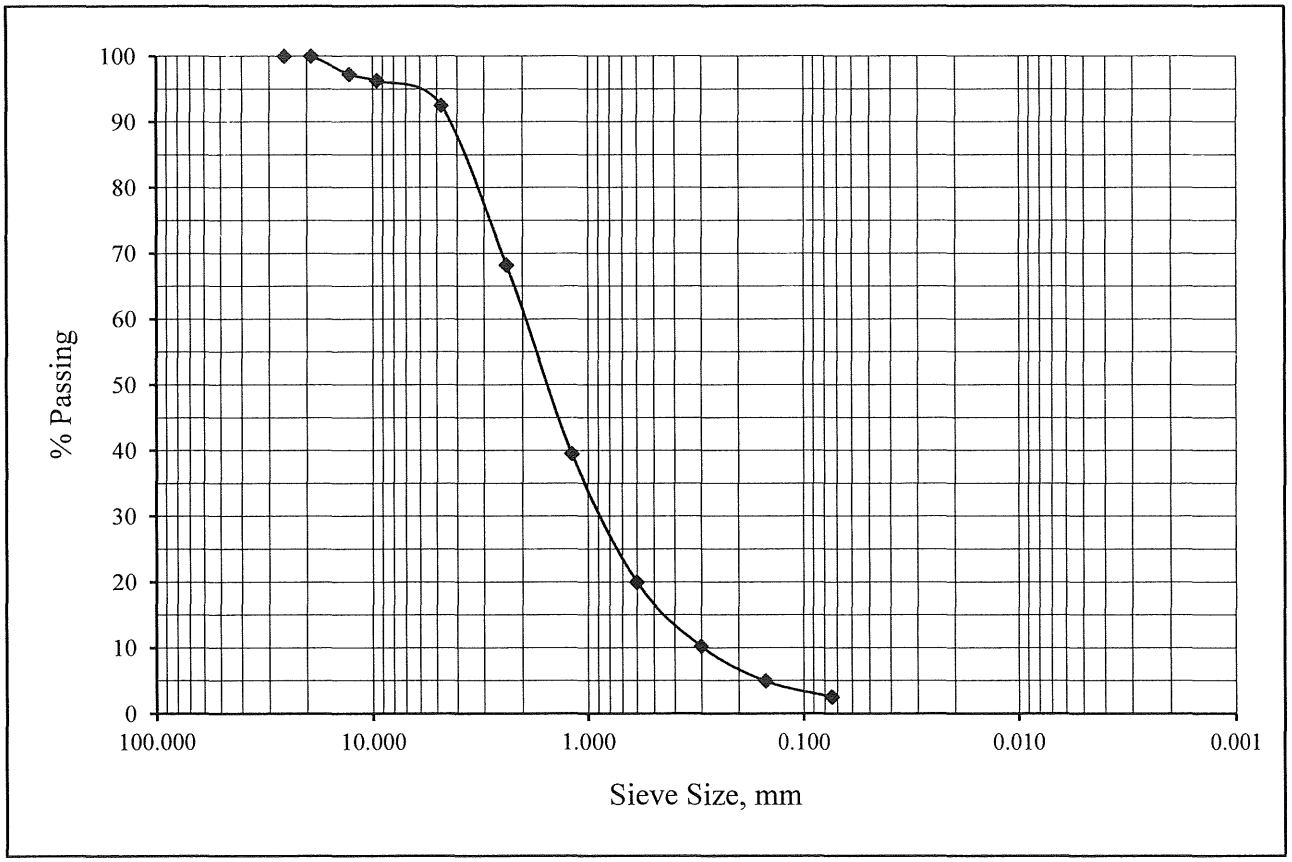
Gradation

ASTM C117 & C136

Project Number: 544-22471 December 30, 2022
Project Name: East Broadway
Lab ID Number: LN6-22566
Sample ID: BH-5 R-3 @ 15' Soil Classification: SW

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	97.2
3/8"	9.53	96.3
#4	4.75	92.5
#8	2.36	68.2
#16	1.18	39.5
#30	0.60	20.0
#50	0.30	10.3
#100	0.15	5.0
#200	0.074	2.5



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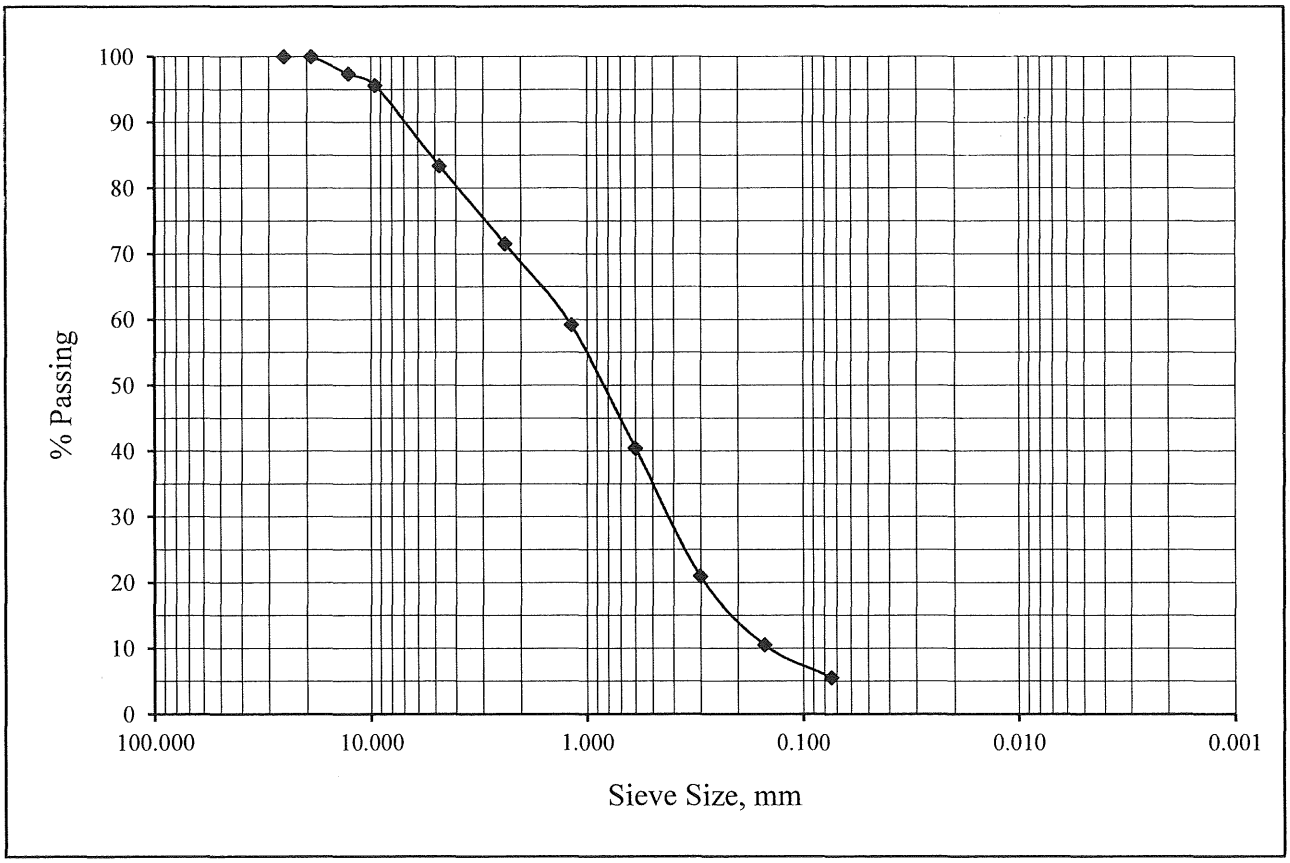
Gradation

ASTM C117 & C136

Project Number: 544-22471 December 30, 2022
Project Name: East Broadway
Lab ID Number: LN6-22566
Sample ID: BH-7 S-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	97.4
3/8"	9.53	95.6
#4	4.75	83.4
#8	2.36	71.5
#16	1.18	59.2
#30	0.60	40.4
#50	0.30	21.0
#100	0.15	10.5
#200	0.074	5.6



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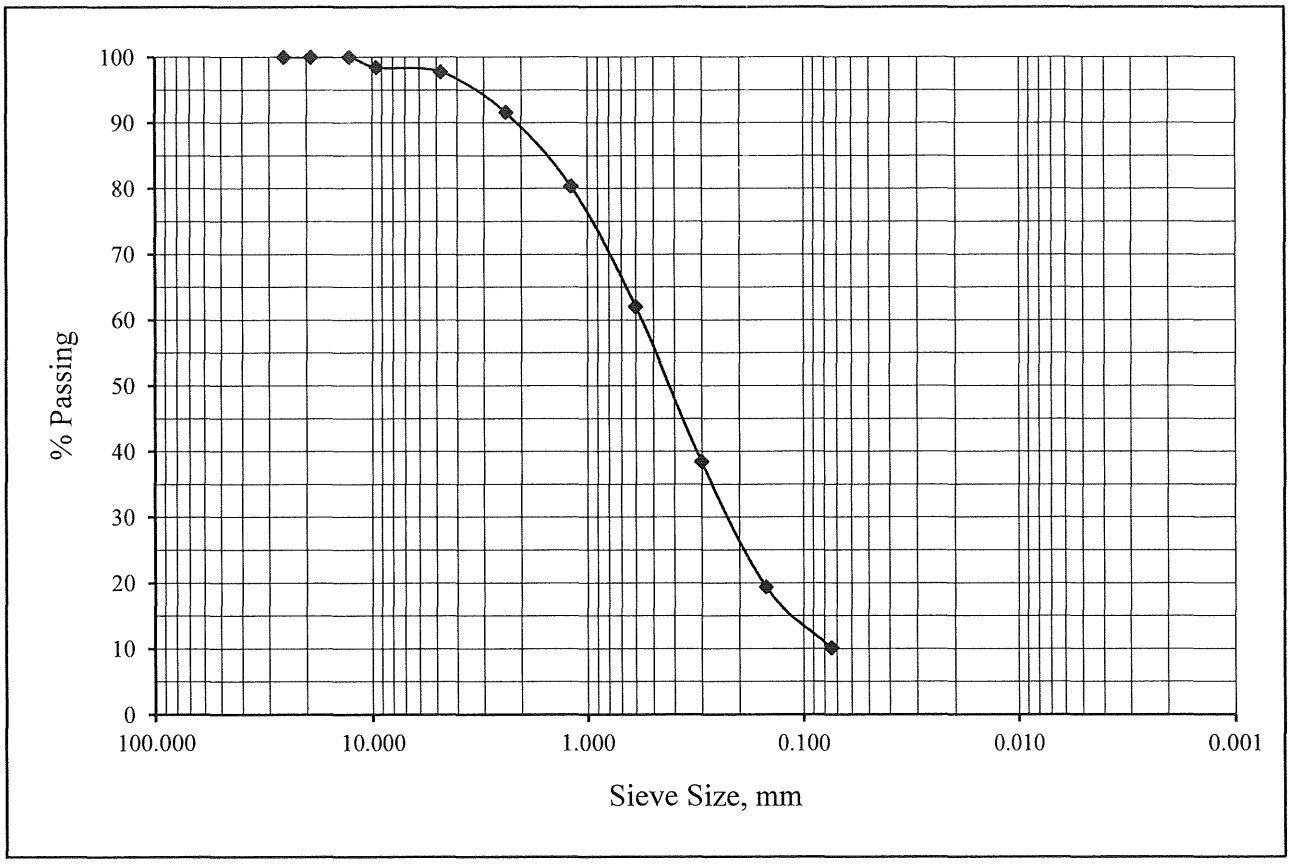
Gradation

ASTM C117 & C136

Project Number: 544-22471 December 30, 2022
Project Name: East Broadway
Lab ID Number: LN6-22566
Sample ID: BH-8 S-2 @ 10' 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	98.4
#4	4.75	97.8
#8	2.36	91.6
#16	1.18	80.3
#30	0.60	62.0
#50	0.30	38.4
#100	0.15	19.4
#200	0.074	10.1



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One Dimensional Consolidation

ASTM D2435 & D5333

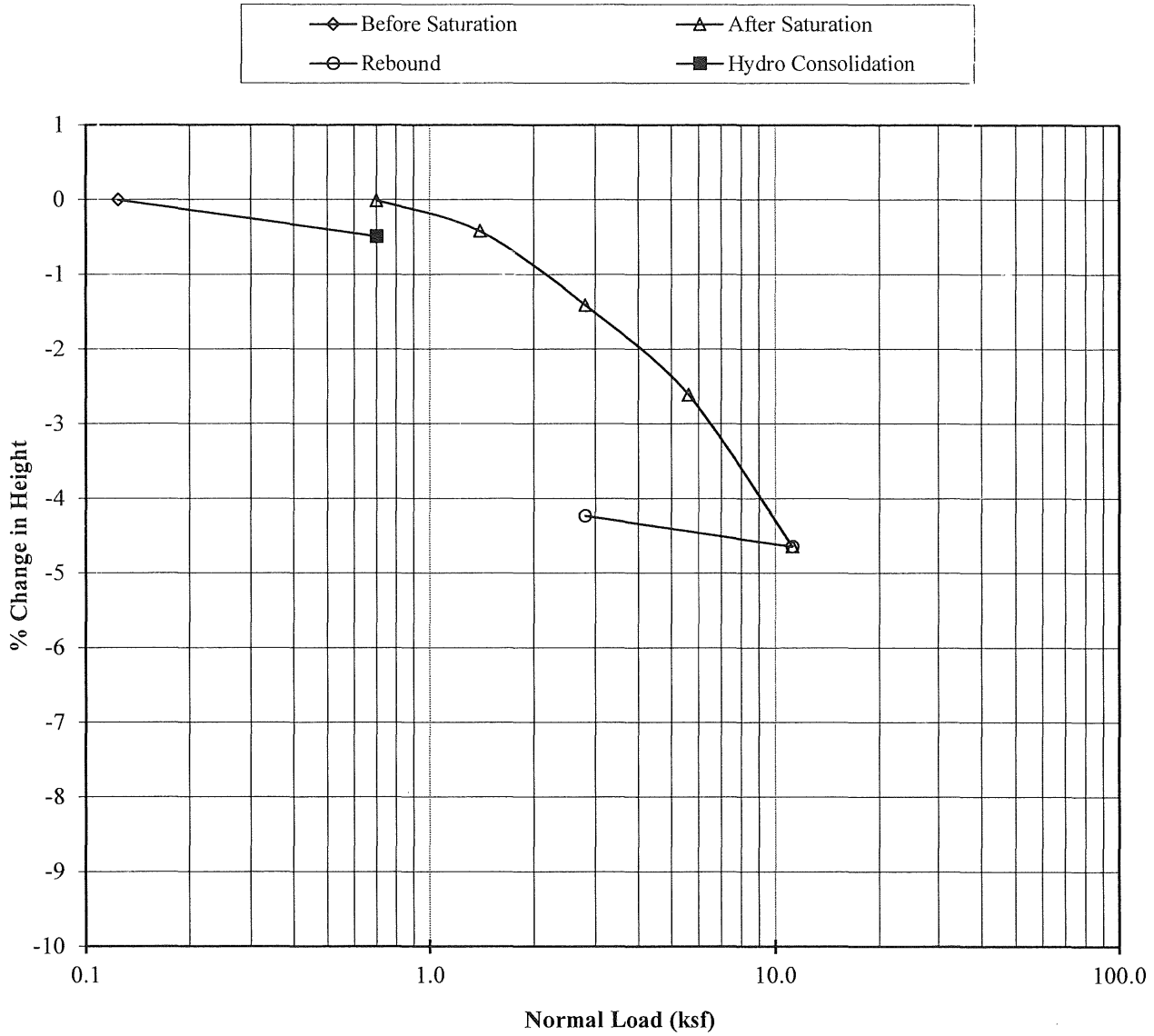
Job Number: 544-22471
Job Name: East Broadway

December 30, 2022

Lab ID Number: LN6-22566
Sample ID: BH-1 R-2 @ 5'
Soil Description: Brown Silty Sand (SM)

Initial Dry Density, pcf:	108.5
Initial Moisture, %:	1.2
Initial Void Ratio:	0.537
Specific Gravity:	2.67

% Change in Height vs Normal Presssure Diagram



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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: December 30, 2022

Account No.: 544-22471

Customer: Four Star Realty c/o Ms. Kim Chen

Location: APN 0605-051-01, East Broadway, Joshua Tree Area

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-1 @ 0-5'	8.7	80	30	7900

APPENDIX C

SEISMIC DESIGN MAP AND REPORT
SITE-SPECIFIC GROUND MOTION PARAMETERS

East Broadway Street, Joshua Tree; APN 0605-051-01

Latitude, Longitude: 34.1623, -116.2690

Date	1/4/2023, 10:55:29 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.96	MCE_R ground motion. (for 0.2 second period)
S_1	0.714	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.96	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.307	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.845	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.929	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.96	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	2.156	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.191	Factored deterministic acceleration value. (0.2 second)
S1RT	0.714	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.793	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.804	Factored deterministic acceleration value. (1.0 second)
PGAd	0.909	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.845	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration

Type	Value	Description
C_{RS}	0.909	Mapped value of the risk coefficient at short periods
C_{R1}	0.9	Mapped value of the risk coefficient at a period of 1 s
C_V	1.492	Vertical coefficient

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SITE-SPECIFIC GROUND MOTION ANALYSIS
(ASCE 7-16)

Project: East Broadway Street, Joshua Tree; APN 0605-051-01
Project Number: 544-22471
Client: Four Star Realty, c/o Kim Chen
Site Lat/Long: 34.1623/-116.2690
Controlling Seismic Source: Pinto Mountain

REFERENCE	NOTATION	VALUE
Site Class	C, D, D default, or E	D measured
Site Class D - Table 11.4-1	F_a	1.0
Site Class D - 21.3(ii)	F_v	2.5
$0.2*(S_{D1}/S_{DS})$	T_0	0.182
S_{D1}/S_{DS}	T_S	0.911
Fundamental Period (12.8.2)	T	Period
Seismic Design Maps or Fig 22-14	T_L	8
Equation 11.4-4 - $2/3*S_{M1}$	S_{D1}	1.1900
Equation 11.4-2 - F_V*S_1 [1]	S_{M1}	1.7850

[1] - F_v as determined by Section 21.3

REFERENCE	NOTATION	VALUE
Fv (Table 11.4-2)[Used for General Spectrum]	F_v	1.7
Design Maps	S_s	1.960
Design Maps	S_1	0.714
Equation 11.4-1 - F_A*S_S	S_{MS}	1.960*
Equation 11.4-3 - $2/3*S_{MS}$	S_{DS}	1.307*
Design Maps	PGA	0.845
Table 11.8-1	F_{PGA}	1.1
Equation 11.8-1 - $F_{PGA}*PGA$	PGA_M	0.93*
Section 21.5.3	80% of PGA_M	0.744
Design Maps	C_{RS}	0.909
Design Maps	C_{R1}	0.9

REFERENCE	NOTATION	VALUE
$0.2*(S_{D1}/S_{DS})$	T_0	0.124*
S_{D1}/S_{DS}	T_S	0.619*
Equation 11.4-4 - $2/3*S_{M1}$	S_{D1}	0.8092*
Equation 11.4-2 - F_V*S_1	S_{M1}	1.2138*

RISK COEFFICIENT

Cr - At Perods <=0.2, Cr=C_{RS}	C_{RS}	0.909
Cr - At Periods >=1.0, Cr=C_{R1}	C_{R1}	0.9

Cr - At Periods between 0.2 and 1.0 use trendline formula to complete

Period	Cr
0.200	0.909
0.300	0.908
0.400	0.907
0.500	0.906
0.600	0.905
0.680	0.904
1.000	0.9

* **Code based design value.** See accompanying data for Site Specific Design values.

Mapped values from https://hazards.atcouncil.org/
https://www.seismicmaps.org/

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PROBABILISTIC SPECTRA[1]
2% in 50 year Exceedence

Project No: 544-22471

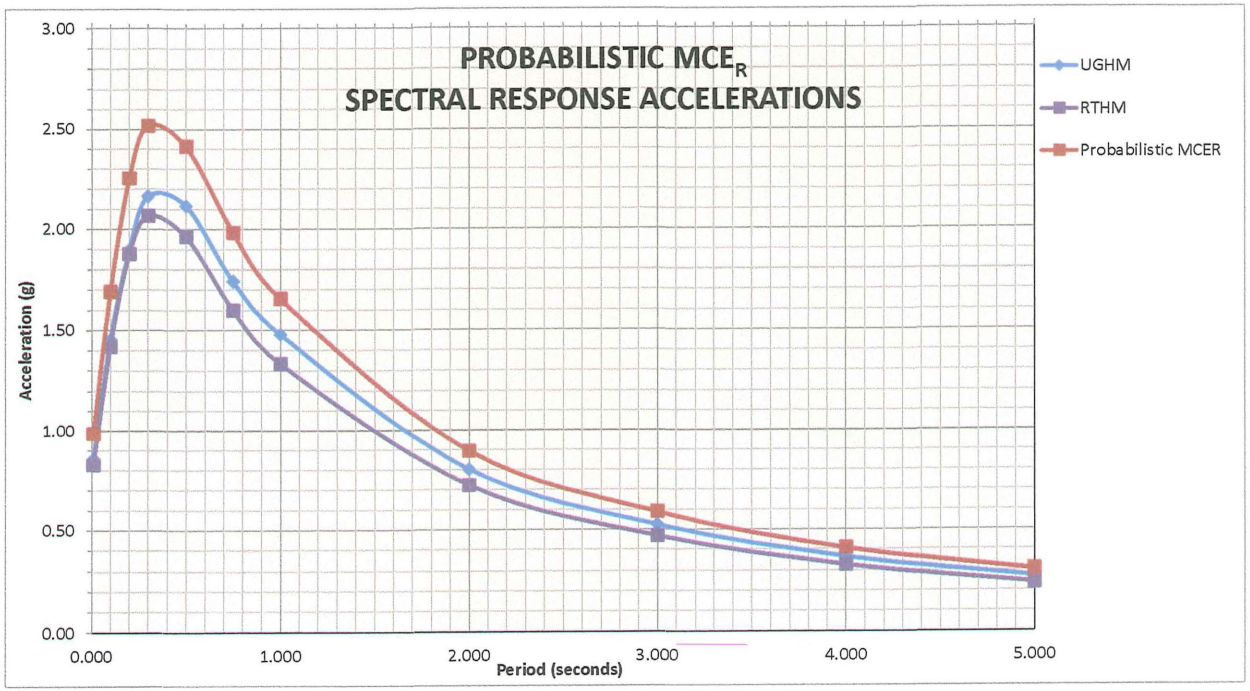
Period	UGHM	RTGM	Max Directional Scale Factor[2]	Probabilistic MCE
0.010	0.858	0.828	1.19	0.985
0.100	1.454	1.419	1.19	1.689
0.200	1.897	1.876	1.20	2.251
0.300	2.162	2.064	1.22	2.518
0.500	2.114	1.961	1.23	2.412
0.750	1.740	1.598	1.24	1.982
1.000	1.479	1.334	1.24	1.654
2.000	0.802	0.721	1.24	0.894
3.000	0.524	0.469	1.25	0.586
4.000	0.364	0.325	1.25	0.406
5.000	0.271	0.240	1.26	0.302

Probabilistic PGA: 0.858

Is Probabilistic $Sa_{(max)}$<1.2F_a? NO

[1] Data Sources:
https://earthquake.usgs.gov/hazards/interactive/
https://earthquake.usgs.gov/designmaps/rtgm/

[2] Shahi-Baker RotD100/RotD50 Factors (2014)



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DETERMINISTIC SPECTRUM

Largest Amplitudes of Ground Motions Considering All Sources Calculated using Weighted Mean of Attenuation Equations[1]

Controlling Source: Pinto Mountain

Is Probabilistic $Sa_{(max)}$<1.2Fa? NO

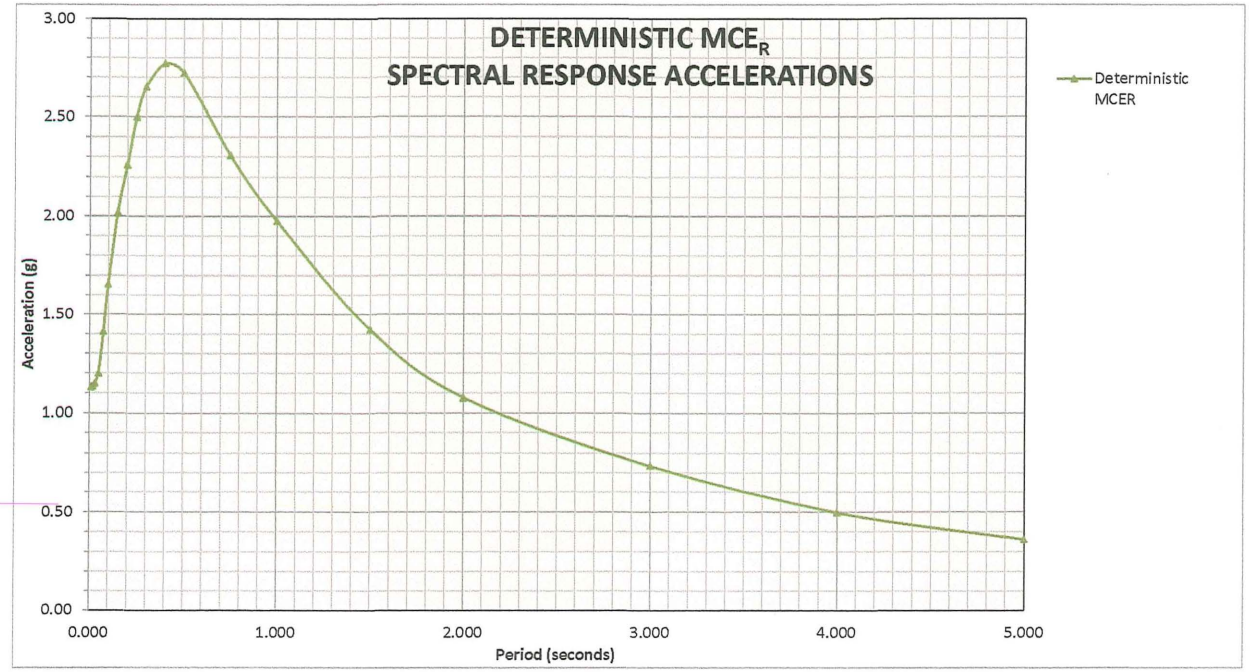
Period	Deterministic PSa Median + 1.σ for 5% Damping	Max Directional Scale Factor[2]	Deterministic MCE	Section 21.2.2 Scaling Factor Applied
0.010	0.949	1.19	1.129	1.129
0.020	0.953	1.19	1.134	1.134
0.030	0.964	1.19	1.148	1.148
0.050	1.007	1.19	1.199	1.199
0.075	1.186	1.19	1.411	1.411
0.100	1.391	1.19	1.655	1.655
0.150	1.680	1.20	2.016	2.016
0.200	1.883	1.20	2.260	2.260
0.250	2.066	1.21	2.499	2.499
0.300	2.174	1.22	2.652	2.652
0.400	2.252	1.23	2.770	2.770
0.500	2.213	1.23	2.722	2.722
0.750	1.860	1.24	2.306	2.306
1.000	1.592	1.24	1.974	1.974
1.500	1.146	1.24	1.421	1.421
2.000	0.867	1.24	1.075	1.075
3.000	0.587	1.25	0.734	0.734
4.000	0.396	1.25	0.495	0.495
5.000	0.286	1.26	0.360	0.360

Project No: 544-22471

Is Determinstic $Sa_{(max)}$<1.5*Fa?	NO
Section 21.2.2 Scaling Factor:	N/A
Deterministic PGA:	0.949
Is Deterministic PGA >=F_{PGA}*0.5?	YES

[1] NGAWest 2 GMPE worksheet and Uniform California Earthquake Rupture Forecast, Version 3 (UCERF3) - Time Dependent Model

[2] Shahi-Baker RotD100/RotD50 Factors (2014)



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SITE SPECIFIC SPECTRA

Period	Probabilistic MCE	Deterministic MCE	Site-Specific MCE	Design Response Spectrum (Sa)
0.010	0.985	1.129	0.985	0.657
0.100	1.689	1.655	1.655	1.104
0.200	2.251	2.260	2.251	1.501
0.300	2.518	2.652	2.518	1.679
0.500	2.412	2.722	2.412	1.608
0.750	1.982	2.306	1.982	1.321
1.000	1.654	1.974	1.654	1.103
2.000	0.894	1.075	0.894	0.596
3.000	0.586	0.734	0.586	0.391
4.000	0.406	0.495	0.406	0.271
5.000	0.302	0.360	0.302	0.202

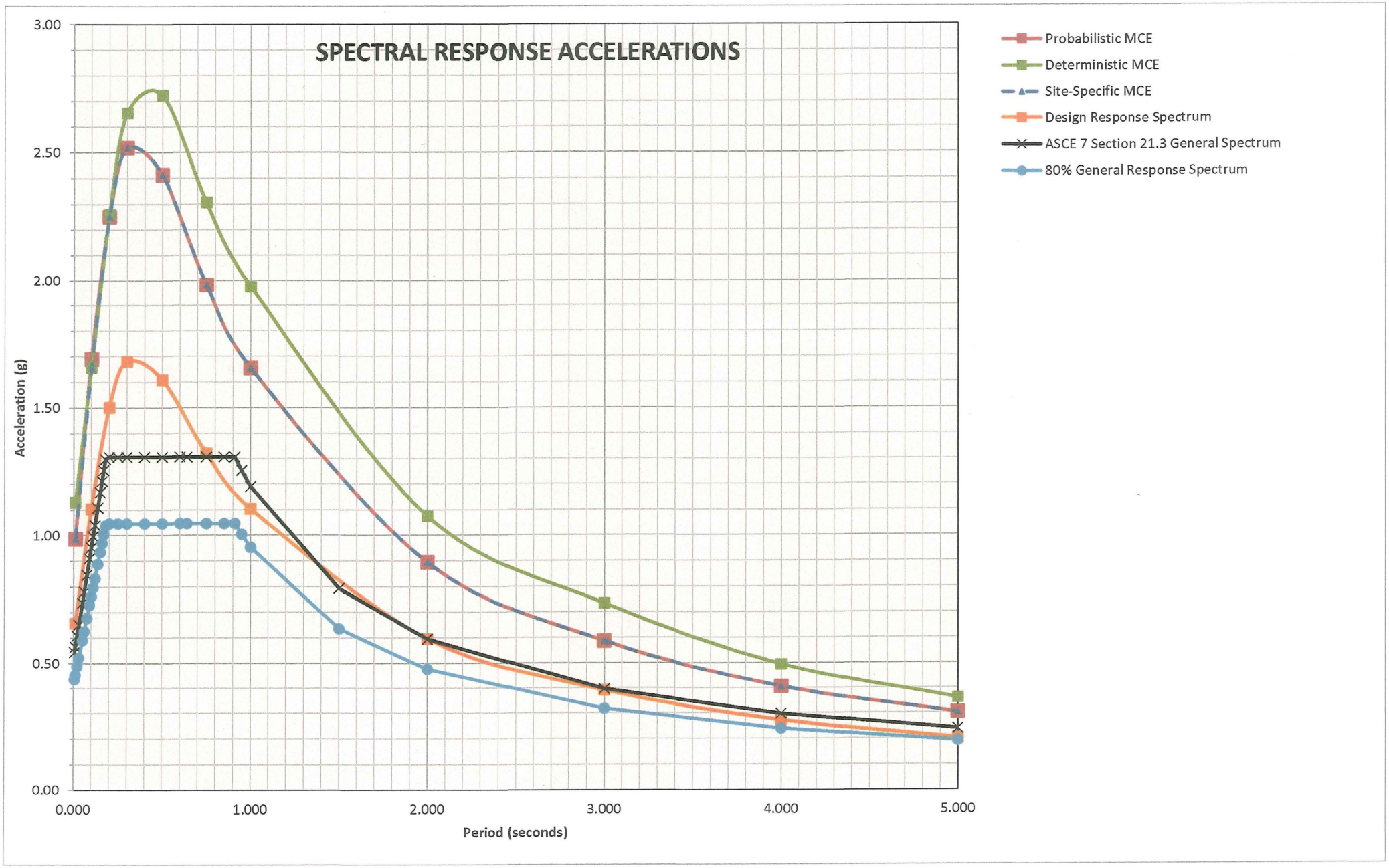
ASCE 7-16: Section 21.4
Site Specific

	Calculated Value	Design Value
SDS:	1.511	1.511
SD1:	1.192	1.192
SMS:	2.266	2.266
SM1:	1.788	1.788
Site Specific PGAm:	0.858	0.858
Site Class:	D measured	

Seismic Design Category - Short* D
Seismic Design Category - 1s* D
* Risk Categories I, II, or III

Period	ASCE 7 SECTION 21.3 General Spectrum	80% General Response Spectrum
0.005	0.544	0.435
0.010	0.566	0.453
0.020	0.609	0.487
0.030	0.652	0.521
0.050	0.738	0.590
0.060	0.781	0.625
0.075	0.845	0.676
0.090	0.910	0.728
0.100	0.953	0.762
0.110	0.996	0.797
0.120	1.039	0.831
0.136	1.108	0.886
0.150	1.168	0.935
0.160	1.211	0.969
0.170	1.254	1.004
0.180	1.297	1.038
0.200	1.307	1.045
0.250	1.307	1.045
0.300	1.307	1.045
0.400	1.307	1.045
0.500	1.307	1.045
0.600	1.307	1.045
0.640	1.307	1.045
0.750	1.307	1.045
0.850	1.307	1.045
0.910	1.307	1.045
0.950	1.253	1.002
1.000	1.190	0.952
1.500	0.793	0.635
2.000	0.595	0.476
3.000	0.397	0.317
4.000	0.298	0.238
5.000	0.238	0.190

Project No: 544-22471


SPECTRAL RESPONSE ACCELERATIONS
Acceleration (g)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.000
1.000
2.000
3.000
4.000
5.000
Period (seconds)
Probabilistic MCE
Deterministic MCE
Site-Specific MCE
Design Response Spectrum
ASCE 7 Section 21.3 General Spectrum
80% General Response Spectrum