NoorzayGeo

July 31, 2018

Mr. Ralph Laks
4949 Topanga Canyon Boulevard
Woodland Hills, California 91634

Project No. 18063

Dear Mr. Laks

Attached herewith is the Geotechnical Investigation report prepared for the proposed solar farm (Solar 33) located at assessor's parcel number 0416-041-52-0000 as obtained from the County of San Bernardino Property Information Management System.

We appreciate this opportunity to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact us at your convenience.

Respectfully submitted,
Noorzay Geotechnical Services, Inc.

Maihan Noorzay, G.E.
Principal Engineer

Distribution: Mr. Ralph Laks (1 PDF)

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GEOTECHNICAL INVESTIGATION
PROPOSED SOLAR FARM (SOLAR 33)
APN NO.: 0416-041-52-0000
DAGGETT, CALIFORNIA
PREPARED FOR
MR. RALPH LAKS
NGS PROJECT NO. 18063

NoorzayGeo

INTRODUCTION

During June and July 2018, a geotechnical investigation was performed by this firm for the proposed solar farm located at assessor's parcel number 0416-041-52-0000 in Daggett, California. The purposes of this investigation were to explore and evaluate the geotechnical engineering conditions at the subject site and to provide appropriate geotechnical engineering recommendations for design and construction of the proposed solar farm.

The location of the site is depicted on the Index Map (Enclosure A-1). The overall site layout for the project, prepared by AECOM Technical Services Inc., was used as a base map for our Site Plan (Enclosure A-2).

The results of our investigation, together with our conclusions and recommendations, are presented in this report.

SCOPE OF SERVICES

The scope of services provided during this geotechnical investigation included the following:

- A field reconnaissance of the site and surrounding area
- Logging and sampling of exploratory borings for testing and evaluation
- Laboratory testing on selected samples
- Evaluation of the geotechnical engineering/geologic data to develop site-specific recommendations for site grading and foundation design
- Preparation of this report summarizing our findings, professional opinions and recommendations for the geotechnical aspects of project design and construction

PROJECT CONSIDERATIONS

Information furnished to this office indicates that the client proposes to develop a solar facility on a parcel that is approximately 35 acres (net 33 acres) situated North of Highway Interstate 40 and is bisected by RT 66 (National Trails Highway) in the County of San Bernardino (Township 9 North, Range 1 East Section 25, USGS Minneola, California Quadrangle 2015). The project APN is: 0416-041-52-0000. Of the 35 acres, the project will be developed with solar panels on three pads totaling about 25 acres. We anticipate that the solar structures will be supported by H-beam or similar type driven deep foundations. No additional information was provided during preparation of this report.

Grading and foundation plans were not available for review during preparation of this report. The final project grading and foundation plans should be reviewed by the geotechnical engineer.

SITE DESCRIPTION

The site is a nearly rectangular shaped parcel, approximately 35 acres, and is located north of Interstate 40 in Daggett, California. It is bounded by Interstate 40 to the south and by vacant properties on the remaining sides. National Trails Highway cuts across the northern portion of the site in an east to west direction. Approximately 8 acres of property is located north of National Trails Highway. The subject site is currently vacant.

The site is relatively flat with a shallow gradient of about four percent downhill toward the northeast. The highest elevation on the site is about 2090 feet above mean sea level (MSL) in the southwest site corner, and 1998 MSL in the northeast corner, for a total, onsite relief of about 92 feet. Natural drainage is via sheetflow toward the northeast.

FIELD INVESTIGATION

The soil conditions underlying the subject site were explored by means of four exploratory borings excavated to a maximum depth of 30.5 feet below the existing ground surface (bgs) with a truck-mounted CME 75 drill rig equipped for soil sampling. Due to driller refusal, most exploratory borings were terminated at shallower depths than planned. The approximate locations of our exploratory borings are indicated on Enclosure A-2.

Continuous logs of subsurface conditions, as encountered within the exploratory borings, were recorded at the time of excavation by an engineer from this firm. Both a standard penetration test (SPT) sampler (2-inch outer diameter and 1-3/8-inch inner diameter) and a ring sampler (3-inch outer diameter and 2-1/2-inch inner diameter) were utilized in our investigation. The penetration resistance was recorded on the boring logs as the number of hammer blows used to advance the sampler in 6-inch increments (or less if noted). The samplers were driven with an automatic hammer that drops a 140-pound weight from a height of 30 inches for each blow. After the required seating, samplers are advanced up to 18 inches, providing up to three sets of blow counts at each sampling interval. The recorded blows are raw numbers without any corrections for hammer type (automatic vs. manual cathead) or sampler size (ring sampler vs. standard penetration test sampler). Both relatively undisturbed and bulk samples of typical soil types obtained were returned to the laboratory in sealed containers for testing and evaluation.

The exploratory boring logs are presented in Appendix B. The stratification lines presented on the boring logs represent approximate boundaries between soil types, which may include gradual transitions.

The exploratory borings were backfilled with excavated soils using reasonable effort to restore the areas to their initial condition prior to leaving the site, but they were not compacted to a relative compaction of 90 percent or greater. In an area as small and deep as a boring, consolidation and subsidence of soil backfill may occur over time causing a depression. The client is advised to observe explored areas occasionally and, when needed, backfill noted depressions.

LABORATORY INVESTIGATION

Included in the laboratory testing program were field dry density and moisture content tests on relatively undisturbed samples. The results are included on the exploratory boring logs. An optimum moisture-maximum dry density relationship was established to evaluate the relative compaction of the subsurface soils during construction. Direct shear testing was performed to provide shear strength parameters for bearing capacity and earth pressure evaluations. Sieve analysis were performed to aid in classification of the subsurface soils. A hydroconsolidation test was performed by Aragon Geotechnical, Inc. to evaluate the hydrocollapse potential of the subsurface soils. A selected sample of material was delivered to Babcock Laboratories and tested for preliminary corrosivity analysis. A selected sample of material was delivered to HDR and tested for preliminary thermal resistivity analysis.

Laboratory test results appear in Appendix C. Soil classifications provided in our geotechnical investigation are in general accordance with the Unified Soil Classification System (USCS).

FAULTING AND GROUND RUPTURE

There are no known active faults on or trending toward the subject site; the site does not lie within an Alquist-Priolo Special Studies zone (Enclosure A-5a).

As with most of southern California, the subject site is situated in an area of active and potentially active faults. Active faults present several potential risks to structures, the most common of which are strong ground shaking, dynamic densification, liquefaction, mass wasting, and surface rupture at the fault plane. The following four factors are the principal determinants of seismic risk at a given location:

- Distance to seismogenically capable faults.
- The maximum or "characteristic" magnitude earthquake for a capable fault.
- Seismic recurrence interval, in turn related to tectonic slip rates.
- Nature of earth materials underlying the site.

Based upon proximity to regionally significant active faults, ground shaking is considered to be the primary hazard most likely to affect the site. Characteristics of the major active fault zones selected for inclusion in analysis of strong ground shaking are listed in the following table. Numerous significant fault zones are located at distances exceeding 40 kilometers from the site, but greater distances, lower slip rates, and/or lesser maximum magnitudes indicate much lower risk to the site from the latter fault zones than those listed below.

Fault Zone[1]	Distance from Site (km)	Fault Length (km)[1]	Slip Rate (mm/yr)[1]	Reference Earthquake M(Max)[1]	Fault Type[1]
Camp Rock-Emerson (rl-ss)	7.4	54±5	0.6±0.4	7.0	B
Calico-Hidalgo (rl-ss)	8.5	95±10	0.6±0.4	7.3	B
Harper (rl-ss)	9.3	65±7	0.6±0.4	7.1	B
Manix (ll-ss)	13	35±4	0.1±0.1	7.0	B
Lenwood-Lockhart (rl-ss)	13	145±15	0.6±0.4	7.5	B
Pisgah-Bullion Mtn (rl-ss)	29	89±9	0.6±0.4	7.3	B
Helendale-South Lockhart (rl-ss)	37	97±10	0.6±0.4	7.3	B

Lavic Lake (rl-ss)	39	27±3	unknown	7.1	B
San Andreas (San Bernardino Segment) (rl-ss)	84	103±10	24.0±6.0	7.5	A

1. **California Department of Conservation, Division of Mines and Geology**, 1996 (Appendix A - Revised 2002), *Probabilistic Seismic Hazard Assessment for the State of California*, DMG Open-File Report 96-08.
2. Fault Geometry: (ss) strike slip; (r) reverse; (n) normal; (rl) right lateral; (ll) left lateral; (O) oblique; (45 N) direction.
3. **International Conference of Building Officials**, February 1988, *Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada, to be used with the 1997 Uniform Building Code*, Prepared by **California Department of Conservation, Division of Mines and Geology** in cooperation with **Structural Engineers Association of California Seismology Committee.**

REGIONAL GEOLOGIC SETTING

The project site is situated in the Mojave Desert Geomorphic Province, one of eleven such provinces recognized in California. The Mojave Desert Geomorphic Province is a distinctive geologic and physiographic region encompassing much of southeastern California, extending from the Tehachapi Mountains on the west to an arbitrary boundary of the Colorado River on the east. The southern edge of the province abuts the east-west trending Transverse Ranges (combined San Gabriel, San Bernardino, Little San Bernardino and Eagle Mountains), while the northern boundary is generally recognized to be the Garlock fault zone. Characteristic landforms of the province include relatively narrow, elongated ranges separated by wider, intervening valleys.

The arid climate of the Mojave Desert province demonstrates precipitation patterns commonly associated with such climates. That is, years to decades of little or no precipitation that are separated by brief periods of locally torrential rain. The brief, heavy precipitation over relatively small areas causes deep erosion at higher elevations, followed by rapid deposition of eroded sediments after runoff leaves steep terrain. Alluvial fans extending from isolated mountain ranges often coalesce to form bajadas. The bajadas, which form the margins of many relatively flat-floored valleys in this province, stand in topographic contrast to the deeply eroded and incised, often jagged mountain ranges.

Most of the province is internally draining; thus, many valleys typically include at least one flat playa surface, many of which become shallow, ephemeral lakes in very wet years. The playa lakes and surrounding, alluvial fans and bajadas usually conceal the much deeper, fault-controlled sedimentary basin that may contain thousands of feet of alluvium and soft rock. Topographic relief is subdued in the western Mojave, but becomes increasingly greater to the east and north as the ranges and valleys exhibit general northwesterly trends.

The province contains a diverse array of rock types. Mesozoic-age igneous intrusive granitic rocks are predominant in the western and southern portions of the province and are widely observed in the remainder. Quaternary and Holocene extrusive igneous rocks and volcanic formations may be observed throughout this province, though they are most common in the southern and western portions. Parts of the central and northern portions of the province include thick sequences of metavolcanic rocks, as well as a number of Paleozoic-age, sedimentary formations that can be correlated to similar rocks in Arizona and Nevada. Tertiary and Quaternary-age alluvial and lacustrine sediments fill basins and occasionally form low hills. The sediments often host economically significant deposits of clay and evaporites including salts and borates. The general geology in the area surrounding the subject site is shown on the Regional Geologic Map, (Enclosure A-4) in the Appendix of this report.

SUBSURFACE SOIL CONDITIONS

Surface soils consisted of native alluvial soils including poorly graded sand (SP) with some poorly graded sandy and silty gravel (GP/GM) with cobbles and boulders, slightly moist to dry, medium dense to dense, gray to brown in color with fine to coarse grains of sand. No fill was encountered within the exploratory borings; however, localized areas of undocumented fill may be present at the site. Moderate to severe caving was encountered in all of our borings. Driller refusal was encountered in all of our borings due to boulders and cobbles.

Groundwater was not encountered within the exploratory borings to the maximum depth of approximately 30-1/2 feet below ground surface. More detailed descriptions of the subsurface soil conditions encountered are included within our exploratory logs (Appendix B).

2016 CALIFORNIA BUILDING CODE - SEISMIC PARAMETERS

Based on the geologic setting and anticipated earthwork for construction of the proposed project, the soils underlying the site are classified as Site Class "D, stiff soil profile", according to the 2016 California Building Code (CBC). The seismic parameters according to the 2016 CBC are summarized in the following table.

2016 CBC - Seismic Parameters	
Mapped Spectral Acceleration Parameters	S_s = 1.372 and S_1 = 0.513
Site Coefficients	F_a = 1.000 and F_v = 1.500
Adjusted Maximum Considered Earthquake Spectral Response Parameters	S_{MS} = 1.372 and S_{M1} = 0.769
Design Spectral Acceleration Parameters	S_{DS} = 0.915 and S_{D1} = 0.513
Peak Ground Acceleration	0.589g
De-aggregated Magnitude	7.1

GROUNDWATER

The site is in the east half of Section 25, Township 9 North, Range 1 East. The closest available well data from the California Department of Water Resources was well number 348489N1168154W001, located approximately one-half mile east of the subject site. The last measurement was taken in 1964. Groundwater depth was nearly 200 feet below ground surface. Groundwater is not expected to be a constraint at the subject site.

LIQUEFACTION POTENTIAL AND SEISMIC SETTLEMENT

Liquefaction is a process in which strong ground shaking causes saturated soils to lose their strength and behave as a fluid (Matti and Carson, 1991). Ground failure associated with liquefaction can result in severe damage to structures. Soil types susceptible to liquefaction include sand, silty sand, sandy silt, and silt, as well as soils having a plasticity index (PI) less than 7 (Boulanger and Idriss, 2004) and loose soils with a PI less than 12 and a moisture content greater than 85 percent of the liquid limit (Bray and Sancio, 2006). The geologic conditions for increased susceptibility to liquefaction are: 1) shallow groundwater (generally less than 50 feet in depth); 2) the presence of unconsolidated sandy alluvium, typically Holocene in age; and 3) strong ground shaking. All three of these conditions must be present for liquefaction to occur.

The State of California has not produced seismic hazard maps for the Minneola quadrangle. The County of San Bernardino geologic hazard overlay map for Minneola does not place the subject site within a potential liquefaction zone (Enclosure A-5). Additionally, based on the density and coarse nature of the underlying soils, and on the depth to groundwater, liquefaction is not considered to be a geologic constraint at the subject site.

Severe seismic shaking may cause dry and non-saturated sands to densify, resulting in settlement expressed at the ground surface. Seismic settlement in dry soils generally occurs in loose sands and silty sands, with cohesive soils being less prone to significant settlement.

The seismic settlement was evaluated for the soil profile in Exploratory Boring No. 4. Using the method outlined by Pradel (1998), calculations were performed to estimate the maximum and the differential settlement to be anticipated as a result of a major seismic event. As input into our calculations, a deaggregated modal moment magnitude of 7.1 and an acceleration of 0.589g were utilized. The results indicate that seismic settlement could be considered negligible. The settlement calculated is accumulated from soil layers to a maximum depth of 50 feet and the result of our analysis is provided in Appendix E.

HYDROCONSOLIDATION

To evaluate the potential deformation that may be caused by the addition of water, hydroconsolidation testing was performed on a selected, representative relatively undisturbed sample, obtained at a depth of approximately 5 feet bgs. The results are shown in Appendix C. The test results indicate a hydroconsolidation strain of approximately one percent.

Based on the results of the hydroconsolidation testing and the recommended grading operation, we anticipate a maximum hydrocollapse settlement of less than one inch if the upper soil layers become fully saturated. Because of the localized nature of wetting, the hydroconsolidation settlement should be considered to be both total and differential.

STATIC SETTLEMENT

Potential static settlement was evaluated utilizing field and laboratory data and foundation load assumptions. The calculations indicate total static settlement of less than 1 inch beneath shallow foundations and less than 1/2 inch beneath deep foundations. Most of the potential static settlement should occur during construction. Based on the uniformity of the materials encountered, differential settlement is anticipated to be on the order of 1/2 the total settlement in 40 feet.

LANDSLIDES AND SLOPE STABILITY

The State of California has not produced seismic hazard maps for the Daggett area. The County of San Bernardino geologic hazard overlay map for Minneola does not place the subject site within a potential landslide zone (Enclosure A-5). The area around the subject site is low relief. There was no visual evidence of landslides on or near the subject property noted during the field investigation. There are no mapped landslides on or near the subject site. Landslides are not considered to be a geologic constraint at the subject site.

FLOODING POTENTIAL

Flood Insurance Rate Maps (FIRM) were compiled by the Federal Emergency Management Agency (FEMA) for the Flood Insurance Program and are available for most areas within the United States at the FEMA web site (http://msc.fema.gov/). The attached FEMA Flood Map (Enclosure A-6) and FEMA Flood Map Legend (Enclosure A-6a) were created from FIRMs specific to the area of the subject site. The FEMA Flood Map shows the site is located within 'Zone D', which is an area of undetermined flood potential.

SEICHING

Seiching is the oscillation of an enclosed body water, usually due to strong ground shaking following a seismic event. Seiching can affect lakes, water towers, swimming pools. There were no enclosed bodies of water observed in close enough proximity to affect the subject site. Seiching should not be considered to be a geologic constraint at this site.

TSUNAMIS

Tsunamis are not considered to be a geologic hazard at the subject site due to its inland location.

EXPANSION POTENTIAL

Materials encountered during this investigation were considered granular and non-critically expansive. Specialized construction procedures to specifically resist expansive soil forces are not anticipated at this time. Requirements for reinforcing steel to satisfy structural criteria are not affected by this recommendation. Additional evaluation of soils for expansion potential should be conducted by the geotechnical engineer during the grading operation as warranted.

CONCLUSIONS

On the basis of our field and laboratory investigations, it is the opinion of this firm that the proposed development is feasible from geotechnical engineering and engineering geologic standpoints, provided the recommendations contained in this report are implemented during grading and construction.

Moderate to severe seismic shaking can be expected at the site. There are no known active faults on or trending toward the subject site; the site does not lie within an Alquist-Priolo Special Studies zone.

Localized areas of undocumented fill may be encountered. All fill located within shallow foundation areas should be removed in its entirety and replaced as compacted fill. Moderate to severe caving could occur in trenches, excavations or borings. The contractor should be prepared to deal with caving soils should proposed conditions warrant trenches, excavations or borings.

Driller refusal was encountered in all of our borings due to boulders and cobbles. The contractor should be prepared to deal with difficulty driving piles by means of pre-augering or other methods.

Groundwater was not encountered within any of our exploratory borings at the site. Liquefaction is not considered to be a potential hazard to the site.

Seismic settlement could be considered negligible. Total static settlement of less than 1 inch beneath shallow foundations and less than 1/2 inch beneath deep foundations should be anticipated. Differential static settlement is anticipated to be on the order of 1/2 the total static settlement in 40 feet.

Landslides are not considered to be a geologic constraint on the subject site. Temporary excavations are anticipated to conform to local and State codes with regard to the geologic materials present at the site.

The on-site materials are generally granular and are considered to be non-critically expansive.

The solar panels should be supported on driven deep foundations such as H-beam or similar type driven deep foundations. Ancillary structures such as inverters or switchgears may be supported on conventional spread foundations, either individual spread footings and/or continuous wall footings, in conjunction with a compacted fill mat.

RECOMMENDATIONS

GENERAL SITE GRADING:

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

Grading of the subject site should be performed, at a minimum, in accordance with these recommendations and with applicable portions of the CBC. The following recommendations are presented for your assistance in establishing proper grading criteria.

INITIAL SITE PREPARATION:

All areas to be graded should be stripped or cleaned of significant vegetation and other deleterious materials. These materials should be removed from the site for disposal. The cleaned soils may be reused as properly compacted fill. Rocks or similar irreducible material with a maximum dimension greater than 8 inches should not be used in compacted fills. If encountered, existing utility lines should be traced, removed and rerouted from areas to be graded.

Cavities created by removal of subsurface obstructions such as structures, utility lines and root stocks of vegetation should be thoroughly cleaned of loose soil, organic matter and other deleterious materials, shaped to provide access for construction equipment and backfilled as recommended for compacted fills.

MINIMUM MANDATORY REMOVAL AND RECOMPACTION OF EXISTING SOILS:

A minimum mandatory removal is not anticipated for this site. However, undocumented fill encountered in areas that will support shallow foundations should be removed in its entirety and replaced as documented, compacted fill. The undocumented fill removal should extend 5 feet laterally from the shallow foundation/ on-grade slab areas. The open excavation bottoms should be observed by our engineer/ geologist to verify and document in writing that all undocumented fill is removed prior to refilling with properly tested and documented compacted fill. The removed and cleaned soils may be reused as properly compacted fill.

Further subexcavation may be necessary depending on the conditions of the underlying soils. The actual depth of removal should be determined at the time of grading by the project geotechnical engineer/geologist. The determination will be based on soil conditions exposed within the excavations. At minimum, any undocumented fill, topsoil or other unsuitable materials should be removed and replaced with properly compacted fill.

In-place density tests may be taken in the removal bottom areas where appropriate to provide data to help support and document the engineer/geologist's decision.

PREPARATION OF FILL AREAS:

Prior to placing compacted fill, the surfaces of all areas to receive fill should be scarified and moisture treated to a depth of 6 inches or more. The soils should be brought to near optimum moisture content and compacted to a minimum relative compaction of 90 percent in accordance with ASTM D1557.

PREPARATION OF SHALLOW FOUNDATION AREAS:

All shallow footings should rest upon at least 12 inches of properly compacted fill material. The required overexcavation should extend at least 5 feet laterally beyond the footing lines, where reasonably possible. In instances where the 5-foot lateral overexcavation may not be accomplished, this firm should be contacted to evaluate the effect. The bottom of this excavation should then be scarified and moisture treated to a depth of at least 6 inches, brought to near optimum moisture content and compacted to a minimum of 90 percent relative compaction in accordance with ASTM D1557 prior to refilling the excavation to the required grade as properly compacted fill.

All shallow footing excavations should be observed by a representative of the project geotechnical engineer to verify that they have been excavated into compacted fill prior to placement of forms, reinforcement, or concrete. The excavations should be trimmed neat, level, and square. All loose, sloughed or moisture-softened soils should be removed from the excavations prior to placing of concrete. Excavated soils derived from the footing and/or utility trenches should not be placed in slab-on-grade areas or exterior concrete flatwork areas unless the soils are brought to near optimum moisture content and compacted to at least 90 percent of the maximum dry density.

COMPACTED FILLS:

The on-site soils should provide adequate quality fill material provided they are free from organic matter and other deleterious materials. Rocks or similar irreducible material with a maximum dimension greater than 8 inches should not be used in compacted fills.

If utilized, import fill should be inorganic, non-expansive granular soils free from rocks or lumps greater than 6 inches in maximum dimension. The contractor shall notify the geotechnical engineer of import sources sufficiently ahead of their use so that the sources can be observed and approved as to the physical characteristic of the import material. For all import material, the contractor shall also submit current verified reports from a recognized analytical laboratory indicating that the import has a "not applicable" potential for sulfate attack based upon current American Concrete Institute (ACI) criteria and is "mildly corrosive" to ferrous metal and copper. The reports shall be accompanied by a written statement from the contractor that the laboratory test results are representative of all import material that will be brought to the job.

Fill should be spread in near-horizontal layers, approximately 8 inches thick. Thicker lifts may be approved by the geotechnical engineer if testing indicates that the grading procedures are adequate to achieve the required compaction. Each lift should be spread evenly, thoroughly mixed during spreading to attain uniformity of the material and moisture in each layer, brought to near optimum moisture content and compacted to a minimum relative compaction of 90 percent in accordance with ASTM D1557.

SHALLOW FOUNDATION BEARING CAPACITY DESIGN:

Structures supported on shallow foundations, such as inverters or switchgears, may be safely founded on spread foundations, either individual spread footings and/or continuous wall footings, bearing on a minimum of 12 inches of compacted fill.

Footings should be a minimum of 12 inches wide and should be established at a minimum depth of 12 inches below lowest adjacent final subgrade level. For the minimum width and depth, footings may be designed for a maximum safe soil bearing pressure of 2,100 pounds per square foot (psf) for dead plus live loads. This allowable bearing pressure may be increased by 600 psf for each additional foot of width and by 1,200 psf for each additional foot of depth to a maximum safe soil bearing pressure of 4,000 psf for dead plus live loads. These bearing values may be increased by one-third for wind or seismic loading.

For footings thus designed and constructed, we would anticipate a maximum static settlement of less than 1 inch. Differential static settlement between similarly loaded adjacent footings is expected to be approximately half the total settlement. Static settlement is expected to occur during construction or shortly after.

SHALLOW FOUNDATION LATERAL LOADING DESIGN:

Resistance to lateral loads will be provided by passive earth pressure and base friction. For footings bearing against compacted fill, passive earth pressure may be considered to be developed at a rate of 430 psf per foot of depth. Base friction may be computed at 0.47 times the normal load. Base friction and passive earth pressure may be combined without reduction. Other than conservative soil modeling, the lateral passive earth pressure and base friction values recommended do not include factors of safety. If the design is to be based on allowable lateral resistance values, we recommend that minimum factors of safety of 1.5 and 2.0 be applied to the friction coefficient and passive lateral earth pressure, respectively. The resulting allowable lateral resistance values follow:

Allowable Lateral Resistance Values			
	Ultimate	**Allowable**	**Factor of Safety**
Passive Lateral Earth Pressure (psf/ft)	430	215	2.0
Base Friction Coefficient	0.47	0.31	1.5

DRIVEN-PILE ALLOWABLE AXIAL CAPACITIES:

Vertical allowable and ultimate axial capacities were calculated using Allpile Version 7.13h for a W6 X 10 steel H-beam pile as a function of embedment depth and are included in Appendix D.

The maximum allowable downward capacity utilized a factor of safety of 2.0 for skin friction and zero tip resistance for end bearing. The maximum allowable uplift capacity utilized a factor of safety of 2.0 for skin friction and 1.5 for pile weight. The upper 2 feet were neglected in the capacities provided.

For properly installed piles, it is anticipated that a total settlement of less than 1/2 inch will be required to mobilize allowable capacity.

Full-scale pull-out testing should be performed on selected piles to confirm uplift capacity. Minimum factors of safety may be determined by the structural engineer that can be applied to the ultimate uplift capacity as determined from the pull-out testing.

DRIVEN-PILE INSTALLATION:

The piles should have a minimum embedment depth of 6.0 feet below the lowest adjacent grade. The minimum embedment depth for the piles is based on the depth to zero deflection based on our analysis. After the minimum depth of embedment has been attained, piles should be driven to the required capacity.

The piles should be installed vertically. The driving operation should be monitored, such that if obstructions are encountered, the effect on the posts can be determined. Damaged posts should be replaced. Frequent obstructions may require pre-augering of the holes to facilitate driving, which could impact load carrying capacity and therefore should be reviewed by the geotechnical and structural engineers. Driven piles may not reach the required depths in certain areas of the site. Should shallow refusal be encountered, uplift load testing of the pile should be performed.

Prior to the actual driving of piles for the proposed solar panels, it is recommended that indicator piles be driven at various locations across the site to verify established driving criteria and to verify the underlying soil profile. These piles may be utilized for foundation support if driven to their final position. The driving criteria can be modified as needed based upon the results of these indicator piles.

DRIVEN-PILE ALLOWABLE LATERAL BEARING PRESSURE:

The allowable lateral bearing pressure based on the encountered soil types may be considered to be developed at a rate of 215 psf per foot of depth below natural grade to a maximum of 2,100 psf. The upper 2 feet of soils should be neglected from the allowable lateral bearing pressure.

Full-scale lateral load testing should be performed on selected piles. The required lateral capacity should be achieved while limiting movement to acceptable levels as determined by the structural engineer. Minimum factors of safety may be determined by the structural engineer that can be applied to the ultimate lateral capacity as determined from the lateral load testing.

SLABS-ON-GRADE:

Concrete slabs-on-grade should be a minimum of 4 inches in thickness. To provide adequate support, concrete slabs-on-grade should bear on a minimum of 12 inches of compacted soil. The soil should be compacted to at least 90 percent relative compaction. The final pad surfaces should be rolled to provide smooth, dense surfaces.

Concrete slabs subjected to heavy loads should be designed by a registered civil engineer competent in concrete design. A modulus of vertical subgrade reaction of 350 pounds per cubic inch can be utilized in the design of slabs-on-grade for the proposed project.

EXCAVATIONS:

The soils encountered within our exploratory borings are generally classified as a Type "C" soil in accordance with the CAL/OSHA excavation standards. Unless specifically evaluated by our engineering geologist, all the trench excavations should be performed following the recommendation of CAL/OSHA (State of California, 2013) for Type "C" soil. Based upon a soil classification of Type "C", the temporary excavations should not be inclined steeper than 1.5 horizontal to 1 vertical for maximum trench depth of less than 20 feet. For trench excavations deeper than 20 feet or for conditions that differ from those described for Type "C" in the CAL/OSHA excavation standards, this firm should be contacted.

POTENTIAL EROSION AND DRAINAGE:

The potential for erosion should be mitigated by proper drainage design. The site should be graded so that surface water flows away from structures at a minimum gradient of 5 percent for a minimum distance of 10 feet from structures. Impervious surfaces within 10 feet of structures should be sloped a minimum of 2 percent away from buildings. Water should not be allowed to flow over graded areas or natural areas so as to cause erosion. Graded areas should be planted or otherwise protected from erosion by wind or water.

CHEMICAL/CORROSIVITY TESTING:

A selected sample of material was delivered to Babcock Laboratories for preliminary corrosivity analysis. Laboratory testing consisted of pH, resistivity, chlorides and sulfates. The results of the laboratory tests appear in Appendix C.

The result from the resistivity test indicates a "corrosive" condition to ferrous metals. Specific corrosion control measures, such as coating of the pipe with non-corrosive material or alternative non-metallic pipe material, are considered necessary.

Results of the soluble sulfate testing indicate a "not applicable" (Class S0) anticipated exposure to sulfate attack. Based on the criteria from Table 4.3.1. of the American Concrete Institute Manual of Concrete Practice (2011), special measures, such as specific cement types or water-cement ratios, are not considered necessary for this "not applicable" exposure to sulfate attack.

The soluble chloride content of the soils tested was not at levels high enough to be of concern with respect to corrosion of reinforcing steel. The results should be considered in combination with the soluble chloride content of the hardened concrete in determining the effect of chloride on the corrosion of reinforcing steel.

Noorzay Geotechnical Services does not practice corrosion engineering. If further information concerning the corrosion characteristics, or interpretation of the results submitted herein, is required, then a competent corrosion engineer could be consulted.

SOIL THERMAL RESISTIVITY TESTING:

Soil thermal resistivity testing was performed on a select sample to obtain heat dissipation characteristics of the soils. Testing was performed in accordance with ASTM D5334. The result of the testing is presented in Appendix C. Further evaluation of the thermal resistivity testing should be referred to a specialist.

CONSTRUCTION OBSERVATION:

All grading operations, including site clearing and stripping, should be observed by a representative of the geotechnical engineer. The geotechnical engineer's field representative will be present to provide observation and field testing and will not supervise or direct any of the actual work of the contractor, his employees or agents. Neither the presence of the geotechnical engineer's field representative nor the observations and testing by the geotechnical engineer shall excuse the contractor in any way for defects discovered in his work. It is understood that the geotechnical engineer will not be responsible for job or site safety on this project, which will be the sole responsibility of the contractor.

LIMITATIONS

Noorzay Geotechnical Services has striven to perform our services within the limits prescribed by our client, and in a manner consistent with the usual thoroughness and competence of reputable geotechnical engineers and engineering geologists practicing under similar circumstances. No other representation, express or implied, and no warranty or guarantee is included or intended by virtue of the services performed or reports, opinion, documents, or otherwise supplied.

This report reflects the testing conducted on the site as the site existed during the investigation, which is the subject of this report. However, changes in the conditions of a property can occur with the passage of time, due to natural processes or the works of man on this or adjacent properties. Changes in applicable or appropriate standards may also occur whether as a result of legislation, application or the broadening of knowledge. Therefore, this report is indicative of only those conditions tested at the time of the subject investigation, and the findings of this report may be invalidated fully or partially by changes outside of the control of Noorzay Geotechnical Services. This report is therefore subject to review and should not be relied upon after a period of one year.

The conclusions and recommendations in this report are based upon observations performed and data collected at separate locations, and interpolation between these locations, carried out for the project and the scope of services described. It is assumed and expected that the conditions between locations observed and/or sampled are similar to those encountered at the individual locations where observation and sampling was performed. However, conditions between these locations may vary significantly. Should conditions that appear different than those described herein be encountered in the field by the client or any firm performing services for the client or the client's assign, this firm should be contacted immediately in order that we might evaluate their effect.

If this report or portions thereof are provided to contractors or included in specifications, it should be understood by all parties that they are provided for information only and should be used as such.

The report and its contents resulting from this investigation are not intended or represented to be suitable for reuse on extensions or modifications of the project, or for use on any other project.

CLOSURE

We appreciate this opportunity to be of service and trust this report provides the information desired at this time. Should questions arise, please do not hesitate to contact this office.

Respectfully submitted,
Noorzay Geotechnical Services, Inc.

Richard George, C.E.G. 2516
Consulting Geologist

Maihan Noorzay, G.E. 3085
Principal Engineer

REFERENCES

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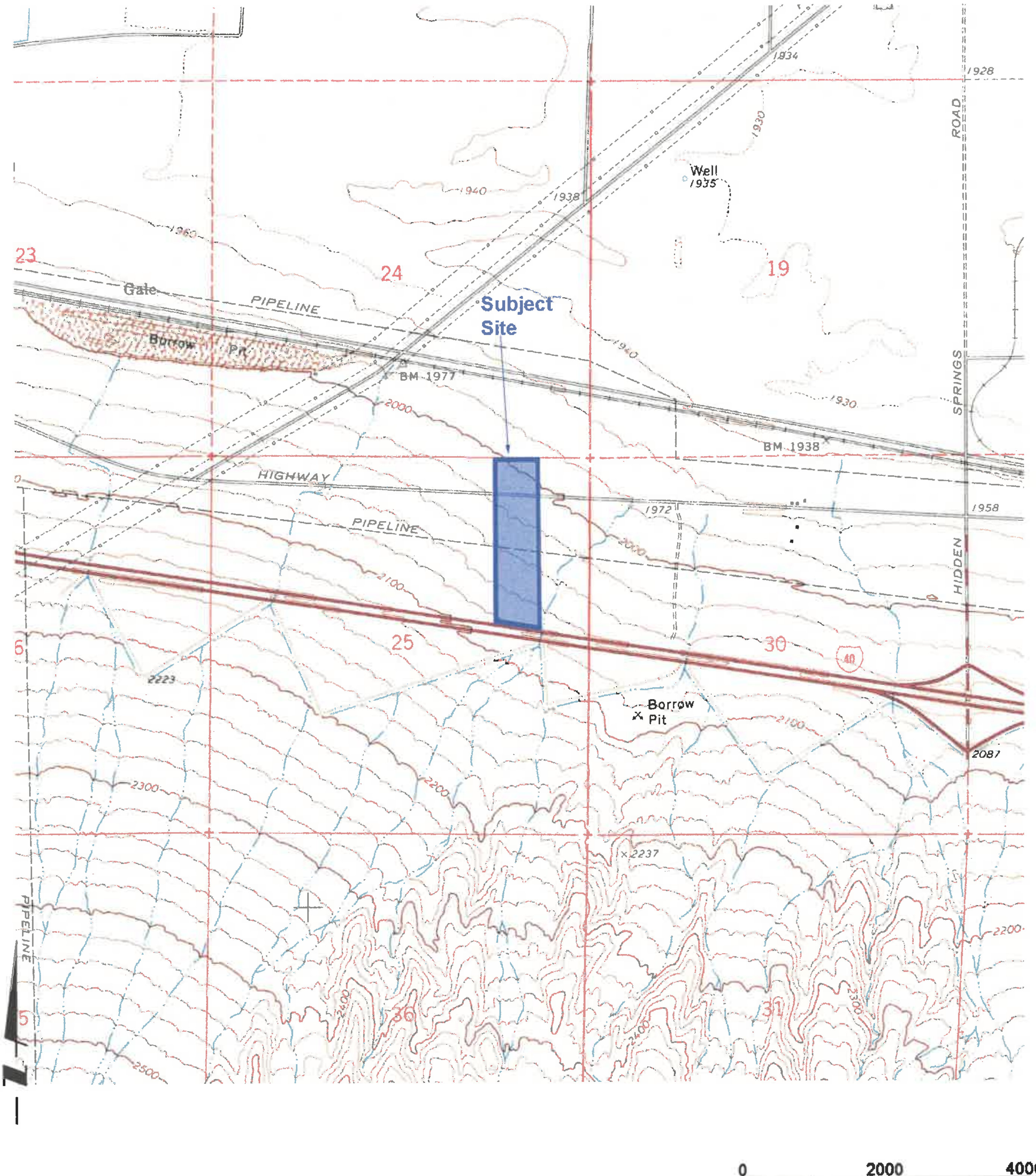
APPENDIX A

MAPS



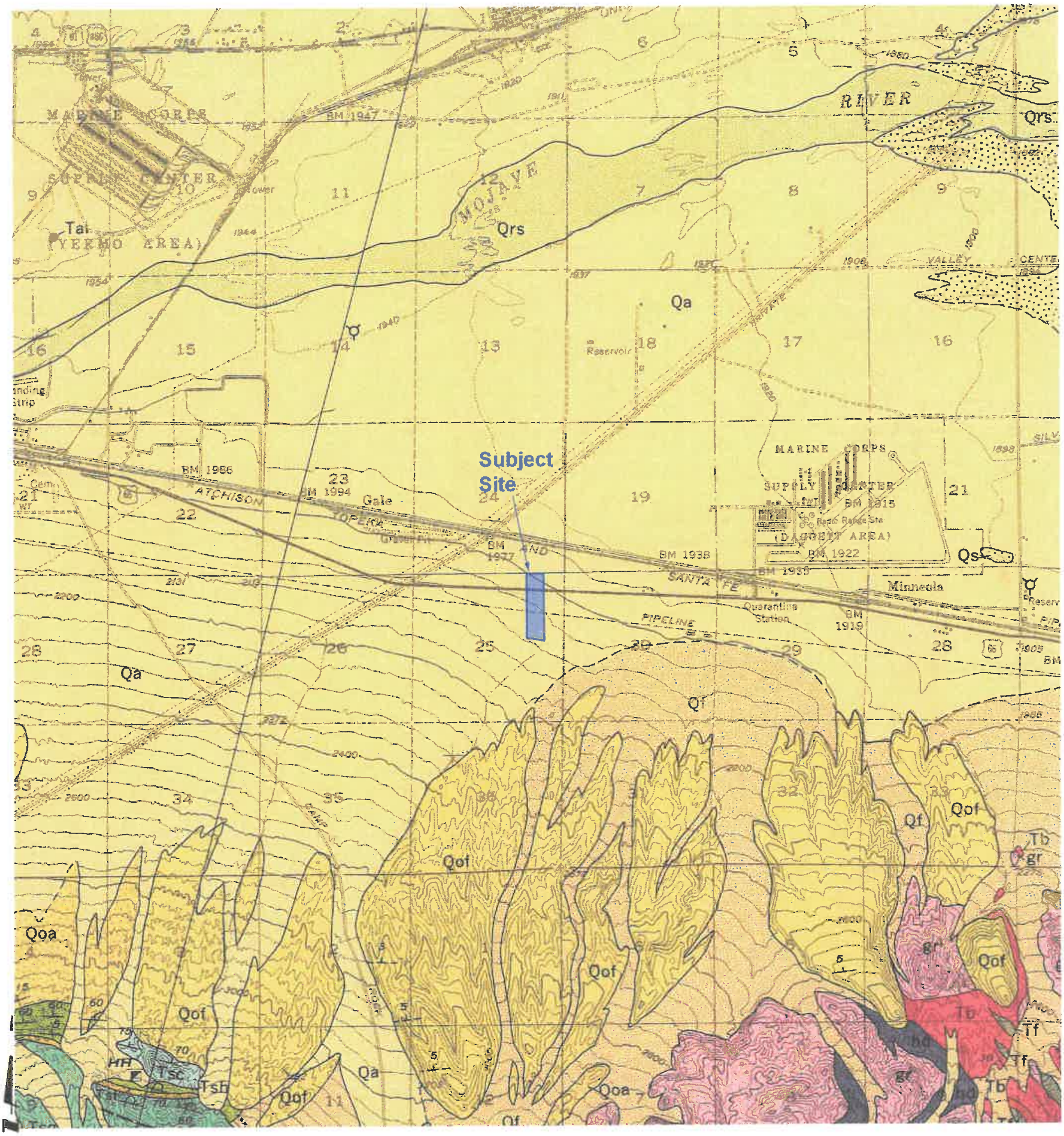
Reference: **United States Department of the Interior, Geological Survey**, 1971, photorevised 1992, *Minneola Quadrangle, California*, 7.5-Minute Topographic, Scale 1:24,000.

DATE 08/01/2018	**Index Map** Solar 33 Daggett, California	NoorzayGeo	A-1
DRAWN BY: RG			

INTENTIONALLY LEFT BLANK

NO CROSS-SECTION NEEDED

DATE			
08/01/2018	**Geologic Cross-section** Solar 33 Daggett, California	NoorzayGeo	A-3
DRAWN BY: RG			

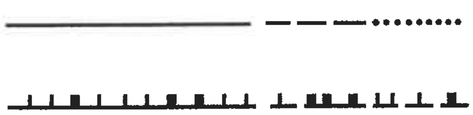


Reference: **U.S. Department of the Interior, Geological Survey**
Morton, D.M, and Miller, F.K., 2006, *Geologic Map of the San Bernardino and Santa Ana 30' x 60' Quadrangles, California*, Open File Report 2006-1217, Scale 1:100,000.

0 5210 10,420
Approximate Scale in Feet

DATE			
08/01/2018	**Regional Geologic Map** Solar 33 Daggett, California	NoorzayGeo	A-4
DRAWN BY: RG			

Legend for Geologic Symbols and Units



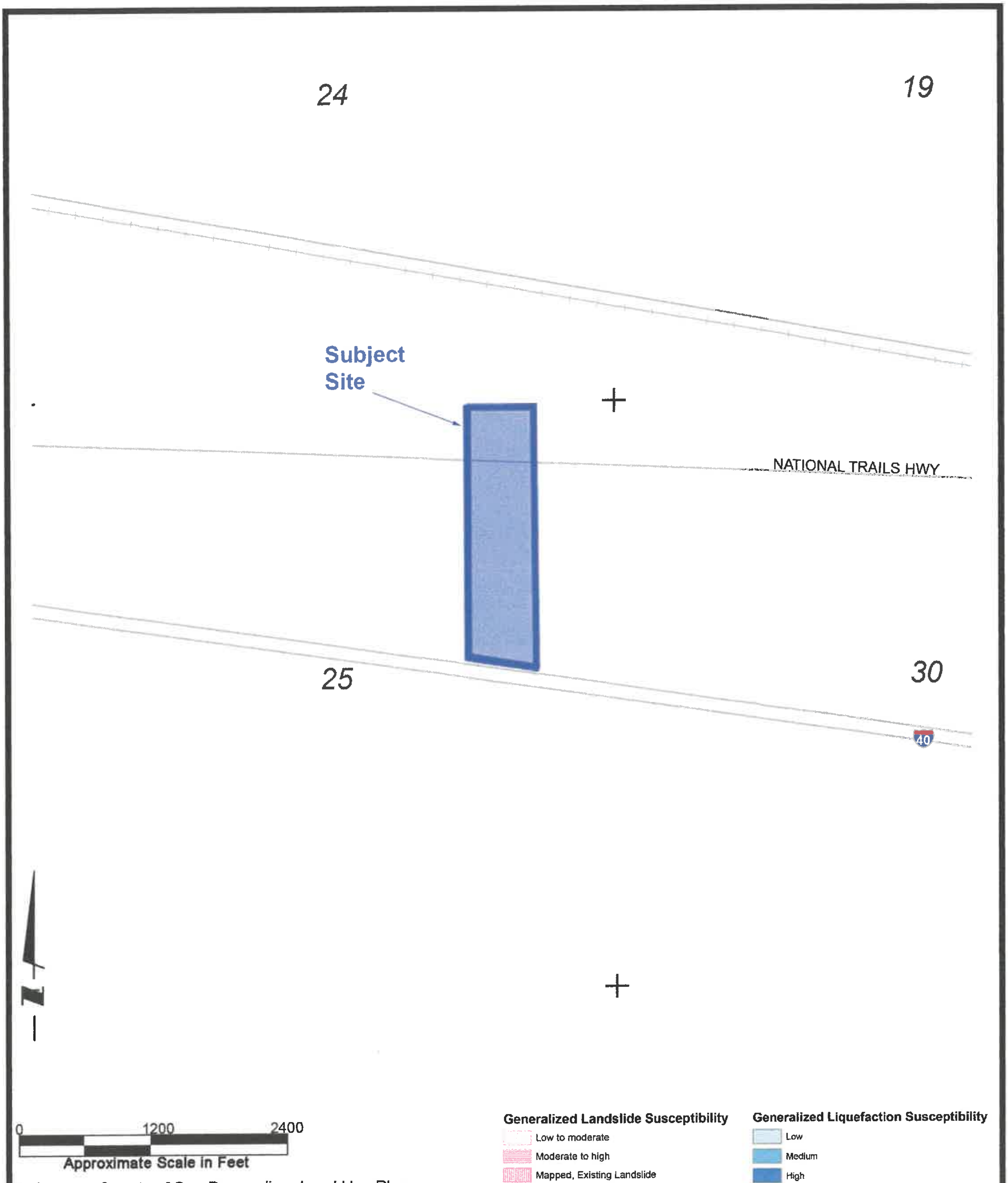
Contact (left)—Separates geologic-map units.Solid where meets map- accuracy standard; dashed where may not meet map-accuracy standard; dotted where concealed.

Contact (left)—Separates terraced alluvial units where younger alluvial unit is incised into older alluvial unit; hachures at base of slope, point toward topographically lower surface. Solid where meets map-accuracy standard; dashed where may not meet map-accuracy standard.

Fault (above)—Solid where meets map-accuracy standard; dashed where may not meet map accuracy standard. Dotted where concealed by mapped covering unit; queried where existence uncertain. Hachures indicate scarp, with hachures on downdropped block. Paired arrows indicate relative movement; single arrow indicates direction and amount of fault-plane dip. Bar and ball on down-thrown block.

Qrs	Wash deposits, sand (Holocene).
Qa	Alluvium, undivided (Holocene, late Pleistocene).
Qf	Alluvial fan deposits (Holocene, late Pleistocene).
Qoa	Older alluvium (Pleistocene).
Qof	Older valley sediments, alluvial fan (Pleistocene).
Tsc	Conglomerate (Miocene).
Tsh	Shale and limestone (Miocene).
Tsg	Granitic conglomerate (Miocene).
Tss	Sandstone (Miocene).
Tss	Tuff deposits (Miocene).
Tf	Fanglomerate of Mesozoic detritus (Oligocene or Miocene).
Tb	Basalt (Oligocene or Miocene).
gr	Granitic rocks (Mesozoic).
hd	Hornblende diorite and gabbro (Mesozoic).

DATE			
08/01/2018	**Regional Geologic Map Legend** Solar 33 Daggett, California	NoorzayGeo	A-4a
DRAWN BY: RG			



Reference: County of San Bernardino, Land Use Plan General Plan, 2007, EI10 C, Minneola, Scale 1:14,400.

DATE 08/01/2018	**Seismic Hazards Map**	NoorzayGeo	A-5
DRAWN BY: RG	Solar 33 Daggett, California		

0 2000 2000

Approximate Scale in Feet

Reference: California Department of Conservation, Division of Mines and Geology
1988, Alquist-Priolo Special Studies Zones, Minneola Quadrangle, Official Map, Scale 1:24,000.

DATE			
08/01/2018	**Alquist-Priolo / Seismic Hazards Map** Solar 33 Daggett, California	NoorzayGeo	A-5a
DRAWN BY: RG			

Reference: FEMA Flood Insurace Rate Map, August 28, 2008
Panel 06071C 4600H, Scale 1:6,000.

DATE 08/01/2018 DRAWN BY: RG	**FEMA Flood Map** Solar 33 Daggett, California	NoorzayGeo	A-6

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- (B) 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- (8) — Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/1/2018 at 7:39:49 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

DATE			
08/01/2018	**FEMA Flood Map Legend** Solar 33 Daggett, California	NoorzayGeo	A-6a
DRAWN BY: RG			

APPENDIX B

EXPLORATORY LOGS

SUBSURFACE EXPLORATION LEGEND

UNIFIED SOIL CLASSIFICATION SYSTEM Visual-Manual Procedure (ASTM D2488)				
MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
Coarse-Grained Soils* More than 50 % Retained on No. 200 Sieve	Gravels 50 % or more of Coarse Fraction Retained on No. 4 Sieve	Clean Gravels	GW	Well Graded Gravels and Gravel-Sand Mixtures, Little or no Fines
			GP	Poorly Graded Gravels and Gravel-Sand Mixtures, Little or no Fines
		Gravels with Fines	GM	Silty Gravels, Gravel-Sand-Silt Mixtures**
			GC	Clayey Gravel, Gravel-Sand-Clay Mixtures**
	Sands More than 50 % of Coarse Fraction Passes No. 4 Sieve	Clean Sands	SW	Well Graded Sands and Gravely Sands, Little or no Fines
			SP	Poorly Graded Sands and Gravely Sands, Little or no Fines
		Sands with Fines	SM	Silty Sands, Sand-Silt Mixtures**
			SC	Clayey Sands, Sand-Clay Mixtures**
Fine Grained Soils* 50 % or more Passes No. 200 Sieve	Silts and Clays Liquid Limits 50 % or less		ML	Inorganic Silts, Sandy Silts, Rock Flour
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
			OL	Organic Silts and Organic silty Clays of Low Plasticity
	Silts and Clays Liquid Limits Greater than 50 %		MH	Inorganic Silts, Micaceous or Diatomaceous silts, Plastic Silts
			CH	Inorganic Clays of High Plasticity, Fat Clays
			OH	Organic Clays of Medium to High Plasticity
Highly Organic Soils			PT	Peat, Muck, or Other Highly Organic Soils

CONSISTENCY / RELATIVE DENSITY

CRITERIA

Reference: 'Foundation Engineering', Peck, Hansen, Thornburn, 2nd Edition.

Standard Penetration Test
Granular Soils

Penetration Resistance, N, (Blows / Foot)	Relative Density
0 - 4	Very Loose
4 - 10	Loose
10 - 30	Medium
30 - 50	Dense
> 50	Very Dense

Standard Penetration Test
Cohesive Soils

Penetration Resistance, N, (Blows / Foot)	Consistency	Unconfined Compressive Strength, (Tons / Sq. Ft.)
< 2	Very Soft	< 0.25
2 - 4	Soft	0.25 - 0.5
4 - 8	Medium	0.5 - 1.0
8 - 15	Stiff	1.0 - 2.0
15 - 30	Very Stiff	2.0 - 4.0
> 30	Hard	> 4.0

* Based on material passing the 3-inch sieve.

** More than 12% passing the No. 200 sieve; 5% to 12% passing No. 200 sieve requires use of duel symbols (i.e., SP-SM., GP-GM, SP-SC, GP-GC, etc.); Border line classifications are designated as CH/Cl, GM/SM, SP/SW, etc.

U.S. Standard Sieve Size 12" 3" 3/4" #4 #10 #40 #200

Unified Soil Classification Designation	Boulders	Cobbles	Gravel		Sand			Silt and Clay
			Coarse	Fine	Coarse	Medium	Fine	

Moisture Condition

- Dry — Absence of moisture, dusty, dry to the touch.
- Moist — Damp but no visible moisture.
- Wet — Visible free water, usually below the water table.

Material Quantity

Trace	< 5 %
Slightly	5 - 12%
Little	12 - 25%
Some	25 - 50 %

Other Symbols

C - Core Sample
S - SPT Sample
B - Bulk Sample
CK - Chunk Sample
R - Ring Sample
N - Nuclear Gauge Test
∇ - Water Table

DATE 08/01/2018 DRAWN BY: RG	Simplified USCS Soils Classification Chart	NoorzayGeo	B

NoorzayGeo

SUBSURFACE EXPLORATION LOG
Exploratory Boring No. 1

Project Number:	18063	Date:	6/29/2018	Logged By:	SN
Type of Rig:	CME 75	Drive Wt.	140 lbs	Elevation:	2025 ±
Drill Hole Dia.:	8"	Drop:	30"	Boring Depth (ft.):	10'

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
0			SP/SM			Qal		**Alluvial Soils:** Surface consisted of cobbles and boulders underlain by slightly silty, poorly graded sand; Tan to light brown in color; Dry; Loose.
1								
2								
3								
4								
5	R	50/4"						No sample recovery.
6								
7								
8								
9								
10								Driller refusal at 10' due to cobbles and boulders No groundwater encountered Severe caving encountered *Attempted to move boring location with similar result
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

NoorzayGeo

SUBSURFACE EXPLORATION LOG
Exploratory Boring No. 2

Project Number:	18063	Date:	6/29/2018	Logged By:	SN
Type of Rig:	CME 75	Drive Wt.	140 lbs	Elevation:	2055 ±
Drill Hole Dia.:	8"	Drop:	30"	Boring Depth (ft.):	15.5'

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
0			SP/SM			Qal		**Alluvial Soils:** Surface consisted of cobbles and boulders underlain by slightly silty, poorly graded sand; Tan to light brown in color; Dry; Loose.
4			GM					Silty, sandy gravel; Tan to light brown; Dry; Medium dense.
5	R	9 18 26						
10	R	50 27 50/5"	GM/GP		1.8			Slightly silty, sandy gravel; Tan to light brown; Dry; Very dense.
15	R	50/2"						No sample recovery.
15.5								End of boring at 15.5' due to refusal on boulders No groundwater encountered Moderate to severe caving encountered Backfilled with excavated material

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

NoorzayGeo

SUBSURFACE EXPLORATION LOG
Exploratory Boring No. 3

Project Number:	18063	Date:	6/29/2018	Logged By:	SN
Type of Rig:	CME 75	Drive Wt.	140 lbs	Elevation:	2065 ±
Drill Hole Dia.:	8"	Drop:	30"	Boring Depth (ft.):	10'

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
0	B		SP-SM			Qal		**Alluvial Soils:** Surface consisted of cobbles and boulders underlain by slightly silty, poorly graded sand; Tan to light brown in color; Dry; Loose.
1								
2								
3								
4								
5	R	50/4"						No sample recovery.
6								
7								
8								
9								
10								Driller refusal at 10' due to cobbles and boulders No groundwater encountered Severe caving encountered *Attempted to move boring location with similar result
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

NoorzayGeo

SUBSURFACE EXPLORATION LOG
Exploratory Boring No. 4

Project Number:	18063	Date:	6/29/2018	Logged By:	SN
Type of Rig:	CME 75	Drive Wt.	140 lbs	Elevation:	2004 ±
Drill Hole Dia.:	8"	Drop:	30"	Boring Depth (ft.):	30.5'

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
0			GP			Qal		**Alluvial Soils:** Poorly graded sandy gravel; Tan to brown; Dry; Loose.
5	S	24 37 28						Poorly graded, sandy gravel; Gray to brown; Dry; Dense.
10	S	22 43 50	GP/SP					Poorly graded sandy gravel and gravelly sand; Brown; Dry; Very dense.
15	S	28 50/5"						Poorly graded, sandy gravel and gravelly sand; Tan; Dry; Very dense.
20	S	25 34 50	SM					Silty sand, trace gravel; Tan; Dry; Very dense.

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

NoorzayGeo

SUBSURFACE EXPLORATION LOG
Exploratory Boring No. 4 (cont.)

Project Number:	18063	Date:	6/29/2018	Logged By:	SN
Type of Rig:	CME 75	Drive Wt.	140 lbs	Elevation:	2004 ±
Drill Hole Dia.:	8"	Drop:	30"	Boring Depth (ft.):	30.5'

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
			SM			Qal		**Alluvial Soils (cont.):** Silty sand, trace gravel; Tan; Dry; Very dense.
25	S	32 50/4"						No sample recovery.
26								
27								
28								
29								
30	S	50/3"						No sample recovery.
31								End of boring @ 30.5' due to refusal on cobbles and boulders No groundwater encountered Moderate to severe caving encountered Backfilled with excavated material
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

APPENDIX C

LABORATORY TESTING

NoorzayGeo

In-Situ Moisture Content and Dry Density

ASTM D2937

Job Name:	Solar Farm 33	Tested By :	M. Noorzay
Job Number:	18063	Date Completed:	7/6/2018
Sampled By:	M. Noorzay	Input By:	M. Noorzay
Date Sampled:	6/29/2018	Sample Number:	B-2 at 10'

Boring Number	**B2**					
Sample Depth (ft)	**10'**					
Sample Number	**1**					
Sample Type	**RING**					
USCS Description	GM/GP					
Number of Rings	0					
Total Weight of Rings + Soil (gms)						
Volume of Rings(ft3)(1r = 0.0027 ft^3)						
Weight of Rings (gms)(1r = 45.497 g)						
Weight of Soil (gms)						
Wet Density (pcf)						
% Saturation (Assumed Gs=2.6)						
Container Number	1					
Tare (gms)	0.0					
Wet Soil + Tare (gms)	202.0					
Dry Soil + Tare (gms)	198.4					
Weight of Water (gms)	3.6					
Water Content (%)	1.8					
Dry Density (pcf)						

NoorzayGeo

Modified Proctor

ASTM D1557

Job Name:	Solar Farm 33	Tested By :	M. Noorzay
Job Number:	18063	Date Completed:	7/6/2018
Sampled By:	M. Noorzay	Input By:	M. Noorzay
Date Sampled:	6/29/2018	Sample Number:	B-3 at 0-5'
Sample Description:	Silty, sandy gravel		

Trial Number	1	2	3	4	5
Water Added (%)	3	6	9	12	
Weight of Soil + Mold (grams)	7295	7500	7625	7635	
Weight of Mold (grams)	2820	2820	2820	2820	
Weight of Wet Soil (grams)	4475	4680	4805	4815	
Wet Density (pcf)	131.54	137.57	141.24	141.54	

Container ID	1	2	3	4	
Wet Soil + Container (grams)	500	500	500	500	
Dry Soil + Container (grams)	482.4	468.6	456.9	439.5	
Weight of Container (grams)	0	0	0	0	
Weight of Dry Soil (grams)	482.4	468.6	456.9	439.5	
Weight of Water (grams)	17.6	31.4	43.1	60.5	
Moisture Content (%)	3.65	6.70	9.43	13.77	
Dry Density (pcf)	126.9	128.9	129.1	124.4	

Compaction Method

ASTM D1557	X
ASTM D698	

Method	C
Mold Size	6
Mold Vol.	0.075

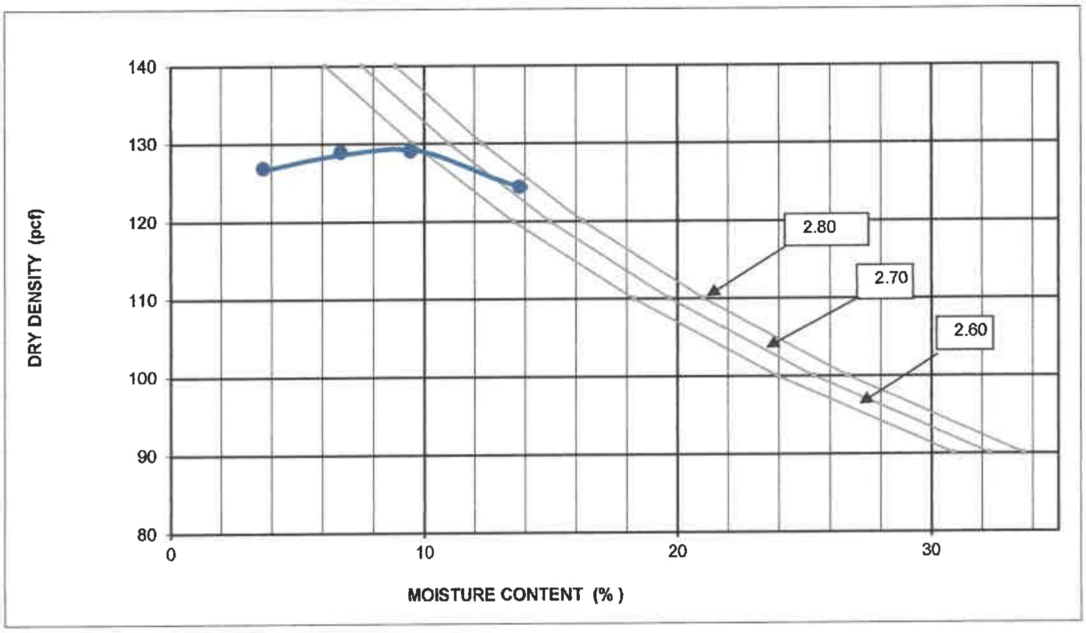
Preparation Method

Moist	X
Dry	

Maximum Dry Density (pcf)	**129.1**
Maximum Dry Density w/ Rock Correction (pcf)	**133.6**
Optimum Moisture Content (%)	**9.4**
Optimum Moisture Content w/ Rock Correction (%)	**8.0**

METHOD C
Percent Retained on 3/4 in Sieve: 15.5%
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per Layer : 56 (Fifty-six)

N/A



NoorzayGeo

Direct Shear

ASTM D3080

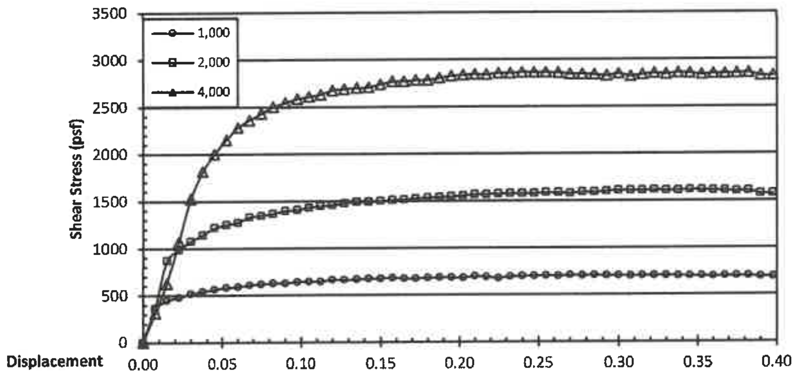
Job Name:	Solar Farm 33	Tested By :	M. Noorzay
Job Number:	18063	Date Completed:	7/6/2018
Sampled By:	M. Noorzay	Input By:	M. Noorzay
Date Sampled:	6/29/2018	Sample Number:	B-2 at 10'
Sample Description:	Silty, sandy gravel		

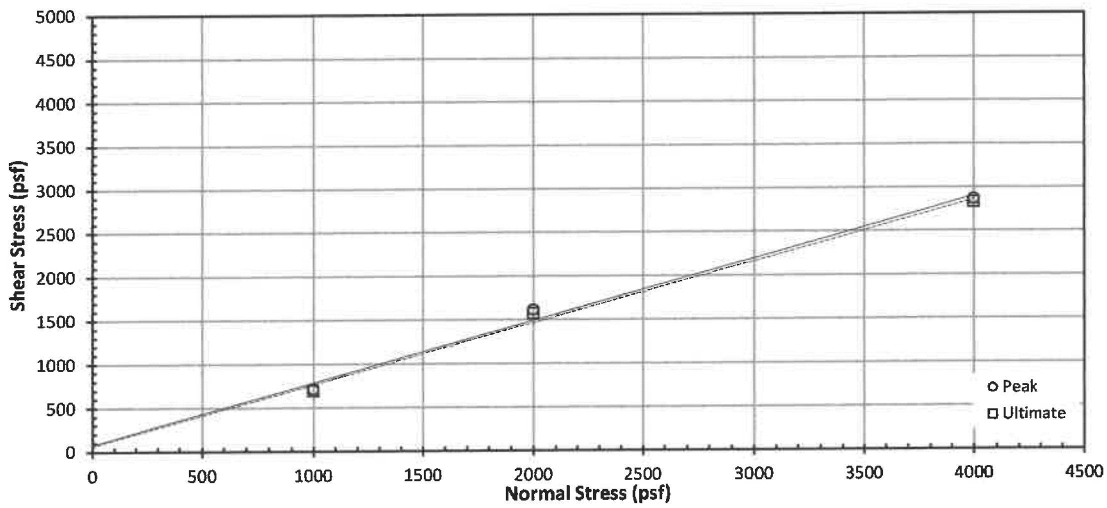
Samples Tested	1	2	3
Boring ID	B2	B2	B2
Depth (in/ft.)	10'	10'	10'
Normal Stress (psf)	1000	2000	4000
Maximum Shear Stress (psf)	707	1611	2865
Ultimate Shear Stress (psf)	691	1571	2827
Soil Type	0	0	0

	Peak	Ultimate
Friction, phi (Deg)	35.2	35.0
Cohesion (psf)	80.1	62.8

Sample Type:	RM
Method:	Drained
Consolidation:	Yes
Saturation:	Yes
Strain Rate (in/min):	0.025

Shear Stress v. Displacement





NoorzayGeo

Sieve Analysis

ASTM C 136/ C 117/ D 422

Job Name:	Solar Farm 33	Tested By :	M. Noorzay
Job Number:	18063	Date Completed:	7/6/2018
Sampled By:	M. Noorzay	Input By:	M. Noorzay
Date Sampled:	6/29/2018	Sample:	B-3 at 0-5'

Sieve Size	Wt. Retain	% Retain	% Pass	Spec.	Pass/Fail
1 1/2	0.0	0.0	100.0		
1	0.0	0.0	100.0		
3/4	35.8	5.4	94.6		
3/8	66.2	9.9	84.7		
No. 4	125.9	18.9	65.8		
No. 10	118.2	17.8	48.0		
No. 20	109.7	16.5	31.5		
No. 40	74.0	11.1	20.4		
No. 60	41.4	6.2	14.2		
No. 100	25.8	3.9	10.3		
No. 140	15.2	2.3	8.0		
No. 200	10.0	1.5	6.5		
Pan*	41.8	6.3	0.2		

* Includes the weight of material passing the #200 sieve by washing

#200 Wash		
Weight Before Wash (Dry)	665.6	grams
Weight After Wash (Dry)	625	grams
% Passing # 200 Wash	6.1%	

NoorzayGeo

Sieve Analysis

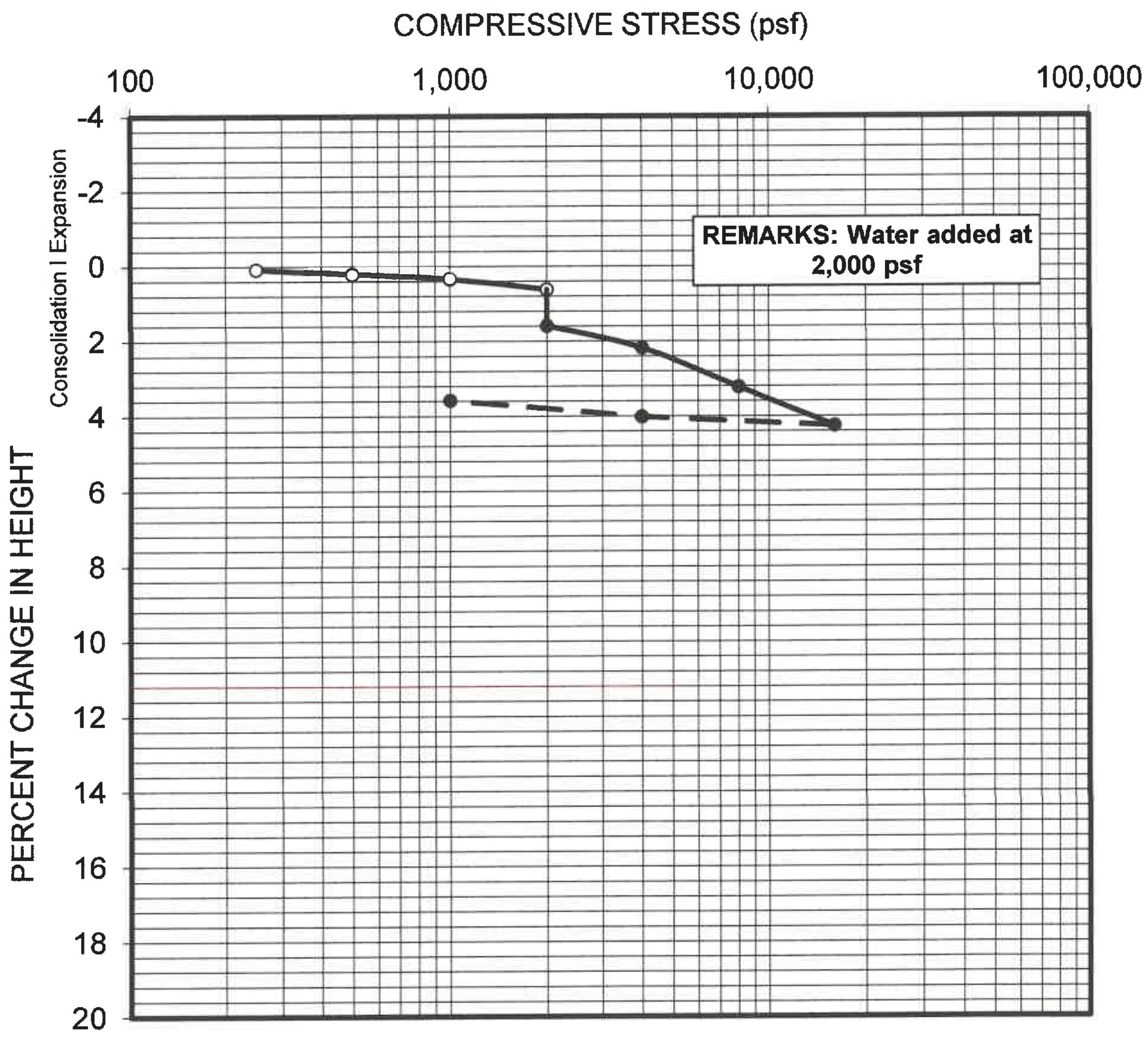
ASTM C 136/ C 117/ D 422

Job Name:	Solar Farm 33	Tested By :	M. Noorzay
Job Number:	18063	Date Completed:	7/6/2018
Sampled By:	M. Noorzay	Input By:	M. Noorzay
Date Sampled:	6/29/2018	Sample:	B4 @ 10,15,20

Sieve Size	Wt. Retain	% Retain	% Pass	Spec.	Pass/Fail
1 1/2	0.0	0.0	100.0		
1	0.0	0.0	100.0		
3/4	0.0	0.0	100.0		
3/8	121.7	17.9	82.1		
No. 4	104.3	15.3	66.8		
No. 10	117.5	17.2	49.6		
No. 20	97.8	14.4	35.2		
No. 40	64.2	9.4	25.8		
No. 60	37.0	5.4	20.4		
No. 100	26.3	3.9	16.5		
No. 140	18.0	2.6	13.9		
No. 200	11.8	1.7	12.1		
Pan*	82.7	12.1	0.0		

* Includes the weight of material passing the #200 sieve by washing

#200 Wash		
Weight Before Wash (Dry)	681.3	grams
Weight After Wash (Dry)	599.8	grams
% Passing # 200 Wash	12.0%	



Boring: B - 2	Depth (ft.): 5.0
Sample Description:	

AGI	**CONSOLIDATION CURVE**
	Solar Farm 33 (NGS #18063), California

PROJECT NO. 4410-TR	DATE: 7/18/18	**PAGE B-1**

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Client Name:	Noorzay Geotechnical Serv. Inc.	Analytical Report:	Page 1 of 3
Contact:	Maihan Noorzay	Project Name:	Noorzay - Soil Corrosivity
Address:	16817 Rainy Vale Ave. Riverside, CA 92503	Project Number:	Solar Farm 33 Daggett, CA
Report Date:	13-Jul-2018	**Work Order Number:**	**B8G0485**

Received on Ice (Y/N): No Temp: 39 °C

Attached is the analytical report for the sample(s) received for your project. Below is a list of the individual sample descriptions with the corresponding laboratory number(s). Also, enclosed is a copy of the Chain of Custody document (if received with your sample(s)). Please note any unused portion of the sample(s) may be responsibly discarded after 30 days from the above report date, unless you have requested otherwise.

Thank you for the opportunity to serve your analytical needs. If you have any questions or concerns regarding this report please contact our client service department.

Sample Identification

Lab Sample #	Client Sample ID	Matrix	Date Sampled	By	Date Submitted	By
B8G0485-01	B4 @ 5' NGS Job #18063	Soil	07/03/18 00:00	Massih	07/05/18 12:10	Massih Noorzay

mailing
P.O Box 432
Riverside, CA 92502-0432

location
6100 Quail Valley Court
Riverside, CA 92507-0704

P 951 653 3351
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www.babcocklabs.com

CA ELAP No. 2698
EPA No. CA00102
NELAP No. OR4035
LACSD No. 10119

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Client Name:	Noorzay Geotechnical Serv. Inc.	Analytical Report:	Page 2 of 3
Contact:	Maihan Noorzay	Project Name:	Noorzay - Soil Corrosivity
Address:	16817 Rainy Vale Ave. Riverside, CA 92503	Project Number:	Solar Farm 33 Daggett, CA
Report Date:	13-Jul-2018	**Work Order Number:**	**B8G0485**

Received on Ice (Y/N): No Temp: 39 °C

Laboratory Reference Number

B8G0485-01

Sample Description	Matrix	Sampled Date/Time	Received Date/Time
B4 @ 5' NGS Job #18063	Soil	07/03/18 00:00	07/05/18 12:10

Analyte(s)	Result	RDL	Units	Method	Analysis Date	Analyst	Flag
Saturated Paste							
pH	8.1	0.1	pH Units	S-1.10 W.S.	07/09/18 17:25	TML	
Saturated Extract							
Saturated Resistivity	1400	5	ohm-cm	SM 2520B	07/09/18 17:25	TML	
Water Extract							
Chloride	87	10	ppm	Ion Chromat.	07/10/18 02:24	KBS	N_WEX
Sulfate	750	10	ppm	Ion Chromat.	07/10/18 02:24	KBS	N_WEX

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Client Name:	Noorzay Geotechnical Serv. Inc.	Analytical Report:	Page 3 of 3
Contact:	Maihan Noorzay	Project Name:	Noorzay - Soil Corrosivity
Address:	16817 Rainy Vale Ave. Riverside, CA 92503	Project Number:	Solar Farm 33 Daggett, CA
Report Date:	13-Jul-2018	**Work Order Number:**	**B8G0485**

Received on Ice (Y/N): No Temp: 39 °C

Notes and Definitions

N_WEX	Analyte determined on a 1:10 water extract from the sample.
ND:	Analyte NOT DETECTED at or above the Method Detection Limit **(if MDL is reported)**, otherwise at or above the Reportable Detection Limit (RDL)
NR:	Not Reported
RDL:	Reportable Detection Limit
MDL:	Method Detection Limit
* / "' :	NELAP does not offer accreditation for this analyte/method/matrix combination

Approval

Enclosed are the analytical results for the submitted sample(s). Babcock Laboratories certify the data presented as part of this report meet the minimum quality standards in the referenced analytical methods. Any exceptions have been noted.

Amanda Porter

Amanda C. Porter

cc:

e-Short_No Alias.rpt

FDR

Table 1 - Laboratory Tests on Soil Samples

Noorzay Geo
Solar 33
Your #18063, HDR Lab #18-0447LAB
16-Jul-18

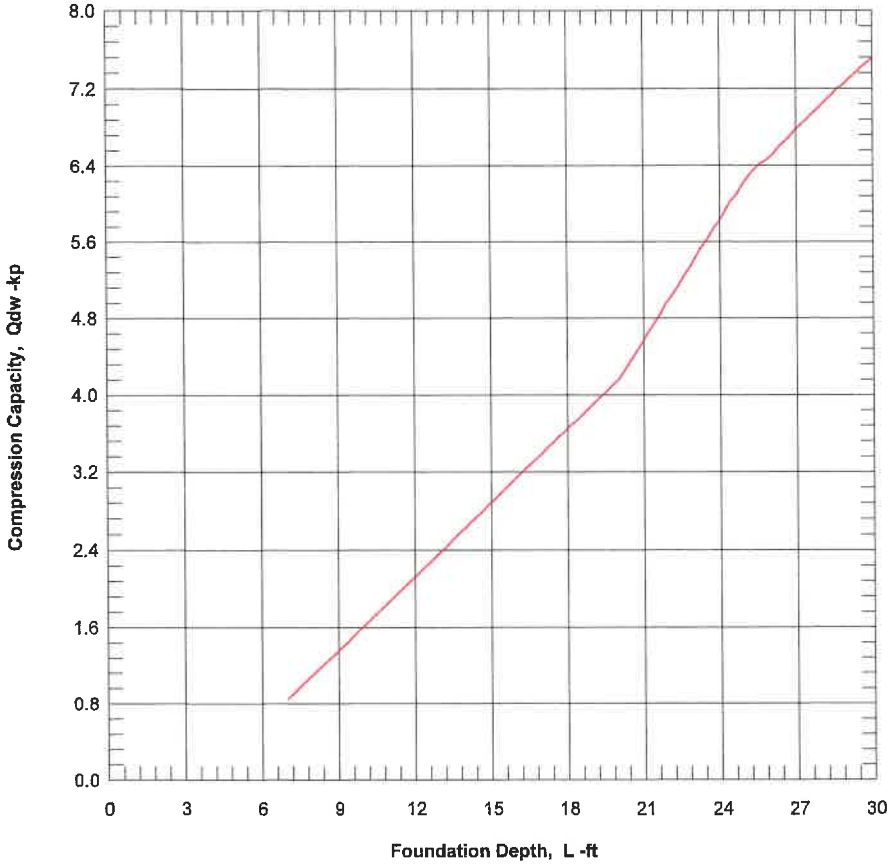
Sample ID		
		B3 @ 0-3'
Thermal Resistivity	**Units**	
	°C-cm/W	184

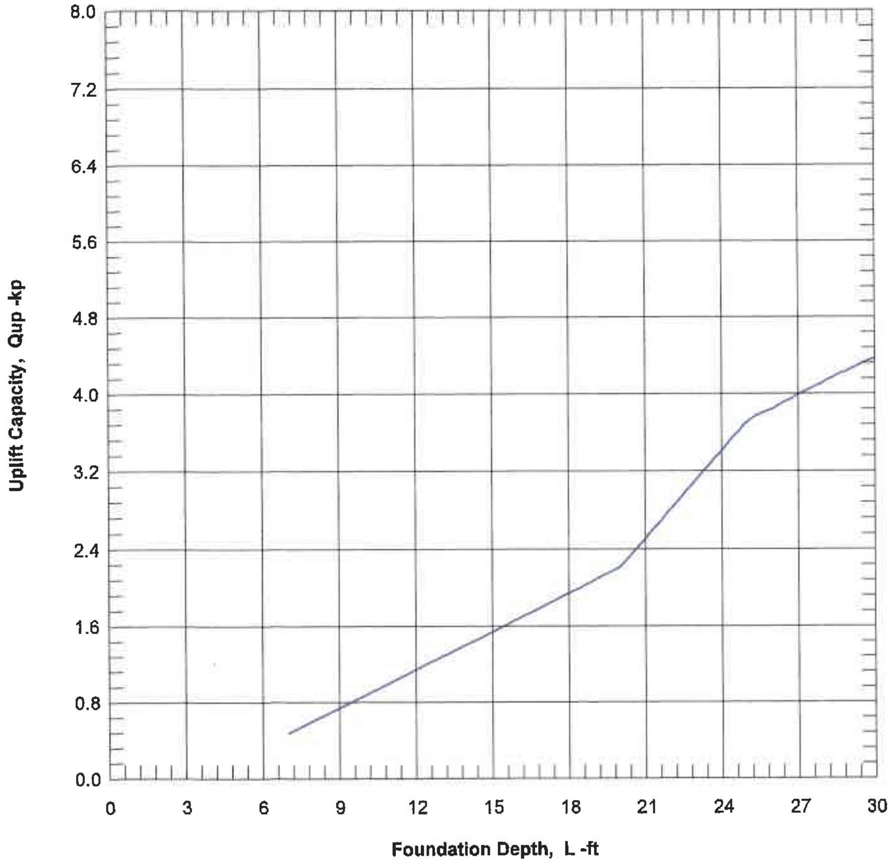
Thermal resistivity determined per ASTM D5334
°C-cm/W = degrees centigrade x centimeters per watt

APPENDIX D

PILE CALCULATIONS

ALLOWABLE CAPACITY vs FOUNDATION DEPTH



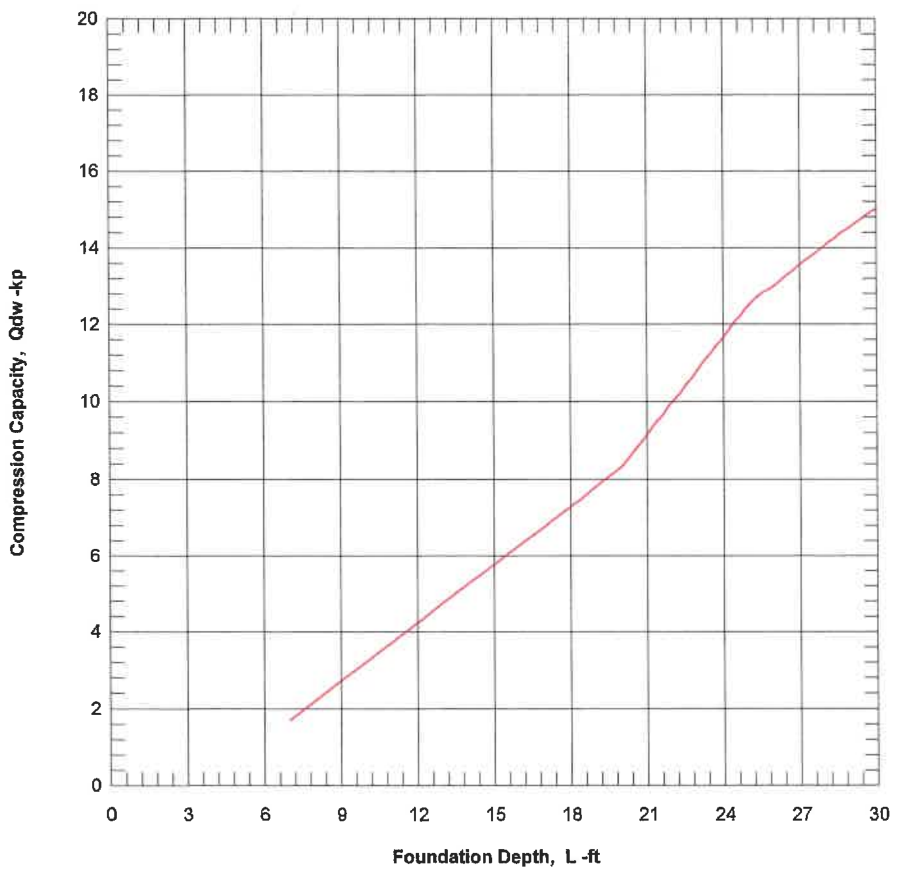


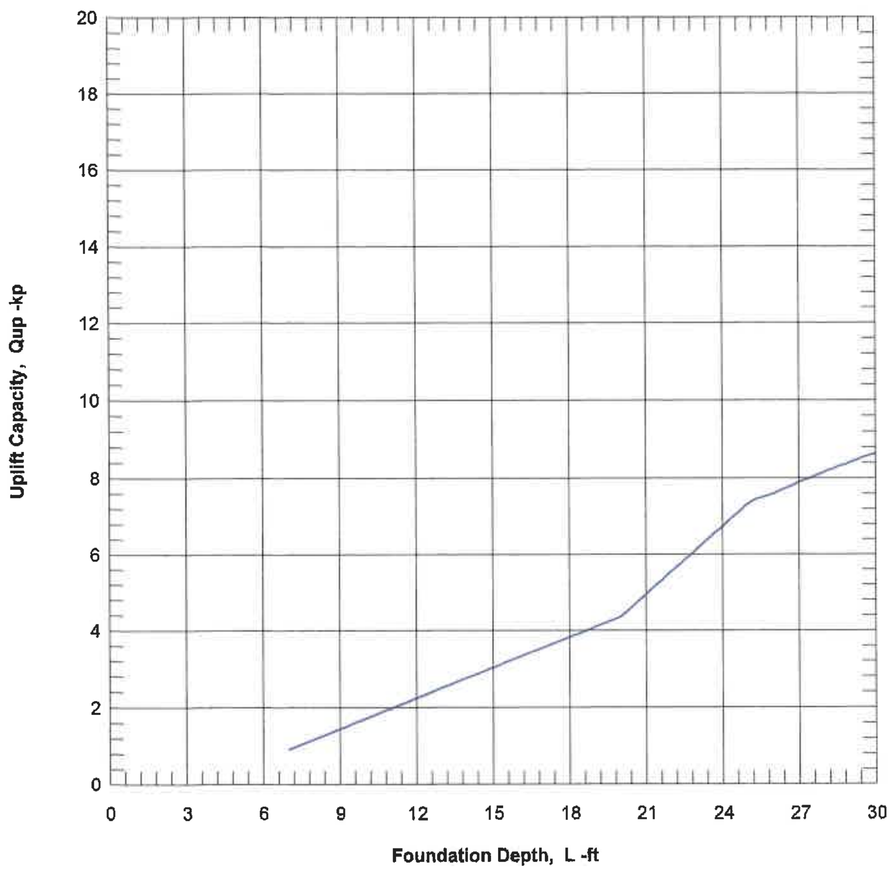
NoorzayGeo

Solar 33 (W6 X 10)
Daggett, California

Enclosure D-1

ULTIMATE CAPACITY vs FOUNDATION DEPTH





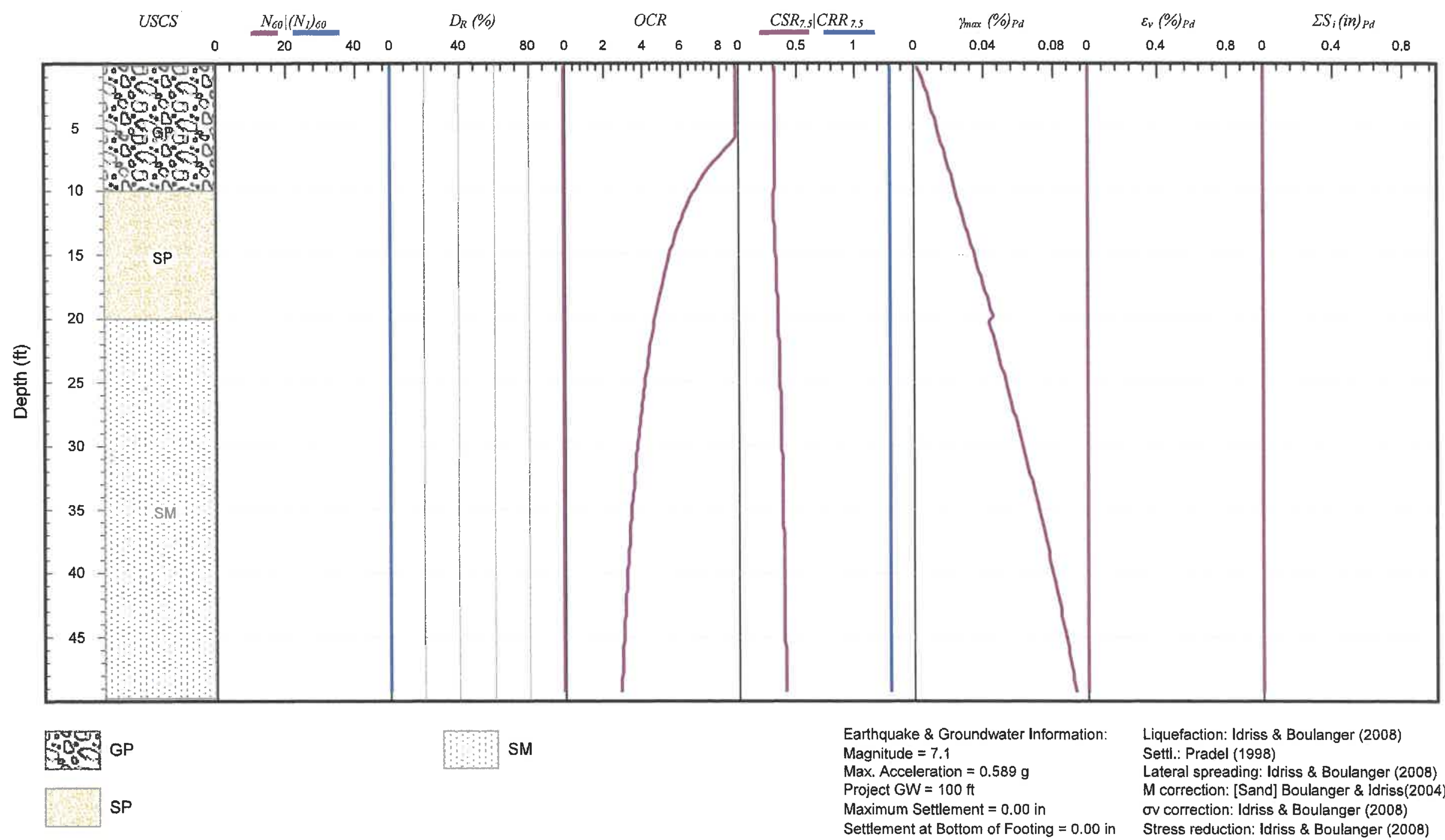
NoorzayGeo

Solar 33 (W6 X 10)
Daggett, California

Enclosure D-2

APPENDIX E

GEOTECHNICAL CALCULATIONS



Earthquake & Groundwater Information:
Magnitude = 7.1
Max. Acceleration = 0.589 g
Project GW = 100 ft
Maximum Settlement = 0.00 in
Settlement at Bottom of Footing = 0.00 in

Liquefaction: Idriss & Boulanger (2008)
Settl.: Pradel (1998)
Lateral spreading: Idriss & Boulanger (2008)
M correction: [Sand] Boulanger & Idriss(2004)
σv correction: Idriss & Boulanger (2008)
Stress reduction: Idriss & Boulanger (2008)

NoorzayGeo

Seismic Settlement Potential - SPT Data

Project:	Solar 33				
Location:	Daggett, California				
Job Number:	18063	Boring No.:	B-4	Enclosure:	E-1