Glacier Solar and Gas Solar Farm

Preliminary Geotechnical Engineering Report

November 14, 2023 | Terracon Project No. LA235050

Prepared for:

Sol-Gen Corporation

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November 14, 2023

Sol-Gen Corporation
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Yermo, California 92398

Attn: Mr. Paul Lampert
Email: **paul@sol-gencorp.com**

Re: Preliminary Geotechnical Engineering Report
Glacier Solar and Gas Solar Farm
Yermo, San Bernardino County, California
Terracon Project No. LA235050

Dear Mr. Lampert:

We have completed the preliminary Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PLA235050 dated May 4, 2023. This report provides a description of subsurface exploration and laboratory testing. Based on field and laboratory test results, this report provides geotechnical engineering recommendations concerning earthwork and the design and construction of the foundations for the proposed Glacier Solar and Gas Solar Farm project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon

Mohamed Mohamed
Staff Engineer

Joshua R. Morgan P.E.
Geotechnical Regional Manager

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Attachments

Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon logo will bring you back to this page. For more interactive features, please view your project online at **client.terracon.com**.

Introduction

This report presents the results of our geotechnical engineering services performed for the proposed Glacier Power and Gas Solar Farm facility located Yermo, San Bernardino County, California.

Our geotechnical engineering scope of work for this phase of the proposed project included the following:

- 4 soil test boring to depths of approximately 21½ feet below ground surface (bgs) in the proposed solar PV array area
- Corrosion testing on soil sample obtained from 1 location
- Laboratory testing of soil samples
- Geotechnical engineering analysis

Maps of the soil test boring locations are shown on the attached Exploration Plans in **Field Exploration Results** section of this report. A log of each boring is included in **Field Exploration Results** section of this report.

The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are summarized in part on the boring logs and are provided in graphical and tabular form in the **Laboratory Test Results** section of this report.

The purpose of these services was to provide information and preliminary geotechnical engineering recommendations relative to the proposed solar development.

- Subsurface soil conditions
- Site preparation and earthwork
- Unpaved access roads
- Corrosion considerations
- Groundwater conditions
- Seismic considerations
- Foundation design and construction

Project Description

Our final understanding of the project conditions is as follows:

Item	Description
Project Description	■ The Project will be within an approximate area of 24 acres illustrated in our site location plan.

Item	Description
	■ Based on the information provided, the proposed construction is currently planned to be a power plant with PV modules aligned in arrays and affixed to single-axis tracking systems or fixed arrays.
Proposed Structures	■ Ground-mounted, single axis tracker with photovoltaic modules ■ Other various project components could include electric cable/conduit laid in trenches, equipment and appurtenances (e.g., invertors, meteorological stations, and combiner boxes)
Proposed Construction	Photovoltaic (PV) arrays: ■ Driven wide flange piles (W6x9 or similar) Inverters, transformers, and other appurtenant equipment: ■ Shallow spread footings, mat slabs, driven piles, or drilled straight shafts
Grading/Slopes	Finished grades are expected to be within two feet of existing grades. A site grading plan has not been developed at this time.
Access Roads	Unpaved access roads are planned for the site as described below: ■ Low-volume access roads that will have a maximum vehicle load of 75,000 lbs. and will travel over the access roads once per week ■ We understand it is acceptable for the access roads to require ongoing maintenance throughout their design life.

Terracon should be notified if any of the above information is inconsistent with the planned construction, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available topographic maps.

Item	Description
Parcel Information	The project site is located in Yermo, San Bernardino County, California. The center of the site is at the following coordinates: ■ Latitude: 34.9093 (approximate) ■ Longitude: -116.7893 (approximate) See Site Location map in the **Field Exploration Results** section of this report for additional site location information.
Existing Improvements	The site is currently undeveloped
Current Ground Cover	The current ground cover consists of exposed soils and sparse desert vegetation

Item	Description
Existing Topography (From USGS)	Relatively flat with approximate elevations ranging from 1,904 to 1,910 feet

Geotechnical Characterization

Soil Conditions from the Exploration

Subsurface soils encountered in exploratory borings generally consisted of medium dense to very dense silty sand to a maximum explored depth of 21.5 feet. A clayey sand layer was encountered in B-3 from an approximate depth of 2½ to 5 feet bgs. Specific conditions encountered at each boring are indicated on the individual boring logs presented in the **Field Exploration Results** section of this report.

General laboratory tests were conducted on selected soil samples and the test results are presented in the **Laboratory Test Results** section of this report. Test results indicate the majority of sandy soils exhibit non-plastic to low plasticity characteristics. The thin layer of clayey sand soils exhibit medium plasticity characteristics.

Groundwater Observations

Groundwater was not observed in any of the test borings at the time of our field exploration, nor when checked upon completion of drilling and excavation. These observations represent groundwater conditions at the time of the field exploration and may not be indicative of other times, or at other locations. Groundwater conditions can change with varying seasonal and weather conditions, and other factors.

According to the Sustainable Groundwater Management Act (SGMA) – Groundwater Data website, State Well No. 345418116455001 (located approximately 1.5 miles southeast of the site), the shallowest historical groundwater level since 1987 was reported deeper than 100 feet bgs.

Laboratory Corrosion Testing

One (1) bulk sample were tested for laboratory soluble sulfate, soluble chloride, electrical resistivity, and pH testing. The values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

Results of soluble sulfate testing indicate that samples of the on-site soils tested classify as "Severe" (S1) according to Table 19.3.1.1 of Section 318 of the American Concrete Institute (ACI) Building Code Requirements for Structural Concrete. Concrete should be designed in accordance with the provisions of the ACI Building Code Requirements for Structural Concrete, Section 318, Chapter 19. The table can be found in the **Laboratory Test Results** section of this report.

Stormwater Management

Terracon reviewed the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey. It is our opinion that the saturated hydraulic conductivity, specifically the *"Capacity of the most limiting layer to transmit water",* associated with these mapped soils can be used as preliminary values needed at this stage of the project.

Based on the review of the referenced maps, the site has a Ksat value ranging from approximately 3.5 inches per hour to 13 inches per hour (high to very high).

Based on the soils encountered in our borings, we expect the percolation rates of the soils could be different when measured in the field due to variations in fines and gravel content. The above provided values can be used by the design team for preliminary planning purposes associated with the project. An appropriate factor of safety (FOS) of 3 should considered for any preliminary basin sizing. These values should not be used for final design or cost/contract estimating purposes.

Infiltration testing should be performed for the final design stages of the project once more precise locations of basins are known.

Seismic Site Class

The 2022 California Building Code (CBC) Seismic Design Parameters have been generated using the SEAOC/OSHPD Seismic Design Maps Tool. This web-based software application calculates seismic design parameters in accordance with ASCE 7-16, and 2022 CBC. The 2022 CBC requires that a site-specific ground motion study be performed in accordance with Section 11.4.8 of ASCE 7-16 for Site Class D sites with a mapped Ss value greater than or equal 0.2.

However, Section 11.4.8 of ASCE 7-16 includes an exception from such analysis for specific structures on Site Class D sites. The commentary for Section 11 of ASCE 7-16 (Page 534 of Section C11 of ASCE 7-16) states that "In general, this exception effectively limits the requirements for site-specific hazard analysis to very tall and or flexible structures at Site Class D sites." Based on our understanding of the proposed structures, it is our assumption that the exception in Section 11.4.8 applies to the proposed structure. However, the structural engineer should verify the applicability of this exception.

Based on this exception, the spectral response accelerations presented below were determined using the site coefficients (Fa and Fv) from Tables 1613.2.3(1) and 1613.2.3(2) presented in Section 16.4.4 of the 2022 CBC.

Description	Value
2022 California Building Code Site Classification (CBC)[1]	D[2]
Site Latitude (°N)	34.9093
Site Longitude (°W)	116.7893
S_s Spectral Acceleration for a 0.2-Second Period	1.682
S_1 Spectral Acceleration for a 1-Second Period	0.6
F_a Site Coefficient for a 0.2-Second Period	1.0
F_v Site Coefficient for a 1-Second Period	1.7

1. Seismic site classification in general accordance with the *2022 California Building Code*.
2. The 2022 California Building Code (CBC) requires a site soil profile determination extending to a depth of 100 feet for seismic site classification. The current scope does not include the 100-foot soil profile determination. Borings were extended to a maximum depth of 21½ feet, and this seismic site class definition considers that similar or denser soils continue below the maximum depth of the subsurface exploration. Additional exploration to deeper depths would be required to confirm the conditions below the current depth of exploration.

Typically, a site-specific ground motion study will generate less conservative coefficients and acceleration values which may reduce construction costs. We recommend consulting with a structural engineer to evaluate the need for such study and its potential impact on construction costs. Terracon should be contacted if a site-specific ground motion study is desired.

Faulting and Estimated Ground Motions

The site is located in southern California, which is a seismically active area. The type and magnitude of seismic hazards affecting the site are dependent on the distance to causative faults, the intensity, and the magnitude of the seismic event. As calculated using the USGS Unified Hazard Tool, the Calico-Hidalgo [15] fault is considered to have the most significant effect at the site from a design standpoint with a magnitude of 7.20 at a distance of approximately 1.76 kilometers from the site.

Based on the USGS Design Maps Summary Report, using the American Society of Civil Engineers (ASCE 7-16) standard, the design peak ground acceleration (PGA_M) for the project site is 0.831g. Based on the USGS Unified Hazard Tool, the project site seismicity for the 2% chance of exceedance hazard is defined by a modal magnitude of 7.51.

The site is not located within an Alquist-Priolo Earthquake Fault Zone for fault rupture hazard based on our review of the California State Fault Hazard Maps.[1]

Liquefaction

Liquefaction is a mode of ground failure that results from the generation of high pore-water pressures during earthquake ground shaking, causing loss of shear strength, and is typically a hazard where loose sandy soils exist below groundwater. The site has not been mapped for liquefaction hazard by the California Geological Survey. The County of San Bernardino has geologic hazard maps for certain areas throughout the county, including liquefaction hazard. Based on our review of these maps the site is not located within a County designated liquefaction hazard zone.

Based on the review of County maps, depth to groundwater, we anticipate liquefaction potential is low. Furthermore, other hazards associated with liquefaction, such as lateral spreading are also considered low.

Geotechnical Overview

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the test borings, provided that the findings and recommendations presented in this report are incorporated into project design and construction.

Based on the geotechnical engineering analyses, subsurface exploration, and laboratory test results, we recommend that electrical equipment associated with the inverters and other self-contained electrical equipment within the solar arrays be supported on shallow foundations bearing on engineered fill. Alternatively, electrical equipment and skids within the solar arrays can be supported on driven piles.

[1] California Geological Survey. https://maps.conservation.ca.gov/cgs/informationwarehouse.

The proposed electrical equipment within the solar array fields areas may be supported on mat foundations and/or support slabs with thickened edges. Shallow foundations should bear on engineered fill extending to a minimum depth of 2 feet below the bottom of foundations, or 4 feet below existing site grade, whichever is greater. Structural fill placed beneath the entire footprint of the proposed structures should extend horizontally a minimum distance of 2 feet beyond the outside edge of perimeter footings. Recommendations for the design and construction of shallow foundations are provided in **Shallow Foundations.**

PV solar panels can be supported by driven W-section steel piles. Considerations for driven piles are provided in **Deep foundations – PV Arrays** section of this report.

The recommendations contained in this report are based upon the results of field and laboratory testing, engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Earthwork

Earthwork will include clearing and grubbing, excavations, and placement of engineered fills on the project. The recommendations presented for design and construction of earth supported elements, including foundations, are contingent upon following the recommendations outlined in this section.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

Grading plans were not reviewed as part of the scope of work for this report. Terracon can be retained to evaluate the grading plans upon client request and can provide updated geotechnical engineering recommendations based on such a review.

Site Preparation

The earthwork described in the following paragraphs and sections is generally intended for the access roadways, drainage, equipment stations and ancillary structure areas. In the proposed solar array field, stripping of topsoil and vegetation may not be necessary if final grades are the same as the existing grades. Keeping existing topsoil and vegetation at the array field could minimize storm water erosion during construction and maintain overall ground surface stability for the solar-energy development.

Strip and remove existing vegetation, debris, and other deleterious materials from proposed development areas except for the on-grade solar array fields. Exposed surfaces within the project area should be free of mounds and depressions which could prevent uniform compaction.

Stripped materials consisting of vegetation and organic materials should be wasted from the site or used to re-vegetate landscaped areas or exposed slopes after completion of grading operations. If it is necessary to dispose of organic materials on-site, they should be placed in non-structural areas, and in fill sections not exceeding 5 feet in height.

If fill is placed in areas of the site where existing slopes are steeper than 5:1 (horizontal: vertical), the area should be benched to reduce the potential for slippage between existing slopes and fills. Benches should be wide enough to accommodate compaction and earth moving equipment, and to allow placement of horizontal lifts of fill. Any soft/loose, dry, and low-density soil should either be removed, or moisture conditioned and compacted in place prior to placing fill.

Subgrade Preparation

The proposed electrical equipment within the solar array fields as well as self-contained electrical equipment areas, may be supported on mat foundations and/or support slabs with thickened edges and should bear on engineered fill extending to a minimum depth of 2 feet below the bottom of foundations, or 4 feet below existing site grade, whichever is greater. On-site soils are considered suitable to be used as structural fill materials. Structural fill placed beneath the entire footprint of the proposed structures should extend horizontally a minimum distance of 2 feet beyond the outside edge of perimeter footings. Recommendations for the design and construction of shallow foundations are provided in **Shallow Foundations.**

Roadway sections may be supported on a minimum of 10 inches of scarified, moisture conditioned, and compacted native soils. The moisture content and compaction of subgrade soils should be maintained until construction. The compaction requirements provided in the **Fill Compaction Requirements** section of this report should be adhered to.

Care should be taken to prevent wetting or drying of the bearing materials during construction. Wet, dry, or loose/disturbed material in the bottom of the footing excavations should be removed before foundation concrete is placed. Place a lean concrete mud-mat over the bearing soils if the excavations must remain open for an extended period of time.

Excavation

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment.

The bottom of excavations should be thoroughly cleaned of loose soils and disturbed materials prior to backfill placement and/or construction.

Individual contractors are responsible for designing and constructing stable, temporary excavations. Excavations should be sloped or shored in the interest of safety following local, and federal regulations, including current OSHA excavation and trench safety standards.

Fill Material Types

Earthen materials used for engineered fill should meet the following material property requirements:

Soil Type	Acceptable Parameters
On-site soils	▪ Low plasticity soils, free of debris, organic matter, and oversized particles (greater than 3 inches in nominal dimension)
Import Soils [1]	Gradation (ASTM D6913) — Percent Finer by Weight ▪ 3" ....100 ▪ No. 4 Sieve........................50-100 ▪ No. 200 Sieve........................10-40 ▪ Maximum liquid limit (LL)........................30 ▪ Maximum plasticity index (PI)........................15 ▪ Maximum Expansion Index[2]........................20

1. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.
2. Tested in general accordance with ASTM D4829.

Compaction Requirements

Recommended compaction, moisture content criteria, and testing frequency for engineered fill materials are as follows:

Material Type and Location	Per the Modified Maximum Density Test (ASTM D1557) [1]			Recommended Test Frequency [2]
	Minimum Compaction Requirement (%)	Range of Moisture Contents for Compaction (% over optimum)		
		Minimum	Maximum	
Approved on-site native soils or imported fill (if necessary): Fill placed in array areas:	85	-1%	+4%	1 test per 5,000 SF per lift
Beneath foundations:	90	-1%	+4%	1 test per 2,000 SF per lift
Miscellaneous backfill:	85	-1%	+4%	1 test per 5,000 SF per lift
Compacted native soils for roadways:	90	-1%	+4%	1 test per 1,000 LF
Utility trench subgrade and backfill[1]:	85	-1%	+4%	1 test per 300 LF per lift
Aggregate base (pavements):	95	-2%	+2%	1 test per 1,000 LF

1. Compaction requirements may be increased by the electrical engineer based on thermal resistivity analyses. Upper 12 inches should be compacted to 90% within structural areas. ASTM D6938 Backscatter Method may be used for compaction testing in trenches in order to avoid damage to conductors. If trenchless technologies, are utilized during construction, then verification tests should be performed to verify the compaction level near the cable. Due to the controlled nature of the trenchless systems, the Engineer of Record may decrease the recommended test frequency at their discretion based on observations and tests results on-site.
2. Frequency of tests may be increased or decreased at the discretion of the Geotechnical Engineer of Record. The on-site materials testing and inspection company, if other than Terracon, shall assume the role of Geotechnical Engineer of Record.

Utility Trench Backfill

Care should be taken that utility trenches are properly backfilled. Backfilling should be accomplished with properly compacted suitable soils with loose lift thicknesses of generally 9 inches except for the first lift above the utility pipes that can be lowered to

12 inches. On-site soils or imported fill materials should be compacted to at least 85% Modified Proctor maximum dry density (ASTM D1557) in the range of -1 and +4 percentage points of the optimum moisture for the material. The on-site soils are susceptible to erosion and may require protection.

Compaction requirements may be increased by the electrical engineer based on thermal resistivity analyses. Upper 12 inches should be compacted to 90% within structural areas. ASTM D6938 Backscatter Method may be used for compaction testing in trenches in order to avoid damage to conductors. If trenchless technologies, are utilized during construction, then verification tests should be performed to verify the compaction level near the cable.

Frequency of tests may be increased or decreased at the discretion of the Geotechnical Engineer of Record. The on-site materials testing and inspection company, if other than Terracon, shall assume the role of Geotechnical Engineer of Record.

Earthwork Construction Considerations

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment.

At the time of our geotechnical exploration of the site, moisture contents of the surface and near-surface native soils ranged from about 3 to 27 percent. Based on these moisture contents, some moisture conditioning of the soils may be needed during construction and grading/engineered fill placement on the project. On-site soils are generally considered suitable for use as engineered fill for this project.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of the access roads. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed, or these materials should be scarified, moisture conditioned, and re-compacted prior to access road construction.

The individual contractors are responsible for designing and constructing stable, temporary excavations (including utility trenches) as required to maintain stability of both the excavation sides and bottom. Excavations should be sloped or shored in the interest of safety following local, and federal regulations, including current OSHA excavation and trench safety standards.

The geotechnical engineer should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation, proof-rolling, placement and compaction of controlled compacted fills and backfilling of excavations to the completed subgrade.

Shallow Foundation

The proposed self-contained electrical elements within the solar areas can be supported by mat foundations and/or support slabs with thickened edges. Design recommendations for mat foundations are presented in the following sections.

Design Parameters

DESCRIPTION	RECOMENDATION
Bearing Material[3]	Engineered fill extending to a minimum depth of 2 feet below the bottom of foundations, or 4 feet below existing site grade, whichever is greater
Maximum Net Allowable Bearing pressure (1-inch Settlement) [1,7]	3,000 psf for mat foundation (Up to 10 feet wide by 20 feet long)
Minimum Dimensions	12 inches
Ultimate Coefficient of Sliding Friction [4]	0.35
Ultimate Passive Resistance [5] **(equivalent fluid pressures)**	360 psf/ft
Minimum Embedment Depth Below Finished Grade	12 inches
Estimated Total Settlement from Structural Loads [2]	As-noted above
Estimated Differential Settlement [2,6]	About ½ of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied.
2. Unsuitable or loose/soft, dry, and low-density soils should be removed and replaced per the recommendations presented in the **Earthwork**.
3. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face.

DESCRIPTION	RECOMENDATION

4. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
5. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure. The designer should select an appropriate factor of safety during design.
6. Differential settlements are as measured over a span of 40 feet.
7. Maximum width is based on settlement analysis

Settlement calculations were performed utilizing Westergaard and Hough's methods[5] to estimate the static settlement and allowable bearing pressure for various foundation widths. Since there are several factors that will control the design of mat foundations besides vertical load, Terracon should be consulted when the final foundation depth and width are determined to assist the structural designer in the evaluation of anticipated settlement.

For structural design of mat foundations, a modulus of subgrade reaction (K_{v1}) of 200 pounds per cubic inch (pci) may be used. Other details including treatment of soft foundation soils, superstructure reinforcement and observation of foundation excavations as outlined in the Earthwork section of this report are applicable for the design and construction of a mat foundation at the site.

The subgrade modulus (K_v) for the mat is affected by the size of the mat foundation and would vary according the following equation:

$$K_v = K_v \frac{(\mathrm{b}+1)^2}{4b^2}$$

Where: K_v is the modulus for the size footing being analyzed
b is the width of the mat foundation.

Our engineer can provide refined estimates of K_c if provided more detailed information regarding the loads and application area to conduct settlement analysis.

5 FHWA Geotechnical Engineering Circular No. 6 – Shallow Foundations, FHWA-SA-02-054.

Shallow Foundation Design Considerations

Finished grade is defined as the lowest adjacent grade within five feet of the foundation for perimeter (or exterior) footings.

The allowable foundation bearing pressure applies to dead loads plus design live load conditions. The design bearing pressure may be increased by one-third when considering total loads that include wind or seismic conditions. The weight of the foundation concrete below grade may be neglected in dead load computations.

Foundations should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of joints at openings or other discontinuities in masonry walls is recommended.

Foundation excavations should be observed by the geotechnical engineer. If the soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

Deep Foundations

Driven Foundations – PV Arrays

Proposed solar PV panels and inverters can be supported on driven steel W-section foundations (assumed to be W6x9 or similar) in general accordance with the following sections.

Driven Pile Considerations

The proposed solar PV panels and inverters may be supported on a driven pile foundation system. The design capacity of a single-driven pile is a function of several factors including:

- Size and type of pile;
- Type and capacity of pile installation equipment;
- Pile integrity after installation; and
- Engineering properties of the subsurface soils.

Based on specific conditions encountered on site, the soils are generally considered drivable for pile installation. The most effective means of verifying pile drivability and capacities for either tension or lateral loads is through pile load tests. Preliminary pile foundation design parameters have been based upon correlated capacities utilizing soil strength criteria determined from the field and laboratory testing conducted during exploration.

The tables below neglect a depth of 2 feet for axial and lateral resistance. This neglect is due to depth of topsoil, scour and/or disturbance from utilities near the piles. Depth of neglect should be verified by the design engineer.

The allowable axial parameters of the pile in compression and tension were determined by dividing the ultimate axial capacity by a minimum factor-of-safety (FOS) of 2.0 for skin friction and 3.0 for end bearing. The allowable unit skin friction was determined using the soil strengths based on our field and laboratory testing. The following geotechnical design parameters can be used to determine the capacity of driven W-section pile foundations. Pile capacity calculations and an example calculation are provided below the table.

Description	Top Depth / Bottom Depth	Total Unit Weight (pcf)	Allowable Compression Unit Skin Friction (psf)[A]	Allowable Bearing Pressure (psf)[B,C]
Stratum 1	1 / 8	100	50	3,000
Stratum 2	8 / 16	110	200	8,000

[A] Allowable uplift capacity is on the order of 70% of the compression capacity values in the table. The values provided should be multiplied by the box perimeter of the pile times the depth. The box perimeter is considered two times the width of the flange plus two times the depth of the web.
[B] The values provided should be multiplied by the box area of the pile and be used for compression resistance only.
[C] Terracon recommends a minimum embedment depth of 5 feet.

Recommended Pile Capacity Calculations:

$$F_{total}\,(lbs) = F_{skin\ axial}\,(lbs) + F_{bearing}\,(lbs)$$

$$F_{skin\ axial}\,(lbs) = F_{s1} \times P \times (h_{1b} - h_{1t}) + F_{s2} \times P \times (h_{2b} - h_{2t}) + \ldots$$

$$F_{bearing}(lbs) = F_b \times A_P$$

Where:

$Fs1$ = Allowable Unit Skin Friction for layer 1 (psf)
P = Pile perimeter = 2 * Flange Width + 2 * Depth (ft)
h_{1b} = bottom depth of embedment of pile (ft) into or bottom of zone
h_{1t} = depth of top of zone (ft)
F_b = allowable bearing pressure at the embedded stratum (psf)
A_P = Box perimeter Area = Flange Width x Web Depth (ft^2)

Recommended soil parameters for lateral load analysis of driven pile foundations have been developed for use in LPILE computer programs. Engineering properties have been estimated as outlined below:

Description	Top Depth Bottom Depth	Effective Unit Weight (pcf)	L-PILE/ GROUP Soil Type	Sand(deg)
Stratum 1	1 8	100	Reese Sand	30
Stratum 2	8 16	110	Reese Sand	35

Note: LPILE default values can be used for the K modulus

Drilled shaft Design Parameters

The proposed structure end/turning poles and bus supports can be supported on drilled shafts. Total required embedment of the drilled shafts should be determined by the structural engineer based on structural loading and parameters provided in this report.

The allowable side friction and end bearing components of resistance were evaluated and are presented in the below table. The allowable total downward capacity is based on a minimum factor of safety of 2.5. The allowable uplift capacities should be based on 70% of the below skin friction values only. The depth below ground surface indicated in the attached graphs is referenced from the existing ground surface at the site at the time of the field exploration.

Recommended geotechnical parameters for lateral load analyses of drilled shaft foundations have been developed for use in the L-PILE computer program. Based on our review of the subsurface conditions within the outline of the substation the Standard Penetration Test (SPT) results, engineering properties have been estimated for the soils conditions as shown in the following table for the substation. Lateral and axial capacity of soils within the upper 2 feet should be neglected due to utilities and anticipated disturbance or scour around shafts. We recommend that Terracon review the final drilled shaft design to verify that sufficient embedment is achieved.

Lateral Load Analyses Estimated Engineering Properties of Soils						
Top Depth Bottom Depth	Effective Unit Weight (pcf)	L-PILE/ GROUP Soil Type	Internal Angle of Friction (Degrees)	Un-drained Shear Strength (ksf)	End Bearing (psf)	Skin Friction (psf)

2 **8**	120	Sand (Reese)	30	--	3,000	80
8 **21**	115	Sand (Reese)	35	--	10,000	300

LPILE default values can be used for the K modulus. The depth below ground surface indicated in the table above is referenced from the existing ground surface at the site at the time of the field exploration. If fill is placed to raise the site grades, the depths shown in the table above must be increased by the thickness of fill placed. The required depths of shaft embedment should also be determined for design lateral loads and overturning moments to determine the most critical design condition.

Lateral load design parameters are valid within the elastic range of the soil. The coefficients of subgrade reaction are ultimate values; therefore, appropriate factors of safety should be applied in the shaft design or deflection limits should be applied to the design.

It should be noted that the load capacities provided herein are based on the stresses induced in the supporting soils. The structural capacity of the shafts should be checked to assure that they can safely accommodate the combined stresses induced by axial and lateral forces. Furthermore, the response of the drilled shaft foundations to lateral loads is dependent upon the soil/structure interaction as well as the shaft's actual diameter, length, stiffness and "fixity" (fixed or free-head condition).

Drilled Shaft Construction Considerations

Drilling to design depths should be possible with conventional single flight power augers. Due to the presence of sand on the site, caving of soils within the drilled shaft excavations should be anticipated. For drilled shaft depths above the depth of groundwater, temporary steel casing will likely be required to properly drill and clean shafts prior to concrete placement.

Drilled shaft foundation concrete should be placed immediately after completion of drilling and cleaning. If foundation concrete cannot be placed in dry conditions, a tremie should be used for concrete placement. Due to potential sloughing and raveling, foundation concrete quantities may exceed calculated geometric volumes

If casing is used for drilled shaft construction, it should be withdrawn in a slow continuous manner maintaining a sufficient head of concrete to prevent the creation of voids in shaft concrete. Shaft concrete should have a relatively high fluidity when placed in cased shaft holes or through a tremie. Shaft concrete with slump in the range of 6 to 8 inches is recommended.

We recommend that all drilled shaft installations be observed on a full-time basis by an experienced geotechnical engineer in order to evaluate that the soils encountered are consistent with the recommended design parameters. If the subsurface soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

The contractor should check for gas and/or oxygen deficiency prior to any workers entering the excavation for observation and manual cleanup. All necessary monitoring and safety precautions as required by OSHA, State or local codes should be strictly enforced by the owner and the EPC.

Access Roads

Compacted Native Soils Access Road Design Recommendations

Based upon the soil conditions encountered in the test borings, the use of on-site soils for construction of on-site roads is considered acceptable. Without the use of asphalt concrete or other hardened material to surface the roadways, there is an increased potential for erosion and deep rutting of the roadway to occur, however, post construction traffic is anticipated to only consist of pickup trucks for operations and maintenance personnel. Therefore, construction of the un-surfaced native roadways should consist of a minimum of 10-inches of compacted on-site soils.

It is our understanding that proposed compacted native roadway grades will match adjacent existing grades so that the existing natural drainage patterns are generally unchanged. The un-surfaced roads are expected to function with periodic maintenance.

Aggregate Surface Roadway Design Recommendations

Aggregate surface roadway design was conducted in general accordance with the Army Corps of Engineers (ACOE) Technical Manual TM-5-822, Design of Aggregate Surface Roads and Airfields (1990). The design was based on Category III, traffic containing as much as 15% trucks, but with not more than 1% of the total traffic composed of trucks having three or more axles (Group 3 vehicles), and Road Class G (Under 70 vehicles per day). We anticipate vehicles within this traffic class will not exceed wheel loads of 12,500 lbs. Based on the Category and Road Class, a Design Index of 1 was utilized, along with a CBR of 10 based on laboratory testing. Terracon should be contacted if significant changes in traffic loads or in the characteristics described are anticipated.

As a minimum, the aggregate surface course should have a minimum thickness of 4 inches and should be constructed over a minimum of 10 inches of scarified, moisture conditioned, and compacted native soils to 95% of the maximum dry density using ASTM D 1557.

The recommended thicknesses should be measured after full compaction. The width of the roadway should extend a minimum distance of 1 foot on each side of the desired surface width.

It is our understanding that aggregate surfaced roads and parking areas will be utilized during the construction of this project. Aggregate materials should conform to the specifications of Class II aggregate base in accordance with the requirements and specifications of the State of California Department of Transportation (CalTrans), or other approved local governing specifications.

Positive drainage should be provided during construction and maintained throughout the life of the roadways. Proposed roadway design should maintain the integrity of the road and eliminate ponding

Aggregate Surfaced Road Construction Considerations

Regardless of the design, un-surfaced roadways will display varying levels of wear and deterioration. We recommend an implementation of a site inspection program at a frequency of at least once per year to verify the adequacy of the roadways. Preventative measures should be applied as needed for erosion control and re-grading. An initial site inspection should be completed approximately three months following construction.

Preventative maintenance should be planned and provided for through an on-going management program to enhance future roadway performance. Preventative maintenance activities are intended to slow the rate of deterioration, and to preserve the roadway investment.

Surfacing materials should not be placed when the surface is wet. Surface drainage should be provided away from the edge of roadways to reduce lateral moisture transmission into the subgrade.

If rut depths become excessive as construction work progresses, re-grading and re-compaction should be performed as necessary. Care should be taken to reduce or eliminate trafficking of the unpaved access road when the subgrade is wet as this will result in accelerated rutting conditions. Scarification, moisture treatment as necessary, and re-compaction of the roadways will likely be necessary as the roadways deteriorate.

Materials and construction of roadways for the project should be in accordance with the requirements and specifications of the California Department of Transportation or the applicable local governing body.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly affect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

Site Location and Exploration Plans

Contents:

Note: All attachments are one page unless noted above.

Site Location

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

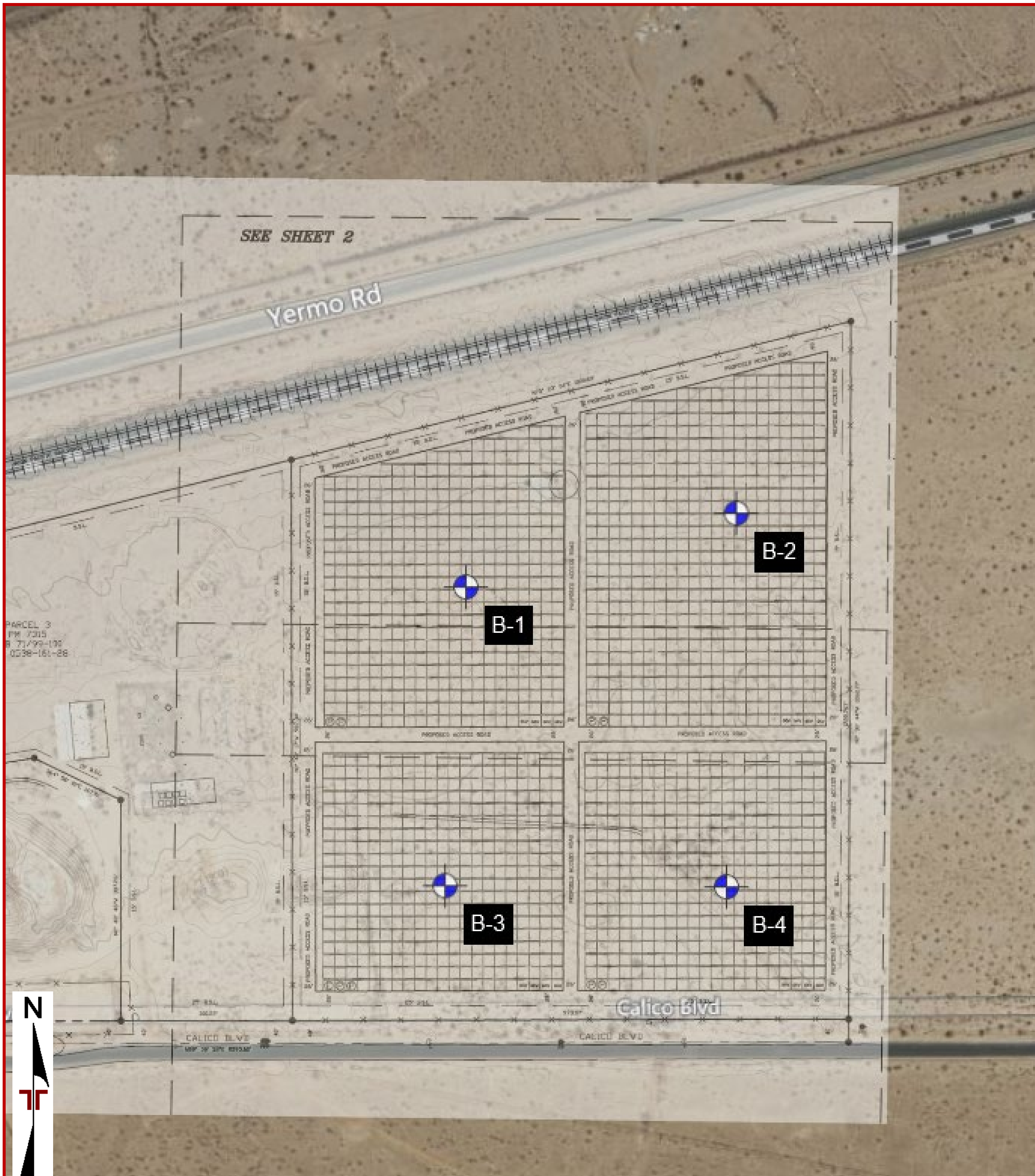


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Field Exploration Results

Exploration and Testing Procedures

Field Exploration

Number of Explorations	Boring/Test Pit ID Nos.	Approximate Boring Depth (feet)	Location
4 Borings	B-1 through B-4	21½	PV Array Areas

Boring Layout and Elevations: Terracon personnel provided the boring and test pit layout using handheld GPS equipment (estimated horizontal accuracy of about ±20 feet) and referencing existing site features. Approximate ground surface elevations were obtained using Google Earth Pro. If a more precise boring and test pit layout or elevations are desired, we recommend borings and test pits be surveyed.

Standard Penetration Test Borings: We advanced the borings with track-mounted drill rigs using hollow stem augers. Four samples were obtained in the upper 10 feet of the borings and at intervals of 5 feet thereafter. A standard 2-inch outer diameter split-barrel sampling spoon is driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. A 3-inch O.D. split-barrel sampling spoon with 2.5-inch I.D. ring lined sampler was also used for sampling. Ring-lined, split-barrel sampling procedures are similar to standard split spoon sampling procedure; however, blow counts are typically recorded for 6-inch intervals for a total of 18 inches of penetration. We observed and recorded groundwater levels during drilling and sampling.

For safety purposes, all borings were backfilled with auger cuttings after their completion. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our field engineer prepared field boring logs as part of the excavation operations. These field logs include visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Boring Log Recording: The sampling depths, penetration distances, and other sampling information was recorded on the field boring and test pit logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling and excavation operations. These field logs included visual classifications of the materials observed during drilling and excavation, and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Glacier Power and Gas Solar Farm
39952 Calico Boulevard | Yermo, CA
Terracon Project No. LA235050

Terracon
145 W Walnut St
Carson, CA

Boring Log No. B-1

Location: See Exploration Plan

Latitude: 34.9110° Longitude: -116.7880°

Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
0 – 2.5	**SILTY SAND (SM)**, light tan			Auger					
2.5 – 7.5	**CLAYEY SAND (SC)**, trace gravel, medium dense			Auger / SPT	5-9-11 N=20				
		5		SPT	5-10-10 N=20	27.4			21
7.5 – 15.0	**SILTY SAND (SM)**, medium dense			SPT	5-10-15 N=25				
	dense	10		SPT	7-15-15 N=30			NP	
15.0 – 21.5	**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, light tan, dense	15		SPT	5-20-22 N=42	9.3			9
	very dense	20		SPT	6-50/6"				
21.5	***Boring Terminated at 21.5 Feet***								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
Not encountered

Drill Rig
Track

Hammer Type
Automatic

Driller
2R

Logged by
AS

Boring Started
09-19-2023

Boring Completed
09-19-2023

Notes
Elevation Reference: Elevations were obtained from Google Earth Pro

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Glacier Power and Gas Solar Farm
39952 Calico Boulevard | Yermo, CA
Terracon Project No. LA235050

Terracon
145 W Walnut St
Carson, CA

Boring Log No. B-2

Location: See Exploration Plan

Latitude: 34.9113° Longitude: -116.7864°

Depth (Ft.)	Material Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
	SILTY SAND (SM), light brown								
	medium dense				8-11-11 N=22				
5.0	**POORLY GRADED SAND (SP)**, light brown to white, medium dense	5			4-10-10 N=20				5
					4-9-9 N=18				
	trace gravel, light tan	10			5-8-5 N=13				
15.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, light tan, dense	15			8-16-15 N=31	7.5			7
		20			4-10-25 N=35				
21.5	***Boring Terminated at 21.5 Feet***								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes
Elevation Reference: Elevations were obtained from Google Earth Pro

Water Level Observations
Not encountered

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Drill Rig
Track

Hammer Type
Automatic

Driller
2R

Logged by
AS

Boring Started
09-19-2023

Boring Completed
09-19-2023

Terracon
145 W Walnut St
Carson, CA

Boring Log No. B-3

Location: See Exploration Plan

Latitude: 34.9095° Longitude: -116.7882°

Depth (Ft.)	Material Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
2.5	**SILTY SAND (SM)**, light tan								
5.0	**CLAYEY SAND (SC)**, brown to light brown, medium dense				3-4-6 N=10			33-16-17	
7.5	**POORLY GRADED SAND (SP)**, with trace silt, light tan, loose	5			8-6-12	3.0	97		5
	POORLY GRADED SAND WITH SILT (SP-SM), light brown, medium dense				5-11-12 N=23				
	dense	10			7-20-27				
	very dense	15			10-25-25				
21.5		20			25-50				
	Boring Terminated at 21.5 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes
Elevation Reference: Elevations were obtained from Google Earth Pro

Water Level Observations
Not encountered

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Drill Rig
Track

Hammer Type
Automatic

Driller
2R

Logged by
AS

Boring Started
09-19-2023

Boring Completed
09-19-2023

Terracon
145 W Walnut St
Carson, CA

Boring Log No. B-4

Location: See Exploration Plan

Latitude: 34.9095° Longitude: -116.7865°

Depth (Ft.)	Material Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI	Percent Fines
	SILTY SAND (SM), trace gravel, light brown								
	medium dense	2.5–4			5-10-12 N=22				
		5–6.5			8-14-15 N=29				16
		7.5–9			6-14-10 N=24				
	dense	10–11.5			6-18-17 N=35	17.3			15
		15–16.5			7-18-20 N=38				
21.5	medium dense	20–21.5			5-11-9 N=20				
	Boring Terminated at 21.5 Feet								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
Not encountered

Notes
Elevation Reference: Elevations were obtained from Google Earth Pro

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Drill Rig
Track

Hammer Type
Automatic

Driller
2R

Logged by
AS

Boring Started
09-19-2023

Boring Completed
09-19-2023

Laboratory Test Results

Laboratory Testing Procedures

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture content of soil by mass
- In-situ dry density (unit weight)
- Atterberg Limits
- Sieve Analysis

The laboratory testing program also included review of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in general accordance with the Unified Soil Classification System.

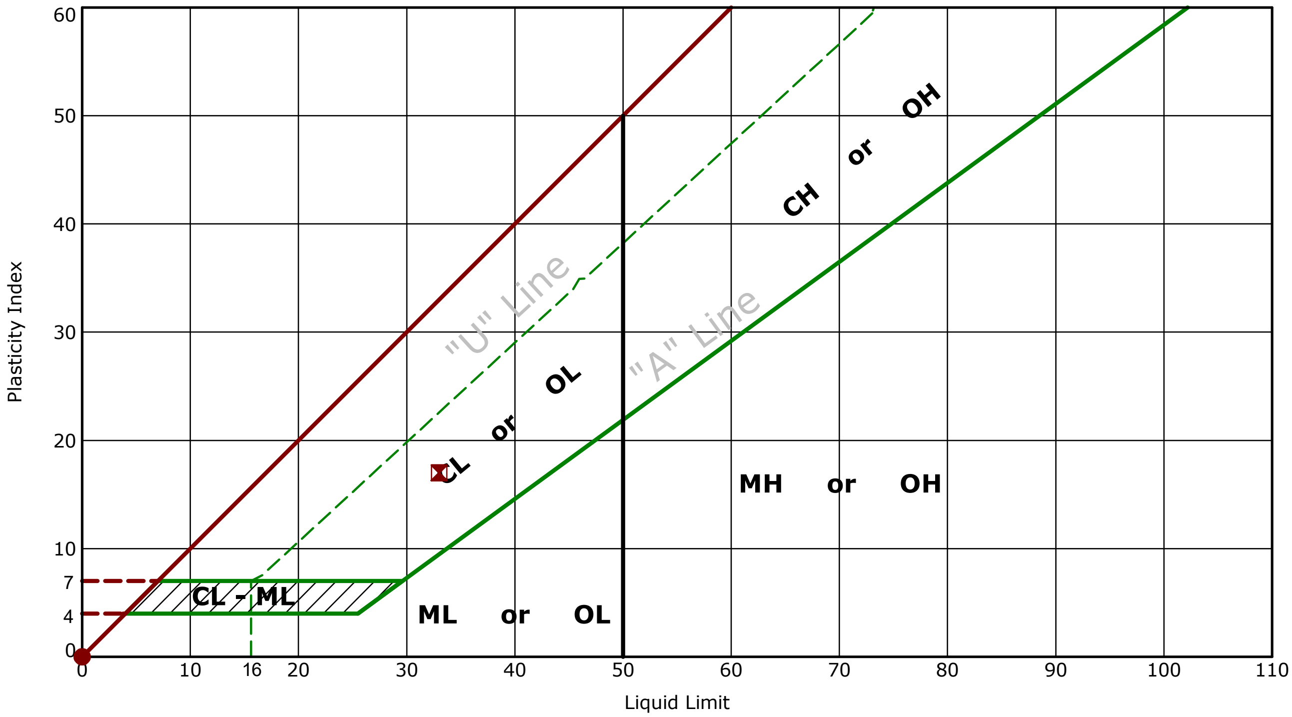
Corrosivity Testing: Bulk samples of near surface soils were tested in the laboratory for the following properties in general accordance with the corresponding standards:

- pH Analysis (ASTM G51)
- Chloride (ASTM D512)
- Sulfate (ASTM C1580)
- Sulfide Content (AWWA 4500-S D)
- Oxidation-Reduction Potential (ASTM G200)
- Total Salts (AWWA 2520 B)
- Minimum Electrical Resistivity Testing (ASTM G187)
- Moisture Content (ASTM D2216)

145 W Walnut St
Carson, CA

Atterberg Limit Results

ASTM D4318

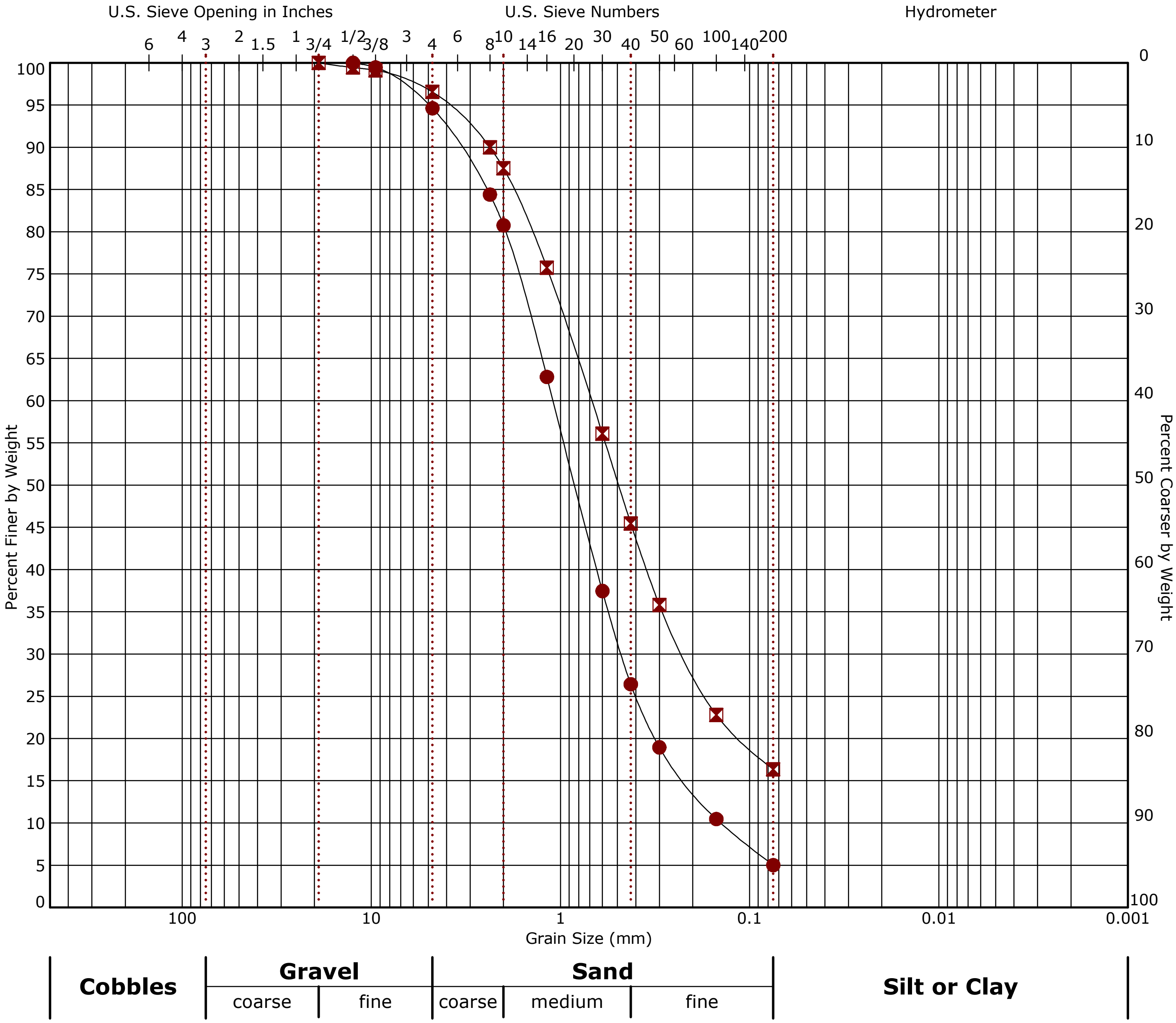


	Boring ID	Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	B-1	10 - 11.5	NP	NP	NP		SM	SILTY SAND
⊠	B-3	2.5 - 4	33	16	17		SC	CLAYEY SAND

145 W Walnut St
Carson, CA

Grain Size Distribution

ASTM D422 / ASTM C136



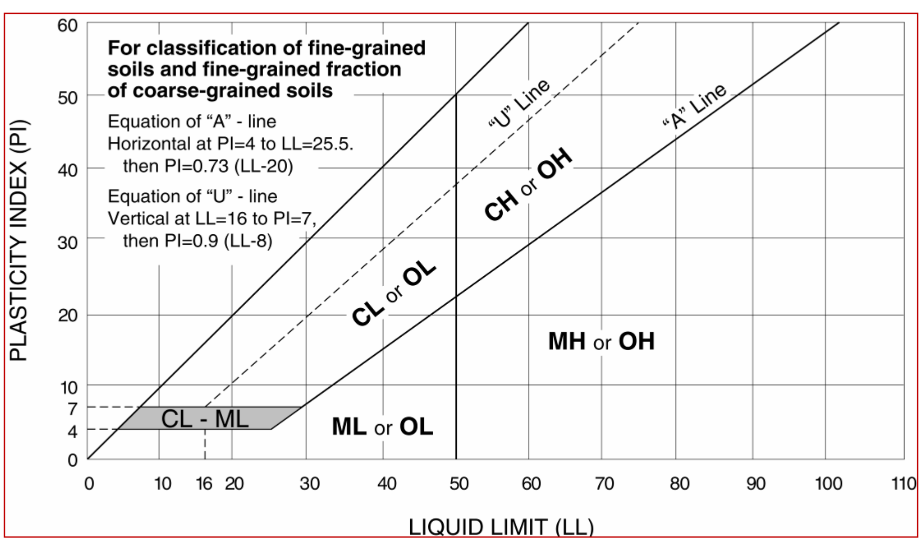
	Boring ID	Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
●	B-2	5 - 6.5	POORLY GRADED SAND	SP				1.46	7.74
⊠	B-4	5 - 6.5	SILTY SAND	SM					

	Boring ID	Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
●	B-2	5 - 6.5	12.5	1.095	0.475	0.141	0.0	5.4	89.6	5.0		
⊠	B-4	5 - 6.5	19	0.686	0.22		0.0	3.4	80.2	16.4		

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



Terracon
145 W Walnut St
Carson, CA

General Notes

Sampling

- Auger Cuttings
- Modified California Ring Sampler
- No Recovery
- Standard Penetration Test

Water Level

- Water Initially Encountered
- Water Level After a Specified Period of Time
- Water Level After a Specified Period of Time
- Cave In Encountered

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

Field Tests

N	Standard Penetration Test Resistance (Blows/Ft.)
(HP)	Hand Penetrometer
(T)	Torvane
(DCP)	Dynamic Cone Penetrometer
UC	Unconfined Compressive Strength
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance			**Consistency of Fine-Grained Soils** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Relative Density	**Standard Penetration or N-Value (Blows/Ft.)**	**Ring Sampler (Blows/Ft.)**	**Consistency**	**Unconfined Compressive Strength Qu (tsf)**	**Standard Penetration or N-Value (Blows/Ft.)**	**Ring Sampler (Blows/Ft.)**
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium Stiff	0.50 to 1.00	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18
Very Dense	> 50	> 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42
			Hard	> 4.00	> 30	> 42

Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.