
Appendix G

Geotechnical Engineering Report

GEOTECHNICAL ENGINEERING REPORT – REVISION 1

**Prepared For
The AES Corporation**

**Proposed
Double Butte Battery Energy Storage Systems
Vicinity of Matthews Road and Palomar Road,
Menifee, Riverside County, CA
331190010, 011, 014, 017, 047, 056, 060**

**Job No: 22-247
August 17, 2022
REVISED September 6, 2023**



BRUIN GEOTECHNICAL SERVICES, INC.

**44732 Yucca Avenue
Lancaster, California 93534
www.bruingsi.net**



**SOIL AND MATERIAL
TESTING AND INSPECTIONS**

August 17, 2022

Job No.: 22-247

REVISED September 6, 2023

Mr. Michael Jenkinson, PE
The AES Corporation
282 Century Place, Suite 2000
Louisville, CO 80027

**Subject: Geotechnical Engineering Report for the Proposed Double Butte Battery Energy Storage Systems Located in the Vicinity of Matthews Road and Palomar Road, Menifee, Riverside County, CA
APN 331190010, 011, 014, 017, 047, 056, 060**

Dear Mr. Jenkinson:

Presented herewith in is our Geotechnical Engineering Report for the subject project. Our work was performed in accordance with the scope of work outlined in our original proposal dated June 6, 2022.

This report presents the results of our field investigation, laboratory testing, along with our engineering judgment, opinions, conclusions, and recommendations pertaining to the proposed development.

It has been a pleasure to be of service to you on this project. Should you have any questions regarding the contents of this report, or should you require additional information, please contact the undersigned at (661) 273-9078.

Respectfully submitted,

BRUIN GEOTECHNICAL SERVICES, INC.

Ryan D. Duke, P.E.
RDD/mes



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EXECUTIVE SUMMARY

There appear to be no significant geotechnical constraints on-site that cannot be mitigated by our recommendations, the proposed planning, design, and utilization of sound construction practices.

Based on our geotechnical investigation of the subject site, the information obtained from our subsurface exploration, and review of available reports and literature, it is our professional opinion that the proposed development is feasible at the site provided that the geotechnical engineering recommendations contained in this report are implemented in the design and construction of the project.

The following key elements should be noted from this investigation:

- The subject site is located within the seismically active Southern California area. As such, the proposed development shall be designed in accordance with seismic considerations specified in the 2019 California Building Code (CBC) and the County requirements.
- The Limitations and Uniformity of Conditions Section should be read for an understanding of the report limitations.
- The south portion of the subject site is located within FEMA Flood Zones A and X.

This Executive Summary should be used in conjunction with the entire report for design and/or construction purposes. It should be recognized that specific details were not included or fully developed in this summary, and the report must be read in its entirety for a complete interpretation of the items contained herein.

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SUMMARY OF RECOMMENDATIONS

DESIGN ITEM	RECOMMENDATIONS
<u>REMEDIAL GRADING</u>	
Structure Over-Excavation	48" below existing or finish grade, whichever is lower
Scarification	12" compacted at 90%
Horizontal Limits	5 feet beyond foundation perimeter
Remedial Grading for Access Driveways	Scarify 12" compacted to 95%
Exterior Non-Traffic Bearing Concrete Flatwork	Scarify 12" compacted to 90%
Native Soil Shrinkage	2-19% (90% Compaction), 4-20% (92% comp), 7-23% (95% comp)
<u>PERIMETER (CONTINUOUS) FOUNDATION DESIGN VALUES</u>	
Allowable Net Bearing Capacity	1,500 psf
Width	Minimum 12 inches
Embedment (minimum)	Minimum 15 inches below lowest adjacent soil elevation
<u>ISOLATED (COLUMN/PIER) FOUNDATION DESIGN VALUES</u>	
Allowable Net Bearing Capacity	1,800 psf
Width	Minimum 24 inches square
Embedment (minimum)	Minimum 15 inches below lowest adjacent soil elevation
<u>MAT FOUNDATION DESIGN VALUES</u>	
Allowable Net Bearing Capacity	1,500 psf
Embedment (minimum)	Minimum 15 inches below lowest adjacent soil elevation
<u>LATERAL EARTH PRESSURES</u>	
Active (Well-Drained Soil)	33 psf
At Rest (Restrained Wall)	55 psf
<u>LATERAL LOAD RESISTANCE</u>	
Allowable Passive Pressure	275 psf per foot
Coefficient of Friction	0.25
<u>SOIL EXPANSION</u>	
Expansion Index	18
Classification	Very Low
<u>CORROSION AND CHEMICAL ATTACK</u>	
Soil Resistivity	2,800-3,300 ohm-cm
Exposure Category	S0 (all samples)

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GEOTECHNICAL ENGINEERING REPORT

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GEOTECHNICAL ENGINEERING REPORT
Double Butte Solar Battery Energy Storage Systems
Vicinity of Matthews Road and Palomar Road
Menifee, Riverside County, CA
APN 331190010, 011, 014, 017, 047, 056, 060

1.0 INTRODUCTION

This report presents the results of the geotechnical investigation performed by Bruin Geotechnical Services, Inc. for the proposed Battery Energy Storage System (BESS) Facility based on the assessor's parcel maps, a preliminary Site Plan, and google KMZ file provided by the client. This report is specific to the proposed development.

The following Assessors Parcels are included are included in this report:

- APN 331190010
- APN 331190011
- APN 331190014
- APN 331190017
- APN 331190047
- APN 331190056
- APN 331190060

The purpose of this investigation was to evaluate the current subsurface soil conditions and to provide geotechnical recommendations relative to earthwork, grading and design parameters for the construction of equipment pad foundations, drilled shafts (substation), and access roads associated with the proposed development.

The scope of the authorized for this investigation included the following tasks:

- Performing a site reconnaissance
- Conducting a field subsurface exploration through borings and soil sampling
- Performing a field and laboratory soil corrosivity study
- Performing a soil thermal analysis of the native soil
- Laboratory testing program of selected soil samples obtained during drilling
- Performing engineering analyses of the data obtained
- Preparing this Geotechnical Engineering Report

This study also includes a review of published and unpublished literature and geotechnical maps with respect to active and potentially active faults located in proximity to the site which may have an impact on the seismic design of the proposed development.

2.0 SITE LOCATION AND DESCRIPTION

The subject square-shaped site, herein after referred to as Site, is located east of the Matthews Road and Palomas Road junction, across the BNSF Railroad in the city of Menifee, Riverside County, California, and consists of seven (7) parcels totaling approximately 27.09 acres. The subject parcels include:

- APN 331190010 – approximately 5.00 acres
- APN 331190011 – approximately 5.00 acres
- APN 331190014 – approximately 3.40 acres
- APN 331190017 – approximately 1.58 acres
- APN 331190047 – approximately 4.61 acres
- APN 331190056 – approximately 3.83 acres
- APN 331190060 – approximately 3.67 acres

At the time of Bruin GSI's field investigation, the site was vacant, undeveloped land. The contiguous APNs are bound by a railroad to the north, an existing solar development to the west, commercial land to the east, and an aqueduct system to the south. The site vegetation consisted of sparse annual weeds and small shrubs.

The Site topography is relatively flat and level gently sloping down to the southwest, with drainage by sheet flow at approximately 1%. The approximate elevation at the site is 1,450 feet above mean sea level.

The intention of the site description is to be illustrative and specifically not intended for use as a legal description of the Site.

The general location of the subject Site is shown on Figure 1.

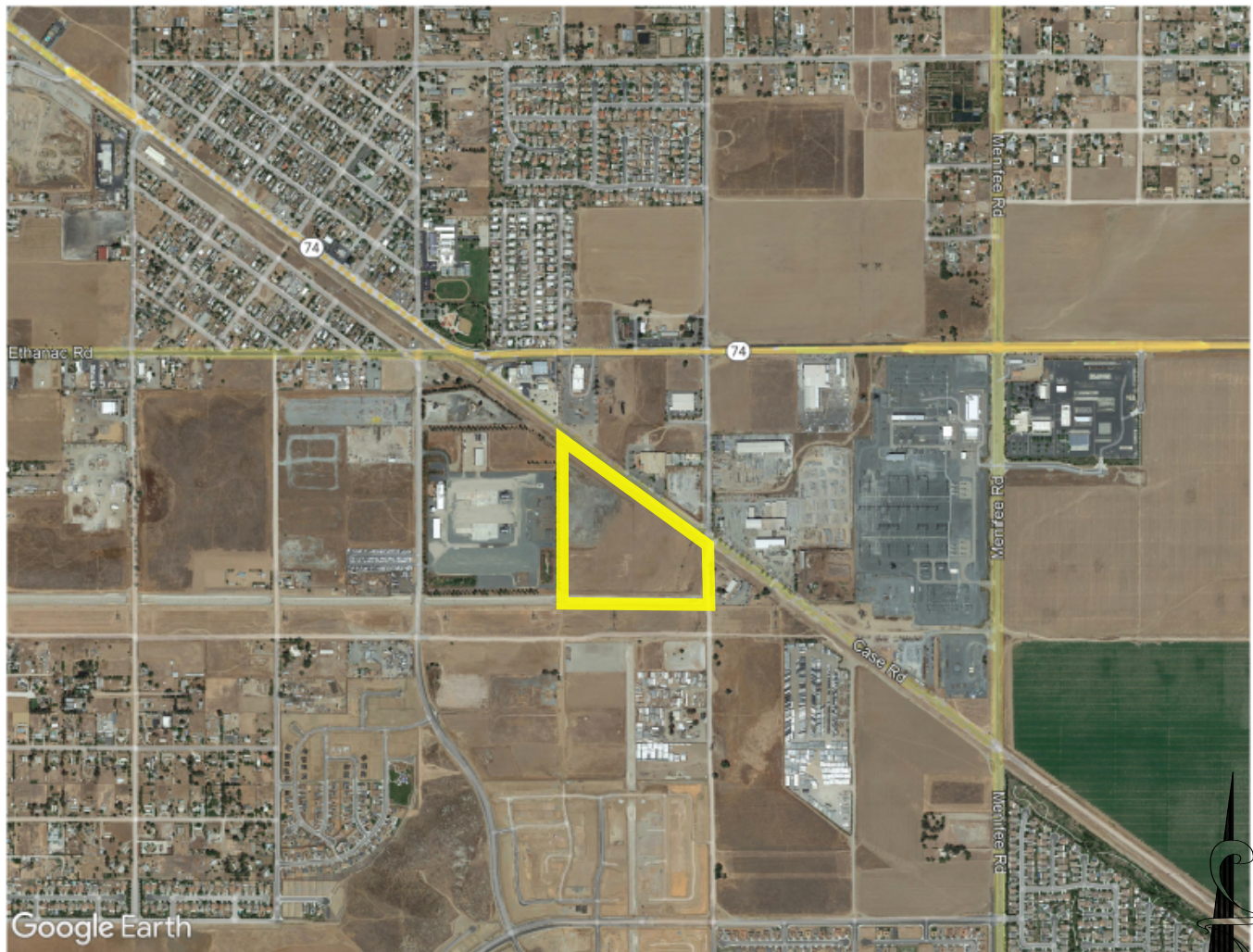
3.0 PROPOSED CONSTRUCTION

Based on our conversations with the client and information obtained through review of the preliminary plans, it is our understanding that the proposed project consists of a Battery Energy Storage System (BESS) Facility. The Project will utilize thickened concrete mat foundations for storage and converter equipment and substation with potential drilled shafts foundations. Construction will also include one (1) infiltration basin approximately three to four (3-4) feet below ground surface for the purpose of percolating sheet-flow storm-drain water.

It is anticipated that the proposed earthwork will consist of clearing and grubbing of the vegetation, construction of shallow infiltration basins (approximately three to four feet

Vicinity Map

N.T.S.



= Denotes approximate parcel boundary



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Figure 1

deep, with maximum 4:1 slopes) and minor grading with cuts and fills of less than one (1) foot, maintaining the natural drainage through the site. Dirt or gravel drive areas for interior access are also anticipated.

Although construction details are not available at the time of writing this report, based upon conversations with the client, we anticipate allowable stress design loads of approximately 2-3 kips for auxiliary structures.

4.0 GEOTECHNICAL INVESTIGATION

The geotechnical investigation included a field exploration program and a laboratory testing program. These programs were performed in accordance with our proposal for Geotechnical Engineering Report dated June 6, 2022 and Addendum Proposal dated June 19, 2023. The scope of work did not include environmental assessment or investigation for the presence or absence of hazardous substances or toxic materials in structures, soil, surface water, groundwater, or air, below or around the site.

4.1 Field Exploration Program

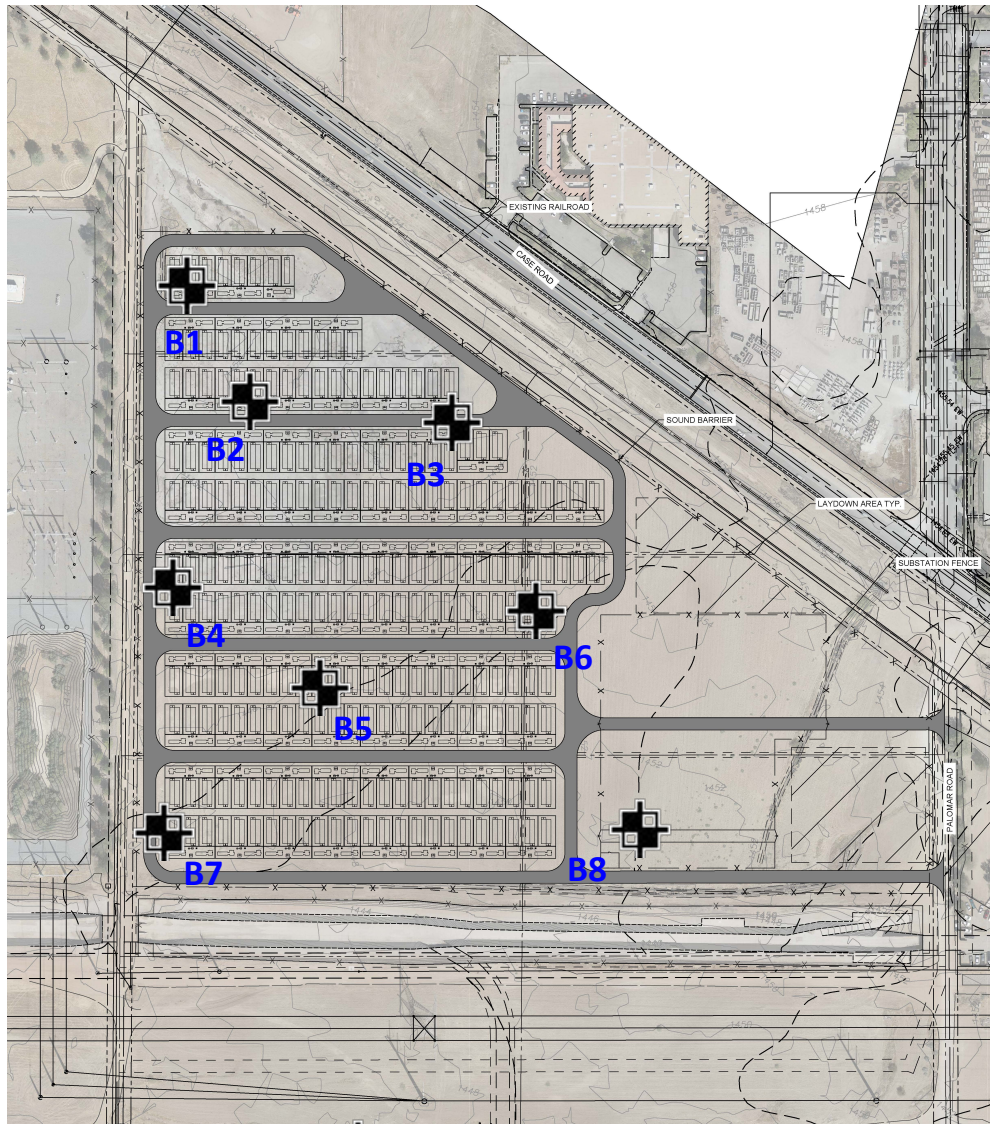
The field exploration program for the geotechnical investigation report was initiated on July 15, 2022 and July 17, 2023, under the technical supervision of our engineer. A total of eight (8) exploratory borings and two (2) exploratory borings, respectively were drilled using a CME 75 drill rig with eight (8) inch hollow stem auger. The borings were advanced to maximum depths of twenty (20) feet below ground surface (bgs).

The approximate locations of the borings are presented on Figure 2. The borings were located in the field by sighting and pacing from existing streets and landmarks. A hand-held GPS device was utilized to determine the approximate latitude and longitude of the borings. If an exact location of the boring locations is desired, it should be performed by a licensed surveyor.

Logs of subsurface materials encountered in the borings were prepared in the field by a representative of Bruin GSI at the time of drilling and sampling. Soil samples were obtained at various depth intervals, consisting of relatively undisturbed brass ring samples (Modified California split-spoon sampler) and Standard Penetration Test (SPT) samples driven by a 140-pound hammer falling thirty (30) inches. Bulk samples were also collected at various depths from zero to five (0-5) feet below existing ground surface. The soil samples were returned to the laboratory for analysis and testing.

Boring Location Map

N.T.S.



B1

= Denotes Approximate
Boring Location (2022)



B1

= Denotes Approximate
Boring Location (2023)



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Figure 2

Final boring logs for the geotechnical investigation were prepared from the field logs and are presented in Appendix A. Stratification lines were approximated by field staff based on observations made at the time of drilling, while actual boundaries between soil types may be gradual and soil conditions may vary at other locations.

4.2 Site and Subsurface Conditions

Native materials were encountered within our exploratory borings. The subsurface soil appears relatively uniform across the subject site and the soil encountered in the exploratory borings generally consists of silty sand (SM) with occasional sandy silt (ML) and sandy clay (SC), to the maximum depth explored of twenty (20) feet below ground surface.

Based on the blow counts obtained during sampling, and in-situ densities obtained, the native material encountered was noted to be medium dense or firm to very dense or hard. Some materials were noted to be slightly cemented. The subsurface materials were noted to be slightly moist to saturated. No groundwater or perched water was encountered through the depth explored (20 feet below ground surface).

For more detailed descriptions of the subsurface materials refer to the boring logs in Appendix A.

4.3 Soil Engineering Properties

Physical tests were performed on the bulk and relatively undisturbed samples to characterize the engineering properties of the native soils.

Moisture content and dry unit weight determinations were performed on samples to evaluate the in-situ unit weights of the different materials. Moisture contents were generally three to twenty-four (3-24) percent. In-place dry densities ranged generally 93 pounds per cubic foot (pcf) to 134 pcf. Moisture content and dry unit weight results are shown on the boring logs in Appendix A.

The expansion index tests (ASTM D 4829) indicate that the surficial soils are within the “very low” expansion category.

Consolidation test results reveal that some samples tested in the upper soil has a moderate potential to hydro-consolidate.

4.4 Groundwater Conditions

The nearest well data for the project site area show that groundwater levels are located approximately 44 feet below the ground surface in the vicinity of the subject site. Well data was gathered from Local Well Site EMWD12759, Site Code 337429N1171494W001. For specific data, refer to Appendix B.

Historically, groundwater in the San Jacinto Groundwater Basin underlies western Riverside County, flowing westward from the unnamed hills in the east toward Lake Perris. Declining groundwater levels of approximately 20-40 feet in the 1960's were reversed in the 1970s and 1980s by the instillation of Lake Perris. Groundwater levels rose to 200 feet below ground surface in the western basin during that time. More recently, groundwater levels have remained steady. This basin is now primarily recharged by percolation of the San Jacinto River and associated tributaries. Recharge is supplemented by infiltration ponds in the San Jacinto River as part of the State Water Project and percolation of recharge ponds throughout the county. Annual rainfall generally ranges between ten to eighteen (10-18) inches (City of Menifee General Plan, 2003).

4.5 Flood Hazard

Bruin GSI reviewed available data regarding the flood potential at the subject site. Based on our FEMA FIRM map database research, the project Site is located on Map Number 06065C2060H, Panel 2060 of 3805. Review of panels indicates the subject site lies within:

Zone A

Areas determined to be special flood hazard area subject to inundation by the 1% annual chance flood.

Zone X

Areas determined to be outside 500-year floodplain determined to be outside the 1% and 0.2% annual chance floodplains.

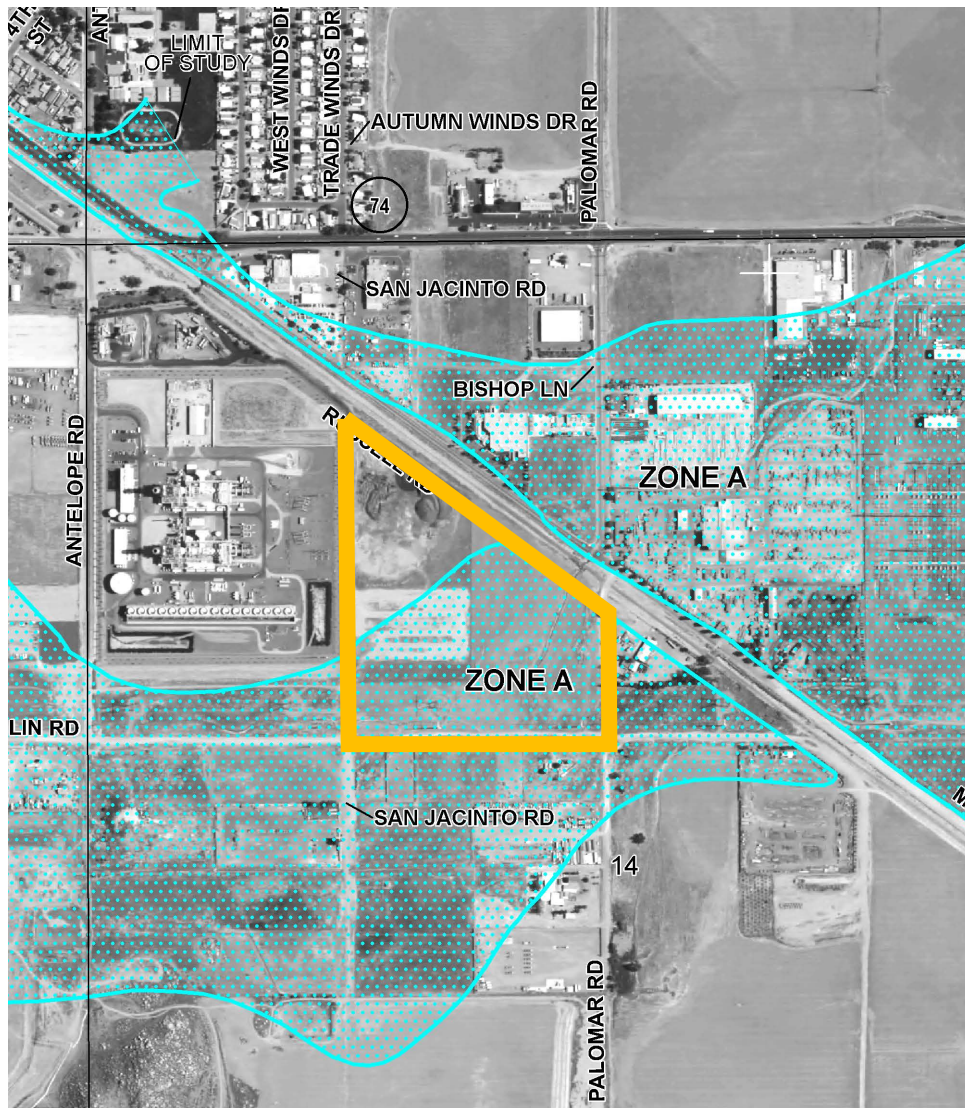
A Hydrology Study and/or flood analysis was not a part of our scope of work.

4.6 Laboratory Testing

Selected samples collected during drilling activities and field work were tested in the laboratory to assist in evaluating the engineering properties of subsurface materials deemed within the structural influence of the site. The field logs were reviewed, and

Flood Zone Map

N.T.S.



 = Approximate site boundary



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Figure 3

the soil samples were classified in accordance with the Unified Soils Classification System and a testing program was established.

The samples were tested to determine the following:

- | | |
|--|----------------|
| • In-situ moisture and density determination | ASTM D 2937 |
| • Consolidation potential | ASTM D 2435 |
| • Shear strength | ASTM D 3080 |
| • Expansion index | ASTM D 4829 |
| • Chemical analyses | CA 422/417/643 |

The following classification tests were performed:

- | | |
|--|-------------|
| • Description and Identification of Soils | ASTM D 2488 |
| • Maximum density – Optimum moisture | ASTM D 1557 |
| • Sieve Analysis of Fine and Coarse Aggregates | ASTM C 136 |
| • Sand Equivalent Value | ASTM D 2419 |
| • Grain Size Analysis (Hydrometer method) | ASTM D 422 |

Tabular and graphical test results are presented in Appendix C.

4.7 Field Resistivity Testing

JDH Corrosion conducted four (4) field resistivity tests at the Site using the Wenner 4-pin method (ASTM G57). Refer to the corrosion report by JDH Corrosion is provided in Appendix D. Design for grounding and corrosion shall be completed by the structural engineer.

The pin spacing was determined based on AES SOW and may have been changed due to project constraints due to structures or boundaries.

4.8 Thermal Resistivity Testing

Two (2) bulk soil samples were obtained during drilling. The soil samples are a mixture of soils within the noted depths. The maximum density/ optimum moisture determinations (ASTM D1557 test method) were performed on each sample. The data and soil samples were delivered to Geotherm USA for thermal resistivity testing (RHO), as requested by the client. The selected samples were remolded by Geotherm USA to 90% relative compaction and evaluated for thermal resistivity to determine thermal dry-out curves. Results from Geotherm USA are presented in Appendix E.

5.0 REGIONAL GEOLOGY AND SEISMIC HAZARD ASSESSMENT

The following sections address the regional geology and seismic hazards, and potential subsurface conditions at the subject site. This information is based on limited field exploration and published maps and reports. Our scope of services included a review of published maps and reports to characterize the regional geology and potential for seismic hazards.

5.1 Regional Geology

The project site is located in the northern portion of the Peninsular Ranges Geomorphic province, bounded easterly by the San Andreas fault zone and reaches westerly offshore. The province is characterized by three major fault blocks: Santa Ana Mountains, Perris, and San Jacinto Mountains blocks. The city of Menifee is located on the Perris block bounded by two faults, one in the southwest (Elsinore Fault) and one in northeast (San Jacinto Fault).

The following fault descriptions are provided by the City of Menifee:

Elsinore Fault

The Elsinore fault is estimated to have an 11 percent probability of rupturing in an earthquake of at least magnitude 6.7 earthquake in the next 30 years.

San Jacinto Fault

The San Jacinto fault has historically produced more large earthquakes than any other fault in southern California, although none of these earthquakes has been as large as the 1857 and 1906 earthquakes on the San Andreas fault. The two most-recent surface-rupturing earthquakes on the San Jacinto fault were the April 9, 1968, Mw 6.5 on the Coyote Creek segment, and the 1987 event on the Superstition Hills segment.

Although the city of Menifee is surrounded by these prominent and active fault systems, the Perris block is an area of lower relief that has remained relatively stable and undeformed for thousands of years (City of Menifee General Plan, 2013).

Seismic activity along the San Andreas, San Jacinto, and Elsinore Faults have resulted in uplift in the San Jacinto and Santa Ana Mountains blocks and down dropping within the Perris block. The uplifted areas of the San Jacinto and Santa Ana mountains are eroding, causing sand, silt, and gravel to be deposited in the lower lying valleys in alluvial fans, washes, and channels. The alluvium deposits have a large range of ages from approximately 1 million years to less than 11,000 years old. At depth, the alluvium is underlain by granitoid and/or metasedimentary crystalline rock.

5.2 Site Geology

The site is located on the Romoland, CA United States Geological Survey (USGS) 7.5-minute topographic quadrangle. Elevation at the site is approximately 1,450 feet above mean sea level.

The Site consists older alluvial fan and channel deposits that emanate from the base of the eastern flanks of San Jacinto and Santa Ana Mountains. Rock outcrops are not visible on the project site. Morton (2003) maps alluvium across the project site area as distal alluvial fan deposits. These are older (Pleistocene) surficial alluvial deposits in this area and are described as well consolidated gravel and sand with layers of silt, and clay. At depth, the site is underlain primarily by Cretaceous granodiorite and less commonly by metasedimentary rocks.

No springs or areas indicative of shallow ground water were mapped or observed on the project site.

5.3 Seismic Hazards Assessment

There are two unnamed faults within the city of Menifee: one in central Sun City and one in western Quail Valley. These faults are confined to bedrock; they do not affect sediments of Holocene or late Pleistocene age (about the last 15,000 years) and thus are not considered active faults (City of Menifee General Plan, 2013).

The purpose of the Alquist-Priolo Geologic Hazards Zone Act, as summarized in CDMG Special Publication 2 (SP 42), is to "prohibit the location of most structures for human occupancy across the traces of active faults and to mitigate thereby the hazard of fault-rupture." As indicated by SP 42, "the State Geologist is required to delineate "earthquake fault zones" (EFZs) along known active faults in California. Cities and counties affected by the zones must regulate certain development 'projects' within the zones. They must withhold development permits for sites within the zones until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting. Zones of Required Investigation referred to as "Seismic Hazard Zones" in CCR Section 3722, are areas shown on Seismic Hazard Zone Maps where Site investigations are required to determine the need for mitigation of potential liquefaction and/or earthquake-induced landslide ground displacements.

The Site is not located in a Landslide and/or Liquefaction Seismic Hazard Zone as specified by the State of California. No other published liquefaction studies were reviewed.

5.3.1 Liquefaction

Our scope of services did not include a fifty (50) foot test boring or detailed analysis of liquefaction, however, due to relatively deep (greater than 40 feet below ground surface) groundwater, we performed a limited research of published liquefaction studies within the area.

Earthquake-induced ground shaking can be the cause of several significant phenomena, including liquefaction of saturated fine sands and silty sands. Loose soils can transform from a solid to a liquid state as a result of increased pore pressure during seismic loading. Liquefaction results in a complete loss of strength and can cause structures to settle or even overturn if it occurs in the bearing zone. If liquefaction occurs beneath sloping ground, a phenomenon known as lateral spreading can occur. Due relatively dense and firm soil encountered during our subsurface investigation and the absence of a shallow groundwater table, the potential for liquefaction is low, and therefore, it is our professional opinion that the project site has a low susceptibility to liquefaction.

5.4 CBC Design Parameters

The following coefficients have been estimated in accordance with the requirements of the 2022 CBC, utilizing the Structural Engineers Association of California and California's Office of Statewide Health Planning and Development Seismic Design Maps Application: <http://seismicmaps.org/>. The following seismic parameters are provided, based on the approximate latitude and longitude at the northern portion of the subject site:

Latitude 33.74150302°
Longitude -117.17036944°

Type	Value	Period
<i>Spectral Response Acceleration, Short Period) – S_s</i>	1.424g	0.2(sec)
<i>Spectral Response Acceleration at 1 sec. – S_1</i>	0.529g	1.0(sec)
<i>Mapped Spectral Response, Short period – S_{DS}</i>	0.949g	0.2(sec)
<i>Mapped Spectral Response at 1 sec. – S_{D1}</i>	*	1.0(sec)
<i>Site Coefficient – F_A</i>	1.0	
<i>Site Coefficient – F_V</i>	*	
<i>Site Modified Spectral Response Acceleration, Short period – S_{MS}</i>	1.424g	
<i>Site Modified Spectral Response Acceleration, Short period – S_{M1}</i>	*	

Site Classification (2022 CBC, further defined in ASCE7-16 Chapter 20) = D Stiff Soil

* The actual method of seismic design should be determined by the Structural Engineer in accordance with Section 11.4.8 Site-Specific Ground Motion Procedures of the ASCE 7-16. Refer to Appendix F for the Design Maps Summary Report provided by the Structural Engineers Association of California and California's Office of Statewide Health Planning and Development website.

5.5 Soil Settlement

Differential soil settlement occurs when supporting soils are not uniform in density or soil type and one portion of soil settles more than the other. When unaccounted for in design, such settlement can result in damage to structures, pavement, and subsurface utilities. Based on the subsurface data obtained during the investigation, the on-site soils are relatively uniform, consisting of predominantly medium dense or firm soils that should not be prone to differential settlement.

Re-compaction of the upper site soils is intended to remedy the potential for surficial differential settlement due to auxiliary structures supported on non-uniform thickness of compacted fill.

In accordance with the specifications in this report, settlement of auxiliary structures founded on compacted fill will be relatively small, less than three-quarter (3/4) inch. Differential settlement is anticipated to be on the order of 50% of the total settlement in a thirty-foot span. Most settlement is anticipated to take place during construction.

5.6 Erosion

The subject site drainage occurs by minor sheet flow and erosion could occur. Appropriate analysis, grading and drainage design and site maintenance should minimize the sheet flow erosion potential.

6.0 OPINIONS AND CONCLUSIONS

Based upon the results of our investigation, it is our professional opinion that the proposed development is considered feasible from a geotechnical standpoint provided that the recommendations presented herein are incorporated into the design and construction. If changes in the design of the structure are made or variations of changed conditions are encountered during construction, Bruin GSI should be contacted to evaluate their effects on these recommendations. The following geotechnical engineering recommendations for the

proposed development are based on observations from the field investigation program and the test results and our experience with sites of similar conditions.

Conventional or mat concrete foundations may be used for equipment pads and structures. However, due to the non-uniform condition of the near surface soils and moderate potential for hydro-consolidation, remedial grading including over-excavation and recompaction is recommended for conventional concrete foundations. Drilled shafts may be used for heavily loaded structures at the substation. Cast-in-drilled-hole (CIDH) foundation may also be used.

7.0 GEOTECHNICAL RECOMMENDATIONS

The following geotechnical engineering recommendations for the proposed development are based on observations from the field investigation program and the laboratory test results and our experience with sites of similar conditions.

The local Department of Building and Safety should be contacted prior to the start of construction to assure the project is properly permitted and inspected during construction.

Field observations and testing during construction operations should be provided by Bruin GSI so a decision can be formed regarding the adequacy of the site preparation, the acceptability of fill materials, and the extent to which the earthwork construction and the degree of compaction comply with the project geotechnical specifications. **Any work related to grading performed without the full knowledge of, and under the supervision of the Geotechnical Consultant, may render the recommendations of this report invalid.**

The Geotechnical Consultant shall observe and approve all removals prior to fill placement. Additional recommendations may be necessary at the time of grading.

7.1 Earthwork

Earthwork is expected to be minimal. Where earthwork is required to achieve design grades, the following procedures shall be implemented during site preparation. The existing vegetation and deleterious materials shall be removed from the area to be graded and shall not be incorporated into the engineered fill. Topsoil was not encountered.

In order to provide a more uniform soil support and reduce the potential for hydroconsolidation, the following recommendations are provided:

7.2 Remedial Grading for Conventional Spread or Mat Foundations

Subsequent to removals of the vegetation and deleterious materials in the areas to be graded, the exposed surface shall be excavated a minimum of forty-eight (48) inches below existing grade or finish grade, whichever is lower. The horizontal limits of the excavation shall extend a minimum of five (5) feet beyond the limits of the proposed foundations.

The bottom of the excavation shall be observed and approved by the Geotechnical Consultant.

Subsequent to approval of the resulting excavated surface by the Geotechnical Consultant, the resulting soil surface shall be scarified an additional twelve (12) inches, properly moisture conditioned or aerated to near optimum moisture content, and mechanically compacted to minimum **90% relative compaction** as determined by ASTM D 1557 test method. **Compaction shall be verified by testing.**

A minimum of thirty-six (36) inches of compacted fill is required beneath the proposed foundations.

7.3 Remedial Grading for Access Drive Areas

Subsequent to clearing and grubbing the site, the existing native soils shall be scarified twelve (12) inches below existing grade or finish grade, whichever is lower. The Geotechnical Consultant shall inspect the resulting surfaces prior to fill placement.

Subsequent to approval of the resulting surface by the Geotechnical Consultant, the resulting soil surface shall be properly moisture conditioned or aerated to near optimum moisture content, and mechanically compacted to minimum **95% relative compaction** as determined by ASTM D 1557 test method. **Compaction shall be verified by testing.**

7.4 Fill Slope Construction and Stability for Infiltration Basins

Permanent cut slopes at infiltration basin locations may be constructed at a slope ratio not exceeding 4:1 (horizontal: vertical) or flatter. Cut slopes constructed as recommended are expected to be both surficial and grossly stable and anticipated to remain so under normal conditions.

The slopes should be planted with native vegetation as soon as possible to minimize erosion and maintenance. If slopes are planned steeper than 2:1, the Geotechnical Consultant shall be notified for slope stability determinations.

7.5 Fill Placement and Compaction Requirements

Native soils may be used as engineered fill. Materials for engineered fill should be free of organic material, debris, and other deleterious substances, and should not contain rocks greater than three (3) inches in maximum dimension.

All native soil fill should be placed in eight (8) inch thick maximum lifts, moisture conditioned or air dried as necessary to achieve optimum moisture condition, and then compacted in place to a minimum relative compaction of 90% **(95% for drive areas)** as determined in accordance with ASTM D 1557 test method.

Non-structural and landscape areas shall be compacted to minimum 85% relative compaction.

A representative of the project consultant should be present on-site during grading operations to verify proper placement and compaction of all fill, as well as to verify compliance with the other geotechnical recommendations presented herein.

7.6 Native Soil Shrinkage

Based on the laboratory data obtained, the following table represents implied shrinkage factors for soils from 0-6 feet below ground surface (recompaction for structures):

	Field Dry Unit Weight (pcf)	Proctor Max Dry Unit Weight (pcf)	Field Percent of Max Dry Unit Weight	Implied Shrinkage at 90% compaction	Implied Shrinkage at 92% compaction	Implied Shrinkage at 95% compaction
<i>Minimum</i>	93.9	129.0	72.79%	19.12%	20.88%	23.38%
<i>Maximum</i>	134	132.0	101.52%	12.79%	10.34%	6.86%
<i>Average</i>	114.6	130.5	87.79%	2.45%	4.57%	7.59%

During compaction, an additional one-quarter inch subsidence of the underlying soil is estimated. Losses from site clearing and grubbing operations may affect quantity calculations and should be taken into account. Actual shrinkage of the soil may vary.

7.7 Fill Slope Construction and Stability

Provided all material is properly compacted as recommended, fill slopes may be constructed at a 2:1 (horizontal to vertical) gradient or flatter. Permanent cut slopes may be constructed at 2:1 or flatter. Fill slopes constructed as recommended at a slope ratio not exceeding 2:1 (horizontal: vertical), are expected to be both grossly and surficially stable and are expected to remain so under normal conditions.

Proper drainage should be planned so water is not allowed to flow over the tops of slopes. The slopes should be planted as soon as possible to minimize erosion and maintenance.

If slopes are planned steeper than 2:1, the Geotechnical Consultant shall be notified for slope stability determinations.

7.8 Import Soil

Import soil must be free from organic material or deleterious substances. The project specifications shall require the contractor to contact the Geotechnical Consultant to review the proposed import soil for conformance with these recommendations at least two weeks prior to importing to the site.

Imported soil must be non-hazardous and derived from a single, consistent soil type conforming to the following criteria:

- 100% passing a 3-inch sieve
- 65% to 100% passing the #4 sieve
- 20 to 45% passing a #200 sieve
- Expansion index less than 20
- Liquid limit less than 35
- Plasticity index less than 12
- R-value greater than 25
- Corrosion potential equal to or better than the on-site soil, including:
 - Soluble Sulfates
 - Soluble Chlorides
 - Minimum Resistivity

7.9 Grading Observations and Testing

The grading of the site shall be observed and tested by the Geotechnical Consultant to verify compliance with the recommendations. Any grading performed without full

knowledge of the Geotechnical Consultant may render the recommendations of this report invalid.

7.10 Foundations

Provided the recommendations contained in this report are implemented during design and construction, it is our opinion that at grade structures can be supported on shallow or mat foundations, driven piles, and cast-in-drilled-hole (CIDH) concrete foundations.

The structural engineer should evaluate reinforcement, embedment depth based on the requirements for the structural loadings, shrinkage, and temperatures stresses.

7.11 Continuous and Isolated Spread Foundations

Continuous and isolated spread footings must have a minimum width of twelve (12) inches and twenty-four (24) inches, respectively. The minimum depth of footing embedment is fifteen (15) inches. Continuous footing foundations may be design using a net allowable bearing pressure of 1,500 pounds per square foot (psf) with a factor of safety of three (3). Isolated spread footing foundations may be designed using a net allowable bearing pressure of 1,800 psf. The net allowable bearing pressure applies to the dead load plus live load (DL + LL) conditions; it may be increased by one-third (1/3) for wind or seismic loads.

Total foundation settlements are expected to be less than one (1) inch and differential settlements between similarly loaded (DL + LL) and sized footings are anticipated to be less than one-half (0.5) inches.

7.12 Mat Foundations

We understand that the structures (equipment pads) may be supported on a concrete mat foundation. The mat foundation may be designed to impose a maximum allowable pressure of 1,500 pounds per square foot (psf) dead plus live loads with a factor of safety of three (3). This value may be increased by one-third (1/3) for transient loads such as seismic or wind. The concrete mat foundation should be at least twelve (12) inches thick and satisfy structural considerations.

Based on the results of our laboratory tests and analyses, total static settlements of the mat foundation under the allowable bearing pressure are expected to be approximately three-quarters (3/4) of an inch, and maximum differential settlements are expected to be about 50% of the total settlement.

Mat foundations values may be used for grade beams provided that the minimum embedment is fifteen (15) inches below adjacent grade.

7.13 Lateral Earth Pressures

Provided the Site is prepared as recommended above, the following earth pressure parameters for footings may be used for design purposes. The parameters shown in the table below are for drained conditions of selected non-expansive engineered fill or undisturbed native soil.

Table 1: Recommended Static Lateral Earth Pressures for Footings	
Lateral Pressure Condition	Equivalent Fluid Density (pcf) Drained Condition
Active Pressure	33
At Rest Pressure	55
Passive Pressure	275

The lateral earth pressures listed herein are obtained by the conventional equation for active, at rest, and passive conditions assuming level backfill and a bulk unit weight of 115 pcf for the Site soils. A coefficient of friction of 0.25 may be used between soil sub-grade and the bottom of footings.

The coefficient of friction and passive earth pressure values given above represent ultimate soil strength values. The Geotechnical Consultant recommends that a safety factor consistent with the design conditions be included in their usage in accordance with Sections 1806.3.1 through 18106.3.3 of the 2022 CBC. For stability against lateral sliding that is resisted solely by the passive earth pressure against footings or friction along the bottom of footings, appropriate safety factor should be applied by the structural engineer.

For stability against lateral sliding that is resisted by combined passive pressure and frictional resistance, a minimum safety factor of 2.0 is recommended. For lateral stability against seismic loading conditions, a minimum safety factor of 1.2 is recommended.

7.14 Footing Reinforcement

Reinforcement for cast-in-place foundations should be designed by the structural engineer based on the anticipated loading conditions and expansion index of the supporting soil. Preliminary expansion index for the native soil is categorized as “very

low” as determined by ASTM D 4829. Foundations should be reinforced as required by the structural engineer.

7.15 MFAD Parameters

MFAD parameters are inputs required on the MFAD program developed as part of research conducted by the Electric Power Research Institute during the 1980s. Based on our in-house research, the MFAD parameters required the correlation of SPT-N values, as evaluated from the field N60 values obtained during our site visit. The Modulus of Deformation was estimated using the values of SPT-N for cohesionless soil, as referred to the Estimation of E_p from SPT N for cohesionless soils. Based on our evaluation of the current soil layers encountered during our investigation, the following parameters are provided:

Table 2: MFAD Parameters							
Soil Layer	Depth (ft)	USCS	SPT-N (blows/ft)	Total Unit Weight, γ (pcf)	Deformation Modulus, E_p (ksi)	Friction Angle (deg)	Cohesion (psf)
1	0-5	SM	30	110.0	1.8	15	10
2	5-9	SM	33	115.0	2.8	20	30
3	9-15	ML	20	112.0	2.0	10	200

7.16 Soil Interaction Analysis (L-Pile Analysis)

L-Pile is a program that allows the foundation designer to model and evaluate the soil conditions encountered during lateral load pile testing. The solution provided by the program describes the behavior of a beam-column with non-linear support.

The program correlates laboratory data such as effective weight of the soil, cohesion and friction angle for different boring depths, and the designer can use a p-modifier to more closely model the soil response to applied loads based on rebound deflections observed in the field during lateral pile testing.

The table below show preliminary input parameters which are provided for the structural engineer to use in their L-Pile analysis. These values include a safety factor of 1.5 for the lateral load capacity of the pile, and as further discussed in section 1810.3.3.2 of the 2022 CBC. The analysis did not include scour or corrosion, however, when performing the L-Pile analysis, the Structural Engineer should consider the pile section properties and include safety factors in relation to scour and corrosion as deemed appropriate. The following preliminary soil parameters may be used in the

analysis (subject to change based upon review of the results of field pile load testing report, which will be submitted under separate cover upon completion):

Table 3: LPILE Input Parameters for 14ft.+ Embedment Pile	
p-y curve model	Sand (Reese)
Effective Unit Weight, [pcf]	122
Elastic Subgrade Reaction, K [pci]	Default
Angle of Fiction, [degrees]	29
p- modifier *	1.0

*Modification factor from the ground surface to top of pile, assuming top of pile is 4 ft. above grade

7.17 Deep Foundations

The proposed structures may be constructed on drilled concrete cast-in-drilled-hole (CIDH) pile foundations. Provided the recommendations in this report are incorporated into site development, foundations (CIDH) for load bearing members shall be designed using skin friction as follows:

7.17.1 Pile Capacity

Skin friction should be used to design the proposed concrete CIDH piles. Allowable vertical load capacity curve for a thirty-six (36) inch diameter CIDH pile is presented in Appendix G. The vertical load capacity is based on the frictional resistance between the pile and surrounding soil. The allowable capacity shown is based on friction only and has a safety factor of 1.5 for downward loads. Allowable uplift capacity may be taken at one-half (1/2) the downward capacity. The allowable pile capacity may be increased by one-third (1/3) for short term seismic loading including wind. Piles in groups should be spaced a minimum eight (8) diameters from center to center.

7.17.2 Passive Earth Pressure

Allowable lateral forces on friction piles may be resisted by passive earth pressure. A passive earth pressure of 150 psf per foot of depth may be used. This value has a factor of safety of 1.5. Refer to Appendix G for passive earth pressures based on Rankine's Method. The allowable passive earth pressure may be doubled when pier footings are at least eight (8) diameters apart and may also be increased by one-third (1/3) when resisting short term wind and seismic loads.

8.0 CORROSION AND CHEMICAL ATTACK

Four (4) subsurface bulk soil samples obtained from the Site were tested to provide a preliminary screening of the potential for concrete deterioration or steel corrosion due to attack by soil-borne soluble salts. The test results are presented in the table below. The soil was evaluated for minimum resistivity (ASTM 643), sulfate ion concentration (CT 417), chloride ion concentration (CT 422), and pH of soil (ASTM D 4972).

Table 4: Summary of Corrosion Test Results					
Sample Location	pH	Sulfate, mg/kg	Chloride, mg/kg	Minimum Resistivity, ohm-cm	Exposure Category
B2 @ 0-5 feet bgs	7.80	36	N.D.	3,300	S0
B5 @ 0-5 feet bgs	8.12	24	N.D.	3,100	S0
B7 @ 0-5 feet bgs	8.12	22	16	2,800	S0
B8 @ 0-5 feet bgs	8.39	21	N.D.	2,900	S0

The water-soluble sulfate content severity class is considered negligible to concrete (Exposure Category S0 per Table 4.2.1 of ACI 318-11); therefore, Type II cement should be used for design of concrete structure in contact with soil.

Representative samples of the Site soil in the vicinity have a minimum resistivity ranging from 2,800 to 3,300 ohm-cm. Buried metal conduits, ferrous metal pipes, and exposed steel should have a protective coating in accordance with the manufacturer's specification.

Corrosivity results should be provided to design team members for their interpretation of results relative to their specific area of design and incorporated accordingly as deemed necessary. Results are presented in Appendix D.

9.0 EXCAVATIONS AND BACKFILL

The attention of contractors, particularly the underground contractors, should be drawn to the State of California Construction Safety Orders for "Excavations, Trenches, and Earthwork." Trenches or excavations greater than five (5) feet in depth should be shored or sloped back in accordance with OSHA Regulations prior to entry.

Soil backfill around foundations or behind walls below grade should be placed in lifts not exceeding eight (8) inches, moisture conditioned to optimum moisture content and mechanically compacted to 90% relative compaction as determined by ASTM D 1557 test method. **No flooding or jetting will be allowed.**

Trench backfill shall be moisture conditioned to near optimum moisture content, placed in lifts not exceeding six (6) inches, and mechanically compacted to 90% relative compaction as determined by ASTM D 1557 test method. **No flooding or jetting will be allowed.**

For purposes of this section of the report, “bedding” is defined as material placed in a trench up to one (1) foot above a utility pipe, and “backfill” is all material placed in the trench above the bedding. Unless concrete bedding is required around utility pipes, free-draining sand should be used as bedding. Sand proposed for use as bedding should be tested in our laboratory to verify its suitability and measure its compaction characteristics. **Bedding sand should be compacted by mechanical means to achieve at least 90% relative compaction based on ASTM D 1557.**

Backfill operations should be observed and tested by the Geotechnical Consultant to monitor compliance with these recommendations.

All utility trench backfill should be compacted to a minimum relative compaction of 90% **(95% beneath roadways)**. Utility trench backfill beneath roadways should be compacted to minimum 95% relative compaction in roadways in the upper twelve (12) inches. Trench backfill materials should be placed in lifts no greater than approximately eight (8) inches in thickness, watered or air-dried as necessary to achieve near optimum moisture conditions, and then mechanically compacted in place to a minimum relative compaction of 90%. A representative of the project geotechnical consultant shall test the backfill to verify adequate compaction.

9.1 Excavation Stability

Soils encountered within the depth explored are generally classified as Type C soils in accordance with OSHA (Occupational Safety and Health Administration). The slopes surrounding or along temporary excavations may be vertical for excavations that are less than five feet deep and exhibit no indication of potential caving but should be no steeper than 1.5 H:1V for excavations that are deeper than five (5) feet, up to a maximum depth of fifteen (15) feet. Certified trench shields or boxes may also be used to protect workers during construction in excavations that have vertical sidewalls and are greater than five (5) feet deep.

Temporary excavations for the project construction should be left open for as short a time as possible and should be protected from water runoff. In addition, equipment and/or soil stockpiles must be maintained at least ten (10) feet away from the top of the excavations.

Because of variability in soils, Geotechnical Consultant must be afforded the opportunity to observe and document sloping and shoring conditions at the time of

construction. Slope height, slope inclination, and excavation depth (including utility trench excavations) must in no case exceed those specified in local, state, or federal safety regulations, (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations).

10.0 PRELIMINARY STRUCTURAL SECTION (FLEXIBLE PAVEMENT ENTRANCE)

For project entrances that require structural paving sections, the following recommendations are provided. Asphalt concrete pavements shall be designed per the Caltrans Highway Design Manual based on R-Value and Traffic Index. An R-value of the native soil of 12 was utilized for the preliminary structural pavement section. During grading as soils are mixed, soil samples should be tested for R-Value determination.

For budgetary purposes, the preliminary flexible pavement layer thickness is as follows:

Table 5: Recommended Asphalt Pavement Section Layer Thickness	
Pavement Material	Recommended Thickness (TI = 5.0) Entrance Only
Asphalt Concrete	5"
Class II Aggregate Base	13"
Compacted Subgrade Soils	12"

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

Class II aggregate base should conform to Section 26 of the Caltrans Standard Specifications, latest edition. The aggregate base should be compacted to at least 95% of the maximum dry density as determined by ASTM Method D 1557.

Soil samples of the exposed subgrade at entrance approaches and areas requiring flexible pavements should be obtained during construction for R-value determination and final structural section calculations. Structural pavement sections may be subject to review approval of the governing agency.

10.1 Interior Access Roads

A minimum of six (6) inches of class II aggregate base shall be placed and mechanically compacted to minimum **95% relative compaction** as determined by ASTM D 1557 test method. The aggregate base is intended for interior road sections without asphalt.

Subsequent to approval of the resulting surface by the Geotechnical Consultant, the resulting soil surface shall be scarified 12 inches, properly moisture conditioned or aerated to near optimum moisture content, and mechanically compacted to minimum **95% relative compaction** as determined by ASTM D 1557 test method. **Compaction shall be verified by testing.**

Note: If interior access roads are not paved, maintenance should be performed periodically to limit rutting and ponding.

It is our understanding that interior traffic will consist of an occasional pick-up truck maintenance vehicle. If interior access roads are not paved, maintenance should be performed periodically to limit rutting and ponding.

For an optional aggregate base driving surface, a minimum three (3) inch thick of crushed miscellaneous base is recommended. The base shall be placed on compacted subgrade as recommended in this report, and be compacted to minimum 95% relative compaction as determined by ASTM D 1557 test method.

Table 6: Aggregate Surfaced Roadways (18" compacted fill) 20-year design				
Purpose	Estimated ESAL	Estimated TI	R-VALUE	Aggregate Base
Pick Up Truck Access	N/A	N/A	25	N/A
Fire Truck Loading	1,000	4	25	3.0"
Fire Truck Loading	5,000	5	25	3.0"
Fire Truck Loading	10,000	5	25	3.0"

11.0 CONSTRUCTION CONSIDERATIONS

Based on our field exploration program, earthwork may be performed with conventional construction equipment.

11.1 Temporary Shoring

If shoring is considered, it shall be designed by a registered Civil Engineer in accordance with current Cal-OSHA requirements.

11.2 CIDH Or Drilled Shaft Construction

Due to the interbedded silty sands encountered, some caving should be anticipated during drilling. Casing may be required.

In order to minimize caving potential, it is recommended that all drilled holes be filled with concrete within a maximum 24 hours of drilling completion.

Drilled holes should be observed by a representative of the project geotechnical consultant to verify that they have been excavated into competent soils prior to placement of forms, reinforcement or concrete, to verify soil conditions and evaluate any unanticipated conditions.

The drilling contractor should be prepared to provide the appropriate means and methods to properly construct drilled shafts.

11.3 Drainage Considerations

Bruin GSI understands the proposed project incorporates the construction of shallow basins for the purposes of infiltrating runoff water. The control surface drainage in the project areas is an important design consideration. Site drainage is the responsibility of the project civil engineer. Bruin GSI recommends that final grading around shallow foundations must provide for positive and enduring drainage away from the structures, and ponding of water must not be allowed around, or near the shallow foundations, with the exception of piles erected within designated infiltration basin areas. Ground surface profiles next to the shallow foundations other than pile foundations must have at least a 2% gradient away from the structures.

Appropriate drainage considerations should be incorporated into the project design relative to all existing and proposed drainage courses by the project civil engineer. Drainage velocity reducers, swales, riprap, etc. should be implemented as determined by the project civil engineer as deemed necessary to prevent erosion and scouring.

No water should be allowed to flow over fill slopes. A berm should be constructed at the top of the fill slope to divert drainage run-off to an approved area.

Vegetation is an important factor in minimizing erosion due to sheet flow and should be planted as soon as possible. Native indigenous plants should be used to assure sustainability of vegetation during the lifetime of the project.

12.0 ADDITIONAL SERVICES

Final project plans and specifications should be reviewed prior to construction to confirm that the full intent of the recommendations presented herein have been applied to design and construction. This report is based on the assumption that an adequate testing and

inspection program along with client consultation will be performed during final design and construction phases to verify compliance with the recommendations of this report. Retaining Bruin GSI as the geotechnical consultant to provide additional services from preliminary design through project completion will assure continuity of services.

Additional services may include:

- Consultation during design stages of the project.
- Review of the grading and structural plans.
- Observation and testing during grading and trench backfill
- Field pile testing
- Deputy Inspection of structural members
- Consultation as required during construction.

Cost estimates can be prepared if requested. Please contact our office.

13.0 LIMITATIONS AND UNIFORMITY CONDITIONS

This report is based on the development plans provided to our office. If structure design changes or structure locations changes occur, the conclusion and recommendations in this report may not be considered valid unless the changes are reviewed, and the conclusions of this report are modified or approved by the Geotechnical Consultant.

The subsurface conditions and characteristics described herein have been projected from individual borings placed across the subject property. Actual variations in the subsurface conditions and characteristics may occur.

If conditions encountered during construction differ from those described in this report, this office should be notified so as to consider the necessity for modifications. No responsibility for construction compliance with the design concepts, specifications, or recommendations is assumed unless on-site construction review is performed during the course of construction, which pertains to the specific recommendations contained herein.

It is recommended that Bruin GSI be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design specifications. If Bruin GSI is not accorded the privilege of making this recommended review, Bruin GSI can assume no responsibility for misinterpretation of the recommendations contained in this report.

This report has been prepared in accordance with generally accepted practice and standards in this community at this time. No warranties, either expressed or implied, are made as to

the professional advice provided under the terms of the agreement and included in this report. This report has been prepared for the exclusive use of The AES Corporation and their authorized agents. Unauthorized reproduction of any portion of this report without expressed written permission is prohibited.

If parties other than Bruin GSI are engaged to provide construction geotechnical services, they must be notified that they will be required to assume complete responsibility for the geotechnical phase of the project by concurring with the findings and recommendations in this report or providing alternate recommendations.

14.0 CLOSURE

The conclusions, recommendations, and opinions presented herein are: (1) based upon our evaluation and interpretations of the limited data obtained from our field and laboratory programs; (2) based upon an interpolation of soil conditions between and beyond the borings; (3) are subject to confirmation of the actual conditions encountered during construction; and, (4) are based upon the assumption that sufficient observation and testing will be provided during the grading, infrastructure installation and building phases of site development.

15.0 REFERENCES

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- California Groundwater Bulletin 118, 2006, Hydrologic Region South Coast San Jacinto Groundwater Basin, Accessed at https://www.water.ca.gov/8_005_SanJacinto
- City of Menifee General Plan, Environmental Impact Report, September 2013.
- Department of Water Resources, Water Data Library, Online Database. Accessed at <http://www.water.ca.gov/waterdatalibrary/index.cfm>
- Eastern Municipal Water District, West San Jacinto Groundwater Management Area Annual Report, 2021, Accessed at https://www.emwd.org/sites/main/files/fileattachments/west_san_jacinto_2018_annual_report_-_final.pdf
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- U.S. Geological Survey (USGS), 2008, Earthquake Hazards Program, United States National Seismic Hazards Maps, Accessed at <http://earthquake.usgs.gov/research/hazmaps/index.php>
- U.S. Geological Survey (USGS), 2015, Romoland 7.5' Quadrangle, Riverside County, scale 1:24,000.

APPENDIX A

Boring Logs and Classification Key



Date(s) drilled	7/15/2022	LOG OF BORING 1 Page 1 of 1	
Drilling Contractor	GP Drilling		
Drilling Method	Hollow Stem Auger		
Drill Rig Type	CME 75	Logged By:	AM
Drill Bit Size/Type	8"	Checked By:	MS
Sampling Method(s)	CSS	Total Depth of Borehole	20' BGS
Client: AES - Double Butte BESS	Groundwater	None Encountered	Boring Location: See Figure 2
Project Number: 22-247	Borehole Backfill	Native/ Cuttings	Notes:
Project Location: Menifee, CA	Hammer Data	140#, 30" drop	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
5'		SM		Brown silty fine to medium sand w/ occ coarse sand Medium dense, moist	22-23	DIST	7.1
		SM		Reddish brown silty fine to medium sand (slightly cemented) Dense, moist	24-50/3"	110.6	8.1
		SM		Yellowish brown silty medium sand w/ coarse sand & #4 - 1" gravel Very dense, moist	50/4"	116.4	9.2
		SM		Brown silty fine to medium sand (slightly cemented) Very dense, moist	50/6"	DIST	8.7
10'		SM		Yellowish brown silty medium to coarse sand w/ some fines & clay binder Dense, slightly moist	34-50/4"	120.0	4.6
15'		SC		Brown clayey fine to medium sand w/ silt Very dense, moist	50/6"	109.9	11.1
20'		SM		Brown silty fine to medium sand Dense, very moist	27-50/4"	97.2	12.6
25'				Boring terminated @ 20' bgs No groundwater No caving			
30'							



Date(s) drilled	7/15/2022	LOG OF BORING 2 Page 1 of 1	
Drilling Contractor	GP Drilling		
Drilling Method	Hollow Stem Auger		
Drill Rig Type	CME 75	Logged By:	AM
Drill Bit Size/Type	8"	Checked By:	MS
Sampling Method(s)	CSS/Bulk	Total Depth of Borehole	20' BGS
Client:	AES - Double Butte BESS	Groundwater	None Encountered
Project Number:	22-247	Borehole Backfill	Native/ Cuttings
Project Location:	Menifee, CA	Hammer Data	140#, 30" drop
		Boring Location:	See Figure 2
		Notes:	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
5'		SM		Dark brown silty fine to medium sand w/ occ #4 gravel & clay Medium dense, slightly moist	19-22	DIST	5.4
		SC		Reddish brown clayey fine to medium sand w/ silt Stiff, slightly moist	50/5"	101.2	7.1
		SM		Reddish brown silty fine to coarse sand w/ clay Dense, moist	50/6"	96.6	8.1
		SM		Reddish brown silty fine to coarse sand Very dense, slightly moist	50/5"	N/R	N/R
10'		SM		Light brown silty fine to coarse sand w/ clay binder Dense, moist	37-42	115.6	9.5
15'		SM		Brown silty fine to medium sand Dense, very moist	37-50/2"	108.0	13.8
20'		SM		Brown silty fine to medium sand Dense, very moist	50/6"	103.6	13.3
25'				Boring terminated @ 20' bgs No groundwater No caving			
30'							



Date(s) drilled	7/15/2022	LOG OF BORING 3 Page 1 of 1	
Drilling Contractor	GP Drilling		
Drilling Method	Hollow Stem Auger		
Drill Rig Type	CME 75	Logged By:	AM
Drill Bit Size/Type	8"	Checked By:	MS
Sampling Method(s)	CSS	Total Depth of Borehole	20' BGS
Client: AES - Double Butte BESS	Groundwater	None Encountered	Boring Location: See Figure 2
Project Number: 22-247	Borehole Backfill	Native/ Cuttings	Notes:
Project Location: Menifee, CA	Hammer Data	140#, 30" drop	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
5'		SM		Yellowish brown silty medium to coarse sand Medium dense, slightly moist	19-16	120.1	6.3
		SM		Brown silty fine to coarse sand w/ #4 gravel Loose, dry	5-6	111.1	3.4
		SM		Greyish brown silty medium to coarse sand w/ slight fine sand Medium dense, moist	19-27	126.1	7.9
		SM		Dark yellowish brown silty fine to medium sand w/ coarse sand Dense, moist	22-50/6"	127.3	9.1
10'		SM		Brown silty fine to medium sand w/ coarse sand & slight #4 gravel & clay binder Medium dense, moist	12-30	122.5	9.2
15'		SM		Yellowish brown silty medium to coarse sand w/ some fine sand Medium dense, moist	28-22	120.0	8.8
20'		SM		Brown silty fine to medium sand Medium dense, saturated	19-32	109.0	16.7
25'				Boring terminated @ 20' bgs No groundwater No caving			
30'							



Date(s) drilled	7/15/2022	LOG OF BORING 4 Page 1 of 1	
Drilling Contractor	GP Drilling		
Drilling Method	Hollow Stem Auger		
Drill Rig Type	CME 75	Logged By:	AM
Drill Bit Size/Type	8"	Checked By:	MS
Sampling Method(s)	CSS	Total Depth of Borehole	15' BGS
Client:	AES - Double Butte BESS	Groundwater	None Encountered
Project Number:	22-247	Borehole Backfill	Native/ Cuttings
Project Location:	Menifee, CA	Hammer Data	140#, 30" drop
		Boring Location:	See Figure 2
		Notes:	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
5'		SM		Yellowish brown silty fine to coarse sand Medium dense, moist	17-23	127.0	7.0
		SM		Brown silty fine to medium sand Dense, moist	28-50/5"	106.8	9.1
		SM		Brown silty fine to medium sand Dense, moist	50/6"	116.1	7.5
10'		SM		Dark yellowish brown silty fine to medium sand w/ coarse sand Dense, moist	35-50/4"	109.0	9.4
		SM		Reddish brown silty fine to medium sand w/ coarse sand Dense, very moist	32-47	99.2	13.0
15'		SC		Brown clayey fine to medium sand w/ silt Firm, very moist	17-22	113.4	15.1
20'				Boring terminated @ 15' bgs No groundwater No caving			
25'							
30'							



Date(s) drilled	7/15/2022	LOG OF BORING 5 Page 1 of 1
Drilling Contractor	GP Drilling	
Drilling Method	Hollow Stem Auger	
Drill Rig Type	CME 75	Logged By: AM
Drill Bit Size/Type	8"	Checked By: MS
Sampling Method(s)	SPT/Bulk	Total Depth of Borehole 20' BGS
Client: AES - Double Butte BESS	Groundwater None Encountered	Boring Location: See Figure 2
Project Number: 22-247	Borehole Backfill Native/ Cuttings	Notes:
Project Location: Menifee, CA	Hammer Data 140#, 30" drop	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
5'		SM/ML		Dark reddish brown silty fine to coarse sand w/ clay (cemented) Medium dense, slightly moist	17-27-30		5.7
		SC		Dark brown clayey fine to coarse sand Medium dense, moist	20-25-22		8.0
		SM		Dark reddish brown silty fine to coarse sand w/ clay (cemented) Medium dense, moist	15-19-21		8.8
		ML		Dark yellowish brown sandy silt fine to coarse sand (cemented) Firm, moist	12-17-21		11.1
10'		SM		Dark yellowish brown silty fine to coarse sand w/ clay Medium dense, saturated	11-15-24		24.0
15'		SM		Dark yellowish brown very silty fine to coarse sand Loose, slightly moist	7-7-10		6.2
20'		SM		Dark yellowish brown fine to medium sand w/ clay Medium dense, saturated	19-21-20		20.5
25'				Boring terminated @ 20' bgs No groundwater No caving			
30'							



Date(s) drilled	7/15/2022	LOG OF BORING 6 Page 1 of 1	
Drilling Contractor	GP Drilling		
Drilling Method	Hollow Stem Auger		
Drill Rig Type	CME 75	Logged By:	AM
Drill Bit Size/Type	8"	Checked By:	MS
Sampling Method(s)	CSS	Total Depth of Borehole	20' BGS
Client: AES - Double Butte BESS	Groundwater	None Encountered	Boring Location: See Figure 2
Project Number: 22-247	Borehole Backfill	Native/ Cuttings	Notes:
Project Location: Menifee, CA	Hammer Data	140#, 30" drop	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
		SC		Dark brown clayey sandy fine to medium sand w/ occ #4 gravel Loose, moist	9-10	127.2	7.8
		SM		Brown silty fine to medium sand w/ slight #4 gravel Dense, moist	9-50/4"	123.2	7.9
5'		SM		Dark yellowish brown silty fine to coarse sand w/ occ #4 gravel Very dense, moist	50/6"	123.9	8.0
		SM		Yellowish brown silty medium to coarse sand w/ fine sand Very dense, moist	50/6"	112.8	8.5
10'		SM		Dark yellowish brown silty fine to medium sand w/ coarse sand & clay binder Very dense, moist	41-50/6"	115.0	10.7
15'		SM		Brown silty fine to medium sand Very dense, moist	22-50/6"	111.6	13.8
20'		SM		Light brown silty fine to medium sand w/ occ #4 - 3/8" gravel Dense, slightly moist	25-50	108.2	5.8
25'				Boring terminated @ 20' bgs No groundwater No caving			
30'							



Date(s) drilled	7/15/2022	LOG OF BORING 7 Page 1 of 1
Drilling Contractor	GP Drilling	
Drilling Method	Hollow Stem Auger	
Drill Rig Type	CME 75	Logged By: AM
Drill Bit Size/Type	8"	Checked By: MS
Sampling Method(s)	CSS/Bulk	Total Depth of Borehole 20' BGS
Client: AES - Double Butte BESS	Groundwater None Encountered	Boring Location: See Figure 2
Project Number: 22-247	Borehole Backfill Native/ Cuttings	Notes:
Project Location: Menifee, CA	Hammer Data 140#, 30" drop	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
5'		SM		Reddish brown very silty fine to medium sand w/ clay Medium dense, very moist	18-20	104.6	11.7
		SM		Dark yellowish brown silty fine to medium sand w/ clay Medium dense, moist	22-30	116.1	7.9
		SM		Dark yellowish brown silty fine to medium sand w/ coarse sand & occ #4 gravel Dense, moist	50/6"	113.7	7.5
		SM		Brown silty fine to medium sand Dense, moist	50/6"	119.5	8.8
10'		SM		Brown silty fine to medium sand Dense, moist	27-50/6"	113.1	9.8
15'		SM		Yellowish brown silty fine to medium sand w/ coarse sand Medium dense, saturated	18-25	113.9	17.1
20'		SM		Brown silty fine to medium sand w/ clay Medium dense, very moist	21-18	118.2	13.4
25'				Boring terminated @ 20' bgs No groundwater No caving			
30'							



Date(s) drilled	7/15/2022	LOG OF BORING 8 Page 1 of 1	
Drilling Contractor	GP Drilling		
Drilling Method	Hollow Stem Auger		
Drill Rig Type	CME 75	Logged By:	AM
Drill Bit Size/Type	8"	Checked By:	MS
Sampling Method(s)	CSS	Total Depth of Borehole	20' BGS
Client:	AES - Double Butte BESS	Groundwater	None Encountered
Project Number:	22-247	Borehole Backfill	Native/ Cuttings
Project Location:	Menifee, CA	Hammer Data	140#, 30" drop
		Boring Location:	See Figure 2
		Notes:	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
5'		SM		Brown silty fine to medium sand Medium dense, dry	18-20	117.2	3.2
		SM		Orange brown silty fine to medium sand w/ clay (cemented) Medium dense, moist	12-30	102.9	10.1
		SM		Brown silty fine to medium sand w/ clay Very dense, moist	50/6"	110.1	8.0
		SM		Dark yellowish brown silty fine to medium sand w/ clay binder Very dense, moist	50/4"	110.8	8.9
10'		SM		Brown silty fine to medium sand Very dense, moist	32-50/6"	123.9	9.6
15'		SC		Brown clayey fine to medium sand w/ silt (cemented) Medium dense, very moist	20-39	114.6	14.0
20'		SM		Brown silty fine to medium sand w/ clay Very dense, very moist	23-50/6"	112.3	13.4
25'				Boring terminated @ 20' bgs No groundwater No caving			
30'							



Date(s) drilled	7/17/2023	LOG OF BORING 1 Page 1 of 1
Drilling Contractor	GP Drilling	
Drilling Method	Hollow Stem Auger	
Drill Rig Type	CME 75	Logged By: AM
Drill Bit Size/Type	8"	Checked By: MS
Sampling Method(s)	CSS/Bulk	Total Depth of Borehole 20' bgs

Client: AES - Double Butte	Groundwater None Encountered	Boring Location: See Figure 2
Project Number: 22-247	Borehole Backfill Native/ Cuttings	Notes:
Project Location: Menifee	Hammer Data 140#, 30" drop	

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
5'		ML		Light brown fine to medium sandy silt w/ occ. Coarse sand (Soft, Slightly moist)	5-6	93.9	3.4
		SM/ML		Light brown very silty fine to medium sand w/ occ. Coarse sand (Medium dense, slightly moist)	7-13	108.3	3.1
		SM/ML			12-13	105.9	5.9
		SM		Brown silty fine to medium sand w/ coarse sand (Very dense, slightly)	11-50/5"	121.2	13
		SM/ML		Brown fine to medium sandy silt w/ occ. Coarse sand (Very dense, slightly moist)	50/5"	97.8	8.3
10'		SM		Brown very silty fine to medium sand w/ coarse sand (Very dense, moist)	50/6"	126.7	6.8
		SM			50/6"	105.9	6.1
		SM		Moderate brown silty fine to medium sand w/ coarse sand & occ. #4 gravel (Very dense, moist)	50/6"	113.4	7
		SM		Moderate brown silty fine to coarse sand w/ occ. #4 gravel (Slightly cemented, Very dense, moist)	50/6"		
		SM		Reddish brown silty fine to coarse sand w/ occ. #4 gravel & clay binder (Very dense, moist)	50/6"	102.4	14.8
15'		ML		Brown fine to medium sandy silt w/ occ. Coarse sand Stiff, moist	18-30		
		ML		Stiff, moist	15-31	102.8	16.1
20'		ML		Brown fine to medium sandy silt w/ occ. Coarse sand	14-39	112.3	12.8
25'				Stiff, moist			
				Boring terminated @ 20' bgs			
				No groundwater			
30'				No caving			



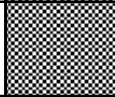
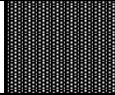
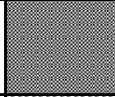
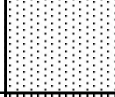
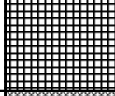
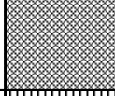
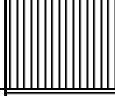
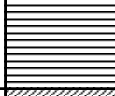
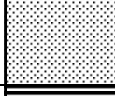
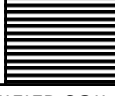
Date(s) drilled	7/17/2023	LOG OF BORING 2 Page 1 of 1	
Drilling Contractor	GP Drilling		
Drilling Method	Hollow Stem Auger		
Drill Rig Type	CME 75	Logged By:	AM
Drill Bit Size/Type	8"	Checked By:	MS
Sampling Method(s)	CSS	Total Depth of Borehole	20' bgs

Client: AES - Double Butte	Groundwater	None Encountered	Boring Location:	See Figure 2
Project Number: 22-247	Borehole Backfill	Native/ Cuttings	Notes:	
Project Location: Menifee	Hammer Data	140#, 30" drop		

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
5'		SM/ML		Dark reddish brown silty very fine to coarse sand (Medium dense, moist)	7-13	DIST	8.8
		SM		Dark reddish brown silty fine to coarse sand w/ occ. #4 gravel and clay binder (very dense, moist)	21-50/5"	134.0	7.2
		SM		Dark brown silty fine to coarse sand w/ occ. #4 gravel (Very dense, slightly moist)	50/6"	110.2	8.7
		SM			50/6"	117.5	9.0
		SM		Brown silty fine to coarse sand w/ occ. #4 gravel (Very dense, slightly moist)	50/6"	106.3	7.5
10'		SM/ML		Brown very silty fine to medium sand w/ coarse sand (Very dense, slightly moist)	29-50/5"	132.7	8.4
		SM			19-40		
		SM			20-46	131.0	9.2
		SP		Greenish brown slightly silty fine to coarse sand w/ occ. #4 gravel (Dense, moist)	26-29	116.5	7.2
		ML		Brown fine to medium sandy silt w/ occ. coarse sand (Stiff, moist)	16-33	117.5	14.2
15'		SM/SP		Yellowish brown silty fine to medium sand w/ coarse sand & occ. #4 gravel Dense, moist	22-39	123.4	8.2
		ML		Yellowish brown fine to medium sandy silt w/ occ. coarse sand & #4 gravel Stiff, slightly moist	21-43	107.7	15.6
20'		ML		Brown fine to medium sandy silt w/ occ. Coarse sand Very firm, moist	17-25	112.3	12.8
25'				Boring terminated @ 20' bgs No groundwater No caving			
30'							

BRUIN GEOTECHNICAL SERVICES, INC.

GEOTECHNICAL REPORTS | MATERIAL TESTING | CONSTRUCTION INSPECTION

SOIL CLASSIFICATION KEY					
MAJOR DIVISIONS			SYMBOL		TYPICAL NAMES
Coarse Grained Soils 50% or more larger than #200 sieve	Gravels More than half coarse-fraction is larger than No. 4 sieve size	Clean gravels with little or no fines	GW		Well graded gravels, gravel-sand mixtures
			GP		Poorly graded gravels, gravel-sand mixtures
		Gravel with over 12% fines	GM		Silty gravels, poorly graded gravel-sand-silt mixtures
			GC		Clayey gravels, poorly graded gravel-sand-clay mixtures
	Sands More than half coarse-fraction is smaller than No. 4 sieve size	Clean sands with little or no fines	SW		Well graded sands, gravelly sands
			SP		Poorly graded sands, gravelly sands
		Sands with over 12% fines	SM		Silty sands, poorly graded sand-silt mixtures
			SC		Clayey sands, poorly graded sand-clay mixtures
Fine Grained Soils 50% or more smaller than #200 sieve	Silts and Clays Liquid limit less than 50		ML		Inorganic silts, rock flour, clayey silts
			CL		Inorganic clays of low to medium plasticity, sandy clays, silty clays
			OL		Organic clays and organic silty clays of low plasticity
	Silts and Clays Liquid limit greater than 50		MH		Inorganic silts, micaceous or diatomaceous fine sandy/silty soils, elastic silts
			CH		Inorganic clays with high plasticity, fat clays
			OH		Organic clays of medium to high plasticity, organic silts
	Highly Organic Soils		Pt		Peat and other highly organic soils
CLASSIFICATION SYSTEM BASED ON THE UNIFIED SOIL CLASSIFICATION SYSTEM					

Boring Log Key

Sheet 2 of 2

Depth	Sample	USCS	Graphic Log	Material Description	Penetration Resistance (Blows/6")	Dry Unit Weight pcf	Water Content %
1	2	3	4	5	6	7	8
COLUMN DESCRIPTIONS							
1	Depth in feet below the ground surface			5	Description of the material encountered. May include consistency, moisture, color, and other descriptors		
2	Sampling Method see "symbols" below			6	Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval		
3	USCS symbol			7	Dry weight per unit volume of soil sample measured in laboratory units in pounds per cubic foot		
4	Graphic depiction of the subsurface material			8	Water content of the sample expressed as a percentage of the dry weight of the sample		
ABBREVIATIONS							
DIST = Disturbed Sample N/A = Not Analyzed N/R = No Recovery CHEM = Chemical Test							
SAMPLING METHOD SYMBOLS							
 California Split Spoon (CSS)  Standard Penetration Test (SPT)  Bulk Sample  Grab Sample							
GENERAL NOTES							
1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests. 2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.							

APPENDIX B

Well Site Data

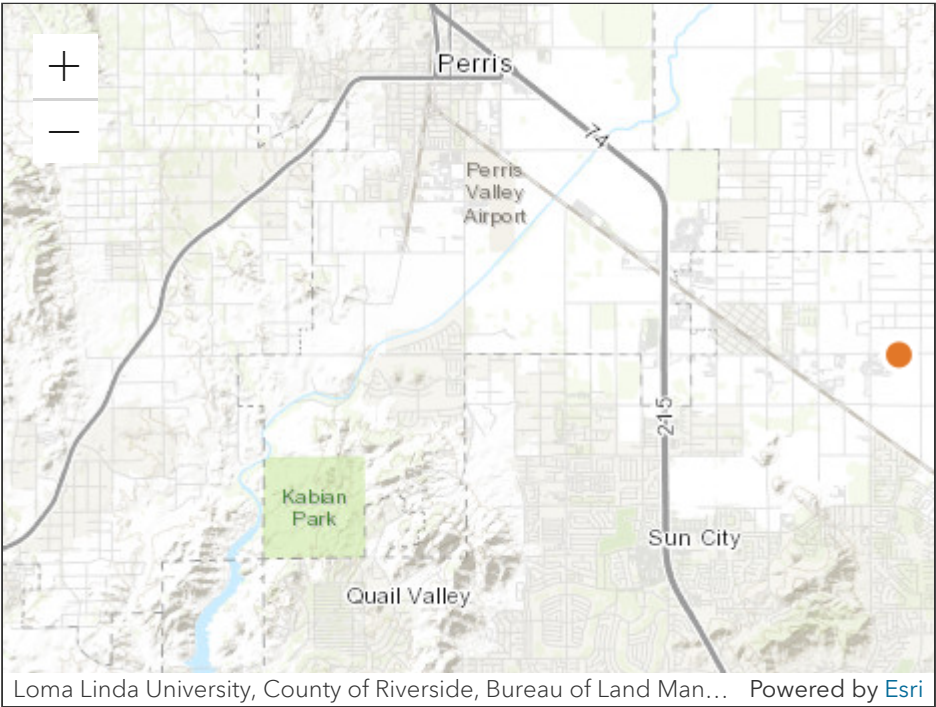


Groundwater Level Report

Station 337429N1171494W001

Station Data Groundwater Level Data

State Well Number:	
Local Well Name:	EMWD12759
Site Code:	337429N1171494W001
Latitude (NAD83):	33.74287
Longitude (NAD83):	-117.149438
Basin Subbasin Name (Code):	San Jacinto (8-005)
Well Use Type:	Observation
Well Status:	Active
WCR Number:	
Reference Point Elevation (NAVD88 ft):	1495.710
Ground Surface Elevation (NAVD88 ft):	1493.610
Well Depth (feet bgs):	693
Perforated Interval Depths (feet bgs):	



text

APPENDIX C

Laboratory Test Data

SUMMARY OF LABORATORY TEST RESULTS
2022

SIEVE ANALYSIS

Percent passing individual sieves

Sample I.D.	1/2"	3/8"	#4	#10	#40	#100	#200
B3@2	100	100	99	91	59	33	23
B4@2	100	100	100	97	79	56	42
B2@5	100	100	100	98	76	51	39
B5@5	100	100	99	93	68	46	34
B1@6	96	94	90	82	51	25	14
B3@6	100	100	100	94	57	24	15
B2@9	100	100	100	95	75	54	41
B5@9	99	96	92	86	66	47	30
B1@10	99	99	98	90	65	42	30
B4@10	100	100	100	99	88	61	41
B3@15	100	100	100	93	67	37	23
B5@20	100	100	98	95	78	53	33

SAND EQUIVALENT

Sample I.D.	Sand Equivalent
B5@3	22
B7@4	28
B3@6	28
B5@7	11
B6@7	28
B1@8	20
B6@15	12

EXPANSION INDEX

Sample I.D.	Expansion Index	Classification
B1@0-5'	18	Very Low

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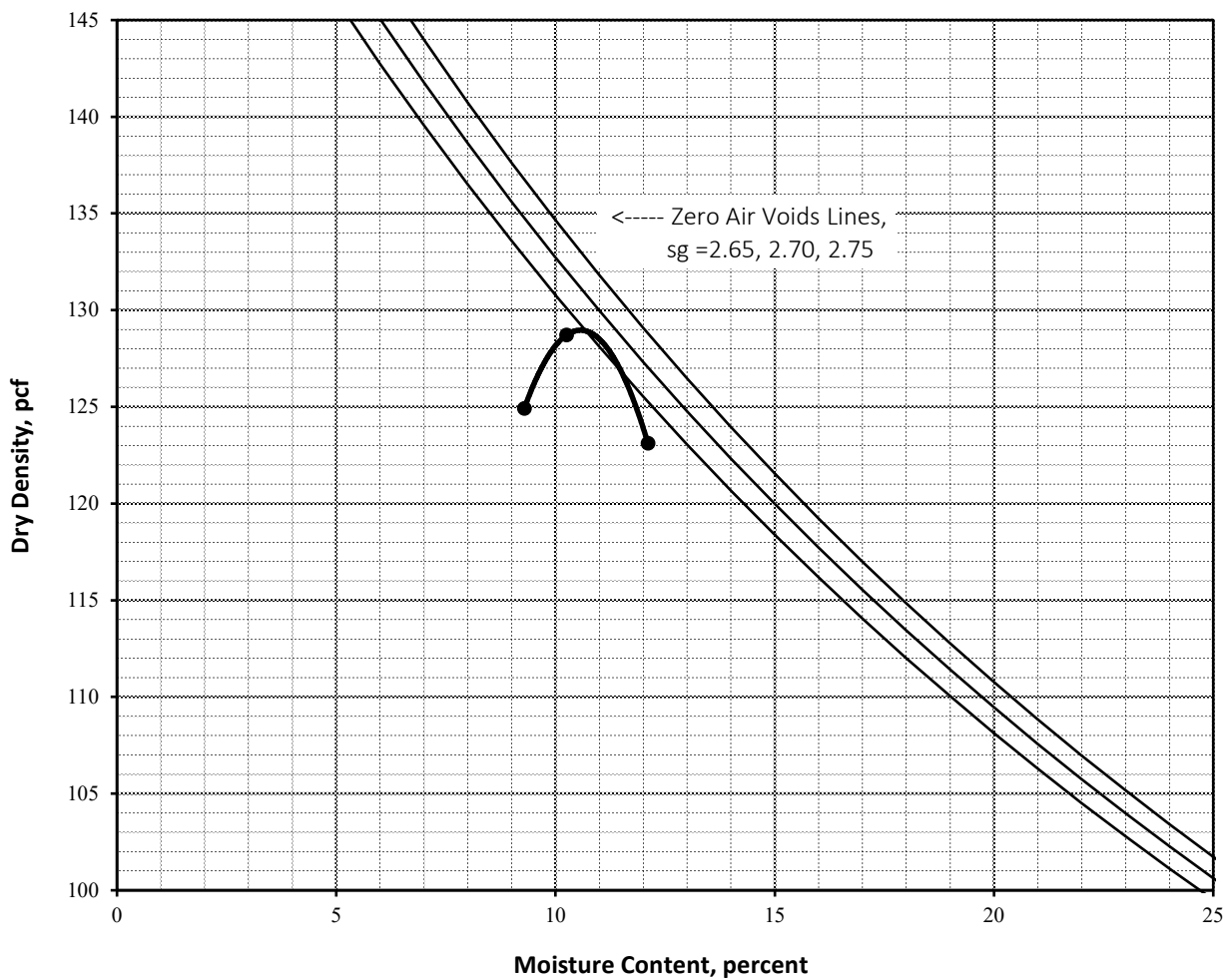
44732 Yucca Avenue
Lancaster, CA 93534
661-273-9078

Maximum Density/Optimum Moisture Proctor ASTM D698/D1557

Job Number: 22-247
Client: AES - Double Butte Storage
Lab ID Number: B5
Sample Location: Bulk 0'-5'
Description: (SC) Dark reddish brown clayey fine to coarse sand w/ silt

July 29, 2022
ASTM D-1557 A
Rammer Type: 10#

Maximum Density:	129 pcf
Optimum Moisture:	10.5%



Bruin Geotechnical Services, Inc.

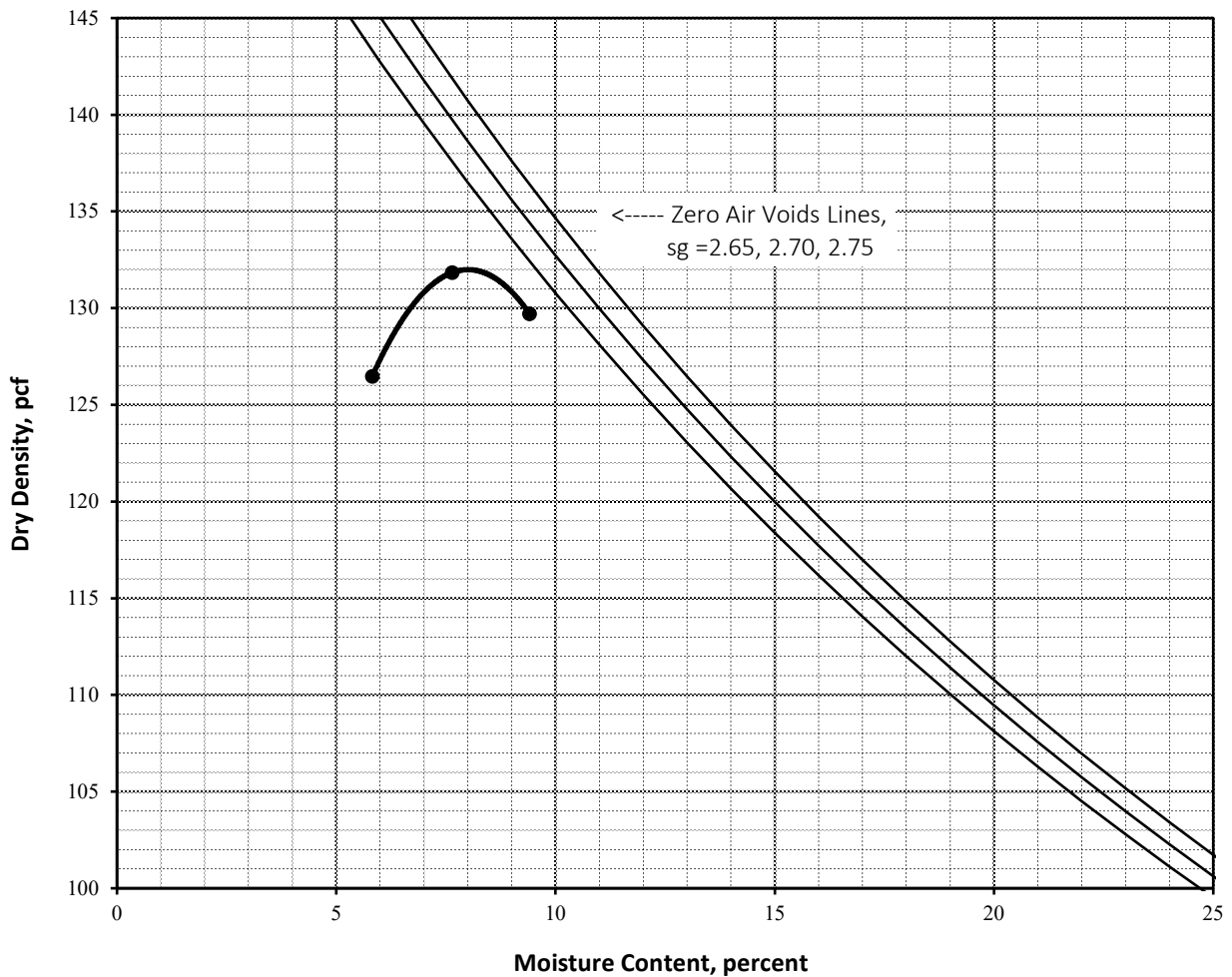
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Lancaster, CA 93534
661-273-9078

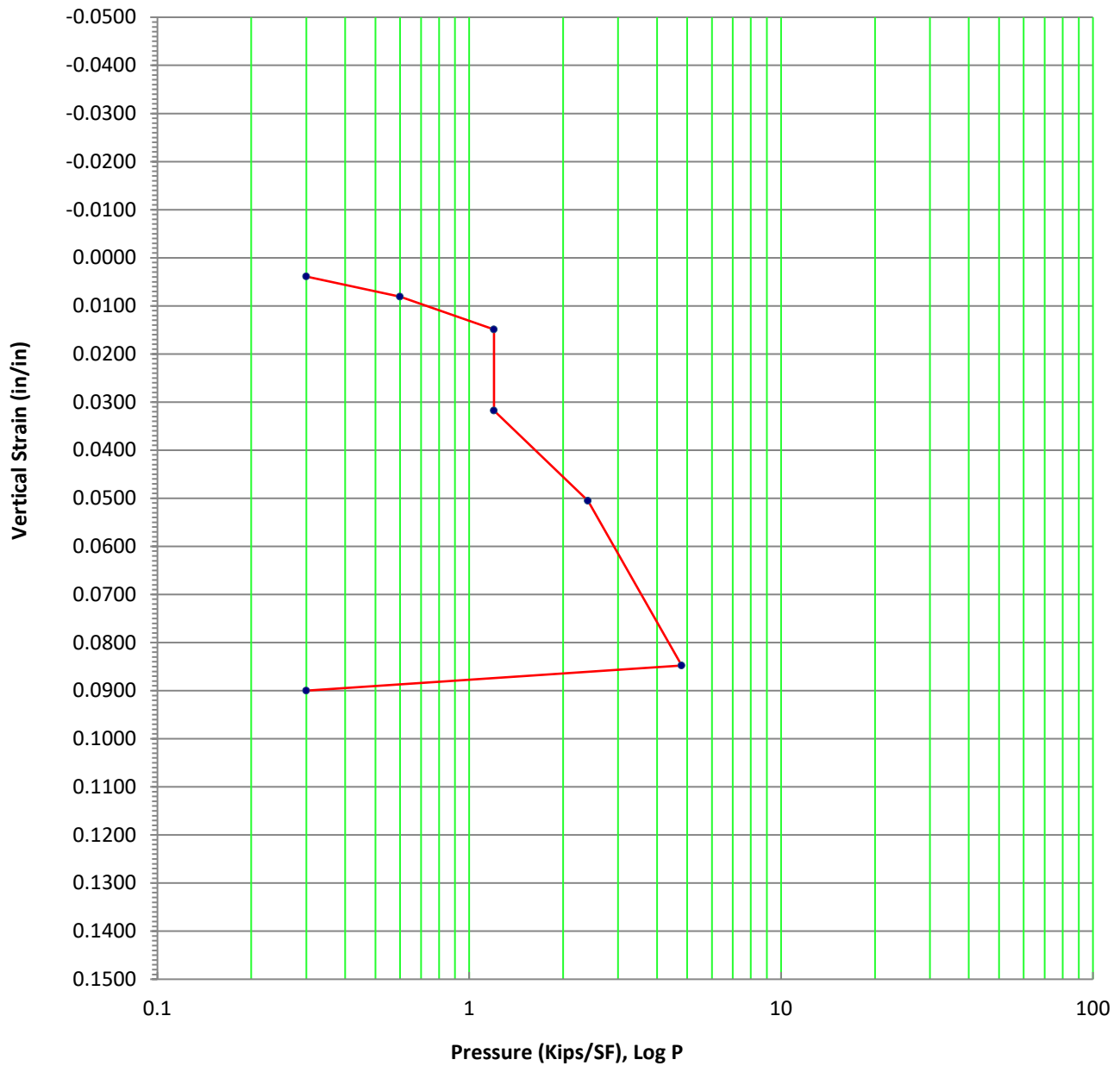
Maximum Density/Optimum Moisture Proctor ASTM D698/D1557

Job Number: 22-247
Client: AES - Double Butte Storage
Lab ID Number: B2
Sample Location: Bulk 0'-5'
Description: (SC) Brown clayey fine to medium sand w/ occ #4 gravel & silt

July 29, 2022
ASTM D-1557 A
Rammer Type: 10#

Maximum Density:	132 pcf
Optimum Moisture:	8%





Sample location: B7@2'
 Material: SM
 Initial Dry Density: 104.6 PCF
 Moisture Content: 11.7 %
 % Hydroconsolidation: 1.7 %

* Test Method: ASTM D-2435

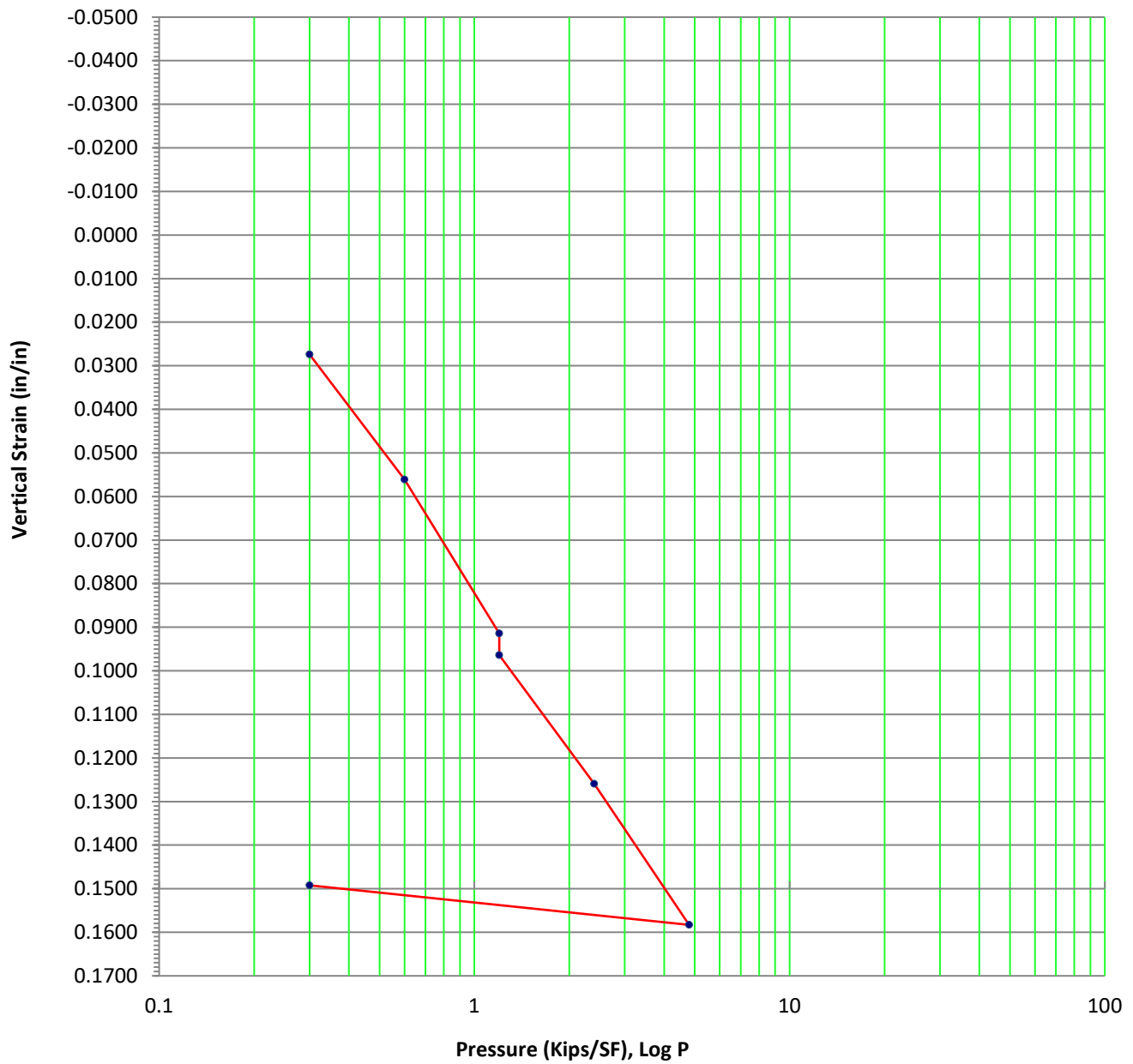
Consolidation Test

AES - Double Butte Storage



22-247

Menifee, CA



Sample location: B2@3'
 Material: SC
 Initial Dry Density: 101.3 PCF
 Moisture Content: 7.1 %
 % Hydroconsolidation: 0.5 %

* Test Method: ASTM D-2435

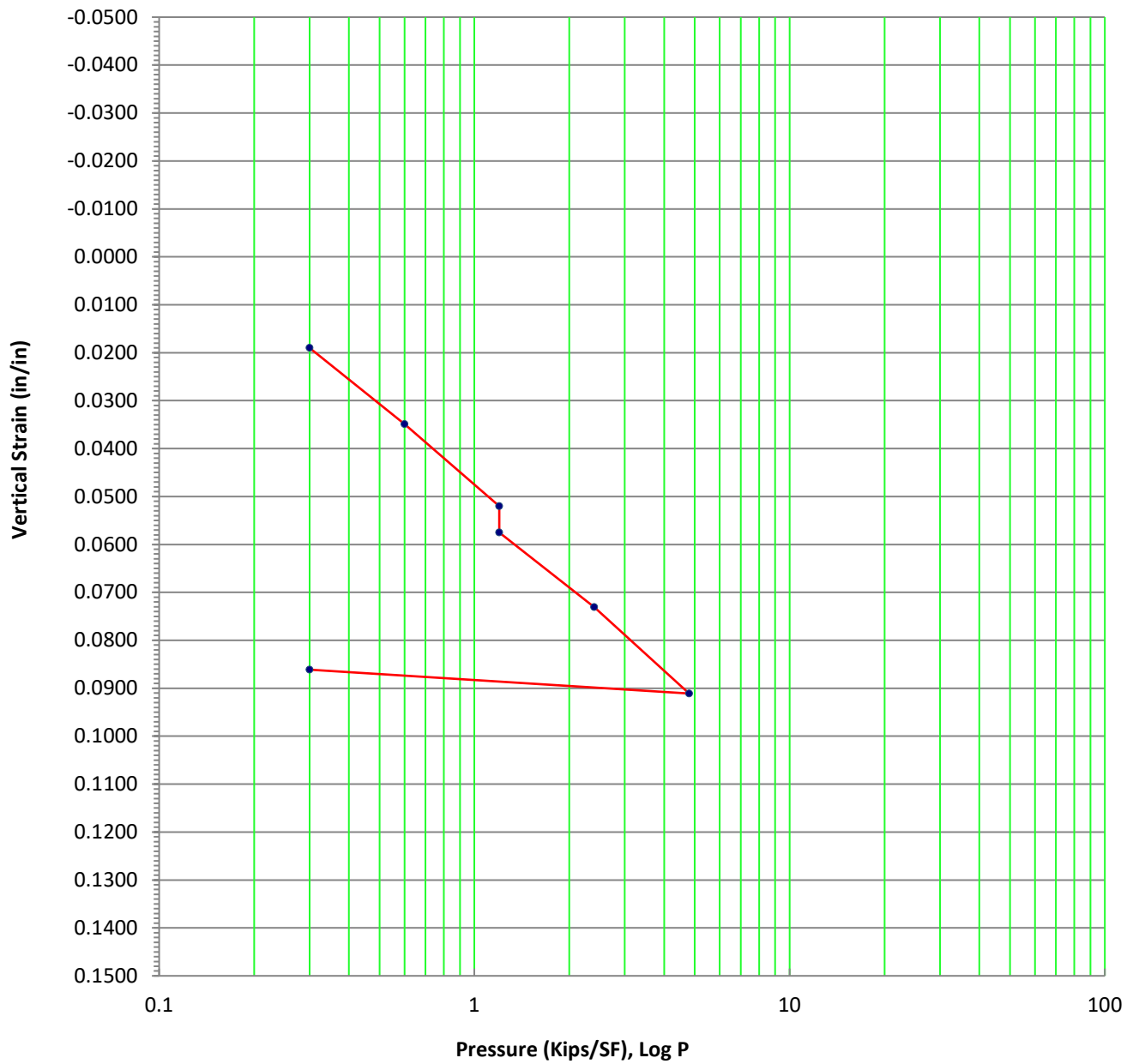
Consolidation Test

AES - Double Butte Storage



22-247

Menifee, CA



Sample location: B3@4'
 Material: SM
 Initial Dry Density: 111.1 PCF
 Moisture Content: 3.4 %
 % Hydroconsolidation: 0.6 %

* Test Method: ASTM D-2435

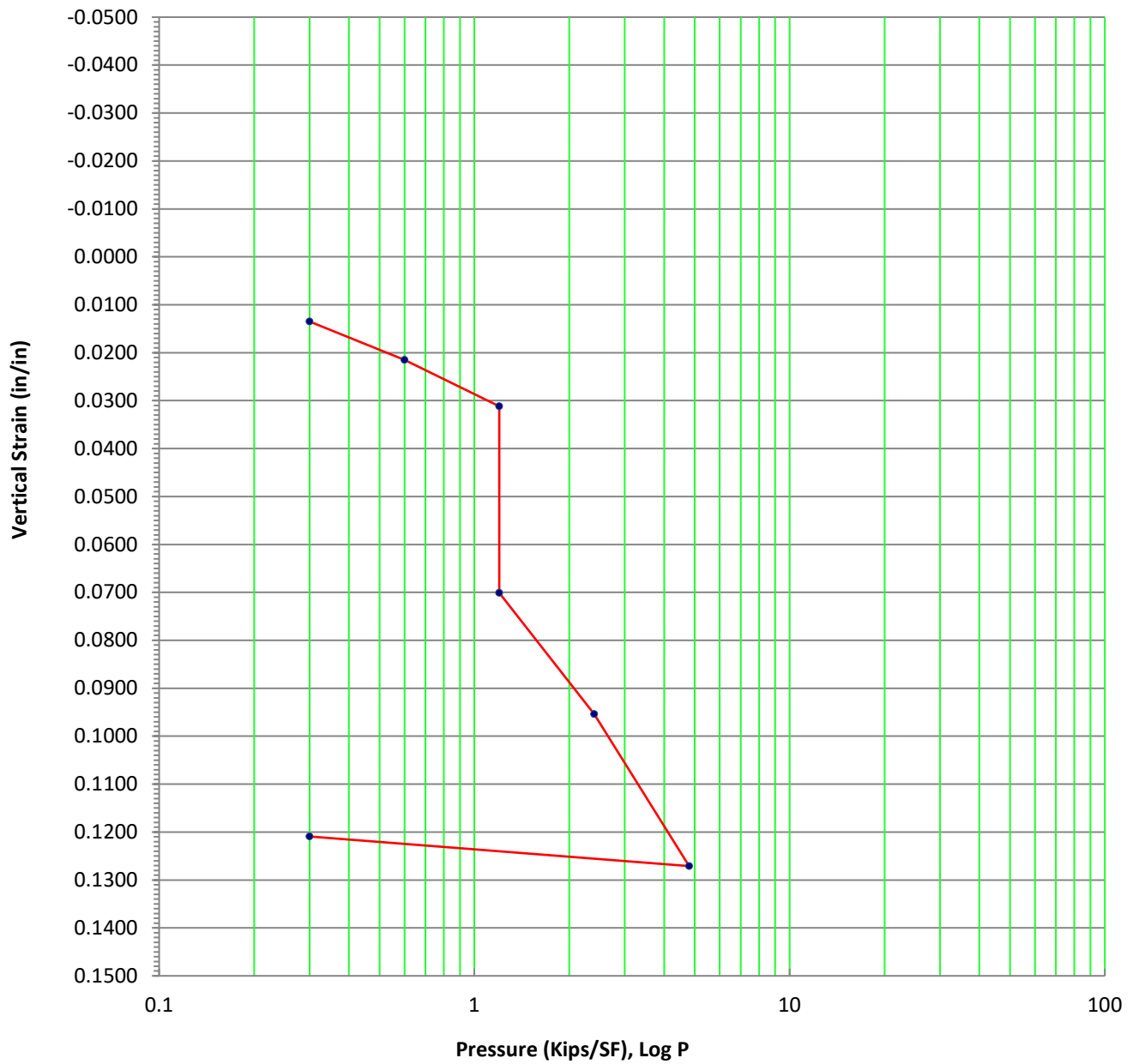
Consolidation Test

AES - Double Butte Storage



22-247

Menifee, CA



Sample location: B4@4'
 Material: SM
 Initial Dry Density: 106.8 PCF
 Moisture Content: 9.1 %
 % Hydroconsolidation: 3.9 %

* Test Method: ASTM D-2435

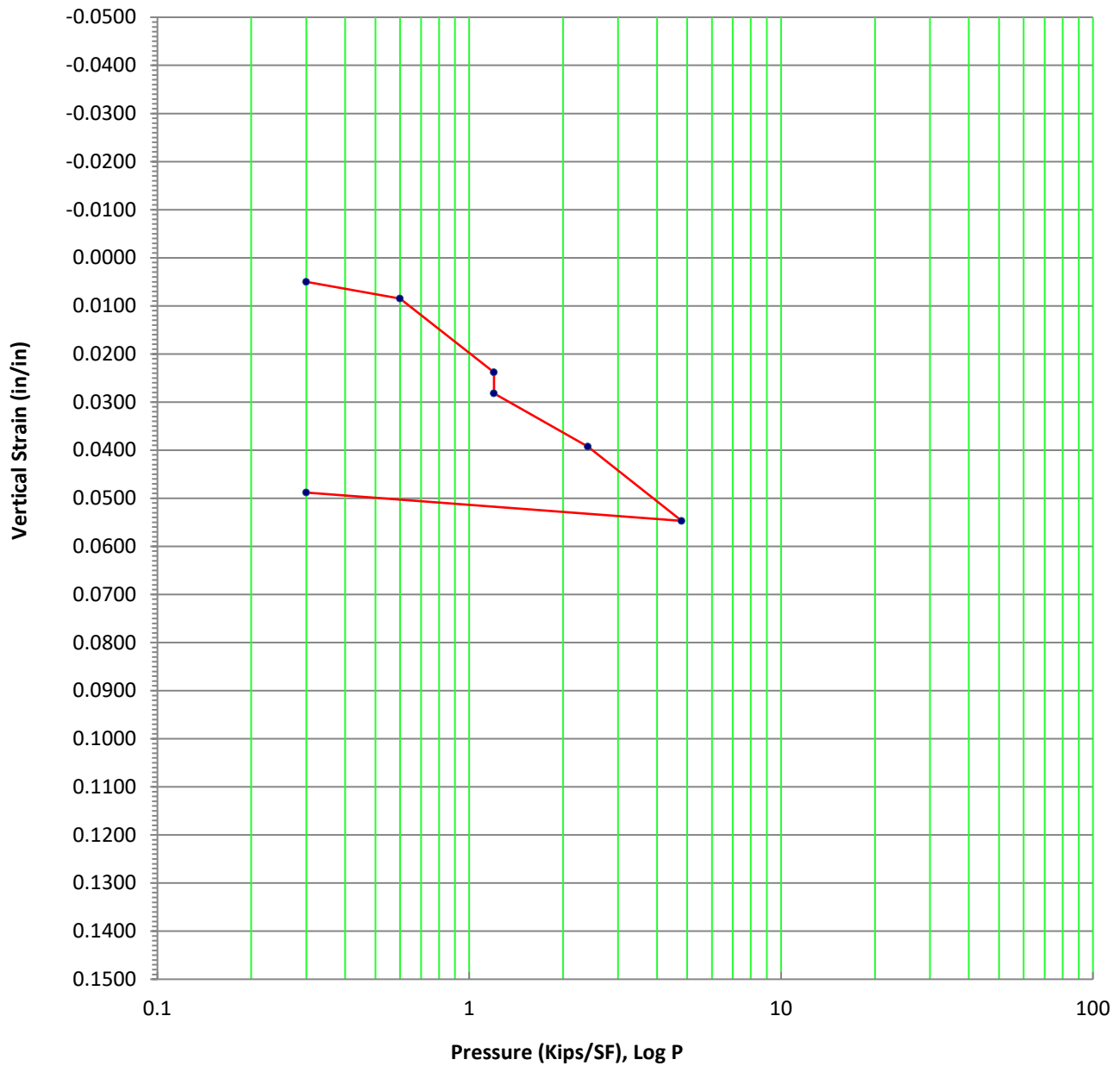
Consolidation Test

AES - Double Butte Storage



22-247

Menifee, CA



Sample location: B7@4'
 Material: SM
 Initial Dry Density: 116.1 PCF
 Moisture Content: 7.9 %
 % Hydroconsolidation: 0.4 %

* Test Method: ASTM D-2435

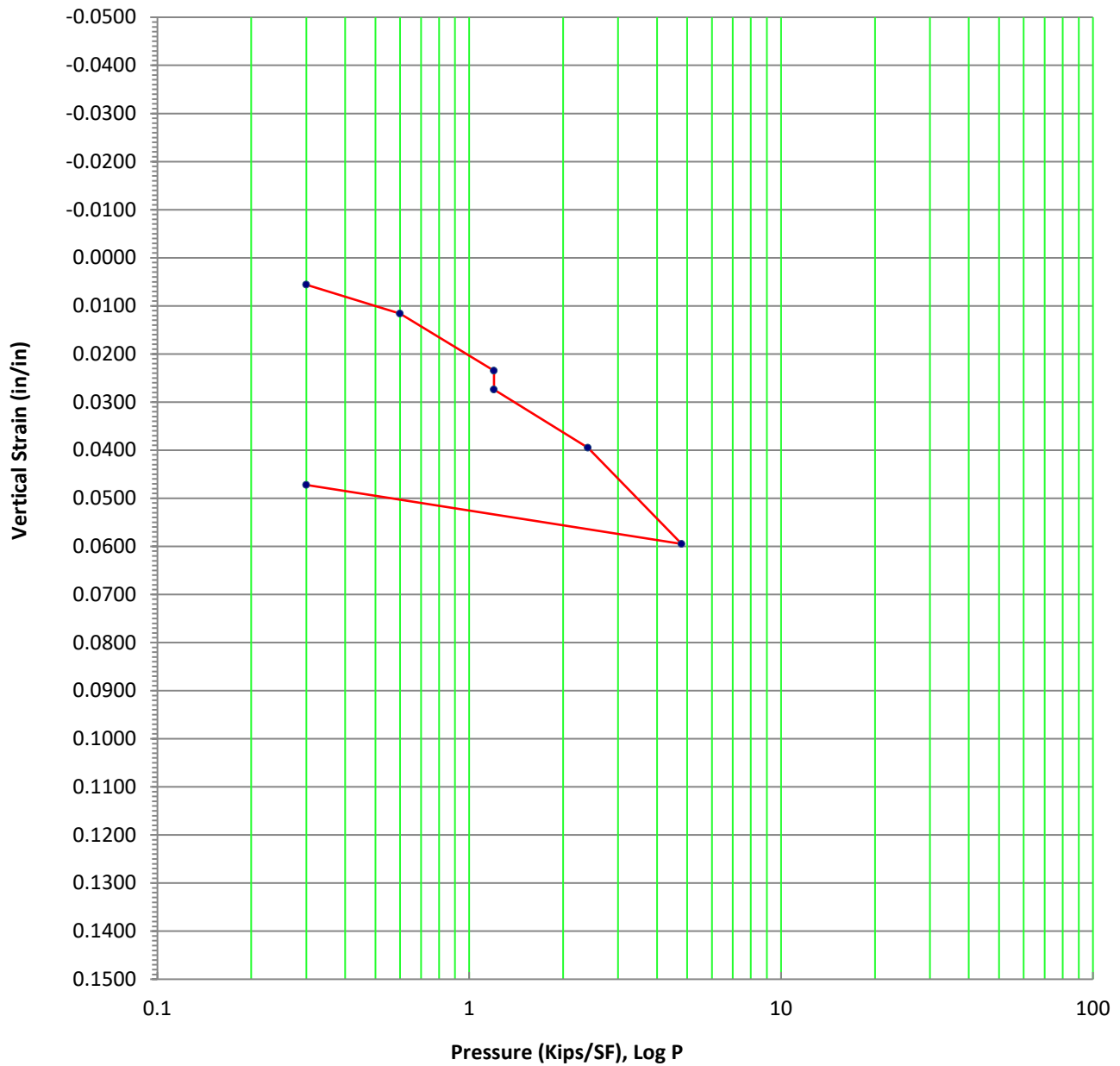
Consolidation Test

AES - Double Butte Storage



22-247

Menifee, CA



Sample location: B8@4'
 Material: SM
 Initial Dry Density: 102.8 PCF
 Moisture Content: 10.1 %
 % Hydroconsolidation: 0.4 %

* Test Method: ASTM D-2435

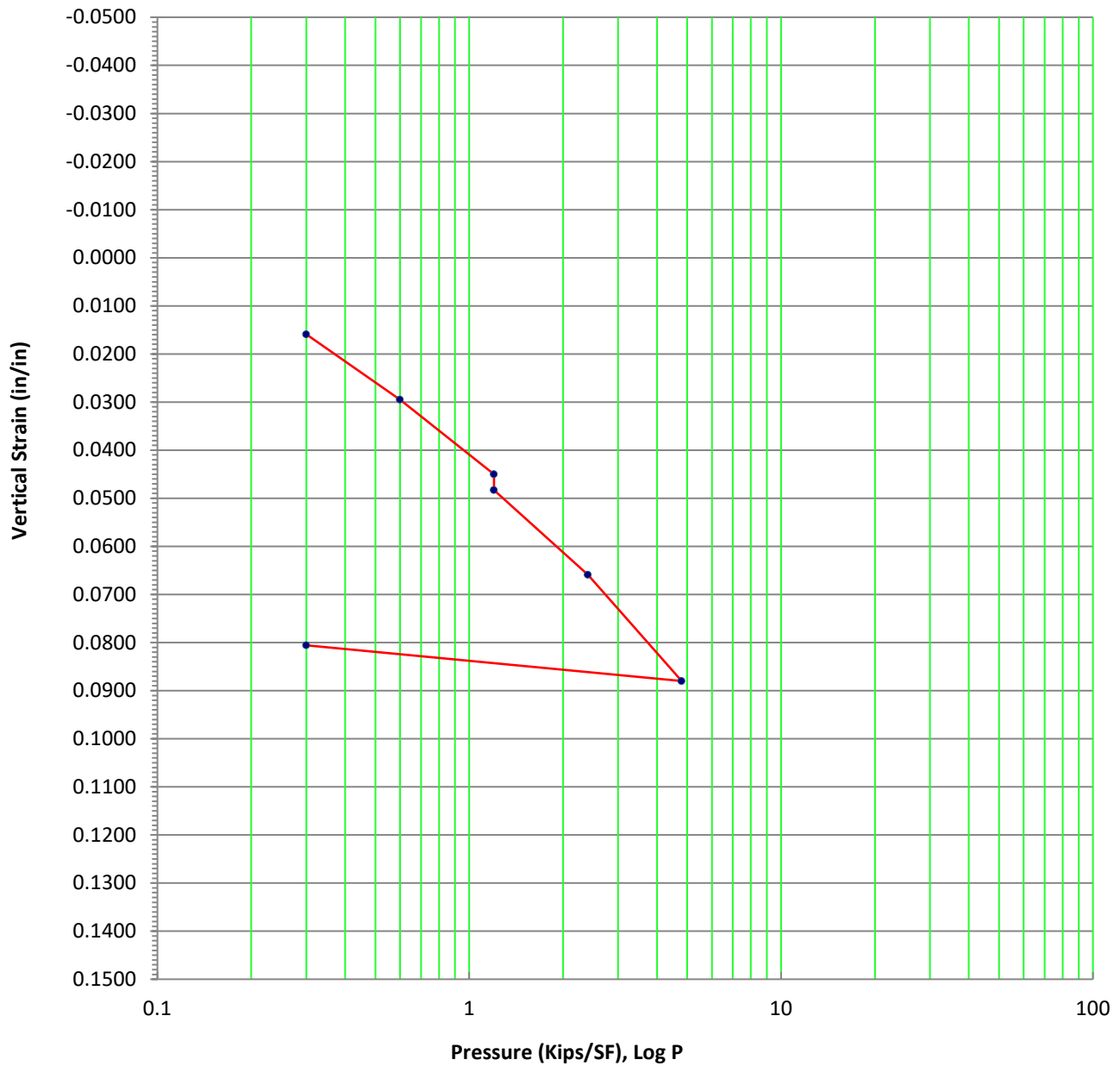
Consolidation Test

AES - Double Butte Storage



22-247

Menifee, CA



Sample location: B1@6'
 Material: SM
 Initial Dry Density: 110.8 PCF
 Moisture Content: 8.1 %
 % Hydroconsolidation: 0.3 %

* Test Method: ASTM D-2435

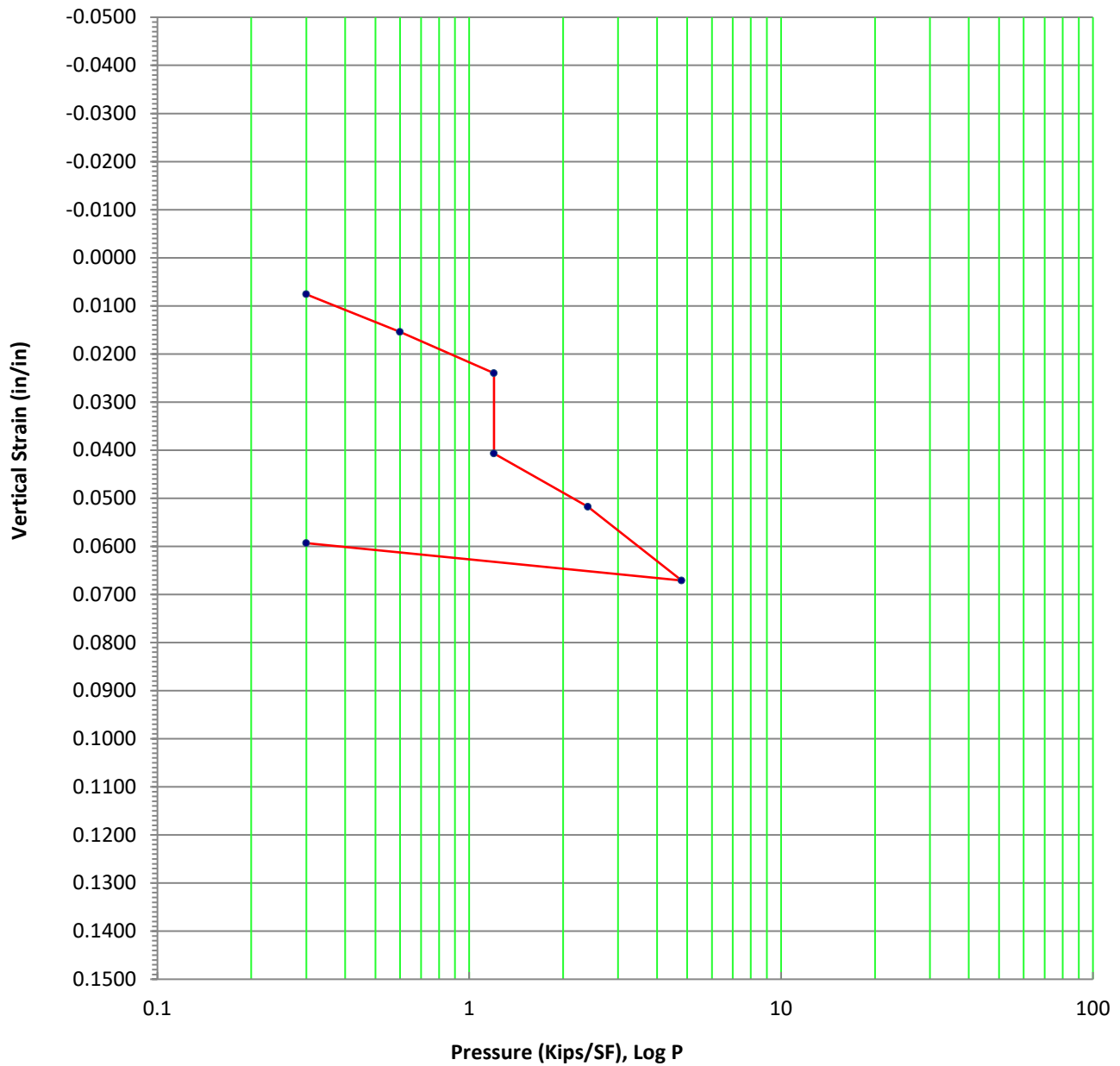
Consolidation Test

AES - Double Butte Storage



22-247

Menifee, CA



Sample location: B4@6'
 Material: SM
 Initial Dry Density: -19.3 PCF
 Moisture Content: 7.5 %
 % Hydroconsolidation: 1.7 %

* Test Method: ASTM D-2435

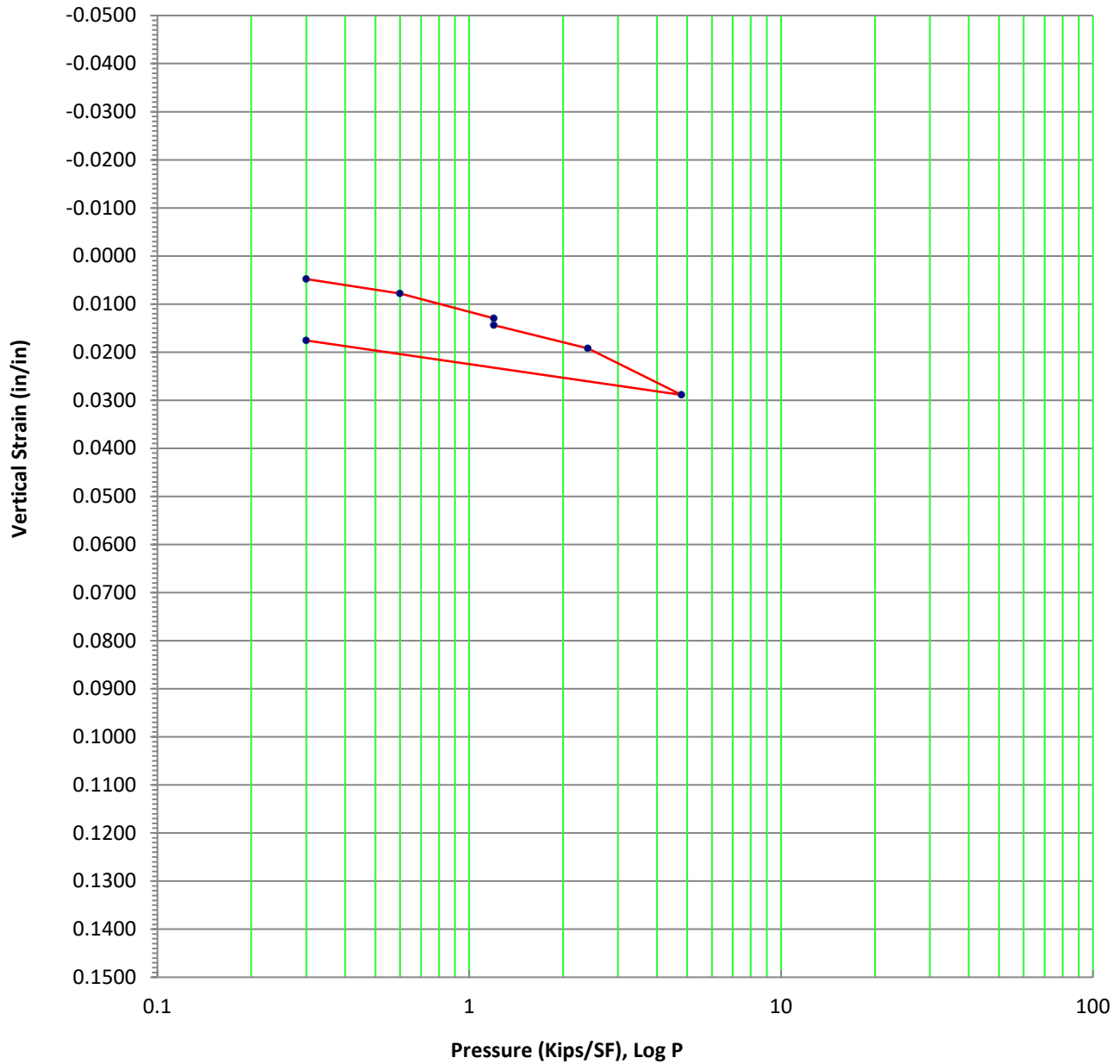
Consolidation Test

AES - Double Butte Storage



22-247

Menifee, CA



Sample location: B3@8'
 Material: SM
 Initial Dry Density: 127.4 PCF
 Moisture Content: 9.1 %
 % Hydroconsolidation: 0.1 %

* Test Method: ASTM D-2435

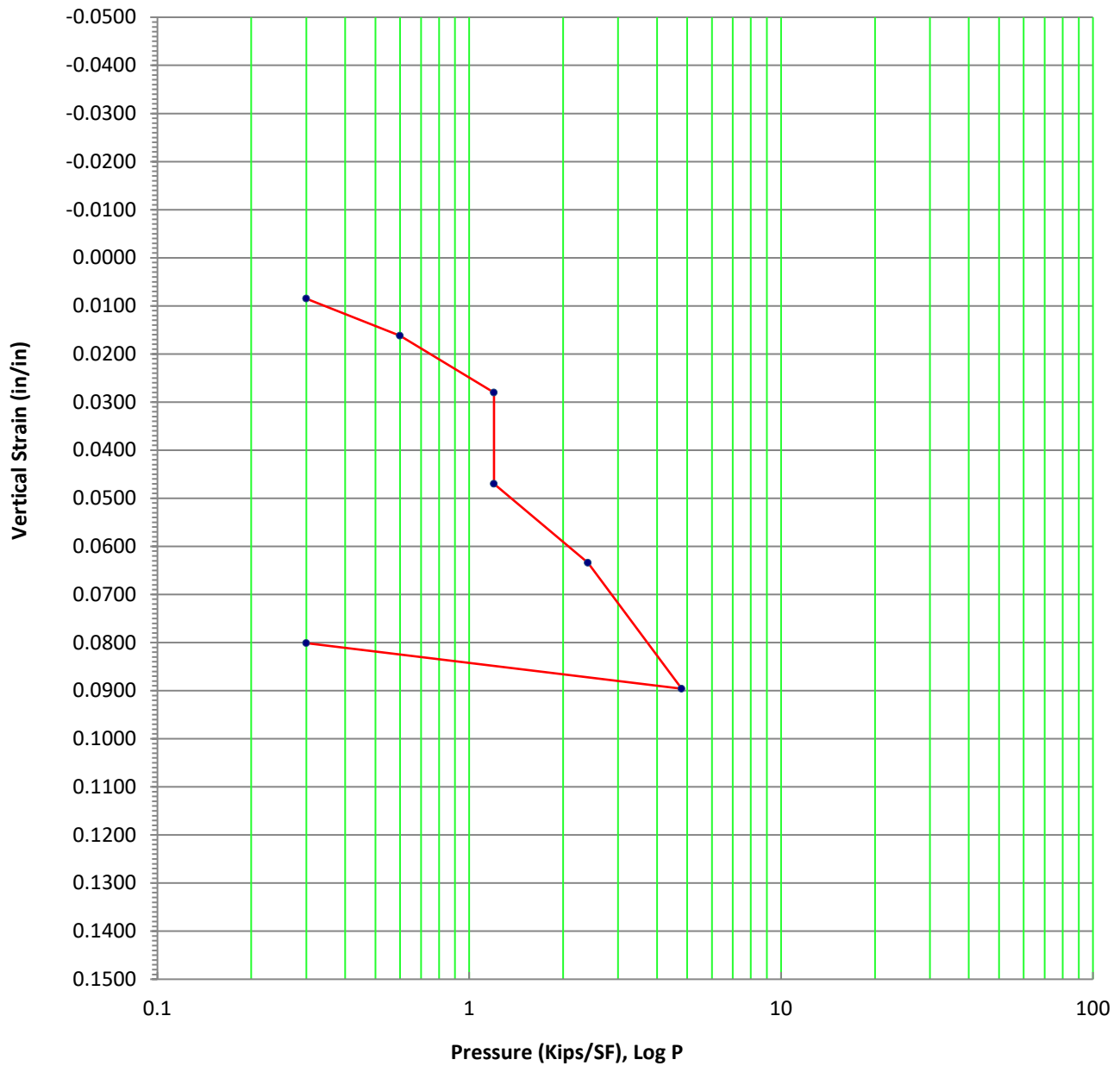
Consolidation Test

AES - Double Butte Storage



22-247

Menifee, CA



Sample location: B4@8'
 Material: SM
 Initial Dry Density: 109.0 PCF
 Moisture Content: 9.4 %
 % Hydroconsolidation: 1.9 %

* Test Method: ASTM D-2435

Consolidation Test

AES - Double Butte Storage



22-247

Menifee, CA

ANAHEIM TEST LAB, INC

196 Technology Drive, Unit D
Irvine, CA 92618
Phone (949) 336-6544

TO:

Bruin Geotechnical Services, Inc.
44732 Yucca Avenue
Lancaster, CA 93534

DATE: 8/8/2022

P.O. NO.: Transmittal

LAB NO.: C-6223

SPECIFICATION: CA 301

MATERIAL: Brown, Sandy Clay

Project No.: 22-247
Job Name: AES Double Butte
Site Address: Matthews Rd/McLaughlin Rd
Site City & State: Menifee, CA
Boring ID: B8 Bulk @ 0-5'

ANALYTICAL REPORT "R" VALUE

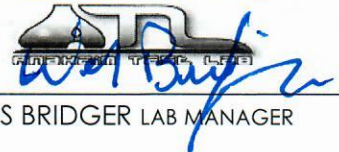
BY EXUDATION

BY EXPANSION

25

12

RESPECTFULLY SUBMITTED


WES BRIDGER LAB MANAGER

"R" VALUE CA 301

Client: Bruin Geotechnical Services, Inc.

ATL No.: C 6223

Date: 8/8/2022

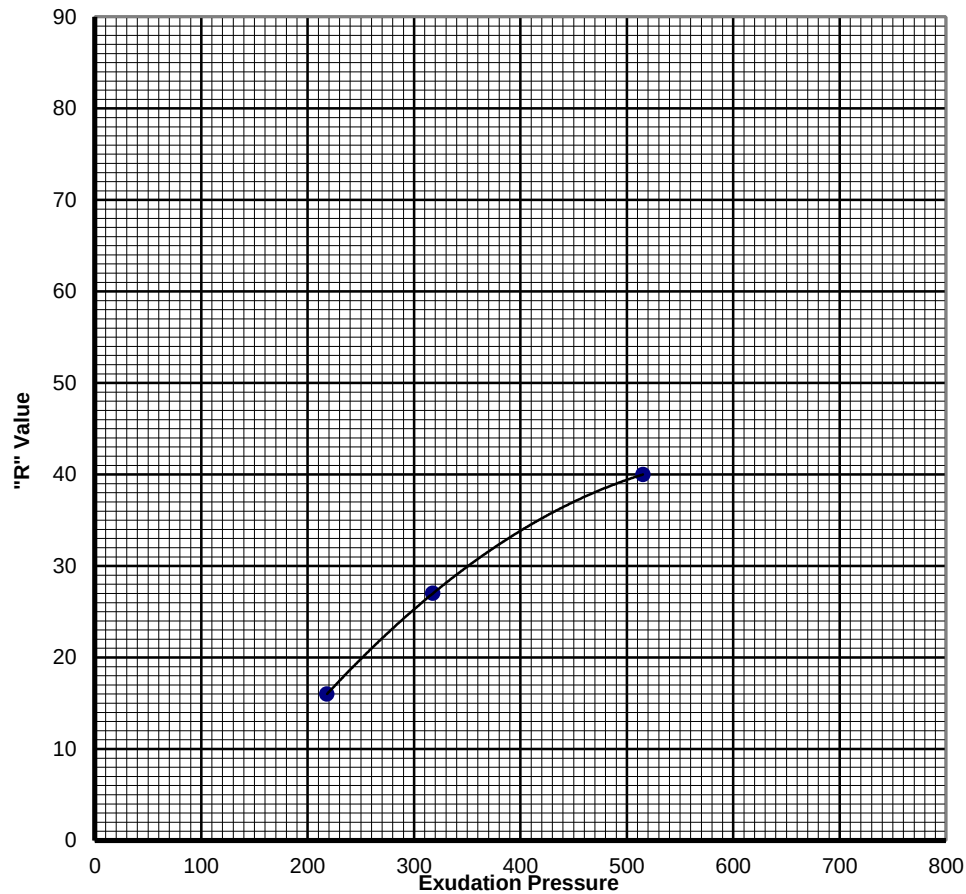
Client Reference No.: 22-247

Sample: B8 Bulk @ 0-5'

Soil Type: Brown, Sandy Clay

TEST SPECIMEN		A	B	C	D
Compactor Air Pressure	psi	120	70	100	
Initial Moisture Content	%	4.3	4.3	4.3	
Moisture at Compaction	%	12.1	14.7	13.4	
Briquette Height	in.	2.51	2.54	2.49	
Dry Density	pcf	124.7	117.3	120.4	
EXUDATION PRESSURE	psi	515	218	318	
EXPANSION PRESSURE	psf	390	160	260	
Ph at 1000 pounds	psi	38	53	45	
Ph at 2000 pounds	psi	80	120	102	
Displacement	turns	3.76	4.43	3.89	
"R" Value		40	16	27	
CORRECTED "R" VALUE		40	16	27	

Final "R" Value	
BY EXUDATION: @ 300 psi	25
BY EXPANSION: TI = 5.0	12



SUMMARY OF LABORATORY TEST RESULTS
2023

SIEVE ANALYSIS

Percent passing individual sieves

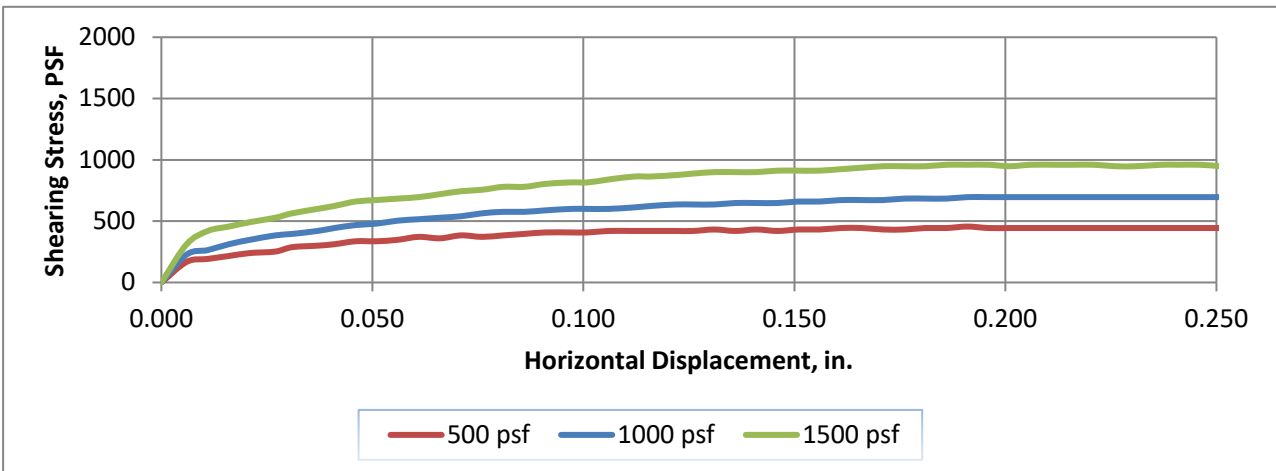
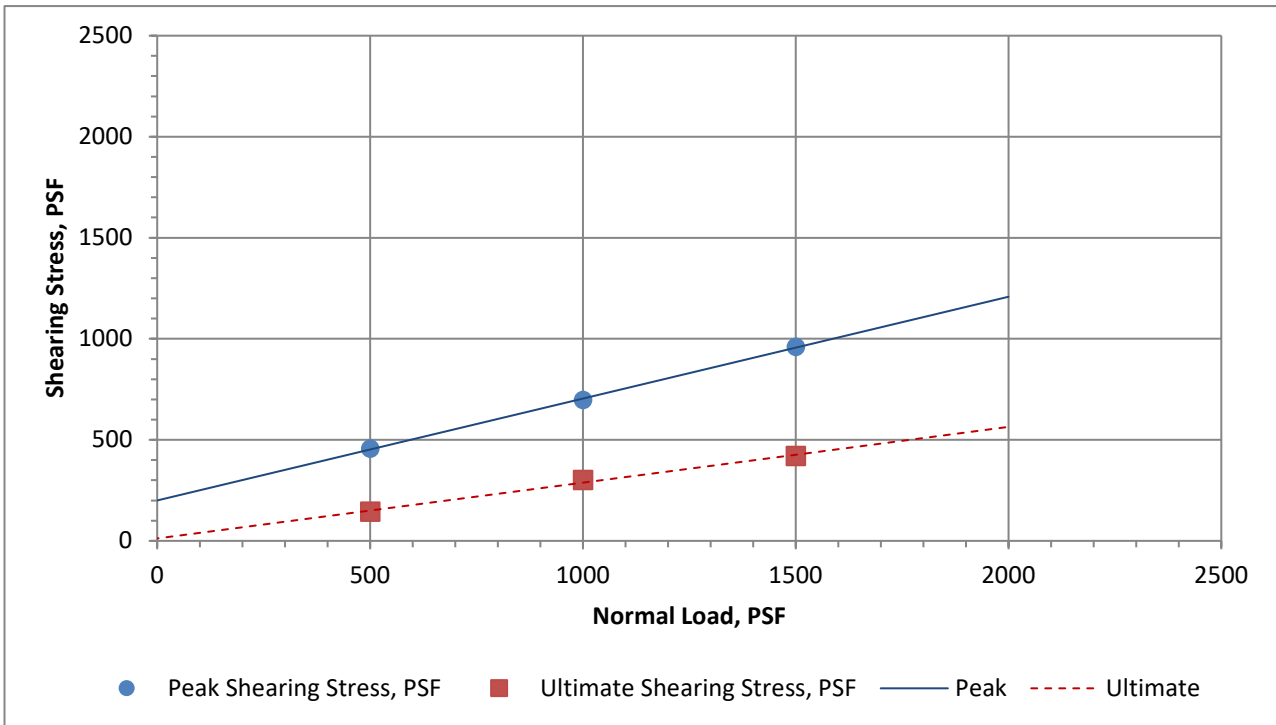
Sample I.D.	1/2"	3/8"	#4	#10	#40	#100	#200
B2@1			100	93	69	48	41
B1@2			100	98	83	60	46
B1@5		100	99	96	77	52	35
B2@6			100	96	76	53	41
B1@7		100	99	90	62	38	26
B2@9		100	98	89	58	35	26
B1@10	100	96	82	66	46	30	21
B2@12		100	99	92	67	35	25
B1@15			100	99	94	69	47
B2@15			100	97	88	69	46

SAND EQUIVALENT

Sample I.D.	Sand Equivalent
B2@4	46
B1@6	15

EXPANSION INDEX

Sample I.D.	Expansion Index	Classification
B1@0-5'	10	Very Low



Sample Description: (SM) - Moderate brown very silty fine to medium sand w/ coarse sand & occ. #4 gravel

DIRECT SHEAR DATA (ASTM D-3080)

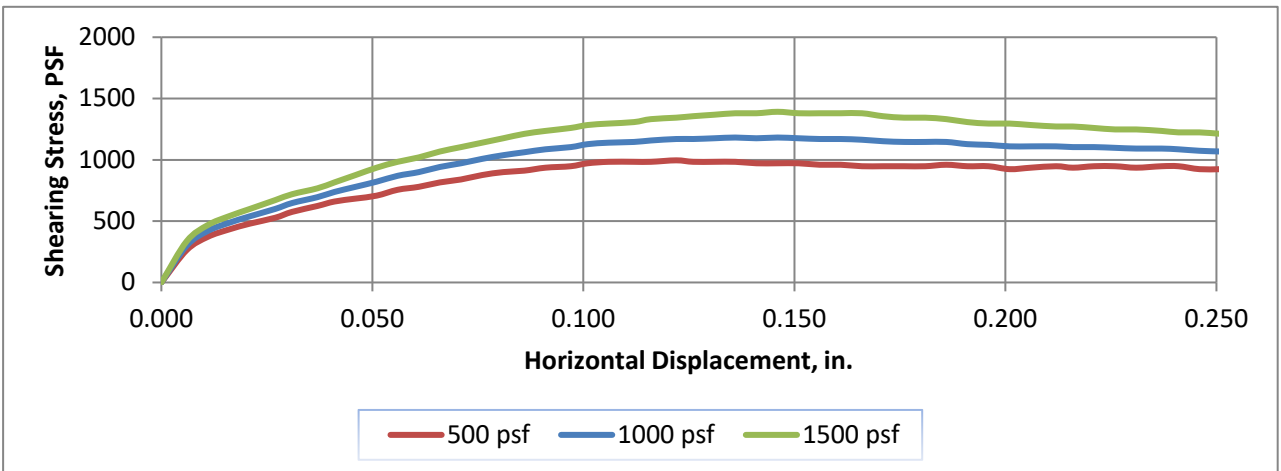
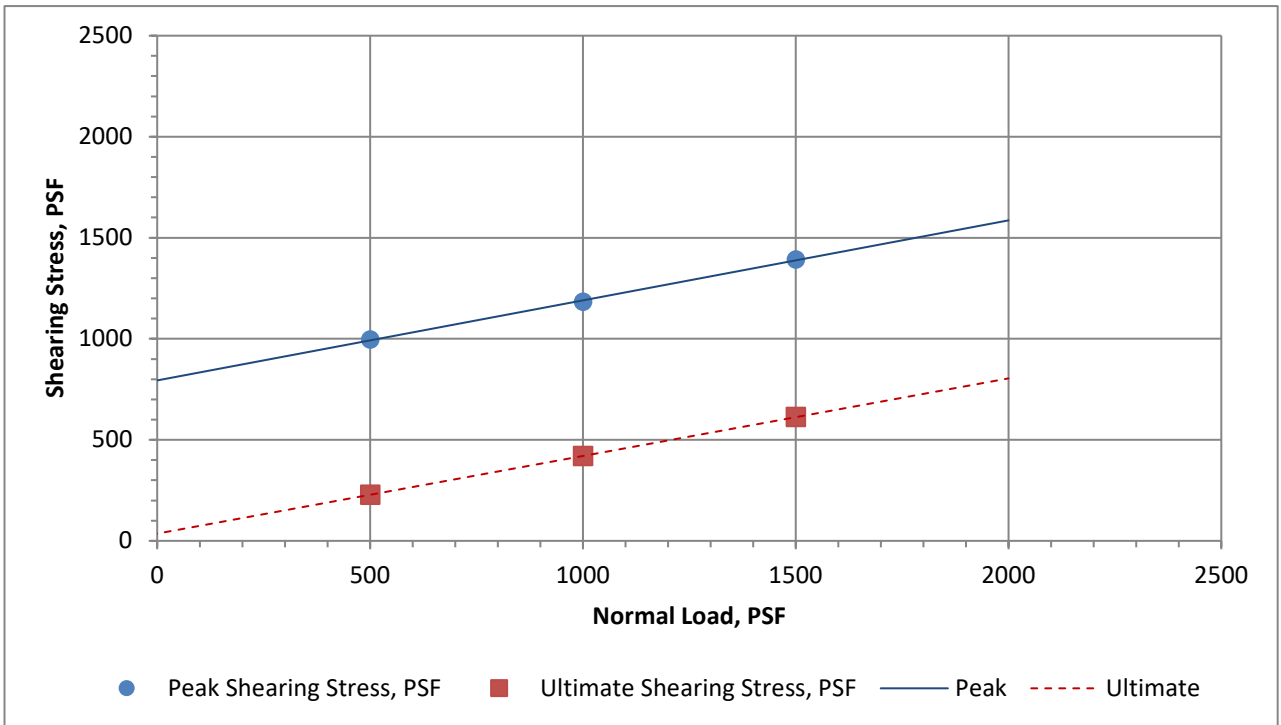
Sample ID	Symbol	Depth, feet	Dry Density, PCF	Average deg. of saturation
B1	●	3'	106	69
			Peak	Ultimate
Angle of friction, (degrees)			27	15
Cohesive Strength (PSF)			200	12

Direct Shear Test

AES - Double Butte



J.N. 22-247



Sample Description: (SC) - Brown clayey fine to coarse sand w/ slight #4-1/2" gravel

DIRECT SHEAR DATA (ASTM D-3080)

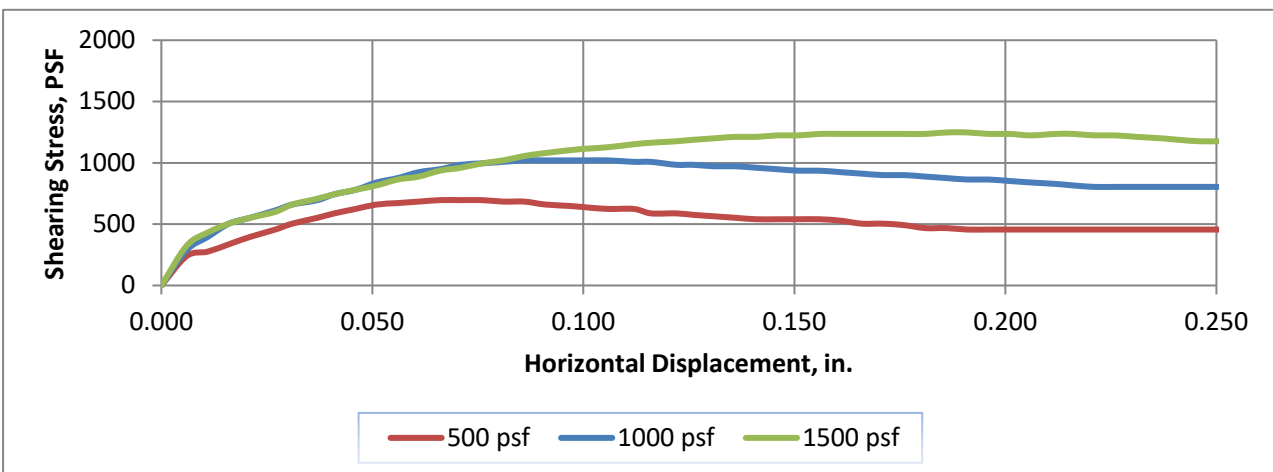
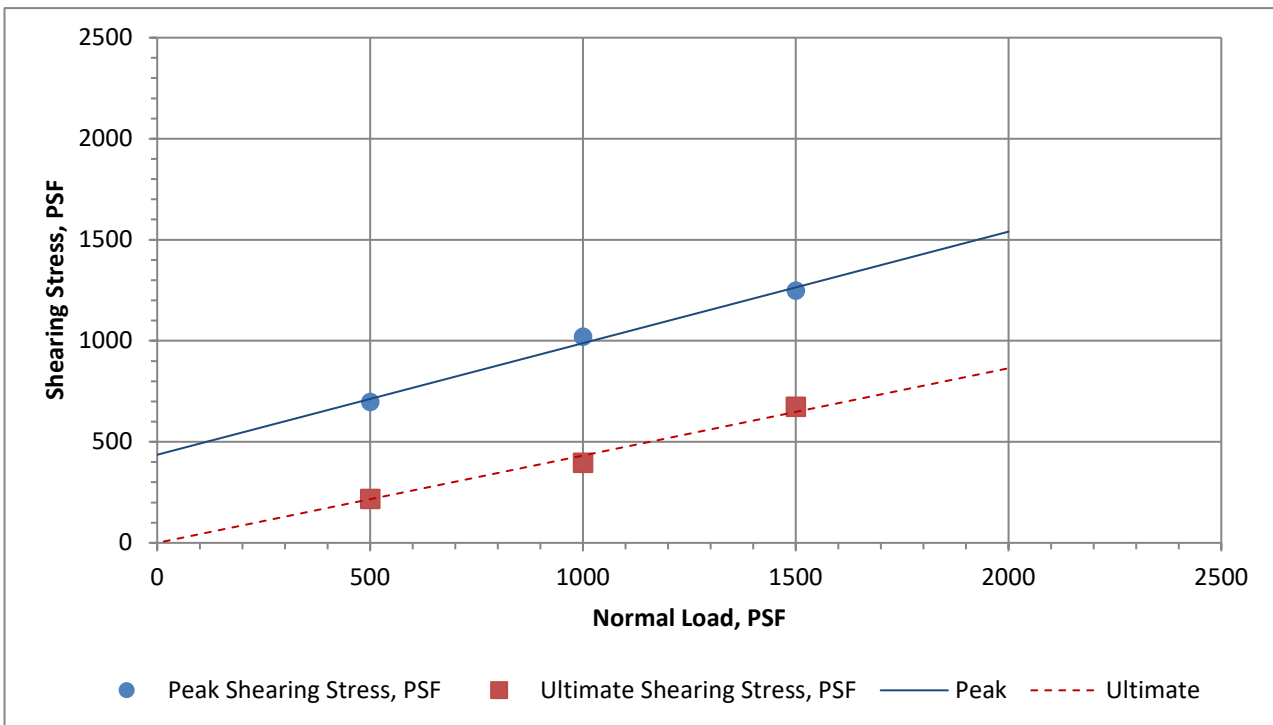
Sample ID	Symbol	Depth, feet	Dry Density, PCF	Average deg. of saturation
B2	●	5'	106	71
			Peak	Ultimate
Angle of friction, (degrees)			22	21
Cohesive Strength (PSF)			794	36

Direct Shear Test

AES - Double Butte



J.N. 22-247



Sample Description: (SM) - Brown silty fine to medium sand w/ coarse sand & occ. #4 gravel (Slightly Cemented)

DIRECT SHEAR DATA (ASTM D-3080)

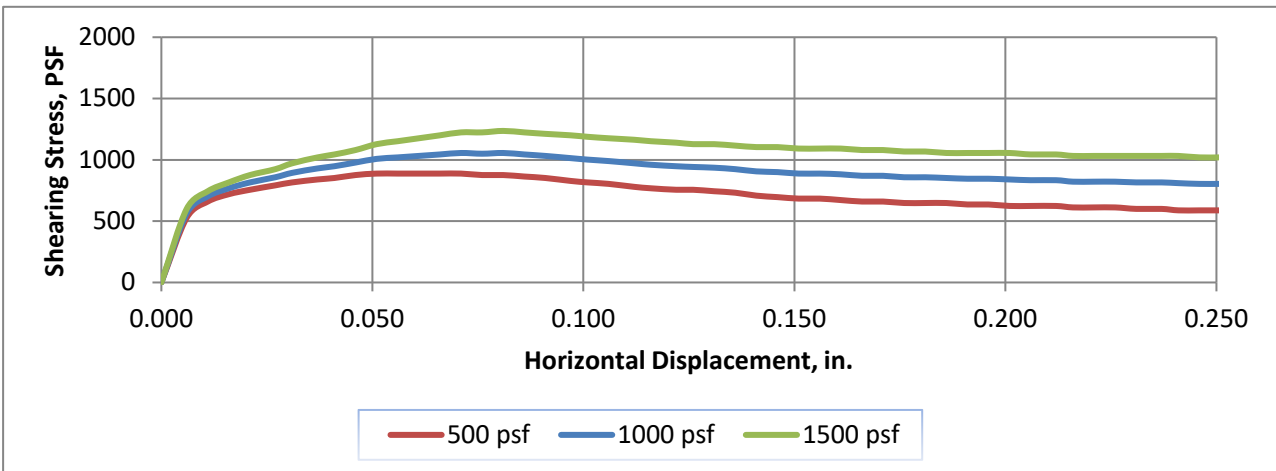
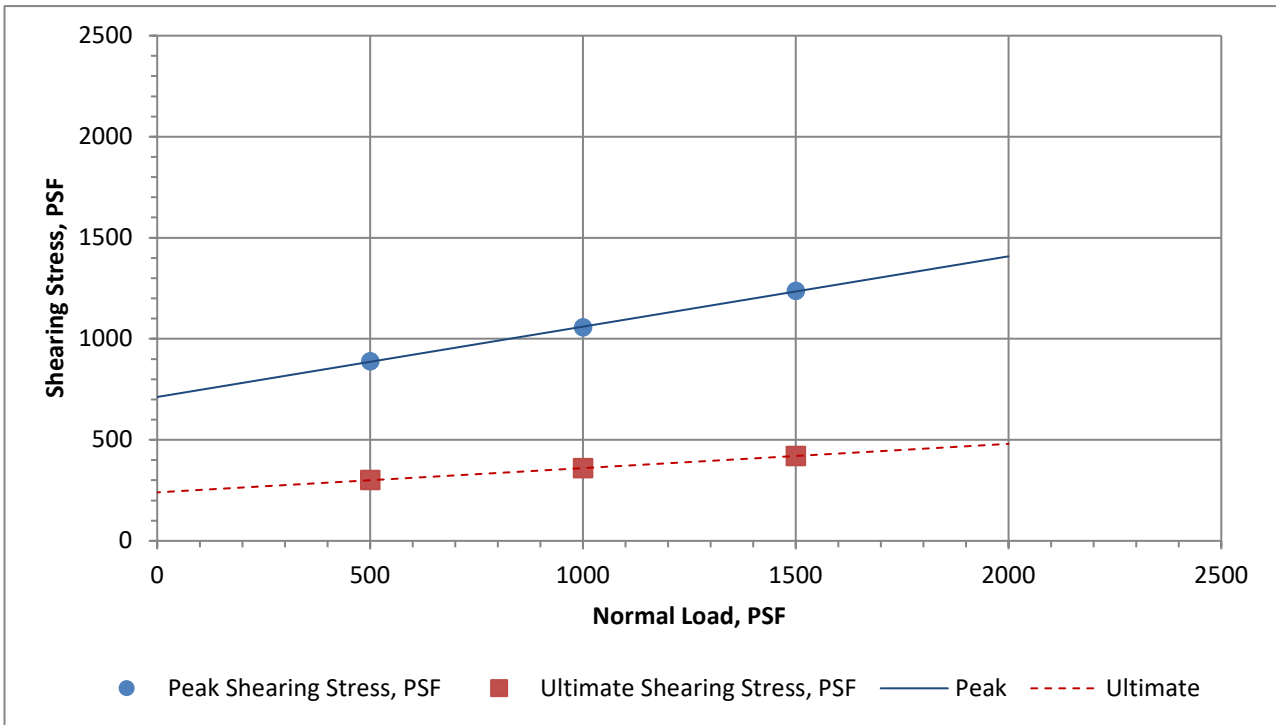
Sample ID	Symbol	Depth, feet	Dry Density, PCF	Average deg. of saturation
B1	●	8'	113	81
			Peak	Ultimate
Angle of friction, (degrees)			29	25
Cohesive Strength (PSF)			436	0

Direct Shear Test

AES - Double Butte



J.N. 22-247



Sample Description: (ML) - Brown fine to medium sandy silt w/ occ. coarse sand

DIRECT SHEAR DATA (ASTM D-3080)

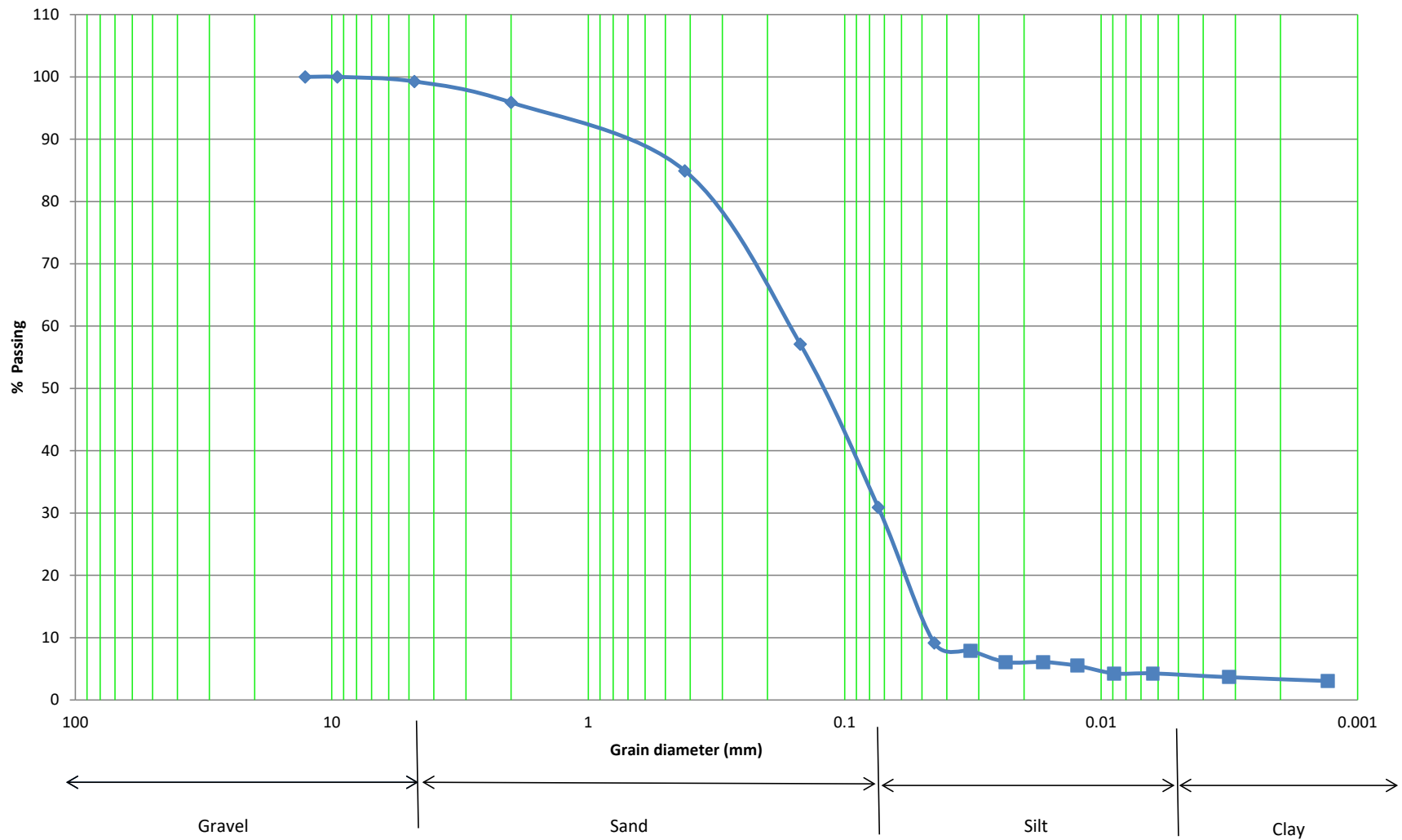
Sample ID	Symbol	Depth, feet	Dry Density, PCF	Average deg. of saturation
B2	●	10'	117	121
			Peak	Ultimate
Angle of friction, (degrees)			19	7
Cohesive Strength (PSF)			712	240

Direct Shear Test

AES - Double Butte



J.N. 22-247



Grain Size Distribution Curve (ASTM D422)

Job Number: 22-247

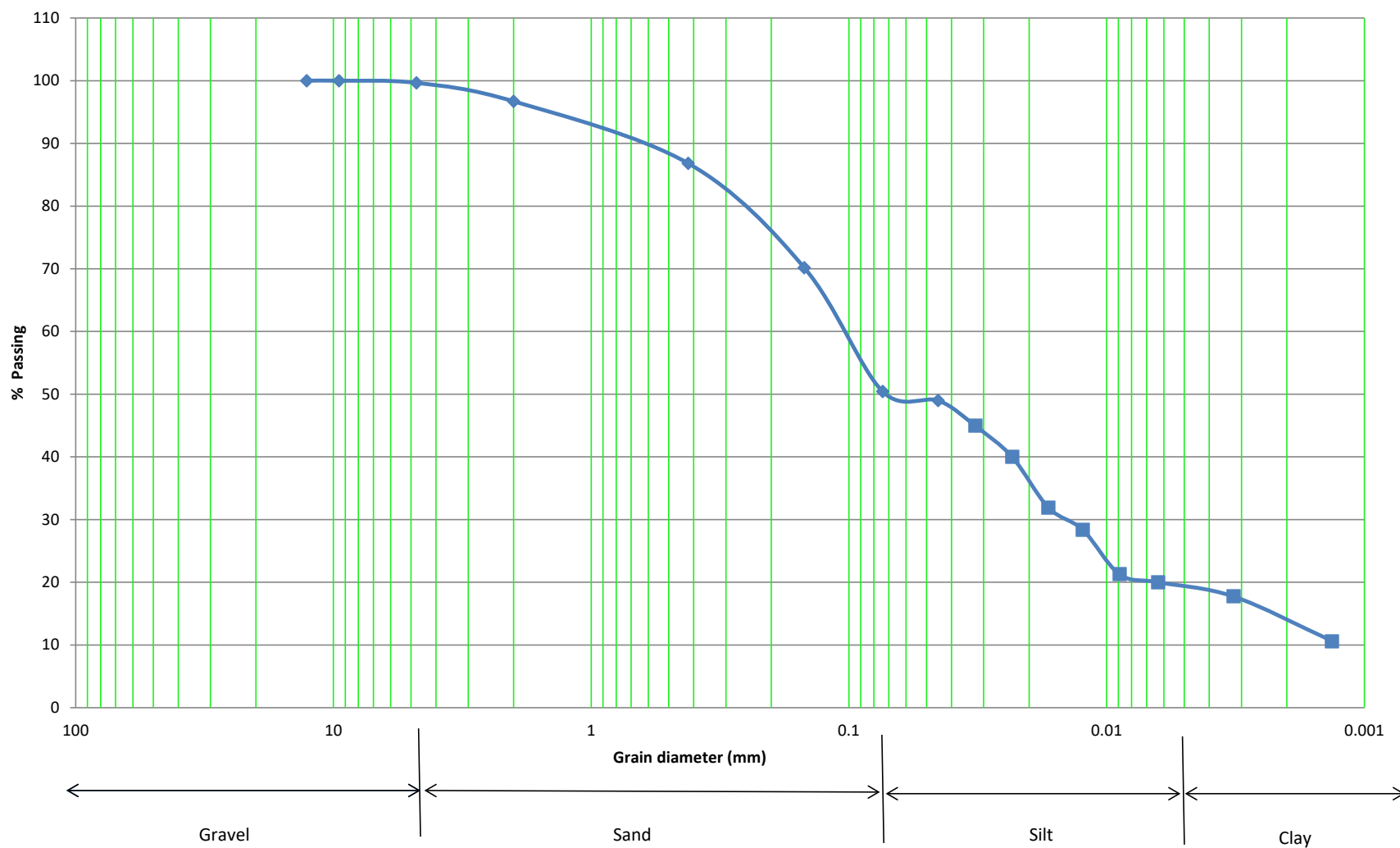
Client Name: AES-Double Butte

Sample I.D.: B1@1'

Coefficient of Uniformity, C_u : 3.73

Particle range, mm: 12.699





Grain Size Distribution Curve (ASTM D422)

Job Number: 22-247

Client Name: AES-Double Butte

Sample I.D.: B1@1'

Coefficient of Uniformity, C_u : 74.00

Particle range, mm: 12.699



APPENDIX D

**Corrosion Report
JDH Corrosion**



Field Electrical Resistivity Testing
Double Butte Storage
Sun City, CA

SUBMITTED TO

Mr. Mark Stevens
Director

Bruin Geotechnical Services Inc.
44732 Yucca Ave
Lancaster, CA 93534

JDH JOB NUMBER

2022254

August 24, 2022

Bruin Geotechnical Services Inc.
44732 Yucca Ave
Lancaster, CA 93534

Attention: Mr. Mark Stevens
Director

Subject: Corrosion Engineering Services
Field Electrical Resistivity Testing
Double Butte Storage
Sun City, CA

Dear Mr. Stevens,

Pursuant to your request, **JDH Corrosion Consultants, Inc.** has conducted a soil resistivity evaluation for the above referenced project site and we have provided herein the data required. The data is to be used for electrical grounding calculations and corrosivity recommendations for buried utilities and concrete foundations.

Our Scope of Work was:

1. Perform soil DC resistivity testing in accordance with ASTM G57 Wenner Four-Pin Method at four (4) locations at the project site.
2. Tests will be performed in two directions at the test location.
3. Electrode spacing "A" shall be recorded at 1, 2, 3, 5, 10, 20, 50 and 100 ft.

Soil Testing and Analysis

Soil Testing Results

Four (4) soil samples was collected from the site by **Bruin Geotechnical** and were transported to a state certified testing laboratory, **CERCO Analytical, Inc.** (certificate no. 2153) located in Concord, CA for chemical analysis. The sample was analyzed for pH, chlorides, resistivity (as received and @ 100% saturation), sulfates and Redox potential using ASTM test methods as detailed in the table below. The preparation of the soil sample for chemical analysis was in accordance with the applicable specifications.

Soil Analysis Test Methods

Chemical Analysis	ASTM Method
Chlorides	D4327
pH	D4972
Resistivity	G57
Sulfate	D4327
Redox Potential	D1498

The results of the chemical analysis are provided in the CERCO Analytical, Inc. reports dated August 11, 2022. The results are summarized as follows:

CERCO Analytical, Inc. Laboratory Analysis

Chemical Analysis	Range of Results	Corrosion Classification*
Chlorides	N. D. – 16 (mg/kg)	Non-corrosive*
pH	7.80 – 8.39	Non-corrosive*
Resistivity (100% saturation)	2,800 – 3,300 ohms-cm	Moderately Corrosive*
Sulfate	21 – 36 (mg/kg)	Non-corrosive**
Redox Potential	280 - 370 mV	Mildly Corrosive*

* With respect to bare steel or ductile iron.

** With respect to mortar coated steel

Chemical Testing Analysis

The chemical analysis provided by **CERCO Analytical, Inc.** indicates that the soils are generally classified as “moderately corrosive” based on the saturated resistivities. The chloride levels indicate “non-corrosive” conditions to steel and ductile iron and the sulfate levels indicate “non-corrosive” conditions for concrete structures placed into these soils with regard to sulfate attack. The pH of the soils is alkaline which classifies them as “non-corrosive” to buried steel and concrete structures. The redox potential indicates aerobic soils and is considered to be “mildly corrosive” to steel and ductile iron.

In-Situ Soil Resistivity Measurements

The in-situ resistivity of the soil was measured at four (4) locations with orientations of approximately North/South and East/West at each location at the project site by **JDH Corrosion Consultants, Inc.** field personnel. Resistance measurements were conducted with probe spacing of 1, 2, 3, 5, 10, 20, 50 and 100-feet at each location. For corrosion analysis purposes we have calculated the resistivity of soil layers 0-1', 1'-2', 2'-3', 3'-5' and 5'-10' using the Barnes Method as follows:

Soil Resistivity Testing
Field Electrical Resistivity Testing, Double Butte Storage, Sun City, CA

$$\rho_{b-a} = KR (b-a)$$

Where;

- ρ_{b-a} = soil resistivity of layer depth b-a (ohm-cm)
- a = soil depth to top layer (ft)
- b = soil depth to bottom layer (ft)
- R_a = soil resistance read at depth a (ohms)
- R_b = soil resistance read at depth b (ohms)
- R_{b-a} = resistance of soil layer from a to b (ft)
- K = layer constant = $60.96\pi(b-a)$ (cm)

$$\text{and } \frac{1}{R_{b-a}} = \frac{1}{R_a} - \frac{1}{R_b}$$

The visual diagrams below describe the Wenner 4-pin testing configuration.

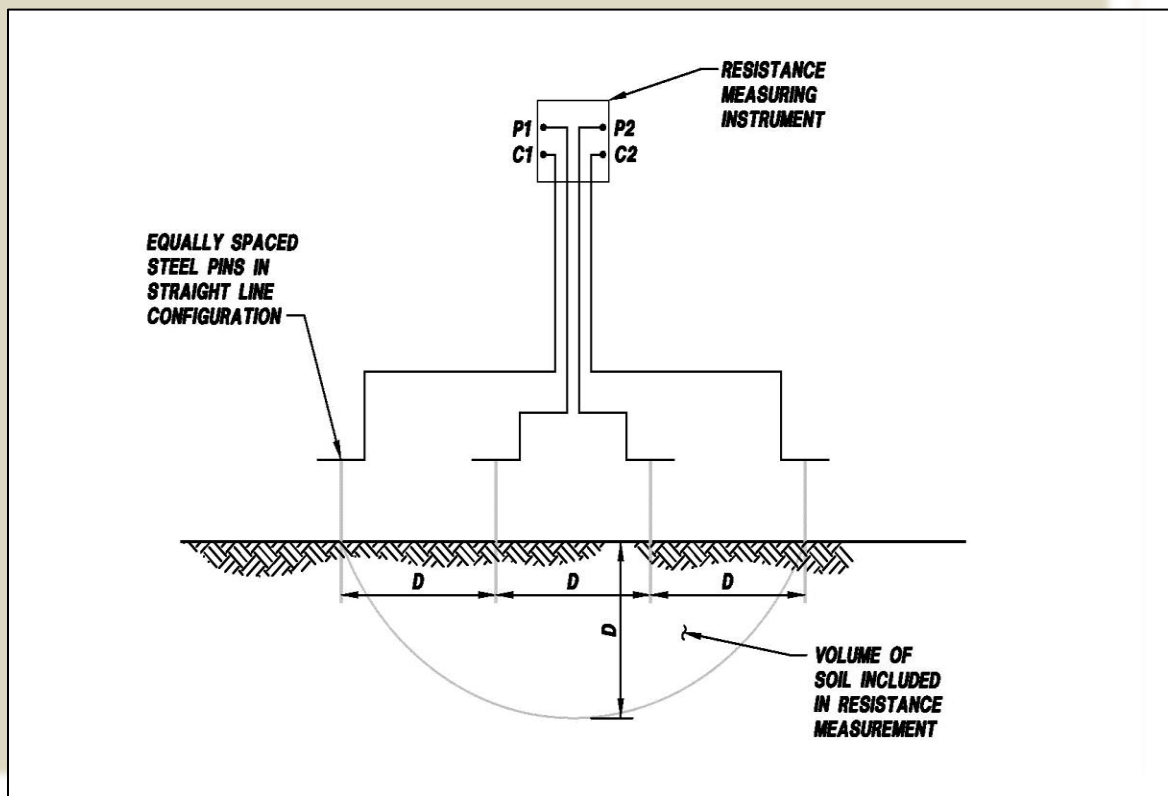


Fig 1: Wenner 4-Pin Resistivity Schematic No.1

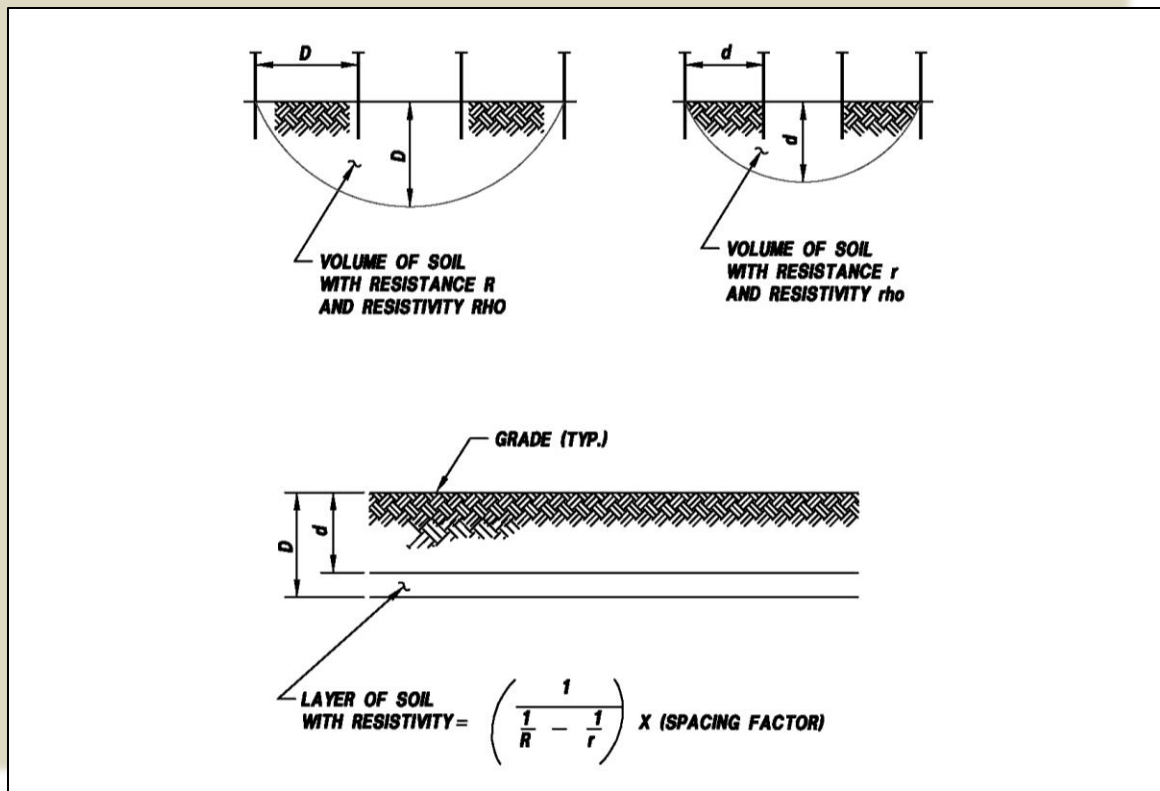


Fig 2: Illustration of Barnes Layer Calculations

In-Situ Soil Resistivity Analysis

Corrosion of a metal is an electro-chemical process and is accompanied by the flow of electric current. Resistivity is a measure of the ability of a soil to conduct an electric current and is, therefore, an important parameter in consideration of corrosion data. Soil resistivity is primarily dependent upon the chemical content and moisture content of the soil mass.

The greater the amount of chemical constituents present in the soil, the lower the resistivity will be. As moisture content increases, resistivity decreases until maximum solubility of dissolved chemicals is attained. Beyond this point, an increase in moisture content results in dilution of the chemical concentration and resistivity increases. The corrosion rate of steel in soil normally increases as resistivity decreases. Therefore, in any particular group of soils, maximum corrosion will generally occur in the lowest resistivity areas. The following classification of soil corrosivity, developed by William J. Ellis, is used for the analysis of the soil data for the project site.

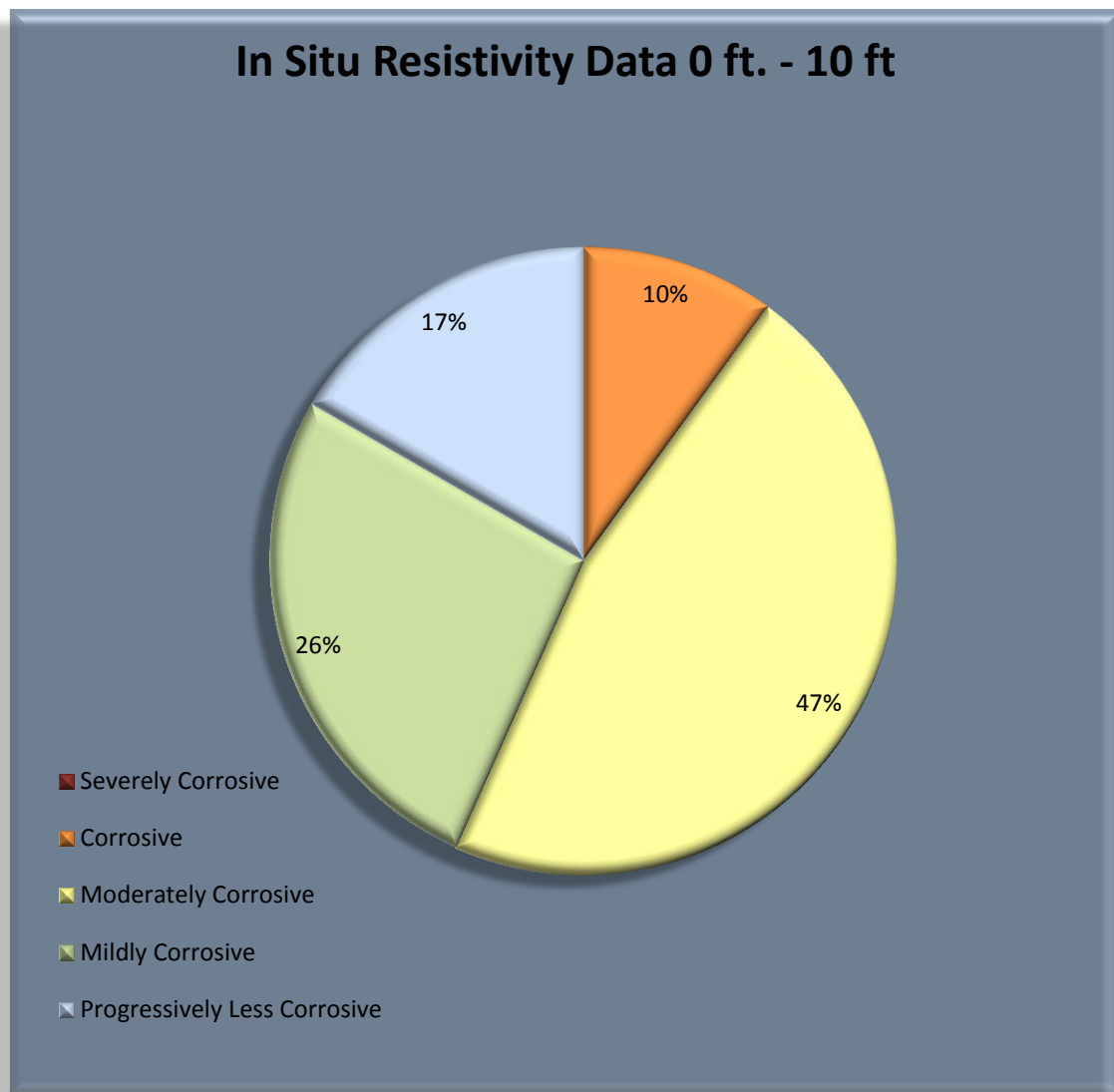
<u>Resistivity (Ohm-cm)</u>	<u>Corrosivity Classification</u>
0 – 500	Severely Corrosive
501 – 2,000	Corrosive
2,001 – 8,000	Moderately Corrosive
8,001 – 32,000	Mildly Corrosive
> 32,000	Progressively Less Corrosive

Soil Resistivity Testing

Field Electrical Resistivity Testing, Double Butte Storage, Sun City, CA

The above classifications are appropriate for the project site and the results are presented in the graph below. In general, the soils are classified as “corrosive to progressively less corrosive” with respect to corrosion of buried steel structures throughout the top 0 to 10 feet of the site.

The chart of the in-situ soil resistivity data for the soil layers 0 to 10 feet indicate that 10% of the soils are classified as “corrosive”, 47% of the soils are classified as “moderately corrosive”, 26% of the soils are classified as “mildly corrosive” and 17% of the soils are classified as “progressively less corrosive”.



Discussion

Reinforced Concrete Foundations

Due to the low levels of water-soluble sulfates found in these soils, there is no special requirement for sulfate resistant concrete to be used at this site. The type of cement used should be in accordance with California Building Code (CBC) for soils which have less than 0.10 percent by weight of water soluble sulfate (SO_4) in soil and the minimum depth of cover for the reinforcing steel should be as specified in CBC as well.

Underground Metallic Pipelines

The soils at the project sites are generally considered to be “corrosive to progressively less corrosive” to ductile/cast iron, steel and dielectric coated steel based on the in-situ resistivity measurements. Therefore, special requirements for corrosion control are required for buried metallic utilities at these sites depending upon the critical nature of the piping. Pressure piping systems such as domestic and fire water should be provided with appropriate coating systems and cathodic protection, where warranted. In addition, all underground pipelines should be electrically isolated from above grade structures, reinforced concrete structures and copper lines in order to avoid potential galvanic corrosion problems.

Recommendations

Reinforced Concrete Slab Foundations

1. We recommend using a Type II concrete mix with a water-to-cement ratio as specified in the 2019 California Building Code (CBC) for soils containing less than 0.10% water soluble sulfate by weight. Adhering to the minimum depth of cover for the reinforcing steel in the foundations as specified in the CBC is recommended for the subject structures as well.

Ductile Iron Pipe (Pressure Piping such as Domestic Water and Fire)

1. Direct buried ductile iron pipe should be encased in 8-mil polyethylene as specified in AWWA specification C-105. Epoxy coatings are also an acceptable alternative type of coating system for the pipe and/or fittings such as valves.
2. All rubber gasket joints, fusion-bonded epoxy coated flanges and flexible couplings on ductile iron pipelines should be bonded with insulated copper cable to insure electrical continuity of the pipeline and fittings.
3. Insulating flanges and/or couplings should be installed to electrically isolate the buried portion of pipeline from other metallic pipelines, reinforced concrete structures and above grade buildings or structures.

4. Test stations shall be installed on all ductile iron pipelines at a spacing of 800 to 1,000 feet. Bonding and test stations shall comply with NACE Standards.
5. A sacrificial type of cathodic protection utilizing **magnesium** anodes should be installed to protect the entire length of buried metallic pipeline. Cathodic protection should be designed in accordance with NACE Standard SP0169-13 and applicable local standards and included with the contract documents to permit installation along with the pipeline.
6. As an alternate, non-metallic piping may be used in lieu of ductile iron piping as allowed by State and local codes. Non-metallic piping does not require the implementation of any special type of corrosion prevention measures. However, all metallic valves, fittings and appurtenances on non-metallic piping will require protection as specified below.

Ductile Iron Fittings & Metallic Valves (On Plastic Pressure Piping)

1. All direct buried ductile iron fittings installed on non-metallic piping shall be provided with a bituminous coating from the factory and encased in an 8-mil polyethylene bag in the field in accordance with AWWA Specification C-105. All bolts, restraining rods, etc. shall be coated with bitumastic prior to encasement in the polyethylene bag.
2. All metallic valves shall be coated from the factory (i.e. using powdered epoxy or equivalent type of coating system) and all bolts shall be stainless steel.
3. A sacrificial type of cathodic protection utilizing **magnesium** anodes should be installed to protect the valves and fittings. Cathodic protection should be designed in accordance with NACE Standard SP0169-13 and applicable local standards and included with the contract documents to permit installation along with the pipeline.

Steel Pipelines (Natural Gas Pipelines & Risers)

1. A fusion-bonded epoxy coating system or a suitable tape coating should be applied to all buried steel pipelines in accordance with ANSI/AWWA C214-95, "AWWA Standard for Tape Coating Systems for the Exterior of Steel Water Pipelines." Also, a tape coating per AWWA Standard C209-95 is recommended for special sections, connections and fittings.
2. Insulating flanges and/or couplings should be installed to electrically isolate the buried portions of steel pipelines from other metallic pipelines, reinforced concrete structures and above grade structures.
3. All rubber gasket joints, fusion epoxy coated flanges and flexible couplings should be bonded with insulated copper cable to insure electrical continuity of the pipeline and fittings.
4. A sacrificial type of cathodic protection using **magnesium** anodes should be installed to protect the buried portions of steel pipelines used for the natural gas piping systems. Cathodic protection should be designed in accordance with NACE Standard SP0169-13 and applicable local standards and included with the contract documents to permit installation along with the subject pipeline.

Soil Resistivity Testing

Field Electrical Resistivity Testing, Double Butte Storage, Sun City, CA

5. As an alternate, non-metallic piping may be used in lieu of steel piping as allowed by State and local codes. Non-metallic piping does not require the implementation of any special type of corrosion prevention measures.

Cast Iron (Gravity Sewer and Storm Drain Lines)

1. Sewer and storm drain lines should be wrapped in 8-mil polyethylene as specified in AWWA specification C-105, if they are under the building footprint.

Copper Water Pipelines (Service Lines)

1. Direct buried copper water service lines should be encased in 6-mil minimum polyethylene as specified in the AWWA specification C-105.
2. All copper water laterals shall be electrically isolated from metallic water mains via the use of insulating type corporation stops installed at the water main.

The required data was collected using a Digital Ground Resistance and Soil Resistivity Tester Model 6470 manufactured by AEMC Instruments and presented in the Data Tables attached.

Weather conditions on 8/22-23/2022 at the time of testing was 90 – 101 degrees with winds at 1 mph from the east.

Extremely dry soil conditions with little soil moisture.

LIMITATIONS

The conclusions and recommendations contained in this report reflect the opinion of the author of this report and are based on the information and assumptions referenced herein. All services provided herein were performed by persons who are experienced and skilled in providing these types of services and in accordance with the standards of workmanship in this profession. No other warranties or guarantees either expressed or implied are provided.

We thank you for the opportunity to be of assistance on this important project. If you have any questions concerning this report or the recommendations provided herein, please feel free to contact us at (925) 927-6630.

Respectfully submitted,



Brendon Hurley
JDH CORROSION CONSULTANTS, INC.
Field Technician

Soil Resistivity Testing
Field Electrical Resistivity Testing, Double Butte Storage, Sun City, CA

Mohammed Ali

Mohammed Ali., P.E.
JDH Corrosion Consultants, Inc.
Senior Corrosion Engineer



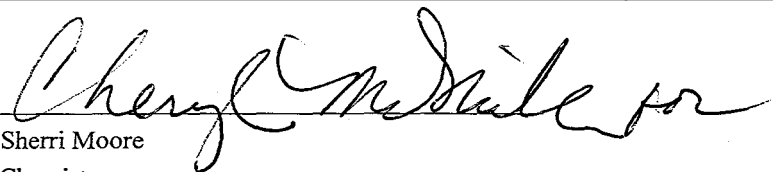
CC: File 2022254

Client: JDH Corrosion Consultants, Inc.
 Client's Project No.: 2022254
 Client's Project Name: AES Double Butte
 Date Sampled: 15-Jul-22
 Date Received: 2-Aug-22
 Matrix: Soil
 Authorization: Signed Chain of Custody

Date of Report: 11-Aug-2022

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Resistivity (As Received) (ohms-cm)	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
2208004-001	B2 @ 0-5'	370	7.80	>80,000	3,300	-	N.D.	36
2208004-002	B5 @ 0-5'	340	8.12	>80,000	3,100	-	N.D.	24
2208004-003	B7 @ 0-5'	300	8.12	>80,000	2,800	-	16	22
2208004-004	B8 @ 0-5'	280	8.39	>80,000	2,900	-	N.D.	21

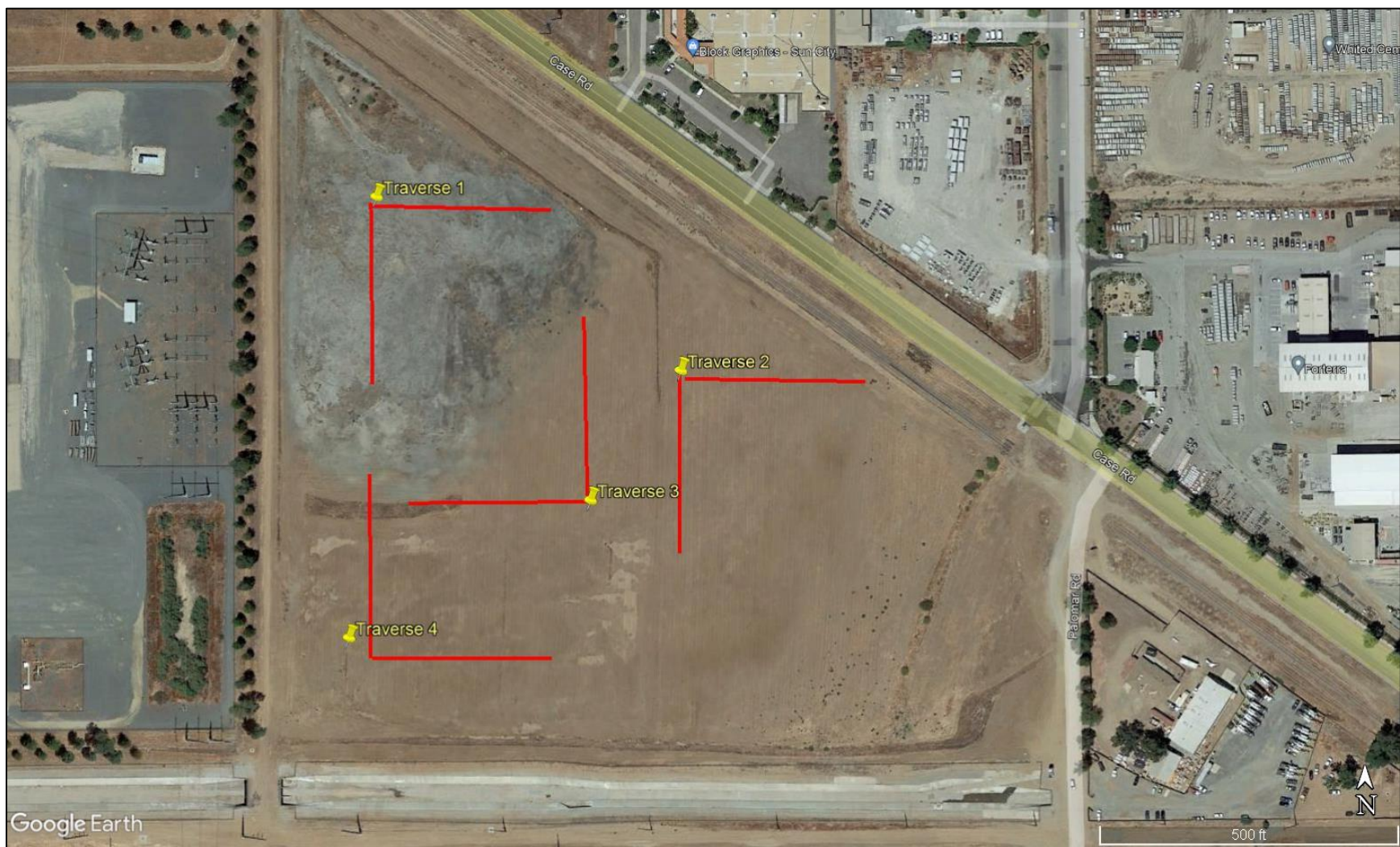
Method:	ASTM D1498	ASTM D4972	ASTM G57	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	-	-	50	15	15
Date Analyzed:	10-Aug-2022	10-Aug-2022	10-Aug-2022	10-Aug-2022	-	10-Aug-2022	10-Aug-2022


 Sherri Moore
 Chemist

* Results Reported on "As Received" Basis
 N.D. - None Detected
 (1) Detection limit is elevated to 75 mg/kg due to dilution

Client:		Bruin Geotechnical															
Project:		Double Butte Storage															
Location:		Sun City, CA															
Date:		8/22-23/2022															
Subject:		In-Situ Soil Resistivity Data															
*Test #	Location Description	Resistance Data From AEMC Meter (ohm)								Soil Resistivities (ohm-cm)							
		1'	2'	3'	5'	10'	20'	50'	100'	1'	2'	3'	5'	10'	20'	50'	100'
1	Traverse 1 N/S	46.00	9.092	5.712	7.097	3.752	1.374	0.190	0.186	8,809.00	3,482.24	3,281.54	6,795.38	7,185.08	5,262.42	1,819.25	3,561.90
2	Traverse 1 E/W	22.380	13.130	5.352	3.036	0.992	0.405	0.164	0.084	4,285.77	5,028.79	3,074.72	2,906.97	1,899.68	1,551.15	1,570.30	1,608.60
3	Traverse 2 N/S	146.90	25.17	315.40	165.30	54.73	55.74	0.182	0.233	28,131.4	9,640.11	181,197.30	158,274.75	104,807.95	213,484.20	1,742.65	4,461.95
4	Traverse 2 E/W	19.21	84.21	97.89	22.12	1.162	1.595	0.185	0.066	3,678.72	32,252.43	56,237.81	21,179.90	2,225.23	6,108.85	1,771.38	1,263.90
5	Traverse 3 N/S	29.69	175.40	259.3	122.60	115.60	0.520	0.188	0.225	5,685.64	67,178.20	148,967.85	117,389.50	221,374.00	1,991.60	1,800.10	4,308.75
6	Traverse 3 E/W	18.94	12.12	102.8	49.13	73.52	57.48	0.204	0.033	3,627.01	4,641.96	59,058.60	47,041.98	140,790.80	220,148.40	1,953.30	631.95
7	Traverse 4 N/S	52.21	21.43	19.23	39.70	7.673	13.91	0.271	0.121	9,998.22	8,207.69	11,047.64	38,012.75	14,693.80	53,275.30	2,594.83	2,317.15
8	Traverse 4 E/W	143.70	32.74	22.41	24.64	3.359	0.646	0.295	0.051	27,518.6	12,539.42	12,874.55	23,592.80	6,432.49	2,474.18	2,824.63	976.65

In-situ Locations



APPENDIX E

Results from Geotherm USA



21239 FM529 Rd., Bldg. F
Cypress, TX 77433
Tel: 281-985-9344
Fax: 832-427-1752
info@geothermusa.com
<http://www.geothermusa.com>

August 15, 2022

Bruin Geotechnical Services Inc.
44732 Yucca Avenue
Lancaster, CA 93534
Attn: Mark Stevens

Re: Thermal Analysis of Native Soil Samples
AES Double Butte – Riverside, CA (Project No. 22-247)

The following is the report of thermal dryout characterization tests conducted on two (2) samples of native soil from the referenced project sent to our laboratory.

Thermal Resistivity Tests: The samples were tested at the 'optimum' moisture content and 90% of the modified Proctor dry density ***provided by Bruin***. The tests were conducted in accordance with the IEEE standard 442-2017. The results are tabulated below and the thermal dryout curves are presented in **Figures 1 and 2**.

Sample ID, Description, Thermal Resistivity, Moisture Content and Density

Sample ID	Depth (ft)	Description (Bruin)	Thermal Resistivity (°C-cm/W)		Moisture Content (%)	Dry Density (lb/ft³)
			Wet	Dry		
B-2	0-5	Brown sandy f.m. clay w/ occ #4 gravel	87	150	8	120
B-5	0-5	Brown v. sandy clay w/ f.m. sand w/ clay bndr	83	169	11	116

Please contact us if you have any questions or if we can be of further assistance.

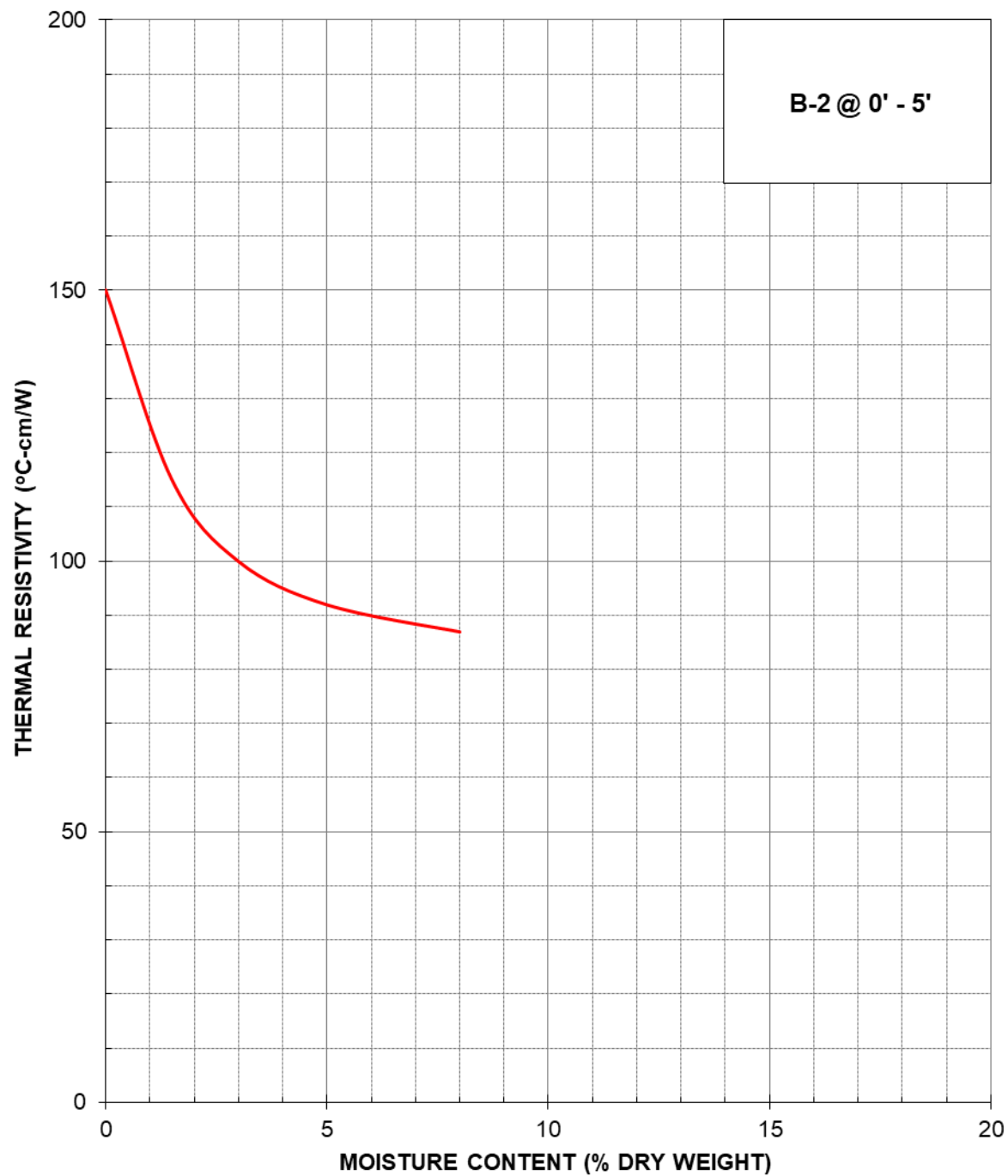
Geotherm USA

Nimesh Patel

COOL SOLUTIONS FOR UNDERGROUND POWER CABLES
THERMAL SURVEYS, CORRECTIVE BACKFILLS & INSTRUMENTATION

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THERMAL DRYOUT CURVE



Terracon (Project No. 22-247)

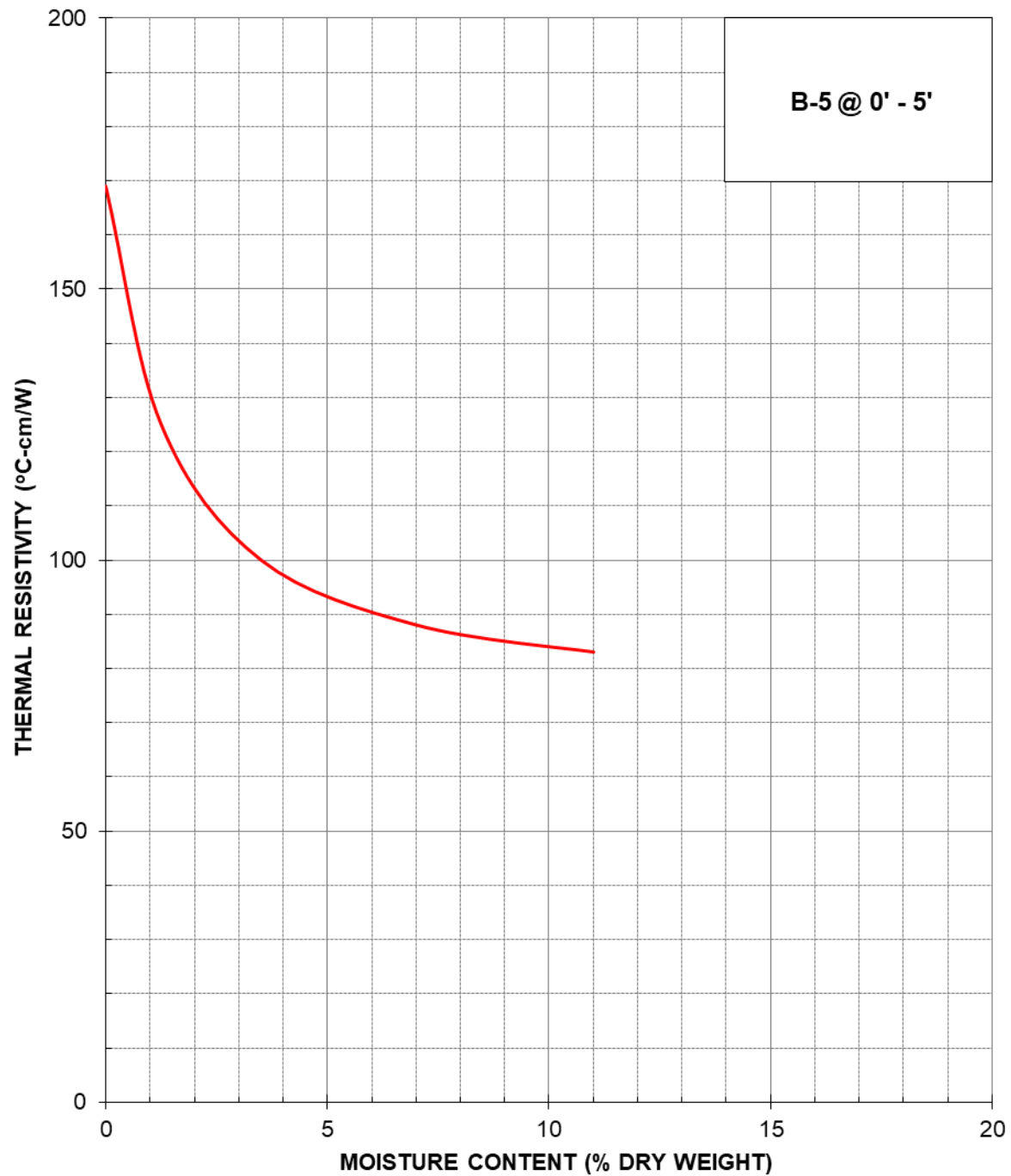
AES Double Butte – Riverside, CA

Thermal Analysis of Native Soil Samples

August 2022

Figure 1

THERMAL DRYOUT CURVE



Terracon (Project No. 22-247)

AES Double Butte – Riverside, CA

Thermal Analysis of Native Soil Samples

August 2022

Figure 2

APPENDIX F

US Seismic Design Maps



22-247 AES - Double Butte

Latitude, Longitude: 33.74150302, -117.17036944



Date	8/18/2022, 11:04:36 AM
Design Code Reference Document	ASCE7-16
Risk Category	I
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.424	MCE_R ground motion. (for 0.2 second period)
S_1	0.529	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.424	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	0.949	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.5	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.55	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
S_{sRT}	1.424	Probabilistic risk-targeted ground motion. (0.2 second)
S_{sUH}	1.525	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
S_{sD}	1.5	Factored deterministic acceleration value. (0.2 second)
S_{1RT}	0.529	Probabilistic risk-targeted ground motion. (1.0 second)
S_{1UH}	0.578	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S_{1D}	0.6	Factored deterministic acceleration value. (1.0 second)
$PGAd$	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.604	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.934	Mapped value of the risk coefficient at short periods
C_{R1}	0.916	Mapped value of the risk coefficient at a period of 1 s
C_V	1.385	Vertical coefficient

DISCLAIMER

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APPENDIX G

Pile Capacity and Skin Friction Values



PILE CAPACITY

JN: **22-247** CONSULT: **Bruin GSI**
CLIENT **AES - Seguro**

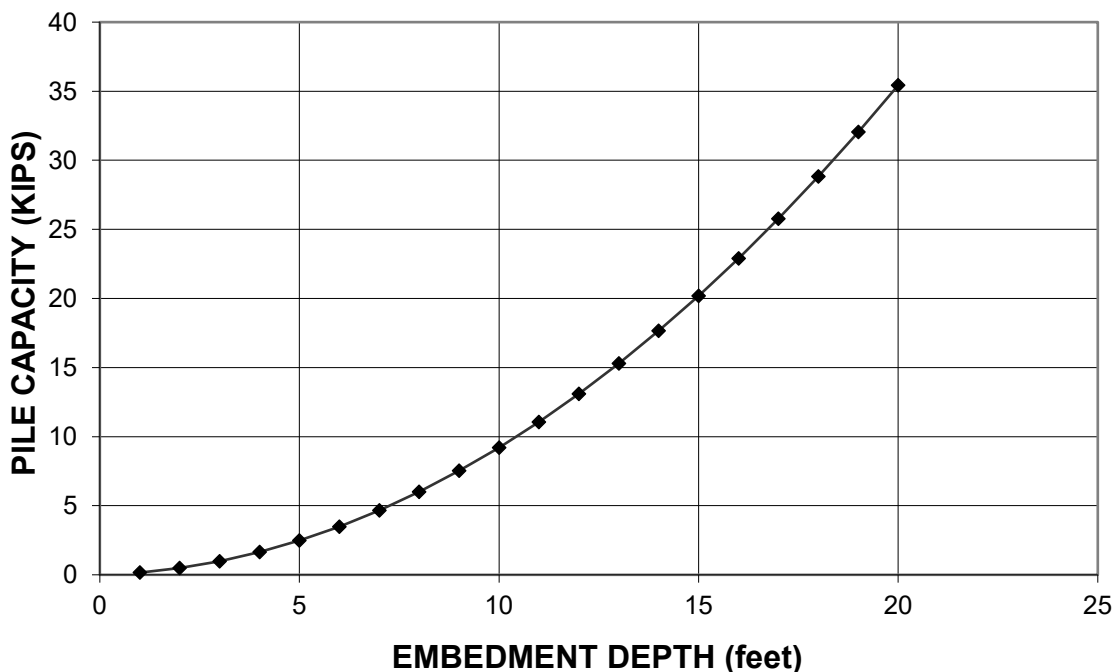
CALCULATION SHEET # **2**

CALCULATE ALLOWABLE SKIN FRICTION RESISTANCE FOR DRILLED, CAST IN PLACE CONCRETE PILES. SKIN FRICTION IS TABULATED AS A FUNCTION OF EMBEDMENT DEPTH. (REFERENCES: NAVFAC DM-7.2, PAGES 193-193 AND J.E. BOWLES, "FOUNDATION ANALYSIS AND DESIGN," 1988.)

CALCULATION PARAMETERS

EARTH MATERIAL:	Native	PILE DIAMETER:	3 feet
SHEAR DIAGRAM:	0	INITIAL PILE DEPTH:	1 feet
COHESION:	30 psf	FINAL PILE DEPTH:	20 feet
PHI ANGLE:	25 degrees	EXTERNAL SURCHARGE:	0 pounds
DENSITY:	110 pcf	ADHESION VALUE:	0.5
SAFETY FACTOR:	2	PILE/SOIL FRICTION:	22.5 degrees
COMPRESSION/TENSION:	C	LATERAL COEFF. (K _o)	0.79
PILE TYPE:	COMPRESSION PILE	NO GROUNDWATER	0.00 feet

FRICTION PILE CAPACITY



CONCLUSIONS:

THE CALCULATED CAPACITY OF 36 INCH DIAMETER PILES, AS A FUNCTION OF EMBEDMENT, ARE SHOWN IN THE GRAPH.



SKIN FRICTION TABLE

JN: **22-247** CONSULT: **Bruin GSI**
CLIENT **AES - Seguro**

CALCULATION SHEET # 1

CALCULATE ALLOWABLE SKIN FRICTION RESISTANCE FOR DRILLED, CAST IN PLACE CONCRETE PILES. SKIN FRICTION IS TABULATED AS A FUNCTION OF EMBEDMENT DEPTH. (REFERENCES: NAVFAC DM-7.2, PAGES 193-194 AND J.E. BOWLES, "FOUNDATION ANALYSIS AND DESIGN," 1988.)

CALCULATION PARAMETERS

EARTH MATERIAL:	Native	PILE DIAMETER:	3 feet
SHEAR DIAGRAM:	0	INITIAL PILE DEPTH:	1 feet
COHESION:	30 psf	FINAL PILE DEPTH:	20 feet
PHI ANGLE:	25 degrees	EXTERNAL SURCHARGE:	0 pounds
DENSITY:	110 pcf	ADHESION VALUE:	0.5
SAFETY FACTOR:	2	PILE/SOIL FRICTION:	22.5 degrees
COMPRESSION/TENSION:	C	LATERAL COEFF. (Ko)	0.79
PILE TYPE:	COMPRESSION PILE	NO GROUNDWATER	0.0 feet

PILE EMBEDMENT DEPTH (feet)	CALCULATED AVERAGE SKIN FRICTION (psf)	PILE CAPACITY (kips)	AVERAGE NORMAL EARTH PRESSURE (psf)
1	16.5	0.2	43.6
2	25.5	0.5	87.1
3	34.6	1.0	130.7
4	43.6	1.6	174.3
5	52.6	2.5	217.8
6	61.6	3.5	261.4
7	70.7	4.7	305.0
8	79.7	6.0	348.5
9	88.7	7.5	392.1
10	97.7	9.2	435.6
11	106.7	11.1	479.2
12	115.8	13.1	522.8
13	124.8	15.3	566.3
14	133.8	17.7	609.9
15	142.8	20.2	653.5
16	151.9	22.9	697.0
17	160.9	25.8	740.6
18	169.9	28.8	784.2
19	178.9	32.0	827.7
20	188.0	35.4	871.3

CONCLUSIONS:

THE CALCULATED SKIN FRICTION AND PILE CAPACITY ARE SHOWN IN THE TABLE.