

Pacific

Materials

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GEOTECHNICAL INVESTIGATION

Park Lane Reservoir Renovation

900 Block of Park Lane

Montecito, California

CLIENT

Montecito Water District
Attn: Adam Kanold
583 San Ysidro Road
Santa Barbara, CA 93108

June 14, 2021
Lab No: 135049-2
File No: 21-13780-2

"We Test The Earth"

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INTRODUCTION

This report presents the results of a foundation investigation performed near the 900 block of Park Lane in the Montecito area of Santa Barbara, California. Existing at the site is a reservoir for the Montecito Water District known as the Park Lane Reservoir. The reservoir is built into the side of a slope with an earth fill on the south side supporting the reservoir wall, while the north wall of the reservoir is supported on the cut excavation. It is proposed to modify the existing reservoir by excavating the bottom of the reservoir to a deeper elevation to increase the capacity.

SCOPE OF WORK

It is the purpose of this investigation to classify the soil disclosed by the exploratory borings and excavations by observation and tests on selected samples. In addition, this study includes laboratory tests to evaluate soil strength, the effect of moisture variation on the soil-bearing capacity, compressibility, liquefaction, and expansiveness. Based upon this information, we will provide grading and foundation recommendations for the proposed modification.

The scope of this investigation does not include the analysis of geologic structures and their associated features, such as faults, fractures, bedding planes, strike and dip angles, ancient landslides, potential for earth movement in undisturbed or natural soil formations sloped or level, or other sources of potential instability which relate to the geologic conditions, as these items should be addressed by a qualified Engineering Geologist.

This exploration was conducted in accordance with presently accepted geotechnical engineering procedures currently applied in the local community in order to provide the appropriate geotechnical design characteristics of the foundations soils and of the proposed fill soils in order to properly evaluate the proposed structure with respect to differential settlement based upon the anticipated soil characteristics at the time of construction.

LIMITATIONS

This Laboratory's basic assumption is that the soil borings presented herein are representative of the entire footprint of the proposed development, however, no warranty is implied. If, during the course of construction, soil conditions are encountered which vary from those presented herein, please contact this Laboratory immediately so appropriate field modifications may be expeditiously proposed.

It is your responsibility to contact our office, providing at least 48 hours of notice for grading or footing excavation observations and testing. The observation of excavations during the construction phase represents an opportunity by our firm to either confirm soil conditions estimated by the exploratory borings or to discover soil conditions which have not been

addressed. When such undisclosed conditions are encountered, opinions and recommendations addressing these conditions will be rendered at that time.

FIELD INVESTIGATION

The subsurface soil conditions were explored by three truck-mounted auger borings, which were drilled to depths of up to 20 feet. The locations of the borings were selected as appropriate and representative. Representative, relatively "undisturbed" tube soil samples were obtained during the drilling operation by the Modified California sampler method. Laboratory tests and analysis of representative soil samples, obtained during the drilling operation, were performed to estimate the engineering properties and determine the soil classification. The locations of the borings are shown on Plate 1; these locations are approximate and have not been located by surveyed measurements. The boring log data is presented in Appendix A, "Field Investigation", while the results of the laboratory tests are provided in Appendix B, "Laboratory Tests".

SOIL CONDITIONS

1. No groundwater was encountered in the exploratory borings, which extended to depths of up to 20 feet. It should be recognized that water table elevations, even seasonal perched water tables, might fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, and climatic conditions, as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.
2. The soil profile along the south side of the dam consists of an approximate 10- to 12-foot layer of fill soil. The fill is underlain by the sandstone rock of the Cold Water Formation. The truck-mounted auger borings were unable to penetrate below the depth of 20 feet due to a hard sandstone strata.
3. The surface soils were found to have a very low potential for expansion.
4. The soil profile at this site is judged to be stiff soil corresponding to a Site Class C as specified in Section 1613.3.2 of the 2019 California Building Code (CBC). This estimate is based on the borings, which encountered the geologic formation known as the Cold Water Formation, which is widely regarded as a Type C soil profile since the Standard Penetration Resistance typically results in blow counts greater than 50.
5. The soil sampling blow counts by the Modified California Sampling Method found the fill soil, on the south earth fill of the reservoir, to be from 25 to 50 blows per foot in both borings. The fill soil is supported by the Cold Water Sandstone Formation, and the supporting formation was measured to have blow counts of greater than 50 per foot. Based on the measured blow counts, the earth fill is considered structurally sound for the intended renovation.

6. The potential for liquefaction in the earth fill embankment and in the native supporting soil is considered to be very low.

CORROSION POTENTIAL

Two (2) soil samples were obtained in order to perform corrosion testing. One of the samples was obtained from Boring No. 1 at the depth of 15 feet and the other from Boring No. 2 at a depth of 15 feet. The samples were evaluated for resistivity, chlorides, sulfates, and pH. The results are presented in Appendix B. We recommend that the utility designer review the test data by consulting a licensed corrosion engineer to assess the relative impact and corrosion potential of buried materials. The results of the sulfate analyses indicate negligible sulfate exposure toward concrete. Type II cement can be used for concrete, unless other environmental or operating conditions indicate a more severe sulfate exposure. The results of the resistivity and chloride analyses indicate that corrosively toward ferrous metals is moderate for the tested soil samples.

CONCLUSIONS AND RECOMMENDATIONS

It is the opinion of this Laboratory the proposed construction is feasible from a soil-engineering perspective provided the recommendations contained in this soil engineering report are incorporated into the design and implemented during construction.

Based upon the soil profile depicted by the exploratory borings, it appears the entire bottom of the reservoir is resting on the undisturbed Cold Water Formation. The proposal to extend the depth deeper appears feasible and, therefore, the following recommendations are provided:

TEMPORARY AND PERMANENT CUT SLOPES

Permanent cut slopes in the Cold Water sandstone exist at this site and are nearly vertical. New cut excavations may be modeled after the existing cut slopes when excavated into similar hard sandstone conditions. Temporary cut slopes in the filled earth embankment shall be limited to a 45° angle (1 H to 1V).

FOUNDATIONS

The proposed foundations for the reservoir modifications may be for permanent retaining walls and for temporary shoring. The corresponding allowable soil bearing value may be assumed to be 2,500 psf with a one-third increase when considering wind or seismic forces when founded on the undisturbed native soil of the Cold Water Formation estimated to be 10- to 12-feet deep below the level grade surrounding the reservoir. Lateral earth pressures may be assumed an active soil pressure equivalent to a fluid (EFP) whose weight is 60 pcf for all backfill angles of up to 27 degrees maximum for compacted soil. The same value may be assumed for cut excavations in the native soil formation and no surcharge increase is required

for native or cut slopes of any steep angle due to the geologic stability of the Cold Water Formation. The EFP value does not include surcharge loads nor hydrostatic lateral forces where drainage is not provided.

RESISTANCE TO LATERAL LOADS

Resistance to lateral loading can be provided by sliding friction acting on the base of spread footings combined with passive pressure acting on the sides of the foundation. A coefficient of 0.35 for resistance to lateral forces bearing in the cut original ground may be assumed. For resistance to lateral load, we recommend using a value of 400 pcf, equivalent fluid weight, for passive resistance acting on the sides of foundations, with concrete placed neat against compacted materials or cut original ground. A one-third increase in passive value can be used when considering short-term wind or seismic loads.

SETTLEMENT

It is the intent of the recommendations contained in this report to achieve angular distortions¹ of approximately 1/480. A total settlement of approximately 1 inch or less is anticipated for foundations supported on the undisturbed native soil.

CONSTRUCTION OBSERVATION

The owner or his agent shall request the Project Geotechnical Engineer to observe all excavations prior to placement of compacted soil, gravel backfill, or rebar and concrete.

PLAN REVIEW

We request the grading and foundation plans be submitted to our office for a general review to verify substantial compliance to the recommendations contained in this report.

CLOSURE

The recommendations contained herein are for the sole use of our client and are based upon this Laboratory's understanding of the project which has been described herein. If the project scope, location, or conceptual design is subsequently altered, this Laboratory shall be requested to modify, as necessary, the recommendations contained herein as is appropriate for the new development concept. If the recommendations of this report are not implemented within one year, we recommend an update and review of the contents of this report be performed by this Laboratory.

The recommendations contained herein are based upon the assumption that Pacific

¹ Angular distortion is the ratio of the vertical differential settlement divided by the horizontal distance over which the vertical differential is measured.

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Materials Laboratory shall be requested to perform the testing and observation services which will be required during the grading and foundation operations in order to verify that the actual soil conditions encountered and the construction procedures are consistent with the recommendations contained herein. If this service is performed by others, only the technical correctness of the actual analytical soil tests described here is attested to by this Laboratory.

Thank you for the opportunity of providing this service. If you have any questions regarding this matter, please do not hesitate to call.

Respectfully submitted,

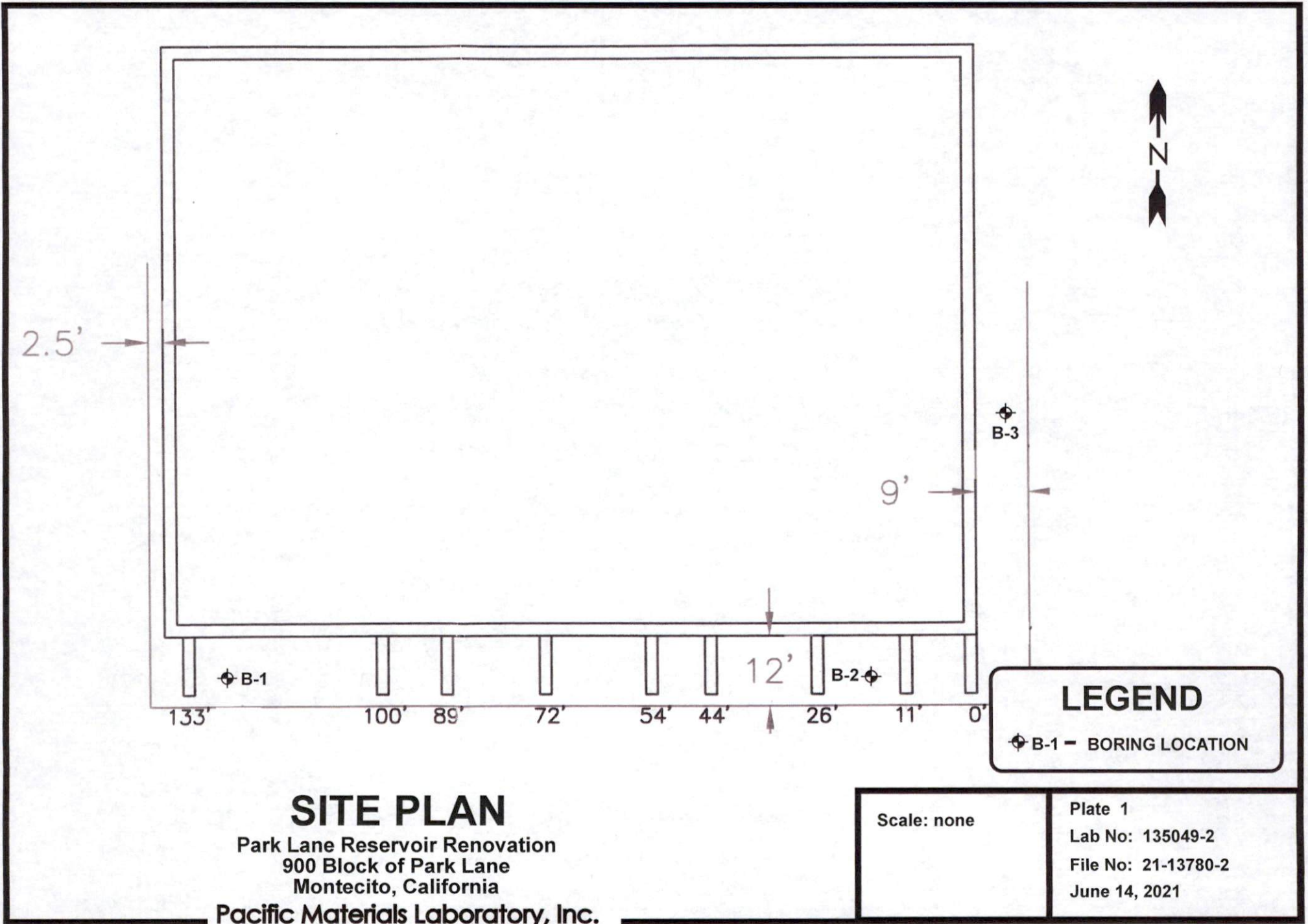
PACIFIC MATERIALS LABORATORY, INC.



Ronald J. Pike
Geotechnical Engineer, G. E. 2291

RJP:mpm

cc: Karl Meier
Email: karlmeier@WoodRodgers.com
Montecito Water District, Attn: Adam Kanold
Email: akanold@montecitowater.com



SITE PLAN

Park Lane Reservoir Renovation
 900 Block of Park Lane
 Montecito, California

Pacific Materials Laboratory, Inc.

LEGEND
 ⊕ B-1 - BORING LOCATION

Scale: none

Plate 1
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APPENDIX A
FIELD INVESTIGATION

June 14, 2021

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-A.1-

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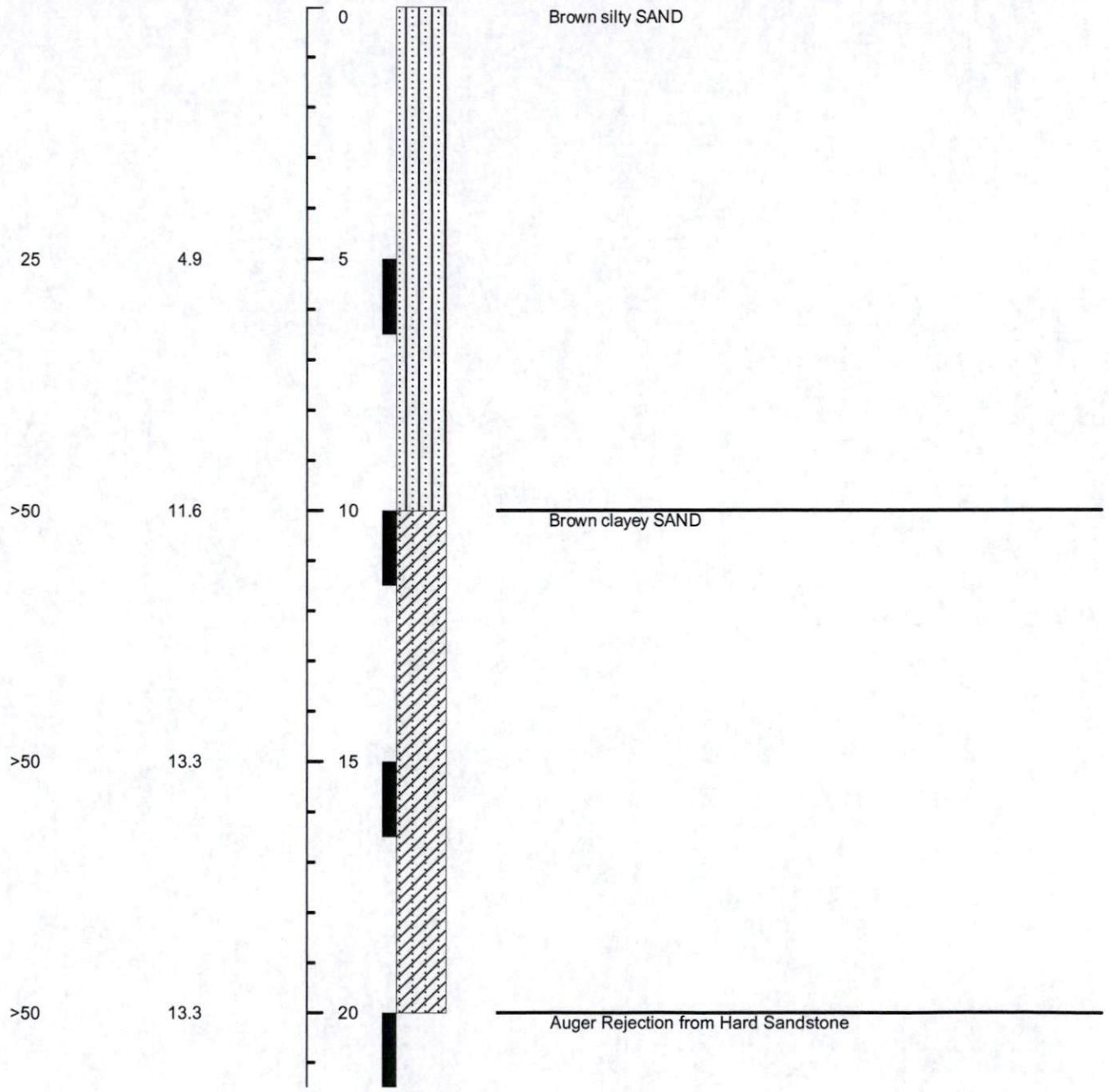
BORING LOG DATA


BORING NO. B-1

Field Technician: ZP

Date Drilled: 05/11/21

Blow Counts	Moisture Content (%)	Depth (ft)	Soil Log	Soil Description
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LEGEND	
	- Modified California Sample

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-A.2-

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File No: 21-13780-2

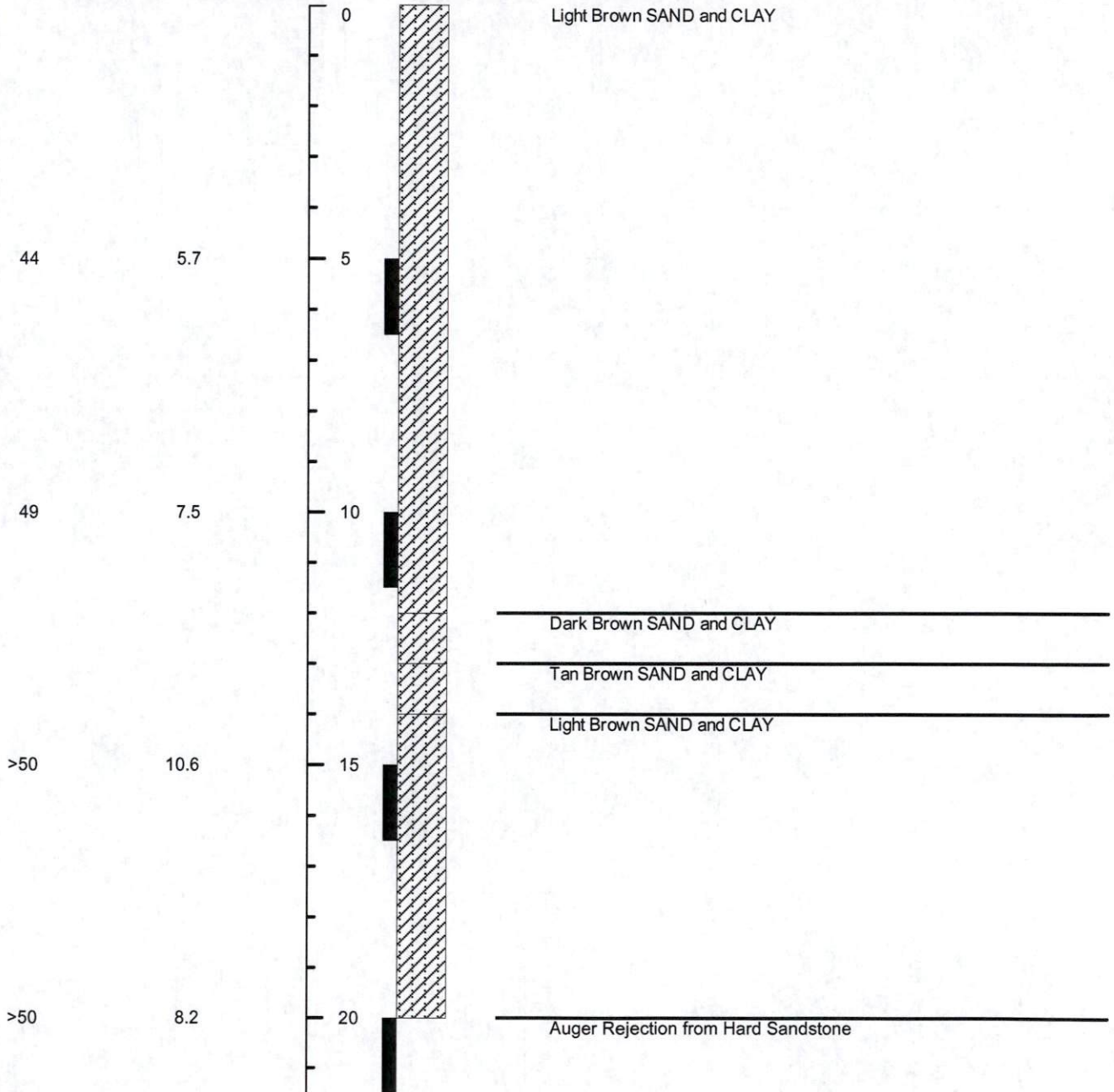
BORING LOG DATA

BORING NO. B-2

Field Technician: ZP

Date Drilled: 05/11/21

Blow Counts	Moisture Content (%)	Depth (ft)	Soil Log	Soil Description
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LEGEND	
■	- Modified California Sample

June 14, 2021

-A.3-

Lab No: 135049-2

File No: 21-13780-2

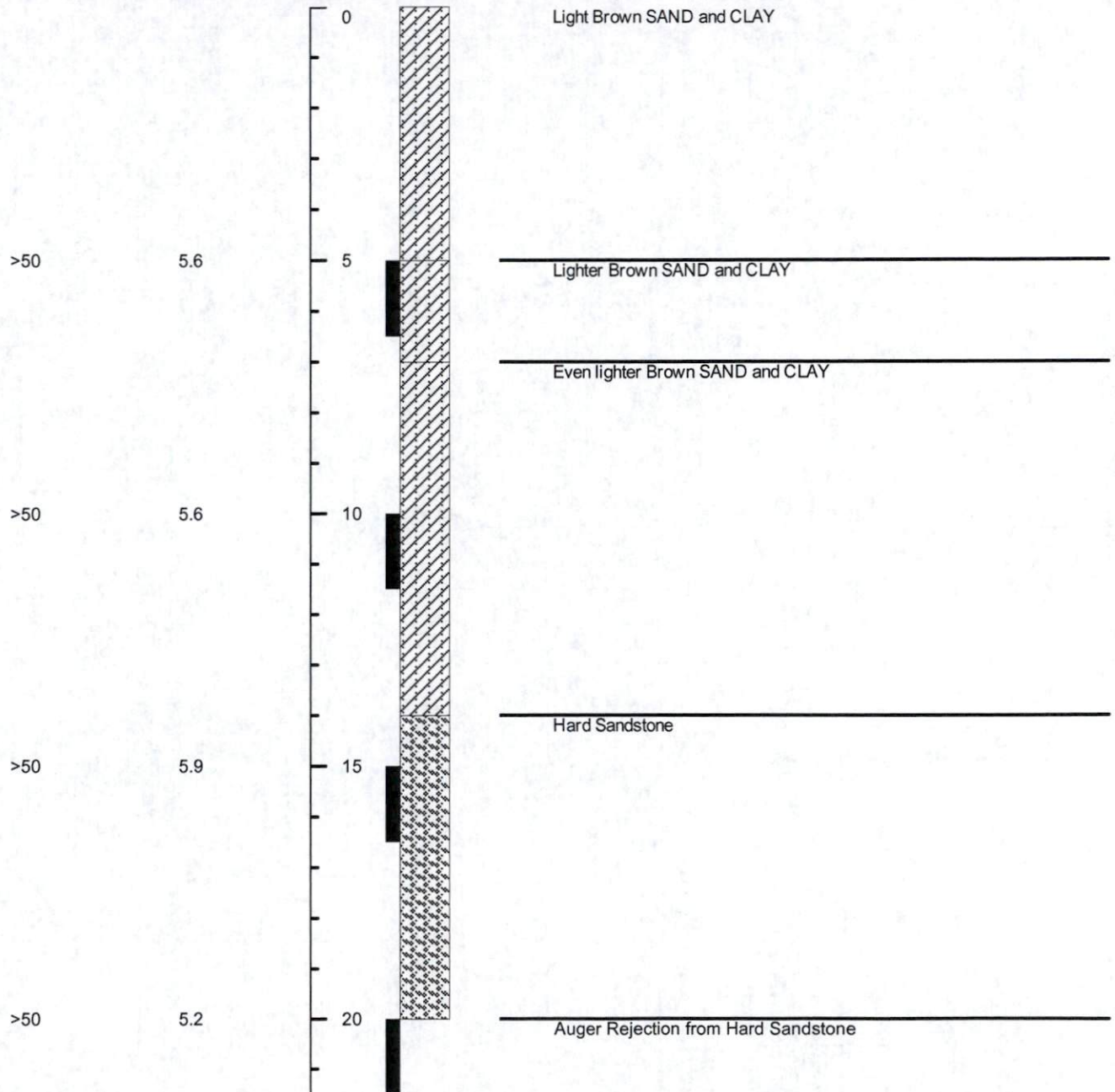
BORING LOG DATA


BORING NO. B-3

Field Technician: ZP

Date Drilled: 05/11/21

Blow Counts	Moisture Content (%)	Depth (ft)	Soil Log	Soil Description
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LEGEND	
	- Modified California Sample

APPENDIX B
LABORATORY TESTS

June 14, 2021

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MECHANICAL ANALYSES (Values in Percent Passing ASTM D 422)

SIEVE SIZE	B-1 @ 10'	B-1 @ 15'	B-2 @ 10'
1/2 Inch	100.0	100.0	100.0
3/8 Inch	100.0	100.0	99.1
No. 4	98.2	99.1	94.7
No. 8	96.3	97.8	91.4
No. 16	94.8	96.6	88.9
No. 30	92.3	94.6	84.7
No. 50	84.6	84.8	73.0
No. 100	61.2	59.3	50.0
No. 200	48.3	45.7	37.3

SAND-SILT-CLAY (By Hydrometer ASTM D 422)

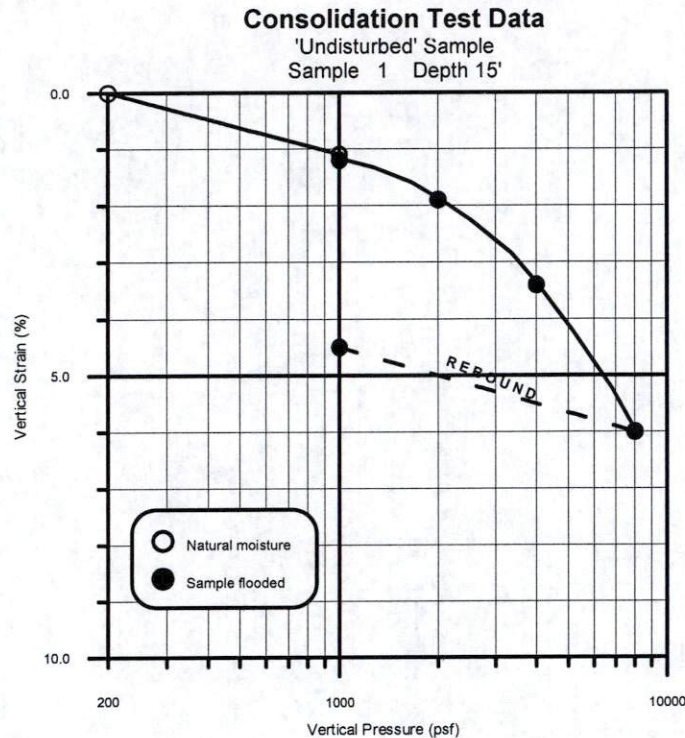
<u>SAMPLE LOCATION</u>	<u>DEPTH (ft.)</u>	<u>SAND %</u>	<u>SILT %</u>	<u>CLAY %</u>	<u>SOIL DESCRIPTION</u>
B-1	10	66	16	18	Silty SAND
B-1	15	60	14	26	Clayey SAND
B-2	10	34	36	30	Sandy silty CLAY

ATTERBERG LIMITS (ASTM D 4318)

<u>SAMPLE LOCATION</u>	<u>DEPTH (ft.)</u>	<u>SOIL TYPE</u>	<u>LIQUID LIMIT</u>	<u>PLASTIC LIMIT</u>	<u>PLASTICITY INDEX</u>
B-1	10	NP	--	--	--
B-1	15	NP	--	--	--
B-2	10	NP	--	--	--

CONSOLIDATION TESTS (ASTM D 2435)

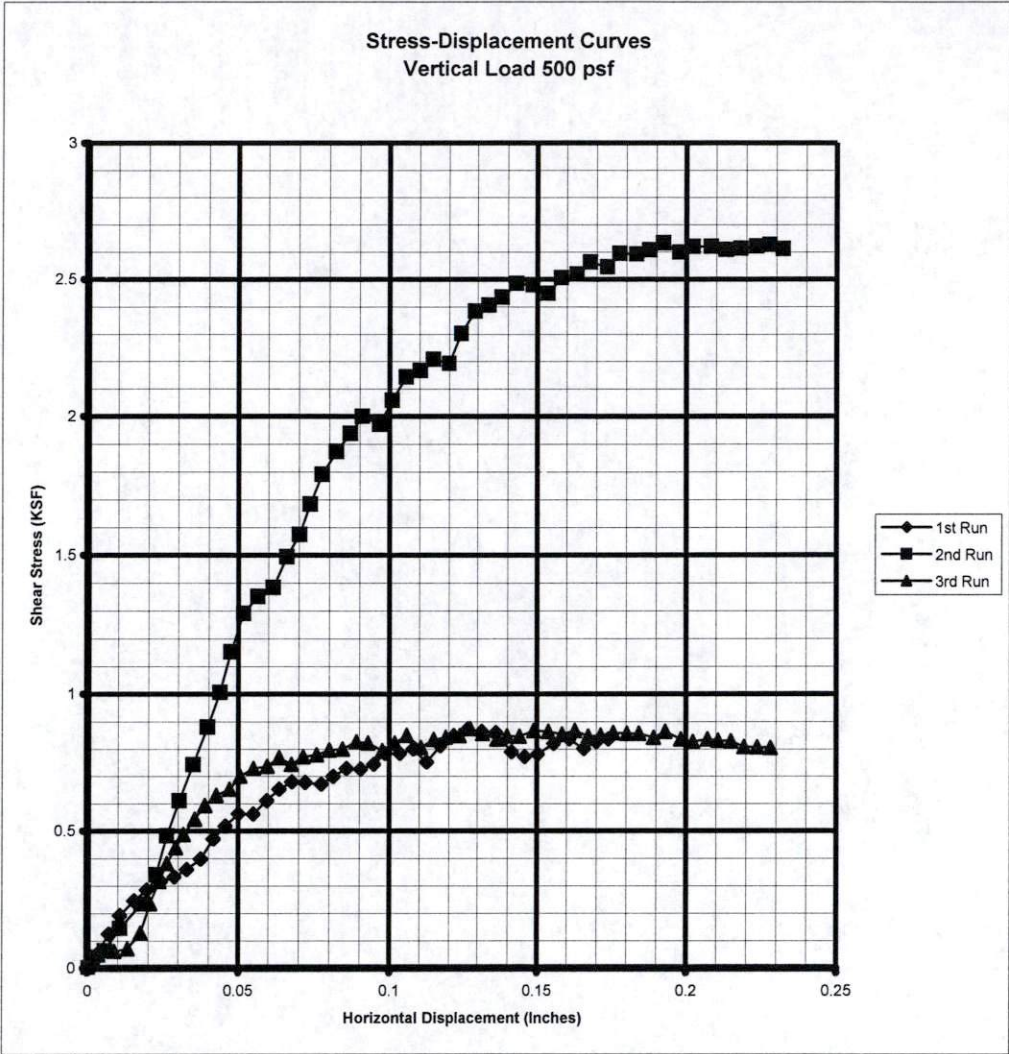
One consolidation test was performed on a representative in-place tube soil sample in both the natural field and at increased moisture contents. The results of the consolidation test are presented graphically below.

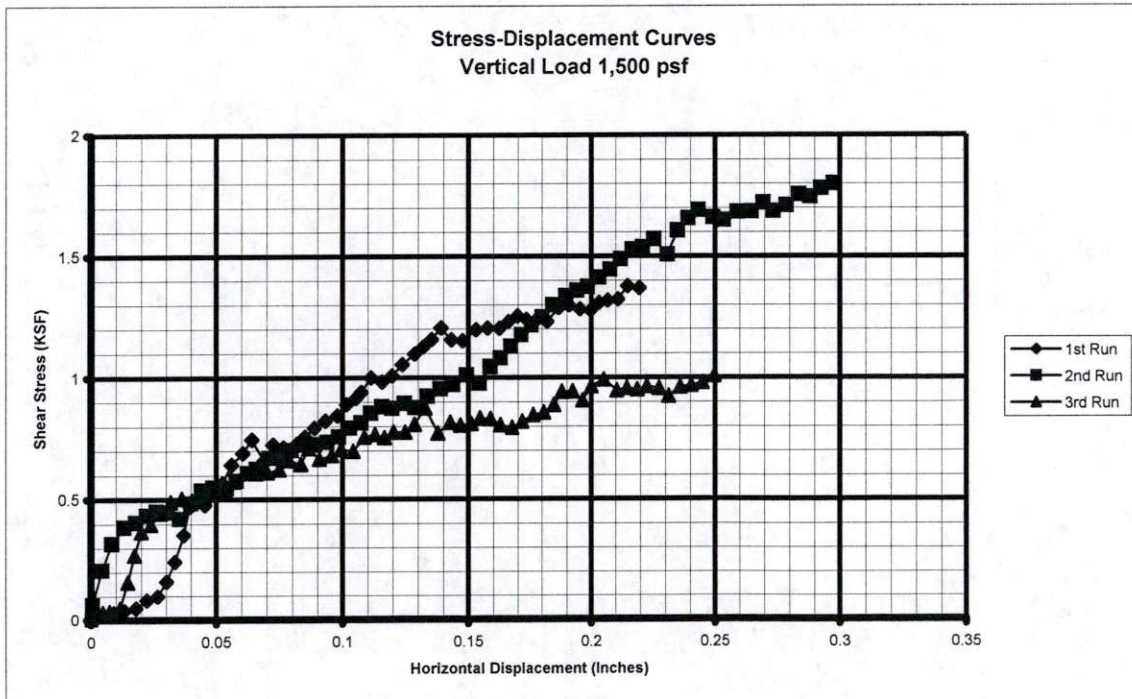
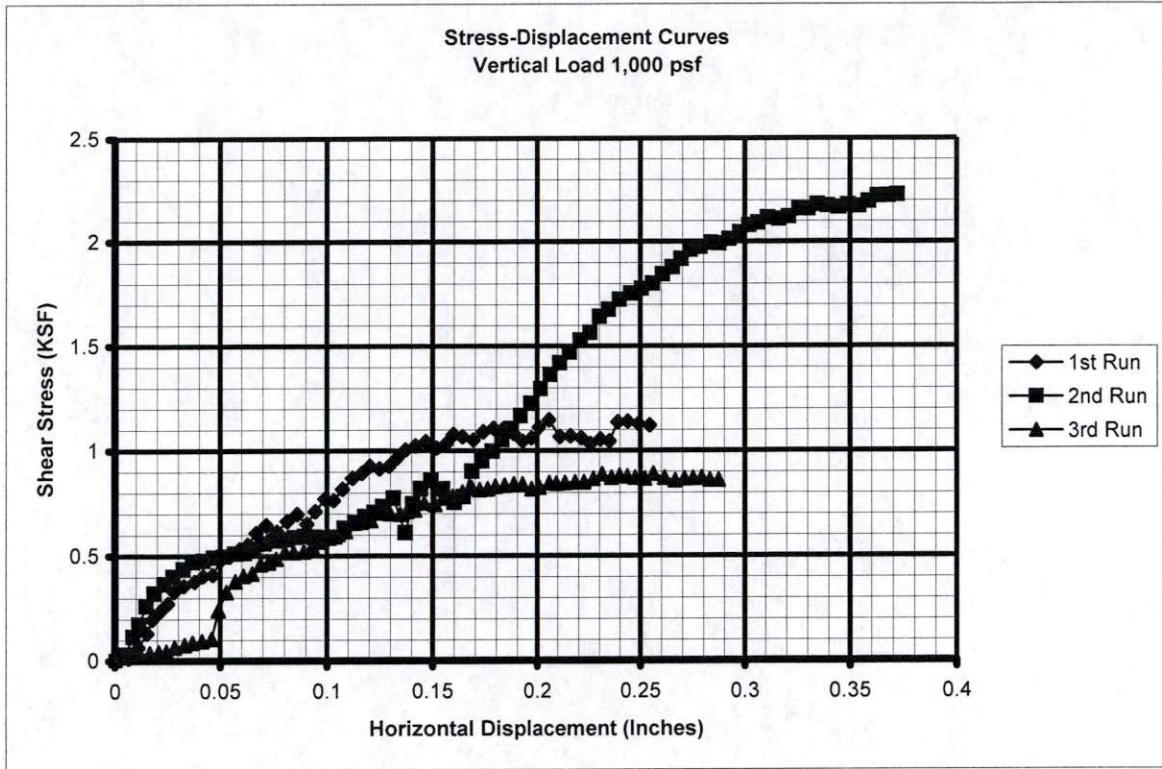


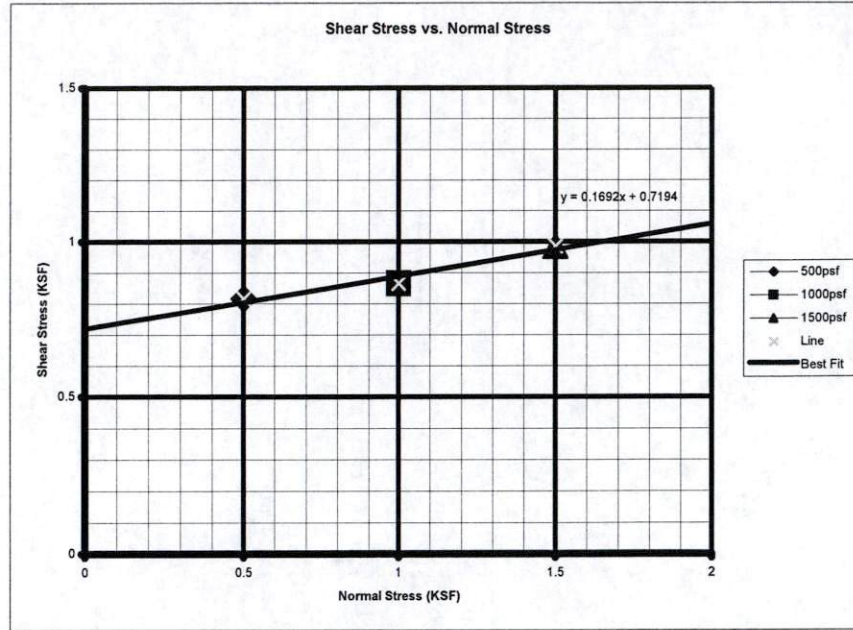
DIRECT SHEAR TEST (ASTM D 3080)

One direct shear test was performed on a representative "undisturbed" soil sample which was 2.365 inches in diameter and 1 inch thick. The test was performed under flooded conditions. The results are tabulated below:

<u>SAMPLE LOCATION</u>	<u>DEPTH (ft.)</u>	<u>INTERNAL ANGLE OF FRICTION (degrees)</u>	<u>COHESION (psf)</u>
B-1	10	10	720









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Prepared for: Pacific Materials Lab Santa Barbara, Inc.
P.O. Box 96
Goleta, CA 93116
Attn: Ron Pike

Report Date: June 3, 2021
Laboratory Number: 210854
Project Name: Park Lane Reservoir
Sampled by: Ron Pike

Enclosed are the analysis results for samples received May 26, 2021 with the Chain of Custody document. The samples were received in good condition, at 24.4°C, and they were identified and assigned the laboratory ID numbers listed below:

<u>SAMPLE DESCRIPTION</u>	<u>CAS LAB NUMBER ID</u>
Park Lane Reservoir 1/15	210854-01
Park Lane Reservoir 2/15	210854-02

By my signature below, I certify that the results contained in this laboratory report comply with applicable standards for certification by the California Department of Public Health's Environmental Laboratories Accreditation Program (ELAP), both technically and for completeness, and that, based on my inquiry of the person or persons directly responsible for performing the analyses, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

A handwritten signature in black ink, appearing to read "M. Ramirez", is written over a horizontal line.

Marcos Ramirez-Laboratory Director

If you have any further questions or concerns, please contact me at your convenience. This report consists of 3 pages excluding the cover letter and the Chain of Custody.

This report shall not be reproduced except in full without the written approval of CAS. The test results reported represent only the item being tested and may not represent the entire material from which the sample was taken.



CERTIFICATE OF ANALYSIS

Client: Pacific Materials
CAS LAB NO: 210854-01
Sample ID: Park Lane Reservoir 1/15
Analyst: GP

Date Sampled: 05/13/21
Date Received: 05/26/21
Sample Matrix: Soil

WET CHEMISTRY SUMMARY

COMPOUND	RESULTS	UNITS	DF	PQL	METHOD	ANALYZED
pH (Corrosivity)	8.4	S.U.	1	---	9045	05/28/21
Resistivity*	7200	Ohms-cm	1	---	SM 120.1M	05/28/21
Chloride	5.4	mg/Kg	1	0.3	300.0M	05/28/21
Sulfate	57	mg/Kg	1	0.3	300.0M	05/28/21

*Sample was extracted using a 1:3 ratio of soil and DI water.

DF: Dilution Factor
PQL: Practical Quantitation Limit
BQL: Below Quantitation Limit
mg/Kg: Milligrams/Kilograms (ppm)



CERTIFICATE OF ANALYSIS

Client: Pacific Materials
CAS LAB NO: 210854-02
Sample ID: Park Lane Reservoir 2/15
Analyst: GP

Date Sampled: 05/13/21
Date Received: 05/26/21
Sample Matrix: Soil

WET CHEMISTRY SUMMARY

COMPOUND	RESULTS	UNITS	DF	PQL	METHOD	ANALYZED
pH (Corrosivity)	8.3	S.U.	1	---	9045	05/28/21
Resistivity*	5600	Ohms-cm	1	---	SM 120.1M	05/28/21
Chloride	9.9	mg/Kg	1	0.3	300.0M	05/28/21
Sulfate	120	mg/Kg	1	0.3	300.0M	05/28/21

*Sample was extracted using a 1:3 ratio of soil and DI water.

DF: Dilution Factor
PQL: Practical Quantitation Limit
BQL: Below Quantitation Limit
mg/Kg: Milligrams/Kilograms (ppm)

Quality Control Report

Client:	Pacific Materials	Date Sampled:	05/13/21
Sample ID:		Date Received:	05/26/21
CAS LAB NO:	210854	Date Analyzed:	05/28/21
Sample Matrix:	SOIL	Analyst:	GP

Sample Name	Qualifier	Sample Result	QC Result	Unit	Spike Level	%REC	Control Limits
<u>Chloride (by EPA 300)</u>							
Method Blank			BQL	mg/L			
Lab Control Sample			29.59	mg/L	30	99	90-110
210855-01 Matrix Spike		1.36	30.68	mg/L	30	98	80-120
210855-01 Matrix Spike Duplicate		1.36	30.58	mg/L	30	97	80-120
<u>Sulfate (by EPA 300)</u>							
Method Blank			BQL	mg/L			
Lab Control Sample			29.63	mg/L	30	99	90-110
210855-01 Matrix Spike		22.82	52.06	mg/L	30	97	80-120
210855-01 Matrix Spike Duplicate		22.82	51.83	mg/L	30	97	80-120

*ALL QC SAMPLES ARE PREPARED IN LIQUID PHASE
 mg/L: Milligrams/Liter (ppm)
 %Rec: Percent Recovered
 BQL: Below Practical Quantitation Limit