



**SUBSURFACE EXPLORATION AND PRELIMINARY ASSESSMENT OF
INFILTRATION CHARACTERISTICS
PROPOSED RECHARGE BASIN SITE
NORTHEAST CORNER OF ELKHORN AVENUE AND HIGHWAY 41
FRESNO COUNTY, CALIFORNIA**

Project Number: A26349.01

For:

Ms. Erin Haagen
County of Fresno Department of Public Works
2220 Tulare Street, Sixth Floor
Fresno, California 93721

May 9, 2016



May 9, 2016

A26349.01

Ms. Erin Haagenon
County of Fresno Department of Public Works
2220 Tulare Street, Sixth Floor
Fresno, California 93721

**Subject: Subsurface Exploration and Preliminary Assessment of
Infiltration Characteristics
Proposed Recharge Basin Site
Northeast Corner of Elkhorn Avenue and Highway 41
Fresno County, California**

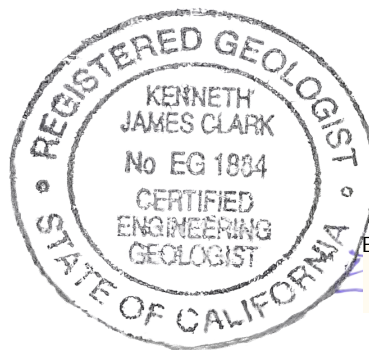
Dear Ms. Haagenon:

We are pleased to submit this report of our subsurface exploration and preliminary assessment of infiltration characteristics for the proposed recharge basin site located at the northeast corner of Elkhorn Avenue and Highway 41 in Fresno County, California. The contents of this report include the purpose of the investigation, scope of services, background information, investigative procedures, our findings and results, and our preliminary assessment.

We appreciate the opportunity to be of service to the County of Fresno Department of Public Works. If you have any questions regarding this report, or if we can be of further assistance, please contact us at your convenience at (800) 268-7021.

Sincerely,
MOORE TWINING ASSOCIATES, INC.
Geotechnical Engineering Division

Kenneth J. Clark, CEG
Engineering Geologist



Exp. 5-31-17

TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION	1
2.0 PURPOSE AND SCOPE OF INVESTIGATION	1
2.1 Purpose	1
2.2 Scope	2
3.0 BACKGROUND INFORMATION	2
3.1 Site Location and Description	2
3.2 Site History and Previous Studies	3
3.3 Anticipated Construction	3
4.0 INVESTIGATIVE PROCEDURES	3
4.1 Field Exploration	3
4.1.1 Site Reconnaissance	3
4.1.2 Drilling Test Boring	3
4.1.3 Soil Sampling	4
4.2 Laboratory Testing	4
5.0 FINDINGS AND RESULTS	5
5.1 Site Geologic Conditions	5
5.2 Soil Profile	5
5.3 Groundwater Conditions	6
6.0 PRELIMINARY ASSESSMENT OF THE POTENTIAL FOR INFILTRATION	6
7.0 ADDITIONAL STUDIES	7
8.0 NOTIFICATION AND LIMITATIONS	7
 <u>APPENDICES</u>	
APPENDIX A - Drawings	A-1
Drawing No. 1 - Test Boring Location Map	
APPENDIX B - Logs of Test Borings	B-1
APPENDIX C - Results of Laboratory Tests	C-1

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1.0 INTRODUCTION

This report presents the results of a subsurface exploration and our preliminary assessment of the infiltration characteristics for the proposed groundwater recharge basin site located at the northeast corner of Elkhorn Avenue and Highway 41 in Fresno County, California. Moore Twining Associates, Inc. (Moore Twining) was authorized by Fresno County to conduct this work in accordance with agreement 14-536, NTP-1, dated March 9, 2016.

The contents of this report include the purpose and the scope of services provided. The background information, a description of the investigative procedures used and the subsequent findings obtained are presented. Finally, the report provides an evaluation of the findings, general conclusions, and related recommendations. The appendices contain the drawings (Appendix A), the logs of borings (Appendix B), and the results of laboratory tests (Appendix C).

The Geotechnical Engineering Division of Moore Twining, headquartered in Fresno, California, performed the investigation.

2.0 PURPOSE AND SCOPE OF INVESTIGATION

2.1 Purpose: The purpose of the investigation was to conduct a limited field exploration and laboratory testing program, evaluate the data collected during the field and laboratory portions of the investigation, and provide the following in accordance with our March 7, 2016 proposal:

- 2.1.1 A general description of the subsurface soil conditions encountered;
- 2.1.2 Discussion of groundwater depths at and near the site based on field data and/or readily available public data;
- 2.1.3 Preliminary assessment of the potential for infiltration based on general correlations of permeability with the soil types encountered; and,
- 2.1.4 Final test boring logs and laboratory test results.

2.2 Scope: Our proposal, revision dated March 7, 2016, outlined the scope of our services. The actions undertaken during the investigation are summarized as follows.

- 2.2.1 A site review was conducted to discuss the boring sites with Mr. Steve Deis, Fresno County Materials Engineer.
- 2.2.2 A soil boring permit was obtained from the Fresno County Department of Public Health Environmental Health Division (permit no. WP0036846).
- 2.2.3 A site reconnaissance and subsurface exploration were conducted.
- 2.2.4 Laboratory tests were conducted for soil classification purposes.
- 2.2.5 Mr. Steve Deis, Fresno County Materials Engineer, was consulted during the investigation.
- 2.2.6 The data obtained from the investigation were reviewed to develop an understanding of the general subsurface conditions encountered.
- 2.2.7 This report was prepared to present the purpose and scope, background information, field exploration procedures, findings, conclusions, and provide a preliminary assessment of the potential for infiltration.

This investigation did not include a hydrogeologic evaluation, nor assessment of other characteristics of the site which would need to be evaluated to assess the potential for groundwater recharge, such as groundwater quality, groundwater flow direction, land use, etc.

3.0 BACKGROUND INFORMATION

The site location and description, site history and previous studies, and the anticipated construction are summarized in the following subsections.

3.1 Site Location and Description: We understand that Fresno County is considering a recharge basin ranging from about 40 to 80 acres at the northeast corner of Elkhorn Avenue and Highway 41 in Fresno County, California. The subject site investigated is about 80 acres. Drawing No. 1 (in Appendix A) depicts the subject site. The site was covered with a grass crop (agricultural use) at the time of our field investigation. The south half of the site was temporarily fenced for livestock grazing. The site is relatively flat and accessible by farm (dirt) roads which intersect with Elkhorn Avenue. An approximate 4-acre detention basin is located adjacent to the southwest portion of the site.

The site appears to be relatively flat. According to the U.S.G.S. Riverdale 7.5 Minute Quadrangle (dated 2012), the site elevation is roughly 240 feet above mean sea level and the ground surface slopes gently to the southwest.

3.2 Site History and Previous Studies: It is our understanding that the proposed basin site has been historically used for agricultural purposes.

We understand that an exploration of the subsurface soil and groundwater conditions at the site has not been previously conducted. No other previous geotechnical engineering, geological, or compaction test reports conducted for this site were provided for review. If available, prior reports should be provided for review.

3.3 Anticipated Construction: It is our understanding that Fresno County is considering constructing a recharge basin at the site. At the time of preparation of this report, it is our understanding that the depth and aerial limits of the basin had not been determined.

4.0 INVESTIGATIVE PROCEDURES

The field exploration and laboratory testing program conducted for this investigation are summarized in the following subsections.

4.1 Field Exploration: A limited field exploration was conducted as part of this report. The field exploration consisted of a site reconnaissance, drilling test borings, soil sampling, and conducting standard penetration tests. On March 22, 2016, a meeting was held at the site with Mr. Steve Deis, Fresno County Materials Engineer, to discuss the soil boring locations.

4.1.1 Site Reconnaissance: The site reconnaissance consisted of walking the site and noting visible surface features. The reconnaissance was conducted by Mr. Jose Diaz, Moore Twining staff engineer, on April 4, 2016. The features noted are described in the “Background Information” section of this report.

4.1.2 Drilling Test Borings: The depths of the borings were specified by the client. Prior to drilling, a soil boring permit was obtained from the Fresno County Department of Public Health, Environmental Health Division (permit no. WP0036846).

On April 4, 5, and 6, 2016, two (2) borings were drilled to a depth of about 100 feet and one (1) boring was drilled to a depth of about 150 feet using a CME-75 hollow-stem auger drilling rig equipped with 6-5/8 inch outside diameter (O.D.) hollow stem augers. The approximate location of the borings drilled for this investigation are depicted on the site plan, Drawing No. 1 in Appendix A of this report.

The test borings were drilled under the direction of a Moore Twining engineering geologist. The soils encountered in the test borings were logged. The field soil classification was in accordance with the Unified Soil Classification System and consisted of particle size, color, and other distinguishing features of the soil.

The presence and elevation of free water, if any, in the borings were noted and recorded during drilling and immediately following completion of the test borings.

The test boring locations were determined by pacing or measuring with a steel tape with reference to the existing site features. After drilling and sampling, the borings were loosely backfilled with soil cuttings to a depth of 20 feet and the upper portion of the boreholes were backfilled with neat cement grout in accordance with the requirements of Fresno County. Excess soil cuttings were spread loosely at each drill site. Due to the loose nature of the test boring backfill, some settlement of the backfill should be anticipated.

4.1.3 Soil Sampling: Consistent with our proposal, soil samples were collected from the borings at approximate 5-foot depth intervals for logging and laboratory testing.

During drilling of the borings, standard penetration tests were conducted, and both disturbed and relatively undisturbed soil samples were obtained. The standard penetration resistance, N-value, is defined as the number of blows required to drive a standard split barrel sampler into the soil. The standard split barrel sampler has a 2-inch O.D. and a 1-3/8 inch inside diameter (I.D.). The sampler is driven by a 140-pound weight free falling 30 inches. The sampler is lowered to the bottom of the bore hole and set by driving it an initial 6 inches. It is then driven an additional 12 inches, or portion thereof, and the number of blows required to advance the sampler an additional 12 inches, or portion thereof, is recorded as the N-value.

Relatively undisturbed soil samples were obtained by pushing or driving a California modified split barrel ring sampler into the soil. The soil was retained in brass rings, 2.5 inches O.D. and 1-inch in height. The lower 6-inch portion of the samples were placed in close-fitting, plastic, airtight containers which, in turn, were placed in cushioned boxes for transport to the laboratory. Soil samples obtained were taken to Moore Twining's laboratory for classification and testing. In addition, bulk samples of soil were obtained for laboratory testing.

4.2 Laboratory Testing: Laboratory testing of soil samples included sieve analyses, hydrometer analyses, and Atterberg Limits tests for soil classification purposes. The results of the laboratory tests on are summarized on the figures in Appendix C. These data, along with the field observations, were used to prepare the final test boring logs in Appendix B.

5.0 FINDINGS AND RESULTS

The findings and results of the limited field exploration and laboratory testing are summarized in the following subsections.

5.1 Site Geologic Conditions: The Geologic Map of California, Fresno Sheet, dated 1966, indicates the site is underlain by Quaternary basin deposits. The NRCS Web Soil Survey describes the near surface soils as Traver sandy loam, Traver fine sandy loam, and Hesperia fine sandy loam.

The site is located in the area of the San Joaquin Valley Groundwater Basin, Kings Subbasin. Groundwater typically flows to the southeast in the site region. Based on review of various documents, it appears that the site is located near the northeast boundary of the A-Clay, C-Clay, and E-clay aquitards.

5.2 Soil Profile: The majority (about 3/4) of the subsurface soils encountered in the test borings were granular soils described as silty sands, poorly graded sands, and poorly graded sand with silt. However, these soils were interbedded with clay soils which were described as lean clays and silty clays. Interbedded silt layers were also encountered. The clayey soils layers were typically estimated to be about 5 to 10 feet thick. The majority of the clay soils encountered in the borings were about 25 to 50 feet below site grade (BSG).

The silty sands, poorly graded sands, and poorly graded sand with silt were typically loose to medium dense to depths of about 30 feet BSG, as determined by standard penetration test (SPT) resistance, N-values, ranging from 3 to 17 blows per foot. Below a depth of about 30 feet BSG, the granular soils were medium dense, as determined by standard penetration resistance, N-values, ranging from 11 to greater than 50 blows per foot.

The lean clays and silty clays were predominantly stiff to medium stiff, as determined by standard penetration resistance, N-values, ranging from 11 to 28 blows per foot, with medium stiff and hard clay encountered at varying depths.

The silts were stiff to very stiff, as determined by standard penetration resistance, N-values, ranging from 15 to 29 blows per foot.

The foregoing is a general summary of the soil conditions encountered in the limited number of test borings drilled for this investigation. Detailed descriptions of the soils encountered in the test borings are presented on the logs of boring in Appendix B. The stratification lines shown on the log represent the approximate boundary between soil types; the actual in-situ transition may be gradual.

5.3 Groundwater Conditions: Groundwater was not encountered in the test borings drilled to maximum depth of about 150 feet BSG. Review of the Department of Water Resources (DWR) website and maps of lines of equal elevation in wells for various years between 2006 and 2011 (most recent data) suggest that the groundwater depth in the site area declined from about 115 feet BSG to a depth of 130 feet BSG during the period of 2006 to 2011.

Historical groundwater information for individual wells reviewed on the DWR website indicates that the water level in well 364902N1197907W001, located roughly a quarter mile east of the southeast corner of the site, declined from a depth of about 120 feet BSG to 148 feet BSG from 2011 to 2015 (most recent data available).

The water level in well 16S20E34H001M, located roughly a half mile northeast of the northeast corner of the site, declined from a depth of about 80 feet BSG to 128 feet BSG from 2000 to 2011 (most recent data available).

Thus, the groundwater depths in water wells near the site have been shallower than 150 feet within the last several years. However, the groundwater levels have declined substantially in the last few years and the current groundwater depth at the site is not known.

It should be recognized, that water table elevations fluctuate with time, since they are 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 both during the construction phase and the design life of the project. The evaluation of such factors was beyond the scope of this investigation and report.

6.0 PRELIMINARY ASSESSMENT OF THE POTENTIAL FOR INFILTRATION

As indicated in our proposal, the scope of the assessment does not include quantifying the infiltration capacity of the subsurface soils for basin design, nor does it include a hydrogeologic assessment. However, the information obtained from this limited field exploration and laboratory testing program was reviewed to provide a preliminary assessment of the infiltration characteristics of the soils encountered.

- 6.1 In general, the subsurface soils encountered to the maximum depth explored (150 feet BSG) are indicative of generally favorable conditions for infiltration of water, such as for use of a recharge basin. However, groundwater was not encountered to the maximum depth explored of 150 feet BSG. The infiltration characteristics of the soils below a depth of 150 feet and the groundwater depth at the site are not known. Thus, future investigations should obtain information to fill these data gaps in order to assess the infiltration characteristics of the subsurface soils to the groundwater surface.

- 6.2 About three quarters of the soils encountered consisted of granular soils which were described as silty sands, poorly graded sands, and poorly graded sand with silt which are favorable for infiltration of surface water. The granular soils were interbedded with clay soils which were described as lean clays and silty clays. Interbedded silt layers were also encountered. The clayey soils layers were typically estimated to be about 5 to 10 feet thick. The majority of the clay soils were encountered below depths of about 25 to 50 feet below site grade (BSG).
- 6.3 Based on the thickness, depth, and lack of continuity of the clay soils encountered, the clay soils do not appear to present a significant lateral restriction to downward migration of water when considering the overall size of the basin anticipated at the site (proposed 40 to 80 acre basin). However, due to the limited exploration conducted herein, future explorations (including soil borings) will need to evaluate the deeper stratigraphy and confirm the lack of continuous clay layers in the area(s) proposed for the recharge basin.

7.0 ADDITIONAL STUDIES

It is our understanding that the findings of this preliminary assessment will be reviewed by Fresno County to determine whether to further investigate the suitability of the site for use as a recharge basin. It is anticipated that information from other sources, such as hydrogeologic studies, may be considered as part of this determination. Considering the limited number and the depth of the borings drilled for this preliminary assessment, additional borings would be recommended as part of future investigations to confirm the lack of continuous clay layers which would reduce the vertical migration of water from a recharge basin. Exploration should also be conducted to assess the depth to groundwater.

In addition to the borings, field and laboratory testing (including permeability testing) and computer analyses/modeling would be required as part of future investigations in order to provide estimates of the infiltration capacity of the subsurface soils.

8.0 NOTIFICATION AND LIMITATIONS

- 8.1 This investigation did not include a hydrogeologic evaluation, nor assessment of other characteristics of the site which would need to be evaluated to assess the potential for groundwater recharge, such as groundwater quality, groundwater flow direction, land use, etc.

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A26349.01

Page 8

- 8.2 The preliminary assessment provided in this report is based on the results of the limited field exploration and laboratory testing conducted, and interpolation of the subsurface conditions between boring locations. The nature and extent of subsurface variations between borings may not become evident until completion of the additional exploration.
- 8.3 The assessment contained in this report is preliminary in nature and applies only for the project discussed in the “Anticipated Construction”. The use of the information contained in this report for other projects or sites not discussed in section 3.1, Site Location and Description, is not recommended. The entity or entities that use or cause to use this report or any portion thereof for another structure or site not covered by this report shall hold Moore Twining, its officers and employees harmless from any and all claims and provide Moore Twining’s defense in the event of a claim.
- 8.4 Our professional services were performed, our findings obtained, and our recommendations prepared in accordance with generally-accepted engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied.
- 8.5 Reliance on this report by a third party (i.e., that is not a party to our written agreement) is at the party’s sole risk. If the project and/or site are purchased by another party, the purchaser must obtain written authorization and sign an agreement with Moore Twining in order to rely upon the information provided in this report.

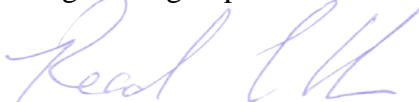
We appreciate the opportunity to be of service to the County of Fresno. If you have any questions regarding this report, or if we can be of further assistance, please contact us at your convenience.

Respectfully Submitted,

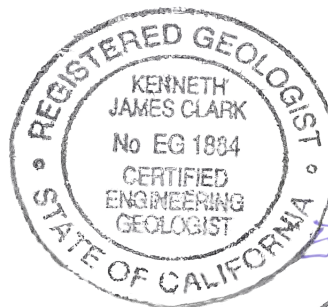
MOORE TWINING ASSOCIATES, INC.
Geotechnical Engineering Division



Kenneth J. Clark, CEG
Engineering Supervisor



Read L. Andersen, RGE
Manager



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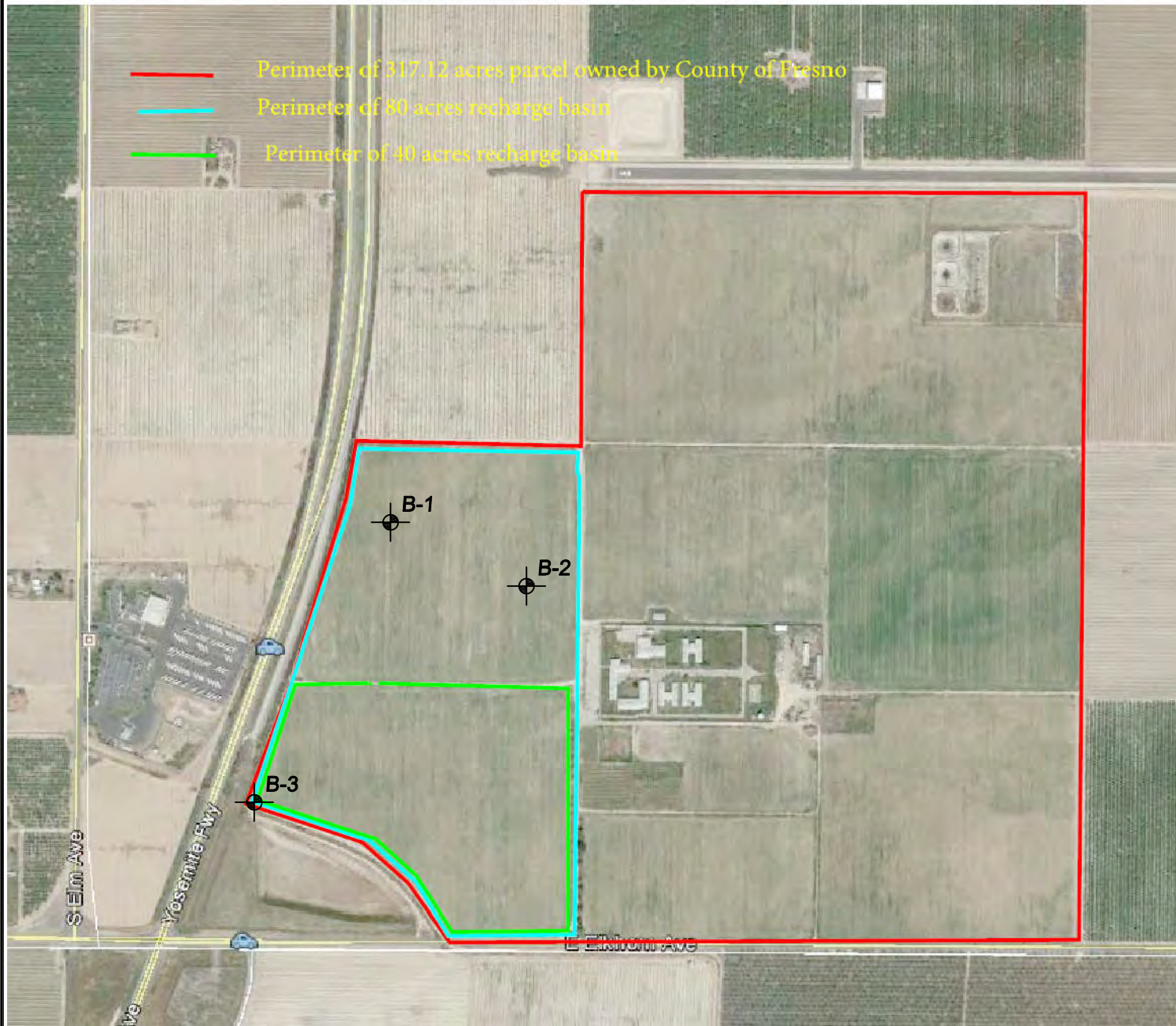
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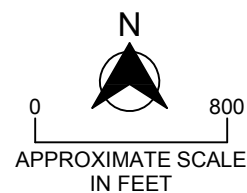
APPENDIX A

DRAWING

Drawing No. 1 - Test Boring Location Map



APPROXIMATE TEST BORING LOCATION



BORING LOCATION MAP
POTENTIAL FRESNO COUNTY DECHARGE BASIN SITE
NEC OF HIGHWAY 41 AND EAST ELKHORN AVENUE
FRESNO COUNTY, CALIFORNIA

FILE NO.
26349-01-01

DRAWN BY:
RM

PROJECT NO.
A26349.01

DATE DRAWN:
05/11/16

APPROVED BY:

DRAWING NO.
1



**MOORE TWINING
ASSOCIATES, INC.**

APPENDIX B**LOGS OF BORINGS**

This appendix contains the final logs of borings. These logs represent our interpretation of the contents of the field log and the results of the field and laboratory tests.

The logs and related information depict subsurface conditions only at these locations and at the particular time designated on the logs. Soil conditions at other locations may differ from conditions occurring at these test boring locations. Also, the passage of time may result in changes in the soil conditions at these test boring locations.

In addition, an explanation of the abbreviations used in the preparation of the log and a description of the Unified Soil Classification System are provided at the end of Appendix B.



Test Boring: B-1

Project: Proposed Assessment of Infiltration Characteristics, Proposed Recharge Basin Site

Project Number: A23649.01

Drilled By: JS

Logged By: JD

Drill Type: CME 75

Date: 4-6-16

Auger Type: 6-5/8" O.D. Hollow Stem

Elevation: N/A

Hammer Type: 140 lb Auto Trip

Depth to Groundwater
First Encountered During Drilling: N/E

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	Remarks	N-Values blows/ft.	Moisture Content %
0	2/6 4/6 4/6	SM	Silty SAND; Loose, damp, fine, light brown		8	
5	5/6 3/6 3/6	SP	Poorly Graded SAND; Loose, damp, fine, light brown		6	
10	1/6 2/6 3/6		Fine to medium, increase in percent sand	=#200=3.3% Sand=96.7%	5	
15	2/6 3/6 5/6				8	
20	2/6 3/6 5/6				8	
25	4/6 5/6 9/6		Medium dense		14	

Notes:

Figure Number



Test Boring: B-1

Project: Proposed Assessment of Infiltration Characteristics, Proposed Recharge Basin Site

Project Number: A23649.01

Drilled By: JS

Logged By: JD

Drill Type: CME 75

Date: 4-6-16

Auger Type: 6-5/8" O.D. Hollow Stem

Elevation: N/A

Hammer Type: 140 lb Auto Trip

Depth to Groundwater

First Encountered During Drilling: N/E

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	Remarks	N-Values blows/ft.	Moisture Content %
30	6/6 12/6 16/6	SM	Silty SAND; Medium dense, moist, fine, brown	#200=46.9% Sand=53.1%	28	
35	16/6 10/6 10/6				20	
40	2/6 3/6 4/6	CL	LEAN CLAY; Medium stiff, moist, low to medium plasticity		7	
45	10/6 11/6 13/6	SP-SM	Poorly Graded SAND, with Silt; Medium dense, damp, fine to medium, light brown		24	
50	7/6 9/6 13/6	SP	Poorly Graded SAND; Medium dense, damp, fine to medium, gray-brown		22	
55	3/6 6/6 8/6	CL-ML	Silty CLAY; Stiff, moist, low plasticity, light brown		14	

Notes:

Figure Number



MOORE TWINING ASSOCIATES, INC.

Test Boring: B-1

Project: Proposed Assessment of Infiltration Characteristics, Proposed Recharge Basin Site

Project Number: A23649.01

Drilled By: JS

Logged By: JD

Drill Type: CME 75

Date: 4-6-16

Auger Type: 6-5/8" O.D. Hollow Stem

Elevation: N/A

Hammer Type: 140 lb Auto Trip

Depth to Groundwater

First Encountered During Drilling: N/E

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	Remarks	N-Values blows/ft.	Moisture Content %
60	10/6 13/6 14/6		Very stiff		27	
65	9/6 10/6 12/6	SM	Silty SAND; medium dense, damp, gray-brown	-#200=34.5% Silt=27.2% Clay=7.3% Sand=65.5% Non-Plastic	22	
70	9/6 13/6 15/6		fine, light brown		28	
75	4/6 7/6 19/6	ML	Sandy SILT; Very stiff, moist, non plastic, light gray-brown	-#200=59.1% Silt=32.6% Clay=26.5% Sand=40.9%	26	
80	12/6 12/6 14/6	SM	Silty SAND; Medium dense, damp, fine to medium, light brown		26	
85				-#200=77.7%	22	

Notes:

Figure Number



Test Boring: B-1

Project: Proposed Assessment of Infiltration Characteristics, Proposed Recharge Basin Site

Project Number: A23649.01

Drilled By: JS

Logged By: JD

Drill Type: CME 75

Date: 4-6-16

Auger Type: 6-5/8" O.D. Hollow Stem

Elevation: N/A

Hammer Type: 140 lb Auto Trip

Depth to Groundwater

First Encountered During Drilling: N/E

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	Remarks	N-Values blows/ft.	Moisture Content %
		CL-ML	Silty CLAY; Very stiff, moist, low plasticity, light brown	Silt=49.6% Clay=28.1% Sand=22.3%		
90		SM	Silty SAND; Medium dense, moist, fine, brown		13	
95		CL	LEAN CLAY, with Sand; Hard, damp, low plasticity, brown		38	
100			Very stiff, increase in percent sand		28	
			Bottom of Boring at 101.5 feet BSG			
105						
110						

Notes:

Figure Number



Test Boring: B-2

Project: Proposed Assessment of Infiltration Characteristics, Proposed Recharge Basin Site

Project Number: A23649.01

Drilled By: JS

Logged By: JD

Drill Type: CME 75

Date: 4-4-16

Auger Type: 6-5/8" O.D. Hollow Stem

Elevation: N/A

Hammer Type: 140 lb Auto Trip

Depth to Groundwater
First Encountered During Drilling: N/E

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	Remarks	N-Values blows/ft.	Moisture Content %
0	2/6 7/6 8/6	SM	Silty SAND; Medium dense, damp, fine, light brown		15	
5	7/6 8/6 7/6	ML	Sandy SILT; Stiff, dry to damp, non plastic, light tan		15	
10	3/6 2/6 5/6	SP	Poorly Graded SAND; Loose, damp, fine to medium, light brown		7	
15	4/6 4/6 4/6				8	
20	4/6 6/6 8/6		Medium dense		14	
25	8/6 5/6 7/6	CL-ML	Silty CLAY; Stiff, moist, low plasticity, gray-brown		12	

Notes:

Figure Number



Test Boring: B-2

Project: Proposed Assessment of Infiltration Characteristics, Proposed Recharge Basin Site

Project Number: A23649.01

Drilled By: JS

Logged By: JD

Drill Type: CME 75

Date: 4-4-16

Auger Type: 6-5/8" O.D. Hollow Stem

Elevation: N/A

Hammer Type: 140 lb Auto Trip

Depth to Groundwater
First Encountered During Drilling: N/E

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	Remarks	N-Values blows/ft.	Moisture Content %
30	12/6 50/5	SM	Silty SAND; Very dense, moist, fine to medium, light green-brown		>50	
35	10/6 16/6 22/6		Dense, brown		38	
40	6/6 13/6 15/6	CL	Sandy LEAN CLAY; Very stiff, moist, non plastic, brown	#200=56.5% Silt=25.5% Clay=31.0% Sand=43.5 PI=25 LL=43	28	
45	9/6 10/6 15/6	SM	Silty SAND; Medium dense, moist, fine, brown		25	
50	6/6 12/6 15/6	SP	Poorly Graded SAND; Medium dense, damp to moist, fine to medium, light brown		27	
55	5/6 9/6 12/6				21	

Notes:

Figure Number



MOORE TWINING ASSOCIATES, INC.

Test Boring: B-2

Project: Proposed Assessment of Infiltration Characteristics, Proposed Recharge Basin Site

Project Number: A23649.01

Drilled By: JS

Logged By: JD

Drill Type: CME 75

Date: 4-4-16

Auger Type: 6-5/8" O.D. Hollow Stem

Elevation: N/A

Hammer Type: 140 lb Auto Trip

Depth to Groundwater

First Encountered During Drilling: N/E

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	Remarks	N-Values blows/ft.	Moisture Content %
60	5/6 8/6 9/6				17	
65	3/6 5/6 11/6				16	
70	9/6 13/6 13/6	SM	Silty SAND; Medium dense, moist, fine, brown, high silt content		26	
75	7/6 12/6 15/6	SP	Poorly Graded SAND; Medium dense, damp, fine to medium, brown		27	
80	11/6 18/6 22/6		Dense, light brown		40	
85					38	

Notes:

Figure Number



MOORE TWINING ASSOCIATES, INC.

Test Boring: B-2

Project: Proposed Assessment of Infiltration Characteristics, Proposed Recharge Basin Site

Project Number: A23649.01

Drilled By: JS

Logged By: JD

Drill Type: CME 75

Date: 4-4-16

Auger Type: 6-5/8" O.D. Hollow Stem

Elevation: N/A

Hammer Type: 140 lb Auto Trip

Depth to Groundwater

First Encountered During Drilling: N/E

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	Remarks	N-Values blows/ft.	Moisture Content %
90	12/6 16/6 22/6		Fine			
95	14/6 15/6 14/6	ML	Sandy SILT; Very stiff, moist, non plastic, gray-brown		29	
100	5/6 2/6 4/6	CL	LEAN CLAY, with Sand; Medium stiff, moist, low plasticity, light brown	#200=70.9% Silt=41.1% Clay=29.8% Sand=29.1%	6	
105	7/6 8/6 12/6	SP-SM	Poorly Graded SAND, with Silt; Medium dense, damp to moist, fine to medium, light brown		20	
110	8/6 11/6 12/6				23	
	6/6 11/6 13/6	SP	Poorly Graded SAND; Medium dense, damp to moist, fine to medium, light brown		24	

Notes:

Figure Number



Test Boring: B-2

Project: Proposed Assessment of Infiltration Characteristics, Proposed Recharge Basin Site

Project Number: A23649.01

Drilled By: JS

Logged By: JD

Drill Type: CME 75

Date: 4-4-16

Auger Type: 6-5/8" O.D. Hollow Stem

Elevation: N/A

Hammer Type: 140 lb Auto Trip

Depth to Groundwater

First Encountered During Drilling: N/E

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	Remarks	N-Values blows/ft.	Moisture Content %
115	7/6 13/6 13/6				26	
120	5/6 12/6 15/6				27	
125	7/6 13/6 15/6				28	
130	8/6 13/6 14/6				27	
135	3/6 3/6 8/6	CL	LEAN CLAY with Sand; Stiff, moist, low plasticity, brown	-#200=74.0% Silt=45.6% Clay=28.4% Sand=26.0% PI=22 LL=38	11	
140	10/6 10/6 16/6		Very stiff, very moist	-#200=60.1% Silt=33.8% Clay=26.3% Sand=39.9%	26	

Notes:

Figure Number



MOORE TWINING ASSOCIATES, INC.

Test Boring: B-2

Project: Proposed Assessment of Infiltration Characteristics, Proposed Recharge Basin Site

Project Number: A23649.01

Drilled By: JS

Logged By: JD

Drill Type: CME 75

Date: 4-4-16

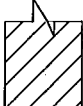
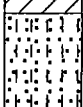
Auger Type: 6-5/8" O.D. Hollow Stem

Elevation: N/A

Hammer Type: 140 lb Auto Trip

Depth to Groundwater

First Encountered During Drilling: N/E

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	Remarks	N-Values blows/ft.	Moisture Content %
145	 11/6 19/6 19/6	SP-SM	Poorly Graded SAND with Silt; Dense, damp, fine to medium, light brown	#200=8.5% Sand=9.3% Gravel=1.2%	38	
150	 10/6 18/6 19/6					
			Bottom of Boring at 151.5 feet BSG			
155						
160						
165						
170						

Notes:

Figure Number



MOORE TWINING ASSOCIATES, INC.

Test Boring: B-3

Project: Proposed Assessment of Infiltration Characteristics, Proposed Recharge Basin Site

Project Number: A23649.01

Drilled By: JS

Logged By: JD

Drill Type: CME 75

Date: 4-5-16

Auger Type: 6-5/8" O.D. Hollow Stem

Elevation: N/A

Hammer Type: 140 lb Auto Trip

Depth to Groundwater

First Encountered During Drilling: N/E

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	Remarks	N-Values blows/ft.	Moisture Content %
0	5/6 7/6 10/6	SM	Silty SAND; Medium dense, damp, fine to medium, brown		17	
5	7/6 9/6 7/6	CL	LEAN CLAY with Sand; Stiff, moist, low plasticity, brown	#200=79.6% Silt=52.7% Clay=26.9% Sand=20.4% PI=33 LL=49	16	
10	4/6 5/6 7/6	SM	Silty SAND; Medium dense, damp, fine, light brown		12	
15	3/6 3/6 3/6	SP	Poorly Graded SAND; Loose, damp, fine to medium, light brown		6	
20	3/6 1/6 2/6		Very loose, gray-brown		3	
25	3/6 4/6 6/6		Loose, fine to coarse		10	

Notes:

Figure Number



Test Boring: B-3

Project: Proposed Assessment of Infiltration Characteristics, Proposed Recharge Basin Site

Project Number: A23649.01

Drilled By: JS

Logged By: JD

Drill Type: CME 75

Date: 4-5-16

Auger Type: 6-5/8" O.D. Hollow Stem

Elevation: N/A

Hammer Type: 140 lb Auto Trip

Depth to Groundwater

First Encountered During Drilling: N/E

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	Remarks	N-Values blows/ft.	Moisture Content %
30	7/6 19/6 26/6	SM	Silty SAND; Medium dense, damp, fine, light brown, high silt content		45	
35	6/6 4/6 4/6	SC	Clayey SAND; Loose, moist, fine to medium, brown	#200=31.9% Sand=67.3% Gravel=0.8%	8	
40	3/6 3/6 6/9	SM	Silty SAND; Loose, moist, fine, brown	#200=39.4% Silt=25.1% Clay=14.3% Sand=60.6%	9	
45	3/6 2/6 3/6				5	
50	8/6 17/6 20/6	CL-ML	Silty CLAY; Very stiff, moist, low plasticity, brown	#200=86.4% Silt=49.5% Clay=36.9% Sand=16.6%	37	
55	7/6 9/6 7/6		Increase in percent sand		16	

Notes:

Figure Number



MOORE TWINING ASSOCIATES, INC.

Test Boring: B-3

Project: Proposed Assessment of Infiltration Characteristics, Proposed Recharge Basin Site

Project Number: A23649.01

Drilled By: JS

Logged By: JD

Drill Type: CME 75

Date: 4-5-16







Auger Type: 6-5/8" O.D. Hollow Stem

Elevation: N/A

Hammer Type: 140 lb Auto Trip

Depth to Groundwater

First Encountered During Drilling: N/E

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	Remarks	N-Values blows/ft.	Moisture Content %
60	 3/6 5/6 6/6	CL-ML	Sandy Silty CLAY; stiff, moist, low plasticity, brown	#200=66.5% Silt=36.4% Clay=30.1% Sand=33.5%	11	
65	 6/6 9/6 11/6	SP	Poorly Graded SAND; Medium dense, damp, fine to medium, light brown		20	
70	 8/6 13/6 22/6				35	
75	 6/6 17/6 25/6		Dense, fine, gray-brown		42	
80	 7/6 10/6 12/6		Medium dense, fine to medium, light brown		22	
85					11	

Notes:

Figure Number



MOORE TWINING ASSOCIATES, INC.

Test Boring: B-3

Project: Proposed Assessment of Infiltration Characteristics, Proposed Recharge Basin Site

Project Number: A23649.01

Drilled By: JS

Logged By: JD

Drill Type: CME 75

Date: 4-5-16

Auger Type: 6-5/8" O.D. Hollow Stem

Elevation: N/A

Hammer Type: 140 lb Auto Trip

Depth to Groundwater

First Encountered During Drilling: N/E

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	Remarks	N-Values blows/ft.	Moisture Content %
90	3/6 5/6 6/6					
95	7/6 8/6 10/6				18	
95	7/6 10/6 16/6	CL	Sandy Lean CLAY; Very stiff, moist, low plasticity, light brown	-#200=55.3% Silt=33.9% Clay=21.4% Sand=44.7%	26	
100	6/6 8/6 12/6	SM	Silty SAND; Medium dense, damp to moist, fine light brown		20	
			Bottom of Boring at 101.5 feet BSG			
105						
110						

Notes:

Figure Number

KEY TO SYMBOLS

Symbol Description

Symbol Description

Strata symbols



Silty sand



Poorly graded sand



Low plasticity clay



Poorly graded sand with silt



Silty low plasticity clay



Silt



Clayey sand

Misc. Symbols



Boring continues

Soil Samplers



Standard penetration test



California Modified split barrel ring sampler

Notes:

1. Test borings were drilled on April 4, 5 and 6, 2016 using a CME 75 drill rig equipped with 6-5/8" Hollow-Stem Augers.
2. Groundwater was not encountered to the maximum depth of the borings.
3. Test boring locations were located by pacing or measuring tape with reference to the existing features.
4. These logs are subject to the limitations, conclusions, and recommendations in this report, or by surveying performed by others.
5. The "N-Value" reported for the California Modified Split Barrel Sampler is the uncorrected field blow count. This value should not be interpreted as an SPT equivalent N-value.
6. Results of tests conducted on samples recovered are reported on the logs. Abbreviations used are:

DD =	Natural dry density (pcf)	LL =	Liquid Limit (%)
UC =	Unconfined compression (psf)	PI =	Plasticity Index (%)
-4 =	Percent passing #4 sieve (%)	pH =	Soil pH
-200 =	Percent passing #200 sieve (%)	SS =	Soluble sulfates (%)
SR =	Soil resistivity (ohm-cm)	Cl =	Soluble chlorides (%)
c =	Cohesion (psf)	ø =	Angle of internal friction (degrees)
TS =	Field Torvane Shear Strength test (tons per square foot)	N/A =	Not applicable
pcf =	pounds per cubic foot	N/E =	Not encountered
psf =	pounds per square foot	AMSL =	Above Mean Sea Level

APPENDIX C**RESULTS OF LABORATORY TESTS**

This appendix contains the individual results of the following tests. The results of the moisture content and dry density tests are included on the test boring logs in Appendix B. These data, along with the field observations, were used to prepare the final test boring logs in Appendix B.

These Included:**To Determine:**

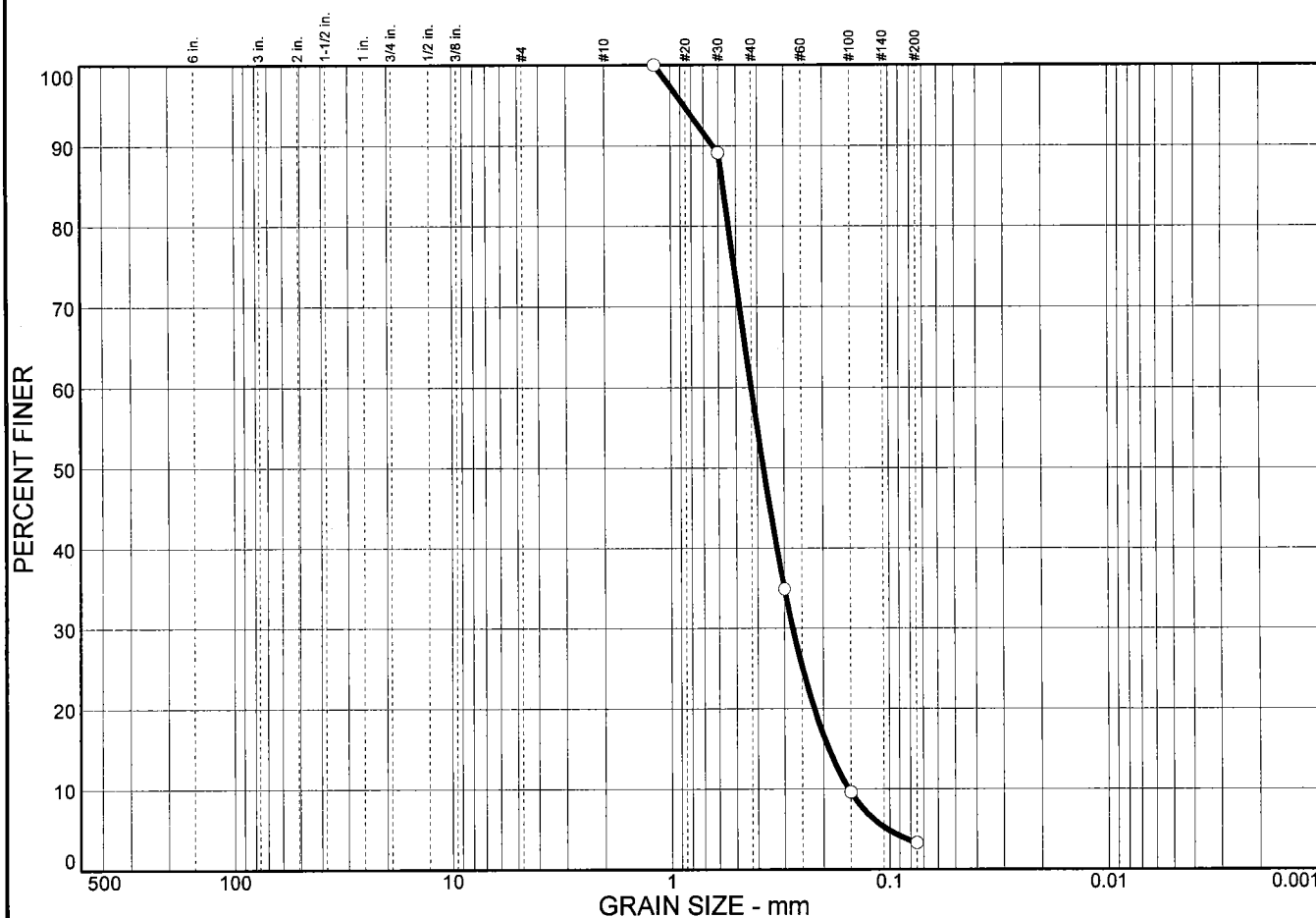
Atterberg Limits
(ASTM D4318)

The consistency and "stickiness," as well as the range of moisture contents within which the material is "workable.

Grain-Size
Distribution
(ASTM D422)

Size and distribution of soil particles, i.e., sand, gravel and fines (silt and clay).

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	96.7	3.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#16	100.0		
#30	89.1		
#50	34.9		
#100	9.6		
#200	3.3		

* (no specification provided)

Material Description
 Poorly graded sand

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₈₅= 0.573 D₆₀= 0.426 D₅₀= 0.375
 D₃₀= 0.275 D₁₅= 0.189 D₁₀= 0.153
 C_u= 2.78 C_c= 1.16

Classification
 USCS= SP AASHTO=

Remarks

Sample No.: B-1
Location:

Source of Sample:

Date: 4/4/16
Elev./Depth: 10-11.5'

Moore Twining Associates, Inc.

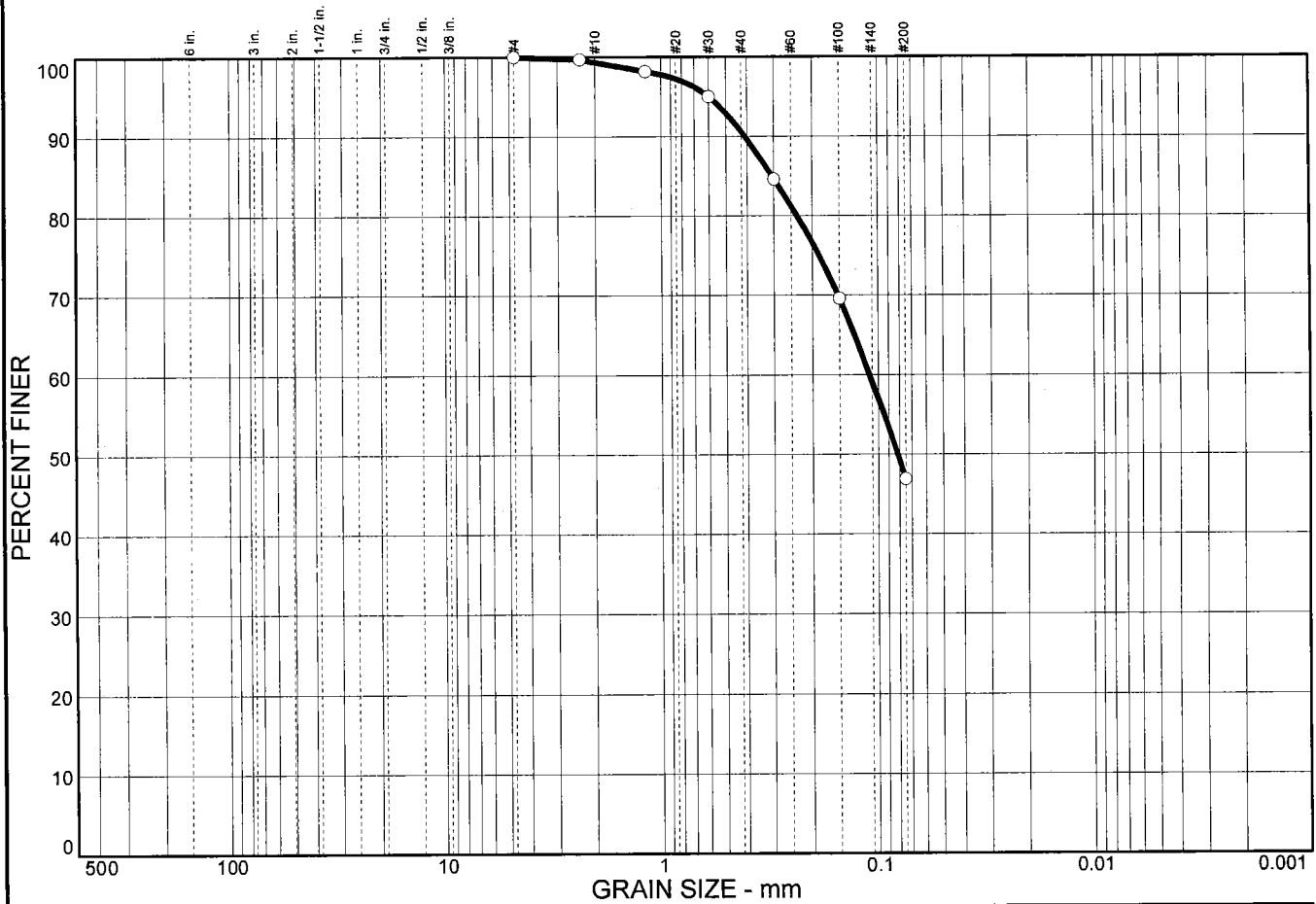
Fresno, CA

Client:
Project: Proposed Recharge Basin Site

Project No: A26349.01

Figure

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	53.1	46.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	99.7		
#16	98.2		
#30	95.0		
#50	84.6		
#100	69.6		
#200	46.9		

Material Description

Silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 0.307 D₆₀= 0.109 D₅₀= 0.0819
D₃₀= D₁₅= D₁₀=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

* (no specification provided)

Sample No.: B-1
Location:

Source of Sample:

Date: 4/4/16
Elev./Depth: 30-31.5'

Moore Twining Associates, Inc.
Fresno, CA

Client:
Project: Proposed Recharge Basin Site
Project No: A26349.01

Figure

The graph displays the grain size distribution for a sand sample. The x-axis represents the grain size in millimeters on a logarithmic scale, ranging from 500 mm to 0.001 mm. The y-axis represents the percent finer, ranging from 0 to 100. The curve starts at 100% finer for grain sizes down to approximately 4.75 mm, then drops sharply between 0.85 mm and 0.075 mm, and finally levels off towards 0% finer for grain sizes below 0.0075 mm.

Grain Size (mm)	Percent Finer (%)
4.75	100
2.5	100
1.18	100
0.85	88
0.425	35
0.25	25
0.15	22
0.106	19
0.075	16
0.05	12
0.03	8
0.02	5
0.015	3
0.0075	1

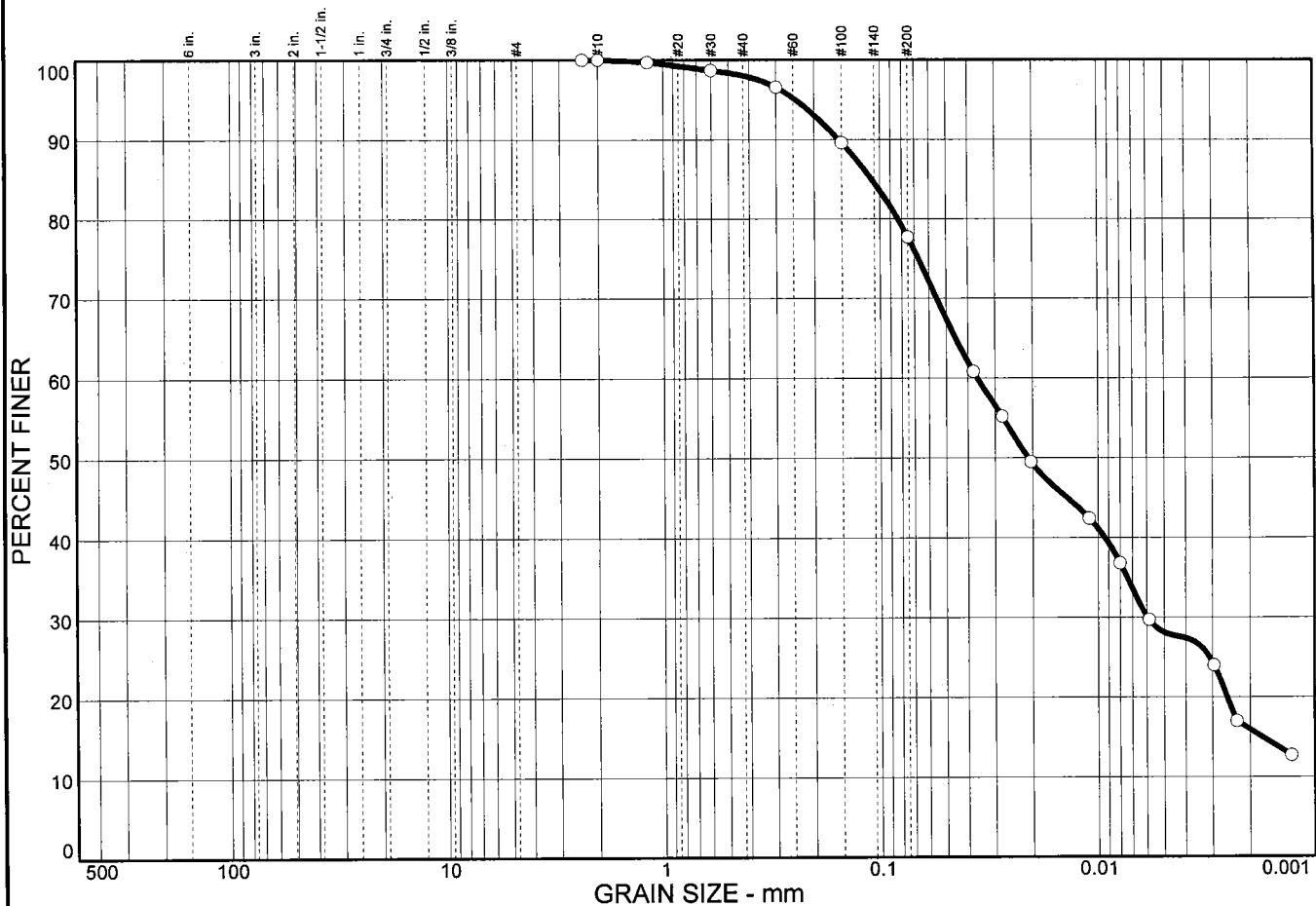
Figure

The graph illustrates the grain size distribution of a soil sample. The y-axis represents the percentage of soil finer than a given grain size, ranging from 0 to 100. The x-axis represents the grain size in millimeters, on a logarithmic scale from 500 mm to 0.001 mm. The curve shows that approximately 100% of the soil is finer than 500 mm, and the percentage finer decreases as the grain size decreases, reaching about 12% finer for 0.001 mm.

Grain Size (mm)	Percent Finer (%)
500	100
100	100
60	100
40	100
30	100
20	100
10	100
6	100
4.75	100
2.5	100
2.0	100
1.5	100
1.18	100
0.85	100
0.6	100
0.425	100
0.3	100
0.25	100
0.2	100
0.15	100
0.106	100
0.075	100
0.053	100
0.0375	100
0.025	100
0.018	100
0.015	100
0.0106	100
0.0075	100
0.0053	100
0.00375	100
0.0025	100
0.0018	100
0.0015	100
0.00106	100
0.00075	100
0.00053	100
0.000375	100
0.00025	100
0.00018	100
0.00015	100
0.000106	100
0.000075	100
0.000053	100
0.0000375	100
0.000025	100
0.000018	100
0.000015	100
0.0000106	100
0.0000075	100
0.0000053	100
0.00000375	100
0.0000025	100
0.0000018	100
0.0000015	100
0.00000106	100
0.00000075	100
0.00000053	100
0.000000375	100
0.00000025	100
0.00000018	100
0.00000015	100
0.000000106	100
0.000000075	100
0.000000053	100
0.0000000375	100
0.000000025	100
0.000000018	100
0.000000015	100
0.0000000106	100
0.0000000075	100
0.0000000053	100
0.00000000375	100
0.0000000025	100
0.0000000018	100
0.0000000015	100
0.00000000106	100
0.00000000075	100
0.00000000053	100
0.000000000375	100
0.00000000025	100
0.00000000018	100
0.00000000015	100
0.000000000106	100
0.000000000075	100
0.000000000053	100
0.0000000000375	100
0.000000000025	100
0.000000000018	100
0.000000000015	100
0.0000000000106	100
0.0000000000075	100
0.0000000000053	100
0.00000000000375	100
0.0000000000025	100
0.0000000000018	100
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0.00000000000053	100
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0.000000000000025	100
0.000000000000018	100
0.000000000000015	100
0.0000000000000106	100
0.0000000000000075	100
0.0000000000000053	100
0.00000000000000375	100
0.0000000000000025	100
0.0000000000000018	

Figure

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	22.3	49.6	28.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#8	100.0		
#10	100.0		
#16	99.7		
#30	98.7		
#50	96.6		
#100	89.6		
#200	77.7		

* (no specification provided)

Material Description
Silty clay with sand

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₈₅= 0.109 D₆₀= 0.0363 D₅₀= 0.0210
 D₃₀= 0.0060 D₁₅= 0.0018 D₁₀=
 C_u= C_c=

Classification
 USCS= CL-ML AASHTO=

Remarks

Sample No.: B-1
Location:

Source of Sample:

Date: 4/4/16
Elev./Depth: 85-86.5'

Moore Twining Associates, Inc.

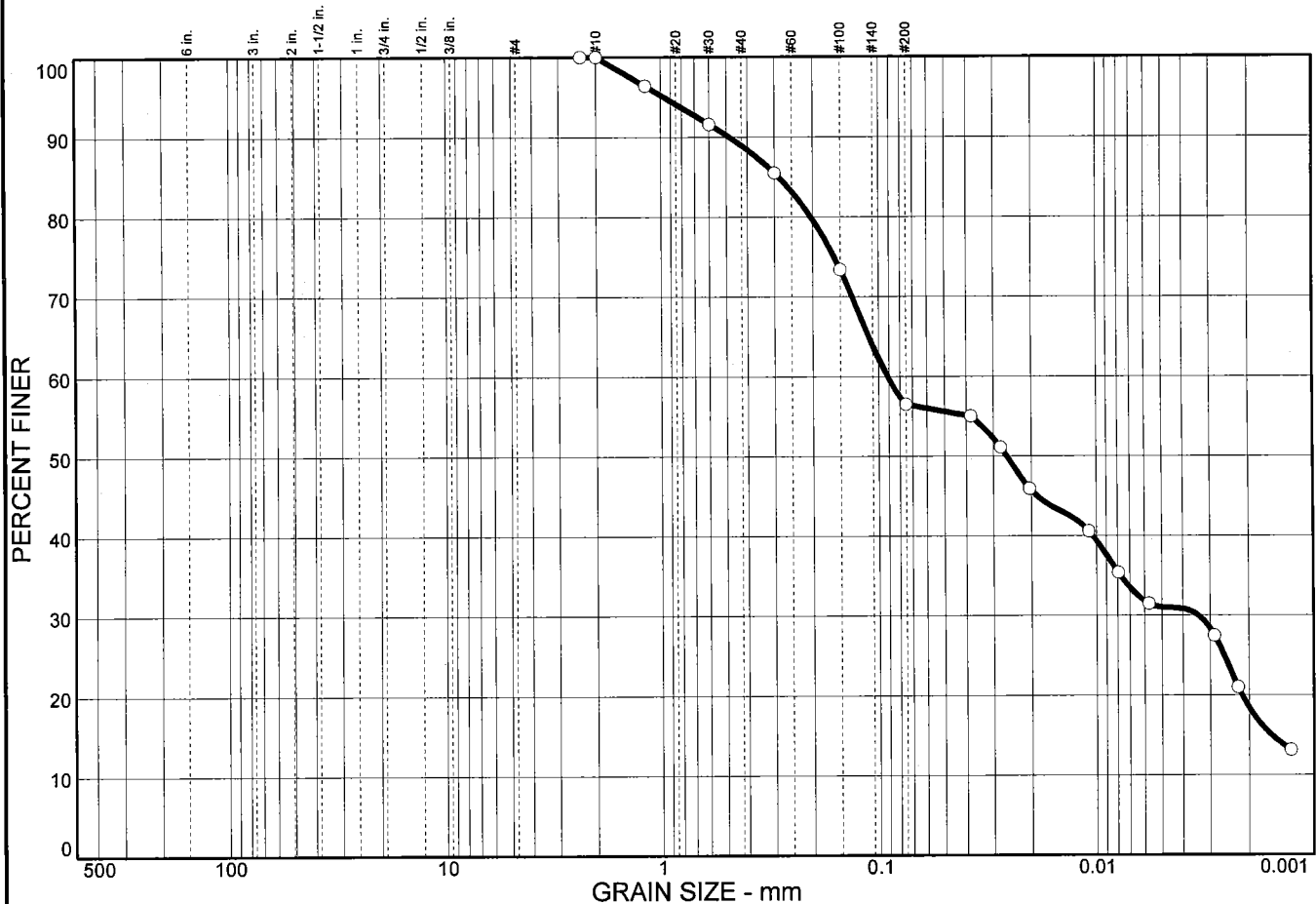
Fresno, CA

Client:
Project: Proposed Recharge Basin Site

Project No: A26349.01

Figure

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	43.5	25.5	31.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#8	100.0		
#10	100.0		
#16	96.4		
#30	91.6		
#50	85.5		
#100	73.4		
#200	56.5		

* (no specification provided)

Material Description

Sandy lean clay

Atterberg Limits

PL= 18

LL= 43

PI= 25

Coefficients

D₈₅= 0.287

D₆₀= 0.0913

D₅₀= 0.0260

D₃₀= 0.0034

D₁₅= 0.0016

D₁₀=

C_u=

C_c=

Classification

USCS= CL

AASHTO=

Remarks

Sample No.: B-2

Location:

Source of Sample:

Date: 4/4/16

Elev./Depth: 40-41.5'

Moore Twining Associates, Inc.

Fresno, CA

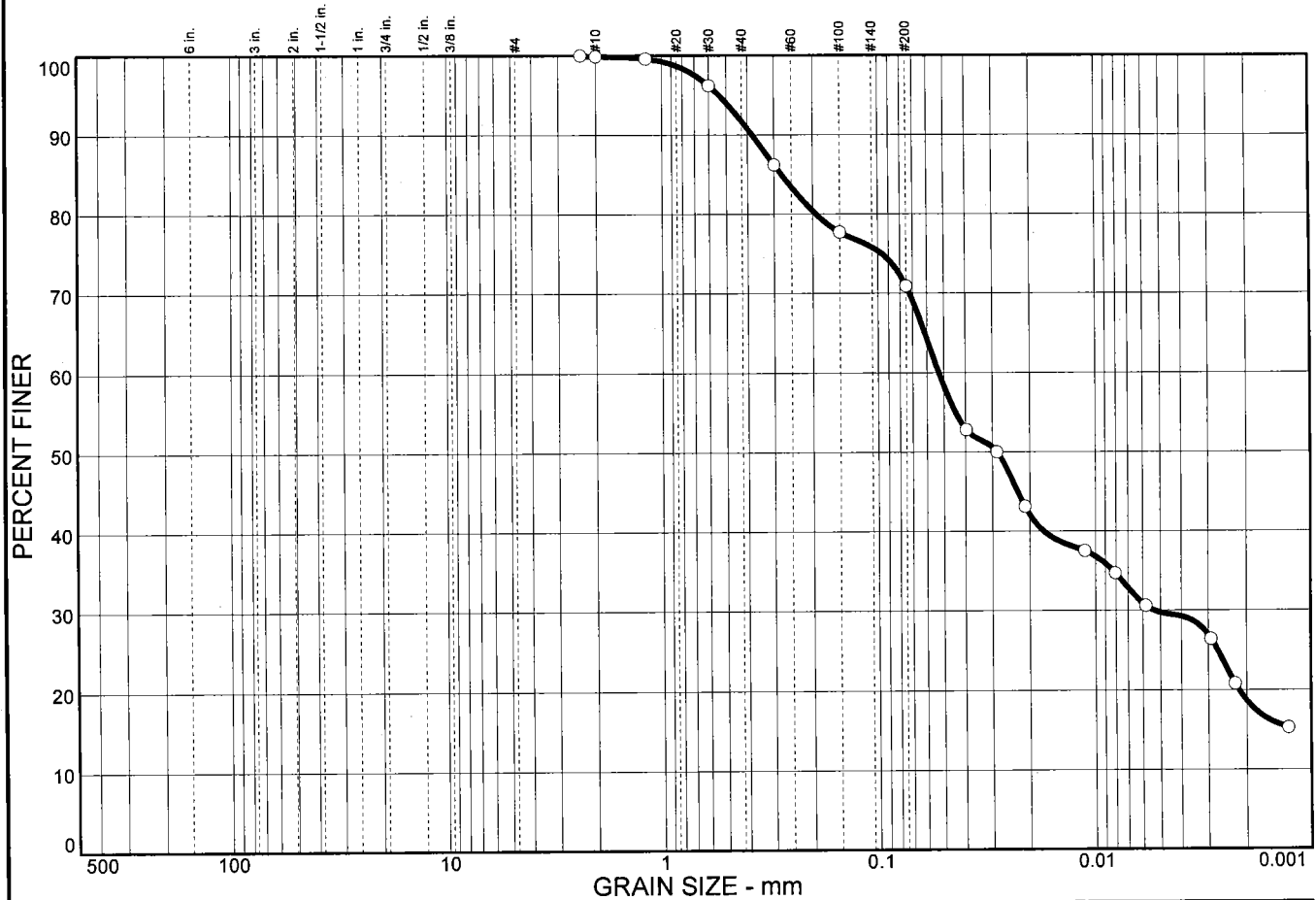
Client:

Project: Proposed Recharge Basin Site

Project No: A26349.01

Figure

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	29.1	41.1	29.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#8	100.0		
#10	99.9		
#16	99.6		
#30	96.2		
#50	86.2		
#100	77.7		
#200	70.9		

* (no specification provided)

Material Description
Lean clay with sand

Atterberg Limits
PL= LL= PI=

Coefficients
D₈₅= 0.278 D₆₀= 0.0528 D₅₀= 0.0285
D₃₀= 0.0053 D₁₅= D₁₀=
C_u= C_c=

Classification
USCS= CL AASHTO=

Remarks

Sample No.: B-2
Location:

Source of Sample:

Date: 4/4/16
Elev./Depth: 95-96.5'

Moore Twining Associates, Inc.

Fresno, CA

Client:
Project: Proposed Recharge Basin Site

Project No: A26349.01

Figure

The graph illustrates the grain size distribution of a soil sample. The y-axis represents the percentage of soil finer than a given grain size, ranging from 0 to 100. The x-axis represents the grain size in millimeters, on a logarithmic scale from 500 mm to 0.001 mm. The curve shows that approximately 100% of the soil is finer than 500 mm, and the percentage finer decreases as the grain size decreases, reaching about 13% finer for 0.001 mm.

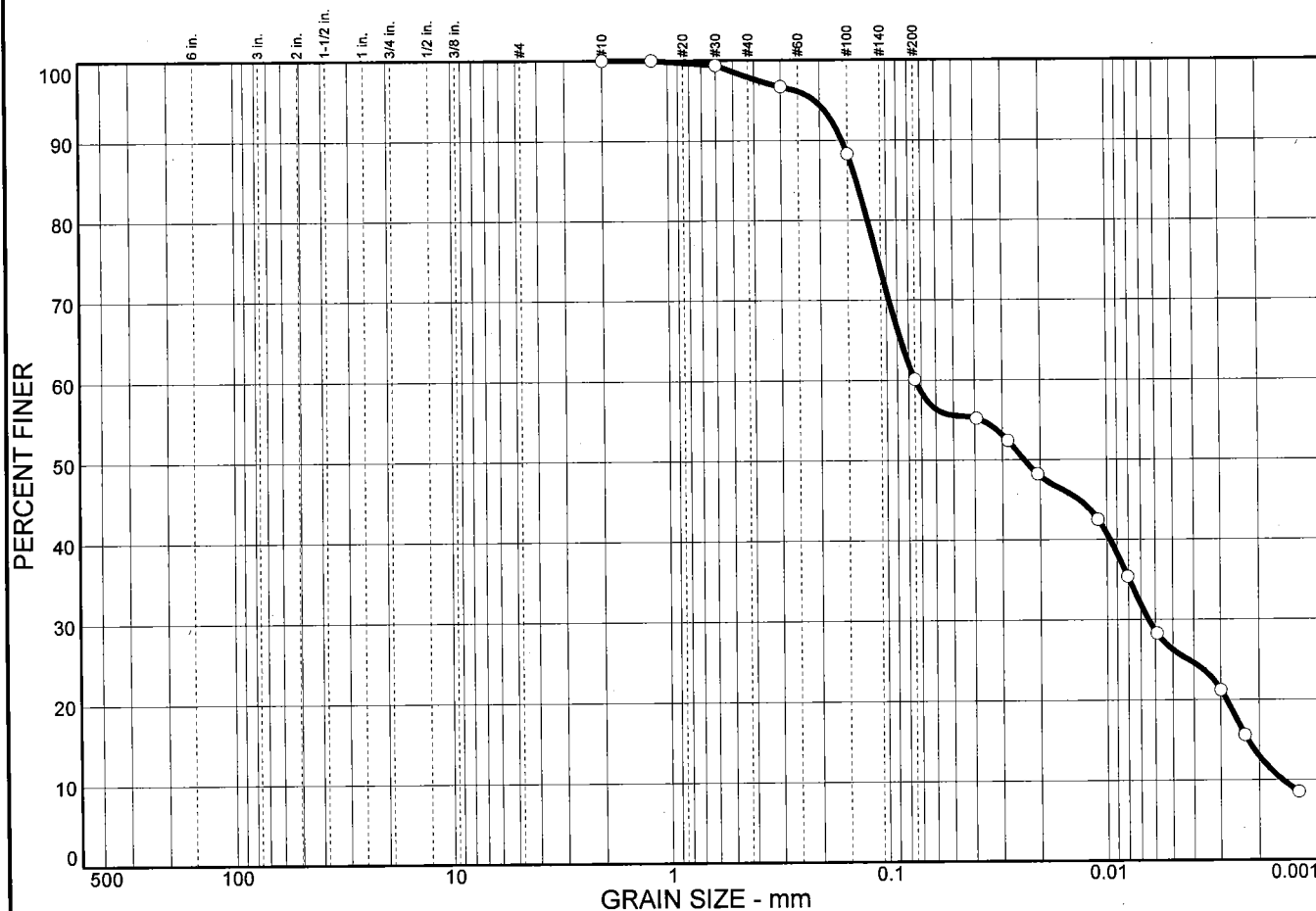
Grain Size (mm)	Percent Finer (%)
500	100
250	100
150	100
100	100
75	100
60	100
47.5	100
37.5	100
30	100
25	100
20	100
15	100
12.5	100
10	100
7.5	100
6	100
4.75	100
3.75	100
3	100
2.5	100
2	100
1.5	100
1.18	100
0.85	100
0.75	100
0.6	100
0.425	100
0.3	100
0.25	100
0.2	100
0.15	100
0.106	100
0.075	100
0.06	100
0.05	100
0.0425	100
0.0375	100
0.03	100
0.025	100
0.02	100
0.015	100
0.0106	100
0.0075	100
0.006	100
0.005	100
0.00425	100
0.00375	100
0.003	100
0.0025	100
0.002	100
0.0015	100
0.00106	100
0.00075	100
0.0006	100
0.0005	100
0.000425	100
0.000375	100
0.0003	100
0.00025	100
0.0002	100
0.00015	100
0.000106	100
0.000075	100
0.00006	100
0.00005	100
0.0000425	100
0.0000375	100
0.00003	100
0.000025	100
0.00002	100
0.000015	100
0.0000106	100
0.0000075	100
0.000006	100
0.000005	100
0.00000425	100
0.00000375	100
0.000003	100
0.0000025	100
0.000002	100
0.0000015	100
0.00000106	100
0.00000075	100
0.0000006	100
0.0000005	100
0.000000425	100
0.000000375	100
0.0000003	100
0.00000025	100
0.0000002	100
0.00000015	100
0.000000106	100
0.000000075	100
0.00000006	100
0.00000005	100
0.0000000425	100
0.0000000375	100
0.00000003	100
0.000000025	100
0.00000002	100
0.000000015	100
0.0000000106	100
0.0000000075	100
0.000000006	100
0.000000005	100
0.00000000425	100
0.00000000375	100
0.000000003	100
0.0000000025	100
0.000000002	100
0.0000000015	100
0.00000000106	100
0.00000000075	100
0.0000000006	100
0.0000000005	100
0.000000000425	100
0.000000000375	100
0.0000000003	100
0.00000000025	100
0.0000000002	100
0.00000000015	100
0.000000000106	100
0.000000000075	100
0.00000000006	100
0.00000000005	100
0.0000000000425	100
0.0000000000375</	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	100.0		
#30	99.5		
#50	98.0		
#100	90.9		
#200	74.0		

Remarks

Figure

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	39.9	33.8	26.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	100.0		
#30	99.4		
#50	96.7		
#100	88.3		
#200	60.1		

* (no specification provided)

Material Description
Lean clay with sand

Atterberg Limits
PL= LL= PI=

Coefficients
D₈₅= 0.137 D₆₀= 0.0747 D₅₀= 0.0237
D₃₀= 0.0064 D₁₅= 0.0023 D₁₀= 0.0016
C_u= 47.79 C_c= 0.36

Classification
USCS= CL AASHTO=

Remarks

Sample No.: B-2
Location:

Source of Sample:

Date: 4/4/16
Elev./Depth: 140-141.5'

Moore Twining Associates, Inc.

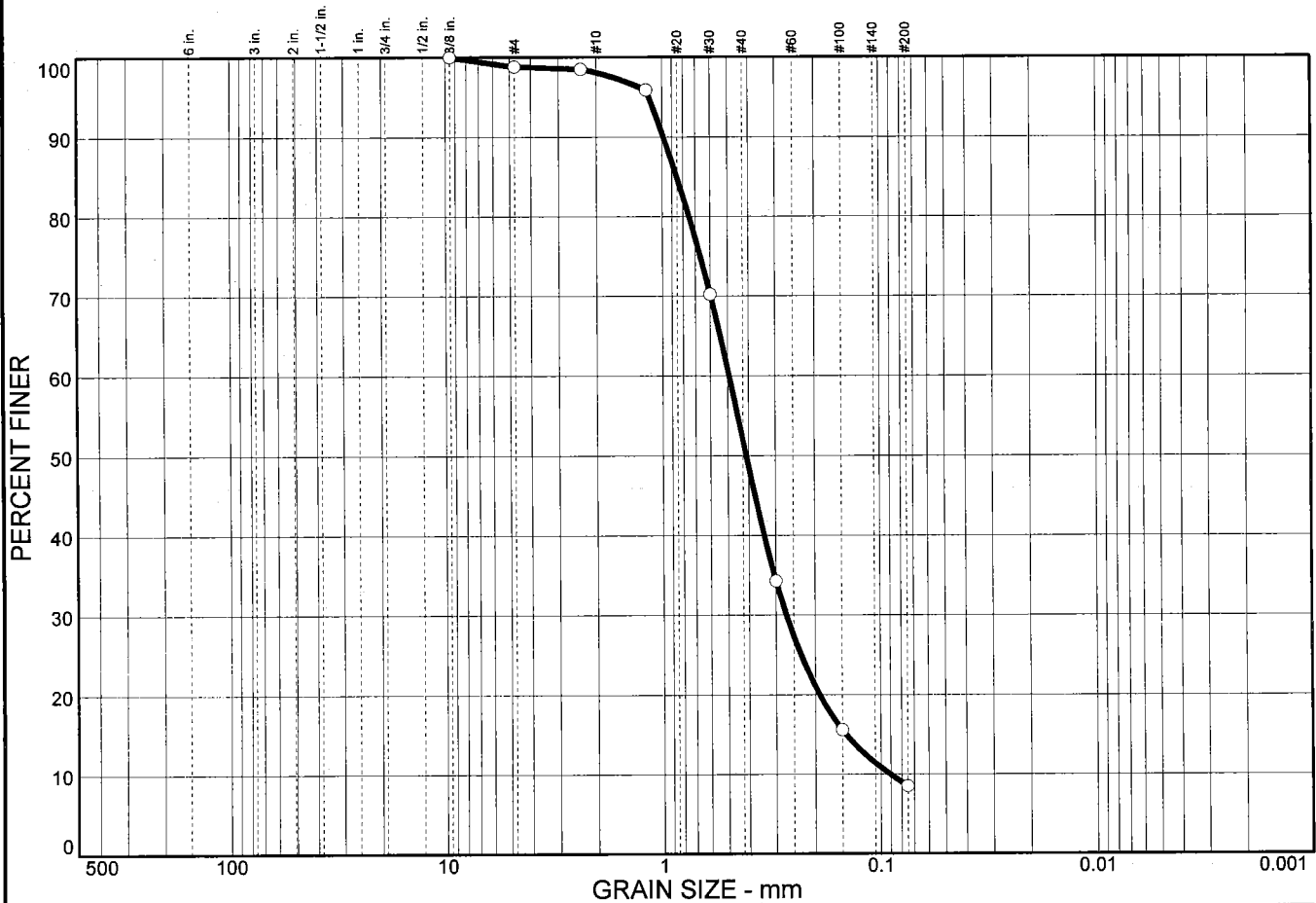
Fresno, CA

Client:
Project: Proposed Recharge Basin Site

Project No: A26349.01

Figure

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	1.2	90.3	8.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8 in.	100.0		
#4	98.8		
#8	98.5		
#16	95.9		
#30	70.2		
#50	34.3		
#100	15.6		
#200	8.5		

* (no specification provided)

Material Description
 Poorly graded sand with silt

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₈₅= 0.854 D₆₀= 0.493 D₅₀= 0.411
 D₃₀= 0.269 D₁₅= 0.144 D₁₀= 0.0906
 C_u= 5.44 C_c= 1.63

Classification
 USCS= SP-SM AASHTO=

Remarks

Sample No.: B-2
Location:

Source of Sample:

Date: 4/4/16
Elev./Depth: 145-146.5'

Moore Twining Associates, Inc.

Fresno, CA

Client:
Project: Proposed Recharge Basin Site

Project No: A26349.01

Figure

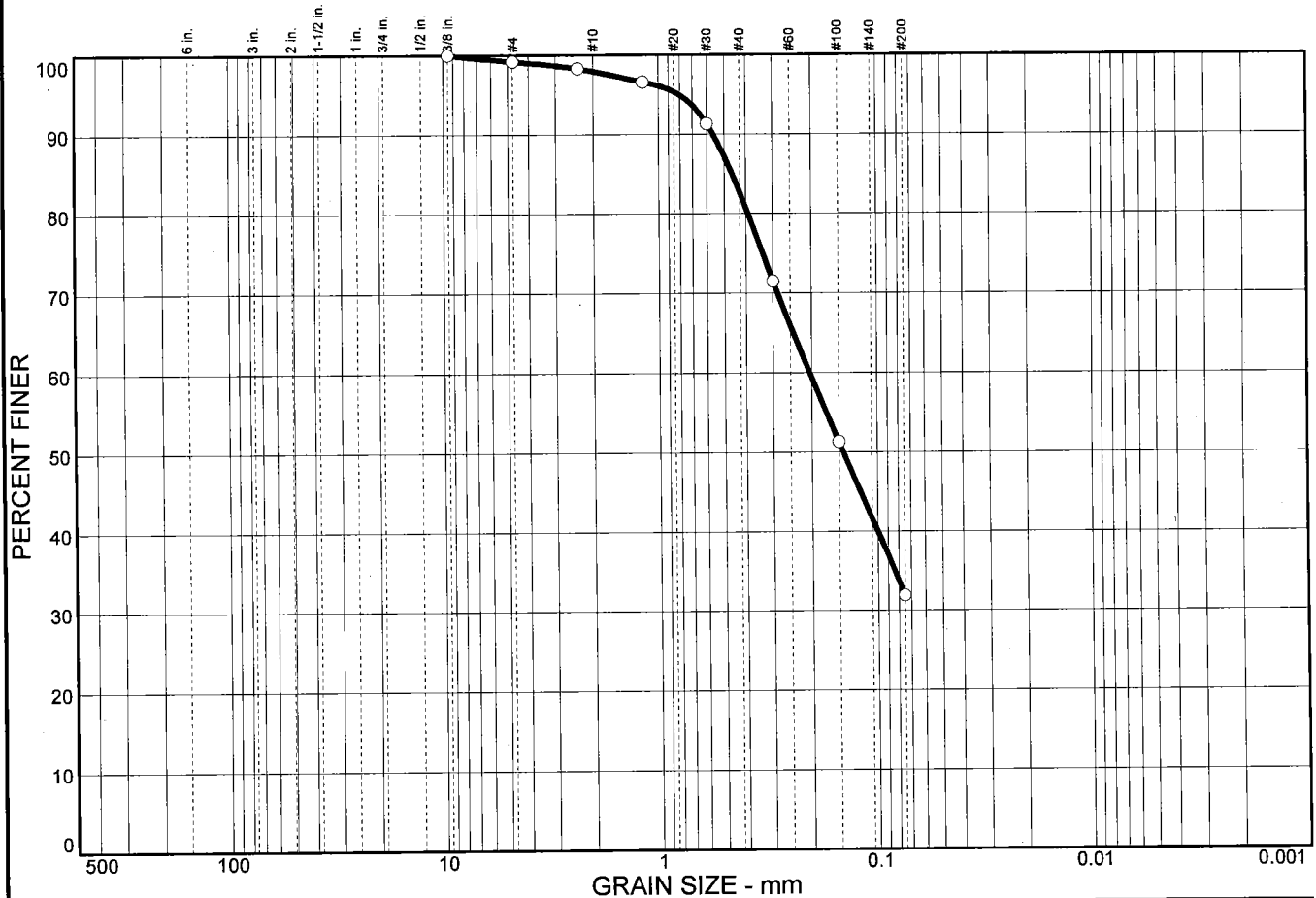
The following table represents the data points estimated from the grain size distribution curve:

Grain Size (mm)	Percent Finer (%)
4.75	100
2.0	100
0.85	100
0.425	100
0.3	100
0.25	98
0.15	92
0.106	80
0.075	56
0.06	53
0.0425	48
0.03	45
0.025	43
0.015	36
0.0106	29
0.0075	27
0.006	25
0.00425	21
0.003	18
0.0025	15

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#8	100.0		
#10	99.9		
#16	99.8		
#30	99.2		
#50	96.5		
#100	91.2		
#200	79.6		

Figure

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.8	67.3	31.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8 in.	100.0		
#4	99.2		
#8	98.3		
#16	96.6		
#30	91.3		
#50	71.5		
#100	51.3		
#200	31.9		

* (no specification provided)

Material Description

Clayey sand

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 0.462 D₆₀= 0.204 D₅₀= 0.143

D₃₀= D₁₅= D₁₀=

C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

Sample No.: B-3
Location:

Source of Sample:

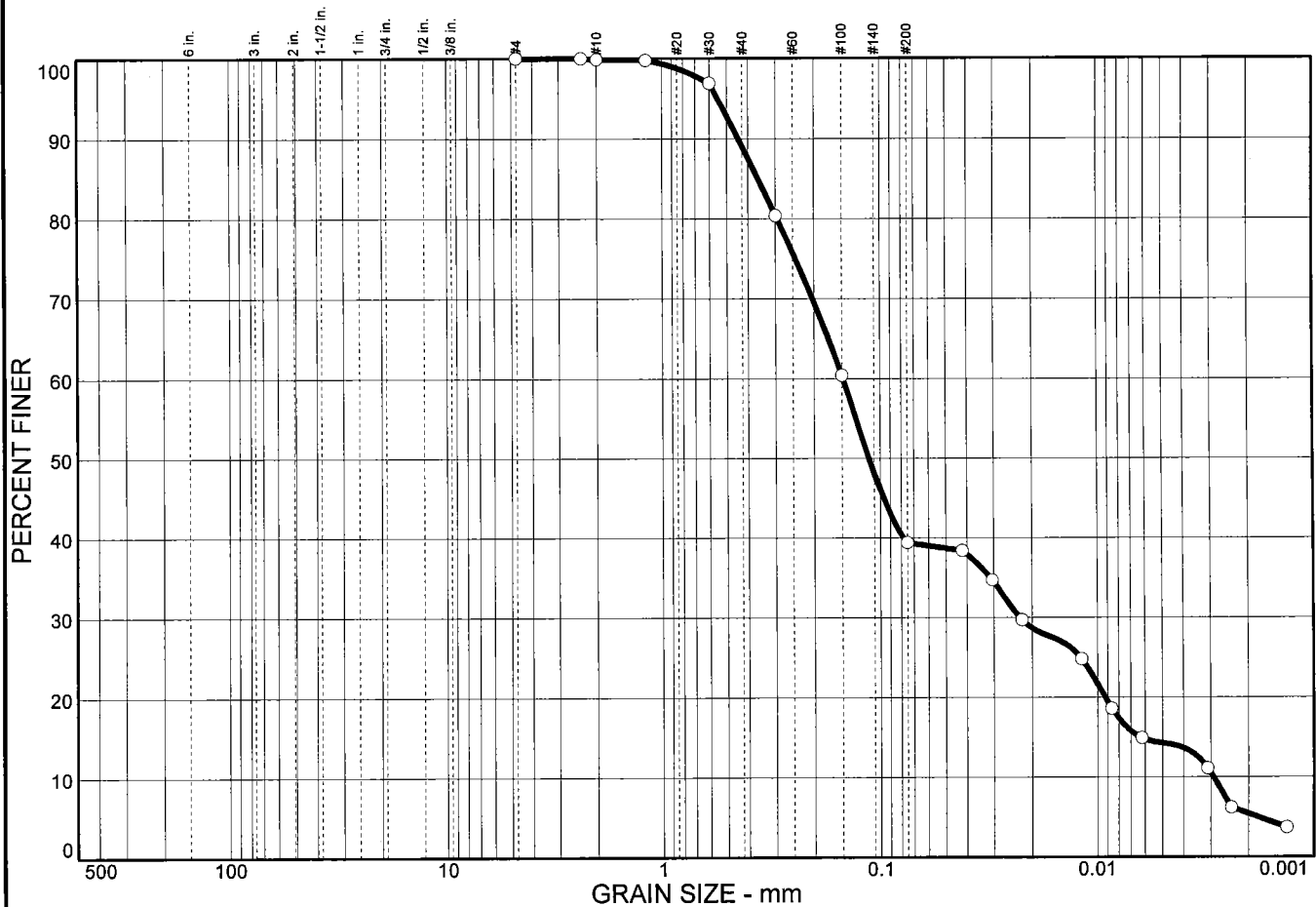
Date: 4/4/16
Elev./Depth: 35-36.5'

Moore Twining Associates, Inc.
Fresno, CA

Client:
Project: Proposed Recharge Basin Site
Project No: A26349.01

Figure

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	60.6	25.1	14.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	100.0		
#10	99.9		
#16	99.8		
#30	96.9		
#50	80.4		
#100	60.4		
#200	39.4		

* (no specification provided)

Material Description
 Silty sand

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₈₅= 0.361 D₆₀= 0.148 D₅₀= 0.112
 D₃₀= 0.0227 D₁₅= 0.0063 D₁₀= 0.0029
 C_u= 50.91 C_c= 1.19

Classification
 USCS= SM AASHTO=

Remarks

Sample No.: B-3
Location:

Source of Sample:

Date: 4/4/16
Elev./Depth: 40-41.5'

Moore Twining Associates, Inc.
Fresno, CA

Client:
Project: Proposed Recharge Basin Site
Project No: A26349.01

Figure

The graph displays the grain size distribution of a soil sample. The y-axis represents the percentage of soil finer than a given grain size, ranging from 0 to 100. The x-axis represents the grain size in millimeters, on a logarithmic scale from 500 mm to 0.001 mm. The curve starts at 100% finer for 500 mm and remains at 100% until approximately 0.425 mm. It then drops sharply, reaching about 88% finer at 0.075 mm, and continues to decrease to approximately 24% finer at 0.001 mm.

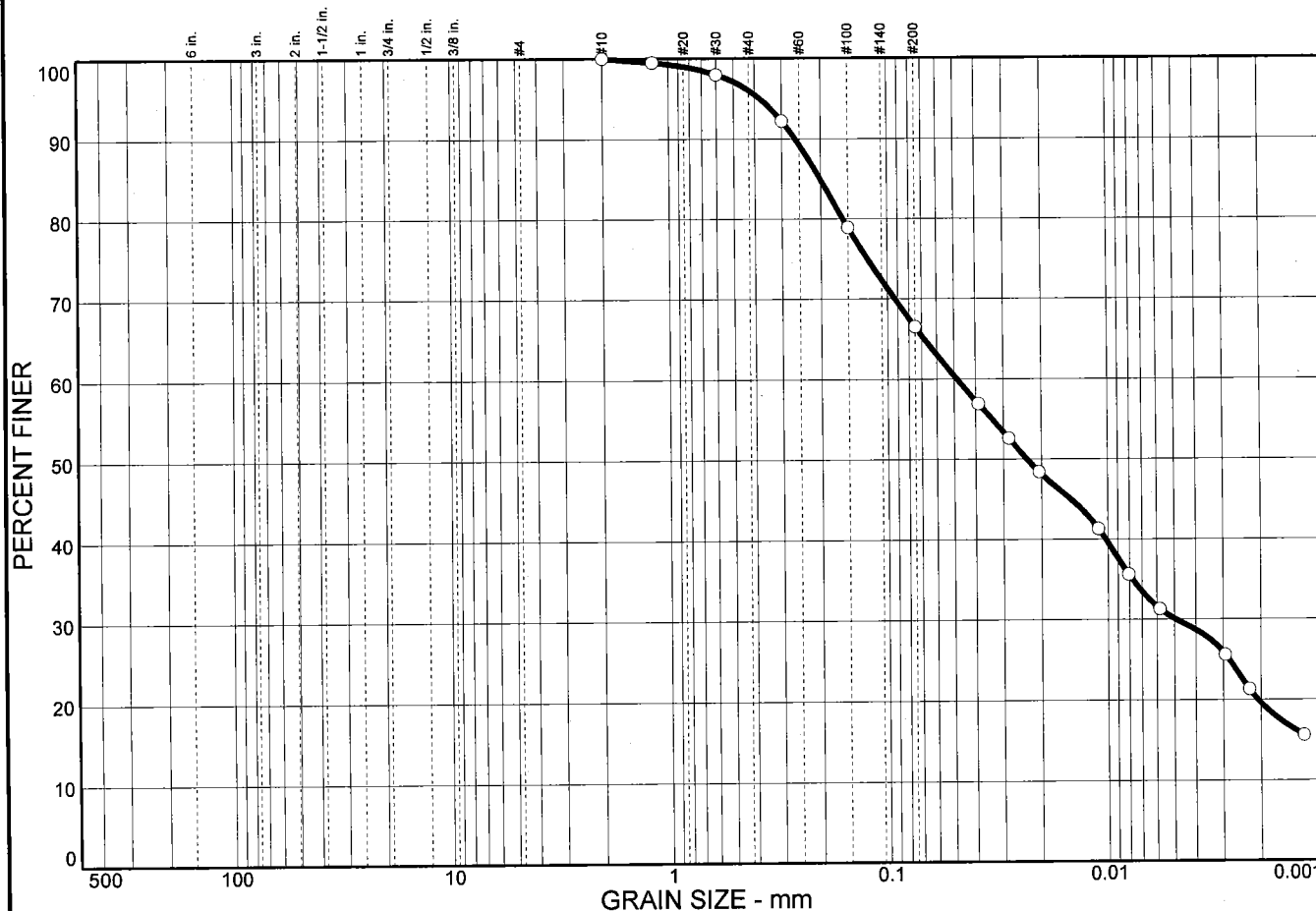
Grain Size (mm)	Percent Finer (%)
500	100
250	100
125	100
63	100
31.5	100
15.75	100
7.75	100
3.75	100
1.9	100
0.85	100
0.425	100
0.25	100
0.15	100
0.075	88
0.0475	67
0.025	62
0.015	56
0.0075	52
0.00475	45
0.0025	39
0.0015	38
0.00075	35
0.000475	29
0.00025	24

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	100.0		
#30	99.6		
#50	98.4		
#100	97.3		
#200	86.4		

Remarks

Figure

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	33.5	36.4	30.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	99.5		
#30	98.0		
#50	92.2		
#100	78.9		
#200	66.5		

* (no specification provided)

Material Description

Sandy silty clay

Atterberg Limits

PL= LL= PI=

Coefficients

D₈₅= 0.202 D₆₀= 0.0486 D₅₀= 0.0233
D₃₀= 0.0049 D₁₅= D₁₀=
C_u= C_c=

Classification

USCS= CL-ML AASHTO=

Remarks

Sample No.: B-3
Location:

Source of Sample:

Date: 4/4/16
Elev./Depth: 60-61.5'

Moore Twining Associates, Inc.

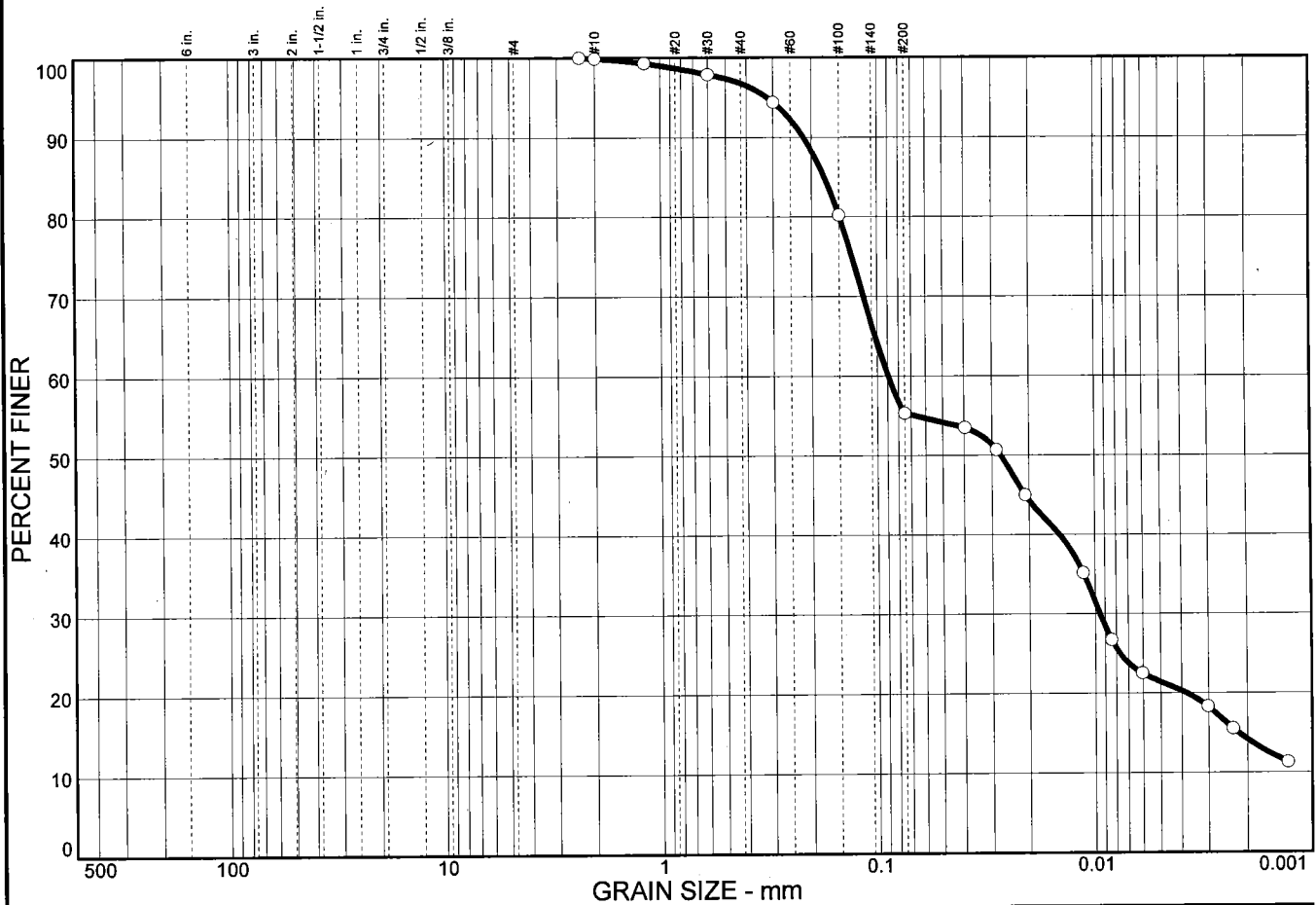
Fresno, CA

Client:
Project: Proposed Recharge Basin Site

Project No: A26349.01

Figure

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	44.7	33.9	21.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#8	100.0		
#10	99.9		
#16	99.3		
#30	97.9		
#50	94.4		
#100	80.2		
#200	55.3		

* (no specification provided)

Sample No.: B-3
Location:

Source of Sample:

Date: 4/4/16
Elev./Depth: 95-96.5'

Moore Twining Associates, Inc.
Fresno, CA

Client:
Project: Proposed Recharge Basin Site
Project No: A26349.01

Figure

Material Description

Sandy lean clay

Atterberg Limits

PL=

LL=

PI=

Coefficients

D₈₅= 0.175
D₃₀= 0.0095
C_u=

D₆₀= 0.0894
D₁₅= 0.0022
C_c=

D₅₀= 0.0273
D₁₀=

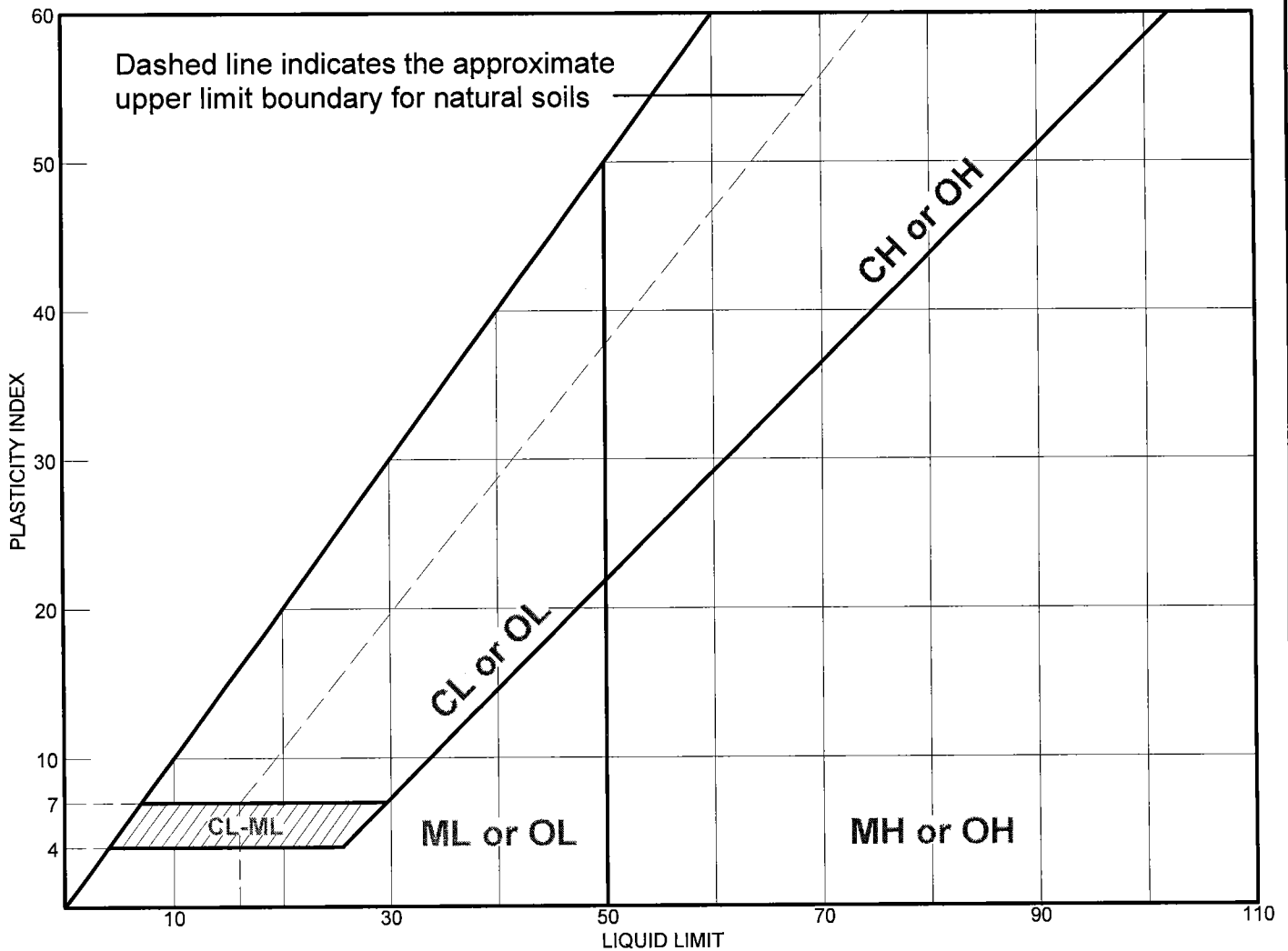
Classification

USCS= CL

AASHTO=

Remarks

LIQUID AND PLASTIC LIMITS TEST REPORT



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
• Silty sand	NV	NP	NP	99.7	34.5	SM

Project No. A26349.01 **Client:**
Project: Proposed Recharge Basin Site

• **Source:** **Sample No.:** B-1 **Elev./Depth:** 65-66.5'

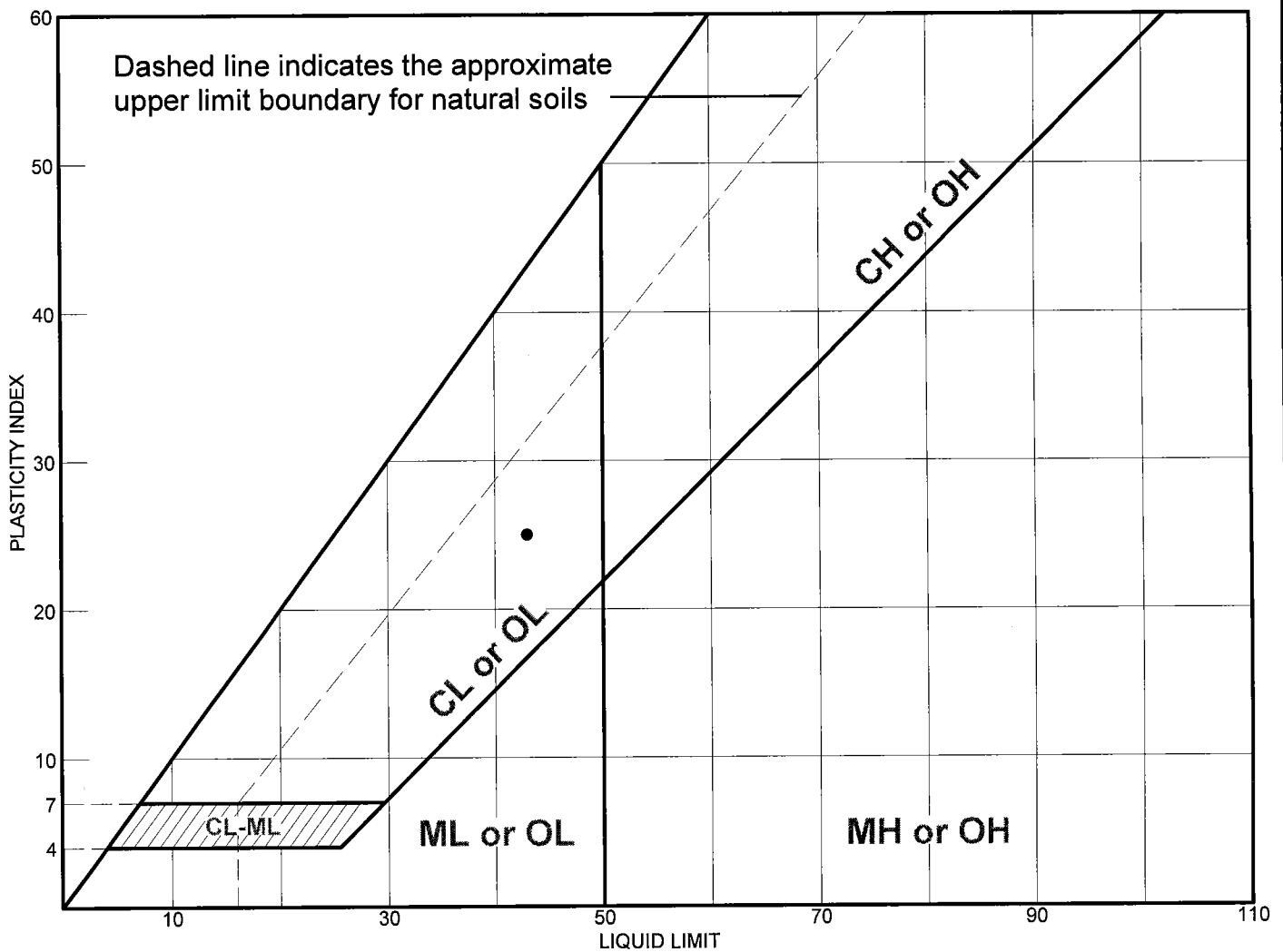
Moore Twining Associates, Inc.
Fresno, CA

Remarks:

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Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
•	Sandy lean clay	43	18	25	88.9	56.5	CL

Project No. A26349.01 Client:

Project: Proposed Recharge Basin Site

• Source: Sample No.: B-2 Elev./Depth: 40-41.5'

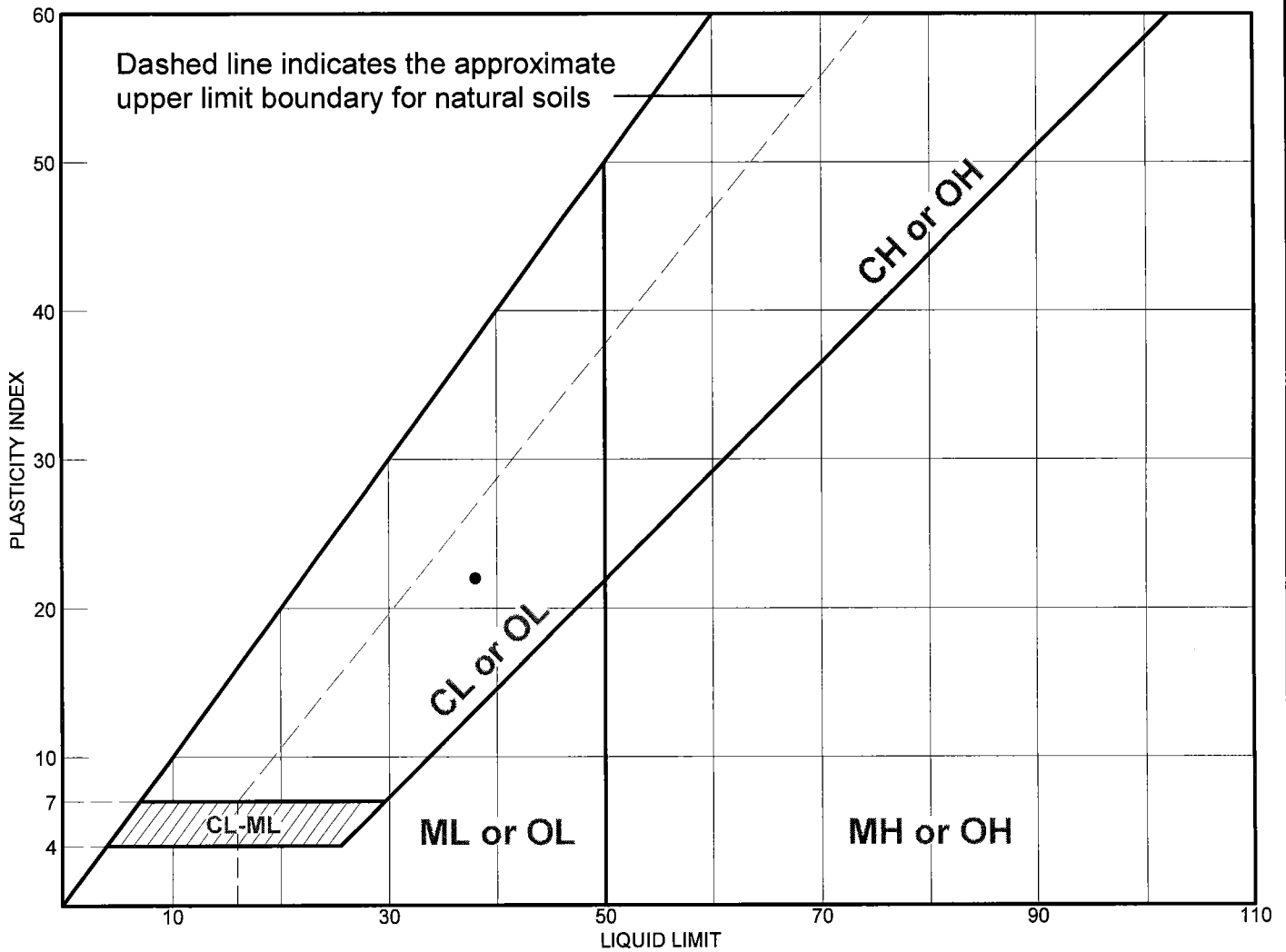
Moore Twining Associates, Inc.
Fresno, CA

Remarks:

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Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
•	Lean clay with sand	38	16	22	99.1	74.0	CL

Project No. A26349.01 **Client:**
Project: Proposed Recharge Basin Site

• **Source:** **Sample No.:** B-2 **Elev./Depth:** 135-136.5'

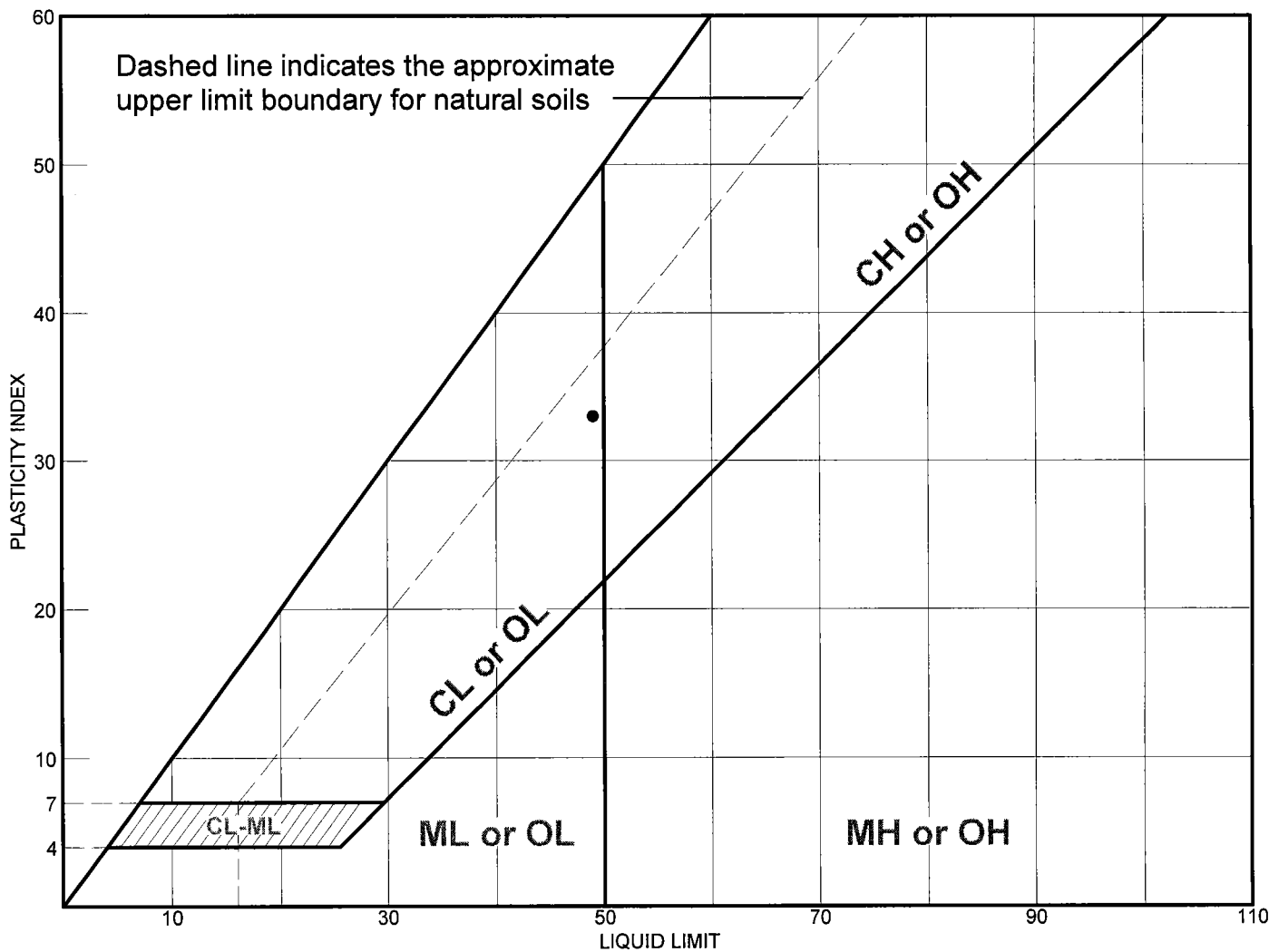
Moore Twining Associates, Inc.
Fresno, CA

Remarks:

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Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
•	Lean clay with sand	49	16	33	98.2	79.6	CL

Project No. A26349.01 Client:
Project: Proposed Recharge Basin Site

• Source: Sample No.: B-3 Elev./Depth: 5-6.5'

Moore Twining Associates, Inc.
Fresno, CA

Remarks:
•

Figure