February 16, 2015
File No. 20152738

Ms. Robin Yates
TRC Engineers Inc.
6051 N. Fresno Street, Suite 200
Fresno, California 93710

SUBJECT: Geotechnical Design Memorandum
Fresno BPMP Scour Countermeasure Project
Los Gatos Road at Los Gatos Creek (Bridge No. 42C0455)
Fresno County, California

Dear Ms. Yates:

This letter presents the results of the geotechnical investigation for the proposed Fresno BPMP Scour Countermeasure project for the subject location in Fresno County, California. This letter describes the study, findings, conclusions, and recommendations for use in project design.

Kleinfelder appreciates the opportunity to provide geotechnical engineering services during the design phase of this project. If there are any questions concerning the information presented in this letter, please contact this office at your convenience.

PROJECT DESCRIPTION

Understanding of the project is based upon discussions with representatives of TRC Engineers Inc. It is understood the project will consist of a scour evaluation at the Los Gatos Road at Los Gatos Creek bridge (Bridge No. 42C0455) location.

FIELD EXPLORATION

Field exploration included one (1) hand auger boring at the bridge site, which was performed on September 26, 2014. The boring was advanced to a depth of 1 foot below the existing creek bed.

The soil encountered in the hand auger boring was visually classified in the field and a continuous log was recorded. A bulk sample was obtained from the auger cuttings at the obtained depth. Upon completion, the exploration location was backfilled with soil cuttings. The bulk sample was transported back to our Fresno Lab for testing.

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LABORATORY TESTING

Kleinfelder performed laboratory tests on the selected sample to evaluate certain physical characteristics that will be necessary to assist TRC in their analysis. The laboratory test performed was a grain-size distribution. Results are shown on Figure 6.

SITE CONDITIONS AND SUBSURFACE SOILS ENCOUNTERED

The banks of the creek supported sparse dry bushes, with gravel.

The following description provides a general summary of the subsurface soil conditions encountered during the field exploration and further verified by the laboratory testing program. For a more thorough description of the actual conditions encountered at the specific boring location, refer to the boring log presented in Figure 5. All soils have been classified in general accordance with the Unified Soil Classification System (ASTM D2487).

The earth material at the site generally consists of silty sand with gravel (SM) to the maximum exploration depth of 1 foot. The boring was terminated at a final depth of 1 foot due to practical auger refusal.

SCOUR POTENTIAL

The mean grain size (D_{50}) and 90% passing grain size (D_{90}) of the soil anticipated to be exposed in the channel is about 3.5 mm and 25.0 mm, respectively.

Should the scour exceed the expected limits, mitigation measures, such as rip rap, may be used.

LIMITATIONS

Recommendations contained in this letter are based on the field observations and subsurface explorations, laboratory tests, and present knowledge of the proposed project. It is possible that soil conditions could vary between or beyond the points explored. Additional soil exploration may be necessary if better definition of any conditions is desired. If the scope of the proposed improvements changes from that described in this letter, the recommendations provided should also be reviewed.

This letter has been prepared in substantial accordance with the generally accepted geotechnical engineering practice, as it exists in the general area at the time of the study. No warranty, express or implied, is provided or intended. The preliminary recommendations provided in this letter are based on the assumption that Kleinfelder will conduct an adequate program of tests and observations during additional phases of the project in order to evaluate compliance with the recommendations.

This letter may be used only by Fresno County, TRC Engineers Inc., other project subconsultants and reviewing regulatory agencies and only for the purposes stated within a reasonable time from its issuance. Land use, site conditions or other factors may change over

time, and additional work may be required with the passage of time. Any other party who wishes to use this letter shall notify Kleinfelder of such intended use. Based on the intended use of the letter, Kleinfelder may require that additional work be performed and that an updated letter be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the misuse of this letter by any unauthorized party.

CLOSING

We appreciate the opportunity to provide geotechnical engineering services to TRC Engineers Inc. and Fresno County. We trust this information meets your current needs. If there are any questions concerning the information presented in this letter, please contact this office at your convenience.

Respectfully Submitted,

KLEINFELDER, INC.

Steven Linton, EIT
Staff Engineer

Neva M. Popenoe, PE, GE
Project Manager

Attachments

Figure 1	Site Vicinity Map
Figure 2	Boring Location Map
Figure 3	Graphics Key
Figure 4	Soil Description Key
Figure 5	Boring Log B-3
Figure 6	Grain-Size Distribution

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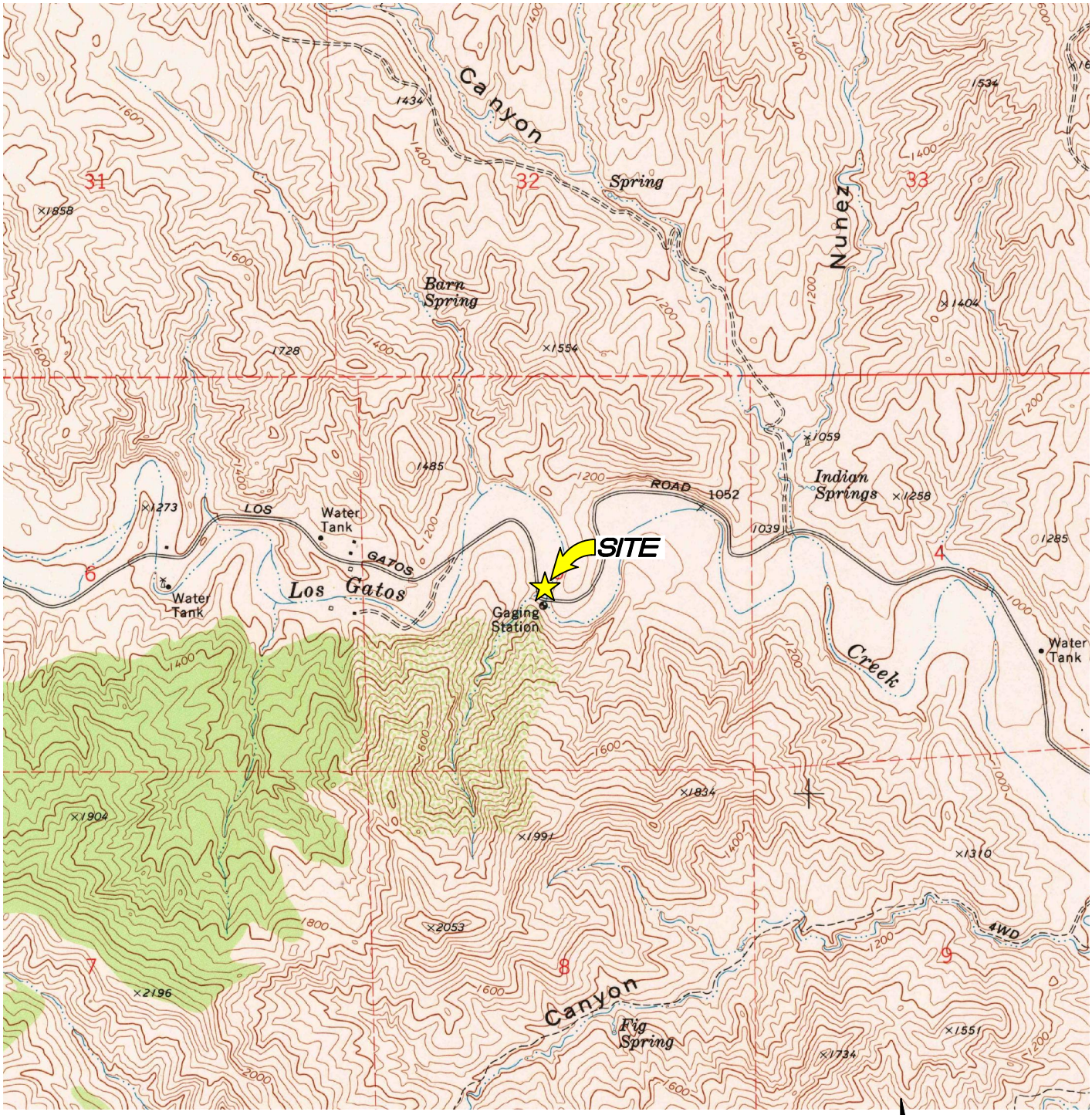
ATTACHMENTS



SOURCE: U.S.G.S. 7.5' Topographic series, Alcalde Hills, California Quadrangle Dated, 1969.

N

2,000 1,000 0 2,000

APPROXIMATE SCALE (feet)

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FILE NAME:	20152738-fig1_SVM_3.dwg

SITE VICINITY MAP

LOS GATOS ROAD AT LOS GATOS CREEK
(BRIDGE NO. 42C0455)
FRESNO COUNTY BRIDGE BPMP, PHASE 2
FRESNO COUNTY, CA

FIGURE
1

ATTACHED IMAGES: Images: USGS_AlcaldeHills-CA_1969_Quad.jpg
ATTACHED XREFS:
LONG BEACH, CA
CAD FILE: L:CADD\2015\20152738\FresnoBridge-BPMP_01-2015\1,2,3_LosGatosRd\ LAYOUT: 3 PLOTTED: 10 Jan 2015, 2:11pm, MGriffin

40 20 0 40

APPROXIMATE SCALE (feet)

EXPLANATION

B-3 APPROXIMATE BORING LOCATION

SOURCE: GOOGLE EARTH PRO 2015, IMAGE DATE 4/13/13.

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BORING LOCATION MAP

LOS GATOS ROAD AT LOS GATOS CREEK
(BRIDGE NO. 42C0455)
FRESNO COUNTY BRIDGE BPMP, PHASE 2
FRESNO COUNTY, CA

FIGURE 2

ATTACHED IMAGES: Images: Aerial-Image_Site-3-LosGatosRd_100_4-13-013.jpg
ATTACHED XREFS:
LONG BEACH, CA CAD FILE: L:\CADD\2015\20152738\FresnoBridge-BPMP_012015\1,2,3_LosGatosRd\ LAYOUT: 3 PLOTTED: 10 Jan 2015, 2:26pm, MGriffin

SAMPLE/SAMPLER TYPE GRAPHICS

BULK SAMPLE

GROUND WATER GRAPHICS

WATER LEVEL (level where first observed)

WATER LEVEL (level after exploration completion)

WATER LEVEL (additional levels after exploration)

OBSERVED SEEPAGE

NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, ie., GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	**GRAVELS** (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVEL WITH <5% FINES	Cu ≥4 and 1≤ Cc≤3		**GW**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			Cu <4 and/ or 1>Cc >3		**GP**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH 5% TO 12% FINES	Cu ≥4 and 1≤ Cc≤3		**GW-GM**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
					GW-GC	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
			Cu <4 and/ or 1>Cc >3		**GP-GM**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
					GP-GC	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
		GRAVELS WITH > 12% FINES			**GM**	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
					GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
					GC-GM	CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES
	SANDS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH <5% FINES	Cu ≥6 and 1≤ Cc≤3		**SW**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			Cu <6 and/ or 1>Cc >3		**SP**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH 5% TO 12% FINES	Cu ≥6 and 1≤ Cc≤3		**SW-SM**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
					SW-SC	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
			Cu <6 and/ or 1>Cc >3		**SP-SM**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
					SP-SC	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
		SANDS WITH > 12% FINES			**SM**	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
					SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
					SC-SM	CLAYEY SANDS, SAND-SILT-CLAY MIXTURES

FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid Limit less than 50)	**ML**	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		CL-ML	INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid Limit greater than 50)	**MH**	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY

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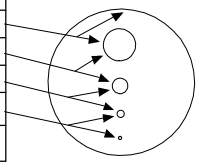
GRAPHICS KEY

Fresno County Bridge BPMP Phase 2
Fresno County, CA

FIGURE
3

GRAIN SIZE

DESCRIPTION		SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders		>12 in. (304.8 mm.)	>12 in. (304.8 mm.)	Larger than basketball-sized
Cobbles		3 - 12 in. (76.2 - 304.8 mm.)	3 - 12 in. (76.2 - 304.8 mm.)	Fist-sized to basketball-sized
Gravel	coarse	3/4 -3 in. (19 - 76.2 mm.)	3/4 -3 in. (19 - 76.2 mm.)	Thumb-sized to fist-sized
	fine	#4 - 3/4 in. (#4 - 19 mm.)	0.19 - 0.75 in. (4.8 - 19 mm.)	Pea-sized to thumb-sized
Sand	coarse	#10 - #4	0.079 - 0.19 in. (2 - 4.9 mm.)	Rock salt-sized to pea-sized
	medium	#40 - #10	0.017 - 0.079 in. (0.43 - 2 mm.)	Sugar-sized to rock salt-sized
	fine	#200 - #10	0.0029 - 0.017 in. (0.07 - 0.43 mm.)	Flour-sized to sugar-sized
Fines		Passing #200	<0.0029 in. (<0.07 mm.)	Flour-sized and smaller



Munsell Color

NAME	ABBR
Red	R
Yellow Red	YR
Yellow	Y
Green Yellow	GY
Green	G
Blue Green	BG
Blue	B
Purple Blue	PB
Purple	P
Red Purple	RP
Black	N

ANGULARITY

DESCRIPTION	CRITERIA
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular	Particles are similar to angular description but have rounded edges
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges
Rounded	Particles have smoothly curved sides and no edges

Particles Present

Amount	Percentage
trace	<5
few	5-10
little	15-25
some	30-45
and	50
mostly	50-100

PLASTICITY

DESCRIPTION	LL	FIELD TEST
Non-plastic	NP	A 1/8-in. (3 mm.) thread cannot be rolled at any water content.
Low (L)	< 30	The thread can barely be rolled and the lump or thread cannot be formed when drier than the plastic limit.
Medium (M)	30 - 50	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump or thread crumbles when drier than the plastic limit
High (H)	> 50	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump or thread can be formed without crumbling when drier than the plastic limit

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

REACTION WITH HYDROCHLORIC ACID

DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

APPARENT DENSITY	SPT-N_{60} (# blows/ft)	MODIFIED CA SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)
Very Loose	<4	<4	<5	0 - 15
Loose	4 - 10	5 - 12	5 - 15	15 - 35
Medium Dense	10 - 30	12 - 35	15 - 40	35 - 65
Dense	30 - 50	35 - 60	40 - 70	65 - 85
Very Dense	>50	>60	>70	85 - 100

NOTE: AFTER TERZAGHI AND PECK, 1948

CONSISTENCY - FINE-GRAINED SOIL

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (q_u)(psf)	CRITERIA
Very Soft	< 1000	Thumb will penetrate soil more than 1 in. (25 mm.)
Soft	1000 - 2000	Thumb will penetrate soil about 1 in. (25 mm.)
Firm	2000 - 4000	Thumb will indent soil about 1/4-in. (6 mm.)
Hard	4000 - 8000	Thumb will not indent soil but readily indented with thumbnail
Very Hard	> 8000	Thumbnail will not indent soil

STRUCTURE

DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 1/4-in. thick, note thickness
Laminated	Alternating layers of varying material or color with the layer less than 1/4-in. thick, note thickness
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided	Fracture planes appear polished or glossy, sometimes striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness
Homogeneous	Same color and appearance throughout

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

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SOIL DESCRIPTION KEY

Fresno County Bridge BPMP Phase 2
Fresno County, CA

FIGURE
4

BORING LOG B-3

Date Begin - End:	9/26/2014	**Drilling Company:**	Kleinfelder
Logged By:	T. DeSouza	**Drill Crew:**	T. DeSouza
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger
Plunge:	-90 degrees	**Drilling Method:**	Hand Auger
Weather:	Sunny/warm	**Exploration Diameter:**	4 in. O.D.

Depth (feet)	Graphical Log	FIELD EXPLORATION: Surface Condition: Stream bed / Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Recovery (NR=No Recovery)	LABORATORY RESULTS: USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		Silty SAND with Gravel (SM): non-plastic, brownish gray, moist, subangular gravel up to 3 inches, subrounded cobbles up to 6 inches, with sand							53	25			

The boring was terminated because of practical auger refusal ( ) at approximately 1 ft. below ground surface. The exploration was backfilled with auger cuttings on September 26, 2014.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not encountered during drilling or after completion.
GENERAL NOTES:

5

10

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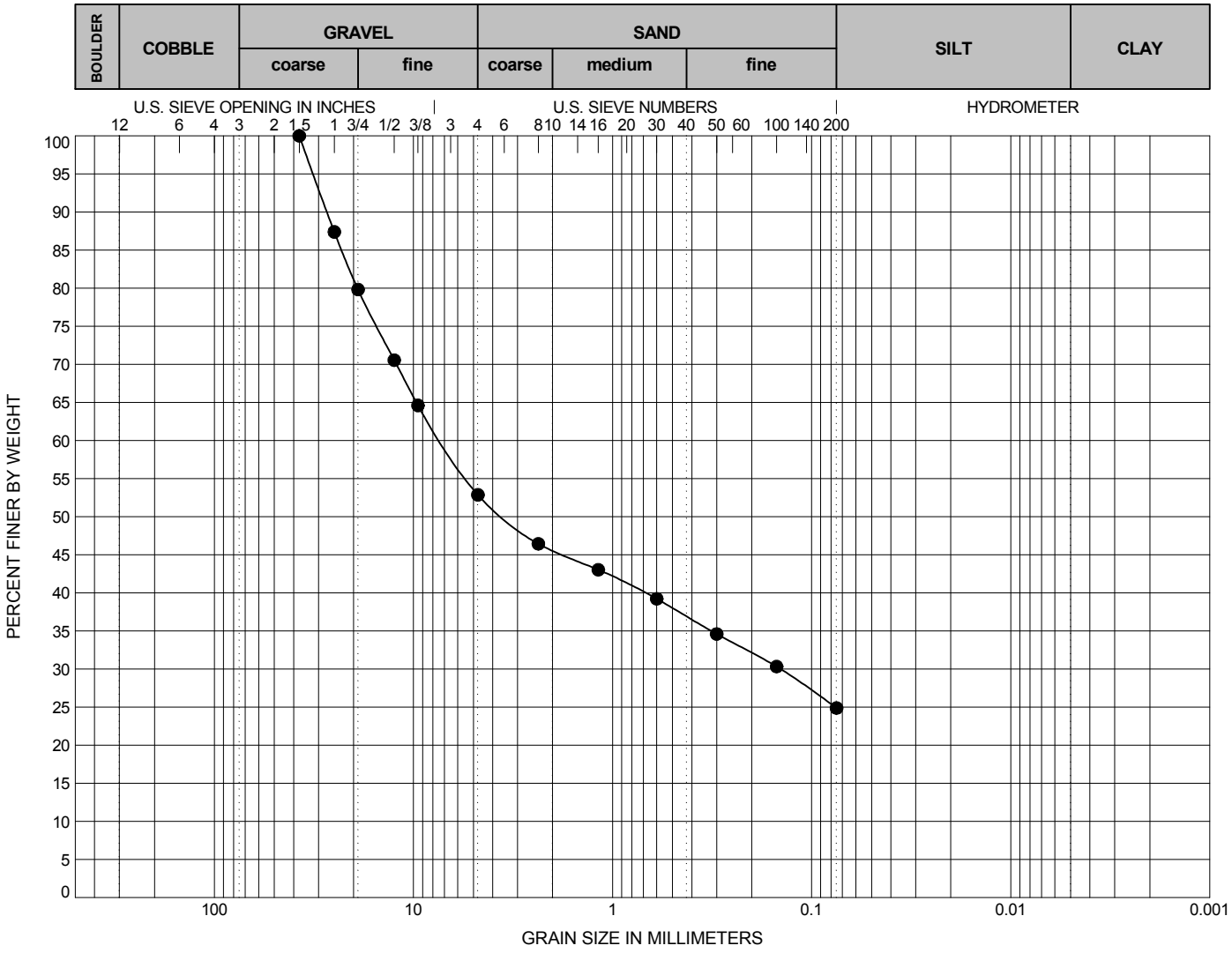
BORING LOG B-3

Fresno County Bridge BPMP Phase 2
Fresno County, CA

FIGURE
5

PAGE: 1 of 1



Exploration ID	Depth (ft.)	Sample Description	LL	PL	PI
● B-3	0 - 1	SILTY SAND WITH GRAVEL (SM)	NM	NM	NM

Exploration ID	Depth (ft.)	D_{100}	D_{60}	D_{30}	D_{10}	Cc	Cu	Passing 3/4"	Passing #4	Passing #200	%Silt	%Clay
● B-3	0 - 1	37.5	7.237	0.144	NM	NM	NM	80	53	25	NM	NM

Coefficients of Uniformity - $C_u = D_{60} / D_{10}$
Coefficients of Curvature - $C_C = (D_{30})^2 / D_{60}\ D_{10}$
D_{60} = Grain diameter at 60% passing
D_{30} = Grain diameter at 30% passing
D_{10} = Grain diameter at 10% passing

Sieve Analysis and Hydrometer Analysis testing performed in general accordance with ASTM D422.
NP = Nonplastic
NM = Not Measured

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SIEVE ANALYSIS

Fresno County Bridge BPMP Phase 2
Fresno County, CA

FIGURE
6