KOURY
ENGINEERING
& TESTING, INC.

GEOTECHNICAL & SEISMIC ENGINEERING, CONSTRUCTION INSPECTION & MATERIALS TESTING SERVICES

June 26, 2017
Project No. 17-0320

Mr. John R. Burroughs, LEED AP, President
Commerce Construction Co., L.P.
13191 Crossroads Parkway North 6th Floor
City of Industry, CA 91746

Subject: Feasibility Study, Proposed East Borrow Site
Southeast Corner of Pine Avenue & Johnson Avenue
City of Chino, CA

Dear Mr. Burroughs:

Presented herein are our preliminary findings and conclusions regarding the suitability of the soils to be used as engineered fill to balance the grade for the OC Prado site construction located on the southeast corner of Bickmore Avenue and Mountain Avenue, in the City of Chino.

The East Borrow Site consists of two vacant parcels with a total area of about 37 acres. The site is bounded by Pine Avenue to the north, Johnson Avenue to the west, OC Parks on the south and agricultural land on the east. A Site Vicinity Map with approximate ground contour elevations is presented in Appendix A as Figure A-1. Metal fences surround the site except for the east side where wooden fences separate the site from Johnson Avenue. The site is owned by the County of Orange Flood Control District.

Field Exploration and Laboratory Testing for Feasibility Study

The field exploration program for the feasibility study consisted of drilling four soil test borings and excavating nine test pits. Truck-mounted hollow-stem auger drilling equipment was used to drill the test borings to depths of about 31½ feet. In addition, a rubber tire mounted backhoe was used to excavate 9 test pits ranging in depths from about 11½ to 13½ feet. The locations of the borings and test pits are shown on the Field Exploration Map, Figure A-2, presented in Appendix A. Standard penetration test samples, California ring samples and bulk samples were obtained from the borings for laboratory testing, and bulk samples were obtained from the test pits. The contractor used a 140-lbs automatic hammer to drive the samplers 18 inches into the soils.

Laboratory tests, including moisture content, dry unit weight, #200 sieve wash, gradation, pocket penetrometer, expansion index, and plasticity index were performed to aid in the classification of the materials encountered and to evaluate their engineering properties. Sulfates, chlorides, resistivity, and PH tests (corrosivity tests) were also performed on selected samples. The results of pertinent laboratory tests are presented on the boring logs in Appendix B, and/or in Appendix C.

Site Geology

The site is located within the Upper Santa Ana River Valley, which consists of a series of coalescing alluvial fans formed by streams flowing out of the San Gabriel Mountains to the north. The valley lies within the Peninsular Ranges geomorphic province, which is characterized by alluviated basins, elevated erosion surfaces, and northwest-trending mountain ranges bounded by northwest trending faults. The site, which is located within the Chino Basin, is underlain by sediments deposited by the Santa Ana River and its tributaries such as the Chino Creek.

Morton and Miller (2006) show the site to be underlain by very old alluvial-fan deposits (See Figure A-3 in Appendix A). The sediments observed during drilling consisted predominantly of clay.

Surface Site Conditions

The site in its present state has been cleared of the past structures such as buildings, animal shelters, and other above ground ancillary facilities; however, it appears that several foundations and slab on grade are still in place. The dominant features of the site are few berms, a water pond that was constructed near the south end of the site, and power line towers. Many of the berms appear to have been constructed by pushing onsite soils into piles. Most of the berms have heights in the range of 3 to 5 feet and consist of relatively loose undocumented fill.

Near the southern end of the site, there is a detention basin approximately 100 feet long, 30 feet wide and 5 feet deep. High voltage overhead power lines, which are supported by steel towers, cross the site from east to west.

Soil Conditions

The subsurface soil profile consists generally of artificial fill underlain by alluvial deposits. For the most part, the fill is generally 1 to 3 feet thick except for the berms/levees that were constructed, which range in height predominantly between 3 and 5 feet. The fill derived from onsite soils consists predominantly of medium plastic clay (lean clay with sand and sandy lean clay).

The soils at shallow depth (upper 15 feet) consist predominantly of medium plastic clay with sand and interbeds of sandy lean clay and fat clay. No significant quantity of sand was encountered. The moisture contents are highly variable, ranging from about 11 to 34 percent with an average of about 18½ percent within the upper 15 feet. However, based on Table 1 presented below, many of the moisture contents are in the range of about 6 to 8 percent above optimum for the soils sampled within the upper 15 feet below existing grade.

Table 1 – Maximum Density Test Results

Test Pit Number	**TP-2**	**TP-5**
Maximum Dry Density (pcf)	103.0	114.0
Optimum Moisture Content (%)	21.2	15.3

To aid in the soils classification and to correlate the soil plasticity with the soils expansion, five plasticity index tests (Atterberg Limits) were performed on samples from depths ranging between about 2 and 21 feet. As shown in Table 2, the liquid limits for the tested samples range between about 35 and 81 and the plasticity index between 16 and 55, which indicate material ranging from low to high plasticity.

Table 2 – Plasticity Test Results

Test Pit/Boring No./Depth	**B-2/**21’	**B-4/**2’	**TP-2/**9’	**TP-3/**11’	**TP-5/**10’
Liquid Limit	62	35	81	39	35
Plastic Limit	31	17	26	21	19
Plasticity Index	31	18	55	18	16

The soil plasticity, thus the expansion potential, appears to generally increase with depth along with the moisture content. The site soils are generally expansive (EI>20). Table 3 presents the data for eight tests with depths ranging between 1 and 10 feet. These tests indicate expansion index up to 92 with an average of about 60.

Table 3 – Expansion Index Test Results

Test Pit/Boring No./Depth	**B-4/**2’	**TP-1/**5’	**TP-2/**9’	**TP-3/**1’	**TP-3/**5’	**TP-3/**10’	**TP-5/**6’	**TP-5/**10’
Expansion Index (EI)	38	57	92	27	62	85	58	40
Field Moisture (%)	16.4	21.4	33.8	18.3	24.2	20.9	25.4	25.5
Percentage of fines (%)	80	74	90	83	77	69	81	78

There is a rough correlation between in situ natural moisture content at depth and expansion index. For the same amounts of fines, site soils with higher moisture and higher plasticity index tend to have higher expansion index.

The corrosivity tests performed indicated that the site soils are generally corrosive to metal. However, the tests performed did not indicate high corrosivity to concrete. The corrosivity test results are summarized in the following Table 4.

Table 4 - Corrosion Test Results

Boring	Depth (ft)	Minimum Resistivity (ohm-cm)	pH	Soluble Sulfate Content (ppm)	Soluble Chloride Content (ppm)
TP-1	2 – 3	5,130	8.0	21	20
TP-5	8 – 8.5	1,690	7.8	135	50

Groundwater

Groundwater seepage was encountered in all the borings. Groundwater was encountered at a depth of about 27 feet in Borings B-1 and B-2 at the north end of the site. Groundwater was encountered at a depth of about 24½ feet near the center of the site and at a depth of about 21½ feet near the southwest end of the site in Boring B-4. The attached Field Exploration Map, Figure A-2, shows the locations of the borings and the corresponding groundwater depths.

Conclusions and Recommendations

Based on the data collected from the field to date, it appears feasible to import material from the East Borrow site to use at the OC Prado site. The shallow soils in the borrow site have some similarity with the shallow soils at the OC Prado site. It appears that with a combination of selective grading (and/or blending), the upper 15 to 17 feet of soils from the borrow site could be imported and used below the proposed building foundations at OC Prado. There are layers of high expansive soils within the upper 15 to 17 feet of subgrade; however, with proper mining and/or mixing, the resulting soil mixtures are anticipated to have expansion index less than 80. Drying back will be required; however, with proper mixing equipment, the moisture conditions should be manageable.

The soils below depths of 15 to 17 feet may be used below the proposed parking lot (preferably below a depth of 2 feet below finished subgrade) and at depths exceeding 4 feet below the building foundations; however, because of their relatively high moisture content and their expansion potential, they will be more difficult to process and to compact, and are less desirable from an engineering performance standpoint.

While the soil expansion index generally increases with depth, it is not uniform across the site and for all the layers. There are lenses and layers of more expansive soils sandwiched between lower expansive soil strata. The Field Exploration Map shows the boring and test pit locations and the zones within each exploration point where soils with expansion index of 80 or greater are deemed present. For quantity estimate purpose, we anticipate that the one to three-foot thick zones that have higher expansive soils will be mixed with the less expansive soils.

We recommend that additional borings and test pits be excavated to further determine the variation of moisture contents and soil expansivity with depth. Because the soil moisture contents increase near the water table, we suggest to limit the borrow site excavation depth to about 5 feet above the water table.

LIMITATIONS

Our work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Koury's profession practicing in the same locality, under similar conditions and at the date the services are provided.

CLOSURE

The findings and recommendations presented in this report were based on the results of our field and laboratory investigations, combined with professional engineering experience and judgment. The report was prepared in accordance with generally accepted engineering principles and practice. We make no other warranty, either expressed or implied. Subsurface variations between and beyond the borings/test pits should be anticipated. Koury should be notified if subsurface conditions are encountered, which differ from those described in this report. Samples obtained during this investigation will be retained in our laboratory for a period of 45 days from the date of this report and will be disposed after this period.

Should you have any questions concerning this submittal, or the recommendations contained herewith, please do not hesitate to call our office.

Respectfully submitted,

KOURY ENGINEERING & TESTING, INC.

REGISTERED PROFESSIONAL ENGINEER
JACQUES B. ROY
NO. 2077
Ex. Date 9/30/19
Geotechnical
STATE OF CALIFORNIA

Jacques Roy

Jacques B. Roy, P.E., G.E.
Principal Engineer

Distribution: 1. Addressee (2 wet stamped copies + a pdf copy via e-mail)
2.File (B)

REFERENCES

1. California Division of Mines and Geological Survey, 1998, Seismic Hazard Zone Report 045 for the Prado Dam 7.5 Minute Quadrangle, California.

2. California Division of Mines and Geological Survey, 2003, Earthquake Fault Zones, Prado Dam Quadrangle, May 1, 2003.

3. City of Chino General Plan, Safety Element, 2010, Final Report.

4. US Army Corps of Engineers, Geotechnical Investigations, Engineering Manual EM 1110-1-1804, dated 8/26/86.

5. US Army Corps of Engineers, Laboratory Soils Testing, Engineering Manual EM 1110-2-1906, dated 8/26/86.

APPENDICES

Appendix A: Maps and Plans

Vicinity Map – Figure A-1
Boring Location Map – Figure A-2
Geology Map – Figure A-3

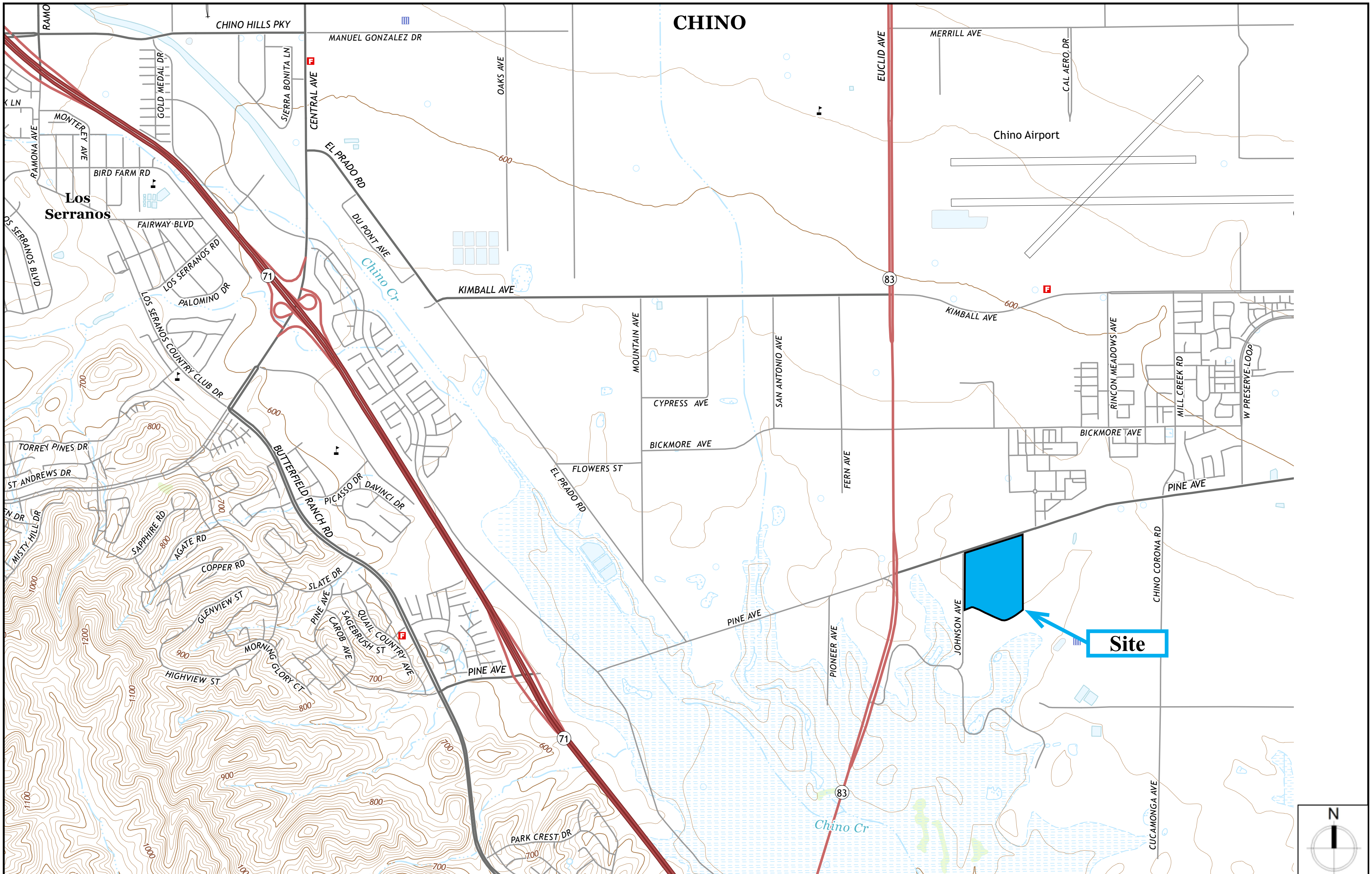
Appendix B: Field Exploratory Boring Logs and Test Pits

Borings B-1 through B-4 and Test Pits 1 through 9

Appendix C: Laboratory Test Results

APPENDIX A

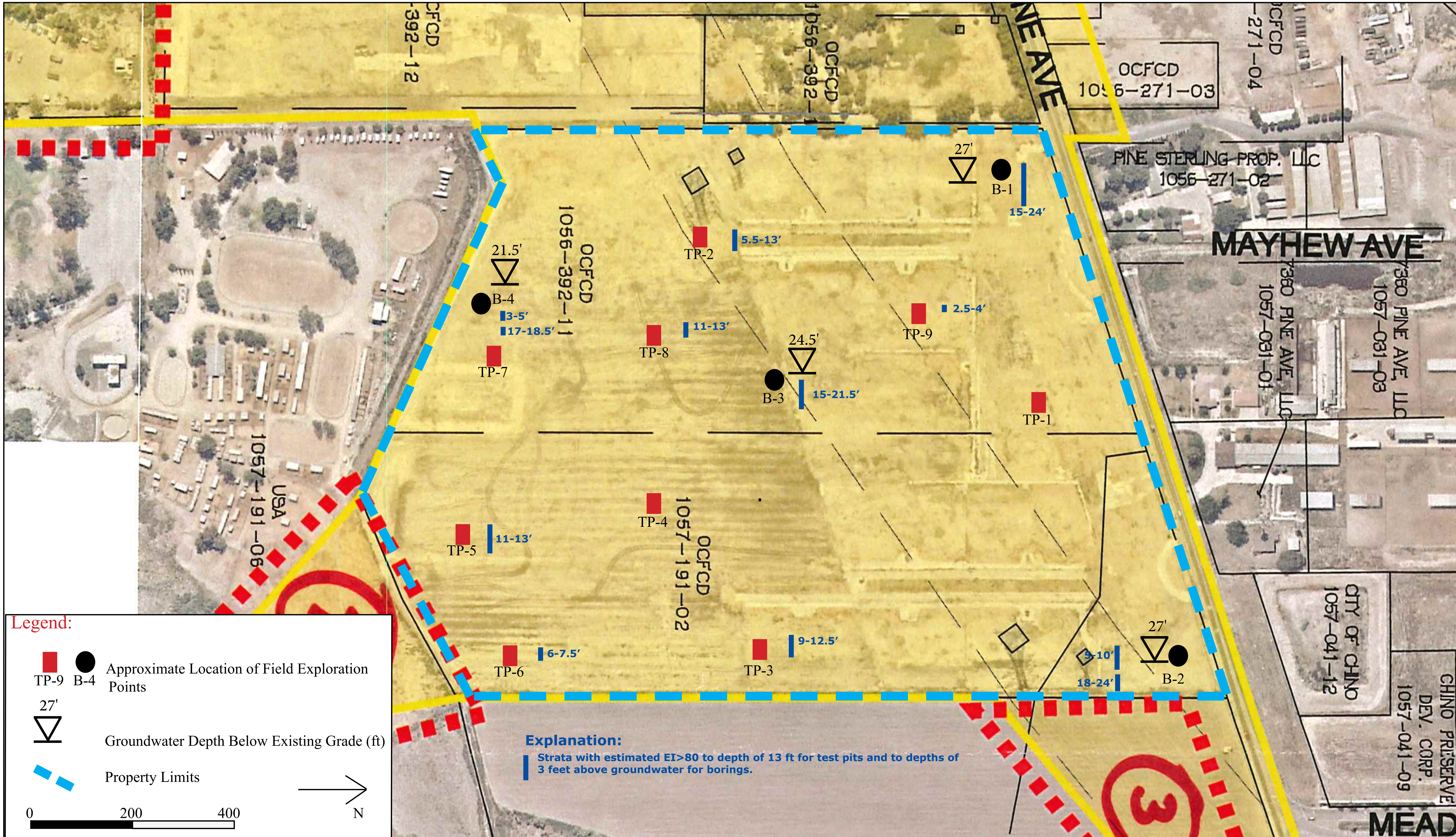
Maps and Plans



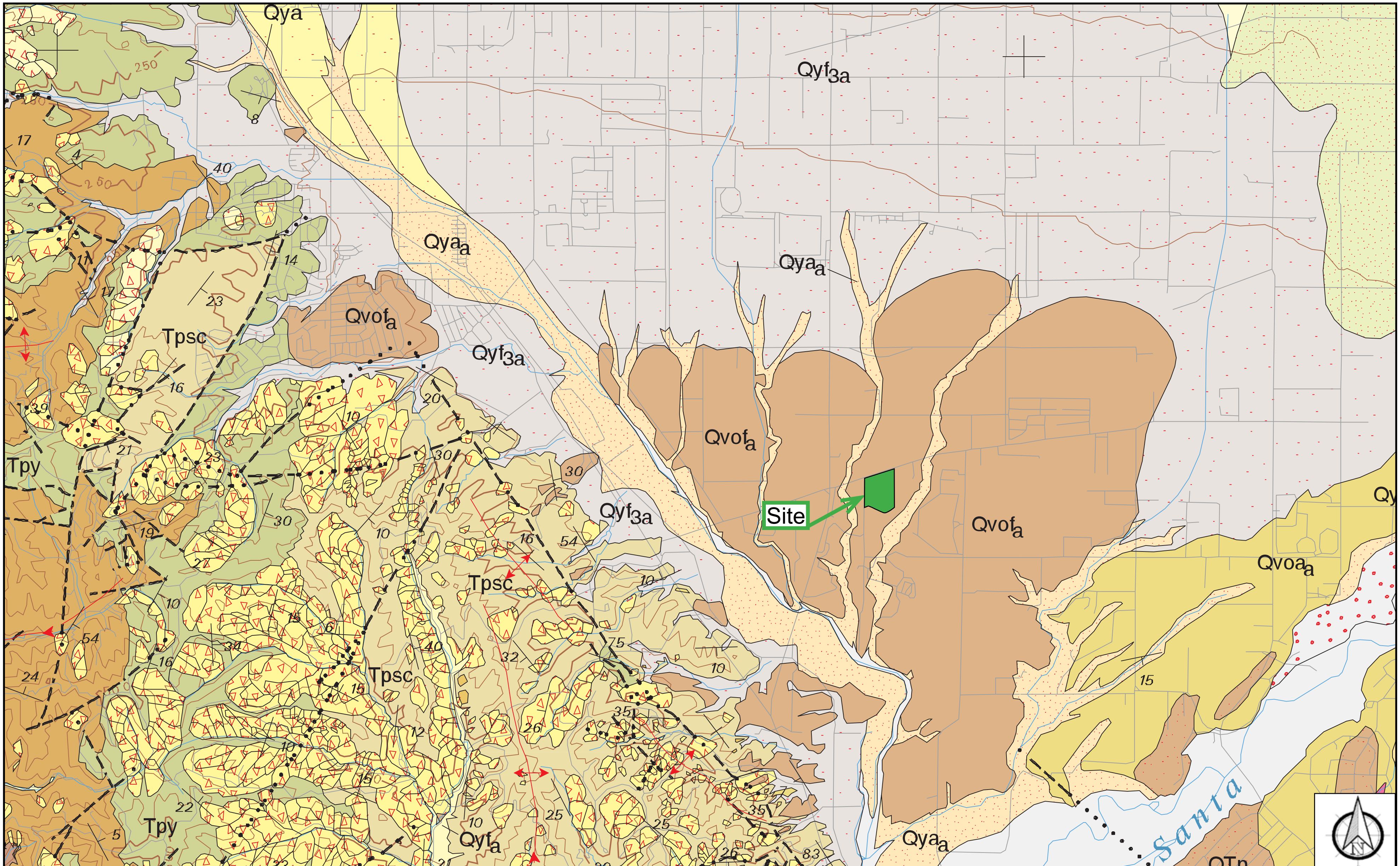
Reference: USGS Topographic Map, Prado Dam Quadrangle, California, 7.5 Minute Series 2015 - Contour Interval 20 feet, NAVD of 1988

0 1/2 1 Mile

KOURY ENGINEERING & TESTING, INC.	Project Name: East Borrow Site Phase II	Project No.: 17-0320 Date: July 2017	Drawing Title: Vicinity Map	Figure: A-1



KOURY ENGINEERING & TESTING, INC.	Project Name: East Borrow Site Phase II	Project No.: 17-0320 Date: July 2017	Drawing Title: Field Exploration Map	Figure: A-2



LEGEND

- Qya — Young alluvial-valley deposits
- Qvof — Very old alluvial-fan deposits

Reference: Geologic Map of the San Bernardino & Santa Ana 30´x60´ Quadrangle California-Version 1.0 Compiled by Douglas M. Morton and Fred K. Miller, 2006

KOURY ENGINEERING & TESTING, INC.	Project Name: East Borrow Site Phase II	Project No.: 17-0320 Date: July 2017	Drawing Title: Geology Map	Figure: A-3

APPENDIX B

Field Exploratory Boring Logs and Test Pits

KEY TO LOGS

SOILS CLASSIFICATION					
MAJOR DIVISIONS			GRAPHIC LOG	USCS SYMBOL	TYPICAL NAMES
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	**GRAVELS** MORE THAN 50% OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	**CLEAN GRAVELS** LESS THAN 5% FINES		**GW**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES MORE THAN 12% FINES		**GM**	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS 50% OR MORE OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	**CLEAN SANDS** LESS THAN 5% FINES		**SW**	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES MORE THAN 12% FINES		**SM**	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS 50% OR MORE OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	**SILTS AND CLAYS** LIQUID LIMIT IS LESS THAN 50			**ML**	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT IS 50 OR MORE			**MH**	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR GRAVELLY ELASTIC SILTS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				**PT**	PEAT AND OTHER HIGHLY ORGANIC SOILS

GRAIN SIZES							
SILT AND CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		
	#200	#40	#10	#4	3/4"	3"	12"

SIEVE SIZES

KEY TO LOGS (continued)

SPT/CD BLOW COUNTS VS. CONSISTENCY/DENSITY					
FINE-GRAINED SOILS (SILTS, CLAYS, etc.)			GRANULAR SOILS (SANDS, GRAVELS, etc.)		
CONSISTENCY	***BLOWS/FOOT**		**RELATIVE DENSITY**	***BLOWS/FOOT**	
	SPT	**CD**		**SPT**	**CD**
SOFT	0-4	0-4	VERY LOOSE	0-4	0-8
FIRM	5-8	5-9	LOOSE	5-10	9-18
STIFF	9-15	10-18	MEDIUM DENSE	11-30	19-54
VERY STIFF	16-30	19-39	DENSE	31-50	55-90
HARD	over 30	over 39	VERY DENSE	over 50	over 90

* CONVERSION BETWEEN CALIFORNIA DRIVE SAMPLERS (CD) AND STANDARD PENETRATION TEST (SPT) BLOW COUNT HAS BEEN CALCULATED USING "FOUNDATION ENGINEERING HAND BOOK" BY H.Y. FANG. (**VALUES ARE FOR 140 Lbs HAMMER WEIGHT ONLY**)

DESCRIPTIVE ADJECTIVE VS. PERCENTAGE	
DESCRIPTIVE ADJECTIVE	**PERCENTAGE REQUIREMENT**
TRACE	1 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%

*THE FOLLOWING "DESCRIPTIVE TERMINOLOGY/ RANGES OF MOISTURE CONTENTS" HAVE BEEN USED FOR MOISTURE CLASSIFICATION IN THE LOGS.

APPROXIMATE MOISTURE CONTENT DEFINITION	
DEFINITION	**DESCRIPTION**
DRY	Dry to the touch; no observable moisture
SLIGHTLY MOIST	Some moisture but still a dry appearance
MOIST	Damp, but no visible water
VERY MOIST	Enough moisture to wet the hands
WET	Almost saturated; visible free water

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-0320
Project Name : East Borrow Site
Boring No. : B-1
Sheet : 1 **Of :** 1

Drilling Method : Hollow Stem 8" Auger
Sampling Method : Bulk - CD - SPT
Ground Elevation:
Hammer Weight : 140 lbs **Drop Height :** 30"
Drilling Co. : Geoboden, Inc.
Location : See Figure A-2
Date Drilled : 05/30/17

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Soil Type (USCS)	Description	Additional Tests
1	13.9			0	CL	**FILL:** **Lean CLAY with SAND;** moist, concretions, dark yellowish brown	#200 Wash Fines = 80%
2	14.4		7 9 11		CL	**ALLUVIUM:** **Lean CLAY with SAND;** very stiff, moist, concretions, yellowish brown with some white	#200 Wash Fines = 79% PP = 4.5 tsf
3	14.6	104	6 9 10	5	CL	**Sandy Lean CLAY;** very stiff, moist, abundant caliche, and concretions, pale yellow with white	#200 Wash Fines = 61% PP = > 4.5 tsf
4	16.1		4 5 6		CL		#200 Wash Fines = 61% PP = 4.5 tsf
5	15.6	115	5 9 14	10	CL		#200 Wash Fines = 57% PP = 4.5 tsf
6	27.6			15	CH	**Fat CLAY with SAND;** firm to stiff, thin layers of sandy silt, moist, light olive brown with some grayish brown	#200 Wash Fines = 82% PP = 1 tsf
7	23.7	102	10 14 18	20	ML	**Sandy SILT;** very stiff, moist, light olive brown with grayish brown, micaceous	#200 Wash Fines = 69%
8	31.2		6 6 8	25	CL/CH	**Lean to Fat CLAY;** stiff moist, yellowish brown	#200 Wash Fines = 88% PP=1.5-2.5 tsf
9	31.3	92	7 10 14	30	CL/CH		#200 Wash Fines = 86% PP=2.5-3.0 tsf
				35		End of boring @ 31' 6" Groundwater encountered @ 27'	
				40			

Groundwater ▽ Bulk ☒ CD ■ SPT ☒

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. 17-0320
Project Name : East Borrow Site

Boring No. : B-2
Sheet : 1 **Of :** 1

Drilling Method : Hollow Stem 8" Auger
Sampling Method : Bulk - CD - SPT
Hammer Weight : 140 lbs **Drop Height :** 30"
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Geoboden Inc.
Date Drilled : 5-30-17

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Soil Type (USCS)	Description	Additional Tests
				CL	**FILL:**	
1	11.1			CL	**Lean CLAY with SAND;** stiff, moist, concretions, brown with yellowish brown	#200 Wash Fines = 78%
				CL	**ALLUVIUM:**	
2	16.8	93	9 6 4	CL	**Sandy Lean CLAY**; stiff, moist, concretions, yellowish brown with white	#200 Wash Fines = 62% PP=3.5-4.5 tsf
3	22.9	93	1 1 1	CL		#200 Wash Fines = 82% PP = 2-2.5 tsf
4	25.0	116	8 14 18	CL/CH	**Lean to Fat CLAY with SAND;** very stiff, moist, concretions, dark yellowish brown with some white	#200 Wash Fines = 85% PP = 4.5 tsf
5	15.5		5 6 11	CL/CH		#200 Wash Fines = 81% PP = 4.5 tsf
6	19.3	112	7 11 12	CL	**Sandy Lean CLAY;** very stiff, moist to very moist, light olive brown/greenish	#200 Wash Fines = 55% PP = 4.5 tsf
7	41.4		3 4 4	CH	**Fat CLAY with SAND;** firm, some concretions, thin layers of sandy lean clay, light olive brown	#200 Wash Fines = 83% PP = 1.5 tsf LL = 62 PL = 31
8	29.2	100	5 5 7	CH	stiff, moist to very moist, concretions, light olive brown	#200 Wash Fines = 92% PP = 3-4 tsf
9	31.5			CH		#200 Wash Fines = 76%

End of boring @ 31' 6"
Groundwater encountered @ 27'

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 35, 40

Groundwater ▽ Bulk ☒ CD ■ SPT ☒

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. 17-0320
Project Name : East Borrow Site

Boring No. : B-3
Sheet : 1 **Of :** 1

Drilling Method : Hollow Stem 8" Auger
Sampling Method : Bulk - CD - SPT
Hammer Weight : 140 lbs **Drop Height :** 30"
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Geoboden Inc.
Date Drilled : 5-30-17

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Sample Location	Soil Type (USCS)	Description	Additional Tests
1	12.7			Bulk	CL	**FILL:** **Lean CLAY with SAND;** trace of gravel, stiff, moist, dark yellowish brown	#200 Wash Fines = 83%
2	19.9		6 8 10	SPT	CL	**ALLUVIUM:** **Lean CLAY with SAND;** very stiff, moist, olive brown with layers of pale yellow to white	#200 Wash Fines = 77% PP = 4.5 tsf
3	21.0	107	7 7 13	CD	CL	**Sandy Lean CLAY;** very stiff, moist to very moist, concretions, olive brown	#200 Wash Fines = 71% PP = 1-1.7 tsf
4	16.5		4 7 11	SPT	CL		#200 Wash Fines = 58% PP = 4.5 tsf
5	16.0	118	9 14 21	CD	CL		#200 Wash Fines = 61% PP = 3.5 tsf
6	30.5		4 6 7	SPT	CH	**Fat CLAY;** stiff, moist, to very moist, concretions, light olive brown	#200 Wash Fines = 85% PP = 2.0 tsf
7	29.4	100	6 9 11	CD	CH	**Fat CLAY with SAND;** layers of sandy silt, very stiff, moist to very moist, concretions, light olive brown	#200 Wash Fines = 75% PP = 4.5 tsf
8	25.0		5 6 10	SPT	CL/CH	**Sandy Lean to Fat CLAY with SAND;** very stiff, moist to very moist, brown	#200 Wash Fines = 80% PP=2-4.5 tsf
9	19.8	111	6 12 19	CD	CL	**Lean CLAY with SAND;** very stiff, moist, concretions olive yellow	#200 Wash Fines = 75% PP = 4.0 tsf
						End of boring @ 31' 6" Groundwater encountered @ 24' 6"	

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 35, 40

Groundwater ▽ Bulk ☒ CD ■ SPT ☒

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-0320
Project Name : East Borrow Site

Boring No. : B-4
Sheet : 1 **Of :** 1

Drilling Method : Hollow Stem 8" Auger
Sampling Method : Bulk - CD - SPT
Hammer Weight : 140 lbs **Drop Height :** 30"
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Geoboden
Date Drilled : 5-30-17

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Soil Type (USCS)	Description	Additional Tests
1	16.4			0	Bulk	CL	**FILL:** **Lean CLAY with SAND;** stiff, moist to very moist, dark brown	#200 Wash Fines = 80% EI = 38 LL = 35 PL = 17
2	22.8	104	4 7 9		CD	CL/CH	**ALLUVIUM:** **Lean to Fat CLAY with SAND;** stiff, very moist, concretions, very pale brown with olive brown	#200 Wash Fines = 75% PP = 4.5 tsf
3	19.4		4 5 7	5	SPT	CL	**Sandy Lean CLAY;** stiff, moist, yellowish brown and grayish brown with some white	#200 Wash Fines = 63% PP = 4.5 tsf
4	12.3	121	5 12 19		CD	CL	light olive brown	#200 Wash Fines = 58% PP = 4.5 tsf
5	18.4		5 5 10	10	SPT	CL		#200 Wash Fines = 52% PP = 4.5 tsf
6	13.8	118	5 22 40	15	CD	SM	**Silty SAND;** fine, moist, yellowish brown	#200 Wash Fines = 13%
7	35.1	116	3 4 5	20	SPT	CH	**Fat CLAY with SAND;** lenses of sandy silt, stiff, very moist, concretions, light olive brown	#200 Wash Fines = 81% PP=1.5-1.75tsf
8	17.1	116	16 11 15	25	CD	CH	**Sandy Lean CLAY;** very stiff, moist, light olive brown	#200 Wash Fines = 50% PP = 4.5 tsf
9			3 6 30	30	SPT	SP-SM	**Poorly Graded SAND with SILT;** fine to medium, wet, grayish brown	#200 Wash Fines = 6%
				35			End of boring @ 31' 6" Groundwater encountered @ 21' 6"	
				40				

Groundwater ▽ Bulk ☒ CD ■ SPT ☒

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-0320
Project Name : East Borrow Site

Test Pit No. : 1
Sheet : 1 **Of :** 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight : **Drop Height :**
Location : See Figure A-2
Ground Elevation:
Drilling Co. : Gilstrap
Date Drilled : 5-30-17

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Soil Type (USCS)	Description	Additional Tests
				0		Few inches of gravel at surface Sandy Lean Clay @ 8"	
1	13.7				CL	**ALLUVIUM @ 1.2'** **Sandy Lean CLAY;** moist, yellowish brown	#200 Wash Fines = 72% Corrosivity
2	21.4			5	CL/CH	**Sandy Lean to Fat CLAY;** moist, stiff, abundant, concretions, yellowish brown with white	Fines = 74% EI = 57
3	15.7				CL	**Sandy Lean CLAY;** moist, stiff, caliche, yellowish brown	#200 Wash Fines = 69%
4	14.0			10		Some white, few concretions	#200 Wash Fines = 60%
5	17.0					More white, abundant concretions	#200 Wash Fines = 57%
						End of test pit @ 11' 6" No groundwater encountered	
				15			
				20			
				25			
				30			
				35			
				40			

Bulk CD SPT

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-0320
Project Name : East Borrow Site

Test Pit No. : 2
Sheet : 1 **Of :** 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight :
Drop Height :
Location : See Figure A-2
Ground Elevation:
Drilling Co. : Gilstrap
Date Drilled : 5-30-17

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Soil Type (USCS)	Description	Additional Tests
				0		**Fill:** high organic content	
1	21.5				CL	**ALLUVIUM:** **Lean CLAY with SAND;** moist to very moist, dark yellowish brown	#200 Wash Fines = 83%
2	15.4			5			#200 Wash Fines = 82%
3	21.4				CH	**Fat CLAY with SAND;** very moist, stiff to very stiff, trace of gravel, abundant concretions, dark yellowish brown	#200 Wash Fines = 83%
4	33.8			10		**Fat CLAY**; moist, stiff, concretions, greenish olive Max density = 103.0 pcf Optimum moisture = 21.2%	Fines = 90% EI = 92 LL = 81 PL = 26
5	30.6					Concretions, caliche	#200 Wash Fines = 88%
				15		End of test pit @ 12' 6" No groundwater encountered	
				20			
				25			
				30			
				35			
				40			

Bulk CD SPT

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-0320
Project Name : East Borrow Site

Test Pit No. : 3
Sheet : 1 **Of :** 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight :
Drop Height :
Location : See Figure A-2
Ground Elevation:
Drilling Co. : Gilstrap
Date Drilled : 5-30-17

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
				0				**Fill: Lean Clay with Sand**	
1	16.3				Bulk		CL	**ALLUVIUM:** **Lean CLAY with SAND;** stiff, moist, dark, yellowish brown	#200 Wash Fines = 83% EI = 27
2	24.2			5	Bulk		CL/CH	**Lean to Fat CLAY with SAND;** stiff, moist to very moist, small concretions, yellowish brown	#200 Wash Fines = 77% EI=62
3	17.4				Bulk		CL	**Sandy Lean CLAY;** stiff, moist, trace concretions and caliche, dark yellowish brown	#200 Wash Fines = 61%
4	20.9			10	Bulk		CL/CH	**Sandy Lean to Fat CLAY;** stiff to very stiff, very moist, yellowish brown	Fines = 69% EI = 85 LL = 39 PL = 21
5	19.5				Bulk		CL	**Sandy Lean CLAY;** very stiff, moist, caliche, concretions, yellowish brown with rusty brown	#200 Wash Fines = 63%
								End of test pit @ 12' 6" No groundwater encountered	
				15					
				20					
				25					
				30					
				35					
				40					

Bulk CD SPT

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. :17-0320
Project Name : East Borrow Site

Test Pit No. : 4
Sheet : 1 **Of :** 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight :
Drop Height :
Location : See Figure A-2
Ground Elevation:
Drilling Co. : Gilstrap
Date Drilled : 5-30-17

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
				0				**Fill: Lean CLAY with SAND;** dark brown (topsoil)	
1	17.7				Bulk		CL	**ALLUVIUM:** **Lean CLAY with SAND;** trace of gravel, stiff, moist, concretions, dark yellowish brown	#200 Wash Fines = 85%
2	19.6			5	Bulk				#200 Wash Fines = 84%
3	21.1			10	Bulk		CL/CH	**Lean to Fat CLAY with SAND;** stiff, moist to very moist, caliche, calcium carbonate, some concretions, light olive brown with some green	#200 Wash Fines = 76%
				15				End of test pit @ 13' 6" No groundwater encountered	
				20					
				25					
				30					
				35					
				40					

Bulk CD SPT

Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. :17-0320
Project Name : East Borrow Site

Test Pit No. : 5
Sheet : 1 **Of :** 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight : **Drop Height :**
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Gilstrap
Date Drilled : 5-30-17

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
				0				**Fill: Lean CLAY with SAND;** dark brown (topsoil)	
1	16.7				Bulk			**Lean CLAY with SAND;** moist to very moist, dark yellowish brown LL = 30 PL = 16	Fines = 86% LL = 30 PL = 16
2	16.9				Bulk			**ALLUVIUM:** **Lean CLAY with SAND;** very stiff, moist, few concretions, dark yellowish brown	#200 Wash Fines = 80%
				5					
3	25.4				Bulk		CL	**Lean CLAY with SAND;** stiff, moist to very moist, few concretions, caliche, dark yellowish brown	#200 Wash Fines = 81% EI = 58
4	21.0				Bulk			**Sandy Lean CLAY;** stiff, moist to very moist, concretions, light olive brown with white	#200 Wash Fines = 66%
5	25.5			10	Bulk			**Lean CLAY with SAND;** stiff, moist, concretions, very pale brown with white Maximum Dry Density 114.0 Optimum moisture 15.3%	#200 Wash Fines = 78% EI = 40 LL = 35 PL = 19
6	25.7				Bulk			few concretions, light olive brown with white	Fines = 78%
								End of test pit @ 13' 6" No groundwater encountered	
				15					
				20					
				25					
				30					
				35					
				40					

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Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-0320
Project Name : East Borrow Site

Test Pit No. : 6
Sheet : 1 **Of :** 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight : **Drop Height :**
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Gilstrap
Date Drilled : 5-30-17

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
				0				**Fill**	
1	16.2				☒		CL/CH	**Lean to Fat Clay with SAND;** stiff, moist, few concretions, very dark brown to dark yellowish brown with white	#200 Wash Fines = 83%
2	19.8				☒				#200 Wash Fines = 83%
3	20.2			5	☒			**Sandy Lean to Fat CLAY;** stiff, moist to very moist, abundant concretions, light olive brown with pale yellow	#200 Wash Fines = 66%
4					☒			**Lean to Fat CLAY with SAND;** stiff, moist to very moist, few concretions, caliche, light olive brown with green	#200 Wash Fines = 82%
5	19.5			10	☒		CL	**Sandy Lean CLAY;** stiff, moist, caliche, few concretions, light olive brown	#200 Wash Fines = 74%
6	16.7				☒				#200 Wash Fines = 70%
				15				End of test pit @ 12' No groundwater encountered	
				20					
				25					
				30					
				35					
				40					

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Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-0320
Project Name : East Borrow Site

Test Pit No. : 7
Sheet : 1 **Of :** 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight : **Drop Height :**
Location : See Figure A-2
Ground Elevation:
Drilling Co. : Gilstrap
Date Drilled : 5-30-17

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Soil Type (USCS)	Description	Additional Tests
				0	CL	**Fill: Lean CLAY with SAND;** black	
1 2	16.4 15.1				CL	**ALLUVIUM:** **Lean CLAY with SAND;** stiff, moist, numerous concretions, dark yellowish brown to dark brown	Fines = 82% Fines = 78%
3	20.1						#200 Wash Fines = 83%
				5			
4	19.2				CL	**Sandy Lean CLAY;** stiff, moist, concretions, caliche, light olive brown with green	#200 Wash Fines = 62%
5	17.8						#200 Wash Fines = 61%
				10			
6	17.6						#200 Wash Fines = 53 %
						End of test pit @ 13' No groundwater encountered	
				15			
				20			
				25			
				30			
				35			
				40			

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Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-0320
Project Name : East Borrow Site

Test Pit No. : 8
Sheet : 1 **Of :** 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight :
Drop Height :
Location : See Figure A-2
Ground Elevation:
Drilling Co. : Gilstrap
Date Drilled : 5-30-17

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
				0			CL	**Fill: Lean CLAY with SAND;** brown	
1	16.1				Bulk		CL	**Lean CLAY with SAND;** stiff, moist, few concretions, dark brown to dark yellowish brown	#200 Wash Fines = 86%
2	16.0				Bulk				#200 Wash Fines = 76%
3	15.9				SPT			**Sandy Lean CLAY;** stiff, moist, abundant concretions, light yellowish brown with white	#200 Wash Fines = 54%
				5					
4	16.6			10	Bulk			light olive brown with green	#200 Wash Fines = 62%
5	20.3				SPT			caliche, calcium carbonate, with rusty brown specs	#200 Wash Fines = 64%
								End of test pit @ 13' No groundwater encountered	
				15					
				20					
				25					
				30					
				35					
				40					

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Boring Log

KOURY ENGINEERING & TESTING, INC.

Project No. : 17-0320
Project Name : East Borrow Site

Test Pit No. : 9
Sheet : 1 **Of :** 1

Drilling Method : Backhoe
Sampling Method : Bulk
Hammer Weight : **Drop Height :**
Location : See Figure A-2

Ground Elevation:
Drilling Co. : Gilstrap
Date Drilled : 5-30-17

Sample No.	Moisture Content (%)	Dry Unit Weight (pcf)	Blows per 6"	Depth (ft)	Sample Location	Graphic Log	Soil Type (USCS)	Description	Additional Tests
				0			CL	**Fill: Lean CLAY with SAND;** brown	
1	13.0						CL	**ALLUVIUM:** **Lean Clay with SAND;** very stiff, moist, abundant concretions, dark yellowish brown	#200 Wash Fines = 80%
2	20.0							crumbly, desiccated, abundant caliche, light yellowish brown with white	#200 Wash Fines = 75%
3	18.8			5				**Sandy Lean CLAY;** stiff to very stiff, moist, some large concretions, very pale brown with white	#200 Wash Fines = 72%
4	17.4			10			ML	**Sandy SILT;** firm to stiff, moist, few concretions, large chunk of caliche, light olive brown with green	#200 Wash Fines = 70%
5	14.2								#200 Wash Fines = 44%
6	19.8						CL	**Sandy Lean CLAY;** firm to stiff, moist, few concretions light olive brown with green	#200 Wash Fines = 50%
				15				End of test pit @ 13' 6" No groundwater encountered	
				20					
				25					
				30					
				35					
				40					

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APPENDIX C

Laboratory Test Results

MAXIMUM DENSITY TEST REPORT

Curve No.: 4467 Series

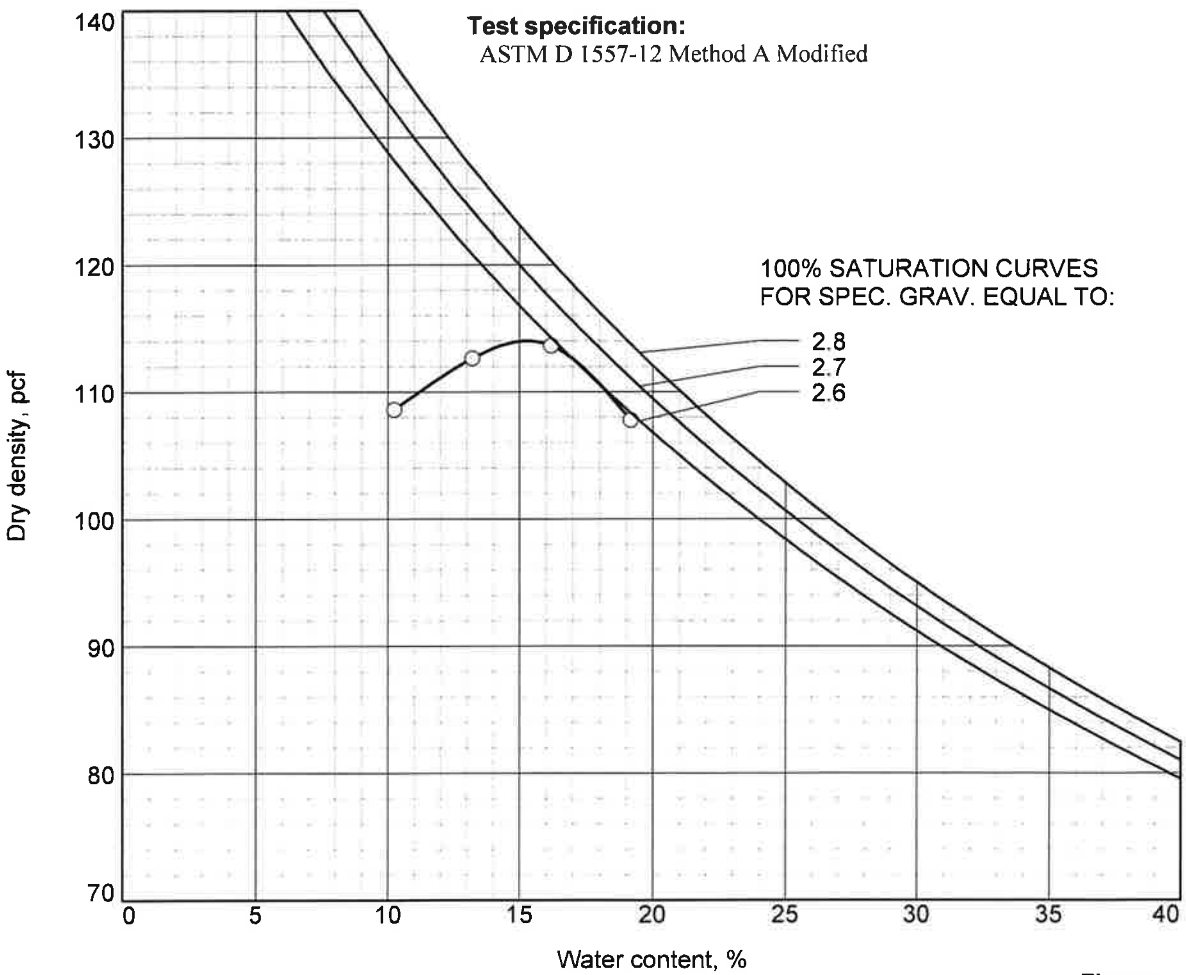
Project No.: 17-0320 **Date:** 6/27/17
Project: East Borrow Site
Client:
Location: TP-5 @ 9.5' - 10.5'
Sample Number: 4467 Series
Remarks: Less than 5% Material retained on the #4 Sieve.

MATERIAL DESCRIPTION

Description: Light Grey to Very Pale Brown Silty Clay

Classifications - **USCS:** CL **AASHTO:**
Nat. Moist. = **Sp.G. =**
Liquid Limit = 35 **Plasticity Index =** 16
% < No.200 =

TEST RESULTS
Maximum dry density = 114.0 pcf
Optimum moisture = 15.3 %



Figure

Koury Engineering & Testing, Inc.

Tested By: BT **Checked By:**

MAXIMUM DENSITY TEST REPORT

Curve No.: 4467 Series

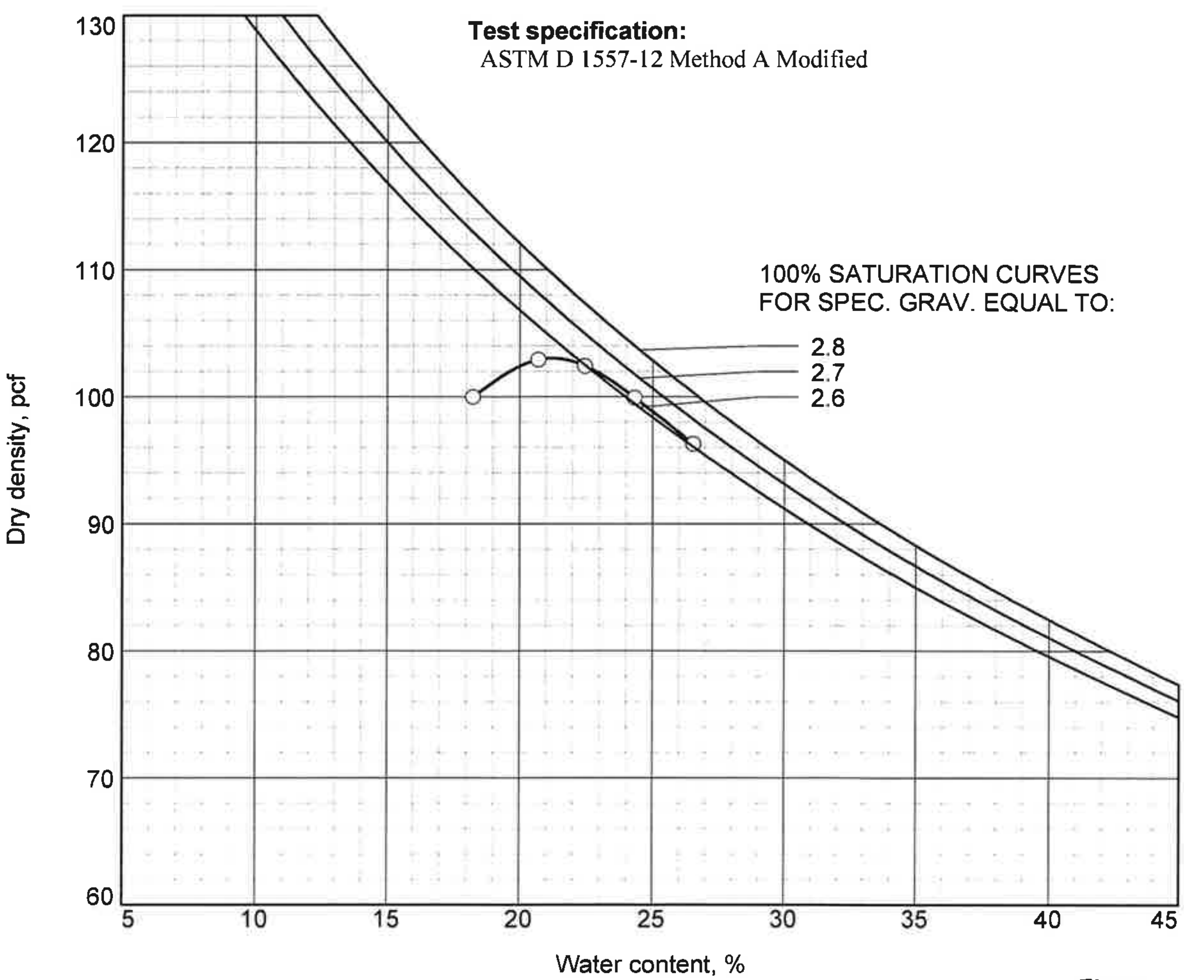
Project No.: 17-0320 **Date:** 06/14/17
Project: East Borrow Site
Client:
Location: Tp2 @ 8.5' - 9.5'
Depth: 8.5' - 9.5'
Remarks: Less Than 5% Material Retained on the #4 Sieve.

MATERIAL DESCRIPTION

Description: Olive Grey to Olive Brown Clay

Classifications - **USCS:** **AASHTO:**
Nat. Moist. = **Sp.G. =**
Liquid Limit = **Plasticity Index =**
% < No.200 =

TEST RESULTS
Maximum dry density = 103.0 pcf
Optimum moisture = 21.2 %



Figure

Koury Engineering & Testing, Inc.

Tested By: ABB/BT **Checked By:**

We are a key member of the construction team while safeguarding the public. We improve operational logistics and provide superior quality control through the continuing development of our engineering staff and technical expertise, utilization of classroom training and field supervisors, thus defining the industry standard.

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