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February 23, 2017

Long Meadow Ranch
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Geotechnical Engineering Report Update — Project Number: 7008.01.12.2
Mills Lane Lodging Project
Mills Lane
St. Helena, California

Introduction

In accordance with your request we have reviewed the geotechnical aspects of the development plans prepared by Turnbull, Griffin & Haesloop, dated September 14, 2016 for the subject project. Those plans indicate that the site will be developed with ten multi-unit guest suite lodges, a fitness center, a multi-purpose building, swimming pool, and associated parking and landscaping. The results of our geotechnical study for a different project on the property were presented in our report dated May 8, 2001. That report addressed a project that included construction of approximately 15 buildings for mixed retail, office, and restaurant use.

Work Performed

For our original study, we explored the subsurface conditions by drilling 11 borings to depths ranging from about 8 to 15½ feet. These borings are shown on Plate 1. On January 20, 2017, we performed a supplemental geotechnical reconnaissance of the site and explored the subsurface conditions by drilling two supplemental borings to depths ranging from about 30½ to 43 feet. The borings were drilled with a track-mounted drill rig equipped with 8-inch diameter, hollow stem augers at the approximate locations shown on the Exploration Plan, Plate 1. The boring locations were determined approximately by pacing their distance from features shown on the Exploration Plan and should be considered accurate only to the degree implied by the method used. Our field engineer located and logged the borings and obtained samples of the materials encountered for visual examination, classification and laboratory testing.

Relatively undisturbed samples were obtained from the borings at selected intervals by driving a 2.43-inch inside diameter, split spoon sampler, containing 6-inch long brass liners, using a 140-pound hammer dropping approximately 30 inches. The sampler was driven 12 to 18 inches. The blows required to drive each 6-inch increment were recorded and the blows required to drive the last 12 inches, or portion thereof, were converted to equivalent Standard Penetration Test (SPT) blow counts for correlation with empirical data. Disturbed samples were also obtained at selected depths by driving a 1.375-inch inside diameter (2-inch outside diameter) SPT sampler, without liners or rings, using a 140-pound hammer dropping approximately 30 inches. The sampler was driven 12 to 18 inches, the blows to drive each 6-inch increment were recorded, and the blows required to drive the final 12 inches, or portion thereof, are provided on the boring logs.

The logs of the borings showing the materials encountered, groundwater conditions, converted blow counts, and sample depths are presented on Plates 2 and 3. The soils are described in accordance with the Unified Soil Classification System, outlined on Plate 4.

The boring logs show our interpretation of the subsurface soil and groundwater conditions on the date and at the locations indicated. Subsurface conditions may vary at other locations and times. Our interpretation is based on visual inspection of soil samples, laboratory test results, and interpretation of drilling and sampling resistance. The location of the soil boundaries should be considered approximate. The transition between soil types may be gradual.

Laboratory Testing

The samples obtained from the borings were transported to our office and re-examined by the project engineer to verify soil classifications, evaluate characteristics, and assign tests pertinent to our analysis. Selected samples were laboratory tested to determine their classification (Atterberg Limits, percent of silt and clay) and expansion potential (Expansion Index - EI). The test results are presented on the boring logs. Results of the classification and expansion potential tests are presented on Plate 5.

Subsurface

Our supplemental borings and laboratory tests indicate that the portion of the site we studied is blanketed by up to 5 feet of weak, porous, compressible, surface soils. It appears that our previous borings were drilled in the access roads as opposed to the agricultural areas, which may explain the difference in the thickness of weak and porous soils. The agricultural areas were likely ripped at about 5 feet. Porous soils appear hard and strong when dry but become weak and compressible as their moisture content increases towards saturation. Our referenced report indicated the presence of 2 to 4 feet of weak and porous soils. The contractor should be aware that additional excavation will be required to strengthen the weak and porous soils.

The weak and porous soils exhibit low plasticity (LL = 25; PI = 6) and low expansion potential (EI = 25). These surface materials are underlain by stiff sandy clays and occasional layers of loose to dense clayey gravels and clayey sands to the maximum depths explored (43 feet).

A detailed description of the subsurface conditions found in our supplemental borings is given on Plates 2 and 3, Appendix A. Based on Table 20.3-1 of American Society of Civil Engineers (ASCE) Standard 7-10, titled “Minimum Design Loads for Buildings and Other Structures” (2010), we have determined a Site Class of D should be used for the site.

Liquefaction and Densification

Liquefaction is a rapid loss of shear strength experienced in saturated, predominantly granular soils below the groundwater level during strong earthquake ground shaking due to an increase in pore water pressure. The occurrence of this phenomenon is dependent on many complex factors including the intensity and duration of ground shaking, particle size distribution and density of the soil.

Granular soils were encountered at the site below the groundwater table. Therefore, we performed an analysis of the blow count data from our borings using the methods of Seed and Idriss (1982), Seed and others (1985), Youd and Idriss (2001), Idriss and Boulanger (2004) and Idriss and Boulanger (2008). These procedures normalize the blow counts to account for overburden pressure, rod length, hammer energy, and fines (percent of silt and clay) content. Once the blow counts are normalized and adjusted to a clean sand blow count, the cyclic resistance ratio (CRR) for each blow count is then determined using the same procedures referenced above. The CRR is compared to the cyclic stress ratio (CSR) induced by the earthquake. Calculating the CSR requires a peak ground acceleration and design earthquake magnitude.

Peak ground acceleration (PGA) was determined using the methods in the 2016 California Building Code (CBC) and ASCE Standard 7-10. Using the U.S. Seismic Design Maps from the United States Geological Survey (USGS) website (http://earthquake.usgs.gov/designmaps/us/application.php), the site's latitude and longitude of 38.5016°N and 122.4597°W, respectively, and a site soil Class of D, the PGA for the site is 0.5g. Using this information, the CSR for a M_M 7.5 earthquake at the site ranges from 0.32 to 0.48. The West Napa fault is most likely controlling the ground motions at the site. According to Petersen (1996), the West Napa fault is capable of a M_M 6.5 earthquake. Therefore, the CRR values at the site must be scaled to account for the difference between M_M 6.5 and M_M 7.5. When the scaling factor for magnitude and confining stress corrections presented in Idriss and Boulanger (2004) are applied, the CRR values at the site do not exceed the CSR values. Therefore, we judge that there is potential for liquefaction at the site.

There are three potential consequences of liquefaction: bearing capacity failure, lateral spreading toward a free face (e.g. riverbank) and settlement. Bearing capacity failure is sudden and extreme settlement of foundations that typically occurs when the liquefied layer is relatively close (typically within two times the footing width, depending on the loads) to the bottom of the foundation. Because the liquefiable layer is 6 feet below the ground surface, it is possible that foundations could be susceptible to bearing capacity failure. However, the groundwater in our borings ranged from 5 ½ to 7 feet after an extensive period of rain. It is likely that the groundwater is at a lower level for most of the year. Furthermore, the upper 5 feet of soil will need to be removed. Therefore, we judge the potential for bearing capacity failure is low.

Lateral spreading can occur where continuous layers of liquefiable soil extend to a free face, such as a creek bank. There are no significant free faces in the vicinity of the site. Therefore, we judge the potential for liquefaction-induced lateral spreading at the site is low.

The third potential consequence of liquefaction is settlement due to densification of the liquefied soils. Potential settlements based on the blow count data and cyclic stress ratio were calculated using the methods of Ishihara and Yoshimine (1992). For the layer encountered in our boring, we calculated total settlement ranging from up to ½ inch. Differential settlement could also range up to ½ inch

Densification is the settlement of loose, granular soils above the groundwater level due to earthquake shaking. Typically, granular soils that would be susceptible to liquefaction, if saturated, are susceptible to densification if not saturated. Provided remedial grading is performed as recommended herein and in our referenced report, we judge there is a low potential for densification to impact structures at the site.

Conclusions and Recommendations

Based on our review and reconnaissance it is our opinion that the recommendations in our report, with the updated information presented below, are valid for design and construction of the proposed lodging facilities.

Seismic Design

Seismic design parameters presented below are based on Section 1613 titled "Earthquake Loads" of the 2016 California Building Code (CBC). Based on Table 20.3-1 of American Society of Civil Engineers (ASCE) Standard 7-10, titled "Minimum Design Loads for Buildings and Other Structures" (2010), we have determined a Site Class of D should be used for the site. Using a site latitude and longitude of 38.5016°N and 122.4597°W, respectively, and the U.S. Seismic Design Maps from the United States Geological Survey (USGS) website (http://earthquake.usgs.gov/designmaps/us/application.php), we recommend that the following seismic design criteria be used for structures at the site.

2016 CBC Seismic Criteria	
Spectral Response Parameter	**Acceleration (g)**
S_S (0.2 second period)	1.500
S_1 (1 second period)	0.600
S_{MS} (0.2 second period)	1.500
S_{M1} (1 second period)	0.900
S_{DS} (0.2 second period)	1.000
S_{D1} (1 second period)	0.600

Excavations

Within building areas, the weak, porous, and compressible surface soils should be excavated to within 6 inches of their entire depth, which should be assumed to be about 5 feet based on our recent borings. All other geotechnical grading recommendations should follow the original report. Contractors bidding for this project should be made aware that the excavations for weak and porous soils extend deeper than the recommendations outlined in our original report.

Very truly yours,
RGH Consultants

Gary W. Russey
Principal Geologist

Eric G. Chase
Senior Associate Engineer

BPC:GWR:EGC:bc:ew
Three wet-signs and electronically submitted

s:\work in progress\7008\7008.01.12.2 mills lane commercial project\report update letter with seismic.doc

Attachments:	Plate 1	Exploration Plan
	Plates 3 and 4	Logs of Borings B-1 and B-2
	Plate 4	Soil Classification Chart and Key to Test Data
	Plate 5	Classification Test Data

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APPENDIX A – REFERENCES

American Society of Civil Engineers, 2016, Minimum Design Loads for Buildings and Other Structures, ASCE Standard ASCE/SEI 7-10.

California Building Code, 2016, California Building Standard Commission.

Hidalgo, J.B., Scoralle, L. A., 2001, Geotechnical Investigation - Mills Lane Commercial Project, RGH Geotechnical and Environmental Consultants.

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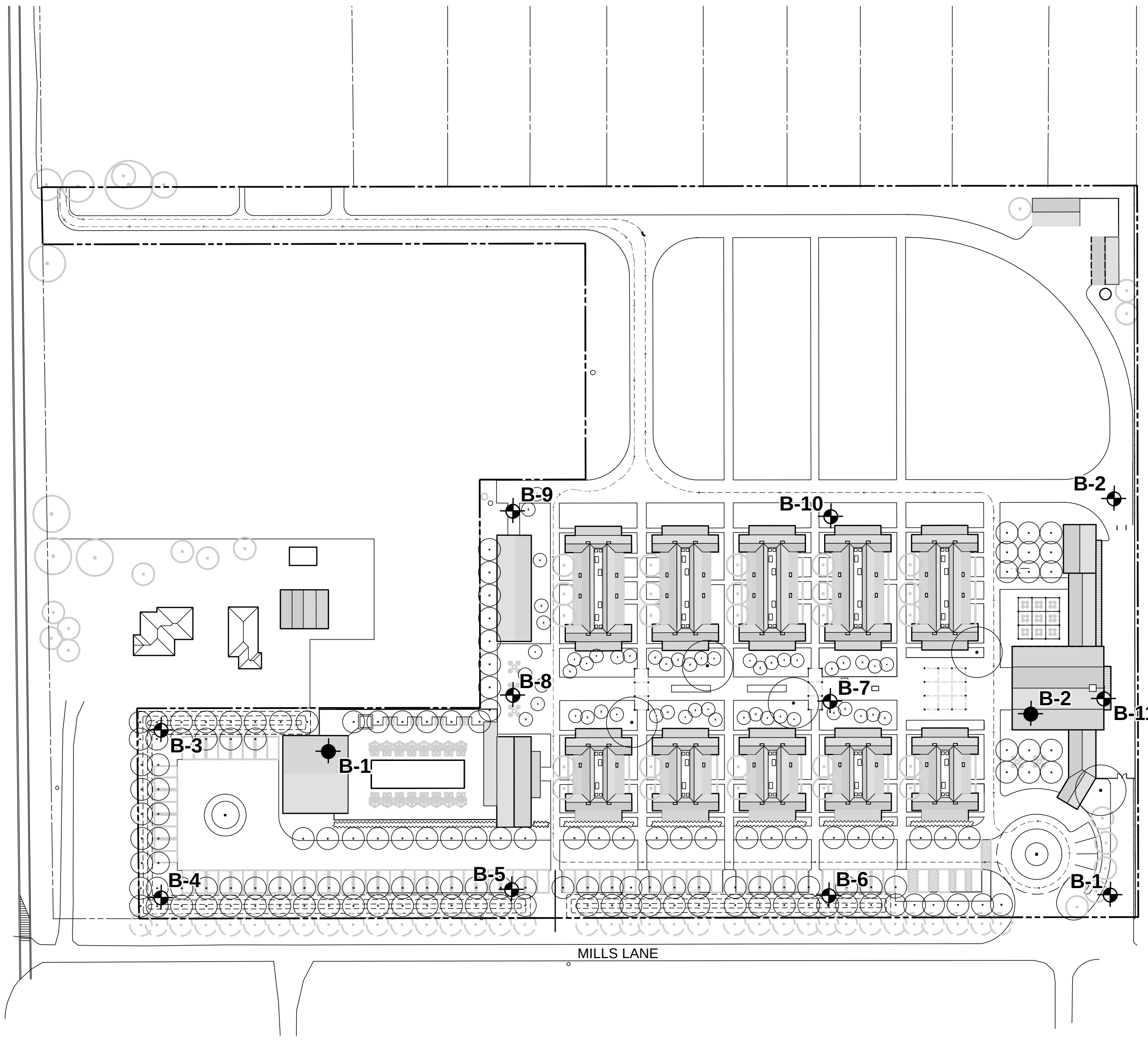

EXPLANATION

B-1 Boring Location and Number, 2016

B-1 Boring Location and Number, 2001

80' 0 80' 160'

Scale 1" = 160'

N

Reference: Master Site Plan prepared by Turnbull, Griffin, and Haesloop, dated January 10, 2016.

Scale: 1" = 160'

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EXPLORATION PLAN
Mills Lane Lodging Project
Mills Lane
St. Helena, California

PLATE
1

Date(s) Drilled **1/20/2017**	Logged By **BPC**	Checked By **EGC**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8-inch HSA**	Total Depth of Borehole **43 feet**
Drill Rig Type **CME-55 Track-Mounted**	Drilling Contractor **Taber**	Approximate Surface Elevation **Existing Ground Surface**
Groundwater Level and Date Measured **5-1/2 feet bgs**	Sampling Method(s) **Modified California, SPT**	Hammer Data **140-lb, 30-inch autotrip**

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance, blows/ft	Graphic Log	MATERIAL DESCRIPTION	Dry Density (pcf)	Water Content (%)	% <#200 Sieve	PI, %	LL, %	Expansion Index (EI)	UC, ksf	REMARKS AND OTHER TESTS
	0				BROWN CLAYEY SAND WITH GRAVEL (SC), loose, wet, fine to coarse sand, many rootlets and organics, porous.								
			2										
			4		BROWN SAND WITH CLAY AND GRAVEL (SP-SC), loose to medium dense, wet, fine to coarse sand, trace fines, porous to 5 feet.								
	5												
			17					8.7					
					MOTTLED RED AND BROWN SANDY CLAY WITH GRAVEL (CL), stiff, wet, fine sand.								
	10												
			14										
	15												
			13										
					BROWN CLAYEY GRAVEL WITH SAND (GC), medium dense to dense, wet, fine to coarse sand.								
	20												

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LOG OF BORING B-1
Mills Lane Lodging Project
Mills Lane
St. Helena, California

PLATE
2a

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance, blows/ft	Graphic Log	MATERIAL DESCRIPTION	Dry Density (pcf)	Water Content (%)	% <#200 Sieve	PI, %	LL, %	Expansion Index (EI)	UC, ksf	REMARKS AND OTHER TESTS
	20				BROWN CLAYEY GRAVEL WITH SAND (GC), medium dense to dense, wet, fine to coarse sand.								
			48/11										
	25												
			10		GRAY-BROWN SANDY CLAY (CL), stiff, wet, fine sand.								
	30				Becomes mottled brown and blue-gray, increasing fines content.								
			10										
					GRAY-BROWN CLAYEY SAND (SC), loose, wet, fine to medium sand.								
	35												
			9		MOTTLED BROWN AND BLUE-GRAY SANDY CLAY (CL), stiff, wet, fine sand.								
					BLUE-GRAY CLAYEY SAND (SC), loose, wet, fine sand.								
					GRAY AND BROWN CLAYEY GRAVEL WITH SAND (GC), dense, wet, medium to coarse sand, large subrounded gravels.								
	40												
			36										
			56										
					Boring terminated at 43 feet. Free water encountered at 10 feet during drilling and stabilized at 5-1/2 feet upon completion.								
	45												

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LOG OF BORING B-1
Mills Lane Lodging Project
Mills Lane
St. Helena, California

PLATE
2b

Date(s) Drilled **1/20/2017**	Logged By **BPC**	Checked By **EGC**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8-inch HSA**	Total Depth of Borehole **31 feet**
Drill Rig Type **CME-55 Track-Mounted**	Drilling Contractor **Taber**	Approximate Surface Elevation **Existing Ground Surface**
Groundwater Level and Date Measured **5-1/2 feet bgs**	Sampling Method(s) **Modified California, SPT**	Hammer Data **140-lb, 30-inch autotrip**

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance, blows/ft	Graphic Log	MATERIAL DESCRIPTION	Dry Density (pcf)	Water Content (%)	% <#200 Sieve	PI, %	LL, %	Expansion Index (EI)	UC, ksf	REMARKS AND OTHER TESTS
	0				DARK BROWN SILTY CLAYEY SAND (SC-SM), very loose, wet, trace fine gravel, many rootlets and organics, porous.								
			2					42.6	6	25			
					BROWN CLAYEY SAND WITH GRAVEL (SC), very loose, wet, trace fine subrounded gravel, porous to 5 feet.								
			3										
	5												
			9					33.9	10	27			
					▼								
					BROWN SAND WITH CLAY AND GRAVEL (SC), loose, wet, medium to coarse sand, fine subrounded gravel.								
	10				∇								
			10		BROWN SANDY CLAY (CL), stiff, moist, fine sand, trace fine subrounded gravel.			51.2					
					MOTTLED GRAY, BROWN AND RED CLAYEY GRAVEL WITH SAND (GC), medium dense, moist, fine to coarse sand, subrounded gravel to 2".								
	15												
			29										
					MOTTLED RED-BROWN AND GRAY SANDY CLAY (CL), very stiff, moist, fine sand.								
	20												

RGH CONSULTANTS	**LOG OF BORING B-2** Mills Lane Lodging Project Mills Lane St. Helena, California	PLATE **3a**
Job No: 7008.01.12.2 — Date: FEB 2017		

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance, blows/ft	Graphic Log	MATERIAL DESCRIPTION	Dry Density (pcf)	Water Content (%)	% <#200 Sieve	PI, %	LL, %	Expansion Index (EI)	UC, ksf	REMARKS AND OTHER TESTS
	20		17		MOTTLED RED-BROWN AND GRAY SANDY CLAY (CL), very stiff, moist, fine sand.								
					GRAY-BROWN GRAVEL WITH CLAY AND SAND (GP-GC), dense, wet, fine to coarse sand, subrounded gravel to 3".								
	25		35										
	30		32/4"										
			50/4"										
					Boring terminated at 31 feet. Free water encountered at 10 feet during drilling and stabilized at 7 feet upon completion.								
	35												
	40												
	45												

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Job No: 7008.01.12.2 | Date: FEB 2017

LOG OF BORING B-2
Mills Lane Lodging Project
Mills Lane
St. Helena, California

PLATE
3b

Elevation (feet)	Depth (feet)	Sample Type	Sampling Resistance, blows/ft	Graphic Log	MATERIAL DESCRIPTION	Dry Density (pcf)	Water Content (%)	% <#200 Sieve	PI, %	LL, %	Expansion Index (EI)	UC, ksf	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9	10	11	12	13	14

COLUMN DESCRIPTIONS

1 Elevation (feet): Elevation (MSL, feet).
2 Depth (feet): Depth in feet below the ground surface.
3 Sample Type: Type of soil sample collected at the depth interval shown.
4 Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating •interval using the hammer identified on the boring log.
5 Graphic Log: Graphic depiction of the subsurface material encountered.
6 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and •other descriptive text.
7 Dry Density (pcf): Dry density, in pcf.
8 Water Content (%): Water content, percent.
9 % <#200 Sieve: % <#200 Sieve
10 PI, %: Plasticity Index, expressed as a water content.
11 LL, %: Liquid Limit, expressed as a water content.
12 Expansion Index (EI): Expansion Index (EI)
13 UC, ksf: Unconfined compressive strength, in kips per square foot.
14 REMARKS AND •OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field •personnel.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

Lean CLAY, CLAY w/SAND, SANDY CLAY (CL)
Clayey GRAVEL (GC)
Poorly graded SAND with Clay (SP-SC)
Poorly graded GRAVEL (GP)
Clayey SAND (SC)

TYPICAL SAMPLER GRAPHIC SYMBOLS

3-inch-OD Modified California w/ brass liners
2½-inch-OD unlined split spoon (SPT)

OTHER GRAPHIC SYMBOLS

Water level (at time of drilling, ATD)
Water level (after waiting)
Minor change in material properties within a stratum
Inferred/gradational contact between strata
? Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

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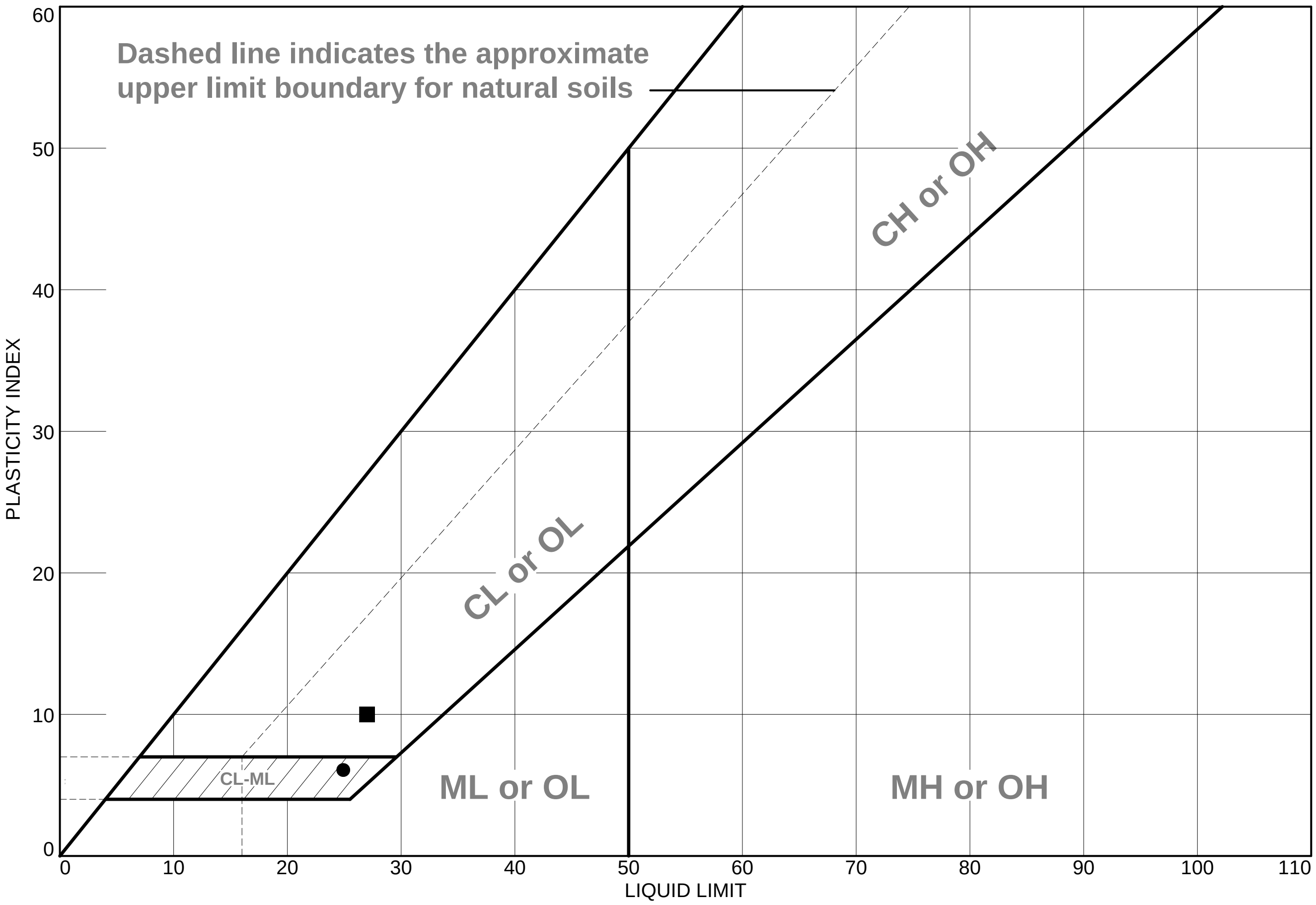
SOIL CLASSIFICATION AND KEY TO TEST DATA
Mills Lane Lodging Project
Mills Lane
St. Helena, California

PLATE
4

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dk Brn Silty Clayey Sand (SC-SM)	25	19	6		42.6	SC
■	Brn Clayey Sand W/ Gravel (SC)	27	17	10		33.9	SC
◆	Brn Sandy Clay (CL)					51.2	CL
▲	Brn Sand W/ Clay & Gravel (SP-SC)					8.7	SP-SC

Project No. 7008.01.12.2 **Client:** RGH Consultants

Project: Mills Lane Commercial Project

● **Source of Sample:** B-2 **Depth:** 1.5' & 2.0'
■ **Source of Sample:** B-2 **Depth:** 6.0'
◆ **Source of Sample:** B-2 **Depth:** 11.0'
▲ **Source of Sample:** B-1 **Depth:** 6.0'

Tested By: SW
Checked By: GEF

Remarks:
●Expansion Index=25

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CLASSIFICATION TEST DATA
Mills Lane Lodging Project
Mills Lane
St. Helena, California

PLATE
5