February 4, 2022

Mr. Jerry Hill
CITY OF MISSION VIEJO
27204 La Paz Road
Mission Viejo, CA 92692

GMU Project 21-283-00

Subject: Geotechnical Investigation for Proposed New Lighting, Marty Russo Youth Athletic Park, Olympiad Road, City of Mission Viejo, California.

Reference: Proposed Lighting Exhibit, Marty Russo Youth Athletic Park, City of Mission Viejo, Prepared by RJM Design Group, dated October 26, 2021.

Dear Mr. Hill:

This correspondence presents our geotechnical design parameters for the pole foundations of the new lights proposed for the baseball and soccer fields at the Marty Russo Youth Athletic Park in Mission Viejo, California. Our design parameters are based on our recent field observations, hollow stem auger (HSA) drill holes, and laboratory testing of the on-site soils.

GEOTECHNICAL SITE CONDITIONS

Our subsurface investigation consisted of the excavation of two HSA drill holes to depths of 36.5 and 51.5 feet below existing ground surfaces. These drill holes were logged by our staff engineer to visually observe and document the subgrade soils and depths to groundwater. Relatively undisturbed samples of the subgrade soils were obtained from each drill hole utilizing a California Modified sampler. Representative bulk bag samples were also obtained. The approximate locations of the drill holes are shown on Plate 1 – Geotechnical Map. The logs of the drill holes are included in Appendix A.

Appendix B contains the results of our laboratory testing which included the determination of in-situ moisture content and dry density, particle size gradation for soil classification, soil corrosivity, and shear strength testing on samples obtained from the drill holes. A summary of our laboratory test procedures and the results of our laboratory testing are included in Appendix B.

Based on our observations, the drill holes exposed 4 inches of topsoil overlying native alluvial deposits (Qal). The alluvial deposits underlying the site consist predominantly of silty and sandy clays with a few isolated lenses of sands. The following geotechnical site conditions are considered representative of the areas of the planned light pole improvements.

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- Foundations Soils: Alluvial Deposits
- Soil Types: CL, SM (silty and sandy clays with sand lenses)
- Soil Strength Values: Cohesion = 300 psf
  Friction Angle (phi) = 21 deg
- Groundwater: 5 feet below existing ground surface

LIQUEFACTION

Based on review of California Geological Survey's (CGS) Seismic Hazard Zone Map for the Lake Forest Quadrangle, the subject site is within a seismic hazard zone requiring liquefaction investigation. However, based on the results of our subsurface exploration and laboratory testing, the subsurface soils consist predominantly of silty clays and sandy clays that are not considered susceptible to liquefaction.

SOIL CORROSION

To evaluate the corrosion potential of the on-site soils to both ferrous metals and concrete, representative samples were tested for pH, minimum resistivity, soluble chlorides, and soluble sulfates. The results of chemical testing contained in Appendix B indicate that the on-site soils possess a moderate sulfate exposure to concrete and should be considered severely corrosive to ferrous metals.

Type II/V cement with a maximum water/cement ratio of 0.50 and minimum compressive strength of 4,000 psi should be used in concrete that will be in contact with on-site soils, as specified in the current CBC and ACI 318. The aforementioned recommendations in regards to concrete are made from a soils perspective only. Final concrete mix design is beyond our purview.

STRUCTURE SEISMIC DESIGN

No active or potentially active faults are known to cross the site; therefore, the potential for primary ground rupture due to faulting on-site is very low to negligible. However, the site will likely be subject to seismic shaking at some time in the future.

The average shear wave velocity for the upper 100 feet of subsurface soil and bedrock materials (V_{s30}) within the subject site is estimated to be greater than 600 feet per second but less than 1,200 feet per second which corresponds to a "stiff soil" soil profile. The seismic design coefficients based on ASCE 7-16 and 2019 CBC are listed in the following table.

Table 1. 2019 CBC and ASCE 7-16 Seismic Design Parameters
(To be utilized as per the requirements of Section 11.4.8 of ASCE 7-16)

Seismic Item	Design Value	2016 ASCE 7-16 or 2019 CBC Reference
Site Class based on soil profile (ASCE 7-16 Table 20.3-1)	D[(a)]	ASCE 7-16 Table 20.3-1
Short Period Spectral Acceleration S_s	1.239[(a)]	CBC Figures 1613.2.1 (1-8)
1-sec. Period Spectral Acceleration S_1	0.443[(a)]	CBC Figures 1613.2.1 (1-8)
Site Coefficient F_a (2019 CBC Table 1613.2.3(1))	1.2[(a)]	CBC Table 1613.2.3 (1)
Site Coefficient F_v (2019 CBC Table 1613.2.3(2))	1.857[(b)]	CBC Table 1613.2.3 (2)
Short Period MCE* Spectral Acceleration S_{MS} $S_{MS} = F_a S_s$	1.486[(a)]	CBC Equation 16-36
1-sec. Period MCE Spectral Acceleration S_{M1} $S_{M1} = F_v S_1$	0.882[(b)]	CBC Equation 16-37
Short Period Design Spectral Acceleration S_{DS} $S_{DS} = 2/3 S_{Ms}$	0.991[(a)]	CBC Equation 16-38
1-sec. Period Design Spectral Acceleration S_{D1} $S_{D1} = 2/3 S_{M1}$	0.588[(b)]	CBC Equation 16-39
Short Period Transition Period T_S (sec) $T_S = S_{D1}/S_{DS}$	0.652[(b)]	ASCE 7-16 Section 11.4.6
Long Period Transition Period T_L (sec)	8[(b)]	ASCE 7-16 Figures 22-14 to 22-17
MCE[(c)] Peak Ground Acceleration (PGA)	0.513[(a)]	ASCE 7-16 Figures 22-9 to 22-13
Site Coefficient F_{PGA} (ASCE 7-16 Table 11.8-1)	1.2[(a)]	ASCE 7-16 Table 11.8-1
Modified MCE[(c)] Peak Ground Acceleration (PGA_M)	0.616[(a)]	ASCE 7-16 Equation 11.8-1
Seismic Design Category	D[(b)]	ASCE 7-16 Tables 11.6.1 and 11.6.2

(a) Design Values Obtained from USGS Earthquake Hazards Program website that are based on the ASCE-7-16 and 2019 CBC and site coordinates of N33.6399° and W117.6412°.
(b) Design Values Determined per ASCE Table 11.4-2 and CBC Equations 16-36 through 16-39.
(c) MCE: Maximum Considered Earthquake.

Since the Site Class is designated as D and the S_1 value is greater than or equal to 0.2, the 2019 CBC requires either a site-specific ground motion hazard analysis per Section 21.2 of ASCE 7-16 or the application of Exception 2 of Section 11.4.8 of ASCE 7-16. Exception 2 states that a site-specific ground motion hazard analysis is not required provided that the value of the seismic response coefficient, Cs, is conservatively calculated by the project structural engineer using Eqn. 12.8-2 of ASCE 7-16 for values of $T \leq 1.5Ts$ and taken as equal to 1.5 times the value computed in accordance with either Eqn. 12.8-3 for $T_L \geq T > 1.5Ts$ or Eqn. 12.8-4 for $T > T_L$.

The project structural engineer should apply all requirements of Section 11.4.8 of ASCE 7-16 to determine if increases to the seismic response coefficient (ie. increases to the loading of the structure) are required.

LIGHT POLE FOUNDATION DESIGN CRITERIA

The following geotechnical design parameters may be used for the design of pole foundations for the new proposed lights:

Bearing Material: Native Alluvium

Depth to Groundwater: 5 feet

Minimum Foundation Diameter: 24 inches

Minimum Pole Foundation Depth: 10 feet

Allowable End Bearing: 2,000 psf (for minimum pole foundation depth of 10 feet)
- One-third increase for wind and seismic loads
- Assumes bottom of drill hole thoroughly cleaned of all loose soil prior to pour.

Allowable Skin Friction: 225 psf
- Disregard upper 2 feet due to possible soil disturbance.
- One-third increase for wind and seismic loads

Allowable Lateral Bearing: 300 psf/ per ft of pole depth.
- Ignore upper 2 feet due to possible soil disturbance.
- Can be applied over an effective width of 2 pole foundation diameters (e.g. 600sf/ft of pole diameter per ft of depth).

The final pole diameter and depth will depend on the design loads from the light poles. GMU has not been provided with information pertaining to potential foundation systems or design loads. When additional foundation design information is available, GMU should review that information and confirm or revise the preliminary design parameters presented herein.

POLE FOUNDATION CONSTRUCTION CONSIDERATIONS

As mentioned previously, groundwater was encountered within both of our drill holes at a depth of 5 feet below the existing ground surface. As a result, the subsurface soils can be expected to be fully saturated at a depth of 5 feet below the existing ground surface and the foundation excavations can be expected to fill up with water to a depth of 5 feet from the ground surface. Based on these conditions, temporary casing or drilling mud will be required to advance the pole foundation excavations beyond a depth of 5 feet. In addition, either each foundation excavation will need to be pumped out immediately before the concrete is placed or the concrete will need to be placed into the bottom of each foundation excavation using a tremie pipe to properly displace the water from the hole as the concrete is placed.

LIMITATIONS

All parties reviewing or utilizing this report should recognize that the findings, conclusions, and recommendations presented represent the results of our professional geological and geotechnical engineering efforts and judgments. Due to the inexact nature of the state of the art of these professions and the possible occurrence of undetected variables in subsurface conditions, we cannot guarantee that the conditions actually encountered during grading and site construction will be identical to those observed, sampled, and interpreted during our study, or that there are no unknown subsurface conditions which could have an adverse effect on the use of the property. We have exercised a degree of care comparable to the standard of practice presently maintained by other professionals in the fields of geotechnical engineering and engineering geology, and believe that our findings present a reasonably representative description of geotechnical conditions and their probable influence on the use of the property.

Our conclusions and recommendations are based on the assumption that our firm will act as the geotechnical engineer of record during construction of the project to observe the actual conditions exposed, to verify our design concepts, and to provide our revised conclusions and recommendations should subsurface conditions differ significantly from those used as the basis for our conclusions and recommendations presented in this report. Since our conclusions and recommendations are based on a limited amount of geotechnical exploration and analysis, all parties should recognize the need for possible revisions to our conclusions and recommendations during construction of the project.

It should be further noted that the recommendations presented herein are intended solely to minimize the effects of post-construction soil movements. Consequently, minor cracking and/or distortion of all on-site improvements should be anticipated.

This report has not been prepared for the use by other parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

Please do not hesitate to call if you have any questions regarding the contents of this letter.

Respectfully submitted,

GMU GEOTECHNICAL, INC.

Scott Ward, EIT
Project Engineer

Alan B. Mutchnick, PG, CEG 1789
Associate Engineering Geologist

David Hansen, M.Sc., PE, GE 3056
Associate Geotechnical Engineer

Attachments:
- Plate 1 – Location Map
- Plate 2 – Geotechnical Map
- Appendix A – Boring Logs
- Appendix B – Laboratory Test Data

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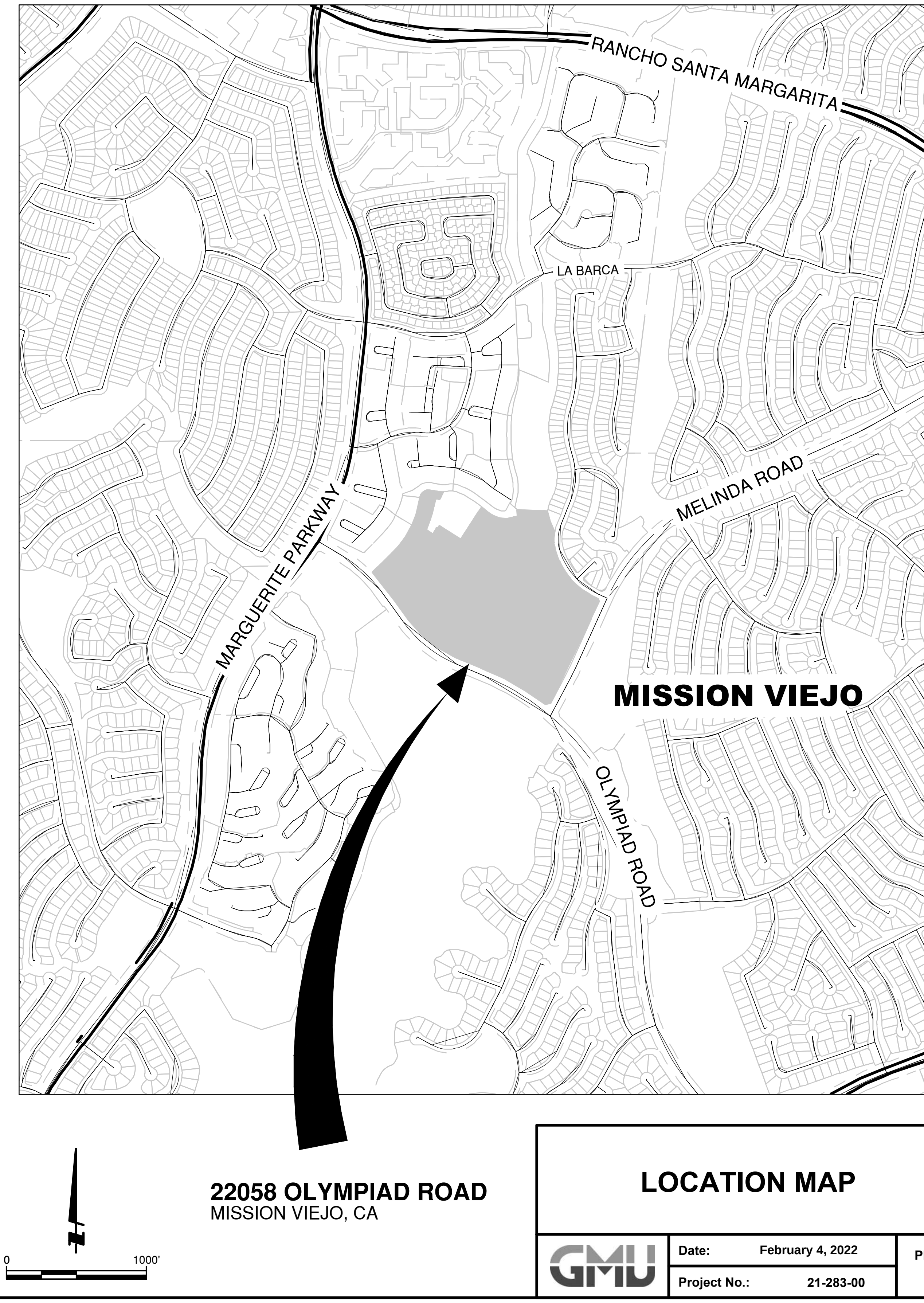

22058 OLYMPIAD ROAD
MISSION VIEJO, CA

DRAWING: q:\2021\21-283-00\dwg\plate 1_location map.dwg PLOTTED: 1/28/2022 3:39 PM BY: Lucie Anderson

LOCATION MAP

GMU	Date:	February 4, 2022	Plate 1
	Project No.:	21-283-00	

GEOTECHNICAL INVESTIGATION MAP

GMU	Date: February 4, 2022	Plate 2
	Project No.: 21-283-00	

LEGEND

DH-2 APPROXIMATE LOCATION OF DRILL HOLE

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APPENDIX A

Geotechnical Exploration Logs

Project: Marty Russo Youth Athletic Park Project Location: Mission Viejo, CA Project Number: 21-283-00	# Log of Drill Hole DH-1 Sheet 1 of 2

Date(s) Drilled	1/7/22	Logged By	RC	Checked By	SW
Drilling Method	Hollow Stem Auger	Drilling Contractor	M R Drilling	Total Depth of Drill Hole	35.0 feet
Drill Rig Type	Track Rig	Diameter(s) of Hole, inches	8	Approx. Surface Elevation, ft MSL	718.0
Groundwater Depth [Elevation], feet	5.0 [713.0]	Sampling Method(s)	California Modifed Sampler with 6-inch sleeve/SPT	Drill Hole Backfill	Native, bentonite
Remarks				Driving Method and Drop	140 lb hammer, 30" drop

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
	0		**Alluvial Deposits (Qal)**		TOPSOIL SILTY CLAY (CL); dark grayish brown, moist to very moist, firm, some fine-grained sand						
715											
	5				Poorly Graded SAND to SILTY SAND (SP-SM); light brown, saturated, loose, fine- to coarse-grained sand		3 3 5		19	106	
710					SILTY CLAY (CL); grayish brown, very moist, soft to firm, some fine-grained sand						
	10						1 2 3				
705											
	15				SANDY CLAY (CL); grayish brown, very moist to saturated, some fine-grained sand		2 2 4		30	92	DS
700											

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ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
					SILTY CLAY (CL); grayish brown, very moist, firm		3 5 6				
695											
	25						2 3 5		35	88	
690											
	30				Becomes soft		1 2 2				
685											
			3 Rings of sand above recovered sample at 35ft, some cementation		SILTY SAND (SM): light brown, saturated, medium dense, fine- to coarse-grained sand				17		
	35				SANDY CLAY to CLAYEY SILT with Sand (CL-ML); grayish brown, very moist, firm, fine-grained sand		3 3 4		27	96	
					Total Depth: 36.5ft Groundwater at 5ft						

Project: Marty Russo Youth Athletic Park **Project Location:** Mission Viejo, CA **Project Number:** 21-283-00	# Log of Drill Hole DH-2

Date(s) Drilled	**1/7/22**	Logged By	**RC**	Checked By	**SW**
Drilling Method	**Hollow Stem Auger**	Drilling Contractor	**M R Drilling**	Total Depth of Drill Hole	**51.5 feet**
Drill Rig Type	**Track Rig**	Diameter(s) of Hole, inches	**8**	Approx. Surface Elevation, ft MSL	**710.0**
Groundwater Depth [Elevation], feet	**5.0 [705.0]**	Sampling Method(s)	**California Modifed Sampler with 6-inch sleeve/SPT**	Drill Hole Backfill	**Native, bentonite**
Remarks				Driving Method and Drop	**140 lb hammer, 30" drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	NUMBER OF BLOWS / 6"	DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
	0		**Alluvial Deposits (Qal)**		TOPSOIL SILTY CLAY (CL); dark brown, damp, firm, some fine-grained sand, some rootlets				26		PS, pH, SU, CH, MR
705	5				▽		2 2 3		36	84	
					Becomes saturated						
700	10				SANDY CLAY (CL); grayish brown, saturated, very soft to soft, fine-grained sand		P P 2				
695	15				SILTY CLAY (CL); grayish brown, very moist, soft to firm, few fine-grained sand		3 4 4		39	79	

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ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
					SILTY CLAY (CL); grayish brown, very moist, soft to firm, few fine-grained sand		2 2 3				
685	25						2 3 3		51	70	DS
680	30				Becomes soft		P P 3				
675	35						P 3 4		43	75	
670	40						P 2 2				

Project: Marty Russo Youth Athletic Park
Project Location: Mission Viejo, CA
Project Number: 21-283-00

Log of Drill Hole DH-2

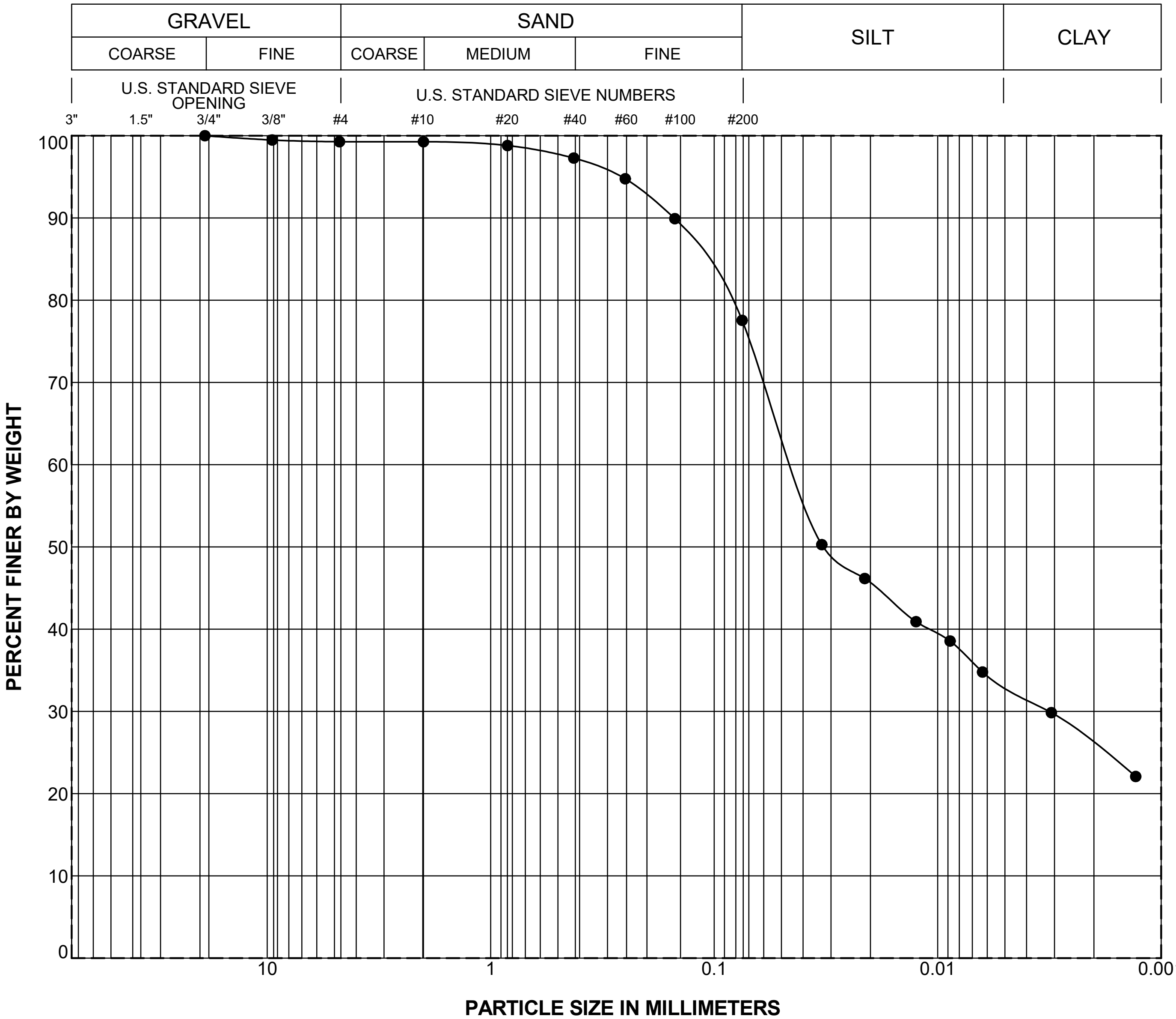
ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	GEOLOGICAL CLASSIFICATION AND DESCRIPTION	ORIENTATION DATA	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: NUMBER OF BLOWS / 6"	SAMPLE DATA: DRIVING WEIGHT, lbs	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
					SILTY CLAY (CL); grayish brown, moist, soft to firm, trace fine-grained sand		2 4 5		40	79	
660	50						P 2 2				
					Total Depth: 51.5ft Groundwater at 5ft						

APPENDIX B

Laboratory Test Data

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			Geologic Unit	USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, pcf	In Situ Satur-ation, %	Sieve/Hydrometer				Atterberg Limits			Compaction		Expansion Index	R-Value	Chemical Test Results			
Boring Number	Depth, feet	Elevation, feet						Gravel, %	Sand, %	<#200, %	<2μ, %	LL	PL	PI	Maximum Dry Unit Weight, pcf	Optimum Water Content, %			pH	Sulfate (ppm)	Chloride (ppm)	Min. Resistivity (ohm/cm)
DH-1	5	713.0	Qal	SP-SM	18.8	106	90															
DH-1	15	703.0	Qal	CL	30.4	92	101															
DH-1	25	693.0	Qal	CL	35.3	88	105															
DH-1	34	684.0	Qal	SM	16.7					6												
DH-1	35	683.0	Qal	CL/ML	27.5	96	100															
DH-2	0	710.0	Qal	CL	26.4			1	22	78	26								7.6	1336	444	452
DH-2	5	705.0	Qal	CL	36.4	84	101															
DH-2	15	695.0	Qal	CL	38.8	79	94															
DH-2	25	685.0	Qal	CL	50.5	70	97															
DH-2	35	675.0	Qal	CL	42.9	75	95															
DH-2	45	665.0	Qal	CL	40.3	79	97															



Boring Number	Depth (feet)	Geologic Unit	Symbol	LL	PI	Classification
DH-2	0.0	Qal	●			SILTY CLAY (CL)

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Project No. 21-283-00

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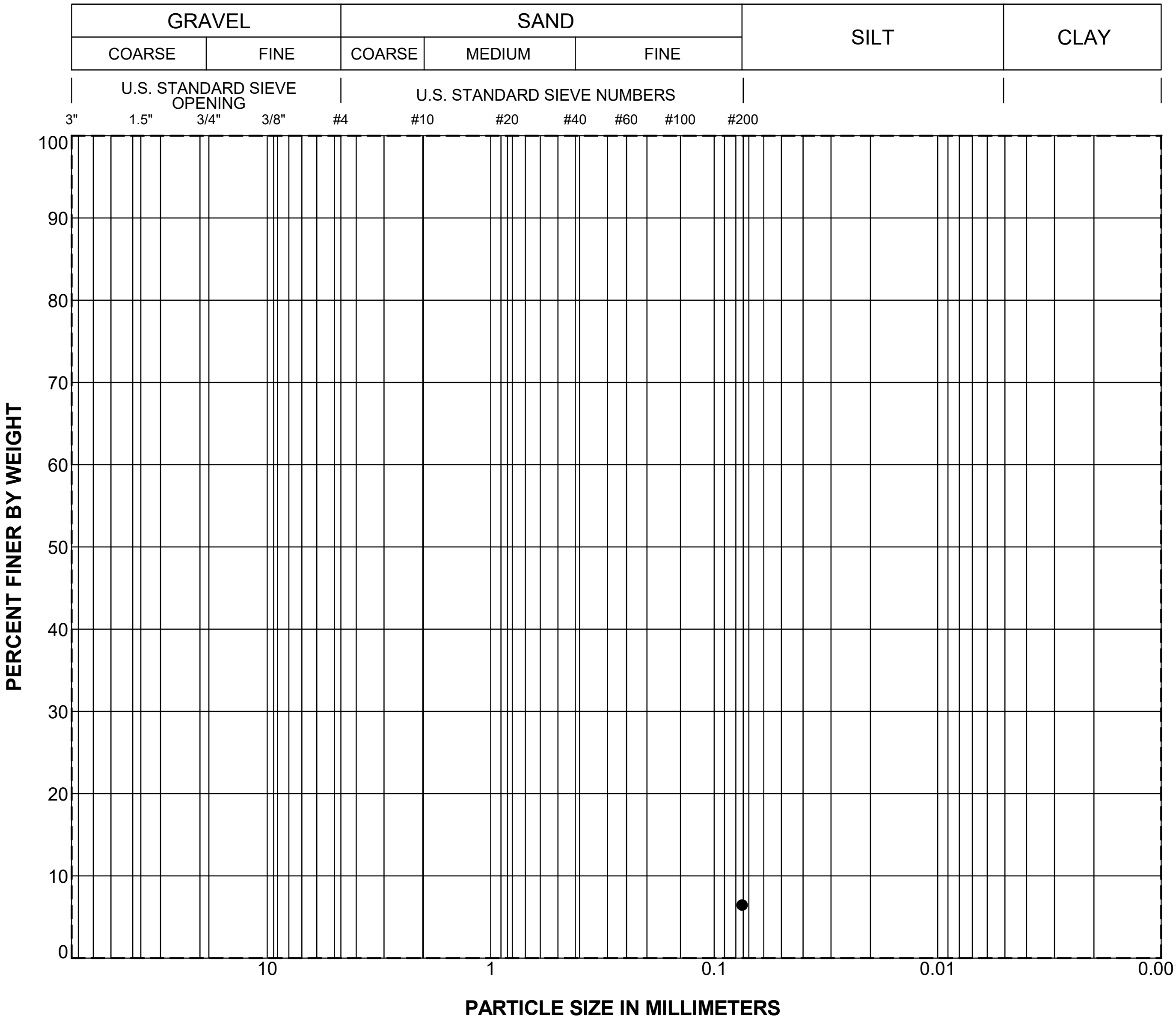

Boring Number	Depth (feet)	Geologic Unit	Symbol	LL	PI	Classification
DH-1	34.0	Qal	●			SILTY SAND (SM)

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Project No. 21-283-00

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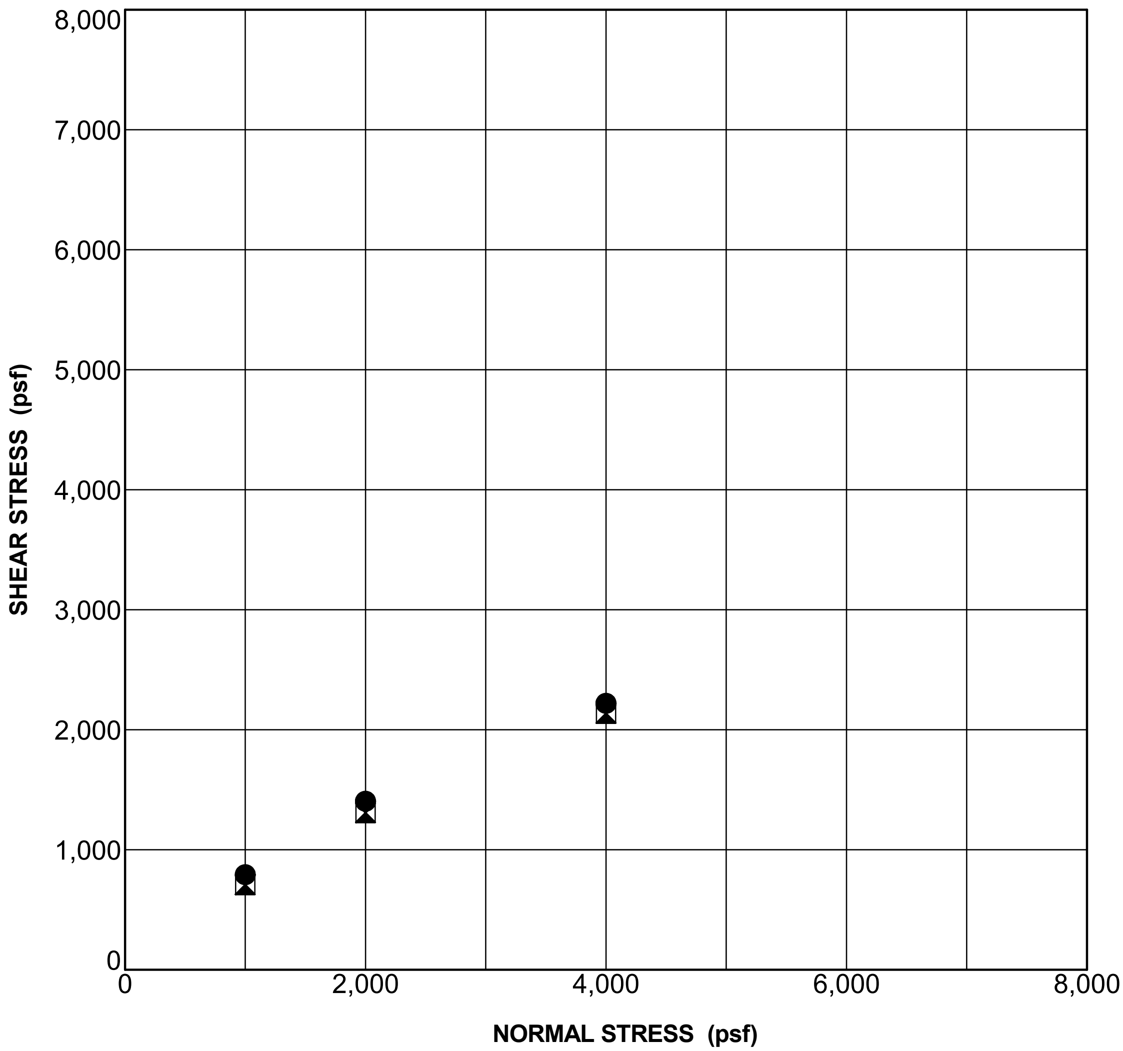

SAMPLE AND TEST DESCRIPTION
Sample Location: DH-1 @ 15.0 ft **Geologic Unit:** Qal **Classification:** SANDY CLAY (CL)
Strain Rate (in/min): 0.005 **Sample Preparation:** Undisturbed
Notes: Sample saturated prior and during shearing

STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	384	25.0
⧗ Ultimate Strength	294	25.0

SHEAR TEST DATA

Project: Marty Russo Youth Athletic Park
Project No. 21-283-00

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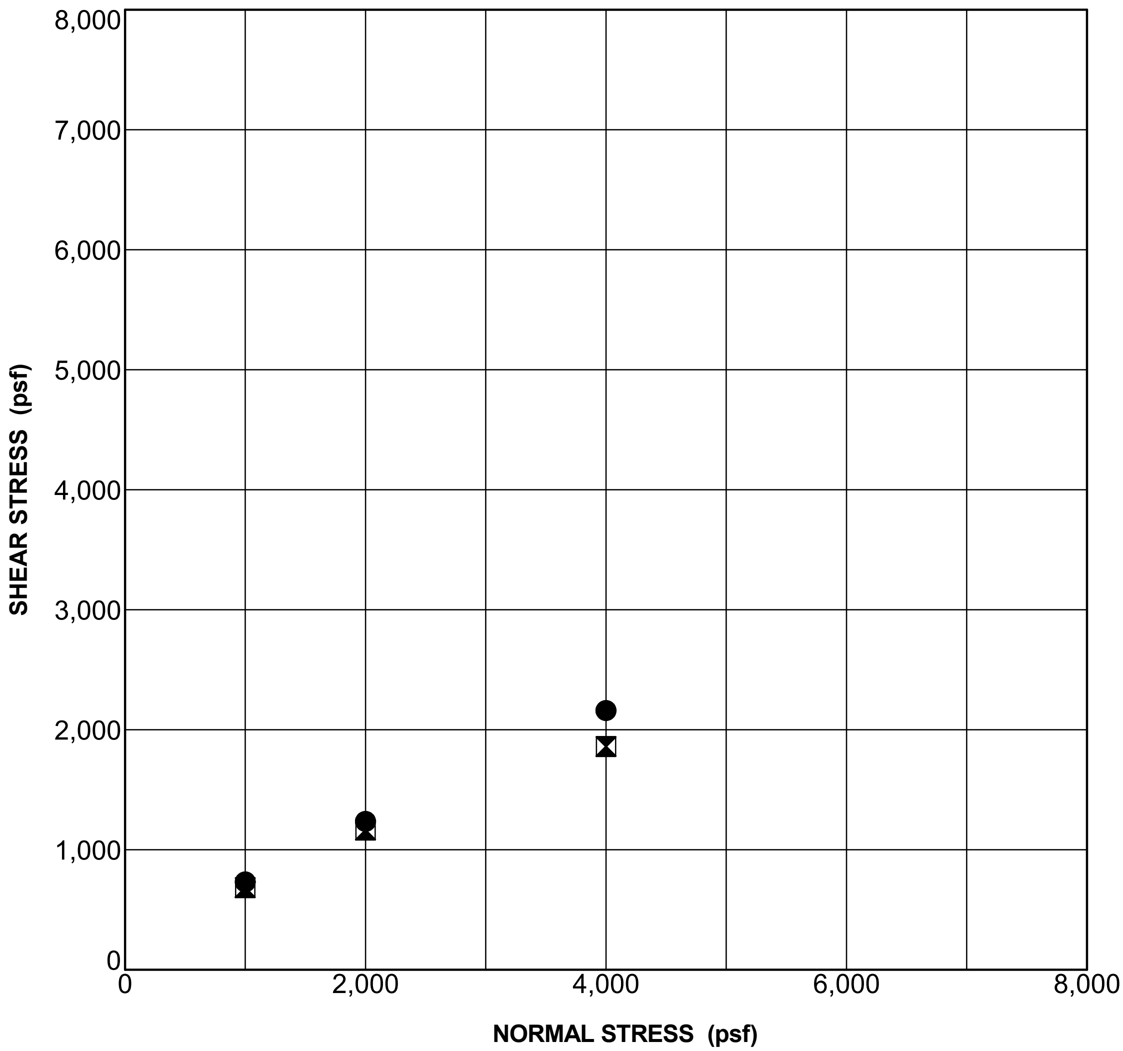

SAMPLE AND TEST DESCRIPTION
Sample Location: DH-2 @ 25.0 ft **Geologic Unit:** Qal **Classification:** SILTY CLAY (CL)
Strain Rate (in/min): 0.005 **Sample Preparation:** Undisturbed
Notes: Sample saturated prior and during shearing

STRENGTH PARAMETERS		
STRENGTH TYPE	**COHESION (psf)**	**FRICTION ANGLE (degrees)**
● Peak Strength	270	25.0
⧗ Ultimate Strength	336	21.0

GMU_DIRECT_SHEAR 21-283-00.GPJ GMU&U.GDT 2/7/22

SHEAR TEST DATA

Project: Marty Russo Youth Athletic Park
Project No. 21-283-00