GEOTECHNICAL INVESTIGATION
HOOLEHUA VETERAN AND HOMESTEAD RESIDENT'S CENTER
DEPARTMENT OF HAWAIIAN HOME LANDS
HOOLEHUA, MOLOKAI, HAWAII

for

G70

HIRATA & ASSOCIATES, INC.
W.O. 17-6139
January 23, 2018

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January 23, 2018
W.O. 17-6139

Peter Mow
G70
925 Bethel Street, Fifth Floor
Honolulu, Hawaii 96813

Dear Mr. Mow:

Our report, "Geotechnical Investigation, Hoolehua Veteran and Homestead Resident's Center, Department of Hawaiian Home Lands, Hoolehua, Molokai, Hawaii," dated January 23, 2018, our Work Order 17-6139 is enclosed. This investigation was conducted in general conformance with the scope of services presented in our proposal dated September 8, 2017.

Our borings encountered surface soil classified as brown to mottled brown clayey silt with gravel and completely to highly weathered rock fragments. The clayey silt was in a stiff condition, extending to the maximum depths drilled. Laboratory testing on the clayey silt indicated that the soil has a low expansion potential. Neither groundwater nor seepage water was encountered in the borings.

Conventional shallow foundations bearing directly on the undisturbed clayey silt may be used to support the proposed resident's center. Building slabs-on-grade will require only the standard 4-inch gravel cushion and vapor barrier.

The following is a summary of our geotechnical recommendations. This summary is not intended to be a substitute for our report which includes more detailed explanations of our recommendations, as well as additional requirements.

- Allowable bearing value = 3,000 psf
- Coefficient of friction = 0.4
- Passive earth pressure = 300 pcf

We appreciate this opportunity to be of service. Should you have any questions concerning this report, please feel free to call on us.

Very truly yours,

HIRATA & ASSOCIATES, INC.

Paul S. Morimoto President

PSM:EY

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GEOTECHNICAL INVESTIGATION
HOOLEHUA VETERAN AND HOMESTEAD RESIDENT'S CENTER
DEPARTMENT OF HAWAIIAN HOME LANDS
HOOLEHUA, MOLOKAI, HAWAII

INTRODUCTION

This report presents the results of our geotechnical investigation performed for the proposed veteran and homestead resident's center in Hoolehua, Molokai, Hawaii. Our scope of services for this study included the following:

- A visual reconnaissance of the site and its vicinity to observe existing conditions which may affect the project. The general location of the project site is shown on the enclosed Location Map, Plate A2.1.

- A review of available in-house soils information pertinent to the site and the proposed project.

- Drilling and sampling six exploratory borings to depths ranging from about 5.5 to 15.5 feet. A description of our field investigation is summarized on Plates A1.1 and A1.2. The approximate exploratory boring locations are shown on the enclosed Boring Location Plan, Plate A2.2, and the soils encountered in the borings are described on the Boring Logs, Plates A4.1 through A4.6.

- Drilling four percolation test holes to depths of approximately 5 feet. The approximate test hole locations are shown on Plate A2.2. Falling head percolation tests were performed in the test holes and results are presented on the Department of Health Site Evaluation/Percolation Test forms, Plates A5.1 through A5.4.

- Laboratory testing of selected soil samples. Testing procedures are presented in the Description of Laboratory Testing, Plates B1.1 and B1.2. Test results are presented in the Description of Laboratory Testing, and on the Unified Soil Classification System Sheet (Plate A3.2), Boring Logs (Plates A4.1 through A4.6), Consolidation Test report (Plate B2.1), Direct Shear Test report (Plate B3.1), Modified Proctor Test report (Plate B4.1), and CBR Test

report (Plate B5.1).

- Engineering analyses of the field and laboratory data.

- Preparation of this report presenting geotechnical recommendations for the design of foundations, including seismic considerations, resistance to lateral pressures, concrete slabs-on-grade, flexible pavement, and site grading.

PROJECT CONSIDERATIONS

Information regarding the proposed project was provided by personnel from your office.

The proposed veteran and homestead resident's center will be located on the north side of the existing Lanikeha Community Center (LCC) site. The center will consist of modular type buildings for classroom, meeting room, kitchen, office, and storage spaces, and will have an overall footprint area of about 59 by 120 feet. Although not available at the time of this report, we expect that the final building loads will be relatively light.

The project will also include a new parking lot with plan dimensions of about 61 by 145.5 feet, and will accommodate a total of 34 parking stalls. A new 24-ft wide driveway/fire lane, with a length of about 350 lineal feet, will extend from the existing LCC site to the new parking lot. Low Impact Development (LID) features in the vicinity of the new resident's center and parking lot are also planned.

Finish floor elevations were not available at the time this report. However, we assume that finish elevations will generally match that of the existing. As a result, only minor site grading is expected, including shallow fills on the northwest corner of the site.

SITE CONDITIONS

The project site is located on the west side of Keena Place, north of its intersection with Farrington Avenue in Hoolehua, Molokai, Hawaii. The site is generally bordered by the LCC on the south, residential lots on the west and north, and undeveloped land on the east. The proposed resident's center will be located on the northern portion of the site.

At the time of our fieldwork, the area of the proposed veteran and homestead resident's center was vacant of structures and covered with grassed landscaping. Ground elevations range from about +796 on the eastern side of the site to about +793 on the northwestern side.

SOIL CONDITIONS

Our borings encountered surface soil classified as brown to mottled brown clayey silt with gravel and completely to highly weathered rock fragments. The clayey silt was in a stiff condition, extending to the maximum depths drilled. Laboratory testing on the clayey silt indicated that the soil has a low expansion potential.

Neither groundwater nor seepage water was encountered in the borings.

CONCLUSIONS AND RECOMMENDATIONS

Based on our exploratory fieldwork and laboratory testing, it is our opinion that conventional shallow foundations bearing directly on the undisturbed clayey silt may be used to support the proposed resident's center. Building slabs-on-grade will require only the standard 4-inch gravel cushion and vapor barrier.

Foundations

Conventional shallow foundations bearing directly on the undisturbed clayey silt may be used to support the proposed resident's center and may be designed for an allowable bearing value of 3,000 pounds per square foot.

The recommended allowable bearing value is for the total of dead and frequently applied live loads, and may be increased by one-third for short duration loading which includes the effects of wind and seismic forces.

Spread footings should be a minimum 16 inches in width, and embedded at least 12 inches below finish adjacent grade. The bottom of footing excavations should be thoroughly tamped and cleaned of loose material prior to placement of reinforcing steel and concrete.

Seismic Design

Based on the borings drilled as part of this study and our knowledge of the deep soil conditions in the area, the subsurface soils can be characterized as a stiff soil profile. Therefore, based on the 2012 International Building Code, Site Class D is recommended for this site.

Lateral Design

Resistance to lateral loading may be provided by friction acting at the base of foundations, and by passive earth pressure acting on the buried portions of foundations.

A coefficient of friction of 0.4 may be used with the dead load forces. Passive earth pressure may be computed as an equivalent fluid having a density of 300 pounds per cubic foot with a maximum earth pressure 3,000 pounds per square foot. Unless covered by pavement or concrete slabs, the upper 12 inches of soil should not be considered in computing lateral resistance.

Foundation Settlement

Structural loads were not available at the time of this report. However, structural loads are expected to be relatively light and excessive total and differential settlement is not anticipated.

Slabs-on-Grade

To provide uniform support, all building slabs-on-grade should be underlain by a minimum 4 inches of gravel cushion, such as #3 Fine (ASTM C 33, No.67). All building slabs should also be protected by a vapor barrier.

The exposed subgrade should be scarified to a minimum depth of 6 inches, moisture conditioned to about 2 percent above optimum moisture content, and compacted to a minimum 90 percent compaction as determined by ASTM D 1557.

In terms of serving as a slab cushion, basaltic termite barrier (BTB) may be used in place of the 4 inches of clean gravel. The recommended minimum thickness of the BTB material should be compacted as indicated by the manufacturer's specifications.

Slabs-on-grade which will receive floor covering should include control joints saw-cut into the concrete slab. The purpose of this is to help reduce the potential for reflective cracking of the floor covering due to shrinkage cracks in the

concrete slab. Proper curing of the concrete slab will help reduce shrinkage cracking.

Exterior slabs-on-grade and concrete walkways should be underlain by a minimum 4 inches consisting of aggregate base course in lieu of the typical gravel cushion. The base course should be compacted to a minimum 95 percent compaction as determined by ASTM D 1557.

Pavement Design

Flexible pavement for the fire access lane and parking lot may be designed on the following sections.

Driveway/Fire Access Lane

3.0"	Asphaltic Concrete
6.0"	Base Course (CBR = 85 minimum)
8.0"	Total Thickness

Parking Lot Stalls

2.0"	Asphaltic Concrete
6.0"	Base Course (CBR = 85 minimum)
8.0"	Total Thickness

Prior to placement of base course, the exposed subgrade should be scarified to a minimum depth of 6 inches, moisture conditioned to about 2 percent above optimum moisture content, and compacted to a minimum 90 percent compaction as determined by ASTM D 1557. The base course should be compacted in lifts to a minimum 95 percent compaction as determined by ASTM D 1557.

Site Grading

Site Preparation - The project site should be cleared of all vegetation, demolition debris, and other deleterious material. In areas requiring fill placement, the exposed subgrade should be scarified to a minimum depth of 6 inches, moisture conditioned to about 2 percent above the optimum moisture content, and

compacted to a minimum 90 percent compaction as determined by ASTM D 1557.

Structural Excavations - Based on our exploratory borings, we believe that excavations into the onsite clayey silt can generally be accomplished using conventional excavating equipment.

Temporary cuts into the clayey fills should be stable at slope gradients of 1H:1V or flatter. However, it should be the Contractor's responsibility to conform to all OSHA safety standards for excavations.

Onsite Fill Material – The onsite clayey silt will be acceptable for reuse in compacted fills and backfills. All rock fragments larger than 3 inches in maximum dimension should be removed prior to reuse.

Imported Fill Material - Imported structural fill should be well-graded, non-expansive granular material. Specifications for imported granular structural fill should indicate a maximum particle size of 3 inches, and state that between 8 and 20 percent of soil by weight shall pass the #200 sieve. In addition, the plasticity index (P.I.) of that portion of the soil passing the #40 sieve shall not be greater than 10. Imported structural fill should have a CBR expansion value no greater than 1.0 percent and a minimum CBR value of 15 percent, when tested in accordance with ASTM D 1883.

Compaction – Cohesive soils, such as the onsite clayey silt, should be placed in horizontal lifts restricted to eight inches in loose thickness and compacted to a minimum 90 percent compaction as determined by ASTM D 1557.

Imported structural fill should also be placed in horizontal lifts restricted to eight inches in loose thickness and compacted to a minimum 95 percent compaction as determined by ASTM D 1557.

Fill placed in areas which slope steeper than 5H:1V should be continually benched as the fill is brought up in lifts.

ADDITIONAL SERVICES

We recommend that we perform a general review of the final design plans and specifications. This will allow us to verify that the foundation design and earthwork recommendations have been properly interpreted and implemented in the design plans and construction specifications.

For continuity, we recommend that we be retained during construction to (1) observe footing excavations prior to placement of reinforcing steel and concrete, (2) review and/or perform laboratory testing on import borrow to determine its acceptability for use in compacted fills, (3) observe structural fill placement and perform compaction testing, and (4) provide geotechnical consultation as required.

Our services during construction will allow us to verify that our recommendations are properly interpreted and included in construction, and if necessary, to make modifications to those recommendations, thereby reducing construction delays in the event subsurface conditions differ from those anticipated.

LIMITATIONS

The boring logs indicate the approximate subsurface soil conditions encountered only at those times and locations where our borings were made, and may not represent conditions at other times and locations.

This report was prepared specifically for G70 and their sub-consultants for design of the proposed veteran and homestead resident's center in Hoolehua, Molokai, Hawaii. The boring logs, laboratory test results, and recommendations presented in this report are for design purposes only, and are not intended for use in developing cost estimates by the contractor.

During construction, should subsurface conditions differ from those encountered in our borings, we should be advised immediately in order to re-evaluate our recommendations, and to revise or verify them in writing before proceeding with construction.

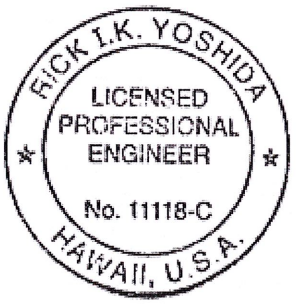
Our recommendations and conclusions are based upon the site materials observed, the preliminary design information made available, the data obtained from our site exploration, our engineering analyses, and our experience and engineering judgment. The conclusions and recommendations in this report are professional opinions which we have strived to develop in a manner consistent with that level of care, skill, and competence ordinarily exercised by members of the profession in good standing, currently practicing under similar conditions in the same locality. We will be responsible for those recommendations and conclusions, but will not be responsible for the interpretation by others of the information developed. No warranty is made regarding the services performed, either expressed or implied.

Respectfully submitted,

HIRATA & ASSOCIATES, INC.

Rick Yoshida, Project Manager

RY:EY



This work was prepared by
me or under my supervision.
Expiration Date of License:
April 30, 2018

APPENDIX A

FIELD INVESTIGATION

DESCRIPTION OF FIELD INVESTIGATION

GENERAL

The site was explored on November 28 and 29, 2017, by performing a visual reconnaissance of the site and drilling six test borings to depths ranging from about 5.5 to 15.5 feet with a truck-mounted drill rig. In addition, four percolation test holes were drilled to depths of about 5 feet and tested in general accordance with Department of Health guidelines.

During drilling operations, the soils were continuously logged by our field engineer and classified by visual examination in accordance with the Unified Soil Classification System. The boring logs indicate the depths at which the soils or their characteristics change, although the change could actually be gradual. If the change occurred between sample locations, the depth was interpreted based on field observations. Classifications and sampling intervals are shown on the boring logs. A Boring Log Legend is presented on Plate A3.1. The Unified Soil Classification and Rock Weathering Classification Systems are shown on Plates A3.2 and A3.3, respectively. The soils encountered are logged on Plates A4.1 through A4.6.

Borings were located in the field by measuring/taping offsets from existing site features shown on the plans provided by your office. Surface elevations at boring locations were estimated based on the Conceptual Site Layout provided by your office on September 6, 2017. The accuracy of the boring locations shown on Plate A2.2 and the elevations shown on Plates A4.1 through A4.6 are therefore approximate, in accordance with the field methods used.

SOIL SAMPLING

Representative soil samples were recovered from the borings for selected laboratory testing and analyses. Representative samples were recovered by driving a 3-inch O.D. split tube sampler a total of 18 inches with a 140-pound

hammer dropped from a height of 30 inches. The number of blows required to drive the sampler the final 12 inches are recorded at the appropriate depths on the boring logs, unless noted otherwise. In addition, a bulk soil sample was recovered from boring B4 at a depth of about 0.5 feet below grade.

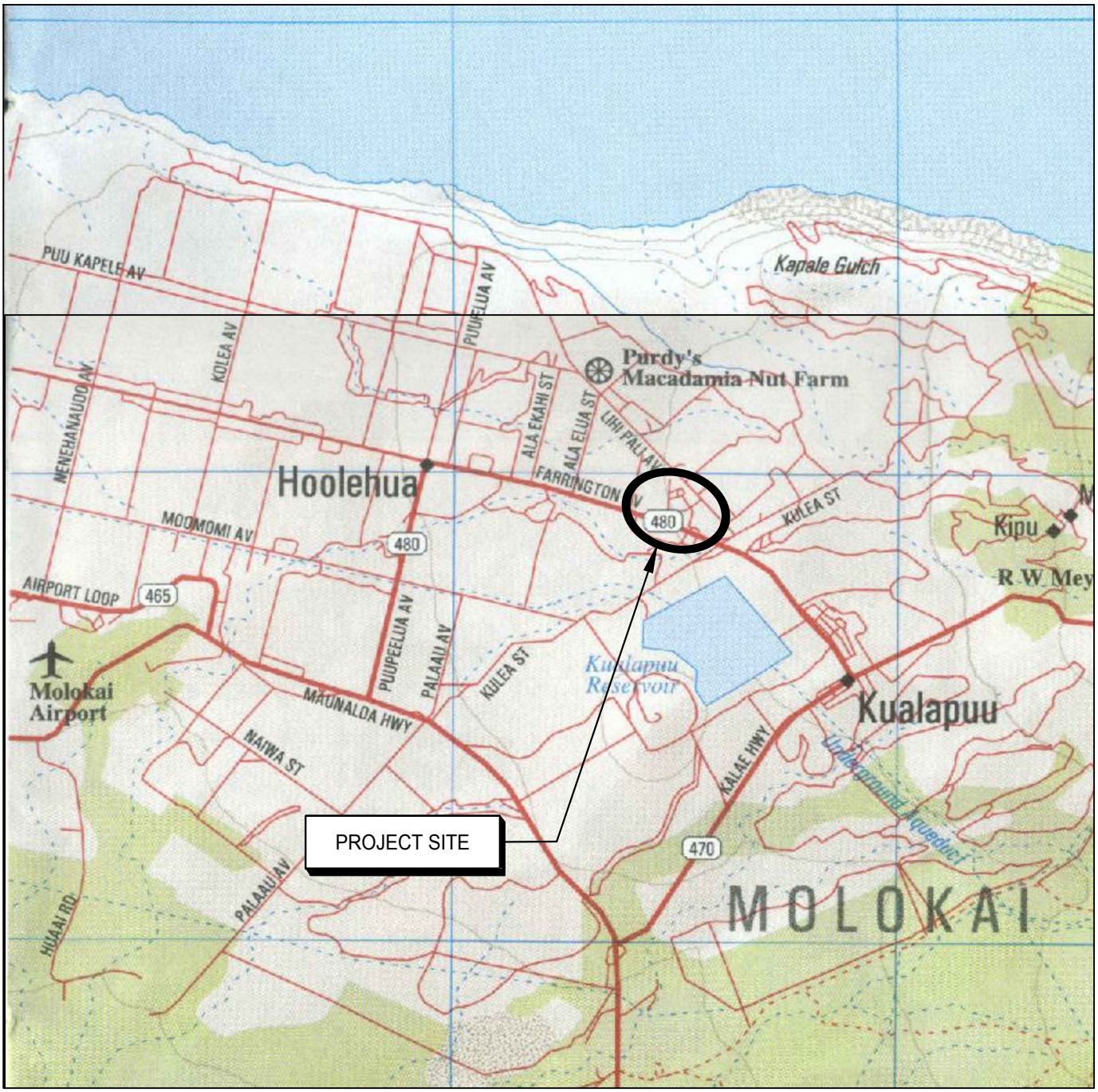
PERCOLATION TESTING

Our fieldwork also included drilling and testing four percolation test holes to depths of about 5 feet. Falling head percolation tests were performed in the test holes in general accordance with Department of Health guidelines.

Based on the procedures outlined in the Department of Health guidelines, results of the falling head percolation tests were recorded as percolation rates measured in minutes per inch. However, the City and County of Honolulu's Storm Water BMP Guide requires that infiltration rates, measured in inches per hour, be used in the design of infiltration systems. Therefore, the Porchet Method (also known as the Inverse Borehole Method) was used to estimate the infiltration rates from the percolation field test data. The Porchet Method considers time interval, drop in water level, test hole radius, and test hole depth.

The approximate test hole locations are shown on Plate A2.2, and test results are presented on the Department of Health Site Evaluation/Percolation test forms, Plates A5.1 through A5.4. The results are summarized in the following table.

Test Hole	Depth (ft)	Percolation Rate (min./in.)	Infiltration Rate (in./hr.)
P1	5	13.3	0.68
P2	5	17.8	0.18
P3	5	17.1	0.20
P4	5	30.0	0.09



Reference: Hawaii Atlas & Gazetteer, Topo Maps of the Entire State by DeLorme (1999)

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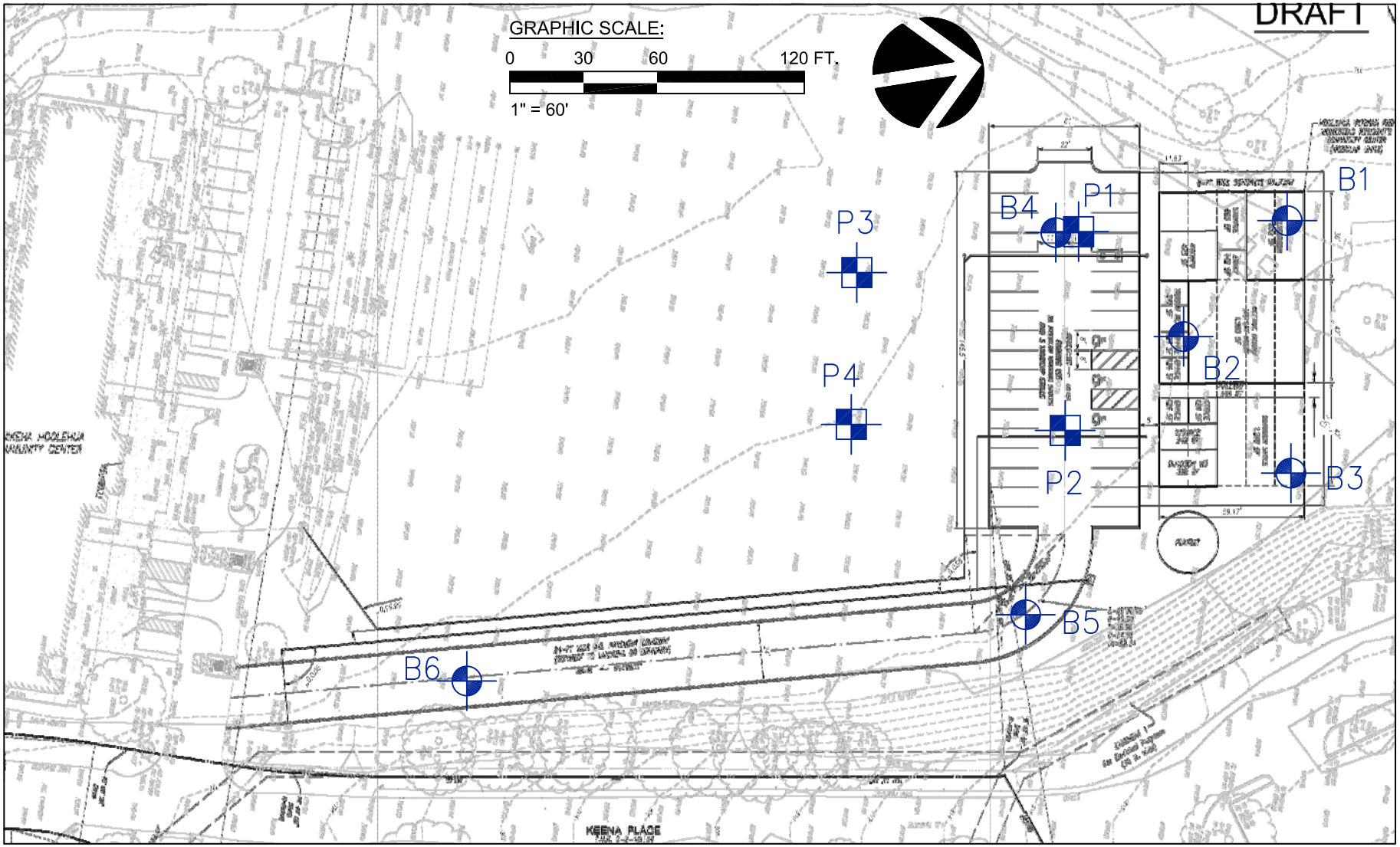
LOCATION MAP

Plate A2.1



LEGEND

Approximate location of borings

Approximate location of percolation tests

Reference: Conceptual Site Layout provided by G70 on September 6, 2017.

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BORING LOCATION PLAN

Plate A2.2

MAJOR DIVISIONS			GROUP DIVISIONS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of the material is LARGER than No. 200 sieve size.)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size.)	CLEAN GRAVELS (Little or no fines.)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines.)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size.)	CLEAN SANDS (Little or no fines.)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. of fines.)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of the material is SMALLER than No. 200 sieve size.)	SILTS AND CLAYS (Liquid limit 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 high plasticity, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50.)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, 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 silts.
FORMATIONS				FRESH TO MODERATELY WEATHERED BASALT
				VOLCANIC TUFF / HIGHLY TO COMPLETELY WEATHERED BASALT
				CORAL

SAMPLE DEFINITION

2" O.D. Standard Split Spoon Sampler	Shelby Tube	RQD: Rock Quality Designation
3" O.D. Split Tube Sampler	Core Sample	Water Table

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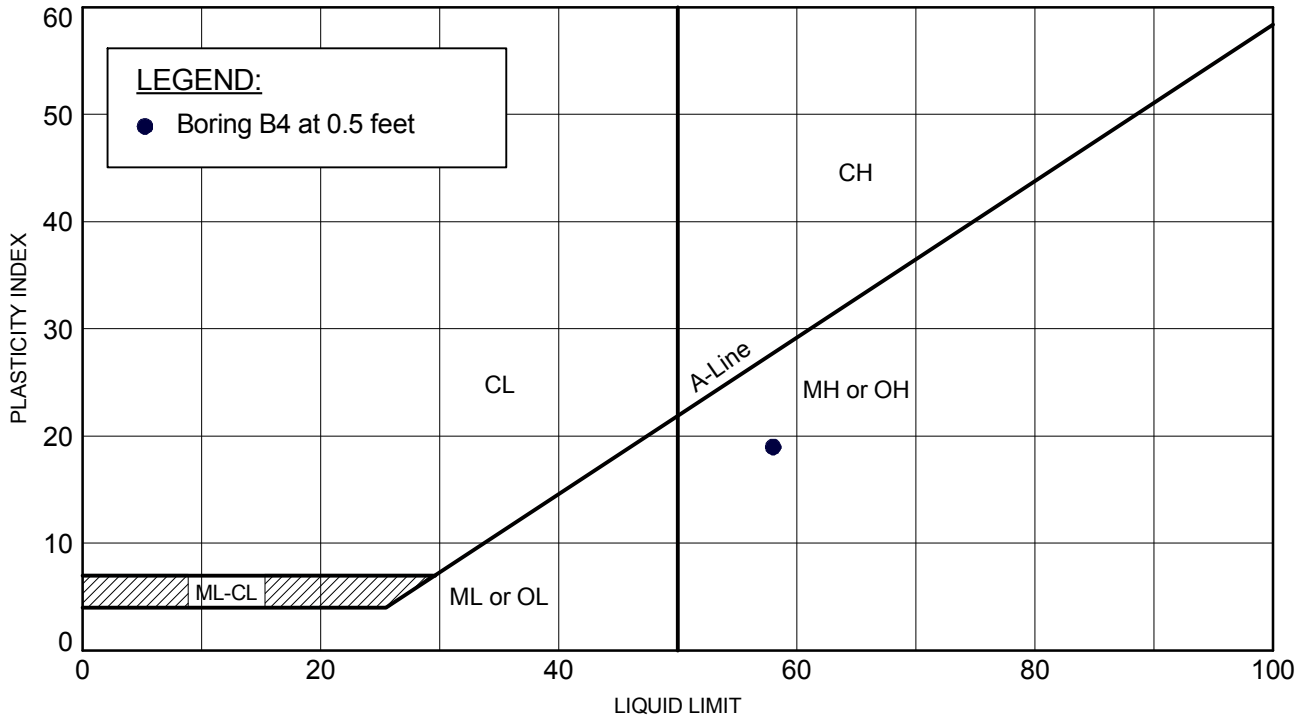
BORING LOG LEGEND

Plate A3.1

PLASTICITY CHART



GRADATION CHART

COMPONENT DEFINITIONS BY GRADATION	
COMPONENT	SIZE RANGE
Boulders	Above 12 in.
Cobbles	3 in. to 12 in.
Gravel	3 in. to No. 4 (4.76 mm)
Coarse	3 in. to 3/4 in.
Fine Gravel	3/4 in. to No. 4 (4.76 mm)
Sand	No. 4 (4.76 mm) to No. 200 (0.074mm)
Coarse Sand	No. 4 (4.76 mm) to No. 10 (2.0 mm)
Medium Sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine Sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074 mm)

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UNIFIED SOIL CLASSIFICATION SYSTEM

Plate
A3.2

Grade	Symbol	Description
Fresh	F	No visible signs of decomposition or discoloration. Rings under hammer impact.
Slightly Weathered	WS	Slight discoloration inwards from open fractures, otherwise similar to F.
Moderately Weathered	WM	Discoloration throughout. Weaker minerals such as feldspar decomposed. Strength somewhat less than fresh rock but cores cannot be broken by hand or scraped by knife. Texture preserved.
Highly Weathered	WH	Most minerals somewhat decomposed. Specimens can be broken by hand with effort or shaved with knife. Core stones present in rock mass. Texture becoming indistinct but fabric preserved.
Completely Weathered	WC	Minerals decomposed to soil but fabric and structure preserved (Saprolite). Specimens easily crumbled or penetrated.
Residual Soil	RS	Advance state of decomposition resulting in plastic soils. Rock fabric and structure completely destroyed. Large volume change.

Reference: Soil Mechanics, NAVFAC DM-7.1, Department of the Navy, Naval Facilities Engineering Command, September, 1986.

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ROCK WEATHERING CLASSIFICATION SYSTEM

Plate A3.3

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Boring No.
B1

BORING LOG

PROJECT NAME Hoolehua Veteran and Homestead Resident's Center
WORK ORDER NO. 17-6139 DRIVING WT. 140 lb. START DATE 11/28/17
SURFACE ELEV. 795.6 ±* DROP 30 in. END DATE 11/28/17

REMARKS/ SAMPLE NO.	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
			29	76	25				Clayey SILT (MH) - Brown, moist, stiff, with gravel.
Direct Shear Test			52/6"	75	24				
			54/6"	84	21	5			Mottled brown in color, with completely to highly weathered rock fragments from 4.5 feet.
			75	82	19	10			
			77	82	27	15			
									End boring at 15.5 feet.
									Neither groundwater nor seepage water encountered.
						20			* Elevations based on Conceptual Site Layout provided by G70 on September 6, 2017.
						25			
						30			
						35			

Plate A4.1

Hirata & Associates, Inc.
GEOTECHNICAL ENGINEERING

Boring No.
B2

BORING LOG

PROJECT NAME Hoolehua Veteran and Homestead Resident's Center
WORK ORDER NO. 17-6139 DRIVING WT. 140 lb. START DATE 11/28/17
SURFACE ELEV. 795.8 ± DROP 30 in. END DATE 11/28/17

REMARKS/ SAMPLE NO.	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
									Clayey SILT (MH) - Brown, moist, stiff, with gravel.
			61	58	39				
Consolidation Test			54/6"	85	24	5			Mottled brown in color, with completely to highly weathered rock fragments from 3.5 feet.
			47	71	40	10			
			35	85	32				
						15			End boring at 14.5 feet.
									Neither groundwater nor seepage water encountered.
						20			
						25			
						30			
						35			

Plate A4.2

Hirata & Associates, Inc.
GEOTECHNICAL ENGINEERING

Boring No.
B3

BORING LOG

PROJECT NAME Hoolehua Veteran and Homestead Resident's Center
WORK ORDER NO. 17-6139 DRIVING WT. 140 lb. START DATE 11/28/17
SURFACE ELEV. 796.4 ± DROP 30 in. END DATE 11/28/17

REMARKS/ SAMPLE NO.	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
			47	73	11				Clayey SILT (MH) - Brown, moist, stiff, with gravel.
									Mottled brown in color, with completely to highly weathered rock fragments from 1.5 feet.
			92/11"	83	19				
			74	114	15	5			
			42	77	41	10			Decreased gravel content from 9 feet.
			31	78	41	15			
									End boring at 15.5 feet.
									Neither groundwater nor seepage water encountered.
						20			
						25			
						30			
						35			

Plate A4.3

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GEOTECHNICAL ENGINEERING

Boring No.
B4

BORING LOG

PROJECT NAME Hoolehua Veteran and Homestead Resident's Center
WORK ORDER NO. 17-6139 DRIVING WT. 140 lb. START DATE 11/29/17
SURFACE ELEV. 795.4 ± DROP 30 in. END DATE 11/29/17

REMARKS/ SAMPLE NO.	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
			33	76	23				Clayey SILT (MH) - Brown, moist, stiff, with gravel.
									Mottled brown in color, with completely weathered rock fragments from 2 feet.
			100/9.5"	80	22	5			
									End boring at 5.5 feet.
									Neither groundwater nor seepage water encountered.
						10			
						15			
						20			
						25			
						30			
						35			

Plate A4.4

Hirata & Associates, Inc.
GEOTECHNICAL ENGINEERING

Boring No.
B5

BORING LOG

PROJECT NAME Hoolehua Veteran and Homestead Resident's Center
WORK ORDER NO. 17-6139 DRIVING WT. 140 lb. START DATE 11/29/17
SURFACE ELEV. 796.1 ± DROP 30 in. END DATE 11/29/17

REMARKS/ SAMPLE NO.	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
			52	84	26				Clayey SILT (MH) - Brown, moist, stiff, with gravel. Mottled brown in color, with completely to highly weathered rock fragments from 1 foot.
			76	80	13				Increased gravel content from 3 feet.
			96	84	9	5			
									End boring at 6.5 feet.
						10			Neither groundwater nor seepage water encountered.
						15			
						20			
						25			
						30			
						35			

Plate A4.5

Hirata & Associates, Inc.
GEOTECHNICAL ENGINEERING

Boring No.
B6

BORING LOG

PROJECT NAME Hoolehua Veteran and Homestead Resident's Center
WORK ORDER NO. 17-6139 DRIVING WT. 140 lb. START DATE 11/29/17
SURFACE ELEV. 794.3 ± DROP 30 in. END DATE 11/29/17

REMARKS/ SAMPLE NO.	CORE RECOVERY (%)	RQD (%)	BLOWS PER FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	DEPTH (ft)	GRAPHIC LOG	SAMPLE	MATERIAL DESCRIPTION
			48	72	34				Clayey SILT (MH) - Brown, moist, stiff, with gravel. Mottled brown in color, with completely to highly weathered rock fragments from 1 foot.
			82/9"	70	20				
			98/9.5"	75	17	5			
									End boring at 6.5 feet.
									Neither groundwater nor seepage water encountered.
						10			
						15			
						20			
						25			
						30			
						35			

Plate A4.6

SITE EVALUATION/PERCOLATION TEST

Date/Time: 11/28/17 12:43 pm
Test performed by: Hirata & Associates, Inc.
Owner: Department of Hawaiian Home Lands
Tax Map Key: 5-2-15 : 53
Test Number: P1

Elevation: +795.4 ft.
Depth to Groundwater Table: >14.5 ft. below grade (Based on boring B2)
Depth to Bedrock, if observed: >14.5 ft. below grade (Based on boring B2)
Diameter of Hole: 4 in.
Depth to Hole Bottom: 5 ft. below grade

Depth (inches)	Soil Profile (Color, texture, other)
0-24	Brown clayey silt
24-60	Mottled brown clayey silt (highly to completely weathered basalt)

PERCOLATION READINGS

Time 12 inches of water to seep away: >30 min.
Time 12 inches of water to seep away: _____ min.

___ For percolation tests in sandy soils, record time intervals and water drops every 10 minutes for at least 1 hour.

✓ For percolation tests in non-sandy soils, presoak the test hole for at least 4 hours. Record time intervals and water drops at least every 10 minutes for 1 hour; or if the time for the first 6 inches to seep away is greater than 30 minutes, record time intervals and water drops at least every 30 minutes for 4 hours or until 2 successive drops do not vary by more than 1/16 inch.

Time interval	Drop in inches	Time interval	Drop in inches
10 min	2 - 3/16	10 min	3/4
10 min	2 - 3/16		
10 min	2 - 5/16		
10 min	1		
10 min	15/16		
10 min	13/16		

Percolation Rate (time/final water level drop): 13.3 min/in

As the engineer responsible for gathering and providing site information and percolation test results, I attest to the fact that above site information is accurate and that the site evaluation was conducted in accordance with the provisions of Chapter 11-62, "Wastewater Systems" and the results were acceptable.

RICK I.K. YOSHIDA
LICENSED PROFESSIONAL ENGINEER
No. 11118-C
HAWAII, U.S.A.

Engineer's Signature/Stamp

Plate A5.1

SITE EVALUATION/PERCOLATION TEST

Date/Time: 11/28/17 12:31 pm
Test performed by: Hirata & Associates, Inc.
Owner: Department of Hawaiian Home Lands
Tax Map Key: 5-2-15 : 53
Test Number: P2

Elevation: +795.5 ft.
Depth to Groundwater Table: >14.5 ft. below grade (Based on boring B2)
Depth to Bedrock, if observed: >14.5 ft. below grade (Based on boring B2)
Diameter of Hole: 4 in.
Depth to Hole Bottom: 5 ft. below grade

Depth (inches)	Soil Profile (Color, texture, other)
0-42	Brown clayey silt
42-60	Mottled brown clayey silt (highly to completely weathered basalt)

PERCOLATION READINGS

Time 12 inches of water to seep away: >30 min.
Time 12 inches of water to seep away: _____ min.

___ For percolation tests in sandy soils, record time intervals and water drops every 10 minutes for at least 1 hour.

✓ For percolation tests in non-sandy soils, presoak the test hole for at least 4 hours. Record time intervals and water drops at least every 10 minutes for 1 hour; or if the time for the first 6 inches to seep away is greater than 30 minutes, record time intervals and water drops at least every 30 minutes for 4 hours or until 2 successive drops do not vary by more than 1/16 inch.

Time interval	Drop in inches	Time interval	Drop in inches
10 min	1 - 1/8	30 min	2 - 7/16
10 min	1	30 min	2 - 3/16
10 min	1 - 7/16	30 min	1 - 15/16
10 min	1 - 1/8	30 min	1 - 11/16
30 min	3 - 3/4		
30 min	3 - 1/16		

Percolation Rate (time/final water level drop): 17.8 min/in

As the engineer responsible for gathering and providing site information and percolation test results, I attest to the fact that above site information is accurate and that the site evaluation was conducted in accordance with the provisions of Chapter 11-62, "Wastewater Systems" and the results were acceptable.

RICK I.K. YOSHIDA
LICENSED PROFESSIONAL ENGINEER
No. 11118-C
HAWAII, U.S.A.

Keith I.K. Yoshida
Engineer's Signature/Stamp

Plate A5.2

SITE EVALUATION/PERCOLATION TEST

Date/Time: 11/28/17 10:01 pm
Test performed by: Hirata & Associates, Inc.
Owner: Department of Hawaiian Home Lands
Tax Map Key: 5-2-15 : 53
Test Number: P3

Elevation: +792.9 ft.
Depth to Groundwater Table: >14.5 ft. below grade (Based on boring B2)
Depth to Bedrock, if observed: >14.5 ft. below grade (Based on boring B2)
Diameter of Hole: 4 in.
Depth to Hole Bottom: 5 ft. below grade

Depth (inches)	Soil Profile (Color, texture, other)
0-36	Brown clayey silt
36-60	Mottled brown clayey silt (highly to completely weathered basalt)

PERCOLATION READINGS

Time 12 inches of water to seep away: >30 min.
Time 12 inches of water to seep away: _____ min.

___ For percolation tests in sandy soils, record time intervals and water drops every 10 minutes for at least 1 hour.

✓ For percolation tests in non-sandy soils, presoak the test hole for at least 4 hours. Record time intervals and water drops at least every 10 minutes for 1 hour; or if the time for the first 6 inches to seep away is greater than 30 minutes, record time intervals and water drops at least every 30 minutes for 4 hours or until 2 successive drops do not vary by more than 1/16 inch.

Time interval	Drop in inches	Time interval	Drop in inches
10 min	1/4	30 min	1 - 3/4
10 min	3/16	30 min	1 - 3/4
10 min	1/4		
30 min	7/8		
30 min	1 - 1/16		
30 min	1 - 5/8		

Percolation Rate (time/final water level drop): 17.1 min/in

As the engineer responsible for gathering and providing site information and percolation test results, I attest to the fact that above site information is accurate and that the site evaluation was conducted in accordance with the provisions of Chapter 11-62, "Wastewater Systems" and the results were acceptable.

RICK I.K. YOSHIDA
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HAWAII, U.S.A.

Engineer's Signature/Stamp

Plate A5.3

SITE EVALUATION/PERCOLATION TEST

Date/Time: 11/29/17 10:59 pm

Test performed by: Hirata & Associates, Inc.

Owner: Department of Hawaiian Home Lands

Tax Map Key: 5-2-15 : 53

Test Number: P4

Elevation: +794.1 ft.
Depth to Groundwater Table: >14.5 ft. below grade (Based on boring B2)
Depth to Bedrock, if observed: >14.5 ft. below grade (Based on boring B2)
Diameter of Hole: 4 in.
Depth to Hole Bottom: 5 ft. below grade

Depth (inches)	Soil Profile (Color, texture, other)
0-18	Brown clayey silt
18-60	Mottled brown clayey silt (highly to completely weathered basalt)

PERCOLATION READINGS

Time 12 inches of water to seep away: >30 min.
Time 12 inches of water to seep away: _____ min.

___ For percolation tests in sandy soils, record time intervals and water drops every 10 minutes for at least 1 hour.

✓ For percolation tests in non-sandy soils, presoak the test hole for at least 4 hours. Record time intervals and water drops at least every 10 minutes for 1 hour; or if the time for the first 6 inches to seep away is greater than 30 minutes, record time intervals and water drops at least every 30 minutes for 4 hours or until 2 successive drops do not vary by more than 1/16 inch.

Time interval	Drop in inches	Time interval	Drop in inches
10 min	11/16	30 min	1 - 1/2
10 min	9/16	30 min	1 - 3/16
10 min	5/8	30 min	1 - 1/16
30 min	2- 7/16	30 min	1
30 min	2 - 5/16		
30 min	1 - 13/16		

Percolation Rate (time/final water level drop): 30 min/in

As the engineer responsible for gathering and providing site information and percolation test results, I attest to the fact that above site information is accurate and that the site evaluation was conducted in accordance with the provisions of Chapter 11-62, "Wastewater Systems" and the results were acceptable.

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Engineer's Signature/Stamp

Plate A5.4

APPENDIX B

LABORATORY TESTING

DESCRIPTION OF LABORATORY TESTING

CLASSIFICATION

Field classification was verified in the laboratory in accordance with the Unified Soil Classification System. Laboratory classification was determined by both visual examination and Atterberg Limit tests performed in general accordance with ASTM D 4318. The results of the Atterberg Limit tests are plotted on Plate A3.2. The final classifications are shown at the appropriate locations on the Boring Logs, Plates A4.1 through A4.6.

MOISTURE-DENSITY

Representative samples were tested for field moisture content and dry unit weight. The dry unit weight was determined in pounds per cubic foot while the moisture content was determined as a percentage of dry weight. Samples were obtained using a 3-inch O.D. split tube sampler. Test results are shown at the appropriate depths on the Boring Logs, Plates A4.1 through A4.6.

CONSOLIDATION

A selected representative sample was tested for its consolidation characteristics. The test sample was 2.42 inches in diameter and 1 inch high. Porous stones were placed in contact with the top and bottom of the test sample to permit addition and release of pore fluid. Loads were then applied in several increments in a geometric progression, and the resulting deformations recorded at selected time intervals. Test results are plotted on the Consolidation Test report, Plate B2.1.

SHEAR TESTS

Shear tests were performed in the Direct Shear Machine which is of the strain control type. Each sample was sheared under varying confining loads in order to determine the Coulomb shear strength parameters, cohesion and angle of internal friction. Test results are presented on Plate B3.1.

SWELL TEST

Swell tests were performed on representative samples by placing a 90 psf surcharge load on one-inch high specimens. The samples were inundated with water, and total expansion recorded after a period of at least 24 hours. Test results were recorded as a percentage of original height. Test results are summarized in the following table:

Sample	Sample Type	Recorded Expansion	Moisture Content Prior to Test
B1 @ 3’	Representative	1.2%	24%
B4 @ 2'	Representative	0.1%	23%

EXPANSION INDEX TEST

An expansion index test was performed in general accordance with ASTM D 4829. A surcharge load of 144 psf was placed on a one-inch high by four inch diameter specimen which was molded to about 50 percent saturation. The sample was inundated with water, and total expansion recorded after volumetric equilibrium was reached. An expansion index test performed on a bulk soil sample obtained from boring B4 at a depth of about 0.5 feet below existing grade resulted in an expansion index of 48, corresponding to a low expansion potential.

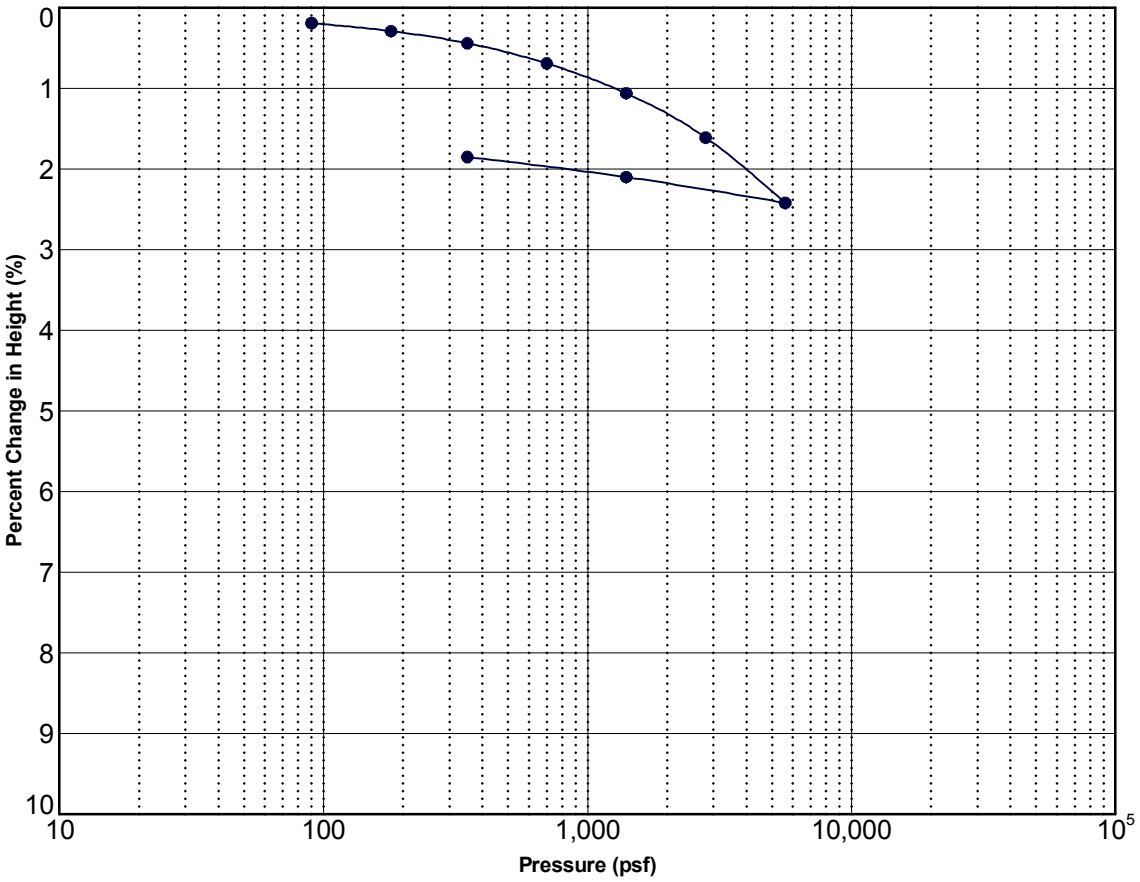
PROCTOR TEST

A Modified Proctor test was performed in general accordance with ASTM D 1557 on a bulk sample obtained from boring B4 at a depth of about 0.5 feet below existing grade. The test is used to determine the optimum moisture content at which the soil compacts to 100 percent dry density. Results are shown on Plate B4.1.

CALIFORNIA BEARING RATIO TEST

A CBR test was performed on a bulk sample obtained from boring B4 at a depth of about 0.5 feet below existing grade, in general accordance with ASTM D 1883. The test is used to evaluate the relative quality of subgrade soils to be used in the design of flexible pavement. Results are shown on Plate B5.1.

Consolidation Test Results



Sample Description

Boring No.: B2 Depth (ft): 4

Soil Description: Mottled brown clayey silt

	Moisture Content (%)	Dry Density (pcf)
Initial	24.3	85.1
Final	23.1	86.7

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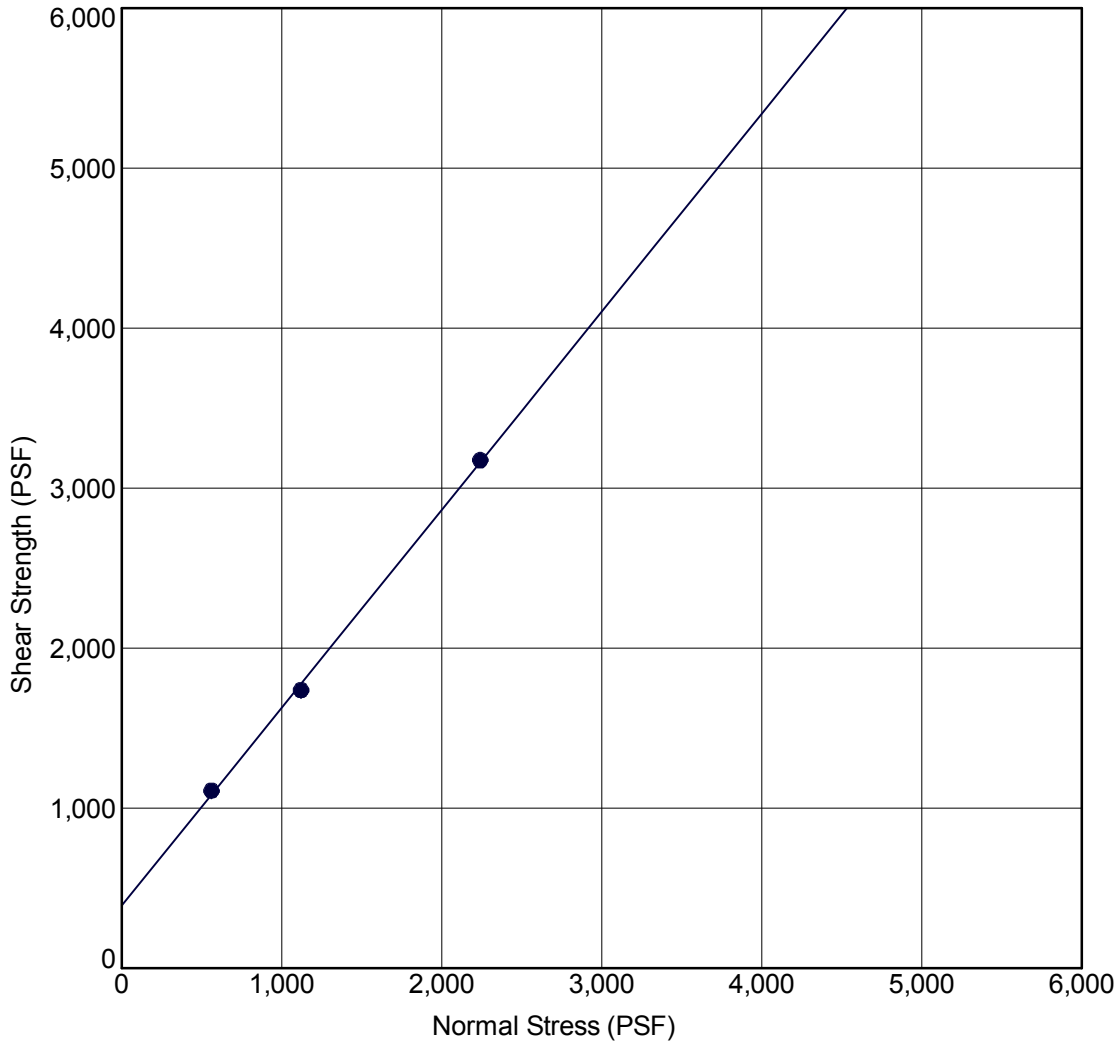
W.O. 17-6139

CONSOLIDATION TEST

ASTM D2435 / D2435M - 11

Plate B2.1

Direct Shear Test Results



Soil Data

Boring No.: B1 Depth (ft): 3
Soil Description: Brown clayey silt

Test Results

Strength Intercept (c): 390.9 PSF (Peak Strength)
Friction Angle (phi): 51.1 DEG (Peak Strength)

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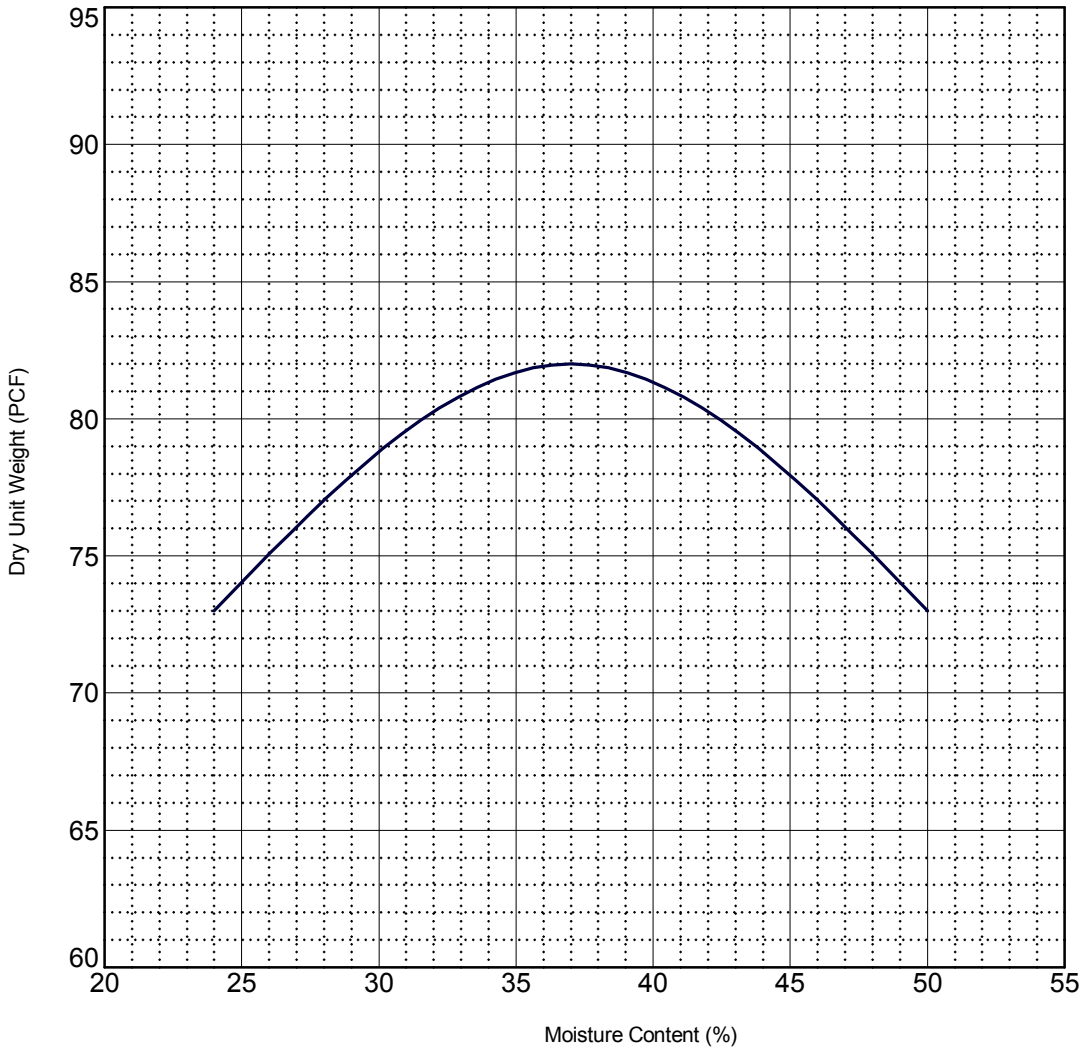
	HIRATA & ASSOCIATES, INC. Geotechnical Engineering	**DIRECT SHEAR TEST**	Plate B3.1
	W.O. 17-6139	*ASTM D3080*	



Soil Data

Location: Boring B4 at 0.5 feet

Description: Brown clayey silt

Test Results

Maximum Dry Density: 82.0 PCF

Optimum Moisture Content: 37.0 %

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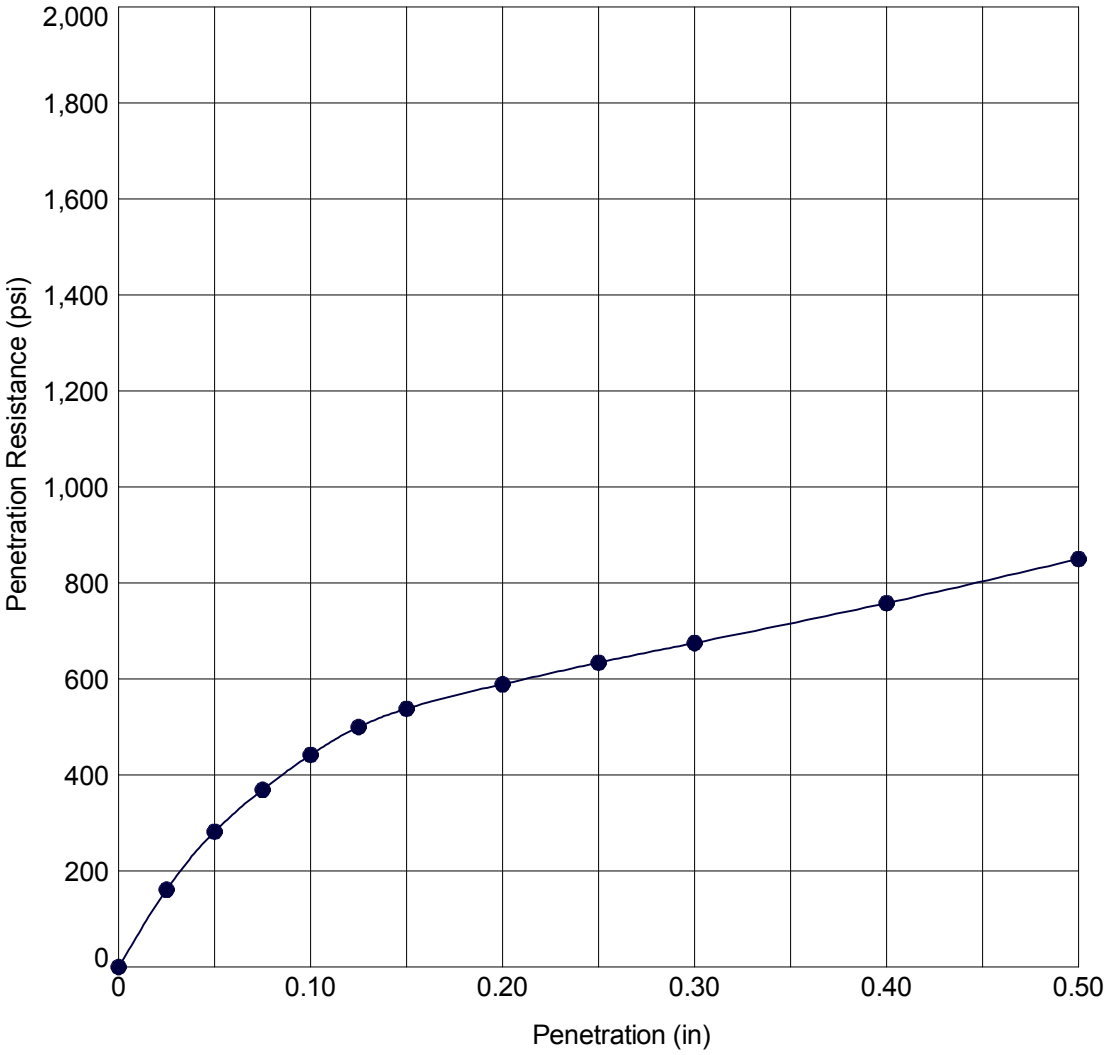
MODIFIED PROCTOR CURVE

ASTM D1557

Plate B4.1



Soil Data

Location:	Boring B4 at 0.5 feet
Description:	Brown clayey silt
Sample Dry Density	82.0 pcf
Sample Moisture Content	37.0 %

Test Results

CBR Value:	44.0 %
Expansion:	0.5 %

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CBR STRESS PENETRATION CURVE

ASTM D1883

Plate B5.1