GEOTECHNICAL ENGINEERING EXPLORATION
HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

W.O. 7818-00   FEBRUARY 19, 2019

Prepared for

MG ARCHITECTURE

GEOLABS, INC.
Geotechnical Engineering and Drilling Services

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MGA ARCHITECTURE

JOHN Y.L. CHEN
LICENSED PROFESSIONAL ENGINEER
No. 10029-C

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION.

John Chen
SIGNATURE

4-30-20
EXPIRATION DATE
OF THE LICENSE

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Hawaii • California

GEOLABS, INC.
Geotechnical Engineering and Drilling Services

February 21, 2019
W.O. 7818-00

Mr. Ronald Barber
MGA Architecture
2270 Kalakaua Avenue, Suite 1502
Honolulu, HI 96815

Dear **Mr. Barber:**

Geolabs, Inc. is pleased to submit our report entitled "Geotechnical Engineering Exploration, Hawaii State Veterans Home, Kapolei, Oahu, Hawaii" prepared for the design of the new veterans' home facility.

Our work was performed in general accordance with the scope of services outlined in our revised fee proposal dated October 23, 2018.

Please note that the soil and rock samples recovered during our field exploration (remaining after testing) will be stored for a period of two months from the date of this report. The samples will be discarded after that date unless arrangements are made for a longer sample storage period. Please contact our office for alternative sample storage requirements, if appropriate.

Detailed discussion and specific design recommendations are contained in the body of this report. If there is any point that is unclear, please contact our office.

Very truly yours,

GEOLABS, INC.

John Chen

John Y.L. Chen, P.E.
Vice President

JC:NK:as

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Hawaii • California

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TABLE OF CONTENTS

Page

SUMMARY OF FINDINGS AND RECOMMENDATIONS.. iii

1. GENERAL.. 1
- 1.1 Project Considerations.. 1
- 1.2 Purpose and Scope 2

2. SITE CHARACTERIZATION.. 4
- 2.1 Regional Geology 4
- 2.2 Site Description... 5
- 2.3 Subsurface Conditions.. 5
- 2.4 Seismic Design Considerations 6
  - 2.4.1 Earthquakes and Seismicity 6
  - 2.4.2 Soil Profile Type for Seismic Design 7
  - 2.4.3 Liquefaction Potential 8

3. DISCUSSION AND RECOMMENDATIONS 10
- 3.1 Shallow Foundations.. 10
- 3.2 Slabs-On-Grade... 12
- 3.3 Retaining Structures 14
  - 3.3.1 Retaining Structure Foundations.. 14
  - 3.3.2 Lateral Earth Pressures.. 15
  - 3.3.3 Drainage.. 16
- 3.4 Site Grading.. 16
  - 3.4.1 Site Preparation... 17
  - 3.4.2 Fills and Backfills... 18
  - 3.4.3 Fill Placement and Compaction Requirements.......................... 18
  - 3.4.4 Excavation... 19
- 3.5 Pavement Design 19
- 3.6 Field Infiltration Testing... 21
- 3.7 Utility Trenches 23
- 3.8 Corrosion Potential 24
- 3.9 Design Review... 25
- 3.10 Post-Design Services/Services During Construction 25

4. LIMITATIONS.. 26

CLOSURE... 28

Page

PLATES
Project Location Map .... Plate 1
Site Plan .... Plate 2

APPENDIX A
Field Exploration .... Page A-1
Soil Log Legend .... Plate A-0.1
Soil Classification Log Key .... Plate A-0.2
Logs of Borings .... Plates A-1 thru A-23

APPENDIX B
Laboratory Tests .... Page B-1
Laboratory Test Data .... Plates B-1 thru B-16

APPENDIX C
Field Infiltration Test Data .... Plates C-1 thru C-9

APPENDIX D
TestAmerica Analytical Report (13 Sheets)

GEOTECHNICAL ENGINEERING EXPLORATION
HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII
W.O. 7818-00 FEBRUARY 21, 2019

SUMMARY OF FINDINGS AND RECOMMENDATIONS

In general, our field exploration encountered clayey fills over older alluvium materials extending to the maximum depth explored of approximately 26.5 feet below the existing ground surface. We did not encounter groundwater in the borings drilled at the time of our field exploration. However, it should be noted groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors.

Based on the subsurface conditions encountered during our field exploration, we believe that the new veterans care home may be supported on shallow spread and/or continuous footings bearing on the recompacted on-site soils or compacted select granular fill material. An allowable bearing pressure of up to 3,000 pounds per square foot may be used for the design of shallow foundations bearing on the recompacted on-site soils or compacted select granular fill material needed to achieve the design finished grades.

Based on the results of the borehole percolation testing, the infiltration rates at the site are highly variable, ranging from minimal to about 13 inches per hour. We recommend the contractor to verify the actual infiltration rate during construction.

Based on the results of our field exploration, the project site is underlain by clayey soils with a moderate to very high shrinking and swelling potential when subjected to moisture fluctuations. Based on the grading plan provided, we understand that site grading within the new building footprint requires about 2 to 7 feet of fill, to achieve the design finish grade. We recommend placing select granular fills within the new building footprint. We also recommend embedding the thickened-edge slabs-on-grade footings a minimum of 12 inches below the lowest adjacent grade.

The text of this report should be referred to for detailed discussion and recommendations.

END OF SUMMARY OF FINDINGS AND RECOMMENDATIONS

SECTION 1. GENERAL

This report presents the results of our geotechnical engineering exploration performed for the *Hawaii State Veterans Home* project in the Kapolei area on the Island of Oahu, Hawaii. The project location and general vicinity are shown on the Project Location Map, Plate 1.

This report summarizes the findings and geotechnical recommendations resulting from our field exploration, laboratory testing, and engineering analyses for the project. These findings and geotechnical recommendations are intended for the design of foundations, slabs-on-grade, retaining structures, site grading, and pavements only. The findings and recommendations presented herein are subject to the limitations noted at the end of this report.

1.1 Project Considerations

The project site is located within the southeastern quadrant of a vacant lot, approximately 26.6 acres, in the Kapolei area on the Island of Oahu, Hawaii as shown on the Project Location Map, Plate 1. It is generally bounded by Farrington Highway to the northwest, Kealanani Avenue to the northeast, residential homes to the southeast, and Fort Barrette Road to the southwest as shown on the Site Plan, Plate 2.

Based on the grading plans provided, we anticipate that site grading will consist of cuts and fills on the order of up to about 1 and 7 feet, respectively. We understand that the proposed veterans' home project will consist of three two-story buildings, two parking lots, and one loading dock. We envision that new underground utilities, including water, sewer, drain, electric, and others will be installed for the new care home facility. A conceptual layout of the new care home facility is shown on the Site Plan, Plate 2.

As part of the field exploration program, field infiltration tests were performed to evaluate the infiltration characteristics of the subsurface materials for the design of the storm water runoff disposal system in order to meet the new drainage requirements for Low Impact Development (LID).

1.2 Purpose and Scope

The purpose of our geotechnical engineering exploration was to obtain an overview of the surface and subsurface conditions to develop an idealized soil/rock data set to formulate geotechnical engineering recommendations for the design of the new veteran home facility. The scope of work for this project included the following tasks and work efforts:

1. Research and review of available in-house soils and boring data in the project vicinity.
2. Coordination of boring stake-out and underground utility toning and clearances by our engineer.
3. Mobilization and demobilization of a truck-mounted drill rig, water truck, and two operators to the project site and back.
4. Drilling and sampling of 14 boreholes to depths of approximately 6.5 to 26.5 feet below the existing ground surface for a total of 246 lineal feet of exploration.
5. Performance of nine field infiltration tests at selected locations to evaluate the hydraulic characteristics of the subsurface materials in support of the design of the storm water runoff disposal system.
6. Coordination of the field exploration and logging of the boreholes by our geologist and engineer.
7. Laboratory testing of selected soil samples obtained during the field exploration as an aid in classifying the materials and evaluating their engineering properties.
8. Analyses of the field and laboratory data to formulate geotechnical engineering recommendations for the proposed project design.
9. Preparation of this geotechnical engineering report summarizing our work on the project and presenting our findings and recommendations.
10. Coordination of our overall work on the project by our engineer.
11. Quality assurance of our work and client/design team consultation by our principal engineer.
12. Miscellaneous work efforts, such as drafting, word processing, clerical support, and reproductions.

Detailed descriptions of our field exploration methodology and the Logs of Borings are presented in Appendix A. Results of the laboratory tests performed on selected soil samples are presented in Appendix B. Results of the infiltration tests performed at selected locations are presented in Appendix C. Results of the corrosion tests performed by TestAmerica Laboratories, Inc. are presented in Appendix D.

END OF GENERAL

SECTION 2. SITE CHARACTERIZATION

2.1 Regional Geology

The Island of Oahu was built by the extrusion of basalt and basaltic lava from the Waianae and Koolau shield volcanoes. The older Waianae Volcano is estimated to be middle to late Pliocene in age, and the younger Koolau Volcano is estimated to be late Pliocene to early Pleistocene in age. As volcanic activity in the Waianae Volcano ceased, lava flows from the Koolau Volcano banked against its eroded eastern slope forming a broad plateau, now known as the Schofield Plateau. The project site is located on the southwestern flank of the Waianae Volcano.

Physical and chemical weathering, followed by erosion of the Schofield Plateau, generated sediments, which were transported to the coast. In the vicinity of the project site and to the south, these sediments accumulated and interbedded with marine sediments and coral/algal reef formations to form a sedimentary wedge. The thickness of the sedimentary wedge ranges from zero in the area of the Interstate Route H-1 Highway to over 1,000 feet at Ewa Beach. This wedge forms the Ewa Plain and serves as the confining formation, or "caprock," over the artesian basal aquifers of southern Oahu. Deposition of sediments has continued from earlier geologic time through the present.

During the Pleistocene Epoch, sea levels fluctuated in response to the cycles of continental glaciation. As the glaciers grew and advanced, less water was available to fill the oceanic basins such that sea levels fell below the present stands of the sea. When the glaciers melted and receded, an excess of water became available such that the sea levels rose to above the present sea level.

The higher sea level stands caused the formation of deltas and fans of accumulated terrigenous sediments in the heads of old bays, accumulated reef deposits at correspondingly higher elevations, and deposited lagoonal/marine sediments in the quiet waters protected by fringing reefs. The lower sea stands caused streams to carve valleys in the sediments and reef deposits. Subaerial exposure of the sediments and calcareous materials caused consolidation of the lagoonal deposits and induration of the calcareous reef materials. Placement of man-made fills and commercial development of the area within the last 20 years has brought the project area to its present form.

2.2 Site Description

The project site is located within the southeastern quadrant of a roughly rectangular vacant lot, designated as TMK: (1) 9-1-016: 35, encompassing about 6.6 acres in the Kapolei area on the Island of Oahu, Hawaii. The vacant lot is generally bounded by Farrington Highway to the northwest, Kealanani Avenue to the northeast, residential homes to the southeast, and Fort Barrette Road to the southwest.

Based on the provided grading plan and our field observations, the existing grade of the parcel is generally lower than the surrounding roadways and is covered by short land grasses. In general, the parcel slopes gently down from north to south with existing ground elevations ranging from about +94 feet Mean Sea Level (MSL) to about +87 feet MSL. A shallow earthen drainage swale crosses the majority of the vacant lot along the southern boundary near the residential subdivision.

2.3 Subsurface Conditions

The subsurface conditions were explored by drilling and sampling 14 borings, designated as Boring Nos. 1 through 14, extending to depths of approximately 6.5 to 26.5 feet below the existing ground surface. Two bulk samples of the near-surface soils, designated as Bulk-1 and Bulk-2, were collected for laboratory California Bearing Ratio (CBR) tests to evaluate the pavement support characteristics of the near-surface soils. In addition, nine field infiltration tests, designated as LID-1 through LID 9, were performed at various depths to evaluate the permeability characteristics of the subsurface materials in support of the design of the storm water runoff disposal systems. The approximate boring, bulk sample, and field infiltration test locations are shown on the Site Plan, Plate 2.

In general, our field exploration encountered a surface fill layer, consisting of medium stiff to hard silty and/or clayey material, ranging in thickness from approximately 2.5 to 11 feet below the existing ground surface. Beneath the surface fill soils, medium stiff to hard silty and/or clayey older alluvium was encountered extending to the maximum depth explored of approximately 26.5 feet below the existing ground surface. It should be noted that a 4-inch thick layer of asphaltic concrete was encountered at the ground surface at LID-2 location.

We did not encounter groundwater in the drilled borings at the time of our field exploration. However, it should be noted groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors.

Detailed descriptions of the field exploration methodology are presented in Appendix A. Descriptions and graphic representations of the materials encountered in the borings are presented on the Logs of Borings in Appendix A. Laboratory tests were performed on selected soil samples and the test results are presented in Appendix B. Results of the infiltration tests performed at selected locations are presented in Appendix C.

2.4 Seismic Design Considerations

Based on the International Building Code (2006 Edition), the project site may be subject to seismic activity, and seismic design considerations will need to be addressed. The following sections provide discussions on the seismicity, soil profile type for seismic design, and the potential for liquefaction at the project site.

2.4.1 Earthquakes and Seismicity

In general, earthquakes throughout the world are caused by shifts in the tectonic plates. In contrast, earthquake activity in Hawaii is linked primarily to volcanic activity; therefore, earthquake activity in Hawaii generally occurs before or during volcanic eruptions. In addition, earthquakes may result from the underground movement of magma that comes close to the surface but does not erupt. The Island of Hawaii experiences thousands of earthquakes each year, but most are so small that they can only be detected by sensitive instruments. However, some of the earthquakes are strong enough to be felt, and a few cause minor to moderate damage.

In general, earthquakes associated with volcanic activity are most common on the Island of Hawaii. Earthquakes that are directly associated with the movement of magma are concentrated beneath the active Kilauea and Mauna Loa Volcanoes on the Island of Hawaii. Because the majority of earthquakes in Hawaii (over 90 percent) are related to volcanic activity, the risk of seismic activity and degree of ground shaking diminishes with increased distance from the Island of Hawaii. The Island of Hawaii has experienced numerous earthquakes greater than Magnitude 5 (M5+); however, earthquakes are not confined only to the Island of Hawaii. To a lesser degree, the Island of Maui has experienced several earthquakes greater than Magnitude 5. Therefore, moderate to strong earthquakes have occurred in the County of Maui.

2.4.2 Soil Profile Type for Seismic Design

Based on the subsurface materials anticipated at the project site and the geologic setting of the area, we believe the project site may be classified from a seismic analysis standpoint as being a "Stiff Soil Profile". Therefore, we believe the seismic design of the building structure may be designed based on a Site Class D soil profile based on the International Building Code (Table No. 1613.5.2), 2006 Edition.

When seismic waves propagate through a soil profile, often the seismic shear waves get intensified and amplified (or attenuated) depending on the thickness and properties of the soils. Based on a Site Class D soil profile, the following seismic design parameters were estimated and may be used for the seismic analysis of the project site.

SEISMIC DESIGN PARAMETERS INTERNATIONAL BUILDING CODE 2006 EDITION	
Parameter	**Value**
Peak Bedrock Acceleration, PBA (Site Class B)	0.253
Spectral Response Acceleration (Site Class B), S_S	0.589
Spectral Response Acceleration (Site Class B), S_1	0.165

SEISMIC DESIGN PARAMETERS INTERNATIONAL BUILDING CODE 2006 EDITION	
Parameter	**Value**
Site Class	“D”
Site Coefficient, F_a	1.329
Site Coefficient, F_v	2.139
Design Peak Ground Acceleration, PGA (Site Class D)	0.208
Design Spectral Response Acceleration, S_{DS}	0.521
Design Spectral Response Acceleration, S_{D1}	0.236

2.4.3 Liquefaction Potential

Based on the International Building Code (2006 Edition), the project site should be evaluated for the potential for soil liquefaction. Soil liquefaction is a condition where saturated cohesionless soils near the ground surface undergo a substantial loss of strength due to the build-up of excess pore water pressures resulting from cyclic stress applications induced by earthquakes. In this process, when the loose saturated sand deposit is subjected to vibration (such as during an earthquake), the soil tends to densify and decrease in volume causing an increase in pore water pressure. If drainage is unable to occur rapidly enough to dissipate the build-up of pore water pressure, the effective stress (internal strength) of the soil is reduced. Under sustained vibrations, the pore water pressure build-up could equal the overburden pressure, essentially reducing the soil shear strength to zero and causing it to behave as a viscous fluid. During liquefaction, the soil acquires mobility sufficient to permit both horizontal and vertical movements, and if not confined, will result in significant deformations.

Soils most susceptible to liquefaction are loose, uniformly graded, fine-grained sands and loose silts with little cohesion. The major factors affecting the liquefaction characteristics of a soil deposit are as follows:

FACTORS	LIQUEFACTION SUSCEPTIBILITY
Grain Size Distribution	Fine and uniform sands and silts are more susceptible to liquefaction than coarse or well-graded sands.
Initial Relative Density	Loose sands and silts are most susceptible to liquefaction. Liquefaction potential is inversely proportional to relative density.
Magnitude and Duration of Vibration	Liquefaction potential is directly proportional to the magnitude and duration of the earthquake.

Based on the subsurface conditions encountered, the phenomenon of soil liquefaction is not a design consideration for this project site. The risk for potential liquefaction is non-existent at this project site based on the subsurface conditions encountered (relatively stiff silty and/or clayey older alluvium in the absence of groundwater within the depths of the borings).

END OF SITE CHARACTERIZATION

SECTION 3. DISCUSSION AND RECOMMENDATIONS

Our field exploration generally encountered a surface fill layer, consisting of medium stiff to hard silty and/or clayey material, ranging in thickness from approximately 2.5 to 11 feet below the existing ground surface. Beneath the surface fill soils, medium stiff to hard silty and/or clayey older alluvium was encountered to the maximum depth explored of approximately 26.5 feet below the existing ground surface. We did not encounter groundwater in the borings drilled at the time of our field exploration.

Based on the subsurface conditions encountered during our field exploration, we believe that the new facility buildings may be supported on shallow spread and/or continuous footings bearing on the recompacted on-site soils or compacted select granular fill material. An allowable bearing pressure of up to 3,000 pounds per square foot (psf) may be used for the design of shallow foundations bearing on the recompacted on-site soils or compacted select granular fill material needed to achieve the design finished grades.

Based on the results of our field exploration, the in-situ clayey soils exhibit a moderate to very high shrinking and swelling potential when subjected to moisture fluctuations. Based on the grading plan provided, we understand that site grading within the new building footprint requires about 2 to 7 feet of fill, to achieve the design finished grade. To reduce the potential risk of foundation distress from the soil shrinking and swelling, we recommend placing select granular fills within the new building footprint. We also recommend embedding the thickened-edge slabs-on-grade footings a minimum of 12 inches below the lowest adjacent grade.

Detailed discussions and recommendations for the design of foundations, slabs-on-grade, retaining structures, site grading, pavements, and other geotechnical aspects of the project are presented in the following sections.

3.1 Shallow Foundations

Based on the subsurface conditions encountered during our field exploration, we recommend that the new veterans care home buildings may be supported on shallow spread and/or continuous footings bearing on the recompacted on-site soils or compacted select granular fill material. An allowable bearing pressure of up to 3,000 psf may be used for the design of the footings bearing on the recompacted on-site soils or compacted select granular fill material needed to achieve the design finished grades. The bearing value recommended is for dead-plus-live loads and may be increased by one-third (⅓) for transient loads, such as those caused by wind or seismic forces.

Bottom of the footing excavations should be compacted to at least 90 percent relative compaction to provide a relatively firm and smooth bearing surface prior to the placement of reinforcing steel and/or concrete. If soft and/or loose materials are encountered at the bottom of the footing excavations, they should be over-excavated to expose the underlying firm materials. The over-excavation may be backfilled with select granular materials compacted to a minimum of 90 percent relative compaction.

In general, the bottom of footings should be embedded a minimum of 18 inches below the lowest adjacent finished grade. Footings located adjacent to slopes or on slopes should be embedded to a sufficient depth to provide a minimum horizontal setback distance of at least 6 feet measured from the outside edge of the footing to the face of the slope. Foundations located next to utility trenches or easements should be embedded below a 45-degree imaginary plane extending upward from the bottom edge of the utility trench, or the footings should be extended to a depth as deep as the inverts of the utility lines.

If the foundations are designed and constructed as recommended herein, we estimate total settlements of footings supported on the recompacted on-site soils or compacted select granular fill material to be on the order of about 1 inch or less. Differential settlements between adjacent footings supported on similar materials should be on the order of about 0.5 inches or less.

Lateral loads acting on the structure may be resisted by a combination of frictional resistance between the base of the foundation and the bearing materials and by passive earth pressure developed against the near-vertical faces of the embedded portion of the footings. A coefficient of friction of 0.35 may be used for footings bearing on the recompacted on-site soils or new compacted select granular fills. Resistance due to passive earth pressure may be estimated using an equivalent fluid pressure of 350 pounds per square foot per foot of depth (pcf). The passive earth pressure value assumes that the soils around the footings are well compacted. Unless covered by pavements or slabs, the passive pressure resistance in the upper 12 inches below the finished grade should be neglected.

Resistance to uplift loads may be mobilized by the dead weight of the structure and the footing. In addition, the weight of the soil below the ground floor slab-on-grade and above the footing may be used to resist uplift loads. The contribution of dead weight from the soil above the footing may be estimated using a unit weight of 110 pounds per cubic foot (pcf).

A Geolabs representative should observe the footing excavations prior to placing the reinforcing steel and/or concrete to confirm the foundation bearing conditions and the required embedment depths. Observation of the foundation excavations should be designated a “Special Inspection” item in accordance with Section 1704 of the International Building Code (2003).

3.2 Slabs-On-Grade

Based on the results of our field exploration, the project site is underlain by clayey soils with a moderate to very high shrinking and swelling potential when subjected to moisture fluctuations. Based on the site grading plan provided, we understand that the new buildings will be supported on 2 to 5 feet of fills. To reduce the potential for future distress to the lightly loaded slabs-on-grade resulting from shrinking and swelling of the in-situ clayey soils, we recommend placing the non-expansive select granular fills within the building footprint. In addition, we recommend embedding the thickened-edge footings a minimum of 12 inches below the lowest adjacent grade.

We recommend properly preparing the slab-on-grade subgrades by scarifying to a depth of about 8 inches, moisture conditioning to above the optimum moisture, and compacting to a minimum of 90 percent relative compaction. Where shrinkage cracks are noted after compaction of the subgrade, we recommend thoroughly moistening the soils to close the cracks or preparing the subgrades again. Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage may require over-excavation of the soft areas and replacement with well-compacted fill.

For interior building slabs (not subjected to vehicular traffic or machinery vibration), we recommend placing a minimum 4-inch thick layer of cushion fill consisting of open-graded gravel (ASTM C33, No. 67 gradation) below the slabs. The open-graded gravel cushion fill would provide uniform support of the slabs and would serve as a capillary moisture break. To reduce the potential for future moisture infiltration through the slab and subsequent damage to floor coverings, and impervious moisture barrier is recommended on top of the gravel cushion fill layer. Flexible floor coverings, such as carpet or sheet vinyl, should be considered because they can better mask minor slab cracking.

Where the slabs-on-grade will be subjected to equipment vibration and/or vehicular traffic, we recommend placing the floor slab over 6 inches of aggregate subbase in lieu of the 4-inch thick cushion fill layer. The aggregate subbase should consist of crushed basaltic aggregates compacted to a minimum of 95 percent relative compaction. Where slabs are intended to function as rigid pavements, a minimum slab thickness of 6 inches may be used for preliminary design purposes. Provisions should be made for proper load transfer across the slab joints that will be subject to vehicular traffic.

We anticipate that exterior concrete flatwork, such as walkways and patios, will be provided at various locations throughout the project site. As previously mentioned, the project site is generally underlain by moderate to highly expansive clayey soils. Therefore, exterior flatwork required for the project should be underlain by a minimum 24-inch thick layer of non-expansive, select granular material. The subgrade soils below the flatwork should be scarified to a depth of about 8 inches, moisture-conditioned to above the optimum moisture content, and recompacted to a minimum of 90 percent relative compaction. The non-expansive, select granular material should be compacted to a minimum of 90 percent relative compaction. To reduce the potential for substantial shrinkage cracks developing in the slabs, crack control joints should be provided at intervals equal to the width of the walkways with expansion joints provided at right-angle intersections.

It should be emphasized that the areas adjacent to the slab edges should be backfilled tightly against the edges of the slabs with relatively impervious soils. These areas should also be graded to divert water away from the slabs and to reduce the potential for water ponding around the slabs.

3.3 Retaining Structures

We envision that low retaining walls may be required for grade separation for the proposed care home facility. In addition, we anticipate that below-grade structures, such as catch basins and manhole structures, will be required for the project. Based on our field exploration results, the following guidelines may be used for design of retaining structures planned.

3.3.1 Retaining Structure Foundations

In general, we believe retaining wall foundations required for the project construction may be designed in accordance with the recommendations presented in the "Shallow Foundations" section herein. In addition, retaining wall foundations should be at least 18 inches wide and should be embedded a minimum of 24 inches below the lowest adjacent finished grades. For sloping ground conditions, the footing should extend deeper to obtain a minimum 6-foot setback distance measured horizontally from the outside edge of the footing to the face of the slope. Wall footings oriented parallel to the direction of the slope should be constructed in stepped footings.

In general, we recommend that the bottom of the catch basins and special drainage manholes bear on 6 inches of open-graded, free-draining gravel such as No. 3B Fine Gravel (ASTM C33, No. 67 gradation), or similar material, placed over the recompacted in-situ soils and/or new compacted fills. The gravel cushion layer is intended to provide uniform bearing support of the catch basin and special drainage structures. The use of sand or S4C as backfill materials around the drainage structure should be prohibited due to the potential for migration or loss of fines during heavy rains which may result in potential ground settlement and distress to improvements above the structure.

3.3.2 Lateral Earth Pressures

Retaining structures should be designed to resist the lateral earth pressures due to the adjacent soils and surcharge effects. The recommended lateral earth pressures, expressed in equivalent fluid pressures of pounds per square foot per foot of depth (pcf), are presented in the following table.

STATIC LATERAL EARTH PRESSURES
FOR DESIGN OF RETAINING STRUCTURES

Backfill Condition	**Earth Pressure Component**	**Active** (pcf)	**At-Rest** (pcf)
Level Backfill	Horizontal	40	60
	Vertical	None	None
Maximum 2H:1V Sloping Backfill	Horizontal	60	76
	Vertical	30	38

The values provided above assume that the on-site soils or select granular fill will be used to backfill behind the retaining structure. It is assumed that the backfill behind the retaining structure will be compacted to between 90 and 95 percent relative compaction. Over-compaction of the retaining wall backfill should be avoided. In general, an active condition may be used for gravity retaining walls and walls that are free to deflect by as much as 0.5 percent of the wall height. If the tops of the walls are not free to deflect beyond this degree or are restrained, the walls should be designed for the at-rest condition. These lateral earth pressures do not include hydrostatic pressures that might be caused by groundwater trapped behind the walls.

Surcharge stresses due to areal surcharges, line loads, and point loads within a horizontal distance equal to the depth of the retaining structures should be considered in the design. For uniform surcharge stresses imposed on the loaded side of the structure, a rectangular distribution with a uniform pressure equal to 33 percent of the vertical surcharge pressure acting over the entire height of the wall, which is free to deflect (cantilever), may be used in the design. For walls that are restrained, a rectangular distribution equal to 50 percent of the vertical surcharge pressure acting over the entire height of the structure may be used for design. Additional analyses during design may be needed to evaluate the surcharge effects of point loads and line loads.

3.3.3 Drainage

Retaining walls should be well drained to reduce the build-up of hydrostatic pressures. A typical drainage system would consist of a 12-inch wide zone of permeable material, such as No. 3B Fine Gravel (ASTM C33, No. 67 gradation), placed directly around a perforated pipe (perforations facing down) at the base of the wall discharging to an appropriate outlet or weepholes. As an alternative, a prefabricated drainage product, such as MiraDrain or EnkaDrain, may be used instead of the drainage material. The prefabricated drainage product should also be connected hydraulically to a perforated pipe at the base of the wall.

The backfill from the bottom of the wall to the bottom of the weephole should consist of relatively impervious materials to reduce the potential for significant water infiltration into the subsurface. In addition, the upper 12 inches of the retaining wall backfill should consist of relatively impervious materials to reduce the potential for significant water infiltration behind the retaining structure unless covered by concrete slabs at the surface.

3.4 Site Grading

Based on the grading plan provided, we anticipate about 2 to 7 feet of fill will be required below the new veterans’ care home buildings to achieve the design finished grade. In addition, cuts on the order of about 1 foot in height will be required for the driveways near the northern corner of the project site. Items of site grading that are addressed in the subsequent subsections include the following:

1. Site Preparation
2. Fills and Backfills
3. Fill Placement and Compaction Requirements
4. Excavation

A Geolabs representative should monitor site grading operations to observe whether undesirable materials are encountered during the excavation and scarification process and to confirm whether the exposed soil conditions are similar to those assumed in this report.

3.4.1 Site Preparation

At the on-set of earthwork, the area within the contract grading limits should be cleared thoroughly. Surface vegetation and other unsuitable materials should be removed and disposed of properly off-site. Soft and yielding areas encountered during clearing below areas designated to receive fill and/or future improvements should be over-excavated to expose firm material and the resulting excavation should be backfilled with well-compacted fill. The excavated soft soils should be properly disposed of off-site and/or used in landscape areas, where appropriate.

After clearing, the exposed subgrades should be scarified to a depth of about 8 inches, moisture-conditioned to at least 2 percent above the optimum moisture, and recompacted to a minimum of 90 percent relative compaction. The compaction requirements for finished subgrades subjected to vehicular traffic should be increased to a minimum of 95 percent relative compaction. Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same soil established in accordance with ASTM D1557. Optimum moisture is the water content (percentage by dry weight) corresponding to the maximum dry density.

Where shrinkage cracks are observed after the subgrade compaction, we recommend preparing the subgrade soil again as recommended above. Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage may require over-excavating the soft areas and replacing these areas with engineered fill. A Geolabs field representative should evaluate the need for over-excavation due to soft subgrade soil conditions.

3.4.2 Fills and Backfills

In general, the excavated on-site soils should be suitable for use as general fill materials, provided that the maximum particle size is less than 3 inches in largest dimension. The on-site materials generated from the excavations may be used as a source of general fill or backfill materials, provided they are screened of the over-sized materials and/or processed to meet the above gradation requirements (less than 3 inches in largest dimension).

Imported materials required for site filling should consist of select granular fill material, such as crushed coralline and/or basaltic materials. The materials should be well graded from coarse to fine with particles no greater than 3 inches in largest dimension. In addition, the materials also should contain between 10 and 30 percent particles passing the No. 200 sieve. The materials should have a CBR value of 20 or higher, and a swell potential of 1 percent or less when tested in accordance with ASTM D1883. Geolabs should test imported fill materials a minimum of seven days prior to being transported to the project site for the intended use.

3.4.3 Fill Placement and Compaction Requirements

Fill materials consisting of the on-site soils should be moisture-conditioned to at least 2 percent above the optimum moisture, placed in level lifts not exceeding 8 inches in loose thickness, and compacted to a minimum of 90 percent relative compaction. Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same soil established in accordance with ASTM D1557. Optimum moisture is the water content (percentage by weight) corresponding to the maximum dry density.

Imported select granular fill materials should be moisture-conditioned to above the optimum moisture content, placed in level lifts of about 8 inches in loose thickness, and compacted to a minimum of 90 or 95 percent relative compaction, as appropriate. Aggregate base course and subbase materials should be moisture-conditioned to above the optimum moisture content, placed in level lifts not exceeding 8 inches in loose thickness, and compacted to a minimum of 95 percent relative compaction.

Compaction should be accomplished by sheepsfoot rollers or other types of acceptable compaction equipment. Water tamping, jetting, or ponding should not be allowed to compact the fills. Where compaction is less than required, additional compactive effort should be applied with adjustment of moisture content, as necessary, to obtain the specified compaction.

3.4.4 Excavation

Based on our field exploration, the project site generally is underlain by medium stiff to hard fill material and older alluvial soils. It is anticipated that the near-surface fill material and older alluvial soils may be excavated with normal heavy excavation equipment, such as excavating with a backhoe excavator or ripping with a bulldozer. However, it should be noted that there is potential to encounter hard boulders in localized areas in the fills and older alluvium deposits that may require the use of hoerams or chipping.

The above discussions regarding the rippability of the subsurface materials are based on our field exploration data from the borings drilled and experience in the project vicinity. We recommend that contractors proposing to bid on this project be encouraged to examine the site conditions and the boring data to make their own interpretation.

3.5 Pavement Design

We envision both flexible and rigid pavements may be required to serve the new veterans care home facility. In general, we anticipate the vehicle loading for the parking lots will primarily consist of passenger vehicles, pick-up trucks, Handi-Vans, and occasional light trucks. In addition, we envision that vehicle loading for the access driveway and loading dock will generally consist of heavy delivery trucks.

Based on our field exploration, the pavement subgrades beneath the proposed driveways and parking lots are generally underlain by medium stiff to hard clay. We anticipate that the on-site clayey soils exhibit poor pavement support characteristics.

Therefore, we recommend placing the pavement sections on a minimum 24-inch thick layer of non-expansive, select granular fill material.

The select granular fill material should have a laboratory CBR value of 20 or more and a maximum swell of 1 percent or less when tested in accordance with ASTM D1883. Therefore, a design CBR value of 20 and a maximum swell of less than 1 percent with a subgrade of resilient modulus (MR) of 17,380 pounds per square inch (psi) were adopted in our pavement analyses for the select granular fill subgrade conditions.

Based on the pavement sections being underlain by 24-inch thick select granular fills as described above, we recommend using the following pavement designs for this project.

Parking Lot (Flexible Pavement)

2.0-Inch Asphaltic Concrete
6.0-Inch Aggregate Base Course (95 Percent Relative Compaction)
8.0-Inch Total Pavement Thickness on Moist Compacted Subgrade

Access Driveway & Loading Dock (Flexible Pavement)

2.0-Inch Asphaltic Concrete
10.0-Inch Aggregate Base Course (95 Percent Relative Compaction)
12.0-Inch Total Pavement Thickness on Moist Compacted Subgrade

Access Driveway & Loading Dock (Rigid Pavement)

6.0-Inch Portland Cement Concrete
6.0-Inch Aggregate Subbase (95 Percent Relative Compaction)
12.0-Inch Total Pavement Thickness on Moist Compacted Subgrade

The pavement subgrades should be scarified to a depth of about 8 inches, moisture-conditioned to above the optimum moisture, and recompacted to a minimum of 95 percent relative compaction. Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same soil established in accordance with ASTM D1557. Optimum moisture is the water content (percentage by dry weight) corresponding to the maximum dry density.

The aggregate base course and aggregate subbase materials should meet the requirements stipulated in Sections 31 and 30 of the Standard Specifications for Public Works Construction, City and County of Honolulu (September 1986), respectively. Aggregate base and aggregate subbase course materials should be moisture-conditioned to above the optimum moisture content, placed in level lifts not exceeding 8 inches in loose thickness, and compacted to no less than 95 percent relative compaction. California Bearing Ratio and field density tests should be performed on the actual subgrade soils encountered during construction to confirm the adequacy of the above sections.

Paved areas should be sloped, and drainage gradients should be maintained to carry surface water off the site. Surface water ponding should not be allowed on the site during or after construction. Where concrete curbs are used to isolate landscaping in or adjacent to the pavement areas, we recommend extending the curbs a minimum of 2 inches into the soils below the aggregate base course and aggregate subbase layers to reduce the potential for migration of landscape water into the pavement section. Alternatively, a subdrain system could be constructed to collect excess water from landscaping irrigation. For long-term performance, we recommend constructing a subdrain system adjacent to the paved/landscaped areas.

3.6 Field Infiltration Testing

A total of 36 infiltration tests were conducted at nine test locations, designated as LID-1 through LID-9, to evaluate the infiltration characteristics of the subsurface materials encountered at the site. The infiltration tests were performed at specified depths of approximately 4 to 8 feet below the existing ground surface. The approximate infiltration test locations conducted at the project site are depicted on the Site Plan (Plate 2). These tests were performed in general accordance with the procedures outlined in Appendix D of the State of Maryland Department of the Environment "Stormwater Design Manual, Volumes I and II" (rev. 2009). These procedures are consistent with other states' procedures and may generally be considered an industry standard.

The field infiltration tests were performed by augering a borehole to the specified test depth. Upon reaching the test depth and cleaning out the borehole of soil cuttings, a 4-inch diameter PVC solid casing was set to the bottom of the drilled hole to allow infiltration only through the soil exposed at the bottom of the boring. Each borehole was pre-soaked with water for at least 24 hours prior to testing. Water was introduced into the borehole and the drop of the water level in the borehole was measured along with time for the falling head test until the water level approach the bottom of the borehole or for one hour. The tests were carried out in several increments until achieving a steady-state with a relatively constant water infiltration rate. Results of the infiltration testing are summarized in the table below. Details of our field infiltration tests are presented on Plates C-1 through C-9 of Appendix C.

SUMMARY OF CASED BOREHOLE PERCOLATION TESTING

Boring No.	**Depth** (feet)	**Average Infiltration Rate** (inch/hour)
LID-1	5.8	0.0
LID-2	6.0	0.0
LID-3	6.0	0.0
LID-4	4.0	0.0
LID-5	4.0	0.0
LID-6	6.0	0.0
LID-7	6.0	3.0
LID-8	8.0	13.0
LID-9	8.0	0.0

The results of the percolation testing indicated that the infiltration rates at the site may be minimal to non-existent at the test locations selected except for locations of LID-7 and LID-8, where infiltration rates of 3 and 13 inches per hour were measured, respectively. The above infiltration rates correspond to drainage rates of about 45 and 195 gallons per square foot per day, respectively.

It should be noted that the infiltration values presented above are the rates of infiltration through the soil exposed at the bottoms of a 4-inch diameter borehole, which may not represent the actual infiltration condition within the entire infiltration basin footprint. Due to the variability of the subsurface conditions, the absorption capacity of the selected storm water disposal system should be confirmed by conducting additional infiltration tests during construction.

3.7 Utility Trenches

We anticipate that underground utility connections will be required for the project. In general, good construction practices should be utilized for the installation and backfilling of the trenches for the new utilities. The contractor should determine the method and equipment to be used for trench excavation, subject to practical limits and safety considerations. In addition, the excavations should comply with the applicable federal, state, and local safety requirements. The contractor should be responsible for trench shoring design and installation.

In general, we recommend providing granular bedding consisting of 6 inches of open-graded gravel (ASTM C33, No. 67 gradation) under the pipes for uniform support. Free-draining granular materials, such as open-graded gravel (ASTM C33, No. 67 gradation), also should be used for the initial trench backfill up to about 12 inches above the pipes to provide adequate support around the pipes. It is critical to use this free-draining material to reduce the potential for formation of voids below the haunches of pipes and to provide adequate support for the sides of the pipes. Improper trench backfill could result in backfill settlement and pipe damage.

The upper portion of the trench backfill from the level 12 inches above the pipes to the top of the subgrade or finished grade may consist of on-site soils or select granular fill material. The backfill material should be moisture-conditioned to above the optimum moisture content, placed in maximum 8-inch level loose lifts, and mechanically compacted to at least 90 percent relative compaction. In areas where trenches will be in paved areas, the upper 3 feet of the trench backfill below the pavement finished grade should be compacted to no less than 95 percent relative compaction. Mechanical compaction equipment should be used to compact the backfill materials. Compaction efforts by water tamping, jetting, or ponding should not be allowed.

3.8 Corrosion Potential

Two sets of Corrosivity Tests, including pH (ASTM G51), Minimum Resistivity (ASTM G57), Chloride Content (EPA 300.0), and Sulfate Content (EPA 300.0), were performed by our office and TestAmerica Laboratories, Inc. on selected soil samples obtained from our field exploration. Results of the corrosivity tests are presented on Plate B-12 of Appendix B.

Resistivity is generally recognized as one of the most significant soil characteristics with regard to the corrosivity of the soil to buried metallic objects. In general, the lower the resistivity, the greater the potential for corrosion of the buried metallic structure. Conversely, the higher the resistivity, the less likely the soil will contribute to corrosion of metallic objects.

On the basis of the laboratory resistivity results, the subsurface soils at the project site exhibit minimum resistivity values of equal to or less than 1,000 ohm-cm, corresponding to a corrosion rating of 1 in accordance with the *Water System External Corrosion Control Standards, Volume 3* published by the Board of Water Supply, City and County of Honolulu, in 1991 and amended in 1995. Based on the resistivity value of the in-situ soils encountered, the subsurface materials may be classified as extremely corrosive for buried metallic structures. A corrosion engineer should be consulted for detailed recommendations on corrosion protection of metallic substructures, if appropriate.

The method used to control the corrosion of underground concrete pipelines and structures is dependent on the pH, and the chloride and sulfate contents found in the soil. In general, soils with a chloride content of less than 500 parts per million (ppm), sulfate content of less than 2,000 ppm, and a pH of greater than 5.0 may be considered "non-corrosive" to underground concrete pipelines and structures. It should be noted the sample tested at Boring No. 2 had a chloride content of about 700 ppm. A corrosion engineer should be consulted for detailed recommendations on corrosion protection of concrete structures in contact with the ground planned.

3.9 Design Review

Preliminary and final drawings and specifications for the project should be forwarded to Geolabs for review and written comments prior to bid solicitation for construction. This review is necessary to evaluate conformance of the plans and specifications with the intent of the foundation and earthwork recommendations provided herein. If this review is not made, Geolabs cannot be responsible for misinterpretation of our recommendations.

3.10 Post-Design Services/Services During Construction

Geolabs should be retained to provide geotechnical engineering services during construction. The critical items of construction monitoring that require "Special Inspections" include the following:

1. Observation of subgrade preparation
2. Observation of general fill placement and compaction
3. Observation of select granular fill placement and compaction
4. Observation of the shallow foundation excavations

A Geolabs representative also should monitor other aspects of earthwork construction to observe compliance with the design concepts, specifications, or recommendations and to expedite suggestions for design changes that may be required in the event that subsurface conditions differ from those anticipated at the time this report was prepared. Geolabs should be accorded the opportunity to provide geotechnical engineering services during construction to confirm our assumptions in providing the recommendations presented herein.

If the actual exposed subsurface conditions encountered during construction differ from those assumed or considered herein, Geolabs should be contacted to review and/or revise the geotechnical recommendations presented herein.

END OF DISCUSSION AND RECOMMENDATIONS

SECTION 4. LIMITATIONS

The analyses and recommendations submitted herein are based in part upon information obtained from our test borings. Variations of the subsurface conditions between and beyond the test borings may occur and the nature and extent of these variations may not become evident until construction is underway. If variations then appear evident, it will be necessary to re-evaluate the recommendations presented herein.

The test borings, bulk samples, and field infiltration test locations indicated herein are approximate, having been estimated by using a hand-held Global Positioning System (GPS) to field locate selected locations from reference points shown on the grading plan transmitted by Hida Okamoto & Associates, Inc. on February 5, 2019. Elevations of the borings were estimated from contours and spot elevations on the same plan. The field boring locations should be considered accurate only to the degree implied by the methods used.

The stratification breaks represented on the Logs of Borings depict the approximate boundaries between soil types and, as such, may denote a gradual transition. We did not encounter groundwater in the borings at the time of our field exploration. However, it must be noted that fluctuation may occur due to variation in seasonal rainfall and other factors. These data have been reviewed and interpretations made in the formulation of this report.

This report has been prepared for the exclusive use of MGA Architecture and their subconsultants for specific application to the proposed *Hawaii State Veterans Home* project as described herein in accordance with generally accepted geotechnical engineering principles and practices. No warranty is expressed or implied.

This report has been prepared solely for the purpose of assisting the design engineers in the design of the proposed project. Therefore, this report may not contain sufficient data, or the proper information, to serve as a basis for detailed construction cost estimates.

The owner/client should be aware that unanticipated soil conditions are commonly encountered. Unforeseen subsurface conditions, such as perched groundwater, soft deposits, hard layers, or cavities may occur in localized areas and may require additional probing or corrections in the field (which may result in construction delays) to attain a properly constructed project. Therefore, a sufficient contingency fund is recommended to accommodate these possible extra costs.

This geotechnical engineering exploration conducted at the project site was not intended to investigate the potential presence of hazardous materials existing at the project site. It should be noted that the equipment, techniques, and personnel used to conduct a geo-environmental exploration differ substantially from those applied in geotechnical engineering.

END OF LIMITATIONS

CLOSURE

The following plates and appendices are attached and complete this report:

Project Location Map..Plate 1

Site Plan..Plate 2

Field Exploration..Appendix A

Laboratory Tests..Appendix B

Field Infiltration Tests..Appendix C

Corrosion Tests..Appendix D

-ΩΩΩΩΩΩΩΩΩ-

Respectfully submitted,

GEOLABS, INC.

By John Chen

John Y.L. Chen, P.E.
Vice President

JC:NK:as

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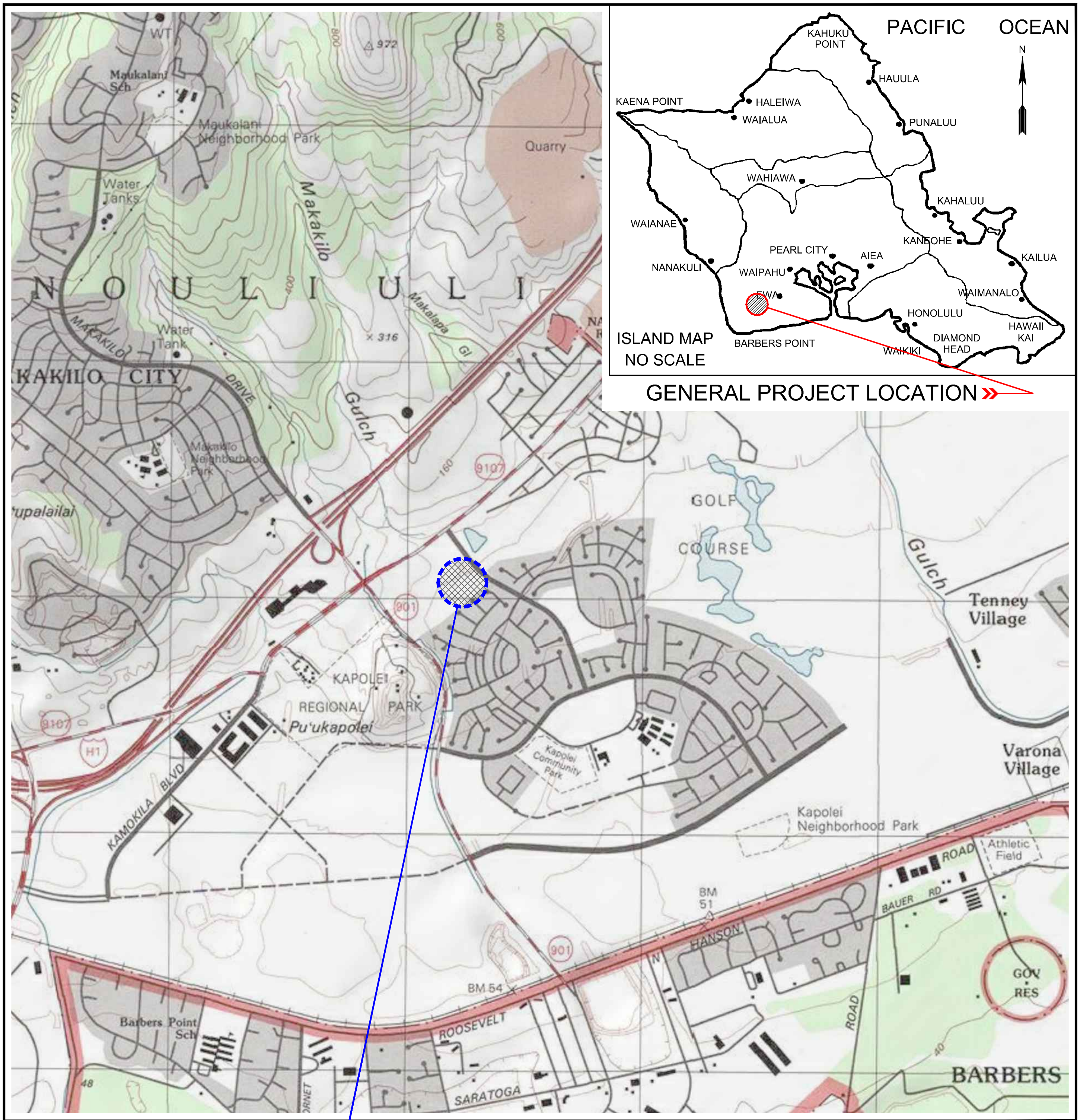
PLATES



PROJECT LOCATION »

PROJECT LOCATION MAP

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

2000 1000 0 2000 FT.

GRAPHIC SCALE

N

REFERENCE: MAP CREATED WITH TOPO!® ©2010 NATIONAL GEOGRAPHIC; ©2007 TELE ATLAS, REL. 1/2007.

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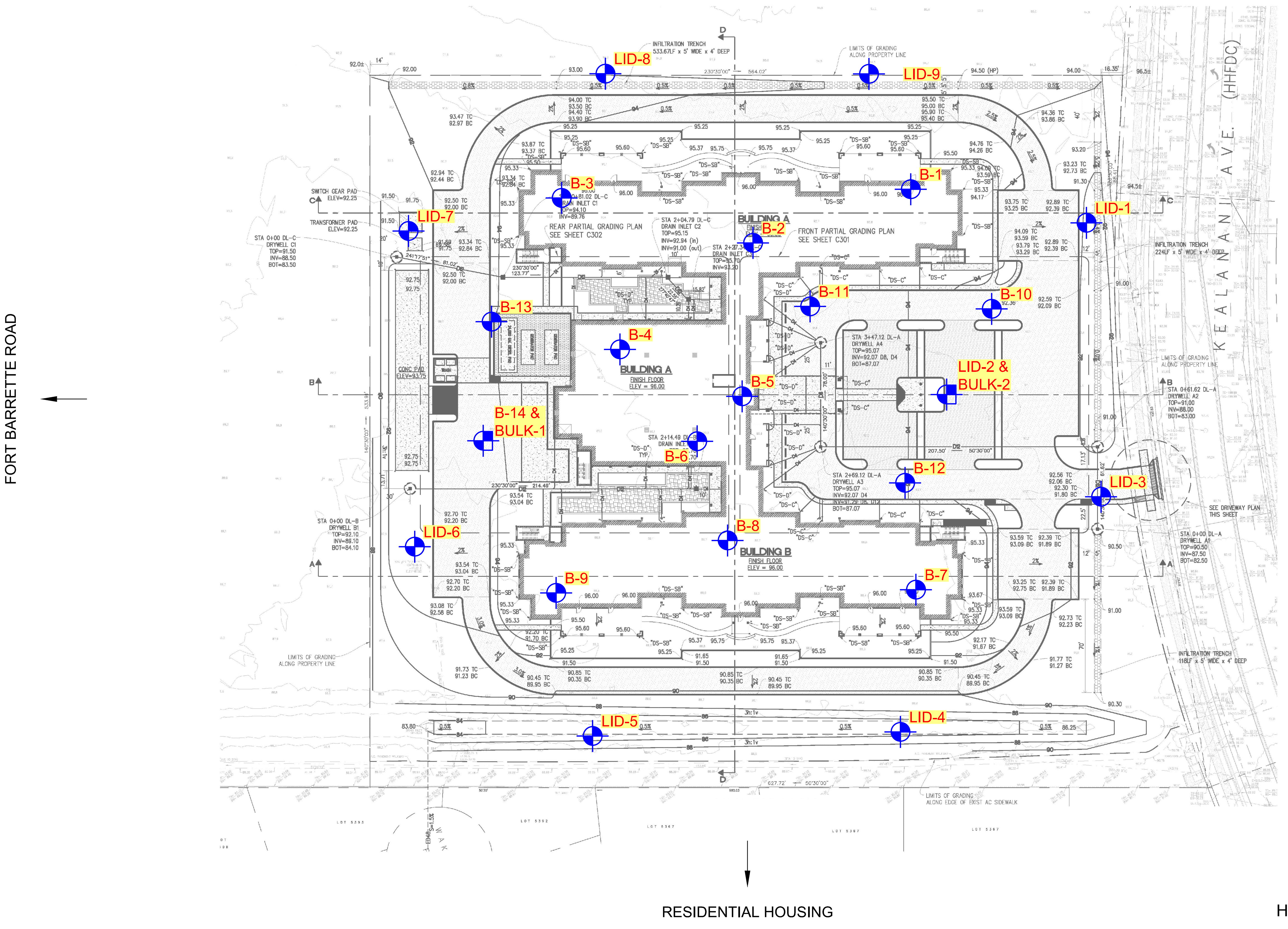
DATE	DRAWN BY	PLATE
FEBRUARY 2019	ASP	
SCALE	W.O.	1
1" = 2,000'	7818-00	

CAD User: HENRY File Last Updated: February 01, 2019 6:53:59pm Plot Date: February 21, 2019 - 11:03:28am
File: T:\Drafting\Working\7818-00_Hawaii_State_Veterans_Home\7818-00PLM.dwg\1.0 PLM
Plotter: DWG To PDF-GEO.pc3 Plotstyle: GEO-No-Dithering.ctb



LEGEND:

⊕ APPROXIMATE BORING LOCATION

▣ APPROXIMATE BULK SAMPLE LOCATION

0 40 80 160 240 FT.

GRAPHIC SCALE

REFERENCE: GRADING PLAN TRANSMITTED BY HIDA OKAMOTO & ASSOCIATES, INC. ON FEBRUARY 5, 2019.

SITE PLAN

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

GEOLABS, INC.

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DATE	DRAWN BY	PLATE
FEBRUARY 2019	ASP	
SCALE	W.O.	
1" = 80'	7818-00	2

CAD User: HENRY File Last Updated: February 12, 2019 4:34:07pm Plot Date: February 21, 2019 - 11:02:59am
File: T:\Drafting\Working\7818-00_Hawaii_State_Veterans_Home\7818-00SitePlan.dwg\2.0 SitePlan
Plotter: DWG To PDF-GEO.pc3 Plotstyle: GEO-No-Dithering-Blue-Boring.ctb

APPENDIX A

APPENDIX A

Field Exploration

We explored the subsurface conditions at the project site by drilling and sampling 14 boreholes, designated as Boring Nos. 1 through 14, extending to depths between about 6.5 and 26.5 feet below the existing ground surface. In addition, nine field infiltration test boreholes, designated as LID-1 through LID-9, were drilled and sampled to depths of approximately 4 to 8 feet below the existing ground surface. The approximate boring and field infiltration test locations are shown on the Site Plan, Plate 2. The borings were drilled using a truck-mounted drill rig equipped with continuous flight augers.

Our geologist/engineer classified the materials encountered in the borings by visual and textural examination in the field in general accordance with ASTM D2488, Standard Practice for Description and Identification of Soils, and monitored the drilling operations on a near-continuous (full-time) basis. These classifications were further reviewed visually and by testing in the laboratory. Soils were classified in general accordance with ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), as shown on the Soil Log Legend, Plate A-0.1. Deviations made to the soil classification in accordance with ASTM D2487 are described on the Soil Classification Log Key, Plate A-0.2. Graphic representations of the materials encountered are presented on the Logs of Borings, Plates A-1 through A-23.

Relatively “undisturbed” soil samples were obtained in general accordance with ASTM D3550, Ring-Lined Barrel Sampling of Soils, by driving a 3-inch OD Modified California sampler with a 140-pound hammer falling 30 inches. In addition, some samples were obtained from the drilled borings in general accordance with ASTM D1586, Penetration Test and Split-Barrel Sampling of Soils, by driving a 2-inch OD standard penetration sampler using the same hammer and drop. The blow counts needed to drive the sampler the second and third 6 inches of an 18-inch drive are shown as the “Penetration Resistance” on the Logs of Borings at the appropriate sample depths. The penetration resistance shown on the logs of borings indicates the number of blows required for the specific sampler type used. The blow counts may need to be factored to obtain the Standard Penetration Test (SPT) blow counts.

Pocket penetrometer tests were performed on selected cohesive soil samples retrieved in the field. The pocket penetrometer test provides an indication of the unconfined compressive strength of the sample. Pocket penetrometer test results are summarized on the Logs of Borings at the appropriate sample depths.

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Soil Log Legend

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			USCS		TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS MORE THAN 50% OF MATERIAL RETAINED ON NO. 200 SIEVE	GRAVELS MORE THAN 50% OF COARSE FRACTION RETAINED ON 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 PASSING THROUGH 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 PASSING THROUGH NO. 200 SIEVE	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 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 50 OR MORE	▨	**MH**	INORGANIC SILT, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			▨	**CH**	INORGANIC CLAYS OF HIGH PLASTICITY
			▨	**OH**	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			▨	**PT**	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

LEGEND

◪	(2-INCH) O.D. STANDARD PENETRATION TEST
⧗	(3-INCH) O.D. MODIFIED CALIFORNIA SAMPLE
S	SHELBY TUBE SAMPLE
G	GRAB SAMPLE
▮	CORE SAMPLE
▽	WATER LEVEL OBSERVED IN BORING AT TIME OF DRILLING
▼	WATER LEVEL OBSERVED IN BORING AFTER DRILLING
⊽	WATER LEVEL OBSERVED IN BORING OVERNIGHT

LL	LIQUID LIMIT (NP=NON-PLASTIC)
PI	PLASTICITY INDEX (NP=NON-PLASTIC)
TV	TORVANE SHEAR (tsf)
UC	UNCONFINED COMPRESSION OR UNIAXIAL COMPRESSIVE STRENGTH
TXUU	UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (ksf)

Plate

A-0.1

GEOLABS, INC.

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Soil Classification Log Key

(with deviations from ASTM D2488)

GEOLABS, INC. CLASSIFICATION*

GRANULAR SOIL (- #200 <50%)

- **PRIMARY** constituents are composed of the largest percent of the soil mass. Primary constituents are capitalized and bold (i.e., **GRAVEL, SAND**)
- **SECONDARY** constituents are composed of a percentage less than the primary constituent. If the soil mass consists of 12 percent or more fines content, a cohesive constituent is used (**SILTY** or **CLAYEY**); otherwise, a granular constituent is used (**GRAVELLY** or **SANDY**) provided that the secondary constituent consists of 20 percent or more of the soil mass. Secondary constituents are capitalized and bold (i.e., **SANDY** GRAVEL, **CLAYEY** SAND) and precede the primary constituent.
- **accessory descriptions** compose of the following:
  with some: >12%
  with a little: 5 - 12%
  with traces of: <5%
  accessory descriptions are lower cased and follow the Primary and Secondary Constituents
  (i.e., SILTY GRAVEL **with a little sand**)

COHESIVE SOIL (- #200 ≥50%)

- **PRIMARY** constituents are based on plasticity. Primary constituents are capitalized and bold (i.e., **CLAY, SILT**)
- **SECONDARY** constituents are composed of a percentage less than the primary constituent, but more than 20 percent of the soil mass. Secondary constituents are capitalized and bold (i.e., **SANDY** CLAY, **SILTY** CLAY, **CLAYEY** SILT) and precede the primary constituent.
- **accessory descriptions** compose of the following:
  with some: >12%
  with a little: 5 - 12%
  with traces of: <5%
  accessory descriptions are lower cased and follow the Primary and Secondary Constituents
  (i.e., SILTY CLAY **with some sand**)

EXAMPLE: Soil Containing 60% Gravel, 25% Sand, 15% Fines. Described as: **SILTY GRAVEL** with some sand

RELATIVE DENSITY / CONSISTENCY

Granular Soils			Cohesive Soils			
N-Value (Blows/Foot)		Relative Density	N-Value (Blows/Foot)		PP Readings (tsf)	Consistency
SPT	MCS		SPT	MCS		
0 - 4	0 - 7	Very Loose	0 - 2	0 - 4		Very Soft
4 - 10	7 - 18	Loose	2 - 4	4 - 7	< 0.5	Soft
10 - 30	18 - 55	Medium Dense	4 - 8	7 - 15	0.5 - 1.0	Medium Stiff
30 - 50	55 - 91	Dense	8 - 15	15 - 27	1.0 - 2.0	Stiff
> 50	> 91	Very Dense	15 - 30	27 - 55	2.0 - 4.0	Very Stiff
			> 30	> 55	> 4.0	Hard

MOISTURE CONTENT DEFINITIONS

Dry: Absence of moisture, dry to the touch

Moist: Damp but no visible water

Wet: Visible free water, usually soil is below water table

ABBREVIATIONS

WOH: Weight of Hammer

WOR: Weight of Drill Rods

SPT: Standard Penetration Test Split-Spoon Sampler

MCS: Modified California Sampler

PP: Pocket Penetrometer

GRAIN SIZE DEFINITION

Description	Sieve Number and / or Size
Boulders	> 12 inches (305-mm)
Cobbles	3 to 12 inches (75-mm to 305-mm)
Gravel	3-inch to #4 (75-mm to 4.75-mm)
Coarse Gravel	3-inch to 3/4-inch (75-mm to 19-mm)
Fine Gravel	3/4-inch to #4 (19-mm to 4.75-mm)
Sand	#4 to #200 (4.75-mm to 0.075-mm)
Coarse Sand	#4 to #10 (4.75-mm to 2-mm)
Medium Sand	#10 to #40 (2-mm to 0.425-mm)
Fine Sand	#40 to #200 (0.425-mm to 0.075-mm)

**Soil descriptions are based on ASTM D2488-09a, Visual-Manual Procedure, with the above modifications by Geolabs, Inc. to the Unified Soil Classification System (USCS).*

Plate

A-0.2

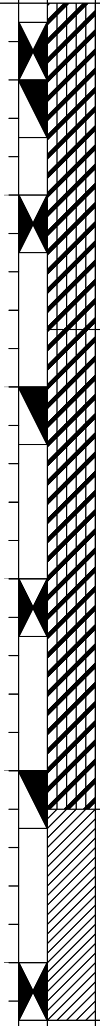
GEOLABS, INC.

Geotechnical Engineering

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Log of Boring

1



Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Approximate Ground Surface Elevation (feet): 93 * Description
	16	74			9					CL	Dark reddish brown **SILTY CLAY** with traces of roots and gravel (basaltic), medium stiff, damp (fill)
	17				7						
LL=46 PI=25	14	81			12		5				
										CL	Dark reddish brown **SILTY CLAY** with a little gravel (basaltic), very stiff to hard, damp (older alluvium)
LL=44 PI=22	20				51		10				
Consol.	22	94			32	4.5	15				
	37				11		20				
										CH	Grayish brown with orange mottling **SILTY CLAY**, stiff, moist (older alluvium)
	51	77			17		25				
											Boring terminated at 26.5 feet
							30				* Elevations estimated from Grading Plan transmitted by Hida Okamoto & Associates, Inc. on February 5, 2019.
							35				

Date Started:	November 14, 2018	Water Level: ⊻	Not Encountered	Plate
Date Completed:	November 14, 2018			
Logged By:	Karl Gerstnecker	Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	A - 1
Total Depth:	26.5 feet	Drilling Method:	4" Solid Stem Auger	
Work Order:	7818-00	Driving Energy:	140 lb. wt., 30 in. drop	

GEOLABS, INC.

Geotechnical Engineering

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Log of Boring

2

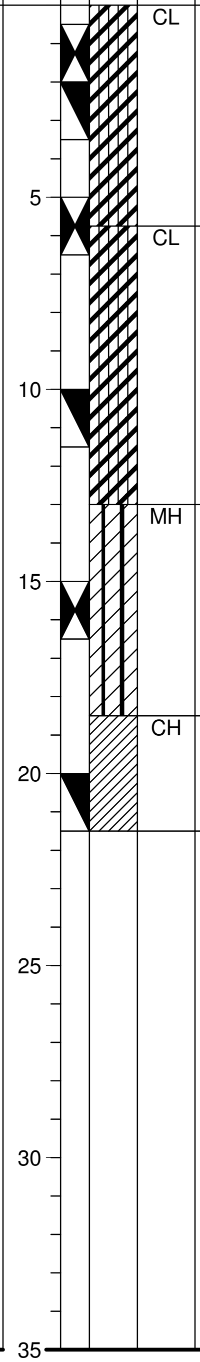
Approximate Ground Surface Elevation (feet): 92 *

Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	19	93			24	4.5				MH	Dark brown **CLAYEY SILT** with some gravel (basaltic), very stiff, damp (fill)
	19				18						
LL=57 PI=37	21	102			46	4.5	5			CH	Reddish brown **SILTY CLAY**, very stiff to hard, damp (older alluvium)
	19				42		10				
										MH	Reddish brown **CLAYEY SILT** with some gravel (coralline), stiff, moist (older alluvium)
	25	77			18		15				
											Boring terminated at 16.5 feet
							20				
							25				
							30				
							35				

Date Started:	November 16, 2018	Water Level: ▽	Not Encountered	Plate A - 2
Date Completed:	November 16, 2018			
Logged By:	Karl Gerstnecker	Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	
Total Depth:	16.5 feet	Drilling Method:	4" Solid Stem Auger	
Work Order:	7818-00	Driving Energy:	140 lb. wt., 30 in. drop	

GEOLABS, INC. Geotechnical Engineering	HAWAII STATE VETERANS HOME KAPOLEI, OAHU, HAWAII	Log of Boring 3

Approximate Ground Surface Elevation (feet): 91 *



Laboratory			Field						
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	18	93			70	4.5		CL	Reddish brown **SILTY CLAY** with a little gravel and cobbles (basaltic), hard, damp (fill)
LL=35 PI=22	7				30				
TXUU	17	97			55		5		
								CL	Reddish brown **SILTY CLAY** with some gravel (basaltic), hard, damp (older alluvium)
LL=44 PI=23	14				65		10		
								MH	Brownish red **CLAYEY SILT** with some gravel (coralline), stiff, moist (older alluvium)
	44	66			18	4.5	15		
								CH	Dark grayish brown **SILTY CLAY**, stiff, moist (older alluvium)
	64				10		20		
									Boring terminated at 21.5 feet
							25		
							30		
							35		

Date Started: November 15, 2018

Date Completed: November 15, 2018

Logged By: Karl Gerstnecker

Total Depth: 21.5 feet

Work Order: 7818-00

Water Level: ⊻ Not Encountered

Drill Rig: CME-45C TRUCK *(Energy Transfer Ratio = 78%)*

Drilling Method: 4" Solid Stem Auger

Driving Energy: 140 lb. wt., 30 in. drop

Plate

A - 3

GEOLABS, INC.

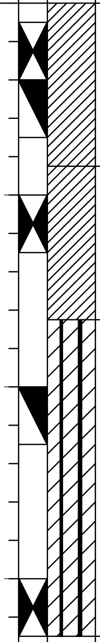
Geotechnical Engineering

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Log of Boring

4

Approximate Ground Surface Elevation (feet): 90.5 *



Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	18	95			22	4.5				CH	Reddish brown **SILTY CLAY** with some roots and gravel (basaltic), stiff to very stiff, damp (fill)
LL=57 PI=37	10				24						
TXUU	27	94			84	4.5	5			CH	Brownish red **SILTY CLAY** with some gravel (basaltic), hard, moist (older alluvium)
										MH	Brownish red **CLAYEY SILT** with some gravel (basaltic), hard, moist (older alluvium)
	23				56		10				
	38	74			70	4.5	15				
											Boring terminated at 16.5 feet
							20				
							25				
							30				
							35				

Date Started: November 16, 2018
Date Completed: November 16, 2018
Logged By: Karl Gerstnecker
Total Depth: 16.5 feet
Work Order: 7818-00

Water Level: ⊻ Not Encountered
Drill Rig: CME-45C TRUCK *(Energy Transfer Ratio = 78%)*
Drilling Method: 4" Solid Stem Auger
Driving Energy: 140 lb. wt., 30 in. drop

Plate

A - 4

GEOLABS, INC.

Geotechnical Engineering

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Log of Boring

5

Approximate Ground Surface Elevation (feet): 91.5 *

Laboratory			Field						
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
								MH	Dark reddish brown **CLAYEY SILT** with some gravel, stiff to very stiff, damp (fill)
	17	86			33	4.5			
	21				23				
								MH	Dark reddish brown **CLAYEY SILT** with some weathered basalt gravel, stiff, moist (older alluvium)
TXUU	23	97			17	4.5	5		
	18				38		10		
								SM	Light brownish tan fine to medium grained angular **SILTY SAND (CORALLINE)**, medium dense to dense, moist (coralline detritus)
									Light orangish tan **CORAL**, moderately to highly weathered, soft (coral formation)
	3	87			14		15		
								MH	Dark grayish brown and dark reddish orange **CLAYEY SILT**, medium stiff, moist (older alluvium)
LL=77 PI=41	63				8		20		
	27	104			77	4.5	25		grades to hard
									Boring terminated at 26.5 feet
							30		
							35		

Date Started:	November 14, 2018	Water Level: ⊻	Not Encountered
Date Completed:	November 14, 2018		
Logged By:	Karl Gerstnecker	Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*
Total Depth:	26.5 feet	Drilling Method:	4" Solid Stem Auger
Work Order:	7818-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate

A - 5

GEOLABS, INC.

Geotechnical Engineering

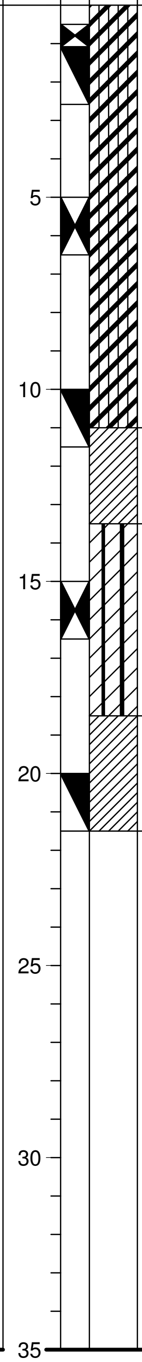
HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Log of Boring

6

Approximate Ground Surface Elevation (feet): 91 *

Description



Laboratory			Field					
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	USCS	Description
LL=47 PI=25	18 19	87			30/1" 12	4.5	CL	Reddish brown **SILTY CLAY** with some gravel, stiff, damp (fill)
Consol.	25	84			15			
	21				28			
							CH	Brownish red **SILTY CLAY** with some cobbles (basaltic), hard, damp (older alluvium)
	42	68			40		MH	Brownish red **CLAYEY SILT**, very stiff, moist (older alluvium)
	73				6		CH	Dark grayish brown **SILTY CLAY**, medium stiff, moist (older alluvium)

Boring terminated at 21.5 feet

Date Started: November 15, 2018
Date Completed: November 15, 2018
Logged By: Karl Gerstnecker
Total Depth: 21.5 feet
Work Order: 7818-00

Water Level: ⊻ Not Encountered

Drill Rig: CME-45C TRUCK *(Energy Transfer Ratio = 78%)*
Drilling Method: 4" Solid Stem Auger
Driving Energy: 140 lb. wt., 30 in. drop

Plate

A - 6

GEOLABS, INC. Geotechnical Engineering	HAWAII STATE VETERANS HOME KAPOLEI, OAHU, HAWAII	Log of Boring 7

Approximate Ground Surface Elevation (feet): 89.5 *

Laboratory			Field						
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	19	90			23	4.5		CH	Reddish brown **SILTY CLAY** with some gravel, stiff to very stiff, damp (fill)
LL=54 PI=34	17				25				
					70	4.5	5	CH	Reddish brown **SILTY CLAY** with some gravel (basaltic), hard, damp (older alluvium)
								MH	Reddish brown **CLAYEY SILT** with some weathered basalt gravel, very stiff to hard, damp (older alluvium)
	19				73		10		
TXUU	20	92			58/6" +75/3"	4.5	15		
								CH	Brownish red **SILTY CLAY**, hard, damp (older alluvium)
	21				44		20		
									Boring terminated at 21.5 feet
							25		
							30		
							35		

Date Started:	November 15, 2018	Water Level: ⊻	Not Encountered
Date Completed:	November 15, 2018		
Logged By:	Karl Gerstnecker	Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*
Total Depth:	21.5 feet	Drilling Method:	4" Solid Stem Auger
Work Order:	7818-00	Driving Energy:	140 lb. wt., 30 in. drop

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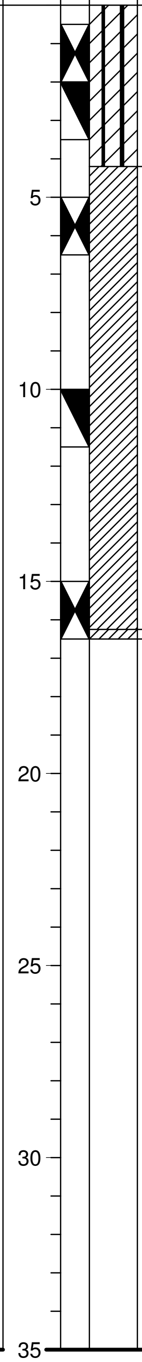
Geotechnical Engineering

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Log of Boring
8

Approximate Ground Surface Elevation (feet): 90 *

Laboratory			Field						
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	18	78			15	4.5		MH	Reddish brown **CLAYEY SILT** with some roots and gravel (basaltic), medium stiff to very stiff, damp (fill)
	16				25				
LL=58 PI=39	17	95			77	4.5	5	CH	Reddish brown **SILTY CLAY** with some weathered basalt gravel, hard, damp (older alluvium)
	24				63		10		
	21	85			23	4.5	15		
								CH	Reddish gray **SILTY CLAY**, hard, damp (older alluvium)
									Boring terminated at 16.5 feet



Date Started:	November 15, 2018
Date Completed:	November 15, 2018
Logged By:	Karl Gerstnecker
Total Depth:	16.5 feet
Work Order:	7818-00

Water Level: ⊻	Not Encountered
Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*
Drilling Method:	4" Solid Stem Auger
Driving Energy:	140 lb. wt., 30 in. drop

Plate

A - 8

GEOLABS, INC.

Geotechnical Engineering

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Log of Boring

9

Approximate Ground Surface Elevation (feet): 88 *

Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
TXUU	20	87			20			⧗	▨	CH	Dark brownish red **SILTY CLAY** with some gravel (coralline), stiff to very stiff, damp (fill)
LL=52 PI=31	19				18			▼	▨		
Consol.	19	91			21		5	⧗	▨	CH	Dark reddish brown with mottled black **SILTY CLAY** with a little cobbles (basaltic), very stiff, damp (older alluvium)
LL=55 PI=33	22				20		10	▼	▨		
	14	101			40/6" Ref.		15	⧗	▨		
									▨		grades to moist
	35				21		20	▼	▨		
	61	70			22	4.5	25	⧗	▨		
										MH	Light grayish brown **CLAYEY SILT**, stiff, moist (older alluvium)
											Boring terminated at 26.5 feet
							30				
							35				

Date Started:	November 14, 2018	Water Level: ⊻	Not Encountered
Date Completed:	November 14, 2018		
Logged By:	Karl Gerstnecker	Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*
Total Depth:	26.5 feet	Drilling Method:	4" Solid Stem Auger
Work Order:	7818-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate

A - 9

GEOLABS, INC. Geotechnical Engineering	HAWAII STATE VETERANS HOME KAPOLEI, OAHU, HAWAII	**Log of Boring** 10

Approximate Ground Surface Elevation (feet): 93 *

Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
					22			⧗	▨	MH	Dark brown **CLAYEY SILT** with some gravel (basaltic), stiff, damp (fill)
	20				11			▼	▨	CH	Dark brown **SILTY CLAY** with some roots and sand (basaltic), stiff, moist (fill)
LL=66 PI=46	23	100			36	4.5	5	⧗	▨	CH	Brownish red **SILTY CLAY** with some sand (basaltic), very stiff, moist (older alluvium)
									▨		grades to with some orange mottling, hard
	24				36		10	▼	▨		
											Boring terminated at 11.5 feet
							15				
							20				
							25				
							30				
							35				

Date Started:	November 16, 2018	Water Level: ⊻	Not Encountered	Plate
Date Completed:	November 16, 2018			
Logged By:	Karl Gerstnecker	Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	A - 10
Total Depth:	11.5 feet	Drilling Method:	4" Solid Stem Auger	
Work Order:	7818-00	Driving Energy:	140 lb. wt., 30 in. drop	

GEOLABS, INC.

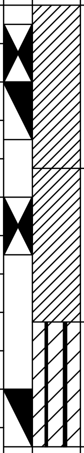
Geotechnical Engineering

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Log of Boring

11

Approximate Ground Surface Elevation (feet): 92 *



Laboratory			Field						
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
LL=50 PI=28	20	92			30	4.5		CH	Light grayish brown **SILTY CLAY** with a little sand, stiff to very stiff, damp (fill)
	20				8				
	21	103			36	4.5	5	CH	Reddish brown **SILTY CLAY** with some sand (basaltic), very stiff, damp (older alluvium)
								MH	Brownish red **CLAYEY SILT** with some gravel (coralline), hard, damp (older alluvium)
	21				42		10		
									Boring terminated at 11.5 feet
							15		
							20		
							25		
							30		
							35		

Date Started:	November 16, 2018	Water Level: ⊻	Not Encountered
Date Completed:	November 16, 2018		
Logged By:	Karl Gerstnecker	Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*
Total Depth:	11.5 feet	Drilling Method:	4" Solid Stem Auger
Work Order:	7818-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate

A - 11

GEOLABS, INC.

Geotechnical Engineering

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Log of Boring

12

Approximate Ground Surface Elevation (feet): 90 *

Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	17	77			27	4.5				CH	Light gray and brown **SILTY CLAY** with some gravel and cobbles, very stiff, damp (fill)
LL=61 PI=40	20				25						
										MH	Reddish brown **CLAYEY SILT** with some gravel (basaltic), very stiff to hard, damp (older alluvium)
	19	89			64	4.5	5				
											Boring terminated at 6.5 feet
							10				
							15				
							20				
							25				
							30				
							35				

Date Started: November 14, 2018

Date Completed: November 14, 2018

Logged By: Karl Gerstnecker

Total Depth: 6.5 feet

Work Order: 7818-00

Water Level: ⊻ Not Encountered

Drill Rig: CME-45C TRUCK *(Energy Transfer Ratio = 78%)*

Drilling Method: 4" Solid Stem Auger

Driving Energy: 140 lb. wt., 30 in. drop

Plate

A - 12

GEOLABS, INC.

Geotechnical Engineering

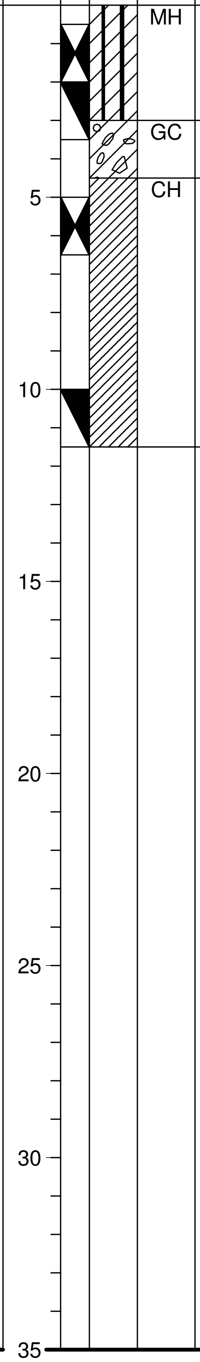
HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Log of Boring

13

Approximate Ground Surface Elevation (feet): 89.5 *

Laboratory			Field						
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	12	101			79			MH	Reddish brown **CLAYEY SILT** with some gravel (basaltic), hard, dry (fill)
	10				40				
								GC	Light gray angular **CLAYEY GRAVEL (BASALTIC)**, dense, damp (fill)
LL=55 PI=36	17	110			68	4.5	5	CH	Reddish brown **SILTY CLAY** with traces of gravel, hard, damp (older alluvium)
	24				31		10		
									Boring terminated at 11.5 feet



Date Started:	November 16, 2018	Water Level: ⊻	Not Encountered
Date Completed:	November 16, 2018		
Logged By:	Karl Gerstnecker	Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*
Total Depth:	11.5 feet	Drilling Method:	4" Solid Stem Auger
Work Order:	7818-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate

A - 13

GEOLABS, INC. Geotechnical Engineering	HAWAII STATE VETERANS HOME KAPOLEI, OAHU, HAWAII	**Log of Boring** 14

Approximate Ground Surface Elevation (feet): 89 *

Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	23	88			22	4.5				MH	Brown **CLAYEY SILT** with some gravel (basaltic), medium stiff to stiff, moist (fill)
	16				23					CH	Reddish brown **SILTY CLAY** with some cobbles (basaltic), stiff to very stiff, damp (fill)
	22	96			54	4.5	5			CH	Reddish brown **SILTY CLAY**, very stiff, moist (older alluvium)
	23				22		10				
											Boring terminated at 11.5 feet
							15				
							20				
							25				
							30				
							35				

Date Started:	November 16, 2018	Water Level: ⊻	Not Encountered	Plate
Date Completed:	November 16, 2018			
Logged By:	Karl Gerstnecker	Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	A - 14
Total Depth:	11.5 feet	Drilling Method:	4" Solid Stem Auger	
Work Order:	7818-00	Driving Energy:	140 lb. wt., 30 in. drop	

GEOLABS, INC.

Geotechnical Engineering

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Log of Boring

LID-1

Laboratory			Field								Approximate Ground Surface Elevation (feet): 94 *
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	19	96			25					MH	Dark brown **CLAYEY SILT** with some gravel (basaltic), stiff, damp (fill)
	20				25					CH	Reddish brown **SILTY CLAY** with some gravel (basaltic), very stiff, damp (fill)
	21	96			41		5				
											Boring terminated at 6 feet
							10				
							15				
							20				
							25				
							30				
							35				

Date Started: November 19, 2018
Date Completed: November 19, 2018
Logged By: Karl Gerstnecker
Total Depth: 6 feet
Work Order: 7818-00

Water Level: ⊻ Not Encountered
Drill Rig: CME-45C TRUCK *(Energy Transfer Ratio = 78%)*
Drilling Method: 4" Solid Stem Auger
Driving Energy: 140 lb. wt., 30 in. drop

Plate

A - 15

GEOLABS, INC.

Geotechnical Engineering

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Log of Boring

LID-2

Laboratory			Field								Approximate Ground Surface Elevation (feet): 92 *
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
											4-inch **ASPHALTIC CONCRETE**
	27	90			17			⧗	▨	CH	Dark brown **SILTY CLAY** with some gravel (basaltic), stiff, moist (fill)
	29				9			▼	▨		
	26	100			40		5	⧗	▨	CH	Dark brown **SILTY CLAY** with some gravel (basaltic), very stiff, moist (older alluvium)
											Boring terminated at 6 feet
							10				
							15				
							20				
							25				
							30				
							35				

Date Started:	November 19, 2018	Water Level: ⊻	Not Encountered	Plate
Date Completed:	November 19, 2018			
Logged By:	Karl Gerstnecker	Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	
Total Depth:	6 feet	Drilling Method:	4" Solid Stem Auger	A - 16
Work Order:	7818-00	Driving Energy:	140 lb. wt., 30 in. drop	

GEOLABS, INC.

Geotechnical Engineering

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Log of Boring

LID-3

Approximate Ground Surface Elevation (feet): 92.5 *

Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	20	76			24					MH	Reddish brown **CLAYEY SILT** with some roots and gravel (basaltic), very stiff, damp (fill)
	18				15						
	18	88			64		5				grades to hard
											Boring terminated at 6 feet
							10				
							15				
							20				
							25				
							30				
							35				

Date Started:	November 15, 2018	Water Level: ∇	Not Encountered	Plate
Date Completed:	November 15, 2018			
Logged By:	Karl Gerstnecker	Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	A - 17
Total Depth:	6 feet	Drilling Method:	4" Solid Stem Auger	
Work Order:	7818-00	Driving Energy:	140 lb. wt., 30 in. drop	

BORING_LOG 7818-00.GPJ GEOLABS.GDT 2/21/19

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HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Log of Boring

LID-4

Approximate Ground Surface Elevation (feet): 88 *

Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	17	95			36					MH	Brown **CLAYEY SILT** with some roots, very stiff, damp (fill)
	18				42					CH	Brown **SILTY CLAY** with some roots and gravel (coralline), hard, damp (fill)
											Boring terminated at 4 feet
							5				
							10				
							15				
							20				
							25				
							30				
							35				

Date Started:	November 19, 2018	Water Level: ⊻	Not Encountered	Plate
Date Completed:	November 19, 2018			
Logged By:	Karl Gerstnecker	Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	A - 18
Total Depth:	4 feet	Drilling Method:	4" Solid Stem Auger	
Work Order:	7818-00	Driving Energy:	140 lb. wt., 30 in. drop	

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KAPOLEI, OAHU, HAWAII

Log of Boring

LID-5

Approximate Ground Surface Elevation (feet): 86 *

Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	14	94			24			⧗		GM	Light brownish tan subangular **SILTY GRAVEL (CORALLINE)**, medium dense, moist (fill)
	18				4			▼	▨	MH	Brown **CLAYEY SILT** with some gravel (coralline), medium stiff, damp (fill)
											Boring terminated at 4 feet
							5				
							10				
							15				
							20				
							25				
							30				
							35				

Date Started:	November 19, 2018
Date Completed:	November 19, 2018
Logged By:	Karl Gerstnecker
Total Depth:	4 feet
Work Order:	7818-00

Water Level: ⊻	Not Encountered
Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*
Drilling Method:	4" Solid Stem Auger
Driving Energy:	140 lb. wt., 30 in. drop

Plate

A - 19

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KAPOLEI, OAHU, HAWAII

Log of Boring

LID-6

Approximate Ground Surface Elevation (feet): 88 *

Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	20	90			27					MH	Dark brown **SILTY CLAY** with some sand and gravel, very stiff, damp (fill)
	19				17						
	20	102			30		5				
											Boring terminated at 6 feet
							10				
							15				
							20				
							25				
							30				
							35				

Date Started:	November 19, 2018	Water Level: ⊻	Not Encountered
Date Completed:	November 19, 2018		
Logged By:	Karl Gerstnecker	Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*
Total Depth:	6 feet	Drilling Method:	4" Solid Stem Auger
Work Order:	7818-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate

A - 20

	GEOLABS, INC. Geotechnical Engineering	HAWAII STATE VETERANS HOME KAPOLEI, OAHU, HAWAII	**Log of Boring** LID-7

Approximate Ground Surface Elevation (feet): 89.5 *

Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	18	93			33					MH	Brown **CLAYEY SILT** with some gravel (basaltic), very stiff, damp (fill)
	20				32						
										MH	Brown **CLAYEY SILT**, hard, damp (older alluvium)
	19	101			128		5				
											Boring terminated at 6 feet
							10				
							15				
							20				
							25				
							30				
							35				

Date Started:	November 19, 2018	Water Level: ⊻	Not Encountered	Plate A - 21
Date Completed:	November 19, 2018			
Logged By:	Karl Gerstnecker	Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	
Total Depth:	6 feet	Drilling Method:	4" Solid Stem Auger	
Work Order:	7818-00	Driving Energy:	140 lb. wt., 30 in. drop	

BORING_LOG 7818-00.GPJ GEOLABS.GDT 2/21/19

GEOLABS, INC.

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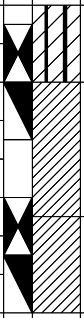
KAPOLEI, OAHU, HAWAII

Log of Boring

LID-8

Approximate Ground Surface Elevation (feet): 94 *



Laboratory			Field						
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	18	98			40			MH	Brown **CLAYEY SILT** with some gravel (basaltic), very stiff, damp (fill)
	9				76			CH	Reddish brown **SILTY CLAY**, with some cobbles (basaltic) hard, damp (fill)
	20	110			99		5	CH	Reddish brown **SILTY CLAY** with some gravel (basaltic), hard, damp (older alluvium)
	17				32				
									Boring terminated at 8 feet
							10		
							15		
							20		
							25		
							30		
							35		

Date Started: November 19, 2018
Date Completed: November 19, 2018
Logged By: Karl Gerstnecker
Total Depth: 8 feet
Work Order: 7818-00

Water Level: ⊻ Not Encountered
Drill Rig: CME-45C TRUCK *(Energy Transfer Ratio = 78%)*
Drilling Method: 4" Solid Stem Auger
Driving Energy: 140 lb. wt., 30 in. drop

Plate

A - 22

GEOLABS, INC. Geotechnical Engineering		HAWAII STATE VETERANS HOME KAPOLEI, OAHU, HAWAII	**Log of Boring** LID-9

Laboratory			Field								Approximate Ground Surface Elevation (feet): 95 *
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	24	92			30					MH	Dark brown and dark reddish brown **CLAYEY SILT** with some gravel (basaltic), very stiff, moist (fill)
	25				15						
	21	96			65		5			CH	Dark reddish brown with black mottling **SILTY CLAY**, very stiff to hard, damp (older alluvium)
	21				28						
											Boring terminated at 8 feet
							10				
							15				
							20				
							25				
							30				
							35				

Date Started:	November 19, 2018	Water Level: ⊽	Not Encountered	Plate A - 23
Date Completed:	November 19, 2018			
Logged By:	Karl Gerstnecker	Drill Rig:	CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	
Total Depth:	8 feet	Drilling Method:	4" Solid Stem Auger	
Work Order:	7818-00	Driving Energy:	140 lb. wt., 30 in. drop	

APPENDIX B

APPENDIX B

Laboratory Tests

Moisture Content (ASTM D2216) and Unit Weight (ASTM D2937) determinations were performed on selected samples as an aid in the classification and evaluation of soil properties. The test results are presented on the Logs of Borings at the appropriate sample depths.

Sixteen Atterberg Limits tests (ASTM D4318) were performed on selected soil samples to evaluate the liquid and plastic limits to aid in soil classifications. The test results are summarized on the Logs of Borings at the appropriate sample depths. Graphic presentations of the test results are provided on Plates B-1 and B-2.

Twelve one-inch ring swell tests were performed on relatively undisturbed or remolded samples to evaluate the swelling potential of the near-surface soils. The test results are summarized on Plate B-3.

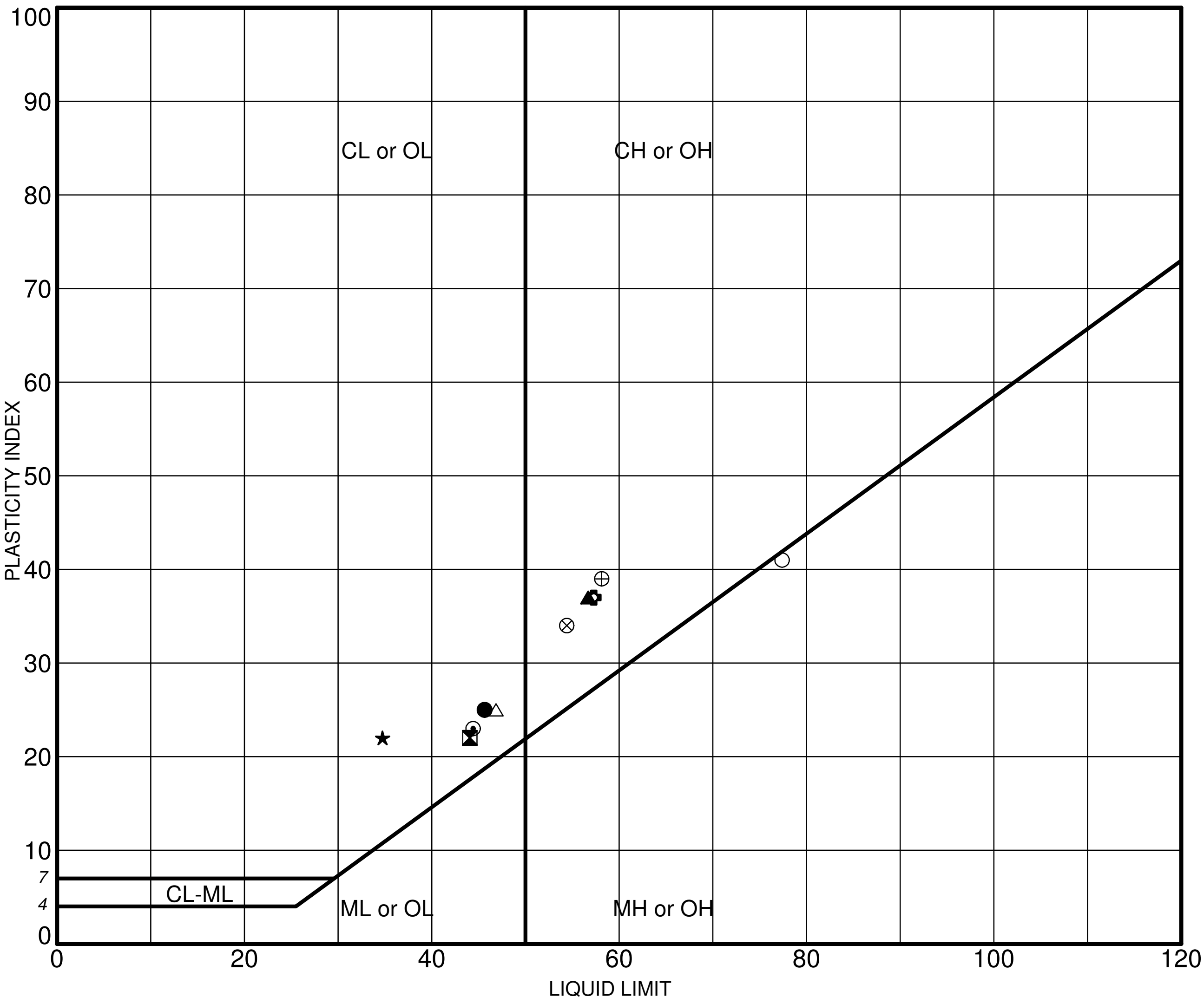
Five Unconsolidated Undrained Triaxial Compression tests (ASTM D2850) were performed on selected soil samples to evaluate the undrained shear strength of the in-situ soils. The approximate in-situ effective overburden pressure was used as the applied confining pressure for the relatively “undisturbed” soil sample. The test results and the stress-strain curves are presented on Plates B-4 through B-8.

Three Consolidation tests with time rates (ASTM D2435) were performed on samples of the potentially compressible soils to evaluate the compressibility characteristics of the materials encountered. Results of the consolidation tests are presented on Plates B-9 through B-11.

Two sets of Corrosivity tests, including pH (ASTM G51), Minimum Resistivity (ASTM G57), Chloride Content (EPA 300.0), and Sulfate Content (EPA 300.0), were performed by our office and TestAmerica Laboratories, Inc. on selected soil samples obtained from our field exploration. The test results are summarized on Plate B-12.

Two Modified Proctor compaction tests (ASTM D1557) were performed on bulk samples of the near-surface soils to evaluate the dry density and moisture content relationships. The test results are presented on Plates B-13 and B-14.

Two laboratory California Bearing Ratio tests (ASTM D1883) were performed on bulk samples of the near-surface soils to evaluate the pavement support characteristics of the soils. The test results are presented on Plates B-15 and B-16.



	Sample	Depth (ft)	LL	PL	PI	Description
●	B-1	5.0-6.5	46	21	25	Dark reddish brown silty clay (CL) with traces of gravel
⧗	B-1	10.0-11.5	44	22	22	Dark reddish brown sandy clay (CL) with a little gravel
▲	B-2	5.0-6.5	57	20	37	Reddish brown silty clay (CH)
★	B-3	2.0-3.5	35	13	22	Reddish brown silty clay (CL) with a little gravel
⦿	B-3	10.0-11.5	44	21	23	Reddish brown silty clay (CL) with some gravel
✿	B-4	2.0-3.5	57	20	37	Reddish brown silty clay (CH) with some gravel
○	B-5	20.0-21.5	77	36	41	Dark grayish brown clayey silt (MH)
△	B-6	0.5-1.1	47	22	25	Reddish brown silty clay (CL) with some gravel
⊗	B-7	2.0-3.5	54	20	34	Reddish brown silty clay (CH) with some gravel
⊕	B-8	5.0-6.5	58	19	39	Reddish brown silty clay (CH)

NP = NON-PLASTIC

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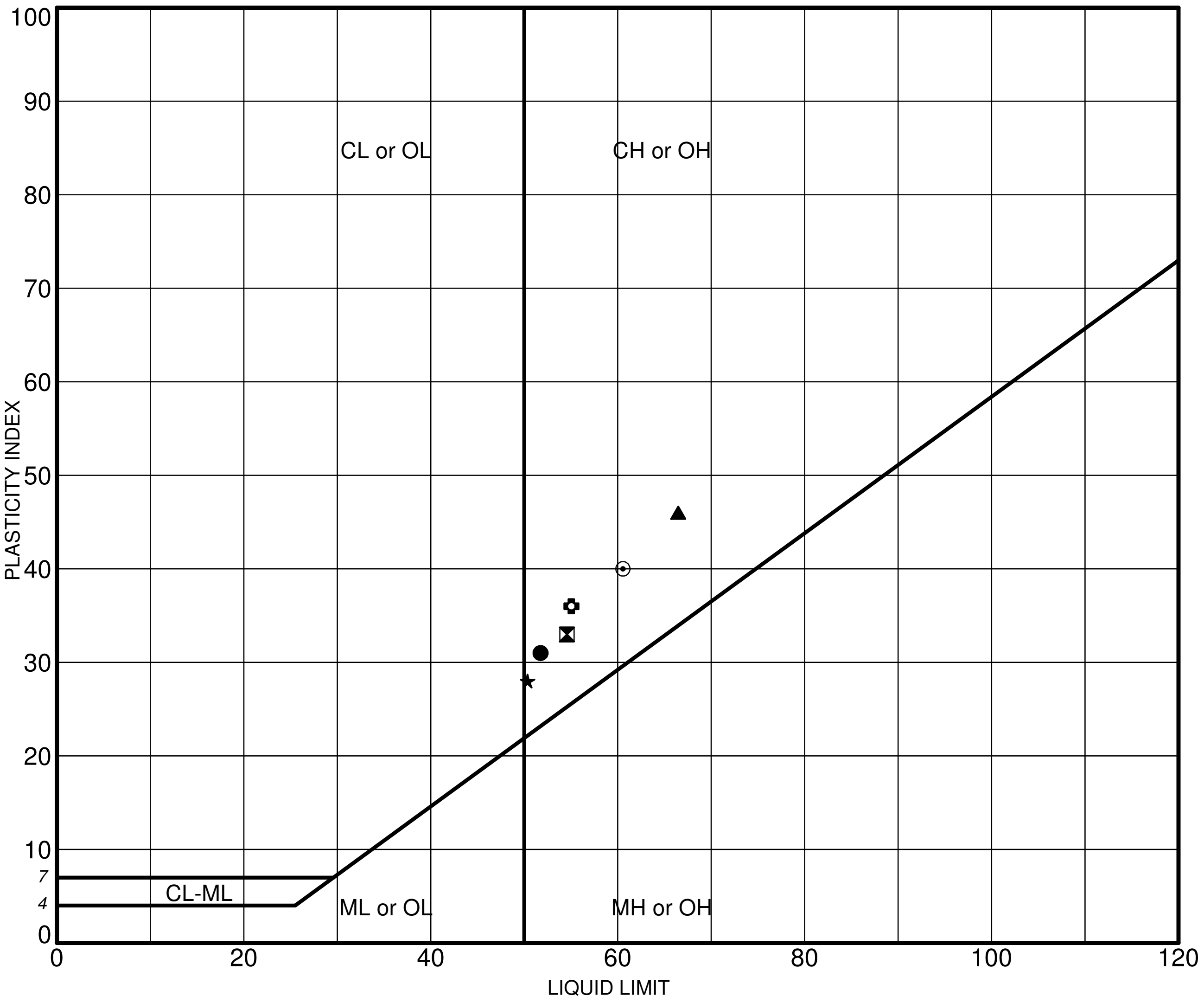
ATTERBERG LIMITS TEST RESULTS - ASTM D4318

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Plate
B - 1



	Sample	Depth (ft)	LL	PL	PI	Description
●	B-9	2.0-3.5	52	21	31	Dark brownish red silty clay (CH) with some gravel
⧗	B-9	10.0-11.5	55	22	33	Dark reddish brown silty clay (CH) with a little cobbles
▲	B-10	5.0-6.5	66	20	46	Brownish red silty clay (CH) with some sand
★	B-11	0.5-2.0	50	22	28	Light grayish brown silty clay (CH) with a little sand
⊙	B-12	2.0-3.5	61	21	40	Light gray and brown silty clay (CH) with some gravel and cobbles
✿	B-13	5.0-6.5	55	19	36	Reddish brown silty clay (CH) with traces of gravel

NP = NON-PLASTIC

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ATTERBERG LIMITS TEST RESULTS - ASTM D4318

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Plate
B - 2

G ATTERBERG PI-100 LL-120 7818-00.GPJ GEOLABS.GDT 2/21/19

Location	Depth	Soil Description	Dry Density	Moisture Contents			Ring Swell
				Initial	Air-Dried	Final	
	(feet)		(pcf)	(%)	(%)	(%)	(%)
B-1*	0.5 - 2.0	Dark reddish brown silty clay (CL) with traces of gravel	75.0	39.1	34.2	49.7	1.7
B-2*	0.5 - 2.0	Dark brown clayey silt with some gravel	90.4	19.2	14.5	34.6	8.2
B-3*	0.5 - 2.0	Reddish brown silty clay (CL) with a little gravel	98.3	17.4	13.6	36.3	16.4
B-4*	0.5 - 2.0	Reddish brown silty clay (CH) with some gravel	93.0	18.3	14.2	35.5	10.6
B-6*	0.5 - 1.1	Reddish brown silty clay (CL) with some gravel	80.4	21.1	16.2	41.6	4.7
B-7*	0.5 - 2.0	Reddish brown silty clay (CH) with some gravel	99.1	13.0	16.7	29.9	6.4
B-8*	0.5 - 2.0	Reddish brown clayey silt with some gravel	78.3	22.1	15.1	38.2	1.9
B-9*	0.5 - 2.0	Dark brownish red silty clay (CH) with some gravel	87.8	20.3	15.8	39.4	6.5
B-10*	5.0 - 6.5	Brownish red silty clay (CH) with some sand	96.3	16.5	19.6	35.8	12.4
B-11*	0.5 - 2.0	Light grayish brown silty clay (CH) with a little sand	98.2	19.9	15.9	31.4	10.6
B-12*	0.5 - 2.0	Light gray and brown silty clay (CH) with some gravel and cobbles	82.5	20.0	15.4	39.4	5.3
B-13*	5.0 - 6.5	Reddish brown silty clay (CH) with traces of gravel	99.0	10.3	14.8	26.6	3.9

NOTE: Samples tested were either relatively undisturbed or remolded in 2.4-inch diameter by 1-inch high rings. They were air-dried overnight and then saturated for 24 hours under a surcharge pressure of 55 psf.

* Relatively Undisturbed

** Remolded

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SUMMARY OF RING SWELL TESTS

HAWAII STATE VETERANS HOME
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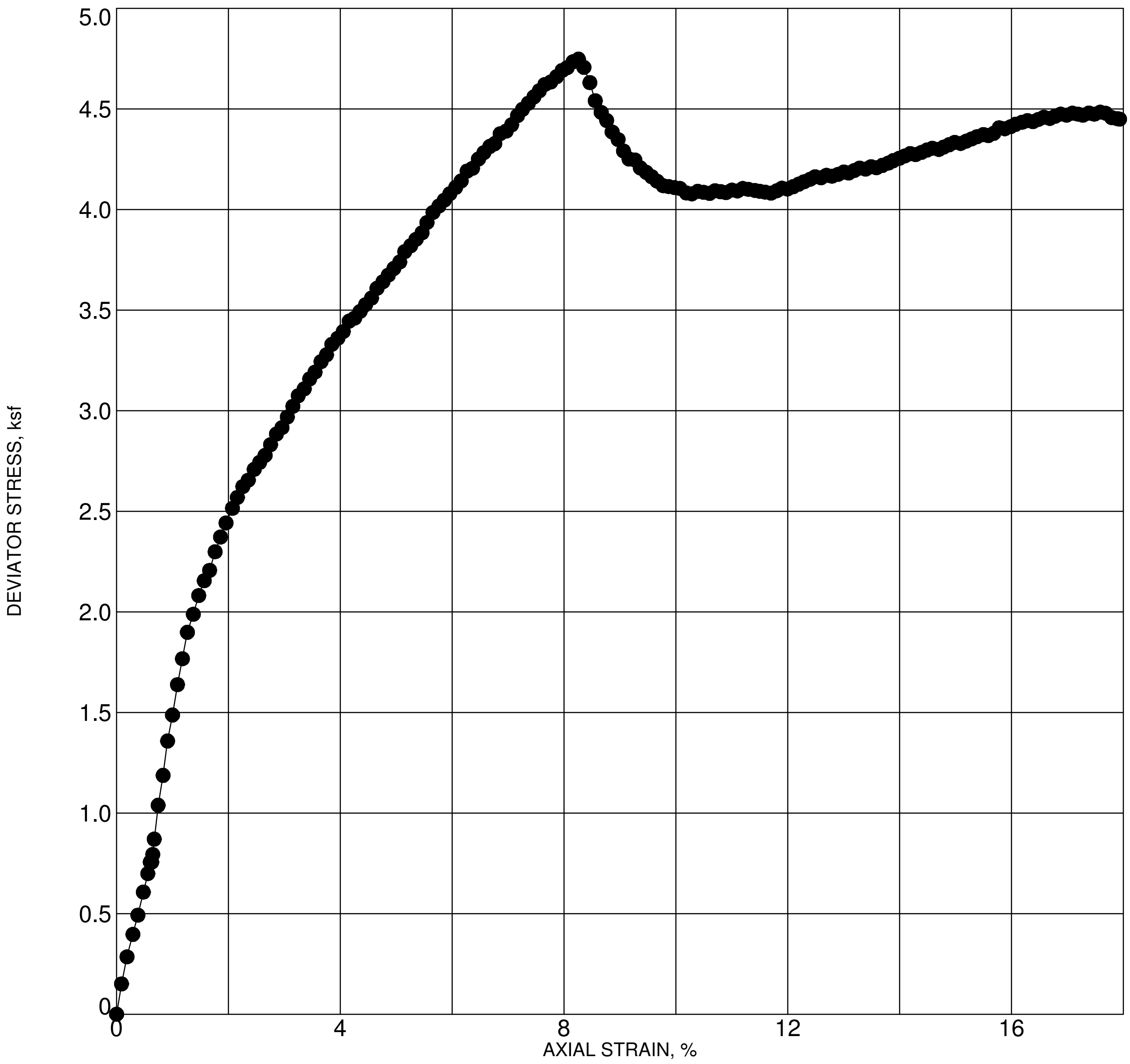

Max. Deviator Stress (ksf):	4.7
Confining Stress (ksf):	0.6

Location: B-3
Depth: 5.0 - 6.5 feet
Description: Reddish brown silty clay with some gravel
Test Date: 1/2/2019

Dry Density (pcf)	97.5	Sample Diameter (inches)	2.390
Moisture (%)	17.3	Sample Height (inches)	4.975
Axial Strain at Failure (%)	8.2	Strain Rate (% / minute)	1.00

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TRIAXIAL UU COMPRESSION TEST - ASTM D2850

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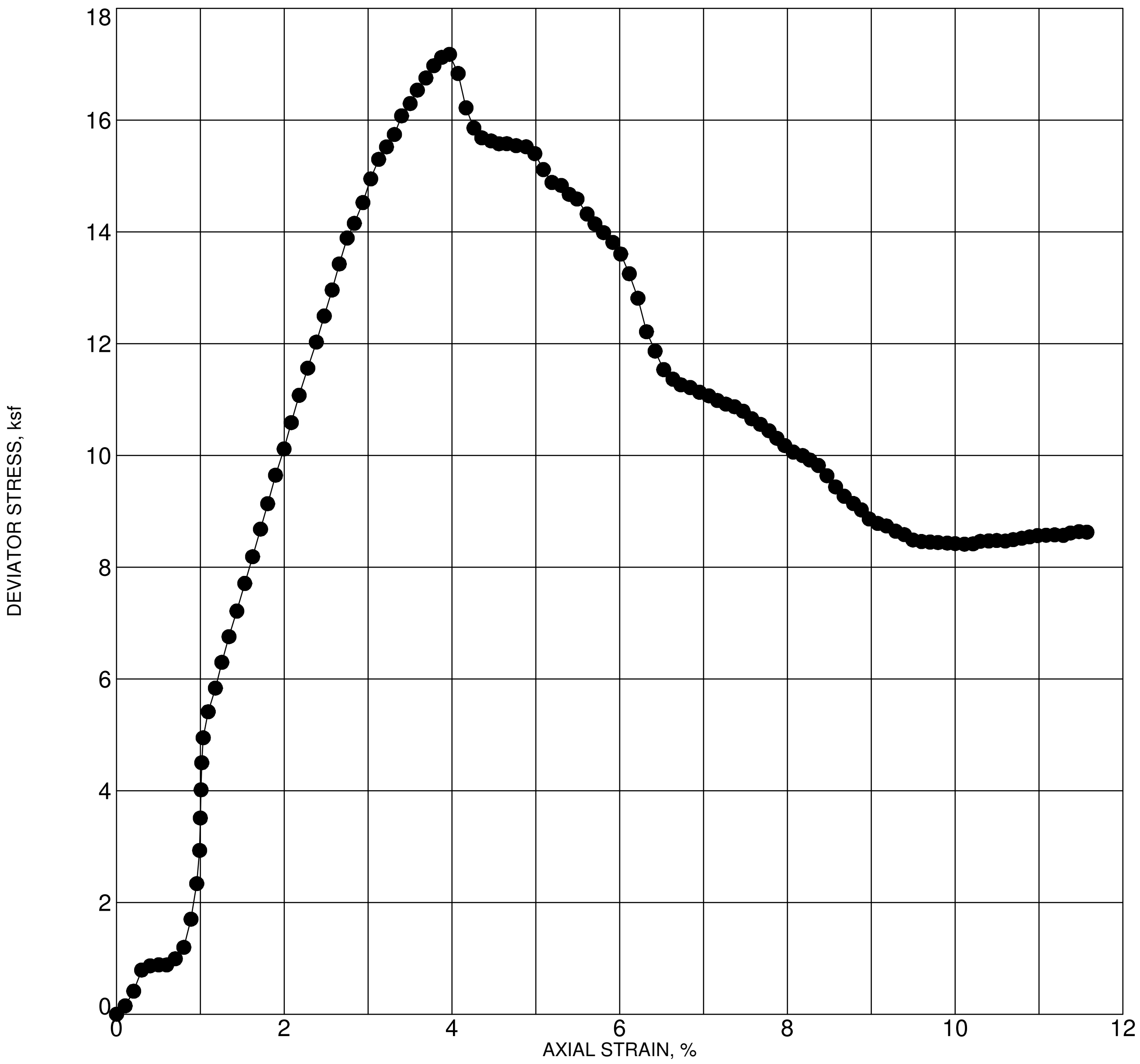
Plate
B - 4



Max. Deviator Stress (ksf):	17.2
Confining Stress (ksf):	0.6

Location: B-4
Depth: 5.0 - 6.5 feet
Description: Brownish red silty clay with some gravel
Test Date: 1/2/2019

Dry Density (pcf)	94.0	Sample Diameter (inches)	2.400
Moisture (%)	27.2	Sample Height (inches)	5.157
Axial Strain at Failure (%)	4.0	Strain Rate (% / minute)	0.94

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TRIAXIAL UU COMPRESSION TEST - ASTM D2850

HAWAII STATE VETERANS HOME
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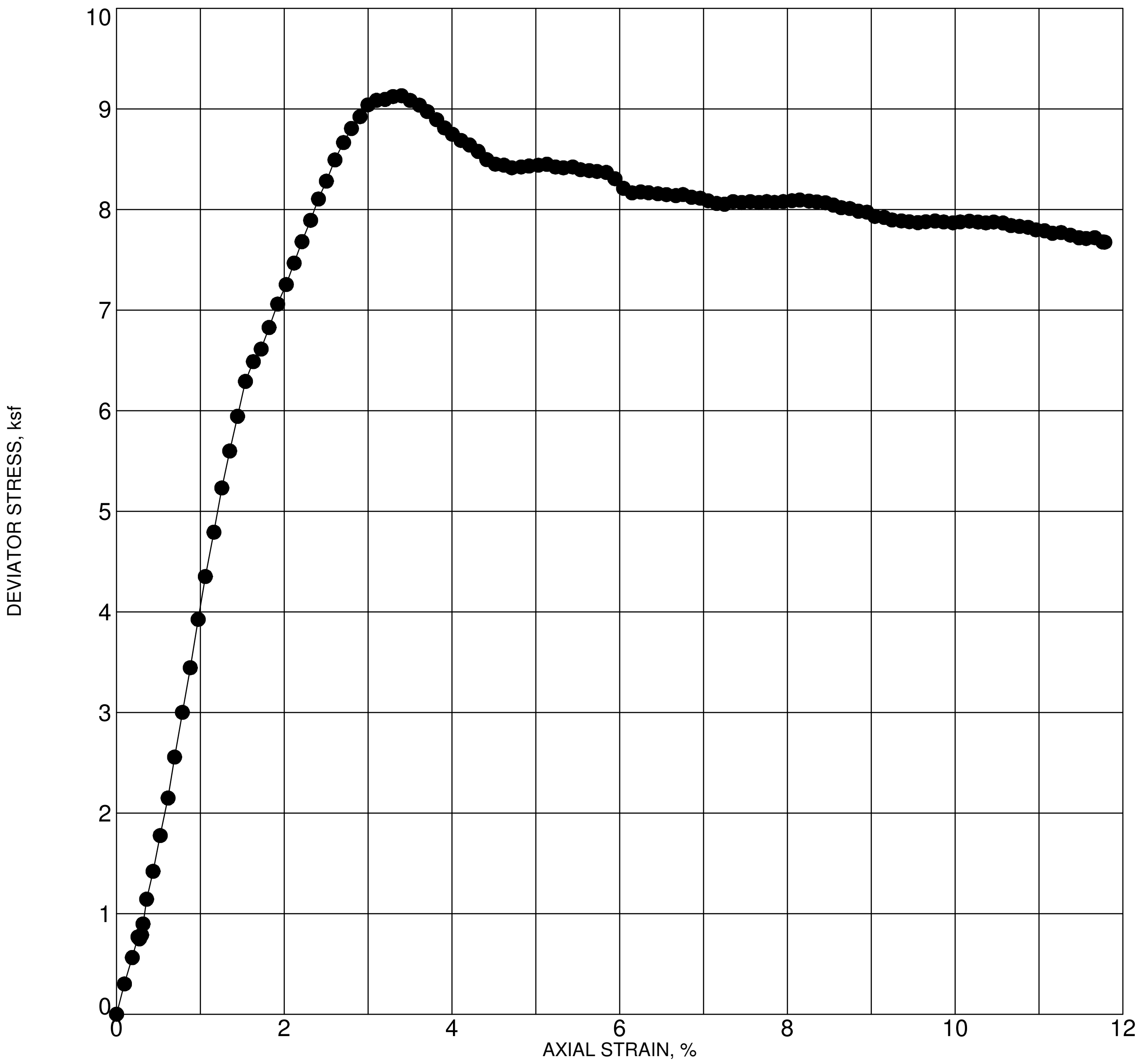
Plate
B - 5



Max. Deviator Stress (ksf):	9.1
Confining Stress (ksf):	0.6

Location: B-5
Depth: 5.0 - 6.5 feet
Description: Dark reddish brown clayey silt with some weathered basalt gravel
Test Date: 1/4/2019

Dry Density (pcf)	97.2	Sample Diameter (inches)	2.400
Moisture (%)	22.6	Sample Height (inches)	5.147
Axial Strain at Failure (%)	3.4	Strain Rate (% / minute)	0.99

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TRIAXIAL UU COMPRESSION TEST - ASTM D2850

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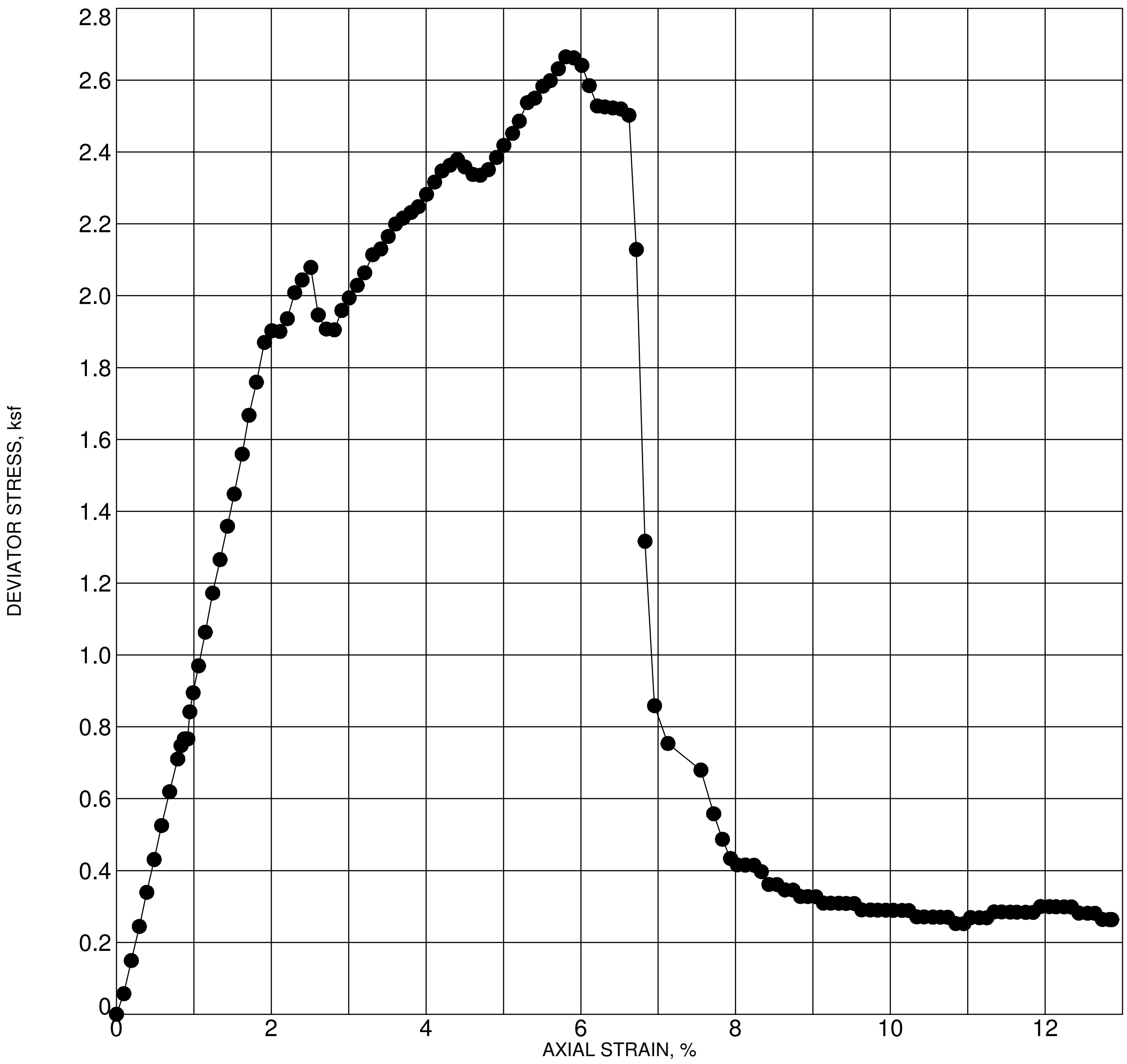
Plate
B - 6



Max. Deviator Stress (ksf):	2.7
Confining Stress (ksf):	0.6

Location: B-7
Depth: 15.0 - 16.5 feet
Description: Reddish brown clayey silt with some weathered basalt gravel
Test Date: 1/4/2018

Dry Density (pcf)	99.8	Sample Diameter (inches)	2.400
Moisture (%)	26.4	Sample Height (inches)	5.067
Axial Strain at Failure (%)	5.8	Strain Rate (% / minute)	1.00

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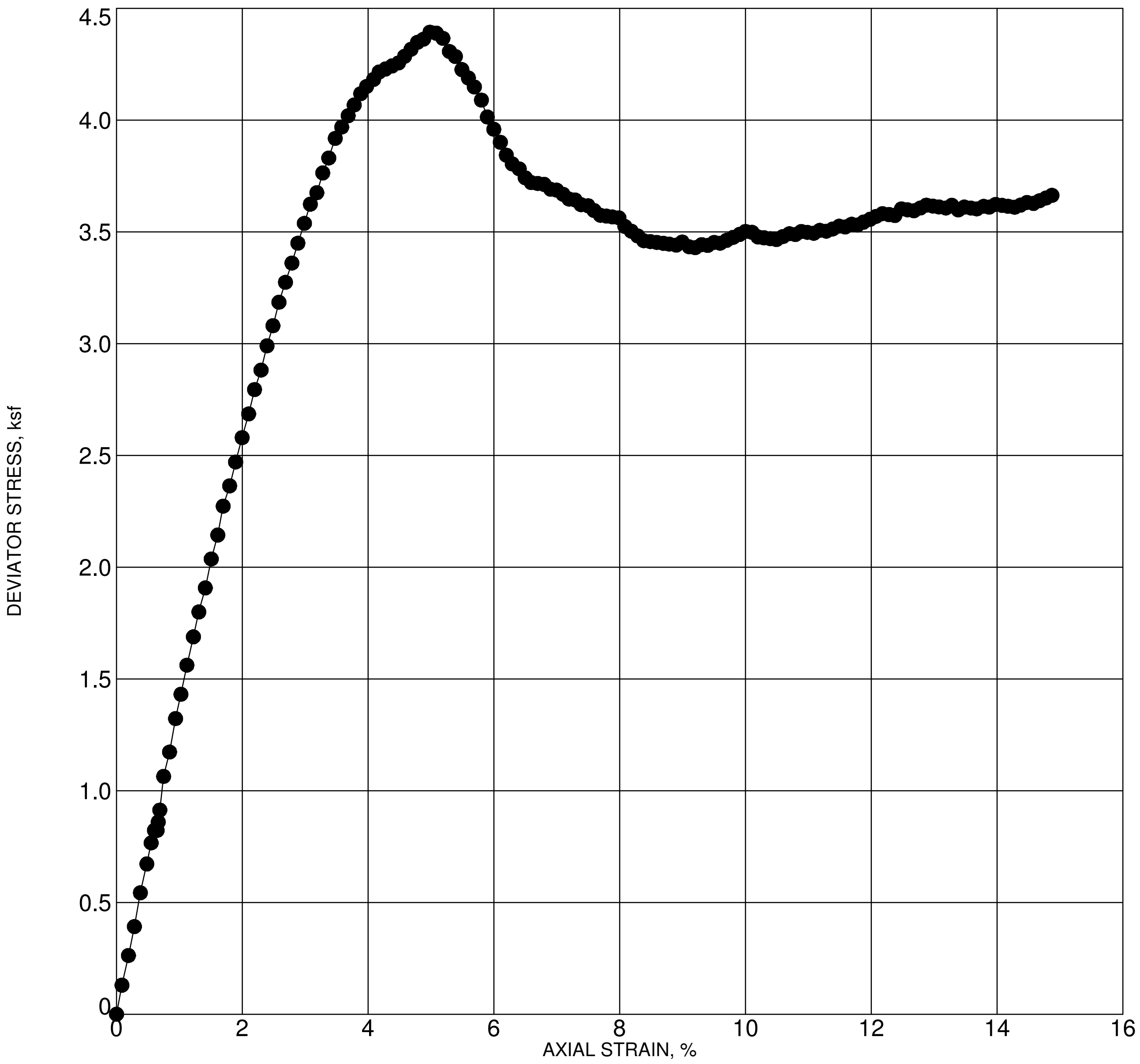
TRIAXIAL UU COMPRESSION TEST - ASTM D2850

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Plate
B - 7



Max. Deviator Stress (ksf):	4.4
Confining Stress (ksf):	0.6

Location: B-9
Depth: 0.5 - 2.0 feet
Description: Dark brownish red silty clay (CH) with some gravel
Test Date: 1/4/2019

Dry Density (pcf)	87.3	Sample Diameter (inches)	2.400
Moisture (%)	20.4	Sample Height (inches)	5.107
Axial Strain at Failure (%)	5.1	Strain Rate (% / minute)	1.00

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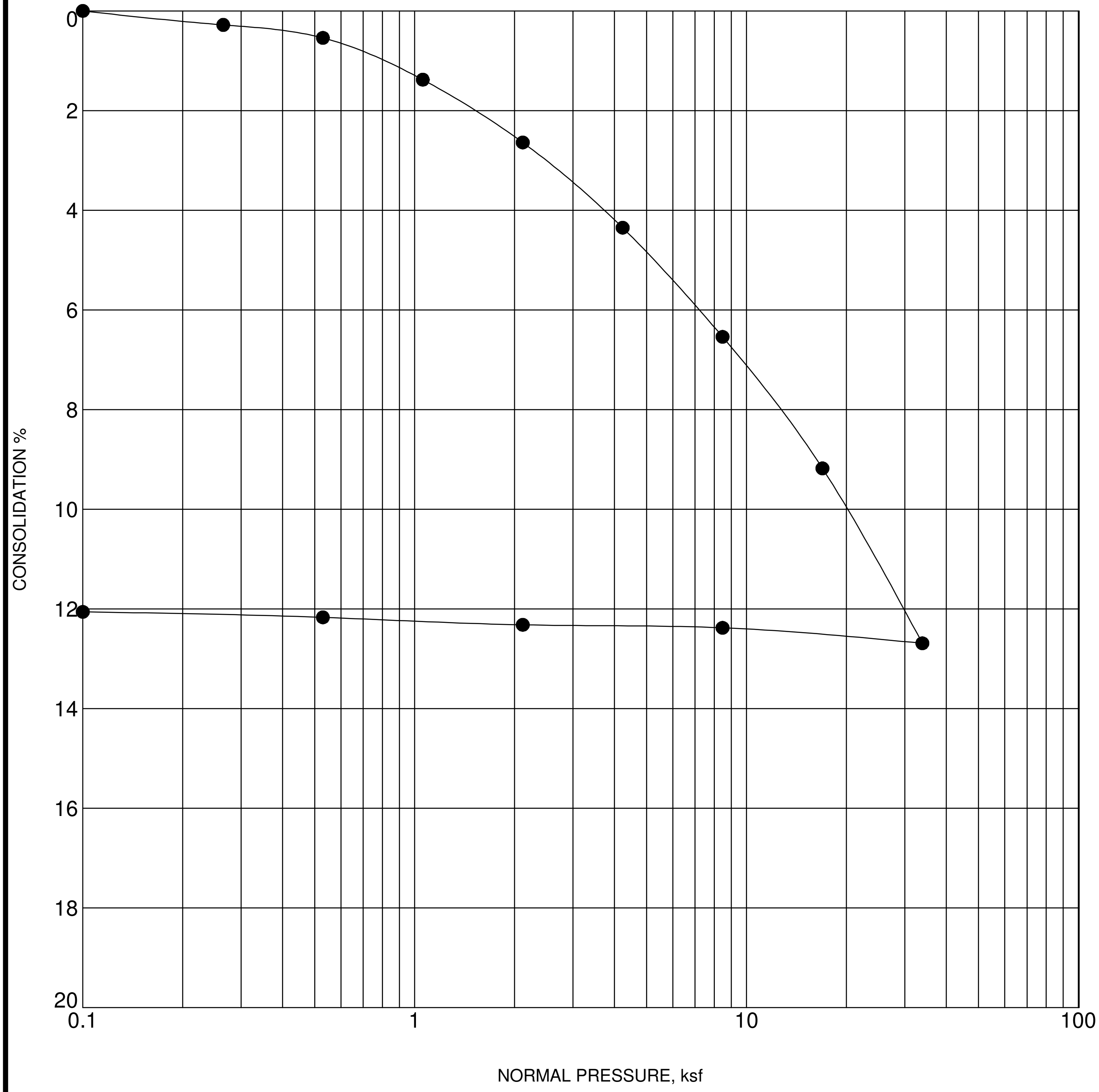
TRIAXIAL UU COMPRESSION TEST - ASTM D2850

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Plate
B - 8



Sample: B-1
Depth: 15.0 - 16.5 feet
Description: Dark reddish brown silty clay (CL) with a little gravel

Liquid Limit = N/A Plasticity Index = N/A

	Initial	Final
Water Content, %	21.7	30.7
Dry Density, pcf:	82.3	93.6
Void Ratio	1.107	0.853
Degree of Saturation, %	54.6	100.0
Sample Height, inches	1.0000	0.8769

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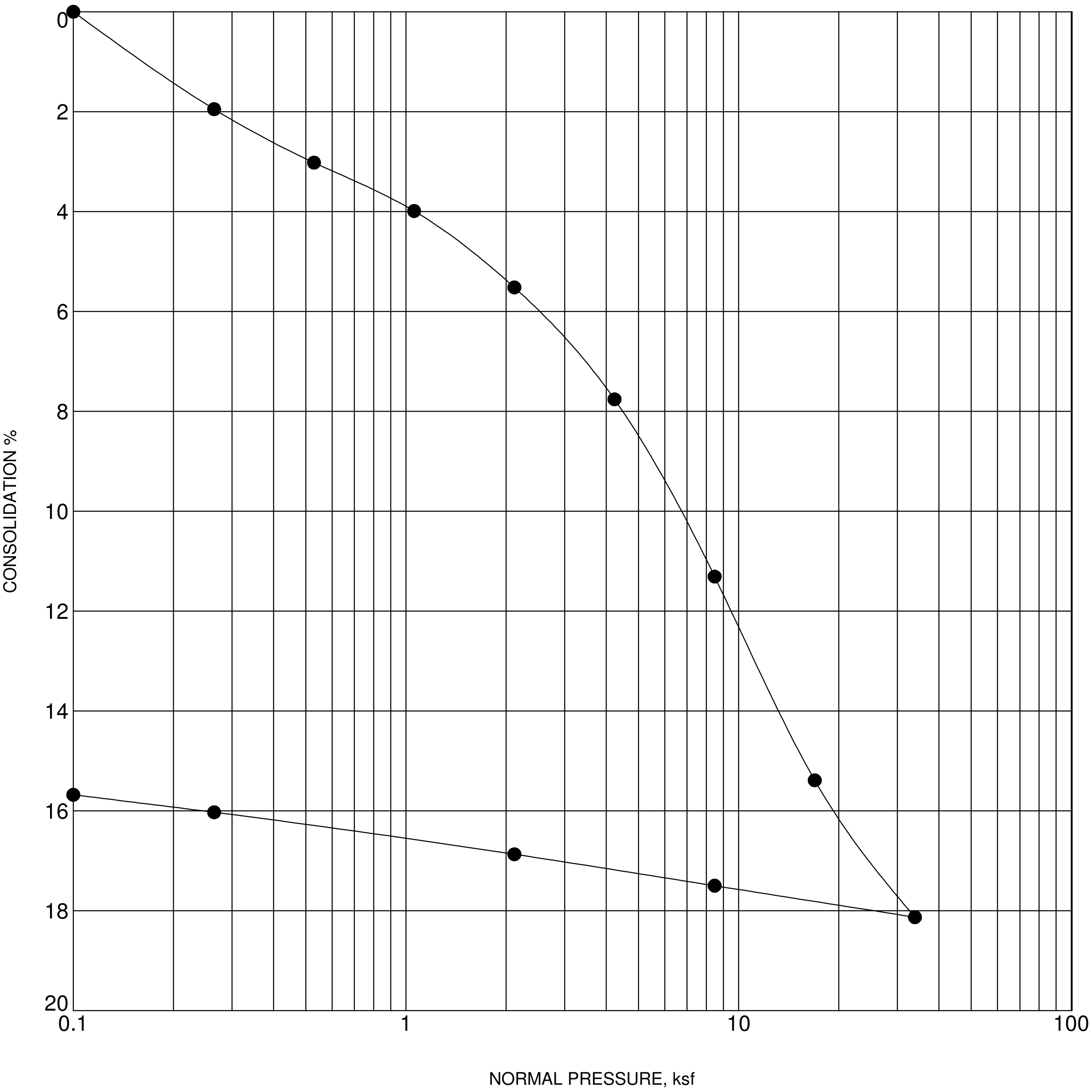
CONSOLIDATION TEST - ASTM D2435

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Plate
B - 9

G CONSOL 7818-00.GPJ GEOLABS.GDT 2/21/19



Sample: B-6
Depth: 5.0 - 6.5 feet
Description: Reddish brown silty clay with some gravel

Liquid Limit = N/A Plasticity Index = N/A

	Initial	Final
Water Content, %	26.1	34.3
Dry Density, pcf:	83.7	99.3
Void Ratio	1.613	1.203
Degree of Saturation, %	56.8	100.0
Sample Height, inches	1.0000	0.8417

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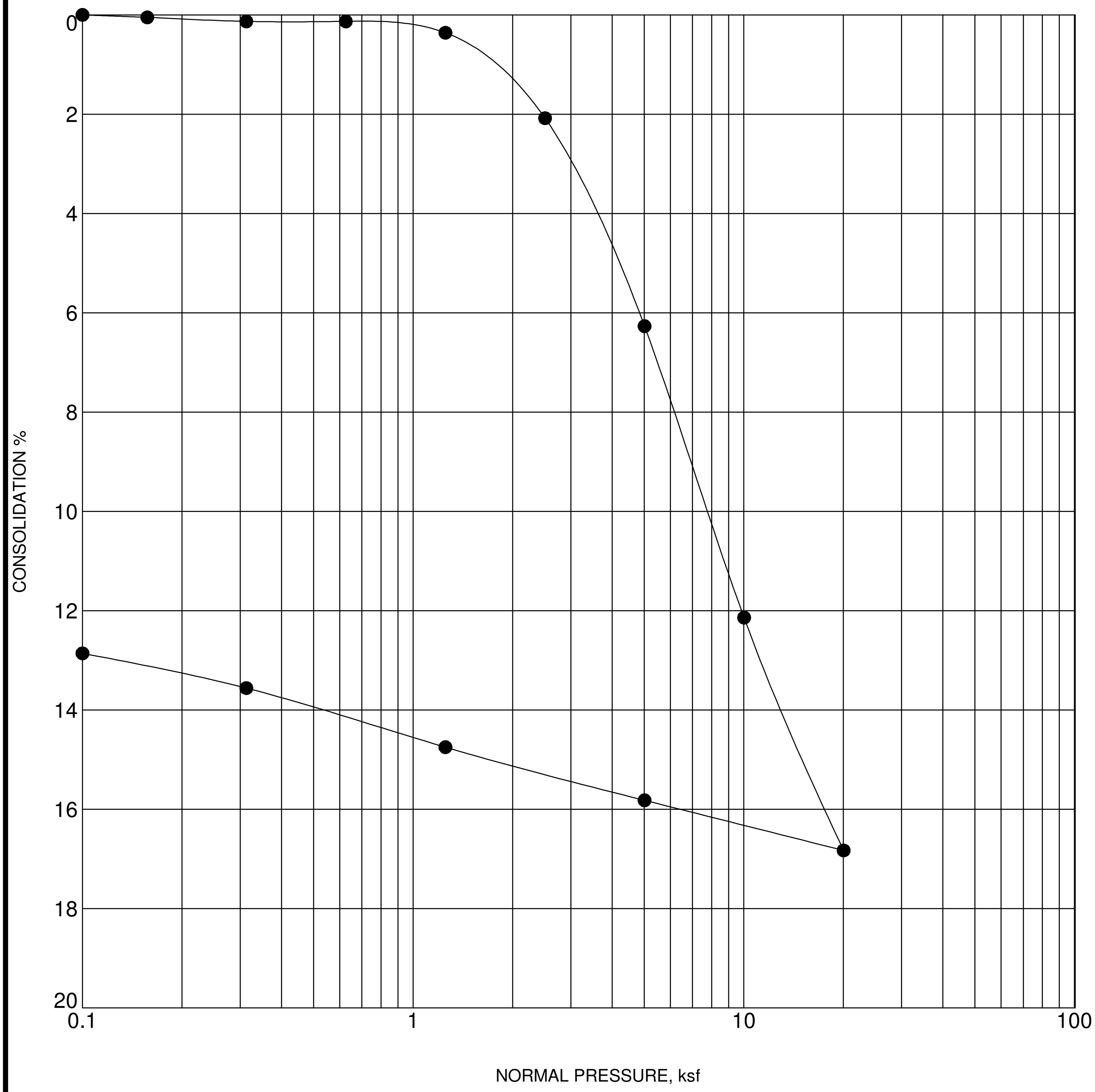
CONSOLIDATION TEST - ASTM D2435

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Plate
B - 10



Sample: B-9
Depth: 5.0 - 6.5 feet
Description: Dark reddish brown silty clay (CH) with a little cobbles

Liquid Limit = N/A
Plasticity Index = N/A

	Initial	Final
Water Content, %	17.6	27.3
Dry Density, pcf:	87.4	100.3
Void Ratio	1.044	0.781
Degree of Saturation, %	48.3	100.0
Sample Height, inches	1.0000	0.8645

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CONSOLIDATION TEST - ASTM D2435

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Plate
B - 11

G_CONSOL 7818-00.GPJ GEOLABS.GDT 2/21/19

Location	Depth	pH Value	Minimum Resistivity	Chloride Content	Sulfate Content
	(feet)		(ohm-cm)	(mg/kg)	(mg/kg)
B-2	0.5 - 2.0	7.92*	480*	700	340
B-8	0.5 - 2.0	8.08*	1000*	170	100

TEST METHODS (by TestAmerica Laboratories, Inc.)

pH Value	Method 9045C
Minimum Resistivity	SM 2510B
Chloride Content	EPA 300.0
Sulfate Content	EPA 300.0

TEST METHODS (by Geolabs, Inc.)*

pH Value	ASTM G51
Minimum Resistivity	ASTM G57
Chloride Content	N/A
Sulfate Content	N/A

ND: Not Detected Within Reporting Limits

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SUMMARY OF CORROSIVITY TESTS

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Plate
B - 12

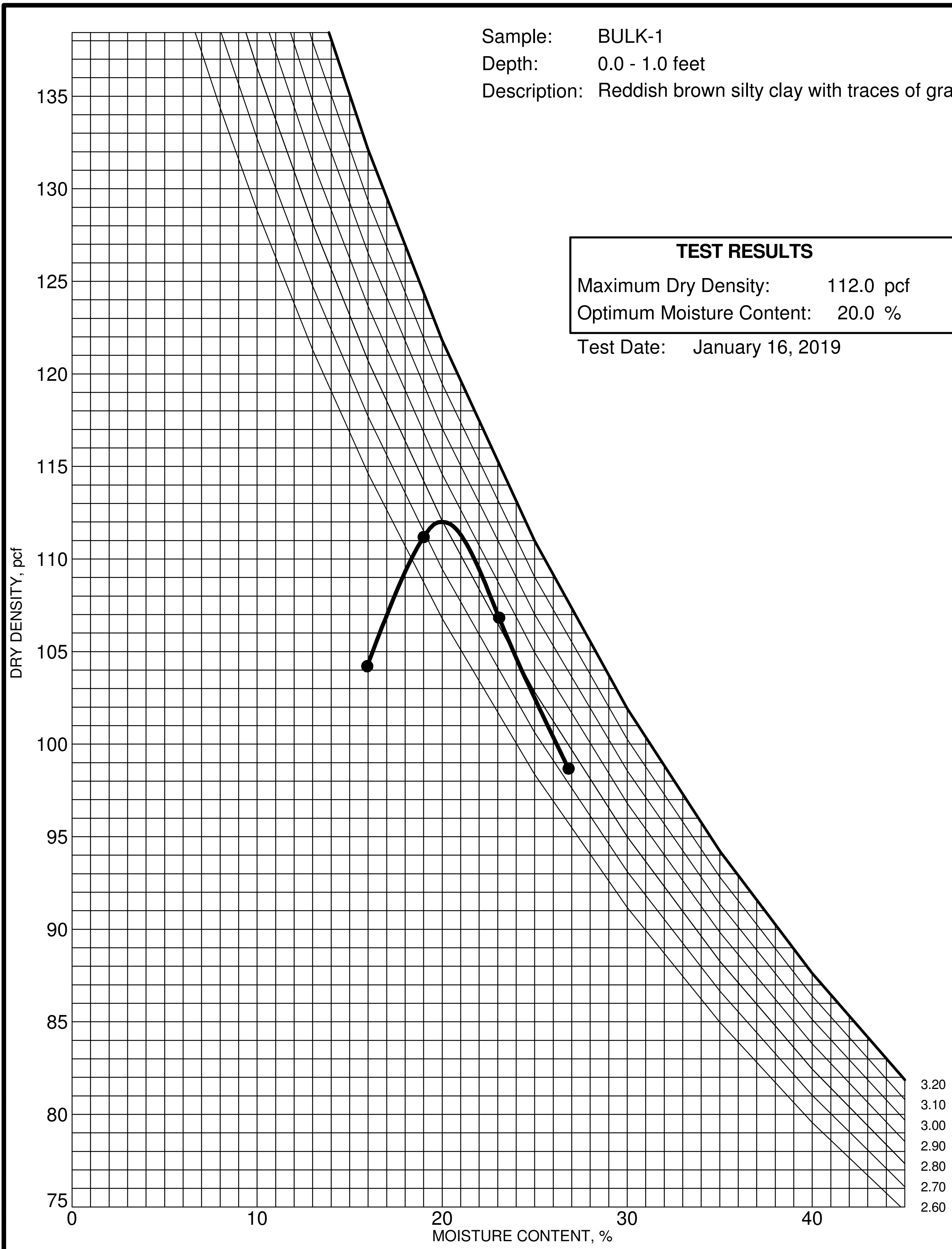
G SUMMARY OF CORROSIVITY TESTS 7818-00.GPJ GEOLABS.GDT 2/21/19

Sample: BULK-1
Depth: 0.0 - 1.0 feet
Description: Reddish brown silty clay with traces of gravel

TEST RESULTS

Maximum Dry Density:	112.0 pcf
Optimum Moisture Content:	20.0 %

Test Date: January 16, 2019



GEOLABS, INC.
GEOTECHNICAL ENGINEERING

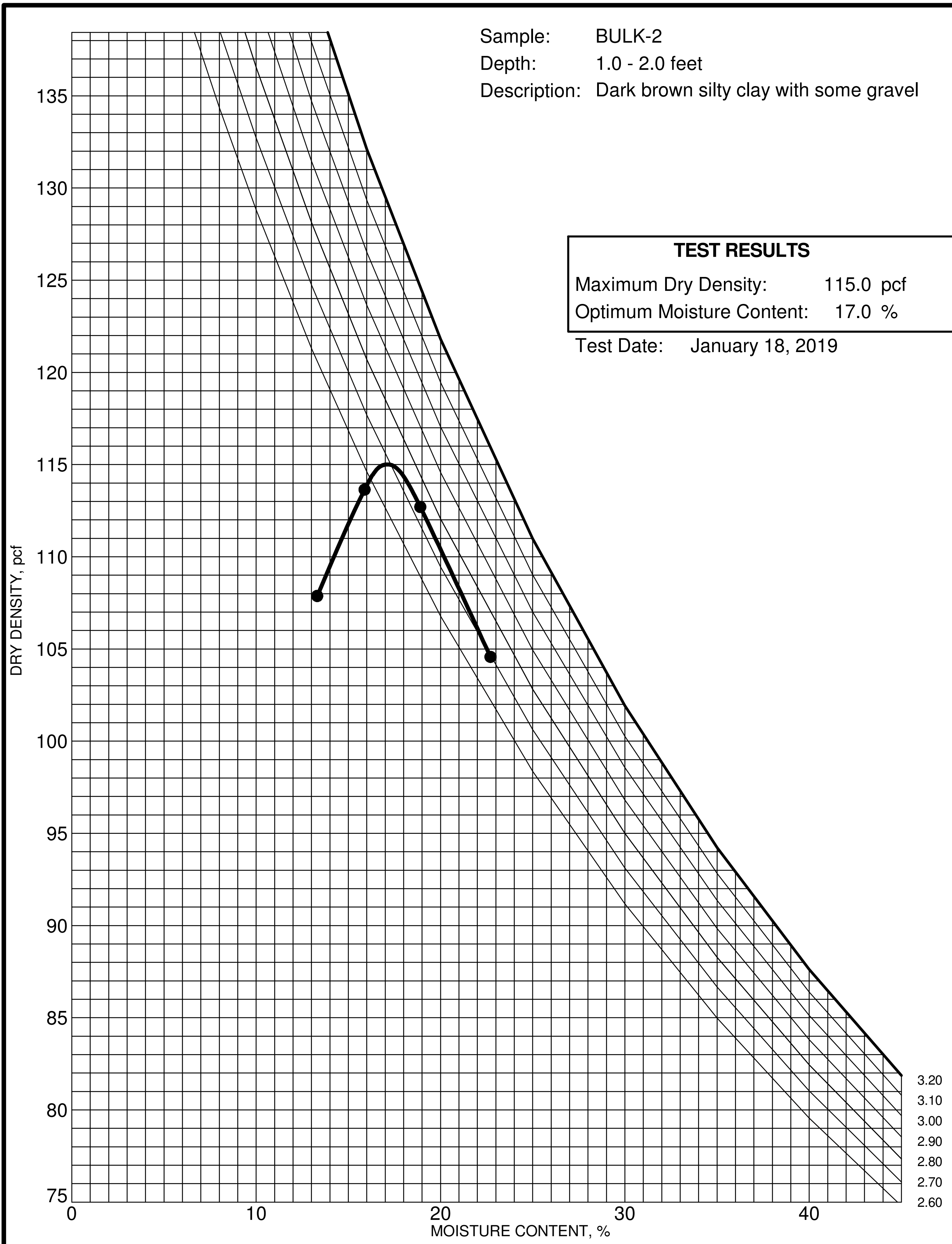
W.O. 7818-00

MOISTURE-DENSITY RELATIONSHIP - ASTM D1557B

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Plate
B - 13

Sample: BULK-2
Depth: 1.0 - 2.0 feet
Description: Dark brown silty clay with some gravel



TEST RESULTS

Maximum Dry Density:	115.0 pcf
Optimum Moisture Content:	17.0 %

Test Date: January 18, 2019

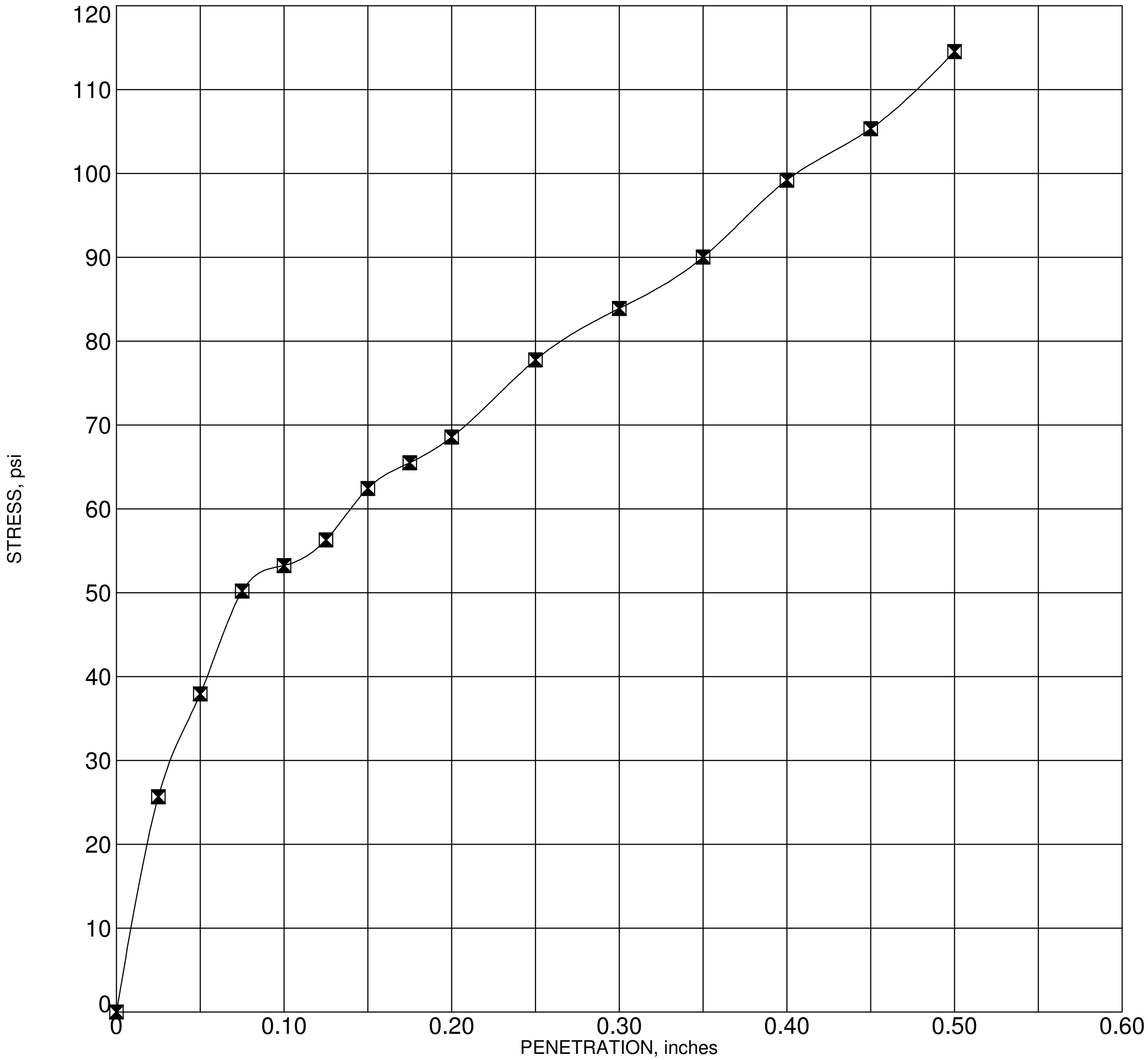
G_COMPACTION 7818-00.GPJ GEOLABS.GDT 2/21/19

GEOLABS, INC.
GEOTECHNICAL ENGINEERING
W.O. 7818-00

MOISTURE-DENSITY RELATIONSHIP - ASTM D1557A

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Plate
B - 14



Corr. CBR @ 0.1"	5.3
Corr. CBR @ 0.2"	4.6
Swell (%)	3.42

Sample: BULK-1
Depth: 0.0 - 1.0 feet
Description: Reddish brown silty clay with traces of gravel

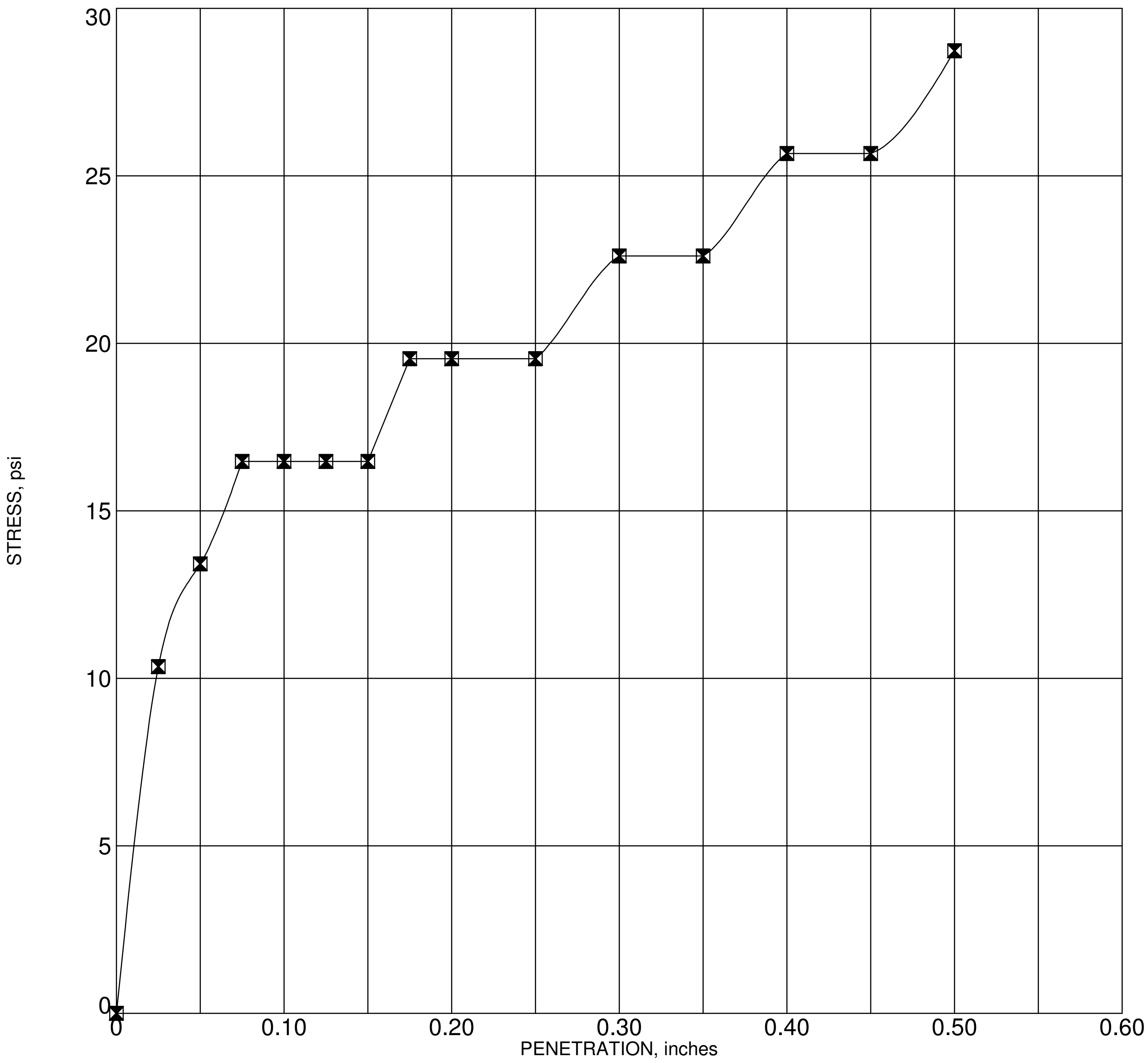
Molding Dry Density (pcf)	110.9	Hammer Wt. (lbs)	10
Molding Moisture (%)	19.4	Hammer Drop (inches)	18
Days Soaked	5	No. of Blows	56
Aggregate	3/4 inch minus	No. of Layers	5

GEOLABS, INC.
GEOTECHNICAL ENGINEERING
W.O. 7818-00

CALIFORNIA BEARING RATIO - ASTM D1883

HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Plate
B - 15



Corr. CBR @ 0.1"	1.6
Corr. CBR @ 0.2"	1.3
Swell (%)	8.01

Sample: BULK-2
Depth: 1.0 - 2.0 feet
Description: Dark brown silty clay with some gravel

Molding Dry Density (pcf)	110.4	Hammer Wt. (lbs)	10
Molding Moisture (%)	14.4	Hammer Drop (inches)	18
Days Soaked	6	No. of Blows	56
Aggregate	3/4 inch minus	No. of Layers	5

GEOLABS, INC.
GEOTECHNICAL ENGINEERING
W.O. 7818-00

CALIFORNIA BEARING RATIO - ASTM D1883

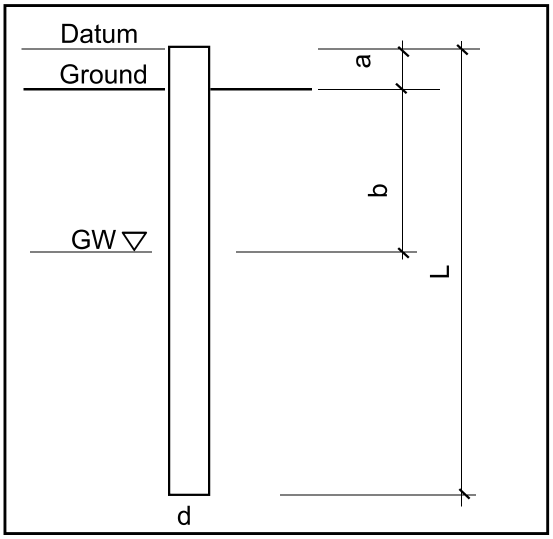
HAWAII STATE VETERANS HOME
KAPOLEI, OAHU, HAWAII

Plate
B - 16

G_CBR 7818-00.GPJ GEOLABS.GDT 2/21/19

APPENDIX C

INFILTRATION TEST RECORD



Project: Hawaii State Veterans Home

W.O.: 7818-00

Test No.: LID-1

Date of Testing: 11/20/2018

Method of Testing: BMP Falling Head (Flush Bottom)

Source of Water: Water Truck

GW level, b (from ground): N/A feet

Datum, a (above ground): 1.2 feet

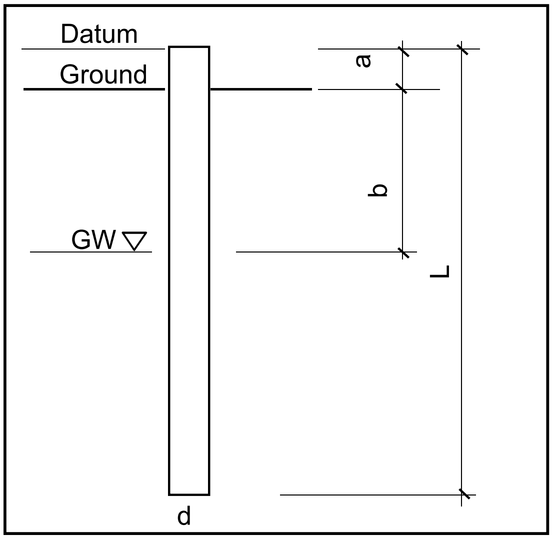
Depth of Boring: 5.8 feet

Length, L (from datum): 7.0 feet

Diameter of Casing, d (I.D.): 4.0 inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	9:02	60.00	
	15	9:17	60.00	
	30	9:32	60.00	
	45	9:47	60.00	
	60	10:02	60.00	0.00
Trial 2	0	10:02	60.00	
	15	10:17	60.00	
	30	10:32	60.00	
	45	10:47	60.00	
	60	11:02	60.00	0.00
Trial 3	0	11:02	60.00	
	15	11:17	60.00	
	30	11:32	60.00	
	45	11:47	60.00	
	60	12:02	60.00	0.00
Trial 4	0	12:02	60.00	
	15	12:17	60.00	
	30	12:32	60.00	
	45	12:47	60.00	
	60	13:02	60.00	0.00

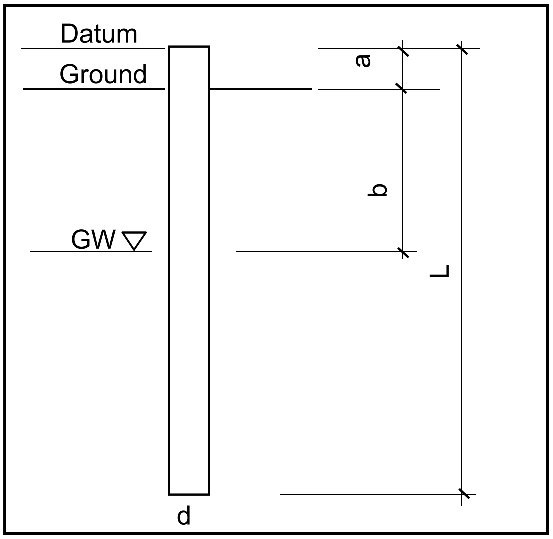
INFILTRATION TEST RECORD



Project: Hawaii State Veterans Home
W.O.: 7818-00
Test No.: LID-2
Date of Testing: 11/20/2018
Method of Testing: BMP Falling Head (Flush Bottom)
Source of Water: Water Truck
GW level, b (from ground): N/A feet
Datum, a (above ground): 0.0 feet
Depth of Boring: 6.0 feet
Length, L (from datum): 6.0 feet
Diameter of Casing, d (I.D.): 4.0 inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	12:26	48.00	
	15	12:41	48.00	
	30	12:56	48.00	
	45	13:11	48.00	
	60	13:26	48.00	0.00
Trial 2	0	13:26	48.00	
	15	13:41	48.00	
	30	13:56	48.00	
	45	14:11	48.00	
	60	14:26	48.00	0.00
Trial 3	0	14:26	48.00	
	15	14:41	48.00	
	30	14:56	48.00	
	45	15:11	48.00	
	60	15:26	48.00	0.00
Trial 4	0	15:26	48.00	
	15	15:41	48.00	
	30	15:56	48.00	
	45	16:11	48.00	
	60	16:26	48.00	0.00

INFILTRATION TEST RECORD



Project: Hawaii State Veterans Home

W.O.: 7818-00

Test No.: LID-3

Date of Testing: 11/20/2018

Method of Testing: BMP Falling Head (Flush Bottom)

Source of Water: Water Truck

GW level, b (from ground): N/A feet

Datum, a (above ground): 0.0 feet

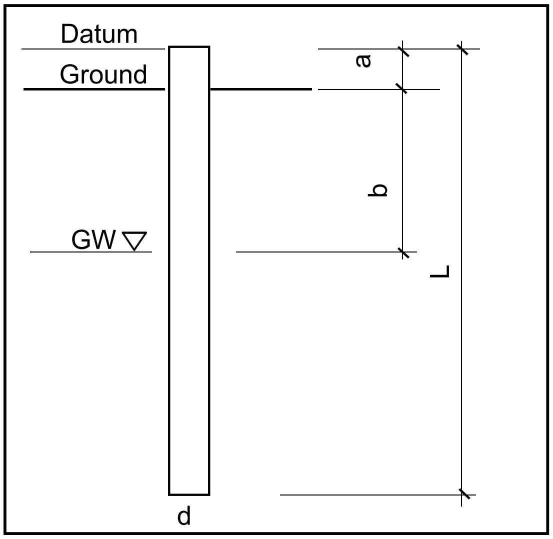
Depth of Boring: 6.0 feet

Length, L (from datum): 6.0 feet

Diameter of Casing, d (I.D.): 4.0 inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	12:15	48.00	
	15	12:30	48.00	
	30	12:45	48.00	
	45	13:00	48.00	
	60	13:15	48.00	0.00
Trial 2	0	13:15	48.00	
	15	13:30	48.00	
	30	13:45	48.00	
	45	14:00	48.00	
	60	14:15	48.00	0.00
Trial 3	0	14:15	48.00	
	15	14:30	48.00	
	30	14:45	48.00	
	45	15:00	48.00	
	60	15:15	48.00	0.00
Trial 4	0	15:15	48.00	
	15	15:30	48.00	
	30	15:45	48.00	
	45	16:00	48.00	
	60	16:15	48.00	0.00

INFILTRATION TEST RECORD



Project: Hawaii State Veterans Home

W.O.: 7818-00

Test No.: LID-4

Date of Testing: 11/20/2018

Method of Testing: BMP Falling Head (Flush Bottom)

Source of Water: Water Truck

GW level, b (from ground): N/A feet

Datum, a (above ground): 0.0 feet

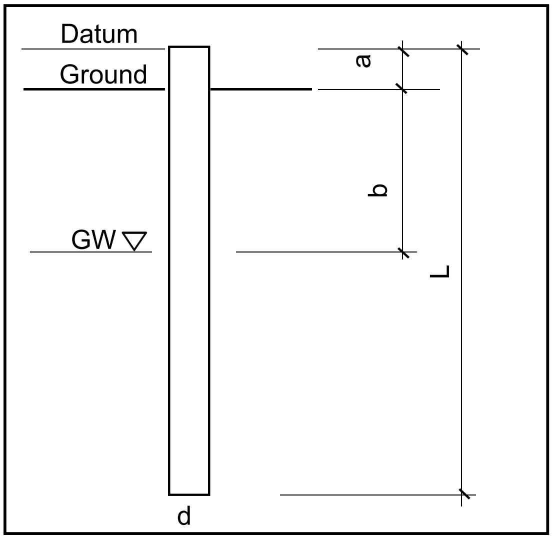
Depth of Boring: 4.0 feet

Length, L (from datum): 4.0 feet

Diameter of Casing, d (I.D.): 4.0 inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	12:35	24.00	
	15	12:50	24.00	
	30	13:05	24.00	
	45	13:20	24.00	
	60	13:35	24.00	0.00
Trial 2	0	13:35	24.00	
	15	13:50	24.00	
	30	14:05	24.00	
	45	14:20	24.00	
	60	14:35	24.00	0.00
Trial 3	0	14:35	24.00	
	15	14:50	24.00	
	30	15:05	24.00	
	45	15:20	24.00	
	60	15:35	24.00	0.00
Trial 4	0	15:35	24.00	
	15	15:50	24.00	
	30	16:05	24.00	
	45	16:20	24.00	
	60	16:35	24.00	0.00

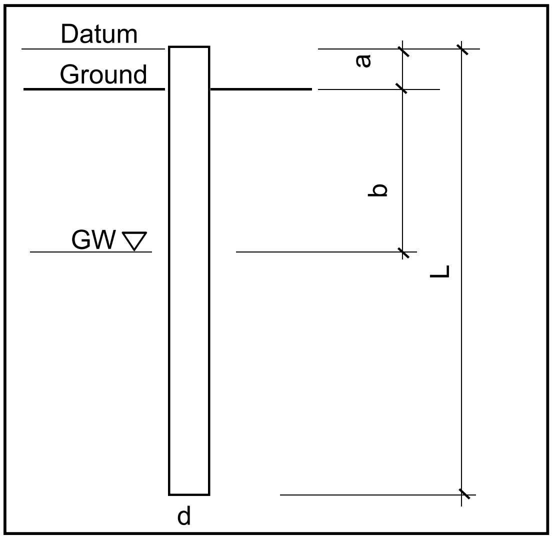
INFILTRATION TEST RECORD



Project:	Hawaii State Veterans Home	
W.O.:	7818-00	
Test No.:	LID-5	
Date of Testing:	11/20/2018	
Method of Testing:	BMP Falling Head (Flush Bottom)	
Source of Water:	Water Truck	
GW level, b (from ground):	N/A	feet
Datum, a (above ground):	0.3	feet
Depth of Boring:	4.0	feet
Length, L (from datum):	4.3	feet
Diameter of Casing, d (I.D.):	4.0	inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	12:53	27.00	
	15	13:08	27.00	
	30	13:23	27.00	
	45	13:38	27.00	
	60	13:53	27.00	0.00
Trial 2	0	13:53	27.00	
	15	14:08	27.00	
	30	14:23	27.00	
	45	14:38	27.00	
	60	14:53	27.00	0.00
Trial 3	0	14:53	27.00	
	15	15:08	27.00	
	30	15:23	27.00	
	45	15:38	27.00	
	60	15:53	27.00	0.00
Trial 4	0	15:53	27.00	
	15	16:08	27.00	
	30	16:23	27.00	
	45	16:38	27.00	
	60	16:53	27.00	0.00

INFILTRATION TEST RECORD



Project: Hawaii State Veterans Home

W.O.: 7818-00

Test No.: LID-6

Date of Testing: 11/20/2018

Method of Testing: BMP Falling Head (Flush Bottom)

Source of Water: Water Truck

GW level, b (from ground): N/A feet

Datum, a (above ground): 0.1 feet

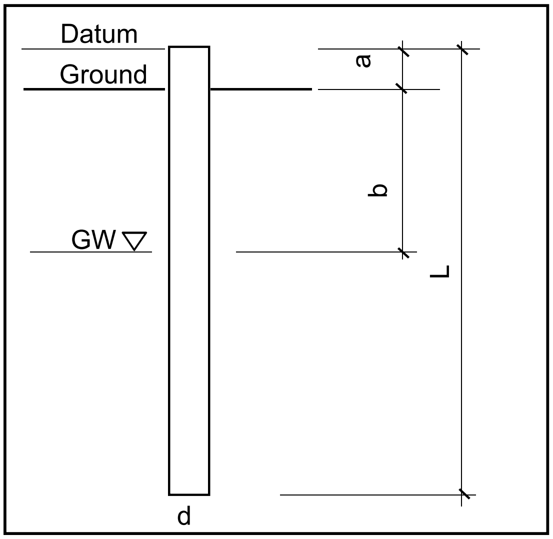
Depth of Boring: 6.0 feet

Length, L (from datum): 6.1 feet

Diameter of Casing, d (I.D.): 4.0 inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	11:35	49.00	
	15	11:50	49.00	
	30	12:05	49.00	
	45	12:20	49.00	
	60	12:35	49.00	0.00
Trial 2	0	12:35	49.00	
	15	12:50	49.00	
	30	13:05	49.00	
	45	13:20	49.00	
	60	13:35	49.00	0.00
Trial 3	0	13:35	49.00	
	15	13:50	49.00	
	30	14:05	49.00	
	45	14:20	49.00	
	60	14:35	49.00	0.00
Trial 4	0	14:35	49.00	
	15	14:50	49.00	
	30	15:05	49.00	
	45	15:20	49.00	
	60	15:35	49.00	0.00

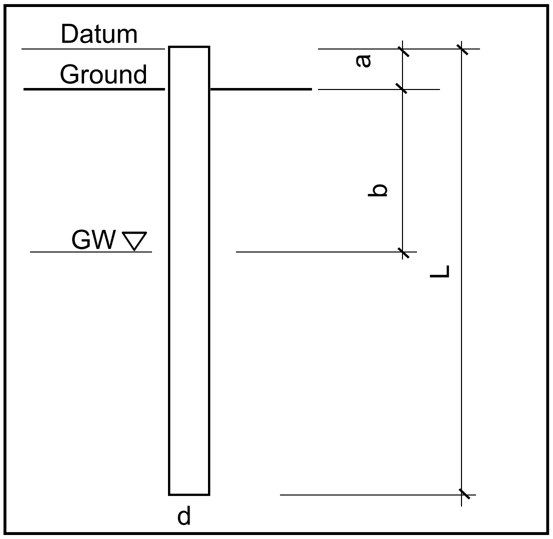
INFILTRATION TEST RECORD



Project: Hawaii State Veterans Home
W.O.: 7818-00
Test No.: LID-7
Date of Testing: 11/20/2018
Method of Testing: BMP Falling Head (Flush Bottom)
Source of Water: Water Truck
GW level, b (from ground): N/A feet
Datum, a (above ground): 1.5 feet
Depth of Boring: 6.0 feet
Length, L (from datum): 7.5 feet
Diameter of Casing, d (I.D.): 4.0 inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	10:23	66.00	
	15	10:38	67.00	
	30	10:53	68.00	
	45	11:08	69.00	
	60	11:23	69.50	3.50
Trial 2	0	11:23	66.00	
	15	11:38	67.00	
	30	11:53	68.00	
	45	12:08	68.50	
	60	12:23	69.00	3.00
Trial 3	0	12:23	66.00	
	15	12:38	67.00	
	30	12:53	68.00	
	45	13:08	68.50	
	60	13:23	69.00	3.00
Trial 4	0	13:23	66.00	
	15	13:38	67.00	
	30	13:53	68.50	
	45	14:08	69.00	
	60	14:23	69.00	3.00

INFILTRATION TEST RECORD



Project: Hawaii State Veterans Home

W.O.: 7818-00

Test No.: LID-8

Date of Testing: 11/20/2018

Method of Testing: BMP Falling Head (Flush Bottom)

Source of Water: Water Truck

GW level, b (from ground): N/A feet

Datum, a (above ground): 1.0 feet

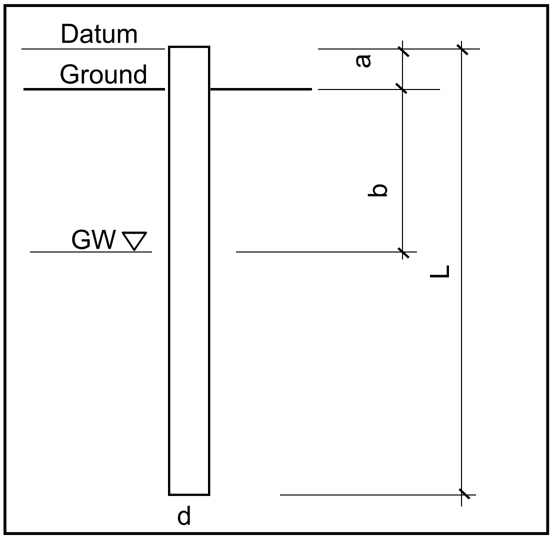
Depth of Boring: 8.0 feet

Length, L (from datum): 9.0 feet

Diameter of Casing, d (I.D.): 4.0 inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	9:33	84.00	
	15	9:48	88.00	
	30	10:03	91.50	
	45	10:18	95.00	
	60	10:33	97.00	13.00
Trial 2	0	10:33	84.00	
	15	10:48	88.00	
	30	11:03	92.00	
	45	11:18	95.00	
	60	11:33	97.00	13.00
Trial 3	0	11:33	84.00	
	15	11:48	88.00	
	30	12:03	91.50	
	45	12:18	95.00	
	60	12:33	97.00	13.00
Trial 4	0	12:33	84.00	
	15	12:48	88.00	
	30	13:03	91.50	
	45	13:18	95.00	
	60	13:33	97.00	13.00

INFILTRATION TEST RECORD



Project: Hawaii State Veterans Home

W.O.: 7818-00

Test No.: LID-9

Date of Testing: 11/20/2018

Method of Testing: BMP Falling Head (Flush Bottom)

Source of Water: Water Truck

GW level, b (from ground): N/A feet

Datum, a (above ground): 0.1 feet

Depth of Boring: 8.0 feet

Length, L (from datum): 8.1 feet

Diameter of Casing, d (I.D.): 4.0 inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	9:15	73.00	
	15	9:30	73.00	
	30	9:45	73.00	
	45	10:00	73.00	
	60	10:15	73.00	0.00
Trial 2	0	10:15	73.00	
	15	10:30	73.00	
	30	10:45	73.00	
	45	11:00	73.00	
	60	11:15	73.00	0.00
Trial 3	0	11:15	73.00	
	15	11:30	73.00	
	30	11:45	73.00	
	45	12:00	73.00	
	60	12:15	73.00	0.00
Trial 4	0	12:15	73.00	
	15	12:30	73.00	
	30	12:45	73.00	
	45	13:00	73.00	
	60	13:15	73.00	0.00

APPENDIX D

1
2
3
4
5
6
7
8
9
10
11
12
13

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Irvine
17461 Derian Ave
Suite 100
Irvine, CA 92614-5817
Tel: (949)261-1022

TestAmerica Job ID: 440-229493-1
TestAmerica Sample Delivery Group: 7818-00
Client Project/Site: Hawaii State Veterans Home

For:
GeoLabs Inc
2006 Kalihi St.
Honolulu, Hawaii 96819

Attn: Nick Kam

Authorized for release by:
1/21/2019 10:25:55 AM

Sheri Fama, Project Manager I
(949)261-1022
sheri.fama@testamericainc.com

Table of Contents

Cover Page 1
Table of Contents 2
Sample Summary 3
Case Narrative 4
Client Sample Results 5
Method Summary 6
Lab Chronicle 7
QC Sample Results 8
QC Association Summary 9
Definitions/Glossary 10
Certification Summary 11
Chain of Custody 12
Receipt Checklists 13

Sample Summary

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
440-229493-1	B2 RS 1 0.5-2FT	Solid	11/14/18 08:00	01/09/19 09:30
440-229493-2	B8 RS 1 0.5-2FT	Solid	11/15/18 08:00	01/09/19 09:30

Case Narrative

Client: GeoLabs Inc
Project/Site: Hawaii State Veterans Home

TestAmerica Job ID: 440-229493-1
SDG: 7818-00

Job ID: 440-229493-1

Laboratory: TestAmerica Irvine

Narrative

Job Narrative
440-229493-1

Comments
No additional comments.

Receipt
The samples were received on 1/9/2019 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 5.4° C.

Receipt Exceptions
The Field Sampler was not listed on the Chain of Custody.

HPLC/IC
Method(s) 300.0: The following samples were received outside of holding time: B2 RS 1 0.5-2FT (440-229493-1) and B8 RS 1 0.5-2FT (440-229493-2).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Client Sample Results

Client Sample ID: B2 RS 1 0.5-2FT

Lab Sample ID: 440-229493-1

Date Collected: 11/14/18 08:00

Matrix: Solid

Date Received: 01/09/19 09:30

Method: 300.0 - Anions, Ion Chromatography - Soluble

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**700**	**H**	100		mg/Kg			01/12/19 22:08	20
Sulfate	**340**	**H**	5.0		mg/Kg			01/12/19 00:32	1

Client Sample ID: B8 RS 1 0.5-2FT

Lab Sample ID: 440-229493-2

Date Collected: 11/15/18 08:00

Matrix: Solid

Date Received: 01/09/19 09:30

Method: 300.0 - Anions, Ion Chromatography - Soluble

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**170**	**H**	5.0		mg/Kg			01/12/19 00:51	1
Sulfate	**100**	**H**	5.0		mg/Kg			01/12/19 00:51	1

Method Summary

Client: GeoLabs Inc
Project/Site: Hawaii State Veterans Home

TestAmerica Job ID: 440-229493-1
SDG: 7818-00

Method	Method Description	Protocol	Laboratory
300.0	Anions, Ion Chromatography	MCAWW	TAL IRV
DI Leach	Deionized Water Leaching Procedure	ASTM	TAL IRV

Protocol References:

ASTM = ASTM International
MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.

Laboratory References:

TAL IRV = TestAmerica Irvine, 17461 Derian Ave, Suite 100, Irvine, CA 92614-5817, TEL (949)261-1022

Lab Chronicle

Client Sample ID: B2 RS 1 0.5-2FT

Lab Sample ID: 440-229493-1

Date Collected: 11/14/18 08:00

Matrix: Solid

Date Received: 01/09/19 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Soluble	Leach	DI Leach			4.00 g	40 mL	522067	01/11/19 21:26	NTN	TAL IRV
Soluble	Analysis	300.0		1			521897	01/12/19 00:32	NTN	TAL IRV
Soluble	Leach	DI Leach			4.00 g	40 mL	522067	01/11/19 21:26	NTN	TAL IRV
Soluble	Analysis	300.0		20			522123	01/12/19 22:08	NTN	TAL IRV

Client Sample ID: B8 RS 1 0.5-2FT

Lab Sample ID: 440-229493-2

Date Collected: 11/15/18 08:00

Matrix: Solid

Date Received: 01/09/19 09:30

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Soluble	Leach	DI Leach			3.98 g	40 mL	522067	01/11/19 21:26	NTN	TAL IRV
Soluble	Analysis	300.0		1			521897	01/12/19 00:51	NTN	TAL IRV

Laboratory References:

TAL IRV = TestAmerica Irvine, 17461 Derian Ave, Suite 100, Irvine, CA 92614-5817, TEL (949)261-1022

1 2 3 4 5 6 7 8 9 10 11 12 13

Method: 300.0 - Anions, Ion Chromatography

Lab Sample ID: MB 440-522067/1-A
Matrix: Solid
Analysis Batch: 521897

Client Sample ID: Method Blank
Prep Type: Soluble

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		5.0		mg/Kg			01/11/19 22:53	1
Sulfate	ND		5.0		mg/Kg			01/11/19 22:53	1

Lab Sample ID: LCS 440-522067/2-A
Matrix: Solid
Analysis Batch: 521897

Client Sample ID: Lab Control Sample
Prep Type: Soluble

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Chloride			50.0	47.2		mg/Kg		94	90 - 110		
Sulfate			50.0	48.6		mg/Kg		97	90 - 110		

Lab Sample ID: 440-229499-A-3-B MS
Matrix: Solid
Analysis Batch: 521897

Client Sample ID: Matrix Spike
Prep Type: Soluble

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Chloride	110		50.0	153		mg/Kg		94	80 - 120		
Sulfate	66		50.0	110		mg/Kg		89	80 - 120		

Lab Sample ID: 440-229499-A-3-C MSD
Matrix: Solid
Analysis Batch: 521897

Client Sample ID: Matrix Spike Duplicate
Prep Type: Soluble

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chloride	110		50.0	160		mg/Kg		108	80 - 120	4	20
Sulfate	66		50.0	114		mg/Kg		96	80 - 120	3	20

QC Association Summary

HPLC/IC

Analysis Batch: 521897

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
440-229493-1	B2 RS 1 0.5-2FT	Soluble	Solid	300.0	522067
440-229493-2	B8 RS 1 0.5-2FT	Soluble	Solid	300.0	522067
MB 440-522067/1-A	Method Blank	Soluble	Solid	300.0	522067
LCS 440-522067/2-A	Lab Control Sample	Soluble	Solid	300.0	522067
440-229499-A-3-B MS	Matrix Spike	Soluble	Solid	300.0	522067
440-229499-A-3-C MSD	Matrix Spike Duplicate	Soluble	Solid	300.0	522067

Leach Batch: 522067

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
440-229493-1	B2 RS 1 0.5-2FT	Soluble	Solid	DI Leach	
440-229493-2	B8 RS 1 0.5-2FT	Soluble	Solid	DI Leach	
MB 440-522067/1-A	Method Blank	Soluble	Solid	DI Leach	
LCS 440-522067/2-A	Lab Control Sample	Soluble	Solid	DI Leach	
440-229499-A-3-B MS	Matrix Spike	Soluble	Solid	DI Leach	
440-229499-A-3-C MSD	Matrix Spike Duplicate	Soluble	Solid	DI Leach	

Analysis Batch: 522123

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
440-229493-1	B2 RS 1 0.5-2FT	Soluble	Solid	300.0	522067

Definitions/Glossary

Qualifiers

HPLC/IC

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Accreditation/Certification Summary

Laboratory: TestAmerica Irvine

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	**Program**	**EPA Region**	**Identification Number**	**Expiration Date**
Hawaii	State Program	9	N/A	01-29-19 *

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
300.0		Solid	Chloride
300.0		Solid	Sulfate

Laboratory: TestAmerica Honolulu

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	**Program**	**EPA Region**	**Identification Number**	**Expiration Date**
Hawaii	State Program	9	N/A	06-28-10 *
USDA	Federal		P330-17-00296	08-30-20

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* Accreditation/Certification renewal pending - accreditation/certification considered valid.

TestAmerica Honolulu
1946 Young Street
Suite 400A
Honolulu, HI 96826
Phone: 808.486.5227 Fax:

Chain of Custody Record

131889

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
TestAmerica Laboratories, Inc.
TAL-8210 (0713)

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact
Company Name: GEOLABS, INC.
Address: 2006 KALIHI ST.
City/State/Zip: HON. HI, 96819
Phone: 841-5064
Fax:
Project Name: HAWAII STATE VETERANS
Site: HOME
P O # 7818.00

Project Manager: NICK KAM
Tel/Fax: nick_k@geolabs.net

Analysis Turnaround Time
☐ CALENDAR DAYS ☐ WORKING DAYS
TAT if different from Below ________
☐ 2 weeks
☐ 1 week
☐ 2 days
☐ 1 day

Site Contact:
Lab Contact:
Date:
Carrier:

COC No
______ of ______ COCs
Sampler:
For Lab Use Only:
Walk-in Client:
Lab Sampling
Job / SDG No

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	CHLORIDE	SULFATE	Sample Specific Notes:
B2 RS1 0.5-2FT.	11/14/18	8AM	G	TUBE	1			✓	✓	
B8 RS1 0.5-2FT	11/15/18	8AM	G	TUBE	1			✓	✓	

440-229493 Chain of Custody

LD 1/9/19

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ________

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal by Lab ☐ Archive for ________ Months

Special Instructions/QC Requirements & Comments:
tracking # 7741 4487 5562

Custody Seals Intact: ☑ Yes ☐ No
Custody Seal No.:
Cooler Temp. (°C) Obs'd: 22.5 Corr'd 23.1 Therm ID No.: IR-95

Relinquished by: HENRY BELTRAN	Company: GEOLABS	Date/Time: 1/8/19 9:15am	Received by: Jon Nguyen	Company: TA-HON	Date/Time: 1/8/19 9:15
Relinquished by: Jon Nguyen	Company: TA-HON	Date/Time: 1/8/19 1:30p	Received by:	Company	Date/Time
Relinquished by:	Company:	Date/Time	Received in Laboratory by:	Company TA-IRV	Date/Time: 1/9/19 9:30

5.4/5.4 IR09

1/29/2019

Login Sample Receipt Checklist

Client: GeoLabs Inc

Job Number: 440-229493-1
SDG Number: 7818-00

Login Number: 229493
List Number: 1
Creator: Bonta, Lucia F

List Source: TestAmerica Irvine

Question	**Answer**	**Comment**
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	Not Present
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	False	Refer to Job Narrative for details.
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	