PALI VIEW ESTATES - PRELIMINARY SOIL REPORT
KANEHOE, OAHU, HAWAII
TAX MAP KEY: 4-5-98:1

FOR REFERENCE
not to be taken from this room

To:
PARK ENGINEERING, INCORPORATED

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

NOVEMBER 9, 1971
November 9, 1971

PARK ENGINEERING, INC.
1149 Bethel Street, Room 710
Honolulu, Hawaii  96813

Gentlemen:

Subject: Pali View Estates
Preliminary Soil Report
(for residential development)
Kaneohe, Oahu, Hawaii
Tax Map Key: 4-5-98: 1
Chapter 23, Revised Ordinances of
Honolulu, 1961 As Amended

In accordance with your request, soil explorations were made to determine general soil conditions at the proposed residential development site for Pali View Estates at Kaneohe, Oahu, Hawaii.

The surface soils at the site are part of a volcanic ash deposit and may be generally described as stiff brown clayey silts ("MH" soils) to about 2 to 9-ft depths underlain by clayey silts with decomposed rocks to about 15 to 25 ft, the depths drilled.

The proposed light residential houses may be supported either directly on stiff existing ground or on compacted fills constructed from on-site soils.

Some grading of the site involving low cuts and fills is contemplated. The earthwork should be done in accordance with the requirements of Chapter 23, Revised Ordinances of Honolulu, 1961 As Amended and the recommendations contained herein.

This report includes a Boring Location Plan, boring logs, laboratory test results, recommendations and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

Ezra Koike
Professional Engineer
Hawaii No. 1450
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SCOPE OF EXPLORATION

The purpose of this exploration was to determine general soil conditions for residential development for the proposed Pali View Estates.

This report includes field explorations, laboratory tests and general recommendations for site grading and residential foundation design.

FIELD EXPLORATION

Thirteen exploratory borings were made at the site. The approximate locations of these borings are shown on the Boring Location Plan. Descriptions of the underlying soils encountered are shown on Boring Logs Nos. 1 thru 10.

Borings were made with 3-in. diameter augers using carbide drag and finger type bits. Soil samples were recovered with 2-in. thin-wall tube samplers and a standard split spoon sampler driven with a 140-lb hammer falling 30 inches.

LABORATORY TESTS

Laboratory tests included: natural water content and density, unconfined compression, Atterberg limit, sieve analysis, AASHO T-180-57 density, expansion and CBR.
A list of the standard field and laboratory test methods used for this project is given in the Appendix.

A summary of the laboratory test results is given in Tables IA and IB.

SOIL CLASSIFICATION SYSTEM

Soil samples were visually observed and subjected to appropriate tests in the laboratory. Based on visual observations and laboratory tests, the soil descriptions given on the boring logs are generally made in accordance with the "Unified Soil Classification System."

GENERAL SITE CONDITIONS

The proposed site is located about 500 ft west of Kamehameha Highway and 1.3 miles north of the Castle Junction at Kaneohe, Oahu, Hawaii.

The site is a pasture crossed with cow trails and access roads. Soil stockpiles 3 to 5 ft high were noted. There were two abandoned quonset huts on the southern section of the site at the time of the explorations.

The existing ground consists of relatively low dips and rises of about 5 to 10 ft.

INTERPRETATION OF SOIL CONDITIONS

From the field exploration and laboratory test results, the soils may be generally described as follows:
Stiff brown clayey silts ("MH" soils) to about 2 to 9-ft depths underlain by clayey silts with decomposed rocks to about 15 to 25 ft, the depths drilled.

Water was not noted in the borings during the field explorations.

For more detailed descriptions of soils encountered in the borings, refer to the boring logs.

DISCUSSION AND RECOMMENDATIONS

In general, the present plan is to clear and grade the site for residential development. Cut and fill slopes should generally be limited to less than 10 ft in height.

In the opinion of the Soil Engineer, the on-site soils, in general, have sufficient strength to support the fills and proposed light residential structures, provided the site is cleared and grubbed, drained and localized soft spots are removed.

High moisture soils may be encountered in the deeper cuts. If used for the construction of fills, compaction may be difficult and will require special treatment.

Cesspools may be encountered near the abandoned quonset huts. They should be located on the grading plan prior to grading operations, if practicable. Sludge should be removed and the cesspool backfilled with granular material.
Soils with decomposed rocks were encountered at about 2 to 9-ft depths in some borings. Because of the shallow depths to decomposed rocks, boulders will probably be found interspersed over the site. As the excavation gets closer to decomposed rocks, the quantity of boulders will be greater. These boulders may be used to construct fill slopes outside of houselots. See Figure 1.

A temporary storm water retention basin about 6 to 11 ft deep with a spillway at the northern edge is planned for Lot 24. Three horizontal to 1 vertical slopes are recommended for the basin.

The inlets, outlets, and spillways should be lined with boulders. There should be a layer of filter rock between the natural soil and boulder lining. Boulders and other hard spots should be removed before filling the retention basin for houselots. The inlets, outlets and ponding basin should be maintained and repaired, particularly before and after a rainstorm.

Site Grading

Surface vegetation, stockpiled soils and miscellaneous debris should be cleared and removed prior to site filling. Localized soft pockets encountered during the site preparations should be excavated and backfilled with compacted select material. Provisions to drain the site should be included during and after the completion of filling operations.
Because existing buildings were noted in the southern section of the site, cesspools, concrete slabs, footings, pipes and other conduits may be encountered. If practicable, they should be located in the field and removed.

In general, the on-site soils may be used for the construction of the proposed fills. Grading work should be done as required by the F.H.A. Data Sheet 79-G; Revised Ordinances of Honolulu, 1961 As Amended; and as recommended below:

1. The area should be cleared and grubbed.

2. Topsoil and stockpiled soils should be either (a) stripped to stiff natural ground or (b) scarified and recompacted before the placement of fills.

3. The bottom and sides of ditches or natural drainage-ways should be stripped down to stiff natural ground or scarified and recompacted before the placement of fills.

4. Subdrains should be placed in a herringbone pattern along the bottom and sides of natural drainageways before the placement of fills.
The locations of subdrains should be determined in the field after clearing and grubbing.

5. Hard surfaces along access roads should be scarified down to stiff soils and recompacted to match the density of the surrounding soil.

6. Fills should be constructed in approximately level layers starting at the lower end and working upward. Where fills are made on sloping areas steeper than about 5 horizontal to 1 vertical, the ground at the toe of the fill should be benched to a generally level condition. As the fill is brought up, it should be keyed continually into the stiff natural ground by cutting steps into the slopes and compacting the fill into these steps.

7. Fills should be laid in 6-in. compacted layers to 90% of the maximum density determined by the AASHO T-180-57 test method. However, the on-site soils from the deeper cut areas generally will have relatively high water
contents and may be difficult to compact. In such cases, the construction of fills should be compacted in one-foot layers to the maximum density obtainable in the laboratory at the water content approximating the field moisture condition. In addition, the relative density of the compacted soil should be greater than 85% of AASHO T-180-57 density.

Existing Cesspools

Cesspools may be encountered during the site preparation work where the quonset huts are located. When encountered, they should be flagged and indicated on the plans. Sludge should be removed from the bottom and the cesspool backfilled with fairly well-graded granular materials. The materials should be placed in thin layers and rammed into place or compacted with vibratory equipment. The top 5 ft of fill should be compacted in 6-in. compacted layers.

Building foundations should be designed to bridge over the cesspool.

Slopes

In general, cut and fill slopes of 2 horizontal to 1 vertical or flatter should be used.
If slope heights (top to toe) of greater than 15 ft are considered, 8-ft-wide benches should be placed at about 15-ft height intervals.

To minimize erosion, the runoff from rainstorms should be diverted by berms or ditches away from slopes whenever practicable.

The surface of fill slopes should be compacted by cat-tracking or with a sheepsfoot roller.

Slope planting is recommended on cut and fill slopes to minimize erosion.

Slope adjustments or other precautions may be necessary if seepage zones or soft spots are encountered in localized areas.

Foundations
If earthwork is carried out as specified, the stiff natural ground and compacted fills should develop adequate bearing values to support the proposed light residential structures.

For light one and 2-story houses, differential settlements will probably be negligible and within the settlement tolerances of residential structures.
General recommendations for foundation construction are as follows:

1. For the proposed light one-story residential structures, conventional house foundations such as slab-on-ground construction or post-and-beam construction may be used.

2. Bearing values for a given soil usually vary with the size and depth of footings. For light, residential structures, bearing values of about 1000 p.s.f. on compacted fills and 1500 p.s.f. on stiff natural ground may be used.

3. Soft spots or pockets of loose material encountered in footing excavations or below the building area should be excavated and the excavation backfilled with well-graded granular material such as S4C or other approved material.

4. Because of the downhill creep effect of soils on a slope, some settlements may occur near the tops of slopes. Buildings should be
placed generally about 15 ft from the tops of slopes. This distance may be reduced for lower slope heights, e.g., 10 ft for 10-ft-high slopes, but generally should not be closer than 5 ft from the top of any slope.

5. Construction of retaining walls on slopes generally should be avoided.

6. Good surface drainage away from the foundation of structures should be maintained, and the site should be graded at all times to prevent the ponding of water.

**Concrete Slabs on Ground**

For concrete slabs on ground, a base course of 4 in. of well-graded gravel less than 3/4-in. and greater than 1/4-in. in size is recommended.

The subgrade should be compacted and shaped to drain, if practicable. The subgrade should be kept slightly higher than the finish grade outside the building.

**Roadway**

In general, a rough estimate of the roadway pavement thickness for the light automobile traffic anticipated is as follows:
2. Base course - 6-in. base course.
3. Subbase course - 6-in. subbase course over a prepared subgrade.

Provisions should be made in the contract documents to allow for local adjustments regarding subbase requirements in the field in accordance with the design standards of the City and County of Honolulu. In fill areas, the use of select soils within the top 2 to 3 ft of the subgrade may reduce the thickness or eliminate the need for the subbase course.

The subgrade should be compacted and shaped to drain. To avoid the ponding of water and softening of the subgrade at low points, weep holes should be placed at subgrade levels thru the walls of the catch basins which are placed in these low areas.

Utilities
Utilities should be placed after the fills are constructed. Utility lines should be designed with flexible joints, particularly where lines are connected to structures. Gravity flow lines should be made as steep as practicable. The bottoms of utility trenches should be daylighted and graded to shed water.
Unforeseen Conditions

Unforeseen or undetected conditions such as soft spots and abandoned utilities may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.
PROPOSED SPECIFICATION FOR EARTHWORK

PALL VIEW ESTATES

General Description

This item shall consist of clearing and grubbing, preparing of land to be filled, excavating and filling of the land, spreading, compacting and testing of the fill, and subsidiary work necessary for grading the site.

Clearing, Grubbing and Preparing Areas to be Filled

Vegetation and rubbish shall be removed and disposed of, leaving the disturbed area with a neat, debris-free appearance.

Vegetable matter shall be removed from the surface upon which fill is to be placed. Topsoil and stockpiled soils shall be (1) stripped to stiff natural ground or (2) scarified and recompacted before the placement of fills. Loose surface soils encountered at finish grade shall be scarified and recompacted.

The bottom and sides of natural drainageways shall be stripped down to stiff natural ground or scarified and recompacted before the placement of fills.

Subdrains shall be placed along the bottom of natural drainageways before the placement of fills. The locations of subdrains should be determined in the field after clearing and grubbing.

Access roads shall be scarified and recompacted to match the density of the surrounding soil.
Materials

Fill material shall consist of selected on-site soils or approved borrow soils. The soils shall not contain more than a trace of organic or deleterious matter.

Borrow soils shall be select soils generally less than 3-in. maximum size, with more than 30% fines and a plasticity index generally less than 20.

Fill material placed in the top 2 ft of fills shall contain less than 30% gravel.

Placing, Spreading and Compacting Fill Material

The selected fill material shall be placed in level layers which, when compacted, shall not exceed 6 inches. Each layer shall be spread evenly and thoroughly blade-mixed during the spreading to insure uniformity of material and water content within each layer.

Rocks or cobbles shall not be allowed to nest, and voids between rocks shall be carefully filled and compacted with small stones or earth.

When the water content of the fill material is much below the optimum for compacting purposes, water shall be added until the water content assures a thorough bonding during the compacting process.

When the water content of the material is above the optimum for compacting purposes, the fill material shall be aerated by blading or by other satisfactory methods until the water content is near the optimum.

After each layer has been placed, mixed and spread evenly, it shall be compacted to 90% of maximum density in accordance with AASHO Test No. T-180-57 or other comparable density tests. Compaction shall be with
sheepsfoot rollers, multiple-wheel pneumatic-tired rollers or other acceptable rollers which shall be able to compact the fill to the specified density. Rolling shall be accomplished while the fill material is at the specified water content. The rolling of each layer shall be continuous over its entire area, and the roller shall make sufficient passes to obtain the desired density.

Field density tests shall be made to get an indication of the compaction of the fill. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density readings shall be taken as often as necessary in the compacted material below the disturbed surface. When these readings indicate that the density of any layer of fill or portion thereof is below the required 90% density, that layer or portion shall be reworked until the required density has been obtained.

The fill operation shall be continued in 6-in. compacted layers, as specified above, until the fill has been brought to the finished slopes and grades as shown on the accepted plans.

Compaction of High Moisture Fill Material

The on-site soils from the deeper cut areas with relatively high water contents will be difficult to compact.

When used for the construction of fills, these soils shall be compacted in one-foot layers to the maximum density obtainable in the laboratory at the water content approximating the field moisture condition. In addition, the relative density of the compacted soil shall be greater than 85% of AASHO Test No. T-180-57.
Backfilling of Old Cesspools

The following procedures shall be followed for backfilling:

(1) **Sludge Removal**

Remove the sludge from the bottom of the old cesspool by (a) pumping or (b) by clamshell or any other suitable method. The material shall be disposed of away from the site. The completeness of removal shall be verified by probing, and the sludge shall be less than 12 in. at the bottom.

(2) **Granular Fill (below 3 ft from finish grade)**

Use granular material, graded from 6 to 0 inches. The fines passing the No. 200 sieve shall be less than 10%. The materials shall be placed in thin layers (12 in. maximum) and compacted with vibratory equipment to 90% of AASHO T-180-57 density. Ramming each layer into place with a clamshell bucket will be allowed. The granular fill shall be wetted before placement into the cesspools. Compaction tests shall be conducted to verify that 90% compaction is obtained by the construction method selected.

(3) **Top 3 Ft of Fill**

Linings encountered in the cesspools within the top 3 ft from finish grade shall be removed. The fill
within the top 3 ft from finish grade shall be constructed from on-site soils in 6-in. compacted layers to 90% of AASHO T-180-57 density. The material at finish grade shall blend with the surrounding soil.

**Excavation**

Suitable material from excavation shall be used in the fill and unsuitable material from excavation shall be disposed of.

**Boulder Fills**

If boulders are proposed to be used in the construction of fills, they shall be placed along the toe section of slopes and at locations indicated on the plan. The subgrade shall be stripped to stiff natural ground and shaped to drain. A layer of granular filter material shall be placed on it. All voids between boulders shall be filled with smaller granular soils. A blanket of filter material shall be placed against the boulder fill before construction of earth fills behind or above the boulders.

**Unforeseen Conditions**

If unforeseen or undetected critical soil conditions such as soft spots or seepage water are encountered during the field operations, corrective measures shall be made in the field as they are detected.
Rainy Weather

Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests indicate that the water content and density are as previously specified.
BORING LOGS

The stratification lines shown on each of the boring logs represent the approximate boundary between soil types and the transition may be gradual.

Symbols

Symbols used generally are in accordance with the Unified Soil Classification System.

Where a parenthesis "(MH)" is used, the soil sample was classified by visual observation of the sample recovered.

Where no parenthesis "MH" is used, the soil sample was classified from either the Atterberg limit or sieve analysis test results.
### Boring Log

**PROJECT** Pali View Estates  
**LOCATION** Kaneohe, Oahu, Hawaii  
**Tax Map Key:** 4-5-98: 1

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<th>HAMMER:</th>
<th>WEIGHT: 140#</th>
<th>DROP: 30&quot;</th>
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**Driller:** W. Lum Assoc., Inc.  
**Date:** Sept. 15, 1971

**Type of Boring:** AUGER (MOBILE), Diam.: 3"

**Location:** H.P.A.L.V.E.S.T.A.T.E.S.

**DESCRIPTIONS:**

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<td>0</td>
<td>0</td>
<td>0</td>
<td>0 10 20 30 40</td>
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- **STIFF, REDDISH BROWN CLAYEY SILT**
- **MEDIUM, BROWN CLAYEY SILT (DECOMPOSED ROCK)**

**END OF BORING @ 16.5 ft**

**Penetration Data**

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<th>STANDARD PENETRATION TEST</th>
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*Elevation estimated from topo map.*
Boring Log

PROJECT: PALI VIEW ESTATES
LOCATION: Kaneohe, Oahu, Hawaii
Tax Map Key: 4-5-98: 1

HAMMER:
Weight: 140#
Drop: 90"

SAMPLER: 2" O.D. THIN WALL TUBE

---

**PENETRATION DATA**

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**DESCRIPTION**

(MH) REDDISH BROWN CLAYEY SILT (DECOMPOSED ROCK)

(MH) SOFT, BROWN CLAYEY SILT (DECOMPOSED ROCK)

END OF BORING @ 16'

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*ELEVATION ESTIMATED FROM TOPO MAP*
**BORING NO. 2**  Sheet No. 1 of 1

**PROJECT**  PALL VIEW ESTATES

**LOCATION**  Kaneohe, Oahu, Hawaii

**Tax Map Key:**  4-5-98: 1

**HAMMER:**
- Weight: 140*
- Drop: 30'

**SAMPLER:**
- 2" 5' O.D. Thin Wall Tube
- 2" 5" 2" Standard Split Spoon

**Type of Boring:** AUGER (Mobile MINI TRAX)

**ELEVATION:**
- Datum: 279.4'

**PENETRATION DATA**

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**Elevation Estimated from Topo Map**
## Boring Log

**PROJECT**
PALI VIEW ESTATES

**LOCATION**
Kaneohe, Oahu, Hawaii

**Tax Map Key:** 4-5-98: 1

---

**HAMMER:**

- **Weight:** 140*
- **Drop:** 30"  
  - **2" 3/8" O.D. THIN WALL TUBE**
  - **2.5" S. 2" O.D. STANDARD SPLIT SPOON**

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**DESCRIPTION**

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**END OF BORING @ 15.2'**

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* ELEVATION ESTIMATED FROM TOPO. MAP.
Boring Log

**PROJECT**
PALI VIEW ESTATES

**LOCATION**
Kaneohe, Oahu, Hawaii

**Tax Map Key**
4-5-98: 1

---

**HAMMER:**
Weight 140 *
Drop 30"

**SAMPLER:**
2" 9.2" O.D. THIN WALL TUBE
2" 95.2" STANDARD SPLIT SPOON

---

**Boring No:** 3
**Sheet No:** of
**Date:** SEPT. 25, 1971

**Field Party:** SUZUKI, KAKU, TSUKAZAKI

**Type of Boring:** AUGER (MOBILE MINUTEMAN)
**Diam:** 3"
**Datum:** 284' +
**Drill Bit:** T.C.DR.AG
**Water Level:** HOT
**Time:** —
**Date:** 9-25-71

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**Penetration Data**

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<td>5' 5</td>
<td>3-F</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>6' 0</td>
<td>3-G</td>
<td>3/5' 4/5'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40</td>
</tr>
</tbody>
</table>

---

* ELEVATION ESTIMATED FROM TOPO MAP
# Boring Log

**PROJECT:** Pali View Estates  
**LOCATION:** Kaneohe, Oahu, Hawaii  
**Tax Map Key:** 4-5-98:1

**HAMMER:**  
- Weight: 140#  
- Drop: 30"  
- Type of Boring: Auger (Mobile)  
- Diam.: 3"

**Site Details:**  
- Field Party: Suzuki, Oshiro  
- Date: Sept. 29, 1971

**Penetration Data**  
- Standard Penetration Test:  
- 2" O.D. Thin Wall Tube Sampler  
- 0 10 20 30 40 BLOWS/0.5'

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample No.</th>
<th>Wet Density P.C.F.</th>
<th>Dry Density P.C.F.</th>
<th>Unconf. Comp. P.S.F.</th>
<th>Penetration Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.55</td>
<td>4.4</td>
<td>101</td>
<td>47</td>
<td>72</td>
<td>13000</td>
</tr>
<tr>
<td>2.5</td>
<td>4.5</td>
<td>83</td>
<td>62</td>
<td>51</td>
<td>5080</td>
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<tr>
<td>2.35</td>
<td>4.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Elevation estimated from topo map.
**Boring Log**

**PROJECT**
Pali View Estates

**LOCATION**
Kaneohe, Oahu, Hawaii

**Tax Map Key:**
4-5-98: 1

**HAMMER:**

- **Type of Boring:** AUGER (MOBILE MINUTEMAN)
  - Diam.: 3"
  - Elevation: 300'

- **Field Party:** Suzuki, Oshiro

**SAMPLER:**

1. **Unit Classification:**
   - **LOOSE (DRT) REDDISH BROWN CLAYEY SILT (FILL)**
   - **STIFF PARK REDDISH BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK**

2. **Depth (Ft):**
   - 0

3. **Sample No:**
   - 1

4. **Water Content %:**
   - 0

5. **Unconf. Comp. P.S.F.:**
   - 0

6. **Penetration Test:**

<table>
<thead>
<tr>
<th>Blows per foot</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
</tr>
</thead>
</table>

**ELEVATION ESTIMATED FROM TOPO MAP**

**NOTE:** Elevation is estimated based on topographical map data.
# Boring Log

**PROJECT**: Pali View Estates  
**LOCATION**: Kaneohe, Oahu, Hawaii  
**Tax Map Key**: 4-5-98: 1

### HAMMER:

- **Weight**: 140 lbs  
- **Drop**: 30"  
- **Type of Boring**: AUGER (MOBILE)  
- **Diam.**: 3"  
- **Drill Bit**: FINGER TYPE

### SAMPLER:

- **2.5" x 2" OD THIN WALL TUBE**  
- **2.65" x 2" STANDARD SPLIT SPOON**

### Field Party:

- **Driller**: W. LUM ASSOC., INC.  
- **Field Party**: SUZUKI, KAKU

## PENETRATION DATA

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample No.</th>
<th>Water Cont.</th>
<th>Dry Dens.</th>
<th>Penetration Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.55</td>
<td>S-A</td>
<td>41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>S-B</td>
<td>21</td>
<td>97</td>
<td></td>
</tr>
<tr>
<td>2.65</td>
<td>S-C</td>
<td>44</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>2.55</td>
<td>S-D</td>
<td>55</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Description:

- **STIFF, REDDISH BROWN CLAYEY SILT**
- **STIFF, REDDISH BROWN CLAYEY Silt w/ TRACES OF DECOMPOSED ROCK**

**END OF BORING @ 10.5**

---

*ELEVATION ESTIMATED FROM TOPO MAP*
# Boring Log

**PROJECT**  Pali View Estates  
**LOCATION**  Kaneohe, Oahu, Hawaii  
**Tax Map Key**  4-5-98-1  

**HAMMER:**  
- **Weight**  140 lb  
- **Drop**  20"  
**SAMPLER:**  
- **2" 5' + 2" O.D. thin wall tube**  
- **2" 65' 2" Standard split spoon**

**BORING NO.**  C  
**Date**  9-19-71  
**Driller**  W. Lum Assoc., Inc.  
**Field Party**  Suzuki, Kaku  
**Type of Boring**  Auger (Minuteman)  
**Diam.**  3"  
**Elev.**  200'  
**Drill Bit**  Finger Type

## Elevation Estimated From Topo Map

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MH</td>
<td>Stiff, brown clayey silt</td>
<td>2.05</td>
<td>G-A</td>
<td>94</td>
<td>LL</td>
<td>61</td>
<td>FL</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MH</td>
<td>Stiff, brown clayey silt  w/ decomposed rock</td>
<td>2.5</td>
<td>G-B</td>
<td>60</td>
<td>LL</td>
<td>61</td>
<td>FL</td>
<td>42</td>
<td></td>
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</tr>
<tr>
<td>MH</td>
<td>Soft, mottled brown clayey silt  w/ decomposed rock</td>
<td>2.55</td>
<td>G-C</td>
<td>85</td>
<td>LL</td>
<td>84</td>
<td>FL</td>
<td>69</td>
<td></td>
<td>3 BLOWS/1.0'</td>
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<tr>
<td></td>
<td>Cobble</td>
<td>3.0</td>
<td>G-D</td>
<td>36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decomposed rock  w/ mottled brown clayey silt</td>
<td>2.5</td>
<td>G-E</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>End of boring @ 21.5'</td>
<td>2.55</td>
<td>G-E</td>
<td>50</td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

**PENETRATION DATA**

- **Standard Penetration Test**
- **2" O.D. Thin Wall Tube Sampler**

**ELEV. = 200'**

---

### Notes
- Water Level: Not Observed
- Time: --
- Date: 9-19-71
**Boring Log**

**PROJECT**
Pali View Estates

**LOCATION**
Kaneohe, Oahu, Hawaii

**Tax Map Key:** 4-5-98: 1

**PROJECT**
Pali View Estates

**LOCATION**
Kaneohe, Oahu, Hawaii

**Tax Map Key:** 4-5-98: 1

**Hammer:**

- **Weight:** 140 lbs
- **Height:** 30 in
- **Drop:** 2 ft 3 in, 2 in. D. Thin Wall Tube
- **Sampler:** 2.5 ft, 2 in. Standard Split Spoon

---

**Penetration Data**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(MH)</td>
<td>Stiff, reddish brown clayey silt &amp; roots</td>
<td>2.55</td>
<td>T:A</td>
<td>33</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(MH)</td>
<td>Stiff, light brown clayey silt &amp; decomposed rock</td>
<td>2.5</td>
<td>T:B</td>
<td>104</td>
<td>55</td>
<td>67</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(MH)</td>
<td>Soft, mottled brown clayey silt &amp; decomposed rock</td>
<td>2.55</td>
<td>T:C</td>
<td>75</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(MH)</td>
<td>End of boring &amp; 12.5</td>
<td>2.55</td>
<td>T:D</td>
<td>72</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>-</td>
</tr>
</tbody>
</table>

---

*Elevation estimated from topo map*
# Boring Log

**PROJECT:** Pali View Estates  
**LOCATION:** Kaneohe, Oahu, Hawaii  
**Tax Map Key:** 4-5-98-1  
**HAMMER:** 140*  
**Weight:** 30"  
**Drop:** 2" 2" O.D. THIN WALL TUBE  
**SAMPLER:** 2" 2" STANDARD SPLIT SPOON

### PENETRATION DATA

<table>
<thead>
<tr>
<th>Unified Soil Classification</th>
<th>DESCRIPTION</th>
<th>Depth (Ft)</th>
<th>Sample</th>
<th>Penetration Test %</th>
<th>Water Cont.</th>
<th>Dry Density</th>
<th>Uncomp. Comp.</th>
<th>Penetration (N Blows per foot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(MH)</td>
<td>Stiff, reddish brown clayey silt w/roots</td>
<td>2.55</td>
<td>B-A</td>
<td>37</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MH</td>
<td>Stiff, reddish brown clayey silt w/ traces of decomposed rock</td>
<td>2.55</td>
<td>B-B</td>
<td>41</td>
<td>LL = 42</td>
<td>PL = 41</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(MH)</td>
<td>Medium, mottled brown clayey silt w/ decomposed rock</td>
<td>2.55</td>
<td>B-C</td>
<td>85</td>
<td>GC</td>
<td>51</td>
<td>2180</td>
<td>-</td>
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<tr>
<td>MH</td>
<td>End of boring @ 16.5&quot;</td>
<td>2.55</td>
<td>B-D</td>
<td>62</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tbody>
</table>

*Elevation estimated from topo. map.*
Boring Log

PROJECT: PALI VIEW ESTATES
LOCATION: Kaneohe, Oahu, Hawaii
Tax Map Key: 4-5-98: 1

HAMMER:
Weight: 140#
Drop: 30'

SAMPLER:
2" 5" 2" O.D. THIN WALL TUBE
2" 55" 2" STANDARD SPLIT SPOON

BORING NO. 0 Sheet No. ______ of ______
Driller: W. LUM ASSOC., INC. Date: SEPT. 12, 1971
Field Party: SUZUKI, KAKU
Type of Boring: AUGER (MOBILE)
Diam.: 2"
Elev.: 322' +
Datum:
Drill Bit: FINGER TYPE

Water Level:
Time:
Date: 9-13-71

Penetration Data

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<thead>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>MH</td>
<td>STIFF, BROWN CLAYET SILT</td>
<td></td>
<td>2.5</td>
<td>O-A</td>
<td>37</td>
<td>32</td>
<td>68</td>
<td>43</td>
<td>100</td>
<td>13000</td>
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<tr>
<td>(MH)</td>
<td>MEDIUM-STIFF, BROWN CLAYET SILT 1/ DECOMPOSED ROCK</td>
<td>2.55</td>
<td>O-P</td>
<td>57</td>
<td>50</td>
<td>57</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>END OF BORING @ 10.5'</td>
<td>2.35</td>
<td>O-P</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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* ELEVATION ESTIMATED FROM TOPO MAP
Boring Log

PROJECT: PALI VIEW ESTATES
LOCATION: Kaneohe, Oahu, Hawaii
Tax Map Key: 4-5-98: 1

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER:
2" S. 2" O.D. THIN WALL TUBE
2.55 2" STANDARD SPLIT SPOON

---

**UNIFIED SOIL CLASSIFICATION**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>ELEV. = 295'17</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>(MH) STIFF, BROWN CLAYEY SILT w/ ROOTS</td>
<td>2.55</td>
<td>10-A</td>
</tr>
<tr>
<td>(MH) STIFF, REDDISH BROWN CLAYEY SILT</td>
<td>2.5</td>
<td>10-B</td>
</tr>
<tr>
<td>(MH) STIFF, MOTTLED BROWN CLAYEY SILT w/ TRACES OF DECOMPOSED ROCK</td>
<td>2.55</td>
<td>10-C</td>
</tr>
</tbody>
</table>

**END OF BORING @ 10.5'**

---

**PENETRATION DATA**

<table>
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<td>0</td>
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<td>2.55</td>
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<td>2.5</td>
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<td>47</td>
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<td>1504</td>
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<td>10-C</td>
<td>56</td>
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**ELEVATION ESTIMATED FROM TOPO MAP**
## TABLE I.A - SUMMARY OF LABORATORY TEST RESULTS

<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>SAMPLE NO.</th>
<th>DEPTH BELOW SURFACE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>10'-11.5'</td>
<td>BROWN CLAYEY SILT (DECOMP. ROCK)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15' - 16.5'</td>
<td>BROWN CLAYEY SILT (DECOMP. ROCK)</td>
</tr>
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<td></td>
<td></td>
<td>5' - 6'</td>
<td>BROWN CLAYEY SILT</td>
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</tbody>
</table>

### GRAIN-SIZE ANALYSIS (% Passing)

<table>
<thead>
<tr>
<th>Sieve</th>
<th>1'</th>
<th>1/2'</th>
<th>#4</th>
<th>#10</th>
<th>#20</th>
<th>#40</th>
<th>#100</th>
<th>#200</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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<td>100</td>
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<td>97.8</td>
<td>93.3</td>
<td>91.2</td>
<td>88.2</td>
<td>86.4</td>
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### ATTERBERG LIMITS

<table>
<thead>
<tr>
<th>Air Dried or Natural</th>
<th>Liquid Limit</th>
<th>Plastic Limit</th>
<th>Plasticity Index</th>
<th>Dilatancy</th>
<th>Toughness</th>
<th>Dry Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NATURAL</td>
<td>NATURAL</td>
<td>NATURAL</td>
<td>QUICK</td>
<td>QUICK</td>
<td>SLIGHT-MED</td>
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<td>86.0</td>
<td>64.0</td>
<td>40.0</td>
<td>SLIGHT-MED</td>
<td>SLIGHT-MED</td>
<td>SLIGHT-MED</td>
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</table>

### UNIFIED SOIL CLASSIFICATION

| MH | MH | MH | MH |

### APPARENT SPECIFIC GRAVITY

| 3.06 |

### EXPANSION AND CBR TESTS

(Surcharge-5 ft P.S.F.)

<table>
<thead>
<tr>
<th>Molding Moisture, %</th>
<th>Molding Dry Density, P.C.F.</th>
<th>Swell upon saturation, %</th>
<th>CBR at 0.1&quot; Penetration</th>
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<tbody>
<tr>
<td></td>
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<tr>
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### MOISTURE-DENSITY RELATIONS OF SOILS

(AASHO T-180-57 Method)

<table>
<thead>
<tr>
<th>Dry to Wet or Wet to Dry</th>
<th>Max. Dry Density (P.C.F.)</th>
<th>Optimum Moisture (%)</th>
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<tr>
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</tr>
<tr>
<td>A</td>
<td>WET TO DRY</td>
<td>92.5</td>
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### REMARKS:

Date: 10-21-71 By: BT

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>SAMPLE NO.</th>
<th>DEPTH BELOW SURFACE</th>
<th>DESCRIPTION</th>
<th>GRAIN-SIZE ANALYSIS</th>
<th>ATTERBERG LIMITS</th>
<th>UNIFIED SOIL CLASSIFICATION</th>
<th>APPARENT SPECIFIC GRAVITY</th>
<th>EXPANSION AND CBR TESTS</th>
<th>MOISTURE-DENSITY RELATIONS OF SOILS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>10-11.5'</td>
<td>MOTTLED BROWN CLAYEY Silt &amp; DECOMP. ROCK</td>
<td>10-11.5'</td>
<td>31-32</td>
<td>MH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>B</td>
<td>5-5.4'</td>
<td>REDDISH BROWN CLAYEY Silt WITRACES OF DECOMP. ROCK</td>
<td>5.5-5.4'</td>
<td>33-33</td>
<td>MH</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>A</td>
<td>0.5-2'</td>
<td>BROWN CLAYEY Silt</td>
<td>0.5-2'</td>
<td>33-33</td>
<td>MH</td>
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**REMARKS:**

Date (10-21-7) By B.T.
PLASTICITY CHART

PROJECT: PALI VIEW ESTATES
LOCATION: KANEHOE, OAHU, HAWAII

PLASTICITY INDEX

LIQUID LIMIT

CL
CL-ML
ML

"A" LINE

CH

SURFACE

0-60

60-80

80-90

90-100

100-120

120-130

CL-MI

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 10-21-71  BY  B.T.
MOISTURE-DENSITY CURVE (AASHO T-180-57, METHOD A)

PROJECT: Pali View Estates

LOCATION: Kaneohe, Oahu, Hawaii

SAMPLE NO.: 6 SURFACE

SAMPLE DESCRIPTION: Brown clayey silt w/ traces of sand

AGGREGATE: 1/4" minus
MOLD SIZE: 4" dia. 9.59" high
HAMMER: 10.62 lb, 18" drop
LAYERS: 5
BLOWS: 25/LAYER

ZERO AIR VOIDS CURVE
SPECIFIC GRAVITY = 2.66

MAXIMUM DRY DENSITY = 98.8 p.c.f.

OPTIMUM MOISTURE CONTENT = 9.8%.

DATE 9-30-71 BY SK

WALTER LUM ASSOCIATES, INC.
CIVIL STRUCTURAL SOILS ENGINEERS
CBR TEST

PROJECT: PALI VIEW ESTATES
LOCATION: KANEHOE, OAHU, HAWAII
SAMPLE NO: G SURFACE
SAMPLE DESCRIPTION: BROWN CLAYEY SILT W/SAND

TEST RESULTS:
MOLDING MOISTURE, %: 24.3
MOLDING DRY DENSITY, P.C.F.: 95.1
CBR @ 0.1" PENETRATION: 4.0
DAYS SOAKED: 5

DATE 9-24-71 BY MO
DATE 10-5-71 BY SK

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
GENERAL TESTING METHODS

EXPLORATORY BORINGS AND SAMPLING

Method for soil investigation and sampling by auger borings (Tentative)

Method for thin wall tube sampling of soils (Tentative)

Method for penetration test and split barrel sampling of soils (Tentative)

LABORATORY TESTING

Grading Analysis

Sieve analysis of fine and coarse aggregates

Amount of material finer than No. 200 sieve in aggregate

Atterberg Limits

Determining the liquid limit of soils
Modified as follows: Substitute Casagrande grooving tool. Tests conducted from natural moisture content unless noted otherwise.

Determining the plastic limit of soils

Calculating the plasticity index of soils

Specific Gravity

Specific gravity of soils
Modified as follows: 500 ML Pycnometer

Expansion and CBR Tests

Expansion test and California Bearing Ratio (CBR)

Compaction Test

Moisture-Density relations of soils using a 10# hammer and an 18" drop

Unified Soil Classification

ASTM Designation: D 1452-63T

ASTM Designation: D 1587-63T

ASTM Designation: D 1586-64T

AASHO Designation: T 27-60

AASHO Designation: T 11-60

AASHO Designation: T 89-60

AASHO Designation: T 90-56

AASHO Designation: T 91-54

AASHO Designation: T 100-60

Section VIII - TM 5-530
"Materials Testing" by Headquarters, Dept. of the Army

AASHO Designation: T 180-57

Designation E-3 from "Earth Manual" by the United States Department of the Interior Bureau of Reclamation
GENERAL TESTING METHODS

Consolidation Test

Laboratory Shear Test

Laboratory shear test using the Torvane

Chapter IX
"Soil Testing for Engineers"
by T. William Lambe
The Massachusetts Institute of Technology

Brochure by Soiltest, Inc.
LIMITATIONS

In general, soil formations are commonly erratic and rarely uniform or regular. The boring logs indicate the approximate subsurface soil conditions encountered only at the drill holes where the borings were made at the times designated on the logs and may not represent conditions at other locations or at other dates. Soil conditions and water levels may change with the passage of time and construction methods or improvements at the site.

During construction, should subsurface conditions much different from those in the borings be observed, encountered, or otherwise indicated, we should be advised immediately to review or reconsider our recommendations in light of the new developments.

Our professional services were performed, findings obtained and recommendations prepared in accordance with generally accepted engineering practices. This warranty is in lieu of all other warranties expressed or implied.
SECTION

NOT TO SCALE

FIGURE 1

PROPOSED BOULDER FILL

Pali View Estates

Kaneohe, Oahu, Hawaii

TMK: 4-5-98

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