SUPPLEMENTARY SOILS INVESTIGATION

KAOPA SUBDIVISION, UNIT 1-B-1

KAILUA, KOOLAUPOKO, OAHU, HAWAII

for

HAWAIIAN PACIFIC INDUSTRIES

T.M.K., 4-2-04:

MUNICIPAL REFERENCES & RECORDS CENTER
City & County of Honolulu
City Hall Annex, 556 S. King Street
Honolulu, Hawai'i 96813

ERNEST K. HIRATA & ASSOCIATES, INC.

December 10, 1971
W.O. 127
Hawaiian Pacific Industries
1020-E Keolu Drive
Kailua, Oahu, Hawaii

Attention: Mr. William Rus

Subject: Supplementary Soils Investigation
Kaopa Subdivision, Unit 1-B-1
Heeia, Koolaupoko, Oahu, Hawaii

Reference: Proposed Kaopa Park Site Subdivision
Preliminary Soil Report
Prepared by Walter Lum Associates, Inc.
Dated May 10, 1971

Gentlemen:

This report presents the results of our soils investigation conducted on the subject property. This investigation was authorized to determine the subsurface soil conditions at the site and to provide recommendations for the housing development. A previous soils investigation conducted on the site by Walter Lum Associates, Inc. has been reviewed and their results utilized to the fullest extent applicable.

SITE DESCRIPTION

This investigation encompasses approximately 9.8 acres of land between Keolu Drive and the southern portion of Enchanted Lakes. The eastern boundary is bordered by Keolu Elementary School while the western boundary is bordered by an existing subdivision.
The area consists of low lying marsh in the northeastern portion while the remainder of the area has been filled.

Groundwater was encountered in all test pits and borings. We understand that subdrains were placed under the toe of slope bordering the western property line.

FIELD EXPLORATION

Field exploration was performed on November 27 and 28, 1971 using a truck mounted rotary auger drill rig. Four exploratory borings were drilled to depths ranging from 16 to 32.5 feet.

The soils were continuously logged by our field engineer and classified by visual examination in accordance with the Unified Soil Classification System.

Undisturbed and bag samples were recovered from the borings for laboratory testing. Undisturbed samples were obtained by driving a 3" O.D. split tube sampler with a 140 pound hammer from a height of 30 inches. The required blow count for each 6 inches of penetration is shown on the Boring Logs.
LABORATORY TESTING

Laboratory testing was performed on the undisturbed samples. Laboratory tests included moisture-density relationships, swells, and consolidation tests.

SOIL CONDITIONS

Results of the subsurface investigation indicate that the controlled fill is firm and stiff. The fill north of Akeke Place is loose and is not controlled fill.

The fill is approximately 9 feet thick south of lot 29 along the western lots, while only 4 feet of fill was encountered on lot 9. Underlying the fill was a strata of sandy and silty clay in a medium to soft condition. Decomposed rock was encountered at depths ranging from elevation -16 in boring 1 to elevation -9.5 in boring 3.

DISCUSSION AND RECOMMENDATIONS

Consolidation tests indicate that the gray sandy and silty clay are highly compressible. Due to economic feasibility and time element of this project, the soft clays should be monitored with settlement markers to determine when settlement becomes negligible.
We recommend placing settlement markers at 300 feet intervals to monitor settlement. Settlement markers should be placed prior to any further grading and readings taken weekly. If any markers are destroyed during grading, they should be replaced immediately and new readings taken within a few days. Markers should be placed in two separate straight lines and horizontal control should also be established.

We recommend that portions of this subdivision be designed for post and beam construction while slab-on-grade design be used for lots with an adequate thickness of fill. We recommend that lots 14 through 29 inclusive may use slab-on-grade construction while the remainder of the lots be built for post and beam foundations. Allowable bearing values for foundations will be submitted at the completion of grading.

Loose fill exists north from Akeke Place and this material should be removed to within two feet of water level and recompacted under the supervision of a soils engineer.

Prior to placement of any fill, the existing ground surface should be scarified to a depth of 12 inches and recompacted. All uncontrolled fill or stockpile material existing on the site shall be removed down to elevations where fill has been certified.
The existing fill slope between lots 14 and 20 may be cut to a slope gradient of 2:1 (horizontal to vertical). We feel that the possibility of a deep slope failure would be unlikely and removing load from the slope would reduce any driving force developed.

Our standard grading specifications are included in this report and will be considered as a part of the recommendations.

We appreciate the opportunity to be of service. Should you have any questions, please call on us.

Respectfully submitted,


Ernest K. Hirata  P.E. 2732

Enc:  Plates A1 through A4
      Plates B1 through B4
      Std. Grading Specifications
      Grading Plan
**BORING NO.** B1  **SURFACE ELEV.** 31 +  **DROP** 30 in.  **DATE OF DRILLING** 11-27-71

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>CORE</th>
<th>PENET. RESIST. BLOWS/FOOT</th>
<th>DRY DENSITY PCF</th>
<th>MOISTURE CONTENT %</th>
<th>RELATIVE COMPACT %</th>
<th>DIRECT SHEAR STRENGTH PARAMETERS</th>
<th>CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>x 12</td>
<td>86.0</td>
<td>27.8</td>
<td></td>
<td></td>
<td></td>
<td>FILL - Silty Clay, reddish brown moist stiff, rocky Grading to orange brown color from 4 feet.</td>
</tr>
<tr>
<td>10</td>
<td>x 5</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>Sandy CLAY (MH) - Dark brown, moist, medium stiff.</td>
</tr>
<tr>
<td>15</td>
<td>x 9</td>
<td>No Recovery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Decomposed Rock - Silty Clay, brown with strata of sand and gravel, dense.</td>
</tr>
<tr>
<td>20</td>
<td>x 10</td>
<td>No Recovery</td>
<td>7/4&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>x 18</td>
<td>No Recovery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>x 17</td>
<td>No Recovery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>End boring at 29.5 feet. Water level at 16.5 feet.</td>
</tr>
</tbody>
</table>
# Boring Log

**BORING NO.:** B2  
**DRIVING WT.:** 140 lb.  
**DATE OF DRILLING:** 11-27-71

<table>
<thead>
<tr>
<th>Depth (Feet)</th>
<th>Core</th>
<th>Bag</th>
<th>Penet. Resist. Blows/foot</th>
<th>Dry Density Pcf</th>
<th>Moisture Content %</th>
<th>Relative Compaction %</th>
<th>Direct Shear Strength Parameters</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>x</td>
<td>5</td>
<td>85.0</td>
<td>34.2</td>
<td></td>
<td></td>
<td>FILL - Silty Clay, brown, stiff, some rocks</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Grading orangish brown color from 3.5 feet.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>x</td>
<td>6</td>
<td>78.9</td>
<td>42.8</td>
<td></td>
<td></td>
<td>Silty CLAY (MH) - Dark gray to black, stiff, moist.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>x</td>
<td>2</td>
<td>77.5</td>
<td>44.4</td>
<td></td>
<td></td>
<td>Sandy CLAY (MH) - Mottled gray, soft.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>x</td>
<td>5</td>
<td>81.4</td>
<td>42.8</td>
<td></td>
<td></td>
<td>Grading medium stiff at 20 feet.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>x</td>
<td>2</td>
<td>68.3</td>
<td>52.1</td>
<td></td>
<td></td>
<td>Soft at 25 feet.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>End boring at 26.5 feet. Water level at 14 feet.</td>
<td></td>
</tr>
</tbody>
</table>

**Plate A2**
# ERNEST K. HIRATA & ASSOC.

**BORING NO.** B3  
**DRIVING WT.** 140 lb  
**DATE OF DRILLING** 11-28-71

<table>
<thead>
<tr>
<th>DEPTH FEET</th>
<th>CORE</th>
<th>BAG</th>
<th>PENET RESIST. BLOWS/FOOT</th>
<th>DRY DENSITY PFC</th>
<th>MOISTURE CONTENT %</th>
<th>RELATIVE COMPAC%</th>
<th>DIRECT SHEAR STRENGTH PARAMETERS</th>
<th>CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>x</td>
<td>7</td>
<td>85.7</td>
<td>36.5</td>
<td></td>
<td></td>
<td></td>
<td>FILL - Silty Clay, mottled brown, moist, some cobbles.</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Silty CLAY (MH) - Dark gray, medium to soft.</td>
</tr>
<tr>
<td>10</td>
<td>x</td>
<td>2</td>
<td>73.4</td>
<td>48.7</td>
<td></td>
<td></td>
<td></td>
<td>Grading to black sandy clay at 17 feet.</td>
</tr>
<tr>
<td>15</td>
<td>x</td>
<td>2</td>
<td>No Recovery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Decomposed Rock</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>End boring at 32.5 feet.</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Water level at 7 feet.</td>
</tr>
<tr>
<td>30</td>
<td>x</td>
<td>18</td>
<td>No Recovery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Plate A3
## Boring Log

**Boring No.** B4  
**Driving Wt.** 140 lb.  
**Date of Drilling** 11-28-71

<table>
<thead>
<tr>
<th>Depth Feet</th>
<th>Core</th>
<th>Bag</th>
<th>Penetration Resist. B/B</th>
<th>Blows/Feet</th>
<th>Density Pcf</th>
<th>Moisture Content</th>
<th>Relative Compaction</th>
<th>Direct Shear Strength Parameters</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FILL - Clayey Silt, brown, with rocks and cobbles, loose, Grading to sandy clay.</td>
</tr>
<tr>
<td>5-10</td>
<td></td>
<td>x</td>
<td>2</td>
<td>73.1</td>
<td>48.2</td>
<td></td>
<td></td>
<td>Silty CLAY (MH) - Dark gray, soft.</td>
<td></td>
</tr>
<tr>
<td>10-20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>End boring at 16 feet. Water level at 5.5 feet.</td>
<td></td>
</tr>
</tbody>
</table>

**Surface Elev.** 9 +  
**Drop** 30 in.  
**W.O.** 127

Plate A4
CONSOLIDATION-PRESSURE CURVE

% SWELL

% CONSOLIDATION

NORMAL PRESSURE, KIPS PER SQ. FT.

DATE 12-6-71
JOB Kailua - Unit 1-B-1
BORING NO. B3
DEPTH 11.5'

Plate B3
CONSOLIDATION-PRESSURE CURVE

% SWELL

% CONSOLIDATION

NORMAL PRESSURE, KIPS PER SQ. FT.

* Water added at 700 PSF

Plate B1
**CONSOLIDATION-PRESSURE CURVE**

*Water added at 700 PSF*
CONSOLIDATION-PRESSURE CURVE

% SWELL

0 2 4 6 8 10 12 14

% CONSOLIDATION

0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

NORMAL PRESSURE, KIPS PER SQ. FT.

Plate B4
These specifications present the usual and minimum requirements for grading operations performed under the control of Ernest K. Hirata & Associates Inc.

No deviation from these specifications will be allowed, except where specifically superseded in the preliminary soils report, or in other written communication signed by the Soils Engineer.

I. GENERAL

A. The Soils Engineer is the Owner's or Builder's representative on the project. For the purpose of these specifications, supervision by the Soils Engineer includes that inspection performed by any person or persons employed by, and responsible to, the licensed Civil Engineer signing the soils report.

B. All clearing, site preparation or earthwork performed on the project shall be conducted by the Contractor under the supervision of the Soils Engineer.

C. It is the Contractor's responsibility to prepare the ground surface to receive the fills to the satisfaction of the Soils Engineer and to place, spread, mix, water and compact the fill in accordance with the specifications of the Soils Engineer. The Contractor shall also remove all material considered unsatisfactory by the Soils Engineer.

D. It is also the Contractor's responsibility to have suitable and sufficient compaction equipment on the job site to handle the amount of fill being placed. If necessary, excavation equipment will be shut down to permit completion of compaction. Sufficient watering apparatus will also be provided by the Contractor, with due consideration for the fill material, rate of placement and time of year.

E. A final report shall be issued by the Soils Engineer attesting to the Contractor's conformance with these specifications.
II. SITE PREPARATION

A. All vegetation and deleterious material such as rubbish shall be disposed of offsite. This removal must be concluded prior to placing fill.

B. Soil, alluvium or rock materials determined by the Soils Engineer as being unsuitable for placement in compacted fills shall be removed and wasted from the site. Any material incorporated as a part of a compacted fill must be approved by the Soils Engineer.

C. After the ground surface to receive fill has been cleared, it shall be scarified, disced or bladed by the Contractor until it is uniform and free from ruts, hollows, hummocks or other uneven features which may prevent uniform compaction.

The scarified ground surface shall then be brought to optimum moisture, mixed as required, and compacted as specified. If the scarified zone is greater than twelve inches in depth, the excess shall be removed and placed in lifts restricted to six inches.

Prior to placing fill, the ground surface to receive fill shall be inspected, tested and approved by the Soils Engineer.

D. Any underground structures such as cesspools, cisterns, tunnels, septic tanks, wells, pipelines or others not located prior to grading are to be removed or treated in a manner prescribed by the Soils Engineer.

III. COMPACTED FILLS

A. Any material imported or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable by the Soils Engineer. Roots, tree branches and other matter missed during clearing shall be removed from the fill as directed by the Soils Engineer.
B. Rock fragments less than six inches in diameter may be utilized in the fill, provided:

1. They are not placed in concentrated pockets.

2. There is a sufficient percentage of fine-grained material to surround the rocks.

3. The distribution of the rocks is supervised by the Soils Engineer.

C. Rocks greater than six inches in diameter shall be taken offsite, or placed in accordance with the recommendations of the Soils Engineer in areas designated as suitable for rock disposal.

D. Material that is spongy, subject to decay, or otherwise considered unsuitable shall not be used in the compacted fill.

E. Representative samples of materials to be utilized as compacted fill shall be analyzed in the laboratory by the Soils Engineer to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material shall be conducted by the Soils Engineer as soon as possible.

F. Material used in the compacting process shall be evenly spread, watered, processed and compacted in thin lifts not to exceed six inches in thickness to obtain a uniformly dense layer. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Soils Engineer.

G. If the moisture content or relative density varies from that required by the Soils Engineer, the Contractor shall rework the fill until it is approved by the Soils Engineer.

H. Each layer shall be compacted to 90 percent of the maximum density in compliance with the testing method specified by the controlling governmental agency.
If compaction to a lesser percentage is authorized by the controlling governmental agency because of a specific land use or expansive soil conditions, the area to receive fill compacted to less than 90 percent shall either be delineated on the grading plan or appropriate reference made to the area in the soil report.

I. All fills shall be keyed and benched through all topsoil, colluvium, alluvium or creep material, into sound bedrock or firm material where the slope receiving fill exceeds a ratio of five horizontal to one vertical, in accordance with the recommendations of the Soils Engineer.

J. The key for side hill fills shall be a minimum of 15 feet within bedrock or firm materials, unless otherwise specified in the soils report.

K. Drainage terraces and subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency, or with the recommendations of the Soils Engineer.

L. The Contractor will be required to obtain a minimum relative compaction of 90 percent out to the finish slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment, or by any other procedure which produces the required compaction.

If a method other than overbuilding and cutting back to the compacted core is to be employed, slope tests will be made by the Soils Engineer during construction of the slopes to determine if the required compaction is being achieved. Where failing tests occur or other field problems arise, the Contractor will be notified of such conditions by written communication from the Soils Engineer in the form of a conference memorandum, to avoid any misunderstanding arising from oral communication.
If the method of achieving the required slope compaction selected by the Contractor fails to produce the necessary results, the Contractor shall rework or rebuild such slopes until the required degree of compaction is obtained, at no additional cost to the Owner or Soils Engineer.

M. All fill slopes should be planted or protected from erosion by methods specified in the soils report.

N. Fill-over-cut slopes shall be properly keyed through topsoil, colluvium or creep material into rock or firm materials; and the transition shall be stripped of all soil prior to placing fill.

IV. CUT SLOPES

A. If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature are encountered during grading, these conditions shall be analyzed by the Soils Engineer; and recommendations shall be made to treat these problems.

B. Unless otherwise specified in the soils report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.

C. Drainage terraces shall be constructed in compliance with the ordinances of controlling governmental agencies, or with the recommendations of the Soils Engineer.

V. GRADING CONTROL

A. Inspection of the fill placement shall be provided by the Soils Engineer during the progress of grading.

B. In general, density tests shall be made at intervals not exceeding two feet of fill height of every 500 cubic yards of fill placed. This criteria will vary
depending on soil conditions and the size of the job. In any event, an adequate number of field density tests shall be made to verify that the required compaction is being achieved.

C. Density tests shall also be made on the surface material to receive fill as required by the Soils Engineer.

D. All cleanout, processed ground to receive fill, key excavations, subdrains and rock disposal must be inspected and approved by the Soils Engineer prior to placing any fill. It shall be the Contractor's responsibility to notify the Soils Engineer when such areas are ready for inspection.

VI. CONSTRUCTION CONSIDERATIONS

A. Erosion control measures, when necessary, shall be provided by the Contractor during grading and prior to the completion and construction of permanent drainage controls.

B. Upon completion of grading and termination of inspections by the Soils Engineer, no further filling or excavating, including that necessary for footings, foundations, large tree wells, retaining walls, or other features shall be performed without the approval of the Soils Engineer.

C. Care shall be taken by the Contractor during final grading to preserve any berms, drainage terraces, interceptor swales, or other devices of a permanent nature on or adjacent to the property.
January 7, 1972
W.O. 127

Hawaiian Pacific Industries, Inc.
1020-E Keolu Drive
Kailua, Oahu, Hawaii

Attention: Mr. William Rus

Subject: Addendum #1 to Supplementary Soils Investigation
Kaopa Subdivision, Unit 1-B-1
Heeia, Koolaupoko, Oahu, Hawaii

Gentlemen:

We recommend that the following steps be taken for that portion of the site presently covered by the marsh area in order to place fill to the final proposed elevations.

1. Removal of all vegetation using either a clam shell or drag line and wasting the vegetation off site.

2. Removal of the upper five to six feet of soft black muck or to a depth as approved by the Soils Engineer as determined in the field.

3. Replacement of the excavated area with rock fill up to an elevation of approximately two feet above water level. From this elevation, imported fill shall be placed in thin lifts not exceeding six inches, watered as required to obtain optimum moisture content, and compacted to at least 90 percent of the maximum laboratory density.

Respectfully submitted,


Ernest K. Hirata
P.E. 2732
December 16, 1971

ISLAND CONSTRUCTION CO., INC.
1020 Ke'olau Drive
Kailua, Oahu, Hawaii 96734

ATTENTION: Mr. William Rus

Gentlemen:

RE: Kaopa Subdivision – Section 1-B-1
(Kaopa Park Site Subdivision)
Existing Fill

The existing fill in the above subdivision was constructed with on-site and borrow material. The fill was placed in thin layers and compacted. A soil technician from our office was present at the site on an intermittent basis to observe grading progress and to take density tests up to the approximate elevations shown on the compaction sheets.

A test location plan, a summary of the field density test results and laboratory test results are attached.

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.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

Wallace Wakahiro
Professional Engineer
Hawaii No. 2016
FIELD DENSITY TESTS REPORT
KACPA PARK SITE SUBDIVISION

Field Density Tests Results as following:

Ending AUGUST 26, 1971

<table>
<thead>
<tr>
<th>Date</th>
<th>Lot No.</th>
<th>ELEVATION **</th>
<th>Moisture Content</th>
<th>Dry Density*</th>
<th>Standard Density*</th>
<th>Relative Compaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.6.71</td>
<td>25</td>
<td>19' 31&quot;</td>
<td>29.9</td>
<td>85.9</td>
<td>92.0</td>
<td>93</td>
</tr>
<tr>
<td>5.6.71</td>
<td>22</td>
<td>23' 35&quot;</td>
<td>33.8</td>
<td>84.5</td>
<td>92.3</td>
<td>92</td>
</tr>
<tr>
<td>5.6.71</td>
<td>18</td>
<td>27' 33&quot;</td>
<td>39.0</td>
<td>82.0</td>
<td>86.2</td>
<td>95</td>
</tr>
<tr>
<td>5.25.71</td>
<td>5</td>
<td>9' 15&quot;</td>
<td>29.3</td>
<td>85.9</td>
<td>92.8</td>
<td>92</td>
</tr>
<tr>
<td>5.25.71</td>
<td>29</td>
<td>10' 15&quot;</td>
<td>33.8</td>
<td>83.9</td>
<td>92.0</td>
<td>91</td>
</tr>
<tr>
<td>5.25.71</td>
<td>8</td>
<td>13'</td>
<td>29.0</td>
<td>81.8</td>
<td>95.3</td>
<td>94</td>
</tr>
<tr>
<td>5.27.71</td>
<td>31</td>
<td>11' 23&quot;</td>
<td>24.3</td>
<td>92.5</td>
<td>95.3</td>
<td>97</td>
</tr>
<tr>
<td>5.27.71</td>
<td>ROADWAY NEXT TO 4</td>
<td>12' 4&quot;</td>
<td>33.4</td>
<td>85.9</td>
<td>92.0</td>
<td>93</td>
</tr>
<tr>
<td>5.27.71</td>
<td>7</td>
<td>13'</td>
<td>29.6</td>
<td>84.9</td>
<td>92</td>
<td></td>
</tr>
<tr>
<td>5.27.71</td>
<td>27</td>
<td>13'</td>
<td>23.0</td>
<td>94.4</td>
<td>95.3</td>
<td>99</td>
</tr>
<tr>
<td>5.27.71</td>
<td>26</td>
<td>17' 11&quot;</td>
<td>23.0</td>
<td>98.1</td>
<td>92.0</td>
<td>96</td>
</tr>
<tr>
<td>5.27.71</td>
<td>25</td>
<td>22' 33&quot;</td>
<td>19.1</td>
<td>87.7</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>5.27.71</td>
<td>20</td>
<td>26' 22&quot;</td>
<td>22.1</td>
<td>97.7</td>
<td>92.8</td>
<td>94</td>
</tr>
</tbody>
</table>

* Density in pounds per cubic foot. Standard density refers to density as indicated by the AASHO Method, T-180-57.

** Depth below finish grade.

1 Indicates Test__ taken in the Lot__ shown.

BY S. Kam
FIELD DENSITY TESTS REPORT

KAOPA PARK SITE SUBDIVISION

Field Density Tests Results as following:

<table>
<thead>
<tr>
<th>Date</th>
<th>Lot No.</th>
<th>ELEVATION</th>
<th>Moisture Content</th>
<th>Dry Density*</th>
<th>Standard Density*</th>
<th>Relative Compaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-28-71</td>
<td>4 1</td>
<td>16½' 17'</td>
<td>26.3</td>
<td>88.5</td>
<td>92.9</td>
<td>96</td>
</tr>
<tr>
<td>6-29-71</td>
<td>6 1</td>
<td>17½</td>
<td>30.1</td>
<td>85.9</td>
<td>92.0</td>
<td>93</td>
</tr>
<tr>
<td>6-29-71</td>
<td>7 2</td>
<td>17½</td>
<td>26.0</td>
<td>91.3</td>
<td>92.8</td>
<td>98</td>
</tr>
<tr>
<td>6-29-71</td>
<td>9 1</td>
<td>20½</td>
<td>26.4</td>
<td>81.8</td>
<td>92.0</td>
<td>96</td>
</tr>
<tr>
<td>6-29-71</td>
<td>11 1</td>
<td>22½ 13</td>
<td>29.0</td>
<td>84.4</td>
<td>92.3</td>
<td>92</td>
</tr>
<tr>
<td>6-29-71</td>
<td>21 2</td>
<td>165½ 25'</td>
<td>27.9</td>
<td>89.4</td>
<td>90.8</td>
<td>95</td>
</tr>
<tr>
<td>6-29-71</td>
<td>29 2</td>
<td>165½ 25'</td>
<td>27.3</td>
<td>84.4</td>
<td>92.6</td>
<td>91</td>
</tr>
<tr>
<td>6-29-71</td>
<td>27 2</td>
<td>18½</td>
<td>31.5</td>
<td>87.7</td>
<td>95.0</td>
<td>94</td>
</tr>
<tr>
<td>6-29-71</td>
<td>26 2</td>
<td>19½</td>
<td>22.8</td>
<td>89.5</td>
<td>95.3</td>
<td>94</td>
</tr>
<tr>
<td>6-30-71</td>
<td>12 1</td>
<td>23½</td>
<td>24.7</td>
<td>93.0</td>
<td>92.0</td>
<td>7100</td>
</tr>
<tr>
<td>6-30-71</td>
<td>14 1</td>
<td>25½</td>
<td>31.5</td>
<td>89.0</td>
<td>96.0</td>
<td>93</td>
</tr>
<tr>
<td>6-30-71</td>
<td>21 1</td>
<td>25½ 35½'</td>
<td>27.5</td>
<td>90.9</td>
<td>93.2</td>
<td>98</td>
</tr>
<tr>
<td>6-30-71</td>
<td>16 1</td>
<td>26½</td>
<td>36.2</td>
<td>85.8</td>
<td>92.3</td>
<td>93</td>
</tr>
<tr>
<td>6-30-71</td>
<td>19 1</td>
<td>27½</td>
<td>27.6</td>
<td>91.9</td>
<td>93.2</td>
<td>99</td>
</tr>
<tr>
<td>6-30-71</td>
<td>17 1</td>
<td>29½</td>
<td>25.3</td>
<td>90.8</td>
<td>93.8</td>
<td>97</td>
</tr>
<tr>
<td>6-30-71</td>
<td>18 2</td>
<td>31½ 33½'</td>
<td>25.2</td>
<td>92.9</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

* Density in pounds per cubic foot. Standard density refers to density as indicated by the AASHO Method, T-180-57.

** Depth below finish grade.

(1) Indicates Test#1 taken in the lot shown.

BY S. KAM
FIELD DENSITY TESTS REPORT

KAOPA PARK SITE SUBDIVISION

Field Density Tests Results as following:

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<tr>
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<th>Dry Density*</th>
<th>Standard Density*</th>
<th>Relative Compaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-18-71</td>
<td>1 (2)</td>
<td>14½</td>
<td>28.7</td>
<td>85.4</td>
<td>95.3</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>4 (2)</td>
<td>17½</td>
<td>21.6</td>
<td>83.3</td>
<td>&quot;</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td>8 (2)</td>
<td>19½</td>
<td>27.6</td>
<td>80.3</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>11 (2)</td>
<td>23½</td>
<td>30.5</td>
<td>82.3</td>
<td>&quot;</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>15 (1)</td>
<td>26½ 1/2</td>
<td>20.5</td>
<td>85.9</td>
<td>&quot;</td>
<td>90</td>
</tr>
<tr>
<td>8-19-71</td>
<td>4 (3)</td>
<td>17½</td>
<td>20.7</td>
<td>84.7</td>
<td>95.3</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td>11 (3)</td>
<td>26½</td>
<td>26.3</td>
<td>86.7</td>
<td>&quot;</td>
<td>91</td>
</tr>
<tr>
<td>8-24-71</td>
<td>14 (2)</td>
<td>27½</td>
<td>13.8</td>
<td>104.2</td>
<td>105.0</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>17 (2)</td>
<td>30½</td>
<td>17.3</td>
<td>108.5</td>
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<td>7.100</td>
</tr>
<tr>
<td>8-26-71</td>
<td>2 (2)</td>
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<td>18.3</td>
<td>97.9</td>
<td>95.3</td>
<td>7.100</td>
</tr>
<tr>
<td></td>
<td>4 (2)</td>
<td>16½ 17'</td>
<td>70.9</td>
<td>94.7</td>
<td>&quot;</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td>6 (2)</td>
<td>18½</td>
<td>22.0</td>
<td>95.6</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>9 (2)</td>
<td>20½</td>
<td>26.6</td>
<td>94.0</td>
<td>&quot;</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>12 (2)</td>
<td>24½ 1/2</td>
<td>30.0</td>
<td>88.1</td>
<td>&quot;</td>
<td>92</td>
</tr>
</tbody>
</table>

* Density in pounds per cubic foot. Standard density refers to density as indicated by the AASHO Method, T-180-57.

** Depth below finish grade.

(1) Indicates Test #2 taken in the Lot shown.

BY

[Signature]
### TABLE I - SUMMARY OF LABORATORY TEST RESULTS

<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>SAMPLE NO.</th>
<th>DEPTH BELOW SURFACE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**DESCRIPTION**
- Dark Gray Organic Clay
- Gray Clay W/Sand
- Gray Clay W/Precipitated Rock

**GRAIN-SIZE ANALYSIS (％ Passing)**

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percentage Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot;</td>
<td></td>
</tr>
<tr>
<td>1/2&quot;</td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td></td>
</tr>
<tr>
<td>#10</td>
<td></td>
</tr>
<tr>
<td>#20</td>
<td></td>
</tr>
<tr>
<td>#40</td>
<td></td>
</tr>
<tr>
<td>#100</td>
<td></td>
</tr>
<tr>
<td>#200</td>
<td></td>
</tr>
</tbody>
</table>

**ATTERBERG LIMITS**
- Air Dried or Natural
- Liquid Limit
- Plastic Limit
- Plasticity Index
- Dilatancy
- Toughness
- Dry Strength

**UNIFIED SOIL CLASSIFICATION**

**APPARENT SPECIFIC GRAVITY**

**EXPANSION AND CBR TESTS**
- (Surcharge-51 P.S.F.)
- Molding Moisture, ％
- Molding Dry Density, P.C.F.
- Swell upon saturation, ％
- CBR at 0.1" Penetration

**MOISTURE-DENSITY RELATIONS OF SOILS**
- (AASHO T-180-57 Method)
- Dry to Wet or Wet to Dry
- Max. Dry Density (P.C.F.)
- Optimum Moisture (％)

**REMARKS:**

**Date** 9-28-71 **By** SK
PLASTICITY CHART

PROJECT: KAOPA PARK SITE SUBDIVISION
LOCATION: HEEIA, OAHU, HAWAII

PLASTICITY INDEX

LIQUID LIMIT

CL-

ML

MH & OH

CH

"A" LINE

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

DATE 7-14-71
BY ST