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REPORT

TO

KAISER HAWAII KAI DEVELOPMENT COMPANY

HONOLULU, HAWAII

SOIL EXPLORATION FOR RESIDENTIAL DEVELOPMENT

HAWAII KAI MARINA SUBDIVISION UNIT 3

AND EXTENSION OF HAWAII-KAI DRIVE

HAWAII KAI, MAUNALUA, OAHU, HAWAII

By

WALTER LUM ASSOCIATES, INCORPORATED

CIVIL ENGINEERS

May 20, 1966

MUNICIPAL REFERENCE & RECORDS CENTER  
City & County of Honolulu  
City Hall Annex, 305 S. King Street  
Honolulu, Hawaii 96813

**WALTER LUM ASSOCIATES, INC.**

**CIVIL, STRUCTURAL, SOILS ENGINEERS**

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May 20, 1966

KAISER HAWAII KAI DEVELOPMENT CO.  
P. O. Box 2997  
Honolulu, Hawaii 96802

Gentlemen:

Subject: Hahaione Marina Subdivision Unit 3  
and Extension of Hawaii-Kai Drive  
Chapter 23, Revised Ordinances of  
Honolulu, 1961 As Amended

In accordance with your request, an exploration was made of the underlying soil conditions at the proposed residential development site for the Hahaione Marina Subdivision Unit 3 and Extension of Hawaii-Kai Drive at Hawaii Kai, Maunaloa, Oahu, Hawaii.

The field explorations and laboratory test results indicate that the area is suitable for residential housing development. Houses can be supported either directly on the existing soils or on properly compacted fills constructed from suitable existing soils or borrow material.

Unforeseen or undetected conditions such as soft spots or seepage may preclude our findings in localized areas. These situations will have to be adjusted in the field as they are detected. All earthwork should be done in accordance with the requirements of Chapter 23, Revised Ordinances of Honolulu, 1961 As Amended and the recommendations contained herein.

It is anticipated that some settlements may occur where soft underlying soil formations are indicated by the borings and soundings. It is recommended that level readings be taken after fills are placed to determine when movements become negligible. Building construction should be delayed as long as possible.

The accompanying report includes a boring location plan, logs of the subsurface explorations, laboratory test results and recommendations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.



Ezra Koike  
Registered Engineer No. 1450

EK:es

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**REPORT**  
**ON**  
**SOIL EXPLORATION FOR RESIDENTIAL DEVELOPMENT**  
**HAWAII KAI MARINA SUBDIVISION UNIT 3**  
**AND EXTENSION OF HAWAII-KAI DRIVE**  
**HAWAII KAI, MAUNALUA, OAHU, HAWAII**

**SCOPE OF EXPLORATION**

The purpose of this exploration was to determine the general suitability of the proposed site, Hawaii Kai Marina Subdivision Unit 3 and Extension of Hawaii-Kai Drive at Hawaii Kai, Maunaloa, Oahu, Hawaii, for residential housing construction.

This report includes field explorations, laboratory tests and recommendations regarding the existing soils at the site.

**FIELD EXPLORATIONS**

A series of seven test borings and two continuous penetration tests were made at the site. The locations of these borings and penetration tests are shown on the Boring Location Plan. Descriptions of the underlying soils are shown on the Boring Logs Nos. 1 thru 9. Both disturbed and exploratory thin wall tube drive samples were collected during the boring operations.

Soil samples were visually identified and tentatively classified in the field. In the laboratory, these samples were further subjected to appropriate tests. The field identifications and classifications were then reviewed and modified to conform with the results of the laboratory tests in accordance with the "Unified Soil Classification System".

#### LABORATORY TESTS

Laboratory tests included: in-place natural density, moisture content and unconfined compression; Atterberg limits; specific gravity; gradation; AASHTO T-180-57 density; expansion and C. B. R.

A list of the standard field and laboratory tests used for this project is attached.

A summary of the results of the laboratory tests is given in Table A.

#### SOIL CONDITIONS

In general, the project site is fairly level. The remainder of the site is partly overgrown with shrubs and tall grass. Stockpiled earth and boulders were visible over portions of the site. Dredging operations were in progress in the channel adjacent to the project site.

In general, the borings indicated varying surface layers of medium to stiff clays and silty clays underlain by a thin layer (3' to 5') of soft to medium clayey silts or organic clay. Beneath the soft layer was loose clayey sand at Borings Nos. 1, 2 and 6 and loose to medium dense coral or sand at Borings Nos. 3 and 7. Ground water was generally encountered from 6' to 10' below the ground surface.

## ROADWAYS

Adjustments regarding subbase requirements can be made in the field depending on the material at subgrade level.

The design standards of the City and County of Honolulu require the following:

- (1) A 6-inch base course on 6 inches of compacted existing soil where the expansion of the existing soil is less than 1%.
- (2) A 6-inch base course on a 6-inch subbase of select material where the expansion of the existing soil is greater than 1% and less than 3%.
- (3) A 6-inch base course and a 4-inch select borrow subbase course on a 12-inch subbase of select material where the expansion of the existing soil is greater than 3% and less than 6%.

## FILLS

The in-place strengths of the soils are generally adequate to support the proposed low fills and light buildings.

For the construction of fills, the following is recommended:

- (1) All stockpiled material and boulders should be removed down to stiff ground before the placement of any fills over the area.

- (2) All loose topsoil should be stripped down to stiff ground or scarified and recompacted before the placement of any fills over the area.
- (3) All hard surfaces along existing haul roads and areas affected by dredging operations should be stripped down to stiff soils or scarified and recompacted to match the densities of the surrounding soils.

It is essential that all fills be constructed and compacted according to Chapter 23, Revised Ordinances of Honolulu, 1961 As Amended and the "Proposed Specification for Earthwork" attached hereto.

#### UNDERGROUND UTILITIES

The underground utilities and structure should be installed after the fills are completed. It is recommended that flexible joints be used in this area, especially at the connection of lines to structure.

All subsurface construction, especially those involving dewatering operations, should be completed prior to building surface structures. Future excavation and dewatering operations should be done with extreme care.

## FOUNDATIONS

Construction of residential structures on fills should be delayed until:

- (1) The utilities are in place.
- (2) The settlement readings indicate that much of the construction settlement has taken place.
- (3) The estimated remaining settlement can be tolerated according to limits defined by the designer for the structures and utilities.

### Bearing Values

Bearing values for a given soil usually vary with the size and depth of the footings. For light residential structures placed directly on compacted fill, safe bearing values of about 1500 p.s.f. may be used for either slab-on-ground construction or post-and-beam construction with individual block footings.

### Post-And-Beam Construction

For post-and-beam construction, it is recommended that the bottom of concrete footing blocks be carried down about 12 inches below finish grades. Good surface drainage away from the foundation areas is essential.

### Slab-On-Ground Construction

For slab-on-ground construction, the floor slab should be laid on a 4-inch layer of select material, properly compacted. Good surface drainage away from the foundation area is essential.



PROPOSED SPECIFICATION FOR EARTHWORK

HAAHAI KAI MARINA SUBDIVISION UNIT 3

AND EXTENSION OF HAWAII-KAI DRIVE

General Description

This item shall consist of all clearing and grubbing, removal of existing structures, preparation of land to be filled, filling of the land, spreading, compaction and testing of the fill, and all subsidiary work necessary to complete the grading of the filled areas to conform with the lines, grades and slopes as shown on the accepted plan.

Clearing, Grubbing and Preparing Areas to be Filled

All stockpiled earth and boulders, brush and other rubbish shall be removed, piled and burned or otherwise disposed of so as to leave the areas that have been disturbed with a neat and finished appearance free from unsightly debris.

All vegetable matter shall be removed from the surface upon which the fill is to be placed. All loose topsoil shall be stripped to stiff natural ground before the placement of any fills over the area. All loose topsoil encountered at finish grades shall be removed and recompacted.

Materials

Fill material shall consist of on-site or off-site soil which is approved by the Soils Engineer. The soils shall contain not more than a trace of organic matter and shall contain no particles larger than 6 inches in diameter. In addition, it shall contain not more than 40% gravel (#4 x 3") and not more than 10% cobbles larger than gravel and smaller than 6 inches in diameter. Fill material placed in the top two feet of fills shall contain not more than 30% gravel (#4 x 3"), and it shall

contain no material larger than gravel.

Placing, Spreading and Compacting Fill Material

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

No rocks or cobbles shall be allowed to nest and all voids between rocks must be carefully filled with small stones or earth and properly compacted.

When the moisture content of the fill material is below that specified by the Soils Engineer, water shall be added until the moisture content is as specified to assure thorough bonding during the compacting process.

When the moisture content of the fill material is above that specified by the Soils Engineer, the fill material shall be aerated by blading or other satisfactory methods until the moisture content is as specified.

After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to not less than ninety percent (90%) of maximum density in accordance with AASHTO Test No. T-180-57 or other density tests which will obtain equivalent results. Compaction shall be with sheepfoot rollers, multiple-wheel pneumatic-tired rollers or other types of acceptable rollers. Rollers shall be such design that they will be able to compact the fill to the specified density. Rolling shall be accomplished while the fill material is at the specified moisture content.

Rolling of each layer shall be continuous over its entire area and the roller shall make sufficient passes to insure that the desired density has been obtained. .

Field density tests shall be made by the Soils Engineer of the compaction of each layer of fill. Density tests may be made at intervals not exceeding two feet (2') of fill height provided all layers are tested. Where sheepfoot rollers are used, the soil may be disturbed to a depth of several inches. Density reading shall be taken in the compacted material below the disturbed surface, and as often as necessary, as determined by the Soils Engineer. When these readings indicate that the density of any layer of fill or portion thereof is below the required ninety percent (90%) density, the particular layer or portion shall be reworked until the required density has been obtained.

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

#### Soil Engineering Services

The Soils Engineer shall observe the filling and compacting operations and make necessary tests in accordance with the guide specifications.

#### Rainy Weather

No fill material shall 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 by the Soils Engineer indicate that the moisture content and density of the fill are as previously specified.

PROPOSED SPECIFICATION FOR BASE COURSE

Materials

The base course for use under floor slabs shall consist of clean crushed rock, gravel, coral, cinders or other material as approved by the Soils Engineer. It shall be free from adobe, organic matter, and other such deleterious substances.

Grading

The base course material shall conform to the following gradations:

<u>Sieve</u>	<u>% Passing</u>
2" Sq.	100%
#4	0

Compacting

The base course material shall be thoroughly compacted with vibratory and/or pneumatic tools.