RETENTION POND FOR FOREMOST FARMS
PRELIMINARY SOIL EXPLORATION REPORT

WAUMANALO, OAHU, HAWAII
TAX MAP KEY: 4-1-08

FOR REFERENCE
not to be taken from this room.

To:
AUSTIN, SMITH & ASSOCIATES, INCORPORATED

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
November 19, 1971

MUNICIPAL REFERENCE & RECORDS CENTER
City & County of Honolulu
City Hall Annex, 558 S. King Street
Honolulu, Hawaii 96813

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NOV. 19 1971
AUSTIN, SMITH & ASSOCIATES, INC.
November 19, 1971

AUSTIN, SMITH & ASSOCIATES, INC.
745 Fort Street, Suite 900
Honolulu, Hawaii 96813

Gentlemen:

Subject: Retention Pond for Foremost Farms
Waimanalo, Oahu, Hawaii
Tax Map Key: 4-1-08
Preliminary Soil Exploration

As requested, soil explorations were conducted to determine general soil conditions for the design of a berm for the proposed Retention Pond at Foremost Farms in Waimanalo, Oahu, Hawaii.

GENERAL SITE CONDITIONS

The proposed retention pond site is situated in a swale or shallow drainageway that slopes down toward the north at about 3% gradient.

The floor of the drainageway is fairly level with a surface layer of soft organic silts. Side slopes about 18 to 20 ft in height at about 20 to 25% gradient rise up to adjacent access roads along the east and west sides.

Wash water from cattle pens was flowing into the site from the south end at the time of the field explorations.

INTERPRETATION OF SOIL CONDITIONS

From the field explorations and laboratory test results, the soils may be generally described as follows:

A surface layer of about 1/2 ft to 1-1/2 ft or more of soft organic silts along the floor of the drainageway underlain by medium silty clays to about 13 to 19-ft depths followed by stiffer silty clays to 15 to 22 ft, the depths drilled.
Pockets of clay and decomposed rocks may be interspersed in the silty clay layers.

Water was noted in the borings at about 2 to 4.5-ft depths during the field explorations.

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

**DISCUSSION AND RECOMMENDATIONS**

The present plan is to construct a 15-ft high berm across the north end (low side) of a swale to create a retention pond on the grounds of Foremost Farms in Waimanalo.

Wash water from the cattle pens will be discharged into the pond. The waste water will then be pumped periodically from the pond into open pasture areas.

In general, the berm is to be constructed with on-site soils that will be excavated from the central area of the pond.

**Slopes for Retention Pond**

For the design of unlined earth slopes for the retention pond at the site, the following slopes are recommended:

- **Downstream slope of berm**: 3 horizontal to 1 vertical assuming internal drainage of the berm is provided.
- **Upstream slope of berm**: 6 horizontal to 1 vertical.
- **Side slopes inside of pond (excluding berm)**: 3 horizontal to 1 vertical assuming that the slopes will require some maintenance and repair wherever a slough occurs.
Site Grading

Some guidelines for grading follow:

1. The site should be cleared and grubbed. Surface vegetation and miscellaneous debris should be removed from the site.

2. Loose surface soils should be stripped from the berm area. Soft pockets should be excavated and backfilled with compacted select on-site soils to match the surrounding ground.

3. The subgrade should be compacted and shaped to drain before the start of berm construction.

4. A blanket of filter rock should be placed below the outer half of the berm with a vertical drainage path placed in the center of the berm. See Figure 1.

5. The berm may be constructed with select on-site soils from the pond excavation. In general, the surface layers of organic soils should be removed and the subsoils used for the construction of the berm.

   The outer shell of the upstream slope of the berm that is flatter than 3 to 1 slope may be constructed with the organic on-site material except that highly organic material such as grass and roots should be wasted.

6. Fills should be constructed in approximately level layers starting at the lower end and working upward.

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.
Overflow Line

The backfill around the overflow line should be well compacted. Concrete collars should be used around the overflow pipe to minimize possible internal erosion of the backfill around the pipe.

The inlet, outlet and spillway sections should be lined with boulders. There should be a layer of filter rock between the natural soil and the boulder lining.

Maintenance

The inlets, outlets, berm and ponding basin should be maintained and repaired periodically, particularly before and after rainstorms.

Unforeseen Conditions

Unforeseen conditions such as soft spots or seepage water may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.

Attached are the boring logs, laboratory test results, limitations and a Boring Location Plan.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

Ezra Koike
Professional Engineer
Hawaii No. 1450
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:** RETENTION POND FOR FOREMOST FARMS

**LOCATION:** Waimanalo, Oahu, Hawaii

**Tax Map Key:** 4-1-08

**HAMMER:**
- **Weight:** 140 lbs
- **Drop:** 30" (102")

**DRILL BIT:** T.C. DRAG

**WATER LEVEL:** 2.5'

**TIME:** 2:50 PM

**DATE:** 11/1/71

**LOCATION:** Waimanalo, Oahu, Hawaii

**PARTY:** MAESHIRO, RADOVICH, KAKU

**Boring Log Details:**

<table>
<thead>
<tr>
<th>Depth (Ft.)</th>
<th>Plastic Limit</th>
<th>Liquid Limit</th>
<th>Unconf. Comp.</th>
<th>P.S.F.</th>
<th>Penetration Test</th>
<th>2&quot; O.D. Thin Wall Tube Sampler</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
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<td>3/5 3/5</td>
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<tr>
<td>10</td>
<td>51 53 81</td>
<td>3000 1900</td>
<td>2800 1800</td>
<td>3/5 4/5</td>
<td></td>
<td>3/5 4/5</td>
</tr>
<tr>
<td>15</td>
<td>39 45 77</td>
<td>4400 1900</td>
<td>3/5 10/5</td>
<td></td>
<td></td>
<td>3/5 10/5</td>
</tr>
</tbody>
</table>

**ELEV. 102' ± 2**

**DESCRIPTION:**
- MEDIUM, MOTTLED BROWN SILTY CLAY W/ROOTS & DECOMPOSED ROCK
- MEDIUM, MOTTLED BROWN SILTY CLAY W/GRAY CLAY & DECOMPOSED ROCK
- STIFF, MOTTLED BROWN SILTY CLAY W/TRACES OF GRAY, CLAY & DECOMPOSED ROCK

**END OF BORING @ 16'**

*ELEVATION ESTIMATED FROM "RETENTION POND PLAN" DATED 9/1/71*
**Boring Log**

**PROJECT**  RETENTION POND FOR FOREMOST FARMS

**LOCATION**  Waimanalo, Oahu, Hawaii

**Tax Map Key:**  4-1-08

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

**BORING NO.**  2

**Driller:**  W. LUM ASSOCIATES, INC.
**Date:**  OCT 23, 1971

**Drill Bit:**  T.C. DRAG

**LOCATION**  RETENTION POND FOR FOREMOST FARMS

**BORING NO.**  W. LUM ASSOCIATES, INC.
**Date:**  OCT 23, 1971

**Field Party:**  SUZUKI, RADOVICH

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

**T.C. DRAG**

**Elev.**  9' + 2

**Water Level**  1' 9"

**Time**  8:30 AM

**Date**  10-23-71

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### PENETRATION DATA

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<td>MEDIUM TO STIFF MOTTLED BROWN CLAYEY Silt VITRACES OF DECOMPOSED ROCK</td>
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<td>2.5</td>
<td>2-A</td>
<td>45</td>
<td>58</td>
<td>100</td>
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<td>-</td>
<td>40 BLOWES/0.5</td>
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<tr>
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<td>5</td>
<td>2.5</td>
<td>2-B</td>
<td>42</td>
<td>50</td>
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<td>2600</td>
<td>700</td>
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<td>(CH)</td>
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<td>-</td>
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<td>-</td>
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<tr>
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<td>- END OF BORING</td>
<td>15</td>
<td>2-D</td>
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<td>4480</td>
<td>1000</td>
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*ELEVATION ESTIMATED FROM "RETENTION POND PLAN" DATED 9/1/71*
**Boring Log**

**PROJECT:** RETENTION POND FOR FOREMOST FARMS  
**LOCATION:** Waimanalo, Oahu, Hawaii  
**Tax Map Key:** 4-1-08

**HAMMER:**
- **Weight:** 140 lbs  
- **Drop:** 30"  
- **2-5/8" - 2" O.D. THIN WALL TUBE**  
- **4-5/8" - 2" STANDARD SPLIT SPOON**

**Other Information:**
- **Type of Boring:** AUGER(MOBILE) diam. 3"  
- **Elev. 92'+**  
- **Datum:**  
- **Drill Bit:** T.C. DRAG  
- **Water Level:** 5.2'  
- **Time:** 4:00 PM  
- **Date:** 10-28-71

### PENETRATION DATA

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<th>Unified Soil Classification</th>
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<th>ELEV. = 92'+</th>
<th>Depth (ft)</th>
<th>Sample No.</th>
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<th>Liquid Limit</th>
<th>Unconf. Comp.</th>
<th>P.S.E.</th>
<th>P.S.E.</th>
<th>N (Blows per foot)</th>
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<tbody>
<tr>
<td>(MH)</td>
<td>STIFF, MOTTLED BROWN CLAYEY Silt w/ traces of GRAY, CLAY</td>
<td>2'5.5</td>
<td>3-A</td>
<td>27</td>
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<td>100</td>
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<tr>
<td>(MH)</td>
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<td>10</td>
<td>2'5</td>
<td>3-B</td>
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<td>160</td>
<td>500</td>
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<td>3-D</td>
<td>55</td>
<td>340</td>
<td>1100</td>
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*ELEVATION ESTIMATED FROM "RETENTION POND PLAN" DATED 9/1/71*
### Boring Log

**PROJECT:** RETENTION POND FOR FOREMOST FARMS  
**LOCATION:** Waimanalo, Oahu, Hawaii  
**Driller:** W. LUM ASSOC., INC.  
**Date:** OCT. 29, 1971  
**Type of Boring:** AUGER/DRILL (MINIMUM)  
**Drill Bit:** T.C. DRAG

<table>
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<th>DESCRIPTION</th>
<th>Depth (ft)</th>
<th>Sampler</th>
<th>Plastic Unit</th>
<th>Water Cont.</th>
<th>Liquid Unit</th>
<th>Unconf. Comp.</th>
<th>P.S.F.</th>
<th>Vane Shear</th>
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<tr>
<td>MEDIUM TO STIFF MOTTLED BROWN CLAYLY Silt w/ Roots</td>
<td>2'5</td>
<td>4-A</td>
<td>48</td>
<td>65</td>
<td>93</td>
<td>-</td>
<td>-</td>
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<tr>
<td>SOFT, GRAY-BROWN SILTY CLAY, &amp; TRACES OF DECOMPOSED ROCK</td>
<td>2'5</td>
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<td>48</td>
<td>65</td>
<td>93</td>
<td>-</td>
<td>-</td>
<td></td>
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<tr>
<td>MEDIUM TO STIFF MOTTLED BROWN SILTY CLAY, &amp; TRACES OF DECOMPOSED ROCK &amp; GRAY, CLAY POKETS</td>
<td>2'5</td>
<td>4-C</td>
<td>48</td>
<td>65</td>
<td>93</td>
<td>-</td>
<td>-</td>
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<tr>
<td>STIFF, MOTTLED BROWN &amp; GRAY, CLAY &amp; DECOMPOSED ROCK</td>
<td>2'5</td>
<td>4-D</td>
<td>41</td>
<td>69</td>
<td>101</td>
<td>1900</td>
<td>1200</td>
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**END OF BORING @ 21.5'**

* ELEVATION ESTIMATED FROM "RETENTION POND PLAN" DATED 9/1/71

**Penetration Data**

<table>
<thead>
<tr>
<th>Standard Penetration Test</th>
<th>2&quot; O.D. THIN WALL TUBE SAMPLER</th>
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<tbody>
<tr>
<td>N (Blows per foot)</td>
<td>0 10 20 30 40 BLOWS/0.5'</td>
</tr>
</tbody>
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**Notes:**
- Water Level: 3.5'
- Time: 11:30 AM
- Date: 10-29-71
# Boring Log

**Project:** Retention Pond for Foremost Farms  
**Location:** Waimanalo, Oahu, Hawaii  
**Tax Map Key:** 4-1-08

---

### Hammer:
- **Weight:** 140 lbs
- **Drop:** 3.0"  

### Sampler:
- **2" - 2" O.D. Thin Wall Tube**  
- **2.5" - 2" Standard Split Spoon**

---

### Penetration Data

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<th>Drift No.</th>
<th>Diameter</th>
<th>Depth (ft)</th>
<th>B/A</th>
<th>Plastic Limit (%)</th>
<th>Liquid Limit (%)</th>
<th>Unconf. Comp.</th>
<th>P.S.F.</th>
<th>Penetration Test (Blows per foot)</th>
<th>N</th>
<th>10</th>
<th>20</th>
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<th>Blows/0.5</th>
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<td></td>
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<td>3</td>
<td>0</td>
<td>10</td>
<td>30</td>
<td>40</td>
<td>3/5 4/5</td>
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**Elevation Estimated from "Retention Pond Plan" Dated 9/1/71**

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**Notes:**
- **Date:** 11-1-71  
- **Time:** 11:30 AM  
- **Drill Bit:** T.C. DRAG  
- **Water Level:** 4.5'

---

**Locations:**
- **Waimanalo, Oahu, Hawaii**
# Table I.A - Summary of Laboratory Test Results

| BORING NO. | 1 | 1 | 2 |
| SAMPLE NO. | 0 | 0 | SURFACE |
| DEPTH BELOW SURFACE | 5'-6' | 15'-16' | BROWN & GRAY ORGANIC Silt w/GRASS |
| DESCRIPTION | MOTTED BROWN SILTY CLAY | MOTTED BROWN SILTY CLAY & DECOMP. ROCK | TRACES OF GRY CLAY & DECOMP. ROCK |

## Grain-Size Analysis (% Passing)

<table>
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<th>Sieve</th>
<th>1&quot;</th>
<th>1/2&quot;</th>
<th>#4</th>
<th>#10</th>
<th>#20</th>
<th>#40</th>
<th>#100</th>
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## Atterberg Limits

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<th>Air Dried or Natural</th>
<th>Natural</th>
<th>Natural</th>
<th>Natural</th>
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<td>Liquid Limit</td>
<td>87</td>
<td>77</td>
<td>85</td>
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<td>Plastic Limit</td>
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<td>Plasticity Index</td>
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<table>
<thead>
<tr>
<th>Dilatancy</th>
<th>NONE-SLOW</th>
<th>NONE-SLOW</th>
<th>MEO-QUICK</th>
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<tr>
<td>Toughness</td>
<td>MEO-HIGH</td>
<td>MEO-HIGH</td>
<td>MEO-HIGH</td>
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<tr>
<td>Dry Strength</td>
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## Unified Soil Classification

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## Apparent Specific Gravity

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## 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 11-18-71 By BT.
TABLE II - SUMMARY OF LABORATORY TEST RESULTS

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<th>BORING NO.</th>
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<th>4</th>
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<tr>
<td>SAMPLE NO.</td>
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</tr>
<tr>
<td>DEPTH BELOW SURFACE</td>
<td>0.5'-2'</td>
<td>5'-6'</td>
<td>0.5'-2'</td>
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<tr>
<td>DESCRIPTION</td>
<td>MOTTLED BROWN</td>
<td>MOTTLED SIENNA CLAY</td>
<td>MOTTLED BROWN</td>
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<td></td>
<td>CLAYENY SILT</td>
<td>WUDERCOMP. ROCK</td>
<td>CLAYENY SILT</td>
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<tr>
<td></td>
<td>MOTTLED DECOMP. ROCK</td>
<td>POKETS</td>
<td>WUDEERSTE</td>
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**GRAIN-SIZE ANALYSIS**  
(% Passing)

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<th>1/2&quot;</th>
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**ATTERBERG LIMITS**

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

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<tr>
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<td>51</td>
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<tr>
<td>SLOW-MED</td>
<td>SLOW-MED</td>
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<tr>
<td>MEDIUM</td>
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<td>MEDIUM</td>
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**UNIFIED SOIL CLASSIFICATION**

| MH | MH | MH |

**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 11-18-71 By BT
### Table I.C. - 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'</td>
<td>MOTTLED BROWN &amp; GRAY CLAY, WITH DECUMPO ROCK &amp; GRAY CLAY POCKETS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15'-16'</td>
<td>MOTTLED BROWN &amp; GRAY CLAY</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10'-11'</td>
<td>BROWN &amp; GRAY CLAY</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grain-Size Analysis (% Passing)</th>
<th>Sieve</th>
<th>1&quot;</th>
<th>1/2&quot;</th>
<th>#4</th>
<th>#10</th>
<th>#20</th>
<th>#40</th>
<th>#100</th>
<th>#200</th>
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<tr>
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<td>0%</td>
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<td>10%</td>
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<thead>
<tr>
<th>Atterberg Limits</th>
<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>
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<tbody>
<tr>
<td></td>
<td>Natural</td>
<td>85</td>
<td>46</td>
<td>48</td>
<td>NONE</td>
<td>MEDIUM-HIGH</td>
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<tr>
<td></td>
<td>Natural</td>
<td>101</td>
<td>41</td>
<td>60</td>
<td>SLOW-MED.</td>
<td>MEDIUM-HIGH</td>
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<tr>
<td></td>
<td>Natural</td>
<td>83</td>
<td>35</td>
<td>48</td>
<td>NONE</td>
<td>HIGH</td>
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<thead>
<tr>
<th>Unified Soil Classification</th>
<th>MH</th>
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<th>CH</th>
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<table>
<thead>
<tr>
<th>Apparent Specific Gravity</th>
<th>MH</th>
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<tr>
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<th>(Surcharge-51 P.S.F.)</th>
<th>Molding Moisture, %</th>
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<table>
<thead>
<tr>
<th>Moisture-Density Relations of Soils</th>
<th>(AASHO T-180-57 Method)</th>
<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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**Remarks:**

Date 11-18-71  By BT
PLASTICITY CHART

PROJECT: RETENTION POND FOR FOREMOST FARMS
LOCATION: WAIMANALO, OAHU, HAWAII

PLASTICITY INDEX

LIQUID LIMIT

"A" LINE

CL-ML

CL

ML

MH & OH

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

DATE 11-18-71 BY RT.
MOISTURE–DENSITY CURVE (AASHO T-180-57, METHOD A)

PROJECT: RETENTION POND FOR FOREMOST FARMS

LOCATION: WAIMEANALO, OAHU, HAWAII

SAMPLE NO.: SURFACE

SAMPLE DESCRIPTION: BROWN & GRAY ORGANIC SILT W/GRASS BLOWS:

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

DATE 11-17-71  BY  BT
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.
SELECT ON-SITE SOILS FROM DEEPER CUT SECTIONS. FILLS SHOULD BE LAYED IN FAIRLY LEVEL 6" COMPACTED LAYERS.

ORGANIC SURFACE SOILS FROM THE POND AREA.

12" BLANKET OF FILTER ROCK.

STIP LOOSE SURFACE SOILS BELOW BERM AREA. EXCAVATE SOFT POCKETS AND BACKFILL EXCAVATION WITH SELECT ON-SITE SOILS TO MATCH THE DENSITY OF THE SURROUNDING GROUND. RE-COMPACT SUBGRADE AND SHAPE TO DRAIN.

SUGGESTED SECTION THRU BERM

NOTE TO SCALE

FIGURE 1

RETENTION POND FOR FOREMOST FARMS

WAIMAHALO, OAHU, HAWAII

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