PUMPING TEST
SAND ISLAND FISHERY STATION WELL
KAPALAMA, OAHU, HAWAII
MEMO

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER AND LAND DEVELOPMENT
P.O. BOX 373
HONOLULU, HAWAII 96809

TO

FROM

DATE

SUBJECT

MESSAGE:

SIGNED
INSTRUCTIONS: Please type or print. If information is not available or not applicable, indicate as N/A. Fill out as completely as possible, sign, and file form with the Division of Water Resource Management, P.O. Box 373, Honolulu, Hawaii 96809. Phone 548-3948 or 548-7543 for assistance.

BATTERY OF WELLS: For a battery of wells, on the surface, in a tunnel, or in a shaft, submit a registration form for each well together with a single map or plot plan showing layout of wells.

STATE OF HAWAII
COMMISSION ON WATER RESOURCE MANAGEMENT
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER RESOURCE MANAGEMENT

REGISTRATION OF WELL
AND DECLARATION OF WATER USE

STATE WELL NO.: ISLAND: 964-08 OAHU
WELL NAME OR DESIGNATION: Anuenue Fisheries - seawater well
SOURCE OR STATION NAME (For a battery of wells):

A. WELL OPERATOR

Firm name: Division of Aquatic Resources
Contact person: Michael Fujimoto
Address: Area 4, Sand Island
Honolulu, HI
Zip: 96819 Phone: 845-9561

B. OWNER OF WELL SITE

Firm name: State of Hawaii
Contact person: Dept. of Land & Natural Res.
Address: 1151 Punchbowl St., Room 330
Honolulu, HI
Zip: 96813 Phone: 548-4001

C. WELL LOCATION

Tax Map Key: 1-5-41-6 Town, Place, District: Sand Island, Oahu
Attach USGS "Quad" map (scale 1:24,000), tax map, or other map showing the well location.

D. WELL DATA

For Drilled Wells, submit "as-built" drawing, driller's log, and pump test results, and complete items below.

For Tunnels and Shafts, submit construction drawings, plot plan, or sketch map.

Ground elevation (mean sea level): 5.43 ft.
Reference point (used to measure depth to water):
Elevation: ____________________________ ft.
Description: __________________________

Depth to water (Below reference point): ____________________________ ft.
Maximum recorded chloride: ______ ppm
Minimum recorded chloride: ______ ppm
Maximum chloride in 1987: ______ ppm

E. INSTALLED PUMP DATA

Pump type: [ ] Vertical shaft [ ] Submersible [ ] Centrifugal [ ] Other (specify):
Power: [ ] Diesel, ______ HP [ ] Gas, ______ HP [ ] Electric, ______ HP [ ] Other (specify):
Pump capacity: ______ gallons per minute
Pump installation contractor: ____________________________

... (continued over)

For Official Use Only:
Date received: 1-5-89 Date accepted: ____________________________
Field checked by: ____________________________ Date: ________________
Latitude: 21° 18' 28" Hydrologic Unit: ____________________________
Longitude: 157° 52' 29" State Well No.: 1952-08

References: Hawaii Revised Statutes, Chapter 174C.
Hawaii Administrative Rules, Chapters 13-167 to 13-171.
F. DECLARATION OF WATER USE

NOTE: The purpose of the Declaration of Water Use is to obtain information necessary for the management of the State’s water resources. The Declaration does not confer a legal right to water or its use.

Water use data are recorded: [ ] Daily [ ] Weekly [ ] Monthly
[ ] Other (Describe): 

Method of measurement: [ ] Flow Meter [ ] Orifice
[ ] Other (Describe): Pump Capacity

Quantity of Use: (Report metered or estimated monthly water use from the well described on the reverse side of this form. For a battery of wells which are not individually metered, but which are connected to a single meter or other measuring device, report total use from the battery):

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
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<td>4,000</td>
<td>4,000</td>
<td>4,000</td>
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<td>4,000</td>
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<td>4,000</td>
<td>4,000</td>
<td>4,000</td>
<td>4,000</td>
<td>17,000</td>
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<td>August</td>
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<td>17,000</td>
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<td>4,000</td>
<td>4,000</td>
<td>4,000</td>
<td>17,000</td>
<td>17,000</td>
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<tr>
<td>October</td>
<td>4,000</td>
<td>4,000</td>
<td>4,000</td>
<td>17,000</td>
<td>17,000</td>
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<td>November</td>
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<td>4,000</td>
<td>4,000</td>
<td>17,000</td>
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<tr>
<td>December</td>
<td>4,000</td>
<td>4,000</td>
<td>4,000</td>
<td>17,000</td>
<td>17,000</td>
</tr>
<tr>
<td>ANNUAL</td>
<td>48,000</td>
<td>48,000</td>
<td>48,000</td>
<td>126,000</td>
<td>204,000</td>
</tr>
</tbody>
</table>

Minimum day's use: 576,000 gallons 
Maximum day's use: 576,000 gallons 
Typical times of usage: 24 hours/day

Type of Use (Check all category boxes that apply and provide additional information as indicated):

- [ ] Municipal (including resorts, hotels, businesses)
- [ ] Domestic (systems serving 25 people or less)
- [ ] Irrigation
- [ ] Industrial
- [ ] Military
- [ ] Other

Additional Information

Number of service connections: 

Acres Irrigated:
Crop(s): [ ] Sugar [ ] Pineapple
[ ] Other (specify):
Non-Crop: [ ] Landscape [ ] Golf Course
[ ] Other (specify):
Method: [ ] Drip [ ] Furrow [ ] Sprinkler
[ ] Cooling [ ] Manufacturing [ ] Mill
[ ] Other (specify):

Specify (livestock, aquaculture, etc.): Fisheries R & D

I declare that the contents of the above Declaration of Water Use are, to the best of my knowledge and belief, true, correct, and complete.

Water User's Signature: Henry M. Sakuda
Printed Name: Henry Sakuda
Firm or Title (Well Operator, etc.): Division of Aquatic Resources

Date: 2/29/78
MEMORANDUM

TO: Manabu Tagomori, Deputy
Commission on Water Resources, DLNR

FROM: Henry M. Sakuda, Director
Division of Aquatic Resources

SUBJECT: Registration of Well and Declaration of Water Use
(see attached letter [January 31, 1988] for ref.)

According to the form you sent us our seawater well at Anuenue Fisheries Research Center (Sand Island) is identified as No. 1852-08 (Coast Guard). We are not sure if this is our well. Based on your records would you please verify the date on which well No. 1852-08 was drilled. If the date is June 1971 then possibly the well is ours, in which case the registration/declaration form (see attached) we submitted to you on December 29, 1988 should be revised (insert appropriate well number and name). If not, the previously submitted form remains applicable.

If you or your staff have any questions, please call Michael Fujimoto, Chief of Anuenue Fisheries Research Center, at 845-9561.

Attachments

Our Film shows:
1852-08
Drilled 1971 by Nat Whiston
b. 1700 s f.

HENRY M. SAKUDA
TABLE 1.
Chemical analysis of sea water from Anuenue Fisheries Research Center's well by Geological Survey, United States Department of the Interior (milligrams per liter)

<table>
<thead>
<tr>
<th>Laboratory Number</th>
<th>HAW 1856</th>
<th>HAW 1357</th>
<th>HAW 1858</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of collection</td>
<td>6-23-71</td>
<td>6-23-71</td>
<td>6-23-71</td>
</tr>
<tr>
<td>Time (hrs)</td>
<td>1300</td>
<td>0925</td>
<td>1010</td>
</tr>
<tr>
<td>Silica (SiO₂)</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Manganese (Mn)</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Calcium (Ca)</td>
<td>390</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium (Mg)</td>
<td>1,250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium (Na)</td>
<td>10,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium (K)</td>
<td>410</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bicarbonate (HCO₃⁻)</td>
<td>162</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbonate (CO₃⁻)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfate (SO₄²⁻)</td>
<td>2,780</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloride (Cl⁻)</td>
<td>19,000</td>
<td>18,800</td>
<td>19,000</td>
</tr>
<tr>
<td>Fluoride (F⁻)</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrate (NO₃⁻)</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dissolved solids
- Residue on evaporation at 180°C
  - Calculated
  - 34,400
- Hardness as CaCO₃
  - 6,120
- Noncarbonate hardness as CaCO₃
  - 5,990
- Alkalinity as CaCO₃
  - 133
- Specific conductance
  - (Micromhos at 25°C)
  - 51,000
- pH
  - 6.6
- Color
  - -
- Carbon dioxide (CO₂) calculated
  - -
- Temperature (°C)
  - -

HAW 1856-1860 (inclusive) - Sand Island Well, Oahu, Hawaii; owner - State of Hawaii Fish and Game; W.L. - 0.81' ± above MSL; yield - 9:00 GPM pump; Appearance - clear; Collected by Joe Menor; Five 8-oz samples collected at different times during pump test.
FIGURE 2. Anahue Fisheries Research Center
Pumping Test of Sea Water Well
## Analyses by Geological Survey, United States Department of the Interior
(milligrams per liter)

<table>
<thead>
<tr>
<th>Laboratory Number</th>
<th>HAW 1856</th>
<th>HAW 1857</th>
<th>HAW 1858</th>
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<tbody>
<tr>
<td>Date of collection</td>
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<td>6-23-71</td>
<td>6-23-71</td>
</tr>
<tr>
<td>Time (hrs)</td>
<td>1300</td>
<td>0925</td>
<td>1010</td>
</tr>
<tr>
<td>Silica (SiO₂)</td>
<td>14</td>
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<tr>
<td>Iron (Fe)</td>
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<tr>
<td>Manganese (Mn)</td>
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<tr>
<td>Calcium (Ca)</td>
<td>390</td>
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<tr>
<td>Magnesium (Mg)</td>
<td>1,250</td>
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</tr>
<tr>
<td>Sodium (Na)</td>
<td>10,500</td>
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<tr>
<td>Potassium (K)</td>
<td>418</td>
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<tr>
<td>Bicarbonate (HCO₃)</td>
<td>162</td>
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<td></td>
</tr>
<tr>
<td>Carbonate (CO₃)</td>
<td>0</td>
<td></td>
<td></td>
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<td>2,780</td>
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<td></td>
</tr>
<tr>
<td>Nitrate (NO₃)</td>
<td>0.0</td>
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<td></td>
</tr>
</tbody>
</table>

### Dissolved solids
- Residue on evaporation at 180°C: -
- Calculated: 34,400
- Hardness as CaCO₃: 6,120
- Noncarbonate hardness as CaCO₃: 5,990
- Alkalinity as CaCO₃: 133
- Specific conductance (micromhos at 25°C): 51,000
- pH: 6.6
- Color: -
- Carbon dioxide (CO₂) calculated: -
- Temperature (°C): -

HAW 1856-1860 (inclusive) - Sand Island Well, Oahu, Hawaii; owner - State of Hawaii Fish & Game; W.L. - 0.81' above MSL; yield - 9,000 GPM pump; Appearance - clear; Collected by Joe Menor; Five 8-oz samples collected at different times during pump test.
Analyses by Geological Survey, United States Department of the Interior
(milligrams per liter)

<table>
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<th>HAW</th>
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<tr>
<td>Time (hrs)</td>
<td>1110</td>
<td>1210</td>
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<tr>
<td>Silica (SiO₂)</td>
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<tr>
<td>Iron (Fe)</td>
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<tr>
<td>Calcium (Ca)</td>
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<td>Magnesium (Mg)</td>
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<td>Sodium (Na)</td>
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<tr>
<td>Sulfate (SO₄²⁻)</td>
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<td>Chloride (Cl⁻)</td>
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<tr>
<td>Fluoride (F⁻)</td>
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<tr>
<td>Nitrate (NO₃⁻)</td>
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<tr>
<td>Dissolved solids</td>
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<tr>
<td>Residue on evaporation at 180°C</td>
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<tr>
<td>Calculated</td>
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<td>Hardness as CaCO₃</td>
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<td>Noncarbonate hardness as CaCO₃</td>
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<td>Alkalinity as CaCO₃</td>
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<td>Specific conductance</td>
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<td>(micromhos at 25°C)</td>
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<tr>
<td>pH</td>
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<tr>
<td>Color</td>
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<tr>
<td>Carbon dioxide (CO₂)calculated</td>
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<tr>
<td>Temperature (°C)</td>
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</tr>
</tbody>
</table>
PUMPING TEST RECORD

for

SAND ISLAND Well

(name) (No.)

Project or Job No. JUNE 25 1971

Description of Well--

1. Elevation: ground surface ____ ft., top of casing ____ ft., table ____ ft., referenced to _____ benchmark
2. Total depth of well ____ ft.; or ____ ft. elevation, msl
3. ____ in. solid casing to ____ ft. depth, perforated to ____ ft. depth
4. Static water level on 19 ft. below ground surface, top of casing; or ____ ft. elevation, msl measured ______ method

Description of Pump and Pump Setting--

5. ____ type pump with ____ stage bowl assembly
6. Gasoline, diesel, electric, power with ____ horsepower
7. Shaft speed: ____ rpm at ____ gpm flow
8. Depth of pump intake: ____ ft. below ____; or ____ ft. elevation, msl
9. Depth of airline bottom: ____ ft. below ____; or ____ ft. elevation, msl
10. Center of gage: ____ ft. elevation, msl. Flow measured with ____
11. Test conducted by ____

<table>
<thead>
<tr>
<th>Date &amp; Pumping Time (qpm)</th>
<th>Drawdown (feet)</th>
<th>Chlorides (ppm)</th>
<th>Temperature (°F)</th>
<th>Cond. (mmhos, 25°C)</th>
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</thead>
<tbody>
<tr>
<td>0935</td>
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<tr>
<td>1010 090</td>
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<td>1040 090</td>
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<tr>
<td>1440 090</td>
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<td>0935 STOP PUMP RECOVERY</td>
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</tr>
</tbody>
</table>

1849 090
1911
1915
1930
1935
1940

4.26 HIGH OUT 19
1. Sample before and every hour
2. Measure drawdown every hour
3. Measure water level of well at start. Top of pipe, Top of pipe is 5.76 ft.
   "X" on top of steep casing.
4. Measure water level after test
5. Record time after 1st hour
   etc.

6. Hours per day

Graph: Height from bottom of pit in feet vs. GPM.
Disired \( Q = 1300 \text{ GPM} \)  
\( = 2.90 \text{ cfs} \)  
\( s = 0.0055 \)

\( 1 \text{ cfs} = 448.8 \text{ GPM} \)

From King Handbook

**FOR CIRCULAR CHANNEL**

\( Q = \frac{K'}{n} \cdot \frac{d^{5/2}}{s^{1/2}} \)

\( d = 1.00 \quad A \% = 1 \)
\( s = 0.0055 \quad s^{1/2} = 0.07416 \)
\( n = 0.013 \)

\( K' = 0.232 \quad \frac{b}{d} = \frac{1}{2} \)

\( Q = \frac{0.232}{0.013} \times 1 \times 0.07416 \)
\( = \frac{0.0177}{0.013} \)
\( = 1.373 \text{ cfs} \quad \text{or} \quad 59.4 \text{ GPM} \)

\( \frac{2.900}{1.373} \) \text{ desired} \( Q \)

\( \frac{1.373}{1.577} \)

**FOR TRAPEZOIDAL CHANNEL**

\( Q = \frac{K'}{n} \cdot \frac{b^{5/2}}{s^{1/2}} \)

\( b = 5.00 \quad b^{1/2} = 73.1 \)
\( s = 0.0055 \quad s^{1/2} = 0.07416 \)

\( Q = \frac{0.00378}{0.013} \times 73.1 \times 0.07416 \)
\( = 1.577 \text{ cfs} = 708 \text{ GPM} \)

1.577 \text{ cfs} = 1.0140 \text{ GPM}
\[ 0.14' \times 5' = 0.70 \text{ sq ft} \]

\[ 0.167 \times 5 = \frac{8.35}{4} = 2.09 \text{ sq ft} \]

\[ 0.76 \div 0.4175 = 1.82 \text{ sq ft} \]

\[ 0.28 \times 5 = D \times 5 \]

\[ D = \frac{0.28 \times 5}{5} = 0.56'^2 \]

\[ Q = 0.688 \text{ cfs} \]

\[ Q = \frac{K'}{0.94} \times 73.1 \times 0.7416 \]

\[ D = \frac{0.888}{5} = 0.167 \]

\[ K' = 0.0165 \]

\[ Q = 0.688 \text{ cfs} \]

\[ 309 \text{ gpm} \]

**Total Depth**

\[ 0.50 \]

\[ 0.1667 \]

\[ 0.0585 \]

\[ 0.72'^2 \]

\[ 1300 \text{ gpm} \]

from bottom of 12" 1/2 pipe

\[ Q = a \times 1.486 \times \left[ \frac{2.4}{P} \right] \times 0.7416 \]

\[ Q = 0.70 \times 1.486 \times \left[ \frac{0.70}{P} \right] \times 0.7416 \]

\[ 1575 = 1.75 \]

\[ 2.154 = 0.65 \]

\[ 1.54 = 0.54 \]

\[ 1.04 = 0.54 \]

\[ 0.65 = 0.26 \]

\[ 0.54 = 0.26 \]

\[ 0.26 = 0.26 \]

\[ 0.133 = 0.26 \]

\[ 0.26 = 0.26 \]
\[ Q = \frac{K'_{1}}{u} \sqrt{d^{3/2} = \frac{T}{d^{3/2} \sqrt{V}} \frac{90 \times 0.013}{1 \times 0.0746} } \]

\[ K' = 0.538 \quad \text{will overflow } \frac{1}{4} \text{ circular pipe} \]

\[ Q_{\text{max}} \quad \text{flow in } \frac{1}{4} \text{ circular pipe} \]

\[ \frac{D}{d} = \frac{5}{1.8} = 2.78 \quad \implies K' = 0.30 \]

\[ Q_{\text{max}} = \frac{K'_{1}}{n} \left( \frac{d}{3} \right)^{5/4} \]

\[ = \frac{0.30}{0.71} \left( \frac{1}{0.013} \right) = 1.33 \text{ cfs} \]

\[ \text{Overflow} = 5.70 - 1.33 = 4.37 \text{ cfs} \]

\[ \text{For rectangular channel,} \]

\[ Q = \frac{K'_{1}}{n} b^{3/2} \sqrt{h} \quad \text{b = 5.00} \]

\[ K' = \frac{Q \times n}{b^{3/2} \sqrt{h}} \]

\[ K' = \frac{1.37 \times 0.013}{73.1 \times 0.0746} = 0.0378 \]

\[ \frac{D}{d} = \frac{.03 + D - .15}{.15 \times 5.0} = \frac{.63}{.21} \]

Total depth from bottom of \( \frac{1}{4} \) circular pipe

\[ .5 + .17 + .06 = 0.73 \]
STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER AND LAND DEVELOPMENT

PUMPING TEST
SAND ISLAND FISHERY STATION WELL
KAPALAMA, OAHU, HAWAII
LOG OF BORINGS AND DESCRIPTION
OF 12" SALT WATER WELL S.I.
KEEHI FISH PONDS

DIVISION OF FISH AND GAME
DEPT. OF LAND-NATURAL RESOURCES

ELEV. ALL MILLI.
O.C. 45.43

Top of casing 44.17
(Steel)

Top of casing 43.7
(Tech 72)

EXISTING GROUND ELL
0.00

-5.5 feet coral fill
-6.4 medium coral cement

GROUT SPIGOT

SOFT, LOOSE FINGERTREE CORAL, SAND, SILT, SHELLS

-26.30 BOTTOM OF CASINGS

-32.0 END OF 2" CASINGS
HARD CORAL ROCK
-32.070 - 38.0

35.0
-25.0
350 - 80.00 - (48.2)

HARD CORAL ROCK, SOME STREAKS OF MEDIUM CORAL (PERMEABLE STRATA)

-80.00 END OF OPEN HOLE

SHOWING CONCRETE BOX

JAT WHITON DRILLING CO., INC.
APPLICATION AND INFORMATION SHEET
WITH RESPECT TO GROUND-WATER DEVELOPMENT AND USE

INSTRUCTIONS: Please send 5 copies to Honolulu Board of Water Supply, P. O. Box 3410, who will distribute to other agencies concerned. In filling out, refer to applicable rules and regulations of Honolulu Board of Water Supply and State Division of Sanitation. This form may be used for a multi-well project.

OWNER: State of Hawaii Department of Land and Natural Resources

Division of Water and Land Development

ADDRESS: P. O. Box 373

(a) Plans a new well project which has been classified by the Manager and Chief Engineer of the Honolulu Board of Water Supply as (Check one):

Artesian
Non-artesian X
Caprock
Shaft
Tunnel
Test Boring

(b) Plans to recase a drilled well.

(c) Plans to reopen a well which has been unused for more than five (5) years.

THE LOCATION OF THE WELL IS: Anuenue Island TMK 1-5-41

Map is attached

(A sketch or map is attached hereto.)

THE WORK WILL BE PERFORMED BY Contractor

USE TO WHICH WATER FROM THE WELL WILL BE PUT (Check proper use(s)):

(a) Irrigation
(b) Industrial X
Aquaculture
(c) Wholly domestic
(d) Partially domestic

AREA SERVED:

DESCRIPTION OF WELL (including altitude of well head, diameter, depth):

12" cased well approx. 100' deep.
DESCRIPTION OF CASING (material, diameter, thickness, welded or screw joints, shoe (if any), total length, limits of any perforated section): Casing shall

be 12" PVC approx. 40' long.

DESCRIPTION OF PUMP (type, nominal capacity):

MEANS OF MEASURING DRAFT: Visual - Elv. of well @ +8.0+

*****

The Owner hereby agrees to perform the work and thereafter to operate and maintain control of the well in accordance with the laws of the State of Hawaii and the Rules and Regulations of the Honolulu Board of Water Supply and the State Division of Sanitation.

The $25.00 fee (per well) is: enclosed. X not required.

Date Submitted

Signature of Owner

*****

APPROVED: JAN 6 1971

Date

George Yuen
Manager and Chief Engineer
Board of Water Supply
Honolulu, Hawaii
ADDITIONAL RECORD

Application and Information Sheet received by Board of Water Supply.

Driller's log received by Board of Water Supply, including final depth of well and of casing, and results of production test, including chloride content of water.

Certificate for Furnishing Water for Potable Purposes, if required, mailed by Division of Sanitation to Owner.

Owner informed by Board of Water Supply of his compliance with all requirements.

Well designated No. by U. S. Geological Survey.

cc: State Division of Sanitation
    State Division of Water and Land Development
    U. S. Geological Survey