HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: LAUMIA A

STATE, HAWAII

YEAR: 1877

THIRD ORDER

SOURCE: G-SP15c

GEODETIC LATITUDE: 19°56'43.33"
GEODETIC LONGITUDE: 155°22'51.569"

ELEVATION: METERS

FEET

STATE COORDINATES (Fermi)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (IN. D. + ANGLE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>9101</td>
<td>540,872.32</td>
<td>403,877.49</td>
<td>+ 0'02.26</td>
</tr>
</tbody>
</table>

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE FERMAT FORMULA NEGLECTING THE SECOND TERM.

<table>
<thead>
<tr>
<th>TO STATION OR OBJECT</th>
<th>GEOGRAPHIC AZIMUTH (True north)</th>
<th>PLANE AZIMUTH* (True north)</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>QQ 365</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

JUN 1978
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY
Laupahoehoe (Hawaii Island, E. R. Hand, 1913).—Established by Hawaiian Government Survey. On the northeast coast of Hawaii, at Laupahoehoe, out on the flat rocky point close to the sea. Station is outside of wall which surrounds lighthouse and is 18 meters from it. The northeast corner of the light building (in 1913) bears S. 80° W. distant 32.5 meters (107 feet). The northeast gable of police station (station Yellow) bears 8. 5° E., distant 110 meters. Marked by a concrete cylinder about 10 inches in diameter set upright among the stones, centered with a very small triangle.

RECOVERY NOTE. TRIANGULATION STATION

NAME OF STATION: LAUPAHOE HOE

RECOVERED BY: R.C.R. YEAR: 1913 STATE: Hawaii

DESCRIPTION: Suggests original destruction; including marks found, changes made, and other pertinent facts; station destroyed. The concrete cylinder marked with triangulation sign believed destroyed by Tsunami.

RECOVERY NOTE. TRIANGULATION STATION

NAME OF STATION: LAUPAHOE HOE

RECOVERED BY: D.M. Whipp YEAR: 1916 COUNTY: Hawaii

DESCRIPTION: Suggests original destruction; including marks found, changes made, and other pertinent facts; station is gone. It was probably destroyed by a Tsunami, as a considerable amount of the point was washed away.

HORIZONTAL CONTROL DATA

by the National Ocean Survey
OLD HAWAIIAN DATUM

HAWAII
LATITUDE 19° 30' 70° 49'
LONGITUDE 155° 40' 125° 30'
DIAGRAM 5-1.5 HAWAII

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: LAUPAHOE HOE

STATE: HAWAII YEAR: 1913 THIRD ORDER

SOURCE: G-92184

DEGREES LATITUDE: 19 56 48.076
DEGREES LONGITUDE: 155 14 34.465
ELEVATION: SCALED 4 METERS

<table>
<thead>
<tr>
<th>STATE &amp; CODE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>H (H.D. AT MILE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>588,266.23</td>
<td>422,537.47</td>
<td>+ 0.05 17</td>
</tr>
</tbody>
</table>

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE H.-R.-H. FORMULA NEGLECTING THE SECOND TERM.
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

LELEWI (USGS)
(Hawaii Island, E. R. Hand, 1912) — On east coast of Hawaii, on Lelewi Point, 3 miles east of Hilo breakwater. From this point there are three similar points in line, bearing north, the first two close by and equally spaced from the point on which the station stands, and the other distant several hundred meters. On the other side the outermost point bears southwest. The station is placed; it becomes very narrow where it joins the mainland. Its top is flat, its sides vertical, and its height about 10 feet above high water. The center is marked by a United States Geological Survey copper plate set in cement grout with flat surface of lava. It is 2.8 meters (28 feet) from extreme end of point; highest point of area 1.0 meter north of deep crack which runs about east and west, and 1.76 meters (5.7 feet) west of another crack which runs north and south.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION:  LELEWI (USGS)
Established by: E. R. Hand Year: 1912 State: Hawaii
Recovered by: C.E. Whipp Year: 1966 County: Hawaii

Detailed statement as to the fitness of the original description, including marks found, stumpage, changes made, and other pertinent facts:
The station was recovered as described and in good condition.

A new description follows:
The station is located about 3 miles east of the Hilo Breakwater; about 0.5 mile east of the old Punalu’u Hospital; 761 feet on the east coast of triangulation station KEAUKAHANA and 29 feet west of the end of Lelewi Point.

To reach the station from the bridge which spans the Waiau River in the town of Hilo, go easterly on the main traveled road, turn left onto the left hand side of the main road, pass through a gate into the Punalu’u Hospital grounds, and go southerly, passing to the left hand side of the main building and go 0.5 mile to a turn around at the end of the paved road. From this point go south and east on a track road for 0.5 mile to the end of track travel at a small shack. The station lies about 0.1 mile east of this shack.
The station is located on a U.S. Geological Survey disk, too badly mutilated to read, which is set into a drill hole in bedrock.

This station is located by distance and direction from triangulation station KEAUKAHANA.

STATE COORDINATES

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hl 1</td>
<td>9131</td>
<td>666.750.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td>329+378+47</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ 0 10 00</td>
</tr>
</tbody>
</table>

POSITION DETERMINED BY TRAVERSE FROM STATION KEAUKAHANA

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY
NATIONAL GEODETIC SURVEY

(continued on next page)
HORIZONTAL CONTROL DATA
by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

LELEIWI (USGS) (continued)

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: LELEIWI (USGS)
ESTABLISHED BY: R. B. Rand
YEAR: 1912
STATE: Hawaii
COUNTY: Hawaii
RECOVERED BY: R. R. Helby
YEAR: 1975
COUNTY: Hawaii
AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN:
5½ miles east of Hilo.

Detailed statement as to the fitness of the original description, including notes found, conditions, changes made, and other pertinent facts:

The station was recovered in good condition as described in 1949 and 1955. The station is on a bare rocky point about 19 feet above sea level. The station is a U.S.G.S. disk stamped "HAWAII" cemented in a drill hole in the bare bedrock.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: Lalalui (USGS)
ESTABLISHED BY: E.R.K.
YEAR: 1912
STATE: Hawaii
COUNTY: Hawaii
RECOVERED BY: C.K. Townsend
YEAR: 1975
COUNTY: Hawaii
AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN:
5¼ miles east of Hilo.

Detailed statement as to the fitness of the original description, including notes found, conditions, changes made, and other pertinent facts:

Recovered in good condition as described in 1949.
**HORIZONTAL CONTROL DATA**

by the National Ocean Survey

**0 101551**

**STATION** 1105

**HAWAI’I**

**LATITUDE** 19° 30’ TO 20° 30’

**LONGITUDE** 155° 20’ TO 155° 30’

**DIAGRAM** NE 5-1.3 HAWAI’I

**ADJUSTED HORIZONTAL CONTROL DATA**

**NAME OF STATION** LEPEANJA

**STATE** HAWAI’I

**YEAR** 1891

**THIRD** ORDER

**SOURCE** G-SP156

<table>
<thead>
<tr>
<th>DECELER LATITUDE</th>
<th>19° 45’ 25.700</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECELER LONGITUDE</td>
<td>155° 27’ 41.717</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STATE CODE</th>
<th>X</th>
<th>Y</th>
<th>X (RAD) + Y (RAD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>513.207.82</td>
<td>335.475.07 + 0 00' 47''</td>
</tr>
</tbody>
</table>

*PHASE AZIMUTH HAS BEEN COMPUTED BY THE A + 0.5 Δ FORMULA NEGLECTING THE THIRD TERM

<table>
<thead>
<tr>
<th>STATION OR OBJECT</th>
<th>GEODETIC AZIMUTH (FROM NORTH)</th>
<th>PLANE AZIMUTH + (FROM NORTH)</th>
<th>CODE</th>
</tr>
</thead>
</table>

QQ 376
## HORIZONTAL CONTROL DATA

**by the National Ocean Survey**

Hawaii

...1106...

---

**ADJUSTED HORIZONTAL CONTROL DATA**

**NAME OF STATION:** LILINDE NEW

**STATE:** HAWAII

**YEAR:** 1892

**THIRD ORDER**

---

**SOURCE:** G-SPI56

---

<table>
<thead>
<tr>
<th>GEODETIC LATITUDE</th>
<th>GEODETIC LONGITUDE</th>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>15° 48' 44.59&quot; N</td>
<td>155° 27' 39.62&quot; W</td>
<td></td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>513,403.48</td>
<td>355,576.21</td>
<td>+ 0 00 48</td>
</tr>
</tbody>
</table>

---

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE D - D FORMULA, NEGLECTING THE SECOND TERM.

---

<table>
<thead>
<tr>
<th>STATION OR OBJECT</th>
<th>GEODETIC AZIMUTH</th>
<th>PLANE AZIMUTH</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>00 384</td>
</tr>
</tbody>
</table>

---

---
HORIZONTAL CONTROL DATA
by the National Ocean Survey
old Hawaiian Datum

NAME OF STATION: LI0 HGS
ESTABLISHED BY: L.A. Critchlow
YEAR: 1977
STATE: Hawa1i
COUNTY: Hawa1i

AIRLNE DISTANCE AND DIRECTION FROM NEAREST TOWN: 3 miles NW of Mountain View
HEIGHT OF TELESCOPE ABOVE STATION MARK: 4 feet
HEIGHT OF LIGHT ABOVE STATION MARK: 4 feet

DISTANCES AND DIRECTIONS TO AZIMUTH MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION:

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>Bearing</th>
<th>Distance Feet</th>
<th>Distance Meters</th>
<th>Azimuth</th>
</tr>
</thead>
<tbody>
<tr>
<td>KULANI HGS 1891'</td>
<td>N</td>
<td>46.21</td>
<td>14.086</td>
<td>00 00 00'</td>
</tr>
<tr>
<td>RM 1</td>
<td>E</td>
<td>17.77</td>
<td>5.419</td>
<td>201 41 11</td>
</tr>
<tr>
<td>RM 1 to RM 2</td>
<td>E</td>
<td>47.01</td>
<td>14.329</td>
<td></td>
</tr>
</tbody>
</table>

The station is located about 11 miles south of Hilo, 9 1/2 miles east of Kulani Honor Camp and 3 miles northwest of Mountain View on the south side of Kainakau Highway. (On road right-of-way)
To reach the station from the junction of State Highway 11 and 19 in Hilo, go south on State Highway 11 for 4.3 miles to a crossroad, turn right and go southwestery on Kainakau Highway 6.9 miles to road intersection left, (Kulani Road). Continue southwestery on Kainakau Highway 1.7 miles to the station site on the left.
The station marks are State of Hawa1i survey disks stamped LIO 1977. The surface disk is set in a round concrete post flush with the ground. The underground disk is set in an irregular mass of concrete about 4 feet below the ground. They are 42.3 feet west of telephone pole number 162, 13 feet south of the centerline of the highway, 5.15 feet southeast of a task in the road and 4 feet south of the south edge of the highway.
Reference mark 1, stumped 1, is a railroad spike with a punch hole marking the center, cemented in a drill hole in lava rock, 26 feet northwest of the centerline of the highway. 2 feet northwest of a small decline and 3 feet above the highway.
Reference mark 2, stumped 2, is a railroad spike with a punch hole marking the center, cemented in a drill hole in a rock ledge, 21 feet southeast of the centerline of the highway and 2 feet higher than the highway.
**ADJUSTED HORIZONTAL CONTROL DATA**

**NAME OF STATION:** LDA1

**STATE:** HI

**YEAR:** 1991

**SOURCE:** G-SP156

**COORDINATE SYSTEM:** (From)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>X - ORD - Y - MEAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>525,012.70</td>
<td>339,028.97</td>
<td>+ 0 02 20</td>
</tr>
</tbody>
</table>

*Plane azimuth has been computed by the **⊥** formula neglecting the second term.*

**TO STATION OR OBJECT** | **DEGREES** | **PLANE AZIMUTH** | **CODE**
-------------------------|-------------|-------------------|----------------
|                          |             |                   | QD 375          |
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: LONE HALE
STATE: HAWAII
YEAR: 1902
THIRD ORDER

SOURCE: O-SP156

DEGREES LATITUDE: 19° 37 19.93"
DEGREES LONGITUDE: 155° 11 30.54"

ELEVATION: METER

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>X OR Y = ANGLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5191</td>
<td>405,836.60</td>
<td>407,531.22</td>
<td>+ 0° 36.19</td>
</tr>
</tbody>
</table>

* PLANE AZIMUTH HAS BEEN COMPUTED USING THE "S" FORMULA.- SHORTLY BEFORE THE SECOND SERIES.

TO STATION OR OBJECT

GEODETIC AZIMUTH (From north)
PLANER AZIMUTH

CODE

595 QO
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: LUKA CALIBRATION PT

STATE: HAWAII
YEAR: 1977

ELEVATION: 9201.3
METERS: 48784
FEET: 48784

SOURCE: D-16241

DEErect LAtitude: 19° 49' 53.91546
GEODESIC LONGITUDE: 155° 26' 28.14699

STATE & zone CODE X Y N (NO E11) 41 FORMULA NEGLECTING THE SECOND TERM.

HI 1 5101 509,552.87 360,522.67 + 0 00 34'

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

3H 109
Manowaoepae 3 (Hawaii Island, E. R. Hand, 1913).—Established by Hawaiian Government Survey. On northeast coast of Hawaii, on the extreme edge of the bluff about 160 meters east of Laupahoehoe railroad station, which is not at the town of that name but on top of the cliffs about 3 mile to the east. About 30 meters east of the station, between it and Papaloa, is a deep but narrow gulch. The flagstaff of the railroad station bears S. 85° E. and it and the near or east corner of the roof are exactly on range from the station, which may be found by extending down into the ground about 2½ feet. Bottom of cone is 1.9 feet in diameter, top about 5 inches. Centered with a 1-inch galvanized iron pipe protruding about 8 inches above the concrete.

RECOVERY NOTE: TRIANGULATION STATION

MANOWAOEPAE 3

EXPIRED BY: E. R. H.
RECOVERED BY: U.S.G.S.
YEAR: 1913
STATE: Hawaii
COUNTY: Hawaii

Station destroyed. Baffed saved in, believe station destroyed by tidal wave.

RECOVERY NOTE: TRIANGULATION STATION

MANOWAOEPAE 3

ESTABLISHED BY: E. R. H.
RECOVERED BY: D. W. Whipp
YEAR: 1913
STATE: Hawaii
COUNTY: Island: Hawaii

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: MANOWAOEPAE 3
STATE: Hawaii
YEAR: 1913

NAME OF STATION: MANOWAOEPAE 3
STATE: Hawaii
YEAR: 1913
COUNTY: Island: Hawaii

Station was not recovered. It is believed that part of the cliff has fallen off and the station lost as it was only 1 meter from the edge originally.
Mauna Kea (Hawaii Island, Hawaiian Government Survey, 1892). On 49 feet lower than the highest summit. Marked by an iron stake, and a cairn of stones.

HORIZONTAL CONTROL DATA

NAME OF STATION: MAUNA KÉA
STATE: HAWAII
YEAR: 1892
STATION: 113

SOURCE: G-SP156

DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY
NATIONAL GEOGRAPHIC SURVEY

LATITUDE: 19° 49' 31.3"
LONGITUDE: 155° 28' 18.014"
ELEVATION: 470 METERS

STATE COORDINATES (FUS):

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>P W.D. H. ANGLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>506,736.64</td>
<td>361,111.51</td>
<td>0 00 35</td>
</tr>
</tbody>
</table>

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE F J. D. F. FORMULA NEGLECTING THE SECOND TERM.

TO STATION OR OBJECT | GEODETIC AZIMUTH | PLANE AZIMUTH | CODE
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 141551</td>
<td></td>
<td></td>
<td>361</td>
</tr>
</tbody>
</table>

HI 155 HAWAII
NAME OF STATION: MAUNA KEA UNIV OF HAWAII OBS DOME

CROFT OF PARTY: L.A. CRITCHLOW YEAR: 1977
STATE: Hawaii COUNTY: Hawaii

DESCRIPTION, INCLUDING INDEX OF OBJECT: The station is located near the summit of Mauna Kea and is the top and center of the University of Hawaii observatory dome. It is painted white, is about 75 feet high, and is the highest object on the summit.

HORIZONTAL CONTROL DATA

by the National Ocean Survey
OLD HAWAIIAN DATUM

QUAD 191251 STATION 1114
HAWAII
LATITUDE 19°50' TO 20°00'
LONGITUDE 156°00' TO 156°30'
DIAGRAM NE 5.5 HAWAII

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: MAUNA KEA UNIV OF HAWAII OBS DOME
STATE: "HAWAII YEAR 1978
STATION: OBS BY NGS

SOURCE: 19 54 56.54642
ELEVATION: 3606.49677

STATE COORDINATES (YTD)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z or Δ n ANGLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>H 1</td>
<td>5401</td>
<td>0594511.87</td>
<td>3606496.77</td>
<td>0 00 54'</td>
</tr>
</tbody>
</table>

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE Σ OR Δ FORMULA REFLECTING THE SECOND TERM

TO STATION OR OBJECT | GEOGRAPHIC AZIMUTH (FROM NORTH) | PLANE AZIMUTH (FROM NORTH) |
|---------------------|-------------------------------|---------------------------|

THESE DATA OBTAINED FROM ADJUSTMENT OF JAN 1979

ÅM 114
Mauna Kea (Waiāu) Latitude station (Hawaiian Island, Hawaiian Government Survey, 1892).—On Mauna Kea, between 35 and 40 feet southeast of Lake Waiau, in one of the summit craters. Marked by a pier 3 by 2½ feet, and 3 feet high, built of stone and cement, with a cross cut in the stone on top.
### HORIZONTAL CONTROL DATA

**HAWAII**

**NAME OF STATION:** HAWAII

**STATE:** HAWAII

**YEAR:** 1891

**STATION:** 1116

<table>
<thead>
<tr>
<th>GEOGRAPHIC LATITUDE</th>
<th>GEOGRAPHIC LONGITUDE</th>
<th>ELEVATION METERS</th>
<th>ELEVATION FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>15° 40' 27.423&quot; N</td>
<td>155° 20' 57.742&quot; W</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

**STATE COORDINATES (EAST):**

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X (METERS)</th>
<th>Y (METERS)</th>
<th>Z (METERS)</th>
<th>Z (FEET)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>551,815.43</td>
<td>305,406.99</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

*Plane Azimuth has been computed by the $\phi + \Delta \phi$ formula neglecting the second term.*

**TO STATION OR OBJECT**

<table>
<thead>
<tr>
<th>GEOGRAPHIC AZIMUTH (degrees)</th>
<th>PLANE AZIMUTH* (degrees)</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**QO 383**
## HORIZONTAL CONTROL DATA

### Adjusted Horizontal Control Data

**Name of Station:** Tallest of 3 Stacks  
**State:** Hawaii  
**Year:** 1990  
**Third Order**

**Source:** G-SP156

<table>
<thead>
<tr>
<th>Geodetic Latitude</th>
<th>Geodetic Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>19° 44' 28.130&quot;</td>
<td>155° 05' 34.215&quot;</td>
</tr>
</tbody>
</table>

**Elevation:** 15 feet  
**Meters:** 4.6 meters

<table>
<thead>
<tr>
<th>State &amp; Zone</th>
<th>Code</th>
<th>X</th>
<th>Y</th>
<th>Z (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>640,016.40</td>
<td>329,834.06</td>
<td>0' 08' 15&quot;</td>
</tr>
</tbody>
</table>

*Plane Azimuth has been computed by the S or Δ Δ formula neglecting the second term.

**Table:**

<table>
<thead>
<tr>
<th>To Station or Object</th>
<th>Geodetic Azimuth (from north)</th>
<th>Plane Azimuth (from north)</th>
<th>Code</th>
</tr>
</thead>
</table>

**DD 356**
Mokula (Hawaii Island, Hawaiian Government Survey, 1878; E. R. Hand, 1912).—On eastern coast of Hawaii, in Hilo Harbor, on the outermost point of Coconut Island, in the sand at the very edge of the grass line. Marked by a granite block about 6 inches square set in a foundation of lava bowlders, forming an equilateral triangle about 1 foot high and 4 feet on side, top finished smooth with cement. The granite block projects slightly above the cement surface. The whole mark now lies slightly to seaward, and may have suffered some change. Although resting in sand, it is protected from seaward by a flat ledge of lava a few feet away, which forms a protecting arm.

MOKULA
STATE: HAWAII
COUNTY: HAWAII
URCHED: By H. C. Murray
YEAR: 1929

Detailed description, as in the styles of the original description: A Type B Monument was erected over the original mark, a 4 in concrete, on solid bowlders by H. C. Murray of the Hawaii Territory Survey on Dec. 24, 1929. Mokula, 1929 is not the original Mokula Trip Station but is a new station set on a more prominent point several feet away from the old concrete triangular block which has Mokula, a large masonry triangular block lies slightly tilted on a depression nearby.

J. C. R. Young
1928

MOKULA
STATE: HAWAII
COUNTY: HAWAII
URCHED: By J. C. R. Young
YEAR: 1928

Detailed description as in the styles of the original description: This station was recovered and reoccupied for magnetic observations in May 1928. The old triangular block of concrete with the granite post center is still there but it is now tilted to the southeastern.

A new station has been established by the Hawaiian Government Survey on the Levee near the northeastern part of the old station. A concrete base above six feet square and from two to three feet high on the sides has been built on the solid rock. A central raised pillar of concrete with a two and one-half inch short pipe imbedded there in mark the center of the station. A signal beam of two inch pipe with crossed steel burners slips into the short section to provide a signal. On the top of the six foot square base is one side are letters about nine inches in height forming the inscription "MOKULA 1928".

Distance of the new station from the present position of the old station 9.12 meters.

Note: Some of the stations should be removed. The officer who actually relied the stations should sign his name at the top of the survey chart.

*Note: The survey line was surveyed on the 28th of March, 1929.

**Note: One of the lines must be used for every station removed.

HORIZONTAL CONTROL DATA

<table>
<thead>
<tr>
<th>NAME OF STATION</th>
<th>MOKULA</th>
<th>HAWAII</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEAR</td>
<td>1878</td>
<td>1929</td>
</tr>
</tbody>
</table>

ADJUSTED HORIZONTAL CONTROL DATA

<table>
<thead>
<tr>
<th>NAME OF STATION</th>
<th>MOKULA</th>
<th>STATE</th>
<th>HAWAII</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEAR</td>
<td>1878</td>
<td>1929</td>
<td>1928</td>
</tr>
</tbody>
</table>

DESCRIPTIVE DATE

<table>
<thead>
<tr>
<th>STATE</th>
<th>HAWAII</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEAR</td>
<td>1878</td>
</tr>
</tbody>
</table>

LATITUDE: 16° 30' TO 20° 00'
LONGITUDE: 155° 00' TO 155° 30'

DIAGRAM: # 5-15 HAWAII

MOKULA
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

NO ORIGINAL TEXT

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: Hokula 2
ESTABLISHED BY: C.T. Huesmeyer YEAR: 1971 STATE: Hawaii
RECOVERED BY: C.K. Townsend YEAR: 1976 COUNTY: Hawaii
AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN: Hilo, Kona Coast
HEIGHT OF TELESCOPE ABOVE STATION MARK: FEET.

DISTANCES AND DIRECTIONS TO AZIMUTHS OF REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>AZIMUTH BEARING</th>
<th>DISTANCE (FEET)</th>
<th>DISTANCE (METERS)</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>HALAI HIL 1977</td>
<td></td>
<td>00 00 00 00</td>
<td>2846.531</td>
<td>168 25 42.3</td>
</tr>
<tr>
<td>KILOA 2 1951</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Recovered in good condition. The published date does not agree with the date inscribed in concrete by the station. Directions and distances observed to the station agree with the published position. A complete description is as follows: To reach the station from the post office in Hilo proceed northeast on Wailuku St. for 0.15 miles, bear right onto Kaumakane Ave. for 1.3 miles, turn left onto access road to Kona Island. Station is 130 yds. to the north at end of island. Station is a triangle inscribed in a concrete slab 6 by 6 ft. and about 6" thick. Over the station is a concrete footing with a 2" diameter pipe designed for use with a metal crosshanger. No reference marks were found.

---

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: HOKULA 2
STATE: Hawaii
YEAR: 1981
THIRD ORDER

SOURCE

J = 9.23

CRITICAL LATITUDE 19 44 30.2350
CRITICAL LONGITUDE 155 04 16.7540
ELEVATION 1.0 METERS

STATE COORDINATES (Feet)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>( \gamma ) ( \alpha )</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI A</td>
<td>5101</td>
<td>647,422.73</td>
<td>327,037.25</td>
<td>+0.00 91</td>
</tr>
</tbody>
</table>

*Plane azimuth has been computed by the Z and V formula neglecting the second term.

<table>
<thead>
<tr>
<th>TO STATION OR OBJECT</th>
<th>GEOGRAPHIC AZIMUTH (From north)</th>
<th>PLANE AZIMUTH (From north)</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>WNL 1 NL 3</td>
<td>62°30'35.3&quot;</td>
<td>62°30'16&quot;</td>
<td>0101</td>
</tr>
</tbody>
</table>

These data are obtained from adjustment of 1967

SM 116
## ADJUSTED HORIZONTAL CONTROL DATA

### NAME OF STATION
**NORTH BASE 1**

### STATE
**HAWAII**

### YEAR
**1891**

### THIRD ORDER

### SOURCE
G-SPI56

### GEOGRAPHIC LATITUDE
19°45'52.472"

### GEOGRAPHIC LONGITUDE
155°22'07.380"

### ELEVATION
554.138.30

### METERS
336.191.78

### FEET
+ 0 02 40

### STATE COORDINATES (U.S.G.S.)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>W m. L. &amp; A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>545,139.30</td>
<td>336,191.78</td>
<td>+ 0 02 40</td>
</tr>
</tbody>
</table>

* PLANES ADJUSTMENT HAS BEEN COMPUTED BY THE L. H. P. FORMULA NEGLIGEBLY THE SECOND TERM

<table>
<thead>
<tr>
<th>TO STATION OR OBJECT</th>
<th>GEOGRAPHIC AZIMUTH (From north)</th>
<th>PLANE AZIMUTH*</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Q0 376
## HORIZONTAL CONTROL DATA

### ADJUSTED HORIZONTAL CONTROL DATA

**NAME OF STATION:** NORTH BASE 92  
**STATE:** HAWAII  
**YEAR:** 1852  
**THIRD ORDER**  
**SOURCE:** GSP156

<table>
<thead>
<tr>
<th>DEGREES</th>
<th>ELEVATION</th>
<th>METERS</th>
<th>FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1042.16381</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1552750.654</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### STATE COORDINATES (feet)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>ORIG. X ANGLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>9101</td>
<td>512358.27</td>
<td>316316.77</td>
<td>0 00 44</td>
<td></td>
</tr>
</tbody>
</table>

*Plane azimuth has been computed by the x or y formula reflecting the second term.

### TO STATION OR DEGREE

<table>
<thead>
<tr>
<th>TO STATION OR DEGREE</th>
<th>GEOGRAPHIC AZIMUTH</th>
<th>PLANE AZIMUTH</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>QQ 380</td>
</tr>
</tbody>
</table>
HORIZONTAL CONTROL DATA

by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

NO STATION ASSIGNED TO THIS NUMBER
HORIZONTAL CONTROL DATA

OLAA (HGS)
(Hawaii Island, Hawaiian Government Survey, 1896).—In eastern part of Hawaii, on a grassy knoll a short distance west of the road from Hilo to the Volcano, near the 11-mile post. Marked by a copper bolt set with cement into the solid rock.

RECOVERY NOTE, TRIANGULATION STATION

The station was recovered in good condition. In 1930 the Territory Survey built a stone platform 6 feet square and 9 feet high over the station mark, leaving the original mark exposed to view. A new description follows:

The station is located on a rock wall which lies about 2.6 miles southwest of Olaa, about 200 yards northwest of the highway which runs between Hilo and the Volcano; about 100 yards south of a church; about 200 feet northwest of a house and on the highest ground in the immediate vicinity.

To reach from the post office at Olaa; go south and west, on the road which leads toward the Volcano for 8.4; pass the Honolulu Church, in the village of Olaa, and continue southwesterly, on the road to the Volcano for 2.6 miles; turn right, into a palm tree bordered lane, and go north-west for about 100 yards to the end of truck travel at the garage. From this point, go easterly, through the yard, for about 200 feet to a rock wall intersection; turn left and go northwest for about 160 feet to the station.

The station is the center of a 1/2 inch copper bolt set in concrete, and of such a size, as the bolts should be buried here. The well of the station should also be 16 inches at the center of the concrete base.

(continued on next page)

---

<table>
<thead>
<tr>
<th>NAME OF STATION</th>
<th>OLAA HGS</th>
<th>OBS BY CGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATE</td>
<td>'HAWAII</td>
<td></td>
</tr>
<tr>
<td>YEAR</td>
<td>1896</td>
<td></td>
</tr>
<tr>
<td>FIRST ORDER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOURCE</td>
<td>9-979</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COORDINATE SYSTEM</th>
<th>GEODETIC LATITUDE</th>
<th>GEODETIC LONGITUDE</th>
<th>ELEVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1 1</td>
<td>19° 30' 00&quot; N</td>
<td>155° 39' 30&quot; W</td>
<td>204.3 M</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (RDn, RDn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1 1</td>
<td>5101</td>
<td>423,518.38</td>
<td>279,560.14</td>
<td>+ 0.08 P8 M4</td>
</tr>
</tbody>
</table>

* PLANE ASTRAGNTH HAS BEEN COMPUTED BY THE Z (RDn, RDn) FORMULA NEGLECTING THE SECOND TERM.

<table>
<thead>
<tr>
<th>TO STATION OR OBJECT</th>
<th>GEODETIC ASTRAGNTH (From station)</th>
<th>PLANE ASTRAGNTH (From station)</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>KALULI 2</td>
<td>257' 32' 35&quot;</td>
<td>257' 43' 30&quot;</td>
<td>5101</td>
</tr>
</tbody>
</table>

THESE DATA ARE OBTAINED FROM ADJUSTMENT OF 1951

JH 121
HORIZONTAL CONTROL DATA
by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: OLAH (RSG)
ESTABLISHED BY: D.M. Whipp
YEAR: 1896 STATE: Hawaii
RECOVERY BY: D.M. Whipp
YEAR: 1967 COUNTY: Hawaii
ILAND: Hawaii
HEIGHT OF TELESCOPE ABOVE STATION MARK l FEET.
HEIGHT OF LIGHT ABOVE STATION MARK l FEET.

DISTANCES AND DIRECTION TO ADMIT MARK, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE SOURCE AT THE STATION

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>Bearing</th>
<th>Distance</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEO 1949</td>
<td>VR</td>
<td>16,101</td>
<td>00 00 00 0.0</td>
</tr>
<tr>
<td>RM No. 2</td>
<td>MR</td>
<td>17,121</td>
<td>22 13 55</td>
</tr>
<tr>
<td>YALO 1949</td>
<td>NR</td>
<td>20,150</td>
<td>51 10 07 4.0</td>
</tr>
<tr>
<td>HONUAILA (HTS) 1901</td>
<td>NR</td>
<td>23,139</td>
<td>44,158</td>
</tr>
</tbody>
</table>

The station mark and reference mark 1 and 2 were recovered in good condition. Compared to the 1967 recovery note the distance to reference mark 1 was found shorter by 0.006 meter and the direction was found smaller by 0.002 degrees and the direction was found smaller by 0.004 degrees. A complete new description follows.

The station is located in Kurtistown, about 1/2 mile southwest of Keau, 200 feet south of a Japanese Mission, and 500 feet southeast of the highway, on the northeast end of an old stone wall which ends on the hill. To reach the station from the post office in Keau, go o.1 mile to crossroad, turn left and go 0.1 mile to State Highway 11. Turn left and go southwest on the highway 1.0 miles to paved side road right, at sign "KURTISTOWN J O D O MISSION." Turn right and go 0.1 mile; turn left and go 0.5 mile to end of truck travel in the mission yard. Walk south, along edge of the coffee grove about 200 feet to station in brush. Station mark is a 3-inch copper pin, with a wooden handle and a concrete pad above ground. A red and white metal tag extends 3 feet above ground. Station north of the shed as described.

Reference mark number one is a standard disk stamped "OLAH HS 1896 NO 1 1967," cemented in a drill hole in a bedrock outcrop projecting 8 inches. It is in the southeast corner of the coffee grove, 45 feet north of the shed.

Reference mark number two is a standard disk stamped "OLAH HS 1896 NO 2 1967," cemented in a drill hole in a bedrock outcrop projecting 8 inches. It is in the southwest corner of the coffee grove, 8 feet southwest of a pandanus tree and 3 feet lower than station mark.

NOTE: One of these forms must be used for every station recovered.

ACKN-OI STAI-494

RECOVERY FORM 30-30A
(11-76)
INTRODUCTION

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: OLAH SUGAR CO., STACK
Erected by: G.T. Huesmeier
Year: 1949
Locality: Puna District

Detailed statement as to the source of the original description:

This stack is not the same stack which was observed in 1914. However, it rests on the same base and may be considered identical with the old stack. A new description follows.

The station is located at the Ola Sugar Company Mill in the village of Olaa. It is about 20 feet east of the boiler house.

The stack is the top and center of a steel smoke stack 9 feet in diameter and 180 feet high. It rests on a rock base 26 feet square and 26 feet high which was built in 1901.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: OLAH SUGAR CO., STACK
RECOVERED BY: D.M. Whipp
Year: 1957

Detailed statement of any material evidence concerning the recovery of the station:

Station was recovered. It is the tall steel stack, painted silver, with black top, located at the Ola Sugar Co. Mill, 3/4-mile northeast of Keauo Village.

RECESSION OF TRIANGULATION INTERSECTION STATION

NAME OF STATION: OLAH SUGAR CO. STACK 1949
Chief of Party: R.A. Critchlow
Year: 1977

Detailed statement of any material evidence concerning the recovery of the station:

The station was recovered in good condition and as described with the exception it is now owned by the Puna Sugar Company.

<table>
<thead>
<tr>
<th>X Coordinate</th>
<th>Y Coordinate</th>
</tr>
</thead>
<tbody>
<tr>
<td>660,440.82</td>
<td>290,999.73</td>
</tr>
</tbody>
</table>

*Plane azimuth has been computed by the formula.*
HORIZONTAL CONTROL DATA

OLAA SUGAR CO WATER TANK

HAWAII

STATE: HAWAII

YEAR: 1949

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: OLA SUGAR CO WATER TANK

YEAR: 1949

ELEVATION: METERS

LATITUDE: 19° 38' 33.463"

LONGITUDE: 155° 02' 05.660"

SOURCE: G-9275

STATE COORDINATES (FOOT):

STATE & ZONE CODE X Y

HI 1 5101 4768.1094 341.08 291.080.05 0.05 23

PLANE AZIMUTH HAS BEEN COMPUTED BY THE KURU FORMULA NEGLCETING THE SECOND TERM.

TO STATION OR OBJECT GEOID ADJACENT (FROM"

PLANE ADJACENT (FROM"

FLOOD

OLAA SUGAR CO WATER TANK

DESCRIPTION OF TRIANGULATION INTERSECTION STATION

NAME OF STATION: OLAA SUGAR CO WATER TANK

CHIEF OF PARTY: C.T. Husemeyer

The station is the top and center of an elevated steel water tank on the grounds of the Olaa Sugar Company Mill.

The tank is about 30 feet in diameter and about 25 feet high.

It is located about 400 yards west of the grinding mill.

RECOVERY NOTE: TRIANGULATION STATION

NAME OF STATION: Olaa Sugar Co., Water Tank

ESTABLISHED BY: C.T. Husemeyer YEAR: 1949

RECOVERED BY: B.M. Whipp YEAR: 1967

AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN:

Detailed statement as to the features of the original description, including names, landmarks, changes made, and other pertinent facts:

Station was recovered. It is the silver-colored, elevated, water tank, with painted top painted alternate red and white, located at the Olaa Sugar Co. Mill, 3/4-mile northeast of Keaau Village.

RECOVERY NOTE: TRIANGULATION INTERSECTION STATION

NAME OF STATION: OLA SUGAR CO WATER TANK

CHIEF OF PARTY: L.A. Critchlow

YEAR: 1977

STATE: HAWAII

COUNTY: HAWAII

The station was recovered in good condition and as described with the exception it is now owned by the Puna Sugar Company.

OLAA FORM 39-2

(U.S. DEPARTMENT OF COMMERCE)

16-7-71

101551

STATION 1126

HAWAII

LATITUDE: 19° 33' TO 19° 30'

LONGITUDE: 155° 00' TO 155° 30'

DIAGRAM NE 5-1-3 HAWAII

0
HORIZONTAL CONTROL DATA

Omakokei (Hawaii Island, Hawaiian Government Survey, 1891).--In the central part of Hawaii, on a hill of the same name, near the southeast foot of Mauna Kea. Marked by a triangle cut in the rock imbedded in the ground, with three ridges of imbedded rocks radiating from the center.

RECOVERY NOTE. TRIANGULATION STATION

Omakokei

NAME OF STATION: Omakokei STATE: Hawaii COUNTY: Hawaii
ESTABLISHED BY: H.O.S. YEAR: 1891 LOCALITY: Hilo, Hanalei Rd., Hawaii
RECOVERED BY: J. H. Murray YEAR: 1955

Detailed statement as to the fitness of the original description:

Location of Station: On the summit of a large hill of the same name near the southeast foot of Mauna Kea slope. The Klei-Humula road skirts the foot of north slope of this hill at a point 0.1/2 miles from Humula.

Old mark found: The old mark, a 6 on rock and stone pile was found.

New station mark: U.S. Type D Monument (Triangular concrete monument 7 1/2 feet on each side with 2 1/2" pipe 3 feet long set on steel legs over the old mark which is left exposed to view. A standard metal target is set in the 2 1/2" pipe.

Form 326
11-12-23

U.S. DEPARTMENT OF COMMERCE - COAST AND GEODETIC SURVEY

RECOVERY NOTE. TRIANGULATION STATION

NAME OF STATION: Omakokei
ESTABLISHED BY: H.O.S. YEAR: 1891 STATE: Hawaii
RECOVERED BY: J. H. Murray YEAR: 1955 COUNTY: Hawaii

Detailed statement as to the fitness of the original description: Includes mark found, stationline changes made, and other pertinent facts:

Located about 3.2 mi. SE of Pahukule Huijine Lodge, 2.2 mi. SE of Humula Sheep Station, northerly of a group of six similar hills, at the

outmost point of the hill known as Omakokei.

To reach from Hilo Post Office, drive W on old Rd. 1/2 mi. to locked gate; 0.7 mi. past the first agriculture dept.; 3.2 mi. beyond this point at a crest in the road, turn W.

Station mark: The old mark is a 6 on rock and stone pile.

Reference mark No. 1: Copper nail and washer cemented in lava rock. Reference mark No. 2: Copper nail and washer cemented in lava rock and 0.17 ft. from station mark in azimuth 137°01'.

*Plates of party should be handed here. The officer who actually visited and marked the station should sign his name at the end of the party notes.

HAWAII LATITUDE 19°30' TO 20°03'
LONGITUDE 155°00' TO 155°30'

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: Omakokei
STATE: Hawaii YEAR: 1891

ELEVATION: 2161.0 METERS 7090 FEET

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>500.445.49</td>
<td>320.249.07 * + 0002</td>
</tr>
</tbody>
</table>

* Plane azimuth has been computed by the + method.
**HORIZONTAL CONTROL DATA**

by the
National Ocean Survey
OLD HAWAIIAN DATUM

---

**NAME OF STATION:** HAWAII H83

**STATE:** HAWAII

**COUNTY:** HAWAII

**DISTANCE AND DIRECTION FROM NEAREST TOWN:** 3 miles south of Hilo

**HEIGHT OF TELESCOPE ABOVE STATION MARK:** 4 feet

**HEIGHS OF LIGHT ABOVE STATION MARK:** 4 feet

**DISTANCES AND DIRECTIONS TO ALTIMETER MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION**

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>NORTH (FEET)</th>
<th>SOUTH (METERS)</th>
<th>WEST (FEET)</th>
<th>EAST (METERS)</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM 1</td>
<td>31.99</td>
<td>9.750</td>
<td>96</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>RM 2</td>
<td>28.38</td>
<td>8.650</td>
<td>23</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>RM 1 to RM 2</td>
<td>36.10</td>
<td>11.002</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The station is located about 4 miles north of Hilo and 3 miles south of Hilo on the east side of State Highway 11 on the highway right-of-way.

To reach the station from the junction of State Highways 11 and 19 in Hilo, go south on State Highway 11 for 3.45 miles to a small powerline crossing, 0.03 miles south of a highway bridge. Park east of this on a steep bank about 40 feet from the edge of the highway to the station site.

The station marks are State of Hawaii survey disks stamped PANAMA 1977. The surface disk is set in a round concrete post centered in a 4 foot concrete platform and recessed 0.3 foot. The underground disk is set in an irregular mass of concrete about 4 feet below the ground. They are about 40 feet east of the east edge of the highway, 29 feet south of a powerpole and 8 feet east of the top of a slope.

Reference mark 1, stamped 1, is a railroad spike with a punch hole marking the center, cemented in a drill hole in a boulder, 13 feet east of the top of a slope and 10 feet southeast of upper end of a rock end concrete waterline cover.

Reference mark 2, stamped 2, is a railroad spike with a punch hole marking the center, cemented in a drill hole in a concrete foundation for a manhole cover 18 feet east of a powerpole.

---

**ADJUSTED HORIZONTAL CONTROL DATA**

**NAME OF STATION:** PANAMA HGS

**STATE:** HAWAII

**YEAR:** 1977

**FIRST:** YES

**SOURCE:** G-16, 41

**ELEVATION:** 66.2 feet

**METERS:** 217 feet

**STATE COORDINATES (METRIC)**

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>648,932.75</td>
<td>304,928.08</td>
<td>0 08 45</td>
</tr>
</tbody>
</table>

**STATE & CODE**

<table>
<thead>
<tr>
<th>STATE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAWAI</td>
<td>HGS</td>
<td>648,932.75</td>
<td>304,928.08</td>
<td>0 08 45</td>
</tr>
</tbody>
</table>

**TO STATION OR OBJECT**

<table>
<thead>
<tr>
<th>GEOGRAPHIC HORIZONTAL (DEGREES)</th>
<th>PLANAR AZIMUTH (DEGREES)</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAWAI 2 HGS</td>
<td>144 58 46.2</td>
<td>5101</td>
</tr>
<tr>
<td></td>
<td>144 58 03</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** DATA OBTAINED FROM ADJUSTMENT OF JAN 1977

---

* Name of chief of party should be inserted here. The person who actually visited the station should sign his name at the end of the survey note.

**U.S. DEPARTMENT OF COMMERCE**

**NOAA FORM 76-30**

**SUPERSEDING CASE FORMS MAY BE USED.**

---

**SM 129**
HORIZONTAL CONTROL DATA
by the
National Ocean Survey
OLD HAWAIIAN DATUM

NO ORIGINAL TEXT

Papaaloa (Hawaii Island, Hawaiian Government Survey, 1877; E. R. Hand, 1910).—On northeast coast of Hawaii, North Hilo District, land of Papaaloa, on the high flat-topped hill immediately behind the Papaaloa and about ½ mile from the road. To reach the station take the road or trail at plantation stable, near hospital, and go directly up the hill; the trail will turn to right and go under a flume, then continue again to top of hill. Just before top of the trail forks and goes either side of station, which will be found at highest point of hill. Station originally marked by a buried copper triangle; later by a cylinder of concrete, with top, 1 foot in diameter, level with ground. A United States Geological Survey tablet set in the concrete marks the center. A large pile of stones surrounds it.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: PAPAALOA


Detailed description as to the stones of the original description. Original station was described as an Ohia post with a copper triangle under it. In 1899 station was remarked with a concrete cylinder set in rammed stone and cement, marked with a drill hole, two inches deep and a cross. In 1912 the station was remarked by the U.S. Geological Survey with a bronze tablet set in a concrete cylinder 12 inches in diameter and projecting about six inches above the ground. In 1929 the U.S. Territory Survey placed a six-foot square concrete platform with four foot high masonry supports over the station. The disk may be plumbed to through a 3.5 inch pipe in the center of the platform.

Located on the northeast coast of Hawaii, in North Hilo District. Of Papaloa, on a high flat topped cone covered hill immediately behind the Papaloa and about ½ mile from the government road.

To reach from the post office in Hilo: go north on the coast highway for 25.0 miles to Papaloa post office, turn left and follow paved road up steep hill for 0.7 miles to a fork at small shack and station on right.

REFERENCE MARK NO.1 is east southeast of the station, on the west side of the road, two feet from the fence line and near the southeast corner of the shack. A standard reference disk stamped PAPAALOA NO 1 1949, set in the top of a square topped concrete post projecting three inches above the ground.

REFERENCE MARK NO.2 is south southwest of the station, on the south side of the road at a fence corner, near the northwest corner of the shack. A standard reference disk stamped, PAPAALOA NO 2 1949, set in the top of a square topped concrete flush with the ground.

(continued on next page)
HORIZONTAL CONTROL DATA
by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: PAPAALOA
ESTABLISHED BY: NGS
YEAR: 1877
STATE: Hawaii
COUNTY: Hawaii
Island: Hawaii
BENCH MARKS: Also
RECOVERED BY: D.M. Whipp
YEAR: 1966
AERIAL DISTANCE AND DIRECTION FROM NEAREST TOWN:

Detailed statements as to the tenure of the original description, including marks found, stamps, changes made, and other pertinent facts:

Station mark was recovered in good condition. The reference marks were searched for by distance and angle but not found and are believed destroyed by cultivation. No new reference marks are set. An oak planted next to the road and there is no suitable location. The shack mentioned in the 1949 description has been removed. A complete description follows:

Station is located about 3/4-mile southwest of Papatla Village and State Highway 19, on northwest bank of road at fork of paved cane field roads, at about 915 feet elevation, and 100 feet northwest of a prominent, lone, slender ironwood tree about 100 feet tall.

To reach station from the post office in Papatla, go east for 0.6 mile; cross State Highway 19 and continue upgrade for 1.0 mile to station.

Station mark is a USGS disk stamped "1927 1927", set in the top of a 12-inch-diameter concrete monument that projects 2 inches. A Type A signal is centered over the disk, with the 6-foot-square, concrete platform 4 feet above ground. It is 15 feet northwest of center line of road and 25 feet north-northwest of the roadway.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: PAPAALOA
ESTABLISHED BY: HGS
YEAR: 1877
STATE: Hawaii
COUNTY: Hawaii
BENCH MARKS: Also
RECOVERED BY: J.M. Collo
YEAR: 1966
AERIAL DISTANCE AND DIRECTION FROM NEAREST TOWN:

Detailed statements as to the tenure of the original description, including marks found, stamps, changes made, and other pertinent facts:

Station recovered in good condition. 1966 description adequate.
Papalekoki (Hawaii Island, Hawaiian Government Survey, 1877).—In the northern part of Hawaii, on the northern slope of Mauna Kea, on the north brow of the summit called Papalekoki, between the summits of Mauna Kea and Kaluamakanii. Station marked by a copper triangle underground, with an immense cairn over it.

RECOVERY NOTE. TRIANGULATION STATION

The mark for this station was not searched for as it is buried in an immense cairn. Some of the rocks of the cairn were removed but as the time for the building party was limited, the task was discontinued.

Station Papalekoki 2 (ceo) is at the surface of this same cairn which is very prominent for miles distant.

Station Papalekoki 2 is NNE of the cairn, 3.342 meters.

* Facts of chief of party should be inserted here. The officer who actually visited the station should sign his name at the end of the narrative above. Note.—For the plane terms must be used for every station measured.
HORIZONTAL CONTROL DATA

DESCRIPTION OF TRIANGULATION STATION

NAME OF STATION: PAPALEKOKI 2
STATE: HAWAII
COUNTY: NORTH SLOPE OF MAUNA KEA

CHIEF OF PARTY: L.C. WILDER
YEAR: 1948

HEIGHT OF STATION ABOVE STATION MARK: 1.7 METERS
HEIGHT OF LIGHT ABOVE STATION MARK: METERS

NOTE: DISTANCES AND DIRECTIONS TO ADJACENT MARKS, REFERENCE MARKS AND PROMINENT OBJECTS WHICH CAN BE SEEN FROM THE GROUND AT THE STATION

OBJECT: NONOMAOHE (target target)
PAPALEKOKI 2 RCC.

DISTANCE: 3.342 METER
DIRECTION: 00 00 00
DIRECTION: 226 10 54

The station is located on the northeastern and lower end of a prominent red ridge, on the northern slope of Mauna Kea. It is about 15 miles south of Honokaa, about 3.5 miles north northeast of the summit of Mauna Kea, about 0.2 mile northeast of the summit of a prominent red ridge, about 100 feet north of a small crater and 3.342 meters northwest of a large caldera.

The station is best reached by horse, from the northerly foot of Mauna Kea. This is about a 4 hour horse ride. The station is about 1000 feet above timber line. All water must be packed from the foot of the mountain. Good shelter for a tent is available in the small crater which lies about 100 feet south of the station.

The station is a standard disk, stamped PAPALEKOKI 1948, set into a drill hole in a boulder which projects about 6 inches.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: PAPALEKOKI 2
ELEVATION: 3426.4 FEET

STATE: HAWAII
YEAR: 1948

ELEVATION: 3426.4 FEET

STATE COORDINATES (FEET)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>COORD</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>505,120.62</td>
<td>379,075.50</td>
<td>+ 0 00 18</td>
</tr>
</tbody>
</table>

NOHOMAOHE

(continued on next page)
HORIZONTAL CONTROL DATA

by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

QUAD 192551
STATION 1131

LATITUDE * TO *
LONGITUDE * TO *

PAPALEOKI 2 (continued)

mile to fork. Take right fork and go 1.25 miles; take left fork and go 1.6 miles to fork; take left fork and go 2.35 miles to fork. Take right fork and go 1.1 miles to end of road at base of cinder hills at about 11,400 feet elevation. From here pack left, northeast, along approximately same elevation for about 4-1/2 miles to station.

Station mark is a standard disk stamped "PAPALEOKI 1948", cemented in a drill hole in bedrock flush with surrounding area.

PAPALEOKI 2 BGC 1948 is 3.342 meters (10.96 ft.) from station, in azimuth 329° 37' 34".
HORIZONTAL CONTROL DATA

NAME OF STATION: PAPALEKOKI 2 EEC
STATE: HAWAII
YEAR: 1948
SECOND ORDER

Station was recovered in good condition. It is now possible to reach station without use of horses, by using a 4-wheel-drive vehicle to gain station elevation, and then hiking about 4-1/2 miles at same level.

Station is located about 16 miles southeast of Kamuela, 15 miles south of Honokaa and 4 miles north of the summit of Mauna Kea, at about 11,241 feet elevation, on the northeast and lower point of a northeast-southwest ridge about 1600 feet long (the southwest, higher point very large cairn about 12 feet in diameter and 6 feet high, which is reportedly built over old station PAPALEKOKI (HGS) 1877.

To reach station from the post office in Kamuela, go south on State Highway 19 for 6.2 miles to junction with State Highway 20. Go left, on State Highway 20, for 9.8 miles to board gate on left, by power pole 71. Pass through gate and follow red cinder road for 1.7 miles; take left fork and go 0.05 mile; take left fork and follow main road for 2.25 miles to Pua Leau Cabin. Pass through gate and continue on track road...
for 0.9 mile to fork. Take right fork and go 1.25 miles; take left
fork and go 1.6 miles to fork; take left fork and go 2.35 miles to fork.
Take right fork and go 1.1 miles to end of road at base of cinder hills
at about 11,400 feet elevation. From here pack left, northeast, along
approximately same elevation for about 1 1/2 miles to station.
Station mark is a standard disk stamped "PAPALEKOXI 2 EOC 1948",
cemented in a drill hole in a rock in the top and center of the large
cairn. A smaller cairn, with a 4 x 4-inch signal pole in the center,
is built over the mark and extends 4 feet above the top of the large
cairn.
PAPALEKOXI 2 1948 is 3,342 meters (10,96 ft.) from station, in
azimuth 149° 37' 34".
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

0 151591 STATION 1133
HAWAII
LATITUDE 15°30' TO 20°00'
LONGITUDE 155°00' TO 155°30'
DIAGRAM NE 5-1-3 HAWAII

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION PAUKAA LIGHTHOUSE
STATE HAWAII YEAR 1950 THIRD ORDER

SOURCE G-SP156

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>640,097.75</td>
<td>338,656.49</td>
<td>+ 0.38 ft</td>
</tr>
</tbody>
</table>

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE X FORMULA REJECTING THE SECOND TERM

<table>
<thead>
<tr>
<th>TO STATION OR OBJECT</th>
<th>GEOGRAPHIC AZIMUTH (FROM NORTH)</th>
<th>PLANE AZIMUTH (FROM NORTH)</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

QD 335
Peak A (Poli'ahu) (Hawaiian Government Survey, 1892).—On the most conspicuous, but not the highest peak of Mauna Kea. Marked by a tall stone cairn, with tin box containing records of six parties since 1888.
### HORIZONTAL CONTROL DATA

**Station:** 1135  
**Latitude:** 19° 30' TO 20° 00'  
**Longitude:** 155° 00' TO 155° 30'  
**Diagram:** NE 5-13 HAWAII

#### ADJUSTED HORIZONTAL CONTROL DATA

**Name of Station:** PEAK B  
**State:** HAWAII  
**Year:** 1892  
**Third Order**

**Source:** G-SP15e

<table>
<thead>
<tr>
<th>Geodetic Latitude</th>
<th>19° 49' 30.11&quot;</th>
<th>Elevation</th>
<th>Meters</th>
<th>Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geodetic Longitude</td>
<td>155° 28' 34.04&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### State Coordinates (Feet)

<table>
<thead>
<tr>
<th>State Zone</th>
<th>Code</th>
<th>°</th>
<th>'</th>
<th>&quot;</th>
<th>°</th>
<th>'</th>
<th>&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>508,207.24</td>
<td>357,103.94</td>
<td>+0 00 29</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Plane Azimuth has been computed by the \( \mathbf{2 (in 00.01') \text{ formula neglecting the second term.} \)

#### To Station or Object

<table>
<thead>
<tr>
<th>Station or Object</th>
<th>Geodetic Azimuth (Short units)</th>
<th>Plane Azimuth (Long units)</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**QQ 387**
HORIZONTAL CONTROL DATA

NEW HAWAIIAN DATUM 1959

NAME OF STATION: PEEP EEKO POINT
YEAR: 1949
STATE: Hawaii County: Hawaii

CHIEF OF PARTY: C. T. Huesmeyer

Description: The station is the center of the light of Peep Eeko Point Lighthouse on the east coast of the island of Hawaii. The light flashes white and is mounted on a steel tower which is about 76 feet high. It is 247 feet above the ocean.

The station is located on Peep Eeko Point about 0.6 mile south of the plantation village.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: PEPE EKO POINT PHONE LIGHT

STABILIZED BY: H. J. J. Year: 1952
STATE: HAWAII

Detailed statement as to the names of the station, including marks found, stamplings, changes made, and other pertinent facts:

The station was recovered in good condition as described. The station is located on the water side of the plantation village and north of the playground.

RECOVERY NOTE, TRIANGULATION STATION INTERSECTION

NAME OF STATION: Peep Eeko Point Light

STABILIZED BY: C. T. Huesmeyer Year: 1949
STATE: Hawaii

Detailed statement as to the names of the station, including marks found, stamplings, changes made, and other pertinent facts:

The station was identified by angle check and recovered. Located at the north end of Peep Eeko Village, on Peep Eeko Point, at north end of large lagoon area. Station is center of flashing white light mounted atop a white, steel tower. Light is about 97 feet above ground and 125 above sea level.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: Peep Eeko Point Light

STABILIZED BY: C. T. Huesmeyer Year: 1949
STATE: Hawaii

Detailed statement as to the names of the station, including marks found, stamplings, changes made, and other pertinent facts:

The station was recovered in good condition as described. It is designated as No. 3071 in the publication 'Light List, Volume III, Pacific Coast and Pacific Islands, 1975'.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: Peep Eeko Point Light

STABILIZED BY: R. B. Misby Year: 1975
STATE: Hawaii

Detailed statement as to the names of the station, including marks found, stamplings, changes made, and other pertinent facts:

The station was recovered in good condition as described in 1966.
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

HAWAII
LATITUDE 15°30' TO 20°00'
LONGITUDE 155°00' TO 155°30'

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: PIPE
STATE: HAWAII
YEAR: 1900
THIRD ORDER

SOURCE: G-SP156

DEGREED LATITUDE: 19°46'55.342"
DEGREED LONGITUDE: 155°05'32.232"
ELEVATION: 5101.00

STATE COORDINATES:

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>N</th>
<th>E</th>
<th>Z COG &amp; 2 RADIANS</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>640.170.10</td>
<td>354.685.31</td>
<td>+ 0 08.17</td>
</tr>
</tbody>
</table>

* PLANE ADJUSTMENT HAS BEEN COMPUTED BY THE P.C.O.P. FORMULA NEGLIGENT THE SECOND TERM.

TO STATION OR OBJECT | GEODETIC ADJUST. (FROM CIRCUM.) | PLANE ADJUSTMENT (P.C.O.P.) | CODE
|---------------------|-----------------------------|-----------------|---|

QD 34...
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

NO ORIGINAL TEXT

Puu Ohai (Hawaii Island, Hawaiian Government Survey, 1877; E. R. Hand, 1913).—On northeast coast of Hawaii, in North Hilo District, land of Pakakuwai, on a not very pronounced cone-covered hill between Mauhau Gulch and the railroad station of Ninole. Station bears S. 27° W. from a church which is 1,200 meters east of Mauhau Gulch, on the road, and 200 meters from the sea. It is reached by leaving the government road at the plantation's road which goes "mauka" (inland) just a short distance east of the east end of the railroad tunnel. Follow this road past Kakakea Camp (Papaalaoa plantation) and when the church and a mango grove bear N. 27° E. turn up to top of hill about 200 meters above road. Marked by a buried copper triangle, above which is a concrete cylinder flush with the ground in the center of which is a United States Geological Survey disk.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: PUU OHAI
Established by Hawaiian Govt. YEAR: 1877 STATE: Hawaii
Recovered by E. R. Hand. YEAR: 1913 COUNTY: Hilo

Detailed statement as to the status of the original description, including marks found, stamping, change made, and other pertinent facts:

In 1877 when this station was established by the Hawaiian Government Survey, the following description was written: "Station marks, piece of concrete 2 feet underground 2 pits and a flat stone, by survey in Hawaii and in the adjacent of Pakakuwai 1/4 mile above the main road." In 1913 the station was recovered by E. R. Hand who noted the following note: "Station recovered. Present station marks a 12 inch concrete cylinder, covered by concrete covering, marked by a drill hole in its center and projecting 2 inches above the ground secured by a 4 foot long stake." In 1980, the station was recovered by the U.S. Geological Survey who noted the following note: "Original station recovered. Marked by a bronze tablet set in the top of the original concrete cylinder." This bronze disk was recovered by E. R. Hand in the year of 1913. At the time of this survey, the U.S. Geological Survey disk was recovered in good condition, however, it is now surrounded by a triangular slab of concrete, 5 feet on each side, which is flush with the surface of the soil. This concrete slab was installed by the Territory Survey about 1890. A new description follows:

The station is located, in cane land, about 5 miles southeast of Kaupo Point, about 2.5 miles northwest of Kauhoma, about 0.7 mile northwest of the highway which runs between Hilo and Honomu and about 150 feet north of a graded road.

The station is a U.S. Geological Survey bronze disk, stamped 70th, set in the top of a concrete cylinder which is 12 inches in diameter and flush with the surface of the soil. It is surrounded by a triangular slab of concrete 5 feet on each side and flush with the surface of the surrounding ground.

No reference marks were established at this station.

To reach from the post office in Hilo, go northerly, on the road which leads toward Honomu, for 21.4 miles; cross over the Ahole Bridge and turn left, onto a graded field road; go westward, up a steep grade, for 0.7 mile to the end of truck travel. From this point park north for about 150 feet to the station.

NOTE

OBJECT MEASURING DISTANCE

HAIKO (100) 00 00 00 3 miles
POLOLO 3 miles 48 26 39.70
PAPILOA (900) 3 miles 177 25 23.08

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: PUU OHAI
STATE: HAWAII YEAR: 1877 SECOND ORDER
SOURCE: G-9275

GEODETIC LATITUDE: 19° 36' 43.594
GEODETIC LONGITUDE: 155° 11' 31.694
ELEVATION: 224.2 METERS

STATE COORDINATES (DEG)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>X - 000</th>
<th>Y - 000</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>605,733.24</td>
<td>423,966.06</td>
<td>0 00 18</td>
<td></td>
</tr>
</tbody>
</table>

PLANE AZIMUTH HAS BEEN COMPUTED BY THE X - 000, Y - 000 FORMULA OR THE SECOND ORDER FORMULA.

TO STATION OR OBJECT

GEODETIC AZIMUTH (FROM STATION)
307 22 20.3
307 16 02

GEODETIC AZIMUTH (FROM OBJECT)
307 22 20.3
307 16 02

CODE

5101

GE 177
PUU OHAI (continued)

RECOVERY NOTE, TRIANGULATION STATION

Name of Station: PUU OHAI
Established by: HOS
Recovered by: D.M. Whipp

Year: 1877  State: Hawaii

County: Hawaii

Island: Hawaii

Station was recovered and found to be shifted several inches from its original position due to undermining of the concrete platform during cultivation of the canefield. Station should be considered destroyed.

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATHERMERIC ADMINISTRATION
NATIONAL OCEAN SURVEY, NATIONAL GEODETIC SURVEY

HORIZONTAL CONTROL DATA
by the NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

QUAD 191551  STATION 1138

LATITUDE °' TO °'
LONGITUDE °' TO °'
DIAMETER

U.S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY
HORIZONTAL CONTROL DATA
by the
National Ocean Survey
OLD HAWAIIAN DATUM

PUU OO (Hawaii Island, Hawaiian Government Survey, 1891).—In the central part of Hawaii, on south side of the summit of the hill, Puu Oo, near the southeastern foot of Mauna Kea. Marked by a triangle cut in the rock, and a chain of stones.

RECOVERY NOTE. TRIANGULATION STATION

NAME OF STATION: Puu Oo
STATE: Hawaii
COUNTY: Hawaii
Established by: U.S. Coast and Geodetic Survey
Year: 1891

Location of Station: In the central part of Hawaii, on the south side of the summit of Puu Oo Hill which is about 0.6 mile northwest of Puu Oo Ranch House and lies on the south side of Mauna Kea.

Old Station mark: Original 4 on rock and stonepile.

New Station mark: H.T.S. Type 4 monument (Triangular concrete monument 7 1/2 feet on each side with 1 1/2" pipe 8 feet long set on steel legs over the old mark which is left exposed to view. A standard metal target is set in the 1 1/2" pipe.

RECOVERY NOTE. TRIANGULATION STATION

NAME OF STATION: Puu Oo
STATE: Hawaii
COUNTY: Hawaii
Established by: Yo Yamamoto
Year: 1955

Location of Station: 20.2 mi. W of Hilo, 6.9 mi. NE of Humuula Stream station and 500 ft. 2 of a gravel rd., on top of a hill known as Puu Oo. To reach from Hilo Post Office, drive N. For 23.5 mi. along Saddle Rd. to site rd. leading N. to Halemaumau; then N. For 2.3 mi. to rd. fork; take right fork and continue 1.1 mi. to 500 ft. of low hill on a side of rd. 0.4 mi. beyond the side rd. leading down to the Puu Oo ranch house. Leave truck and climb to top of hill and station. A 5-min. walk.

Station mark: Drill hole and triangle cut in lava rock around which JNG has erected a type "D" monument. (The concrete platform 7.5 ft. on a side and 0.3 ft. above the station mark has been built.)

Reference marks: 1. Copper nail and washer cemented in rock, 51.35 ft. 2. 159° 27′ 40″. 3. Reference mark in talus, 219.5° 00′.

Diaphragm reference mark in talus, 219.5° 00′.
**HORIZONTAL CONTROL DATA**

by the National Ocean Survey
OLD HAWAIIAN DATUM

**ADJUSTED HORIZONTAL CONTROL DATA**

**NAME OF STATION:** PUU ULAULA

**STATE:** HAWAII

**YEAR:** 1991

**SHELF: G-SP156**

<table>
<thead>
<tr>
<th>STATE CODE</th>
<th>X</th>
<th>Y</th>
<th>Z (DP5) HI'95</th>
<th>ADJ LOK</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>511,505.96</td>
<td>254,211.02</td>
<td>+ 0 00 40</td>
<td></td>
</tr>
</tbody>
</table>

*Plane Azimuth has been computed by the z = (D - H) formula neglecting the second term.*

<table>
<thead>
<tr>
<th>TO STATION OR OBJECT</th>
<th>GEODESIC AZIMUTH</th>
<th>PLANE AZIMUTH</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>00 370</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Description of Triangulation Station

**Name of Station:** Puu Ulnila 2 (HTS) State

**Hawaii County:** Hawaii

**Chief of Party:** C. J. Huffman

**Year:** 1949

**Surveyed by:** C. J. Hoppin

**Height of Local Datum Station Base:** 3.05 ft

**Remarks:**

### Station Data

<table>
<thead>
<tr>
<th>Object</th>
<th>Distance</th>
<th>Bearing</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The station is located on the summit of Puu Ulnila, about 90 miles southwest of Hilo, about 18 miles northeast of the Hawaiian National Park Headquarters, about 9 miles east of the summit of Mauna Loa, about 200 feet east of the Pau Ulnala Reef House and at an elevation of 1003 feet.

To reach the Headquarters of the Hawaiian National Park, go westward on the road which leads toward Hilo, for 2.1 miles; turn right, as per the sign reading "Nani Pali," and go westward for 1.4 miles to a turn-around at the head of the road. The road continues straight ahead on the gravel road, for 0.4 miles, then through a locked gate (key for this gate may be obtained from the Hawaiian National Park Headquarters) and continues northwesterly on the main traveled road, for 1.4 miles to the summit of the road and to the station. From this point pass northwesterly, along a good trail for about 0.5 miles to the Pau Ulnala Reef House and the station hill.

Water can be obtained from the tank at the Pau Ulnala Reef House. This is about a 4-hour hike.

This station is the center of a triangle of concrete which projects about 2 feet from the top of a triangular slab of concrete which is about 6 feet on each side and is flush with the surface of the ground.

Reference mark 1 is the center of a bronze disk 18 inches in diameter which is used to point out the center of interest from the station hill. It is set in the center of a stone and concrete slab which is about 4 feet in height.

In 1848 when the Survey of Hawaii established this station, they placed the following note on their recovery card: "Nothing was found to indicate the mark which records show was never marked originally on the monument. However, a monument was placed at the highest point of the hill, 30 feet away from the top disk, with the marker, in the center of a stone and concrete slab which is about 4 feet in height. This disk, according to map by A. W. Leland, former U.S.G.S. Survey on Hawaii, is not the station mark. In any event the new monument should be re-located from the mark."
HORIZONTAL CONTROL DATA
by the
NATIONAL GEODETIC SURVEY
OLD HAWAIIAN DATUM

Puu Uulaula 2 (HTS) (continued)

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: Puu Uulaula 2 (HTS)
Established by: C.T. Huqseymeyer
Year: 1967
Bench Mark: Hawaii
County: Hawaii
Island: Island

Airline Distance and Direction from Nearest Town:

Lat: 00 00 00
Long: 00 00 00

Diluted statement as to the sources of the original description, including marks found, monuments, changes made, and other pertinent facts.

Station mark was recovered and found to be in poor condition. It was marked by a nail in the center of a cement-filled tomato can, which was set at the middle of a triangular, concrete platform about 7 feet on each side. The iron bar mentioned in original descriptions was not centered over this nail. The platform is somewhat cracked and broken so both the iron bar and center nail were in danger of being lost, so the station was re-marked with a standard station disk. The distance to the reference mark was checked. A complete description follows:

Station is located about 25 miles southwest of Hilo and 15 miles northwest of the Hawaii Volcanoes National Park Headquarters, on the top of a red cinder hill, known as Red Hill, on the east shoulder of Mauna Loa, 250 feet east from a cabin, and at about 10035 feet elevation.

To reach station from the Hawaii Volcanoes National Park Headquarters, go westward on Crater Rim Road for 1.8 miles; go right for 0.1 mile to crossroad at State Highway 11. Continue straight ahead, as per sign "Mauna Loa Strip Scenic Road", for 1.6 miles to road loop at Bird Park. Pass through stone gateposts and follow winding, macadam road for 10.2 miles to end of road. Pack northwesterly on Mauna Loa Trail for about 7 miles to Red Hill and station.

Station mark is a standard disk stamped "Puu Uulaula 2 1949 1967", riveted to the top of a 1-inch, iron pipe that is set in concrete about 2 inches below the top of the triangular concrete platform. A metal target, supported by 3 iron legs, is centered over the mark, and extends 8 feet above the platform.

Reference mark number one is the center of a 18-inch-diameter, bronze disk, with arrows indicating various points of interest, mounted on top of a stone and concrete cairn about 4 feet high.

NOTE: Packing time is about 4 hours. Water is available at the Puu Uulaula Cabin near station.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: Puu Uulaula 2 HTS
Established by: C.T. Huqseymeyer
Year: 1949
Bench Mark: Hawaii
County: Hawaii
Island: Island

Airline Distance and Direction from Nearest Town:

Distances and Directions to Nearest Mark, Reference Marks, and prominent objects which can be seen from the ground at the station:

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>DEG</th>
<th>DISTANCE</th>
<th>HEIGHT</th>
<th>DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>UMTAHUENA HGS 1956</td>
<td>29.945</td>
<td>8.529</td>
<td>03 27 35</td>
<td></td>
</tr>
<tr>
<td>RN 1</td>
<td>25.96</td>
<td>7.913</td>
<td>184 59 56</td>
<td></td>
</tr>
<tr>
<td>RN 2</td>
<td>2.59</td>
<td>0.790</td>
<td>323 08</td>
<td></td>
</tr>
<tr>
<td>77-506 USA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The triangular concrete platform and the metal target on the cairn were found destroyed. The station mark was found slightly loose in the ground and was reinforced with concrete on this date. Reference mark 1 was recovered in fair condition as the cairn it is cemented in was found slightly loose and, as a probable result, the distance to reference mark 1 differed from the 1949 measurement by 27 mm, and the direction differed by about 25 minutes. Reference mark 2 was set on this date. The previous descriptions are accurate with the following additions:

The station was reached by helicopter on this date but can also be reached by following the 1967 description.

Reference mark 2 is the center of a 3/4-inch galvanized pipe 2 feet long set in an irregular mass of concrete and projecting 0.2 feet above the ground.
NO STATION ASSIGNED TO THIS NUMBER
HORIZONTAL CONTROL DATA

RED HILL (HGS)
(Hawaii Island, Hawaiian Government Survey, 1877).—In the northern part of Hawaii, on a prominent peak on the northeast slope of Mauna Kea. Marked by a copper triangle underground, with a large stone cairn over it. Visible from the Volcano House.

RECOVERY NOTE, TRIANGULATION STATION

NAME OF STATION: RED HILL (HGS)
STATE: HAWAII
COUNTY: HAWAI'I
RECOVERED BY: C.G. Murray YEAR: 1956

Detailed statement as to the status of the original description:

Location of Station: In the northern part of Hawaii on a prominent peak on the northeast slope of Mauna Kea. The hill is about 4 miles southwesterly from Puu Kiihe ranch house.

Old Station Mark: The old copper triangle was the only definite mark to identify the station was found lying loose in a pile of stones on about the highest point of the hill. An old grave was found in this pile of stones.

New Station Mark: An H.T.S. Type D Monument was erected over the joint where the copper triangle was found but there is a question as to whether this station is built over the original point. It should be re-triangulated on.

DEPARTMENT OF COMMERCE

NAME OF STATION: RED HILL (HGS)
STATE: HAWAI'I
COUNTY: HAWAI'I
RECOVERED BY: C.G. Murray YEAR: 1940

Detailed statement as to the status of the original description, including marks found, stampings, changes made, and other pertinent facts:

The original station, consisting of a copper triangle, was found lying loose in a pile of stones by the Territory Survey in 1856 when they built a triangular concrete platform at the station site. They made note of the fact that some doubt exists as to whether this station is built over the original point. A new description follows.

The station is located on the northeast summit of Red Hill, which lies on the easterly slope of Mauna Kea, about 16.8 miles south-southeast of Honokaa, about 20 miles west of Honokaa, about 3.7 miles east-northeast of the summit of Mauna Kea and at an elevation of 11,054 feet.

The station can be reached, by trail, from the Puu Kiihe Ranch House which is about 7.8 miles, by road, west of the Kahinau Ranch Headquarters.

This station is the center of a 2 1/2 inch iron pipe which projects about 2 feet from the top of a triangular slab of concrete which is 6 feet on each side and about flush with the surrounding rock.

This station was located by 16 position intersections from various triangulation stations.

(continued on next page)
RECOVERY NOTE, TRIANGULATION STATION

Station was not visited, but the target may be seen from surrounding stations.
Located about 23 miles west-northeast of Hilo, on the northeast slopes of Mauna Kea, on the summit of Red Hill, at about 11,853 feet elevation, about 3/4-mile northeast of Puu Makanaka.
Station is marked by a 2-1/2-inch iron pipe, projecting 2 feet from the center of a triangular concrete platform. A red and white metal target is mounted in the iron pipe and extends about 8 feet above the platform.

REMARKS ON RECOVERED DESCRIPTION:

The station mark was recovered in good condition as described in the NGS recovery note by C. T. Hummeyer, 1949.
Reached via helicopter.
# Horizontal Control Data

**Statement**

**Name of Station:** REEF  
**State:** HAWAII  
**Year:** 1990  
**Third Order**

**Source:** G-SF15c

**Geodetic Coordinates (feet):**

<table>
<thead>
<tr>
<th>State &amp; Zone</th>
<th>Code</th>
<th>X (feet)</th>
<th>Y (feet)</th>
<th>Z (feet)</th>
<th>* ΔX * ΔY + ΔZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>647,262.00</td>
<td>327,722.31</td>
<td>+ 0 08 41</td>
<td></td>
</tr>
</tbody>
</table>

* Plane Azimuth has been computed by the H.H.O. formula neglecting the second term.

<table>
<thead>
<tr>
<th>To Station or Object</th>
<th>Geodetic Azimuth (true north)</th>
<th>Plane Azimuth*</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>QO 325</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State &amp; Zone</td>
<td>Code</td>
<td>X</td>
<td>Y</td>
</tr>
<tr>
<td>--------------</td>
<td>------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>580,183.01</td>
<td>421,573.76</td>
</tr>
</tbody>
</table>

*Plane Azimuth has been computed by the $\phi - \lambda$ formula neglecting the second term.

## Geodetic Control Data

**Station:** 1145

**State:** Hawaii

**Latitude:** 19° 30' to 20° 30'

**Longitude:** 155° 00' to 155° 30'

**Diagram:** No. 515

**Adjusted Horizontal Control Data**

**Name of Station:** Ridge

**State:** Hawaii

**Year:** 1902

**Third:** Lower

**Source:** G-59156

**Geodetic Latitude:** 19°30'36.056

**Geodetic Longitude:** 155°15'59.256

**Elevation (Meters):**

**Elevation (Feet):**
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

ADJUSTED HORIZONTAL CONTROL DATA

OBS BY NGS
SECOND ORDER

NAME OF STATION: HANAI
STATE: HI
YEAR: 1977

GEOGRAPHIC LATITUDE: 19° 30' 3" N
GEOGRAPHIC LONGITUDE: 155° 49' 19.5" W
ELEVATION: 4201.9 ft

STATE COORDINATES (First)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z OR H.</th>
<th>MILES</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI I</td>
<td>5401</td>
<td>594,591.02</td>
<td>360,418.71</td>
<td>+ 0 00 34</td>
<td></td>
</tr>
</tbody>
</table>

"PLANE AZIMUTH HAS BEEN COMPUTED BY THE X Y Z " FORMULA REJECTING THE SECONDARY EQUATION.

<table>
<thead>
<tr>
<th>TO STATION OR OBJECT</th>
<th>GEOGRAPHIC AZIMUTH (From North)</th>
<th>PLANE AZIMUTH (From North)</th>
<th>CODE</th>
</tr>
</thead>
</table>

DATA OCCURRED FROM ADJUSTMENT OF JAN 1979

N M 1944
**HORIZONTAL CONTROL DATA**

by the
National Ocean Survey
OLD NAVARAN DATUM

**ADJUSTED HORIZONTAL CONTROL DATA**

**NAME OF STATION**: SOUTH ALIMUTH STATION  
**STATE**: HAWAII  
**YEAR**: 1892  
**STATION**: 1147  
**DIAGRAM**: NE 3-13  

**SOURCE**: 6-SP156

**DEGEEC T LATITUDE**: 15°48'48.81"  
**DEGREE Longitude**: 155°28'47.08"

<table>
<thead>
<tr>
<th>DEGREE DEGREES (1992)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATE &amp; ZONE</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>HI 1</td>
</tr>
</tbody>
</table>

*Plane azimuth has been computed by the A'O'D formula neglecting the second term.*

**TO STATION ON OBJECT**

**DEGEEC T LATITUDE**:  
**DEGREE Longitude**:  
**PLANE AZIMUTH**:  
**CODEx**:  

**QD 388**
HORIZONTAL CONTROL DATA
by the National Ocean Survey
OLD HAWAIIAN DATUM

NO TEXT

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION: SOUTH BASE 1
STATE: HAWAII
YEAR: 1891
THIRD ORDER

SOURCE: O-SP150

GEODETIC LATITUDE: 19° 45' 42.884"
GEODETIC LONGITUDE: 155° 22' 15.096"

ELEVATION: METERS

STATE COORDINATES (Feet)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>544,403.06</td>
<td>337,223.99</td>
<td>0 02 37</td>
</tr>
</tbody>
</table>

* PLANE AZIMUTH HAS BEEN COMPUTED BY THE X X Y FORMULA NEGLECTING THE SECOND TERM

<table>
<thead>
<tr>
<th>TO STATION OR OBJECT</th>
<th>GEODETIC AZIMUTH (2-90 marks)</th>
<th>PLANE AZIMUTH (From mark)</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Q3 373</td>
</tr>
</tbody>
</table>
HORIZONTAL CONTROL DATA

by the
National Ocean Survey
OLD HAWAIIAN DATUM

SEE STATION HILO SOUTH BASE

HAWAII
LATTITUDE 19° 30' TO 20° 00'
LONGITUDE 155° 00' TO 155° 30'
DIAGRAM NE 3 1/2 HAWAII

ADJUSTED HORIZONTAL CONTROL DATA

NAME OF STATION STAKE 88
STATE HAWAI'I
YEAR 1940
THIRD

SOURCE G-5276
NO OBSERVATION CHECK ON THIS POSITION

GEODETIC LATITUDE 19° 40' 55.47'
GEODETIC LONGITUDE 155° 03' 14.73'
ELEVATION 44.7 METERS

STATE COORDINATES (FIPS)

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>θ (OR Δ H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>5101</td>
<td>653,395.91</td>
<td>308,817.92</td>
<td>+ 0 09 01</td>
</tr>
</tbody>
</table>

* PLAN A ZENITH HAS BEEN COMPUTED BY THE Z = OR Δ H FORMULA NEGLIGEING THE SECOND TERM.

TO STATION OR OBJECT GEODETIC AZIMUTH (From north) PLANE AZIMUTH (From north) CODE

POSITION DETERMINED BY TRAVERSE FROM STATION HILO SOUTH BASE

QE 275
**HORIZONTAL CONTROL DATA**

by the
National Ocean Survey
OLD HAWAIIAN DATUM

<table>
<thead>
<tr>
<th>STATION</th>
<th>1152</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAWAII</td>
<td></td>
</tr>
<tr>
<td>LATITUDE</td>
<td>15°30' TO 20°00'</td>
</tr>
<tr>
<td>LONGITUDE</td>
<td>155°00' TO 155°30'</td>
</tr>
<tr>
<td>DIAGRAM</td>
<td>NE 5.1.3 HAWAII</td>
</tr>
</tbody>
</table>

**ADJUSTED HORIZONTAL CONTROL DATA**

**NAME OF STATION:** STAND

**STATE:** HAWAII

**YEAR:** 1900

**THIRD ORDER**

**SOURCE:** G-SP156

**NO OBSERVATION CHECK ON THIS POSITION**

**DEGEOGRAPHIC LATITUDE:** 19°43'31.48"

**DEGEOGRAPHIC LONGITUDE:** 155°34'49.56"

**ELEVATION:** 0 METERS

**ELEVATION:** 0 FEET

**STATE COORDINATES (HUDO)**

<table>
<thead>
<tr>
<th>STATE &amp; ZONE</th>
<th>CODE</th>
<th>X</th>
<th>Y</th>
<th>Ω &lt;X, Y, Ω&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 1</td>
<td>9101</td>
<td>444,296.18</td>
<td>324,129.60</td>
<td>+ 0°08.30</td>
</tr>
</tbody>
</table>

*PLANE AZIMUTH HAS BEEN COMPUTED BY THE Ω = (Y, X) FORMULA NEGLECTING THE SECOND TERM.*

**TO STATION OR OBJECT**

<table>
<thead>
<tr>
<th>GEODETIC AZIMUTH (From north)</th>
<th>PLANE AZIMUTH (From north)</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>QQ 330</td>
</tr>
</tbody>
</table>