

## SECTION 6

# GEOGRAPHY AND ENVIRONMENT

This section relates to area, climatologic, topographic, hydrologic, and other geographic and environmental measurements of Hawaii.

The State consists of eight major Islands and 124 minor Islands with a total land area of 6,425 square miles and a coastline of 750 miles. Honolulu is 214 miles from Hilo, 1,367 miles from Kure Atoll (the westernmost end of the State), and 2,397 miles from San Francisco. The highest peak in the State is Mauna Kea, 13,796 feet above sea level; the longest stream is Kauhonahua Stream, 33 miles in length; the biggest lake is Halalii, 841 acres; and the highest named waterfall is Kahiwa, a 1,750-foot cascade. Various measures of air pollution, such as suspended particulate matter and radioactivity, indicate that Honolulu is one of the cleanest cities in the nation. There is also very little water pollution: eight out of nine major Oahu beaches were rated "A" in 1971 (coliform not exceeding 50 to 100 ml.) and only one was rated either "B" (51-500) or "C" (501 or more). Climatically, Hawaii is marked by remarkably balmy temperatures and wide variations in rainfall. The all-time temperature range in downtown Honolulu, for example, is from 57° to 88°F. Normal precipitation, however, ranges from 5.7 inches near Kawaihae to 486 inches atop Waialeale. The longest volcanic eruption in Island history lasted 875 days, the worst earthquake attained 7.5 on the Richter scale, and the highest tsunami wave reached 66 feet.

Important sources of data include the U.S. Geological Survey, National Ocean Survey, National Weather Service, U.S. Bureau of the Census Geography Division, the Division of Water and Land Development of the State Department of Land and Natural Resources, the State Department of Health, and the University of Hawaii Institute of Geophysics. Detailed information is given in *Geographic Statistics of Hawaii*, published by the Department of Planning and Economic Development (now out of print). National data are reported in *Statistical Abstract of the United States: 1972*, Section 6.

**Table 70.—GREAT CIRCLE DISTANCES IN STATUTE MILES BETWEEN HONOLULU INTERNATIONAL AIRPORT AND SPECIFIED PLACES**

| Place  | Miles from Honolulu | Place                                  | Miles from Honolulu |
|--|---------------------|--|---------------------|
| <b>Hawaiian Islands:</b>                       |                     | <b>Other Pacific, con.:</b>            |                     |
| Cape Kumukahi, Hawaii <sup>1</sup> .....       | 236                 | Hong Kong .....                        | 5,541               |
| Hilo, Hawaii .....                             | 214                 | Johnston Island .....                  | 820                 |
| Ka Lae (South Cape), Hawaii .....              | 221                 | Kingman Reef .....                     | 1,073               |
| Kailua, Kona, Hawaii .....                     | 168                 | Manila, Philippines .....              | 5,293               |
| Kahului, Maui .....                            | 98                  | Pago Pago, Amer. Samoa .....           | 2,606               |
| Lanai Airport .....                            | 72                  | Palmyra Islands .....                  | 1,101               |
| Molokai Airport .....                          | 54                  | Papeete, Tahiti .....                  | 2,741               |
| Lihue, Kauai .....                             | 103                 | Suva, Fiji .....                       | 3,159               |
| Puuwai, Niihau .....                           | 152                 | Sydney (Port Jackson), Australia ..... | 5,070               |
| Nihoa .....                                    | 283                 | Tokyo, Japan .....                     | 3,847               |
| Necker Island .....                            | 520                 | Wake Island .....                      | 2,294               |
| French Frigate Shoals .....                    | 556                 |  |                     |
| Gardner Pinnacles .....                        | 688                 |  |                     |
| Maro Reef .....                                | 851                 |  |                     |
| Laysan Island .....                            | 936                 |  |                     |
| Lisianski Island .....                         | 1,065               | <b>North America:</b>                  |                     |
| Pearl and Hermes Atoll .....                   | 1,208               | Anchorage, Alaska .....                | 2,781               |
| Midway Islands .....                           | 1,309               | Chicago, Illinois .....                | 4,179               |
| Kure Atoll <sup>1</sup> .....                  | 1,367               | Cristobal, Canal Zone .....            | 5,214               |
|  |                     | Los Angeles, California .....          | 2,557               |
| <b>Trust Territory of the Pacific Islands:</b> |                     | Miami, Florida .....                   | 4,856               |
| Majuro, Marshall Islands .....                 | 2,271               | New York, N.Y. ....                    | 4,959               |
| Kwajalein, Marshall Islands .....              | 2,443               | Portland, Oregon .....                 | 2,595               |
| Kolonia, Ponape, E.C.I. ....                   | 3,087               | San Diego, California .....            | 2,610               |
| Saipan, Mariana Islands .....                  | 3,704               | San Francisco, California .....        | 2,397               |
| Koror, Palau, W.C.I. ....                      | 4,593               | Seattle, Washington .....              | 2,679               |
|  |                     | Vancouver, B.C. ....                   | 2,709               |
| <b>Other Pacific locations:</b>                |                     | Victoria, B.C. ....                    | 2,668               |
| Apra Harbor, Guam .....                        | 3,806               | Tijuana, Mexico .....                  | 2,616               |
| Auckland, N.Z. ....                            | 4,393               | Washington, D.C. ....                  | 4,829               |

<sup>1</sup>The great circle distance from Kure Atoll to Cape Kumukahi, Hawaii, is 1,523 statute miles. This distance represents the total length of the Hawaiian Archipelago.

Source: U.S. Geological Survey measurements cited in the Hawaii State Department of Planning and Economic Development, *Geographic Statistics of Hawaii* (Statistical Report 67, July 1, 1969), p. 5.

Table 71.—AREA AND COASTLINE OF COUNTIES, ISLANDS, AND CITIES

| County, Island or city       | Area in square statute miles |         |              | Coastline in statute miles     |                 |
|------------------------------|------------------------------|---------|--------------|--------------------------------|-----------------|
|                              | Total                        | Land    | Inland water | General coastline <sup>1</sup> | Tidal shoreline |
| The State .....              | 6,450                        | 6,425   | 25           | 750                            | 1,052           |
| Counties:                    |                              |         |              |                                |                 |
| Hawaii .....                 | 4,038.0                      | 4,037.0 | 1.0          | 266                            | 313             |
| Maui .....                   | 1,161.1                      | 1,160.3 | 0.8          | } 210                          | 343             |
| Kalawao .....                | 13.3                         | 13.3    | —            |                                |                 |
| Honolulu .....               | 610.9                        | 595.7   | 15.2         |                                |                 |
| Kauai .....                  | 627.1                        | 619.1   | 8.0          | 137                            | 234             |
|                              |                              |         |              | 137                            | 162             |
| Islands:                     |                              |         |              |                                |                 |
| Hawaii .....                 | 4,038.0                      | 4,037.0 | 1.0          | 266                            | 313             |
| Maui .....                   | 728.8                        | 728.2   | 0.6          | 120                            | 149             |
| Kahoolawe .....              | 45.0                         | 45.0    | —            | 29                             | 36              |
| Molokini .....               | <0.01                        | <0.01   | —            | —                              | —               |
| Lanai .....                  | 139.5                        | 139.5   | —            | 47                             | 52              |
| Molokai .....                | 261.1                        | 260.9   | 0.2          | 88                             | 106             |
| Oahu .....                   | 607.7                        | 592.7   | 15.0         | 112                            | 209             |
| Kauai .....                  | 553.3                        | 548.7   | 4.6          | 90                             | 110             |
| Niihau .....                 | 73.0                         | 69.6    | 3.4          | 45                             | 50              |
| Lehua .....                  | 0.4                          | 0.4     | —            | —                              | —               |
| Kaula .....                  | 0.4                          | 0.4     | —            | 2                              | 2               |
| Northwestern Haw'n Isl. .... | 3.2                          | 3.0     | 0.2          | 25                             | 25              |
| Cities:                      |                              |         |              |                                |                 |
| Hilo .....                   | 298.9                        | 298.9   | —            | —                              | —               |
| Honolulu .....               | 88.7                         | 86.6    | 2.1          | —                              | —               |
| On Oahu .....                | 85.5                         | 83.6    | 1.9          | —                              | —               |
| On NW Haw'n Isl. ....        | 3.2                          | 3.0     | 0.2          | 25                             | 25              |

<sup>1</sup>Figures for the four Islands of Maui County are not consistent with the published County total.

Source: Hawaii State Department of Planning and Economic Development, *Geographic Statistics of Hawaii* (Statistical Report 67, July 1, 1969).

**Table 72.—MOUNTAIN HEIGHTS**  
(Elevation of the highest point on each Island and other important peaks.)

| Island and mountain            | Elevation (feet) | Island and mountain                | Elevation (feet) |
|--------------------------------|------------------|------------------------------------|------------------|
| <b>Hawaii:</b>                 |                  | <b>Oahu:</b>                       |                  |
| Mauna Kea <sup>1</sup> .....   | 13,796           | Kaala .....                        | 4,020            |
| Mauna Loa .....                | 13,677           | Konahuanui <sup>2</sup> .....      | 3,150            |
| Hualalai .....                 | 8,271            | Tantalus .....                     | 2,013            |
| Kohala .....                   | 5,480            | Olomana .....                      | 1,643            |
| Kilauea (Uwekahuna) .....      | 4,090            | Diamond Head .....                 | 760              |
| Kilauea (Halemaumau Rim) ..... | 3,646            | Punchbowl .....                    | 500              |
|                                |                  | Koko Head .....                    | 642              |
| <b>Kahoolawe:</b>              |                  | <b>Kauai:</b>                      |                  |
| Lua Makika .....               | 1,477            | Kawaikini .....                    | 5,243            |
|                                |                  | Waialeale .....                    | 5,148            |
| <b>Maui:</b>                   |                  | <b>Niihau:</b>                     |                  |
| Haleakala (Red Hill) .....     | 10,023           | Paniau .....                       | 1,281            |
| Haleakala (Kaupo Gap) .....    | 8,201            |                                    |                  |
| Puu Kukui .....                | 5,788            | Kaula .....                        | 550              |
| Iao Needle .....               | 2,250            | Nihoa .....                        | 910              |
| <b>Lanai:</b>                  |                  | Necker Island .....                | 277              |
| Lanaihale .....                | 3,370            | La Perouse Pinnacle .....          | 135              |
|                                |                  | Gardner Pinnacles .....            | 190              |
| <b>Molokai:</b>                |                  | Maro Reef .....                    | Awash            |
| Kamakou .....                  | 4,970            | Laysan Island .....                | 35               |
| Puu Nana .....                 | 1,381            | Lisianski Island .....             | 20               |
|                                |                  | Pearl and Hermes Atoll .....       | —                |
|                                |                  | Midway Islands <sup>3</sup> .....  | 12+              |
|                                |                  | Kure Atoll .....                   | 20               |
|                                |                  | Kingman Reef <sup>3</sup> .....    | 3                |
|                                |                  | Palmyra Islands <sup>3</sup> ..... | 6                |

<sup>1</sup>Includes 19 cones over 11,000 feet, five of them over 13,000.

<sup>2</sup>Two distinct peaks. The lower has an elevation of 3,105 feet.

<sup>3</sup>Not part of the State of Hawaii.

Source: U.S. Geological Survey data cited in the Hawaii Department of Planning and Economic Development, *Elevations of Major Mountains in Hawaii* (Statistical Report 52, November 7, 1967), as revised.

**Table 73.—MAJOR STREAMS, LAKES, AND WATERFALLS**

| Subject  | Name            | Island  | Magnitude |
|--|-----------------|---------|-----------|
| <b>Streams:</b>  |                 |         |           |
| Longest water feature (mi.) . . . . .                  | Kaukonahua Str. | Oahu    | 33.0      |
| Second longest water feature (mi.) . . . . .           | Wailuku Riv.    | Hawaii  | 32.0      |
| Greatest ave. discharge (million gal./day) . . . . .   | Wailuku Riv.    | Hawaii  | 303.5     |
| <b>Lakes:</b>  |                 |         |           |
| Greatest area (natural) (acres) <sup>1</sup> . . . . . | Halulu          | Niihau  | 182       |
| Greatest area (man-made) (acres) . . . . .             | Koloa Res.      | Kauai   | 422       |
| Longest shoreline (miles) . . . . .                    | Wahiawa Res.    | Oahu    | 11        |
| Highest (feet above sea level) . . . . .               | Lake Waiau      | Hawaii  | 13,020    |
| <b>Named waterfalls:</b>                               |                 |         |           |
| Greatest sheer drop (feet) . . . . .                   | Akaka           | Hawaii  | 442       |
| Highest cascade (feet) . . . . .                       | Kahiwa          | Molokai | 1,750     |

<sup>1</sup>Excludes fishponds and intermittent lakes. The largest intermittent lake is Halalii Lake, Niihau (840.7 acres).

Source: Hawaii State Department of Planning and Economic Development, *Geographic Statistics of Hawaii* (Statistical Report 67, July 1, 1969), as corrected.

**Table 74.—VOLCANIC ERUPTIONS: 1790 TO 1973**

(Includes eruptions over 200 days in duration, 15 square miles in area, or 200,000,000 cubic yards in volume; the most recent eruption of record for each volcano; and all eruptions since 1968.)

| Volcano and date of outbreak    | Duration (days) | Area (square miles) | Volume (cubic yards) |
|---------------------------------|-----------------|---------------------|----------------------|
| <b>Haleakala:</b>               |                 |                     |                      |
| c. 1790 .....                   | (NA)            | 2.2                 | 35,000,000           |
| <b>Hualalai:</b>                |                 |                     |                      |
| 1800-1801 .....                 | (NA)            | 17.7                | 410,000,000          |
| <b>Mauna Loa:</b>               |                 |                     |                      |
| 1843: Jan. 9 .....              | 90              | 20.2                | 250,000,000          |
| 1855: Aug. 11 .....             | 450             | 12.2                | 150,000,000          |
| 1859: Jan. 23 .....             | 300             | 32.7                | 600,000,000          |
| 1873: Apr. 20 .....             | 547             | (NA)                | (NA)                 |
| 1880: Nov. 1 .....              | 280             | 24.0                | 300,000,000          |
| 1887: Jan. 16 .....             | 10              | 11.3                | 300,000,000          |
| 1899: July 4 .....              | 19              | 16.2                | 200,000,000          |
| 1919: Sept. 29 .....            | Short           | 9.2                 | 350,000,000          |
| 1950: June 1 .....              | 23              | 35.0                | 600,000,000          |
| <b>Kilauea:</b>                 |                 |                     |                      |
| 1840: May 30 .....              | 26              | 6.6                 | 281,000,000          |
| 1919: Feb. 7 .....              | 294             | 1.6                 | 34,500,000           |
| Dec. 21 .....                   | 221             | 5.0                 | 62,000,000           |
| 1967: Nov. 5 .....              | 251             | 0.25                | 110,000,000          |
| 1968: Aug. 22 .....             | 5               | 0.01                | 50,000               |
| Oct. 7 .....                    | 15              | 0.8                 | 9,000,000            |
| 1969: Feb. 22 .....             | 6               | 2.3                 | 22,00,000            |
| May 24 .....                    | 875             | 19.0                | 240,000,000          |
| 1971: Aug. 14 .....             | < 1             | 0.8                 | 12,000,000           |
| Sept. 24 .....                  | 5               | 1.5                 | 10,000,000           |
| 1972: Feb. 4 <sup>1</sup> ..... | In progress     | 13.5                | 175,000,000          |
| 1973: May 5 .....               | < 1             | 0.07                | 1,200,000            |

NA Not available.

<sup>1</sup>Still in progress, July 1973; area and volume are as of early May 1973.

Source: Gordon A. Macdonald and Agatin T. Abbott, *Volcanoes in the Sea* (University of Hawaii Press, 1970), pp. 50, 53, 56-57, and 74-75; Hawaiian Volcano Observatory, records.

**Table 75.—EARTHQUAKES OF MAGNITUDE 5 OR GREATER: 1838 TO 1973**

| Date                     | Location                      | Estimated Richter magnitude <sup>1</sup> |
|--------------------------|-------------------------------|--|
| 1838: December 12 .....  | Hawaii .....                  | 6  |
| 1841: April 7 .....      | Hawaii .....                  | 6  |
| 1852: March 31 .....     | Hawaii .....                  | 6  |
| 1868: March 28 .....     | Hawaii .....                  | 6.5                                      |
| April 2 .....            | Hawaii .....                  | 7.5                                      |
| 1871: February 18 .....  | South of Oahu .....           | 6.5                                      |
| 1875: November 23 .....  | Hawaii .....                  | 6  |
| 1887: January 24 .....   | Hawaii .....                  | 6  |
| 1913: October 25 .....   | Hawaii .....                  | 6.5                                      |
| 1918: November 1 .....   | Hawaii .....                  | 6.5                                      |
| 1919: September 14 ..... | Hawaii .....                  | 6.5                                      |
| 1929: October 6 .....    | Hawaii .....                  | 6.5                                      |
| 1938: January 23 .....   | N. of Pauwela Pt., Maui ..... | 6.75                                     |
| 1940: June 17 .....      | Hawaii .....                  | 6  |
| 1941: September 25 ..... | Hawaii .....                  | 6  |
| 1950: May 30 .....       | Hawaii .....                  | 6.25                                     |
| 1951: April 23 .....     | Hawaii .....                  | 6.5                                      |
| August 21 .....          | Hawaii .....                  | 6.9                                      |
| 1952: May 23 .....       | Hawaii .....                  | 6  |
| 1953: January 15 .....   | Hawaii .....                  | 5.25                                     |
| 1954: March 30 .....     | Hawaii .....                  | 6  |
| March 30 .....           | Hawaii .....                  | 6.5                                      |
| 1961: September 25 ..... | Hawaii .....                  | 5.75-6                                   |
| 1962: June 28 .....      | Hawaii .....                  | 6.1                                      |
| 1963: October 23 .....   | Hawaii .....                  | 5  |
| 1964: October 11 .....   | W. of Kona Coast .....        | 5  |
| 1972: December 23 .....  | W. of Kona Coast .....        | 5  |
| 1973: April 26 .....     | Honolulu, Hawaii .....        | 6.2                                      |

<sup>1</sup>Except for the earthquake of April 2, 1868, magnitudes prior to 1929 are conjectural.

Source: Information supplied by Wm. Mansfield Adams and Augustine S. Furumoto, Hawaii Institute of Geophysics, University of Hawaii; *Honolulu Advertiser*, April 27, 1973. Correct to April 26, 1973.

**Table 76.—TSUNAMIS WITH RUN-UP OF 2 METERS (6.6 FEET) OR MORE: 1819 TO 1973**

| Date <sup>1</sup>       | Maximum height in Hawaii (feet) | Deaths in Hawaii | Damage in Hawaii |
|-------------------------|---------------------------------|------------------|------------------|
| 1819: April 12 .....    | 6.6                             | —                | Unknown          |
| 1837: Nov. 7 .....      | 19.7                            | 16               | 174 houses       |
| 1841: May 17 .....      | 15.1                            | —                | Unknown          |
| 1868: April 2 .....     | 65.6                            | 46               | Great locally    |
| August 14 .....         | 15.1                            | —                | Severe           |
| 1869: July 25 .....     | 29.9                            | —                | Some             |
| 1877: May 10 .....      | 16.1                            | 5                | Extensive        |
| 1878: Jan. 20 .....     | 9.8                             | —                | Some houses      |
| 1896: June 15 .....     | 29.9                            | —                | Unknown          |
| 1906: Jan. 31 .....     | 11.8                            | —                | Minor            |
| August 16 .....         | 11.8                            | —                | Some             |
| 1919: April 9 .....     | 14.1                            | —                | Minor            |
| April 30 .....          | 13.8                            | —                | Unknown          |
| 1922: November 11 ..... | 6.9                             | —                | Minor            |
| 1923: February 3 .....  | 20.0                            | 1                | \$1,500,000      |
| 1924: May 30 .....      | 16.4                            | —                | Great locally    |
| 1933: March 2 .....     | 9.5                             | —                | Unknown          |
| 1946: April 1 .....     | 55.8                            | 159              | \$26,000,000     |
| 1952: November 4 .....  | 20.0                            | —                | \$ 1,000,000     |
| 1957: March 9 .....     | 52.5                            | —                | \$ 5,000,000     |
| 1960: May 23 .....      | 34.4                            | 61               | \$23,000,000     |
| 1964: March 27 .....    | 15.7                            | —                | \$ 67,590        |

<sup>1</sup>Limited to tsunamis with a maximum run-up of 2.0 meters or more.

Source: George Pararas-Carayannis, *Catalog of Tsunamis in the Hawaiian Islands* (U.S. Coast and Geodetic Survey, May 1969); Robert C. Schmitt, "Catastrophic Mortality in Hawaii," *The Hawaiian Journal of History*, Vol. III (1969), pp. 66-86; Hawaii Institute of Geophysics, records. Correct to January 30, 1973.

**Table 77.—WATER QUALITY DATA FOR OAHU BEACHES: 1950 TO 1971**

| Beach                | Coliform per 100 milliliters (logarithmic average) |      |      |      |      |      |
|----------------------|--|------|------|------|------|------|
|                      | 1950   | 1960 | 1968 | 1969 | 1970 | 1971 |
| Ala Moana Park ..... | 177.0  | 11   | 14   | 5    | 3    | 7    |
| Fort De Russy .....  | 19.2   | 7    | 25   | 13   | 11   | 15   |
| Kuhio Beach .....    | 4.0  | 6    | 12   | 15   | 25   | 43   |
| Hanauma Bay .....    | 3.9  | 2    | 6    | 13   | 16   | 7    |
| Kailua Beach .....   | 6.4  | 6    | 12   | 13   | 15   | 14   |
| Punaluu Park .....   | 6.3  | 157  | 20   | 7    | 8    | 74   |
| Haleiwa Park .....   | 12.6   | 81   | 21   | 7    | 7    | 11   |
| Waianae Park .....   | 1.7  | 3    | 52   | 9    | 13   | 32   |
| Ewa Beach .....      | 2.4  | 9    | 6    | 6    | 4    | 6    |

Source: *Annual Report, Department of Health, State of Hawaii, Statistical Supplement, 1950-1971.*



**Table 78.—DAILY REFUSE, FOR OAHU: 1970**  
 (Excludes agricultural and military refuse.)

| Kind of refuse                   | Tons  |
|----------------------------------|-------|
| Total refuse .....               | 2,236 |
| Combustible:                     |       |
| Paper .....                      | 635   |
| Trimming .....                   | 362   |
| Rags .....                       | 23    |
| Wood .....                       | 494   |
| Food .....                       | 51    |
| Plastics and miscellaneous ..... | 20    |
| Non-combustible:                 |       |
| Metal .....                      | 127   |
| Glass .....                      | 63    |
| Demolition material .....        | 461   |

Source: Metcalf & Eddy, *Solid Waste Management Plan for City and County of Honolulu* (July 1971), p. 61.

**Table 79.—AEROMETRIC SURVEY DATA, FOR HONOLULU: 1957 TO 1972**

| Year       | Suspended particulate matter (mean micrograms per cubic meter) | Benzene-soluble organic matter (mean micrograms per cubic meter) | Beta radioactivity (mean micromicrocuries per cubic meter) |
|------------|--|--|--|
| 1957 ..... | 47   | 3.5  | 0.6  |
| 1958 ..... | 59   | 7.5  | 3.3  |
| 1959 ..... | 63   | 5.4  | 1.3  |
| 1960 ..... | 47   | 4.1  | 0.0  |
| 1961 ..... | 43   | 3.0  | 0.8  |
| 1962 ..... | 41   | 3.1  | 4.0  |
| 1963 ..... | 42   | 4.3  | 3.7  |
| 1964 ..... | 44   | 2.3  | 0.9  |
| 1965 ..... | 41   | 2.5  | 0.3  |
| 1966 ..... | 35   | 2.8  | 0.2  |
| 1967 ..... | 38   | 2.5  | 0.3  |
| 1968 ..... | 45   | 2.8  | (NA)   |
| 1969 ..... | 43   | 2.3  | (NA)   |
| 1970 ..... | 37   | 1.5  | (NA)   |
| 1971 ..... | 45   | (NA)   | (NA)   |
| 1972 ..... | 41   | (NA)   | (NA)   |

NA Not available.

Source: Hawaii State Department of Health, Environmental Health Division, Air Sanitation Branch, records.

**Table 80.—AIR POLLUTANT EMISSIONS, BY SOURCE AND COUNTY: 1970**

(In tons per year)

| Source or county                           | Sulphur oxides | Particulates | Carbon monoxide | Hydrocarbons | Nitrogen oxides |
|--|----------------|--------------|-----------------|--------------|-----------------|
| Total .....                                | 58,000         | 78,000       | 636,000         | 145,000      | 77,000          |
| Source:                                    |                |              |                 |              |                 |
| Motor vehicles .....                       | 1,000          | 1,420        | 413,500         | 67,900       | 40,700          |
| Aircraft .....                             | 570            | 1,390        | 4,570           | 3,810        | 1,250           |
| Vessels .....                              | 1,490          | 160          | 400             | 100          | 610             |
| Other transportation .....                 | 420            | 240          | 3,040           | 3,460        | 3,220           |
| Fuel combustion in stationary sources .... | 53,000         | 25,000       | 1,550           | 3,200        | 25,000          |
| Residential, commercial, institutional ... | 12,200         | 490          | 83              | 170          | 3,470           |
| Industrial .....                           | 12,000         | 910          | 11              | 160          | 3,000           |
| Agricultural .....                         | 2,550          | 22,800       | 1,450           | 2,200        | 3,900           |
| Steam-electric utilities .....             | 26,200         | 1,150        | 6               | 700          | 14,800          |
| Solid waste disposal .....                 | 400            | 5,800        | 24,600          | 8,700        | 1,900           |
| Industrial process losses .....            | 1,280          | 11,800       | 270             | 20,200       | 200             |
| Agricultural .....                         | (N)            | 31,900       | 188,000         | 37,600       | 3,740           |
| County:                                    |                |              |                 |              |                 |
| City and County of Honolulu .....          | 50,500         | 29,300       | 396,000         | 91,700       | 58,400          |
| Hawaii County .....                        | 3,000          | 22,800       | 97,400          | 21,800       | 8,100           |
| Kauai County .....                         | 1,200          | 11,900       | 55,600          | 12,200       | 3,900           |
| Maui County .....                          | 3,400          | 14,000       | 86,600          | 19,200       | 6,200           |

N Negligible

Source: Hawaii State Department of Health, Air Sanitation Branch, *Summary of Air Pollutant Emissions in the State of Hawaii, 1970* (table).

**Table 81.—AEROMETRIC SURVEY DATA FOR SPECIFIED LOCATIONS:1972**

| Subject  | Department of Health Bldg. <sup>1</sup> | Kalihi Kai <sup>2</sup> | Pearl City <sup>2</sup> | Barbers Point <sup>3</sup> | Waimanalo <sup>4</sup> | Ala Moana <sup>2</sup> | Kahului, Maui <sup>5</sup> | Kihei, Maui <sup>6</sup> | Hilo, Hawaii <sup>7</sup> |
|--|---|-------------------------|-------------------------|----------------------------|------------------------|------------------------|----------------------------|--------------------------|---------------------------|
| <b>Minimum:</b>                                |   |                         |                         |                            |                        |                        |                            |                          |                           |
| Particulate matter <sup>8</sup> .....          | 17                                      | 33                      | 20                      | 24                         | 17                     | 32                     | 26                         | 19                       | 14                        |
| Sulfur dioxide <sup>8</sup> .....              | < 5                                     | < 5                     | < 5                     | < 5                        | —                      | < 5                    | < 5                        | —                        | < 5                       |
| Nitrogen dioxide <sup>8</sup> .....            | <20                                     | <20                     | <20                     | <20                        | —                      | <20                    | —                          | —                        | <20                       |
| Carbon monoxide, 1 hr. values <sup>9</sup> ... | 1.5                                     | —                       | —                       | —                          | —                      | —                      | —                          | —                        | —                         |
| Carbon monoxide, 8 hr. values <sup>9</sup> ... | 0.1                                     | —                       | —                       | —                          | —                      | —                      | —                          | —                        | —                         |
| Photochemical oxidants <sup>8</sup> .....      | < 1                                     | —                       | —                       | —                          | —                      | —                      | —                          | —                        | —                         |
| <b>Maximum:</b>                                |   |                         |                         |                            |                        |                        |                            |                          |                           |
| Particulate matter <sup>8</sup> .....          | 114                                     | 232                     | 172                     | 155                        | 78                     | 104                    | 184                        | 125                      | 95                        |
| Sulfur dioxide <sup>8</sup> .....              | 36                                      | < 5                     | 7                       | 7                          | —                      | 12                     | 234                        | —                        | 16                        |
| Nitrogen dioxide <sup>8</sup> .....            | 236                                     | 170                     | 102                     | 49                         | —                      | 190                    | —                          | —                        | 36                        |
| Carbon monoxide, 1 hr. values <sup>9</sup> ... | 25.1                                    | —                       | —                       | —                          | —                      | —                      | —                          | —                        | —                         |
| Carbon monoxide, 8 hr. values <sup>9</sup> ... | 8.6                                     | —                       | —                       | —                          | —                      | —                      | —                          | —                        | —                         |
| Photochemical oxidants <sup>8</sup> .....      | 57                                      | —                       | —                       | —                          | —                      | —                      | —                          | —                        | —                         |
| <b>Annual average:</b>                         |   |                         |                         |                            |                        |                        |                            |                          |                           |
| Particulate matter <sup>8</sup> .....          | 41                                      | 78                      | 44                      | 55                         | 34                     | 70                     | 61                         | 67                       | 34                        |
| Sulfur dioxide <sup>8</sup> .....              | 11                                      | < 5                     | < 5                     | < 5                        | —                      | < 5                    | 38                         | —                        | < 5                       |
| Nitrogen dioxide <sup>8</sup> .....            | 56                                      | 47                      | 26                      | 21                         | —                      | 64                     | —                          | —                        | 27                        |

<sup>1</sup>Period of sampling: 12 months for particulates, 12 months for sulfur dioxide, 12 months for nitrogen dioxide, 11 months for carbon monoxide, and 12 months for photochemical oxidants.

<sup>2</sup>Period of sampling: 12 months for particulates, 12 months for sulfur dioxide, and 12 months for nitrogen dioxide.

<sup>3</sup>Period of sampling: 9 months for particulates, 9 months for sulfur dioxide, and 9 months for nitrogen dioxide.

<sup>4</sup>Period of sampling: 12 months.

<sup>5</sup>Period of sampling: 12 months for particulates and 9 months for sulfur dioxide.

<sup>6</sup>Period of sampling: 9 months.

<sup>7</sup>Period of sampling: 9 months for particulates, 7 months for sulfur dioxides, and 7 months for nitrogen dioxide.

<sup>8</sup>Concentration in micrograms per cubic meter.

<sup>9</sup>Concentration in milligrams per cubic meter.

Source: Hawaii State Department of Health, Environmental Health Division, Air Sanitation Branch, records.

**Table 82.—ENVIRONMENTAL QUALITY CONTROL: 1970-1971**

| Level of government<br>and expenditure<br>category | Revenue:<br>fiscal<br>1970-71 <sup>1</sup><br>(\$1,000) | Expenditure: fiscal<br>1970-71 (\$1,000) |                   | Employment:<br>October 1971 |               | Payroll:<br>October<br>1971<br>(\$1,000) |
|--|---|--|-------------------|-----------------------------|---------------|--|
|  |   | Current<br>operation                     | Capital<br>outlay | Full-<br>time               | Part-<br>time |  |
| <b>State of Hawaii:</b>                            |   |  |                   |                             |               |  |
| Water quality control .....                        | —   | 299                                      | 199               | 19                          | —             | 16                                       |
| Solid waste management .....                       | —   | 83                                       | —                 | —                           | 52            | 6  |
| Air quality control .....                          | —   | 246                                      | —                 | 22                          | —             | 20                                       |
| <b>City &amp; Co. of Honolulu:</b>                 |   |  |                   |                             |               |  |
| Water quality control .....                        | 253   | 4,402                                    | 15,678            | 394                         | —             | 325                                      |
| Solid waste management .....                       | 1,504   | 5,690                                    | 1,480             | 592                         | —             | 411                                      |
| Air quality control .....                          | —   | —  | —                 | —                           | —             | —  |

<sup>1</sup>From sewerage or sanitation charges.

Source: U.S. Bureau of the Census, *Environmental Quality Control, Finances and Employment for Selected Large Governmental Units: Fiscal 1970-71*, GSS-No. 63 (December 1972).

Table 83.—CLIMATIC DATA FOR SELECTED PLACES

| Island and station                           | Ground elevation (feet) | Average temperature (°F) |               | Extreme temperature of record (°F) |         | Average annual precipitation (inches) | Average annual possible sunshine (percent) |
|--|-------------------------|--------------------------|---------------|------------------------------------|---------|---------------------------------------|--|
|  |                         | Coolest month            | Warmest month | Lowest                             | Highest |                                       |  |
| <b>Hawaii:</b>                               |                         |                          |               |                                    |         |                                       |  |
| Hilo Airport .....                           | 27                      | 70.6                     | 75.8          | 53                                 | 94      | 136.62                                | 38   |
| Haw'n Volcanoes Nat. Park Hdq.               | 3,971                   | 57.9                     | 63.5          | 37                                 | 85      | 100.69                                | —  |
| Kona (Kailua) .....                          | 30                      | 72.1                     | 77.3          | 54                                 | 93      | 25.22                                 | —  |
| Puako <sup>1</sup> .....                     | 10                      | 73.1                     | 79.8          | 52                                 | 98      | 9.47                                  | —  |
| Waimea (Kamuela) .....                       | 2,670                   | 62.3                     | 66.8          | 34                                 | 90      | 40.05                                 | —  |
| Mauna Kea summit <sup>2</sup> .....          | 13,796                  | 31.1                     | 42.5          | 11                                 | 66      | 8.08                                  | —  |
| <b>Maui:</b>                                 |                         |                          |               |                                    |         |                                       |  |
| Hana .....                                   | 120                     | 71.3                     | 76.8          | 50                                 | 90      | 70.65                                 | —  |
| Haleakala summit .....                       | 9,960                   | 42.6                     | 50.0          | 14                                 | 73      | 50.69                                 | —  |
| Kihei <sup>3</sup> .....                     | 90                      | 70.9                     | 78.4          | 49                                 | 98      | 13.25                                 | —  |
| Kahului Airport .....                        | 48                      | 71.7                     | 79.0          | 48                                 | 95      | 16.33                                 | 70   |
| Lahaina .....                                | 45                      | 71.2                     | 77.7          | 52                                 | 93      | 14.53                                 | —  |
| <b>Molokai:</b>                              |                         |                          |               |                                    |         |                                       |  |
| Kaunakakai .....                             | 12                      | —                        | —             | —                                  | —       | 14.08                                 | —  |
| Molokai Airport .....                        | 450                     | 70.2                     | 77.6          | 48                                 | 90      | 29.21                                 | —  |
| <b>Lanai:</b>                                |                         |                          |               |                                    |         |                                       |  |
| Lanai City .....                             | 1,620                   | 65.8                     | 72.8          | 46                                 | 88      | 38.44                                 | —  |
| <b>Oahu:</b>                                 |                         |                          |               |                                    |         |                                       |  |
| Honolulu International Airport ..            | 7                       | 72.4                     | 79.4          | 52                                 | 92      | 21.89                                 | 69   |
| Honolulu Federal Building <sup>4</sup> ..... | 12                      | 71.9                     | 78.4          | 57                                 | 88      | 23.96                                 | 65   |
| Waikiki <sup>5</sup> .....                   | 10                      | 71.9                     | 80.6          | 51                                 | 93      | 28.90                                 | —  |
| Manoa (HSPA) .....                           | 500                     | 69.4                     | 75.2          | —                                  | —       | 158.41                                | —  |
| Kaneohe MCAS .....                           | 10                      | 72.9                     | 79.1          | 58                                 | 90      | 43.88                                 | —  |
| Kahuku .....                                 | 25                      | 70.6                     | 77.8          | 49                                 | 95      | 41.10                                 | —  |
| Wheeler AFB .....                            | 826                     | 68.2                     | 75.5          | 52                                 | 89      | 39.85                                 | —  |
| Waianae .....                                | 20                      | 72.1                     | 79.7          | 45                                 | 96      | 20.31                                 | —  |
| <b>Kauai:</b>                                |                         |                          |               |                                    |         |                                       |  |
| Kilauea .....                                | 315                     | 68.7                     | 75.6          | 49                                 | 94      | 68.03                                 | —  |
| Kealia .....                                 | 9                       | 70.2                     | 78.0          | 44                                 | 93      | 43.28                                 | —  |
| Lihue Airport .....                          | 103                     | 70.7                     | 78.4          | 50                                 | 90      | 43.00                                 | 55   |
| Poipu (Makahuena Pt.) .....                  | 52                      | 72.4                     | 79.4          | 50                                 | 93      | 36.39                                 | —  |
| Kokee (Kanalohuluhulu) .....                 | 3,600                   | 54.9                     | 65.5          | 31                                 | 80      | 72.25                                 | —  |
| Waialeale .....                              | 5,075                   | —                        | —             | —                                  | —       | 486.                                  | —  |
| <b>Northwestern Hawaiian Islands:</b>        |                         |                          |               |                                    |         |                                       |  |
| Midway .....                                 | 10                      | 65.0                     | 78.6          | 52                                 | 89      | 43.60                                 | —  |

<sup>1</sup>Temperature data are for Mahukona.

<sup>2</sup>Based on incomplete and non-continuous data for 1966-1972.

<sup>3</sup>Temperature data refer to Puunene Airport.

<sup>4</sup>Temperature sensors are 87 feet above the ground.

<sup>5</sup>Located at Honolulu Zoo. Available only from 1965. The rainfall average shown is thought to be above the long-term average.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service Pacific Region, data supplied March 13, 1973.

**Table 84.—CLIMATIC DATA FOR THE PERIOD OF RECORD**

| Subject   | Date                       | Place                      | Magnitude |
|---|----------------------------|----------------------------|-----------|
| Long-term average:  |                            |                            |           |
| Lowest monthly average minimum temperature (°F.) . . . . .  | February . . . . .         | Mauna Kea summit . . . . . | 23.3      |
| Lowest monthly average daily temp. (°F.) . . . . .          | February . . . . .         | Mauna Kea summit . . . . . | 31.1      |
| Highest monthly average maximum temperature (°F.) . . . . . | August . . . . .           | Waiawa, Kauai . . . . .    | 89.7      |
| Highest monthly average daily temp. (°F.) . . . . .         | August . . . . .           | Puako, Hawaii . . . . .    | 80.7      |
| Lowest average annual rainfall (inches) . . . . .           | . . . . .                  | N. of Kawaihae . . . . .   | 5.7       |
| Highest average annual rainfall (inches) . . . . .          | . . . . .                  | Waialeale . . . . .        | 486       |
| Single events:  |                            |                            |           |
| Lowest temperature of record (°F.) . . . . .                | Feb. 11, 1973 . . . . .    | Mauna Kea summit . . . . . | 11        |
| Highest temperature of record (°F.) . . . . .               | April 27, 1931 . . . . .   | Pahala . . . . .           | 100       |
| Lowest annual rainfall of record (inches) . . . . .         | 1953 . . . . .             | Kawaihae, Hawaii . . . . . | 0.2       |
| Highest annual rainfall of record (inches) . . . . .        | 1947-1948 . . . . .        | Waialeale . . . . .        | 624       |
| Highest wind speed of record (m.p.h.) . . . . .             | Jan. 17-18, 1959 . . . . . | Mauna Loa Obser. . . . .   | 105+      |

Source: U.S. Department of Commerce, National Weather Service Pacific Region, data supplied March 14, 1973.

**Table 85.—HAWAII AUDUBON SOCIETY BIRD COUNT OF THE HONOLULU AREA:  
1945 TO 1972**

(Counts made in late December, in a circle, 15 miles in diameter,  
centered near Nuuanu Pali.)

| Years         | Annual average |                     | Species                     | Birds,<br>1972 |
|---------------|----------------|---------------------|-----------------------------|----------------|
|               | Species        | Individual<br>birds |                             |                |
| 1945-49 ..... | 30             | 3,190               | House Sparrow .....         | 2,538          |
| 1950-54 ..... | 26             | 3,561               | Common Mynah .....          | 2,427          |
| 1955-59 ..... | 35             | 5,383               | Barred Dove .....           | 1,809          |
| 1960-64 ..... | 36             | 5,936               | Red-footed Booby .....      | 1,615          |
| 1965-69 ..... | 50             | 14,256              | Cattle Egret .....          | 1,208          |
|               |                |                     | Great Frigatebird .....     | 984            |
| 1970 .....    | 51             | 10,454              | Pacific Golden Plover ..... | 683            |
| 1971 .....    | 50             | 13,218              | Spotted Dove .....          | 627            |
| 1972 .....    | 52             | 14,559              | Japanese White-eye .....    | 561            |
|               |                |                     | Rice bird .....             | 369            |

Source: Hawaii Audubon Society, *The Elepaio*, for Feb. 1949, Feb. 1958, Feb. 1962, Feb. 1972, and Feb. 1973.