

Section 5

GEOGRAPHY AND ENVIRONMENT

This section relates to land and water areas, physical geography, climate, air and water quality, noise 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 general coastline of 750 miles. Honolulu is 214 miles from Hilo, 1,367 miles from Kure Atoll (the westernmost end of the State), 2,397 miles from San Francisco, and 4,829 miles from Washington, D.C. The highest peak in the State is Mauna Kea, 13,796 feet above sea level; the longest stream is Kaukonahua Stream, Oahu, 33 miles in length; the biggest lake is Halalii, on Niihau, 841 acres; and the highest named waterfall is Kahiwa, Molokai, a 1,750-foot cascade. Various measures of air pollution, such as suspended particulate matter, indicate that Honolulu is one of the cleanest cities in the nation. There is also relatively little water pollution: 39 major beaches surveyed in 1980 were found to have fecal coliform levels per 100 ml. ranging from 2.1 to 195.5, and all were within EPA standards. More than 1,100 species, subspecies, and varieties of native flora were endangered, threatened, or extinct, according to a 1977 survey. Climatically, Hawaii is marked by remarkably balmy temperatures and wide variations in rainfall. The all-time temperature range at Honolulu International Airport, for example, was from 53° to 92°F. Normal precipitation, however, ranges from 5.7 inches near Kawaihae, South Kohala, to 451 inches atop Waialeale. The longest volcanic eruption in Island history lasted 867 days, the worst earthquake attained 7.5 on the Richter scale, and the highest tsunami wave reached 56 feet. Water withdrawn for use in 1975 averaged 2.8 billion gallons per day, compared with 2.7 billion in 1970 and 2.0 billion in 1965. Among thirty neighborhoods on Oahu, median noise levels in 1974 ranged from 44.7 decibels (in Pearl City) to 61.5 decibels (in Waikiki).

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 Atlas of Hawaii, published by the University Press of Hawaii in 1973, and Hawai'i, the Natural Environment, issued by the Department of Planning and Economic Development in 1974. National data are reported in Statistical Abstract of the United States: 1980, Section 7.

Table 98.-- GREAT CIRCLE DISTANCES BETWEEN HONOLULU INTERNATIONAL AIRPORT AND SPECIFIED PLACES

Place	Distance from Honolulu	
	Statute miles	Kilometers
Hawaiian Islands:		
Cape Kumukahi, Hawaii	236	380
Hilo, Hawaii	214	344
Ka Lae (South Cape), Hawaii	221	356
Kailua, Kona, Hawaii	168	270
Kahului, Maui	98	158
Lanai Airport	72	116
Molokai Airport	54	87
Lihue, Kauai	103	166
Puuwai, Niihau	152	245
Nihoa	283	455
Necker Island	520	837
French Frigate Shoals	556	895
Gardner Pinnacles	688	1,107
Maro Reef	851	1,369
Laysan Island	936	1,506
Lisianski Island	1,065	1,714
Pearl and Hermes Atoll	1,208	1,944
Midway Islands	1,309	2,106
Kure Atoll	1,367	2,200
Trust Territory of the Pacific Islands:		
Majuro, Marshall Islands	2,271	3,654
Kwajalein, Marshall Islands	2,443	3,931
Kolonia, Ponape, E.C.I.	3,087	4,967
Saipan, Mariana Islands	3,704	5,960
Koror, Palau, W.C.I.	4,593	7,390
Other Pacific locations:		
Apra Harbor, Guam	3,806	6,124
Auckland, New Zealand	4,393	7,068
Avarua, Rarotonga	2,950	4,750
Funafuti, Tuvalu	2,550	4,106
Hong Kong	5,541	8,915
Johnston Island	820	1,319
Kingman Reef	1,073	1,726
Manila, Philippines	5,293	8,516
Nuku'alofa, Tongatapu	3,165	5,096
Nuku Hiva, Marquesas Islands	2,400	3,864
Pago Pago, American Samoa	2,606	4,193

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Table 98.-- GREAT CIRCLE DISTANCES BETWEEN HONOLULU INTERNATIONAL AIRPORT AND SPECIFIED PLACES -- Con.

Place	Distance from Honolulu	
	Statute miles	Kilometers
Other Pacific locations, con.:		
Palmyra Island	1,101	1,772
Papeete, Tahiti	2,741	4,410
Suva, Fiji	3,159	5,083
Sydney (Port Jackson), Australia	5,070	8,158
Tokyo, Japan	3,847	6,190
Wake Island	2,294	3,691
North and South America:		
Anchorage, Alaska	2,781	4,475
Cape Horn, Chile	7,457	11,998
Chicago, Illinois	4,179	6,724
Cristobal, Canal Zone	5,214	8,389
Lima, Peru	5,950	9,580
Los Angeles, California	2,557	4,114
Miami, Florida	4,856	7,813
New York, New York	4,959	7,979
Portland, Oregon	2,595	4,175
San Diego, California	2,610	4,199
San Francisco, California	2,397	3,857
Seattle, Washington	2,679	4,311
Vancouver, B.C.	2,709	4,359
Victoria, B.C.	2,668	4,293
Tijuana, Mexico	2,616	4,209
Washington, D.C.	4,829	7,770
London, England	7,226	11,627
Bombay, India	8,010	12,888
Ghanzi, Botswana ^{1/}	12,417	19,979
Equator, due south of Honolulu	1,470	2,367
North Pole	4,740	7,631
South Pole	7,660	12,333

^{1/} Ghanzi, Botswana, is Honolulu's antipode, that is, the point precisely opposite to it on the globe.

Source follows next table.

Table 99.-- GREAT CIRCLE DISTANCES FROM HILO AND KURE ATOLL

Places	Great circle distance	
	Statute miles	Kilometers
Hilo to --		
Honolulu, Oahu	214	344
Los Angeles, California	2,447	3,937
San Francisco, California	2,315	3,725
Kure Atoll to --		
Cape Kumukahi, Puna, Hawaii <u>1/</u>	1,523	2,451
Honolulu, Oahu	1,367	2,200
Log Point, Elliot Key, Florida <u>2/</u>	5,852	9,416
Tokyo, Japan	2,486	4,000
West Quoddy Head, Maine	5,788	9,313

1/ Cape Kumukahi and Kure Atoll are the points farthest apart in the Hawaiian Archipelago and State of Hawaii.

2/ Log Point and Kure Atoll are the points farthest apart in the fifty states.

Source: U. S. Department of the Interior, Geological Survey, Elevations and Distances in the United States (1970), and distance computations prepared for the Department of Planning and Economic Development.

Table 100.-- WIDTHS AND DEPTHS OF CHANNELS

Channel <u>1/</u>	Width <u>2/</u>		Depth <u>3/</u>		
	Statute miles	Kilometers	Fathoms	Feet	Meters
Alenuihaha	29.6	47.6	1,135	6,810	2,076
Alalakeiki	6.7	10.8	137	822	251
Kealaikahiki	17.8	28.6	181	1,086	331
Auau	9.5	15.3	42	252	77
Kalohi	9.2	14.8	90	540	165
Pailolo	8.8	14.2	141	846	258
Kaiwi	25.8	41.5	367	2,202	671
Kauai	72.1	116.0	1,815	10,890	3,319
Kaulakahi	17.2	27.7	595	3,570	1,088
Niihau-Kaula	21.5	34.6	894	5,364	1,635
Niihau-Nihoa	133.9	215.5	2,425	14,550	4,435
Nihoa-Necker I.	179.6	289.0	2,100	12,600	3,840
Necker I.-French Frigate Shoals	100.3	161.4	2,130	12,780	3,895
French Frigate Shoals- Gardner Pinnacles	137.0	220.5	1,908	11,448	3,489
Gardner Pinnacles-Marø Reef	155.5	250.3	2,050	12,300	3,749
Marø Reef-Laysan I.	65.9	106.1	1,380	8,280	2,524
Laysan I.-Lisianski I.	137.4	221.1	2,805	16,830	5,130
Lisianski I.-Pearl and Hermes Atoll	162.6	261.7	2,900	17,400	5,304
Pearl and Hermes Atoll- Midway Islands	86.9	139.9	2,640	15,840	4,828
Midway Islands-Kure Atoll .	57.1	91.9	2,160	12,960	3,950

Footnotes and source on next page.

Table 100.-- WIDTHS AND DEPTHS OF CHANNELS -- Con.

1/ Listed in geographic order, from east to west. The channels were measured between the following points:

Alenuihaha: Upolu Pt., Hawaii, to Puhilele Pt., Maui;
Alalakeiki: Lae o ka Ule, Kahoolawe, to Nukuele Pt., Maui;
Kealaikahiki: Makaalae, Kahoolawe, to Kamaiki Pt., Lanai;
Auau: Kikoa Pt., Lanai, to Lahaina, Maui;
Kalohi: Wahie Pt., Lanai, to Kamalo, Molokai;
Pailolo: Lipoa Pt., Maui, to Pohakuloa, Molokai;
Kaiwi: Ilio Pt., Molokai, to Makapuu Pt., Oahu;
Kauai: Kaena Pt., Oahu, to Kamilo Pt., Kauai;
Kaulakahi: Mana Pt., Kauai, to Kaunuopou, Niihau;
Niihau-Kaula: Leahi, Niihau, to Kaula;
Niihau-Nihoa: Kuakamoku, Niihau, to Nihoa;
Nihoa-Necker Island: Nihoa to Necker Island;
Necker Island-French Frigate Shoals: Necker Island to La Perouse Pinnacle, French Frigate Shoals;
French Frigate Shoals-Gardner Pinnacles: La Perouse Pinnacle, French Frigate Shoals, to Gardner Pinnacles;
Gardner Pinnacles-Marø Reef: Gardner Pinnacles to eastern end of Marø Reef;
Marø Reef-Laysan Island: Western end of Marø Reef to Laysan Island;
Laysan Island-Lisianski Island: Laysan Island to Lisianski Island;
Lisianski Island-Pearl and Hermes Atoll: Lisianski Island to Southeast Island, Pearl and Hermes Atoll;
Pearl and Hermes Atoll-Midway Islands: Western extremity of Pearl and Hermes Atoll to Eastern Island, Midway Islands;
Midway Islands-Kure Atoll: Sand Island, Midway Islands, to Green Island, Kure Atoll.

2/ Width measured in statute miles between designated points on National Ocean Survey and Coast and Geodetic Survey charts. Width in kilometers calculated from miles (1 mile = 1.60934 km.).

3/ Depths given are the deepest soundings noted at or near the line joining the two designated points, on National Ocean Survey and Coast and Geodetic Survey charts. Depths measured in fathoms and converted to feet and meters (1 fathom = 6 feet = 1.8288 meters).

Source: Compiled by Lee S. Motteler, Pacific Scientific Information Center, Bernice P. Bishop Museum, in November 1980.

Table 101.-- GENERAL COASTLINE AND TIDAL SHORELINE OF COUNTIES AND ISLANDS

County and island	General coastline <u>1/</u>		Tidal shoreline <u>2/</u>	
	Statute miles	Kilo-meters <u>3/</u>	Statute miles	Kilo-meters <u>3/</u>
State total <u>4/</u>	750	1,207	1,052	1,693
Counties:				
Hawaii	266	428	313	504
Maui, including Kalawao	210	338	343	552
Honolulu	137	220	234	377
Kauai	137	220	162	261
Islands: <u>5/</u>				
Hawaii	266	428	313	504
Maui	120	193	149	240
Kahoolawe	29	47	36	58
Lanai	47	76	52	84
Molokai	88	142	106	171
Oahu	112	180	209	336
Kauai	90	145	110	177
Niihau	45	72	50	80
Kaula	2	3	2	3
Northwestern Hawaiian Islands <u>6/</u> ..	25	40	25	40
Nihoa	3	5	3	5
Necker Island	2	3	2	3
French Frigate Shoals	6	10	6	10
Laysan Island	6	10	6	10
Lisianski Island	3	5	3	5
Kure Atoll	5	8	5	8

1/ Figures are lengths of general outline of seacoast. Data for the four islands of Maui County are not consistent with the reported county total.

2/ Shoreline of outer coast, offshore islands, bays, rivers, and creeks is included to the head of tidewater or to a point where tidal waters narrow to a width of 100 feet.

3/ Derived from data expressed in statute miles; independently rounded and accordingly may not add exactly to indicated totals and subtotals.

1 mi. = 1.609 km.

4/ Among the States and Territories, Hawaii ranks fourth in general coastline and seventeenth in tidal shoreline.

5/ Data are not available for five minor islands: Molokini, Lehua, Gardner Pinnacles, Maro Reef, and Pearl and Hermes Atoll.

6/ Excludes the Midway Islands, which are part of the Hawaiian Archipelago but not legally part of the State of Hawaii. Midway has a general coastline of 20 miles and a tidal shoreline of 33 miles.

Source: U.S. Coast and Geodetic Survey, Coastline of the United States (April 1, 1961) and letter dated October 24, 1961.

Table 102.-- LAND AND WATER AREA OF COUNTIES AND ISLANDS

County or island	Square miles			Square kilometers <u>1/</u>		Acres <u>1/</u>	
	Total area	Land area <u>2/</u>	Inland water <u>3/</u>	Total area	Land area <u>2/</u>	Total area	Land area <u>2/</u>
State total	6,450.4	6,425.4	25.0	16,706.5	16,641.7	4,128,256	4,112,256
Counties:							
Hawaii	4,038.0	4,037.0	1.0	10,458.4	10,455.8	2,584,320	2,583,680
Maui	1,161.1	1,160.3	0.8	3,007.2	3,005.2	743,104	742,592
Kalawao	13.3	13.3	-	34.4	34.4	8,512	8,512
Honolulu	610.9	595.7	15.2	1,582.2	1,542.9	390,976	381,248
Kauai	627.1	619.1	8.0	1,624.2	1,603.5	401,344	396,224
Islands:							
Hawaii	4,038.0	4,037.0	1.0	10,458.4	10,455.8	2,584,320	2,583,680
Maui	728.8	728.2	0.6	1,887.6	1,886.0	466,432	466,048
Kahoolawe	45.0	45.0	-	116.5	116.5	28,800	28,800
Molokini <u>4/</u>	0.0	0.0	-	0.1	0.1	19	19
Lanai	139.5	139.5	-	361.3	361.3	89,280	89,280
Molokai	261.1	260.9	0.2	676.2	675.7	167,104	166,976
Oahu	607.7	592.7	15.0	1,573.9	1,535.1	388,928	379,328
Kauai	553.3	548.7	4.6	1,433.0	1,421.1	354,112	351,168
Niihau	73.0	69.6	3.4	189.1	180.3	46,720	44,544
Lehua	0.4	0.4	-	1.0	1.0	243	243
Kaula	0.4	0.4	-	1.1	1.1	280	280
Northwestern Hawaiian Islands <u>5/</u>	3.2	3.0	0.2	8.2	7.7	2,036	1,895

Footnotes and source on next page.

Table 102.-- LAND AND WATER AREA OF COUNTIES AND ISLANDS -- Con.

1/ Areas in square kilometers and acres were calculated directly from the figures shown for square miles (except for Molokini, Lehua, Kaula, and the Northwestern Hawaiian Islands, for which square miles calculated to three decimal places were used); these equivalents were independently rounded, and hence may not add exactly to the indicated totals and subtotals. 1 sq. mi. = 640 A. = 2.58999 sq. km.

2/ Dry land and land temporarily or partially covered by water, as marshland, swamps, etc.; streams and canals under one-eighth statute mile wide; and lakes, reservoirs, and ponds under 40 acres of area.

3/ Permanent inland water surface, such as lakes, reservoirs, and ponds having 40 acres or more of area; streams, sloughs, estuaries, and canals one-eighth of a statute mile or more in width; deeply indented embayments and sounds, and other coastal waters behind or sheltered by headlands or islands separated by less than one nautical mile of water; and islands having less than 40 acres of area.

4/ More exactly, the area of Molokini is 18.6 acres (equivalent to 0.03 square miles or 0.075 square kilometers).

5/ Exclusive of the Midway Islands, which are part of the Hawaiian Archipelago but not legally part of the State of Hawaii. Islands included in the State and their land areas in square miles are: Nihoa, 0.298; Necker Island, 0.091; French Frigate Shoals, 0.088; Gardner Pinnacles, 0.004; Maro Reef, awash; Laysan Island, 1.312 (plus 0.220 of inland water, for a total area of 1.533); Lisianski Island, 0.675; Pearl and Hermes Atoll, 0.122; and Kure Atoll, 0.371.

Source: Data from U.S. Bureau of the Census, Geography Division, cited in the Hawaii State Department of Planning and Economic Development, Hawai'i the Natural Environment (1974), pp. 9 and 10.

Table 103.-- MAJOR SUMMITS

[Elevation of the highest point on each island and other important peaks.]

Island and mountain	Elevation	
	Feet	Meters
Hawaii:		
Mauna Kea	13,796	4,205
Mauna Loa	13,677	4,169
Hualalai	8,271	2,521
Kohala	5,480	1,670
Kilauea (Uwekahuna)	4,093	1,248
Kilauea (Halemaumau Rim)	3,660	1,116
Kahoolawe:		
Lua Makika	1,477	450
Molokini	160	49
Maui:		
Haleakala (Red Hill)	10,023	3,055
Haleakala (Kaupo Gap)	8,201	2,500
Puu Kukui	5,788	1,764
Iao Needle	2,250	686
Lanai:		
Lanaihale	3,370	1,027
Molokai:		
Kamakou	4,970	1,515
Olokui	4,602	1,403
Kaunuohua	4,535	1,382
Kalaupapa Lookout	1,600	488
Puu Nana	1,381	421
Oahu:		
Kaala	4,020	1,225
Puu Kalena	3,504	1,068
Konahuanui <u>1</u> /	3,150	960
Tantalus	2,013	614
Olomana	1,643	501
Koko Crater (Koholepelepe) ...	1,208	368
Nuuanu Pali Lookout	1,186	361
Diamond Head	760	232
Punchbowl	500	152
Koko Head	642	196

Continued on next page.

Table 103.-- MAJOR SUMMITS -- Con.

[Elevation of the highest point on each island
and other important peaks.]

Island and mountain	Elevation	
	Feet	Meters
Kauai:		
Kawaikini	5,243	1,598
Waialeale	5,148	1,569
Namolokama Mountain	4,421	1,348
Kalalau Lookout	4,120	1,256
Haupu	2,297	700
Hole-in-the-Mountain (Puu Konanae)	1,433	437
Sleeping Giant (Nonou)	1,241	378
Niihau:		
Paniau	1,281	390
Lehua	702	214
Kaula	550	168
Nihoa:		
Millers Peak	910	277
Necker Island:		
Summit Hill	277	84
French Frigate Shoals:		
La Perouse Pinnacles	135	41
Gardner Pinnacles	190	58
Maro Reef	Awash	Awash
Laysan Island	35	11
Lisianski Island	20	6
Pearl and Hermes Atoll	10	3
Midway Islands <u>2/</u>	12	4
Kure Atoll	20	6
Kingman Reef <u>2/</u>	3	1
Palmyra Island <u>2/</u>	6	2
Johnston Atoll: <u>2/</u>		
Sand Island	15	5

Footnotes and source on next page.

Table 103.-- MAJOR SUMMITS -- Con.

1/ Two distinct peaks. The lower one has an elevation of 3,105 feet.

2/ Not part of the State of Hawaii.

Source: U.S. Geological Survey data cited in the Hawaii State Department of Planning and Economic Development, Elevations of Major Mountains in Hawaii (Statistical Report 52, November 7, 1967), as revised by U.S. National Cartographic Information Center, October 11, 1978; U.S. Geological Survey topographic maps; E. D. Baldwin, 1883 Molokini figure on Hawaiian Government Survey Reg. Map No. 1276; U.S.S. Tanager survey, 1923 (for Pearl and Hermes Atoll); A. B. Amerson, Jr., and P. C. Shelton, The Natural History of Johnston Atoll, Atoll Research Bull. No. 192 (The Smithsonian Institution, Dec. 1976). Data compiled with assistance of Lee S. Motteler, Pacific Scientific Information Center, Bernice P. Bishop Museum.

Table 104.-- LAND AND WATER AREA WITHIN THE FISHERY CONSERVATION ZONE

[Land and water area within the 200 nautical mile Fishery Conservation Zone surrounding the Hawaiian Archipelago.]

Category	Square nautical miles	Square statute miles	Square kilometers
Total	634,023	839,623	2,174,626
Land area	4,852	6,425	16,641
Water area	629,171	833,198	2,157,985

Source: Charles E. Harrington, Chief Geographer, Marine Surveys and Maps, National Ocean Survey, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, information supplied September 15, 1978

Table 105.-- MAJOR STREAMS, BY ISLANDS

Island	Feature or stream	Length or ave. discharge
Longest water feature (miles):		
Hawaii	Wailuku River	32.0
Maui	Kaliialinui-Waiale Gulch	18.0
Kahoolawe	Ahupu Gulch	4.0
Lanai	Maunalei-Waialala Gulch	12.9
Molokai	Wailau-Pulena Stream	6.5
Oahu	Kaukonahua Stream (So. Fork)	33.0
Kauai	Waimea River-Poomau Stream .	19.5
Niihau	Keanaulii-Puniopo Valley ...	5.9
Longest perennial stream (miles): <u>1/</u>		
Hawaii	Wailuku River	22.7
Maui	Palikea Stream	7.8
Molokai	Wailau-Pulena Stream	6.5
Oahu	Kaukonahua Stream	30.0
Kauai	Waimea River	19.7
Streams with greatest average discharge (million gal./day):		
Hawaii	Wailuku River	184.0
Maui	Iao Stream	54.1
Molokai	Pulena Stream	22.1
Oahu	Waikele Stream	25.7
Kauai	Hanalei River	151.0

1/ Estimated on basis of drainage area rather than stream runoff. Other major streams include Honokohau Stream, Maui (9.4 miles long); Halawa Stream (6.4), Waikolu Stream (4.7), and Pelekunu (2.3), all on Molokai; Waikele Stream (15.3), Kipapa Stream (12.8), and Waiakakalaua Stream (11.8), all on Oahu; and the Makaweli River (15.1), Wainiha River (13.8), Hanapepe River (13.3), and Wailua River (11.8), all on Kauai.

Source: Lengths from Hawaii State Department of Planning and Economic Development, Hawai'i, the Natural Environment (1974), p. 15; discharges from Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, data supplied May 27, 1977.

Table 106.-- LARGEST LAKES, BY ISLANDS

[Excludes shoreline fish ponds and areas filled only during floods. The largest intermittent lake is Halalii Lake, Niihau, with an area of 840.7 acres.]

Island	Name of largest lake	Category	Maximum depth (feet)	Elevation (feet)	Area (acres)	Shoreline (miles)
Hawaii ..	Waiakea Pond	Natural	(NA)	Sea level	27	2
	Lake Waiau ^{1/} ...	Natural	10	13,020	1.5	0.2
Maui	Kanaha Pond	Natural	(NA)	Sea level	41	2
Kahoolawe	None					
Lanai ...	None					
Molokai .	Meyer Lake	Natural	5	2,021	6	1
Oahu	Wahiawa Reservoir	Man-made	85	842	302	11
Kaūai ...	Waita Reservoir .	Man-made	23	241	424	3
Niihau ..	Halulu Lake	Natural	(NA)	Sea level	182	3

NA Not available.

^{1/} Highest lake in the State and third highest in the United States.

Source: Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, data supplied February 11, 1981.

Table 107.-- MISCELLANEOUS GEOGRAPHIC STATISTICS, BY ISLANDS

Island	Extreme width (miles)	Extreme width (miles)	Miles of sea cliffs with heights 1,000 ft. or more	Miles from coast of most remote point	Percent of area within 5 miles of coast
The State ..	...	...	33	28.5	48.6
Hawaii	93	76	4	28.5	30.0
Maui	48	26	-	10.6	76.1
Kahoolawe	11	6	-	2.4	100.0
Lanai	18	13	1	5.2	100.0
Molokai	38	10	14	3.9	100.0
Oahu	44	30	-	10.6	79.0
Kauai	33	25	11	10.8	67.0
Niihau	18	6	3	2.4	100.0
Island	Percent of area with elevation --		Approximate mean altitude (feet)	Percent of area with slope --	
	Less than 500 feet	2,000 feet or more		Less than 10 percent	20 percent or more
The State ..	20.8	50.9	3,030	63.5	17.0
Hawaii	12.0	68.4	3,950	76.0	4.0
Maui	24.9	41.4	2,390	38.5	36.0
Kahoolawe	38.9	0	600	60.0	9.0
Lanai	24.8	6.3	1,140	61.0	16.0
Molokai	37.3	17.8	1,150	53.0	26.0
Oahu	45.3	4.6	860	42.5	45.5
Kauai	35.6	24.0	1,380	33.5	50.5
Niihau	78.2	0	530	68.0	12.5

Source: Hawaii State Department of Planning and Economic Development, Hawai'i, the Natural Environment (1974), p. 19; U.S. Geological Survey, Elevations and Distances in the United States (1978), pp. 4-5.

Table 108.-- VOLCANIC ERUPTIONS: 1969 TO 1981

Volcano and date of outbreak	Repose period since previous eruption (months)	Duration (days)	Location <u>1/</u>	Elevation (feet)	Area (square miles)	Volume (1,000 cubic yards)
Mauna Loa:						
1975: July 5	300	1	S	13,000-12,100	5.2	39,200
Kilauea:						
1969: Feb. 22 ...	4.0	6	ER	3,100-2,900	2.3	22,000
May 24	2.0	867	ER	3,150	19.3	242,000
1971: Aug. 14 ...	-	1	C	3,660-3,600	0.8	12,400
Sept. 24 ..	-	5	C, SWR	3,740-2,730	1.5	10,500
1972: Feb. 4	4.3	645	ER	3,150	13.7	167,000
1973: May 5	-	1	ER	3,340-3,250	0.1	1,600
Nov. 10 ...	-	30	ER	3,250-2,900	0.4	3,700
Dec. 12 ...	0.1	203	ER	3,150	3.1	39,300
1974: July 19 ...	-	3	C, ER	3,600-3,520	1.2	9,000
Sept. 19 ..	2.0	1	C	3,680	0.4	14,000
Dec. 31 ...	3.4	1	C	3,600	2.9	19,600
1975: Nov. 29 ...	11.0	1	C	3,600	0.05	330
1977: Sept. 13 ..	21.5	18	ER	1,600-2,080	3.0	45,000
1979: Nov. 16 ...	26.3	1	ER	3,270-3,200	0.1	800

1/ C, caldera; ER, east rift; S, summit; SWR, southwest rift.

Source: Gordon A. Macdonald and Douglass H. Hubbard, Volcanoes of the National Parks in Hawaii, 7th edition (Hawaii Natural History Association, December 1974), pp. 14 and 29, as corrected by Dr. Macdonald, May 5, 1976, and updated by the staff of the Hawaiian Volcano Observatory through March 5, 1981.

Table 109.-- EARTHQUAKES OF MAGNITUDE 5 OR GREATER: 1971 TO 1981

[Complete to October 1980.]

Date	Location	Magnitude (Richter Scale)
1971: Aug. 1	S.E. of Hawaii	4.5-5
1972: Dec. 23	W. of Kona	5
1973: Apr. 26	Hawaii	6.2
Oct. 9	Hawaii	4.8-5
1974: Nov. 30	Hawaii	5.5-6
1975: Jan. 1, 2:41 AM ...	Near Pahala, Hawaii	5.1
Jan. 1, 3:20 AM ...	Mauna Loa, Hawaii	5.1
Jan. 2	Near Pahala, Hawaii	5.6
Jan. 5	Mauna Loa, Hawaii	5.1
Nov. 29, 3:35 AM ..	Puna, Hawaii	5.7
Nov. 29, 4:47 AM ..	Puna, Hawaii	7.2
1977: Jan. 22	100 miles S. of Kauai	5.0
1979: March 29	40 miles S.W. of Oahu	5.5
Sept. 21	Puna, Hawaii	5.5
1981: March 5	Molokai area	5.0

Source: Augustine S. Furumoto, N. Norby Nielsen, and William R. Phillips, A Study of Past Earthquakes, Isoseismic Zones of Intensity and Recommended Zones for Structural Design for Hawaii (University of Hawaii, Center for Engineering Research, June 15, 1972), pp. 16-19; Hawaii Institute of Geophysics, records; U.S. Geological Survey, National Earthquake Information Service. Data provided by Professor Augustine S. Furumoto, Hawaii Institute of Geophysics, University of Hawaii.

Table 110.-- TSUNAMIS WITH RUN-UP OF 2 METERS (6.6 FEET) OR MORE:
1946 TO 1981

[Correct to April 20, 1981.]

Date	Maximum height in Hawaii		Deaths in Hawaii	Damage in Hawaii (dollars)
	Meters	Feet		
1946: April 1	17.0	55.8	159	26,000,000
1952: Nov. 4	6.1	20.0	-	1,000,000
1957: March 9	16.0	52.5	-	5,000,000
1960: May 22	10.5	34.5	61	23,000,000
1964: March 27	4.8	15.7	-	67,590
1975: Nov. 29	14.6	48.0	2	1,500,000

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; Harold G. Loomis, The Tsunami of November 29, 1975 in Hawaii (Hawaii Institute of Geophysics, December 1975), pp. 1 and 10; D.C. Cox and J. Morgan, Local Tsunamis and Possible Local Tsunamis in Hawaii (Hawaii Institute of Geophysics, Report HIG 77-14, November 1977).

Table 111.-- MAJOR DAMS: 1981

Name ^{1/}	Location	Height (ft.)	Length (ft.)	Volume of water impounded (acre ft.)
Wahiawa Dam ...	Wahiawa, Oahu	98	460	7,671
Waita	Koloa, Kauai	28	3,250	6,500
Kualapuu	Kualapuu, Molokai .	58	7,100	4,265
Alexander Dam .	Kalaheo, Kauai	119	600	2,500
Nuuanu No. 4 ..	Honolulu, Oahu	73	1,730	1,420

^{1/} Listed by volume of water impounded.

Source: Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, information supplied February 11, 1981.

Table 112.-- LARGE RESERVOIRS: 1980

Island and reservoir	Capacity (million gallons)
Hawaii:	
Puukapu	315
Molokai:	
Kualapuu	1,400
Oahu:	
Kaneohe-Kailua	800
Ku Tree	320
Nuuanu	1,400
Wahiawa	3,000
Kauai:	
Alexander	850
Kapaia	520
Koloko	450
Puu Lua	290
Wailua	300
Waita	2,600

Source: Hawaii State Department of Planning and Economic Development and U.S. Department of Energy, Hydroelectric Power in Hawaii (February 1981), p. E-10.

Table 113.-- WATER USE, BY ISLANDS: 1975

[In millions of gallons per day.]

Island	All uses		Municipal	Agricultural <u>1/</u>
	Including seawater	Fresh only		
State total	2,808	1,775	234	971
Hawaii	283	278	18	17
Maui	606	564	18	410
Lanai	2	2	1	1
Molokai	5	5	1	4
Oahu	1,430	471	183	238
Kauai	482	455	13	301
Niihau	(z)	(z)	(z)	(z)
	Industrial			
	Thermoelectric		Hydro-electric	Other <u>2/</u>
	Fresh	Seawater		
State total	137	1,033	204	232
Hawaii	79	5	70	95
Maui	25	42	47	66
Lanai	-	-	-	-
Molokai	(z)	-	-	(z)
Oahu	16	959	-	34
Kauai	17	27	87	37
Niihau	-	-	-	-

z Less than 0.5 mgd.

1/ Maui, Oahu, and Kauai data include recycled water.2/ Hawaii, Maui, and Kauai data include recycled water.Source: Hawaii State Department of Land and Natural Resources, State Water Resources Development Plan and Technical Reference Document (September 1980), p. III-20.

Table 114.-- WATER SERVICES AND CONSUMPTION, FOR COUNTY WATERWORKS:
1979 AND 1980

Geographic area	Number of services, June 30		Consumption ^{1/} (millions of gallons)	
	1979	1980	1979	1980
State total	170,542	175,382	54,628	55,610
City and County of Honolulu ..	122,067	124,752	42,446	42,519
Honolulu ^{2/}	57,574	58,082	24,271	24,168
Rest of Oahu	64,493	66,670	18,175	18,351
Hawaii County	21,380	22,446	4,088	4,433
Kauai County	9,684	10,169	2,444	2,745
Maui County	17,411	18,015	5,650	5,913
Maui	16,326	16,892	5,403	5,649
Molokai	1,085	1,123	246	265

^{1/} Year ended June 30.

^{2/} Maunaloa to Moanalua.

Source: Honolulu Board of Water Supply, Annual Report and Statistical Summary for 1978-1979 and 1979-1980; Hawaii Department of Water Supply, 1979-1980 Annual Report; Kauai Department of Water, records; Maui Department of Water Supply, Annual Report for the Fiscal Year Ended June 30, 1980.

Table 115.-- WATER QUALITY AT SPECIFIED PUBLIC BEACHES: 1976 TO 1980

Island and beach	Number of samples, 1980	Fecal coliform density $\frac{1}{}$ (geometric mean, MPN/100 ml)				
		1976	1977	1978	1979	1980
Hawaii (Hilo side):						
Exit of Ice Pond	12	145.3	248.2	84.0	42.3	41.6
Leileiwi Beach Park	12	106.6	87.2	63.1	93.5	195.5
Onekahakaha	12	14.8	11.8	6.0	6.8	13.5
Puhi Bay No. 3	12	6.2	9.1	10.8	6.9	9.1
Hawaii (Kona side):						
Hapuna Beach	9	2.5	2.0	3.1	6.1	16.2
Kahaluu Beach	9	2.1	3.0	3.5	2.7	2.5
Kealakekua Bay (off curio stand) .	10	2.3	2.0	2.3	2.6	2.5
Kealakekua Bay (off canoe landing)	9	20.9	11.0	2.4	3.0	2.8
Magic Sands Beach	9	2.2	4.3	21.5	3.2	3.6
Puako Beach Lots (middle)	9	10.0	7.0	14.9	13.8	16.7
Puako Beach Lots (far end)	9	24.6	21.8	48.6	17.4	35.8
Spencer Beach Park	9	13.9	23.9	9.1	9.3	7.8
Maui:						
Hukilau Hotel shoreline	11	3.8	2.6	8.3	5.6	3.3
Kahului Breakwater	11	1,116.9	245.7	32.4	7.6	2.1
Wailuku Breakwater	11	521.9	222.0	387.7	5.5	4.2
Oahu:						
Ala Moana Park (ewa)	40	4.7	3.8	5.0	5.6	5.1
Ala Moana Park (center)	14	6.0	2.0	3.2	3.7	3.1
Ala Moana Park (diamond head)	13	5.4	2.0	3.9	6.8	7.9
Elks Club Beach	15	14.0	4.2	5.0	15.8	5.9
Ewa Beach	12	6.2	2.5	6.2	4.5	4.3
Ft. DeRussy Beach	13	24.3	3.1	4.2	18.5	7.2
Gray's Beach	41	6.2	4.7	6.6	6.9	5.7
Hanauma Bay	12	6.7	4.0	2.4	10.0	5.1
Kahana Park Beach	10	18.7	81.4	49.5	42.9	35.9
Kahanamoku Beach	13	4.6	6.3	4.2	17.3	8.9
Kahanamoku Lagoon (diamond head) .	41	12.5	8.7	84.9	94.8	127.3
Kailua Bay outfall shoreline	12	15.9	2.0	2.3	2.5	8.8
Kailua Beach Park	12	6.6	9.1	6.7	17.8	13.2
Kokokahi Pier	12	33.1	58.0	30.3	45.6	60.6
Kuhio Beach	13	25.0	19.3	10.6	17.9	37.3
Public Bath Beach	41	4.5	2.4	3.6	4.3	4.6
Tavern Beach	13	3.5	4.2	10.1	8.9	17.9
Sand Island Pt. #1	10	6.7	4.2	28.2	13.9	3.6
Sand Island Pt. #2	12	140.7	25.3	21.5	33.2	3.9
Sand Island Pt. #3	12	71.0	14.8	24.7	89.6	8.9
Sand Island Pt. #4	12	48.0	10.2	15.2	19.6	17.3

Continued on next page.

Table 115.-- WATER QUALITY AT SPECIFIED PUBLIC BEACHES: 1976 TO 1980 - Con.

Island and beach	Number of samples, 1980	Fecal coliform density ^{1/} (geometric mean, MPNS/100 ml)				
		1976	1977	1978	1979	1980
Kauai:						
Brennecke Beach	7	3.1	2.1	3.6	2.9	2.7
Hanalei Bay Landing	7	14.8	27.3	64.4	25.5	30.6
Poipu Beach	7	4.0	4.0	9.0	3.7	2.3

^{1/} The EPA criterion for bathing waters is that the fecal coliform bacteria not exceed a geometric mean value of 200 MPN/100ml.

Source: Hawaii State Department of Health, Pollution Investigation and Enforcement Branch, data supplied June 18, 1981.

Table 116.-- AVERAGE WATER TEMPERATURES AT WAIKIKI BEACH

[°F.]

Month	Morning	Afternoon
March	75	77
August	77	82

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Local Climatological Data, Annual Summary With Comparative Data, Honolulu, Hawaii, 1980.

Table 117.-- AIR QUALITY IN DOWNTOWN HONOLULU:
1970 TO 1980

[Sampling is conducted approximately 46 ft. above ground on the roof of the State Health Department building, 1250 Punchbowl Street, Honolulu, Hawaii.]

Year	Annual arithmetic means (ug/m ³)	
	Total suspended particulates	Sulfur oxides
1970	37	...
1971	45	11
1972	41	11
1973	34	7
1974	35	10
1975	40	9
1976	34	23
1977	31	17
1978	29	18
1979	32	22
1980	37	18
Standards: <u>1/</u>		
Primary	75	80
Secondary	60	60

1/ Primary and secondary National Ambient air quality standards have been promulgated by the Federal government. Primary standards are designed to prevent adverse effects on public health, while secondary standards are designed to prevent adverse effects on public welfare, including the effects on comfort, visibility, vegetation, animals, aesthetic values, and soiling and deterioration of materials.

Source: Hawaii State Department of Health, Pollution Investigation and Enforcement Branch, data supplied June 18, 1981.

Table 118.-- SOURCES OF AIR POLLUTANT EMISSIONS, BY COUNTIES:
MAY 1978

[Percent distributions for the sums of weights of sulfur oxides, particulate matter, carbon monoxide, hydrocarbons, and nitrogen oxide emissions.]

Source	State total	Hawaii	Honolulu	Kauai	Maui
All sources	100	100	100	100	100
Transportation	49	37	55	23	34
Motor vehicles	45	33	51	19	29
Aircraft	3	3	3	3	3
Vessels	1	(N)	1	(N)	1
Gasoline handling and evaporation	(N)	(N)	(N)	(N)	(N)
Fuel combustion in stationary sources	27	17	31	15	19
Residential, commercial, institutional	(N)	(N)	(N)	(N)	(N)
Industrial	17	13	20	11	5
Steam-electric utilities .	10	4	11	4	13
Solid waste disposal	1	2	2	1	1
Open burning	1	2	1	1	1
Incineration	(N)	0	1	0	0
Industrial process losses ..	6	4	8	2	2
Agricultural field burning .	16	40	4	59	44

N Less than 0.5 percent.

Source: Hawaii State Department of Health, Pollution Investigation and Enforcement Branch, data supplied June 18, 1981.

Table 119.-- AIR QUALITY AT SPECIFIED LOCATIONS: 1980

[24-hour sampling, in micrograms per cubic meter.]

Sampling station	Total suspended particulates			Sulfur dioxide		
	Annual range		Arith- metic average	Annual range		Arith- metic average
	Minimum	Maximum		Minimum	Maximum	
Oahu:						
Barbers Point ...	29	158	53	<5	10	<5
Downtown Honolulu	23	103	37	<5	60	18
Kalihi Kai	29	106	55	<5	5	<5
Pearl City	22	93	36	<5	15	<5
Waikiki	20	116	36	<5	<5	<5
Waimanalo	10	90	29	...	...	...
Maui:						
Kahului	25	143	79	<5	406	64
Kihei	18	158	56	...	...	...
Hawaii:						
Hilo	10	84	21	<5	17	<5
Honokaa	10	49	23	...	...	...
Kauai:						
Lihue	16	98	38	<5	<5	<5

Source: Hawaii State Department of Health, Pollution Investigation and Enforcement Branch, data supplied June 18, 1981.

Table 120.-- NOISE LEVELS IN VARIOUS NEIGHBORHOODS ON OAHU: 1974

Neighborhood	Noise level (in decibels) exceeded --		
	10 percent of time	50 percent of time	90 percent of time
HONOLULU			
Aina Haina	53.5	45.0	40.0
Aina Koa	61.0	48.4	42.3
Downtown	67.0	58.0	50.5
Hawaii Kai	57.0	46.5	40.5
Kahala	56.7	45.5	42.0
Kaimuki	59.0	50.7	44.0
Kalihi	58.0	50.2	43.7
Kapahulu	55.0	49.7	44.0
Kapalama-Liliha	63.8	56.0	46.0
Kuliouou	53.5	46.3	40.5
Makiki	64.5	55.0	49.5
Manoa	58.7	45.3	40.0
Moiliili	62.0	55.0	50.0
Niu Valley	57.0	46.7	39.5
Nuuanu	63.0	50.1	45.4
Palolo	58.5	49.4	44.0
Pawaa	65.5	60.0	54.0
Waikiki	69.0	61.5	54.0
Waiialae-Iki	60.0	50.5	41.5
Ward to Punchbowl	67.5	60.2	57.0
REST OF OAHU			
Aiea-Waimalu	57.5	47.3	40.5
Halawa Heights, Foster Village, Salt Lake, Aliamanu	57.5	54.5	48.7
Kailua	55.5	45.0	37.5
Kaneohe	54.0	45.5	40.5
Mililani Town	57.5	50.0	45.0
Pearl City	53.2	44.7	38.7
Wahiawa	62.5	50.5	46.0
Waianae	56.5	50.0	45.0
Waimanalo	54.5	50.0	44.5
Waipahu	59.0	51.0	45.5

Source: Survey conducted by Dr. Iwao Miyake for the Hawaii State Department of Health, and summarized by the Noise and Radiation Branch, Department of Health.

Table 121.-- 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		
Hawaii:							
Hilo Airport	26	71.0	75.9	53	94	133.57	40
Hawaii Volcanoes Nat. Park Hdq. .	3,971	57.6	63.2	37	85	102.81	...
Kailua	30	72.1	77.3	54	93	25.22	...
Puako 1/	10	73.1	79.8	52	98	9.47	...
Waimea (Kamuela)	2,670	62.3	66.8	34	90	40.05	...
Mauna Kea summit 2/	13,796	31.1	42.5	11	66	8.08	...
Maui:							
Hana	120	71.3	76.8	50	90	70.65	...
Haleakala summit	9,960	42.6	50.0	14	73	50.69	...
Kihei 3/	90	70.9	78.4	49	98	13.79	...
Kahului Airport	48	71.6	78.8	48	96	18.43	70
Lahaina	45	71.5	78.0	52	93	15.51	...
Molokai:							
Kaunakakai	12	...	...	...	...	14.08	...
Molokai Airport	450	70.2	77.6	48	90	29.21	...
Lanai:							
Lanai City	1,620	65.8	72.8	46	88	38.44	...
Oahu:							
Honolulu International Airport ..	7	72.3	80.7	53	93	22.90	68
Honolulu Federal Bldg. 4/	12	72.0	78.6	57	88	25.35	65
Waikiki 5/	10	71.9	80.6	51	93	27.32	...
Manoa (HSPA)	500	69.4	75.2	...	...	158.41	...
Kaneohe MCAS	10	72.9	79.1	58	90	43.88	...
Kahuku	25	71.6	78.8	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	...

Continued on next page.

Table 121.-- CLIMATIC DATA FOR SELECTED PLACES -- Con.

Island and station	Ground elevation (feet)	Average temperature (°F.)		Extreme temperature of record (°F.)		Average annual precipitation (inches)	Average annual possible sunshine (percent)
		Coollest month	Warmest month	Lowest	Highest		
Kauai:							
Kilauea	315	68.7	75.6	49	94	68.03	...
Kealia	9	70.2	78.0	44	93	43.28	...
Lihue Airport	103	71.2	79.1	50	90	44.18	56
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	...	...	...	...	451.00	...
Northwestern Hawaiian Islands:							
Midway	10	65.0	78.6	52	89	43.60	...

- 1/ Temperature data are for Mohukona.
- 2/ Based on incomplete and non-continuous data for 1966-1972.
- 3/ Temperature data refer to Puunene Airport.
- 4/ Temperature sensors are 87 feet above the ground.
- 5/ Located at Honolulu Zoo. Available only from 1965.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service Pacific Region, data supplied March 17, 1976 and May 2, 1977, and National Climatic Center, Local Climatological Data, Annual Summary With Comparative Data, 1980 for Hilo, Kahului, Honolulu, and Lihue; Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, data supplied July 2, 1981.

Table 122.-- MONTHLY AND ANNUAL CLIMATIC DATA FOR HONOLULU INTERNATIONAL AIRPORT

Month	Normal temperature (°F.)			Extreme temperature (°F.) 1/		Precipitation (inches)			
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest	Normal total	Maximum monthly	Minimum monthly	Maximum in 24 hours
Jan. .	79.3	65.3	72.3	87	53	4.40	14.74	0.34	6.72
Feb. .	79.2	65.3	72.3	87	53	2.46	13.68	0.32	6.88
Mar. .	79.7	66.3	73.0	88	55	3.18	20.79	0.01	17.07
Apr. .	81.4	68.1	74.8	89	59	1.36	8.92	0.01	4.21
May ..	83.6	70.2	76.9	90	63	0.96	7.23	0.05	3.44
June .	85.6	72.2	78.9	90	65	0.32	2.46	T	2.28
July .	86.8	73.4	80.1	91	67	0.60	2.01	0.03	1.03
Aug. .	87.4	74.0	80.7	92	67	0.76	3.08	T	2.35
Sept.	87.4	73.4	80.4	92	66	0.67	2.74	0.05	1.40
Oct. .	85.8	72.0	78.9	93	64	1.51	11.15	0.11	7.57
Nov. .	83.2	69.8	76.5	89	58	2.99	14.72	0.03	9.15
Dec. .	80.3	67.1	73.7	89	54	3.69	12.09	0.06	8.14
Ann. .	83.3	69.8	76.6	93	53	22.90	20.79	T	17.07

Continued on next page.

Table 122.-- MONTHLY AND ANNUAL CLIMATIC DATA FOR HONOLULU INTERNATIONAL AIRPORT -- Con.

Month	Relative humidity (percent) <u>2/</u>		Wind (miles/hour)		Percent of possible sun- shine	Mean sky cover, sunrise to sun- set <u>3/</u>	Mean number of days		
	8 A.M.	2 P.M.	Mean speed	Fastest mile			Sunrise to sunset		Precip. .01 inch or more
							Clear	Cloudy	
Jan. ...	80	63	10.0	67	62	5.5	9	9	10
Feb. ...	78	60	10.6	63	63	5.7	7	9	10
Mar. ...	73	59	11.7	59	68	5.9	7	10	9
Apr. ...	70	57	12.2	40	67	6.3	6	11	9
May	67	55	12.2	35	69	6.1	6	10	7
June ...	67	54	13.0	39	70	5.7	6	7	6
July ...	66	52	13.7	34	73	5.3	8	6	8
Aug	68	53	13.4	52	75	5.3	8	6	7
Sept. ..	67	52	11.7	36	75	5.2	8	6	7
Oct. ...	68	55	10.9	40	68	5.6	8	8	9
Nov. ...	74	59	11.0	65	61	5.7	7	9	9
Dec. ...	78	61	10.9	59	59	5.6	8	10	10
Ann. ...	71	57	11.8	67	68	5.7	88	101	101

T Trace, an amount too small to measure.

1/ For periods October 1962 through December 1964 and September 1971 through December 1980.

2/ Data for 1963, 1964, and 1972-1980.

3/ Sky cover is expressed in a range of 0 for no clouds or obscuring phenomena to 10 for complete sky cover.

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data and Information Service, Local Climatological Data, Annual Summary With Comparative Data, Honolulu, 1980.

Table 123.-- CLIMATIC DATA FOR THE PERIOD OF RECORD

Subject	Date	Place	Magnitude
Long-term averages:			
Lowest monthly average minimum temp. (°F.) ..	February	Mauna Kea summit ..	23.3
Lowest monthly average daily temp. (°F.)	February	Mauna Kea summit ..	31.1
Highest monthly average maximum temp. (°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	451.0
Single events:			
Lowest temperature of record (°F.)	Feb. 11, 1973 ...	Mauna Kea summit ..	11.
Highest temperature of record (°F.)	April 27, 1931 ..	Pahala, Hawaii	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; Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, data supplied July 2, 1981.

Table 124.-- RAINFALL, FOR SPECIFIED LOCATIONS: ANNUALLY, 1970 TO 1980

[In inches.]

Year	Hawaii		Maui		Oahu: Hono- lulu 1/	Kauai	
	Hilo 2/	Kona 3/	Kahului 2/	Lahaina		Lihue 2/	Koloa
1970 ..	153.98	20.78	18.61	11.95	18.35	39.18	64.45
1971 ..	140.69	37.61	20.13	15.93	28.61	49.62	75.33
1972 ..	98.85	33.22	15.71	20.21	26.72	43.54	66.72
1973 ..	107.97	14.85	10.27	10.13	18.66	35.27	66.78
1974 ..	112.92	40.49	18.68	13.01	28.24	45.60	86.35
1975 ..	99.93	25.97	13.74	12.19	24.63	35.52	49.91
1976 ..	114.67	25.51	12.83	8.86	...	32.83	62.60
1977 ..	90.38	...	11.50	8.28	...	40.34	52.51
1978 ..	119.09	26.29	19.15	11.97	25.63	39.11	70.64
1979 ..	158.77	...	26.82	20.85	24.78	37.09	55.98
1980 ..	127.74	...	27.87	22.69	27.21	54.64	78.78

1/ Old Federal Building (South King St. and Richards St.). Observations suspended November 26, 1976 - March 31, 1977.

2/ Airport data.

3/ Holualoa Beach. Observations incomplete for 1977 and discontinued after December 31, 1978.

Source: U.S. Department of Commerce, National Climatic Center, Local Climatological Data, Annual Summary with Comparative Data, 1980 for Hilo, Kahului, and Lihue; U.S. Department of Commerce, National Weather Service, Pacific Region, records; and Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, records.

Table 125.-- CLIMATIC DATA FOR HONOLULU INTERNATIONAL AIRPORT: ANNUALLY,
1970 TO 1980

Year	Average temperature (°F.)			Extreme temp. (°F.)		Precipitation (inches)
	Annual	Coolest month	Warmest month	Lowest	Highest	
1970 ...	78.2	73.3	83.8	58	92	15.49
1971 ...	76.1	71.7	79.5	56	89	26.64
1972 ...	76.2	70.4	81.1	53	90	26.94
1973 ...	77.2	72.6	81.2	55	91	14.24
1974 ...	77.5	74.0	81.2	58	92	24.02
1975 ...	76.2	72.4	80.1	56	90	24.39
1976 ...	76.8	72.0	80.8	53	91	12.90
1977 ...	78.2	73.7	82.2	59	92	12.36
1978 ...	76.8	72.4	80.5	57	91	25.05
1979 ...	77.0	69.9	81.1	57	93	16.93
1980 ...	77.5	71.9	81.6	56	91	26.90

Year	Relative humidity (%)		Wind speed (miles/hour)		Percent of possible sunshine	Days with precipitation .01 inch or more
	8 A.M.	2 P.M.	Annual average	Fastest mile		
1970 ...	69	54	13.2	40	72	120
1971 ...	72	57	13.3	34	70	110
1972 ...	72	57	13.2	33	65	93
1973 ...	70	54	12.7	33	63	110
1974 ...	73	58	10.9	34	61	118
1975 ...	72	56	12.2	36	62	82
1976 ...	64	52	11.5	38	60	105
1977 ...	71	55	12.2	37	68	81
1978 ...	74	58	11.9	34	69	90
1979 ...	74	57	11.4	34	68	89
1980 ...	75	59	11.9	35	69	115

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Center, Local Climatological Data, Annual Summary With Comparative Data, Honolulu, Hawaii (annual).

Table 126.-- TRADE WINDS, HIGH SURF, AND TEMPERATURES IN HAWAIIAN WATERS,
BY MONTHS

Month	Trade wind frequency <u>1/</u> (percent)	Expected days of strong trade winds <u>2/</u>	Highest surf <u>3/</u> (average number of days)		Water temperature (°F.)	
			Flat or 1 foot	6 feet or more	Mean maximum	Mean minimum
Jan. ...	42	9	1	19	74.7	71.1
Feb. ...	55	7	1	16	75.6	70.3
March ..	61	10	1	12	76.5	71.8
April ..	74	10	3	7	77.7	73.0
May	86	7	8	3	79.5	74.7
June ...	91	7	15	-	81.1	77.7
July ...	95	10	16	-	81.1	78.3
Aug. ...	94	7	15	-	81.9	79.2
Sept. ..	83	4	10	2	81.9	78.4
Oct. ...	71	4	1	12	81.1	77.2
Nov. ...	64	8	-	19	79.3	74.5
Dec. ...	57	9	-	20	75.9	71.4
Ann. ...	65	92	71	110	78.6	74.8

1/ Mean monthly frequency of trade winds in Hawaiian waters.

2/ Expected number of hazardous days in Hawaiian waters due to strong trade winds.

3/ Observations at Sunset Beach, Oahu. Annual averages were: flat or 1 foot, 71 days; 2-5 feet, 184 days; 6-10 feet, 71 days; 11-15 feet, 26 days; 16 feet or higher, 13 days.

4/ Observations at Kaneohe, Oahu. The mean ranged from 73.0 in January and February to 80.2 in August. Absolute maximums and minimums were respectively 84 (in July, August, and October) and 68 (December and February).

Source: Paul Haraguchi, Weather in Hawaiian Waters (Honolulu: Pacific Weather, Inc., 1979), pages 14, 22, 56, and 74.

Table 127.-- SUNRISE, SUNSET, AND HOURS OF DAYLIGHT AT HILO, HONOLULU, AND LIHUE, FOR SELECTED DATES

(Hawaiian Standard Time)

Subject	March 21	June 21	Sept. 23	Dec. 22
Sunrise (A.M.):				
Hilo	6:24	5:42	6:09	6:51
Honolulu	6:35	5:50	6:21	7:05
Lihue	6:41	5:55	6:26	7:12
Sunset (P.M.):				
Hilo	6:32	7:02	6:16	5:47
Honolulu	6:43	7:16	6:27	5:55
Lihue	6:49	7:23	6:33	6:00
Hours of daylight:				
Hilo	12:08	13:20	12:07	10:56
Honolulu	12:08	13:26	12:06	10:50
Lihue	12:08	13:28	12:07	10:48

Source: Nautical Almanac Office, U.S. Naval Observatory, Tables of Sunrise and Sunset, No. 1083 and 1084 and records.

Table 128.-- TREES ALONG STREETS OR IN PARKS UNDER THE JURISDICTION OF THE CITY AND COUNTY OF HONOLULU: 1979 AND 1980

Location	June 30, 1979	June 30, 1980
Along City and County streets and highways ^{1/}	104,499	108,202
In City and County parks	95,600	95,700

^{1/} Excludes Federal, State, and private thoroughfares.

Source: City and County of Honolulu, Department of Parks and Recreation, records.

Table 129.-- HAWAII AUDUBON SOCIETY BIRD COUNTS OF THE
HONOLULU AREA: 1970 TO 1980

[Counts are made in late December, in a circle, 15 miles
in diameter, centered near Nuuanu Pali.]

Species <u>1/</u>	Annual averages		1980
	1970- 1974	1975- 1979	
All species:			
Species	49	54	44
Individual birds ..	11,614	15,811	20,226
Endemic species:			
'Apapane	35	135	147
Hawaiian Coot	69	35	28
Hawaiian Stilt	112	128	115
Oahu 'Amakihi	42	132	152
Indigenous species:			
Great Frigatebird	614	597	615
Red-footed Booby	1,463	1,401	1,132
Introduced species:			
Barred Dove	1,468	2,216	2,541
Cattle Egret	759	1,156	1,072
Common Myna	2,567	2,241	3,577
House Sparrow	1,373	1,155	1,684
Japanese White-eye	450	1,165	1,003
Red-vented Bulbul	31	503	1,174
Spotted Dove	586	1,091	1,104
Migratory species:			
Golden Plover	564	1,138	1,884
Ruddy Turnstone	97	165	397

1/ Separate data are shown for endemic birds averaging more than 25 individuals in 1975-1979, indigenous birds more than 200, introduced birds more than 500, and migratory species and stragglers more than 100. Endemic birds are those peculiar to a particular region, in this case Hawaii, and therefore found nowhere else in the world; indigenous birds are those native to a given region, in this case Hawaii, but with a total range of distribution encompassing a much wider area. The classification is that in Andrew J. Berger, Hawaiian Birdlife (1972).

Source: Hawaii Audubon Society, The 'Elepaio (monthly).

Table 130.-- ENDANGERED, THREATENED, AND EXTINCT SPECIES OF NATIVE
HIGHER PLANTS: 1977

Status	Species, subspecies, and varieties	Percent
Total native flora	2,200	100.0
Endangered, threatened, or extinct ^{1/} ...	1,113	50.6
Endangered	646	29.4
Threatened	197	8.9
Extinct	270	12.3
Not endangered, threatened, or extinct .	1,087	49.4

^{1/} For the other 49 States, 2,140 (or 10.7 percent) of all 20,000 native higher plants are endangered, threatened, or extinct.

Source: Edward S. Ayensu and Robert A. DeFilipps, Endangered and Threatened Plants of the United States (Smithsonian Institution and the World Wildlife Fund, Inc., 1978), p. xiii.