HANNIBAL TAVARES
Mayor
TELEPHONE 244-7855

OFFICE OF THE MAYOR
COUNTY OF MAUI
WAILUKU, MAUI, HAWAII 96793

August 17, 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Re: Revised Environmental Impact Statement for Makawao-Kula Water Treatment Plants

I have reviewed the Revised Environmental Impact Statement for the Makawao-Kula Water Treatment Plants prepared by the Department of Water Supply.

I hereby accept the Revised Environmental Impact Statement.

Your expeditious review and processing of this document will be appreciated. Should you have any questions, please contact William S. Haines at 244-7816.

Very truly yours,

Hannibal Tavares

HANNIBAL TAVARES
Mayor, County of Maui

cc: Dept. of Water Supply
Environmental Impact Study Corp.
Norman Saito Engineering Consultants, Inc.
Roy Takemoto

REVISED
ENVIRONMENTAL IMPACT STATEMENT

MAKAWAO-KULA WATER TREATMENT PLANTS

COUNTY OF MAUI

DEPARTMENT OF WATER SUPPLY

REVISED

ENVIRONMENTAL IMPACT STATEMENT

FOR THE

MAKAWAO AND KULA WATER TREATMENT PLANTS

Maui, Hawaii

Submitted By:

William S. Haines

William Haines
Director
Department of Water Supply

Prepared By:

Environment Impact Study Corporation
Honolulu and Maui, Hawaii

June, 1982

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[Continued on next page]

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ERRATA SHEET

All references to Chapter 49, Public Health Regulations (PHR) are amended to read Chapter 20, Title 11, Administrative Rules which is the current state regulation for potable water systems. Chapter 49, PHR was revised as Chapter 20, Title 11, Administrative Rules on December 26, 1981. In its present form, there is no standard for sodium. The proposed 20 parts per million mcl was reduced to a requirement to monitor for sodium.

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Summary

SUMMARY

MAKAWAO-KULA WATER
TREATMENT PLANTS

REVISED

ENVIRONMENTAL IMPACT STATEMENT

Maui, Hawaii

PROPOSING AGENCY:	Department of Water Supply, County of Maui
INITIAL ACCEPTING AUTHORITY:	Mayor, County of Maui
FINAL ACCEPTING AUTHORITY:	Governor, State of Hawaii

The Department of Water Supply, County of Maui, proposes to construct three water treatment plants to enable the Makawao and Kula water systems to conform with Federal Safe Drinking Water Regulations. Proposed sites for the plants are located near the Kamole Weir (Wailoa Forebay), and Olinda and Piiholo reservoirs. The plant near Kamole Weir will primarily serve the Makawao service area and provide water to the Kula service areas during drought conditions; the plant near Olinda Reservoir will primarily serve the Upper Kula service area. Lower Kula The proposed water treatment facilities will utilize various types and combinations of treatment units to achieve the desired water quality. The selection of these unit processes depends upon the type and amount of contaminants in the water, as determined by pilot testing.

The primary objective of the proposed project is to furnish consumers with safe and appealing drinking water at a reasonable cost. Present day construction costs for the three plants are estimated at $14.6 million.

Located on the northwest flank of the dormant volcano, Haleakala, the proposed sites are underlain by the Honomanu Volcanic Series and the Kula Volcanic Series.

Soils at the Kamole Weir site are Hamakuapoko silty clay and those at the Piiholo and Olinda reservoir sites are Olinda loam. At all sites, permeability is moderately rapid, runoff is slow to medium, and the erosion hazard is slight to moderate. The sites are located toward the windward side of Maui and receive rainfall from both winter storms and year-round trade wind showers.

Water sources of the Makawao and Kula water systems are surface waters. Water quality is thus poor after periods of intense rainfall. For the protection of the consumer, the facilities will be designed to provide treatment for the two major contaminants, turbidity and bacteria.

No rare or endangered species of plants or animals were seen or are potentially present on the project site. No significant archaeologic or historic materials or sites were located during the surface reconnaissance of the project site.

Electrical and telephone services are available for all three sites from nearby overhead lines. Disposal of dewatered waste water residue will be required as a routine procedure.

The proposed project will not alter the demand for emergency services in the areas of the three sites.

The state land use designation for the three sites is Agriculture. The Piiholo and Olinda sites are designated General Agriculture by the Makawao-Pukalani-Kula General Plan. The Kamole Weir site is not within the

General Plan boundaries. The proposed project will contribute to attainment of County General Plan policies for long-term development, under the category of Utility and Facility Systems. Maui County Planning Commission Special Use Permits will be required.

The proposed project will generate short-term primary impacts affecting air quality, noise levels and traffic. The adverse construction-related impacts will be mitigated by appropriate measures.

Long-term primary impacts resulting from the project include impacts on air quality and noise levels, and an improvement of the quantity and quality of potable water in the Makawao and Kula areas.

The secondary adverse impacts of the proposed project will be limited to the loss of 3 to 4 acres of land, used for grazing. However, this loss will not adversely affect cattle production.

Several alternatives have been investigated. They include: "no action", alternative sites, alternative water treatment plant design, alternative method of compliance and alternative phasing of the treatment plants.

The construction materials, capital, energy, and labor involved in this project will be irreversibly and irretrievably committed. The water treatment plants are expected to improve the quality of potable water in the area, and meet the requirements mandated by the Federal Safe Drinking Water Act.

Proposed Project

1

SECTION 1

DESCRIPTION OF THE PROPOSED PROJECT

I. INTRODUCTION

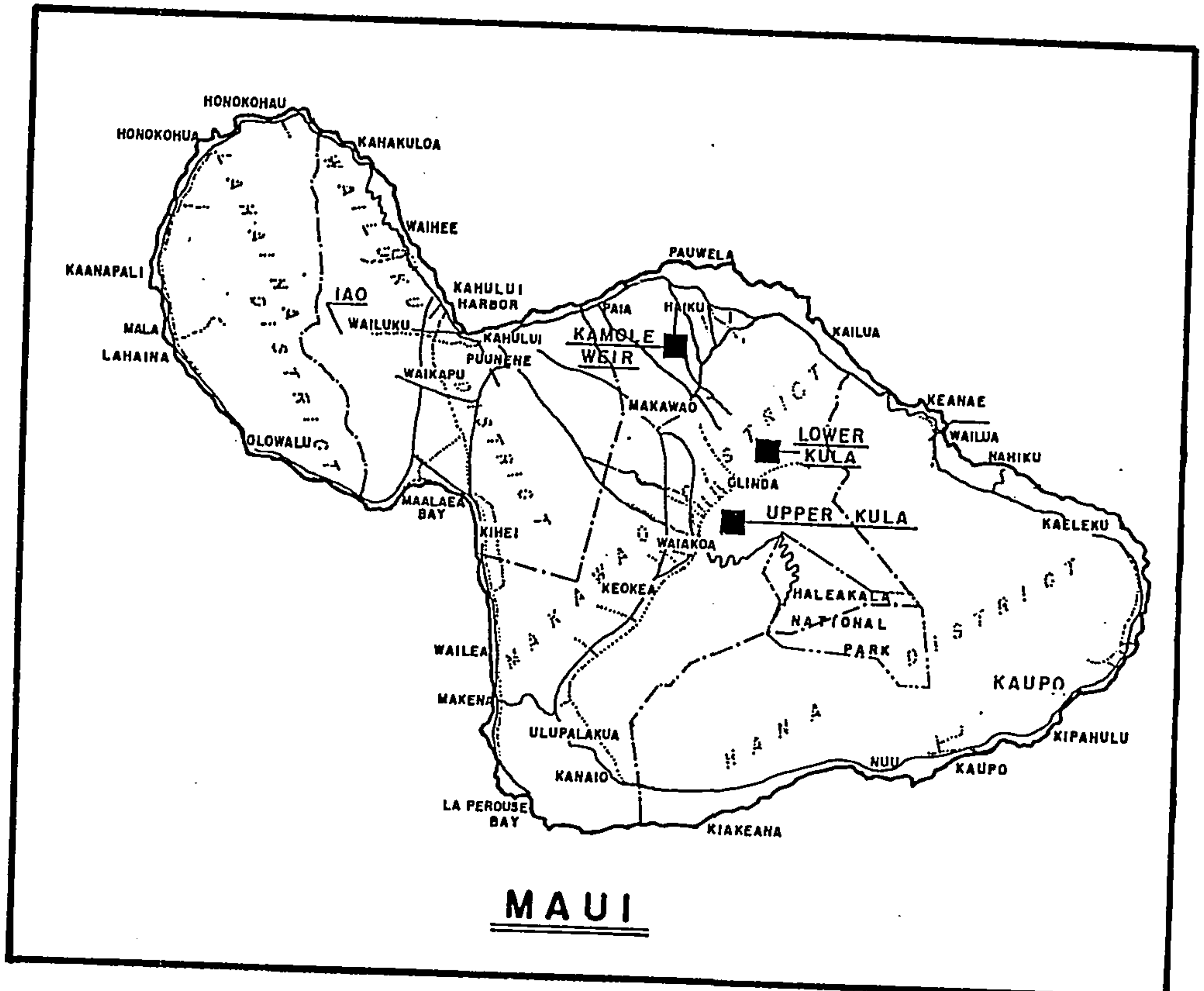
The Department of Water Supply, County of Maui, proposes the construction of three water treatment plants for the Makawao and Kula water systems, to meet the requirements mandated by the Federal Safe Drinking Water Act.

The treatment plant sites will be located near the Kamole Weir (Wailoa Forebay), and Olinda and Piiholo reservoirs (Figures 1-1 through 1-4). The plant near Kamole Weir will primarily serve the Makawao service area and provide water to the Kula service area during drought conditions; the plant near Olinda Reservoir will primarily serve the Upper Kula service area; and the plant near Piiholo Reservoir will serve the Lower Kula service area. This is discussed in greater detail later in this section.

II. BACKGROUND AND OBJECTIVES

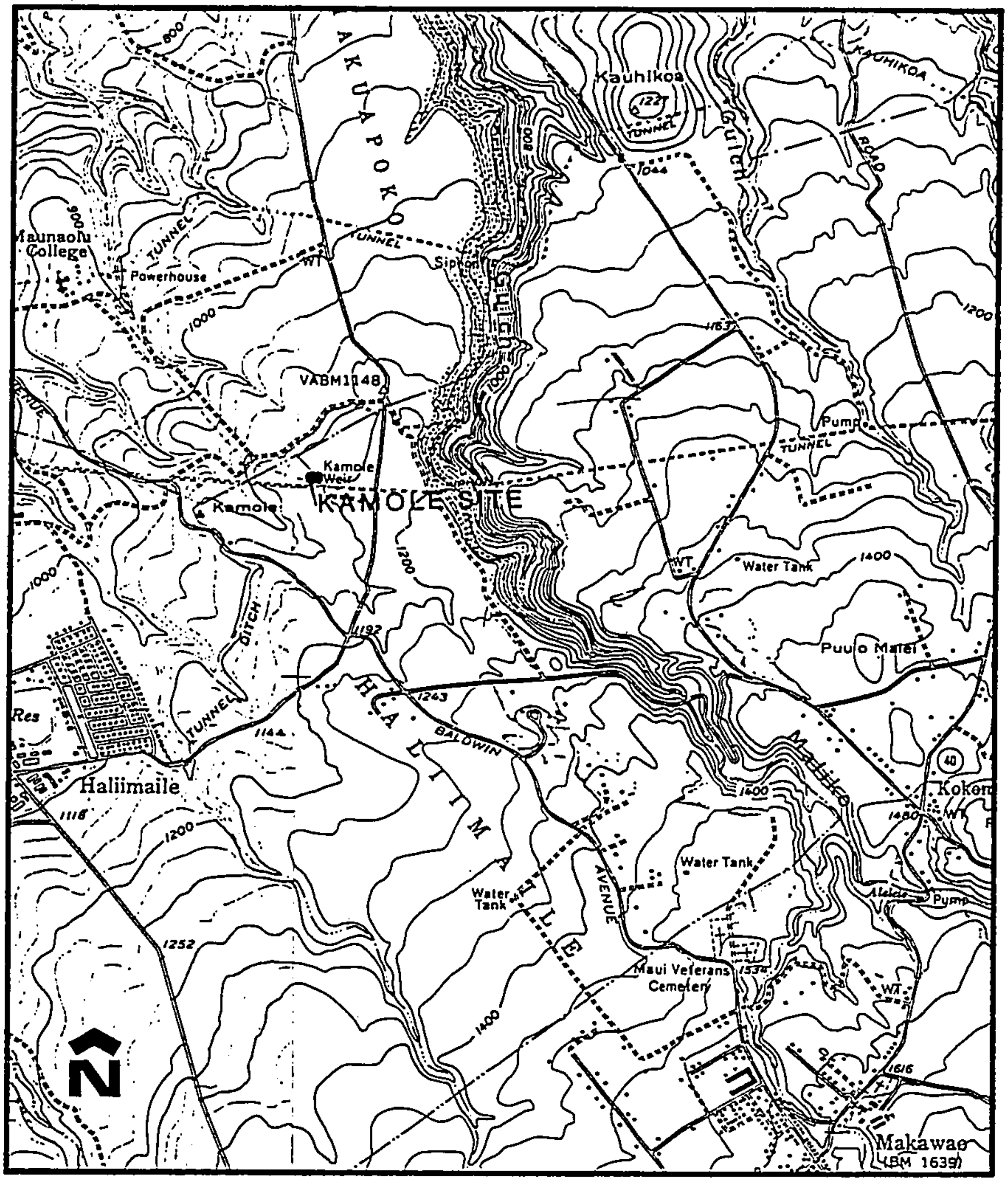
A. Background

The construction of the three water treatment facilities is required to conform to the National Interim Primary Drinking Water Regulations established by PL 93-523 (June 24, 1977) and State Department of Health Regulation, Chapter 49, Potable Water Systems (August 16, 1977). The United States Environmental



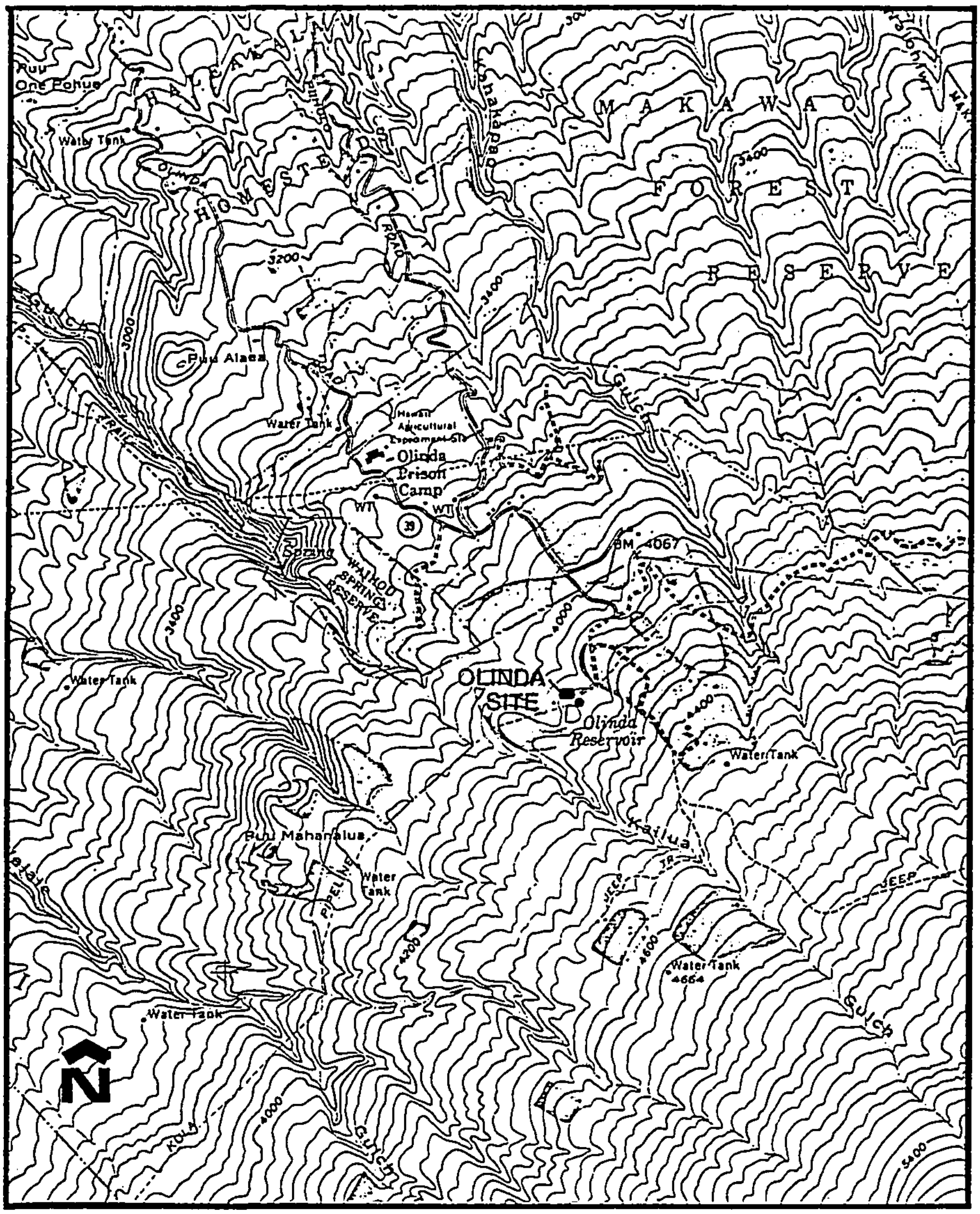
MAKAWAO - KULA WATER TREATMENT PLANTS

FIGURE 1-1



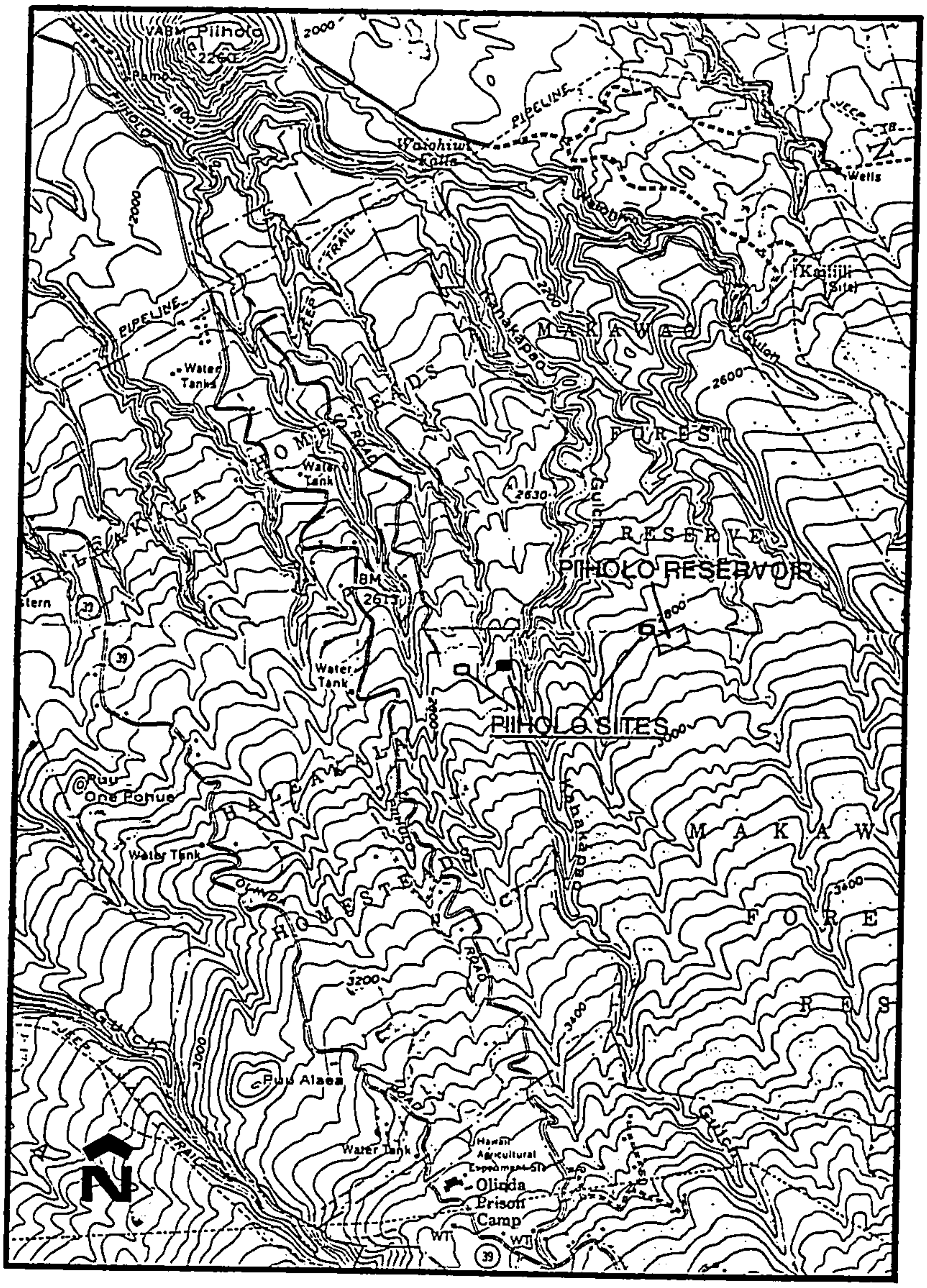
KAMOLE WEIR SITE

FIGURE 1-2



OLINDA SITE

FIGURE 1-3



■ .PRIMARY SITE
□ ALTERNATE SITES

PIIHOLO SITES

FIGURE 1-4

Protection Agency (USEPA) has developed primary and secondary drinking water standards to replace the United States Public Health Service Standards. The primary standards are based on dangers to health and are legally enforceable. The requirements for specific maximum contaminant levels (MCL) are found in Appendix A of this report.

B. <u>Objectives</u>

1. <u>General</u>

The primary objective of the water treatment plants is to: first, furnish water safe for human consumption; second, produce water that is appealing to the consumer; and third, produce water using reasonable facilities with respect to capital and operating costs.

2. <u>Specific</u>

The County of Maui has requested the consultants to perform the following:

- Review all laws, ordinances, regulations, standards and other data
- Consult with applicable agencies
- Develop final design criteria for the treatment facilities, including construction cost and operations and maintenance estimates
- Evaluate treatment methods and alternatives
- Evaluate alternative treatment sites

III. GENERAL DESCRIPTION OF THE EXISTING WATER SYSTEM

The Makawao-Kula potable water supply system is a complex, interconnected system located on the northwestern slope of Haleakala. Refer to Figures 1-5 and 1-6. Also refer to Table 1-1 for the storage capacity of the various dams, reservoirs and tanks in the Makawao-Kula system.

The following discusses the individual systems; however each system must be viewed as part of one larger system because of the interconnections.

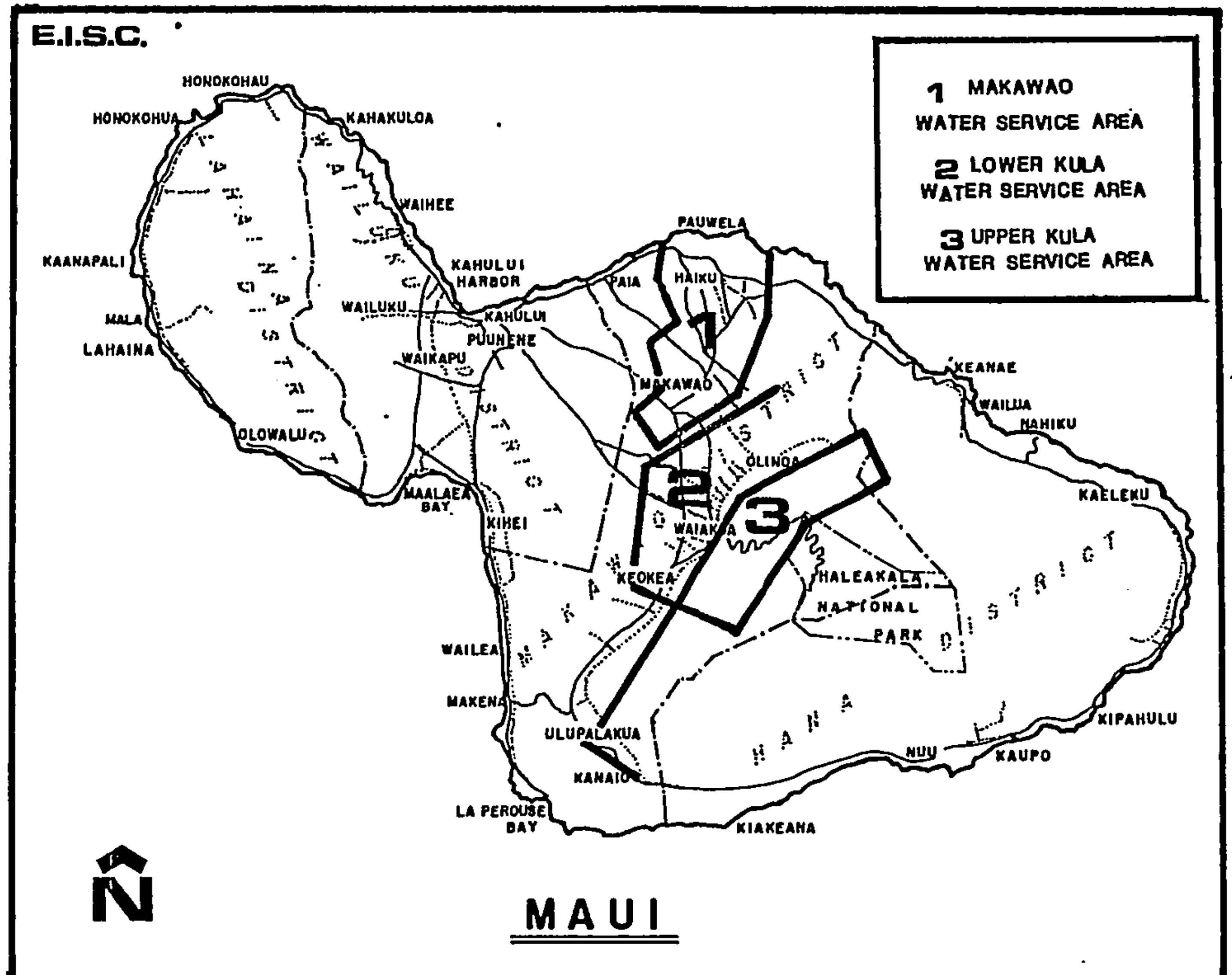
A. Kula Water System

The Kula water system is the most complex of all the water systems on the island of Maui [1.1]. It serves the Ulupalakua-Kanaio area as well as the communities (i.e., Olinda) within the Kula area. This system is divided into two subsystems, the Lower and Upper Kula systems, which are interconnected at several locations.

1. Lower Kula System

a. Sources

Water for the Lower Kula system is from a series of seven surface intakes located in the upper region of Waikamoi watershed. The intakes are located between the 2,500- and 3,000-feet elevations, in the following



MAKAWAO - KULA WATER SYSTEM

FIGURE 1-5

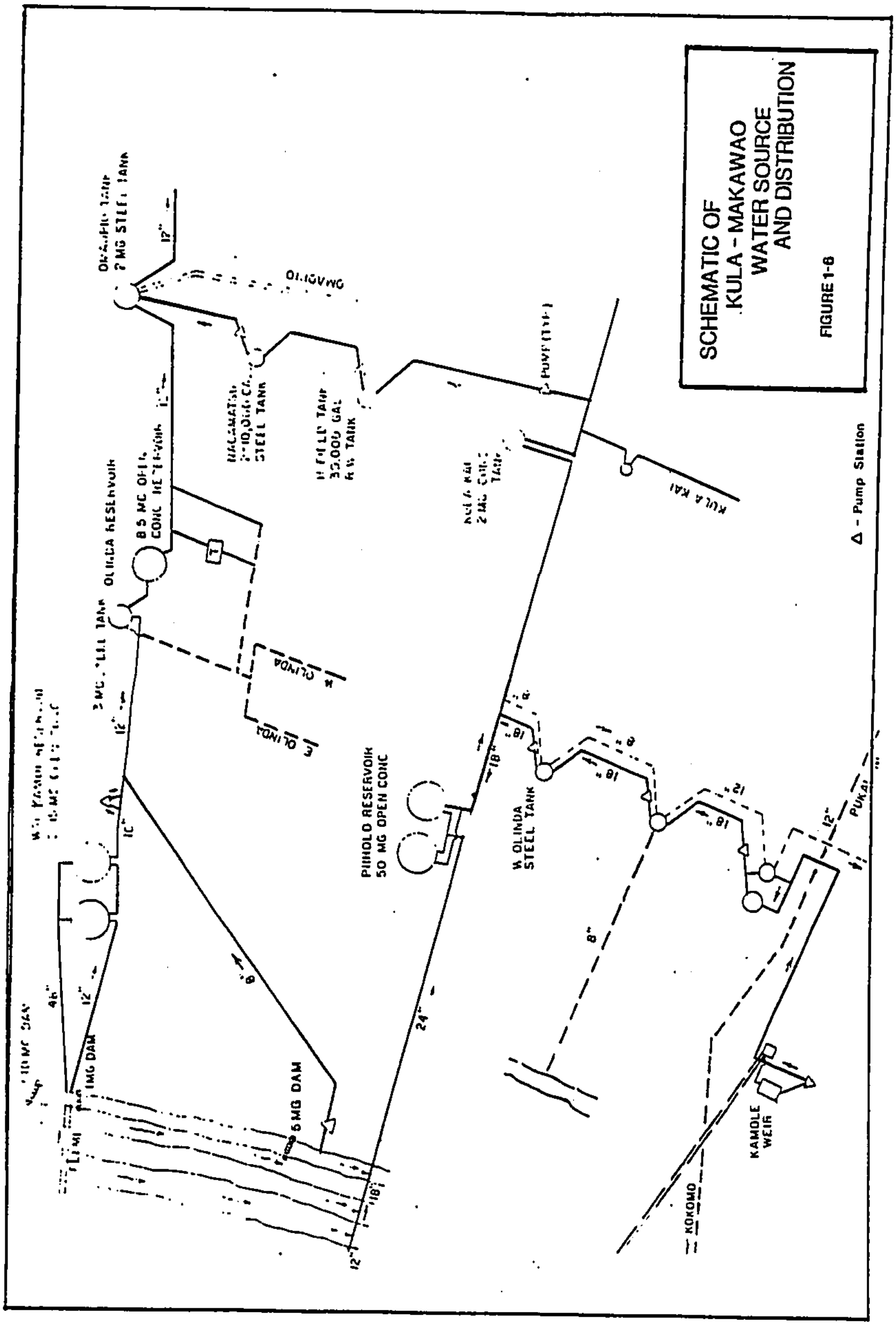

SCHEMATIC OF
KULA - MAKAWAO
WATER SOURCE
AND DISTRIBUTION
FIGURE 1-8
Δ - Pump Station
OLINDA RESERVOIR
8.5 MG OPEN CONC RESERVOIR
PIIHOLO RESERVOIR
50 MG OPEN CONC
W. OLINDA
STEEL TANK
1 MG DAM
5 MG DAM
KAMOLE
WEIR
KULA KAI
OMAOPIO
KOKOMO
24"
12"
8"

Table 1-1

STORAGE CAPACITY

TANK NUMBER	DESCRIPTION	LOCATION	CAPACITY	ELEVATION (ft)
	Waikamoi Dam	Waikamoi		4,282
	Waikamoi Arch Dam	Waikamoi	10.5 MG	4,320
388	Waikamoi Reservoir #1	Waikamoi	15.0 MG	4,267
389	Waikamoi Reservoir #2	Waikamoi	15.0 MG	4,267
253	Steel Tank	Olinda	3.0 MG	4,136
252	Concrete Reservoir	Olinda	8.5 MG	4,091
392	Steel Tank	Omaopio	2.1 MG	3,886
368	R.W. Tank	Kula Heights	20,000 Gal.	3,867 *
367	Steel Tank	Haleakala Acres	50,000 Gal.	4,171
380	Steel Tank	Pulehu Iki	70,000 Gal.	3,652
362	Steel Tank	Alae	2.1 MG	3,628
360	Steel Tank	Waiohuli	70,000 Gal.	3,529
357	Steel Tank	Keokea	47,000 Gal.	3,225 *
393	Steel Tank	Kamaole	0.5 MG	3,238
355	Steel Tank	East Kuhulu	50,000 Gal.	3,040 *
356	Steel Tank	West Kuhulu	50,000 Gal.	3,040 *
351	Steel Tank	Kanaio	12,000 Gal.	2,860 *
352	Steel Tank		50,000 Gal.	2,900
353	Steel Cylinder	Ulupalakua	25,000 Gal.	1,991
398	Steel Tank		500 Gal.	1,870
395	Steel Tank	Kuhulu Upper	500 Gal.	2,950 *
394	Steel Tank	Kuhulu Lower	500 Gal.	2,690 *
354	Steel Pressure Tank	Kamaole	500 Gal.	2,900 *
361	Steel Tank	Poli Poli	12,000 Gal.	3,245
363	R.W. Tank	Naalae	20,000 Gal.	2,880 *
384	Steel Tank		8,000 Gal.	2,482
387	Steel Tank	Waiakoa Farm Lots	47,000 Gal.	3,400
364	R.W. Tank	Kealahou #1	20,000 Gal.	3,290
365	R.W. Tank	Kealahou #2	30,000 Gal.	2,921
385	Steel Tank		12,001 Gal.	2,526
399	Steel Tank		300 Gal.	2,720
366	R.W. Tank		10,000 Gal.	2,315
381	Steel Tank	Pulehu Iki	12,000 Gal.	2,420 *
374	R.W. Tank		5,000 Gal.	2,650
373	R.W. Tank	Lower Kimo #2	5,000 Gal.	2,900 *
372	R.W. Tank	Lower Kimo #1	10,000 Gal.	3,179
375	R.W. Tank	Kula Orchard	50,000 Gal.	3,265 *
370	R.W. Tank	Upper Kimo #2	5,000 Gal.	3,446 *
369	R.W. Tank	Upper Kimo Drive	5,000 Gal.	3,620 *
383	Steel Tank	Nagamatsu (W)	10,000 Gal.	3,520
382	Steel Tank	Nagamatsu (E)	10,000 Gal.	3,520
371	R.W. Tank	Harry Field	30,000 Gal.	3,165
376	R.W. Tank		100,000 Gal.	2,728

Table 1-1, Continued

STORAGE CAPACITY

TANK NUMBER	DESCRIPTION	LOCATION	CAPACITY	ELEVATION (ft)
359	Steel	Kamehameiki Lateral	300 Gal.	2,720 *
396	Steel	Kukahuelo #1	10,000 Gal.	2,904
397	Steel	Kukahuelo #2	10,000 Gal.	2,581
398	Steel	Kukahuelo #3	10,000 Gal.	2,266
390	Steel Tank		25,000 Gal.	2,476
-	Concrete Tank		2.0 MG	Unknown
272	Steel Pressure Tank	Olinda	500 Gal.	3,500
273	Steel Pressure Tank	Olinda	500 Gal.	3,100
271	R.W. Tank		5,000 Gal.	2,730
377	Steel Tank		12,000 Gal.	2,202
378	Steel Tank		12,000 Gal.	1,952
379	Steel Tank		12,000 Gal.	1,557
-	Piiholo Reservoir		50.0 MG	2,870
254	Steel Tank		50,000 Gal.	2,464
270	Steel Tank		5,000 Gal.	Unknown
268	R.W. Tank		100,000 Gal.	1,710
251	Concrete Tank		1.0 MG	1,684
264	Steel Tank		70,000 Gal.	1,673
266	Concrete Tank		0.85 MG	1,416
265	Steel Tank		25,000 Gal.	1,422
257	Steel Tank		47,000 Gal.	1,329
269	R.W. Tank		5,000 Gal.	1,580
256	Steel Tank		300,000 Gal.	1,807
255	Steel Tank		0.5 MG	2,050
258	Steel Tank		100,000 Gal.	1,500
263	Steel Tank		70,000 Gal.	1,421
275	Steel Tank		70,000 Gal.	871
262	Steel Tank		70,000 Gal.	705
261	R.W. Tank		5,000 Gal.	640
260	R.W. Tank		10,000 Gal.	803
259	Steel Tank		12,000 Gal.	1,030
403	Steel Tank	Olinda	25,000 Gal.	3,578

* Unconfirmed

streams: Honomanu, Haipuaena, Puohokamoa (east, west and middle), and Waikamoi (east and west).

The surface intakes are located in a region of higher rainfall (217" to 317" isohyetal lines) than are the water sources of the Upper Kula system.

The surface water from the seven intakes is collected and transmitted through a 24-inch line into the Piiholo 50 million gallon (MG) open, concrete-lined storage reservoir. The water is then conveyed through a 24-inch line which reduces to an 18-inch line approximately 3,000 feet west of the reservoir. The 18-inch line conveys water southwesterly to Naalae Road.

b. Capacity

The rated capacity of the 18-inch line is approximately 5.0 million gallons per day (MGD). When required, water can be pumped from Kamole Weir (Makawao system) through a four-stage pump station/force main (18-inch) which connects at the intersection of West Olinda Road.

c. <u>Treatment</u>

Chlorinators are located at Piiholo Road, Omaopio and Kealahou. Water pumped from Makawao is also chlorinated.

d. <u>Storage System</u>

The major storage facility is the 50 million gallon concrete Piiholo reservoir located in the Makawao Forest Reserve. This reservoir feeds 12 storage tanks ranging in size from 10,000 gallons to 2 million gallons. Please refer to Table 1-1 for additional information.

e. <u>Treatment Plant Size</u>

The treatment plant will be designed to handle 2.5 MGD, and ultimately 5 MGD.

2. <u>Upper Kula System</u>

a. <u>Source</u>

The major water sources for the Upper Kula system are from Haipuaena Stream intake, middle Puohokamoa Stream and Waikamoi Stream, located at the 4,200-foot elevation. The water is transported via a 24-inch by 12-inch redwood flume and 12-inch tubing into Waikamoi Dam. The water from the dam flows through a 48-inch pipe which conveys water into two 15.0 MG concrete reservoirs. A 16-inch gravity transmission line then conveys the water to the booster pump and a 12-inch line into a 3.0 MG steel storage tank which overflows into the open, butyl rubber lined 8.5 MG Olinda Reservoir.

During drought conditions, water from Kamole Weir (Makawao system) can be pumped up to the Upper Kula system, as well as to the Lower Kula system.

Water can also be pumped up from the Lower Kula system (Omaopio, and Kealahou) to the Upper. For example, the capacity of the Omaopio pumps from the lower system to the upper system is presently 0.9 MGD and potentially 1.9 MGD.

Additional water is also pumped from the lower Waikamoi catchment basin (3,100-foot elevation). This supplements the upper system.

b. <u>Capacity</u>

The rated capacity of the 12-inch line from Waikamoi to Olinda is 1.5 MGD. The capacity increases to 2.5 MGD when the booster pump is used.

c. Treatment

Chlorinators are located at Olinda Reservoir, Omaopio, Kealahou, Alae, Hapapa and along Upper Kimo Drive.

d. Storage System

The major facilities include: Waikamoi Arch Dam, Waikamoi Dam, two 15 million gallon concrete Waikamoi reservoirs, 3 MG steel Olinda tank, 8.5 MG concrete Olinda Reservoir, 2.1 MG steel Omaopio tank, 2.1 MG Alae tank and 0.5 MG steel Kamole tank reservoir. There are also 31 minor storage facilities ranging in size from 500 gallons to 70,000 gallons.

e. Treatment Plant Size

The treatment plant will be designed to handle 2.5 MGD.

B. Makawao Water System

The Makawao water system serves the communities of Makawao, Pukalani, Haliimaile, Kokomo, Kuiaha, Kaupakulua, Haiku, Ulumalu, Pauwela and Peahi.

1. Source

Water for this system during normal conditions is from Awalau and Opana Streams' intakes which is mixed with water from the Lower Kula line in Maluhia Tank. Additional water can also be obtained from the Upper Kula transmission system.

During drought conditions, water for Olinda, Makawao, Kokomo, Pukalani, Haliimaile and Haiku is provided by the Kamole Weir located at the Wailoa Ditch and is pumped through a 24-inch force main to the Pookela storage tank. Water is also provided for Kuiaha, Kaupakulua, Ulumalu, Pauwela and Peahi by the Kuiaha Intake located also along Wailoa Ditch. The Lilikoi intake also services Haiku. When the treatment plant is completed, water sources not in compliance will not be used.

An agreement between Alexander and Baldwin, Inc. and the County of Maui allows for the removal of up to 16 MGD of water from the Wailoa Ditch. This agreement allows for the removal of water at Kamole Weir, which is pumped to the Makawao, Lower Kula and Upper Kula systems.

2. Capacity

Between Kamole Weir and Pookela Tank, the pumping capacity is 7 MGD at present, with a potential of 12 MGD.

3. Treatment

Automatic gas chlorinators provide treatment at the Haliimaile, Maluhia, Haiku, West Kuiaha, Opae Pilau, and Pookela tanks.

4. Storage System (Refer to Table 1-1.)

There is a total of 18 storage facilities normally fed by the Awalau and Opana streams' intakes. The 50,000-gallon steel Olinda tank receives water from the Kula system during normal conditions. Peahi, Kuiaha, Kaupakulua, Pauwela and Ulumalu are served by the 12,000-gallon steel Opae Pilau Tank, 10,000-gallon Peahi Tank, 70,000-gallon West Kuiaha Tank and 5,000 Tamayose Tank. Pukalani is served by 0.85 MG concrete tank, 25,000-gallon steel cylindrical tank, 70,000-gallon steel tank, 1.0 MG concrete tank. The rest of Makawao is served by the 50,000-gallon Olinda Tank, 0.5 MG Maluhia Tank, 0.3 MG Pookela Tank, 2 MG Pookela Tank, 70,000-gallon Haiku Tank, 0.1 MG Kokomo Tank, and 47,000-gallon Haliimaile Tank.

5. Treatment Plant Size

The treatment plant will be designed to ultimately handle 10.0 MGD.

IV. WATER RESOURCES

(Please refer to Appendix B for additional information.)

A. Kula Water System

The water resources of the Upper and Lower Kula water systems are limited. The minimum amount of water available is based on stream flows which vary during drought conditions from 0.1 to 0.5 MGD. The maximum water available is presently limited by the pipeline capacity and pumps.

	Minimum	Maximum
Upper Kula Intake	0.005 MGD	1.5 to 2.5 MGD
Lower Kula Intake	0.35 MGD	5.0 to 6.5 MGD

B. Makawao System

Maximum withdrawal from the Wailoa Ditch is limited by the water agreement between the County of Maui and East Maui Irrigation Company, which limits withdrawal up to a maximum of 16 MGD.

V. WATER QUALITY

The water quality of the surface water sources of the Kula and Makawao water systems is an important aspect for the design of the treatment facilities. Since the water sources are surface waters, the water quality is poor after periods of intense rainfall. The runoff erodes gulches and stream banks and creates turbidity problems.

Also, the watershed of the Kula system is subject to leaching of humic material and produces the characteristic yellow-brown colored water. The runoff can also carry bacteria into reservoirs and may present potential health problems.

For these reasons, and for the protection of the consumer, it is essential that the water be properly treated to conform to the standards established by Federal and State governments.

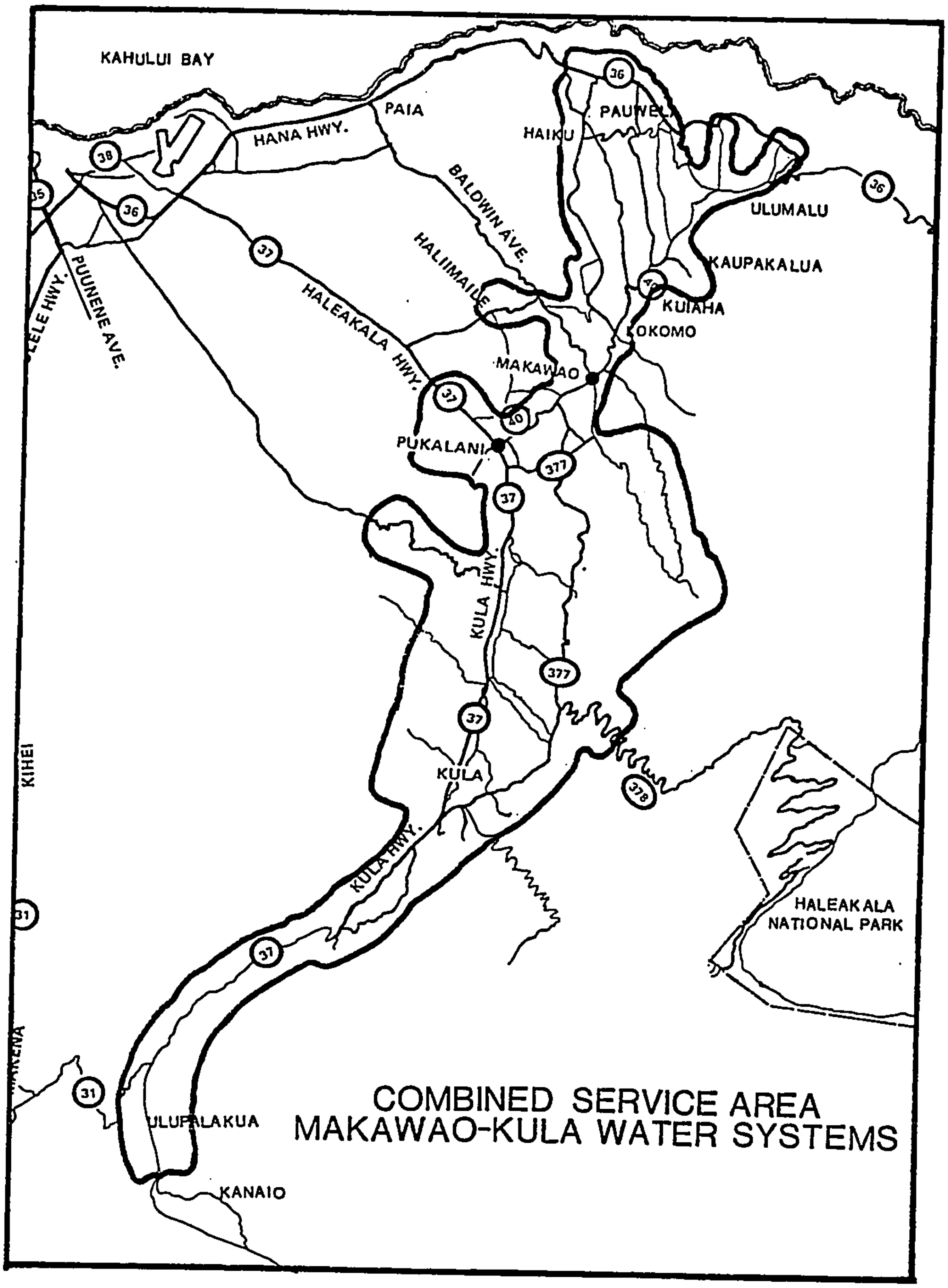
The preliminary testing of the water indicates that turbidity and bacteria are the two major areas of concern and the treatment facilities will be designed to provide treatment for the contaminants. Additional information on analysis and test results of the existing surface water quality can be found in Appendix C.

VI. EXISTING WATER CONSUMPTION

A map showing the approximate combined service area of the Kula and Makawao water systems is presented in Figure 1-7. General information on water consumption is presented below. Refer to Appendix D for additional information.

A. Kula Water System

There are approximately 1,902 metered connections, and average daily consumption is estimated at 1.9 MGD. Approximately 50% of the water consumed is used for agricultural purposes.



COMBINED SERVICE AREA
MAKAWAO-KULA WATER SYSTEMS

FIGURE 1-7

B. Makawao Water System

There are approximately 3,351 metered connections, and average daily consumption is estimated at 1.36 MGD.

VII. PROPOSED WATER TREATMENT FACILITIES

The proposed water treatment facilities will utilize various types and combinations of treatment units to achieve the desired water quality. The selection of these unit processes depends upon the type and amount of contaminants in the water, as determined by pilot testing. In general, the Upper Kula (Olinda Site) and Lower Kula (Piiholo site) plants will use the processes of rapid mixing (flash mixing), flocculation, sedimentation, filtration, and disinfection; and the Makawao (Kamole Weir) plant will use all of these processes except flocculation and sedimentation. Refer to Appendix E for more details. Based on preliminary test results, disinfection will most likely consist of chlorination.

Generally, the waste water will undergo concentration (thickening) and then dewatering. The method for disposal of the dewatered sludge is delivery to a sanitary landfill.

A. Makawao Water Treatment Plant (Kamole Weir Site)

This plant will basically use the unit processes described above, except that preliminary test results indicate that the sedimentation process will not be required. Space will be provided for this process in the event that it is desired at a later time. Refer to Figure 1-8.

The Makawao Water Treatment Plant (WTP) will be designed to bring the water into conformance with Federal and State standards and, based on preliminary tests, the contaminants which will have to be addressed include the following: coliform organisms (bacteria), turbidity, corrosivity, cadmium, iron, total trihalomethanes (THM), pH, odor, and sodium. The plant will essentially be designed to treat for the first two of these contaminants, and it is anticipated that corrosivity, cadmium, THM and odor will be reduced and pH adjusted. Sodium will increase because of the treatment process but will not exceed standards. This site will be located on a County-owned parcel of land identified as Tax Map Key (TMK) 2-5-04: portion 39 (Lot A).

B. <u>Lower Kula Water Treatment Plant</u> (Piiholo Site)

This plant will also basically use the unit processes described above. Refer to Figure 1-9. The plant will most likely be located on a parcel of land identified as TMK 2-4-13: portion 62. This parcel is presently privately owned.

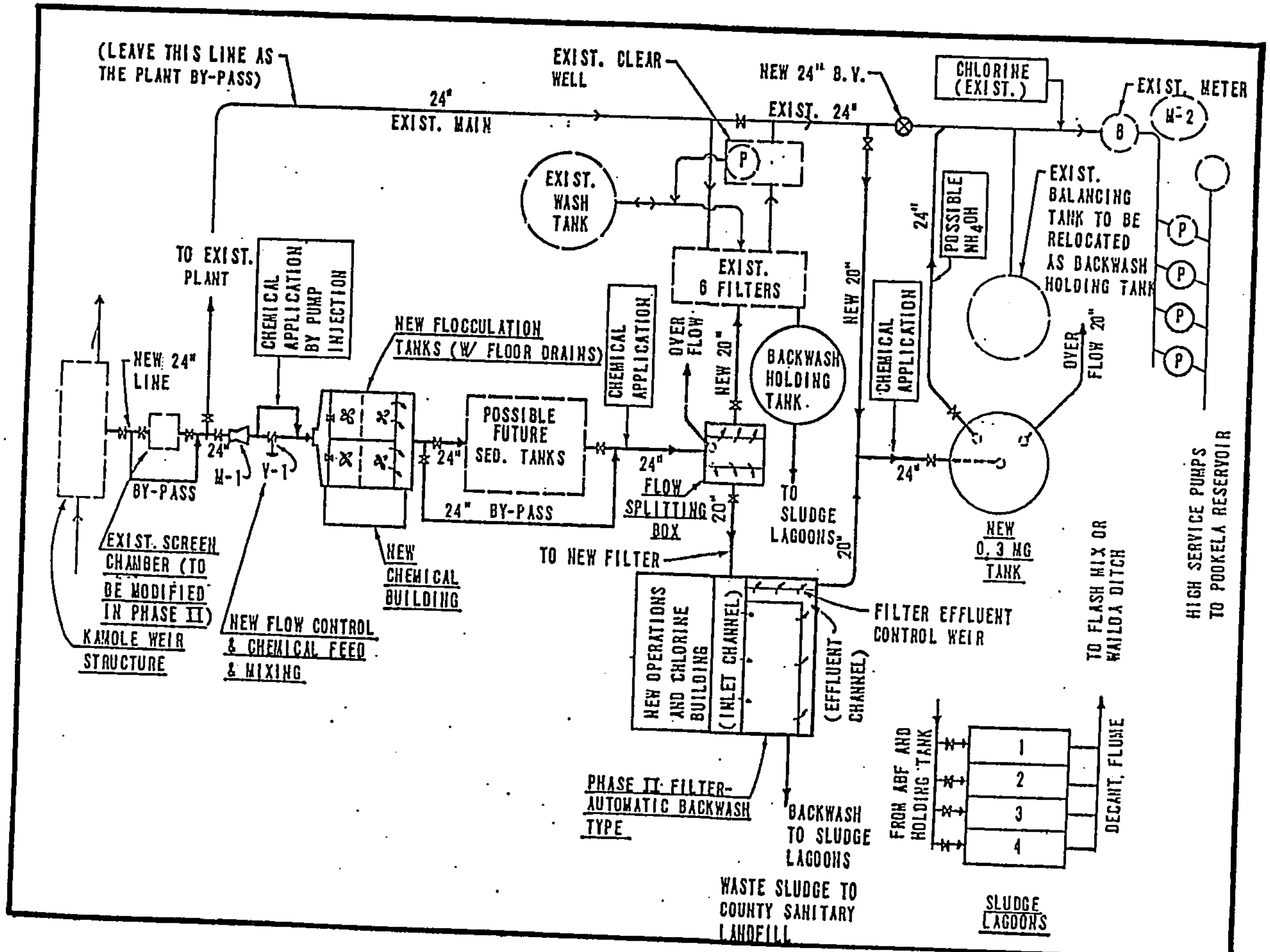
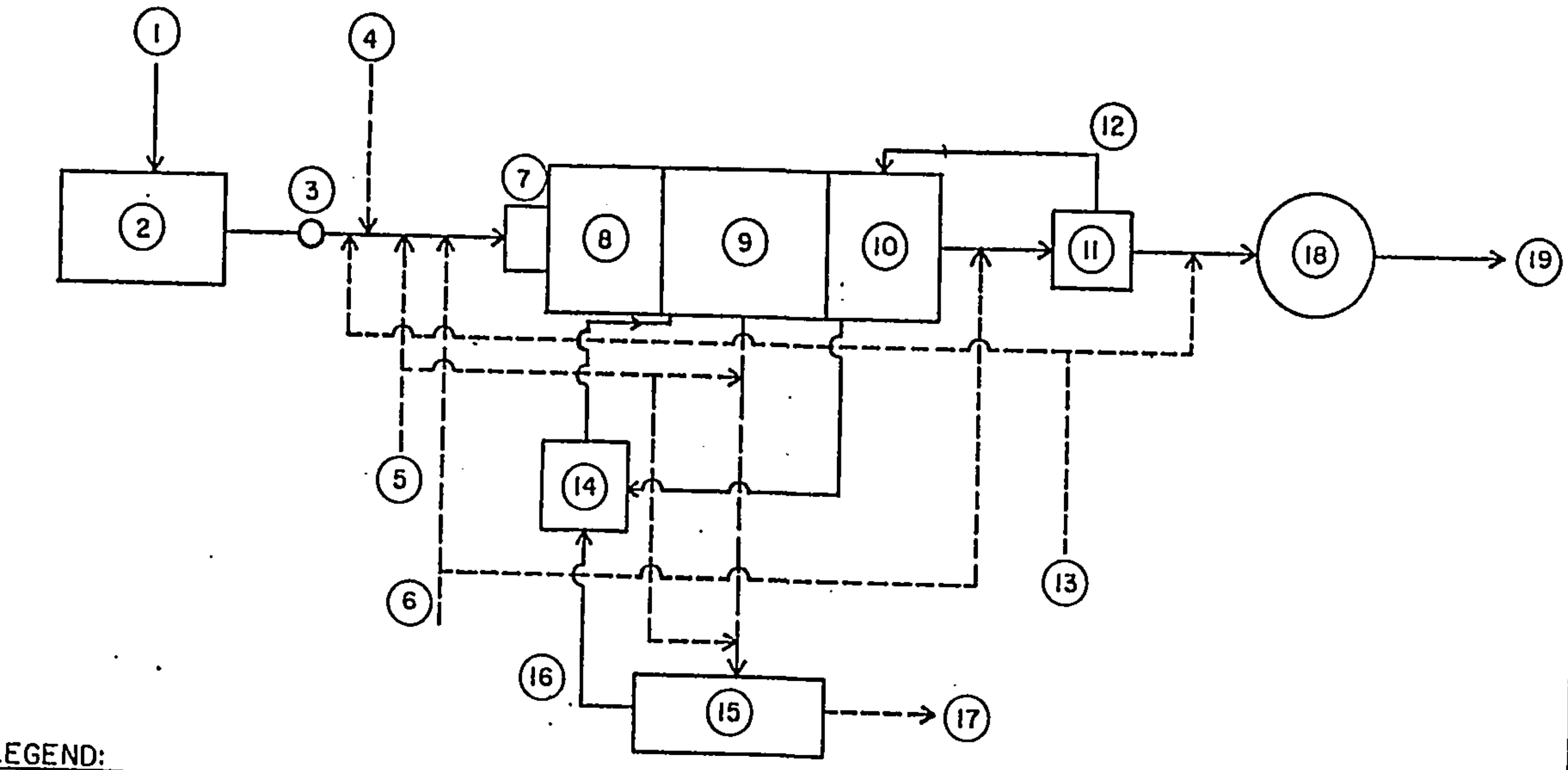


FIGURE 1-8

PROPOSED MAKAWAO WTP



LEGEND:

1 STREAM INTAKES
2 50MG. PIIHOLO RESERVOIR
3 FLOW CONTROL VALVE
4 ALUMINUM FEED
5 POLYMER FEED
6 pH CONTROL
7 RAPID MIX TANK
8 FLOCCULATION TANK
9 SEDIMENTATION TANK
10 SAND FILTER (DUAL MEDIA)
11 WET WELL & PUMP STATION
12 BACKWASH FEED
13 CHLORINE FEED
14 FILTER BACKWASH STORAGE
15 DEWATERING
16 SUPERNATANT RETURN
17 DEWATERED SLUDGE TO LANDFILL
18 CLEARWELL STORAGE TANK
19 TREATED WATER

——— LIQUID FLOW
— — — SOLIDS FLOW
- - - - CHEMICAL FEED

FIGURE 1-9

PROPOSED LOWER KULA WTP

The Lower Kula WTP will be designed to bring the water into compliance with Federal and State standards and, based on preliminary tests, the contaminants which will have to be addressed include the following: coliforms, turbidity, color, corrosivity, cadmium, lead, THM, iron, manganese, pH, and odor. It is anticipated that the plant will be designed to treat for the first two of these contaminants, and that those remaining will be reduced in the process, and pH adjusted.

C. Upper Kula Water Treatment Plant (Olinda Site)

The Upper Kula WTP will use the unit processes described above, with the addition of pH adjustment after disinfection. Refer to Figure 1-10. The plant will be located near the Olinda Reservoir on a parcel of land identified as TMK 2-3-6: portion 6. The parcel is presently owned by the State of Hawaii.

As with the other two plants, this plant will be designed to meet applicable Federal and State standards. Based on preliminary water quality tests, the contaminants which will have to be addressed include the following: coliform, turbidity, color, corrosivity, cadmium, iron, THM, and pH. It is anticipated that the plant will be designed to treat the

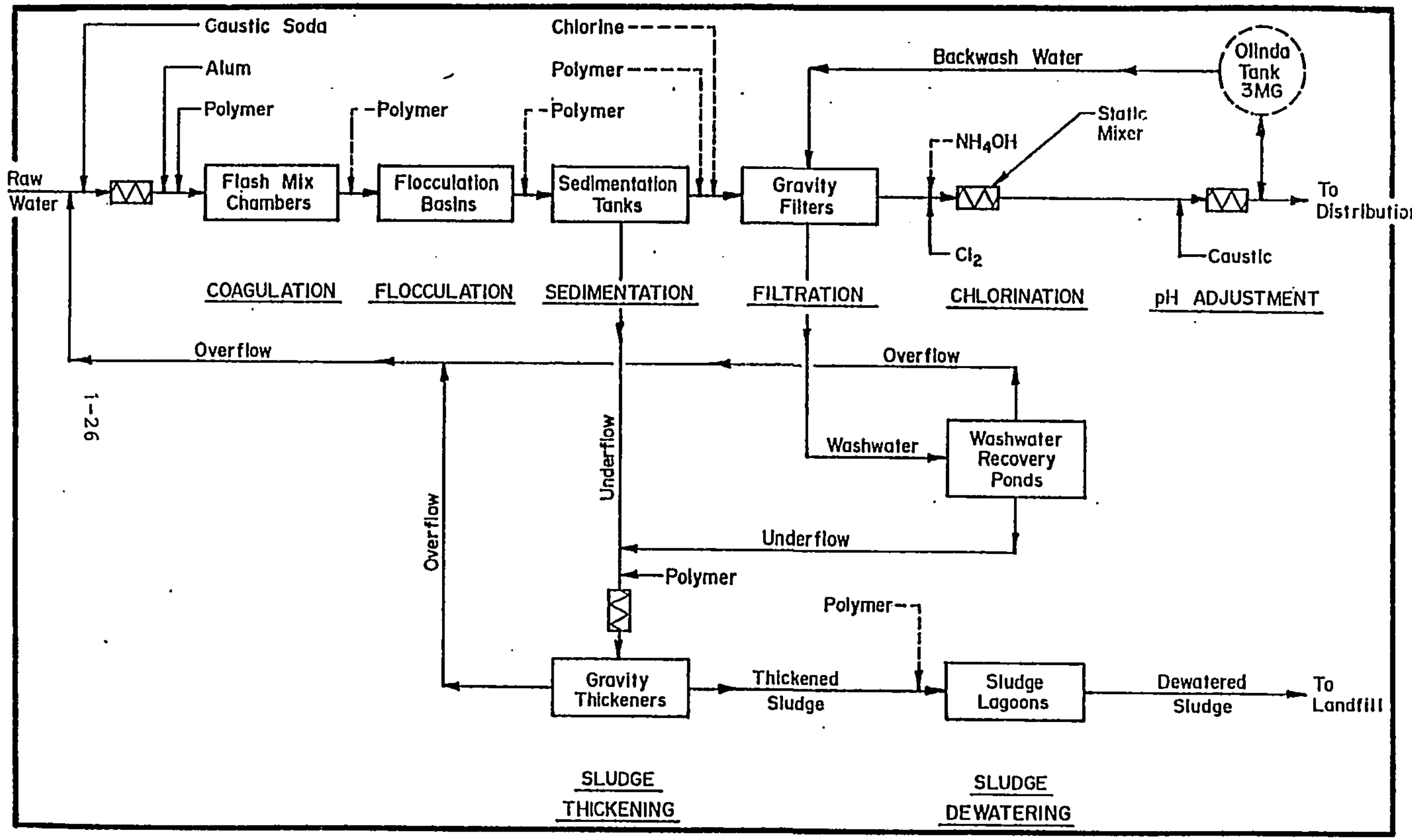


FIGURE 1-10

PROPOSED UPPER KULA WTP

first two of these contaminants, and that most of those remaining will be reduced in the process, and pH adjusted.

VIII. FUNDING

Funding for the design and construction of the proposed projects will come from two sources:

1) State Department of Health Act 243, SLH 78, Item E18, Allotment Advice No. 401 in the sum of $317,000 and Allotment Advice No. 505 in the sum of $222,500 for design.

2) County of Maui, 1980 General Obligation Bond in the sum of $5,500,000 for design and construction.

Efforts are being made to obtain additional funds. Based on EPA cost curves* for the Lower and Upper Kula water treatment plants, the following construction costs are roughly estimated for each of the plants:

1) Makawao WTP - Present day construction costs are estimated at $6.5 million. This figure does not include allowance for such items as additional land purchases and access road improvements to the site.

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*EPA publication #EPA-600/2-79-162a.

2) Lower Kula WTP - Present day construction costs are estimated at least $5.3 million. This figure includes the water treatment plant, 2 MG holding tank, access, power, and drainage.

3) Upper Kula WTP - Present day construction costs for this plant are estimated at $2.8 million. In general, this cost includes facilities normally provided in a conventional water treatment plant, including the plant itself, refurbishing the existing 3 MG Olinda tank, and access road.

The current amount of funding available may require that a priority regarding construction of the treatment plants be established and that other methods be evaluated to comply with the Safe Drinking Water Regulations.

REFERENCES TO SECTION 1

[1.1] Part I. Final Report Interim Drinking Water Study Municipal Water System, State of Hawaii. Department of Health, State of Hawaii. Prepared by S & S Engineers, Inc. November, 1977. pages 11-103.

Existing Environment

2

SECTION 2

DESCRIPTION OF THE EXISTING ENVIRONMENT

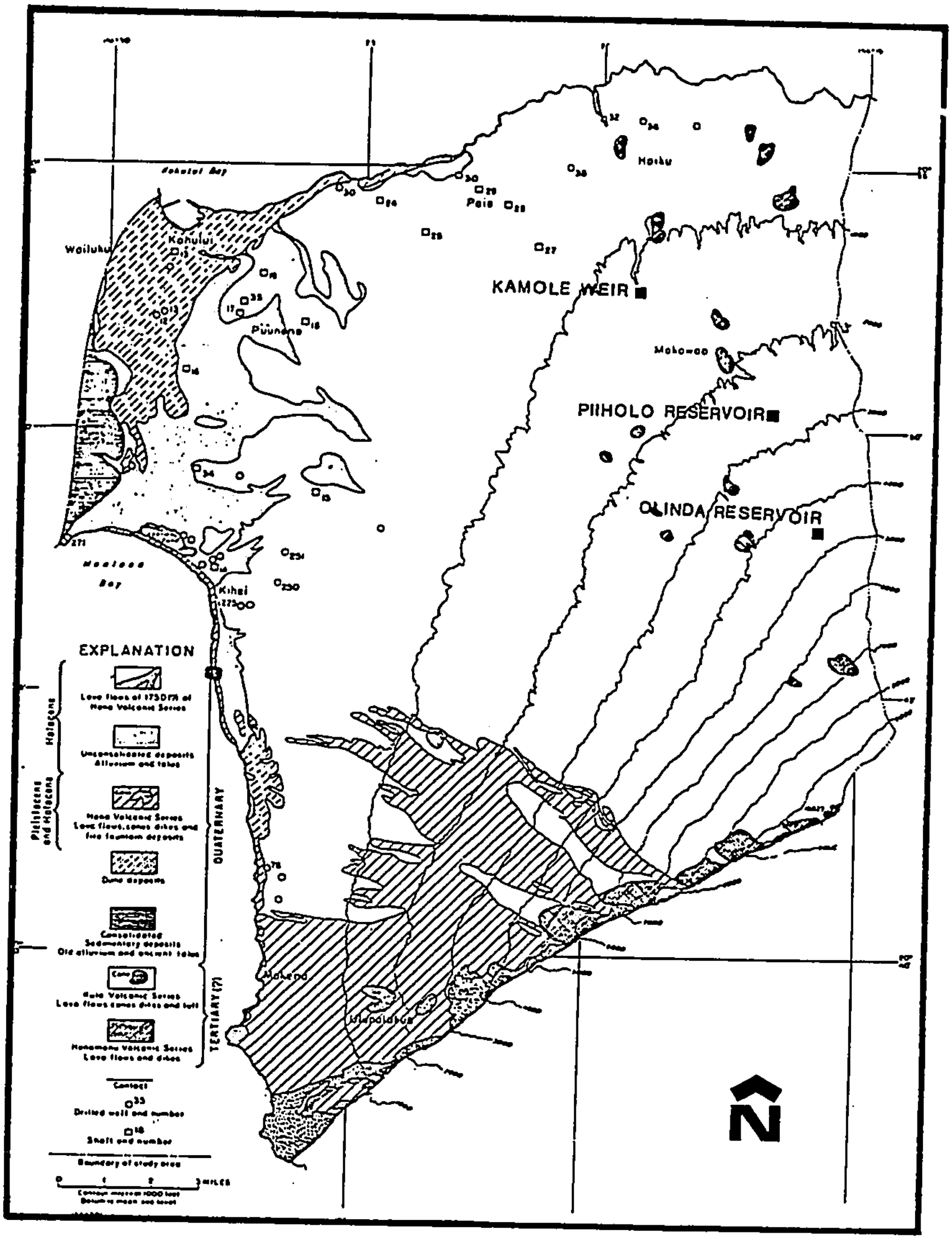
This section provides information on the biophysical and socioeconomic characteristics of the area involved with the proposed project. This information base is used in the evaluation of impacts anticipated from the proposed project, as discussed in Section 4 of this report.

I. PHYSICAL CHARACTERISTICS

A. Geology

The island of Maui consists of two major volcanoes, West Maui and Haleakala. The proposed water treatment plant sites are all located on the northwest flank of Haleakala, which is a dormant volcano. Please refer to Figure 2-1. [2.1]

"The primitive shield of Haleakala volcano is composed of pahoehoe and aa flows of tholeiite, tholeiitic olivine basalt, and oceanite averaging about 15 feet in thickness, with which are associated very minor amounts of pyroclastic materials." This makes up the Honomanu Volcanic Series, which, above sea level, has almost been entirely covered by later flows. This volcanic series was subsequently overlain by the Kula Volcanic Series, which is composed mostly of hawaiite with lesser amounts of alkalic olivine basalt and ankaramite. Aa is predominant but there is some pahoehoe near vents. [2.2]



GEOLOGY

FIGURE 2-1

The Kula eruptions occurred along three well-defined rift zones, the most prominent being the southwestward and the east-northeastward from the summit. Refer to Figure 2-2. The less prominent rift extends north-northwestward from the summit and is marked by a row of cinder cones that extends almost to the coast. [2.3]

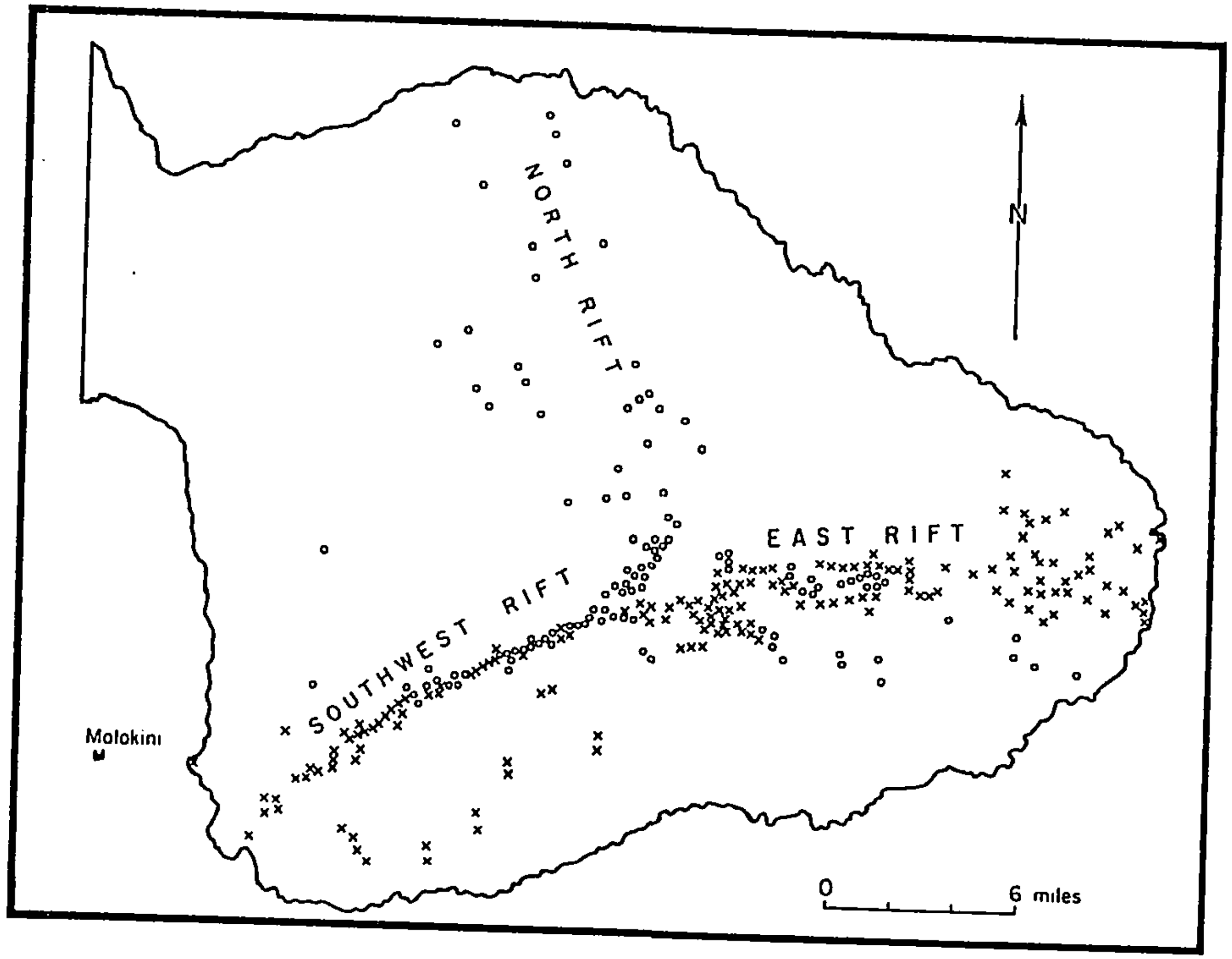
B. Soils

Since the three proposed plant sites are located in two different soil associations, soil classifications are presented as follows, by site:

1. Kamole Weir Site

Soils of this proposed site fall within the general classification of the Pauwela-Haiku Association. "This association consists of well-drained, fine-textured soils on low uplands on the north-facing slopes of East Maui. These soils are gently sloping to moderately steep. They developed in material weathered from basic igneous rock. This association makes up about 3 percent of the island." [2.4]

Pauwela soils make up about 45 percent of this association, with Haiku constituting about 40 percent, and Hamakuapoko soils the remainder. [2.5]



Source: (2.1) P. 331

o Kula Volcanic Series
x Hana Volcanic Series
Molokini Islet is a tuff cone on the southwest rift zone of Haleakala

HALEAKALA RIFT ZONES.

FIGURE 2-2

The particular soils types of this site fall under the category of the Hamakuapoko Series which "consists of well-drained soils on uplands on the island of Maui. These soils developed in material weathered from basic igneous rock. They are gently to strongly sloping." These soils are geographically associated with Haiku, Haliimaile, and Paia soils. [2.6]

Specifically, the soils at this site are as follows: (Refer to Figure 2-3)

> <u>Hamakuapoko silty clay, 3 to 7 percent slopes (HIB)</u>
>
> "In a representative profile the surface layer is dark-brown silty clay about 16 inches thick. The subsoil, about 35 inches thick, is dark-brown and very dark grayish-brown silty clay that has subangular blocky structure. The substratum is soft, weathered basic igneous rock. The soil is extremely acid in the surface layer and strongly acid or very strongly acid in the subsoil. Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight." [2.7]
>
> <u>Hamakuapoko silty clay, 7 to 15 percent slopes (HIC)</u>
>
> "On this soil, runoff is medium and the erosion hazard is moderate." [2.8]

2. <u>Piiholo and Olinda Reservoir Sites</u>

Soils at these sites are part of the general category of the Laumaia-Kaipoioi-Olinda Association which "consists of well-drained, medium-

HIC HAMAKUAPOKO SILTY CLAY
HIB HAMAKUAPOKO SILTY CLAY

KAMOLE SITE SOILS

FIGURE 2-3

textured soils on the intermediate and high uplands of East Maui. These soils are gently sloping to very steep. They developed in material weathered from volcanic ash. The association makes up about 5 percent of the island." [2.9]

"Laumaia soils make up about 45 percent of the association, Kaipoioi soils about 40 percent, and Olinda soils about 15 percent. Olinda soils have a surface layer of dark reddish-brown, friable loam. The subsoil is dark reddish-brown and yellowish-red, friable silty clay loam. The substratum is soft, weathered basic igneous rock. It occurs at a depth of 40 to 60 inches or more." [2.10]

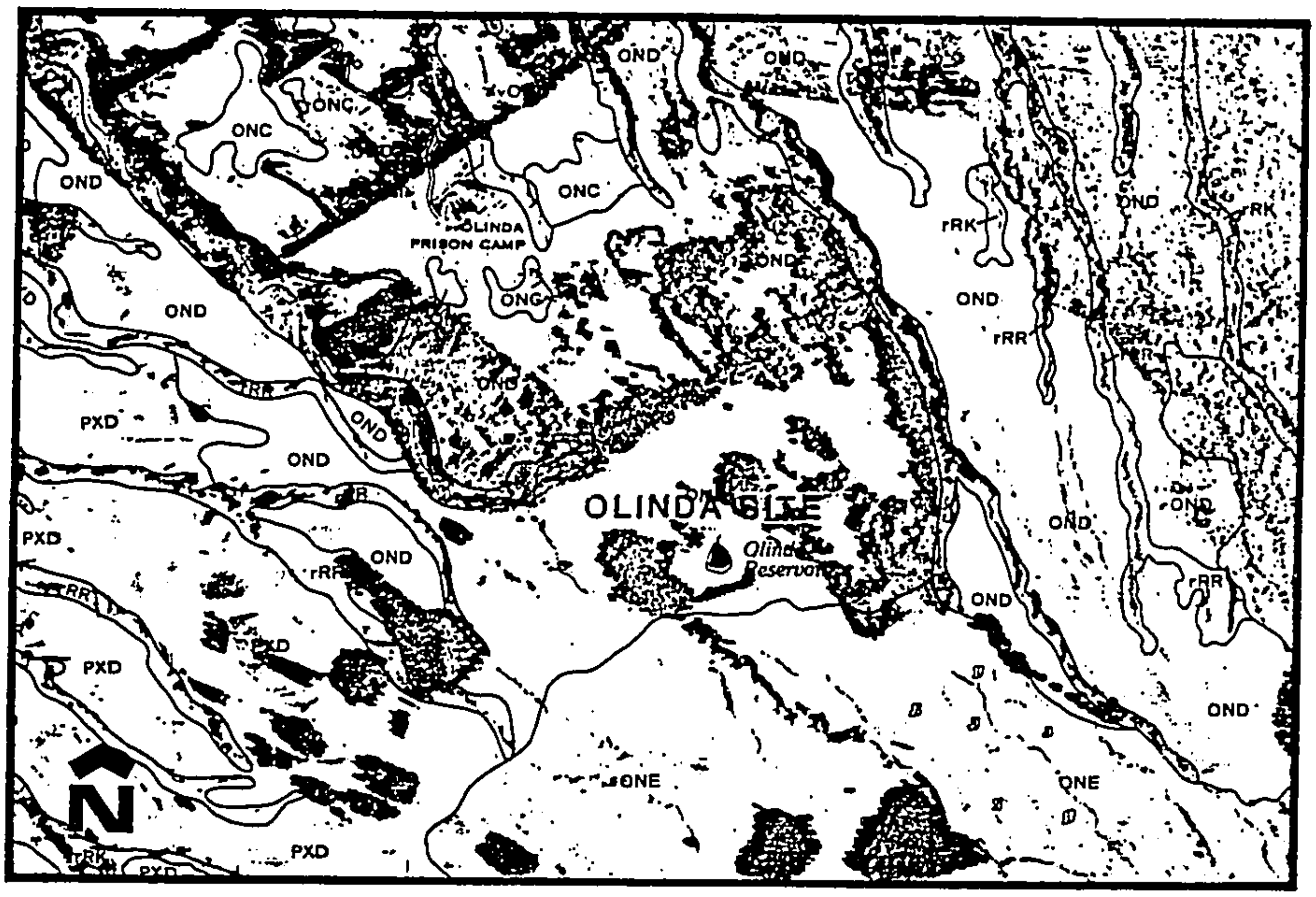
These proposed plant sites are located within the Olinda Series which "consists of well-drained soils on uplands on the island of Maui. These soils developed in volcanic ash. They are gently sloping to steep. Specifically, the soil type located on these sites is as follows: (Refer to Figures 2-4 and 2-5)

> <u>Olinda loam, 12 to 20 percent slopes (OND) [2.11]</u>
>
> "This soil is on smooth, intermediate to high mountain slopes. Included in mapping were small areas of Kaipoioi and Pane soils. In a few places small, eroded spots were included.

ONC & OND OLINDA LOAM
rRK ROCK LAND

PIIHOLO SITE SOILS

FIGURE 2-4



OND OLINDA LOAM

OLINDA SITE SOILS

FIGURE 2-5

In a representative profile the surface layer is dark reddish-brown loam about 6 inches thick. The subsoil, about 5 inches thick, is dark reddish-brown and yellowish-red silty clay loam that has subangular blocky structure. Below this is yellowish-red and reddish-brown silty clay loam and gravelly silty clay loam. This is underlain by slightly weathered basic igneous rock. The soil is slightly acid in the surface layer and subsoil.

Permeability is moderately rapid. Runoff is slow to medium, and the erosion hazard is slight to moderate."

C. Seismic Potential [2.12]

Earthquakes are densely concentrated in the southern half of the island of Hawaii. Some earthquakes of significant magnitude have occurred off Maui, but it is not as active as Kona or Kau.

Some of the earthquakes of greater magnitude than 4 on the Richter scale which affected Maui include June 14, 1932, January 23, 1938, June 17, 1940, August 7, 1955, August 10, 1957, August 18, 1957. Historically, the most significant earthquakes occurred in 1868, 1871, 1938, and 1951.

The Kau earthquake of April 2, 1868 was the largest historical earthquake. Although seismographs were nonexistent then, the estimated magnitude was 7.5 - 7.75, based on descriptions of the earthquake's effects. The island of Hawaii was naturally the hardest hit but some effects were felt on Maui. Vibrations "rattled dishes, swashed water over tops of nearly full cisterns, and made it difficult to stand on slopes of fresh lava of Haleakala."

The February 19, 1871 earthquake was not as large as the 1868 one and it occurred near Honolulu. It caused considerable damage to Honolulu and Oahu; damaged houses, stonewalls, and furniture on Molokai; caused landslides on Lanai; and caused some serious damage to adobe and stone houses in Lahaina. It is estimated that this earthquake had a magnitude of about 7, with the epicenter in the Molokai-Maui area.

On January 23, 1938 an earthquake of magnitude 6.75 occurred 25 miles north of Maui. There was considerable damage on Maui and minor damage on Oahu. Details of this earthquake are not available.

The Kona earthquake occurred on August 21, 1951 off the coast of Kealakekua with a magnitude of 6.9. The epicenter of the quake was along the Kealakekua Fault, approximately 6 miles below sea level. Although it caused extensive damage on the island of Hawaii, it was only weakly felt on the islands of Maui and Oahu.

Maui is located in Seismic Probability Zone 2, "Moderate Damage." Refer to Figure 2-6.

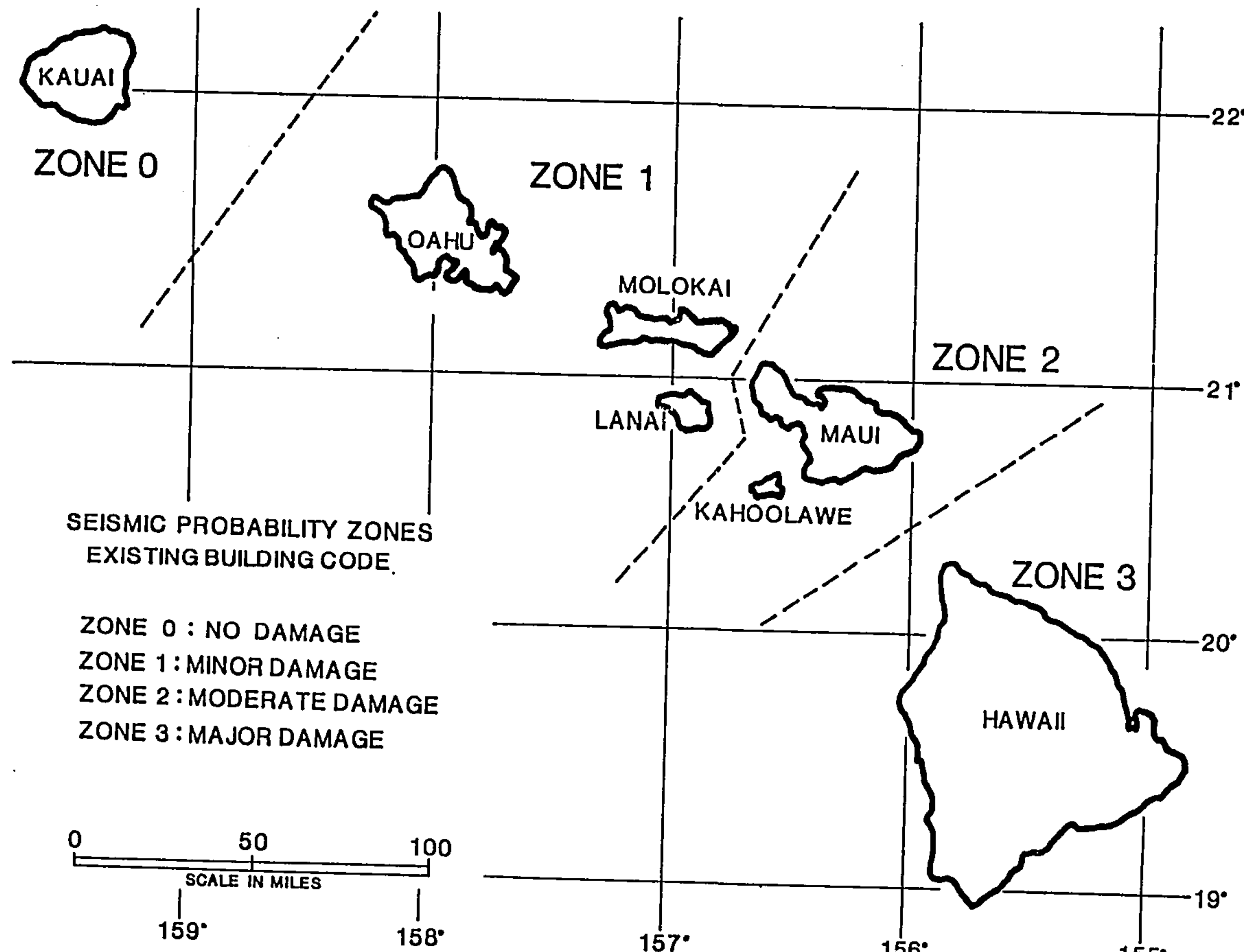


FIGURE 2-6 Source: (2-12)

SEISMIC PROBABILITY ZONES

D. Climate

The majority of Hawaii exhibits only two seasons: the summer, which occurs between May and October when the weather is warmer and drier and the tradewinds are most persistent; and the winter, which is between October and April when the weather is cooler and the tradewinds are more often interrupted by other winds and by intervals of widespread clouds and rain. Hawaii's general climate is reflected by four factors: latitude, the surrounding ocean, Hawaii's location relative to the storm tracts and the Pacific anticyclone, and terrain [2.13].

The latitude of Hawaii puts it well within the tropics, accounting for a relatively uniform day length throughout the year. Consequently, a relatively uniform amount of solar energy is received and, therefore, temperature is relatively uniform. The surrounding ocean supplies moisture to the air, and acts as a thermostat. Because the ocean's temperature varies little compared to large land masses, the temperature varies only 1 to 2 degrees from day to night and only about 6 degrees at the sea's surface on a seasonal basis [2.14].

The Pacific High or anticyclone is a large, subtropical high pressure system which generally lies northeast of Hawaii. The air, moving outward from this anticyclone, streams past the islands and is the source of the northeasterly tradewinds. Along with its associated storm tracts, this anticyclone follows the seasonal shift in the sun, moving northward in the summer and southward in the winter and tending to be stronger and more persistent in the summer than in the winter. Since the anticyclone weakens and is occasionally absent in the winter, the tradewinds may be interrupted by northerly fronts or by Kona storms; therefore, winter is exhibited by more frequent cloudiness and rain storms and southerly and westerly winds. [2.15]

Terrain has profound effects on weather and climate. Mountains tend to obstruct, deflect, and accelerate air flow. As warm, moist winds rise over windward coasts and slopes, cloudiness and rainfall are more prevalent than over the open sea. Leeward areas, where air descends, tend to be sunny and dry. Terrain can also account for orographic (mountain-caused) rainfall, which is formed when moist tradewind air moves from the sea and is forced up the steep and high terrain of the island. Rainfall distribution, therefore, is usually greatest over the upper slopes and crests and least along the leeward lowlands. [2.16]

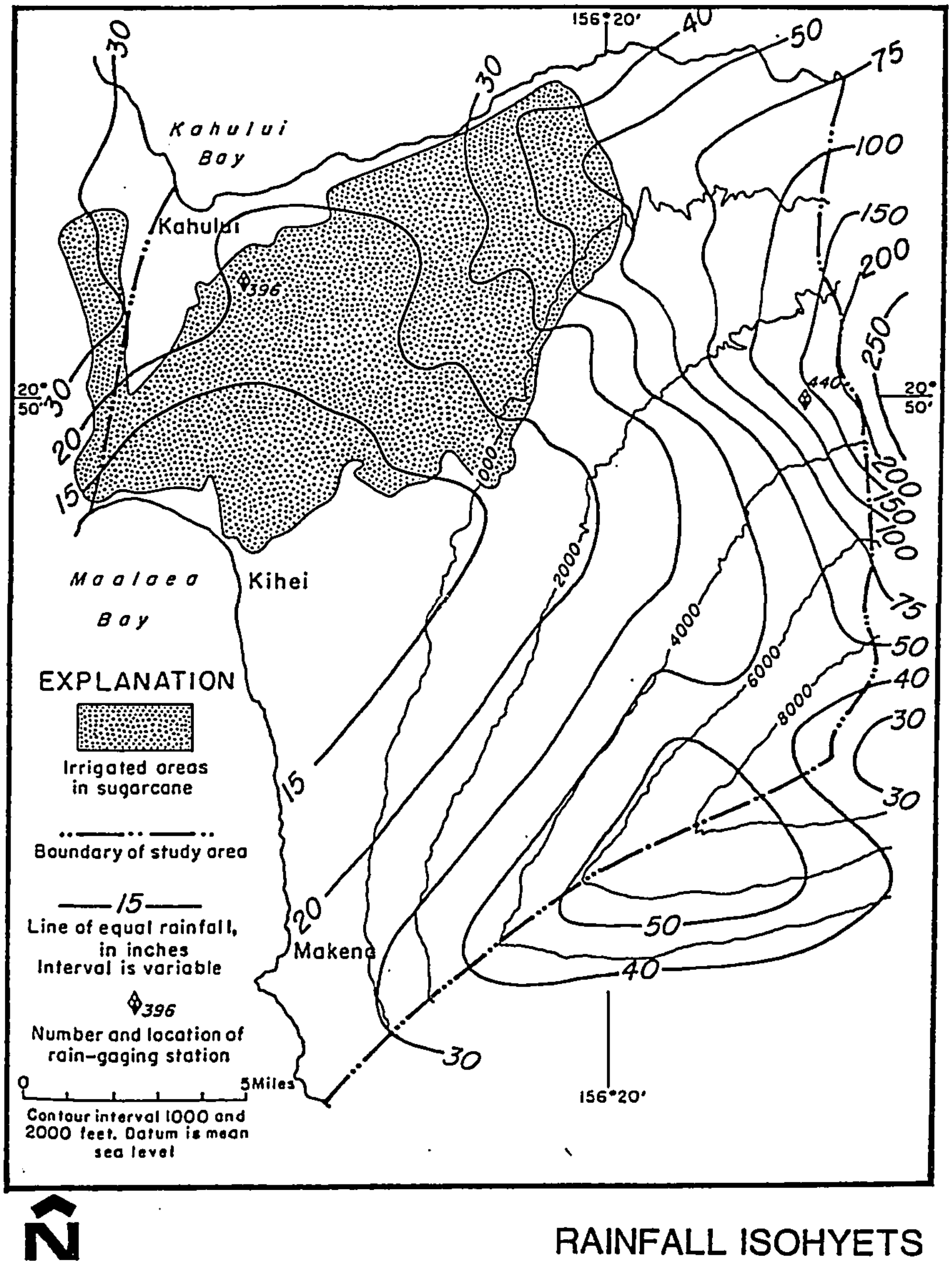
1. Rainfall

The heaviest rains in Hawaii are usually brought about by winter storms. Lowland lee areas and other dry areas obtain most of their rainfall by winter storms, so the rainfall is strongly seasonal, with summers being arid. The project sites and the Kula watershed, however, are located toward the windward side of the island and receive rainfall from both winter storms and year-round trade wind showers. Refer to Figures 2-7 and 2-8.

Historical rainfall data for the Kula watershed are presented in Table 2-1. The data for each station is graphed in Figures 2-9 through 2-13.

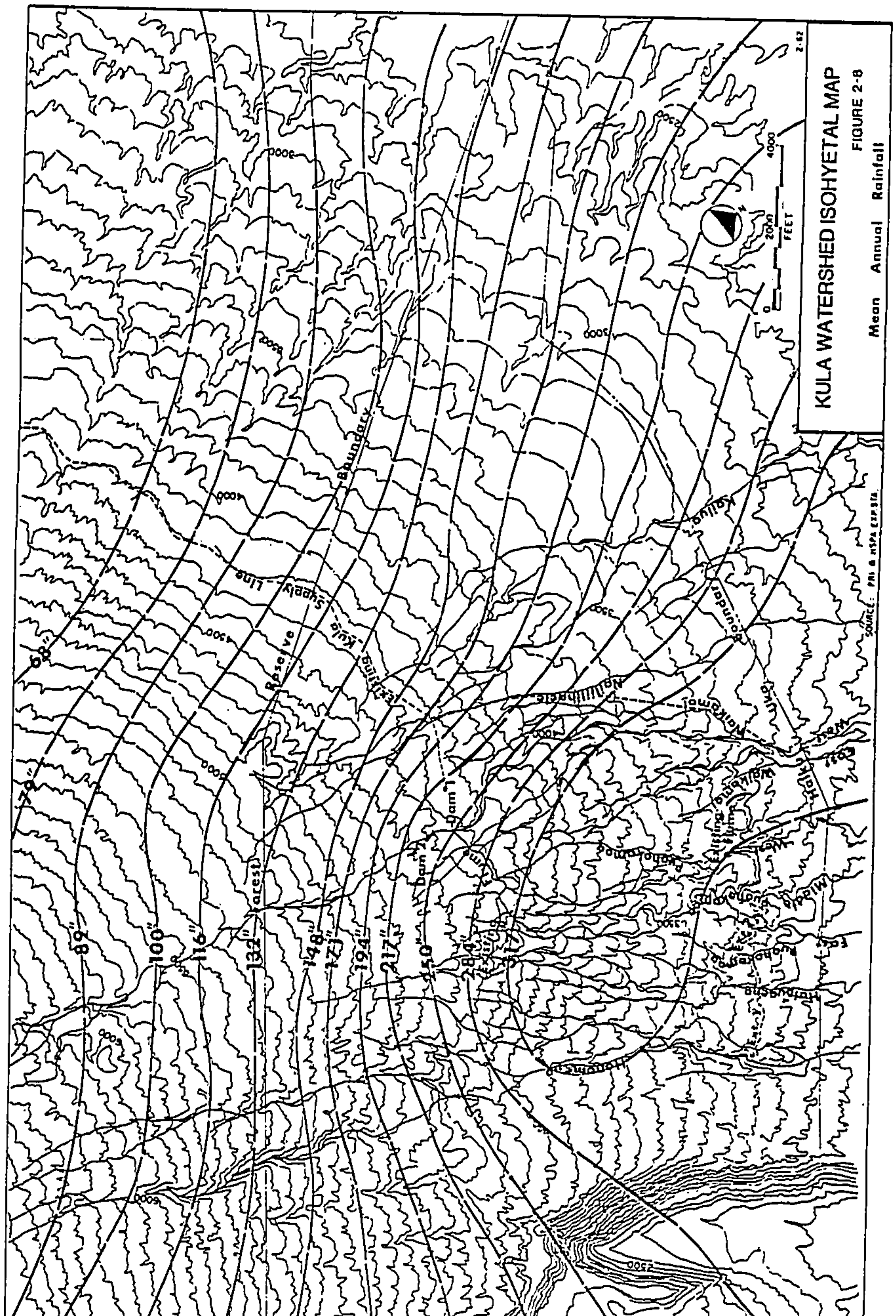
2. Temperature

Hawaii's equable temperatures result from the small seasonal variations in energy received from the sun and the tempering effect of the surrounding ocean. Throughout Hawaii the warmest and coolest months differ, on the average, by 9 degrees or less. The daily variation between day and night are greater than the variations between seasons. Windward coasts exposed to tradewind air off the sea have the least variation



RAINFALL ISOHYETS

FIGURE 2-7



KULA WATERSHED ISOHYETAL MAP
FIGURE 2-8
Mean Annual Rainfall

TABLE 2-1

HISTORICAL RAINFALL DATA
[Source: Annual Reports, BWS]

	STATION (Rainfall in Inches)				
Date	Olinda 1/	Forest Reserve 1/	Upper Flume Waikamoi 1/	Lower Flume Waikamoi 2/	Puohokamoa 1/
1953	20.90	48.95	132.36	115.43	118.99
1954	58.27	119.53	200.14	210.57	202.32
1955	49.44	100.91	203.14	217.57	200.55
1956	57.84	123.75	234.12	227.06	247.06
1957	42.94	118.72	259.68	256.83	252.36
1958	40.92	44.89	218.15	241.58	220.46
1959	54.35	115.78	207.55	194.02	205.29
1960	48.13	103.78	217.00	240.00	202.29
1961	38.08	48.79	185.71	205.20	187.36
1962	19.27	42.53	102.76	144.21	110.36
1963	49.00	85.42	117.93	225.72	191.84
1964	50.75	111.74	228.05	271.34	202.35
1965	66.32	140.04	216.13	228.60	212.03
1966	19.45*	29.87*	59.13*	91.37*	65.50*
1967	54.15	83.35	160.77	190.43	183.71
1968	67.07	116.58	218.45	240.62	262.57
1969	77.12	138.22	275.46	284.71	333.50
1970	50.11	107.86	216.00	252.76	221.22
1971	63.08	151.34	224.05	242.57	278.87
1972	26.27	57.71	127.74	161.54	139.45
1973	32.17	82.48	185.53	236.01	188.15
1974	44.51	81.02	141.22	139.93	150.96
1975	32.96	68.07	144.53	108.95	163.67
1976	32.72	68.22	128.85	107.95	127.45
1977	26.83	57.80	127.15	128.96	96.95
1978	28.01	55.38	123.03	133.37	126.72
1979	84.60	125.81	191.97	234.32	176.49
1980	84.32	151.41	206.62	271.47	231.24
Average:	48.87	95.55	187.16	207.51	196.29

* Data available for six months ended June 30, 1966

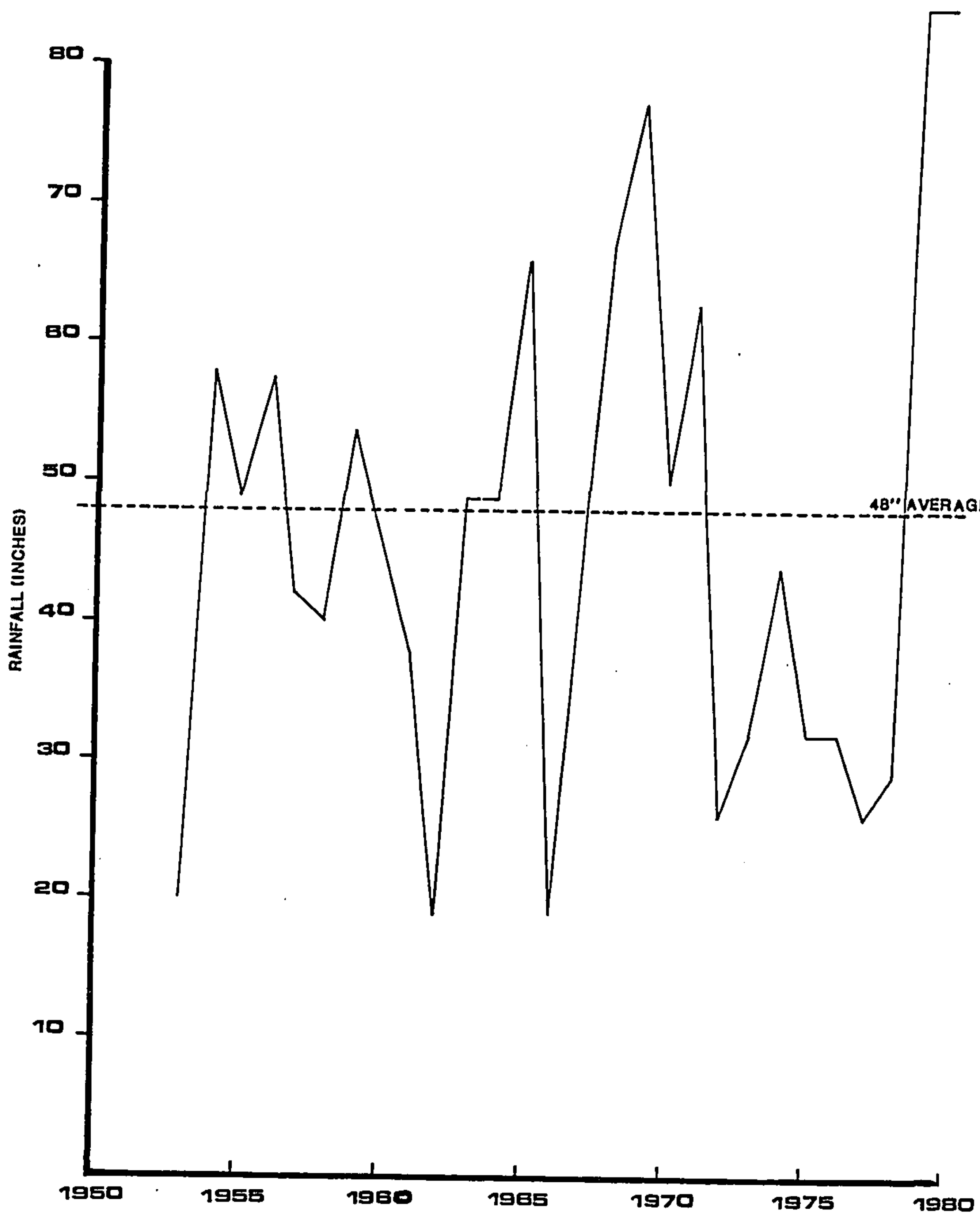
General Location of Stations to Water System:

1/ Upper Kula System

2/ Lower Kula System

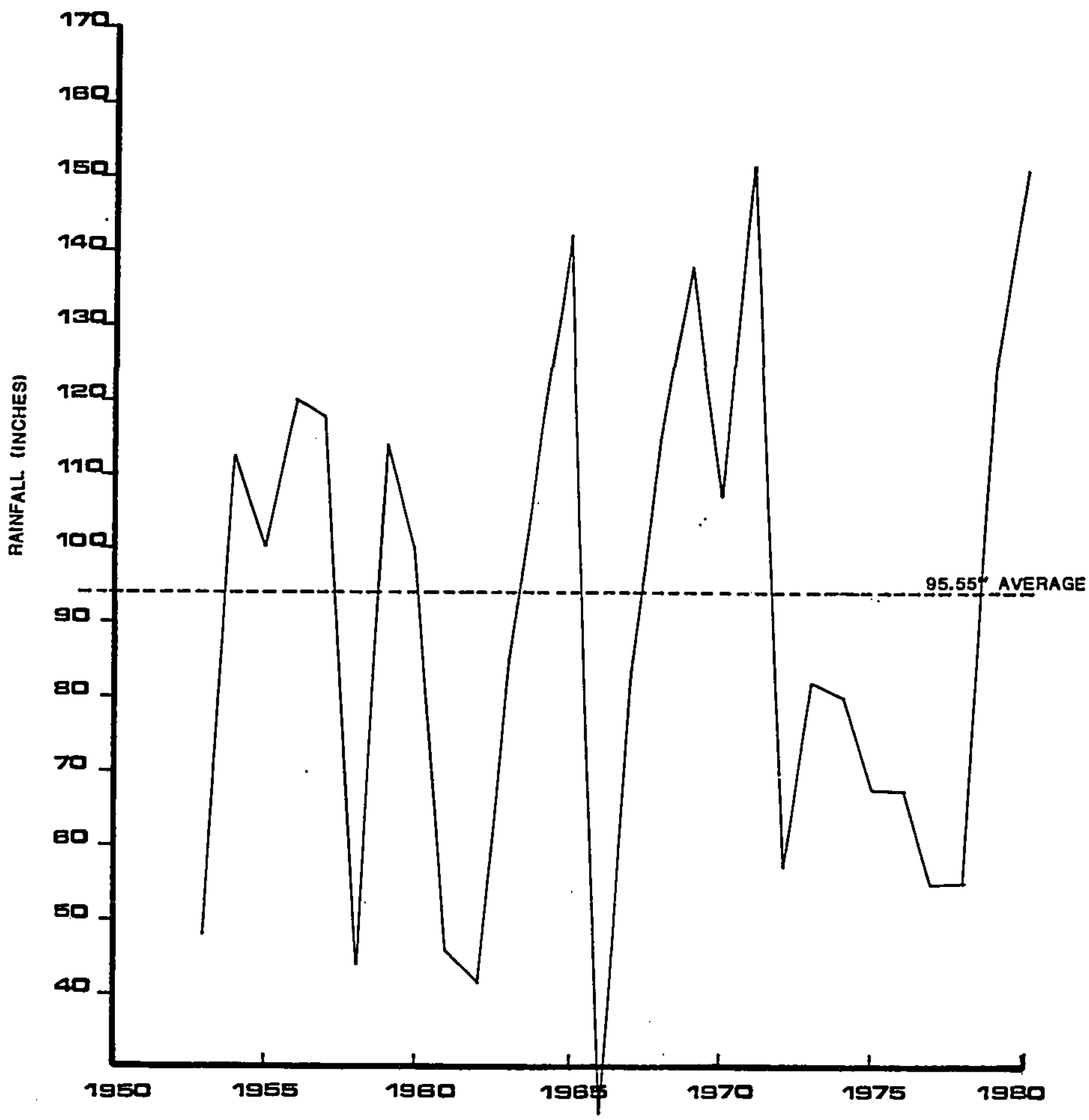
OLINDA

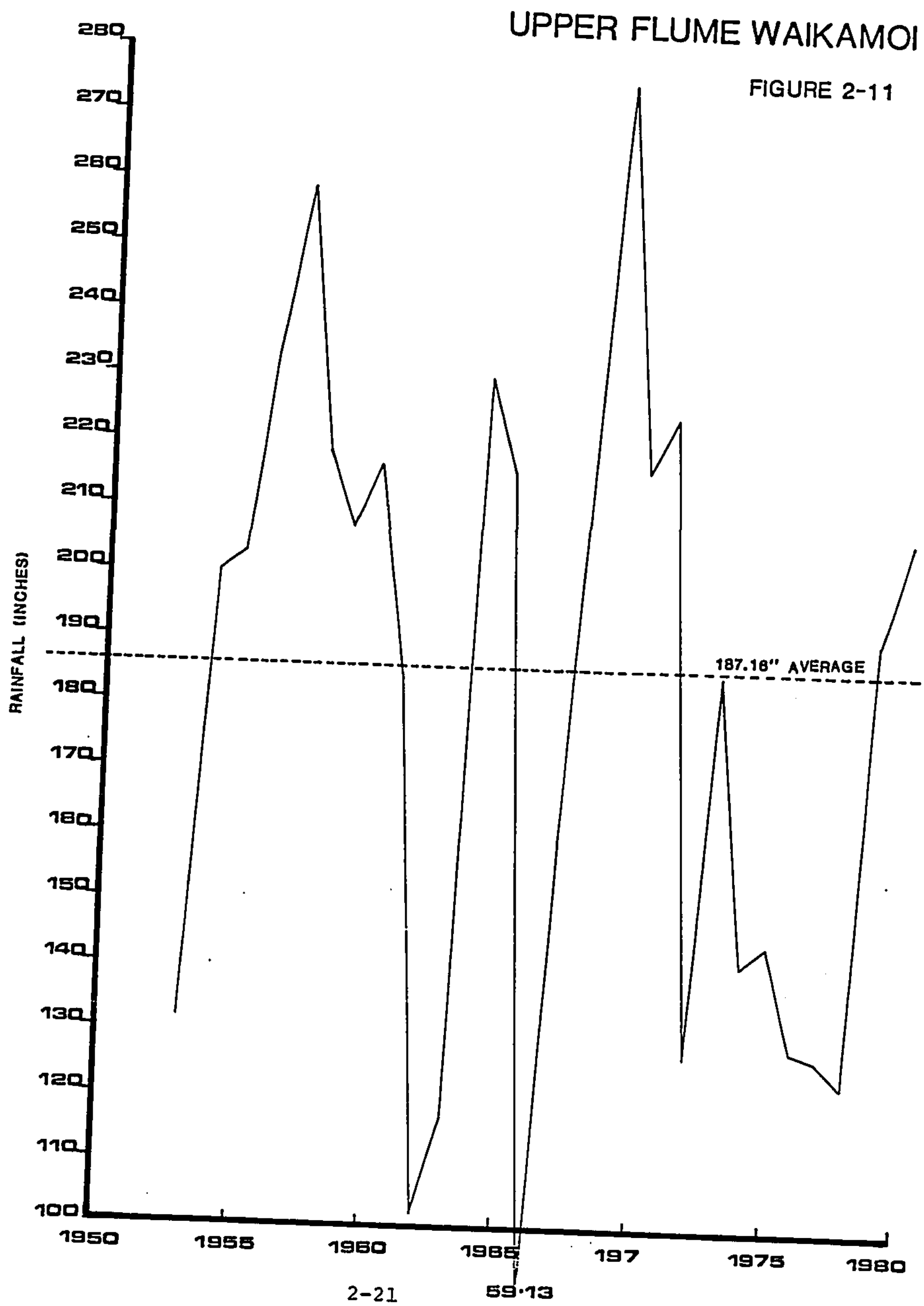
FIGURE 2-9

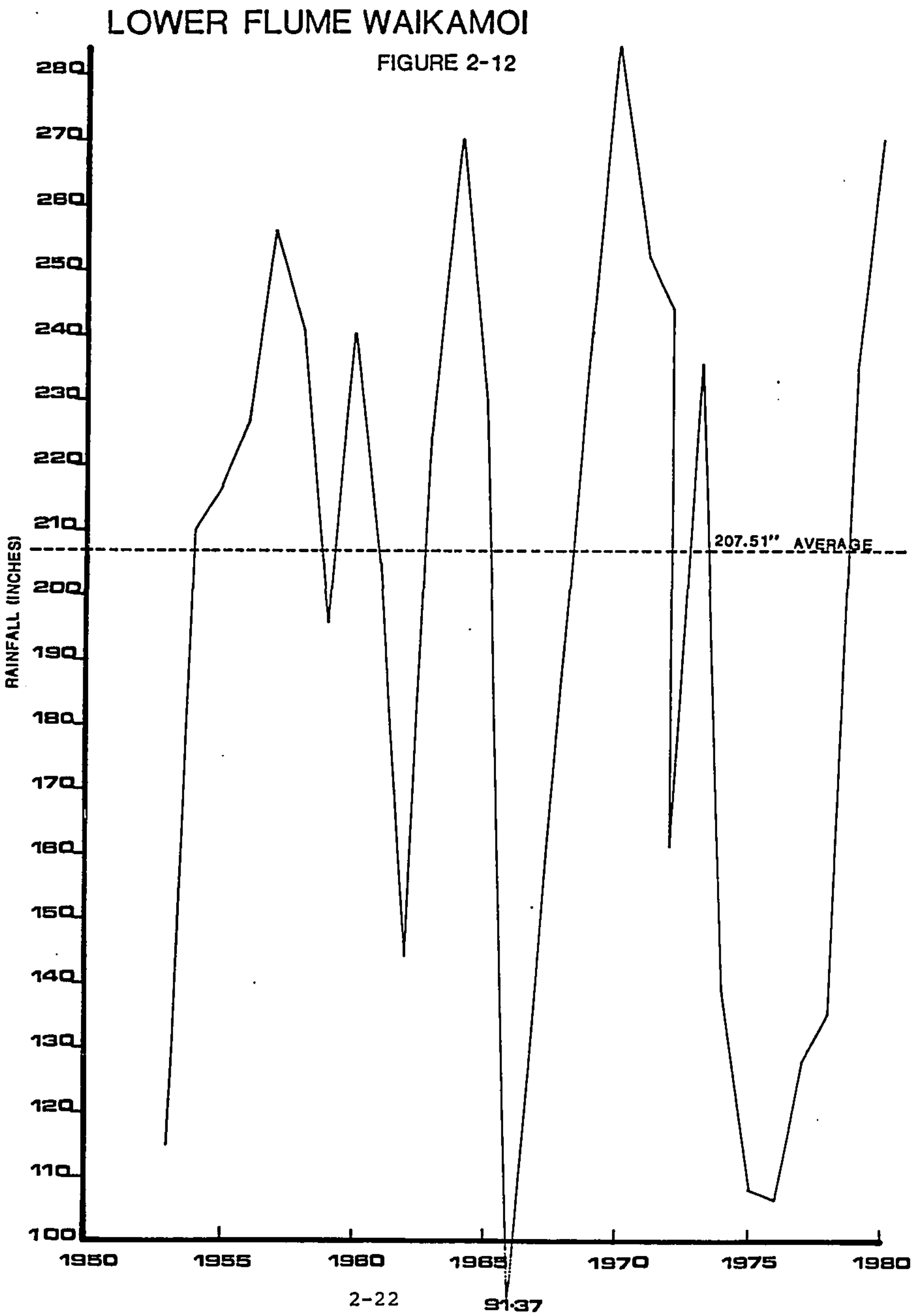


FOREST RESERVE

FIGURE 2-10

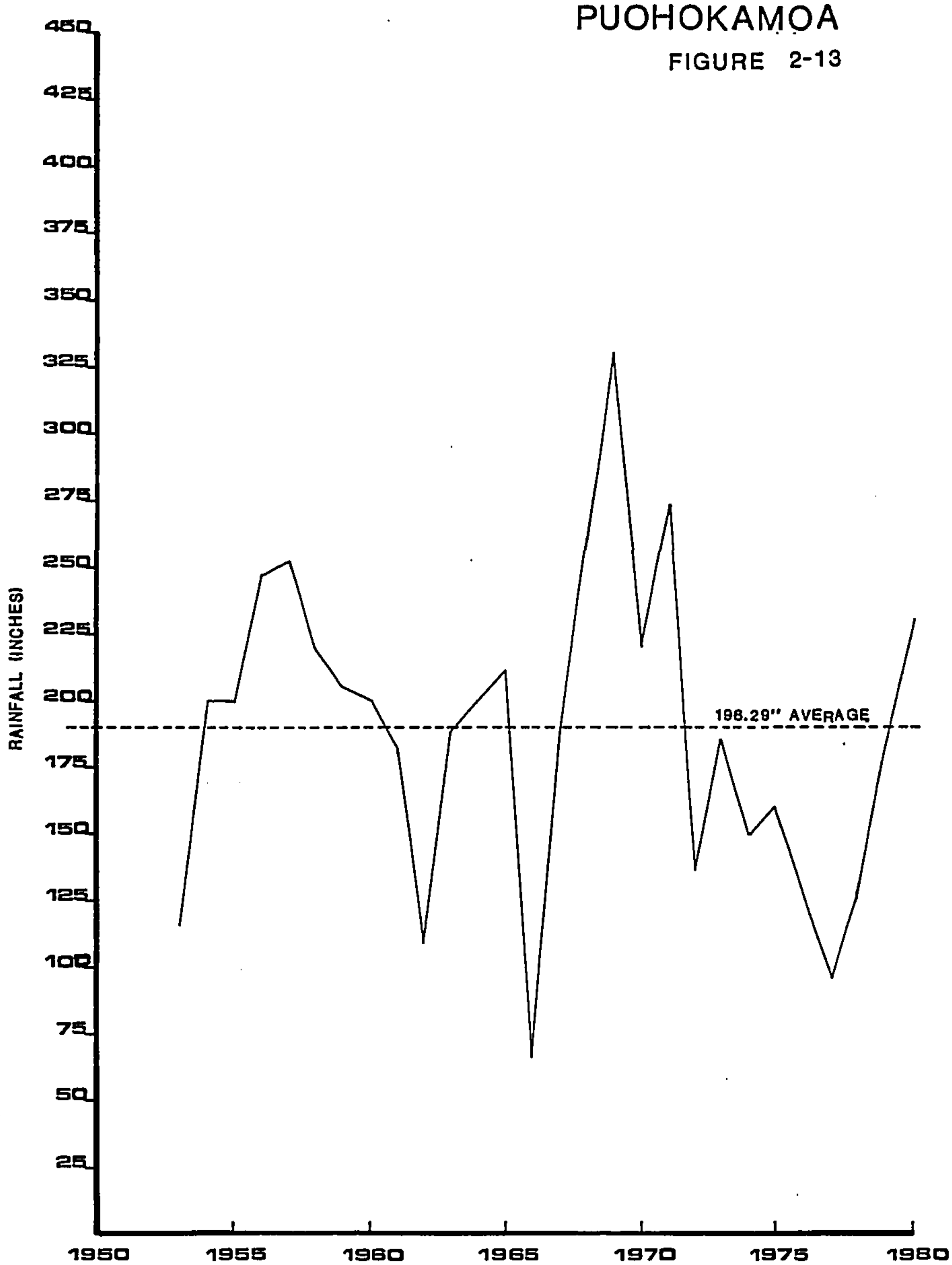



UPPER FLUME WAIKAMOI
FIGURE 2-11
RAINFALL (INCHES)
187.16" AVERAGE
59.13
1950
1955
1960
1965
197
1975
1980


LOWER FLUME WAIKAMOI
FIGURE 2-12
RAINFALL (INCHES)
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
207.51" AVERAGE
1950
1955
1960
1965
1970
1975
1980
91.37

PUOHOKAMOA

FIGURE 2-13



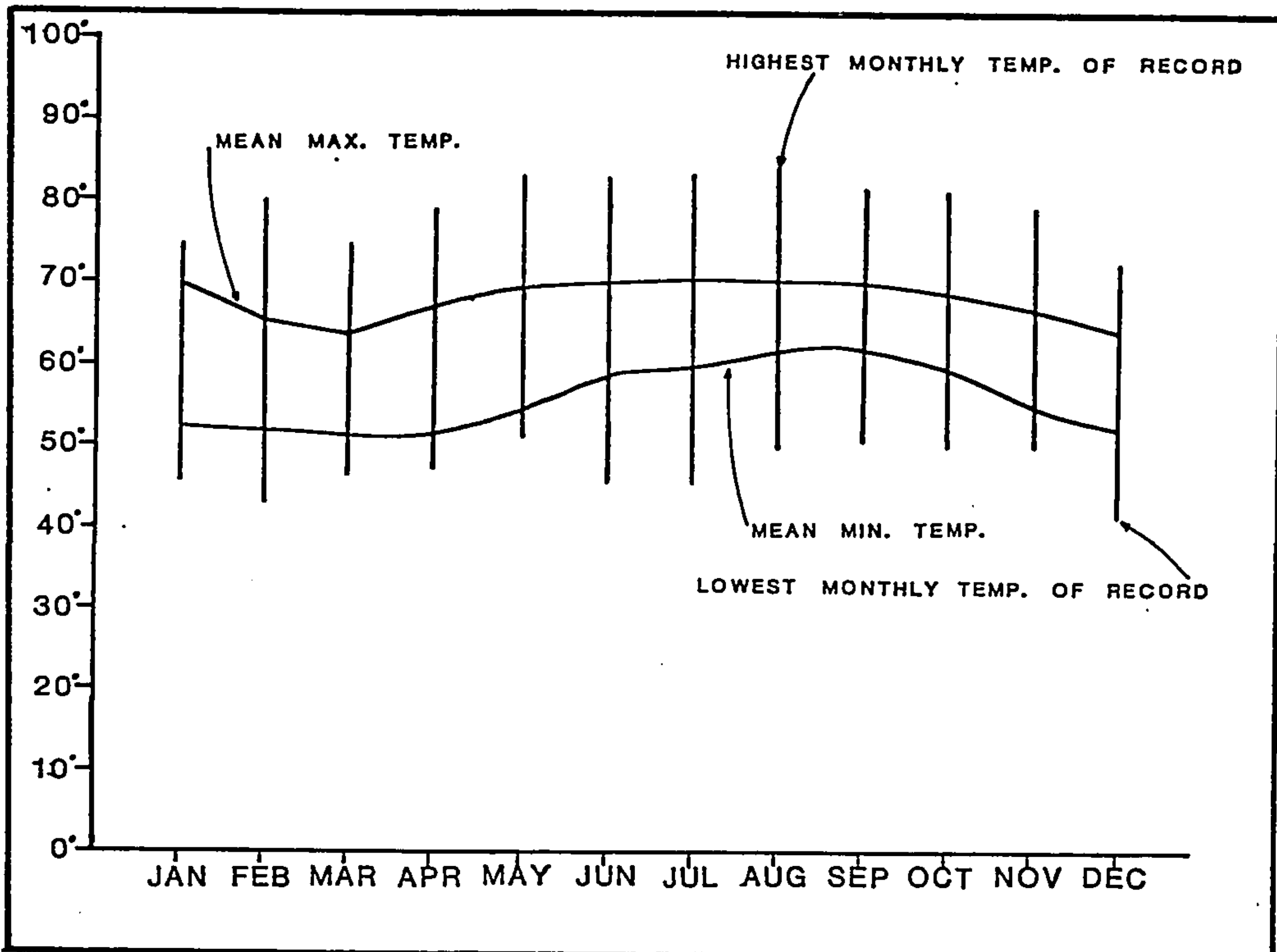
in temperature between day and night. Farther inland, on leeward coasts and at elevations above about 6,000 feet, the daily range increases. The day's highest temperatures generally occur two hours after noon and are coolest near sunrise. [2.17]

Temperature data for Makawao, Maui, which can be considered representative of what would be expected at the project sites, is shown in Figure 2-14.

3. Wind

The northeasterly tradewind prevails throughout the year in Hawaii, is more persistent in the summer (90%) than in the winter (50%), and tends to be stronger in the afternoon than at night. During the winter months, Hawaii may be under the influence of southerly winds from Kona storms or of southwesterly winds preceding the northeasterly winds that follow cold fronts. [2.18]

In the vicinity of the project sites, northeasterly trade winds blow between 5 and 10 mph during the day. A land wind caused by nighttime temperature variations along the slopes of Haleakala gives the area gentle, down-slope



SOURCE: (2.13)

TEMPERATURE REGIME
MAKAWAO

FIGURE 2-14

evening breezes. Kona winds (from the south) occur primarily in the winter months.

E. Air Quality

Ambient air quality in the Kamole Weir vicinity is affected primarily by dust from nearby pineapple fields. Ambient air quality in the vicinity of the other sites does not appear to be impacted by pollutants.

Several locations throughout the State are monitored for air quality, and a summary for 1978 is presented in Table 2-2. For Maui, sampling stations are located at Kahului and at Kihei. The Kahului site is located at the Kahului Shopping Center, in an area which includes Maui Electric Power Plant. The Kihei site is located at the Kihei Wastewater Reclamation Plant in a residential and rural community.

Results from the table show that Kahului and Kihei average the highest for particulate matter of the sites sampled. This may be partly due to the high wind conditions experienced between the West Maui mountains and Haleakala and because much of the area is in sugarcane, portions of which are denuded at any given time. Kahului also exhibits the highest values of sulfur oxides, primarily because of its proximity to Maui Electric Power Plant.

TABLE 2-2

SUMMARY OF AIR QUALITY SAMPLING STATIONS - 24 HOUR SAMPLING
JANUARY 1 - DECEMBER 31, 1978

PARTICULATE MATTER	Dept. Of Health	Barbers Point	Pearl City	Kalihi Kai	Ala Moana	Waimanalo	Kahului, Maui	Kihei, Maui	Hilo, Hawaii	Lihue Kauai	Barbers Point Lighthouse
Parameters											
Period of sampling (mos.)	12	12	12	12	12	12	12	10	12	12	—
Number of samples	60	59	60	58	61	60	55	40	54	59	—
Range of values (ug/m^3)	14-53	22-127	20-81	27-80	21-79	15-61	44-154	16-160	13-169	22-124	—
Average of values (ug/m^3)	29	48	37	46	38	29	74	54	34	37	—
No. of times AQS* exceeded	0	1	0	0	0	0	5	3	2	1	—
SULFUR OXIDES											
Parameters											
Period of sampling (mos.)	12	12	12	12	12	—	12	—	12	12	12
Number of samples	61	57	58	57	61	—	55	—	55	54	56
Range of values (ug/m^3)	<5-44	<5-40	<5-74	<5-7	<5-5	—	<5-273	—	<5-45	<5-<5	<5-7
Average of values (ug/m^3)	18	<5	15	<5	<5	—	63	—	<5	<5	<5
No. of times AQS* exceeded	0	0	0	0	0	—	13	—	0	0	0
CARBON MONOXIDE											
Parameters											
Period of sampling (mos.)	12										
Number of samples	364										
Range of values (ug/m^3)	0-20.7										
Average of values (ug/m^3)	3.125										
No. of times AQS* exceeded	19										

* Hawaii Air Quality Standards

Particulates - 100 ug/m^3
Sulfur Dioxide - 80 ug/m^3
Nitrogen Dioxide - 150 ug/m^3
Carbon Monoxide - 10 mg/m^3
Oxidants - 100 ug/m^3

Source: [2.19]

F. Ambient Noise Levels

Ambient noise levels were recorded at the sites, using a Brüel and Kjäer Sound Level Noise Meter. The existing ambient noise environment is primarily dominated by sounds of wind. Noise levels at the Kamole Weir Site varied from 37-49 dBA, with peak levels of 57-59 dBA near the weir. Noise levels at the other sites varied from 37-40 dBA.

The County of Maui has no specific noise level controls; however, ambient noise levels recorded in the project areas were well below noise standards given in Chapter 44B, Community Noise Control of Oahu, which may be used for comparison only.

II. BIOLOGICAL CHARACTERISTICS

A. Flora

1. Project Sites

A field reconnaissance of the sites was conducted in January, 1981. Flora at the Kamole Weir site include Christmas berry (*Schinus terebinthifolius*) and roadside weeds. Kikuyugrass (*Pennisetum clandestinum*) is the predominant grass at the Olinda site and eucalyptus (*Eucalyptus robusta*) trees surround the area. Kikuyugrass is also found at the Piiholo site, with clumps of gorse (*Ulex europaeus*) and guava (*Psidium guajava*).

Refer to Appendix F for a full species list at each of the sites.

2. Adjacent Areas

The Kamole Weir site is located in an area identified as being in Vegetation Zone C_1, (refer to Figure 2-15) [2.20]. The Olinda site is in Vegetation Zone C_2 and the Piiholo site lies in Vegetation Zone D_2.

3. Endangered Plants

None of the plants observed on the project sites are listed as endangered species by the Federal Government [2.21].

B. Fauna

1. Project Sites

A field reconnaissance was conducted in January, 1981. Avifauna seen on the project sites include upland and forest birds, all primarily introduced. Refer to Appendix F for a complete species list.

The vegetation suggests the presence of the mongoose, as well as mice and rats. Refer to Appendix F for a complete listing.

2. Adjacent Areas

Avifauna and other animals found in adjacent areas are similar to those found on the project sites.

SOURCE: (2.20)

Zone	General elevations	Mean annual temperature	Annual rainfall, principal origin, and characteristics	Topography and soils	Land use	Vegetation characteristics and principal species
A	Sea level to 500 feet on lee sides or low windward lands	75° F. at sea level; maximum exceeding 90° F.	Less than 20 inches; southwest origin; torrential and infrequent; run-off and evaporation high; long, dry periods common	Coastal flats and adjacent sloping lands. Lava common	Irrigated sugar cane, grazing, waste	Ground cover sparse and conditions semi-desert. Algaroba, koa haole, and klu grow well where their roots penetrate ground water. Ilima and uhaloa are common shrubs. Annual grasses and herbs are scarce except following rains.
B	Sea level to 2,000 feet. Lee sides above A where present	70° F.	20-40 inches; southwest origin; similar to zone A	Similar to zone A	Irrigated sugar cane below 1,200 feet, pineapple above; grazing, waste	Vegetation similar to zone A but plants more numerous and vigorous due to increased rainfall. Annuals are longer lived Cactus and *Lantana* often form dense stands. Both perennial and annual grasses occur. Annual herbs are prominent during and following rainy periods.
C_1	Sea level to 2,500 feet. Lies above B except where it reaches the sea	70° F.	40-60 inches; northeast trade-wind origin. Dry periods of more than one month uncommon. Moist spring and dry summer permit maturing of seeds	Gentle and steep slopes dissected by deep gullies; high plateaus. Excellent soil	Irrigated sugar cane and pineapple where topography and soils permit. Grazing restricted to gullies and poorer soils	Both temperate and tropical species adapted, the former seasonal, the latter perennial. Guava is the predominant shrub; *Lantana* and koa haole may form dense stands. Grasses and pasture legumes are responsive and small shrubs are common. Herbaceous forms volunteer good growth on disturbed soils. This zone formerly forested.
C_2	2,500 to 4,000 feet	60° F.	Similar to zone C_1	Steeper mountain gradients and high plateaus. Good soils used for pastures	Too cool for sugar cane or pineapple. Grazing is major use	Like zone C_1 this was once forested. Now mostly open grassland but remnants of koa and ohia lehua occur. Aalii and puakeawe are dominant shrubs. Grasses, legumes, and other herbs generally form good stands.
D_1	Sea level to 1,500 feet on windward sides	73° F. at sea level. 2-3° lower than on lee sides at same elevation	60 inches minimum; northeast trade-wind origin	Rugged; soils leached, acid, poorly aerated	Non-irrigated sugar cane; limited pineapple. Grazing on non-arable land	Perennial shrubs and grasses most abundant but commonly low in protein, minerals, and total dry matter. Guava, *Lantana*, and staghorn fern grow profusely in places restricting other vegetative growth.
D_2	Variable but generally between 1,500 to 4,000 feet on windward sides. Lies above D_1	60° F.	From more than 60 to 450 inches and more; northeast trade-wind origin	Rough topography. Soils acid, often boggy, have little available plant matter, decreased silica, high organic matter	Forest reserve providing main source of water for islands. Grazing in some cleared portions	Nearly impenetrable forest of koa and ohia lehua accompanied by tree ferns and various low growing ferns. Such forests lack diversification of vegetative types and seed producing species
D_3	4,000-7,000 feet on windward sides. Lies above D_2	50° F.	About 100 to 50 inches; northeast trade-wind origin. Mist frequent	Gentle gradient with small gullies	Grazing	Originally forested like zone D_2 but heavy grazing has left only remnants. In cleared portions grasses do well but annuals do not persist because of lack of sunshine and a dry season necessary for seeding. Shrubs are scarce due to grazing.
E_1	4,000 - 7,000 feet. Lies above D_3 in wetter parts and C_2 in drier localities	50° F.	40 inches; northeast trade-wind origin. Mist common. Summers dry. Frost occasional in low regions and ice forms in upper areas.	High plateau and gentle mountain slopes. Lava common. Soil thin but good in places	Grazing	Formerly forested. Much now open grassland. Where grazing not so severe, remnant stands of koa, mamani, and naio persist. Aalii and puakeawe common where trees have disappeared. Herbs are frequent but grazing limits maximum coverage.
E_2	7,000 - 10,000 feet	40° F.	Less than 40 inches; northeast trade-wind origin. Summers are too cool to permit good plant	Topography steep. Soils little weathered and make poor substrata for plants. Lava plentiful	National Park and Forest Reserve; heavy grazing by feral sheep and goats	Vegetation similar to zone E_1 but sparser and more scrubby because of poorer soil and more rigorous climate. Heavy grazing in places has caused severe denudation of both vegetation and soil.
E_3	10,000 - 14,000 feet	Freezing	Less than 20 inches; northeast trade-wind origin. Snow frequent and may remain in sheltered places all year.	Steep but not rugged. Ash cones and lava common. Soil rocky and thin	National Park and Forest Reserve	Little plant growth except moss and lichen association.

VEGETATIVE ZONES FIGURE 2-15

3. Sensitive Wildlife Habitat

None of the animals seen or potentially present on the project sites are rare or endangered species. The native forest birds potentially present at the Olinda and Piiholo sites are considered common.

III. ARCHAEOLOGICAL/HISTORICAL CHARACTERISTICS

An archaeological surface reconnaissance was conducted on the project sites in January, 1981. No significant archaeologic or historic materials or sites were located during the reconnaissance. Refer to Appendix G for the archaeologic report.

IV. SOCIO-ECONOMIC CHARACTERISTICS

A. Population

1. Existing

The resident population of the combined service areas of the Makawao and Kula water systems for the years 1970 and 1980 is given in Table 2-3. The location of the Census Tracts is shown in Figures 2-16 and 2-17. During the 10-year period, Maui County as a whole showed a population increase of 54.8% (from 45,984 to 71,191). Also refer to Appendix D.

TABLE 2-3

RESIDENT POPULATION

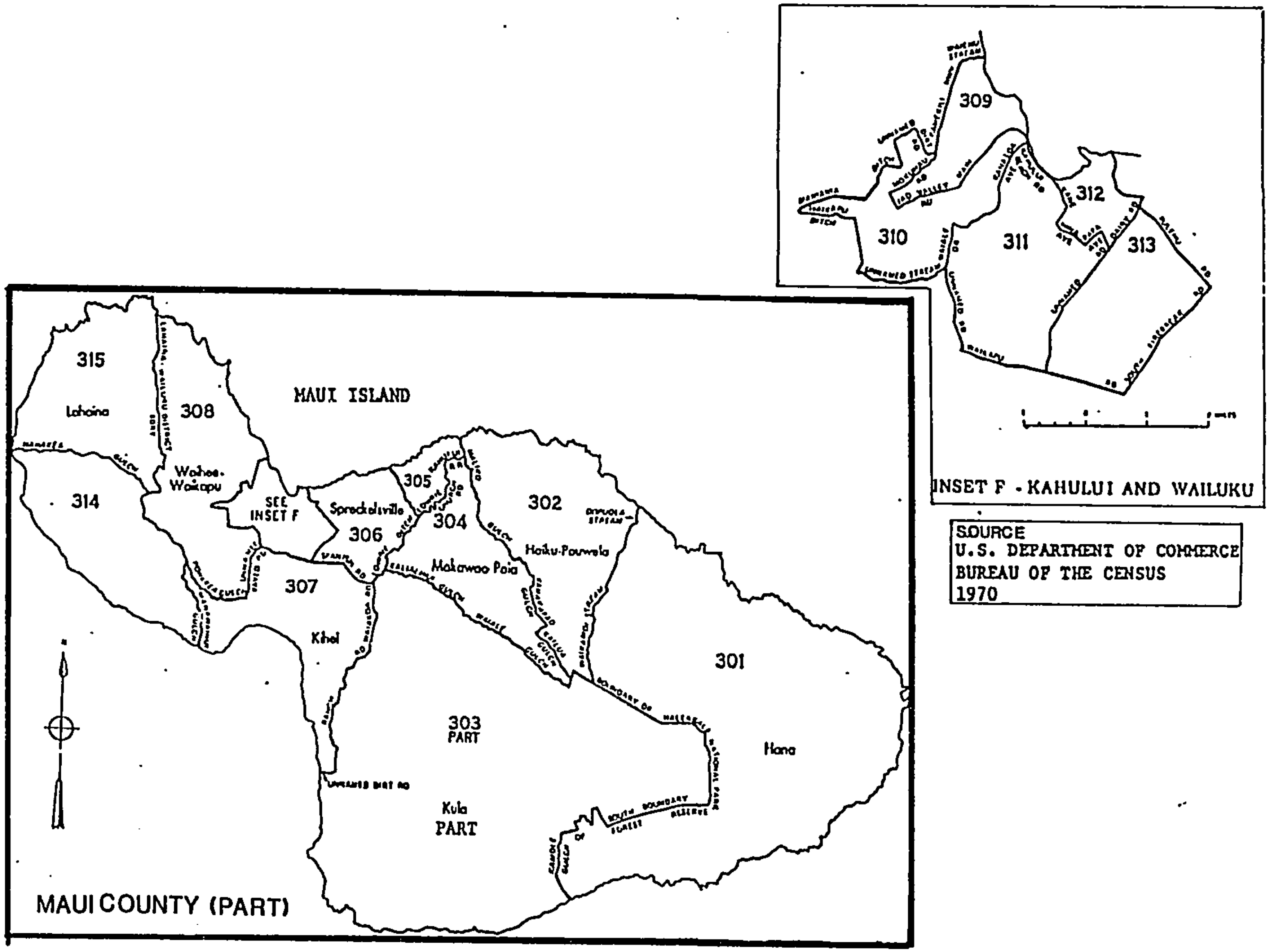
HAIKU - MAKAWAO - KULA, MAUI

1970 - 1980

Census Tract	1970 [1/]	1980 [2/]
302 (Haiku-Pauwela)	2,067	3,567
304 (Makawao)	4,123	10,361
305 (Paia)	1,665	
303 (Kula)	2,124	5,077
TOTAL	9,979	19,005

1/ U.S. Department of Commerce, Bureau of the Census. 1972. 1970 Census of Population and Housing, Census Tracts, Final Report, Honolulu SMSA.

2/ The State of Hawaii Data Book, 1981. Department of Planning and Economic Development, State of Hawaii.



1970 CENSUS TRACTS

FIGURE 2-16

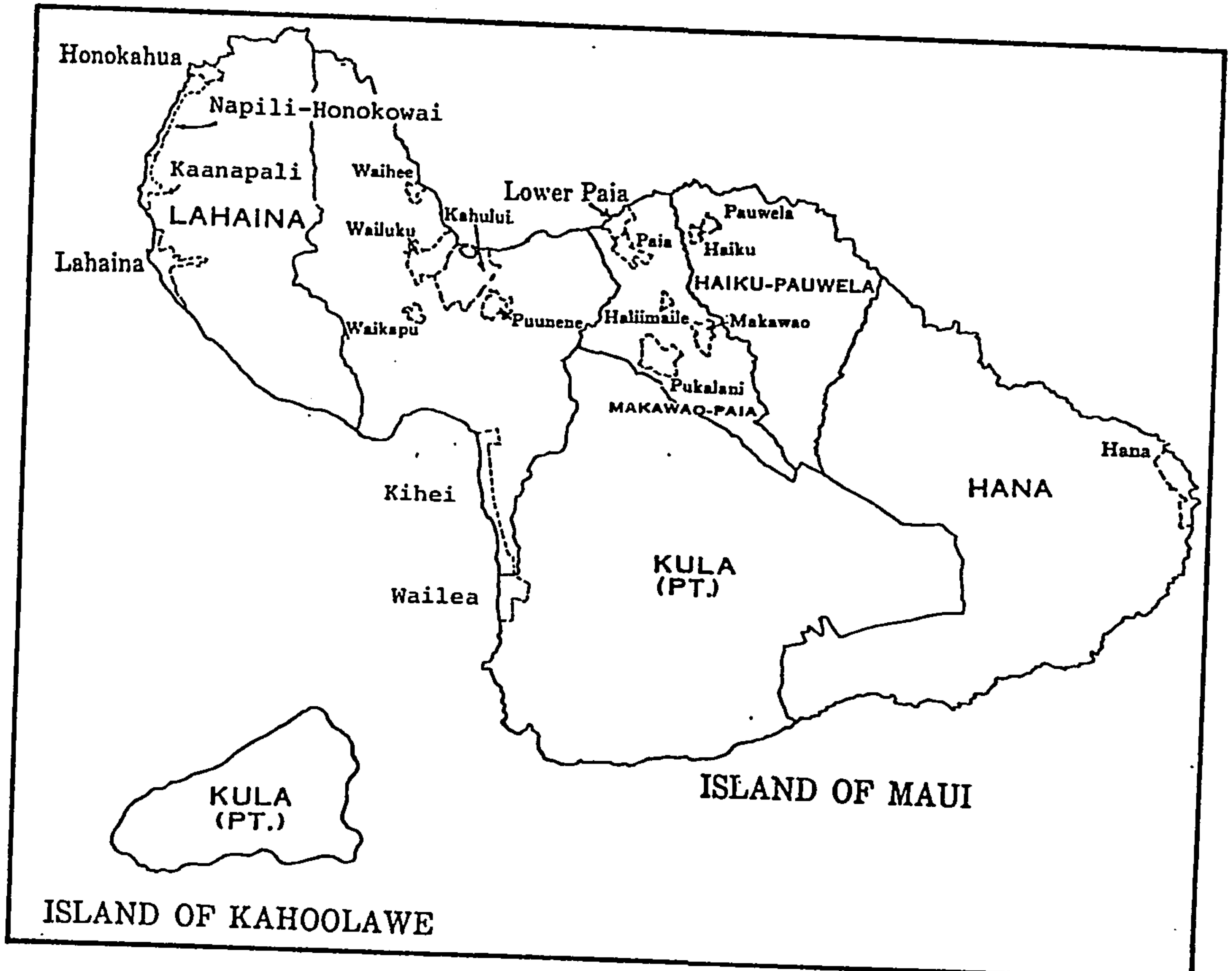


FIGURE 2-17

MAUI COUNTY 1980 CENSUS AREAS

2. Projected

The State Department of Planning and Economic Development (DPED) has requested that all agencies use the series II-F population projection, as it is updated, in order to establish a uniform population planning base. The March 1, 1978 revised population projection for Maui County in the year 1980 is 67,400 and in the year 2000 is 124,700 [2.22]. (Also refer to Appendix D.)

B. Demographic Characteristics

1. Ethnicity [2.23]

According to the OEO 1975 Census Update Survey for Maui County, the majority of persons living within the Northeast Maui District (Census Tracts 301, 302, 304, 305, and 306) were part-Hawaiian, Caucasian, or Japanese. This was also true for the Kihei-Kula District (Census Tracts 303 and 307). Refer to Table 2-4.

2. Age-Sex Distribution [2.24]

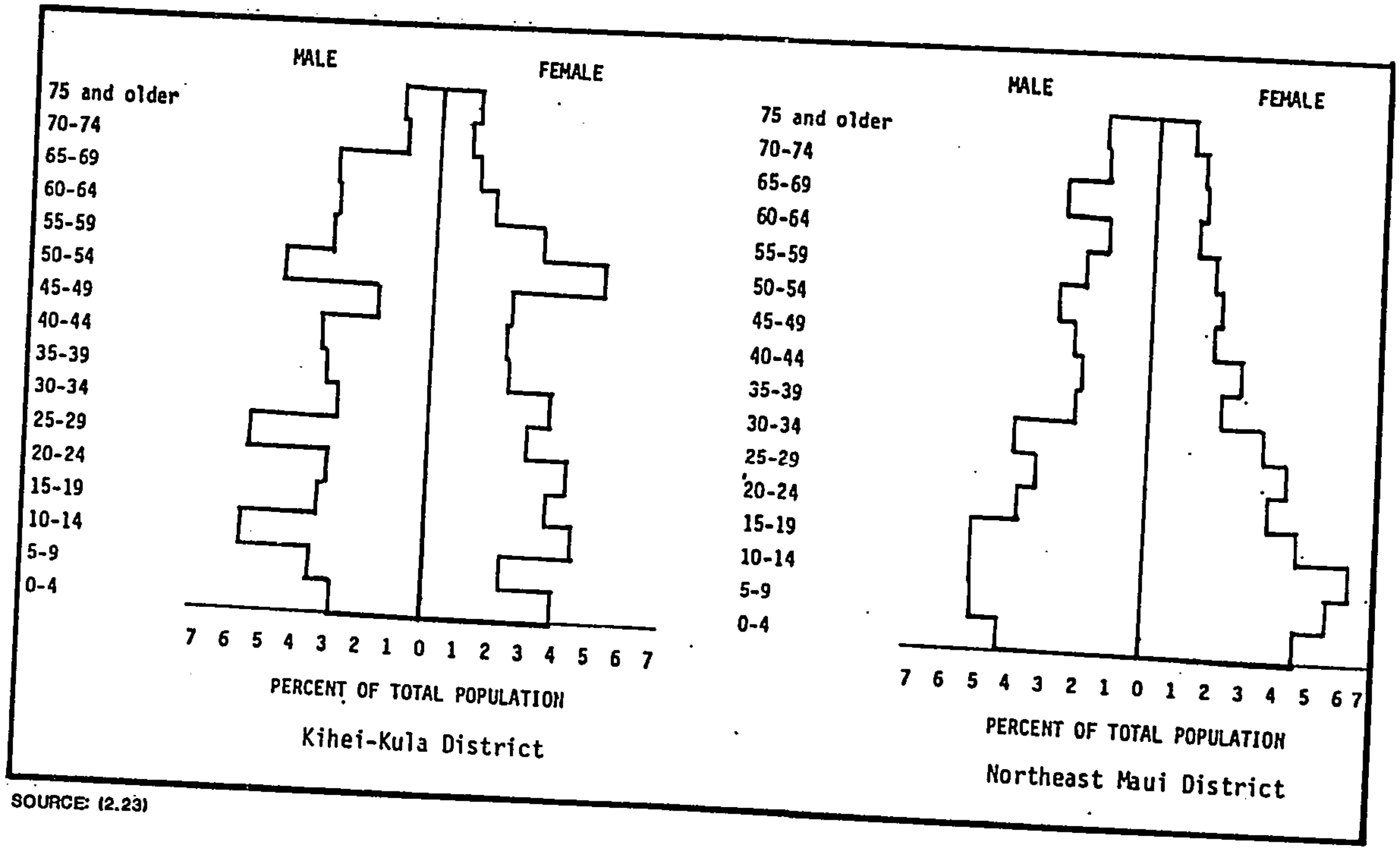
Out of an estimated study population of 10,775, the largest age groups in the Northeast Maui District were 5-9 (10.9%), 10-14 (11.5%), and 15-19 (10.0%). The largest age groups in the Kihei-Kula District were 10-14 (10.3%), 20-24 (7.4%), and 25-29 (8.5%). Refer to Figure 2-18.

TABLE 2-4

ETHNICITY BY DISTRICT

	Total	Northeast Maui	Kihei-Kula	Kahului	Wailuku-Waikupu	Lahaina	Molokai	Lanai
	%	%	%	%	%	%	%	%
Black, Negro	0.1	0.1	0.6	0.0	0.0	0.0	0.0	0.0
Caucasian, Not Portuguese	21.3	19.6	48.9	6.3	12.4	37.4	6.1	6.4
Portuguese	4.4	9.6	5.0	3.7	4.8	1.2	0.6	0.9
Chinese	0.7	0.4	1.6	0.7	1.0	0.2	0.2	0.1
Filipino	15.3	11.4	3.1	24.7	9.4	11.4	27.5	46.5
Hawaiian	1.6	1.7	1.0	0.6	1.5	1.6	3.9	3.2
Part-Hawaiian	21.4	24.4	17.7	11.6	20.3	19.5	46.7	17.5
Japanese	25.1	17.8	14.1	38.9	40.7	22.1	9.8	16.2
Korean	0.3	0.4	0.2	0.7	0.2	0.2	0.2	1.0
Puerto Rican	0.4	0.9	0.0	0.7	0.4	0.0	0.2	0.3
Samoan	0.1	0.1	0.2	0.1	0.1	0.0	0.1	0.0
Mixed (not Part-Hawaiian)	8.6	12.4	7.0	11.1	8.3	5.6	4.6	7.8
other	0.7	0.9	0.5	0.8	0.9	0.9	0.1	0.1
refused/don't know	0.1	0.3	0.0	0.1	0.0	0.0	0.1	0.0
Base (est. pop.)	59,661	10,775	9,347	11,186	10,810	9,278	5,815	2,450

Source: [2.23]



SOURCE: (2.23)

AGE-SEX DISTRIBUTIONS

FIGURE 2-18

The sex distribution for the Northeast Maui District was 49.1% males to 50.9% females in 1975. For the Kihei-Kula District the sex distribution was 51.4% males to 48.6% females. Also refer to Figure 2-18.

3. Education [2.25]

Of an estimated study population of 5,438 that contained persons 25 years of age or older, 60% in the Northeast Maui District had received a high school diploma, while 40% had not. These figures compared with 78.3% and 21.7%, respectively, for the Kihei-Kula District (study population of 5,687).

C. Employment and Income

1. Employment

A study conducted by the State Department of Labor and Industrial Relations covered the period from 1964 to 1975 [2.26]. Employment trends for one area within the combined service area of the the water treatment plants is summarized as follows:

Haiku-Pauwela (Census Tracts 302-305)

This area showed Retail and Services being the primary industries, each representing about 28% of the employees in 1975. There were 896 employees, reflecting a decrease of 72.9% of persons employed between

1964 and 1975. This loss was tremendous in the areas of Manufacturing, a loss of 2,007 employees, and in Agriculture, a loss of 636 employees.

The 1975 OEO Census Update Survey determined the industry of the employed population age 16 and older. For the Northeast Maui District the primary industries listed were service (26.2%), agriculture (18.1%), and retail (16.3%), out of a sample population of 4,093. For the Kihei-Kula District (sample population of 4,260) the main industries listed were service (32.3%), construction (21.4%), and retail (16.6%), with 9.1% for agriculture.

Those persons in agriculture could work for the sugar or pineapple plantations, or for vegetable and flower farms in the area between Makawao and Keokea (including Olinda and upper and lower Kula).

"The exact number of farms or farmers (in this area) differs depending on how they are classified. This is partially due to the difficulty of defining part-time farmer from a full-time farmer or by distinguishing between land dedicated to agriculture for tax purposes that is actively farmed versus that minimally farmed to meet the legal tax requirements. It is further complicated in that the Kula agriculture statistics are reported only as part of Maui/Molokai/Lanai." [2.27]

Despite this, the Makawao-Pukalani-Kula General Plan identified 136 farms in the area, based on the farms identified in the 1972 Land Inventory Report prepared by DPED.

Table 2-5 illustrates overall employment and unemployment trends for the island of Maui from 1970 through 1980. The data shows that there was a relatively high percentage of the work force unemployed from 1971 to 1976. Then 1977 showed a significant decrease in the unemployment rate, which appeared to have been maintained through 1980 [2.28].

2. <u>Income</u> [2.29]

Household incomes in the Northeast Maui District ranged from under $2,000 to $25,000 or more, with half (50.8%) falling between $12,000 and $25,000 or more. Another sizable portion (38.6%) fell rather evenly between $2,000 and $11,999.

Household incomes in the Kihei-Kula District also ranged from under $2,000 to $25,000 or more, with over half (59.1%) falling between

TABLE 2-5

ISLAND OF MAUI

CIVILIAN LABOR FORCE
(1970-1980)

YEAR	AVERAGE ANNUAL EMPLOYED	UNEMPLOYED	% UNEMPLOYED
1970	16,050	1,200	7.0
1971	16,770	1,450	8.0
1972	17,600	1,800	9.3
1973	18,650	1,750	8.7
1974	19,400	1,850	8.8
1975	21,100	2,100	9.0
1976	22,300	2,450	9.9
1977	24,400	1,850	7.0
1978	24,750	1,800	6.9
1979	25,650	1,550	5.7
1980	26,900	1,500	5.3

Source: [2.28]

$10,000 and $25,000 or more. The mean household income in the Northeast Maui area was $12,260 and the median was $13,300. The mean household income in the Kihei-Kula area was $17,040 and the median was $14,980.

V. INFRASTRUCTURE

A. Electrical and Telephone Services

Existing overhead electrical and telephone lines, which may serve the proposed sites, are located along Baldwin Avenue for the Kamole Weir Site (an existing MECO substation is located at the Kamole Weir Site) and along Olinda and Piiholo roads for the other two sites. Final design will be coordinated with Maui Electric Company and Hawaiian Telephone Company, who will review and approve aspects of the the plans prior to government approval of the project plans.

B. Waste Disposal

Disposal of dewatered waste water residue will be required as a routine procedure.

C. Public Facilities

1. Fire

A fire station located at Makawao, which is equipped with 1 large and 1 small fire engine, would service the sites. There are approximately

4 men to each shift and the response time to the sites is estimated at about 5-15 minutes. The nature of the proposed project involves minimal fire potential and is not expected to require assistance from the Fire Department.

2. Medical

The only medical service which would be affected would be emergency care. As previously stated, the nature of the proposed project should require negligible medical service.

Emergency medical service to the proposed project sites would be provided by first phoning 911. There is an ambulance stationed at Makawao, which could be dispatched to either of the sites within 5-15 minutes. The ambulance is always staffed with at least 1 paramedic (MICT - Mobile Intensive Care Technician) who is in constant communication with a physician at Maui Memorial Hospital. If the case can be stabilized in the field, then transport to Maui Memorial Hospital is not necessary. If, however, it is determined that the case should be transported to the hospital, then transit time (excluding field treatment time) is estimated at 20-40 minutes.

3. Police

The central Maui area has 10 beats servicing approximately 342 square miles. One of those beats would service the three proposed project sites, which is part of an area extending approximately from Baldwin Avenue in Paia, to the top of Haleakala, and over to Kanaio. This one beat is comprised of one patrol car manned by one patrol officer. Each of the treatment facilities will be secured by perimeter fencing and locked buildings. Additional police surveillance of the completed facilities should not be required.

4. Schools

Though there are several public schools located within the service area of the treatment facilities, none is within the immediate vicinity of any of the proposed project sites. Makawao Elementary and Intermediate is located near the intersection of Baldwin Avenue and Makawao Avenue, approximately 1.7 miles from the Kamole Weir and over 4 miles from either of the other two sites. Seabury Hall, a private school, is located about 2 miles from the Olinda site, on Olinda Road. Also refer to Table 2-6.

TABLE 2-6

PUBLIC SCHOOLS

HAIKU - MAKAWAO - KULA AREAS

MAUI, HAWAII

AREA	SCHOOL
Haiku - Pauwela	Haiku School
Makawao	Makawao School
Pukalani	Pukalani Elementary School
Kula	Kula Elementary School

5. Parks and Recreation

As shown in Table 2-7, there are several parks and recreation facilities in the region surrounding the 3 project sites. The Olinda site is located within 1/2 mile of Waihou Spring Reserve, an 84-acre State-owned parcel which contains picnic areas. The Piiholo site is located within 1/4 mile of Makawao Forest Reserve, a 2,093-acre State-owned forest reserve which allows hunting. The Kamole Weir site is located about 1 mile from Haliimaile Park, a 5.2-acre County-owned neighborhood park.

D. *Access and Traffic*.

1. Access

To gain access to the proposed Olinda Reservoir or Piiholo project sites from Kahului, one would take Route 36 (Hana Highway) to Route 37 (Haleakala Highway) and then Route 40 (Makawao Avenue). Once on Route 40, one would then take Olinda Road (Route 39) mauka up to Olinda Reservoir. The approximate distance from Kahului is 18 miles. For the Piiholo Site, one would continue a little further along Makawao Avenue and then turn mauka on Piiholo Road for 1.5 miles. At Ehu Road, one would go left and

TABLE 2-7

PARKS AND RECREATION FACILITIES

NAME	OWNERSHIP	ACRES	FACILITIES
Makawao School Park	County	3.4	Playfield
Makawao Park and Mayor Eddie Tam Memorial Center	County	2.9 & 13.7	Baseball, football, horseback riding, social center, gym
Makawao Rodeo Arena	Private	2.0	Horseback riding, rodeo
Makawao Forest Reserve	State	2,093	Hunting
Waihou Spring Reserve	State	84.0	Picnic
Pukalani Park and Community Center	County	5 acres presently, 25 acres total	Basketball, baseball and social center
Baldwin Polo Field	Private	N/A	Horseback riding, polo
Kula Botanical Garden	Private	8.2	Garden - native and introduced plants
Kula School Park	State	6.9	Playfield, basketball
Harold F. Rice Park	County	3.8	Picnic
Keokea Ball Park	County	4.2	Picnic, baseball
Haleakala Nat'l Park	Federal	20,246	Hiking, picnic, camping
Kula Game Management Area*	State	5,938	Hunting, hiking
Kahikinui Game Management Area*	State	13,184	Hunting, hiking
Polipoli Springs State Rec. Area	State	2.0	Hiking, picnic, camping

* Within Forest Reserve

follow it to the end, about 1.2 miles. The approximate distance of the Piiholo Site from Kahului is about 16 miles. Approximate transit times from Kahului to these sites are 40-50 minutes.

Access to the Kamole Weir site can be gained via two routes from Kahului. One would be to continue on Hana Highway past its junction with Haleakala Highway until Hana Highway meets with Baldwin Avenue (Route 39), and continue mauka along Baldwin Avenue to the project site -- about a 12 mile drive from Kahului. The other, and possibly more desirable route, would be to take Haleakala Highway to Haliimaile Road, then travel along Haliimaile Road to Baldwin Avenue. The approximate mileage from Kahului by this route is 11 miles.

2. Traffic.

Makawao Avenue is a two-lane roadway in good condition. It is a Federal Aid Secondary County (FASC) road. Average daily traffic (ADT) in 1973 along Makawao Avenue was 3,450 - 4,123 vehicles per day.

A recent 24-hour traffic count at the intersection of this roadway with Baldwin Avenue and Olinda road is presented in Table 2-8.

TABLE 2-8

24-HOUR TRAFFIC COUNT
MAKAWAO AVENUE, BALDWIN AVENUE AND
OLINDA ROAD INTERSECTION

APRIL 10-11, 1979

	Entering Intersection	Leaving Intersection
Makawao Avenue		
East Leg	1,825	1,946
West Leg	3,380	3,266
Baldwin Avenue	2,396	2,310
Olinda Road	637	716

Source: State Department of Transportation, Wailuku, Maui. 1980. Personal communication.

Traffic counts taken by the State Department of Transportation along Makawao Avenue show little, if any, increase between 1976 and 1979 in traffic volume during the afternoon peak hour. [2.30]

Baldwin Avenue, Olinda Road, and Piiholo Road are two-lane roadways in good condition. Ehu Road is a two-lane road in fair condition. ADT counts are not available for these roads. All-weather access roads will be provided to each of the water treatment plants.

E. Shopping Opportunities

The residents of Makawao and Pukalani are served by several stores, concentrated primarily at the new Pukalani Terrace Center in Pukalani. This 15-store shopping complex contains a supermarket, clothing stores, and a hardware store, for example. There are also gas stations nearby. In addition, residents may patronize three shopping malls between Kahului and Wailuku, as well as downtown Wailuku stores.

REFERENCES TO SECTION 2

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[2.5] *Ibid*.

[2.6] *Ibid*. [2.4]. Page 36.

[2.7] *Ibid*. [2.4].

[2.8] *Ibid*. [2.4]. Page 37.

[2.9] *Ibid*. [2.4].

[2.10] *Ibid*. [2.4]. Pages 10-11.

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[2.25] Ibid.

[2.26] State of Hawaii Department of Labor and Industrial Relations, Research and Statistics Office, Labor Market and Service Research Section. Labor Force Distribution by Employer Site and Industry Category: State of Hawaii.

[2.27] Donald Wolbrink and Associates, Inc. 1974. Makawao-Pukalani-Kula General Plan. Prepared for the Planning Commission, County of Maui.

[2.28] State of Hawaii Department of Labor and Industrial Relations. Research and Statistics Office. March, 1980. Labor Force Data Book, A Compilation of Updated Labor Force Statistics.

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[2.30] Alan M. Voorhees and Associates, Inc. July, 1979. *Traffic Impact Studies, Maui Post Offices: Makawao.*

Land Use Plans Policies Controls

3

SECTION 3

THE RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS, POLICIES AND CONTROLS FOR THE AFFECTED AREA

I. EXISTING LAND USE

A. Project Sites

The proposed location of the Makawao WTP is in the immediate vicinity of the existing Kamole Weir of Wailoa Ditch owned by East Maui Irrigation Co.

The proposed Lower Kula WTP site is presently used as pasture, and is privately owned. The Upper Kula WTP site consists of vacant land adjoining the Olinda Reservoir.

B. Island of Maui

Existing land use on the island of Maui, as of 1972, is shown in Table 3-1.

II. STATE LAND USE DESIGNATIONS

The three proposed sites are within a State Land Use designation of Agriculture [3.1]. One of the alternate sites for the Lower Kula WTP ("Piiholo Site 2") is also within Agriculture, while the other ("Piiholo Site 3") is within a designation of Conservation.

In order to develop Piiholo Site 3, which is within the Makawao Forest reserve, a Conservation District Use Application (CDUA) would have to be filed.

TABLE 3-1

EXISTING LAND USE

ISLAND OF MAUI: 1972

Land Use 1/	Acreage	Percent
Residential	17,292	3.53
Manufacturing	774	0.16
Manufacturing Services and Warehousing 2/	657	0.13
Commercial 3/	233	0.05
Services 4/	30,986	6.32
Social and Cultural 5/	1,302	0.26
Recreation 6/	18,778	3.83
Agriculture	197,900	40.37
Transportation 7/	776	0.16
Unused Open Space Areas 8/	221,534	45.19
TOTAL	490,234	100.00

1/ Excludes public streets and highways.

2/ Includes warehousing, construction services, and public utilites.

3/ Retail and wholesale trade.

4/ Includes commercial amusement and recreation, hotels, military installations, government offices, parking, cemeteries, personal services, business and repair services, professional services, and finance, insurance and real estate.

5/ Educational, cultural and religious.

6/ Excludes commercial amusement and recreation services.

7/ Includes airports, docks, and land transportation facilities.

8/ Includes vacant land, forest reserve, lakes, steep land, and undedicated streets.

Source: Department of Planning and Economic Development, State of Hawaii. The State of Hawaii Data Book: 1980. Table 132, page 157.

III. MAKAWAO-PUKALANI-KULA GENERAL PLAN

The proposed Piiholo and Olinda sites are located in an area designated as "General Agriculture" by the Makawao-Pukalani-Kula General Plan [3.2]. The Kamole Weir site is not within the general plan boundries.

IV. COUNTY GENERAL PLAN [3.3]

The General Plan of the County of Maui sets forth the County's broad policies for long-range development. It consists of (1) general objectives expressing the common wishes and aspirations of County residents and (2) policies which will have to be carried out in order to attain each objective.

Under the category of Utility and Facility Systems, the plan presents the objective and policies with regard to water. Refer to Table 3-2. The proposed water treatment plants will assist the County in attaining the first two policies.

V. COUNTY ZONING

For lands outside of the Urban and Rural State Land Use districts, the County of Maui has no specific zoning ordinances. Instead, the State Land Use designations are followed. Thus, the "zoning" for the three sites is Agriculture.

TABLE 3-2

WATER OBJECTIVE AND POLICIES
MAUI COUNTY GENERAL PLAN

OBJECTIVE:

1. To provide an adequate supply of domestic and irrigation water to meet the needs of our people.

POLICIES:

1. Support water supply services to those areas which historically experience critical water problems.

2. Meet or exceed Federal quality standards in our potable water.

3. Create systems to provide better fire protection.

4. Limit growth activities to existing water supply and expend the supply of water wisely.

5. Minimize moratoriums on water supply in areas used for resident housing.

6. Support expeditious action on bills providing for replacement of inadequate water transmission systems.

7. Encourage cost sharing programs with private developers in the expansion of our water supply.

8. Seek new sources of water by exploration in conjunction with other government agencies.

9. Maintain the right to manage our transmission and deliverance systems at the County level.

10. Develop sufficient water supply during drought seasons so as to keep agricultural activities viable.

11. Maintain a balance between visitors and residents in the consumption of water.

Source: [3.3]

CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

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11. Maintain a balance between visitors and residents in the consumption of water.

Source: [3.3]

VI. STATE AGRICULTURAL LANDS DESIGNATIONS [3.4]

In 1977 a soil classification system was adopted by the State Board of Agriculture. This classification delineates those lands of the State which are of agricultural importance and categorizes agricultural lands into three classes. The three classes are as follows:

Prime Agricultural Land - Land which has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops economically, when treated and managed according to modern farming methods.

Unique Agricultural Land - Land that has the special combination of soil quality, location, growing season, moisture supply, and is used to produce sustained high quality and high yields of a specific crop when treated and managed according to modern farming methods.

Other Important Agricultural Land - Land other than Prime or Unique Agricultural Land that is also of statewide or local importance for agricultural use.

Soils at the Kamole Weir and Piiholo sites are classified as Prime Agricultural Land. Soils at the Olinda site are classified as Other Important Agricultural Land.

VII. OTHER GOVERNING PLANS AND POLICIES

A. Safe Drinking Water Act, 1974: [3.5; 3.6; 3.7; 3.8]

The Safe Drinking Water Act of 1974 (P.L. 93-523) designates the Federal Government (Environmental Protection Agency or EPA) as having primary responsibility of establishing national standards. The states are responsible for enforcing the standards and otherwise supervising public water supply systems and sources of drinking water. A public water system is defined as providing piped water for human consumption and that it has at least 15 service connections or regularly serves at least 25 people.

This Act provides for:

- Establishment of primary regulations for the protection of the public health;
- Establishment of secondary regulations relating to the taste, odor, and appearance of drinking water;
- Measures to protect underground drinking water sources;
- Research and studies regarding health, economic, and technological problems of drinking water supplies. Specifically required are studies of viruses in drinking water and contamination by cancer-causing chemicals;
- A survey of the quality and availability of rural water supplies;
- Aid to the States to improve drinking water programs through technical assistance, training of personnel, and grant support;
- Citizen suits against any party believed to be in violation of the Act;
- Record-keeping, inspection, issuance of regulations, and judicial review;
- A 15-member National Drinking Water Advisory Council to advise the EPA Administrator on scientific and other responsiblilities under the Act;

- A requirement that the Secretary of Health, Education, and Welfare ensure that standards for bottled drinking water conform to the primary regulations established under the Act - or to publish reasons for not doing so; and

- Authorization of appropriations totaling $156 million for fiscal year 1975, 1976, and 1977.

Primary standards were designed to provide maximum feasible protection of the public health, utilizing the best treatment methods generally available, with cost as a consideration. The standards are ultimately to include maximum contaminant levels, treatment techniques, and criteria for operation, maintenance, siting, and intake of public water supply systems.

Secondary standards will also be prescribed for taste, odor, and appearance of drinking water, including sodium and total dissolved solids in the water. Secondary standards are to be enforced at the discretion of the individual states.

The proposed water treatment plants are being designed to comply with the Safe Drinking Water Regulations.

B. <u>State Department of Health, Chapter 49, Potable Water Systems</u> [3.9]

These regulations were adopted by virtue of Chapter 340E, Hawaii Revised Statutes, the purpose being to establish drinking water quality standards.

These standards are based on standards and guidelines developed due to enactment of the Safe Drinking Water Act (P.L. 93-523). P.L. 93-523 sets the parameters for inorganic and organic chemicals and for such factors as turbidity and coliforms. Inorganic and organic chemicals and coliforms are monitored by the State Department of Health and turbidity is monitored by the County. Refer to Appendices A and C for additional information on standards and source water quality.

C. State Environmental Policy Act [3.10]

The purpose of the State Environmental Policy Act is to promote efforts which will prevent damage to the environment and stimulate the health and welfare of Hawaii's residents. The Act consists of: (1) the environmental policy of the State to guide its programs, authorities, and use of resources; and guidelines to be considered by all agencies in the development of their programs. The following is a discussion of relevant policies and guidelines:

Environmental Policy -

> (1) "Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the people of Hawaii."

This project is proposed by the County of Maui in order to meet the requirements mandated by the Federal Safe Drinking Water Act. The existing water supply for the areas to be served by the project, requires treatment.

Guidelines

(2)(A) "Encourage management practices which conserve and fully utilize all natural resources."

Implementation of the proposed projects will improve the quality of potable water in the service area.

(10)(B)"Provide for expanding citizen participation in the decision making process so it continually embraces more citizens and more issues."

This EIS was prepared in accordance with Chapter 343, HRS, which provides for two public review periods.

REFERENCES TO SECTION 3

[3.1] State Land Use Commission. State Land Use District Maps M-10 and M-11. December 20, 1974.

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[3.5] U.S. Environmental Protection Agency. 1976. An Environmental Law, Highlights of the Safe Drinking Water Act of 1974.

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[3.8] U.S. 95th Congress, 1st Session. 1977. The Safe Drinking Water Act, As Amended Through November 1977. Committee Print. Serial No. 95-10.

[3.9] State of Hawaii, Department of Health. Public Health Regulations. Chapter 49, Potable Water Systems.

[3.10] State of Hawaii, Department of Health. Chapter 344, State Environmental Policy.

Environmental Impacts

4

SECTION 4

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATIVE MEASURES TO MINIMIZE ADVERSE IMPACTS

I. INTRODUCTION

This section discusses the anticipated environmental impacts from the construction of the water treatment plants. The environmental impacts are discussed under primary and secondary impacts, including short-term and long-term impacts.

Primary impacts result directly from a proposed project, and can be separated into short-term and long-term impacts. Short-term primary impacts are construction-related, lasting no longer than the construction period. Long-term primary impacts last for the entire life of the project and are directly related to the implementation of the project.

Secondary impacts are those which may be indirect results of the proposed project. Anticipated short-term secondary impacts are those which may result during construction and anticipated long-term impacts are those which may indirectly result from implementation of the proposed project.

The anticipated environmental impacts from the construction of the three treatment plants will be discussed together, because, they will use similar processes and will have similar environmental impacts.

II. PRIMARY IMPACTS OF THE PROPOSED PROJECTS

This discussion presents factors which are expected to be affected directly from the proposed projects. Discussion of each parameter will include anticipated short-term and long-term impacts resulting from the proposed projects.

A. Water Quality

1. Short-term Impacts

During construction of the treatment facilities, precautions will be taken to prevent contamination of the existing potable water system. These precautions will include adherence to approved grading plans, which will divert storm water from the denuded areas away from the existing structures. Dust generated during clearing and grading activities will be controlled in the field by appropriate water sprinkling.

A routine refuse program will be maintained at all times during construction to control litter. Completely contained chemical toilets will be provided for the construction workers, and the contractor will dispose the waste according to County and State regulations. Potential contaminants, such as fuel and lubricants, will be stored in areas that would not endanger the water supply should spillage occur.

2. Long-term Impacts

The proposed water treatment plants are being constructed to comply with Federal and State water regulations for potable water. As previously stated, the existing water supply for the service area requires treatment, particularly for coliforms and turbidity. Implementation of the treatment plants will have a long-term beneficial impact on the potable water quality of the service area.

B. Air Quality

1. Short-term Impacts

Dust will be generated during construction and site preparation. Dust will be mitigated in the field using appropriate water sprinkling methods and this will be a condition in the contract document. To also minimize dust and potential erosion, only those areas necessary for the construction will be cleared.

Exhaust from construction equipment are expected to have an insignificant impact on ambient air quality. These emissions will be of short duration, lasting only for the construction period.

2. Long-term Impacts

Once the proposed treatment facilities have been completed, the only potential air pollutants would be from the equipment and the chemicals used in the treatment process. These pollutants are expected to have a negligible effect on the ambient air quality.

As a part of each treatment plant, chlorine tanks will be stored within the facility. These tanks will be part of the automated portion of the plant for the chlorination process of the treatment. A chlorine detection system will be provided to detect leaks, and the personnel will be provided with gas masks. The potential for chlorine leakage is anticipated to be low and personnel will receive the necessary training on how to store and change tanks to further minimize the potential for a leak.

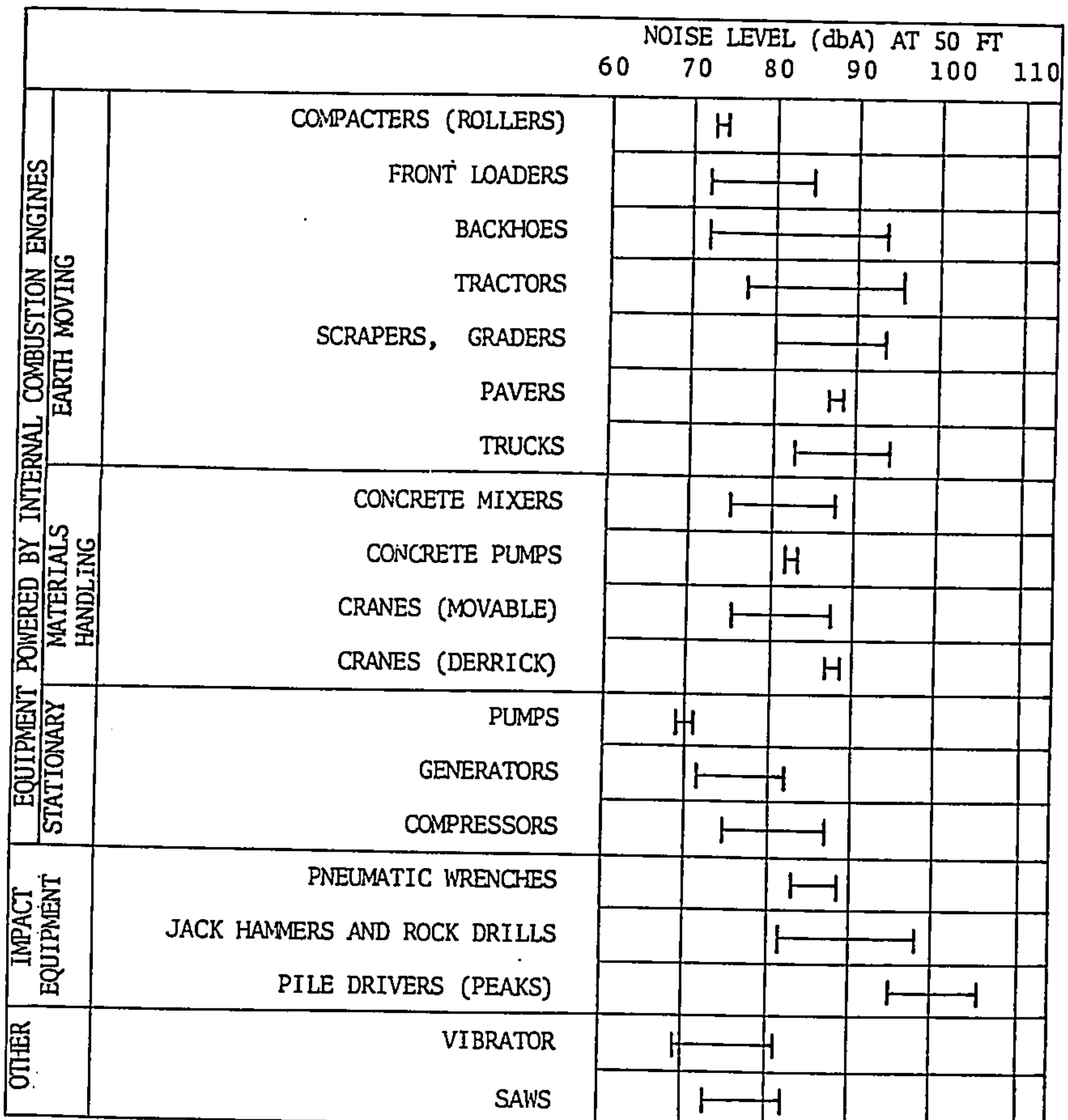
C. Noise

1. Short-term Impacts

During site preparation and construction of buildings, an increase of ambient noise levels is inevitable. Noise levels generated by construction machinery, which can be expected during construction, are present in Figure 4-1.

FIGURE 4-1

CONSTRUCTION EQUIPMENT NOISE RANGES



Note: Based on Limited Available Data Samples

Source: Noise From Construction Equipment and Operations Building Equipment, and Home Appliances, EPA, 1971

All of the proposed plant sites are located sufficiently far enough from residential areas that construction noise impacts, especially in this agriculturally oriented area, are not expected to be a problem. Furthermore, the contractor will take the necessary precautions to mitigate machinery noise levels by ensuring that mufflers on all equipment are in proper operating condition. This increase in ambient noise will be temporary, lasting only for the construction period.

2. <u>Long-term Impacts</u>

Once the proposed plants have been completed, equipment expected to generate significant levels of noise are air compressors, backwash and feed pumps. When operating, the noise level adjacent to the equipment will be about 85 dB. Approximately 70-75 feet away the noise level would be about 70-75 dB; however, this level would be for an unobstructed situation. Since the compressors, backwash and feed pumps will be enclosed within a structure, the levels would be considerably less; insulation within the building also can be provided to further minimize noise levels external to the structure.

D. Geology, Soils, and Mineral Resources

1. Short-term Impacts

The proposed treatment plants essentially will be constructed on level grades and grading will be kept to a minimum by terracing. The overall geology, therefore, will be unaffected by construction. Concern regarding geology involves the island of Maui being in Seismic Zone 2. Design and construction of the structures will consider this as appropriate mitigative measures.

The only potential for increased erosion because of the proposed facilities would be during clearing and grading; however, grading will divert run off patterns away from structures and will not be so great to result in significant erosion of existing soils at the site. Once the structures are in place, denuded areas will be revegetated, as necessary, to mitigate potential future erosion.

2. Long-term Impacts

The long-term erosion patterns and soil loss due to the proposed projects are not expected to differ significantly from existing patterns.

The only mineral resource recorded for the Haleakala area is augite. The proposed plants should not affect such deposits, because the nearest deposits of the mineral have been found along the road just below the summit of Haleakala, and just south of the boundary fence of Haleakala National Park near the lower edge of the Park housing area [Macdonald and Abbott, page 411.]

E. Biological Resources

1. Short-term Impacts

The majority of the vegetation found during the biological survey consists of common species of plants found throughout the state; none are considered endangered. Removal of this vegetation will not be significant nor can the site be considered a critical wildlife habitat.

No endangered species of birds or mammals were found on the sites. Native birds and mammals may visit the mauka areas, but the sites do not offer suitable habitats. Also, during construction, fauna in the immediate vicinity of the construction activities will avoid the sites and return upon completion of the construction.

2. Long-term Impacts

Completion of the projects should not adversly affect the flora and fauna of the project sites. Long-term adverse environmental impacts to the flora and fauna from the operation of the treatment plants will not be significant.

F. Archaeological and Historic Resources

1. Short-term Impacts

The absence of archaeological sites precludes any short-term adverse environmental impacts.

2. Long-term Impacts

The absence of archaeological sites precludes any long-term adverse environmental impacts.

G. Electrical

1. Short-term Impacts

Problems with providing electrical service to the proposed plants are not anticipated. Both the design and construction will be closely coordinated with Maui Electric Company to assure that potential conflicts have been considered and resolved.

2. Long-term Impacts

Additional cost to the consumer because of these proposed projects is not expected to be discernable. Electrical costs incurred by the proposed projects are a necessary aspect of the proposed design to meet Federal and State regulations for potable water.

H. <u>Access and Traffic</u>

1. <u>Short-term Impacts</u>

During construction there will be a brief period of impact to existing traffic patterns, as construction equipment is transported to each site. However, this phase will be completed during off-hours to minimize input. If safety in traffic flow becomes a consideration, then police assistance will be requested.

Once the large equipment is at the site, there will be no alteration of existing traffic patterns and the only routine traffic during construction would be generated by the construction workers themselves. Anticipated impacts resulting from this traffic volume are expected to be negligible.

2. <u>Long-term Impacts</u>

Upon completion, the plants will require daily checking and the occasional delivery of chemicals. The amount of traffic generated by the operation of the treatment plants will be negligible.

None of the sites are currently public areas, nor are they areas through which access must be maintained to reach public areas. Except for the treatment facilities themselves, which will be secured by perimeter fencing, continued access can be gained throughout the area. Therefore, no substantial short-term or long-term impacts to existing access patterns are anticipated.

I. Emergency Services

Fire, medical, or police services should not significantly be affected either for the short-term or the long-term. As stated in Section 2, the Makawao Fire Station, which also houses the ambulance, can respond to the sites within 5-15 minutes. Security for the facilities will be provided both during construction and after completion, so additional police patrols to the site should not be required.

J. Schools

The proposed projects will not have a short- or long-term environmental impact on schools.

K. Parks

The proposed projects will not have a short- or long-term impact on parks.

L. Waste Disposal

1. Short-term Impacts

Construction wastes will be disposed of at the County-operated sanitary landfill.

2. Long-term Impacts

The operation of the water treatment plants generates sludge during the treatment process. The ultimate disposal of the sludge will be a County-operated sanitary landfill.

M. Economic

1. Short-term Impacts

The construction of the treatment plants will undoubtedly be phased due to high capital cost of such an undertaking and it is anticipated that the Makawao Treatment Plant will be started first and the Kula Treatment Plants started as funds become available.

Based on present costs, the Makawao Treatment Plant will have a stimulatory effect on the local construction industry; the effect will be about \$3,445,000 (Phase 1) X 1.7 = \$5,856,000. The estimated construction costs for the Lower and Upper Kula Water Treatment Plants are \$5.3 million and \$2.8 million respectively.

CORRECTION

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2. Long-term Impacts

The operation of the treatment plants will entail manpower, material and energy costs. The exact costs are presently unknown and can only be determined after the treatment plants have been in operation for a given period of time. However, estimates have been made and discussed under secondary impacts.

III. SECONDARY IMPACTS

A. Land Use and Water Resources

The objective of the construction of the three water treatment plants is to treat existing water supplies to meet current State and Federal drinking water standards. No new water sources will be developed as a result of this project and, therefore, there will not be a stimulus for growth.

The future land use for the water service area served by the treatment plants is being guided by the County General Plan (1980), Makawao-Pukalani-Kula General Plan (1974), and the proposed Makawao-Pukalani-Kula Community Plan (October, 1981).

Essentially, the concepts articulated in the 1974 Makawao-Pukalani-Kula General Plan for agriculture are retained in the proposed Makawao-Pukalani-Kula

Community Plan. For example: the enhancement, expansion and protection of present and future agricultural lands have been retained; the plan discourages land speculation and "large estate subdivisions;" and the plan supports the development of an agricultural park.

The future policy regarding water source development, transmission, and competing uses of water will be determined after the Department of Water Supply completes the water master study for the up-country area.

B. Economic

The operation of the water treatment plants requires funds for maintenance, supplies and repair. The estimated operating cost has been developed for the Makawao Treatment Plant, and the costs for the two other treatment plants will be estimated when the engineering reports have been finalized. The Makawao Treatment Plant, being the largest, gives a reasonable estimate of the future costs for treatment.

The following are estimated costs:

		Annual Costs	Cost Per Million Gallons Treated [2/]
Chemical Cost	$	84,000	$ 23.01
Power Cost		761,000 [1/]	208.49
Maintenance, Repairs and Replacement		30,000	8.21
Misc. Supplies and Services		6,000	1.64
Personnel		180,000	49.31
		$1,061,000	$290.66 [3/]

Using these estimates for the Makawao Treatment Plant as a basis, the operation and maintenance costs for the Upper or Lower Kula Treatment Plants are estimated as:

Treatment Plant	Maximum Design Capacity (MGD)	Cost Per MG	Maximum Daily O & M Cost
Makawao	8 to 12	$84.22	$ 673.76 to $1,010.64
Upper Kula	2.5	$84.22	$ 210.55
Lower Kula	2.5 to 5	$84.22	$ 210.55 to $ 421.10

1/ Based on $0.11 per kilowatt hour; however, 99% of the estimated power cost is for the operation of the high service pumps. (Approximately $8,400 is used for the operation of the plant.)

2/ Based on a 10 mgd plant operating 365 days per year.

3/ If all of the cost factors were used as reasonable estimates, with the exception of using a factor of only 1% of the power cost for operation of the treatment plants, then it can be assumed that the cost for treating 1 million gallons would be $84.22.

Another way of looking at the cost for operating the treatment plants is to divide the maximum daily operating cost by the population, with the following results:

Kula: $\frac{\$\ 631.65}{3{,}864 \text{ people}}$ = \$0.16/person/day

Makawao: $\frac{\$1{,}010.64}{8{,}994 \text{ people}}$ = \$0.12/person/day

The average is approximately \$0.14/person/day for the Makawao-Kula water service area.

IV. REASONS FOR PROCEEDING

The construction of the treatment plants should permit the Department of Water Supply to meet the State and Federal drinking water standards and will, therefore, be a positive beneficial impact. No significant adverse environmental impacts will result from the implementation of the projects.

Alternative means of meeting the objectives are being evaluated, and additional studies on water source development, distribution and uses are being undertaken by the Department of Water Supply to formulate future policies and directions.

Adverse Environmental Effects

5

SECTION 5

PROBABLE ADVERSE ENVIRONMENTAL IMPACTS WHICH CANNOT BE AVOIDED

This section summarizes adverse impacts presented in the previous section entitled, "Anticipated Environmental Impacts and Mitigative Measures to Minimize Adverse Impacts," and presents mitigative measures to minimize these impacts.

I. PRIMARY IMPACTS OF THE PROPOSED PROJECT

A. Short-term Adverse Impacts

Short-term adverse impacts anticipated because of the proposed projects are construction-related and, therefore, are of short duration and should last only for the construction period. Although dust will be generated during site preparation, this should not create significant problems since it can be effectively mitigated in the field through water sprinkling. Exhaust emissions from construction equipment should be quite insignificant and should not adversely affect ambient air quality.

Because of the distance of the sites from nearby streams, erosion and sedimentation into stream waters during construction are not expected.

During construction increased noise would probably be the most prominent compared to other anticipated impacts. This will be temporary, and the contractor will ensure that mufflers on equipment are in proper operating condition and will limit the hours of construction.

Vegetation which will be cleared and grubbed from the sites is not rare or endangered.

Although native species of birds may visit the Piiholo and Olinda areas, the sites themselves do not provide suitable habitat. Fauna may relocate to adjacent areas during construction but could return upon completion of the projects. Construction activities should not affect existing aquatic biota.

There are no significant archaeological features on the sites.

Solid waste generated during construction should not be a significant problem and will be regularly transported to the nearest landfill. Liquid waste will be disposed in portable chemical toilets so this is not anticipated to be a significant problem.

Transport of construction equipment should be done during hours of lightest traffic to minimize disruption to existing traffic patterns. If necessary, police assistance during this phase may be requested. Construction worker traffic should not adversely affect existing traffic.

B. Long-term Adverse Impacts

1. Air Quality:

Although exhaust emissions may be generated by plant equipment, these emissions are insignificant and should not adversely affect ambient air quality.

Chlorine tanks will be used on-site and a chlorine detection system will be provided should leakage occur. Mandatory gas masks will also be provided. Potential for leakage is minimal and significant adverse impacts are not expected.

2. Water Quality:

Operations of the proposed water treatment plants will not affect water quality of reservoirs and water sources. Backwash water generated by the plants will be impounded and/or disposed of through acceptable methods. Solids in the backwash water will be primarily silt and clay from the water source and a gelatinous alum floc from the coagulation process. The amount of solids generated will vary seasonally. Since the alum floc is basically inert, adverse impacts are not expected.

3. Noise:

Noise above ambient levels will be generated primarily by the air compressors, backwash and chemical pumps which will be about 85 dB adjacent to the equipment. Approximately 70-75 feet away, the noise level will be about 70-75 dB. Since sensitive wildlife habitats and rare and endangered species are not expected in the areas, adverse impacts to such species are not anticipated.

4. Biological:

Two of the sites are already being utilized for a purpose similar to that being proposed (Makawao and Olinda) and potential displacement of fauna on the sites is expected to be minimal. The flora species at the sites are primarily common exotic species found throughout the State and do not provide sensitive wildlife habitat.

The proposed projects are not expected to draw more water from the existing water sources.

II. SECONDARY ADVERSE IMPACTS OF THE PROPOSED PROJECT

The proposed projects will preclude other land uses. Since the proposed actions are similar to the existing uses, adverse impacts to and conflicts with the sites and surrounding land uses are not expected for the Makawao and Upper Kula sites. The Lower Kula site will remove approximately 3 to 4 acres of land from pasture. This will not adversely affect cattle production.

III. REASONS FOR PROCEEDING

Adverse impacts anticipated because of the proposed projects have been evaluated and are considered minimal, particularly compared to the benefits which will accrue as a result of the proposed action. These adverse impacts can be mitigated and should not constitute significant adverse impacts.

The proposed treatment plants must be built to comply with the State and Federal safe drinking water regulations.

Alternatives

6

SECTION 6

ALTERNATIVES

I. NO ACTION

The alternative of no action will result in the continued violation of the State and Federal safe drinking water regulations. The no action alternative is unacceptable, and immediate action is required by the Department of Water Supply to start construction of treatment plants and facilities and to initiate programs to treat the Maoawao-Kula water sources.

II. ALTERNATIVE SITES

The location of a water treatment plant is determined by basic engineering design concepts, and therefore the placement of a plant is limited. Some basic design criteria are a plant must be located near the water source, and no plants should be sited where existing major facilities are not being used to their full potential.

The Makawao and Upper Kula water treatment plants are located between the major water sources and not where any major facilities already exist; they are not located within major urban centers; and it would be difficult to locate the treatment facilities at alternative sites which will meet the criteria established by the basic engineering concepts.

Providing a costly all weather access road to the Lower Kula plant, if it were to be located near the major water storage facility, required that an alternative site be found. Therefore, the only alternative site evaluated was for the Lower Kula water treatment plant mainly due to having existing filters at the other two sites.

III. ALTERNATIVE WATER TREATMENT PLANT DESIGN

The various unit water treatment processes currently available have been described in Appendix E of this report. Please refer to this appendix for a general discussion of water treatment processes.

Presently, engineering consultants have evaluated various treatment processes and have preliminarily recommended specific processes. The final selections will depend on the evaluation by the Department of Water Supply.

Generally, the unit processes may differ, but the overall environmental impacts are similar.

IV. ALTERNATIVE METHOD OF COMPLIANCE

An alternative method of compliance with the safe drinking water regulations is being evaluated for the Kula water system by the Department of Water Supply.

This method proposes building the water treatment plant at Kamole Weir and pumping a greater amount of treated water to the Upper and Lower Kula water systems. This will enable dilution of the more turbid Kula water by the treated Makawao water. The expected results would be in compliance to the existing standards.

This alternative (and other methods) must be evaluated economically and monitored to ensure that there is no potential risk to the health and safety of the consumer. The cost/benefit of the pumping method is currently being studied, and the results are expected within six months. Determination of compliance to standards will require a monitoring program and testing over a period of time. The details have not been worked out and finalized. However, it is expected that this alternative will be worked out within a few months between the Department of Water Supply and the Department of Health.

V. <u>ALTERNATIVE PHASING OF THE TREATMENT PLANTS</u>

The Makawao Water Treatment Plant will be constructed first, and depending on the final results of the alternative methods of compliance, the need for the Kula water treatment plants will be evaluated.

Commitment of Resources

7

SECTION 7

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

State and County funds, labor, construction and building materials, and fuel will be committed to the projects. Additional maintenance and operation funds and manpower will be required.

The construction of the treatment plants and/or alternative methods to comply with the drinking water regulations will have a positive long-term impact on the public health of the people in the Makawao-Kula water service area.

Since no significant impacts on biological resources are anticipated, no loss of long-term productivity is expected. However, the water consumer will receive long-term benefits.

Short Term Uses - Long Term Productivity

8

SECTION 8

THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The proposed actions have considered the environmental characteristics of the areas and the water requirements of the up-country area. The proposed actions, if implemented, should enable treatment of the existing water to meet Federal and State regulations for potable water, water necessary to meet current requirements for the Makawao-Kula water service area.

The amount of water to be treated from each of the water sources will not be greater than what is presently being drawn.

The proposed actions will not involve trade-offs between short-term losses, foreclose future options, narrow the range of beneficial use of the environment, nor pose long-term risks to health and safety. In fact, the treatment plants will treat existing water from the existing water sources to a level higher than what is presently being distributed to the water service area.

Government Polices to Offset Adverse Effects

9

SECTION 9

AN INDICATION OF WHAT OTHER INTERESTS AND CONSIDERATIONS OF GOVERNMENTAL POLICIES ARE THOUGHT TO OFF-SET THE ADVERSE ENVIRONMENTAL EFFECTS OF THE PROPOSED ACTION

As indicated in Section 4, Anticipated Environmental Impacts and Mitigative Measures to Minimize Adverse Impacts, most of the adverse impacts are short-term and related to construction activities.

The Department of Water Supply is presently undertaking additional studies to determine alternative methods to meet current requirements. Also, studies are underway to analyze other water sources, separate distribution systems for agricultural and domestic uses, and water needs for the service area.

Approvals

10

SECTION 10

LIST OF NECESSARY APPROVALS

State of Hawaii

Department of Health approval by authorities: 1/

- HRS Chapter 340E, Safe Drinking Water Act, Act 84, 1976 Legislature
- Public Health Regulations, Chapter 49, Potable Water Systems

County of Maui

Department of Public Works 1/

1. Building permits through Land Use and Codes Administration.
2. Grading permits by authority of the Permanent Ordinances of the County of Maui, Ordinance No. 639 (Bill No. 39, 1969).
3. Grubbing permits by authority of the Permanent Ordinances of the County of Maui, Ordinance No. 639 (Bill No. 39, 1969).
4. Sludge Disposal permit.

Maui County Planning Commission

- Land Use Commission Special Use Permits in accordance to Act 221.

Other

Hawaiian Telephone Company - approval of plans.

Maui Electric Company - approval of plans.

1/ Source: State of Hawaii, Department of Planning and Economic Development. 1977. Hawaii Coastal Zone Management Program, A Register of Government Permits Required for Development.

Organizations and Persons Consulted

11

SECTION 11

ORGANIZATIONS AND PERSONS CONSULTED

NOTICE OF PREPARATION COMMENTS AND RESPONSES

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FEDERAL GOVERNMENT	
U.S. Department of the Interior, Fish and Wildlife Service	11-3
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Office of Environmental Quality Control, Office of the Govenor	
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County Council	
Department of Public Works	
Mayor's Office	

OTHER ORGANIZATIONS

Brock and Associates	11-11
Alexander and Baldwin, Inc.	11-12 11-13
Hawaiian Commercial & Sugar Co.	11-14
Mr. Douglas Meller	11-15
Mr. Gordon E. Stellway	11-16
Mr. Arman Ashley	11-17
Kula Community Association	
Kula Farmers Coop	
Kula Farmers Exchange	
Kula Kai Community Association	
Kula PTA	
Makawao Community Association	
Maui Economic Opportunity, Inc.	
Pukalani Community Association	
Haleakala Ranch	
Maui Land and Pineapple Co., Ltd.	
Ulupalakua Ranch	

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

January 12, 1982

Mr. John I. Ford
Acting Project Leader
Office of Environmental Services
U. S. Department of the Interior
Fish and Wildlife Service
P. O. Box 50167
Honolulu, Hawaii 96750

Dear Mr. Ford:

SUBJECT: Environmental Assessment of the Makawao-Kula Water Treatment Plants

Thank you for your review and comments regarding the preparation notice and the environmental assessment for the above project.

The appendices of the report will be published with the environmental impact statement. The potential yield of the water of the Makawao Water System is up to 16 mgd.

The description of the existing environment by inclusion and identification of aquatic fauna within the affected ditch and stream system is beyond the scope of this environmental impact statement. The major purpose of the proposed water treatment plants is to bring the existing water supply into conformance with the safe drinking water regulations.

Future water requirements and necessary water sources and storage facilities to meet their requirements is a separate issue to be studied at a later time.

Your comments will be incorporated into the environmental impact statement and a copy of the statement will be sent to you for your review.

Sincerely,

William S. Haines

William S. Haines, Director

"By Water All Things Find Life"

United States Department of the Interior
FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P O BOX 50167
HONOLULU, HAWAII 96850

RECEIVED 1981 OCT 30 AM 10 50
DEPT. OF WATER SUPPLY
COUNTY OF MAUI

Room 6307
OCT 28 1981

Mr. William S. Haines
Director, Department of Water Supply
County of Maui
P.O. Box 1109
Wailuku, Maui, Hawaii 96793

Re: Makawao-Kula Water Treatment Plant Environmental Assessment, Maui, Hawaii

Dear Mr. Haines:

We have reviewed the subject Environmental Assessment and Environmental Impact Statement (EIS) Preparation Notice, and offer the following comments.

The extensive appendices in the subject report provide a great deal of useful information and should also be published with the EIS. We suggest expanding Appendix B by inclusion of a table describing the potential safe yield of water for the Makawao Water System. The description of the existing environment may be enhanced by identifying aquatic fauna within the affected ditch and stream systems. A list of observed aquatic species should be included in Appendix F.

Although the subject report does not specifically state that the proposed water treatment facility will be drawing additional water from existing ditch systems or streams, the material presented in the appendices suggests that this is the case. The EIS should state clearly what additional water is to be drawn from existing sources and what, if any, effects this withdrawal will have on instream uses.

To the best of our knowledge, there are no endangered or threatened species, listed, proposed, or candidate for listing in the proposed project area.

We appreciate this opportunity to comment. We look forward to reviewing the EIS for the proposed water treatment plant.

Sincerely yours,

John I. Ford

John I. Ford
Acting Project Leader
Office of Environmental Services

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

cc/ Eng 10/30/81

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

January 13, 1982

Mr. Kisuk Cheung, Chief
Engineering Division
Department of the Army
U.S. Army Engineer District,
Honolulu
Fort Shafter, Hawaii 96858

Dear Mr. Cheung:

Subject: ENVIRONMENTAL ASSESSMENT OF THE
<u>MAKAWAO-KULA WATER TREATMENT PLANTS</u>

Thank you for reviewing the environmental assessment and preparation notice for the Makawao-Kula Water Treatment Plants.

Your comment that a Department of the Army permit is not required for the proposed project will be included in the environmental impact statement. Also, the fact that the proposed treatment plant sites are situated in Zone C areas, or areas of minimal flooding, according to the Federal Insurance Administration's Flood Insurance Study of the island of Maui, will be included in the environmental impact statement.

A copy of the environmental impact statement will be sent to you for your further review.

Sincerely,

William S. Haines

William S. Haines, Director
Department of Water Supply

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DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT SHAFTER, HAWAII 96858

PODED-PV

4 November 1981

Mr. William S. Haines, Director
Department of Water Supply
County of Maui
PO Box 1109
Wailuku, Maui, HI 96793

Dear Mr. Haines:

Thank you for the opportunity to review the Makawao-Kula Water Treatment Plant Environmental Assessment, sent to us on 22 October 1981. Based on our review, we provide the following comments.

a. A Department of the Army permit is not required for this project.

b. The three proposed water treatment plant sites for the Maui County Department of Water Supply are situated in Zone C areas, or areas of minimal flooding according to the Federal Insurance Administration's Flood Insurance Study for the island of Maui. Zone C areas are not considered special flood hazard areas by the study.

The US Army Corps of Engineers will be happy to review the draft Environmental Impact Statement when it becomes available.

Sincerely,

Kisuk Cheung

KISUK CHEUNG
Chief, Engineering Division

cc: Haines -/1/81

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

January 13, 1982

Mr. Ernest Robello, Jr.
District Conservationist
Soil Conservation Service
U.S. Department of Agriculture
217 Federal Building
Wailuku, Maui, Hawaii 96793

Dear Mr. Robello:

Subject: ENVIRONMENTAL ASSESSMENT OF THE MAKAWAO-KULA WATER TREATMENT PLANTS

Thank you for reviewing the environmental assessment for the Makawao-Kula Water Treatment Plants.

Your letter will be included in the environmental impact statement and a copy of the EIS will be sent to you for your review.

Sincerely,

William S. Haines

William S. Haines, Director
Department of Water Supply

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United States Department of Agriculture — Soil Conservation Service

217 Federal Building
Wailuku, HI 96793

November 19, 1981

Mr. William S. Haines, Director
Department of Water Supply
County of Maui
P. O. Box 1109
Wailuku, HI 96793

Dear Mr. Haines:

Subject: Makawao-Kula Water Treatment Plant Environmental Assessment

We have reviewed the above-mentioned environmental impact statement preparation notice as you requested and have no comments to make at this time.

When the draft environmental impact statement is finished, please send it to me at the following address:

217 Federal Building
Wailuku, HI 96793

Thank you for the opportunity to review this notice.

Sincerely,

Ernest Robello, Jr.

ERNEST ROBELLO, JR.
District Conservationist

cc: Jack P. Kanalz
State Conservationist
SCS, Honolulu, HI

The Soil Conservation Service is an agency of the Department of Agriculture

SCS-AS-1
10 79

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. BOX 3378
HONOLULU, HAWAII 96801

Carl
file

GEORGE A. L. YUEN
DIRECTOR OF HEALTH

JOHN F. CHALMERS, M.D.
DEPUTY DIRECTOR OF HEALTH

HENRY N. THOMPSON, M.A.
DEPUTY DIRECTOR OF HEALTH

MELVIN K. KOIZUMI
DEPUTY DIRECTOR OF HEALTH

ABELINA MADRID SHAW, M.A., J.D.
DEPUTY DIRECTOR OF HEALTH

In reply, please refer to:
File: EPHS-SS

November 13, 1981

Mr. William S. Haines, Director
Department of Water Supply
County of Maui
P. O. Box 1109
Wailuku, Maui 96793

Dear Mr. Haines:

Subject: Request for Comments on Environmental Assessment for Makawao-Kula Water Treatment Plant

Thank you for allowing us to review and comment on the subject environmental assessment. Please be informed that we do not have any objections to this project.

We realize that the statements are general in nature due to preliminary plans being the sole source of discussion. We, therefore, reserve the right to impose future environmental restrictions on the project at the time final plans are submitted to this office for review.

Sincerely,

Brian J. J. Choy

for MELVIN K. KOIZUMI
Deputy Director for
Environmental Health

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

January 13, 1982

Mr. Melvin K. Koizumi
State of Hawaii
Department of Health
P. O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Koizumi:

Subject: ENVIRONMENTAL ASSESSMENT OF THE MAKAWAO-KULA WATER TREATMENT PLANTS

Thank you for reviewing the environmental assessment and preparation notice for the Makawao-Kula Water Treatment Plants.

Your letter will be made part of the environmental impact statement and a copy of the EIS will be sent to you for your further review.

Sincerely,

William S. Haines

William S. Haines, Director
Department of Water Supply

"By Water All Things Find Life"

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

GEORGE R. ARIYOSHI, Governor
HIDETO KONO, Director
FRANK SKRIVANEK, Deputy Director

Kamamalu Building, 250 South King St., Honolulu, Hawaii • Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

November 25, 1981

Ref. No. 3933

Mr. William S. Haines
Director
Department of Water Supply
County of Maui
P.O. Box 1109
Wailuku, Maui, Hawaii 96793

Dear Mr. Haines:

Subject: Makawao-Kula Water Treatment Plant Environmental Impact Statement Preparation Notice

Thank you for giving us the opportunity to comment on the above subject.

In our judgement, the Environmental Impact Statement should discuss the projects' impacts on the agricultural uses of the sites and the projects' energy consumption for pumping and treatment. The data presented in the Notice were not sufficient for us to make any specific comments at this time. In this regard, we would appreciate being involved in the review of the Draft EIS.

Sincerely,

Frank Skrivanek
for Hideto Kono

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

RECEIVED JAN 26 1982

January 15, 1982

Mr. Hideto Kono, Director
Department of Planning and
Economic Development
P. O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Kono:

SUBJECT: Makawao-Kula Water Treatment Plants

Thank you for your valuable comments on the Preparation Notice.

Your letter will be incorporated into the Environmental Impact Statement, and we offer the following responses to your comments.

The impacts on agricultural uses of the land where the water treatment plants will be constructed will be minor. The Upper Kula Treatment Plant will be constructed adjacent to existing storage facilities and will not impact agricultural activities.

The Makawao Treatment Plant will be sited adjacent to the existing treatment and storage facility and will not have a significant impact to the surrounding pineapple fields. The site for the Lower Kula Treatment Plant has been tentatively sited in a pasture and will leave a very minor impact by removal of approximately two acres of pasture land.

The data on the amount of energy required for pumping, and the operation of the Upper and Lower Kula plants will be available when the engineering reports are completed. The estimated annual energy requirements for the Makawao Treatment Plant for treatment plant operations is 67,511 KWH, and 6,850,335 KWH for the high service pumps.

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The estimated power consumption and cost for the operation of the high service pumps accounts for about 99 percent of the total electrical requirements of the Makawao Treatment Plant.

We look forward to receiving your timely comments on the Draft Environmental Impact Statement.

Sincerely,

William S. Haines
Director, Department of Water Supply

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

January 13, 1982

Mr. Edwin T. Okubo
Housing Coordinator
Department of Human Concerns
County of Maui
200 South High Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Okubo:

Subject: <u>ENVIRONMENTAL ASSESSMENT OF THE MAKAWAO-KULA WATER TREATMENT PLANTS</u>

Thank you for reviewing the environmental assessment and preparation notice for the Makawao-Kula Water Treatment Plants.

Your letter will be made part of the environmental impact statement and a copy of the EIS will be sent to you for your further review.

Sincerely,

William S. Haines

William S. Haines, Director
Department of Water Supply

"By Water All Things Find Life"

HANNIBAL TAVARES
Mayor

VELMA M. SANTOS
Director of Human Concerns
Phone 244-7805

County of Maui
DEPARTMENT OF HUMAN CONCERNS
200 South High Street
Wailuku, Maui, Hawaii 96793

1981 NOV 24 AM 8 08

November 23, 1981

Mr. William Haines, Director
Department of Water Supply
County of Maui
Wailuku, Maui, Hawaii

Dear Mr. Haines:

Subject: Makawao-Kula Water Treatment Plant Environmental Assessment

We have reviewed the environmental assessment for the subject project and have no comment to offer. We are returning the environmental assessment report for your use.

Very truly yours,

Edwin T. Okubo

EDWIN T. OKUBO
Housing Coordinator

ETO:ec

Encl.

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

January 13, 1982

Mr. Tosh Ishikawa
Planning Director
Planning Department
County of Maui
200 South High Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Ishikawa:

Subject: ENVIRONMENTAL ASSESSMENT OF THE MAKAWAO-KULA WATER TREATMENT PLANTS

Your letter dated October 28, 1981 will be incorporated into the environmental impact statement and a copy of this statement will be sent to you for your review.

Sincerely,

William S. Haines

William S. Haines, Director
Department of Water Supply

"By Water All Things Find Life"

COUNTY OF MAUI [illegible]
PLANNING DEPARTMENT
200 S. HIGH STREET
WAILUKU, MAUI, HAWAII 96793

HANNIBAL TAVARES
Mayor

TOSH ISHIKAWA
Planning Director

CHRISTOPHER L. HART
Deputy Planning Director

October 28, 1981

Mr. William S. Haines, Director
Department of Water Supply
County of Maui
Wailuku, Maui, HI 96793

Dear Mr. Haines:

Re: Makawao-Kula Water Treatment Plant
Environmental Assessment

This acknowledges receipt of above referenced document.

Please be advised that we will reserve our comments pending a review of the Environmental Impact Statement report.

Please contact my office, should you have any questions.

Very truly yours,

TOSH ISHIKAWA
Planning Director

TI:hk

cc: Chris Hart

To	Fr		Date & Initial
		DIRECTOR	
		DEPUTY	
		SECRETARY	
		CHIEF ENGR	10/28
		FISCAL	WF
		FIELD CHIEF	

☐ HANDLE ☐ SEE ME
☐ FILE ☐ RETURN
☐ CIRCULATE ☐ ROUTING
☐ COMMENT ☐ EXPEDITE
☐ [illegible]

cc: Engr.

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

January 13, 1982

Ms. Julie R. Abramson, Planner
Brock and Associates
48 Market Street
Wailuku, Maui, Hawaii 96793

Dear Ms. Abramson:

Subject: ENVIRONMENTAL ASSESSMENT OF THE MAKAWAO-KULA WATER TREATMENT PLANTS

Thank you for your letter dated October 28, 1981 requesting that Brock and Associates be a consulted party in the preparation of the environmental impact statement.

Your letter will be incorporated into the environmental impact statement and a copy of the EIS will be available at the Wailuku Regional Library for your review.

Sincerely,

William S. Haines
William S. Haines, Director
Department of Water Supply

"By Water All Things Find Life"

BROCK AND ASSOCIATES
SURVEYORS · ENGINEERS · RECEIVED

1981 OCT 30 AM 10 50

DEPT. OF WATER SUPPLY
COUNTY OF MAUI

FILE: 7000
October 28, 1981
Reply to Wailuku Office

Mr. William S. Haines, Director
Department of Water Supply
County of Maui
P. O. Box 1109
Wailuku, Hawaii
96793

Re: EIS - Makawao-Kula Water Treatment Plants, as announced in the EQC Bulletin dated October 23, 1981

Dear Mr. Haines:

As an engineering firm whose sphere of work includes water treatment facilities, we are interested in the above-referenced project.

Please list Brock and Associates as a consulted party in the preparation of the environmental impact statement.

Thank you.

Very truly yours,
BROCK AND ASSOCIATES

Julie R. Abramson
Julie R. Abramson
Planner

:cma

cc Eng 10/30/81

A&B

ALEXANDER & BALDWIN, INC.

RICHARD H. COX
Vice President

October 30, 1981

RECEIVED
1981 NOV 5 FRI 1 00
DEPT. OF WATER SUPPLY
COUNTY OF MAUI

1181.23
11/5
WT.

Mr. William S. Haines, Director
Department of Water Supply
County of Maui
P. O. Box 1109
Wailuku, Hawaii 96793

Dear Mr. Haines:

I would appreciate being consulted on the EIS for the Hakawao-Kula Water Treatment Plants, Hakawao and Kula, Maui as shown in the attached Environmental Quality Commission Bulletin No. 20.

Thank you very much.

Sincerely,

RHC

Richard H. Cox

RHC:dh
Attachment

cc. Haines 11/6

822 BISHOP STREET • P.O. BOX 3440 • HONOLULU, HAWAII • TELEPHONE (808) 525 6670 • TELEGRAPH ALEXBALD

cc Haines

EQC BULLETIN

GEORGE R. ARIYOSHI
Governor

ENVIRONMENTAL QUALITY COMMISSION
550 HALEKAUWILA ST., ROOM 301, HONOLULU, HAWAII 96813 PH: (808) 548-6915

Volume VII | October 23, 1981 | No. 20

REGISTER OF CHAPTER 343, HRS DOCUMENTS

EIS PREPARATION NOTICES

The following proposed actions have been determined to require environmental impact statements. Anyone can be consulted in the preparation of the EIS's by writing to the listed contacts. 30 days are allowed for requests to be a consulted party.

KAHAUALE'A GEOTHERMAL PROJECT, PUNA DISTRICT, HAWAII, The Trustees of the Estate of James Campbell in Coordination with the True/Mid-Pacific Geothermal Venture/Dept. of Land and Natural Resources

The objective of the proposed project is to develop the geothermal resources within Kahauale'a. An EIS is required in support of a Conservation District Use Application (CDUA) and a Geothermal Mining Lease Application by The Trustees of the Estate of James Campbell, fee owner and prospective geothermal mining lessee of the land of Kahauale'a and adjacent Campbell Estate property. The initial objectives of this project are to prove the existence of a geothermal resource, its characteristics, and whether it can be economically produced from the area of discovery and marketed. Subsequent exploration and development, in parallel with market development, will help determine the extent of the producible resource underlying Kahauale'a, the rate of development and whether the planned scope of the project can be realized. The project is located in the Puna District of the Big Island, TMK:1-1-01, Parcel 1 and 1-2-08, Parcel 1. The Kahauale'a ahupua'a is adjacent to the Hawaii Volcanoes National Park and extends downslope from the Volcano to the ocean shoreline by Queen's bath near Kalapana.

Contact: Campbell Estate
Public Affairs Office
828 Fort Street Mall, Suite 500
Honolulu, Hawaii 96813
Telephone: 536-1961

Deadline: November 22, 1981.

HAKAWAO-KULA WATER TREATMENT PLANTS, HAKAWAO AND KULA, MAUI, County of Maui, Dept. of Water Supply

The Department of Water Supply, County of Maui, proposes the construction of three water treatment plants for the Makawao and Kula water systems, to meet the requirements mandated by the Federal Safe Drinking Water Act. The treatment plant sites will be located near the Kamole Weir (Wailoa Forebay), and Olinda and Piiholo reservoirs. The plant near Kamole Weir will primarily serve the Makawao service area and provide water to the Kula service area during drought conditions; the plant near Olinda Reservoir will primarily serve the Upper Kula service area; and the plant near Piiholo Reservoir will serve the Lower Kula service area. The proposed water treatment facilities will utilize various types and combinations of treatment units to achieve the desired water quality. The selection of these unit processes depends upon the type and amount of contaminants in the water, as determined by pilot testing.

Contact: Mr. William S. Haines, Director
Department of Water Supply
County of Maui
P.O. Box 1109
Wailuku, Hawaii 96793
Telephone: (808) 244-7835

Deadline: November 22, 1981.

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

January 13, 1982

Mr. Richard H. Cox
Vice President
Alexander & Baldwin, Inc.
822 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Cox:

Subject: ENVIRONMENTAL ASSESSMENT OF THE MAKAWAO-KULA WATER TREATMENT PLANTS

Think you for your letter dated October 30, 1981 requesting that you be a consulted party on the environmental impact statement for the above project.

Your letter will be incorporated into the environmental impact statement and a copy of the environmental impact statement will be sent to you for your review.

Sincerely,

William S. Haines

Williams S. Haines, Director
Department of Water Supply

"By Water All Things Find Life."

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

January 13, 1982

Mr. Philip F. Conrad
General Manager
Hawaiian Commercial & Sugar Company
Division of Alexander and Baldwin, Inc.
Puunene, Maui, Hawaii 96784

Dear Mr. Conrad:

Subject: ENVIRONMENTAL ASSESSMENT OF THE MAKAWAO-KULA WATER TREATMENT PLANTS

Thank you for reviewing the Makawao-Kula Water Treatment Plants environmental assessment and preparation notice. When the environmental impact statement is prepared, your letter dated November 4, 1981, will be included as part of the environmental impact statement.

Sincerely,

William S. Haines

William S. Haines, Director
Department of Water Supply

"By Water All Things Find Life"

ALEXANDER & BALDWIN INC.
HONOLULU · SAN FRANCISCO

TELEGRAPHIC ADDRESS
"COMMERCIAL"

HAWAIIAN COMMERCIAL & SUGAR COMPANY
A DIVISION OF ALEXANDER & BALDWIN, INC.
PUUNENE, MAUI, HAWAII 96784

November 4, 1981

Mr. William S. Haines, Director
Department of Water Supply
County of Maui
P. O. Box 1109
Wailuku, Maui, HI 96793

Dear Mr. Haines:

Subject: Makawao-Kula Water Treatment Plant Environmental Assessment

We have reviewed the above document and have no comments to make.

Yours truly,

P. F. Conrad

Philip F. Conrad
General Manager

PFC:ec

cc Hames 11/6/81

A DIVISION OF ALEXANDER & BALDWIN, INC. A&B

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

January 12, 1982

Mr. Douglas Meller
1450 Aala Street, No. 1201
Honolulu, Hawaii 96817

Dear Mr. Meller:

SUBJECT: Environmental Assessment of the Makawao-Kula <u>Water Treatment Plants</u>

Your letter dated November 4, 1981 will be incorporated into the environmental impact statement, and a copy of the environmental impact statement will be sent to you for your review. The major purpose of the proposed water treatment plants is to meet existing requirements mandated by the Federal Safe Drinking Water Act, and the treatment plants have been designed to conform with these requirements.

We thank you for your comments regarding the material to be included in the environmental impact statement. As previously mentioned, this environmental impact statement deals specifically with treatment plants designed to meet current Federal and State requirements.

Future water requirements and necessary water sources and storage facilities to meet their requirements is a separate issue to be studied at a later time.

Sincerely,

William S. Haines, Director

"By Water All Things Find Life."

1450 Aala St. No. 1201
Honolulu, Hawaii 96817

November 4, 1981

Mr. William S. Haines, Director
Department of Water Supply
County of Maui
P.O. Box 1109
Wailuku, Maui, Hawaii 96793

Re: Makawao-Kula Water Treatment Plants EIS

Dear Mr. Haines:

I would like to be a consulted party for the forthcoming EIS for the proposed Makawao-Kula Water Treatment Plants. Please send me a copy of the EIS Preparation Notice. Also, I would appreciate being sent a copy of the draft EIS when it becomes available and a copy of the final EIS when it becomes available.

In my opinion, the primary focus of the EIS should be to address the cumulative impact of all planned Maui County projects which directly or indirectly entail removal of water from EMI's top ditch. The EIS also should address the natural variability of water flow in EMI's top ditch and the ability of EMI to manipulate flow in its top ditch by use of reservoirs. As we are both well aware, the future viability of the largest sugar company in Hawaii, i.e. HC & S, is dependent upon an adequate supply of water from EMI's ditches.

Relevant information which needs to be included in the Makawao-Kula Water Treatment Plants EIS is as follows:

1. a table showing the natural probability of different daily levels of flow in EMI's top ditch
2. a table showing actual monthly flow in EMI's top ditch since the 1920s
3. a table showing the capacity of reservoirs which can be used to manipulate flow in EMI's top ditch
4. an estimate of the highest daily flow which could have been sustainable in EMI's top ditch throughout the 1971-1977 drought - - assuming that EMI used its reservoirs to the maximum extent possible to "smooth out" natural variability in water supply
5. a projection of future County population and an estimate of the share of projected population that will need to be serviced with water from EMI's top ditch
6. a table estimating the cumulative impact of existing and planned Maui County facilities on water supply in EMI's top ditch
7. an estimate of HC & S sugar cane acreage that has no other source of irrigation water than EMI's top ditch
8. an estimate of how much water is required from EMI's top ditch to service HC & S mills.

If you have any questions about these points, then please feel free to contact me. Give my regards to the Mayor. I look forward to reading your EIS.

Sincerely,

Douglas Meller

cc:DEQC

RECEIVED
1981 NOV 12 PM 1 28
DEPT. OF WATER SUPPLY
COUNTY OF MAUI

11/7

Aloha,

Please add my name to the list of concerned citizens who wish to be consulted about the upcoming EIS for upcountry water treatment plants.

Sincerely,

GORDON E. STELLWAY Gordon E. Stellway
PO BOX 114
KULA, HI 96790

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

January 13, 1982

Mr. Gordon E. Stellway
Post Office Box 114
Kula, Maui, Hawaii 96790

Dear Mr. Stellway:

Subject: ENVIRONMENTAL ASSESSMENT OF THE MAKAWAO-KULA WATER TREATMENT PLANTS

Thank you for your letter dated November 7, 1981.

Your letter will be incorporated into the environmental impact statement for the Makawao-Kula Water Treatment Plants, and a copy of the environmental impact statement will be available at the Wailuku Regional Library for your review.

Sincerely,

William S. Haines

William S. Haines, Director
Department of Water Supply

"By Water All Things Find Life"

Upcountry water: Environment input is sought

Canada finalizes

American youth hustled

Planning vote reported wrong

&S employee's misspelled

William Haines Water Dept
Box 1109, Wailuku
96793

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

January 13, 1982

Mr. Arman Ashley
2129 Vineyard Boulevard
Wailuku, Maui, Hawaii 96793

Dear Mr. Ashley:

Subject: ENVIRONMENTAL ASSESSMENT OF THE MAKAWAO-KULA WATER TREATMENT PLANTS

Your note regarding the above project will be incorporated into the environmental impact statement. The environmental assessment will be available for your review at the Wailuku Regional Library.

Sincerely,

William S. Haines, Director
Department of Water Supply

"By Water All Things Find Life"

EIS
Review Period

12

SECTION 12

ORGANIZATIONS AND PERSONS CONSULTED AND/OR SENT A COPY TO DURING THE EIS REVIEW PROCESS

The following list includes organizations to where the EIS was sent during the review period. Those with an asterisk are those from whom comments were received. The comments and their responses follow this list.

FEDERAL	PAGE
* Department of Agriculture, Soil Conservation Service	12-3
* Department of the Interior, Fish and Wildlife Service	12-4
* Department of the Interior, Geological Survey	12-5
* U.S. Army Corps of Engineers	12-6
U.S. Coast Guard	
* U.S. Navy	12-7
* U.S. Army	12-8
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State Historic Preservation Officer	
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* Department of Fire Control	12-34

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* Department of Human Concerns
Economic Development Agency 12-35
Planning Department
Police Department
* Department of Public Works
* Department of Parks and Recreation 12-36
12-37

OTHER

Makawao Community Association
Kula PTA
Kula Kai Community Association
Pukalani Community Association
Maui Economic Opportunity, Inc.
Hawaiian Commercial & Sugar Company
Haleakala Ranch
Maui Land and Pineapple Company, Ltd.
* Ulupalakua Ranch
Alexander & Baldwin, Inc. 12-39
Maui Farmers Exchange
Maui Vegetables Growers
Paul Otani
Masaru Urudomo
Glen Otani
George Tanji
Ron Terry
Ray Nishiyama
Maui County Farm Bureau
Seabury Hall
* Life of the Land
* Douglas Meller 12-41
American Lung Association 12-45
Brock & Associates
Jeanette Foster
Hamilton Library, Hawaiian Collection
State Archives
LRB Library
DPED Library
Kahului Library
Lahaina Library
Makawao Library
State Main Branch (Library)
Kaimuki Library
Kaneohe Library
Pearl Ridge Regional Library
Hilo Regional Library
Waiuku Regional Library
Lihue Regional Library
Honolulu Star Bulletin
Advertiser
Maui News

cc: Mr. Haines

United States Department of Agriculture

Soil Conservation Service

P. O. Box 50004
Honolulu, Hawaii
96850

April 23, 1982

Office of Environmental Quality Control
550 Halekauwila St., Room 301
Honolulu, HI 96813

Gentlemen:

Subject: Environmental Impact Statement for Hakawao-Kula Water Treatment Plants, Makawao and Kula, Maui, HI

We have no comments to make on the subject environmental impact statement.

Thank you for the opportunity to review this document.

Sincerely,

Francis C. H. Lum

FRANCIS C. H. LUM
State Conservationist

cc:
Mr. William S. Haines, Director
Department of Water Supply
County of Maui
P. O. Box 1109
Wailuku, HI 96793

12-3

SCS-AS-
10-79

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

April 30, 1982

United States Department of Agriculture
Soil Conservation Service
P. O. Box 50004
Honolulu, Hawaii 96850

ATTENTION: Mr. Francis C. H. Lum

Gentlemen:

RE: Draft Environmental Impact Statement for Hakawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

We acknowledge receipt and hereby wish to thank you for your response on the subject matter.

Sincerely,

William S. Haines

William S. Haines
Director

GO:RC:ab

cc: Programs Manager

"By Water All Things Find Life"

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P.O. BOX 50167
HONOLULU HAWAII 96850

IN REPLY REFER TO:
ES
Room 6307
APR 26 1982

Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Re: Makawao-Kula Water Treatment Plants, Makawao and Kula, Maui

Gentlemen:

We have reviewed the subject Environmental Impact Statement (EIS) and have no additional comments to offer at this time.

Sincerely yours,

Lucian Kramer

Lucian Kramer
Acting Project Leader
Office of Environmental Services

cc: NMFS - WPPO
HDF&G
EPA, San Francisco

12-4

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

April 30, 1982

United States Department
of the Interior
Fish and Wildlife Service
300 Ala Moana Blvd.
P. O. Box 50167
Honolulu, Hawaii 96850

ATTENTION: Mr. Lucian Kramer

Gentlemen:

RE: Draft Environmental Impact Statement for Makawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

We acknowledge receipt and hereby wish to thank you for your response on the subject matter.

Sincerely,

William S. Haines

William S. Haines
Director

GO:RC:ab

cc: Programs Manager

"By Water All Things Find Life"

United States Department of the Interior

GEOLOGICAL SURVEY
Water Resources Division
P.O. Box 50166
Honolulu, Hawaii 96850

April 23, 1982

Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Gentlemen:

We have reviewed the Environmental Impact Statement (EIS) for Makawao-Kula Treatment Plants, and have no significant comments to offer. Generally, we agree with Maui County's plans to provide safe drinking water for the Makawao-Kula area. However, we recommend the treated water be used only for domestic needs. Water for agricultural use does not require the type of treatment outlined in the EIS.

We are returning the EIS for your use.

Sincerely,

Benjamin L. Jones
District Chief

cc: Mr. William S. Haines, Director
Department of Water Supply
County of Maui
P.O. Box 1109
Wailuku, Hawaii 96793

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

June 9, 1982

Mr. Benjamin L. Jones
District Chief
U. S. Department of the Interior
Geological Survey
Water Resources Division
P. O. Box 50166
Honolulu, Hawaii 96850

Dear Mr. Jones:

RE: Draft Environmental Impact Statement for Makawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

We acknowledge receipt and hereby wish to thank you for your response on the subject matter.

Sincerely,

William S. Haines
Director

GO:RC:ab

cc: OEQC
EQC
Programs Manager
Environment Impact Study Corp. (Honolulu & Maui)

"By Water All Things Find Life"

PODED-PV

4 May 1982

Mr. Charles G. Clark, Acting Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

Dear Mr. Clark:

Thank you for the opportunity to review the Environmental Impact Statement (EIS) for the Makawao-Kula Water Treatment Plants, sent to us on 5 April 1982. Since there are no changes in site locations for the proposed water treatment facilities for the three areas, the comments provided in our letter of 4 November 1981 (page 11-4 of the Final EIS) remain valid, and we have no additional comments.

Sincerely,

"signed"

KISUK CHEUNG
Chief, Engineering Division

CF:
Mr. William S. Haines, Director
Department of Water Supply
PO Box 1109, County of Maui
Wailuku, HI 96793

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 14, 1982

Department of the Army
Corp of Engineers
Pacific Ocean Division
Fort Shafter, Hawaii 96858

ATTENTION: PODED - PV

Gentlemen:

RE: Draft Environmental Impact Statement for Makawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

We acknowledge receipt and hereby wish to thank you for your response on the subject matter.

Sincerely,

William S. Haines
Director

GO:RC:ab

cc: Programs Manager

"By Water All Things Find Life"

HEADQUARTERS
NAVAL BASE PEARL HARBOR
BOX 110
PEARL HARBOR, HAWAII 96860

IN REPLY REFER TO:
002B:WKL:jal
Ser 814
12 APR 1982

Environmental Quality Commission
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Gentlemen:

Environmental Impact Statement
Makawao and Kula Water Treatment Plants, Maui, Hawaii

The EIS for the Makawao and Kula Water Treatment Plants, Maui has been reviewed and the Navy has no comments to offer. As this command has no further use for the EIS, the EIS is being returned.

Thank you for the opportunity to review the EIS.

Sincerely,

M. M. DALLAM
CAPTAIN, CEC, U. S. NAVY
FACILITIES ENGINEER
BY DIRECTION OF THE COMMANDER

Enclosure

Copy to:
DIR DEPT Water Supply, Maui

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 3, 1982

Headquarters
Naval Base Pearl Harbor
Box 110
Pearl Harbor, Hawaii 96860

ATTENTION: M. M. Dallam, Captain, CEC, U. S. Navy
Facilities Engineer by direction of the Commander

Gentlemen:

RE: Draft Environmental Impact Statement for Makawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

We acknowledge receipt and hereby wish to thank you for your response on the subject matter.

Sincerely,

William S. Haines

William S. Haines
Director

GO:RC:ab

cc: Programs Manager

"By Water All Things Find Life"

DEPARTMENT OF THE ARMY
HEADQUARTERS UNITED STATES ARMY SUPPORT COMMAND, HAWAII
FORT SHAFTER, HAWAII 96858

APZV-EHV

19 APR 1982

Office of Environmental Quality Control
State of Hawaii
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Gentlemen.

The Environmental Impact Statement (EIS) for the Makawao and Kula Water Treatment Plants, Maui, Hawaii has been reviewed and we have no comments to offer. There are no Army installations or activities in the vicinity of the proposed project.

Thank you for the opportunity to comment on the EIS.

Sincerely,

Original signed by
ADOLPH A. HIGHT
COL, EN
Director of Engineering and Housing

Copy Furnished:
Mr. William S. Haines, Director
Department of Water Supply
County of Maui
P.O. Box 1109
Wailuku, Hawaii 96793

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 3, 1982

Department of the Army
Headquarters United States Army
Support Command, Hawaii
Fort Shafter, Hawaii 96858

ATTENTION: Adolph A. Hight, Col., EN
Director of Engineering and Housing

Gentlemen:

RE: Draft Environmental Impact Statement for Makawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

We acknowledge receipt and hereby wish to thank you for your response on the subject matter.

Sincerely,

William S. Haines
William S. Haines
Director

GO:RC:ab

cc: Programs Manager

"By Water All Things Find Life"

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 15TH AIR BASE WING (PACAF)
HICKAM AIR FORCE BASE, HAWAII 96853

REPLY TO ATTN OF: DEEV (Mr Yamada, 449-1831)

22 APR 1982

SUBJECT: Environmental Impact Statement for the Hakawao-Kula Water Treatment Plants

TO: Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

1. This office has reviewed the subject EIS and has no comment relative to the proposed project.

2. We greatly appreciate your cooperative efforts in keeping the Air Force apprised of your project and thank you for the opportunity to review the document.

WILLIAM T. MORIOKA
Chief, Engrg & Envmtl Plng Div
Directorate of Civil Engineering

Cy to: Mr William S. Haines, Director
Department of Water Supply
County of Maui
P. O. Box 1109
Wailuku, Maui, HI 96793

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 3, 1982

Department of the Air Force
Headquarters 15th Air Base Wing (PACAF)
Hickam Air Force Base, Hawaii 96853

ATTENTION: Mr. William T. Morioka, Chief

Gentlemen:

RE: Draft Environmental Impact Statement for Hakawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

We acknowledge receipt and hereby wish to thank you for your response on the subject matter.

Sincerely,

William S. Haines
Director

CO:RC:ab

cc: Programs Manager

"By Water All Things Find Life"

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES

LETTER NO. (P)1341.2

APR 12 1982

Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Gentlemen:

Subject: EIS for Makawao-Kula Water Treatment Plants Makawao and Kula, Maui

We have reviewed the environmental impact statement for the Makawao-Kula Water Treatment Plants and have no comments to offer.

Very truly yours,

HIDEO MURAKAMI
State Comptroller

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 3, 1982

Department of Accounting and General Services
State of Hawaii
Division of Public Works
P. O. Box 119
Honolulu, Hawaii 96810

ATTENTION: Mr. Hideo Murakami, State Comptroller

Gentlemen:

RE: Draft Environmental Impact Statement for Makawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

We acknowledge receipt and hereby wish to thank you for your response on the subject matter.

Sincerely,

William S. Haines
Director

GO:RC:ab

cc: Programs Manager

"By Water All Things Find Life"

December 7, 1981

MEMORANDUM

To: Mr. William S. Haines, Director
Department of Water Supply

Subject: Makawao-Kula Water Treatment Plant
Environmental Assessment

The Department of Agriculture has reviewed the subject assessment and offers the following comments.

We were unable to find a description of the amount of land area involved in the construction of each of the proposed water treatment plants. We also believe that the Environmental Impact Statement should address whether there are any agricultural activities in the immediate vicinity of the proposed projects and any impact the projects might have on those activities.

Thank you for the opportunity to comment.

Jack K. Suwa

JACK K. SUWA
Chairman, Board of Agriculture

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

April 8, 1982

Mr. Jack K. Suwa, Chairman
Board of Agriculture
Department of Agriculture
State of Hawaii
P. O. Box 22159
Honolulu, Hawaii 96822

Dear Mr. Suwa:

SUBJECT: Makawao-Kula Water Treatment Plants

Thank you for your comments and we offer the following response.

The exact amount of land required for the construction of the proposed water treatment plants has not been determined. However, we have estimated the following: Makawao, 2½ acres; Lower Kula, 4 acres; and Upper Kula, 12 acres.

The existing agricultural land use surrounding the proposed treatment sites are: Pineapple for the Makawao site, and pasture for both the Upper and Lower Kula sites.

Sincerely,

William S. Haines

William S. Haines
Director

GO:RC:ab

"By Water All Things Find Life"

GEORGE R. ARIYOSHI
GOVERNOR

JACK K. SUWA
CHAIRMAN, BOARD OF AGRICULTURE

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
P.O. Box 22159
Honolulu, Hawaii 96822

May 4, 1982

MEMORANDUM

To: Office of Environmental Quality Control

Subject: Environmental Impact Statement
Makawao-Kula Water Treatment Plants

The Department of Agriculture has reviewed the subject Environmental Impact Statement. We note that our comments of December 7, 1981, on the Preparation Notice were not included in the EIS. Since we did not find these points addressed, our comments remain the same (copy attached).

Thank you for the opportunity to comment.

Jack K. Suwa
JACK K. SUWA
Chairman, Board of Agriculture

Encl.

"Support Hawaiian Agricultural Products"

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 24, 1982

Mr. Jack K. Suwa
Chairman, Board of Agriculture
Department of Agriculture
State of Hawaii
P.O. Box 22159
Honolulu, Hawaii 96822

Dear Mr. Suwa:

SUBJECT: MAKAWAO-KULA WATER TREATMENT PLANT

Thank you for your comments and we offer the following response.

Comment:

"We were unable to find a description of the land area involved in the construction of each of the proposed water treatment plants. We also believe that the Environmental Impact Statement should address whether there are any agricultural activities in the immediate vicinity of the proposed projects and any impacts the projects may have on these activities."

Response:

The exact amount of land required for the construction of the proposed water treatment plant has not been determined. However, we have estimated the following: Makawao, 2.5 acres; Lower Kula, 4 acres; and Upper Kula, 12 acres.

Existing agricultural land used surrounding the proposed treatment sites are: pineapple for the Makawao site, and pasture for both Upper and Lower Kula sites. The proposed water treatment plants will not have significant adverse impact on the existing agricultural activities.

Sincerely,

Gordon Okazaki
for William S. Haines, Director
Department of Water Supply

MTM:tah

"By Water All Things Find Life"

State of Hawaii
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 Diamond Head Road
Honolulu, Hawaii 96816

17 APR 1982

HIENG

Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Gentlemen:

Hakawao-Kula Water Treatment Plants

Thank you for providing us the opportunity to review the proposed project, "Makawao-Kula Water Treatment Plants" Environmental Impact Statement.

We have completed our review and have no comments to offer at this time.

Yours truly,

JERRY M. MATSUDA
Captain, HANG
Contr & Engr Officer

cc: Dept of Water Supply/Maui
Env Quality Comm w/EIS

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 3, 1982

State of Hawaii
Department of Defense
Office of the Adjutant General
3949 Diamond Head Road
Honolulu, Hawaii 96816

ATTENTION: Mr. Jerry M. Matsuda, Captain

Gentlemen:

RE: Draft Environmental Impact Statement for Hakawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

We acknowledge receipt and hereby wish to thank you for your response on the subject matter.

Sincerely,

William S. Haines

William S. Haines
Director

CO:RC:ab

cc: Programs Manager

"By Water All Things Find Life."

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. BOX 3378
HONOLULU, HAWAII 96801

GEORGE A. L. YUEN
DIRECTOR OF HEALTH

JOHN F. CHALMERS, M.D.
DEPUTY DIRECTOR OF HEALTH

HENRY N. THOMPSON, M.A.
DEPUTY DIRECTOR OF HEALTH

MELVIN K. KOIZUMI
DEPUTY DIRECTOR OF HEALTH

ADELINA MADRID SHAW, M.A., J.D.
DEPUTY DIRECTOR OF HEALTH

In reply, please refer to:
File: EPHSD-SS

May 10, 1982

MEMORANDUM

To: Office of Environmental Quality Control

From: Deputy Director for Environmental Health

Subject: Environmental Impact Statement (EIS) for Makawao-Kula Water Treatment Plants

Thank you for allowing us to review and comment on the subject EIS. On the basis that the project will comply with all applicable Public Health Regulations, please be informed that we do not have any objections to this project.

The Department of Health administers Chapter 20 of Title 11, Administrative Rules pertaining to potable water systems. The basic intent of Chapter 20, Title 11 is to see that all public water systems in the state of Hawaii serve water which meets the minimum requirements known as primary drinking water standards. The Department is therefore vitally concerned that the proposed treatment plants enable the Kula and Makawao water systems to meet all the primary drinking water standards. Of particular note are those contaminants for which the systems have in the past exceeded the maximum contaminant levels (mcl's) those being for microbiological and turbidity contaminants. Of additional concern are any contaminants which the Department of Water Supply has any indication may pose problems in compliance. Specifically, the information contained on page C-6 shows that the Makawao water system exceeded mcl's for both total trihalomethanes and corrosivity in background testing performed by the design engineers.

All references to Chapter 49, Public Health Regulations (PHR) should be amended to read Chapter 20, Title 11, Administrative Rules which is the current state regulation for potable water systems. Chapter 49, PHR was revised as Chapter 20, Title 11, Administrative Rules during 1981. They were adopted and made effective December 26, 1981. It should be noted that in their present form, there is no standard for sodium. The proposed 20 parts per million mcl was reduced to a requirement to monitor for sodium.

Finally, the Department would like to recommend that if waste disposal is to consist of holding the waste material for transport to suitable landfill facilities, that the holding and transport facilities be in compliance with all applicable regulations.

If you should have any questions, please contact the Drinking Water Program at 548-2235.

We realize that the statements are general in nature due to preliminary plans being the sole source of discussion. We, therefore, reserve the right to impose future environmental restrictions on the project at the time final plans are submitted to this office for review.

For Brian J. J. Choy
MELVIN K. KOIZUMI

BC:kk

cc: Department of Water Supply
County of Maui

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 28, 1982

Mr. Melvin K. Koizumi
Deputy Director of Health
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Koizumi:

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT OF MAKAWAO-KULA WATER TREATMENT PLANTS

Thank you for your valuable comments and we offer the following responses:

Comment:

"On the basis that the project will comply with all applicable Public Health Regulations, please be informed that we do not have any objections to this project."

Response:

We concur that the water treatment plants are necessary to meet the public health requirements.

Comment:

The Department of Health administers Chapter 20 of Title 11, Administrative Rules pertaining to potable water systems. The basic intent of Chapter 20, Title 11, is to meet all public water systems in the State of Hawaii serve water which meets the minimum requirements known as primary drinking water standards. The department is therefore, vitally concerned that all proposed treatment plants enable the Kula and Makawao Water Systems to meet all of the primary drinking water standards. Of particular note of those contaminants for which the system have in the past exceeded the maximum contaminant levels mcl's those being of microbiological and turbidity contaminants. Of additional concern are any contaminants which the Department of Water Supply has any indications may pose problems

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in compliance. Specifically, the information contained on page C-6 shows that the Makawao water system exceeded mcl's for both total trihalomethanes and corrosivity in background testing performed by the design engineers."

Response:

We agree that microbiological and turbidity contaminants have been exceeded in the past. The treatment plants have been designed to remove the microbiological and turbidity contaminants. Also, the treatment plant's design will make provisions for the treatment of corrosive water and it is believed that the treatment process will remove the precursor for trihalomethane formation and thereby eliminate the formation of trihalomethane during chlorination process.

Comment:

"All references to Chapter 49, Public Health Regulations (PHR) should be amended to read Chapter 20, Title 11 Administrative Rules which is the current state regulation for potable water systems. Chapter 49, PHR was revised as Chapter 20, Title 11 Administrative Rules during 1981. They were adopted and made effective December 26, 1981. It should be noted that in their present form, there is no standard for sodium. The proposed 20 parts per million mcl was reduced to a requirement to monitor for sodium."

Response:

Please be advised that the environmental impact statement was prepared prior to the effective date of the amendment of Chapter 49, Public Health Regulations. We will amend the revised environmental impact statement to reflect the changes effective December 26, 1981.

Comment:

"Finally, the Department would like to recommend that if waste disposal is to consist of holding the waste material for transport to suitable landfill facilities, that the holding and transport facilities be in compliance with all applicable regulations."

<u>Response:</u>

The Department of Water Supply will comply with all applicable regulations regarding the waste disposal from the water treatment plants.

Sincerely,

William S. Baines

William S. Baines, Director
Department of Water Supply

HTM:tah

MAY 6 1982

Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Gentlemen:

We appreciate the opportunity to review the Environmental Impact Statement (EIS) for the water treatment plants planned for the Makawao, Lower Kula, and Upper Kula water systems. We recognize the need for improving the water quality of these three systems.

The Makawao plant will be on County-owned land located in an Agricultural District. We, therefore, have no comments to offer except to voice our support of this project.

The upper Kula plant will be on State land in an Agricultural District. A formal request should be made to this department by the County of Maui for the use contemplated.

The site for the Lower Kula plant has not yet been fixed. The preferred site is privately owned. It is in an Agricultural District; the first alternative site is also in an Agricultural District. Both sites are easily accessed.

The second alternative site for the Lower Kula plant would be located in a Resource Subzone of the Conservation District. It would be adjacent to the present Piiholo Reservoir in the Makawao Forest Reserve. This site was completely cleared and altered during the construction of the 50 million gallon reservoir in 1966, and now is composed of leveled fill material that is uniformly sterile. It supports a few species of hardy weeds and grasses. Construction work would not threaten any native ecosystems. It would, however, create a significant traffic load upon the forestry road within Makawao Forest Reserve. The movement of large trucks and equipment over this at times steep dirt road could cause serious surface wear that would require substantial maintenance at the end of the project. The EIS does not address this problem.

Sincerely,

Susumu Ono

SUSUMU ONO, Chairman
Board of Land and Natural Resources

cc: Mr. S. Haines
Dept. of Water Supply
County of Maui

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 28, 1982

Mr. Susumu Ono, Chairman
Board of Land and Natural Resources
Department of Land and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

SUBJECT: MAKAWAO-KULA WATER TREATMENT PLANTS EIS

Thank you for your comments and we offer the following responses:

Comment:

"We appreciate the opportunity to review the Environmental Impact Statement (EIS) for the water treatment plants planned for the Makawao, Lower Kula, and Upper Kula water systems. We recognize the need for improving the water quality of these three systems."

"The Makawao plant will be on County-owned land located in an Agricultural District. We, therefore, have no comments to offer except to voice our support of this project."

Response:

We appreciate your support of the proposed Makawao Water Treatment Plant.

Comment:

"The upper Kula plant will be on State land in an Agricultural District. A formal request should be made to this department by the County of Maui for the use contemplated."

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Response:

Please be assured that a formal request for the use of the Agricultural-designated State land in upper Kula will be submitted to your department.

Comment:

"The site for the Lower Kula plant has not yet been fixed. The preferred site is privately owned. It is in an Agricultural District; the first alternative site is also in an Agricultural Distict. Both sites are easily accessed."

"The second alternative site for the Lower Kula plant would be located in a Resource Subzone of the Conservation District. It would be adjacent to the present Piiholo Reservoir in the Makawao Forest Reserve. This site was completely cleared and altered during the construction of the 50 million gallon reservoir in 1966, and now is composed of leveled fill material that is uniformly sterile. It supports a few species of hardy weeds and grasses. Construction work would not threaten any native ecosystems. It would, however, create a significant traffic load upon the forestry road within Makawao Forest Reserve. The movement of large trucks and equipment over this at times steep dirt road could cause serious surface wear that would require substantial maintenance at the end of the project. The EIS does not address this problem."

Response:

At this time the sites located in the Agricultural District remain the preferred alternatives for the Lower Kula Water Treatment Plant. In the event that the site located in the Conservation District is used, an all-weather road will be constructed to provide safe access and to mitigate soil erosion generated by the movement of large trucks over a poorly maintained road.

Sincerely,

William S. Haines

William S. Haines, Director
Department of Water Supply

MTM:tah

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

May 6, 1982

COPY

Ref. No. 4740

Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Attention: Mr. Melvin Koizumi

Dear Mr. Koizumi:

Subject: Makawao-Kula Water Treatment Plants EIS - Makawao and Kula, Maui

We have reviewed the referenced Environmental Impact Statement and found that our concerns with the EIS Preparation Notice for the above subject have been adequately answered in the EIS.

Thank you for the opportunity to comment on the proposed project.

Sincerely,

Hideto Kono

cc: Mr. William S. Haines
Maui Department of Water Supply

12-19

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

June 10, 1982

Mr. Hideto Kono
Department of Planning and Economic Development
P. O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Kono:

RE: Draft Environmental Impact Statement for Makawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

We acknowledge receipt and hereby wish to thank you for your response on the subject matter.

Sincerely,

William S. Haines

William S. Haines
Director

GO:RC:ab

cc: OEQC
EQC
Programs Manager
Environment Impact Study Corp. (Honolulu & Maui offices)

"By Water All Things Find Life"

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO:
STP 8.8178

April 8, 1982

MEMORANDUM

TO: Office of Environmental Quality Control

FROM: Director of Transportation

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT
MAKAWAO-KULA WATER TREATMENT PLANTS

Thank you for the opportunity to comment on the subject EIS.

We have no substantive comments to offer to improve your statement.

Ryokichi Higashionna

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 3, 1982

State of Hawaii
Department of Transportation
869 Punchbowl
Honolulu, Hawaii 96813

ATTENTION: Mr. Ryokichi Higashionna, Director

Gentlemen:

RE: Draft Environmental Impact Statement for Makawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

We acknowledge receipt and hereby wish to thank you for your response on the subject matter.

Sincerely,

William S. Haines
Director

GO:RC:ab

cc: Programs Manager

"By Water All Things Find Life"

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

Charles G. Clark

May 6, 1982

William Haines, Director
Department of Water Supply
County of Maui
P.O. Box 1109
Wailuku, Maui, Hawaii 96793

SUBJECT: Environmental Impact Statement for Makawao-Kula Water Treatment Plants

Dear Mr. Haines:

We have reviewed the subject statement and offer the following comments for your consideration:

1. A summary sheet should be included pursuant to EIS Regulation 1:42 a.

2. Page 2-31

   The EIS indicates that no rare or endangered species have been seen or are potentially present. The statement should be documented.

3. Section 3 of the EIS should discuss the State Environmental Policy Act, Chapter 344, Hawaii Revised Statutes and how it relates to the proposed project.

4. Page 4-4

   The EIS states that each treatment plant will have chlorine tanks. The size of the tanks and how much chlorine gas stored should be discussed. In addition, there should be discussion regarding the potential impact of chlorine gas leaking and how it may affect the surrounding area and population, if any.

5. The EIS is unclear whether additional water will be pumped for usage. Because water pumpage is part of the entire

action as page E-1 states, "Source treatment and distribution are the main components of a water system," the entire system and any future increase in water usage should be discussed. More importantly, such discussion is required in EIS Regulation 1:12 which states,

> A group of action shall be treated as a single action when: (1) the component actions are phases or increments of a larger total undertaking; (2) an individual project is a necessary precedent for a larger project, (3) an individual project represents a commitment to a larger project; or (4) the actions in questions are essentially the same and a single Statement will adequately address the impacts of any single action.

Therefore, we recommend that any plans of increased pumping or developing new sources should be identified in the EIS and discussed.

6. The EIS should also discuss the impacts of pumpage during drought conditions.

7. It is important to recognize the value of the consultation process in developing an acceptable EIS. We refer you to Doug Meller's comment in the consultation section which remains unanswered and should require an adequate response.

8. The issue of the potential increase of pumpage and its effect on the aquatic fauna should be discussed.

9. The archaeologist conducting the survey should be identified.

We trust that these comments will be helpful to you in preparing the revised statement. An attached sheet lists the commenting parties. We thank you for the opportunity to comment on the document. We look forward to the revised statement.

Sincerely,

Charles G. Clark

Attachments

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 28, 1982

Mr. Charles G. Clark
Director
Office of Environmental Quality Control
State of Hawaii
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Mr. Clark:

SUBJECT: MAKAWAO-KULA WATER TREATMENT PLANTS ENVIRONMENTAL IMPACT STATEMENT

Thank you for reviewing the environmental impact statement and we offer the following responses to your comments:

Comment:

"A summary sheet should be included pursuant to EIS Regulations 1:42A.

Response:

A summary sheet will be included in the revised EIS.

Comment:

Page 2-31, "EIS indicates that no rare or endangered species have been seen or are potentially present. This statement should be documented."

Response:

A documentation may be found in Appendix F of the EIS statement.

Comment:

"Section 3 of the EIS should discuss the State Environmental Policy Act, Chapter 344, Hawaii Revised Statutes and how it relates to the proposed project."

"By Water All Things Find Life"

Response:

Section 3 will discuss the State Environmental Policy Act, Chapter 344, HRS.

Comment:

Page 4-4

"The EIS states the each treatment plant will have chlorine tanks. The size of the tanks and how much chlorine gas storage should be discussed. In addition, there should be discussion regarding the potential impact of chlorine gas leaking and how it may affect the surrounding area and population, if any."

Response:

The size of the chlorine tanks and amount of chlorine gas to be stored has not been exactly determined at this time. The final construction plans for the water treatment plants will evaluate the amount and size of the chlorine gas cylinders. Preliminary design considerations being evaluated include one ton chlorine gas cylinders to be used at the treatment plants.

The potential of a major chlorine gas leak is remote. As a cautionary measure, all treatment plants will have a chlorine detection system and an alarm system will be activated in the events of minor chlorine leaks. We presently use chlorine gas as a disinfectant and have not had a major chlorine leak. In the remote and highly improbable situation where there should be a major chlorine leak, there would be no residences and/or urban centers which will be impacted by a major chlorine gas leak.

Comment:

"The EIS is unclear whether additional water will be pumped for usage. Because water pumpage is part of the entire section as page E-1 states, "source treatment and distribution are the main components of our water system," the entire system and any future increase in water usage should be discussed. More importantly, such discussion is required in EIS Regulations 1:12 which states:

> A group of actions shall be treated as a single action when: "(1) component actions are phases or increments of a larger total undertaking; (2) an individual project is a necessary precedent for a larger project; (3) an individual project represents a commitment to a larger project; or (4) the actions in questions are essentially the same and a single Statement will adequately address the impacts of any single action.

Therefore, we recommend that any plans of increased pumping or developing new sources should be identified in the EIS and discussed."

Response:

The Makawao-Kula Water Treatment Plant EIS specifically deals with the construction of water treatment plants to treat the existing Makawao-Kula water system. The water treatment plant is being proposed to meet current state and federal potable drinking water requirements. The treatment plants are specific actions to be taken within an existing water system, and will not entail the drawing of additional water.

Page E-1 of Appendix E was a general introductory statement to set up a framework for the discussion of water treatment plant design. Furthermore, Appendix E serves as a general discussion on water treatment plants for the public.

We believe that we are in conformance with EIS Regulations 1:12 in that the proposed three water treatment plants have been discussed in a single EIS document; there are no necessary precedents for a larger project; that the individual water treatment projects do not represent a commitment to a larger project; the three water treatment plants proposed are not phases or increments of a larger total undertaking; and, the three water treatment plants are essentially the same and that a single statement will adequately address the impacts of any single action.

Comment:

"The EIS should also discuss the impacts of pumpage during drought conditions."

Response:

The EIS did discuss the intergrated Makawao-Kula water system and the pumpage required to meet the water requirements during drought conditions. Additional information can be found in Appendix D of the EIS.

Comment:

"It is important to recognize the value of the consultation process in developing an acceptable EIS. We refer you to Doug Meller's comment in the consultation section which remains unanswered and should require an adequate response.

Response:

Our response to Mr. Meller and to you is that, the major purpose of the proposed water treatment plants is to meet existing requirements mandated by the Federal Safe Drinking Water Act and the treatment plants have been designed to conform with these requirements. This environmental impact study deals specifically with treatment plants designed to meet current state and federal requirements. Future water requirements and necessary water sources and storage facilities to meet their requirements is a separate issue to be studied at a later time. Once again, we must stress the fact that the treatment plants are designed to meet existing water needs. The amount of water which can be taken from Wailoa Ditch has been fixed at 16 mgd; the amount of water which will be obtained for the upper and lower water treatment plants has been determined by safe yield of the existing water sources.

Comment:

"The issue of the potential increase of pumpage and its affect on the aquatic fauna should be discussed."

Response:

Again, we reiterate the fact that the amount of water to be taken from the Wailoa Ditch is fixed at 16 mgd. The county will not exceed this amount. There are no flowing streams adjacent to the treatment plants which will be impacted by the water treatment plants. Please remember, that the water source for the treatment plants has been in existance for numerous years and we do not plan to increase the present draw.

Comment:

The archaeologists conducting the survey should be identified."

Response:

The archaeologist conducting the survey was Richard Bordner.

Sincerely,

William S. Haines

William S. Haines, Director
Department of Water Supply

MTM:tah

GEORGE R. ARIYOSHI
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF EDUCATION
P. O. BOX 2360
HONOLULU, HAWAII 96804

OFFICE OF THE SUPERINTENDENT

Dr. Donnis H. Thompson
SUPERINTENDENT

April 13, 1982

Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Gentlemen:

Subject: Environmental Impact Statement
Makawao-Kula Water Treatment Plants

We have reviewed the subject EIS and have no comments to offer at this time. We do, however, concur with the purpose for the water treatment plants.

Thank you for the opportunity to review the documents.

Sincerely,

Lloyd K. Migita

Donnis H. Thompson
Superintendent of Education

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 3, 1982

State of Hawaii
Department of Education
P. O. Box 2360
Honolulu, Hawaii 96804

ATTENTION: Mr. Donnis H. Thompson, Superintendent

Gentlemen:

RE: Draft Environmental Impact Statement for Hakawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

We acknowledge receipt and hereby wish to thank you for your response on the subject matter.

Sincerely,

William S. Haines
Director

GO:RC:ab

cc: Programs Manager

"By Water All Things Find Life"

:D
2 5 1982

STATE OF HAWAII
ENVIRONMENTAL QUALITY COMMISSION

April 2, 1982

Dear Reviewer:

Attached for your review is an Environmental Impact Statement (EIS) that was prepared pursuant to Chapter 343, Hawaii Revised Statutes and the Rules and Regulations of the Environmental Quality Commission:

Title: Makawao-Kula Water Treatment Plants

Location: Makawao and Kula, Maui

Classification: Agency Action

Your comments or acknowledgement of no comments on the EIS are welcomed. Please submit your reply to the accepting authority or approving agency:

Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Please send a copy of your reply to the proposing party:

Mr. William S. Haines, Director
Department of Water Supply
County of Maui
P.O. Box 1109
Wailuku, Hawaii 96793

Your comments must be received or postmarked by: May 8, 1982.

If you have no further use for this EIS, please return it to the Commission.

Thank you for your participation in the EIS process. 82:313

→ State Energy Division has no comments.

Edward J. Greaney
Chief, Conservation Branch

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

July 8, 1982

State Energy Division
250 S. King Street
Honolulu, Hawaii 96813

Gentlemen:

Re: DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR MAKAWAO-KULA WATER TREATMENT PLANTS, MAKAWAO AND KULA, MAUI

Your response of "no comments" was inadvertently sent to the Honolulu Board of Water Supply and was returned to us by the Office of Environmental Quality Control on June 22, 1982.

Thank you for your participation and response.

Sincerely,

William S. Haines, Director
Department of Water Supply

RC/ao

cc: Environmental Quality Commission
Office Environmental Quality Control
Programs Manager, Norman Saito Engineering Consultants, Inc.
Environmental Impact Study Corporation (Honolulu/Maui)

"By Water All Things Find Life."

University of Hawaii at Manoa

Water Resources Research Center
Holmes Hall 283 • 2540 Dole Street
Honolulu, Hawaii 96822

30 April 1982

Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Gentlemen:

Subject: EIS for the Makawao and Kula Water Treatment Plants, Maui, Hawaii, March 1982, County of Maui

We have reviewed the subject EIS and offer the following comment. As in sewage treatment plants, water treatment plants (WTP) need properly trained and certified operating personnel. Heretofore WTP operators have not been needed here; therefore, qualified personnel may be lacking locally. Also, legislative and institutional regulations may be needed to require properly qualified and registered operating personnel.

Thank you for the opportunity to comment. This material was reviewed by WRRC personnel.

Sincerely,

Edwin T. Murabayashi

Edwin T. Murabayashi
EIS Coordinator

LTH:ja

cc: H. Gee
Y.S. Fok
DPW, Maui County

AN EQUAL OPPORTUNITY EMPLOYER

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 28, 1982

Mr. Edwin T. Murabayashi
EIS Coordinator
Water Resources Research Center
University of Hawaii at Manoa
Holmes Hall 283
2540 Dole Street
Honolulu, Hawaii 96822

Dear Mr. Murabayashi:

SUBJECT: MAKAWAO-KULA WATER TREATMENT PLANTS

Thank you for your comments and we offer the following response:

Comment:

"We have reviewed the subject EIS and offer the following comment. As in sewage treatment plants, water treatment plants (WTP), need properly trained and certified operating personnel. Heretofore WTP operators have not been needed here; therefore, qualified personnel may be lacking locally. Also, legislative and institutional regulations may be needed to require properly qualified and registered operating personnel."

Response:

The Department of Water Supply is presently in the process of establishing positions through the civil service class for water treatment plant operators. The department has budgeted for the water treatment plant operators and for the training of the treatment plant operators. The treatment plants will be staffed by qualified operators.

Sincerely,

William S. Haines

William S. Haines, Director
Department of Water Supply

MTM:tah

"By Water All Things Find Life"

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

Office of the Director

May 7, 1982

RE:0352

Mr. Melvin Koizumi, Interim Director
Office of Environmental Quality Control
550 Halekauwila Street
Honolulu, Hawaii 96813

Dear Mr. Koizumi:

Draft Environmental Impact Statement
Makawao-Kula Water Treatment Plants
Makawao and Kula, Maui

The Environmental Center have reviewed the draft EIS for the proposed Makawao-Kula water treatment plants on the island of Maui. The comments, assessments and recommendations given hereinafter concerning this project have been prepared with the assistance of Sheila Conant, General Science; R. Alan Holt and Charles Lamoureux, Botany; David Peterson and Jacquelin Miller, Environmental Center. Personnel from the Water Resources Research Center have also been consulted.

Fauna

The discussion of existing fauna at each of the treatment plant sites in both Chapter 2 (page 2-29) and Appendix F is somewhat abbreviated. We recommend that further explanation be provided of the field reconnaissance methods used to assess the fauna of the area. In particular, it would be useful to give information as to when the field study was made (i.e. time of day), for what durations and on how many occasions.

The assessment given to adjacent areas (page 2-29) infers that avifauna and other animals in regions bordering the project are similar to those found at the treatment plant sites themselves. Once again, however, no mention is made of the methods used to arrive at such a conclusion. If field reconnaissance was performed in adjacent regions, the techniques and methodologies of these surveys should be included in the EIS.

The U.S. Fish and Wildlife Services (FWS) has in recent years done extensive surveys of avifauna of this and other regions of Maui. Although not published, the information developed is available to investigative projects of this nature. For that reason, we suggest that the FWS survey data be used in the preparation of the revised EIS and properly referenced.

We concur with Mr. John Ford's implication (letter from FWS to Maui Department of Water Supply, page 11-3) that the description of the existing environment would be enhanced through a survey of aquatic fauna near the proposed treatment plant sites.

Proper evaluation of potential impacts to possible threatened of endangered aquatic life cannot be made without a comprehensive study of all major fauna in the area.

Another concern to be addressed in this discussion of the existing environment is whether a minimum streamflow has been established at any of the project areas in the interest of preserving life forms dependent on the aquatic regime.

Because the fauna checklists of Appendix F include the category of species that are "likely present, or which would possibly visit the site," the following two birds are recommended for inclusion in the table prepared for the Olinda site and given on page F-17:

Scientifice Name	Common Name	Status
Drepanididae		
Psittirostrinae		
Maculata Newtoni	Maui Creeper	E
Drepanididae		
Vestiaria Coccinea	'Iiwi	E

Flora

Pages 2-28 and 2-29 include itemizations of existing plant forms and the vegetation zones in which the treatment plants are located. However, descriptions of the general vegetative characteristics of each area and given vegetation zones is also needed.

The noxious weed Clidemia hirta is reported as growing in Piihola Sites 1 and 2 (page F-6). Since Clidemia is such a pest, and since efforts are being made to prevent its establishment on Maui, we recommend that any plants discovered during this project be reported to the Maui office of the Division of Forestry and Wildlife, State Department of Land and Natural Resources. Furthermore, efforts should be made to avoid spreading Clidemia to other areas during construction. Perhaps the most viable means of avoiding difficulty is to eliminate the species from the sites before starting construction.

Treatment Plant Operation

The treatment of surface water for domestic consumption represents a virtually new activity for the Hawaiian Islands. Because several public water systems on Maui are supplied by surface sources, there is a strong possibility that areas other than Kula-Makawao will ultimately be required to construct treatment facilities. Accordingly, the need for qualified people to operate the treatment plants will also have to be addressed. With respect to this concern we raise the following questions:

1. Are "certified" or "licensed" operators of water treatment plants currently required by Hawaii law and/or regulations, and

2. Are certification courses currently offered in the State of Hawaii?

If such certification courses are considered necessary, has the use of the Maui Community College technical training program been considered? Such questions will ultimately need to be addressed by the Drinking Water Division of the Hawaii Department of Health, and should be considered during these initial phases of the proposed Makawao-Kula treatment programs.

Yours truly,

Doak C. Cox
Director

cc: Dept. of Water Supply ✓
Sheila Conant
R. Alan Holt
Charles Lamoureux
Water Resources Research Center
Jacquelin Miller
David Peterson

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 28, 1982

Dr. Doak C. Cox
Director
University of Hawaii at Manoa
Environmental Center
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Dear Dr. Cox:

SUBJECT: <u>ENVIRONMENTAL IMPACT STATEMENT FOR MAKAWAO-KULA WATER TREATMENT PLANTS</u>

Thank you for your comments and we offer the following responses.

Comment:

Fauna

The discussion of existing fauna at each of the treatment plant sites in Chapter 2 (page 2-29) and Appendix F is somewhat abbreviated. We recommend that further explanation be provided of the field reconnaissance methods used to assess the fauna of the area. In particular, it would be useful to give information as to when the field study was made (i.e., time of day), for what durations and on how many occasions.

Response:

For all of the three treatment sites approximately four hours were spent at the treatment site to conduct the fauna surveys and the surveys were conducted during mid-morning. These surveys were conducted in January 1981 and periodic checks were made at the treatment plant sites over a three or four month period as additional work was done examining the water quality or evaluating the sites.

"By Water All Things Find Life"

Comment:

"The assessment given to adjacent areas (page 2-29) infers that avifauna and other animals in regions bordering the projects are similar to those found in the treatment plant sites themselves. Once again, however, no mention is made of the methods used to arrive at such a conclusion. If a field reconnaissance was performed in adjacent regions, the techniques and methodologies of these surveys should be included in the EIS."

Response:

The fauna survey was conducted for the following area: Makawao, 2.5 acres; Lower Kula, 4 acres; and Upper Kula, 12 acres and approximately 500 feet surrounding the project site. The project areas have already been altered and the following conditions exist: Makawao, the site is located within an existing pineapple field; the Upper Kula site, contains a large reservoir and a filter unit within the 12 acres on site and the Lower Kula treatment site will be located within an existing pasture.

Comment:

The U.S. Fish and Wildlife Service (FWS) has in recent years done extensive surveys of avifauna of this and other regions of Maui. Although not published, the information developed is available to investigative projects of this nature. For that reason, we suggest that FWS survey data be used in the preparation of the revised EIS and properly referenced."

Response:

We will check with the U.S Fish and Wildlife Service and if the information is applicable we will include it in the revised EIS.

Comment:

"We concur with Mr. John Ford's implication (letter from FWS to Maui Department of Water Supply, page 11-3) that the description of the existing environment would be enhanced through a survey of aquatic fauna near the proposed treatment plant sites.

"Proper evaluation of potential impacts to possible threatened of endangered aquatic life cannot be made without a comprehensive study of all major fauna in the area."

Response:

The water source for the three treatment plants has been in existance for a very long time and there are no flowing streams located adjacent to the treatment plants. Furthermore, the description of existing environment by inclusion and identification of aquatic fauna within the effective ditch for Makawao system and stream system is beyond the scope of this environmental impact statement. The major purpose of the proposed water treatment plants is to bring existing water supply into conformance with a safe drinking water regulations.

Comment:

"Another concern to be addressed in this discussion of existing environment is whether existing streamflow has been established at any of the project areas in the interest of preserving life forms dependent on the aquatic regime."

Response:

The establishment of minimum streamflows at any of the project areas and the interest of preserving life forms dependent on aquatic regime is beyond the scope of the department's jurisdiction, and as we have previously mentioned, there are no flowing streams adjacent to the treatment plant sites.

Comment:

"Because of the fauna checklist of Appendix F include the category of species that are 'likely present, or which would possibly visit the site,' the following two birds are recommended for inclusion in the table prepared for the Olinda site and given on page F-17."

Response:

The department will include the two birds mentioned and include it into page F-17.

Comment:

Flora

"Page 2-28 and 2-29 include the itemization of existing plant forms and vegetation zones in which the treatment plants are located. However, description of the general vegetative characteristics of each area and given vegetative zones is also needed."

"The noxious weed Clidemia hirta is reported as growing in Piihola Sites 1 and 2 (page F-6). Since Clidemia is such a pest, and since efforts are being made to prevent its establishment on Maui, we recommend that any plants discovered during this project be reported to the Maui Office of the Division of Forestry and Wildlife, State Department of Land and Natural Resources. Furthermore, efforts should be made to avoid spreading Clidemia to other areas during construction. Perhaps the most viable means of avoiding difficulty is to eliminate the species from the sites before starting construction."

Response:

The department will consult with the Department of Land and Natural Resources, Maui Division of Forestry and Wildlife.

Comment:

Treatment Plant Operations

"The treatment of surface water for domestic consumption represents a virtually new activity for the Hawaiian Islands. Because several public water systems on Maui are supplied by surface sources, there is a strong possibility that areas other than Kula-Makawao will ultimately be required to construct treatment facilities. Accordingly, the need for qualified people to operate the treatment plants will also have to be addressed. With respect to this concern we raise the following questions."

1. Are certified or licensed operators of water treatment plants currently required by Hawaii law and/or regulations, and

2. Are certification courses is currently offered in the State of Hawaii

If such certification courses are considered necessary, has the use of the Maui Community College technical training program been considered? Such questions will ultimately need to be addressed by the Drinking Water Division of the Hawaii Department of Health, and should be considered during these initial phases of the proposed Makawao-Kula treatment program."

Response:

The Department of Water Supply is presently in the process of the establishment of positions through the civil service class for water treatment plant operators. The department has budgeted for these positions and for the training of the water treatment plant operators. All of the treatment plants proposed will be staffed by qualified operators.

Sincerely,

Walter S. Haines

William S. Haines, Director
Department of Water Supply

MTM:tah

University of Hawaii at Manoa

Department of Anthropology
Porteus Hall 346 • 2424 Maile Way
Honolulu, Hawaii 96822

May 6, 1982

Mr. William S. Haines, Director
Department of Water Supply
County of Maui
P. O. Box 1109
Wailuku, HI 96793

Dear Mr. Haines:

The attached letter from a member of our faculty, Professor Matthew Spriggs, is in response to the Environmental Impact Statement that was sent by your office to our Department for comment.

Sincerely,

Richard W. Lieban
Chairman

RWL:it

Attachment

AN EQUAL OPPORTUNITY EMPLOYER

University of Hawaii at Manoa

Department of Anthropology
Porteus Hall 346 • 2424 Maile Way
Honolulu, Hawaii 96822

May 6, 1982

Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

Dear Sir/Madam:

Re: Makawao--Kula Water Treatment Plants, <u>Environmental Impact Statement</u>

I have examined this EIS, in particular the Archaeological Reconnaissance appended as Appendix G. While the reconnaissance revealed no features of archaeological interest, I feel that a historical document search in relation to the project areas should have been undertaken to establish former land use at these sites--Mahele awards or whatever. Such information helps greatly in evaluating the likelihood of prehistoric remains having existed on the sites and subsequent impacts to them. I would hope that future Department of Water Supply EIS include such information.

Yours,

Matthew Spriggs
Assistant Professor

MS:it

AN EQUAL OPPORTUNITY EMPLOYER

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 24, 1982

Dr. Richard W. Lieban
Chairman
Department of Anthropology
University of Hawaii at Manoa
Proteus Hall 346
2424 Maile Way
Honolulu, Hawaii 96822

Dear Dr. Lieban:

SUBJECT: PROFESSOR MATTHEW SPRIGGS'S LETTER REGARDING THE MAKAWAO-KULA WATER TREATMENT PLANTS EIS

Thank you for your comments and we offer the following response:

Comment:

"I have examined this EIS, and particularly the Archaeological Reconnaissance Appended as Appendix G. While the reconnaissance revealed no features of archaeological interest, I feel that historical document research in relation to the project area should have been undertaken to establish former land uses at these sites - Mahele awards or whatever. Since information helps greatly in evaluating the likelihood of prehistoric remains having existed on the sites and subsequent impacts to them. I would hope that future Department of Water Supply EIS include such information."

Response:

Historical document research in relation to the proposed areas was not undertaken based on the archaeological reconnaissance conducted for the project sites. The probability of prehistoric use of the proposed water treatment sites was believed to be non-existant based on available information. We believe that such effort was not needed and the cost not justified to the tax payer.

"By Water All Things Find Life"

The Department of Water Supply's position on historical documentation for future EISs will be the following: if the project is located within an area containing known historical sites, a historical document search will be conducted.

Sincerely,

William S. Haines, Director
Department of Water Supply

MTH:tah

HANNIBAL TAVARES
MAYOR

COUNTY OF MAUI
DEPARTMENT OF FIRE CONTROL
WAILUKU, MAUI, HAWAII 96793

G. M. TAVARES
FIRE CHIEF

April 15, 1982

Office of Environmental Quality Control
County of Maui
200 High Street
Wailuku, Hawaii 96793

Gentlemen:

Re: EIS Makawao-Kula Water Treatment Plants

Our review of your draft regarding the above referenced project does not appear to present a fire potential and subsequently, do not anticipate any adverse impact caused by the project.

Respectfully submitted,

Gerald M. Tavares
Fire Chief

GMT:rm

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 3, 1982

Department of Fire Control
County of Maui
Wailuku, Hawaii 96793

ATTENTION: Mr. Gerald M. Tavares, Fire Chief

Gentlemen:

RE: Draft Environmental Impact Statement for Makawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

We acknowledge receipt and hereby wish to thank you for your response on the subject matter.

Sincerely,

William S. Haines
Director

GO:RC:ab

cc: Programs Manager

"By Water All Things Find Life"

April 12, 1982

Office of Environmental
Quality Control
550 Halekauwila Street
Honolulu, Hawaii 96813

Dear Sir:

Subject: Makawao-Kula Water
Treatment Plants

We have reviewed the draft Environmental Impact Statement for the Makawao-Kula Water Treatment Plants project, and have determined that the proposed program will not have any adverse impact on our planned projects and programs. Therefore, we have no objection to the proposed program.

Very truly yours,

VELMA M. SANTOS
Director of Human Concerns

cc: ✓Department of Water Supply, County of Maui
Housing Coordinator

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

April 30, 1982

Department of Human Concerns
County of Maui
Wailuku, Hawaii 96793

ATTENTION: Ms. Velma M Santos, Director

Gentlemen:

RE: Draft Environmental Impact Statement for Makawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

We acknowledge receipt and hereby wish to thank you for your response on the subject matter.

Sincerely,

William S. Haines
Director

GO:RC:ab

cc: Programs Manager

"By Water All Things Find Life"

HANNIBAL TAVARES
Mayor
RALPH HAYASHI
Director of Public Works
Lester Nakasato
Deputy Director of Public Works

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

DIVISIONS
Engineering
Highway Construction and Maintenance
Land Use and Codes Enforcement
Waste Management

April 21, 1982

Mr. William S. Haines, Director
Department of Water Supply
County of Maui
Wailuku, Maui, Hawaii 96793

Dear Mr. Haines:

Subject: Environmental Impact Statement
Makawao-Kula Water Treatment Plants

Thank you for the opportunity to review the subject statement. We have no comments to offer.

Very truly yours,

RALPH HAYASHI
Director of Public Works

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

April 30, 1982

Department of Public Works
County of Maui
Wailuku, Hawaii 96793

ATTENTION: Mr. Ralph Hayashi, Director

Gentlemen:

RE: Draft Environmental Impact Statement for Makawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

We acknowledge receipt and hereby wish to thank you for your response on the subject matter.

Sincerely,

William S. Haines
Director

GO:RC:ab

cc: Programs Manager

"By Water All Things Find Life."

HANNIBAL TAVARES
Mayor

NOLLE R. SMITH, JR.
Director

DEPARTMENT OF PARKS AND RECREATION
COUNTY OF MAUI
WAILUKU, MAUI, HAWAII 96793

April 21, 1982

Office of Environmental Quality Control
Room 301
550 Halekauwila Street
Honolulu, Hawaii 96813

Gentlemen:

Re: <u>Response to EIS - Makawao-Kula Water Treatment Plants</u>

This is to acknowledge receipt of the Environmental Impact Statement for the Makawao-Kula Water Treatment Plants.

The Department of Parks and Recreation expresses support for a water quality program and system that will serve these areas for many years to come.

Development of a facility of this type at the proposed sites should include serious consideration for:

a. Ongoing operation and long-range maintenance as a part of initial construction.

b. Noise, dust and visual pollution.

c. Buffer zone use.

While archeological and cultural disturbance is not considered a factor at the proposed sites, all of the areas are important recreationally, and any changes to current use should incorporate careful detail to providing alternatives and be initiated with communication and sensitivity to neighboring communities and to current user needs.

Thank you for this opportunity to comment. We are returning the EIS which is enclosed.

Very truly yours,

Nolle R. Smith Jr.

NOLLE R. SMITH, JR.
Director of Parks & Recreation

Encl.
jd

cc: Mr. William S. Haines, Director
Department of Water Supply

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 28, 1982

Mr. Nolle R. Smith, Jr.
Director
Department of Parks and Recreation
County of Maui
Wailuku, Maui, Hawaii 96793

Dear Mr. Smith:

SUBJECT: <u>MAKAWAO-KULA WATER TREATMENT PLANTS EIS</u>

Thank you for your comments and we offer the following responses:

<u>Comment:</u>

"The Department of Parks and Recreation expresses support for a water quality program and system that will serve these areas for many years to come."

<u>Response:</u>

We appreciate your support for the proposed water treatment plants.

<u>Comment:</u>

"Development of a facility of this type at the proposed sites should include serious consideration for:

a. Ongoing operation and long-range maintenance as a part of initial construction.

b. Noise, dust and visual pollution.

c. Buffer zone use."

"By Water All Things Find Life."

Response:

The EIS did discuss the long-term primary and secondary impacts of the operation and maintenance of the proposed water quality treatment plants. In addition, it should be noted that the Department of Water Supply is presently in the process of the establishment of positions through the civil service class for water treatment operators. The department has budgeted for these positions and for the training of the water treatment plant operators. All of the treatment plants proposed will be staffed by qualified operators.

The anticipated impacts to ambient noise levels and air quality and mitigative measures proposed to minimize any adverse effects to same were also discussed in the EIS. The visual intrusion of the proposed water treatment plants in their respective areas is anticipated to be minimal. The existing land uses of the project sites can be described as open space with at least a 1/4 mile buffer zone between a site and the nearest parks and recreation facility.

Comment:

"While archeological and cultural disturbance is not considered a factor at the proposed sites, all of the areas are important recreationally, and any changes to current use should incorporate careful detail to providing alternatives and be initiated with communication and sensitivity to neighboring communities and to current user needs."

Response:

We concur that communication and sensitivity to neighboring communities is necessary to maintain recreational values of surrounding areas.

Sincerely,

William S. Haines

William S. Haines, Director
Department of Water Supply

MTM:tah

Ulupalakı

ULUPALAKL

April 19, 1982

Mr. William S. Haines
Department of Water Supply
County of Maui
P.O. Box 1109
Wailuku, Maui

Dear Mr. Haines:

Re: Draft Enviornmental Impact Statement, Makawao-Kula Water Treatment Plants

I have briefly reviewed the Draft Enviornmental Impact Statement and find that certain questions are left unanswered. The report indicates that approximately 50% of the water to be treated will be used for agricultural purposes and therefor would not require treatment. However the report does not make any estimate as to the proportion of the remaining 50% that is used for drinking water as opposed to general domestic use. I think that this figure is necessary befor the true cost of the system can be determined.

The proposed plan contemplates the expenditure of $ 14.6 million to construct treatment plants to treat 15 MGD most of which does not need to be treated. I feel that alternatives should be weighed closely before the committment of funding of this magnitude towards such a dubious project.

As a matter of interest, we operate in a portion of San Joaquin County, California where the drinking water standards are met by supplying bottled water to residences of agricultural workers.

Until a clear and present danger can be shown by the use of the water supplied in the present system, I feel that the cost is probably too high to justify the expenditure and alternatives should be sought to comply with the drinking water requirement that would avoid treating all of the water in the system.

Sincerely,

C. Pardee Erdman

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 24, 1982

C. Pardee Erdman
Ulupalakua Ranch, Inc.
Maui, Hawaii

Dear Mr. Erdman:

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT FOR MAKAWAO-KULA WATER TREATMENT PLANTS

Your comments are appreciated and the following responses are provided.

Comment:

"I have briefly reviewed the Draft Environmental Impact Statement and find that certain questions are left unanswered. The report indicates that approximately 50% of the water to be treated will be used for agricultural purposes and therefore would not require treatment. However, the report does not make any estimate as to the proportion of the remaining 50% that is used for drinking water as opposed to general domestic use. I think that this figure is necessary before the true cost of the system can be determined."

Response:

The estimate of 50% of the water use for agricultural purposes is correct; however, the environmental impact statement did not state that the water used for agricultural purposes did not require treatment.

We agree that water used strictly for agricultural purposes need not be treated. However, the existing water distribution system precludes separation of water used for domestic and agricultural purposes. We are currently evaluating the feasibility of a separate water source and distribution system for agricultural use. This evaluation will take approximately two years, and a decision made at that time.

"By Water All Things Find Life"

A percentage estimate for the service area of domestic water used for drinking versus general domestic use is unavailable. The amount of water used by individuals not only varies daily, but from individual to individual, and also with different intended uses. Therefore, it is a commonly accepted practice for water suppliers to provide only potable water to each household, and the allocation of the water remains with that household.

The construction of dual lines supplying treated water for drinking and untreated water for general domestic use and irrigation is costly. There is also the potential health problem should individuals drink the untreated water.

Comment:

"The proposed plan contemplates the expenditure of $14.6 million to construct treatment plants to treat 15 MGD most of which does not need to be treated. I feel that alternatives should be weighted closely before the commitment of funding of this magnitude towards such a dubious project."

Response:

Federal and State laws and regulations require compliance with water quality standards. These minimum standards have been promulgated for the protection of the individual water user. The construction of water treatment plants is the most reliable means of providing safe drinking water, even though costly.

Comment:

"As a matter of interest, we operate in a portion of San Joaquin County, California where the drinking water standards are met by supplying bottled water to residences of agricultural workers."

Response:

The use of bottled water for drinking is only acceptable on a small scale and when there is assurance that the health of the individual will not be jeopardized. This is not the case in the Makawao-Kula area. The population of the service area is large and there is no assurance that people will use only the bottled water for drinking.

Comment:

"Until a clear and present danger can be shown by the use of the water supplied in the present system, I feel that the cost is probably too high to justify the expenditure and alternatives should be sought to comply with the drinking water requirement that would avoid treating all of the water in the system."

Response:

The County of Maui is, and will continue to be, in violation of existing State and Federal drinking water standards until the treatment plants are in operation and/or alternative treatment methods are implemented.

Sincerely,

for William S. Haines, Director
Department of Water Supply

MTM:tah

LIFE OF THE LAND

May 4, 1982

Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Mr. William S. Haines, Director
Department of Water Supply
County of Maui
P.O. Box 1109
Wailuku, Hawaii 96793

Subject: EIS for Makawao-Kula Water Treatment Plants

Gentlemen:

On page 11-15 of the draft EIS you will note that there is a letter from Mr. Douglas Meller requesting to be a consulted party. Mr. Meller also requested to be sent a copy of the EIS Preparation Notice and a copy of the draft EIS. Mr. Meller also asked that the EIS address the cumulative impact of all planned Maui County projects which directly or indirectly entail removal of water from East Maui Irrigation Company (EMI)'s top ditch.

Mr. Meller has informed us that (1) he was not sent a copy of the EIS Preparation Notice, (2) he was not sent a copy of the draft EIS, (3) he is not listed as a consulted party on pages 12-1 or 12-2 of the draft EIS, and (4) none of his questions have been addressed in the draft EIS. For that reason, Mr. Meller has asked that Life of the Land act in his behalf and take whatever administrative and legal action is necessary to ensure that his questions are answered. In our judgement, since Mr. Meller is both a member of Life of the Land and a corporate officer, and since Mr. Meller has been empowered to act as a representative of Life of the Land in matters relating to Hanawi Stream, we consider his letter of November 4, 1981 to be an action taken on behalf of Life of the Land. Hence, this letter of May 4, 1982 should be treated as a letter from a consulted party representing persons including but not limited to Douglas Meller.

The point of Mr. Meller's November 4, 1981 letter is very simple. As noted on page B-6 of the draft EIS, the County of Maui can withdraw up to 16 mgd from EMI's top ditch (the Wailoa Ditch) to supply water to upcountry Maui. However, EMI officials have testified in public hearings that the low flow of the Wailoa Ditch is 16 mgd. The same officials also have testified that the two sugar mills of HC & S, which is the largest sugar company in Hawaii, are totally dependent on water from the Wailoa Ditch. Hence, removal of water from the Wailoa Ditch has the potential for severe

250 S Hotel St. Rm. 211, Honolulu, Hawaii 96813. Tel 521-1300

impacts on HC & S viability during droughts. Because of EMI concerns about water supply during droughts, EMI applied for a SMA permit from the Maui Planning Commission to remove most of the water from the last big undiverted stream on Maui - - Hanawi Stream. Mr. Meller successfully represented Life of the Land in a contested case hearing concerning EMI's application to divert Hanawi Stream. EMI withdrew its permit application after the hearing officer found that there was no evidence on the record that the County of Maui planned or needed to take the allowable 16 mgd from the Wailoa Ditch. Mr. Meller has remarked to us that the Maui Department of Water Supply stuck its head in the sand and refused to testify in public concerning the amount of water it needed to remove from the Wailoa Ditch. Consequently, Mr. Meller relied on the population projections used in the December 1980 County of Maui "208" Water Quality Plan.

After EMI withdrew its application to divert Hanawi Stream, Mr. Meller reread the hearing transcript and was surprised to find that EMI had enormous reservoirs. If these reservoirs had been connected to the Wailoa Ditch, then EMI would have been able to meet the needs of its mills and still supply 16 mgd to the County during the worst drought in recorded history. Unfortunately, the hearing transcript did not indicate the elevation of EMI reservoirs. However, it is clear that the recorded low flow of 16 mgd in the Wailoa Ditch may be an artifact of poor management of EMI reservoirs rather than an unavoidable eventuality during droughts.

Given these facts, Mr. Mellers questions were a reasonable attempt to determine the risks involved in increasing water removal from the Wailoa Ditch. We would like to see his questions answered in the Revised EIS, and we are prepared to use whatever administrative and legal remedies are necessary to this end.

Two quotations from the Environmental Quality Commission EIS Regulations are in order at this point. As specified in Section 1:42 CONTENT REQUIREMENTS,

> ... specific reference to related projects, public and private, existent or planned in the region shall be included for purposes of examining the possible overall cumulative impacts of such actions. (Sec. 1:42(c))

> ... The interrelationships and cumulative environmental impacts of the proposed action and other related projects shall be discussed in the EIS. (Sec. 1:42(e))

The Revised EIS for Makawao-Kula Water Treatment Plants will not be in compliance with these provisions of EQC EIS Regulations concerning content requirements unless the cumulative impacts of water removal from the Wailoa Ditch are addressed. Treating development of new pumps and pipes to remove water from the Wailoa Ditch as an action unconnected from development of oversized water treatment plants to permit expanded domestic use of water from the Wailoa Ditch is an outright violation of the spirit and letter of EQC Regulations. Yet this is what is done in the draft EIS.

Sincerely,

Arthur Mori

Arthur Mori
President

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

June 3, 1982

Arthur Mori, President
Life of the Land
250 S. Hotel St., Rm. 211
Honolulu, Hawaii 96813

Douglas Meller
1450 Aaula St., No. 1201
Honolulu, Hawaii 96817

Dear Messrs. Mori and Meller:

SUBJECT: MAKAWAO-KULA WATER TREATMENT PLANTS

Your comments are appreciated and the following responses are provided.

Comment:

"On page 11-15 of the draft EIS you will note that there is a letter from Mr. Douglas Meller requesting to be a consulted party. Mr. Meller also requested to be sent a copy of the EIS Preparation Notice and a copy of the draft EIS. Mr. Meller also asked that the EIS address the cumulative impact of all planned Maui County projects which directly or indirectly entail removal of water from East Maui Irrigation Company (EMI)'s top ditch."

"Mr. Meller has informed us that (1) he was not sent a copy of the EIS Preparation Notice, (2) he was not sent a copy of the draft EIS, (3) he is not listed as a consulted party on pages 12-1 or 12-2 of the draft EIS, and (4) none of his questions have been addressed in the draft EIS. For that reason, Mr. Meller has asked that Life of the Land act in his behalf and take whatever administrative and legal action is necessary to ensure that his questions are answered. In our judgement, since Mr. Meller is both a member of Life of the Land and a corporate officer, and since Mr. Meller has been empowered to act as a representative of Life of the Land in matters relating to Hanawi Stream, we consider his letter of November 4, 1981 to be an action taken on behalf of Life of the Land. Hence, this letter of May 4, 1982 should be treated as a letter from a consulted party representing persons including but not limited to Douglas Meller."

"By Water All Things Find Life"

Response:

The number of copies of the preparation notice were limited and we were unable to send copies to all people requesting copies. However, copies of the EIS are available at the public libraries on Oahu and Maui. A copy of the EIS was sent to Life of the Land on April 2, 1982 and since Mr. Meller is a member and corporate officer of Life of the Land, the EIS is available for his review. Furthermore, we also sent a copy of the EIS directly to Mr. Meller and have listed Mr. Meller and Life of the Land as consulted parties.

Comment:

"The point of Mr. Meller's November 4, 1981 letter is very simple. As noted on page B-6 of the draft EIS, the County of Maui can withdraw up to 16 mgd from EMI's top ditch (the Wailoa Ditch) to supply water to upcountry Maui. However, EMI officials have testified in public hearings that the low flow of the Wailoa Ditch is 16 mgd. The same officials also have testified that the two sugar mills of HC & S, which is the largest sugar company in Hawaii, are totally dependent on water from the Wailoa Ditch. Hence, removal of water from the Wailoa Ditch has the potential for severe impacts on HC & S viability during droughts. Because of EMI concerns about water supply during droughts, EMI applied for a SMA permit from the Maui Planning Commission to remove most of the water from the last big undiverted stream on Maui -- Hanawi Stream. Mr. Meller successfully represented Life of the Land in a contested case hearing concerning EMI's application to divert Hanawi Stream. EMI withdrew its permit application after the hearing officer found that there was no evidence on the record that the County of Maui planned or needed to take the allowable 16 mgd from the Wailoa Ditch. Mr. Meller has remarked to us that the Maui Department of Water Supply stuck its head in the sand and refused to testify in public concerning the amount of water it needed to remove from the Wailoa Ditch. Consequently, Mr. Meller relied on the population projections used in the December 1980 County of Maui "208" Water Quality Plan."

Response:

Our original response to Mr. Meller's comment during the Notice of Preparation review period was, and is, that the EIS deals specifically with water treatment plants and not with water allocation and use. The County of Maui is allocated up to 16 mgd from the Wailoa Ditch and the treatment plants are required and have been designed to provide water to meet existing State and Federal Drinking Water Standards.

Comment:

"After EMI withdrew its application to divert Hanawi Stream, Mr. Meller reread the hearing transcript and was surprised to find that EMI had enormous reservoirs. If these reservoirs had been connected to the Wailoa Ditch, the EMI would have been able to meet the needs of its mills and still supply 16 mgd to the County during the worst drought in recorded history. Unfortunately, the hearing transcript did not indicate the elevation of EMI reservoirs. However, it is clear that the recorded low flow of 16 mgd in the Wailoa Ditch may be an artifact of poor management of EMI reservoirs rather than an unavoidable eventuality during droughts."

Response:

We cannot comment on the management of EMI reservoir and or stream flows; this is a separate matter and issue not relevant to the water treatment plants.

Comment:

"Given these facts, Mr. Mellers questions were a reasonable attempt to determine the risks involved in increasing water removal from the Wailoa Ditch. We would like to see his questions answered in the Revised EIS, and we are prepared to use whatever administrative and legal remedies are necessary to this end."

"Two questions from the Environmental Quality Commission EIS Regulations are in order at this point. As specified in Section 1:42 CONTENT REQUIREMENTS,

... specific reference to related projects, public and private, existent or planned in the region shall be included for purposes of examining the possible overall cumulative impacts of such actions. (Sec. 1:42(c))

... The interrelationships and cumulative environmental impacts of the proposed action and other related projects shall be discussed in the EIS. (Sec. 1:42(e))

The revised EIS for Makawao-Kula Water Treatment Plants will not be in compliance with these provisions of EQC EIS Regulations concerning content requirements unless the cumulative impacts of water removal from the Wailoa Ditch are addressed. Treating development of new pumps and pipes to remove water from the Wailoa Ditch as an action unconnected from development of oversized water treatment plants to permit expanded domestic use of water from the Wailoa Ditch is an outright violation of the spirit and letter of EQC Regulations. Yet this is what is done in the draft EIS."

Response:

We have previously stated that the County of Maui is allocated up to 16 mgd from the Wailoa Ditch. The water treatment plant (Makawao) is required to treat the water to conform to existing state and federal standards. The County will not exceed the 16 mgd allocation and the treatment plant has been designed in phases, but will not exceed 16 mgd. We again stress, that the proposed Makawao Water Treatment Plant is only one component of the existing water system.

Sincerely,

William S. Haines, Director
Department of Water Supply

HTM:tah

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

May 13, 1982

Mr. Douglas Meller
1450 Aala Street, No. 1201
Honolulu, Hawaii 96817

Dear Mr. Meller:

SUBJECT: Draft Environmental Impact Statement

We are transmitting herewith, for your review and comments, the Draft Environmental Impact Statement for the Makawao-Kula Water Treatment Plants, Makawao and Kula, Maui.

Your comments will be appreciated by May 28, 1982. We request that all comments be directed to the Office of Environmental Quality Control with a copy to our office.

Please feel free to contact me if you have any questions regarding this EIS.

Sincerely,

William S. Haines
Director

RC:ab

cc: OEQC/EQC
Programs Management

Encl.

"By Water All Things Find Life"

1450 Aala Street
No. 1201
Honolulu, Hawaii
96817

May 25, 1982

Mr. William S. Haines
Department of Water Supply
County of Maui
P.O. Box 1109
Wailuku, Maui 96793

Office of Environmental Quality Control
550 Halekauwila Street
Room 301
Honolulu, Hawaii 96813

Subject: Draft EIS for Makawao-Kula Water Treatment Plants

Gentlemen:

The Final EIS will be legally deficient unless it addresses the questions I raised in my letter of November 4, 1981. You should also bear in mind that the Governor rather than the Department of Water Supply is responsible to accept the Final EIS.

Lastly, I should point out that the EIS Appendix D (Water Consumption) fails to relate projections for Makawao and Kula to DPED population projections for the Island of Maui. To be specific, DPED projects that between 1980 and the year 2000, Maui's population will increase by 54,000 people. By comparison, based on the EIS Table D-8, the 8% growth rate for Makawao water consumption used in Table D-13 apparently makes the assumption that agricultural zoned lands in Makawao will absorb 46,000 new people between 1980 and the year 2000. If I were you, I would get another consultant to fix these population and water projections for upcountry Maui.

Sincerely,

Doug Heller

Douglas Heller

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
P. O. BOX 1109
WAILUKU, MAUI, HAWAII 96793

June 15, 1982

Mr. Douglas Meller
1450 Aala Street
Suite 1201
Honolulu, Hawaii 96817

Dear Mr. Meller:

SUBJECT: Makawao-Kula Water Treatment Plants
- Letter dated May 25, 1982

Our response to your questions raised on November 4, 1981 remains the same. Please refer to our correspondence (January 12, 1982 and June 3, 1982).

We agree that a line agency cannot accepts its own EIS; the Mayor and Governor will be the initial and final accepting authorities for the revised EIS.

The data presented in Tables D-8 and D-13 are projections for informational use and not intended to be viewed as the Department's developmental policy. There is no assumption that the agricultural designated lands in Makawao will absorb the entire future population.

Sincerely,

William S. Haines

William S. Haines
Director

cc: EQC
OEQC
Programs Manager
Environment Impact Study Corp. (Honolulu/Maui)

"By Water All Things Find Life."

Unresolved Issues

13

SECTION 13

UNRESOLVED ISSUES

This section briefly describes the unresolved issues.

The unresolved issues are primarily concerned with costs and the use of public funds to meet the requirements imposed by the safe drinking water regulations.

COSTS

The costs for the simultaneous construction of three water treatment plants is estimated at 14.208 million dollars. This cost greatly exceeds the funds presently available ($5.8 million). In the interim, a decision has been made to phase the construction of the treatment plants, the first plant to be constructed will be the Makawao Water Treatment plant at a cost of $3.5 million. [Please refer to Table 13-1.] The decision to construct this plant first is based on:

1. The water supply is the most reliable of the three water sources.
2. During drought conditions, water is, and can be, pumped up from the Makawao system to the Upper and Lower Kula systems.
3. There is the possibility that alternative, less costly means could bring the Upper and Lower Kula water systems into compliance with existing standards.

TABLE 13-1

ESTIMATED CONSTRUCTION AND OPERATING COSTS FOR MAKAWAO AND KULA WATER TREATMENT PLANTS

Treatment Plant	Phase	MGD	Capital Cost $ Million	Operation and Maintenance Cost ($ Million)
Upper Kula	1	1.7	5.580	.838
	2	2.5	5.830 to 7.19	1.108
Lower Kula	1	2.5	5.110	.466
	2	5.0	5.460	.782
Makawao	1	8.0	3.518	.383
	2	12.0	4.574 to 5.745	?
	3	12.0	1.079	?

4. An alternative distribution system separating agricultural water from domestic water is being explored. The results of this study could have a significant bearing on the size of the treatment plants and directly affect the cost for the construction of the treatment plants.

5. Turbidity levels of the Makawao water source are high during rains, requiring treatment.

WATER QUALITY

The other major unresolved issue is concerned with whether or not the water, after being treated, will comply with the standards established by the safe drinking water regulations at the consumer's tap. The regulations are explicit in the location of where the water is to be tested with the exception of turbidity which is tested at the treatment plant; all other testing is conducted at the consumer's tap.

There is no doubt that the water leaving the treatment plant will conform to all applicable standards. However, after the water leaves the treatment plant, the water passes through water distribution lines of varying length and age; and is also stored in tanks composed of redwood. The joints of the old waterline were sealed with jute and lead, and the jute joints provide an ideal habitat for the cultivation of microrganisms. The redwood tanks also provide an ideal substratum for the cultivation of microrganisms which can and is being controlled by disinfection.

The high turbidity of existing water can also cause silt build up within the distribution and storage systems which can affect turbidity levels.

There is the possibility that the treated water could become contaminated within the distribution and storage systems. This fact will not be known until the treatment plant(s) are in operation and treated water pumped through the system and tests conducted at the consumer's tap.

In the event that contamination of the treated water occurs within the distribution and storage systems, numerous mitigative measures are available. One of the first steps to be taken is the immediate flushing of the distribution lines and storage systems with the treated water. The second and more costly step will be the replacement of the water distribution lines (only the older segments) and some of the storage tanks.

ALTERNATIVE TREATMENT PROCESS

Turbidity has been one of the parameters which has caused considerable problems within the water service area. The existing standard for turbidity is 1 TU, and on numerous occassions, the turbidity levels have been exceeded. As specified in Section 11-20-5 "Maximum contaminant levels - turbidity" (Chapter 20 of Title 11, Administrative Rules, Potable Water Systems, Department of Health, State of Hawaii) the Department of Water Supply is investigating the feasibility of a 5 NTU standard. Whether this will be acceptable to the enforcement agency is an unresolved issue.

WATER RATES

The cost of construction and operation and maintenance of the water treatment plants will be ultimately borne by the consumer. The exact amount of the increase in water rates is not known at this time.

WATER BUDGET

No attempt has been made in this document to address the water budget for the water service area. Information has been provided on consumption and projections made on future water consumption. The water source budget is a separate issue which will be studied in the near future by the Department of Water Supply.

Appendices

APPENDIX A

WATER QUALITY STANDARDS

APPENDIX A

WATER QUALITY STANDARDS

I. INTRODUCTION

The high quality of most drinking water in Hawaii is recognized. However, mounting concerns over the spread of potential environmental pollution and the development of sensitive methods of detecting pollutants have led to new Federal and State legislation that will ensure that the quality of drinking water poses no threat to public health.

II. ESTABLISHING STANDARDS

The hazard of ingesting chemical pollutants in drinking water can be assessed in two general ways: (1) epidemiological studies and (2) laboratory studies of toxicity. The use of either method, or both, provides baseline information used in the development of the standards. However, research will continue to determine the effects of low dose-rate and potential long-term health effects of toxic agents. As new findings emerge, the standards will change in the future.

III. STANDARDS

The current standards are found in Table A-1. In all instances the State and Federal Primary Standards

TABLE A-1

INORGANIC CHEMICALS (mg/l)

CONSTITUENT	MAXIMUM CONTAMINANT LEVELS: EPA STANDARDS Primary	EPA STANDARDS Secondary	STATE STANDARDS Primary	STATE STANDARDS Secondary
Alkalinity	-	-	-	-
Aluminum	-	-	-	-
Arsenic	0.05	-	0.05	-
Barium	1.0	-	1.0	-
Cadmium	0.01	-	0.01	-
Calcium	-	-	-	-
Chloride	-	250.0	-	-
Chromium (total)	0.05	-	0.05	-
Chromium (VI)	-	-	-	-
Copper	-	1.0	-	-
Fluoride	1.4-2.4	-	1.4-2.4	-
Hardness	-	-	-	-
Iron	0	0.3	-	-
Lead	0.05	-	0.05	-
Magnesium	-	-	-	-
Manganese	-	0.05	-	-
Mercury	0.002	-	0.002	-
Nitrate (as N)	10.0	-	10.0	-
Selenium	0.01	-	0.01	-
Silver	0.05	-	0.05	-
Sodium	-	20.0	-	-
Sulfate	-	250.0	-	-
Zinc	-	5.0	-	-

TABLE A-1

ORGANIC CHEMICALS (mg/1)

CONSTITUENT	MAXIMUM CONTAMINANT LEVELS EPA STANDARDS Primary	EPA STANDARDS Secondary	STATE STANDARDS Primary	STATE STANDARDS Secondary
Carbon (alcohol extract)				
Carbon (chloroform extract)				
Foaming agents (MBAS)		0.5		
Aldrin				
DDT				
Dieldrin				
Endrin	0.0002		0.0002	
Lindane	0.004		0.004	
Methoxychlor	0.1		0.1	
Organophosphates & Carbonates				
Toxaphene	0.005		0.005	
2,4-D	0.1		0.1	
2,4-5-TP (Silvex)	0.01		0.01	
Total herbicide				
Chloroform				
Phenols				
Mineral Oil				

TABLE A-1

PHYSICAL, RADIOLOGICAL, AND MICROBIOLOGICAL PARAMETERS

CONSTITUENT	MAXIMUM CONTAMINANT LEVELS: EPA STANDARDS Primary	EPA STANDARDS Secondary	STATE STANDARDS Primary	STATE STANDARDS Secondary
Physical				
Color - ACU		15 color units		
Corrosivity	Noncorrosive			
Odor - TON		3 threshold odor number		
pH		6.5-8.5		
Suspended solids - mg/l				
Taste				
Turbidity - TU	1			
Foaming agents		0.5mg/l		
Total dissolved solids (TDS)		500mg/l		
Radiological				
Gross Alpha - pCi*/l	15		15	
Gross Beta - pCi/l			4	
Radium 226 & 228 - pCi/1	5		5	
Strontium 90 - pCi/l	8		8	
Tritium	2,000		2,000	
Microbiological				
Coliform - organisms/ 100ml	1		1	

* Picocurie (pCi) - that quantity of radioactive material producing 2.22 nuclear transformations per minute.

are identical. The secondary standards are presently being evaluated by the State and in all probability will follow the recommended Federal Standards.

IV. HEALTH RISKS

The potential health risks for various pollutants are listed in Tables A-2 through A-4.

V. IMPLICATION ON PROJECT

The water quality of the service area (Makawao - Kula) has been tested. The results of all tests conducted to date can be found in Appendix C of this report.

TABLE A-2

INORGANIC PARAMETERS

SUBTANCE	FORMS IN AQUEOUS ENVIRONMENT	POTENTIAL HEALTH EFFECTS
Arsenic (As)	$HAsO_4^-$, $H_2AsO_4^-$, $HAsO_2$, $(CH_3)_2AsO(OH)$, $(CH_3)AsO(OH)_2$	linked with skin cancer and black foot disease; recognized carcinogen
Barium (Ba)	Ba^{++}, $BaSO_4^+$, $BaCO_3^+$	muscle stimulant, toxic to heart, blood vessels and nervous system
Cadmium (Cd)	Cd^{++}, humic acid complex, $CdCO_3^+$	causes nausea and vomiting, concentrated in liver and kidney; carcinogenic
Chloride (Cl)	Cl^-	imparts salty taste at concentrations above 400mg/l, no documented serious health effects
Chromium (Cr)	$HCrO_4^-$, $HCr_2O_7^-$, Cr^{+++}	trivalent form harmless; nausea and ulcers after long-term exposure
Copper (Cu)	Cu^+, Cu^{++}, $Cu(OH)^+$, $Cu(NH_3)_x^{++}$	above 1mg/l causes disagreeable taste and ingestion is unlikely
Fluoride (F)	F^-	concentrations above 1.0mg/l reduces tooth decay; above 4.0mg/l causes mottled teeth; greater than 15.2mg/l may cause fluorosis
Iron (Fe)	Fe^{++}, $Fe(OH)^+$	high levels impart an unattractive appearance and taste
Lead (Pb)	Pb^{++}, $Pb(OH)^+$, $(CH_3)_4Pb$	causes constipation, loss of appetite, anemia, abdominal pains, paralysis and accumulates in bones

TABLE A-2

INORGANIC PARAMETERS

SUBTANCE	FORMS IN AQUEOUS ENVIRONMENT	POTENTIAL HEALTH EFFECTS
Manganese (Mn)	Mn^{++}, MnO_3^-, $MnO_4^=$, MnO_4	not considered health hazard; unpleasant taste; discolors laundry
Mercury (Hg)	$HgCl_2^+$, CH_3Hg^+, $Hg(NH_3)_x^{++}$	highly toxic to man; gingivitis, stomatitis, tremors, chest pains, coughing
Nitrate (NO_3)	NO_3^-	high levels have been associated with methemoglobinemia and diarrhea; note: above 100mg/l interferes with coliform test
Selenium (Se)	$HSeO_3^-$, $SeO_4^=$, $(CH_3)_2Se$, $(CH_3)_2Se_2$	associated with increased dental caires; believed to cause symptoms similar to arsenic poisoning
Silver (Ag)	AgCl-	low concentrations causes darkening of skin; fatal at very high concentrations
Sodium (Na)	Na^+	excessive sodium intake contributes to an age-related increase in blood pressure that culminates in hypertension in genetically susceptible people
Sulfate (SO_4)	$SO_4^=$	high concentrations causes a laxative effect
Total dissolved solids (TDS)	minerals	very high concentrations have cathartic reaction and does not quench thirst
Zinc (Zn)	Zn^{++}, $Zn(OH)^+$, $Zn(Cl)_xY$	astringent taste above 5mg/l; high concentrations give milky appearance and form a greasy film upon boiling; very high concentrations associated with nausea and fainting

TABLE A-3

ORGANIC PARAMETERS

SUBTANCE	EFFECTS
Carbon - alcohol extract	may produce taste and odor; generally provides gross indication of exposure to organics
Carbon - chloroform extract	may produce taste and odor problems; provides gross indication of exposure to organics
Foaming agent (MBAS)	causes foaming
Aldrin ($C_{12}H_6Cl_6$)	neurotoxin; suspected carcinogen
DDT ($C_{14}H_9Cl_9$)	neurotoxin; causes unsteadiness, dizziness, paraesthesis, vomiting, convulsions
Dieldrin ($C_{12}H_4OCl_6$)	neurotoxin; suspected carcinogen
Endrin ($C_{12}HOCl_6$)	neurotoxin; suspected carcinogen
Lindane ($C_6H_6Cl_6$)	suspected carcinogen
Methoxychlor ($C_{16}H_{15}Cl_3O_2$)	fatal at high doses
Organophosphates	parasympathetic stimulation, convulsions, respiratory failure, death
Carbonates	causes achrymation, salivation, myosis, convulsions and death
Toxaphene ($C_{19}H_{10}Cl_8$)	neurotoxin
Herbicide: 2,4-D ($C_8H_6Cl_2O_3$)	nonpoisonous; may produce unpleasant taste in water
Silvex ($C_9H_7O_3Cl_3$)	can produce unpleasant oily taste in exposed fish

TABLE A-4

OTHER PARAMETERS

PARAMETER	POTENTIAL EFFECTS
Physical Parameters	
Color	aesthetically displeasing; may dull clothes, stain food and fixtures; colored compounds may be precursors to organohalides
Odor	undesirable for drinking; may add odor to fish or shell fish; some odor-causing compounds may be precursors to organo-halides
Turbidity	aesthetically displeasing; may interfere with disinfection and maintenance of chlorine residual
Specific conductance	related to TDS; very high levels have cathartic reaction and does not quench thirst
Biological Parameters	
Coliform bacteria	serves as an indicator organisms to determine the adequacy of disinfection; most bacteria are nonpathogenic but may be pathogenic
Radionuclides	
Gross beta	somatic and genetic damage
Radium-226	somatic and genetic damage
Strontium-90	somatic and genetic damage
Gross alpha	somatic and genetic damage

REFERENCES

Tate, Carol H. and R. Rhodes Trussell. 1977. Developing Drinking Water Standards. Journal of the American Water Works Association. September 1977: 486-498.

U. S. Environmental Protection Agency, Office of Water Supply. National Interim Primary Drinking Water Regulations. EPA-570/9-76-003.

Federal Register, Wednesday, August 27, 1980. Part IV. Environmental Protection Agency Interim Primary Drinking Water Regulations. Vol. 45, No. 168. 57333-57344.

APPENDIX B

EXISTING WATER RESOURCES

APPENDIX B

EXISTING WATER RESOURCES

I. INTRODUCTION [B.1]

A review of the water consumption and source and transmission developments for the service area indicates that water shortages occur even though improvements have been made to the water systems over the years.

Water source improvements and storage facilities at the Lower and Upper Waikamoi areas and transmission improvements from Waikamoi to Kanaio (Upper Kula system) and the construction of the Lower Kula transmission system from Lower Waikamoi to Alae have enabled continued water service during drought conditions.

Financing of distribution system improvements has been difficult to obtain, causing construction to lag behind the demand for additional water. Also, the exhaustability of the source limits further expansion of the gravity distribution system. This fact has led to the design of the existing system, which provides for pumpage of water from the lower source to the higher systems as necessary.

A series of pumps are used to transport water from the lower to the upper systems. The Upper Kula pump system receives water from the Lower Kula line, which in turn utilizes the Makawao-Olinda pumping system to supplement the existing water with water from the Makawao System. The series of water transmission systems and pumping systems interconnect the Makawao and Kula water systems. Discussions of the Upper and Lower Kula water systems and the Makawao water system follow.

II. KULA WATER SYSTEM

The Kula water system serves the Olinda-Kula-Kanaio areas. This area is located between approximately the 2,000 and 4,000-foot contours on Haleakala, with Olinda to the north and Kanaio to the south. The Kula system is divided into the Upper and Lower systems.

A. Upper Kula System

This system serves the area above the 2,800-foot elevation to the 4,000-foot elevation. The maximum capacity of the water line is 2.5 mgd and the storage facility is 41 MG [B.2]. The safe yield of the source is 1.0 mgd and of the system is 0.9 mgd. Refer to Table B-1.

Also, the Lower Waikamoi pumps at the 3,100-foot elevation are used to supplement the Upper System from the East and West Waikamoi Streams. The maximum capacity of this system is 0.8 mgd.

The Upper system can be supplemented by the water of the Lower system by use of the Upper Kula

TABLE B-1

EXISTING SAFE YIELD OF SOURCE AND SYSTEM
KULA WATER SYSTEM

DESCRIPTION	SIZE (INCH)	PUMP OR LINE CAPACITY MGD	STORAGE CAPACITY MG	SAFE YIELD Source MGD	SAFE YIELD System MGD
UPPER SYSTEM					
Source					
Intake & Flume		3.0+	41.0		
Lower Pump	8	0.8			
Transmission					
Waikamoi-Olinda	16, 12	2.7	11.5		
Distribution					
Olinda-Omaopio	12	2.5		0.9	0.8
Omaopio-Naalae	12.8	2.3	5.2		
Naalae-Kamaole	8	0.8			
Supplement					
Upper Kula Pumps	12	1.0(1)		1.0(1)	0.9
			SUB TOTAL	1.9	1.7
LOWER SYSTEM					
Source					
Intake Pipeline	12, 24	6.5	50.0		
Transmission & Distribution					
Piiholo-Kula Kai	18	3.0	2.0	1.9	1.7
Supplement					
Olinda Pumps	18	1.5(2)		1.5(2)	1.3
			SUB TOTAL	3.4	3.0
COMBINE - EXISTING					
Upper				0.9(3)	1.7(3)
Lower				3.4	2.1(4)
TOTAL (MGD)				4.3	3.8

(1) Supply pumped from Lower System to Upper System.
(2) Supply from Olinda pumps into Lower System.
(3) Safe yield available to the Upper System.
(4) Safe yield available to the Lower System.

Source: [B-6]

pumping system. The capacity is 0.9 mgd with potential of 1.9 mgd with improvements to the system.

Please refer to Table B-1 for the safe yield estimates.

B. Lower Kula System

The Lower System serves the area below the 2,800 foot elevation and above the 2,000-foot elevation.

This system has a maximum capacity of 6.5 mgd [B.3]. The water source is at the 3,000-foot elevation, and consists of a series of intakes at the East and West Waikamoi, East, Middle and West Puohokamoa, Haipuaena and Honomanu Streams.

Three pump stations located at Olinda obtain water from the Makawao water system, and the Kamole Pumping Station. The Olinda system has a capacity of 1.5 MGD, or 5.5 MGD with further improvements to the system [B.4].

The safe yield of the Lower System is 3.0 mgd and of the source is 3.4 mgd.

Please refer to Table B-1 for safe yield estimates.

C. Combined Systems - Upper and Lower Kula Systems

The safe yield of the water system can be expressed as the maximum daily quantity of water that can be safely drawn from a system at all times without depletion of the water supply and storage of the system. Expressed on a quantity basis, the safe yield of the source includes the availability of the source supply and the capacity of the source facilities available to meet the demand. The safe yield of a system, however, considers the transmission, storage, and distribution ability of the system and the effect on it by losses through leakage and/or breakages. For these calculations, a 13% allowance for losses is deducted from the safe yield of the source to obtain the safe yield of the system.

Table B-1 shows the safe yield of the existing water source and systems. It reflects the ability of the available water yield of the source (4.3 mgd) to meet the safe yield demand of the system (3.8 mgd) [B.5].

III. MAKAWAO WATER SYSTEM

The Makawao water system serves the communities of Makawao, Pukalani, Hailiimaile, Kokomo, Kuiaha, Kaupakulua, Haiku, Ulumalu, Pauwela and Peahi.

Water for this system, during normal conditions, is from the Awalau and Opana Stream Intakes, which are mixed with water from the lower Kula line in Maluhia Tank. Additional water can also be obtained from the Upper Kula transmission system.

During drought conditions, water for Olinda, Makawao, Kokomo, Pukalani, Hailiimaile, and Haiku is provided by the Kamole Weir, located at the Wailoa Ditch, and flows through an 8-inch and 12-inch gravity main to the Kokomo Storage Tank. Water is also provided for Kuiaha, Kaupakulua, Ulumalu, Pauwela and Peahi by the Kuiaha Intake, also located along Wailoa Ditch. The Lilikoi Intake also serves Haiku. When the treatment plant is completed, the water sources not in compliance will not be used.

An agreement between Alexander and Baldwin, Inc. and the County of Maui allows for the removal of up to 16 mgd of water from the Wailoa Ditch. This agreement allows for the removal at Kamole Weir of water which is then pumped to the Makawao, Lower Kula and Upper Kula systems.

IV. FUTURE WATER SUPPLY

A. Kula Water System

The future implementation of the pumping system and storage facilities, which can transport water from the Lower system to the Upper system, will enable the safe yield of the system to be increased from 3.8 mgd to 7.4 mgd. Refer to Table B-2 for additional information [B.6].

B. Makawao Water System

The Wailoa Ditch water source provides and will continue to provide water for the Makawao and Kula water systems. The County of Maui will be allowed to

TABLE B-2

EXISTING SAFE YIELD OF SOURCE AND SYSTEM

MAKAWAO WATER SYSTEM

Description	Line Size (Inches)	Pump or Line Capacity	Storage Capacity (Gallons)	Tank Number	SOURCE (MGD)	SYSTEM (MGD)
Peahi	1, 5, 2, 3, 4, 6		70,000	67		
			5,000	68		
			10,000	69		
			12,000	70		
Kuiaha Intake	6					
Haiku	8					
Lilikoi Intake	6, 8, 12	1-100 HP	100,000	64		
		1-50 HP	70,000	65		
			70,000	66		
Haliimaile	8	1-150 HP		60		
Kamole Weir to Makawao and Olinda	8, 2, 4	1-600 HP	50,000	53		
		2-400 HP	47,000	54		
		1-150 HP	5,000	61		
		1-100 HP	300,000	62		
		1-150 HP	0.5 MG	63		
		2-200 HP				
		2-300 HP				
		1-150 HP				
		1-150 HP				
		2-300 HP				
		1-100 HP				
Kamole Weir to Pukalani	4, 6, 8, 12		100,000	55		
			1.0 MG	56		
			70,000	57		
			0.85 MG	58		
			25,000	59		

remove up to 16 mgd, and current use is below this figure. The safe yield of this source will be limited by the pumping cost, distribution line capacities, and storage facilities.

FOOTNOTES TO APPENDIX B

[B.1] *An Assessment of the Olinda-Kula-Kanaio Water Situation*. Island of Maui. Prepared by Department of Water Supply for Board of Water Supply. September 6, 1977. Page 1.

[B.2] *Ibid*. Page 4.

[B.3] *Ibid*. Page 4.

[B.4] *Ibid*. Page 4.

[B.5] *Ibid*. Page 5.

[B.6] *Ibid*. Page 11.

APPENDIX C

WATER QUALITY TEST RESULTS

APPENDIX C

WATER QUALITY TEST RESULTS

The water quality of the Makawao and Kula water systems is periodically tested by the State Department of Health. Months in which there was at least one violation for bacteria and/or turbidity are presented in Table C-1.

The engineering firms involved in the design phase of the three water treatment plants are also collecting data on water quality. Preliminary results are presented following Table C-1. Results from Austin, Tsutsumi and Associates are for Makawao WTP. Results for the Upper Kula WTP are from Kennedy/Jenks Engineers, and results from R. M. Towill Corporation are for Lower Kula WTP.

TABLE C-1

MAKAWAO-KULA WATER SYSTEM
Bacteriological and Turbidity Violations

CODE: X = Violation

	SYSTEM			
	MAKAWAO		KULA	
MONTH/YEAR	Bacteria (1/100ml)	Turbidity (1TU)	Bacteria (1/100ml)	Turbidity (1TU)
January, 1977				
February				
March				
April				
May				
June				
July	X	X	X	X
August	X	X	X	X
September			X	
October	X	X		X
November		X	X	X
December		X		X
January, 1978		X		X
February		X	X	X
March	X	X		X
April	X	X	X	X
May	X	X	X	X
June	X	X		X
July	X	X	X	X
August	X	X	X	X
September	X	X	X	X
October	X	X	X	X
November		X	X	X
December		X		X
January, 1979		X		X
February		X		X
March		X	X	X
April		X		X
May		X	X	X
June		X		X
July				
August				
September				
October		X		X
November	X	X	X	X
December		X	X	X

TABLE C-1, Continued

MAKAWAO-KULA WATER SYSTEM
Bacteriological and Turbidity Violations

CODE: X = Violation

	SYSTEM			
	MAKAWAO		KULA	
MONTH/YEAR	Bacteria (1/100ml)	Turbidity (1TU)	Bacteria (1/100ml)	Turbidity (1TU)
January, 1980		X	X	X
February		X		X
March	X	X	X	X
April		X		X
May		X		X
June		X		X
July		X	X	X
August		X		X
September		X		X
October		X		X
November		X	X	X
December		X		X

Source: Department of Health Water Violations.

BREWER ANALYTICAL LABORATORIES
a Department of Brewer Chemical Corporation
P.O. BOX 48, HONOLULU, HAWAII 96810, TELEPHONE 533-6411

LABORATORY ANALYSIS REPORT

Corrected Copy

JOB NO.:
DATE: 12-19-80
PAGE ___ OF ___

TO: Austin, Tsutsumi & Associates, Inc. ATTN.: Mr. William Bonnet
ADDRESS: Suite 900, 745 Fort Street Mall PHONE:
SAMPLES OF: Water from Makawao Water System, Kamole Weir, Maui

SAMPLED BY: Client SAMPLING DATE: 11-11-80 TIME: 1:00 PM
RECEIPT DATE: 11-13-80 TIME: 9:15 PM

DATE SAMPLE ANALYZED		11/14-12/08				
TIME SAMPLE ANALYZED						
SAMPLE TYPE		GRAB				
SAMPLE DESCRIPTION	UNITS					
Apparent Color	C.U.	80				
True Color	C.U.	60				
Foaming Agents (MBAS)	mg/L	< 0.025	Called	12-23-80		
Sulfides	mg/L	0.45				
Iron	mg/L	1.53				
Manganese	mg/L	0.02				
Odor	T.O.N.					
Sulfates	mg/L	1.29				
Zinc	mg/L	0.03				
pH		6.18				
Corrosivity		-4.23				
(Langelier Index)						
Copper	mg/l	< 0.02				

LABORATORY REMARKS: Samples analyzed according to "Methods for Chemical Analysis of Water and Wastes", U. S. Environmental Protection Agency, March, 1979.

BREWER ANALYTICAL LABORATORIES
a Department of Brewer Chemical Corporation
P.O. BOX 48, HONOLULU, HAWAII 96810, TELEPHONE 533-4411

JOB NO. 2007
DATE 12-24-80
PAGE ____ OF ____

LABORATORY ANALYSIS REPORT

TO: Austin, Tsutsumi & Associates ATTN.: Mr. William Bonnet
ADDRESS: Suite 900, 745 Fort Street Mall PHONE:
SAMPLES OF: Water from Makawao Water System, Kamole Weir, Maui

SAMPLED BY: Client SAMPLING DATE: TIME:
RECEIPT DATE: 11-26-80 TIME: 3:45 PM

DATE SAMPLE ANALYZED		11/26-12/16					
TIME SAMPLE ANALYZED							
SAMPLE TYPE		Grab					
SAMPLE DESCRIPTION	UNITS						
Apparent Color	C.U.	8					
True Color	C.U.	6					
Foaming Agents(MBAS)	mg/L	<0.025					
Sulfides	mg/L	<0.1					
Iron	mg/L	<0.03					
Manganese	mg/L	0.018					
Odor	T.O.N.	8					
Sulfates	mg/L	0.93					
Zinc	mg/L	0.024					
pH		6.75					
Corrosivity							
(Langlier Index)		0.16					
Turbidity	NTU	0.6					
Copper	mg/L	<0.02					

LABORATORY REMARKS: Samples analyzed according to "Methods for Chemical Analysis of Water and Wastes", U. S. Environmental Protection Agency, March, 1979.

Eaille N. Shiroma

BREWER ANALYTICAL LABORATORIES
a Department of Brewer Chemical Corporation
P.O. BOX 45, HONOLULU, HAWAII 96810, TELEPHONE 533-6411

DATE 1/5/81
PAGE 1 OF 1

LABORATORY ANALYSIS REPORT

TO: Austin, Tsutsumi and Assoc. ATTN.: Mr. Bill Bonnet
ADDRESS: PHONE:
SAMPLES OF: Kamole Weir water

SAMPLED BY: Client SAMPLING DATE: 12/12/80 TIME:
RECEIPT DATE: 12/15/80 TIME: 1130

DATE SAMPLE ANALYZED		12/16 – 12/23				
TIME SAMPLE ANALYZED						
SAMPLE TYPE		Grab.				
SAMPLE DESCRIPTION	UNITS		Kamole Weir			
pH	—		7.10			
Total Alkalinity	mg/L as CaCO3		17.5			
Total Dissolved Solids	Mg/L		44.8			
Odor	T.O.N		8			
Total Hardness	mg/L as CaCO3					
Sulfates	mg/L		0.93			
Sulfides	mg/L		<0.1			
MBAS	mg/L					
Chlorides	mg/L		5.39			
Copper			<0.02			
Iron			<0.03			
Manganese			<0.01			
Zinc			0.008			
Sodium			35.3			
Nitrate-N						
Color						

LABORATORY REMARKS: Samples analyzed according to "Methods for Chemical Analysis of Water and Wastes", U. S. Environmental Protection Agency, March, 1979.

T.O.N. = threshold odor no units.

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS • SURVEYORS

	MCL				
Arsenic	0.05	< 0.002	0.009	< 0.005	
Barium	1.	< 0.1	< 0.1	< 0.10	
Cadmium	0.010	0.009	0.019*	< 0.001	
Chromium	0.05	< 0.05	< 0.05	< 0.005	
Lead	0.05	< 0.05	< 0.05	< 0.01	
Mercury	0.002	0.00013	< 0.00001		
Nitrate (as N)	10.	2.82	0.56	0.01	
Selenium	0.01	< 0.002	< 0.002	0.001	
Silver	0.05	< 0.01	< 0.01	< 0.01	
Fluoride	1.8	< 0.01	< 0.01	< 0.05	
Endrin	0.0002	< 0.000001			
Lindane	0.004	< 0.000001			
Methoxychlor	0.1	< 0.000005			
Toxaphene	0.005	< 0.000001			
2, 4-D	0.1	< 0.01			
2, 4, 5-TP Silvex	0.01	< 0.01			
Turbidity	1. NTU	32 month mean 5.6			
Coliform	1/100 ml.				System
Radionuclides (Gross Alpha)	15 pG/L				0.2 ± 0.5 0.0 ± 0.2
Chloride	250	7.2	5.39		5.84
Total Dissolved Solids	500	89.9	44.8	36	
True Color	15 units	6	60	3	42
Copper	1	< 0.02	< 0.02	< 0.02	< 0.01
Foaming Agents	0.5	< 0.025	< 0.025	< 0.025	
Iron	0.3	< 0.03	< 0.03	1.53*	0.13
Manganese	0.05	0.018	< 0.01	0.02	< 0.03
Odor	3 ton	8*	8*		0
pH	6.5-8.5	6.75	7.10	6.18*	
Sulfate	250	0.93	0.93	1.29	
Zinc	5	0.024	0.008	0.03	0.02
H_2S	0.05				
Corrosivity		0.16	(-)1.84*	(-)4.23*	System
Total THM	100	496*	424*	19	21
Sodium	20	35.3*			3.5

* Exceeds MCL

MONTHLY AVERAGES
RANGE 0.9 - 18.1
MEAN 5.6 (32 months)

Turbidity

8/77	5.8
7/77	6.9
2/80	2.9
1/80	0.9
1/79	9.8
2/79	8.4
3/79	6.8
4/79	6.1
5/79	10.4
6/79	3.6
7/79	2.0
8/79	1.9
9/79	3.6
10/79	3.5
11/79	5.9
12/79	2.7
12/78	18.1
10/78	10.6
9/78	7.0
8/78	11.2
7/78	4.2
6/78	9.6
5/78	5.5
4/78	3.3
3/78	3.6
2/78	2.5
1/78	2.8
12/77	3.4
11/77	3.0
10/77	6.7
9/77	2.9
10/80	2.9

Highest Single reading
6/24/78 76

6/24/78	8:15 am	15
	8:20 am	76
8/22/78	8:47 am	59
	8:52 am	57
5/28/79	11:34 am	45
	11:39 am	61
10/23/78	11:05 am	45
	11:10 am	46
9/22/78	1:10 pm	75
	1:15 pm	71
5/6/78	7:53 am	48
	7:58 am	48

PRELIMINARY CONTAMINENTS AND CONTAMINANT LEVELS

Upper Kula Water Treatment Plant
Olinda, Maui, Hawaii

Constituent	Number of Samples	Range Min.	Range Max.	Mean	Standard Deviation	Maximum Contaminant Level	Occurrences Above MCL %
Interim Primary Drinking Water Regulated Contaminants							
Inorganic Chemicals:							
Arsenic	2	<0.002	<0.01			0.05	
Barium	2	<0.01	<0.1			1.0	
Cadmium	2	<0.002	0.023			0.010	50
Chromium	2	<0.05	0.004			0.05	
Lead	2	<0.01	<0.05			0.05	
Mercury	2	<0.00091	<0.0002			0.002	
Nitrate (as N)	2	<0.09	0.52	0.31		10.0	
Selenium	2	<.002	<.01			0.01	
Silver	2			<0.01		0.05	
Floride	1			<0.03		1.4 - 2.4	
Organic Chemicals:							
Endrin	1			<0.0001	-	0.0002	0
Lindane	1			<0.0001	-	0.002	0
Methoxychlor	1			<0.0001	-	0.1	0
Toxaphone	1			<0.0010	-	0.005	0
2,4-D	1			<0.0005	-	0.1	0
2,4,5 - TP Silvex	1			<0.0005	-	0.01	0
Turbidity	361	0.8	2.8	1.8	1.1	1.0	98.6
Microbiological Contaminants (coliform bacteria):	103	<1	TNTC			4 coliform bacteria per 100 ml. in more than one sample per month.	
Total Trihalomethanes:	1			0.007		0.10	
Radionuclides							
Secondary Constituents							
Chloride	1			1.5	-	250	
Color	1			50	-	15 color units	
Copper	1			<0.01		1.0	
Corrosivity Langlier Index Aggressiveness Index	1					Non-corrosive	-9.20
Foaming Agents	1			<0.1		0.5	
Iron	1			0.75	-	0.3	
Manganese	1			<0.02		0.05	
Odor	1			-		3 Threshold Odor Number	
pH	1			5.2		6.5-8.5 Units.	
Sulfate	1			<1.0		250	
Total Dissolved Solids	1			18		500	
Zinc	1			0.026		5	

LOWER KULA WTP

CONTAMINANTS AND CONTAMINANT LEVELS

(PRELIMINARY)

Section	Page
1. Turbidity Data	C-10
2. Bacteriological Data	C-11
3. Primary Inorganic Parameters	C-12
4. Primary Organic Parameters	C-15
5. Secondary Parameters Amended to Primary	C-16
6. Secondary Parameters	C-18
7. Water Quality Data Summary	C-21

R. M. TOWILL CORPORATION
677 Ala Moana Blvd., #1016
Honolulu, Hawaii 96813

SECTION I

TURBIDITY DATA

Location: Piiholo, Lower Kula

Month	Monthly Ave. (NTU)	2-Day Ave. Over 5.0 NTU	No. of Days Missed
10-80	2.8	7	0
9-80	1.7	0	0
8-80	1.8	0	0
7-80	2.1	0	0
6-80	1.9	0	0
5-80	1.8	0	0
4-80	1.5	0	1
3-80	2.9	2	1
2-80	6.9	15	2
1-80	5.9	15	3
12-79	1.7	0	1
11-79	2.4	0	0
10-79	2.1	0	0
9-79	2.2	0	0
8-79	2.2	0	0
7-79	2.0	0	0
6-79	1.9	0	0
5-79	1.8	0	0
4-79	1.5	0	0
3-79	1.0	0	0
2-79	0.8	0	1
1-79	1.0	0	1
12-78	2.2	0	0
11-78	2.4	0	0
10-78	2.2	0	1
9-78	2.2	0	0
8-78	2.0	0	0
7-78	2.2	0	0
6-78	2.6	0	0
5-78	2.4	0	0
4-78	2.3	0	0
3-78	2.6	0	0
2-78	2.0	0	0
1-78	2.4	0	0
12-77	2.4	0	0
11-77	3.0	0	0
10-77	3.2	0	0
9-77	2.7	0	0
8-77	3.8	0	0
7-77	2.2	0	0
40 Months (Ave.)	2.37	Total 42	11
Minimum	0.8		
Maximum	6.9		

SECTION 2

Bacteriological Data

Location: 1104 Ka Drive, Kula, Maui

Month	Monthly Coliform Count/100 ML
6-80	< 1
5-80	< 1
4-80	< 1
3-80	26
2-80	< 1
1-80	27
12-79	< 1
11-79	< 1
10-79	< 1
9-79	TNTC
8-79	< 1
7-79	TNTC
6-79	TNTC
5-79	< 1
4-79	< 1
3-79	< 1
2-79	< 1
1-79	< 1
12-78	< 1
11-78	< 1
10-78	< 1
9-78	< 1
8-78	< 1
7-78	< 1
6-78	< 1
5-78	> 4
4-78	> 4
3-78	< 1
Median	< 1
Mean	Approx. 2.2

SECTION 3

PRIMARY INORGANIC PARAMETERS

Sample/Date (Location)	Arsenic (mg/l)	Barium (mg/l)	Cadmium (mg/l)	Chromium (mg/l)	Lead (mg/l)
DWS/5-12-80 (Piiholo Trans. Line)	0.003	< 0.1	0.015	< 0.05	< 0.05
RMTC #1/7-7-80 (Piiholo Reservoir)	< 0.002	< 0.1	0.022	< 0.05	0.17
RMTC #2/7-7-80 (Piiholo Reservoir)	< 0.002	< 0.1	< 0.005	< 0.05	0.08
RMTC #3/7-8-80 (Piiholo Reservoir)	< 0.002	< 0.1	0.016	< 0.05	< 0.05
RMTC #4/7-8-80 (Piiholo Reservoir)	< 0.002	< 0.1	0.014	< 0.05	< 0.05
RMTC #5/7-8-80 (Piiholo Reservoir)	< 0.002	< 0.1	< 0.005	< 0.05	0.06
RMTC #6/10-28-80 (Piiholo Reservoir)	-	-	0.033	-	< 0.05
RMTC #7/10-28-80 (Piiholo Reservoir)	-	-	< 0.005	-	< 0.05
RMTC #8/10-28-80 (Piiholo Reservoir)	-	-	< 0.005	-	< 0.05
RMTC #9/10-28-80 (Piiholo Reservoir)	-	-	< 0.005	-	< 0.05
RMTC #10/10-28-80 (Piiholo Reservoir)	-	-	0.014	-	< 0.05
S&S Report/4-22-74 (Kula, Maui)	0.005	0.10	0.001	0.005	0.001
S&S Report/4-29-75 (Kula, Maui)	0.005	0.10	0.001	0.005	0.01
DWS/7-8-80 (Piiholo Trans. Line)	< 0.002	< 0.10	0.007	< 0.05	< 0.05
DWS/7-23-80 (Kula, Maui)	< 0.002	< 0.8	< 0.005	< 0.02	< 0.02
RMTC #11/11-25-80 (Piiholo Reservoir)	< 0.002	< 0.1	< 0.005	< 0.05	< 0.05
RMTC #12/11-25-80 (Piiholo Reservoir)	< 0.002	< 0.1	< 0.005	< 0.05	< 0.05

PRIMARY INORGANIC PARAMETERS (cont'd)

Sample/Date (Location)	Mercury (ug/l)	Nitrate -N (mg/l)	Selenium (mg/l)	Silver (mg/l)	Fluoride (mg/l)
DWS/5-12-80 (Piiholo Trans. Line)	0.01	0.61	< 0.002	< 0.01	< 0.01
RMTC #1/7-7-80 (Piiholo Reservoir)	0.08	4.49	<0.002	< 0.01	-
RMTC #2/7-7-80 (Piiholo Reservoir)	0.06	3.82	<0.002	< 0.01	-
RMTC #3/7-8-80 (Piiholo Reservoir)	0.05	3.27	<0.002	< 0.01	-
RMTC #4/7-8-80 (Piiholo Reservoir)	0.02	3.51	<0.002	< 0.01	-
RMTC #5/7-8-80 (Piiholo Reservoir)	0.02	3.58	<0.002	< 0.01	-
RMTC #6/10-28-80 (Piiholo Reservoir)	-	0.37	-	-	-
RMTC #7/10-28-80 (Piiholo Reservoir)	-	-	-	-	-
RMTC #8/10-28-80 (Piiholo Reservoir)	-	-	-	-	-
RMTC #9/10-28-80 (Piiholo Reservoir)	-	-	-	-	-
RMTC #10/10-28-80 (Piiholo Reservoir)	-	-	-	-	-
S&S Report/4-22-74 (Kula, Maui)	-	0.09	0.001	0.01	-
S&S Report/4-29-75 (Kula, Maui)	-	0.01	0.001	0.01	-
DWS/7-8-80 (Piiholo Trans. Line)	0.12	2.39	< 0.002	< 0.01	< 0.01
DWS/7-23-80 (Kula, Maui)	< 0.5	0.06	< 0.01	< 0.03	< 0.20
RMTC #11/11-25-80 (Piiholo Reservoir)	0.04	0.46	< 0.002	< 0.01	0.05
RMTC #12/11-25-80 (Piiholo Reservoir)	0.04	0.40	< 0.002	< 0.01	0.05

PRIMARY INORGANIC PARAMETERS

SUMMARY

	Parameters	Std.	Min.	Max.	Mean	Median
1.	Arsenic (mg/l)	0.05	< 0.002	< 0.02	0.0039	< 0.002
2.	Barium (mg/l)	1.0	< 0.1	< 0.8	0.21	< 0.1
3.	Cadmium (mg/l)	0.01	0.001	0.033	0.0093	< 0.005
4.	Chromium (mg/l)	0.05	0.005	< 0.05	0.038	< 0.05
5.	Lead (mg/l)	0.05	0.001	0.17	0.051	< 0.05
6.	Mercury (ug/l)	2.0	0.01	0.5	0.13	0.06
7.	Nitrate -N (mg/l)	10.0	0.01	4.49	1.66	0.46
8.	Selenium (mg/l)	0.01	0.001	< 0.01	0.0031	< 0.002
9.	Silver (mg/l)	0.05	< 0.01	< 0.03	0.01	< 0.01
10.	Fluoride (mg/l)	--	< 0.01	< 0.20	0.087	0.05

SECTION 4

PRIMARY ORGANIC PARAMETERS

Sample/Date (Location)	Chlorinated Hydrocarbons (mg/l)	Chlorophenoxys (mg/l)
RMTC #1/7-7-80 (Piiholo Reservoir)	Neg.	Neg.
RMTC #2/7-7-80 (Piiholo Reservoir)	Neg.	Neg.
RMTC #3/7-8-80 (Piiholo Reservoir)	Neg.	Neg.
RMTC #4/7-8-80 (Piiholo Reservoir)	Neg.	Neg.
RMTC #5/7-8-80 (Piiholo Reservoir)	Neg.	Neg.
DWS/7-8-80 (Piiholo Trans. Line)	Neg.	Neg.
RMTC #11/11-25-80 (Piiholo Reservoir)		
RMTC #12/11-25-80 (Piiholo Reservoir)		
Std. (mg/l)	0.1092 (total)	0.11 (total)

CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

PRIMARY INORGANIC PARAMETERS

SUMMARY

	Parameters	Std.	Min.	Max.	Mean	Median
1.	Arsenic (mg/l)	0.05	< 0.002	< 0.02	0.0039	< 0.002
2.	Barium (mg/l)	1.0	< 0.1	< 0.8	0.21	< 0.1
3.	Cadmium (mg/l)	0.01	0.001	0.033	0.0093	< 0.005
4.	Chromium (mg/l)	0.05	0.005	< 0.05	0.038	< 0.05
5.	Lead (mg/l)	0.05	0.001	0.17	0.051	< 0.05
6.	Mercury (ug/l)	2.0	0.01	0.5	0.13	0.06
7.	Nitrate -N (mg/l)	10.0	0.01	4.49	1.66	0.46
8.	Selenium (mg/l)	0.01	0.001	< 0.01	0.0031	< 0.002
9.	Silver (mg/l)	0.05	< 0.01	< 0.03	0.01	< 0.01
10.	Fluoride (mg/l)	-	< 0.01	< 0.20	0.087	0.05

SECTION 4

PRIMARY ORGANIC PARAMETERS

Sample/Date (Location)	Chlorinated Hydrocarbons (mg/l)	Chlorophenoxys (mg/l)
RMTC #1/7-7-80 (Piiholo Reservoir)	Neg.	Neg.
RMTC #2/7-7-80 (Piiholo Reservoir)	Neg.	Neg.
RMTC #3/7-8-80 (Piiholo Reservoir)	Neg.	Neg.
RMTC #4/7-8-80 (Piiholo Reservoir)	Neg.	Neg.
RMTC #5/7-8-80 (Piiholo Reservoir)	Neg.	Neg.
DWS/7-8-80 (Piiholo Trans. Line)	Neg.	Neg.
RMTC #11/11-25-80 (Piiholo Reservoir)		
RMTC #12/11-25-80 (Piiholo Reservoir)		
Std. (mg/l)	0.1092 (total)	0.11 (total)

SECTION 5

PARAMETERS AMENDED TO PRIMARY *

Sample/Date (Location)	Corrosivity	TDS (mg/l)	Chlorides (mg/l)	Sodium (mg/l)	Trihalo-methane (ug/l)
RMTC #1/7-7-80 (Piiholo Reservoir)	-	-	-	-	50
RMTC #6/10-28-80 (Piiholo Reservoir)	-3.79	118	Neg.	4.23	-
RMTC #7/10-28-80 (Piiholo Reservoir)	-3.31	116	Neg.	3.38	68
RMTC #8/10-28-80 (Piiholo Reservoir)	-3.96	92	Neg.	2.67	51
RMTC #9/10-28-80 (Piiholo Reservoir)	-3.88	103	Neg.	2.32	-
RMTC #10/10-28-80 (Piiholo Reservoir)	-3.88	91	Neg.	2.32	-
S&S Report/4-29-75 (Kula, Maui)	-	70	1.5	2.76	-
DWS/7-8-80 (Piiholo Trans. Line)	-	66.2	5.0	12.1	-
DWS/7-23-80 (Kula, Maui)	-	28	4.2	1.6	-
RMTC #11/11-25-80 (Piiholo Reservoir)	-3.9	29	1.2	8.7	
RMTC #12/11-25-80 (Piiholo Reservoir)	-3.8	32	1.3	8.3	
DWS/9-3-80 (Maui Elec. Substa. Kula)	-	22	5.4	1.5	-

*Proposed parameters to be amended to primary.

PARAMETERS AMENDED TO PRIMARY *

SUMMARY

	Parameters	Std.	Min.	Max.	Mean	Median
1.	Corrosivity	Non-corrosive	-3.31	-3.96	-3.79	-3.88
2.	TDS (mg/l)	500	22	118	69.7	70.0
3.	Chlorides (mg/l)	250	Neg.	5.4	1.69	1.2
4.	Sodium (mg/l)	20[1]	1.5	12.1	4.53	2.76
5.	Trihalomethane (ug/l)	100	50	68	56.3	51

1. Proposed std.

SECTION 6

SECONDARY PARAMETERS

Sample/Date (Location)	Color (mg/l)	Copper (mg/l)	Foaming Agent (mg/l)	Hydrogen Sulfide (mg/l)	Iron (mg/l)	Manganese (mg/l)
RMTC #1/7-7-80 (Piiholo Reservoir)	-	< 0.02	-	-	0.33	-
RMTC #2/7-7-80 (Piiholo Reservoir)	-	< 0.02	-	-	0.30	-
RMTC #3/7-8-80 (Piiholo Reservoir)	-	< 0.02	-	-	0.24	-
RMTC #4/7-8-80 (Piiholo Reservoir)	-	< 0.02	-	-	0.23	-
RMTC #5/7-8-80 (Piiholo Reservoir)	-	< 0.02	-	-	0.24	-
RMTC #6/10-28-80 (Piiholo Reservoir)	42	-	-	-	0.60	-
RMTC #7/10-28-80 (Piiholo Reservoir)	44	-	-	-	0.28	-
RMTC #8/10-28-80 (Piiholo Reservoir)	50	-	-	-	0.36	-
RMTC #9/10-28-80 (Piiholo Reservoir)	50	-	-	-	0.38	-
RMTC #10/10-28-80 (Piiholo Reservoir)	45	-	-	-	0.31	-
S&S Report/4-29-75 (Kula, Maui)	27	-	-	-	0.17	-
DWS/7-8-80 (Piiholo Trans. Line)	-	-	-	-	0.07	0.07
RMTC #11/11-25-80 (Piiholo Reservoir)	50	< 0.02	0.02	0.197	0.40	0.40
RMTC #12/11-25-80 (Piiholo Reservoir)	70	< 0.02	0.01	0.166	0.35	0.35

SECONDARY PARAMETERS (cont'd)

Sample/Date (Location)	Odor (TON)	Sulfate (mg/l)	Zinc (mg/l)	pH	Total Alkalinity (mg/l)
RMTC #1/7-7-80 (Piiholo Reservoir)	-	-	-	6.5	-
RMTC #2/7-7-80 (Piiholo Reservoir)	-	-	-	6.3	-
RMTC #3/7-8-80 (Piiholo Reservoir)	-	-	-	6.5	-
RMTC #4/7-8-80 (Piiholo Reservoir)	-	-	-	6.6	-
RMTC #5/7-8-80 (Piiholo Reservoir)	-	-	-	6.4	-
RMTC #6/10-28-80 (Piiholo Reservoir)	-	-	-	6.5	10.0
RMTC #7/10-28-80 (Piiholo Reservoir)	-	-	-	7.1	8.6
RMTC #8/10-28-80 (Piiholo Reservoir)	-	-	-	6.6	7.4
RMTC #9/10-28-80 (Piiholo Reservoir)	-	-	-	6.6	8.0
RMTC #10/10-28-80 (Piiholo Reservoir)	-	-	-	6.6	7.9
S&S Report/4-29-75 (Kula, Maui)	-	-	-	6.7	9.4
DWS/7-8-80 (Piiholo Trans. Line)	-	-	-	-	-
RMTC #11/11-25-80 (Piiholo Reservoir)	2	11.3	0.03	6.5	0.8
RMTC #12/11-25-80 (Piiholo Reservoir)	4	8.1	0.03	6.5	5.0

SECONDARY PARAMETERS

SUMMARY

	Parameters	Std.	Min.	Max.	Mean	Median
1.	Color (units)	15	27	70	47	50
2.	Copper (mg/l)	1.0	< 0.02	< 0.02	< 0.02	< 0.02
3.	Foaming Agent (mg/l)	0.5	< 0.01	< 0.02	0.015	< 0.01
4.	Hydrogen Sulfide (mg/l)		0.166	0.197	0.182	0.166
5.	Iron (mg/l)	0.3	0.07	0.60	0.30	0.30
6.	Manganese (mg/l)	0.05	0.07	0.40	0.27	0.35
7.	Odor (TON)	3	2	4	3	2
8.	Sulfate (mg/l)	250	8.1	11.3	9.7	8.1
9.	Zinc (mg/l)	5	0.03	0.03	0.03	0.03
10.	pH	6.5-8.5	6.3	7.1	6.6	6.5
11.	Total Alkalinity (mg/l)		0.8	10.0	7.1	7.9

SECTION 7

WATER QUALITY DATA SUMMARY

Parameters	Std.	Min.	Max.	Mean	Median
1. Turbidity (NTU)	1.0	0.8	6.9	2.37	-
2. Coliform (/100 ml)	0.1	< 1	TNTC	2.2	< 1
3. Primary Inorganic Parameters					
Arsenic (mg/l)	0.05	< 0.002	< 0.02	0.004	< 0.002
Barium (mg/l)	1.0	< 0.01	< 0.8	0.21	< 0.01
Cadmium (mg/l)	0.01	0.001	0.033	0.009	< 0.005
Chromium (mg/l)	0.05	0.005	< 0.05	0.038	< 0.05
Lead (mg/l)	0.05	0.001	0.17	0.051	< 0.05
Mercury (ug/l)	2.0	0.01	< 0.05	0.13	0.06
Nitrate -N (mg/l)	10.0	0.01	4.9	1.66	0.46
Selenium (mg/l)	0.01	0.001	0.01	0.003	< 0.002
Silver (mg/l)	0.05	< 0.01	< 0.03	0.01	< 0.01
Fluoride (mg/l)	-	< 0.01	< 0.20	0.087	0.05
4. Primary Organic Parameter					
Chlorinated Hydrocarbons (mg/l)	0.1092	Neg.	Neg.	Neg.	Neg.
Chlorophenoxys (mg/l)	0.11	Neg.	Neg.	Neg.	Neg.
5. Secondary Amendments					
Corrosivity	Non-Cor.	-3.31	-3.96	-3.79	-3.88
TDS (mg/l)	500	22.0	118.0	69.7	70.0
Chlorides (mg/l)	250	Neg.	5.4	1.69	4.53
Sodium (mg/l)	20	1.5	12.1	4.53	2.76
Trihalomethane (ug/l)	100	50	68	56.3	51.0
6. Secondary Parameters					
Color (units)	15	27	70	47	50
Copper (mg/l)	1.0	< 0.02	< 0.02	< 0.02	< 0.02
Foaming Agent (mg/l)	0.5	< 0.01	< 0.02	0.015	< 0.01
Hydrogen Sulfide (mg/l)		0.166	0.197	0.182	0.166
Iron (mg/l)	0.3	0.07	0.60	0.30	0.30
Manganese (mg/l)	0.05	0.07	0.40	0.27	0.35
Odor (TON)	3.0	2.0	4.0	3.0	2.0
Sulfate (mg/l)	250	8.1	11.3	9.7	8.1
Zinc (mg/l)	5	0.03	0.03	0.03	0.03
pH	6.5-8.5	6.3	7.1	6.6	6.5
Alkalinity (mg/l)	-	0.8	10.0	7.1	7.9

APPENDIX D

WATER CONSUMPTION

APPENDIX D

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APPENDIX D

LIST OF FIGURES

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D-7A1	Kula Dry Year Projections (4%, 5%, 6%)
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D-8	Makawao Water Projections (8%)

APPENDIX D

WATER CONSUMPTION

Makawao-Kula

I. WATER SERVICE AND CONSUMPTION

The Makawao water system was developed approximately 72 years ago (1908). Most of the residents collected rain water and stored the water in tanks. The system consisted of a 2.5-inch pipeline from the Maluhea Reservoir (150,000 gal. capacity) which served the needs of 22 consumers.

The advent of World War II, followed by the increased development of farms in the Kula area, necessitated by the *nineteen-fifties* the enlargement of the water system.

In 1952 the "First Report of the Maui County Water Works Board" was issued, covering the period of July 1, 1949 through December 31, 1952. According to this report, the total number of consumers in 1952 was 2,044, and the annual consumption was 468,278,000 gallons. The system has expanded over the last twenty-eight years.

In 1980 the system had 5,253 connections and used approximately 1,200,879,000 gallons of water - a growth of about 159% in connections and 164% consumption. (Please refer to Table D-1 and Figure D-1A). Additional information is provided for the water subareas served within the Makawao District in Table D-2.

Average daily consumption of the subareas within the Makawao District is presented in Table D-3 and Figures D-3A through D-3F. The data and figures show a dramatic rise in connections and water consumption over the last two decades, especially for the Kula and Makawao areas.

II. FUTURE WATER REQUIREMENT

A. Introduction

Projections of future water requirements for the Makawao District cannot be done with accuracy. The growth trend, especially in the Kula area with its different water use and requirements, presents problems in projecting future requirements. The vast potential for urbanization and continued need for water for agriculture are evident. The water needs can be tremendous, greater than presently available.

Previous projections for the other subareas, especially the Makawao-Pukalani subarea, have been overestimated, demonstrating that water projections are influenced by numerous variables and, at best, can only indicate trends in future water requirements.

TABLE D-1

SUMMARY OF WATER SERVICES AND CONSUMPTION

MAKAWAO DISTRICT

1952 - 1980

YEAR	NUMBER OF CONSUMERS	GALLONS (1,000 Gallons)
1952	2,044	468,278
1953	2,068	509,488
1954	2,089	456,700
1955	2,099	436,137
1956	2,136	401,625
1957	2,157	481,956
1958	2,175	495,548
1959	2,215	523,129
1960	2,277	564,493
1961	2,326	553,879
1962	2,368	577,924
1963	2,447	464,856
1964	2,208	567,060
1965	2,263	444,397
*1966	2,458	449,491
1967	2,522	512,138
1968	2,593	480,346
1969	2,728	593,437
1970	2,855	683,136
1971	2,997	661,071
1972	3,191	767,107
1973	3,421	895,211
1974	3,573	816,384
1975	3,813	967,703
1976	4,055	1,090,029
1977	4,487	1,221,067
1978	4,793	1,324,924
1979	5,001	1,141,687
1980	5,253	1,200,879

* Covered 18-month period (January 1, 1966 - June 30, 1967)

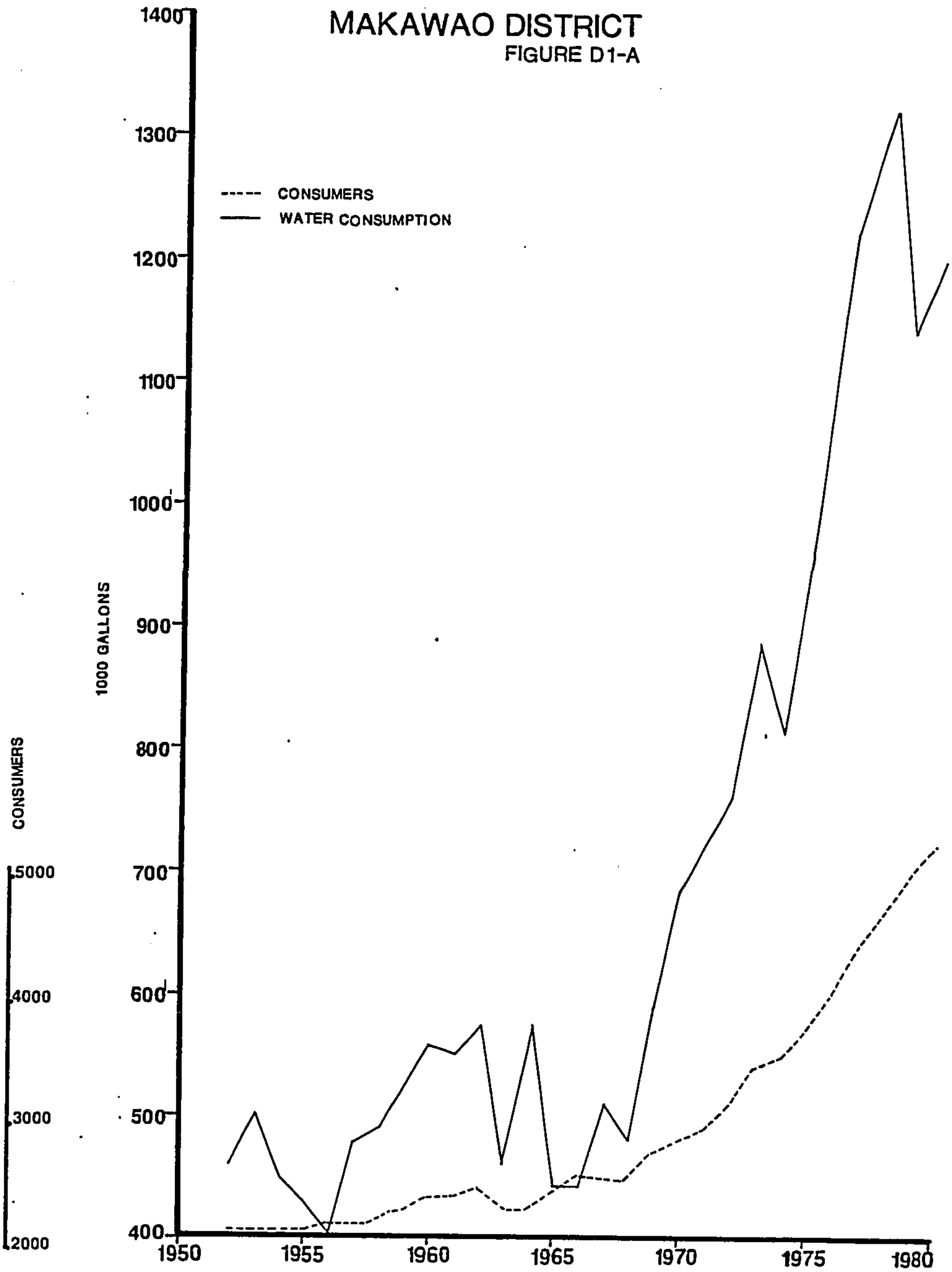

MAKAWAO DISTRICT
FIGURE D1-A
CONSUMERS
WATER CONSUMPTION
1000 GALLONS
CONSUMERS
1400
1300
1200
1100
1000
900
800
700
600
500
400
5000
4000
3000
2000
1950
1955
1960
1965
1970
1975
1980

TABLE D-2

HISTORICAL WATER CONSUMPTION BY SUBAREA (1952-1980)

MAKAWAO DISTRICT Date	KOKOMO-KAUPAKULUA-ULUMALU Consumers	KOKOMO-KAUPAKULUA-ULUMALU 1,000 Gallon Consumption	KUIAHA Consumers	KUIAHA 1,000 Gallon Consumption	HAIKU-PAUWELA Consumers	HAIKU-PAUWELA 1,000 Gallon Consumption	MAKAWAO Consumers	MAKAWAO 1,000 Gallon Consumption	PUKALANI 2/ Consumers	PUKALANI 2/ 1,000 Gallon Consumption
December 31, 1952	179		78		261		452			
December 31, 1953	175		79		261		466			
December 31, 1954										
December 31, 1955										
December 31, 1956										
December 31, 1957	185	13,263	82	29,551	274	25,410	504	80,910		
December 31, 1958	184	11,980	83	28,529	270	27,144	502	80,508		
December 31, 1959	187	13,760	95	32,651	265	26,843	522	85,154		
December 31, 1960	195	13,644	98	34,504	269	27,947	558	88,520		
December 31, 1961	205	15,169	98	33,347	268	31,154	578	94,514		
December 31, 1962	218	15,742	96	34,876	256	30,089	603	95,022		
December 31, 1963	227	15,060	104	25,930	266	28,878	625	81,997		
December 31, 1964	237	16,025	105	20,168	267	27,905	677	96,159		
December 31, 1965	240	17,491	106	23,957	268	28,311	720	87,810		
June 30, 1966	242	17,626	108	22,353	268	29,076	753	94,735		
June 30, 1967	247	17,773	111	27,640	263	27,572	808	107,905		
June 30, 1968	252	19,855	113	25,014	261	24,904	856	102,292		
June 30, 1969	256	20,234	114	24,464	266	25,649	924	122,276		
June 30, 1970	267	20,915	118	22,070	265	25,052	991	135,887		
June 30, 1971	275	21,973	122	16,272	271	26,344	1,067	157,179		
June 30, 1972	295	26,840	125	19,411	269	31,994	1,153	181,948		
June 30, 1973	311	30,200	133	18,319	272	30,307	1,260	192,364		
June 30, 1974	329	34,243	138	19,279	277	32,429	1,314	208,384		
June 30, 1975	347	39,882	147	22,900	297	34,703	1,421	240,422		
June 30, 1976	362	40,531	151	23,094	306	34,664	1,548	273,472		
June 30, 1977 1/	394	45,751	157	22,656	316	38,730	1,831	317,333		
June 30, 1978	427	53,653	161	26,975	329	43,145	904	159,481	1,057	183,297
June 30, 1979	448	50,901	166	22,288	335	40,107	937	130,250	1,111	169,273
June 30, 1980	475	61,406	171	24,995	340	47,756	975	143,578	1,208	184,791

Table D-2 - Continued

HALIIMAILE Consumers	HALIIMAILE 1,000 Gallon Consumption	PAIA-(KUAU) HAMAKUAPOKO Consumers	PAIA-(KUAU) HAMAKUAPOKO 1,000 Gallon Consumption	KULA 3/ Consumers	KULA 3/ 1,000 Gallon Consumption	LOWER KULA Consumers	LOWER KULA 1,000 Gallon Consumption	UPPER KULA Consumers	UPPER KULA 1,000 Gallon Consumption	ULUPALAKUA-KANAIO Consumers	ULUPALAKUA-KANAIO 1,000 Gallon Consumption
		310		764							
		311		776							
		317	35,718	800	297,104						
		315	34,552	821	312,835						
		310	34,580	836	330,141						
		314	38,504	843	361,844						
		319	38,066	858	341,629						
		322	35,536	863	366,664						
		331	33,937	894	279,054						
		355	46,371	919	395,723						
		3	11,753	926	276,075						
147		3	12,301	937	323,400						
146	19,275	3	12,580	944	299,393						
150	20,939	3	8,384	958	278,958						
160	23,282	3	9,214	1,047	368,318						
164	23,119	3	5,756	1,005	450,337						
170	23,852	3	5,901	1,084	409,550						
173	28,044	3	10,552	1,173	468,318						
175	26,689	3	1,257	1,267	596,075						
174	27,850	3	1,976	1,337	492,223						
175	31,562	3	2,654	1,424	595,580						
174	30,741	3	3,734	1,511	683,793						
175	6,430	3	32,494	1,639	757,673						
174	32,649	3	10,975	1,738	4/ 814,754	565	436,547	1,120	357,340	53	20,867
179	26,777	3	8,973	1,822	4/ 693,118	595	379,670	1,170	280,530	57	32,918
179	28,545	3	5,675	1,902	4/ 704,133	633	378,860	1,211	295,053	58	30,220

1/ Kula Moratorium issued.
2/ Pukalani was included with Makawao prior to 1978.
3/ Kula included Makena prior to 7-1-76.
4/ Total for Upper/Lower Kula, Ulupalakua and Kanaio.

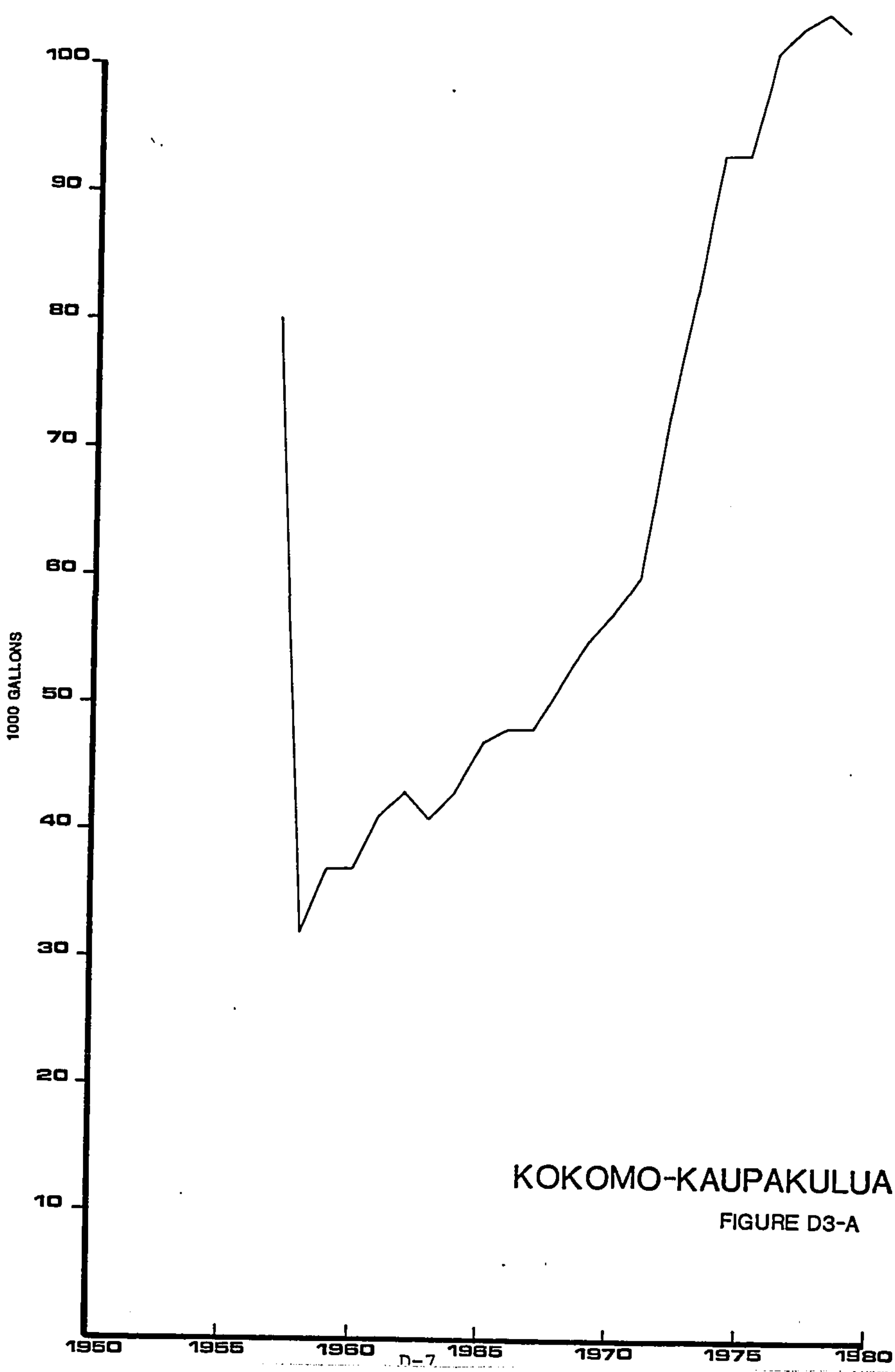
TABLE D-3

AVERAGE DAILY CONSUMPTION BY SUBAREA (1957-1980)
GALLONS*

Year	Kokomo Kaupakulua Ulumalu	Kuiaha	Haiku-Pauwela	Makawao	1/ Pukalani	Hailimaile	2/ Paia-Hamakuapoko	Kula	Lower Kula	Upper Kula	Ulupalakua-Kanaio
1957	36,337	80,961	69,616	221,671			97,857	813,983			
1958	32,822	78,161	74,367	220,569			94,663	857,082			
1959	37,698	89,454	73,542	233,298			94,739	904,495			
1960	37,380	94,531	76,567	242,520			105,490	991,353			
1961	41,558	91,361	85,353	258,942			104,290	935,969			
1962	43,128	95,550	82,435	260,334			97,358	1,004,558			
1963	41,260	71,041	79,117	224,649			92,978	764,531			
1964	43,904	55,254	76,452	263,449			30,356	1,084,172			
1965	47,920	62,895	77,564	240,575			32,200	756,369			
1966	48,290	61,241	79,660	259,547			33,701	886,027			
1967	48,693	75,726	75,539	295,630		52,808	34,465	820,254			
1968	54,397	68,531	68,230	280,252		57,367	22,969	764,268			
1969	55,435	67,024	70,271	335,002		63,786	25,243	1,009,090			
1970	57,301	60,465	68,635	372,293		63,339	15,769	1,233,800			
1971	60,200	44,580	72,175	430,627		65,347	16,167	1,222,054			
1972	73,534	53,180	87,654	498,487		76,832	28,909	1,283,063			
1973	82,739	50,189	83,032	527,024		73,120	3,443	1,633,082			
1974	93,816	52,819	88,846	570,915		76,301	5,413	1,348,556			
1975	109,265	62,739	95,076	658,690		86,471	7,271	1,631,726			
1976	111,043	63,271	94,969	749,238		84,221	10,230	1,873,405			
1977	125,345	62,071	106,109	869,405		17,616	89,024	2,075,816			
1978	146,994	73,904	118,205	436,934	502,183	89,449	30,068	3/ 2,232,202	1,196,019	979,013	57,170
1979	139,454	61,063	109,882	356,849	463,761	73,361	24,583	3/ 1,898,952	1,040,191	768,575	90,186
1980	168,235	68,479	130,838	393,364	506,276	78,205	15,547	3/ 1,929,130	1,037,972	808,364	82,794

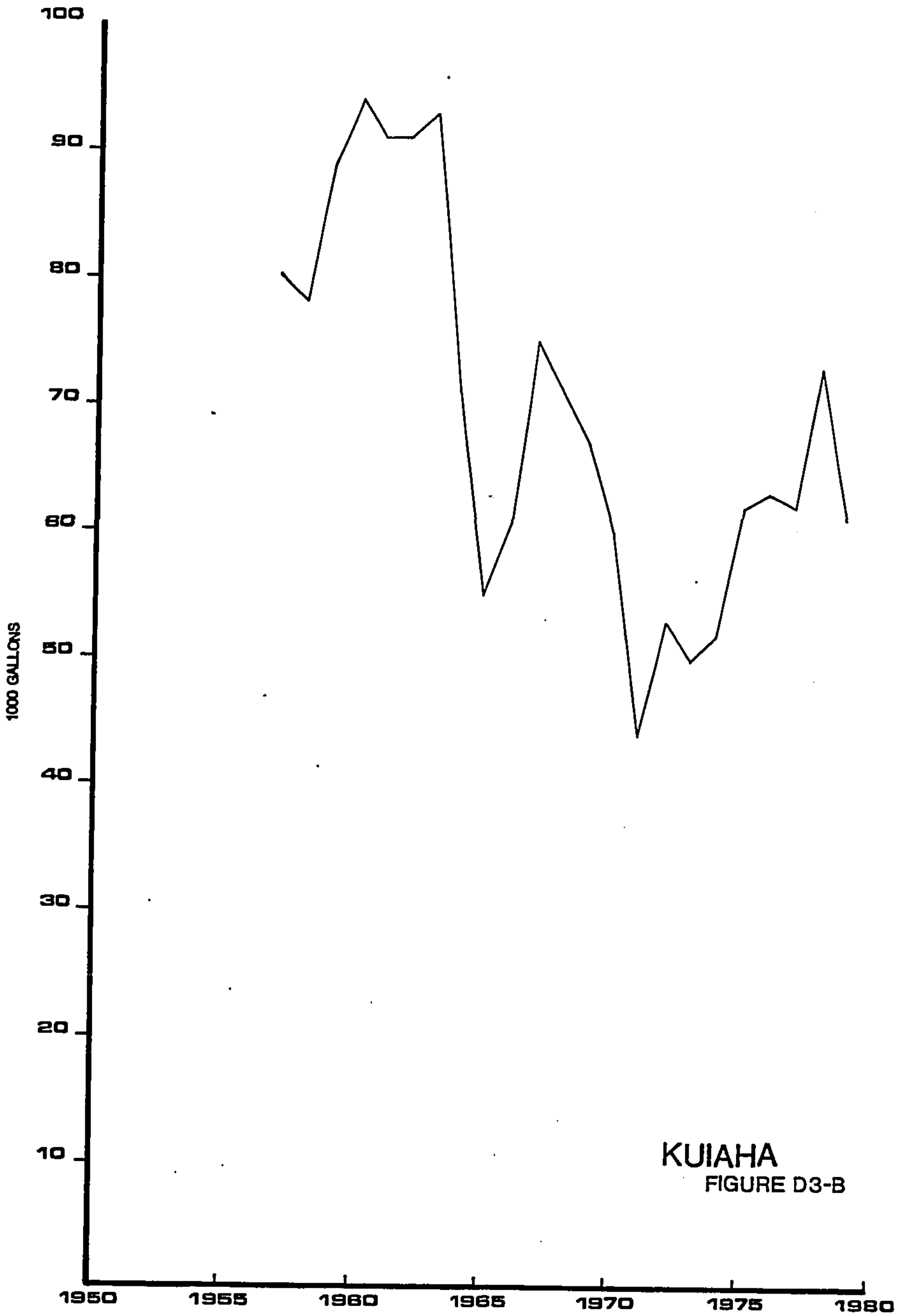
*Please refer to Figures D-3A to D-3F. Daily Consumption Graphs.

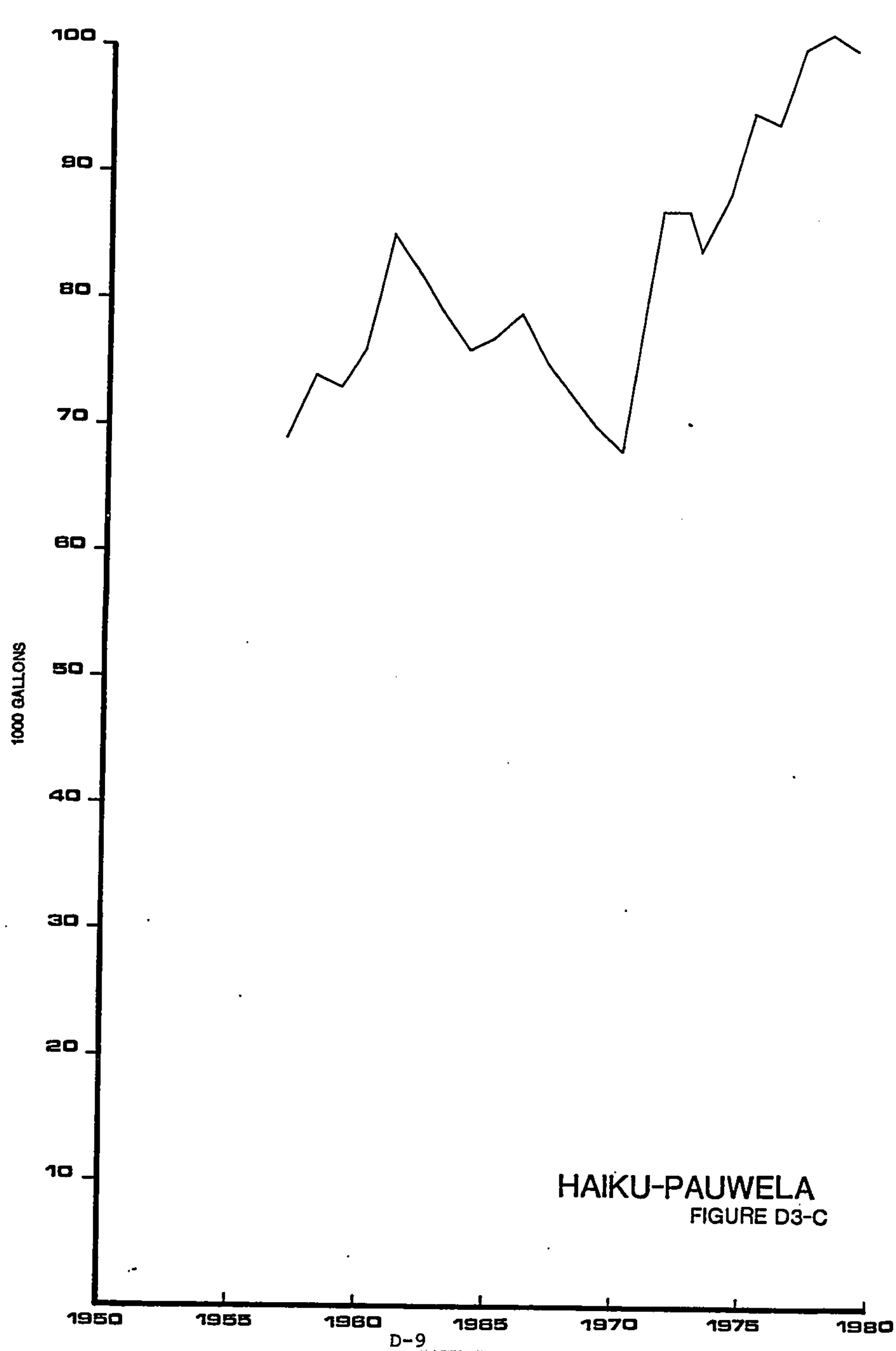
1/ Pukalani was included with Makawao prior to 1978.
2/ This was the Paia-Kuau area prior to 1964.
3/ Combined totals for Lower and Upper Kula, Ulupalakua & Kanaio.

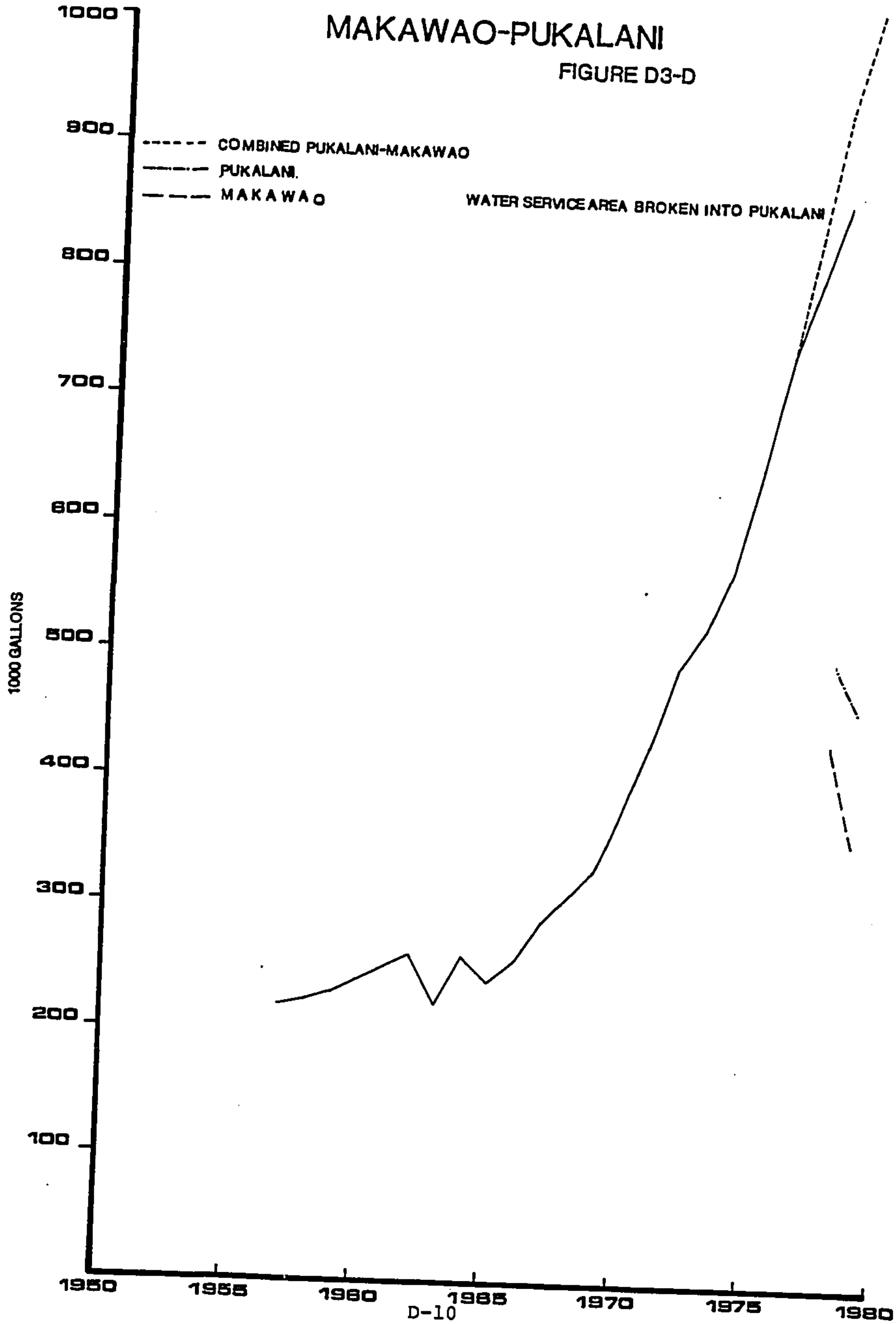


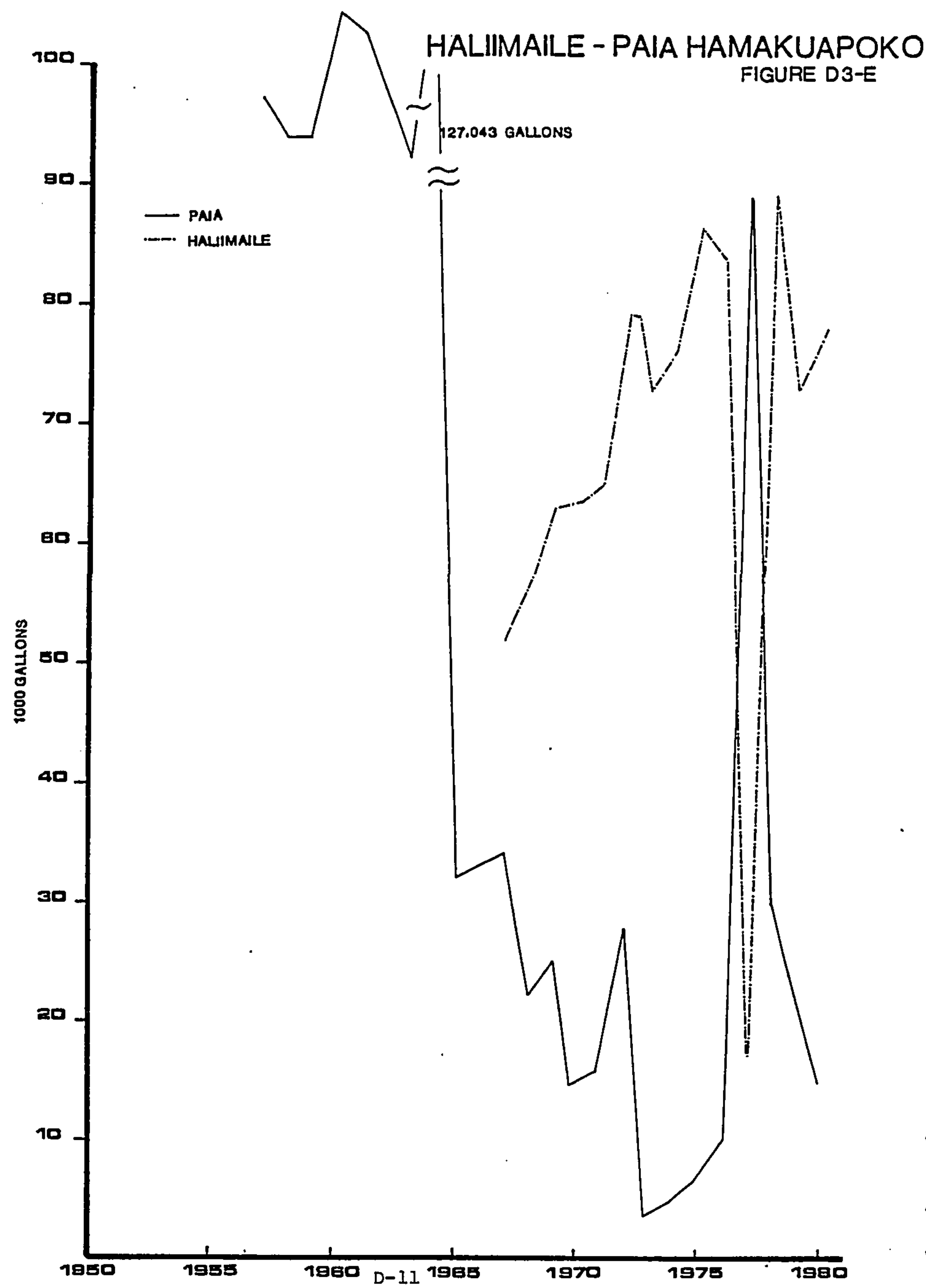
KOKOMO-KAUPAKULUA

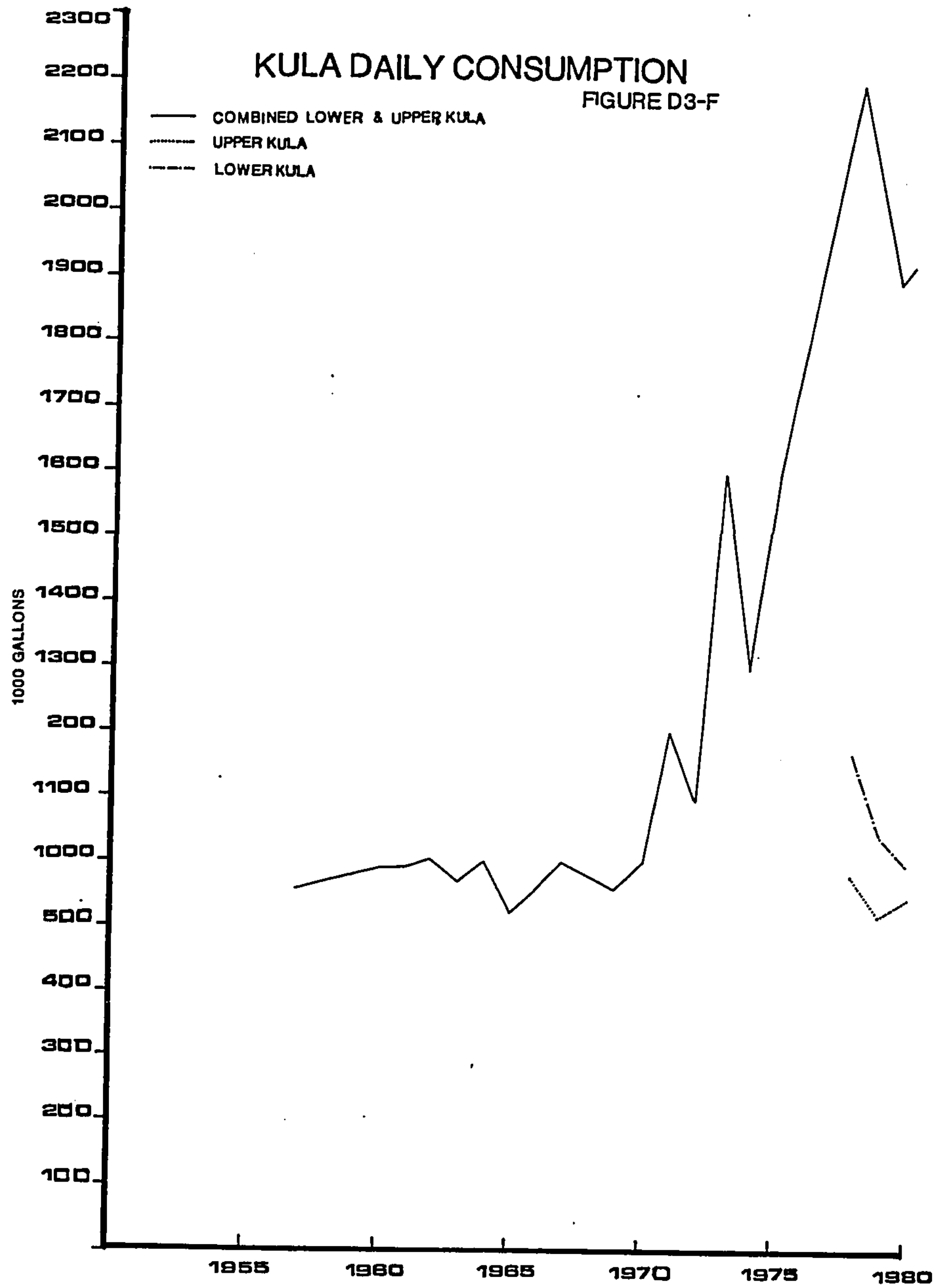
FIGURE D3-A


100
90
80
70
60
50
40
30
20
10
1000 GALLONS
1950
1955
1960
1965
1970
1975
1980
KUIAHA
FIGURE D3-B


100
90
80
70
60
50
40
30
20
10
1000 GALLONS
HAIKU-PAUWELA
FIGURE D3-C
1950
1955
1960
1965
1970
1975
1980


MAKAWAO-PUKALANI
FIGURE D3-D
COMBINED PUKALANI-MAKAWAO
PUKALANI.
MAKAWAO
WATER SERVICE AREA BROKEN INTO PUKALANI
1000 GALLONS
1000
900
800
700
600
500
400
300
200
100
1950
1955
1960
1965
1970
1975
1980


HALIIMAILE - PAIA HAMAKUAPOKO
FIGURE D3-E
127,043 GALLONS
PAIA
HALIIMAILE
1000 GALLONS
100
90
80
70
60
50
40
30
20
10
1950
1955
1960
1965
1970
1975
1980


KULA DAILY CONSUMPTION
FIGURE D3-F
COMBINED LOWER & UPPER KULA
UPPER KULA
LOWER KULA
1000 GALLONS
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
200
1100
1000
500
400
300
200
100
1955
1960
1965
1970
1975
1980

Nonetheless, water projections are necessary for planning purposes and are required to evaluate the optimum size for the water treatment plants. The following discussion and projections are presented with this in mind.

B. Makawao District Water Service Area

Projections of the future water needs for the Makawao District require analysis of the historical consumption pattern. Also, other parameters may be used for water projection; these include population trends, general plans, and other indirect measures of growth such as telephone connections. However, future water projections will only use previous water consumption as a base for projections. The other parameters were evaluated and found not to be useful for projections.

1. Population - 1980

The population of the Makawao Service District is found in Tables D-4, D-5 and D-6. The 1980 Census was used and altered to estimate the population for the water service district. The population for the Makawao Service District is estimated at 16,410 people for 1980.

2. Population Projections

The population estimates for Kula and Makawao are found in Tables D-7 and D-8 and

TABLE D-4

POPULATION - MAKAWAO DISTRICT[1]

Division	CDP	1940	1950	1960	1970	1980	% Change 1970-80	Land Area 1980 Acres
Kula	Wailea[2]	-	-	-	-	1,111	-	1,348
	Keokea	454	698	436	-	-	-	-
	Waiakoa	695	517	416	-	-	-	-
Makawao-Paia	Haliimaile	-	-	-	638	743	16.5	150
	Lower Paia[3]	1,235	1,137	925	1,105	1,516	37.2	626
	Makawao	903	1,098	977	1,066	2,912	173.2	1,111
	Paia[3]	4,272	3,195	2,144	541	193	-64.3	630
	Pukalani	-	-	-	1,629	3,963	143.3	1,478
Haiku-Pauwela	Haiku	-	-	-	464	616	32.7	194
	Pauwela	-	-	-	355	463	30.4	234

1 The Population of Hawaii, 1980. Preliminary Census Results. Statistical Report 141, November 19, 1980. Research and Economic Analysis Division, Department of Planning and Economic Development, State of Hawaii.

2 Wailea is outside of the Makawao District water service area. Therefore, if the Census Designated Place (CDP) is subtracted out of the Kula Division, this would be indicative of the population of the Kula area (4,975 - 1,111 = 3,864).

3 CDP's Lower Paia and Paia are outside of the Makawao District water service area; therefore, they must be subtracted out of the Makawao - Paia Census Division (10,703 - 1,709 = 8,994).

TABLE D-5

CENSUS DIVISION DATA FOR MAKAWAO DISTRICT
UNCORRECTED

Census Division	1950	1960	1970	1980	% Change 1970-80
Kula	NA	2,786	2,124	4,975	134.2
Makawao - Paia	NA	5,680	5,788	10,703	84.9
Haiku - Pauwela	NA	1,943	2,067	3,552	71.8
TOTAL		10,409	9,979	19,230	

TABLE D-6

CENSUS DIVISION DATA CORRECTED FOR MAKAWAO DISTRICT WATER SERVICE AREA

Census Division	1940	1950	1960	1970	1980	% Change 1970-80	1970-80 % Change/ Year
Kula	1,149[1]	1,215[1]	2,786[2]	2,124[2]	3,864[4]	81	8.1
Makawao-Paia	903[1]	1,098[1]	2,611[3]	4,142[3]	8,994[3]	117	11.17
Haiku - Pauwela	NA	-	-	2,067	3,552	72	7
TOTAL	2,052	2,313	5,397	8,333	16,410		

1 CDP Total - Table D-4

2 Kula Census Division - Table D-5

3 Makawao-Paia Census Division less Paia and Lower Paia CDP's - Tables D-4 and D-5

4 Kula Census Division total less Wailea CDP - Table D-4

TABLE D-7

KULA POPULATION PROJECTION

KULA POPULATION CHANGE 1970-1980-81%; Average Change/Year-8.1%
Base Year 1980 - Population = 3,864

Year	Population Projections					
	4%	5%	6%	7%	8%	10%
1990	5,779	6,294	6,919	7,601	8,341	10,022
2000	8,466	10,252	12,392	14,952	18,010	25,995

TABLE D-8

MAKAWAO POPULATION PROJECTION

MAKAWAO POPULATION CHANGE* 1970-1980-102.06% Average Change/Year-10.20%
Base Year 1980 - Population = 12,546

Year	Projections					
	4%	5%	6%	7%	8%	10%
1990	18,570	20,436	22,467	24,680	27,085	32,544
2000	27,489	33,288	39,960	48,549	58,476	84,339

*NOTE: Haiku and Pauwela combined into Makawao - Paia data.

graphed in Figures D-4 and D-5. The population will be used to project future water demands for the Makawao District.

3. Number of People Per Connection

Objective: Determine the number of people per water connection

Assumptions:

a. Assume population of 16,410 for the Makawao District Water Service Area for 1980.

b. Assume a total of 5,253 water connections in 1980.

Calculations:

$$\frac{\text{1980 population}}{\text{1980 service}} \quad \frac{16,410}{5,253} = 3.12 \text{ people/connection}$$

4. Average Daily Consumption Per Connection for the Makawao District

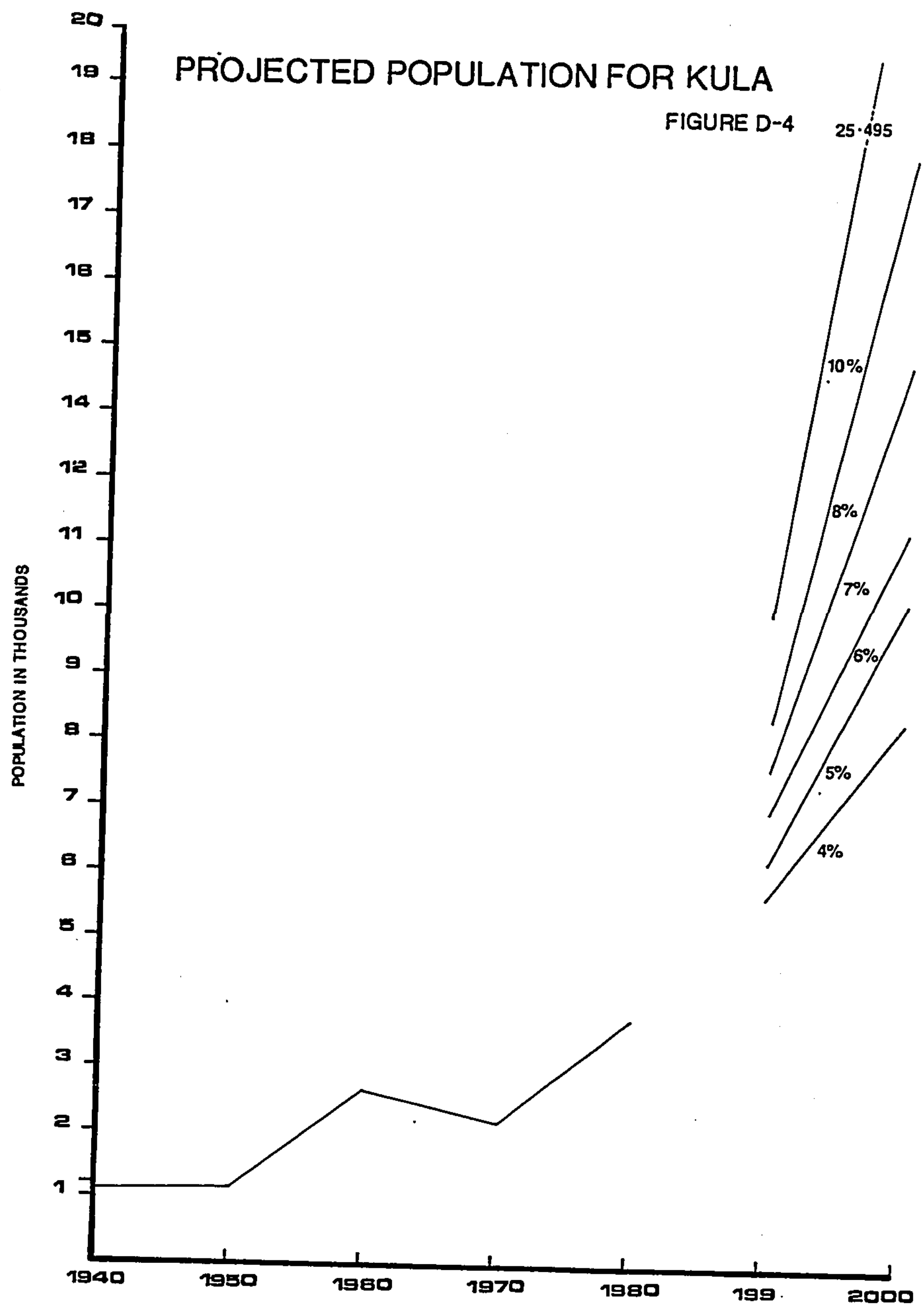
Objective: Determine average daily consumption per connection for Makawao District

Calculation:

$$\frac{\text{1980 average daily consumption}}{\text{1980 connections}} \quad \frac{2,992,814}{5,253} = 569.73 \text{ gpd/connection}$$

5. Average Daily Consumption Per Capita Per Day

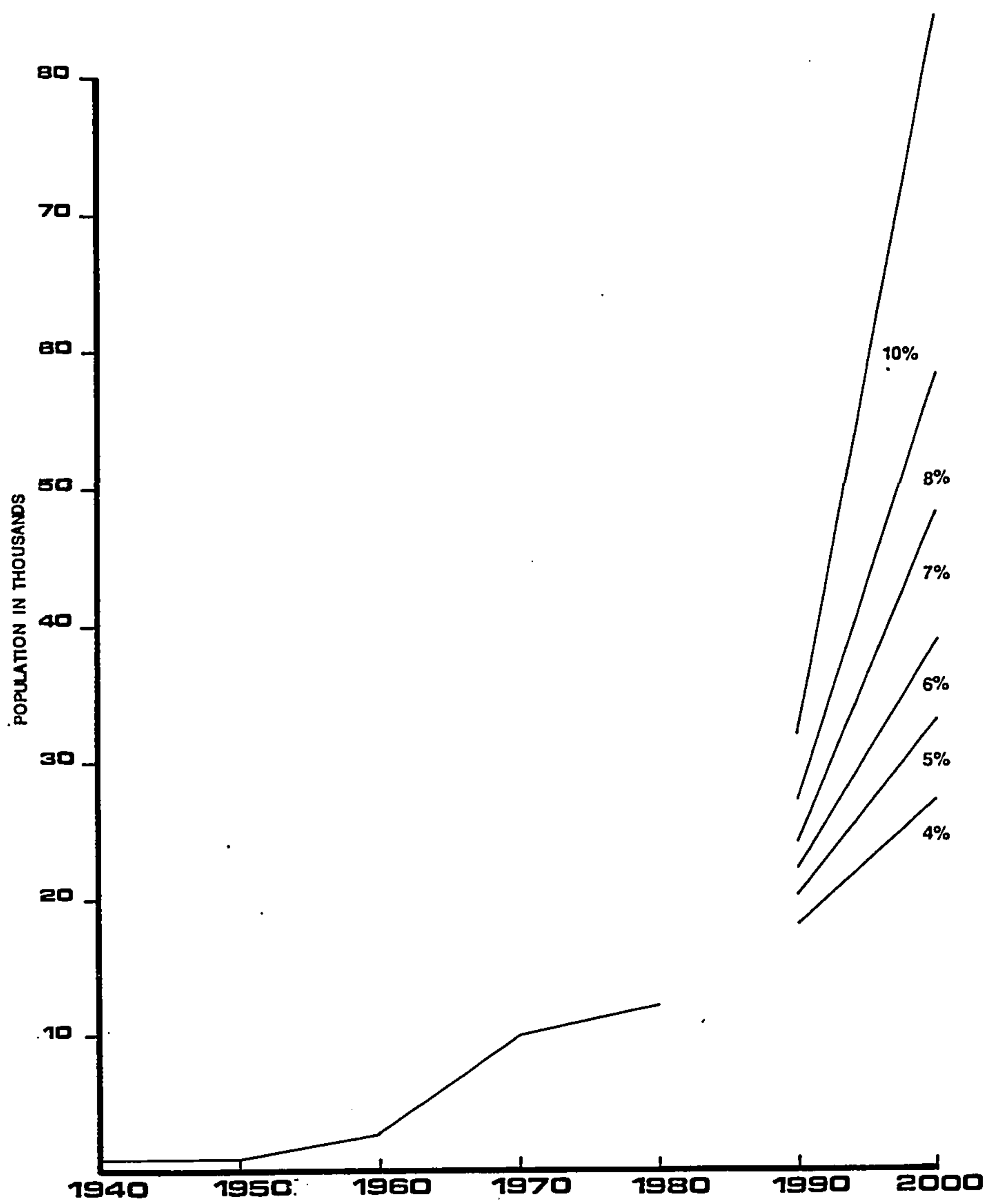
Objective: Determine average consumption per capita per day for Makawao District for 1980



PROJECTED POPULATION FOR KULA
FIGURE D-4
POPULATION IN THOUSANDS
20
19
18
17
16
15
14
12
11
10
9
8
7
6
5
4
3
2
1
1940
1950
1960
1970
1980
199
2000
25·495
10%
8%
7%
6%
5%
4%

FIGURE D- 5

PROJECTED POPULATION FOR MAKAWAO



Assumptions:

a. 3.12 people/connection

b. 569.73 gpd/connection

Calculation:

$$\frac{569.73 \text{ gpd/connection}}{3.12 \text{ people/connection}} = 182.60 \text{ gallons/capita/day}$$

6. Determine Population of Makawao District Using Water Consumption

Objective: Determine population of Makawao District using gallons/capita/day

Assumptions:

a. Average daily consumption of Makawao District 2,992,814 gpd

b. 182.60 gpcd

Calculations:

$$\frac{2,992,814 \text{ gpd}}{182.60 \text{ gpcd}} = 16,390 \text{ people}$$

Analysis:

The calculated population of 16,390 people is a close fit of the 1980 Census of 16,410. However, since agricultural water consumption within the Kula area, especially the lower Kula system, there is a built-in error in the calculations.

The Maui County design criteria* for water use indicate an optimal water use rate of 140 gpcd for "Residential" and "Apartment" areas. (No design criteria are listed for agricultural areas.) The calculated average consumption of 182.6 gpcd for Makawao District thus appears to be rather high. This is due to the fact that there is a great deal of agricultural water consumption within the Kula subarea. Therefore, the actual consumption per capita per day for the District, excluding agricultural use, is probably considerably lower than calculated above.

For example, in 1977 the County of Maui, Department of Water Supply calculated that in the Upper Kula system, 82% of the meters were domestic and used 45% of the water. The agricultural meters totaled 18% and used 55% of the water. In the Lower Kula water system, 75% of the meters were domestic and used 22% of the water. The agricultural meters totaled 23% and used 98% of the water.

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* R.M. Towill Corporation. December, 1979. Water Master Plan for County of Maui. Page 154.

The other subareas served by the Makawao District have very little agricultural water use and are primarily domestic. Additional calculations using the percentage breakdowns for the Kula area are provided below.

C. Kula Service Area

The historical water consumption for the Kula subarea from 1967 through 1980 is found in Table D-9. Figure D-3F graphs the daily consumption from 1957 through 1980. The table and figure show a continual increase in the consumption of water, with dips representing drought conditions.

Table D-10 presents the 1980 data for connections and consumption by the Kula subareas. The data from this table is used to estimate the agriculture and domestic consumption by the Upper and Lower Kula systems. The estimates found in Tables D-11A and D-11B. The projections are presented in Tables D-11C, D-11D, and D-11E. Graphed in Figures D-6A, D-6B, D-7A1, D-7A2, and D-7A3 are estimates and projections for the Upper and Lower Kula water systems.

D. Makawao Service Area

The historical water consumption for the Makawao subarea from 1967 through 1980 is found in Tables D-12A and D-12B. Projections from 1980 to the year

TABLE D-9

KULA WATER SYSTEM/1SUBAREA CONSUMPTION

	YEAR	Number of Meters	% Change	Change	Consumption 1000 Gal. Annual	Consumption 1000 Gal. Change	% of change/ consumption	Average Day MGD Annual	Average Day MGD Change	% of Change	Maximum Day /3 X 1.5 Annual	Maximum Day /3 X 1.5 Change	% of Change
1	1967	944			299,393			.82			1.23		
2	1968	958	1.0	14	278,958	(20,435)	(7.32)	(.76)	(.06)	(7.8)	(1.14)	(.09)	(7.8)
3	1969	1,047	8.5	89	368,318	89,360	32.00	1.0	.24	31.15	1.51	.37	32.24
4	1970	1,005	(4.0)	(42)	450,337	82,019	22.36	1.23	.18	21.95	1.85	.27	21.95
5	1971	1,084	7.86	79	409,550	(40,787)	(9.95)	(1.22)	(.22)	(22.0)	(1.83)	(.33)	(22.0)
6	1972	1,173	8.0	89	468,318	58,768	14.34	1.22	0	0	1.83	0	0
7	1973	1,267	8.0	94	596,075	127,757	27.27	1.63	.41	33.60	2.44	.63	33.60
8	1974	1,337	5.52	70	492,223	(103,343)	(20.97)	(1.35)	(.28)	(20.79)	(2.02)	(.42)	20.74
9	1975	1,424	6.50	87	595,580	102,309	20.76	1.63	.28	20.79	2.44	.42	21.03
10	1976	1,511	6.10	87	683,793	89,601	15.05	1.87	.24	14.72	2.80	.36	14.95
11	1977/2	1,639	8.4	128	757,673	85,764	12.52	2.07	.20	11.00	3.11	.31	11.07
12	1978	1,738	6.0	99	814,754	65,348	8.4	2.28	.16	7.7	3.34	.23	7.5
13	1979	1,822	4.83	84	693,118	(20,416)	(31.24)	(1.89)	(.39)	(20.63)	(2.83)	(.51)	(18.02)
14	1980	1,902	4.39	80	704,133	11,015	1.58	1.92	.03	1.58	2.88	.05	1.76

1/ Combined Upper and Lower Kula Systems, Ulapalakua-Kanaio. 2/ Kula Water Moritorium Issued. 3/ Average Day x 1.5 = Maximum day. ( ) = Decrease

TABLE D-10

KULA AREA WATER CONSUMPTION BY SERVICE AREA

1980

SUB-AREA					
UPPER KULA		ULUPALAKUA*		LOWER KULA	
Connections	Consumption	Connections	Consumption	Connections	Consumption
1,211	295,053	58	30,226	633	378,860

NOTE:

Upper System (Upper Kula + Ulupalakua):

Total Services: 1,269
Consumption: 325,279,000 gal.

Lower System:

Total Services: 633
Consumption: 378,860,000 gal.

TOTALS:

Total Services: 1,902
Consumption: 704,133,000 gal.

TABLE D-11A

KULA WATER USE ESTIMATES FOR 1980

	TOTALS		UPPER KULA SYSTEM				LOWER KULA SYSTEM			
			Domestic		Agriculture		Domestic		Agriculture	
			(% of Totals)				(% of Totals)[3]			
YEAR	Connection	Consumption	(82%) Meters	(45%) Consumption	(18%) Meters	(55%) Consumption	(75%) Meters	(22%) Consumption	(25%) Meters	(78%) Consumption
1977[1]	1,039	770.406	962	197.64	207	244.431	354	71.320	116	257.012
AD				.542		.670		.195		0.704
MD				.813		1.005		.292		1.06
1978[2]	1,738	835.754	961.86	170.192	211.14	208.012	423.75	96.040	141.25	340.506
AD				.466		.569		.263		.933
MD				.699		.854		.394		1.39
1979[2]	1,822	693.118	1,006	141.051	220.86	172.396	446.25	83.527	148.75	296.142
AD				.386		.472		.228		.811
MD				.579		.708		.343		1.21
1980[2]	1,902	704.133	1,040	146.373	228.42	178.901	474.75	83.349	158.25	295.510
AD				.401		.490		.228		.809
MD				.601		.735		.342		1.214

CODE: AD = Average Day
MD = Maximum Day

1 Dept. of Water Supply. An Assessment of the Olinda-Kula Kanaio Water Situation. September 6, 1977.

2 Data from Table D-2

3 Percentages used were based on 1977 Dept. of Water Supply

TABLE D-11B

TOTAL WATER USE FOR KULA

	TOTAL (MG)					
YEAR	AG	AVERAGE DAY	MAX. DAY	DOMESTIC	AVERAGE DAY	MAX.
1977	501.443	1.374	2.06	268.96	.737	1.22
1978	548.518	1.502	2.24	266.23	.729	1.09
1979	468.538 (451.671)	1.283 (1.237)	1.91 (1.85)	224.57 (242.08)	.614 (.663)	.922 (.994)
1980	474.411 (425.452)	1.299 (1.165)	1.94 (1.74)	229.72 (232.20)	.629 (.636)	.943 (.954)
1979[1]	451.967	1.238	1.85	242.256	.663	.995
1980[1]	430.023	1.178	1.76	236.584	.648	.972

[1] Data for Kula Total Ending October 1979 and October 1980 - Dept. of Water Supply

ERROR PERCENTAGES:

1979: Ag -3.6%
Domestic +7.8%

1980: Ag -10.32%
Domestic +2.98%

The error percentages are used to correct the figures in Table D-11B and are represented in parentheses ( ).

TABLE D-11C

UPPER KULA WATER ESTIMATES AND PROJECTIONS

	AGRICULTURE (MG)		DOMESTIC (MG)		TOTAL (MG)	SOURCE	SAFE YIELD[5] (MG)	
Year	Ave. Day	Max. Day	Ave. Day	Max. Day	Max. Day	Req. (+13%)	Source	System
1977[1]	.670	1.005	.542	.813	1.818	2.054	.9	1.7
1978[1]	.569	.854	.569	.853	1.70	1.92		
1979[1]	.472	.708	.597	.896	1.61	1.82		
1980[2]	.490	.735	.627	.941	1.68	1.90		
1981	.670[2]	1.005	.658	.988	2.01	2.26		
1982[2]	.670[2]	1.005	.691	1.037	2.05	2.32		
1983	.670[2]	1.005	.726	1.089	2.10	2.37		
1984	.670[2]	1.005	.762	1.143	2.15	2.43		
1985	.676[3]	1.015	.800[4]	1.2[4]	2.21	2.50		
1990	.70417	1.056	1.021	1.532	2.58	2.924		
1995	.7400	1.110	1.304	1.956	3.066	3.464		
2000	.8175	1.226	1.664	2.497	3.723	4.206		

Note: This data is presented in Figure D-6A

1 Estimates obtained from Table D-11A

2 Assumes no agriculture meters to be issued for next three years, and water consumption could be as high as 1977

3 Assumes 1% compound growth in agricultural consumption of water

4 Assumes 5% compound growth in domestic consumption of water using base year 1977 of 0.542 MG

5 Department of Water Supply, County of Maui

TABLE D-11D

LOWER KULA WATER ESTIMATES AND PROJECTIONS

YEAR	AGRICULTURE Avg. Day	AGRICULTURE Max. Day	DOMESTIC Avg. Day	DOMESTIC Max. Day	TOTAL Max. Day	SOURCE Req. (+13%)	SAFE YIELD Source	SAFE YIELD System
1977[1]	.704	1.06	.195	.292	1.352	1.527	3.4	2.1
1978	.933	1.39	.263	.394	1.784	2.015		
1979	.811	1.21	.228	.343	1.553	1.754		
1980	.809	1.21	.228	.342	1.55	1.751		
1981	.850	1.275[3]	.239[2]	.359	1.634	1.846		
1982	.871	1.306	.251	.377	1.683	1.901		
1983	.936	1.404	.263	.395	1.799	2.032		
1984	.983	1.475	.277	.415	1.89	2.135		
1985	1.032	1.548	.367	.55	2.098	2.370		
1990	1.317	1.976	.371	.55	2.526	2.854		
1995	1.681	2.522	.474	.71	3.232	3.652		
2000	2.146	3.2	.604	.906	4.106	4.643		

1 Estimates from Table D-11A

2 Assume growth of 5% (compound) in domestic consumption using 1980 as base year

3 Assume 5% growth (compound) in Ag consumption using 1980 as base year

TABLE D-11E

TOTAL KULA (UPPER AND LOWER) WET AND DRY YEAR PROJECTIONS
(IN MILLION GALLONS)

YEAR		4%		5%		6%		7%		8%		10%	
		AD	MD	AD	MD	AD	MD	AD	MD	AD	MD	AD	MD
1977 [1]	Dry												
1978	Dry	2.19	3.2	2.215	3.323	2.236	3.354	2.257	3.386	2.278	3.418	2.321	3.481
1979	Dry	2.282	3.423	2.326	3.489	2.370	3.556	2.415	3.623	2.461	3.691	2.553	3.829
1980 [2]	Dry	2.373	3.559	2.442	3.663	2.513	3.769	2.584	3.877	2.657	3.986	2.808	4.212
1981	Dry	2.421	3.631	2.564	3.847	2.663	3.995	2.765	4.148	2.870	4.305	3.089	4.633
	Wet	1.987	2.980	2.016	3.024	2.035	3.052	2.054	3.081	2.073	3.110	2.112	3.168
1982	Dry	2.506	3.759	2.692	4.039	2.823	4.235	2.959	4.439	3.100	4.650	3.398	5.097
	Wet	2.076	3.115	2.160	3.240	2.157	3.235	2.198	3.297	2.239	3.359	2.323	3.484
1983	Dry	2.593	3.890	2.827	4.241	2.993	4.489	3.166	4.749	3.348	5.022	3.738	5.607
	Wet	2.159	3.239	2.191	3.286	2.226	3.333	2.286	3.430	2.352	3.528	2.555	3.833
1984	Dry	2.684	4.026	2.968	4.453	3.172	4.758	3.388	5.082	3.616	5.424	4.111	6.167
	Wet	2.246	3.369	2.333	3.500	2.424	3.636	2.516	3.775	2.612	3.918	2.811	4.216
1985	Dry	2.887	4.331	3.117	4.678	3.362	5.044	3.879	5.81	3.905	5.858	4.522	6.784
	Wet	2.347	3.52	2.461	3.690	2.581	3.872	2.705	4.058	2.834	4.25	3.092	4.638
1990	Dry	3.513	5.269	3.978	5.967	4.50	6.75	5.084	7.62	5.738	8.607	7.284	10.926
	Wet	2.855	4.282	3.142	4.713	3.454	5.181	3.794	5.692	4.164	6.246	4.979	7.469
1995	Dry	4.274	6.411	5.077	7.616	6.022	9.033	7.131	10.697	3.431	12.647	11.731	17.597
	Wet	3.457	5.186	3.991	5.986	4.601	6.902	5.297	7.945	6.090	9.135	8.020	12.030
2000	Dry	5.200	7.80	6.480	9.721	8.059	12.08	10.00	15.0	12.388	18.583	18.893	28.340
	Wet	4.226	6.339	5.118	7.677	6.157	9.236	7.464	11.196	8.991	13.486	12.916	19.375

Percentages are compound.

[1] Dry year 1977, base 2.11 MG

[2] Wet year 1980, base 1.92 MG

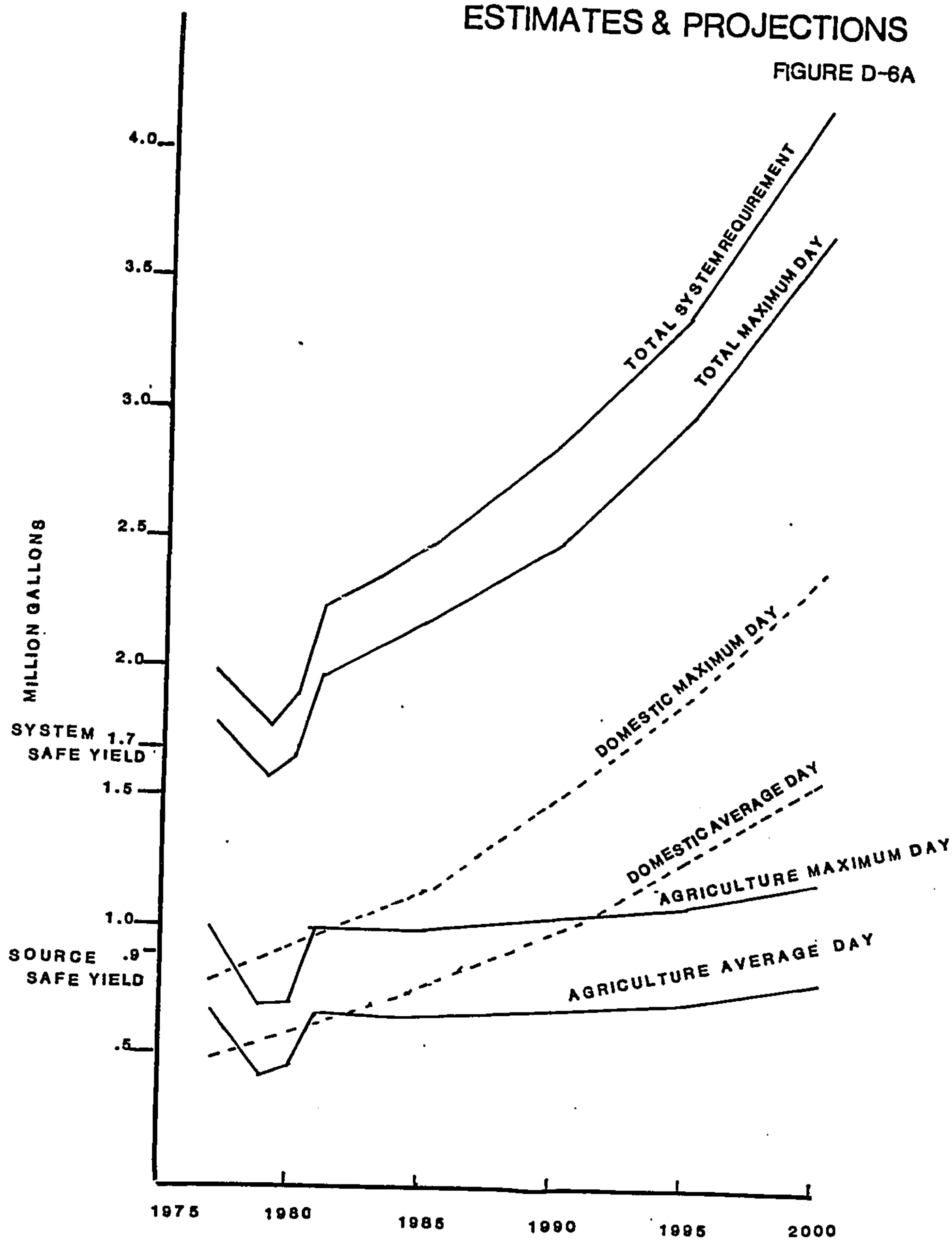
"AD" - Average Day

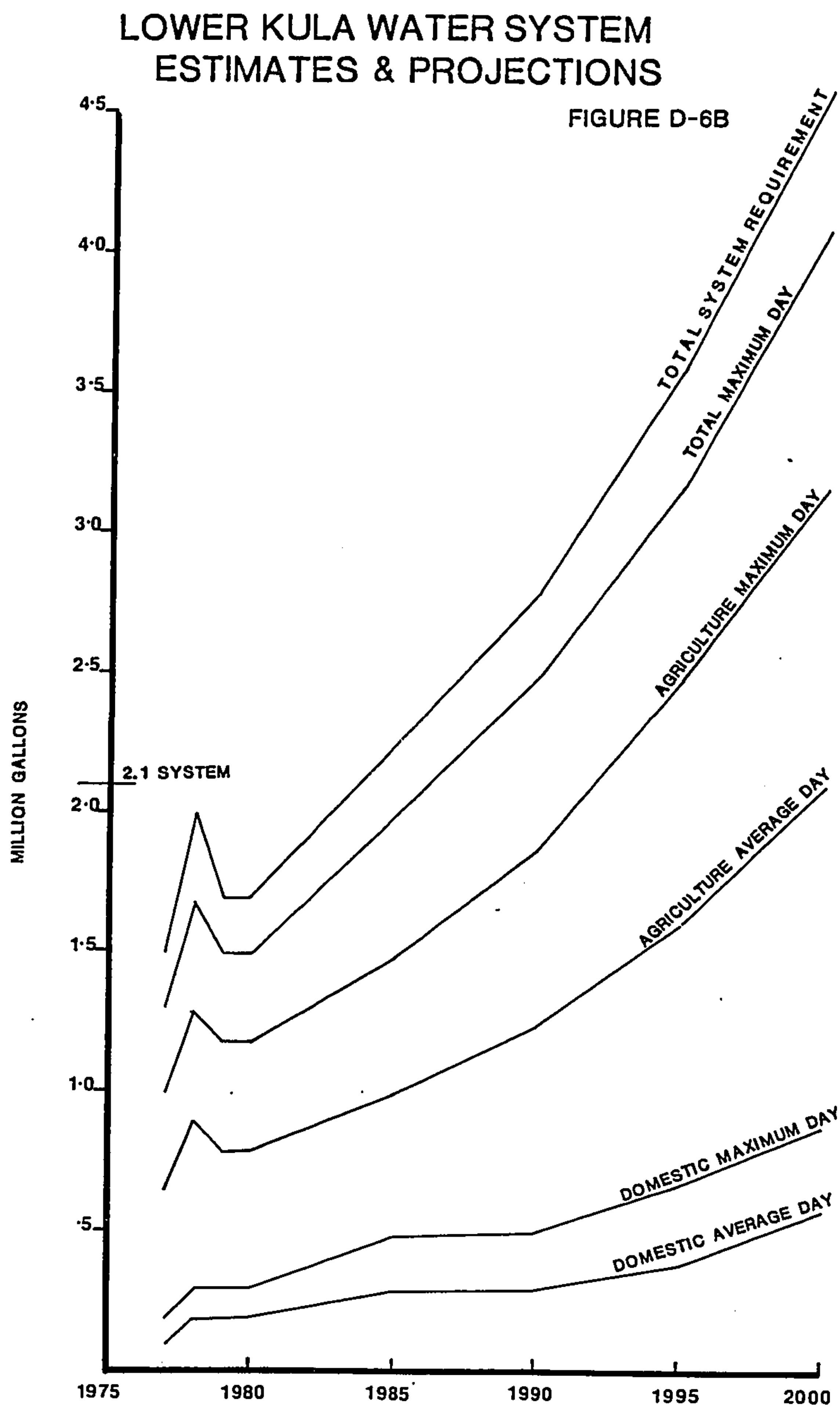
"MD" - Max. Day (AD x 1.5)

NOTE: The figures are based on water sales and do not reflect 10% loss within the system. Therefore, the max. day could be 10% higher.

UPPER KULA WATER SYSTEM
ESTIMATES & PROJECTIONS

FIGURE D-6A

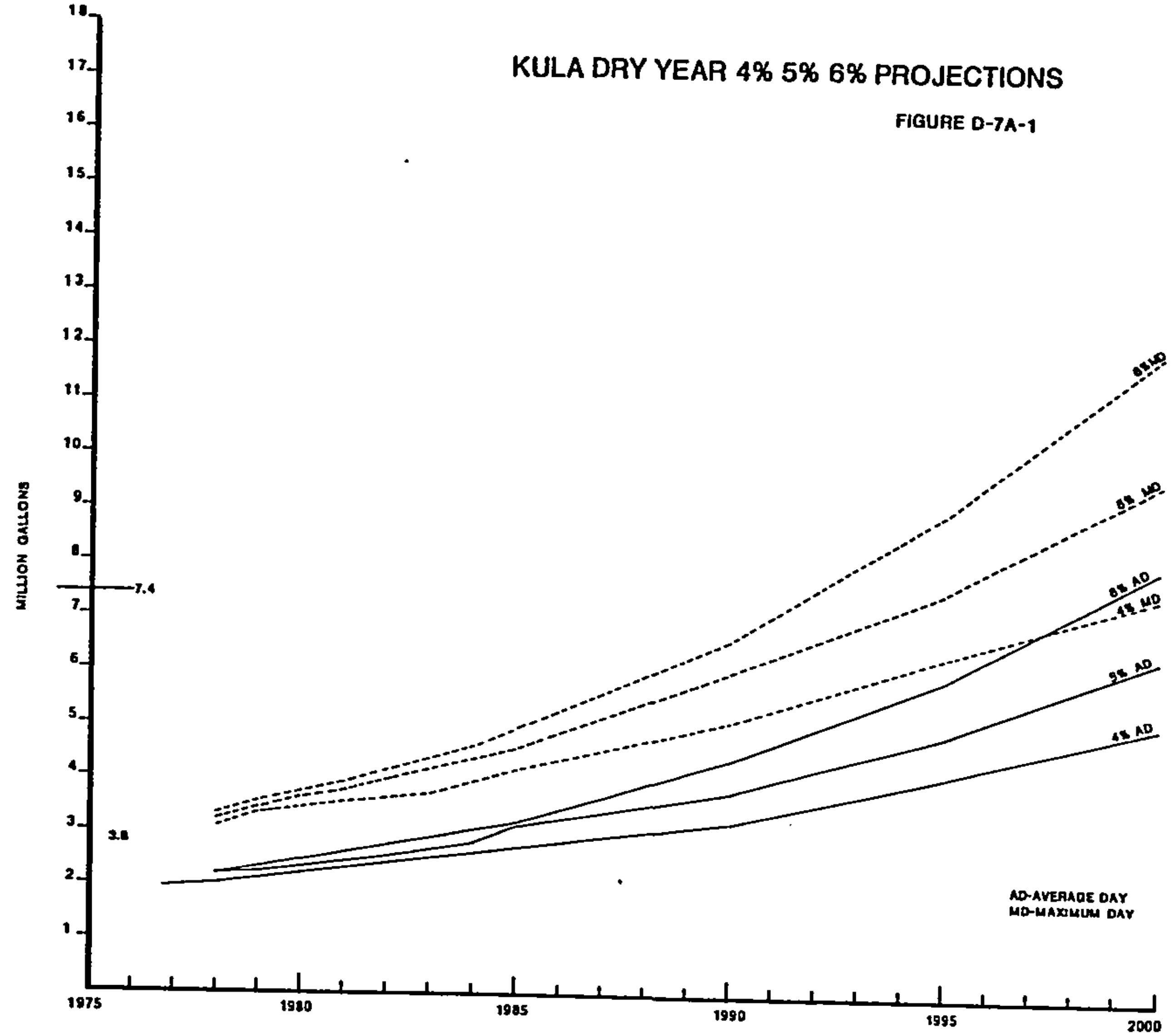


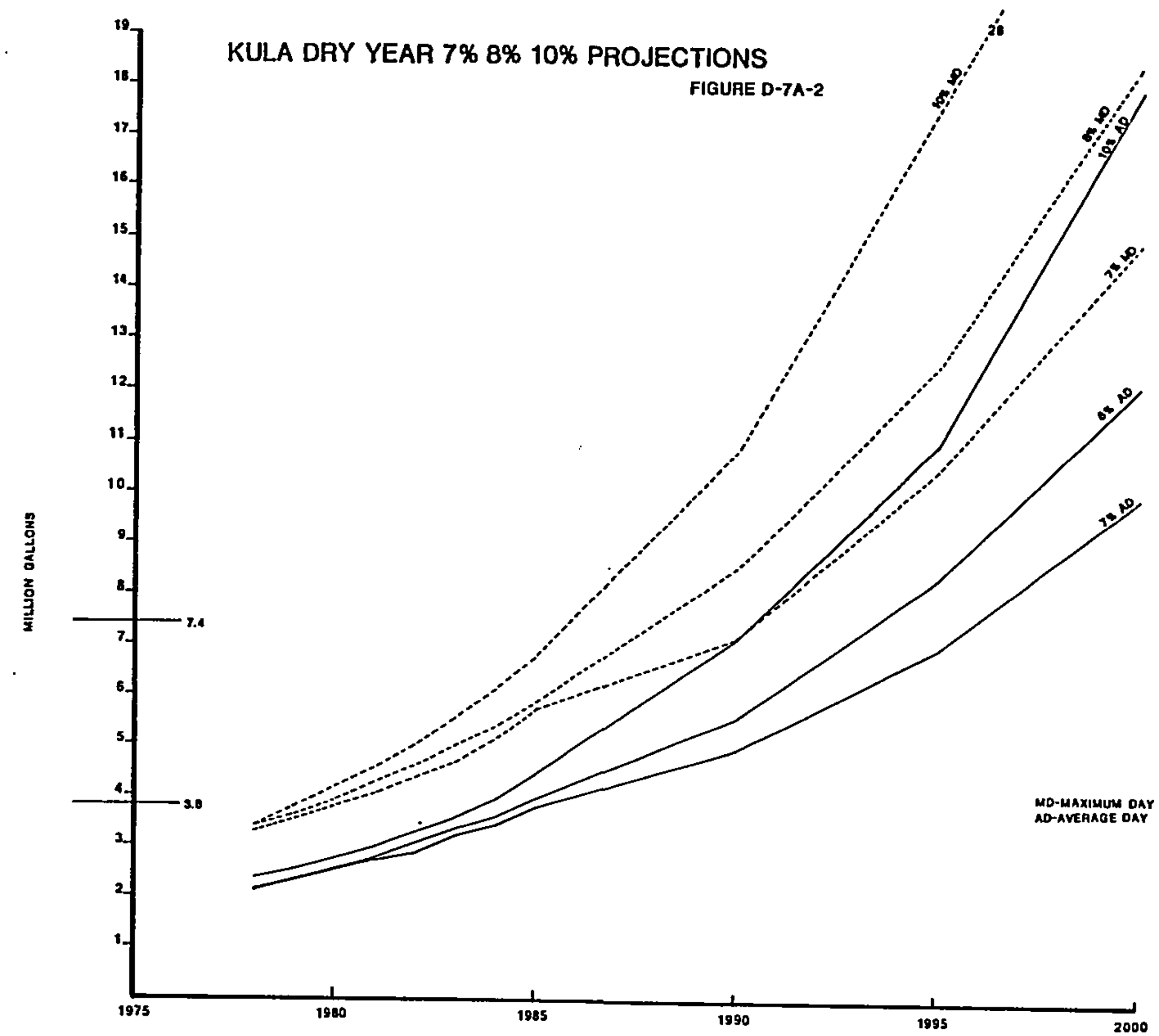


LOWER KULA WATER SYSTEM
ESTIMATES & PROJECTIONS
FIGURE D-6B
MILLION GALLONS
4·5
4·0
3·5
3·0
2·5
2.1 SYSTEM
2·0
1·5
1·0
·5
1975
1980
1985
1990
1995
2000
TOTAL SYSTEM REQUIREMENT
TOTAL MAXIMUM DAY
AGRICULTURE MAXIMUM DAY
AGRICULTURE AVERAGE DAY
DOMESTIC MAXIMUM DAY
DOMESTIC AVERAGE DAY

KULA DRY YEAR 4% 5% 6% PROJECTIONS

FIGURE D-7A-1





KULA DRY YEAR 7% 8% 10% PROJECTIONS

FIGURE D-7A-2

KULA WET YEAR 4% 5% 6% PROJECTIONS

FIGURE D-7A-3

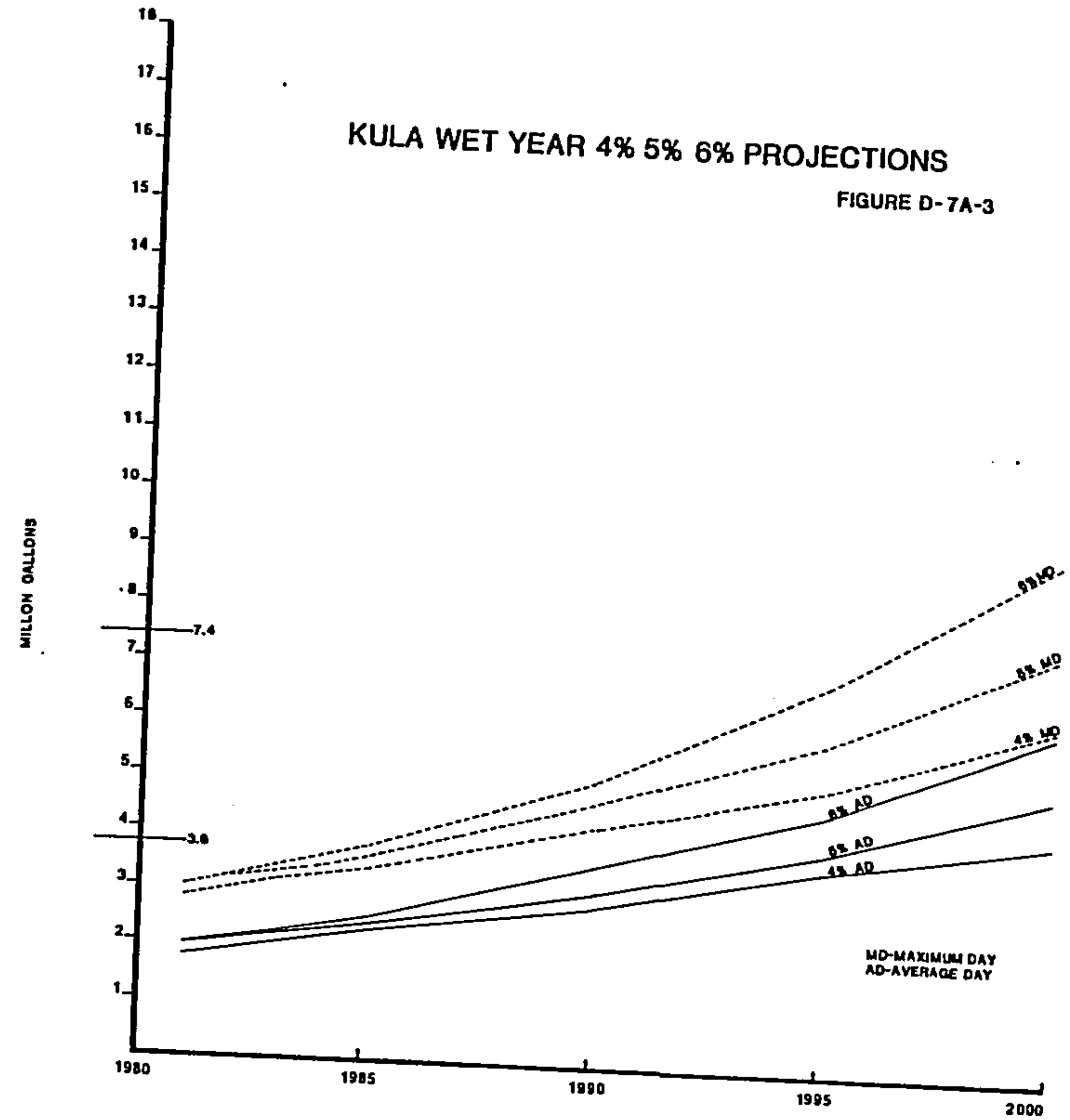


TABLE D-12A

MAKAWAO WATER SYSTEM SUBAREA SERVICE

YEAR	TOTALS Meters	TOTALS Consump.	Kokomo Serv.	Kokomo Consump. (MG)	Kauiaha Serv.	Kauiaha Consump. (MG)	Haiku-Pauwela Serv.	Haiku-Pauwela Consump. (MG)	Makawao Serv.	Makawao Consump. (MG)	Pukalani Serv.	Pukalani Consump. (MG)	Haliimaile Serv.	Haliimaile Consump. (MG)	Paia Serv.	Paia Consump. (MG)
1967	1,578	212.18	247	17.77	111	27.64	263	27.52	808	107.40			146	19.27	3	12.58
1968	1,635	201.36	252	19.85	113	25.01	261	24.90	856	102.29			150	20.93	3	8.38
1969	1,723	225.09	256	20.23	114	24.46	266	25.64	924	122.27			160	23.28	3	9.21
1970	1,808	232.16	267	20.91	118	22.07	265	25.05	991	135.27			164	23.11	3	5.75
1971	1,908	251.30	275	21.97	122	16.07	271	26.34	1,067	157.17			170	23.85	3	5.90
1972	2,018	299.58	295	26.84	125	19.41	269	31.99	1,153	181.94			173	28.85	3	10.55
1973	2,154	299.79	311	30.20	133	18.31	272	30.99	1,260	192.36			175	26.68	3	1.25
1974	2,235	319.13	329	34.24	138	14.27	277	32.42	1,314	208.38			174	27.85	3	1.97
1975	2,390	366.47	347	34.24	147	22.90	297	34.70	1,421	240.42			175	31.56	3	2.65
1976	2,544	406.23	362	40.53	151	23.09	306	34.66	1,548	273.47			174	30.74	3	3.74
1977	2,876	463.38	394	45.75	157	22.65	316	38.73	1,831	317.33			175	6.43	3	32.49
1978	3,055	510.14	427	53.65	161	26.97	329	43.19	904	159.48	1,057	183.29	174	32.64	3	10.97
1979	3,174	448.86	448	50.90	166	22.28	335	40.40	937	130.25	1,111	169.27	174	26.79	3	8.97
1980	3,351	496.71	475	61.40	171	24.99	340	47.75	975	143.57	1,208	184.79	179	28.54	3	5.67

TABLE D-12B

HAKAWAO WATER SYSTEM[1] SUBAREA CONSUMPTION

Year	No. of Meters	Change	% Change	Consumption (MG) Annual	Consumption (MG) Change	% Change	Average Day (MGD)	Average Day (MGD) Change	% Change	Max. Day (MGD)	Max. Day (MGD) Change	% Change
1967	1578	57	4	212.18			0.58			0.87		
1968	1635	57	4	201.36	(10.82)	(5.0)	(0.55)	(0.03)	(5.0)	(0.83)	(0.04)	(5.0)
1969	1723	88	5	225.09	23.73	12	0.62	0.07	13	0.93	0.10	12
1970	1808	85	5	232.16	7.07	3	0.64	0.02	3	0.96	0.03	3
1971	1908	100	6	251.30	19.14	8	0.69	0.05	8	1.04	0.08	8
1972	2018	110	6	299.58	48.28	19	0.82	0.13	19	1.23	0.19	18
1973	2154	136	7	299.79	0.21	0	0.82	0	0	1.23	0	0
1974	2235	81	4	319.13	19.34	6	0.87	0.05	6	1.31	0.08	7
1975	2390	155	7	366.47	47.34	15	1.0	0.13	15	1.50	0.19	15
1976	2544	154	6	406.23	39.76	11	1.11	0.11	11	1.67	0.17	11
1977	2876	332	3	463.38	57.15	14	1.27	0.16	14	1.91	0.24	14
1978	3055	179	6	510.14	46.76	10	1.40	0.13	10	2.10	0.19	10
1979	3174	119	4	448.86	(61.28)	(14)	(1.23)	(0.17)	(14)	(1.85)	(0.25)	(14)
1980	3351	177	6	446.71	47.85	11	1.36	0.13	11	2.04	0.19	10

1 Subareas combined
( ) Decrease

2000 are found in Table D-12C and are graphed in Figure D-8.

E. Summary

The projected water requirements for the Makawao District Water Service Area (Kula and Makawao service areas) from 1981 to the year 2000 are presented in Table D-13. The projections have been broken into wet and dry conditions and include a 10% factor for water loss within the system.

TABLE D-12C

MAKAWAO SUB-AREA
TOTAL WATER CONSUMPTION AND PROJECTIONS
(IN MILLION GALLONS)

YEAR	AD	MD	+10%[2]
1980[1]	1.361	2.04	2.244
1981	1.469	2.204	2.424
1982	1.587	2.381	2.619
1983	1.714	2.571	2.829
1984	1.851	2.777	3.0552
1985	1.999	2.998	3.297
1990	2.938	4.407	4.847
1995	4.317	6.475	7.1225
2000	6.343	9.514	10.465

[1] Base Year 1980 used 1.36 MG

[2] 10% added to max. day for water loss

AD - Average Day
MD - Max. Day (AD x 1.5)

Assume 8% compound growth

NOTE: AD and MD consumption data from 1967-1980 from Table D-12B

MAKAWAO SYSTEM 8% PROJECTIONS

FIGURE D-8

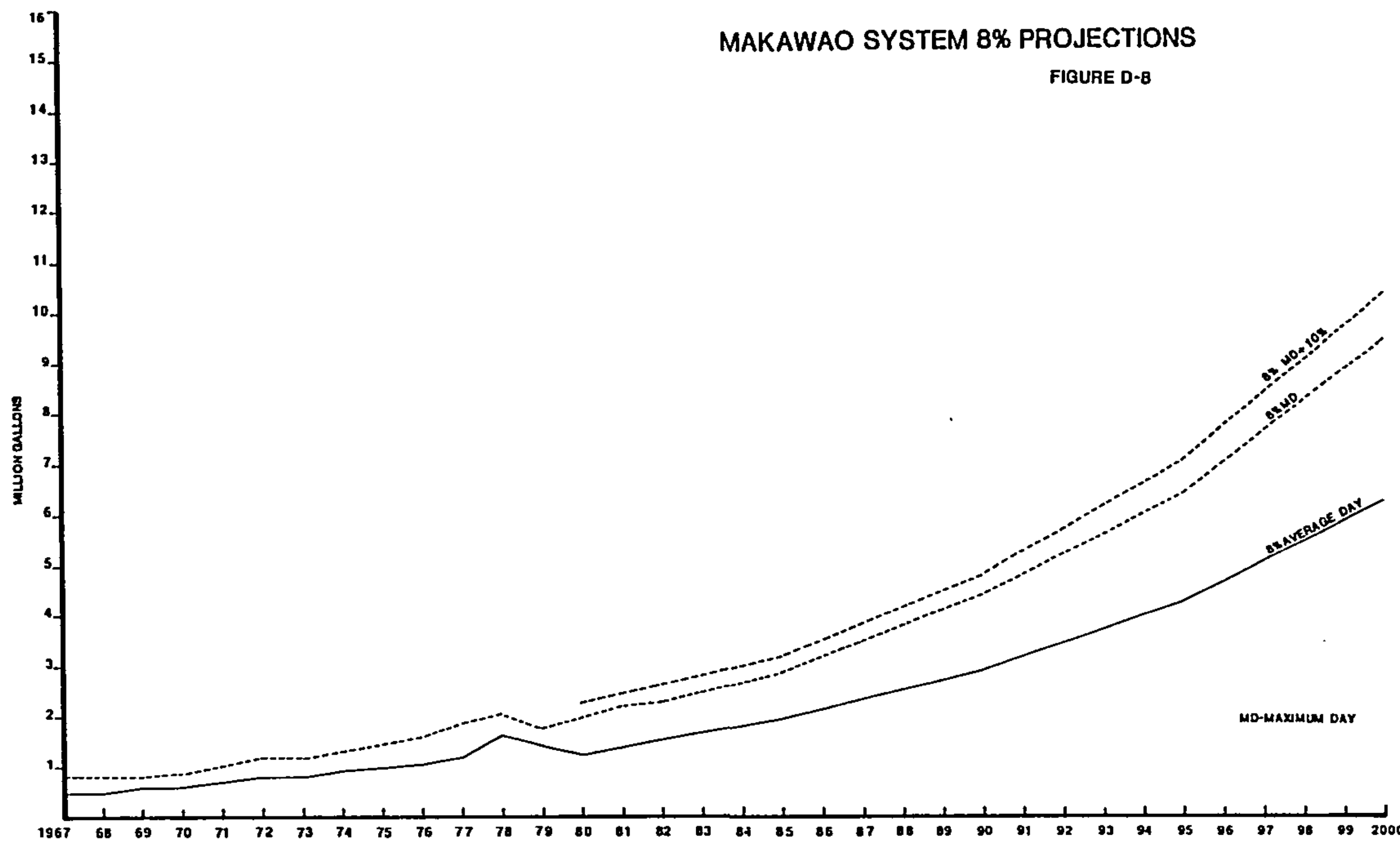


TABLE D-13

PROJECTED WATER REQUIREMENTS - MAKAWAO WATER DISTRICT

YEAR		KULA 5% PROJECTION AD	KULA 5% PROJECTION MD	KULA 5% PROJECTION +10%	MAKAWAO 8% PROJECTION AD	MAKAWAO 8% PROJECTION MD	MAKAWAO 8% PROJECTION +10%	TOTAL REQUIRED MD +10%	SOURCE YIELD TOTAL[1]	WATER REMAINING[2]	3
1981	Wet	2.016	3.024	3.326	1.469	2.204	2.424	5.750	20.3	14.55	
	Dry	2.564	3.847	4.231	"	"	"	6.655	16.6	9.945	6.055
1982	Wet	2.160	3.240	3.564	1.587	2.381	2.619	6.183	20.3	14.117	
	Dry	2.692	4.039	4.442	"	"	"	7.061	16.6	9.539	6.461
1983	Wet	2.191	3.286	3.614	1.714	2.571	2.829	6.443	20.3	13.857	
	Dry	2.827	4.841	4.665	"	"	"	7.494	16.3	8.806	6.894
1984	Wet	2.333	3.500	3.850	1.851	2.777	3.055	6.905	20.3	13.395	
	Dry	2.968	4.453	4.898	"	"	"	7.953	16.6	8.647	7.353
1985	Wet	2.461	3.690	4.059	1.999	2.998	3.297	7.356	20.3	12.944	
	Dry	3.117	4.678	5.145	"	"	"	8.442	16.3	7.858	7.842
1990	Wet	3.142	4.713	5.184	2.938	4.407	4.897	10.031	20.3	10.269	
	Dry	3.978	5.967	6.563	"	"	"	11.410	16.3	4.890	10.81
1995	Wet	3.991	5.986	6.584	4.317	6.475	7.122	13.706	20.3	6.594	
	Dry	5.077	7.616	8.377	"	"	"	15.499	16.3	.801	14.899
2000	Wet	5.118	7.677	8.444	6.343	9.514	10.465	18.909	20.3	1.091	
	Dry	6.480	9.721	10.693	"	"	"	21.158	16.3	-4.858	20.558

1 Combined Upper and Lower Kula 4.3 MGD source safe yield during wet conditions. Combined Upper and Lower Kula .6 MGD source safe yield during dry conditions. Assume source from Wailoa Ditch to be 16 MGD; however, the ditch flows may vary during dry conditions. The 16 MGD is added to the Kula system source safe yield for dry and wet conditions.

During wet years the system source yield is 20.3 MGD
During dry years the system source yield is 16.6 MGD

2 Projected amount of water remaining under wet and dry conditions.

3 Projected amount of water required to be pumped from Makawao system to meet Kula demand during dry conditions. Assume source flows of about .6 MGD for the Kula area during dry conditions.

APPENDIX E

WATER TREATMENT PLANT DESIGN

APPENDIX E

WATER TREATMENT PLANT DESIGN

I. GENERAL

Source, treatment and distribution facilities are the main components of a water system. The treatment plant's major function is to improve water quality. The source and distribution facilities are also important and must be evaluated as factors affecting overall water quality.

The standards established for water quality have been previously discussed in Appendix C. The design of a treatment plant must consider the quality of the water source and the processes required to bring the water into conformance with established water quality standards.

A. Water Source Supply Quality

The type of treatment will depend on the quality of the water source and existing water quality standards. Generally, the quality of the water source will not change dramatically, except for the normal seasonal changes, if the surrounding watershed and/or basin is not altered by man. The two general categories of water sources are: ground water sources (wells, shafts) and surface water sources (rivers, streams, dams). The latter is the case for this report. Each water source has its peculiarities and characteristics; for example, ground water sources generally are uniform in quality, contain higher concentrations of dissolved substances and are free of turbidity and color. On the other hand, surface water sources generally are variable in quality, contain lower concentrations of minerals, are highly colored and turbid, and contain odor and taste substances.

B. Selection of Treatment Process

Various types and combinations of treatment units are generally required to achieve the desired water quality. The selection of a particular type and/or combination of treatment units requires laboratory and pilot testing. Operation and maintenance costs must also be considered in the final selection of the unit process. The various unit processes available are briefly discussed in the following section. The material presented has been extracted from "State of the Art of Small Water Treatment System," USEPA (August, 1977) and "Water Treatment Plant Design," ASCE-AWWA-CSSE (1969). The processes described may not remain those of choice; the state of art changes and new methods are being developed.

II. UNIT PROCESSES

A. Aeration

1. General

Aeration is a process by which water and air are brought into contact with each other to transfer volatile substances to and from water. Volatile substances include, but are not limited to, oxygen, carbon dioxide, nitrogen, hydrogen sulfide, methane, and unidentified organic substances responsible for odor and taste problems.

Aeration may be used to reduce the concentration of taste- and odor-producing substances, such as hydrogen sulfide and certain volatile organic compounds, by adding oxygen to water for the oxidation of these compounds.

The decision to use aeration depends on the water source quality and economic considerations.

a. Surface Water

Surface waters usually exhibit low concentrations of carbon dioxide, high oxygen concentration and no hydrogen sulfide; aeration is not required for the removal or addition of these gases. Also, surface waters in many cases contain volatile organic substances causing odor and taste problems which can be reduced by adding oxygen by aeration. In many instances the aeration process has not been effective because of the low volatility of the taste and odor compounds.

b. Ground Water

Ground water may contain high concentrations of carbon dioxide, methane, hydrogen sulfide, iron and manganese. Aeration has been found effective in removal of methane, hydrogen sulfide (concentrations of 1.0 - 2.0 mg/l) and carbon dioxide removal. The addition of oxygen by aeration is also desirable for iron and manganese removal.

2. Aeration Methods

Three methods of aeration used in small water systems are gravity, mechanical draft, and diffused aeration.

a. Gravity Aeration or Water Fall Aerators

Various types are available, including water fall aerators, spray nozzles, cascades and multiple tray. Common to all types is that aeration is accomplished by causing the water to break into drops or the formation of a thin film, thereby increasing the area of water exposed per unit volume.

b. Mechanical Aerators

Mechanical aerators use motor-driven impellers, alone or in combination with air injection devices, to add oxygen to the water. For small treatment plants, a tower through which water droplets fall and air ascends in countercurrent flow can be used. The tower can be made of a series of trays with wire mesh, slats, or perforated bottoms over which water is distributed. Coke, stone or ceramic balls 5 to 15 cm (2 to 6 inches) in diameter are placed on the trays to increase efficiency by increasing the surface area. The use of coarse material has been effective in removal of iron and manganese, the coarse media functioning as a catalyst for the precipitation of the oxides of iron and manganese.

c. Diffused Aerators

Diffusion aerators are similar to mechanical aerators, as both produce bubbles of air in the water by air injection devices. Generally the aeration units are rectangular basins with diffuser equipment located near the bottom. The diffuser equipment consists of orifices or nozzles in air piping, with diffuser plates or tubes through which compressed air is forced into the water. Basins are 9 to 15 feet (2.7 to

4.6 m) deep and 10 to 30 feet (3.1 to 9.2 m) wide, with ratios of width to depth not to exceed 2:1 for proper mixing. The length of the rectangular basin is determined by the desired retention period, generally 10 to 30 minutes. The amount of air required depends on the purpose of aeration and ranges from 0.01 to 0.15 ft^3 (0.075 to 1.12 m^3) of air per gallon of water treated.

B. Oxidation

Oxidation is used in water treatment to remove and/or destroy of undesirable tastes and odors, to aid in the removal of iron and manganese, and to improve clarification and color removal. The most frequently used oxidizing agents are chlorine, oxygen and potassium permanganate.

1. Oxygen

Aeration adds oxygen to water for the oxidation of iron and manganese. Precipitation of 1 mg/l of iron requires 0.14 mg/l of oxygen, and 0.24 mg/l of oxygen is required for the precipitation of 1 mg/l of manganese.

2. Chemical Agents

Commonly used oxidizing chemicals are chlorine, chlorine dioxide, ozone and potassium permanganate. Chlorine and potassium permanganate are frequently used because of cost and availability, while ozone and chlorine dioxide must be generated on-site and are relatively expensive.

Chemical agents are stronger oxidizing agents than air and are, therefore, more effective. The choice of oxidizing agent depends on availability, cost considerations, and benefits.

Chlorine, chlorine dioxide, and potassium permanganate destroy taste- and odor-producing compounds and oxidize soluble iron and manganese to insoluble oxides which can be removed by coagulation, sedimentation, and filtration. However, the efficiency of an oxidizing agent depends on the concentration, pH, and other factors.

a. Chlorine

Chlorine is effective for iron oxidation but requires longer contact time for the oxidation of manganese, when compared to potassium permanganate at levels greater than 0.2 mg/l. Theoretical amounts of chlorine required for the oxidation of iron and manganese are 0.6 mg/l per 1.0 mg/l of iron and 1.3 mg/l per 1.0 mg/l of manganese.

b. Potassium Permanganate

This oxidizing agent's reaction is faster and not as pH-dependent as chlorine. Theoretical amounts of potassium permanganate required to oxidize 1.0 mg/l of iron and manganese are 0.94 mg/l and 1.92 mg/l, respectively.

C. Adsorption

Adsorption is the attraction and accumulation of one substance on the surface of another. This process is used for the removal of fluoride, arsenic, and organic pollutants. Two adsorptive media commonly used are activated alumina and activated carbon.

1. Activated Alumina

This compound is a highly porous and granular form of aluminum oxide, and is used for the removal of arsenic and fluoride. The removal of these two compounds is by a combination of adsorption and ion exchange. Since the removal of arsenic and fluoride is not a problem, no further discussion is warranted.

2. Activated Carbon

Activated carbon has been used in water treatment plants for numerous years and is effective as an adsorbing agent because of the large surface area-to-mass ratio. It has been used for the removal of hydrocarbons, odor and color, and for control of taste. Two types of activated carbon are used in water treatment, powdered and granular. The former is used for taste and odor control and the latter for removal of organics (including mercury).

D. Clarification

The individual processes which make up clarification are coagulation, rapid mixing, flocculation and sedimentation. Substances creating color and turbidity in water can be removed by clarification. Raw water, especially surface water, often contains suspended substances, creating turbidity problems.

The suspended substances include mineral and organic matter and microorganisms ranging in size from 0.001 to one micrometer (the size of colloidal particles). The larger particles (sand, silt, etc.) readily settle out of water during the sedimentation process and do not require the use of chemical coagulation. The size of the particle, particularly the ratio of particle surface-area-to-mass, is an important characteristic. Large particles have a low surface-area-to-mass ratio and, therefore, sedimentation by gravity occurs. Particles in the colloidal range have a large surface-area-to-mass ratio and are influenced by the surface electrical charge, thus gravity sedimentation will not remove these particles. Both coagulation and flocculation unit processes are needed to remove small particles. The objective of coagulation and flocculation is to form an envelopment of suspended particles within the floc particles, which then can be removed by sedimentation and/or filtration. Coagulation is the precursor of flocculation. The individual unit processes are discussed below.

1. Coagulation

In coagulation, colloidal particles are driven together by chemical forces. This process is rapid and occurs within seconds of the application of the coagulating chemical to the water. The process by which coagulation occurs is a reduction in the force of surface electrical charges which keep suspended colloidal particles apart. The reduction of the repulsive forces allows the colloidal particles to join together to form larger particles. These larger particles are able to form a floc, which can then be settled out.

Coagulation is influenced by physical and chemical forces, including electrical charge on particles, exchange capacity, particle size and concentration, pH, water temperature, and electrolyte concentrations.

The addition of salts of trivalent aluminum, iron or a synthetic polyelectrolyte coagulant to water containing colloidal particles, causes a series of reactions resulting in the reduction of the electrical charges on the particle, with the formation of flocs. The coagulation reaction is influenced by the physical and chemical factors of the raw water, as previously discussed, and these factors must be evaluated prior to the selection of the specific coagulation and/or unit process.

The most frequently used coagulant is aluminum sulfate [$Al_2(SO_4)_3 \cdot 14.3H_2O$, averaging about 17% Al_2O_3]. Other coagulating compounds used are potash, alum and sodium aluminate. Iron salts (ferric sulfate, ferrous sulfate, chlorinated ferrous sulfate, and ferric chloride) are also used as coagulants. In some cases, coagulation can be improved by the use of activated silica, bentonite clays, and polyelectrolytes. Also, pH of 6.0 to 7.8 is optimum for coagulation using aluminum salts, or a slightly broader pH for iron salts.

2. <u>Rapid Mix</u>

Rapid mix is a unit process important to induce coagulation and flocculation; this process rapidly mixes the chemicals and water and uniformly distributes the chemicals throughout the water. Since the reaction of the chemicals with the particles occurs quickly, propellers or impellers are used to create turbulence within the water column, thereby causing uniform mixing.

Design parameters for the rapid mix chamber require 20 seconds to 2 minutes contact time, and mixing units need 0.3 to 0.6 W per m^3/day (1 to 2 hp ft^3/second). A useful parameter is the power input into the water (measured by velocity gradient G). G values of 500 sec^{-1} to 1,000 sec^{-1} and detention times of about 2 minutes have been successful.

3. Flocculation

After the coagulant has been introduced and diffused, the minute particles are brought into contact with each other, resulting in greater density and an increase in size. The primary force of attraction is the Vander Waals force. The likelihood of collisions between particles is enhanced by slow mechanical mixing or agitation of the water.

The completeness of the process depends on the character of the water and the value of GT. The value of the velocity gradient G is useful in estimating the effectiveness of mechanical agitation in the flocculation basins. The optimal range in values is between approximately 20 sec $^{-1}$ and 70 sec $^{-1}$. When the velocity gradient (G) is multiplied by the detention time in seconds, another parameter GT is obtained. The range of GT is approximately 30,000 - 150,000. Retention time for best flocculation is between 20 to 60 minutes. Laboratory and plant trials are required to established G and T values.

4. Sedimentation

After coagulation and flocculation, the water must pass through a relatively large basin at a low velocity to allow the floc particles to settle out. This process is commonly called "sedimentation" or "clarification." Sedimentation is one of the most widely used processes in water treatment, next to chlorination. The efficiency of sedimentation depends on numerous factors and variables which have not yet been satisfactorily formulated mathematically to be useful for design.

Sedimentation generally is used in two ways, plain sedimentation and sedimentation following coagulation and flocculation. Plain sedimentation is used to remove settleable solids occuring naturally in surface water, which are settled without treatment. This is a useful preliminary process for water containing heavy sediment loads.

Sedimentation following chemical coagulation and flocculation is used to remove the settleable solids.

The effectiveness of the sedimentation tank depends on the settling characteristics of the suspended solids and on the hydraulic characteristics of the settling tank.

The hydraulic characteristics of the settling tank depend on both the geometry and the flow through the tank. The most commonly used tank(s) for sedimentation are the horizontal-flow type, either rectangular or circular in shape.

In either shape, the design objective is to obtain the condition of ideal flow through the basin. The ideal flow for a rectangular basin requires that all of the water entering at one end of the basin should flow in parallel paths of equal velocity to the effluent end of the basin. In reality, this condition cannot be achieved because of differential friction drag and irregular tank currents.

The ideal flow for a circular basin occurs when the centrally fed water moves in radial paths of equal velocity to the outlet channel of the basin. In reality, this condition cannot be achieved because the flow from the center is not perfectly radial, but has definite vertical velocity components, downward at the distribution well and changing upward near the periphery.

The choice of type, rectangular or circular, is usually based on personal preference. However, laboratory testing is required prior to establishing the design criteria, and experience over the years has demonstrated that a minimum of two sedimentation basins is preferred.

General design criteria for rectangular basins vary in width from 5 to 24 feet (1.5 to 7.3 m) with an approximate width-to-length ratio of 1:4. The basin depths range from 7 to 16 feet (2.1 to 4.9 m). The basins should be sized to provide an average detention time of 2 to 6 hours, or 8 to 12 hours for treatment of highly turbid waters.

An important parameter in sizing the basins is the "overflow rate", the flow rate divided by the surface area of the basin and expressed in terms of gpd/ft^2 or m^3/m^2 day. The theory is that if the settling velocity of a particle is greater than the overflow rate of the basin, the particle will settle out of the water before the water leaves the basin. Laboratory testing is required to determine the parameters and variations which affect settling and is used to determine the size and overflow rate of the basins.

E. Filtration

Filtration of water is a physical and chemical process for separating suspended and colloidal particles from water by passage through a porous medium, generally a bed of sand or other granular material such as coal. As the water passes through the medium, the suspended and colloidal particles are deposited in the interstices between the grains of the medium or the medium itself.

A number of mechanisms are involved in particle removal by filtration. Some of these mechanisms are physical and others are chemical. The effects of both actions must be considered together to fully explain the overall action of filtration. These actions include adsorption, flocculation, sedimentation and straining. Adsorption of the particles to the surface of the filter grains is dependent upon the physical characteristics of the suspended filter which are functions of the filter grain size, the floc size, the adhesive characteristics of the floc, and the shearing strength of the floc. Adsorption is also affected by the chemical characteristics of the suspended particles, the aqueous suspension medium, and the filter medium. Two important chemical characteristics are the electro-chemical and Vander Waals forces.

Effective filtration requires the pretreatment of water to remove the floc particles that are small enough to penetrate the filter bed. The suspended particles removed during filtration range in diameter from about 0.001 to 50 micrometers and larger.

1. Types of Filters

Water filters are classified in various ways. Hydraulically, they may be classified as slow or rapid, depending upon the rate of flow per unit of surface area. Slow filters operate at rates of 1 to 10 mgd per acre, and rapid filters operate at rates of 1 to 8 gpm per square foot.

Filters are also classified according to the type of filter media used, such as sand, coal (or anthracite), coal-sand, multi-layered, mixed bed, or diatomaceous earth. They may be described according to the direction of flow through the bed, downflow, upflow, biflow, fine-to-coarse or coarse-to-fine. Another distinction is between pressure and gravity (or free surface) filters.

Since the water industry has made considerable progress in filter design and filtration procedures, the filters may be divided into conventional and recent developments. Conventional types include slow sand, rapid gravity and pressure filters (sand or anthracite media). Recent developments include rapid gravity and pressure units with coal-sand, multi-layer or mixed-bed media.

The following is a brief description of the types of filters and media currently used:

a. <u>Gravity Filters</u>

This type of filter is a free surface filter using gravity flow conditions for filtering the water. This type of filter is characterized by downflow operation followed by an upflow washing of the filter media to remove the filtered particles collected on the media.

The vast majority of present day water treatment plants use the gravity rapid sand filter. It is the standard of the water industry. The conventional gravity rapid sand filter is normally a single-media, downflow, fine-to-coarse filter. However, new plants will utilize gravity rapid filters with coarse-to-fine media and utilize mix media beds.

b. Pressure Filters

Pressure filters are similar in filter bed construction to a typical gravity filter. However, in a pressure filter, the entire filter apparatus, including the media layer, gravel bed and underdrains, is enclosed in a steel shell. The advantage of the pressure filter is that pressure in the water lines leading to the filter is not lost and can be used to maintain pressure within the distribution system.

The disadvantages include potential loss or disruption of the media during backwash operations which cannot be visually observed. The inability to see the filter media and the possibility of media bed disruption have, in the past, limited the municipal application of pressure filters to treatment of relatively unpolluted waters and many State health departments have restricted use of pressure filters to the treatment of well waters for the removal of hardness, iron or manganese.

c. Diatomite Filters

Under certain conditions, diatomite filters may be used for municipal purposes. Generally, for small cities where the overriding consideration is low capital cost and where relatively good raw-water conditions permit successful operations.

This type of filter, usually operated under pressure, consists of a layer of diatomaceous earth supported by a septum or filter element. The layer of diatomaceous (1/8-in. or 3.2 mm thick) must be maintained during the filtration process by a constant feed of the diatomite filter medium to the influent unfiltered water. At the conclusion of the filter run, the layer of diatomaceous earth will have increased in thickness from 1/8-inch (3.2

mm) to about 1/2-inch (13 mm). The primary difficulty in using this filter is in maintaining the diatomaceous earth film of uniform permeability and filtering capability.

2. Media

a. Single Media

Single media filters employ only one type of filtering medium as opposed to dual and mixed media filters. The types of single media filters include rapid sand, slow sand and anthracite.

(1) Rapid Sand Filters

The rate of operation is approximately 2 to 4 gpm/ft^2 (120 to 240 $m^3/m^2/day$). Generally, for surface waters, the standard is 2 gpm/ft^2 (120 $m^3/m^2/day$). Higher rates require that pretreatment processes (coagulation, flocculation, and sedimentation) are functioning properly.

The filter medium, silica sand, is supported on a gravel bed located over an underdrain collection system. The silica sand is usually 25 to 30 inches (64 to 76 cm) thick and the gravel bed 12 to 18 inches (30 to 46 cm). The head loss is about 1 ft. (0.3 m) and backwashed when head loss reaches 8 ft. (2.4 m).

The selection of the sand and gravel size will depend on design of the filtering units.

(2) Slow Sand Filters

Slow sand filters have a similar configuration to rapid sand filters, with a bed of sand supported by a layer of gravel. The filtration rate ranges from 0.05 to 0.10 gpm/ft^2 (2.9 to 5.9 m^3/m^2/day). The low filtration rate requires large structures and land area, and for this reason slow sand filters are not currently used.

(3) Anthracite Filters

Anthracite coal is used in single media filters. The coal has a lower specific gravity than sand and has greater bed porosity for a given effective size.

(4) Activated Carbon Filters

Granular activated carbon can be placed over the filter medium for removal of taste- and odor-causing organisms.

b. Dual Media

This type of filter uses two types of filtering media, usually arranged in a coarse-to-fine configuration, the former on the top. The most common type of dual media combination is the anthracite-coal-sand. Typically, the profile consists of a coarse layer of coal 18 inches (46 cm) deep, followed by a fine layer of sand 8 inches (20 cm) deep. Flow rates are about 4 gpm/ft^2 (240 m^3/m^2/day), which is higher than a single media rapid sand filter (2 to 4 gpm/ft^2).

c. Mixed Media

Mixed media filters employ more than two types of filtering media, arranged in a coarse-to-fine configuration. Typically, the mixed media bed consists of three layers: coal (SG 1.4) on top, followed by sand (SG 2.65) in the middle, and garnet (SG 4.2) on the bottom. The volumes used are coal (60%), sand (30%), and garnet (10%). The vast surface area of the filtering media increases the length of filter runs and, since the total surface area of the grain is greater than single or dual media beds, the mixed media bed is more resistant to breakthrough and more tolerant to surges in flow rate.

2. Backwashing Facilities

Filter backwashing is essential for the removal of the material filtered from the water. Backwash water from a clean source is applied to the underside of the filterbed through the underdrains and designed to provide a uniform application of water thorugh the filter media. The backwash water containing the filtered particles is then carried away in wash water troughs located above the surface of the filter medium. Also, in addition to the backwash facilities, filters can be equipped with surface wash facilities which are turned on one minute before and after backwashing. The surface wash facilities can be either rotary washers or fixed jets.

3. Filtration Aids

The addition of a filtering aid, such as a polyelectrolyte, to the settled water prior to its passage through the filter improves the filtrability of the water and permits a higher filtration rate. The use of a polyelectrolyte is usually warranted only for a coarse-to-fine filter (dual or mixed media filters) and not for conventional fine-to-coarse rapid sand filters which can be clogged by the addition of polyelectrolytes.

E. Disinfection

Disinfection is a unit process which involves the destruction or deactivation of objectionable organisms. These organisms may be objectionable from the standpoint of either health or aesthetics. These organisms consist of certain classes of bacteria, viruses, protozoa, and small invertebrates.

Disinfection can be accomplished in several ways. Excluding water treatment processes such as sedimentation, coagulation and filtration, that result in the partial removal of organisms, the specific water disinfection processes include the use of one or a combination of the following: (1) physical treatment such as storage or the application of heat or other physical agents; (2) ultraviolet irradiation; (3) metal ions, Cu and Ag; and (4) oxidants, halogens, ozone and other inorganic or organic materials.

Except for chlorine and some of its compounds, most of the above-mentioned have one or more serious limitations that preclude their general acceptance in the United States for municipal potable water treatment operations. Chlorination, including the use of chlorine dioxide and ozonation, is the most frequently used method of disinfection for potable water treatment.

Chlorine is applied to water in one of three forms: as elemental chlorine, as hypochlorite salts, or as chlorine dioxide. The efficiency of chlorine for disinfection is affected by the following:

- kind and concentration of disinfectant
- contact time provided
- chemical character and temperature of the water
- kind and concentration of organisms to be destroyed

The application of chlorine or its compound to a particular water must be tailored to the circumstances that exist at any given time. For example, hypochlorite chlorine is used for small treatment plants, elemental chlorine is commonly used in municipal plants, and chlorine dioxide by facilities concerned with the reduction of manganese or for the control of very difficult taste and odor problems.

Other factors being constant, the effectiveness of chlorine is proportional to the concentration (chlorine becomes more dilute as it is used up) and reaction time (becomes lower with lessened contact time). Thus, the concentration and reaction time are inter-dependent; with a longer contact time, less chlorine is required; with less contact time, a higher chlorine dose required.

Also, the reaction of chlorine in water must be considered in evaluating this disinfectant. When elemental chlorine is added to water, it forms hypochlorous acid (HOCl) and hydrochloric acid (HCl).

$$Cl_2 + H_2O \rightleftharpoons HOCl + H^+ + Cl^-$$

The reaction generally displaces to the right and very little Cl_2 remains in solution; the hypochlorous acid (HOCl) dissociates into hydrogen and hypochlorite ions.

$$HOCl \rightleftharpoons H^+ + OCl^-$$

The degree of ionization is dependent on the pH of the water. At pH 6.5, approximately 90% of the hypochlorous acid is not dissociated. At pH 8.5 about 90% of the hypochlorous acid dissociates to hydrogen and hypochlorite ions. Between pH 6.5 and 8.5 chlorine will exist as hypochlorous acid and hypochlorite ions. These two forms existing in water as termed "free available chlorine." Free available HOCl and OCl^- forms of chlorine are not equally germicidal, HOCl being superior because of its strong and oxidizing power, and its small molecular size and electrical neutrality which allow it to penetrate cells readily. The increase of H^+ with the addition of chlorine may cause pH adjustment to be required.

Since chlorine is an oxidant, organic matter and other oxidizable material in water deplete the amount of chlorine and lessen its effectiveness as a disinfectant. It is, therefore, important to remove these substances to increase the disinfective effectiveness of elemental chlorine.

Chlorine reacts with ammonia in water. The hypochlorous acid (HOCl) reacts with nitrogen to form various inorganic chloramines - principally monochloramine (NH_2Cl), dichloramine ($NHCl_2$) and under certain conditions trichloramine ($NHCl_3$). The relative amounts of the different chloramines formed are dependent on pH, time, temperature and the quantity of chlorine and ammonia initially present. The formation of chloramines greatly reduces the reactivity of the chlorine and requires longer detention time. Most organic chloramines have little or no germicidal capacity.

Chlorine also reacts with other substances; typical inorganic reducing agents such as hydrogen sulfide, ferrous iron and divalent manganese are rapidly oxidized. The oxidation of nitrites to nitrates by chlorine as well as oxidation, substitution and addition of organic substances, can result in the formation of numerous chloro-organic compounds. Some of these such as chlorophenol cause objectionable taste when present in trace amounts. Also, the formation of trihalomethanes is possible.

For these reasons, it is recommended that chlorine be added only after processes which will reduce the organic concentrations of the water and thereby decrease the probability of trihalomethane formation.

F. Stabilization

Water leaving the treatment plant and entering the distribution system should be stable - neither scale-forming nor aggressive for the temperature experienced in the distribution system. Two ways of stabilizing water are adjustments to pH and addition of polyphosphate or silicates.

1. pH Adjustment

Water is considered to be stable when it is at the point of calcium carbonate saturation equilibrium. At this point, calcium carbonate is neither dissolved nor deposited. Raising pH causes deposition of calcium carbonate and lowering pH causes the water to become aggressive (cause leaching of cadmium, iron, lead and other substances from the pipes). There must be enough calcium ions present in solution for calcium carbonate to form, and if there are not, lime (CaO) should be added to raise the pH. In hard waters, where sufficient calcium ions are present, sodium hydroxide (NaOH) or soda ash should be added to raise the pH.

2. Polyphosphate

The addition of polyphosphate is effective for scale and corrosion control, causing a reaction with iron and other minerals in water so that positive-charged particles are formed. These particles migrate to the cathode area of the corrosion and deposit as a thin film which reduces the corrosion of the metal. Bi-metallic (zinc) polyphosphate or zinc orthophosphate is usually more effective for corrosion control than sodium polyphosphate.

3. Silicate

Sodium silicate is sometimes used for corrosion control.

G. Taste and Odor Control

The occasional appearance of offensive tastes and odors, especially from surface water sources, presents problems in the treatment process from the point of view of cost. Some of the treatment processes include chlorination, use of chlorine dioxide, potassium permanganate and activated carbon. Activated carbon is probably the best known and oldest treatment used for taste and odor control. The cost of treating the water must be carefully evaluated.

APPENDIX F

FLORA/FAUNA CHECKLISTS

APPENDIX F

FLORA/FAUNA CHECKLISTS

For each species, the following information is provided:

1. Family
2. Scientific name
3. Vernacular name
3. Status of the species. The following symbols are employed.

E endemic to the Hawaiian Islands, i.e., occurring naturally nowhere else in the world.

I indigenous, i.e., native to the Hawaiian Islands, but also occurring naturally (without the aid of man) elsewhere.

X exotic, i.e., species of accidental or deliberate introduction after the western discovery of the islands.

P Polynesian introduction; includes those species brought by the Polynesian immigrants previous to Captain Cook's discovery of the islands.

APPENDIX F, cont'd.

FLORA/FAUNA CHECKLISTS

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CHECK LIST OF PLANTS
Kamole Weir Site, Maui, Hawaii

SCIENTIFIC NAME	COMMON NAME	STATUS
MONOCOTYLEDONAE		
BROMELIACEAE		
Ananus comosus (Stickm.) Merr.	Pineapple	X
GRAMINEAE		
Chloris barbata Swart.	Swollen fingergrass	X
Coix lacryma jobi	Job's tears	X
Panicum maximum Jacq.	Guinea grass	X
Panicum purpurascens Ruddi	Paragrass	X
Pennisetum purpurem Schumach	Elephant grass	X
Rhynchelytrum repens (Willd.) C. E. Hubb	Natal redtop	X
LILIACEAE		
Cordyline terminalis (L.) Kunth	Ti, ki	P
DICOTYLEDONAE		
AMARANTHACEAE		
Amaranthus spinosus L.	Spiny amaranth	X
ANACARDIACEAE		
Schinus terebinthifolius Ruddi	Christmas berry	X
COMPOSITAE		
Bidens pilosa L. var. pilosa	Spanish needle	X
Conyza bonariensis (L.) (Ronq.)	Hairy horseweed	X
Emilia sonchifolia (L.) DC.	Flora's paintbrush	X
Verbesina encelioides (cav.) B. & Wex Gray	Golden crown-beard	X

CHECK LIST OF PLANTS, Continued
Kamole Weir Site, Maui, Hawaii

SCIENTIFIC NAME	COMMON NAME	STATUS
DICOTYLEDONAE		
CONVOLVULACEAE		
Ipomoea alba L.	Moonflower	X
EUPHORBIACEAE		
Ricinus communis L.	Castor bean	X
LEGUMINOSAE		
Cassia leschenaultiana D.C.	Japanese tea	X
Crotalaria mucronata Desv.	Smooth rattle pod	X
Desmodium canum (Emel.) Schinz and Thell.	Spanish clover	X
Indigtera suffructicosa Mill.	Indigo	X
Leucaena leucocephala (Lam.) de Wit	Koa-haole	X
Ulex europaeus L.	Gorse	X
MALVACEAE		
Abutilon molle Sweet	Hairy abutilon	X
Malvastrum coromandelianum (L.) Garde	False mallow	X
Sida fallax Walp.	Ilima	I
PASSIFLORACEAE		
Passiflora foetida	Scarlet-fruited passion flower	X
SOLANACEAE		
Solanum nodiflorum Jacq.	Popolo	X
VERBENACEAE		
Strachytarpheta cayennensis (L.) C. Rich	Cayenne vervain	X

CHECK LIST OF PLANTS, Continued
Kamole Weir Site, Maui, Hawaii

GENERAL OBSERVATIONS

The predominant overstory is Christmas berry trees with common roadside weeds along the access road.

CONCLUSION

No species of flora observed during the reconnaissance are considered rare or endangered. The site has been disturbed and is surrounded by pineapple fields presently under cultivation.

CHECK LIST OF PLANTS
Piiholo Sites 1 and 2, Maui, Hawaii (TMK 2-4-13: por. 62)

SCIENTIFIC NAME	COMMON NAME	STATUS
PTERIDOPHYTA		
DICKONIACEAE		
Cibotium spelendens (Gaud.) Krgina ex. Scottss.	Hapu'u	E
POLYPODIACEAE		
Atlyrium microphyllum	Miniature tree fern	E
Sadleria cyatheoides	'Ama'u	E
PSILOTAEAE		
Psilotum nudum (L.)	Moa	I
MONOCOTYLEDONAE		
GRAMINEAE		
Pennisetum clandestinum Hochst. ex Chiov.	Kikuyu grass	X
Sporobolus africanus (Poin) Robyns & Tourney	Rattail	X
LILIACEAE		
Dracaena aurea H. Mann	Halapepe	E
DICOTYLEDONAE		
EPHACRIDACEAE		
Styphelia tameiameiae (Cham.) F. Muell	Pukiawe	I
LEGUMINOSAE		
Ulex europaeus L.	Gorse	X
MELASTOMATACEAE		
Clidemia hirta (L.) D. Don	Clidemia	X
MIMOSOIDEAE		
Acacia koa	Koa	E

CHECK LIST OF PLANTS, Continued
Piiholo Sites 1 and 2, Maui, Hawaii (TMK 2-4-13: por. 62)

SCIENTIFIC NAME	COMMON NAME	STATUS
DICOTYLEDONAE		
MYRTACEAE		
Eucalyptus robusta	Swamp mahagony	X
Metrosiderus collina Polymorpha (Gaud.) Rock	'Ohia-lehua	E
Psidium guajava L.f. guajava	Guava	X
PASSIFLORACEAE		
Passiflora foetida	Scarlet-fruited passion flower	X
ROSACEAE		
Rubus rosaefolius	Thimbleberry	X

GENERAL OBSERVATIONS

This parcel includes the chosen site and one of the alternate sites. The parcel contains an overstory of ohia trees and understory of kikuyugrass and rattail grass. Throughout the pasture gorse and guava can also be found. The gulch separating the two sites contains ferns and other endemic plants, such as halapepe (*Dracena aurea*).

CONCLUSION

Halapepe is a fairly rare plant. A few trees are found in the pasture; however, many more are found in the gulch, which is located outside of the proposed project area. Therefore, no significant impacts are anticipated.

CHECK LIST OF PLANTS
Piiholo Site 3, Maui, Hawaii (Piiholo Reservoir)

SCIENTIFIC NAME	COMMON NAME	STATUS
MONOCOTYLEDONAE		
GRAMINEAE		
Heteropogon contortus (L.) Beauv.	Pili grass	X
Rhynchelytrum repens (Willd.) C. E. Hubb	Natal redtop	X
LILIACEAE		
Cordyline terminalis (L.) Kunth	Ti, ki	P
DICOTYLEDONAE		
COMPOSITAE		
Bidens pilosa L. var. *pilosa*	Spanish needle; koko-kahiki	X
LEGUMINOSAE		
Leucaena leucocephala (Lam.) deWit	Koa-haole	X
Ulex europaeus L.	Gorse	X

GENERAL OBSERVATIONS

The site has been disturbed and attempts have been made to replant the area with a eucalyptus species and pine trees. However, the trees are stunted due to poor soil conditions.

CONCLUSION

No species of flora observed during the reconnaissance are considered rare or endangered. The site has been disturbed.

CHECK LIST OF PLANTS
Olinda Site, Maui, Hawaii

SCIENTIFIC NAME	COMMON NAME	STATUS
GYMNOSPERMAE		
TOXODIACEAE		
Crytomeria japonica (L.F.) D. Don	Japanese cedar	X
MONOCOTYLEDONAE		
GRAMINEAE		
Pennisetum clandestinum Hochst. ex Chiov.	Kikuyugrass	X
Rhynchelytrum repens (Willd.) C. E. Hubb	Natal redtop	X
Sporobolus africanus (Poin) Robyns & Tourney	Rattail	X
IRIDACEAE		
Gladiolus sp.	Gladiolus; 'ukihaole	X
ZINGIBERACEAE		
Hedychium coronanium	Ginger	X
DICOTYLEDONAE		
LAURACEAE		
Persea americana Mill.	Avacado	X
LEGUMINOSAE		
Acacia decurrens Willd.	Black wattle	X
Ulex europaeus	Gorse	X
MORACEAE		
Ficus carica	Common fig	X
MYRTACEAE		
Eucalyptus sp.		X
Eucalyptus robusta	Swamp mahogany	X
Psidium guajava L.F. guajava	Guava	X

CHECK LIST OF PLANTS, Continued
Olinda Site, Maui, Hawaii

SCIENTIFIC NAME	COMMON NAME	STATUS
ROSACEAE		
Prunus persica (L.)	Peach; piki	X
Rubus penetrans Bailey	Blackberry	X
Rubus rosaefolius	Thimbleberry	X

GENERAL OBSERVATIONS

The site is surrounded by eucalyptus trees and the open area surrounding the reservoir is covered with kikuyu-grass and gorse.

CONCLUSIONS

No species of flora observed during the reconnaissance are considered rare or endangered. The site has been disturbed and previously used for pasture.

CHECK LIST OF FAUNA
Kamole Weir Site, Maui, Hawaii

[Fauna observed, likely present, or which would possibly visit the site]

SCIENTIFIC NAME	COMMON NAME	STATUS
CLASS AVES		
PHASIANIDAE		
Coturnix coturnix japonica	Japanese quail	X
Phasianus colchicus torquatus	Ring-necked pheasant	X
CHARADRIIDAE		
Pluvialis dominica fulva	Pacifc golden plover	I
COLUMBIDAE		
Stretopelia chinensis	Lace-necked dove	X
* *Geopelia striata*	Barred dove	X
ALAUDIDAE		
Alauda arvensis arvensis	European skylark	X
MIMIDAE		
Mimus polyglottos	Mockingbird	X
STURNIDAE		
* *Acridotheres tristis*	Mynah	X
ZOSTEROPIDAE		
Zosterops japonica	Japanese white-eye	X
PLOCEIDAE		
ESTRILDINAE		
* *Lonchura punctulata*	Spotted munia; ricebird	X
PASSERINAE		
Passer domesticus	House sparrow	X
FRINGILLIDAE		
CARDUELINAE		
* *Carpodacus mexicanus*	House finch; linnet	X
RICHMONDENINAE		
Richmondena cardinalis	Cardinal	X

CHECK LIST OF FAUNA - Continued
Kamole Weir Site, Maui, Hawaii

SCIENTIFIC NAME	COMMON NAME	STATUS
CLASS MAMMALIA		
MURIDAE		
Rattus norvegicus	Norway rat	X
Rattus exulans	Polynesian rat	P
Mus musculus	House mouse	X
VIVERRIDAE		
Herpestes auropunctatus	Mongoose	X
CLASS AMPHIBIA		
RANIDAE		
Rana rugosa	Wrinkled frog	X

*Observed during field reconnaissance: January, 1981.

CHECK LIST OF FAUNA
Piiholo Sites 1 & 2, Maui, Hawaii (TMK 2-4-13:por. 62)

[Fauna observed, likely present, or which would possibly visit the site]

SCIENTIFIC NAME	COMMON NAME	STATUS
CLASS AVES		
STRIGIDAE		
Asio flammeus sandwichensis	Short-eared owl: pueo	E
PHASIANIDAE		
Coturnix coturnix japonica	Japanese quail	X
* Phasianus colchicus torquatus	Ring-necked pheasant	X
CHARADRIIDAE		
* Pluvialis dominica fulva	Pacifc golden plover	I
COLUMBIDAE		
* Stretopelia chinensis	Lace-necked dove	X
* Geopelia striata	Barred dove	X
ALAUDIDAE		
Alauda arvensis arvensis	European skylark	X
MIMIDAE		
* Mimus polyglottos	Mockingbird	X
STURNIDAE		
* Acridotheres tristis	Mynah	X
DREPANIDIDAE		
PSITTIROSTRINAE		
Loxops virens wilsoni	Maui 'amakihi	E
DREPANIDINAE		
Himatione sanguinea	'Apapane	E
ZOSTEROPIDAE		
* Zosterops japonica	Japanese white-eye	X
PLOCEIDAE		
ESTRILDINAE		
Lonchura punctulata	Spotted munia; ricebird	X
PASSERINAE		
Passer domesticus	House sparrow	X

CHECK LIST OF FAUNA - Continued
Piiholo Sites 1 & 2, Maui, Hawaii (TMK 2-4-13:por. 62)

SCIENTIFIC NAME	COMMON NAME	STATUS
	CLASS AVES	
FRINGILLIDAE		
CARDUELINAE		
* *Carpodacus mexicanus*	House finch; linnet	X
RICHMONDENINAE		
Richmondena cardinalis	Cardinal	X
	CLASS MAMMALIA	
MURIDAE		
Rattus norvegicus	Norway rat	X
Rattus exulans	Polynesian rat	P
Mus musculus	House mouse	X
CANIDAE		
Canis familiaris	Dog	X
VIVERRIDAE		
Herpestes auropunctatus	Mongoose	X
FELIDAE		
Felis catus	Cat	X
BOVIDAE		
Bos taurus	Cattle	X

*Observed during field reconnaissance: January, 1981.

CHECK LIST OF FAUNA
Piiholo Site 3, Maui, Hawaii (Piiholo Reservoir)

[Fauna observed, likely present, or which would possibly visit the site]

SCIENTIFIC NAME	COMMON NAME	STATUS
	CLASS AVES	
STRIGIDAE		
Asio flammeus sandwichensis	Short-eared owl: pueo	E
PHASIANIDAE		
* *Coturnix coturnix japonica*	Japanese quail	X
Phasianus colchicus torquatus	Ring-necked pheasant	X
CHARADRIIDAE		
* *Pluvialis dominica fulva*	Pacifc golden plover	I
COLUMBIDAE		
Stretopelia chinensis	Lace-necked dove	X
Geopelia striata	Barred dove	X
ALAUDIDAE		
Alauda arvensis arvensis	European skylark	X
MIMIDAE		
Mimus polyglottos	Mockingbird	X
DREPANIDIDAE		
PSITTIROSTRINAE		
Loxops virens wilsoni	Maui 'amakihi	E
DREPANIDINAE		
Himatione sanguinea	'Apapane	E
ZOSTEROPIDAE		
Zosterops japonica	Japanese white-eye	X
PLOCEIDAE		
ESTRILDINAE		
Lonchura punctulata	Spotted munia; ricebird	X
PASSERINAE		
Passer domesticus	House sparrow	X

CHECK LIST OF FAUNA - Continued
Piiholo Site 3, Maui, Hawaii (Piiholo Reservoir)

SCIENTIFIC NAME	COMMON NAME	STATUS
CLASS AVES		
FRINGILLIDAE		
CARDUELINAE		
Carpodacus mexicanus	House finch; linnet	X
RICHMONDENINAE		
Richmondena cardinalis	Cardinal	X
CLASS MAMMALIA		
MURIDAE		
Rattus norvegicus	Norway rat	X
Rattus exulans	Polynesian rat	P
Mus musculus	House mouse	X
VIVERRIDAE		
Herpestes auropunctatus	Mongoose	X

* Observed during field reconnaissance: January, 1981.

CHECK LIST OF FAUNA
Olinda Site, Maui, Hawaii

[Fauna observed, likely present, or which would possibly visit the site]

SCIENTIFIC NAME	COMMON NAME	STATUS
	CLASS AVES	
STRIGIDAE		
Asio flammeus sandwichensis	Short-eared owl: pueo	E
PHASIANIDAE		
Coturnix coturnix japonica	Japanese quail	X
Lophortyx californicus	California quail	X
* Phasianus colchicus torquatus	Ring-necked pheasant	X
CHARADRIIDAE		
* Pluvialis dominica fulva	Pacifc golden plover	I
COLUMBIDAE		
Stretopelia chinensis	Lace-necked dove	X
Geopelia striata	Barred dove	X
ALAUDIDAE		
* Alauda arvensis arvensis	European skylark	X
MIMIDAE		
Mimus polyglottos	Mockingbird	X
STURNIDAE		
Acridotheres tristis	Mynah	X
DREPANIDIDAE		
PSITTIROSTRINAE		
* Loxops virens wilsoni	Maui 'amakihi	E
Maculata newtoni	Maui Creeper	E
DREPANIDINAE		
Himatione sanguinea	'Apapane	E
Vestiaria coccinea	'I'iwi	E
ZOSTEROPIDAE		
* Zosterops japonica	Japanese white-eye	X
PLOCEIDAE		
ESTRILDINAE		
Lonchura punctulata	Spotted munia; ricebird	X

CHECK LIST OF FAUNA - Continued
Olinda Site, Maui, Hawaii

SCIENTIFIC NAME	COMMON NAME	STATUS
CLASS AVES		
PASSERINAE		
Passer domesticus	House sparrow	X
FRINGILLIDAE		
CARDUELINAE		
* *Carpodacus mexicanus*	House finch; linnet	X
RICHMONDENINAE		
* *Richmondena cardinalis*	Cardinal	X
CLASS MAMMALIA		
MURIDAE		
Rattus norvegicus	Norway rat	X
Rattus exulans	Polynesian rat	P
Mus musculus	House mouse	X
VIVERRIDAE		
Herpestes auropunctatus	Mongoose	X

* Observed during field reconnaissance: January, 1981.

APPENDIX G

ARCHAEOLOGICAL RECONNAISSANCE

Richard Bordner

APPENDIX G

ARCHAEOLOGICAL RECONNAISSANCE

On January 16-17, 1981 an archaeological reconnaissance was conducted of three proposed water treatment facility sites for the Maui County Department of Water Supply.

Kamole Weir Site

This proposed project site is located in what is presently modified pineapple fields and fill. The central area consists of two man-made hillocks, surrounded by pineapple fields. The entire area has been extensively modified, and there are no surface indications of other cultural material. It is the judgment of the present writer that, due to the lack of significant archaeological and historical materials located during this reconnaissance, this proposed project site will need no further archaeological work.

Olinda Site

This proposed project site is located above Olinda, in an area that presently contains the Olinda Reservoir and associated structures. The land surface, while heavily modified, is, in some sections, apparently undisturbed. The only feature of interest located within the study area was a frame house of shake construction, apparently constructed in about the 1920-40 period. It is not certain whether this house pre-dates the reservoir or if it is an auxiliary to it, but is is presently abandoned and in disrepair. As the house does not appear architecturally significant, nor is it of sufficient age to warrant further historical or archaeological research, no further archaeological work is recommended for this proposed project site.

Piiholo Sites 1 and 2

The proposed project site and alternate site are located in apparently unmodified pasture land. No cultural material was located within the study area. On the basis of this reconnaissance, no further archaeological work is recommended for these proposed sites.

Piiholo Site 3

This alternate site is located in an area consisting of fill from the Piiholo Reservoir. Therefore, no materials of archaeological or historical interest were encountered there. On the basis of this reconnaissance, no further archaeological work is recommended for this site.

CONCLUSION

No cultural materials of significance were located within any of the potential sites. No further archaeological work is recommended for these sites.