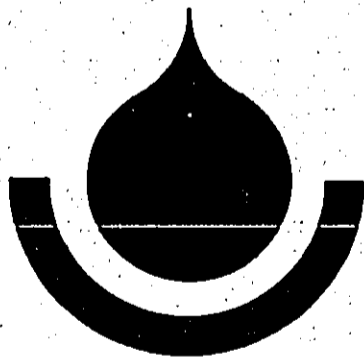


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FOR
Environmental Impact Statement
FOR
WINDWARD OAHU REGIONAL
WATER SYSTEM IMPROVEMENTS

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



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TECHNICAL APPENDICES

FOR

ENVIRONMENTAL IMPACT STATEMENT

FOR

WINDWARD OAHU REGIONAL WATER SYSTEM IMPROVEMENTS

This Environmental Document is Submitted Pursuant to Chapter 343, HRS

PROPOSING AGENCY:

Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

ACCEPTING AUTHORITY:

Governor, State of Hawaii

BOARD MEMBERS:

Donna B. Goth, Chairman
Ernest A. Watari, Vice Chairman
Milton J. Agader
Sister M. Davilyn Ah Chick, O.S.F.
Edward Y. Hirata
Alfred J. Thiede

 Date 3/18/87
KAZU HAYASHIDA
Manager and Chief Engineer

VOLUME II

PREPARED BY:

VTN Pacific
1164 Bishop Street, Suite 906
Honolulu, Hawaii 96813

VOLUME II
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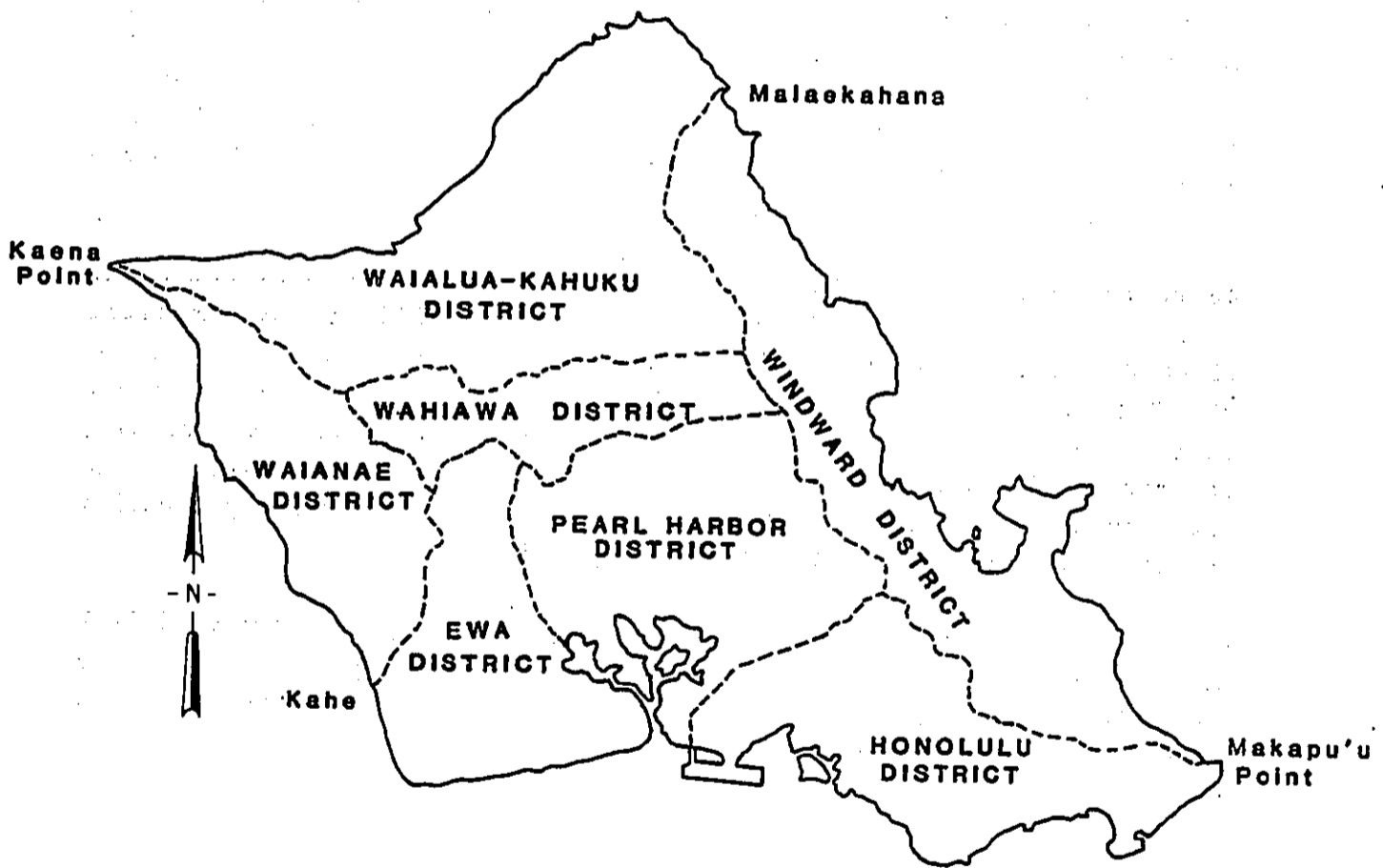
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APPENDIX A

PROJECTED MUNICIPAL WATER DEMAND

The BWS has divided the island of Oahu into seven water use districts for administrative and planning purposes: Honolulu, Pearl Harbor, Ewa, Waianae, Wahiawa, Waiialua-Kahuku, and Windward. [See Figure A-1] Table A-1 shows the resident population, de facto population, population served by the BWS, and municipal water consumption in each of these districts in 1980. De facto population is derived by subtracting residents absent and adding visitors present to the resident population. Population served by other water systems is subtracted from de facto population to arrive at population served by the BWS. Average daily per capita demand is derived by dividing average daily total demand by population served by the BWS.

FIGURE A-1
BWS OAHU WATER USE DISTRICTS



A-1

TABLE A-1
ACTUAL MUNICIPAL WATER DEMAND IN 1980

<u>District</u>	<u>Population</u>			<u>Average Daily Demand</u>	
	<u>Resident</u>	<u>De Facto</u>	<u>Served By BWS</u>	<u>Per Capita (Gallons)</u>	<u>Total (MGD)</u>
Honolulu	366,000	427,000	412,000	181	74.32
Pearl Harbor	155,000	153,000	129,000	138	17.78
Ewa	37,000	36,000	22,000	360	7.85
Waianae	33,000	33,000	31,000	250	7.72
Wahiawa	42,000	41,000	20,000	133	2.61
Waialua-Kahuku	14,000	15,000	12,000	194	2.31
<u>Windward</u>	<u>120,000</u>	<u>119,000</u>	<u>112,000</u>	<u>156</u>	<u>17.50</u>
Total Oahu	767,000	824,000	738,000	177	130.09

Municipal water use is directly affected by both population and climate. Average daily consumption typically ranges from 104 to 168 gallons per capita for single family residences, 90 to 97 gallons per capita for multi-family residences, and 124 to 159 gallons per capita for hotels. Consumption is lower during cool winter months and higher during hot summer months. Consumers living in higher rainfall areas of Oahu use less water per capita than consumers living in dry areas.

Based on 1978 Oahu population and economic projections by the State Department of Planning and Economic Development (DPED) and assumptions about distribution of population, land uses, and employment provided by the City Department of General Planning (DGP), Table A-2 projects resident population, de facto population, population served by the BWS, and municipal water consumption for the seven BWS water use districts in the year 2000. Table A-3 provides a more detailed population projection by geographic area within the Windward District.

Current BWS projections indicate that average daily island-wide municipal water demand will increase from 130.1 mgd in 1980 to 181.0 mgd in the year 2000. During summer months, maximum daily demand might exceed average demand by approximately 30 percent.

TABLE A-2
PROJECTED MUNICIPAL WATER DEMAND IN 2000

<u>District</u>	<u>Population</u>			<u>Average Daily Demand</u>	
	<u>Resident</u>	<u>De Facto</u>	<u>Served By BWS</u>	<u>Per Capita (Gallons)</u>	<u>Total (MGD)</u>
Honolulu	408,000	479,000	464,000	199	92.40
Pearl Harbor	193,000	190,000	166,000	158	26.30
Ewa	79,000	85,000	75,000	303	22.60
Waianae	41,000	41,000	39,000	270	10.60
Wahiawa	45,000	45,000	23,000	144	3.30
Waiialua-Kahuku	20,000	26,000	24,000	214	5.10
<u>Windward</u>	<u>131,000</u>	<u>130,000</u>	<u>122,000</u>	<u>170</u>	<u>20.70</u>
Total Oahu	917,000	996,000	913,000	198	181.00

SOURCE: BWS Planning Section

TABLE A-3
PROJECTED WINDWARD DISTRICT WATER DEMAND IN 2000

<u>District</u>	<u>Population</u>			<u>Average Daily Demand</u>	
	<u>Resident</u>	<u>De Facto</u>	<u>Served By BWS</u>	<u>Per Capita (Gallons)</u>	<u>Total (MGD)</u>
Laie-Kaaawa	10,700	10,800	4,600	170	0.80
Kualoa-Waihee	3,800	3,700	3,300	170	0.60
Kahaluu-Ahuimanu	9,200	9,100	9,100	170	1.50
Haiku-Heeia	11,000	10,900	10,900	170	1.80
Kaneohe-KMCAS	41,000	40,600	39,900	170	6.80
Kailua-Maunawili	45,500	44,900	44,200	170	7.50
<u>Waimanalo</u>	<u>10,100</u>	<u>9,900</u>	<u>9,900</u>	<u>170</u>	<u>1.70</u>
Total	131,300	129,900	121,900	170	20.70

NOTE: Projected per capita consumption was assumed to be uniform throughout the Windward District, which probably is not correct.

SOURCE: BWS Planning Section


These projections of municipal water consumption will need to be revised to reflect 1984 DPED population and economic projections and the most recently adopted County Development Plans. While current BWS projections assume that Oahu will have a resident population of 917,000 and de facto population of 996,000 in the year 2000, DPED now projects a resident population of 926,000 and a de facto population of 1,018,000 by 2000. [Ref. 23]

APPENDIX B

**ASSIMILATION OF NEW WATER SOURCES
AND
RESERVOIRS INTO THE BWS SYSTEM**

LEGEND

 EXISTING WELLS


 PROPOSED WELLS

 EXISTING RESERVOIRS

 PROPOSED RESERVOIRS

 EXISTING TUNNELS OR INCLINED WELLS

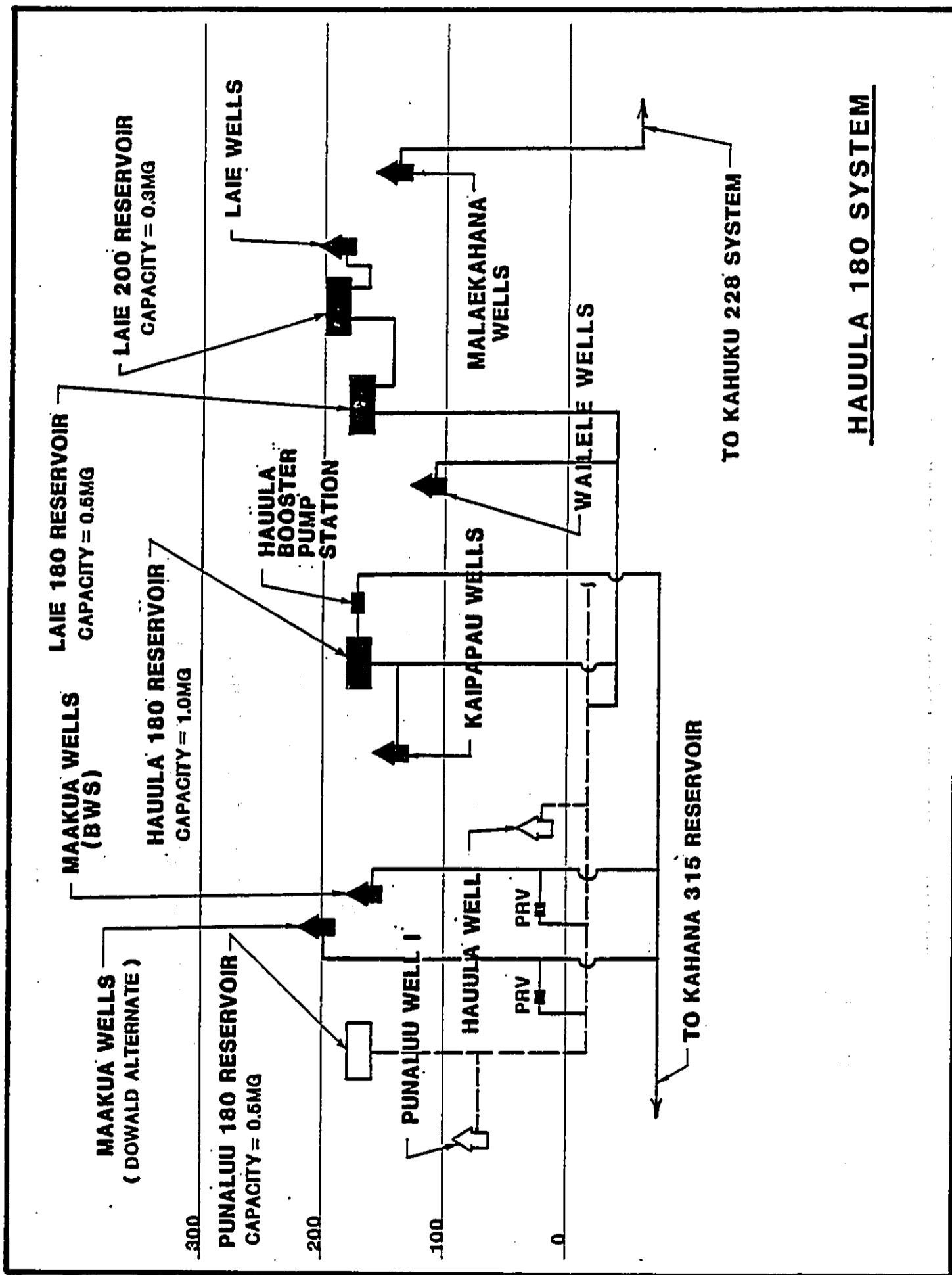
 PROPOSED TUNNELS OR INCLINED WELLS

 EXISTING BOOSTER PUMP STATION

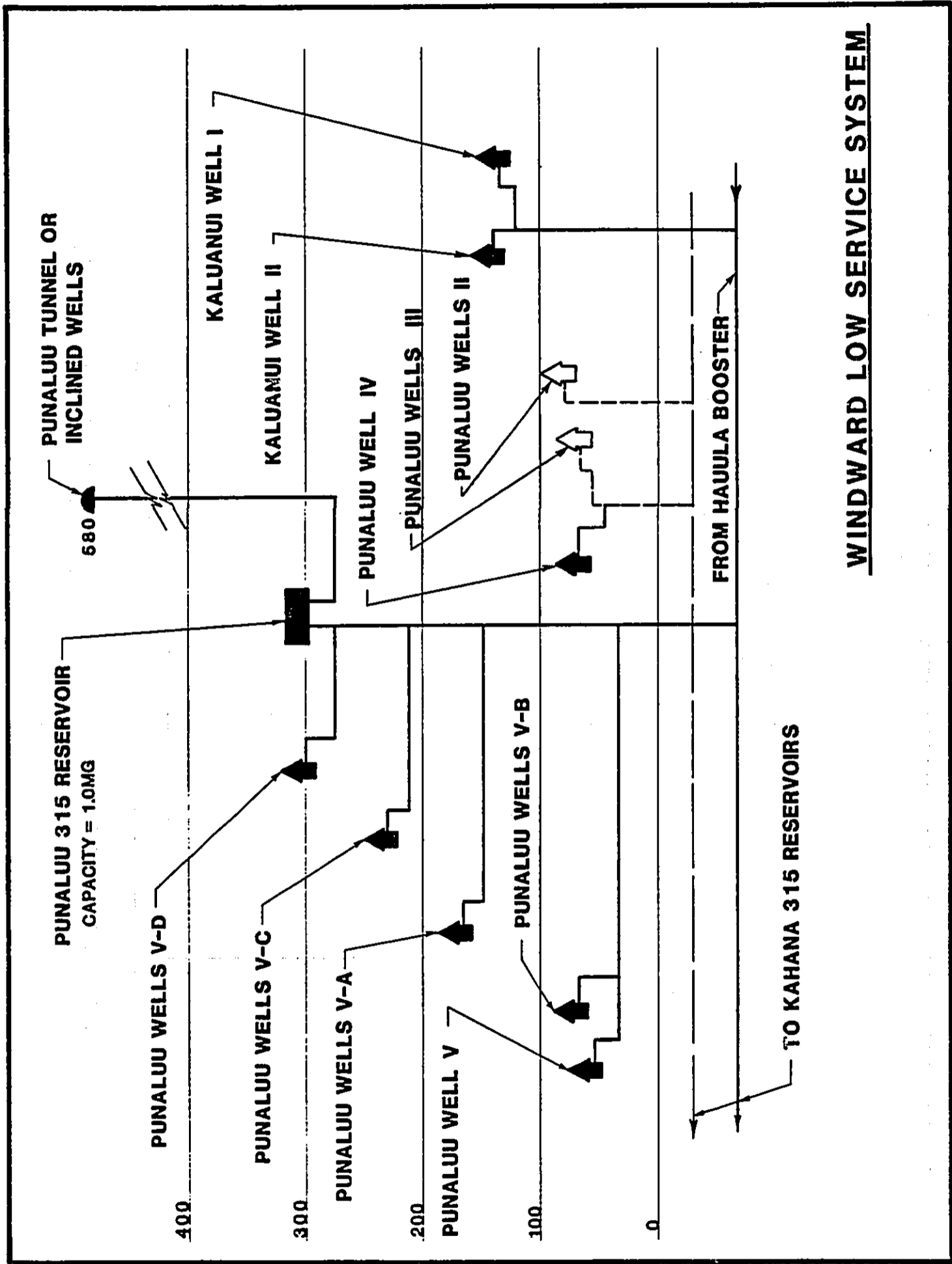
 PROPOSED BOOSTER PUMP STATION

 EXISTING PIPELINE CONNECTION

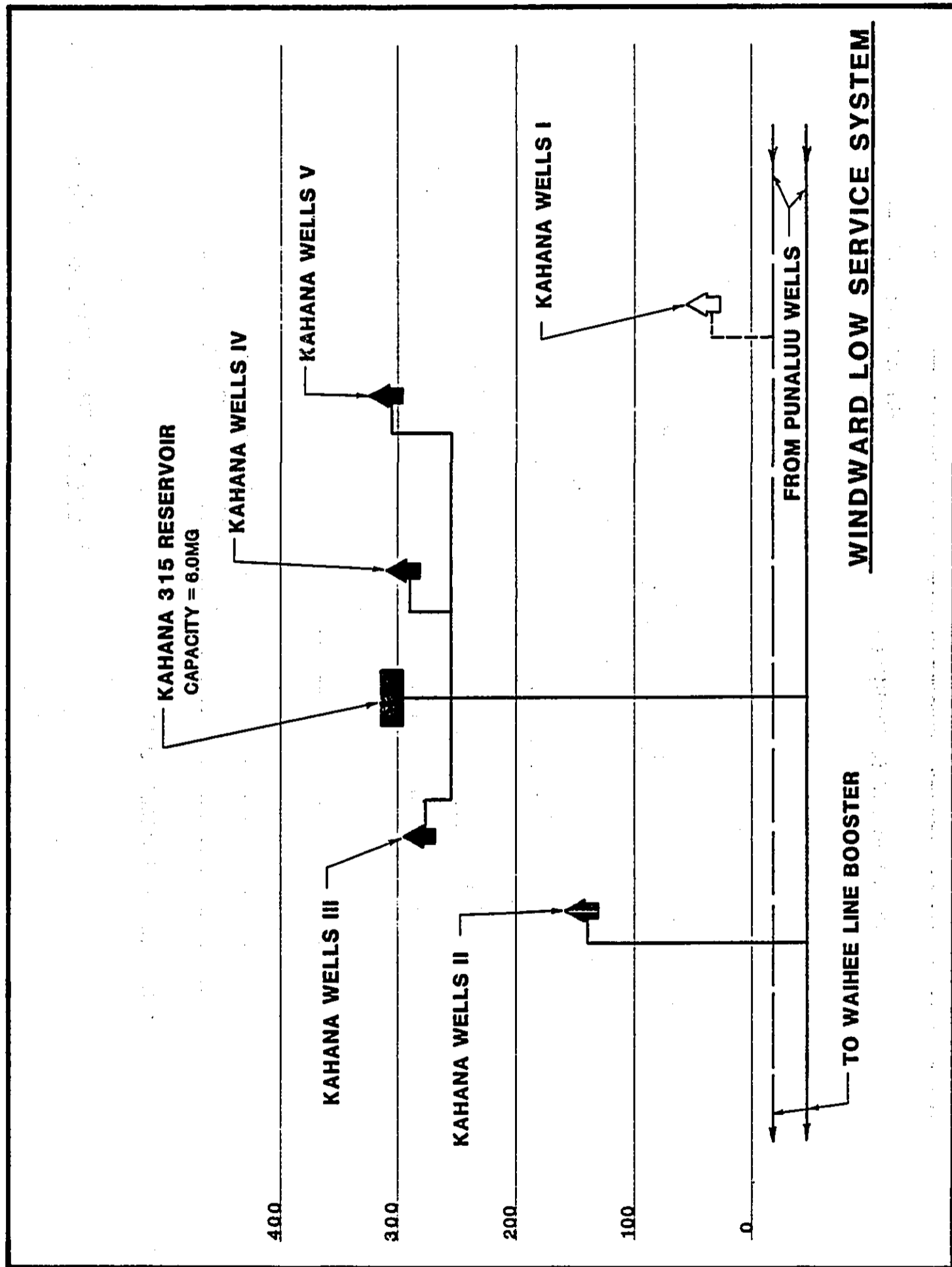
 PROPOSED PIPELINE CONNECTION



HAUULA 180 SYSTEM

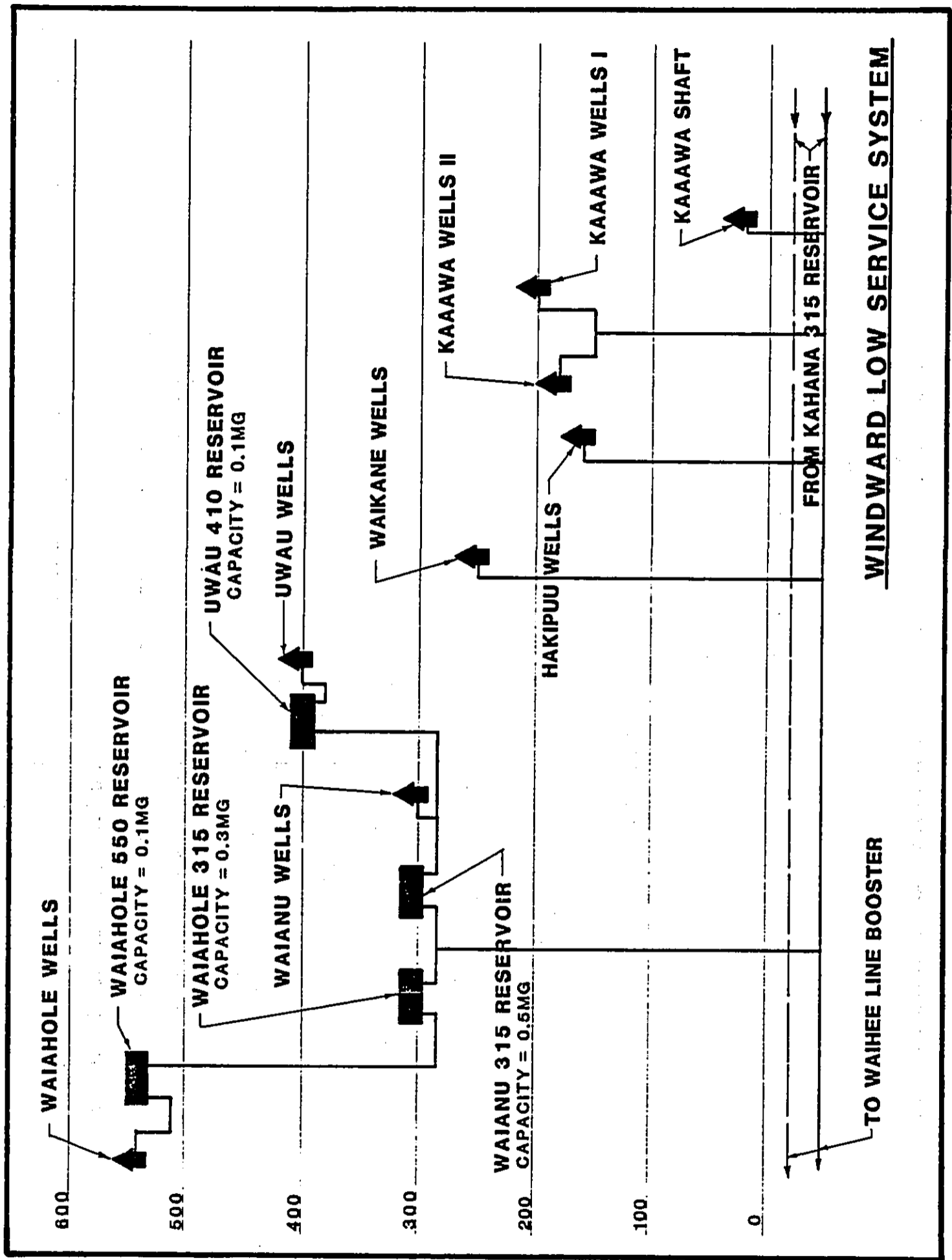


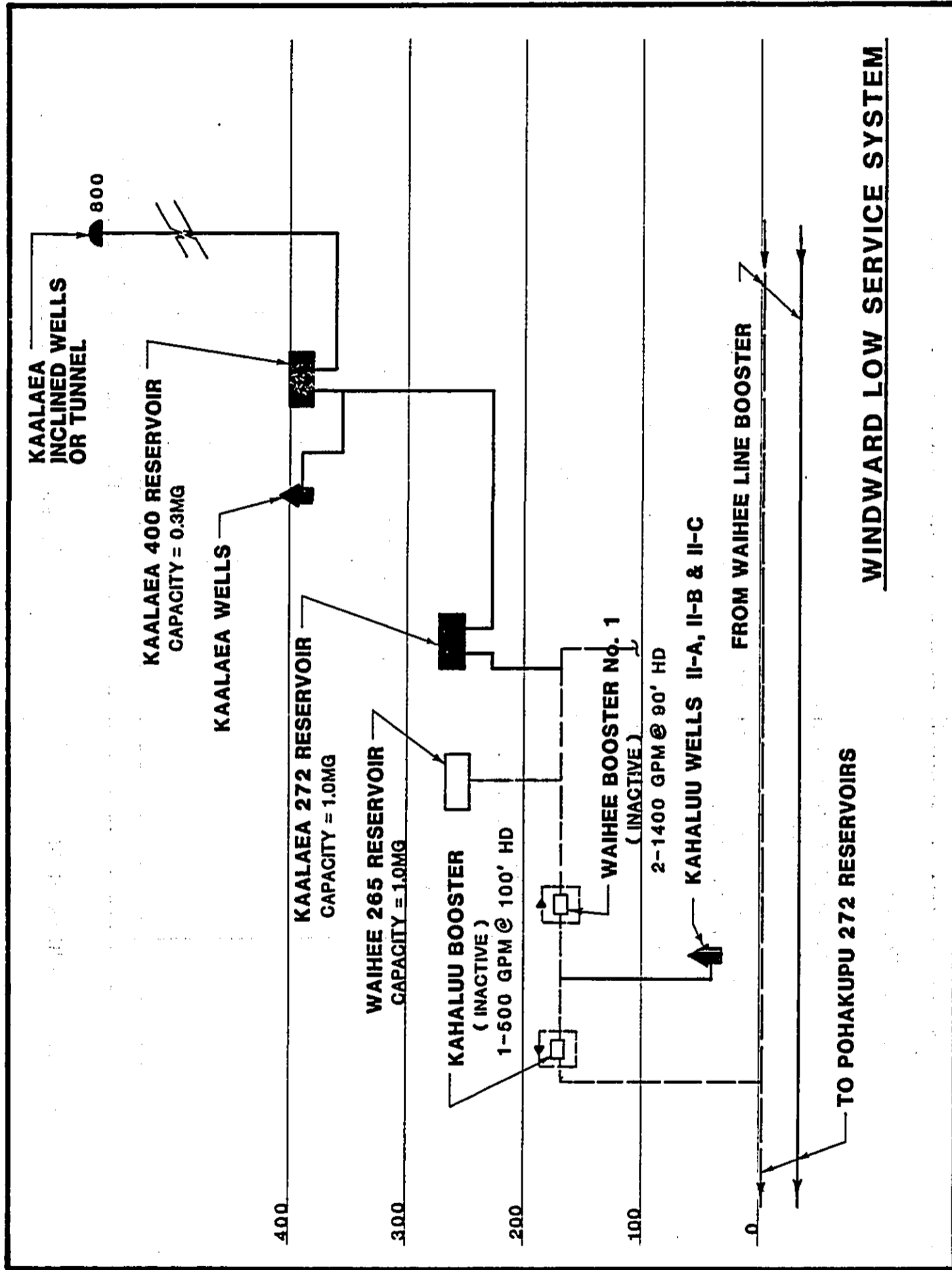
WINDWARD LOW SERVICE SYSTEM

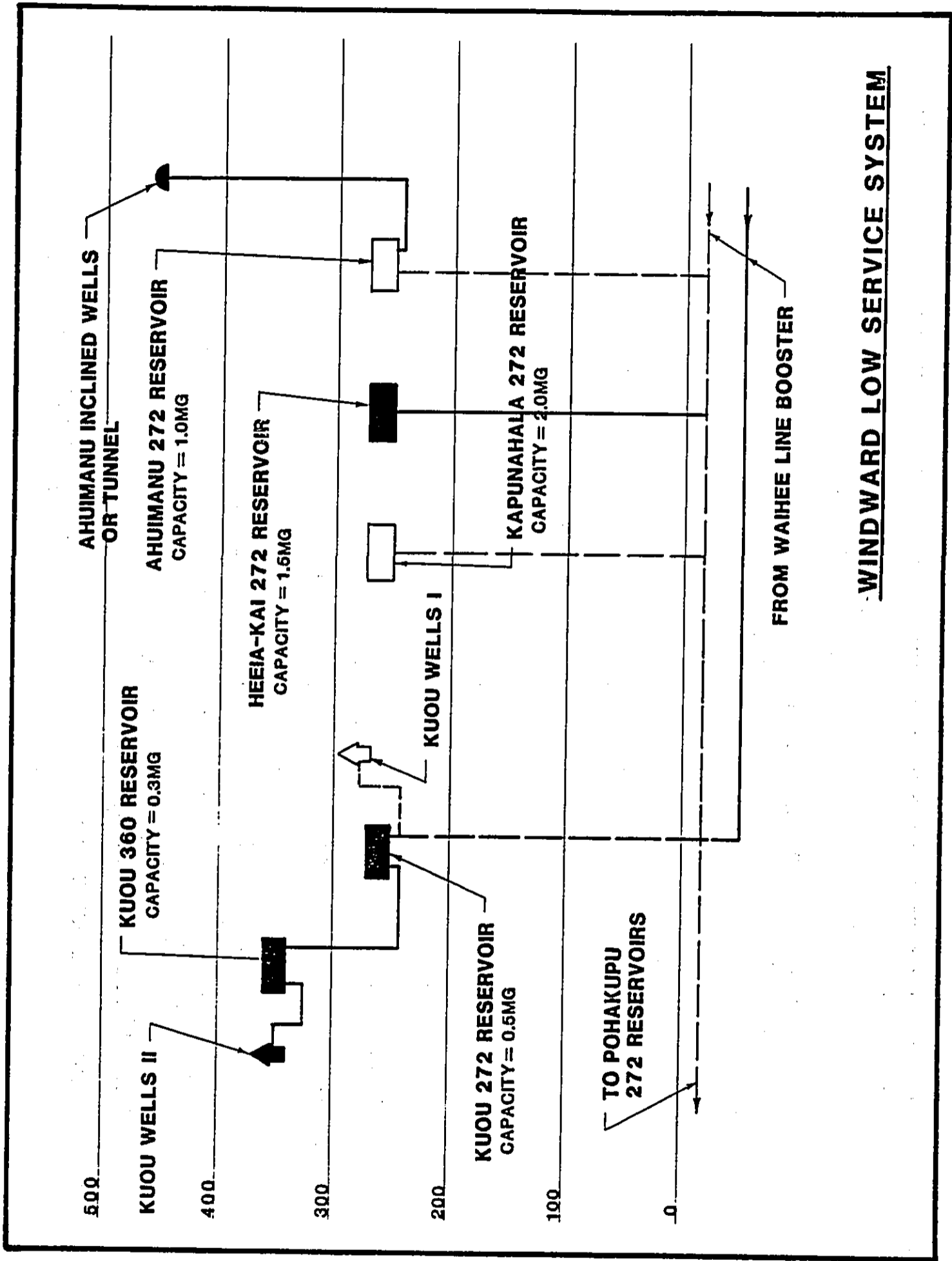


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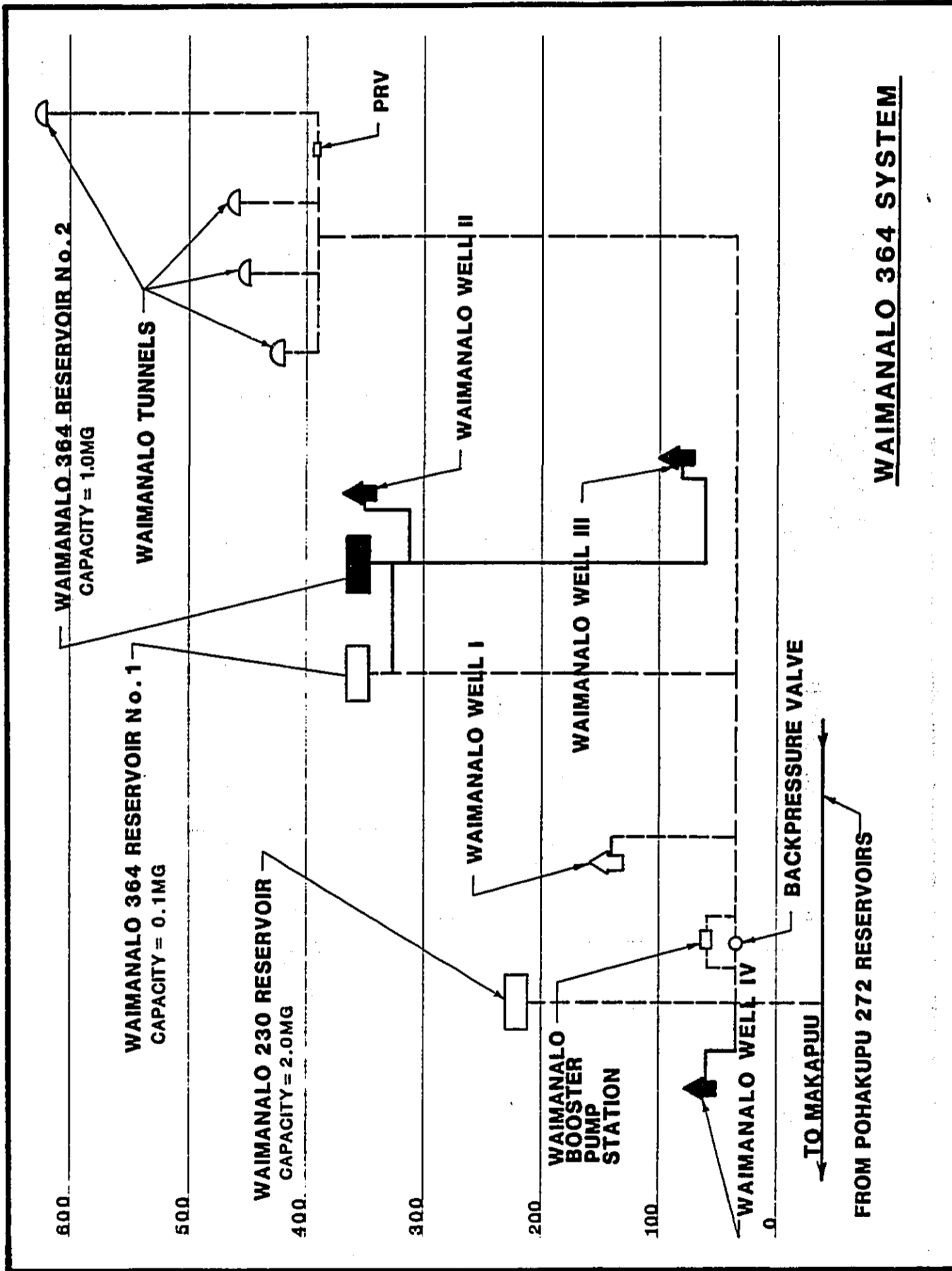
W A I A H O L E W E L L S



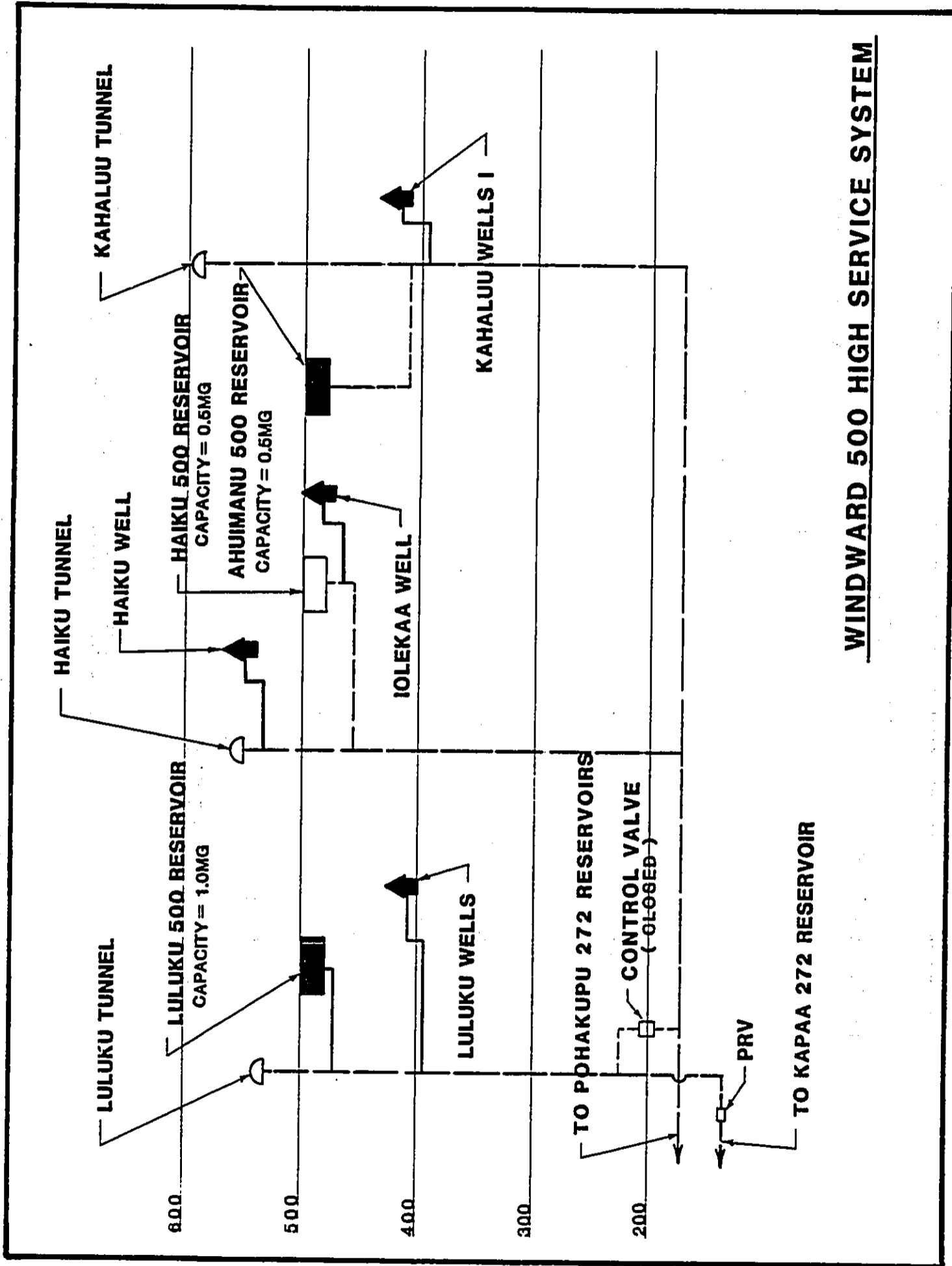




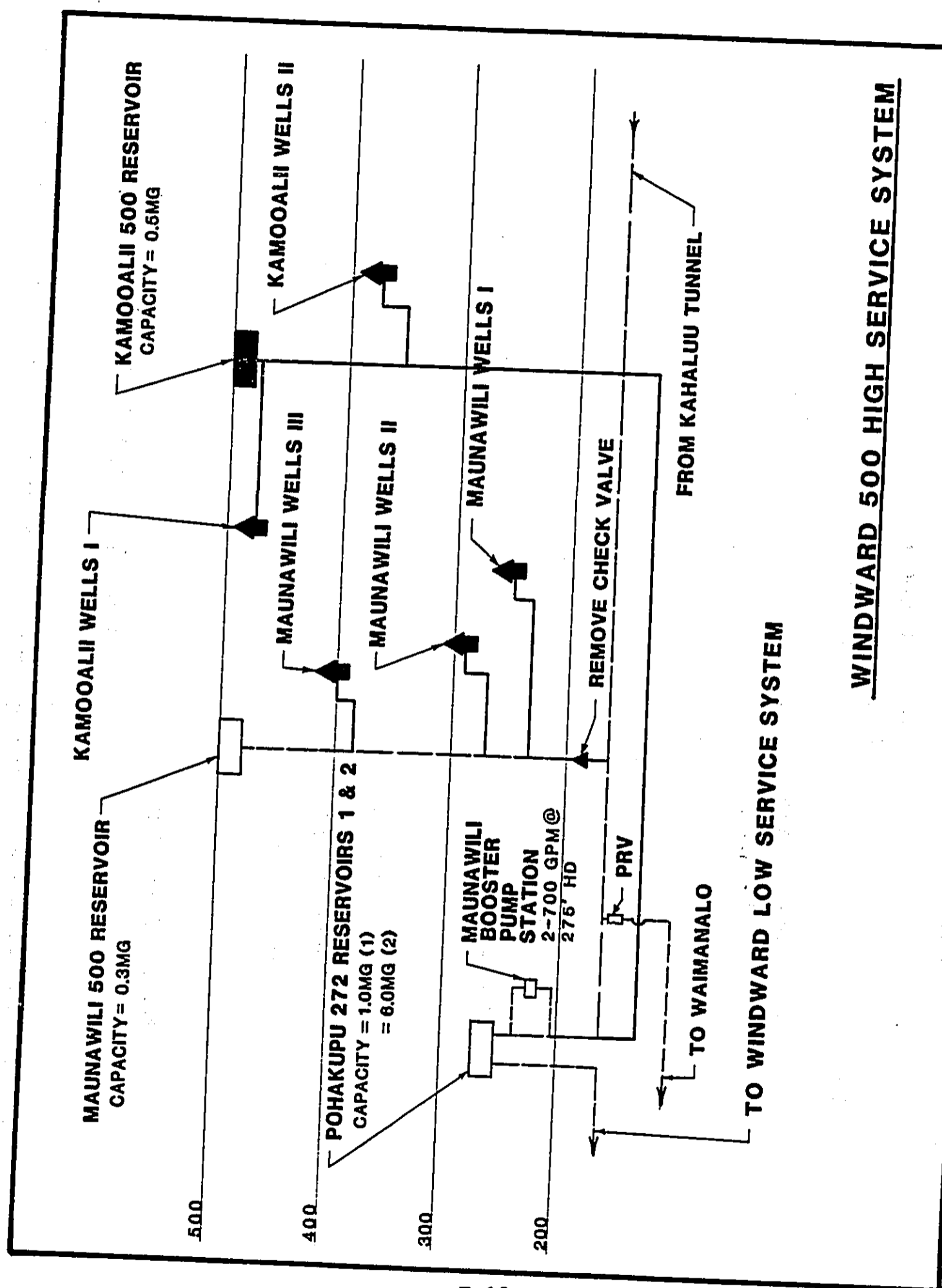
WINDWARD LOW SERVICE SYSTEM



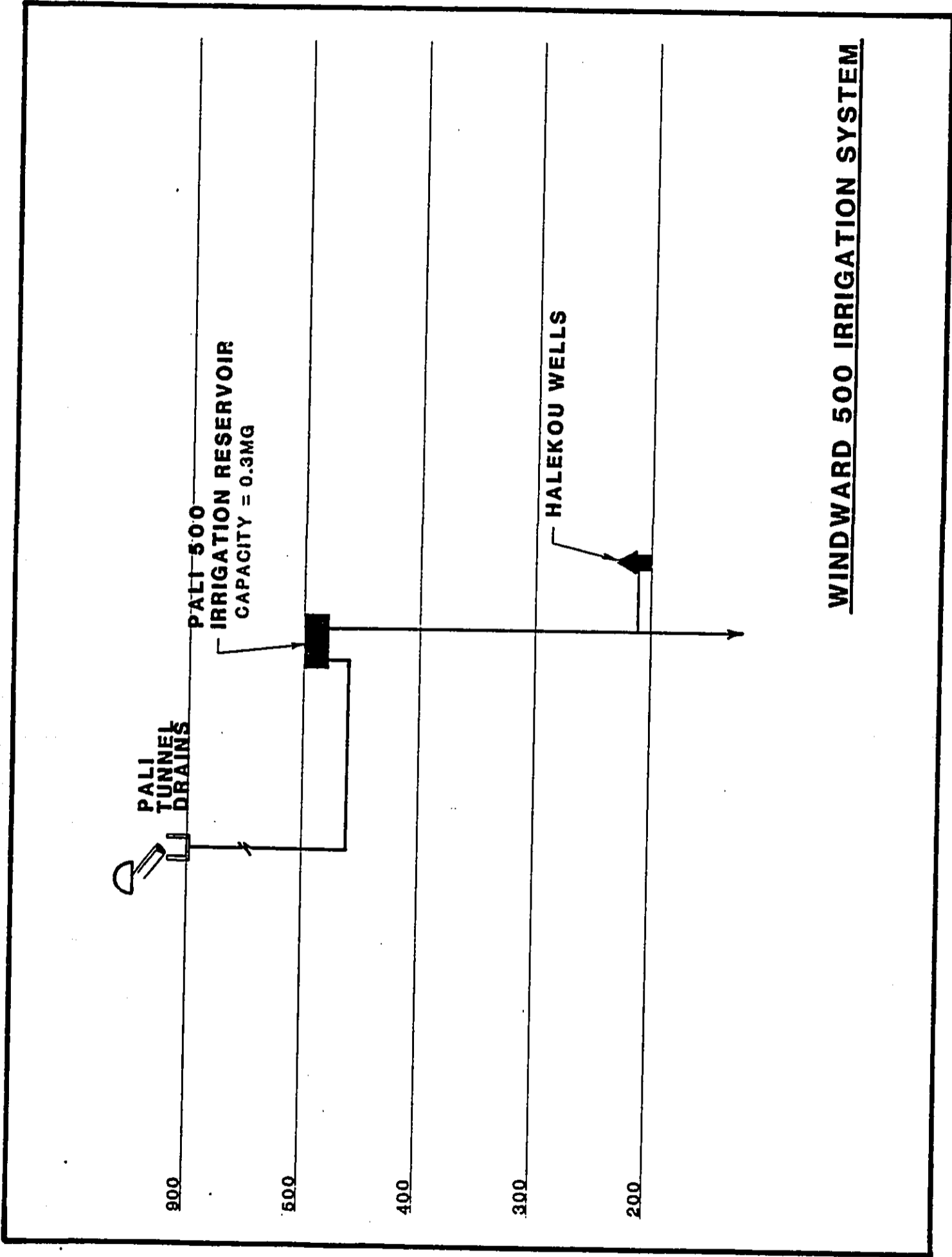
WAIMANALO 364 SYSTEM



WINDWARD 500 HIGH SERVICE SYSTEM



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WINDWARD 500 IRRIGATION SYSTEM

APPENDIX C

STREAM DISCHARGE DATA

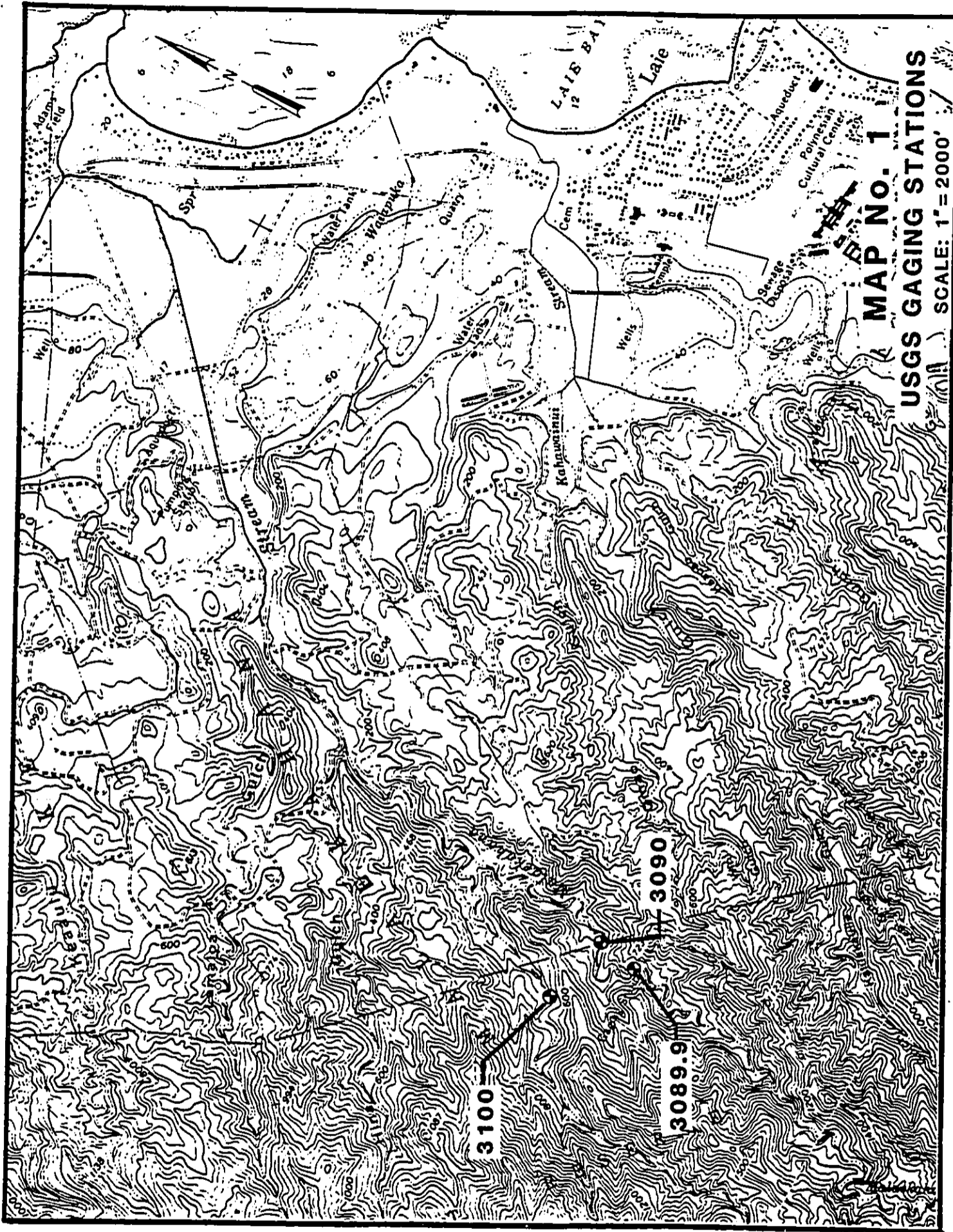
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APPENDIX C --- TABLE OF CONTENTS

Map No.	USGS Gage No.	Stream Name / Location	Period of Record	Map Page
1	3100 3089.9 3090	Middle Branch Malaekahana Near Kahuku Malaekahana Near Laie East Branch Malaekahana Near Kahuku	July 1914 - June 1918 July 1963 - September 1971 October 1914 - June 1918	C-3
2	3080	East Branch Kahawainui Near Laie	September 1914 - June 1918	C-6
3	3070	Wailele Gulch Near Laie	August 1914 - June 1916; November 1917 - June 1919 August 1914 - June 1918	C-8
4	3060	Koloa Gulch Near Laie		
4	3040 3042	Kaluanui Near Hauula Kaluanui Near Punaluu	July 1914 - June 1917 May 1967 - Current	C-11
5	3000 2990 3030 3020	Waihoi Stream Near Punaluu Punaluu at Elevation 539', Near Punaluu Punaluu Near Punaluu Punaluu Ditch Near Punaluu	July 1914 - June 1917 June 1915 - June 1918 May 1953 - Current May 1953 - Current	C-13
6	2960 2965 2970	Kahana Near Kahana Kahana at Elevation 30', Near Kahana East Branch Kahana Near Kahana	July 1914 - June 1917 December 1958 - Current May 1914 - February 1917	C-17
7	-----			C-21
8	2949 2850 2870 2900 2910 2920 2940	Waikane at Altitude 75', at Waikane Waiahole Tunnel at Waianu, Near Waiahole Waiahole Tunnel at North Portal, Near Waiahole Waiahole Below Powerhouse, Near Waiahole Waiahole at Altitude 250', Near Waiahole Waiahole Near Waiahole Waiahole at Waiahole, Near Waikane	December 1959 - Current December 1950 - May 1969 December 1950 - May 1969 May 1915 - September 1915 July 1955 - September 1968 October 1911 - June 1916 October 1911 - December 1912	C-22

APPENDIX C — TABLE OF CONTENTS (Continued)

Map No.	USGS Gage No.	Stream Name / Location	Period of Record	Map Page		
9	2837	North Fork Waihee, Near Heeia	September 1962 - Current	C-28		
	2836	South Fork Waihee, Near Heeia	September 1962 - Current			
	2838	Waihee at Altitude 260', Near Heeia	May 1961 - June 1966			
	2840	Waihee Near Heeia	December 1935 - September 1982			
	2842	Waihee Near Kahaluu	October 1974 - Current			
	2845	Waihee at Kahaluu	November 1966 - September 1971			
	2830	Kahaluu Near Heeia	October 1935 - September 1971			
	2835	Kahaluu at Kahaluu	March 1967 - April 1970			
	10	2780	Iolekaa Mauka Near Heeia		March 1940 - February 1970	C-37
		2790	Iolekaa Near Heeia		February 1914 - June 1916	
2750		Haiku Near Heeia	January 1914 - October 1919; July 1939 - Current			
11	2709	Luluku at Altitude 220', Near Kaneohe	July 1967 - September 1971	C-42		
	2660	Kamooalii Near Kaneohe	February 1914 - June 1916			
	2705	Kamooalii Below Kuou, Near Kaneohe	April 1967 - September 1970;			
	2722	Kamooalii Below Luluku, Near Kaneohe	January 1972 - September 1976			
	2739	Kamooalii at Kaneohe	November 1976 - Current			
	2670	Hooleinaiwa Near Kaneohe	January 1959 - October 1963;			
	2650	Kawa Near Kaneohe	November 1965 - January 1980			
12	-----	-----	January 1914 - June 1916	C-48		
	2630	Kahanaiki Near Kailua	March 1914 - June 1916			
13	2570	Pohakea Near Kailua	November 1914 - June 1916	C-49		
	2560	Kamakalepo Near Kailua	December 1912 - February 1914			
	2492	Maunawili Near Waimanalo	May 1913 - June 1916			
	2540	Makawao Near Kailua	February 1913 - June 1916			
	2580	Maunawili Above Wong Leong's Ditch	February 1913 - June 1916;			
	2600	Maunawili Near Kailua	January 1958 - Current			
	2605	Maunawili at Highway 61, Near Kailua	April 1922 - June 1923			
	2500	Maunawili Ditch Near Waimanalo	May 1913 - June 1916			
	-----	-----	January 1967 - September 1971			
	-----	-----	March 1954 - June 1965			
14	-----	-----	-----	C-55		



MAP NO. 1
USGS GAGING STATIONS
SCALE: 1"=2000'

STREAM FLOW DATA

STREAM NAME: MIDDLE BR. MALAEKAHANA TRIBUTARY OF: OCEAN
 ELEVATION: 440' MAP KEY: 1
 USGS GAGE NO. 3100 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
6-18	365	.08	0	0
6-17	365	.04	0	0
6-16	270	N/A	0	0
6-15	330	N/A	0	0
-			0	0

COMMENT: No diversion above station.

STREAM FLOW DATA

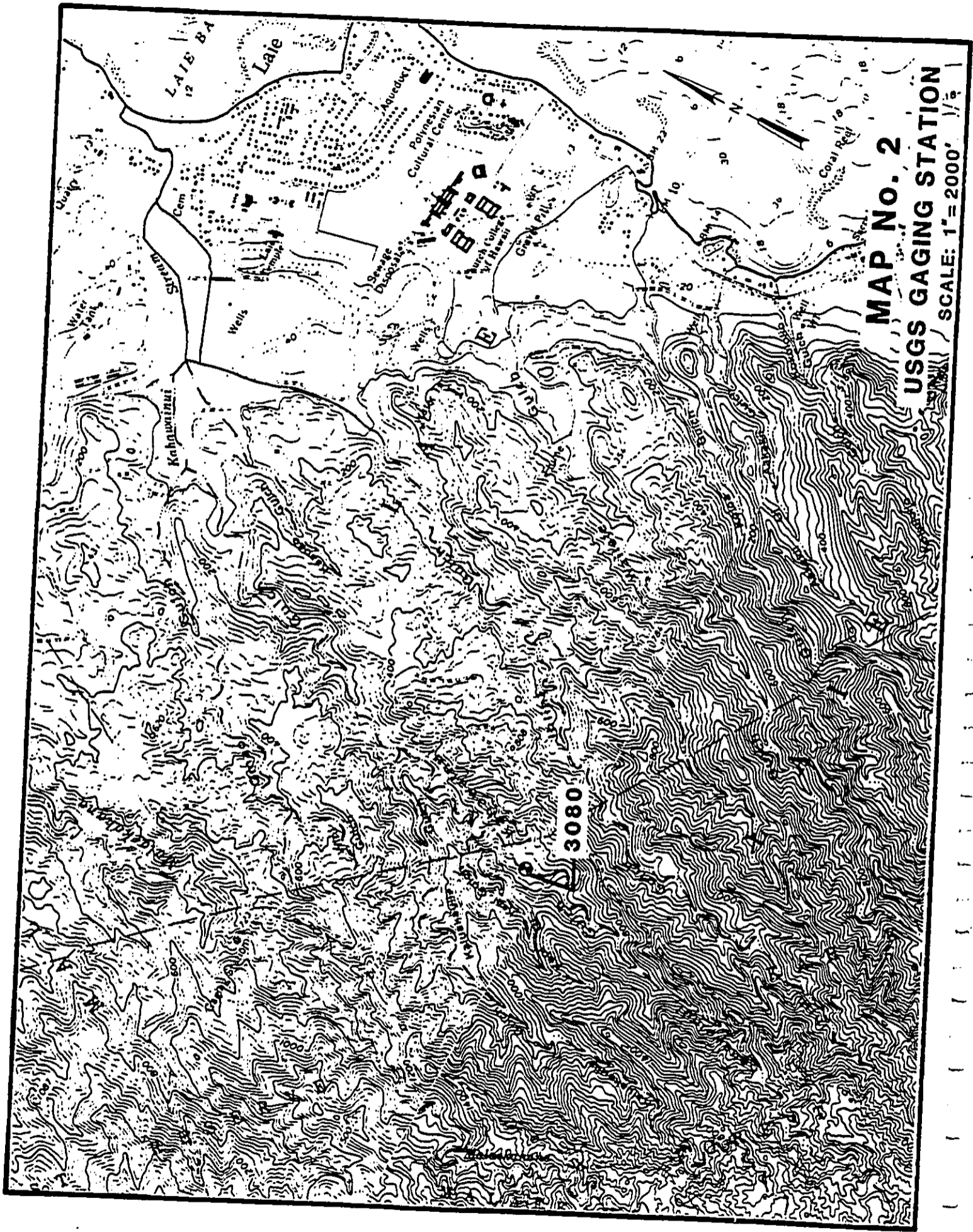
STREAM NAME: MALAEKAHANA TRIBUTARY OF: OCEAN
 ELEVATION: 450' MAP KEY: 1
 USGS GAGE NO. 3089.9 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
9-71	365	.54	.01	00
9-70	365	.97	.17	.01
9-69	365	.67	.19	00
9-68	365	.61	.11	00
9-67	365	.87	.23	.01
9-66	365	.53	.10	00
6-65	365	1.57	.18	00
6-64	365	.67	.14	00

COMMENT: No diversion above station.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

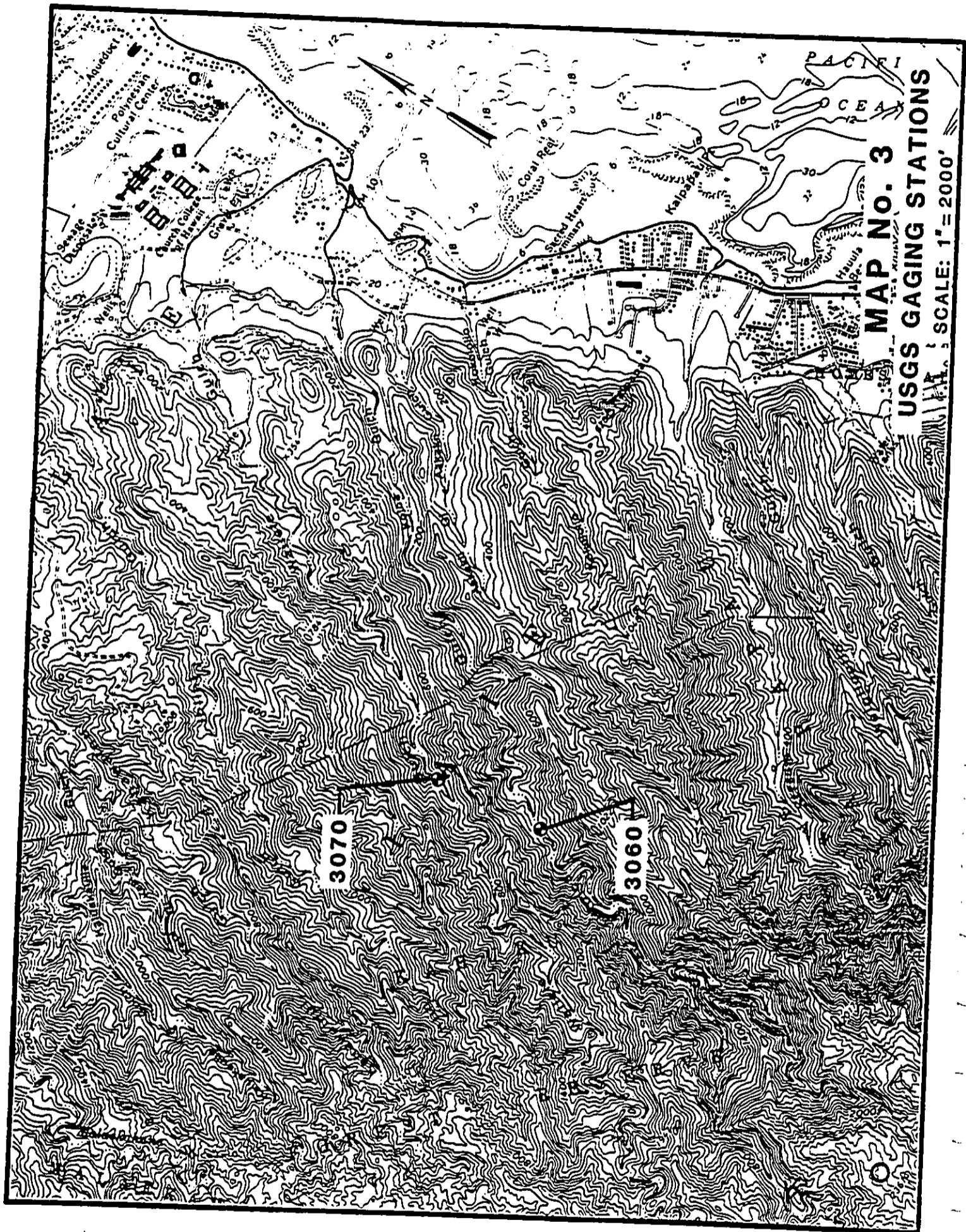


STREAM FLOW DATA

STREAM NAME: E. BRANCH KAHAWAINUI
ELEVATION: 500'
USGS GAGE NO. 3080

TRIBUTARY OF: OCEAN
MAP KEY: 2
COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
6-18	365	.41	0	0
6-17	365	.75	0	0
6-16	120	N/A	.02	N/A
6-15	300	N/A	.32	N/A
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COMMENT: No diversion above station.				

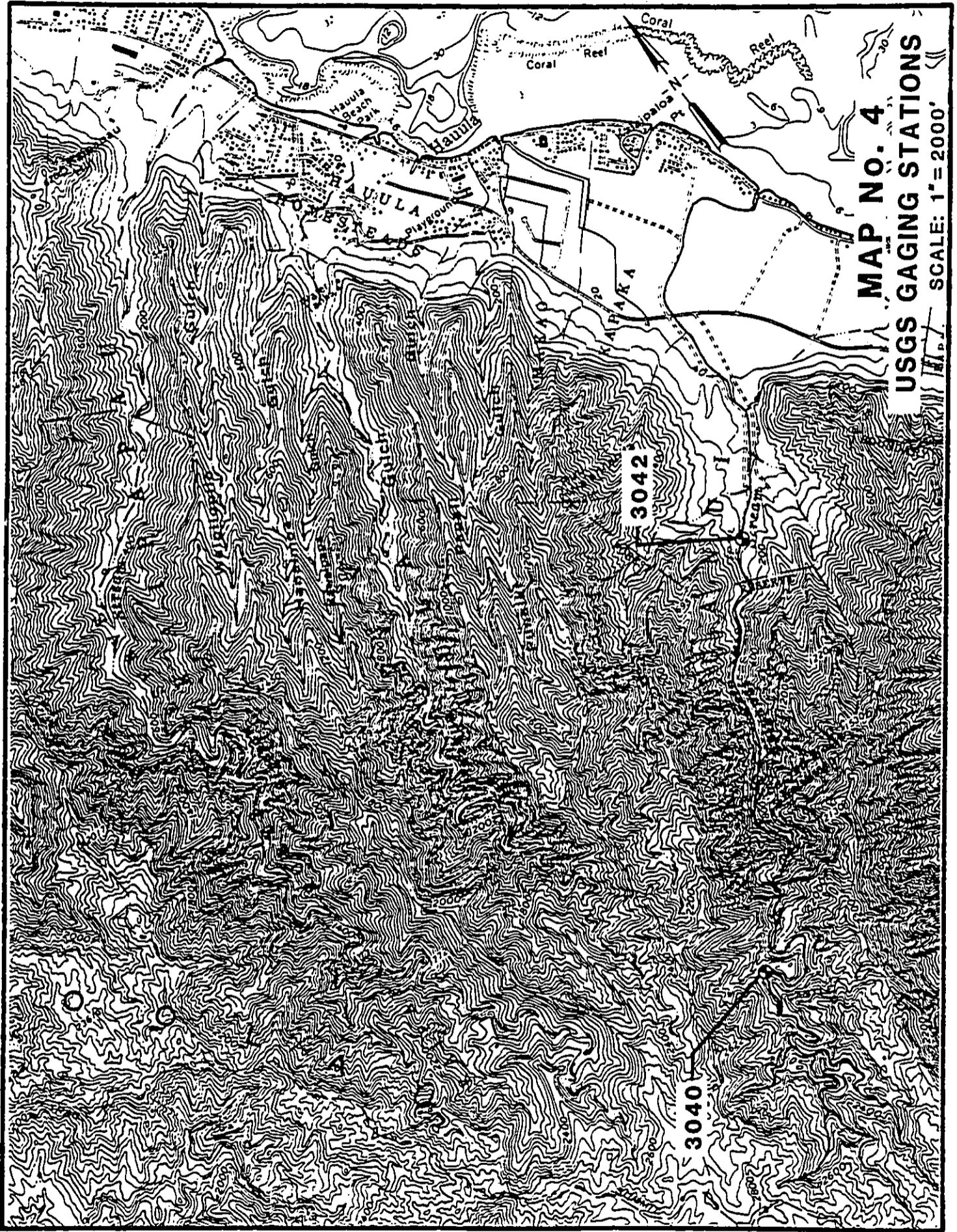


STREAM FLOW DATA

STREAM NAME: KOLOA GULCH
 ELEVATION: 500'
 USGS GAGE NO. 3060

TRIBUTARY OF: OCEAN
 MAP KEY: 3
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE*	LOWEST MONTHLY MEAN DISCHARGE*	LOWEST RECORDED DISCHARGE*
6-18	365	2.05	.26	0
6-17	365	2.29	.85	.30
6-16	300	N/A	.91	N/A
6-15	330	N/A	.45	N/A
COMMENT: No diversion above station.				



STREAM FLOW DATA

STREAM NAME: KALUANUI
 ELEVATION: 1900'
 USGS GAGE NO. 3040

TRIBUTARY OF: OCEAN
 MAP KEY: 4
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
6-17	365	2.37	.69	N/A
6-16	365	2.27	.61	N/A

COMMENT: No diversion above station.

STREAM FLOW DATA

STREAM NAME: KALUANUI
 ELEVATION: 110'
 USGS GAGE NO. 3042

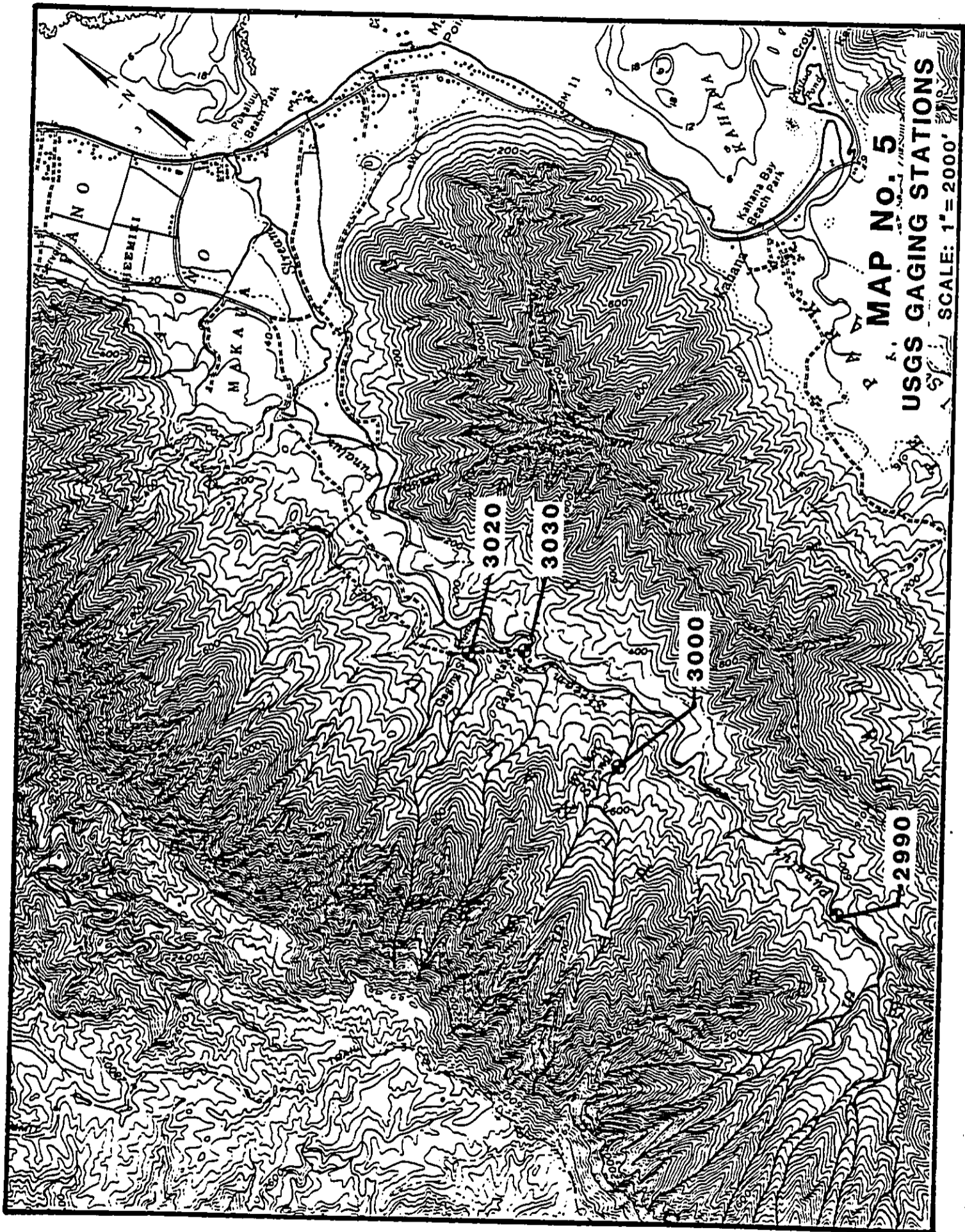
TRIBUTARY OF: OCEAN
 MAP KEY: 4
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
9-84	365	1.03	.34	00
9-83	365	2.19	.09	00
9-82	365	5.31	2.21	.11
9-81	365	1.53	.39	00
9-80	365	3.47	.59	.13
9-79	365	1.54	.54	.04
9-78	365	1.53	.30	00
9-77	365	1.83	.19	00
9-76	365	1.31	.70	.10
9-75	365	1.30	.14	00
9-74	365	2.84	.87	.09
9-73	365	1.33	.59	.02
9-72	365	1.41	.53	.05
9-71	365	1.54	.14	00
9-70	365	1.88	.39	.08
9-69	365	2.48	1.06	.03
9-68	365	1.97	.57	.12
9-67	150	N/A	.99	.10

COMMENT: No diversions above station.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE



STREAM FLOW DATA

STREAM NAME: WAIHOI
 ELEVATION: 500'
 USGS GAGE NO. 3000

TRIBUTARY OF: PUNALUU STREAM
 MAP KEY: 5
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
6-17	365	3.40	2.76	N/A
6-16	365	4.00	3.44	N/A
6-15	60	N/A	4.11	N/A
-				

COMMENT: No diversion above station.

STREAM FLOW DATA

STREAM NAME: PUNALUU
 ELEVATION: 540'
 USGS GAGE NO. 2990

TRIBUTARY OF: OCEAN
 MAP KEY: 5
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
6-18	270	N/A	1.92	N/A
6-17	365	5.73	3.22	2.00
6-16	365	4.78	2.54	1.80
6-15	30	N/A	3.19	N/A

COMMENT: No diversion above station.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

STREAM FLOW DATA

STREAM NAME: PUNALUU
 ELEVATION: 212'
 USGS GAGE NO. 3030

TRIBUTARY OF: OCEAN
 MAP KEY: 5
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
9-84	365	7.04	4.70	3.42
9-83	365	9.01	7.82	5.56
9-82	365	22.74	11.76	2.54
9-81	365	10.14	8.59	7.11
9-80	365	15.70	10.14	3.68
9-79	365	12.47	5.61	4.65
9-78	365	9.92	4.61	3.98
9-77	365	8.04	5.40	4.39
9-76	365	8.59	4.78	3.04
9-75	365	10.63	4.28	3.68
9-74	365	16.02	10.72	5.56
9-73	365	7.59	5.99	5.17
9-72	365	11.95	9.50	7.75
9-71	365	14.02	2.92	2.00
9-70	365	5.32	3.25	1.81
9-69	365	8.20	3.37	.78
9-68	365	9.24	2.34	1.29
9-67	365	9.92	4.72	.78
9-66	365	10.59	1.52	.78
6-65	365	15.30	1.72	.43
6-64	365	6.35	.37	.27
6-63	365	6.32	.49	00
6-62	365	6.03	.31	00
6-61	365	3.63	.44	.03
6-60	365	2.32	.15	00
6-59	365	8.23	.77	00
6-58	365	6.32	.18	00
6-57	365	10.18	2.69	.18
6-56	365	12.50	2.36	.76
6-55	365	13.74	2.91	00
6-54	330	N/A	.29	00
COMMENT: Punaluu Ditch intake just above station.				

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

STREAM FLOW DATA

STREAM NAME: PUNALUU DITCH
 ELEVATION: 200'
 USGS GAGE NO. 3020

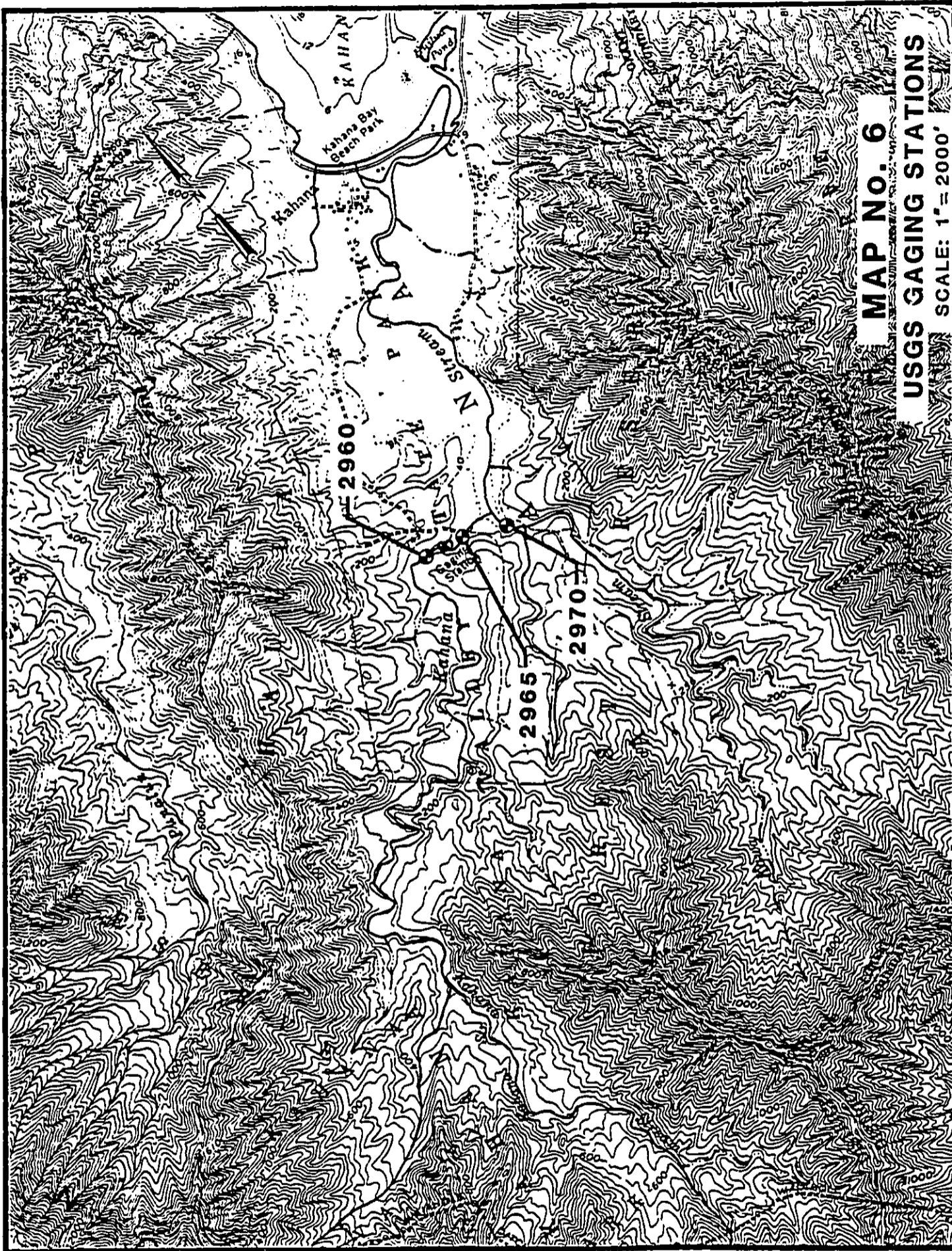
TRIBUTARY OF: N/A
 MAP KEY: 5
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
9-84	365	1.86	.92	.15
9-83	365	1.65	1.07	.06
9-82	365	1.78	.44	.01
9-81	365	.02	00	00
9-80	365	.07	00	00
9-79	365	.17	00	00
9-78	365	2.40	.39	.11
9-77	365	1.65	.04	00
9-76	365	2.32	1.62	1.49
9-75	365	1.97	1.05	.34
9-74	365	1.93	00	00
9-73	365	1.98	1.60	.53
9-72	365	1.08	.45	00
9-71	365	3.04	.89	.32
9-70	365	7.33	2.64	.01
9-69	365	6.04	.22	00
9-68	365	9.30	.05	.03
9-67	365	6.77	2.55	.50
9-66	365	7.31	.23	00
6-65	365	2.60	.18	.02
6-64	365	6.82	1.72	00
6-63	365	6.16	1.63	.04
6-62	365	8.00	.74	.02
6-61	365	10.75	4.16	1.85
6-60	365	9.34	N/A	N/A
6-59	365	8.00	N/A	N/A
6-58	365	8.02	N/A	N/A
6-57	365	7.51	N/A	N/A
6-56	365	4.13	N/A	N/A
6-55	365	6.32	N/A	N/A
6-54	365	7.11	N/A	N/A
-				

COMMENT: Station measures flow of ditch which diverts water from Punaluu Stream.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE



STREAM FLOW DATA

STREAM NAME: KAHANA
 ELEVATION: 30'
 USGS GAGE NO. 2965

TRIBUTARY OF: OCEAN
 MAP KEY: 5
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE*	LOWEST MONTHLY MEAN DISCHARGE*	LOWEST RECORDED DISCHARGE*
9-84	365	12.08	8.79	7.11
9-83	365	18.41	10.66	10.34
9-82	365	36.62	24.61	9.04
9-81	365	14.92	10.40	8.40
9-80	365	24.26	12.60	9.04
9-79	365	18.54	10.27	9.04
9-78	365	15.47	8.53	7.75
9-77	365	13.31	8.33	7.75
9-76	365	14.24	9.75	7.75
9-75	365	16.11	8.59	7.75
9-74	365	29.78	14.01	9.04
9-73	365	13.08	9.04	7.75
9-72	365	17.51	9.75	3.40
9-71	365	17.93	9.63	8.40
9-70	365	17.25	12.34	10.34
9-69	365	30.81	15.12	8.40
9-68	365	20.93	10.08	8.40
9-67	365	26.71	13.63	10.98
9-66	365	21.64	11.63	9.69
6-65	365	27.75	14.80	8.30
6-64	365	24.35	10.80	8.70
6-63	365	15.35	11.10	7.49
6-62	365	16.95	11.60	6.30
6-61	365	17.00	12.60	9.65
6-60	365	16.35	11.20	7.45
6-59	180	N/A	11.50	N/A
-				

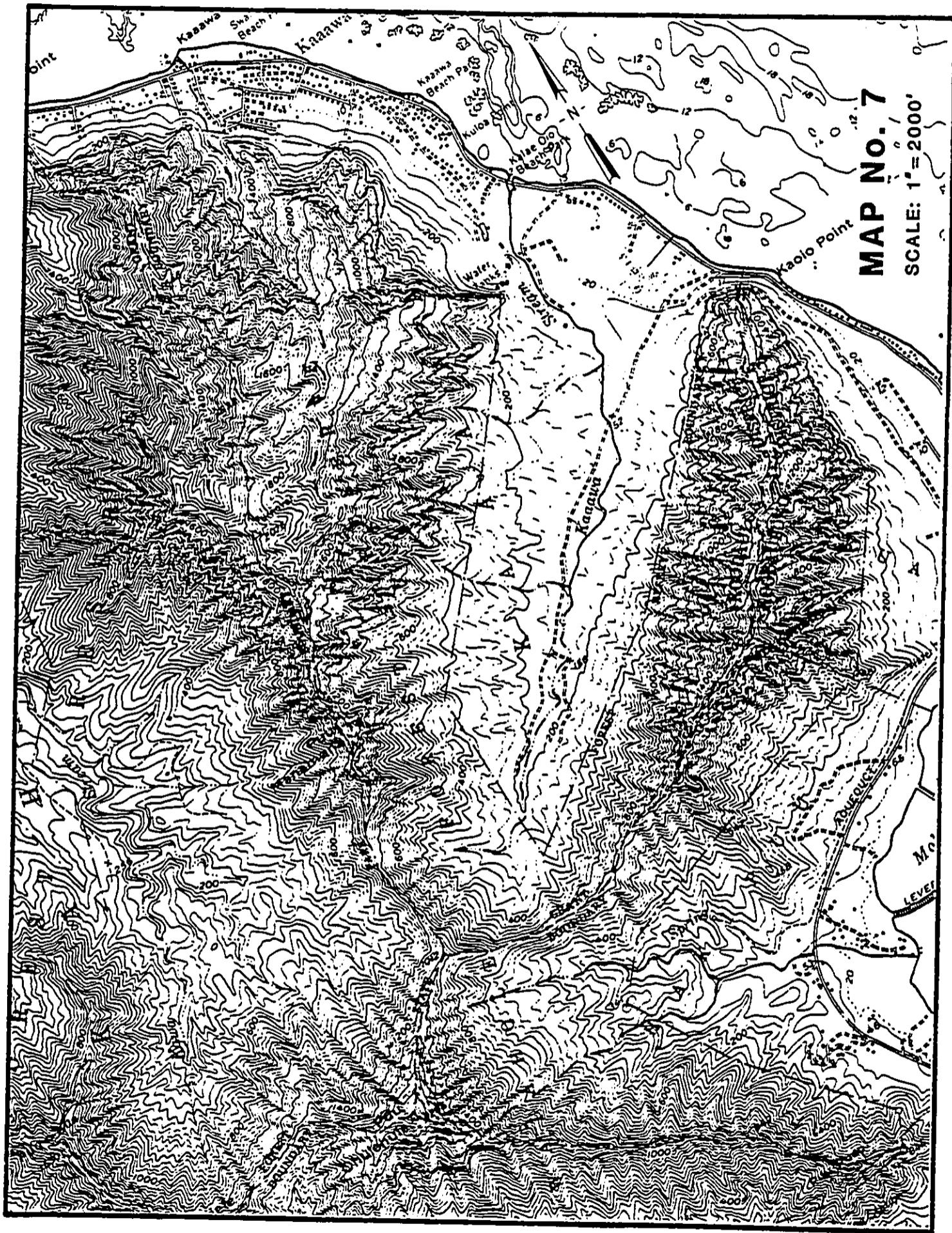
COMMENT: Kahana Tunnel and Waiahole Ditch system divert water 2.3 miles above station since 1929.

* MILLION GALLONS PER DAY N/A: NOT AVAILABLE C-19

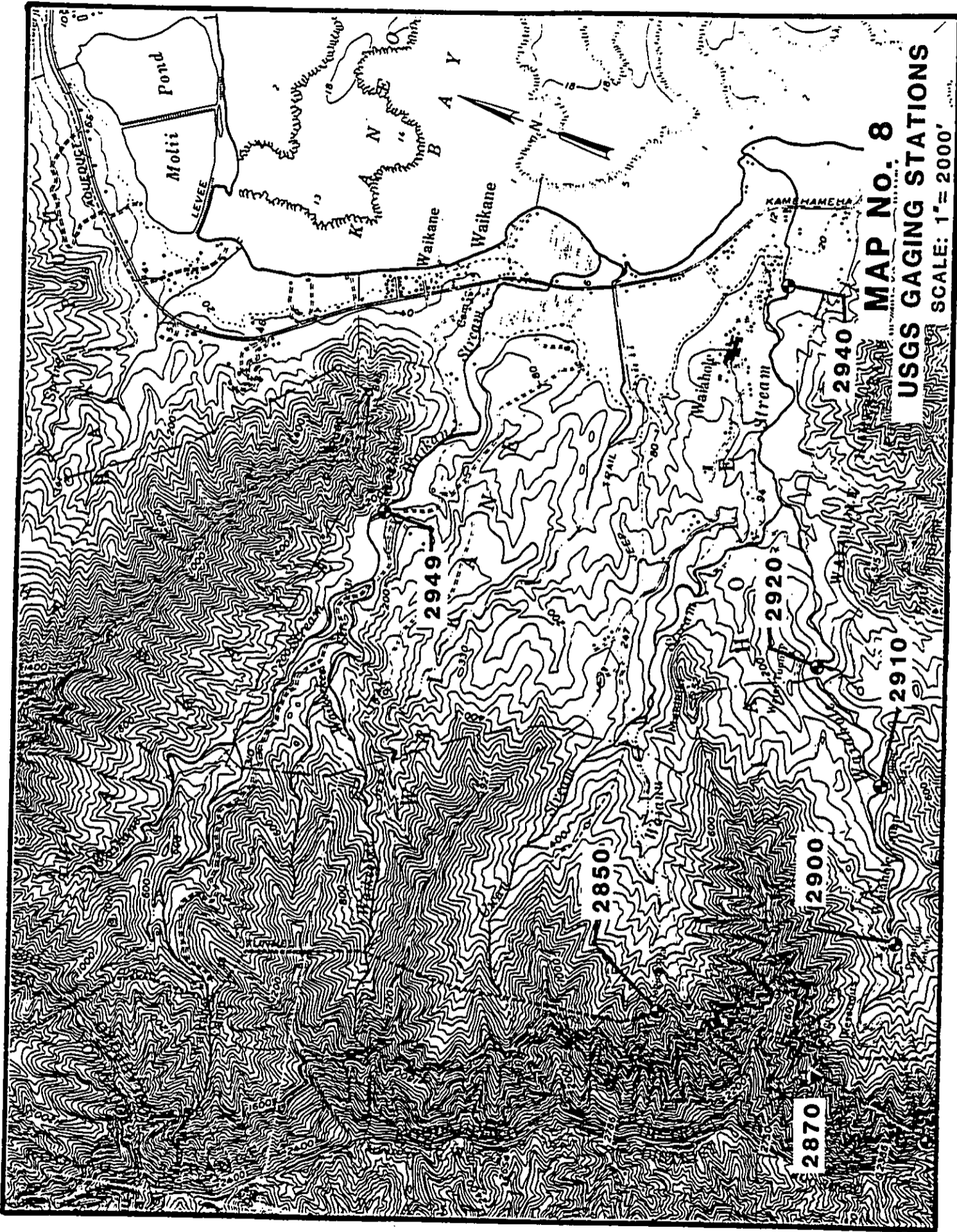
STREAM FLOW DATA

STREAM NAME: E. BRANCH KAHANA (KAWA) TRIBUTARY OF: OCEAN
 ELEVATION: 30' MAP KEY: 5
 USGS GAGE NO. 2970 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
6-17	240	N/A	1.68	N/A
6-16	365	4.67	1.74	1.20
6-15	365	5.28	2.71	.80
6-14	60	N/A	8.33	N/A
COMMENT: No diversion above station.				



MAP NO. 7
SCALE: 1" = 2000'



STREAM FLOW DATA

STREAM NAME: WAIKANE
 ELEVATION: 75'
 USGS GAGE NO. 2949

TRIBUTARY OF: OCEAN
 MAP KEY: Ø
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
9-84	365	1.82	.89	.71
9-83	365	2.50	2.44	1.49
9-82	365	8.49	5.92	1.23
9-81	365	2.08	1.52	1.16
9-80	365	5.33	1.52	1.10
9-79	365	2.76	1.15	.97
9-78	365	2.07	1.15	.90
9-77	365	2.06	1.08	.84
9-76	365	2.28	1.07	.71
9-75	365	2.11	.90	.84
9-74	365	6.07	2.15	1.29
9-73	365	2.10	1.14	.97
9-72	365	2.27	1.38	1.16
9-71	365	3.82	1.45	1.29
9-70	365	2.56	2.16	1.55
9-69	365	5.56	2.81	1.42
9-68	365	4.50	1.69	1.42
9-67	365	6.20	2.87	1.55
9-66	365	3.39	2.09	1.62
6-65	365	3.56	2.33	1.79
6-64	365	3.55	1.60	1.26
6-63	365	4.08	1.38	.99
6-62	365	2.62	1.39	.91
6-61	365	2.50	1.65	1.33
6-60	180	N/A	2.00	N/A
COMMENT: Waiahole Ditch and Tunnel system diverts water above station.				

* MILLION GALLONS PER DAY N/A: NOT AVAILABLE C-23

STREAM FLOW DATA

STREAM NAME: WAIAHOLE TUNNEL
ELEVATION: 786'
USGS GAGE NO. 2850

TRIBUTARY OF: N/A
MAP KEY: 0
COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE*	LOWEST MONTHLY MEAN DISCHARGE*	LOWEST RECORDED DISCHARGE*
5-69	240	N/A	21.51	20.03
9-68	365	30.20	24.42	23.24
9-67	365	28.49	23.58	21.32
9-66	365	29.55	23.44	21.96
6-65	365	31.40	26.30	25.10
6-64	365	29.50	24.90	23.50
6-63	365	22.00	18.10	17.40
6-62	365	21.90	21.20	19.50
6-61	365	24.85	21.80	20.50
6-60	365	20.99	18.55	N/A
6-59	365	27.20	21.70	N/A
6-58	365	22.09	18.07	N/A
6-57	365	26.73	22.60	N/A
6-56	365	25.98	22.74	N/A
6-55	365	26.40	24.80	N/A
6-54	365	19.10	18.07	N/A
6-53	365	24.92	20.67	N/A
6-52	365	24.44	21.70	N/A
6-51	180	N/A	23.14	N/A
COMMENT: Waiahole Ditch and Tunnel system diverts headwaters of all streams from Waiahole through Kahana Valley.				

* MILLION GALLONS PER DAY N/A: NOT AVAILABLE C-24

STREAM FLOW DATA

STREAM NAME: WAIHOLE TUNNEL AT NORTH
 ELEVATION: 752' PORTAL
 USGS GAGE NO. 2870

TRIBUTARY OF: N/A
 MAP KEY: 8
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
5-69	240	N/A	10.72	2.20
9-68	365	30.85	3.24	1.74
9-67	365	30.17	17.89	2.00
9-66	365	28.13	15.24	3.62
6-65	365	36.00	29.00	7.25
6-64	365	31.45	11.50	1.78
6-63	365	23.35	20.30	19.40
6-62	365	24.45	22.60	20.80
6-61	365	28.15	25.40	24.00
6-60	365	23.28	22.32	N/A
6-59	365	30.88	24.73	N/A
6-58	365	24.89	7.94	N/A
6-57	365	29.08	5.46	N/A
6-56	365	28.56	25.52	N/A
6-55	365	27.24	25.87	N/A
6-54	365	20.77	19.33	N/A
6-53	365	27.58	22.73	N/A
6-52	365	27.44	24.53	N/A
6-51	150	N/A	22.81	N/A

COMMENT: Waiahole Ditch and Tunnel system diverts headwaters of all streams from Waiahole through Kahana Valley.

STREAM FLOW DATA

STREAM NAME: WAIAHOLE
 ELEVATION: 420'
 USGS GAGE NO. 2900

TRIBUTARY OF: OCEAN
 MAP KEY: 8
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
9-15	150	N/A	19.2	N/A

COMMENT: Measures water developed by main Waiahole Tunnel.

STREAM FLOW DATA

STREAM NAME: WAIAHOLE, ALTITUDE 250'
 ELEVATION: 250
 USGS GAGE NO. 2910

TRIBUTARY OF: OCEAN
 MAP KEY: 8
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
9-68	365	6.91	3.00	2.58
9-67	365	5.12	3.29	1.68
9-66	365	6.91	1.89	1.68
6-65	365	3.98	2.23	2.10
6-64	365	3.68	2.66	1.56
6-63	365	3.34	1.94	1.48
6-62	365	2.95	2.45	1.90
6-61	365	2.80	2.42	2.10
6-60	365	3.06	2.06	1.90
6-59	365	5.41	2.38	2.10
6-58	365	3.81	1.89	1.71
6-57	365	4.08	2.21	1.98
6-56	365	4.31	2.05	1.80
COMMENT: Water diverted above station and pumped into Waiahole Tunnel.				

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

STREAM FLOW DATA

STREAM NAME: WAIAHOLE
 ELEVATION: 160'
 USGS GAGE NO. 2920

TRIBUTARY OF: OCEAN
 MAP KEY: B
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE*	LOWEST MONTHLY MEAN DISCHARGE*	LOWEST RECORDED DISCHARGE*
6-16	365	20.25	9.00	9.00
6-15	365	40.45	31.50	30.00
6-14	365	26.40	14.00	14.00
6-13	365	14.20	12.90	11.50
6-12	240	N/A	14.30	N/A

COMMENT: From August 1, 1913 to May 27, 1916, discharge from main Waiahole Tunnel construction added to the natural flow of springs feeding stream. After May 28, 1916, tunnel water diverted above station.

STREAM FLOW DATA

STREAM NAME: WAIAHOLE
 ELEVATION: 20'
 USGS GAGE NO. 2940

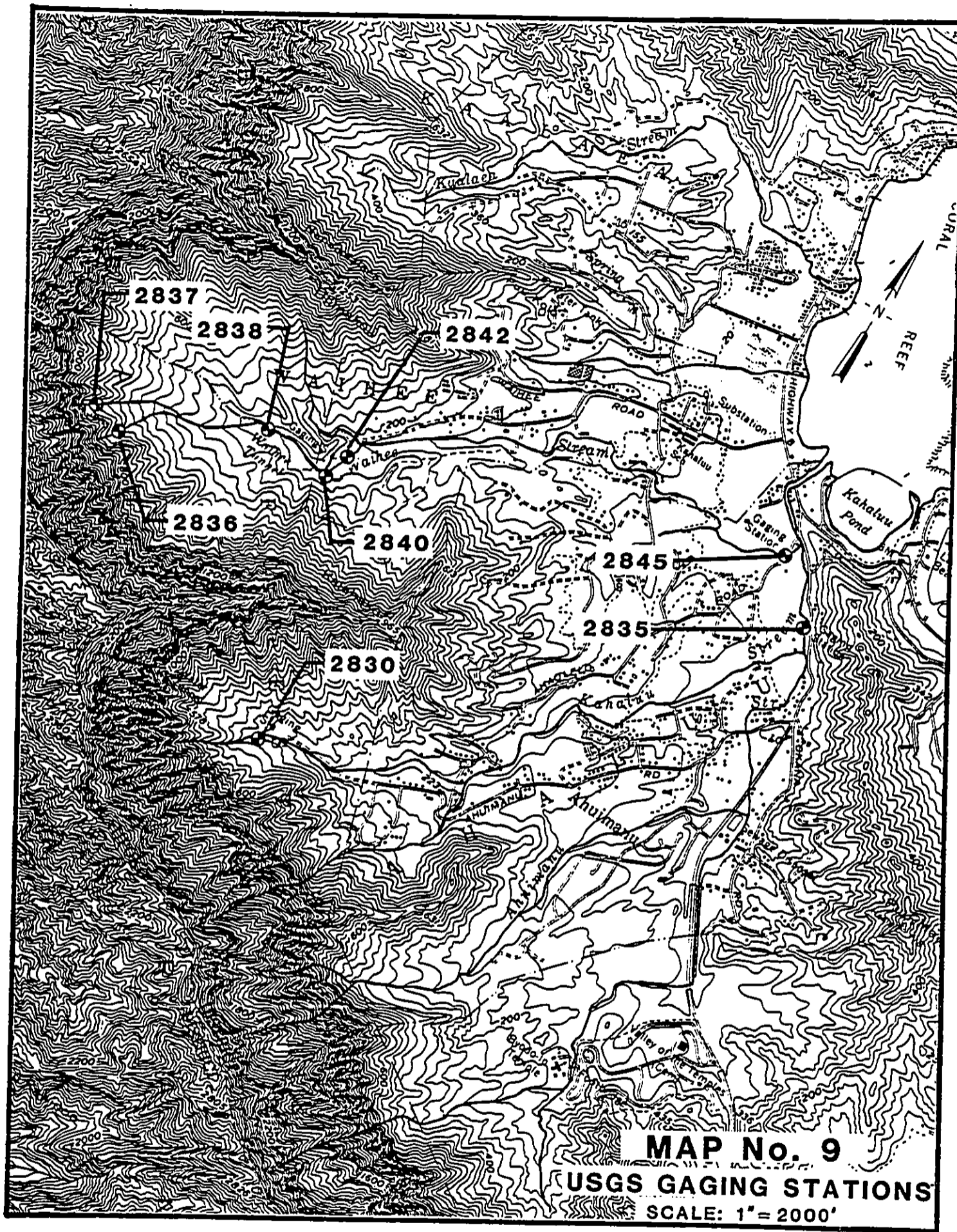
TRIBUTARY OF: OCEAN
 MAP KEY: B
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE*	LOWEST MONTHLY MEAN DISCHARGE*	LOWEST RECORDED DISCHARGE*
6-13	180	N/A	17.1	N/A
6-12	240	N/A	17.6	N/A

COMMENT: Water diverted above station.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE



STREAM FLOW DATA

STREAM NAME: N. FORK WAIHEE
 ELEVATION: 639'
 USGS GAGE NO. 2837

TRIBUTARY OF: WAIHEE STREAM
 MAP KEY: 9
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
9-84	365	.67	.54	.52
9-83	365	.63	.28	.21
9-82	365	.68	.51	.19
9-81	365	.70	.54	.49
9-80	365	.83	.67	.44
9-79	365	.99	.74	.60
9-78	365	.59	.51	.50
9-77	365	.83	.64	.00
9-76	365	1.04	.98	.97
9-75	365	1.20	1.08	1.03
9-74	365	1.26	.99	.84
9-73	365	.95	.87	.84
9-72	365	1.06	.98	.97
9-71	365	1.26	.94	.90
9-70	365	1.31	1.21	1.16
9-69	365	1.45	1.32	1.23
9-68	365	1.45	1.26	1.16
9-67	365	1.15	1.03	1.03
9-66	365	1.46	1.17	1.10
6-65	365	1.36	1.09	1.04
6-64	365	1.24	1.08	1.03
6-63	300	N/A	.88	.86

COMMENT: Waihee Tunnel since 1955 and Waihee Inclined Wells since 1977 divert water above station.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

STREAM FLOW DATA

STREAM NAME: S. FORK WAIHEE
 ELEVATION: 616'
 USGS GAGE NO. 2836

TRIBUTARY OF: WAIHEE STREAM
 MAP KEY: 9
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE*	LOWEST MONTHLY MEAN DISCHARGE*	LOWEST RECORDED DISCHARGE*
9-84	365	.51	.37	.36
9-83	365	.29	.16	.14
9-82	365	.41	.22	.14
9-81	365	.50	.25	.19
9-80	365	.56	.44	.16
9-79	365	.67	.52	.41
9-78	365	.44	.33	.31
9-77	365	.72	.50	.00
9-76	365	.96	.87	.84
9-75	365	1.10	.92	.90
9-74	365	1.11	.92	.84
9-73	365	.81	.72	.71
9-72	365	.98	.89	.84
9-71	365	1.36	1.10	1.03
9-70	365	1.25	1.14	1.03
9-69	365	1.55	1.49	1.36
9-68	365	1.61	1.42	1.29
9-67	365	1.32	1.25	1.16
9-66	365	1.42	1.34	1.29
6-65	365	1.38	1.11	1.00
6-64	365	1.24	1.00	1.00
6-63	300	N/A	.95	.92

COMMENT: Waihee Tunnel since 1955 and Waihee Inclined Wells since 1977 divert water above station.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

STREAM FLOW DATA

STREAM NAME: WAIHEE, ALT. 260'
 ELEVATION: 260'
 USGS GAGE NO. 2838

TRIBUTARY OF: OCEAN
 MAP KEY: 9
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
6-66	270	N/A	3.28	2.71
6-65	365	3.12	2.26	1.93
6-64	365	3.12	2.10	1.93
6-63	365	2.46	1.93	1.63
6-62	365	2.68	2.11	1.74
COMMENT: Waihee Tunnel diverts water above station.				

* MILLION GALLONS PER DAY N/A: NOT AVAILABLE

STREAM FLOW DATA

STREAM NAME: WAIHEE
 ELEVATION: 193'
 USGS GAGE NO. 2840

TRIBUTARY OF: OCEAN
 MAP KEY: 9
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
9-82	365	3.71	1.99	.71
9-81	365	1.58	.85	.65
9-80	365	2.14	1.41	.97
9-79	365	2.05	1.67	1.03
9-78	365	.98	.69	.65
9-77	365	1.64	.90	.00
9-76	365	1.57	1.43	1.29
9-75	365	2.24	1.58	1.42
9-74	365	3.06	1.76	1.23
9-73	365	2.04	1.34	1.29
9-72	365	3.00	2.24	2.20
9-71	365	3.99	3.12	2.78
9-70	365	3.61	2.86	2.45
9-69	365	4.09	3.46	3.23
9-68	365	5.12	3.60	3.29
9-67	365	4.12	3.11	2.39
9-66	365	4.85	2.74	2.52
6-65	365	5.48	3.19	2.96
6-64	365	4.83	3.54	3.28
6-63	365	3.42	2.50	2.26
6-62	365	3.77	3.00	2.44
6-61	365	5.48	4.18	3.92
6-60	365	5.47	4.73	4.48
6-59	365	7.47	5.77	5.20
6-58	365	5.28	4.66	4.40
6-57	365	6.34	5.61	5.40
6-56	365	6.31	3.77	2.75
6-55	365	7.30	5.49	4.00
6-54	365	4.45	3.99	3.70
6-53	365	5.72	5.12	4.90
6-52	365	6.02	5.50	5.20
6-51	365	5.55	4.34	4.00
6-50	365	5.02	3.85	3.60
6-49	365	6.18	5.39	5.10
6-48	365	6.67	4.83	4.60
6-47	365	3.91	3.40	3.30
6-46	365	3.80	3.36	3.30
6-45	365	4.39	4.00	3.95
6-44	365	5.75	4.64	4.30
6-43	365	7.67	6.49	5.60

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

C-32

STREAM FLOW DATA

STREAM NAME: WAIHEE (CONT'D)
 ELEVATION: 193'
 USGS GAGE NO. 2840

TRIBUTARY OF: OCEAN
 MAP KEY: 9
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
6-42	365	6.20	4.65	4.40
6-41	365	5.85	5.02	4.60
6-40	365	6.61	6.22	5.70
6-39	365	7.93	7.05	6.40
6-38	365	9.05	7.70	6.80
6-37	365	8.29	6.14	5.10
6-36	180	N/A	5.68	N/A
—				

COMMENT: Waihee Tunnel since 1955, Waihee Wells since 1973, and Waihee Inclined Wells since 1977 divert water above station.

STREAM FLOW DATA

STREAM NAME: WAIHEE
 ELEVATION: 170'
 USGS GAGE NO. 2842

TRIBUTARY OF: OCEAN
 MAP KEY: 9
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE*	LOWEST MONTHLY MEAN DISCHARGE*	LOWEST RECORDED DISCHARGE*
9-84	365	3.02	2.88	2.34
9-83	365	3.98	3.27	2.91
9-82	365	5.81	3.94	2.58
9-81	365	3.68	2.66	1.94
9-80	365	4.51	3.17	2.84
9-79	365	4.62	3.03	2.58
9-78	365	2.65	2.34	2.33
9-77	365	2.23	1.55	.84
9-76	365	2.39	1.69	1.49
9-75	365	2.82	1.85	1.74

COMMENT: Waihee Tunnel since 1955, Waihee Wells I since 1973, and Waihee Inclined Wells since 1977 divert water above station.

STREAM FLOW DATA

STREAM NAME: WAIHEE
 ELEVATION: 0'
 USGS GAGE NO. 2845

TRIBUTARY OF: OCEAN
 MAP KEY: 9
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE*	LOWEST MONTHLY MEAN DISCHARGE*	LOWEST RECORDED DISCHARGE*
9-71	365	9.08	6.65	5.63
9-70	365	7.43	5.53	5.10
9-69	365	8.49	6.91	6.20
9-68	365	10.40	6.25	5.17
9-67	330	N/A	7.62	6.46

COMMENT: Irrigation diversions and Waihee Tunnel divert water above station.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

STREAM FLOW DATA

STREAM NAME: KAHALUU
 ELEVATION: 357'
 USGS GAGE NO. 2930

TRIBUTARY OF: WAIHEE STREAM
 MAP KEY: 9
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
9-71	365	.20	.12	.09
9-70	365	.22	.13	.09
9-69	365	.45	.19	.14
9-68	365	.42	.17	.14
9-67	365	.28	.17	.09
9-66	365	.98	.23	.14
6-65	365	.48	.12	.07
6-64	365	.27	.12	.09
6-63	365	.23	.09	.03
6-62	365	.18	.12	.07
6-61	365	.17	.13	.07
6-60	365	.23	.09	.06
6-59	365	1.06	.30	.13
6-58	365	.43	.21	.08
6-57	365	.45	.18	.11
6-56	365	.61	.31	.26
6-55	365	.50	.38	.15
6-54	365	.49	.35	.29
6-53	365	.64	.20	.13
6-52	365	.65	.41	.35
6-51	365	.67	.26	.20
6-50	365	.36	.30	.27
6-49	365	.41	.30	.27
6-48	365	.70	.36	.22
6-47	365	2.14	.50	.07
6-46	365	1.69	1.62	1.57
6-45	365	1.90	1.67	1.60
6-44	365	2.41	2.05	1.91
6-43	365	2.96	2.35	2.35
6-42	365	2.80	2.57	2.45
6-41	365	3.17	2.91	2.80
6-40	365	3.65	3.28	3.20
6-39	365	4.39	3.55	3.35
6-38	365	4.66	4.32	3.85
6-37	365	4.10	3.27	2.65
6-36	240	N/A	2.82	N/A
-				

COMMENT: Water diverted above station by Kahaluu Tunnel since 1947.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

C-35

STREAM FLOW DATA

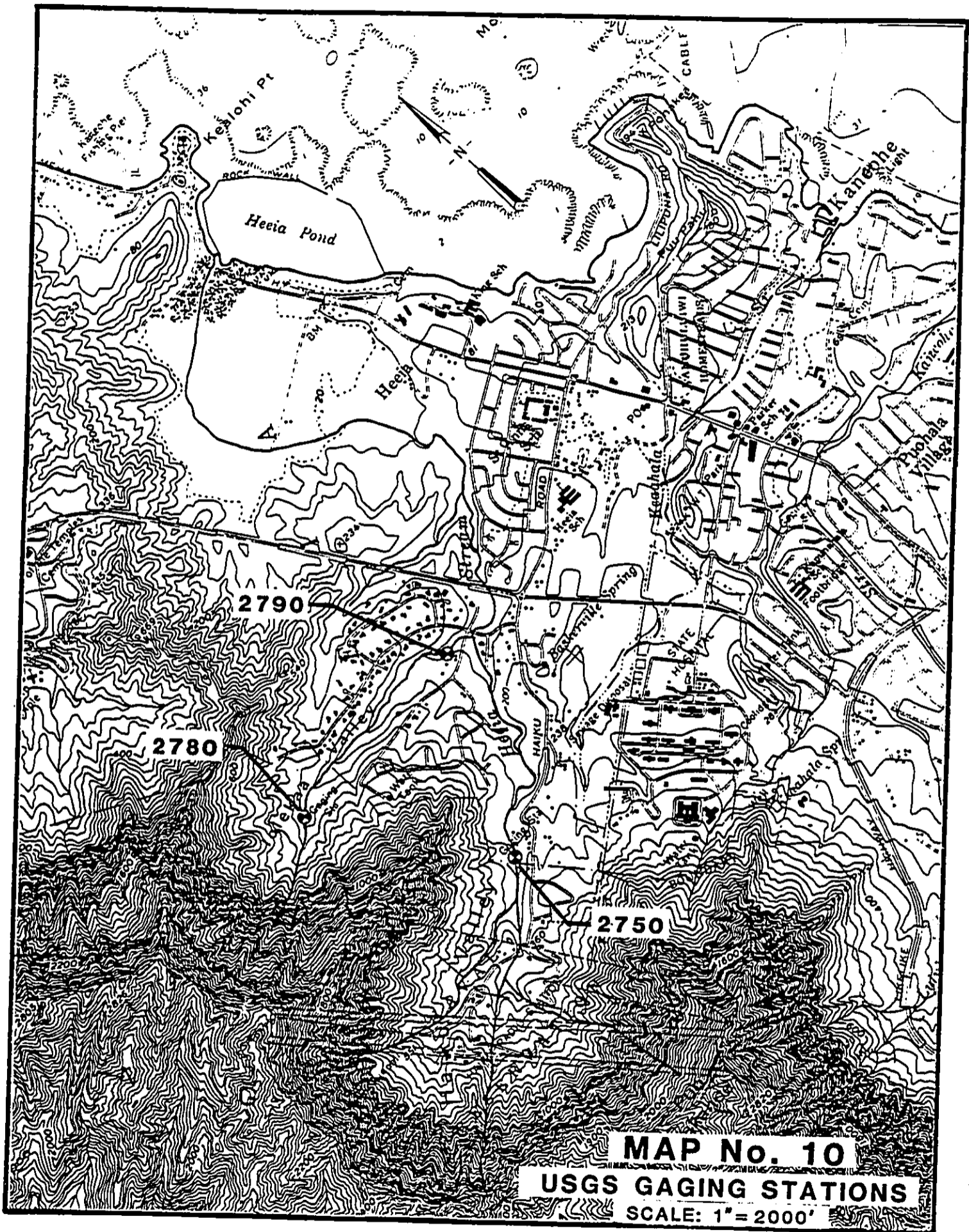
STREAM NAME: KAHALUU
 ELEVATION: 0
 USGS GAGE NO. 2835

TRIBUTARY OF: WAIHEE STREAM
 MAP KEY: 9
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
4-70	210	N/A	2.25	2.07
9-69	365	8.85	2.73	2.07
9-68	365	5.86	2.25	1.31
9-67	210	N/A	4.36	4.00
COMMENT: Kahaluu Tunnel diverts water above station.				

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE



STREAM FLOW DATA

STREAM NAME: IOLEKAA
 ELEVATION: 320'
 USGS GAGE NO. 2780

TRIBUTARY OF: HEEIA STREAM
 MAP KEY: 10
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
2-70	150	N/A	.13	.10
9-69	365	.24	.12	.10
9-68	365	.39	.17	.12
9-67	365	.37	.14	.06
9-66	365	.66	.21	.16
6-65	365	.58	.38	.26
6-64	365	.51	.31	.30
6-63	365	.43	.26	.22
6-62	365	.32	.25	.21
6-61	365	.32	.26	.23
6-60	365	.36	.30	.22
6-59	365	.54	.39	.32
6-58	365	.39	.27	.25
6-57	365	.47	.35	.28
6-56	365	.46	.35	.31
6-55	365	.42	.25	.21
6-54	365	.29	.22	.18
6-53	365	.37	.28	.25
6-52	365	.42	.32	.30
6-51	365	.38	.22	.20
6-50	365	.25	.20	.18
6-49	365	.30	.27	.25
6-48	365	.32	.19	.17
6-47	365	.15	.12	.10
6-46	365	.16	.12	.11
6-45	365	.16	.14	.13
6-44	365	.29	.20	.20
6-43	240	N/A	.30	N/A
6-42	365	.45	.29	.23
6-41	365	.78	.46	.41
6-40	120	N/A	.90	N/A
-				

COMMENT: Water diverted above station by Haiku Tunnel since 1941.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

C-38

STREAM FLOW DATA

STREAM NAME: HAIKU
 ELEVATION: 272'
 USGS GAGE NO. 2750

TRIBUTARY OF: HEEIA STREAM
 MAP KEY: 10
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
9-84	365	.89	.71	.71
9-83	365	1.30	1.04	.97
9-77 ²²	365	.76	.57	.53
9-76	365	.83	.68	.61
9-75	365	.89	.68	.61
9-74	365	1.34	.95	.61
9-73	365	.72	.63	.61
9-72	365	.93	.66	.61
9-71	365	1.33	.81	.78
9-70	365	.99	.83	.78
9-69	365	1.09	.83	.71
9-68	365	1.26	.87	.84
9-67	365	1.52	.91	.78
9-66	365	1.33	.86	.78
6-65	365	1.69	.98	.82
6-64	365	1.14	.98	.56
6-63	365	.71	.26	.19
6-62	365	.67	.26	.19
6-61	365	.63	.33	.24
6-60	365	.66	.34	.25
6-59	365	1.41	.47	.40
6-58	365	.69	.34	.25
6-57	365	1.28	.59	.35
6-56	365	1.34	.59	.35
6-55	365	1.35	.54	.31
6-54	365	.64	.43	.23
6-53	365	1.06	.71	.61
6-52	365	1.27	.79	.66
6-51	365	1.10	.69	.66
6-50	365	.87	.67	.66
6-49	365	1.03	.69	.50
6-48	365	1.52	.85	.76
6-47	365	.90	.25	.19
6-46	365	.33	.21	.19
6-45	365	.71	.38	.23
6-44	365	1.00	.76	.69
6-43	365	2.53	1.36	1.18
6-42	365	3.02	1.59	1.20
6-41	365	4.65	1.93	1.27
6-40	365	2.23	2.00	1.82

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

C-40

STREAM FLOW DATA

STREAM NAME: HAIKU (CONT'D) TRIBUTARY OF: HEEIA STREAM
 ELEVATION: 272' MAP KEY: 10
 USGS GAGE NO. 2750 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
9-20	90	N/A	1.70	N/A
6-19	365	2.67	1.94	1.70
6-18	365	2.76	2.48	2.2
6-17	365	2.91	2.35	1.4
6-16	365	3.07	2.16	1.9
6-15	365	2.75	2.11	1.9
6-14	150	N/A	1.90	N/A

COMMENT: Water diverted above station by Haiku Tunnel since 1941.



STREAM FLOW DATA

STREAM NAME: LULUKU
 ELEVATION: 220'
 USGS GAGE NO. 2709

TRIBUTARY OF: KAMOALII STREAM
 MAP KEY: 11
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
9-71	365	1.23	.66	.46
9-70	365	.93	.49	.37
9-69	365	1.15	.76	.44
9-68	365	.96	.54	.13
9-67	90	N/A	.70	.53

COMMENT: Luluku Tunnel diverts water above station.

STREAM FLOW DATA

STREAM NAME: KAMOALII
 ELEVATION: 180'
 USGS GAGE NO. 2660

TRIBUTARY OF: KANEOHE STREAM
 MAP KEY: 11
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
6-16	365	4.62	3.38	1.40
6-15	330	N/A	2.53	N/A
6-14	150	N/A	2.58	N/A
-				

COMMENT: No diversion above station.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

STREAM FLOW DATA

STREAM NAME: KAMOALII
 ELEVATION: 118'
 USGS GAGE NO. 2705

TRIBUTARY OF: KANEOHE STREAM
 MAP KEY: 11
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
9-76	365	3.33	2.60	2.39
9-75	365	5.02	2.54	2.39
9-74	365	6.39	2.87	2.00
9-73	365	3.28	2.44	2.20
9-72	270	N/A	3.44	3.04
-				
9-70	365	4.67	3.40	3.23
9-69	365	9.33	4.78	3.81
9-68	365	9.63	4.39	3.55
9-67	180	N/A	6.85	5.81
COMMENT: Water diverted above station by Kuou Wells I since 1955.				

STREAM FLOW DATA

STREAM NAME: KAMOOALI
 ELEVATION: 116'
 USGS GAGE NO. 2722

TRIBUTARY OF: KANEOHE STREAM
 MAP KEY: 11
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
9-84	365	2.95	1.88	.41
9-83	365	6.28	4.86	3.9
9-82	365	13.53	6.15	.72
9-81	365	4.61	2.29	.65
9-80	365	8.33	3.28	2.84
9-79	365	7.49	3.36	2.71
9-78	365	3.62	2.47	1.36
9-77	365	3.64	2.61	2.45
COMMENT: Peak flow regulated by dam upstream. Luluku Tunnel and Kuou Wells I divert water above station.				

STREAM FLOW DATA

STREAM NAME: HOOLEINAIWA
 ELEVATION: 195
 USGS GAGE NO. 2670

TRIBUTARY OF: KAMOALII STREAM
 MAP KEY: 11
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
6-16	300	N/A	.16	N/A
6-15	300	N/A	.30	N/A
6-14	120	N/A	.38	N/A
-				

COMMENT: No diversion above station.

STREAM FLOW DATA

STREAM NAME: KAWA
 ELEVATION: 30'
 USGS GAGE NO. 2650

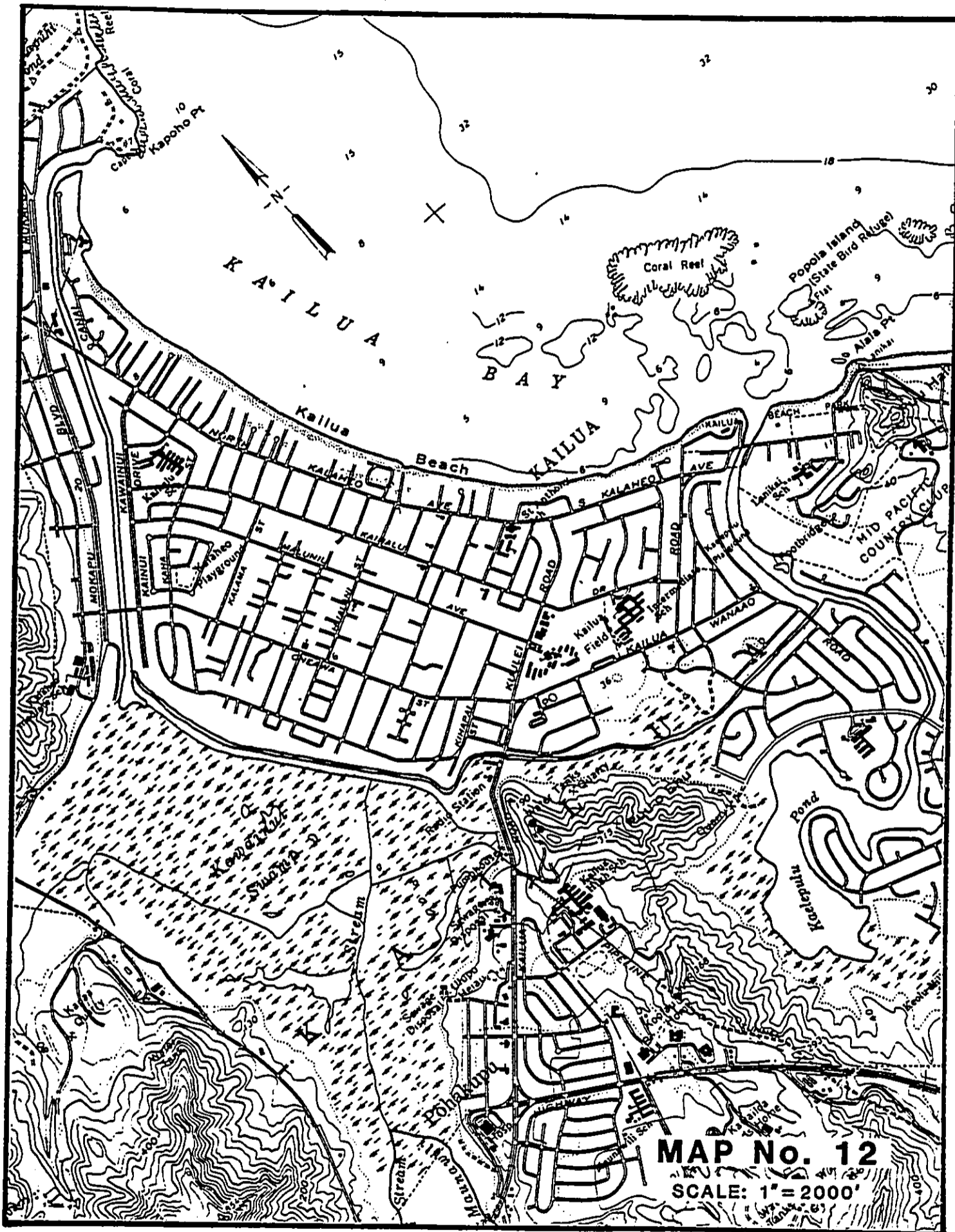
TRIBUTARY OF: OCEAN
 MAP KEY: 11
 COMMENT: _____

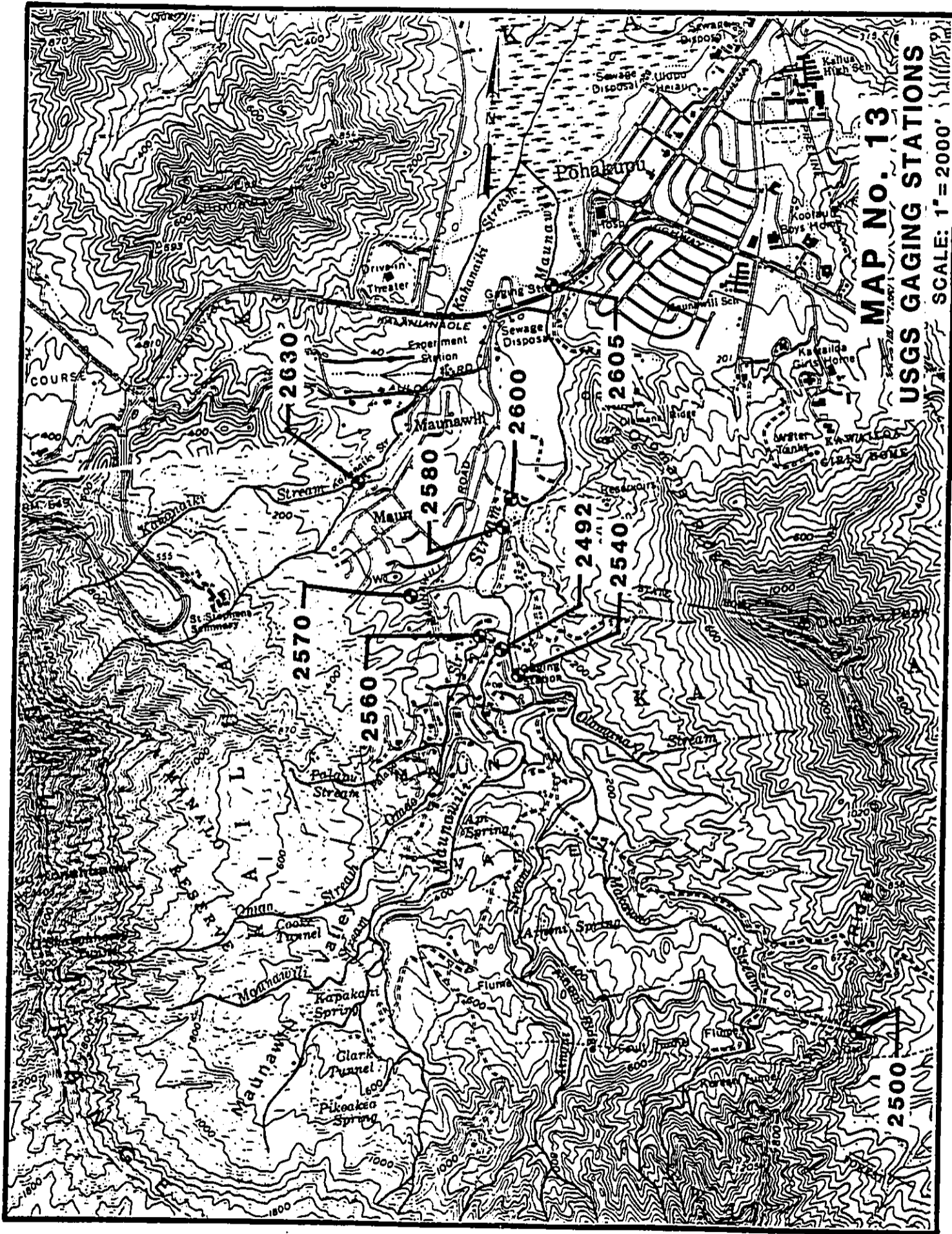
YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
6-16	300	N/A	.55	N/A
6-15	300	N/A	.53	N/A
6-14	120	N/A	1.32	N/A
-				

COMMENT: No diversion above station.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE





STREAM FLOW DATA

STREAM NAME: KAHANAIKI
 ELEVATION: 70'
 USGS GAGE NO. 2630

TRIBUTARY OF: KAWAINUI MARSH
 MAP KEY: 13
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
6-16	365	.75	.43	.30
6-15	240	N/A	.49	N/A

COMMENT: Water diverted by two small ditches above station.

STREAM FLOW DATA

STREAM NAME: POHAKEA
 ELEVATION: 80'
 USGS GAGE NO. 2570

TRIBUTARY OF: MAUNAWILI STREAM
 MAP KEY: 13
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE *	LOWEST MONTHLY MEAN DISCHARGE *	LOWEST RECORDED DISCHARGE *
6-14	240	N/A	.13	N/A
6-13	180	N/A	.18	N/A

COMMENT: No diversion above station.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

STREAM FLOW DATA

STREAM NAME: KAMAKALEPO
 ELEVATION: 80'
 USGS GAGE NO. 2560

TRIBUTARY OF: MAUNAWILI
 MAP KEY: 13
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE*	LOWEST MONTHLY MEAN DISCHARGE*	LOWEST RECORDED DISCHARGE*
6-16	365	2.07	.96	.70
6-15	365	2.07	.86	.70
6-14	365	1.13	.45	.30
6-13	60	N/A	2.55	N/A

COMMENT: Low flow diverted above station.

STREAM FLOW DATA

STREAM NAME: MAUNAWILI
 ELEVATION: 80'
 USGS GAGE NO. 2492

TRIBUTARY OF: KAWAINUI MARSH
 MAP KEY: 13
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE*	LOWEST MONTHLY MEAN DISCHARGE*	LOWEST RECORDED DISCHARGE*
6-16	365	2.15	1.26	.70
6-15	365	3.08	1.20	1.00
6-14	365	1.73	1.00	.80
6-13	120	N/A	.96	N/A
-				

COMMENT: Headwaters diverted above station by Maunawili Ditch system since 1878.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

STREAM FLOW DATA

STREAM NAME: MAKAWAO
 ELEVATION: 80'
 USGS GAGE NO. 2540

TRIBUTARY OF: MAUNAWILI STREAM
 MAP KEY: 13
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE*	LOWEST MONTHLY MEAN DISCHARGE*	LOWEST RECORDED DISCHARGE*
9-84	365	1.35	.70	.57
9-83	365	1.83	1.27	.90
9-82	365	6.18	1.26	.90
9-81	365	2.53	1.12	.97
9-80	365	3.44	.85	.78
9-79	365	3.05	.81	.71
9-78	365	1.60	.72	.65
9-77	365	1.74	.79	.65
9-76	365	1.97	.68	.58
9-75	365	1.35	.65	.63
9-74	365	3.00	.76	.59
9-73	365	.79	.67	.59
9-72	365	1.54	.77	.71
9-71	365	2.53	1.03	.90
9-70	365	1.56	1.02	.84
9-69	365	2.60	1.54	1.16
9-68	365	3.50	1.44	1.36
9-67	365	4.04	2.35	1.23
9-66	365	4.10	1.43	1.23
6-65	365	4.59	.71	.32
6-64	365	2.04	1.30	1.17
6-63	365	2.84	.65	.53
6-62	365	2.88	.73	.62
6-61	365	1.32	.87	.72
6-60	365	1.46	.81	.71
6-59	365	2.37	.91	.67
6-58	180	N/A	1.20	N/A
-	-			
6-16	365	2.44	.88	.80
6-15	365	2.32	1.29	1.00
6-14	365	1.53	1.08	N/A
6-13	180	N/A	1.48	N/A

COMMENT: Maunawili Ditch diverts water above station.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

STREAM FLOW DATA

STREAM NAME: MAUNAWILI
 ELEVATION: 55'
 USGS GAGE NO. 2580

TRIBUTARY OF: KAWAINUI MARSH
 MAP KEY: 13
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE*	LOWEST MONTHLY MEAN DISCHARGE*	LOWEST RECORDED DISCHARGE*
6-23	270	N/A	2.23	N/A
6-22	90	N/A	2.83	N/A

COMMENT: Water diverted above station by Maunawili Ditch and other ditches.

STREAM FLOW DATA

STREAM NAME: MAUNAWILI
 ELEVATION: 50'
 USGS GAGE NO. 2600

TRIBUTARY OF: KAWAINUI MARSH
 MAP KEY: 13
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE*	LOWEST MONTHLY MEAN DISCHARGE*	LOWEST RECORDED DISCHARGE*
6-16	210	N/A	1.20	N/A
6-15	210	N/A	1.15	N/A
6-14	90	N/A	.21	N/A
6-13	60	N/A	3.51	N/A

COMMENT: Ditch diverts all low water flow 200 ft. above station.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE

STREAM FLOW DATA

STREAM NAME: MAUNAWILI
 ELEVATION: 10'
 USGS GAGE NO. 2605

TRIBUTARY OF: KAWAINUI MARSH
 MAP KEY: 13
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE*	LOWEST MONTHLY MEAN DISCHARGE*	LOWEST RECORDED DISCHARGE*
9-71	365	7.40	3.07	1.94
9-70	365	4.51	3.06	2.20
9-69	365	8.14	3.85	2.33
9-68	365	9.33	3.15	2.52
9-67	270	N/A	6.40	5.23

COMMENT: Maunawili Ditch diverts water from headwater of tributary above station.

STREAM FLOW DATA

STREAM NAME: MAUNAWILI DITCH
 ELEVATION: 390'
 USGS GAGE NO. 2500

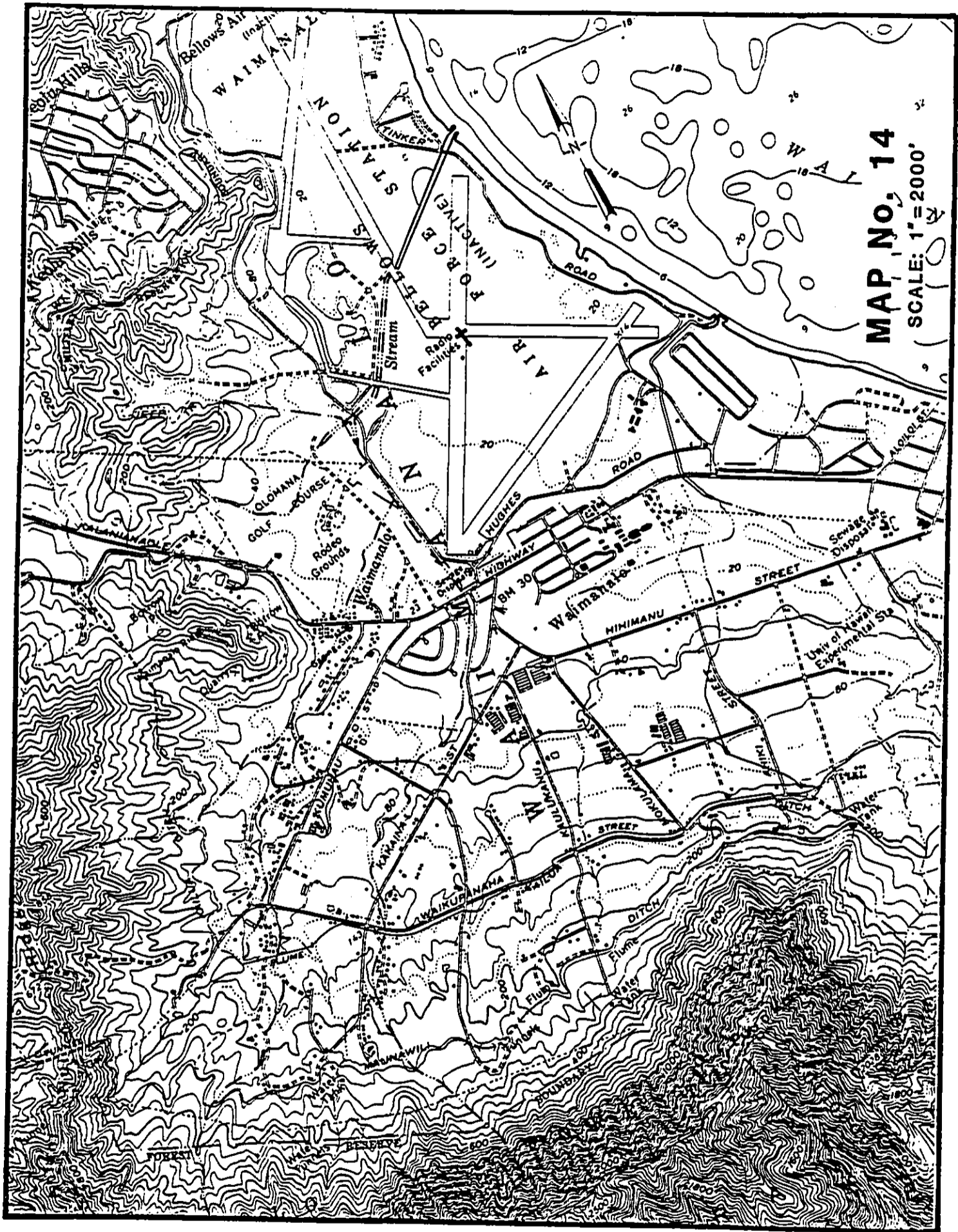
TRIBUTARY OF: N/A
 MAP KEY: 13
 COMMENT: _____

YEAR ENDING	NO. DAYS MEASURED	MEDIAN MONTHLY MEAN DISCHARGE*	LOWEST MONTHLY MEAN DISCHARGE*	LOWEST RECORDED DISCHARGE*
6-65	365	.84	.31	0
6-64	365	1.74	1.27	.53
6-63	365	1.72	.14	0
6-62	365	1.74	.65	0
6-61	365	1.90	.81	0
6-60	365	1.84	.52	N/A
6-59	365	2.00	1.00	N/A
6-58	365	1.95	.92	N/A
6-57	365	2.01	.68	N/A
6-56	365	2.40	.66	N/A
6-55	365	2.69	.85	N/A
6-54	90	N/A	2.53	N/A

COMMENT: Maunawili Ditch diverts water from headwater of tributary above station.

* MILLION GALLONS PER DAY

N/A: NOT AVAILABLE



MAP No. 14

SCALE: 1"=2000'

Annual Rainfall at Waihole and Kaneohe Gages

Calendar Year	Waihole Gage (837.00) Elevation 745 Feet		Kaneohe Gage (781.00) Elevation 200 Feet	
	Annual Rainfall (inches)	Ratio of Annual Rainfall to Median Annual Rainfall	Annual Rainfall (inches)	Ratio of Annual Rainfall to Median Annual Rainfall
1917	118.66	.89	===	===
1918	287.76	2.16	===	===
1919	110.79	.83	===	===
1920	122.09	.92	===	===
1921	138.08	1.04	===	===
1922	120.52	.91	===	===
1923	190.87	1.44	===	===
1924	121.64	.92	===	===
1925	110.94	.83	===	===
1926	93.65	.70	===	===
1927	250.83	1.89	===	===
1928	112.09	.84	===	===
1929	142.95	1.08	58.98	.84
1930	164.47	1.24	88.52	1.26
1931	121.76	.92	63.42	.90
1932	210.32	1.58	92.47	1.32
1933	107.82	.81	55.26	.79
1934	168.86	1.27	68.62	.98
1935	131.36	.99	76.79	1.10
1936	160.06	1.20	70.27	1.00
1937	216.51	1.63	75.74	1.08
1938	235.09	1.77	78.84	1.12
1939	208.32	1.57	81.93	1.17
1940	156.76	1.18	54.09	.77
1941	151.77	1.14	52.71	.75
1942	219.03	1.65	81.35	1.16
1943	149.03	1.12	68.65	.98
1944	115.07	.87	45.63	.65
1945	122.16	.92	47.62	.68
1946	117.43	.88	55.73	.80
1947	123.24	.93	52.73	.75
1948	134.08	1.01	67.91	.97
1949	95.66	.72	46.37	.66
1950	132.96	1.00	73.44	1.05
1951	147.35	1.11	85.74	1.22
1952	118.33	.89	49.05	.70
1953	87.01	.65	33.65	.48
1954	144.36	1.09	71.21	1.02
1955	127.91	.96	88.18	1.26
1956	143.35	1.08	69.93	1.00
1957	123.40	.93	62.04	.88
1958	144.05	1.08	73.28	1.04
1959	90.52	.68	41.45	.59
1960	133.00	1.00	69.02	.98
1961	100.80	.76	56.44	.80
1962	105.49	.79	60.06	.86
1963	150.86	1.14	109.07	1.56
1964	156.67	1.18	83.70	1.19
1965	199.07	1.50	122.02	1.74
1966	111.39	.84	72.62	1.04
1967	170.74	1.28	97.60	1.39
1968	133.28	1.00	87.74	1.25
1969	157.01	1.18	86.34	1.23

Annual Rainfall at Waihole and Kaneohe Gages

Calendar Year	Waihole Gage (837.00) Elevation 745 Feet		Kaneohe Gage (781.00) Elevation 200 Feet	
	Annual Rainfall (inches)	Ratio of Annual Rainfall to Median Annual Rainfall	Annual Rainfall (inches)	Ratio of Annual Rainfall to Median Annual Rainfall
1970	132.93	1.00	80.13	1.14
1971	120.83	.91	70.97	1.01
1972	105.78	.80	66.13	.94
1973	112.33	.84	64.59	.92
1974	140.67	1.06	80.66	1.15
1975	97.82	.74	61.98	.88
1976	103.64	.78	60.55	.86
1977	103.81	.78	54.46	.78
1978	142.78	1.07	82.78	1.18
1979	120.54	.91	81.14	1.16
1980	142.32	1.07	78.36	1.12
1981	136.37	1.03	===	===
1982	214.02	1.61	120.40	1.72
1983	74.98	.56	43.49	.62

Calendar Years	Median Annual Rainfall	Calendar Years	Median Annual Rainfall
1917-1983	132.9"	1929-1983	70.1"
1917-1983	Average Annual Rainfall 141.1"	1929-1983	Average Annual Rainfall 70.8"

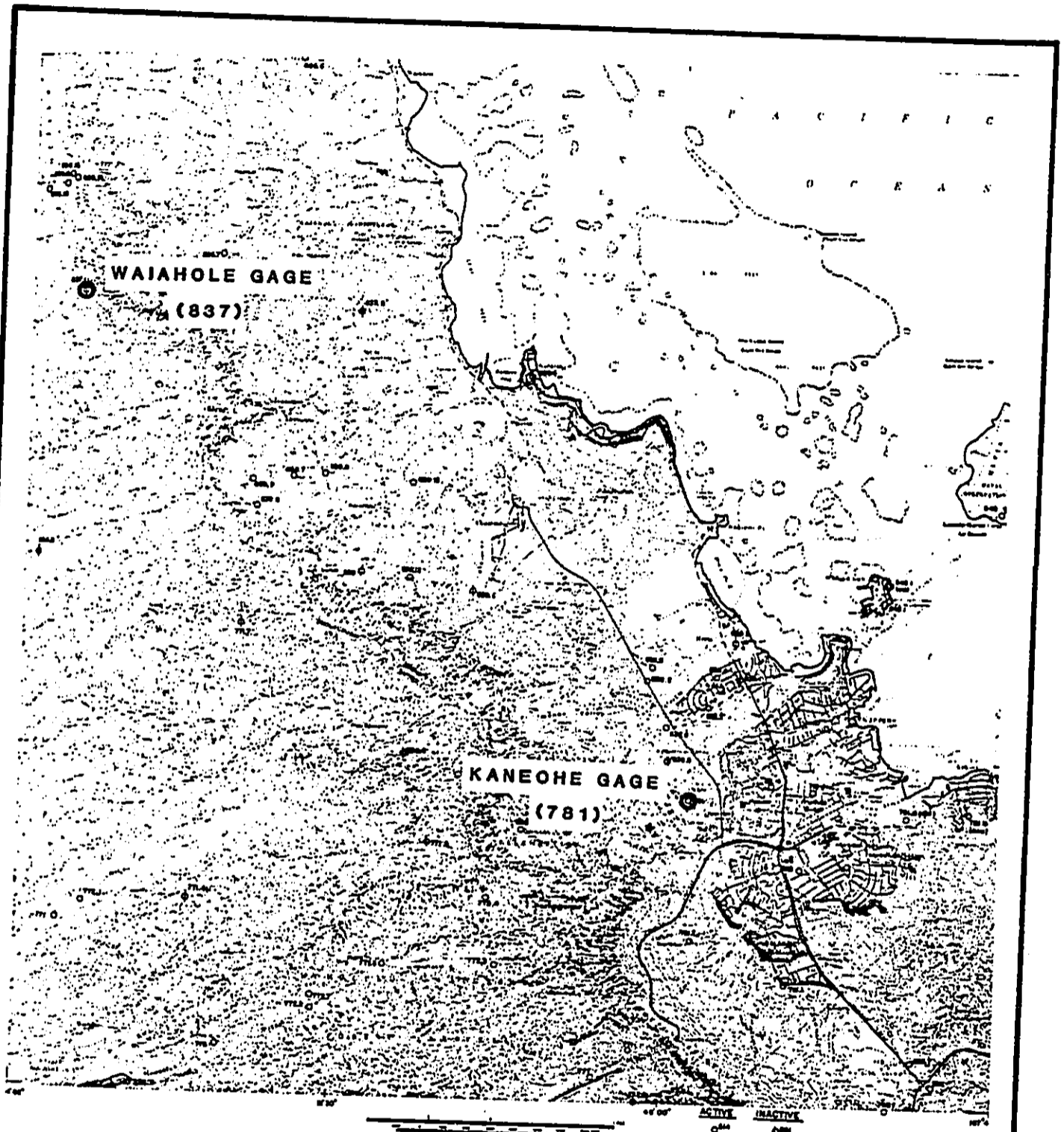


FIGURE C-1

**LOCATION OF
RAINFALL GAGES**

APPENDIX D

**BIOLOGICAL SURVEY AND QUALITY RATING
OF
WINDWARD OAHU STREAMS**

BIOLOGICAL SURVEY AND QUALITY RATING
OF WINDWARD O'AHU STREAMS

SUBMITTED TO VTN PACIFIC, INC.
BY KELLY M. ARCHER
AQUATIC BIOLOGIST

August 1984

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INTRODUCTION

A biological survey of perennial streams from Waimanalo to Kahuku, on the island of O'ahu, was completed in August, 1983. Supplemental data was taken for several Maunawili area streams in December, 1983 (Ref. 1). This survey was designed to supplement existing data to allow for ranking according to biological quality of streams along the windward coast of the island. Twenty-one streams were sampled in 1983. Results were combined with those of previous studies to provide a comprehensive look at the biology of thirty-six Windward O'ahu streams (Table 1).

Emphasis was placed on the diversity and abundance of native stream animals. Only the conspicuous crustacean, molluscan and fish species were identified and enumerated in this survey, or identified from previous studies. The large scope of this survey required streams to be visited a limited number of times, and results should be viewed with this understanding. Previous studies vary in concentration from one-time collections to thorough, long-term researches.

LITERATURE REVIEW

An effort to identify recent biological studies conducted in Windward O'ahu streams produced data from 14 studies completed within the last 15 years (Refs. 1-14). All these studies, with the exception of the masters thesis on Macrobrachium lar by Kubota (Ref. 6), included efforts to identify various stream fauna and estimate their population levels. A number of researches on estuarine environments (Kahana estuary) were also found but the results of these are not included in this report on stream fauna.

METHODOLOGY

Sampling Stations

The determination of the streams to be sampled during this biological survey was made following a review of existing data and a conference with U.S. Fish and Wildlife Service personnel. Stations were established based upon accessibility and efforts to obtain thorough coverage of each study stream. The locations of all sampling stations from which data is available (this survey and all previous studies) are summarized in Table 3 and shown in Figures 1 through 13.

Sampling Methods

Two sampling methods were employed during this survey: electroshocking and visual sampling (including snorkeling). Stations were established as a 20 x 1 m stretch of stream. A Coffelt BP 3 model backpack shocker was used to stun animals that were then netted, identified, counted and released. Collections started at the lower limits of the station and proceeded upstream. Visual sampling also began at the downstream end of the station, and animals were identified and counted. Previous studies employed either electroshocking (Refs. 2,3,4,5,8,13,14) or visual sampling (Refs. 1,9,10,11,12) with stations being established as mentioned above.

Visual sampling is suitable for determining the presence and relative abundance of fish and large invertebrates in Hawaiian streams. When combined with snorkeling (when possible) only the most cryptic organisms may avoid detection. Native stream fauna, though usually benthic, are not cryptic and are identified readily by the experienced observer. Sampling success with the backpack electroshocker is dependent upon many factors (Ref. 15); experience of operator, condition of electroshocker, depth and conductivity of water, stream velocity, and agility of operator in pursuing stunned organisms. Electroshocking can, however, supplement visual sampling in shallow, high velocity reaches and along thickly vegetated stream banks in particular.

HAWAIIAN STREAM FAUNA

The stream fauna in Hawaii are frequently discussed in terms of their origin. Native fauna are animals found naturally in the State while exotics are present as a result of the actions of man. Stream fauna commonly found in Hawaiian streams are listed in Table 2.

Native Stream Fauna

Ten of the 24 species listed in Table 2 are considered native aquatic fauna. Two crustaceans, two molluscs and six fishes are either found naturally only in Hawaii (endemic) or are found naturally here and elsewhere (indigenous). Both crustacean species, one of the mollusc species and five of the fish species are diadromous, meaning that passage to the ocean and back is essential to their reproductive success. These diadromous species live and spawn in fresh water and hatchlings from their eggs must spend a period of development in the ocean before migrating upstream. The following is a summary of each of these species with regard to lifestyle and distribution (Refs. 7,16,17).

1. Atyoida bisulcata: o'pae kala'ole.

A small (2-4 cm) endemic shrimp, common to abundant in perennial Hawaiian streams to 1,000 m elevation. The opae is primarily a detrital filter feeder and is diadromous, although there is still some question as to whether the diadromy is obligatory.

2. Macrobrachium grandimanus: o'pae o'eha'a.

This endemic, diadromous, palaemonid prawn inhabits lower reaches of streams and mixohaline shoreline ponds throughout the State and ranges in size from 2 to 9 cm in total length (distance from tip of rostrum to the tip of the telson). This o'pae is an omnivore that ingests mostly detritus, although adults appear to prey on other benthic animals.

3. Melanoides sp. : pond snail.

Melanoides are distributed statewide in streams, marshes and mixohaline ponds. Frequently Melanoides are found in slow-flowing, low-quality aquatic environments feeding on algae and detritus. Shell length is generally less than 5 cm. This mollusc completes its life cycle in fresh water.

4. Neritina granosa: hihiwai.

This endemic, diadromous mollusc is common in remote streams on the Neighbor Islands but occurs in very few O'ahu streams. Reaching a size of over 5 cm, this mollusc feeds on algae and is usually found in riffle areas having high flow velocities.

5. Stenogobius genivittatus: o'opu naniha.

One of the smaller (5-6 cm in length) diadromous native stream gobies, the naniha is widely distributed in Hawaii in mixohaline waters and lower stream reaches. This o'opu is also found in other areas in the tropical Pacific. Omnivorous, naniha eat plant material, plankton and small invertebrates.

6. Awaous stamineus: o'opu nakea.

This endemic, diadromous o'opu is the largest of the native gobies, reaching a maximum length of 30 cm. A small fishery is supported by nakea on the island of Kauai. The nakea is widely distributed on all islands but is found in small numbers on O'ahu and is considered "depleted" (Ref. 18). This o'opu is omnivorous, feeding on filamentous algae and benthic animals.

7. Eleotris sandwicensis: o'opu okuhe.

This diadromous eleotrid lacks the ventral sucking disk of the true gobies but is similar in appearance and is a ubiquitous endemic with a distribution similar to o'opu naniha. Okuhe may reach a size of 25 cm and is sometimes caught as a food fish. This o'opu is a carnivore, ingesting fish, insects and benthic animals.

8. Lentipes concolor: o'opu alamo'o.

Endemic, diadromous and comparatively rare, this Hawaiian goby is currently listed as "Category 2" in the Federal Register, which states that "information now in possession of the Service (USFWS) indicates that proposing to list the species as endangered or threatened is possibly appropriate, but for which substantial data are not currently available to biologically support a proposed rule" (Ref. 19). Lentipes are found in only 15 % of all Hawaiian streams (Ref. 17), and its abundance is frequently low with distribution limited to upstream areas. Although omnivorous, larger Lentipes (to 14 cm) eat more animal material (primarily atyid shrimp and insect larvae), while smaller fishes appear to consume more algal material (Ref. 20). Only a single specimen of Lentipes has been collected on O'ahu (Kaluanui stream) in recent years (Ref. 17).

9. Kuhlia sandwicensis: aholehole.

This kuhliid bass is an endemic mixohaline fish that is widely distributed throughout the state. Aholehole may reach 20 cm and, being mostly marine, are a principal predator in stream mouths and estuaries in Hawaii.

10. Sicyopterus stimpsoni: o'opu nopili.

The nopili is an endemic, diadromous goby and is the only member of the genus Sicyopterus in Hawaii. Ranging in size up to 13 cm, the nopili is found on all islands in varying abundances but is listed as "threatened" on O'ahu (Ref. 18) and of "special concern" for the entire state (Ref. 20). On O'ahu, the nopili has been found only in Kaluanui and Koloa streams in very small numbers. It is adapted for feeding on the epilithic community, primarily algae with microzoan associates.

Introduced Stream Fauna

A majority of the aquatic animals found in Hawaiian streams have been intentionally or unintentionally introduced to the streams by man. A short synopsis of the lifestyle and distribution (if known) of each of these species follows. All introduced stream fauna, with the exception of Macrobrachium lar and possibly some tilapia, complete their life cycle in fresh water.

1. Macrobrachium lar: Tahitian prawn.

Since its introduction to the state in 1956 (Ref. 21), this insular, Indo-Pacific prawn has established itself successfully in fresh and mixohaline waters on all of the major islands. Males may grow to over 14 cm in total length while females attain lengths greater than 11 cm. This prawn is diadromous and an omnivorous bottom scavenger (Ref. 6), but also preys on gobies and other invertebrates (Ref. 17).

2. Procambarus clarkii: crayfish.

This crustacean is a carnivore feeding on small invertebrates and dead and decaying organisms. The crayfish may reach a total length of over 15 cm and burrows into the banks of streams and ponds. Taro farmers are often troubled by the crayfish, as burrowing can interfere with irrigation practices. Crayfish are increasingly common in streams on all of the Hawaiian islands, often reaching very substantial densities.

3. Clarias fuscus: chinese catfish.

This relatively small catfish (up to 25 cm) is known to be carnivorous, feeding on invertebrates and animal detritus. Nocturnal in nature, this fish remains well hidden during the day and is normally found in slow, ponded water within streams. Distribution is statewide.

4. Cichlasoma sp.: cichlid.

Aquarium fishes found naturally only in Africa, Madagascar, India and Tropical America, these carnivorous egg-layers may be found on all of the major islands in low densities. Size normally ranges from 7 to 15 cm and color changes are rapid and dramatic.

5. Cyprinus carpio: carp.

This opportunistic omnivore may reach a size of over 50 cm and 10 kg. The carp can survive in low quality water and withstand extreme changes in environmental conditions. Although well established in many mainland streams few have been collected from streams within the state.

6. Gambusia affinis: mosquitofish.

A live-bearer, this 2-4 cm fish is a carnivore feeding mostly on mosquito larvae. Its ubiquitous distribution in streams in the State is probably a result of stocking by the State Department of Health, Vector Control Division, to control mosquito populations in wetland areas.

7. Lepomis macrochirus: bluegill.

Native to North America, this carnivore may reach a size of 20 cm feeding on invertebrates and small fish. The bluegill is a nest builder and eggs are protected by the male. Distribution of L. macrochirus within the state is apparently limited to O'ahu and Kaua'i.

8. Micropterus dolomieu: smallmouth bass.

Another native of North America, the smallmouth bass is considered a fine gamefish and may reach a size of over 50 cm. An active predator on invertebrates and fishes, this fish could potentially seriously alter the Hawaiian stream community. Bass have been collected on Kauai and O'ahu but may have become established on other islands as well.

9. Misgurnus anquillicaudatus: dojo, loach.

With an eel-like body of up to 30 cm, this fish can withstand poor water quality conditions and is known to burrow in the banks of streams and taro patches. An opportunistic bottom scavenger, the loach is distributed statewide.

10. Ophicephalus striatus : snakehead.

This snakehead is an active predator of small invertebrates and reaches a length of approximately 20 cm. A native of Asia and Africa, the snakehead is an important food fish in the Orient. Distribution appears limited to O'ahu and densities are not great.

11. Poecilia spp.: guppies, mollies.

Much like G. affinis, Poecilia spp. are 2-4 cm in length, live-bearers, feed on mosquito larvae and are commonly found in streams on each of the islands in the State. A number of species of this genus have been collected in Hawaii. Again, stocking by the State Department of Health may be one of the factors involved in the distribution of these species.

12. Tilapia (Sarothorodon) spp.: tilapia.

A number of Tilapia species are established in the state (Ref. 22). Omnivorous and tolerant of high salinity and temperature ranges (0-117 ppt and 6-42 C for T. mossambica), adult fish are capable of marine dispersal between stream mouths. Fish up to 20 cm may be commonly found. Species introduced to the State by the Division of Fish and Game, Department of Land and Natural Resources between 1951 and 1957, and subsequent introductions for aquaculture purposes brings the total number of recognized species to seven. Substantial interbreeding has occurred, producing countless hybrids thus making species identification nearly impossible. Even the "red" hybrid, introduced for aquacultural purposes, is commonly seen in streams in Windward O'ahu.

13. Xiphophorus helleri: swordtail.

Live-bearing algae eaters, swordtails are very common inhabitants of Hawaiian streams. Males are easily recognized by their long caudal fin spike, with total fish lengths of 10 cm common. Females may deliver between 100 and 200 young. The "Green" color division seems to be the principal variety collected in the state.

14. Xiphophorus maculatus: Southern platyfish.

A number of color variations are recognized within this species. The ecology and life style of X. maculatus is the same as X. helleri though their abundance and distribution is more restricted. The platyfish may reach lengths of up to 6 cm.

Effect of Stream Alterations on Native Fauna

Two studies completed in the last six years directly address the issue of the effect of channel alterations on native stream fauna (Refs 8,23). Extreme values of environmental variables (pH, temperature, conductivity and dissolved O₂) have been reported in channelized stream reaches. The loss of shade and bottom shelter due to artificially-lined channel bottoms is also a result of flood control-prompted channelizations. These changes in stream environmental characteristics favor exotic fauna (Refs 8,23). Often exotic species have broader environmental tolerance and can thrive in highly degraded stream systems. The diadromous nature of most of the less tolerant native stream fauna exposes these animals to extreme environmental conditions and predation by exotics both as downstream moving larvae and returning juveniles. Timbol and Maciolek (Ref. 14) reported that exotics clearly dominated all artificial bottom channels by both numbers and weight. The effect of increasing both the number of streams being channelized and the length of channelized reaches within a stream appears to be the displacement of native diadromous fauna by exotics.

Instream flow requirements are another important issue involving streams within the State. Because of past and proposed water development projects, there is serious concern over maintaining adequate flows in streams to insure biological, esthetic and recreational values (Ref. 24). Timbol (Ref. 13), working in Kahana stream, O'ahu, stated that 60% of the present average discharge of the stream was needed to maintain good survival conditions for macrobiota and also general recreational qualities. This figure was based on examples of effects of water removal from an adjacent stream (Punaluu) and on Timbol's personal experience. No serious attempt at delineating instream flow requirements for Hawaiian streams has been made even though the methodology has been discussed (Ref. 24). The Instream Use Study for Windward O'ahu (Ref. 24) assigned a value for "Potential as Stream Fauna Habitat" for isolated stream reaches on the criterion of whether the reach was in a natural or man-altered (i.e. channelized) state. Although a beginning, the general assignments fall short of providing sufficient information to allow for decisions on stream management. There remains the need for extensive research, on a stream-by-stream basis, to determine instream flow regulations prior to the onset of water development projects.

The U.S. Fish and Wildlife Service, State of Hawaii (Dowald), University of Hawaii WRRC and Department of Zoology are currently involved in a joint-agency research study to identify specific habitat use-preference data for 3 diadromous Hawaiian gobies. This information will ultimately be combined together with empirical data on channel morphology and flow to construct a model or simulation of useable habitat vs. available stream flows.

RESULTS

A compilation of data collected during this survey and selected, relevant data from previous biological studies is presented in Table 4. Sampling site locations are represented in Figures 1 to 13. For additional reference, Table 3 lists the site numbers found on individual streams.

STREAM QUALITY

Introduction

The Hawaii State Department of Health (Ref. 25) developed water quality standards based on various ecological factors. Maciolek (Ref. 26), working in several Maui streams, proposed a criterion coupling the number of native stream species and the amount of habitat lost due to water diversion. With knowledge of these two studies, this biological survey and literature review has the primary purpose of determining the quality of Windward O'ahu streams with specific regard to the distribution and abundance of native fauna.

Establishing stream quality ratings based strictly on the presence or absence of a particular species or group of species may be inappropriate for Hawaiian streams. Even the rare endemic goby, Lentipes concolor can be found on occasion (and in very limited numbers) in highly modified environments (Ref. 27). Thus, the physicochemical factors previously documented to be involved in the distribution of native stream fauna must also be included in any effort to rate stream quality within the state. These factors include: substantial vegetative canopy to prevent or reduce algal mat growth, high water flow velocity, clear to only slightly turbid water, and substrata consisting of cobble and boulders with little silt accumulation (Refs 13,16,17).

Established, actively recruiting populations of native fauna are positive indications of stream quality. Because of the widespread distribution of exotic species (M. lar, poeciliids, and the caddisfly Cheumatopsyche analis in particular), no stream in the State remains in pristine condition. On the island of O'ahu no streams are unaffected by human actions. Even streams in relatively remote regions on O'ahu have been modified by man at their ocean terminus. Many Windward O'ahu streams are highly modified and degraded. The identification of those streams that exhibit established populations of native fauna and adequate physicochemical qualities to support them will provide important management information.

Neighbor Island streams have not suffered the extent of channel alteration that is common on O'ahu (Ref. 14). Dewatering for domestic and agricultural purposes is the major alteration. Many more Neighbor Island streams support viable populations of native fauna than do O'ahu streams.

Stream Rating Criteria

The stream quality ratings assigned in this report have been developed to indicate how the streams in Windward O'ahu compare with each other. Comments regarding how Windward O'ahu streams compare with streams on other islands appear elsewhere in this report. The criteria for the ratings are the presence and abundance of native fauna and the previously mentioned physicochemical factors regularly associated with their presence.

The basis for determining the distribution and abundance of native fauna was a compilation of data from the biological survey completed by the author during August 1983 and results of 14 previously completed studies (Refs. 1-14). The physicochemical parameters were assessed through on-site inspection and reference to previous studies.

Three rating categories will be employed:

High Quality:

1. Usually at least 3 established native species common or more abundant.
2. Stream channel usually unaltered (aside from road crossings).
3. Significant lengths of riffle areas with high stream flow velocities.
4. Stream water normally clear during all but freshet flows.

Moderate Quality:

1. Usually at least 2 established native species common or more abundant.
2. Stream channels usually altered.
3. Some riffle areas with high stream flow velocities.
4. Stream water clear during base and average annual flows.

Low Quality: The remaining streams are best represented as having;

1. Less than 2 established native species common or more abundant.
2. Significant stream channelization or alteration.
3. Few, if any, natural riffle areas with high stream flow velocities.
4. Stream water clear only at base flow.

Stream Ratings

Table 5 is a listing of streams according to quality rating. Streams are listed in geographic order in each rating designation from Waimanalo toward Kahuku. All six streams assigned the "High Quality" rating are located in relatively undeveloped watersheds.

One stream included in Table 1 has not been given a rating. Maakua is an intermittent stream near Hauula in which only the introduced prawn, Macrobrachium lar, was collected during the biological survey completed for this study. This collection occurred during freshet conditions and is very probably an inadequate measure of the biological community. Conversations with knowledgeable hikers who have frequently visited the stream indicate that three native species, Awaous stamineus, Atya bisulcata and Neritina granosa, may be present in abundance. Fauna together with the stream's other good qualities would place Maakua stream in the "High Quality" as opposed to "Low Quality" rating designation. In addition, collections were not made in another intermittent stream, Wailele, and a continuous stream, Malaekahana, both located in Kahuku. Information on their fauna is lacking, so no quality rating was assigned. Local residents claim that both may contain native crustaceans and gobies.

Also included in Table 3, are two lentic water bodies on the Windward side: Kaelepulu Pond and Kawainui Marsh near Kailua. Kaelepulu Pond was found to contain exotic fish species while Kawainui Marsh supported at least four native animals with abundances common or greater. The data for Kawainui Marsh is the result of efforts by John Ford in 1975 (Ref. 4). An extensive, thorough biological survey of the swamp would need to be undertaken in order to confidently document its current complement of aquatic fauna.

COMPARISON OF WINDWARD O'AHU AND NEIGHBOR ISLAND STREAMS

A number of studies have been completed in Neighbor Island streams which provide information about their biological communities. Timbol (Ref. 28) investigated conspicuous stream animal populations in Wailoa Stream, Island of Hawaii and Wainiha, Hanalei and Wailua (North Fork), Island of Kauai. The U.S. Fish and Wildlife Service studied Lumahai River on Kauai and Waihee River on Maui (Ref. 29). Timbol and Maciolek completed a statewide survey listing the distribution and abundance of fish and decapod crustaceans in altered and unaltered streams on all the major islands (Ref. 14). Timbol et al. (Ref. 17) list the relative abundance of five fish (four native) and two crustaceans (one native) in a number of streams in which Lentipes concolor was found. This is not a comprehensive list of Neighbor Island stream studies; however, these studies provide adequate data to make statements comparing the general quality of Windward O'ahu streams with that of streams found on the Neighbor Islands.

According to proposed state water quality standards (Ref. 25) no stream on O'ahu is considered to be in the highest quality category. O'ahu is known as having the poorest quality streams in the State (Ref. 14). By comparison, 34% of Maui's 96 perennial streams are considered high quality (Ref. 14).

The number of native species that are common or more abundant has been used as an indicator of stream quality. The six "high quality" Windward O'ahu streams contain from three native species in Waiahole and Koloa Streams to a high of six species in Punaluu. The mean number of native species for these streams was just over four. Timbol and Maciolek (Ref. 14) reported numbers of native species in selected unaltered streams on the four other major islands of the State. They reported Hawaii, Maui and Kauai streams to

average five native species and Molokai six. The rare endemic goby, Lentipes concolor, is found in only 56 of the 366 perennial streams in Hawaii (Ref. 14). None of these are on O'ahu, although one juvenile was collected in Kaluanui Stream in 1979 (Ref. 16). The thick "streams" of Neritina granosa and the swarms of hinana (juvenile gobies) observed traveling upstream in Lumahai River, Kauai, are scenes which have not been observed in O'ahu streams. A seasonal nakea (Awaous stamineus) fishery still exists on Kauai, indicating the number and large size of the fish in streams on that island.

This information and further observations of O'ahu and Neighbor Island streams lead to the judgment that the six "High Quality" Windward O'ahu streams are of only moderate quality when compared with streams statewide. The other two ratings used in this study, "Moderate" and "Low Quality", must also be considered as too high in regard to the presence of native fauna and environmental conditions to sustain their populations when comparing stream quality on a statewide basis.

CONCLUSIONS AND RECOMMENDATIONS

1. Channelization and water diversion (dewatering) affect the biological quality of streams in Hawaii through increasing variability of environmental parameters. The more tolerant exotic fauna are then favored over native species, thus reducing the intrinsic biological value of the stream.
2. Of the 36 Windward O'ahu streams evaluated, data indicate that six (Waiahole, Waikane, Kahana, Punaluu, Kaluanui and Koloa) are of significantly higher quality than the others in terms of native aquatic fauna and the environmental conditions conducive to their survival.
3. Other factors involved in high quality designation of these streams include: lack of channelized reaches, high flow velocity reaches, and regularly clear stream water.
4. Many Neighbor Island streams are of higher quality than even the best Windward O'ahu streams.

In terms of native stream fauna, Koloa, Kaluanui, Punaluu, Kahana, Waikane and Waiahole Streams are of significantly higher environmental quality than other Windward O'ahu streams. Punaluu, Kahana, and Waiahole Streams are among the few O'ahu streams sizable enough to provide extensive habitat for relatively large o'opu nakea (Awaous stamineus), the most common native goby. Two native crustacean and three native fish species maintain populations in the lower reaches of Waikane Stream. While the rarest native species of goby (Lentipes concolor) is functionally extinct on O'ahu, one specimen was collected in 1979 in Kaluanui Stream. As of 1983, Kaluanui and Koloa Streams are the only two O'ahu streams which still contain hihiwai (Neritina granosa).

If the maintenance of streams containing reproducing populations of native aquatic fauna on the island of O'ahu is deemed important, then care must be taken to prevent altering the environmental conditions found in the six high quality streams found in Windward O'ahu. These are among the least biologically disturbed on the island. The establishment of reasonable instream flow standards must be a priority. Once established, they must be strictly adhered to. In the face of the growing water needs of the entire island, concentrating efforts on effectively protecting Waiahole, Waikane, Kahana, Punaluu, Kaluanui and Koloa Streams may provide the most reasonable method of maintaining optimal use of this resource by the community.

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Table 1. List of 32 perennial Windward O'ahu streams evaluated during this study.

STREAM NAME	TRIBUTARY OF	PREVIOUS STUDIES USED	NEW DATA COLLECTED
Kahawai	Waimanalo	no	yes
Waimanalo	ocean	yes	yes
Kahanaiki	Kawainui Marsh	yes	no
Maunawili	Kawainui Marsh	yes	yes
Makawao	Maunawili	yes	yes
Ainoni	Makawao	no	yes
Omao	Maunawili	yes	no
Palapu	Omao	yes	no
Kawa	ocean	yes	no
Kaneohe	ocean	yes	no
Kamooalii	Kaneohe	yes	yes
Luluku	Kamooalii	yes	no
Keaahala	ocean	yes	yes
Heeia	ocean	yes	yes
Haiku	Heeia	yes	yes
Waihee	ocean	yes	no
Kahaluu	Waihee	yes	no
Ahuimanu	Kahaluu	yes	no
Waiola	Ahuimanu	yes	no
Kaalaea	ocean	yes	yes
Waiahole	ocean	yes	yes
Waianu	Waiahole	yes	no
Uwau	Waianu	yes	no
Waikane	ocean	yes	yes
Hakipuu	ocean	yes	yes
Kaaawa	ocean	no	yes
Makaua	ocean	no	yes
Kahana	ocean	yes	no
Kawa	Kahana	yes	no
Punaluu	ocean	yes	yes
Kaluanui	ocean	yes	no
Maakua	ocean	no	yes
Waipilopilo	ocean	no	yes
Kaipapau	ocean	no	yes
Koloa	ocean	no	yes
Kahawainui	ocean	no	yes

Table 2. List of conspicuous invertebrates and fishes commonly found in streams in the Hawaiian Islands.

Scientific Name	Local Name	Origin ¹
Crustaceans		
<u>Atyoida bisulcata</u>	o'pae kala'ole	endemic
<u>Macrobrachium grandimanus</u>	o'pae o'eha'a	endemic
<u>Macrobrachium lar</u>	Tahitian prawn	introduced
<u>Procambarus clarkii</u>	crayfish	introduced
Molluscs		
<u>Melanoides sp.</u>	pond snail	indigenous
<u>Neritina granosa</u>	hihiwai	endemic
Fishes		
<u>Awaous stamineus</u>	o'opu nakea	endemic ²
<u>Clarias fuscus</u>	chinese catfish	introduced
<u>Cichlasoma sp.</u>	cichlid	introduced
<u>Cyprinus carpio</u>	carp	introduced
<u>Eleotris sandwicensis</u>	o'opu okuhe	endemic
<u>Gambusia affinis</u>	mosquitofish	introduced
<u>Kuhlia sandwicensis</u>	aholehole	endemic
<u>Lentipes concolor</u>	o'opu alamo'o	endemic
<u>Lepomis macrochirus</u>	bluegill	introduced
<u>Micropterus dolomieu</u>	smallmouth bass	introduced
<u>Misgurnus anquillicaudatus</u>	dojo, loach	introduced
<u>Ophicephalus striatus</u>	snakehead	introduced
<u>Poecilia spp.</u>	guppies, mollies	introduced
<u>Sicyopterus stimpsoni</u>	o'opu nopili	endemic
<u>Stenogobius genivittatus</u>	o'opu naniha	indigenous
<u>Tilapia (Sarotherodon) spp.</u>	tilapia	introduced
<u>Xiphophorus helleri</u>	swordtail	introduced
<u>Xiphophorus maculatus</u>	Southern platyfish	introduced

1

endemic - found naturally in Hawaii only.

2

indigenous - found naturally in Hawaii and elsewhere.

The systematics of this species and other native gobies is currently in question. See Kinzie and Ford (Ref. 15) for a thorough discussion.

Table 3. Locations of sampling stations.

Sampling Station No.	Figure No.	Location	Tributary of
1	1	Kahawai Stream	Waimanalo Stream
2-3	1	Waimanalo Stream	ocean
4	2	Kaelepulu Canal	ocean
5	2	Kaelepulu Stream	Kaelepulu Canal
6-7	2	Kawainui Canal	ocean
8-10	2	Kawainui Marsh	Kawainui Canal
11	3	Kahanaiki Stream	Kawainui Marsh
12-15, 26-32	3	Maunawili Stream	Kawainui Marsh
16-22	3	Makawao Stream	Maunawili Stream
23-25	3	Ainoni Stream	Makawao Stream
33	3	Omao Stream	Maunawili Stream
34	3	Palapu Stream	Omao Stream
35-37	4	Kawa Stream	ocean
38-42	4	Kaneohe Stream	ocean
43-47, 51-52	4	Kamooalii Stream	Kaneohe Stream
48-50	4	Luluku Stream	Kamooalii Stream
53-56	5	Keaahala Stream	ocean
57-60	5	Heeia Stream	ocean
61-62	5	Haiku Stream	Heeia Stream
63-64	6	Waihee Stream	ocean
65-66	6	Kahaluu Stream	Waihee Stream
67-72	6	Ahuimanu Stream	Kahaluu Stream
73-75	6	Waiola Stream	Ahuimanu Stream
76-80	6	Kaalaea Stream	ocean
81-82, 84-86	7	Waiahole Stream	ocean
83	7	Waianu Stream	Waiahole Stream
87	7	Uwau Stream	Waiahole Stream
88-89	7	Waikane Stream	ocean
90-93	8	Hakipuu Stream	ocean
94-96	8	Kaaawa Stream	ocean
97	8	Makaua Stream	ocean
98-99, 101-109	9	Kahana Stream	ocean
100-101	9	Kawa Stream	Kahana Stream
110-114	10	Punaluu Stream	ocean
115-121	11	Kaluanui Stream	ocean
122	11	Maakua Stream	ocean
123	11	Waipilopilo Stream	ocean
124	11	Kaipapau Stream	ocean
125	12	Koloa Stream	ocean
126	13	Kahawainui Stream	ocean

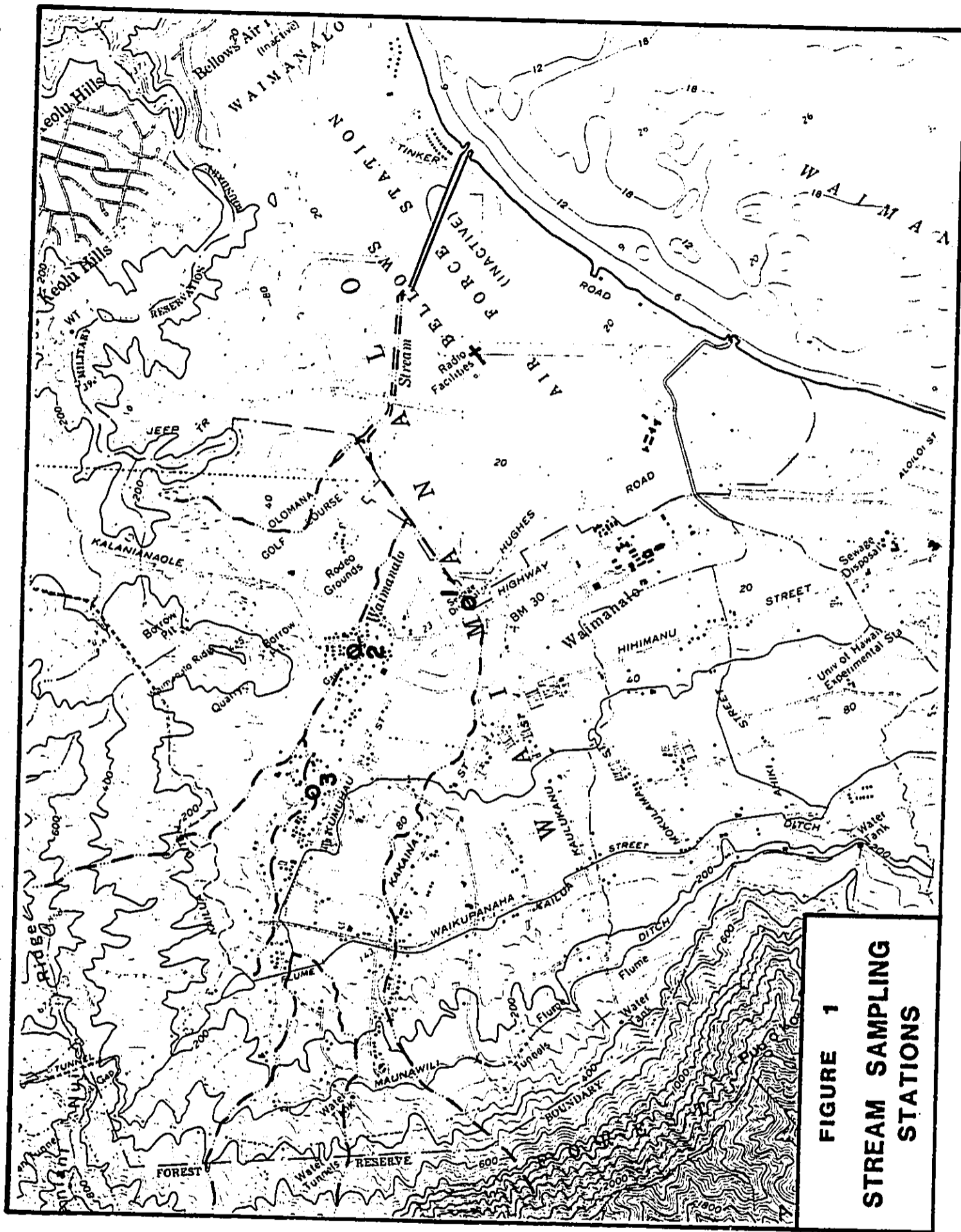
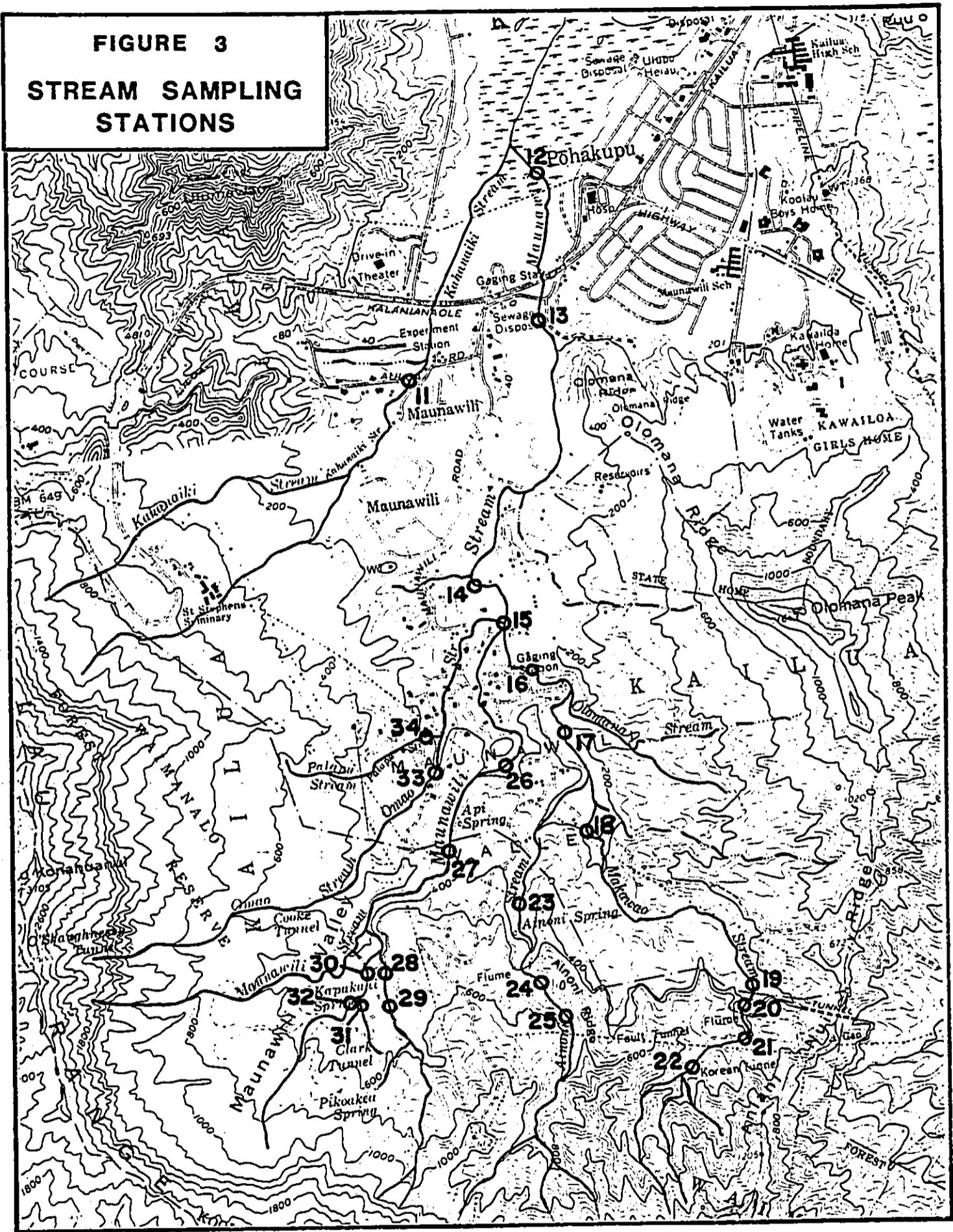


FIGURE 2
STREAM SAMPLING
STATIONS



FIGURE 3
STREAM SAMPLING STATIONS



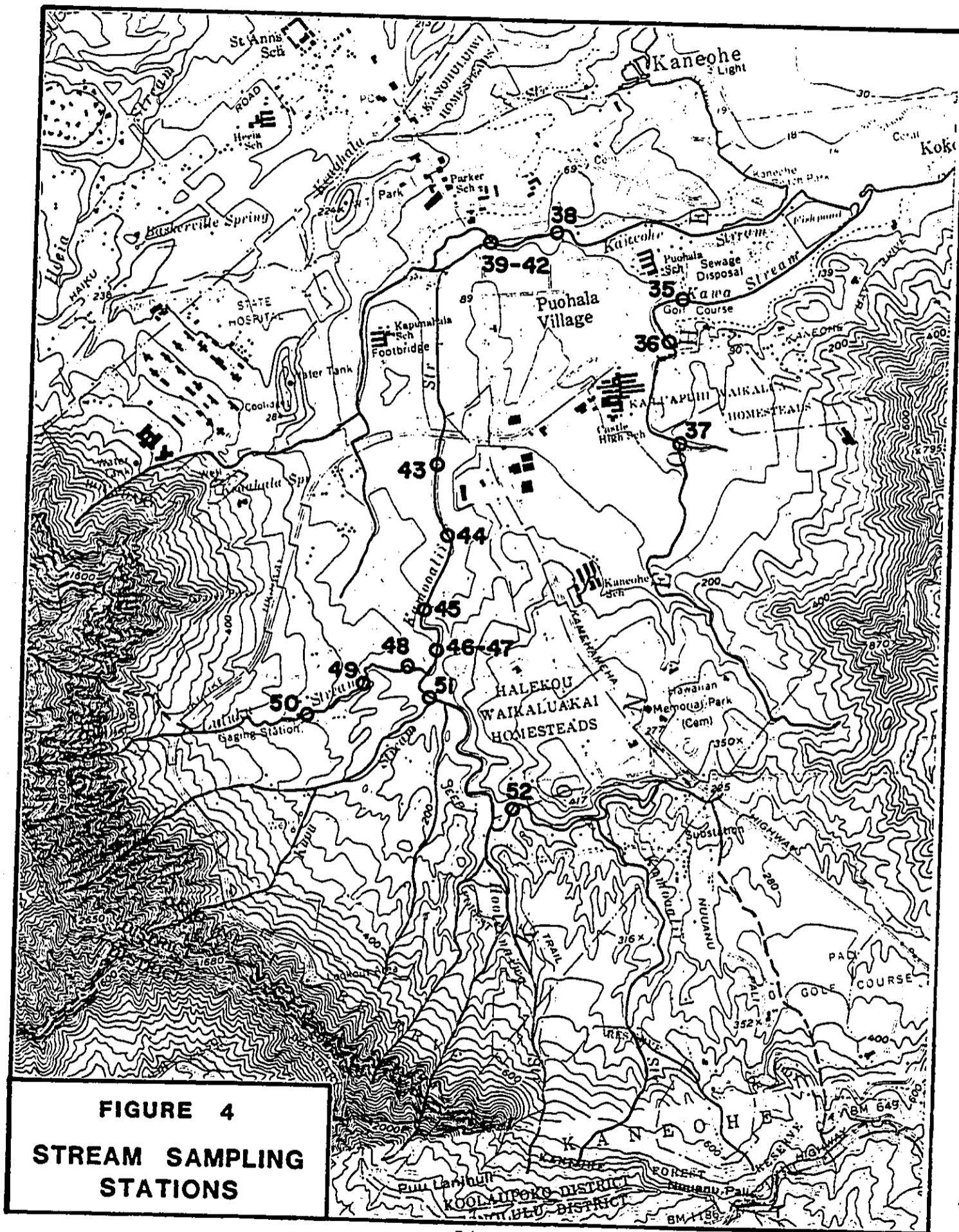
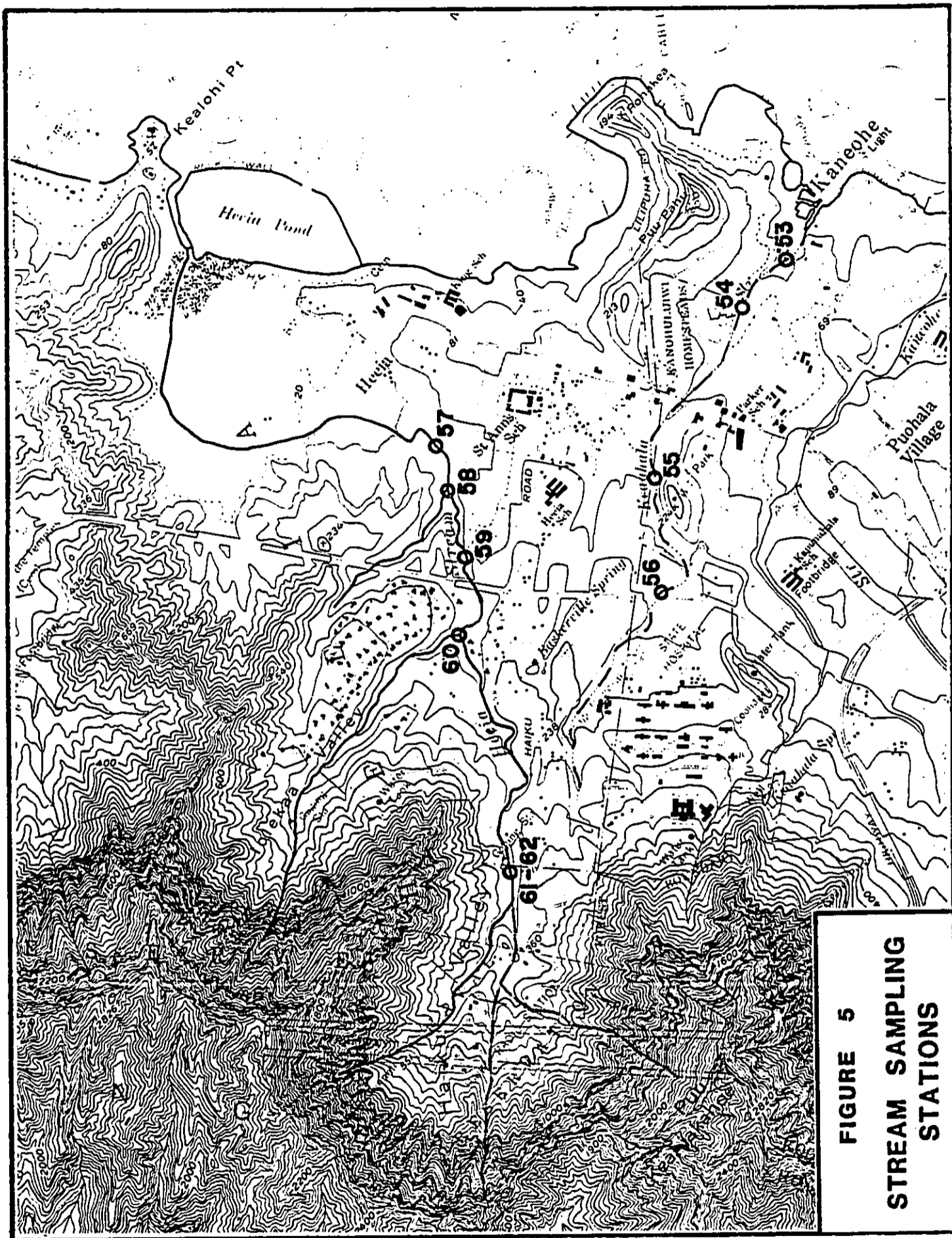


FIGURE 4
STREAM SAMPLING
STATIONS



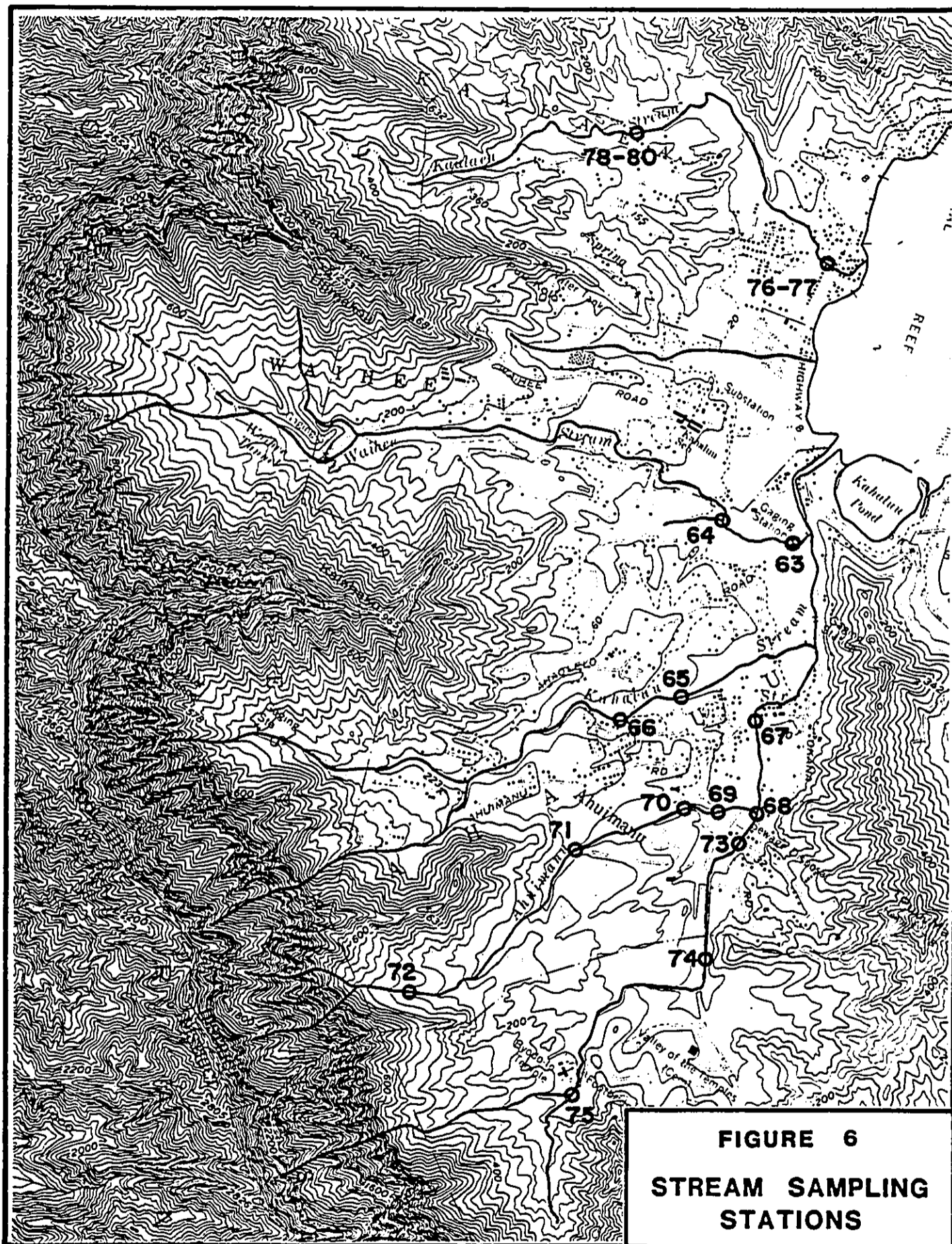


FIGURE 6
STREAM SAMPLING
STATIONS

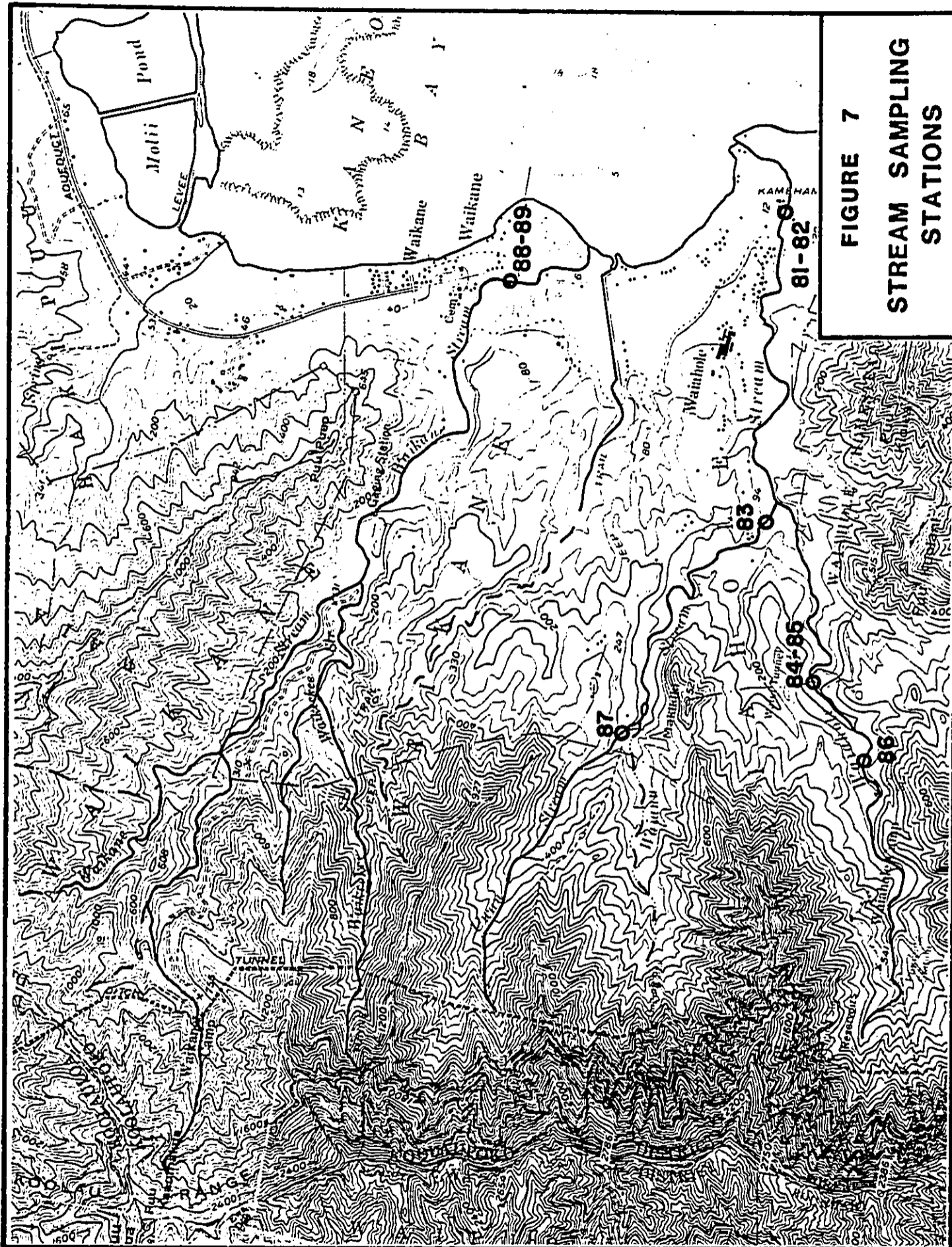


FIGURE 7
STREAM SAMPLING
STATIONS

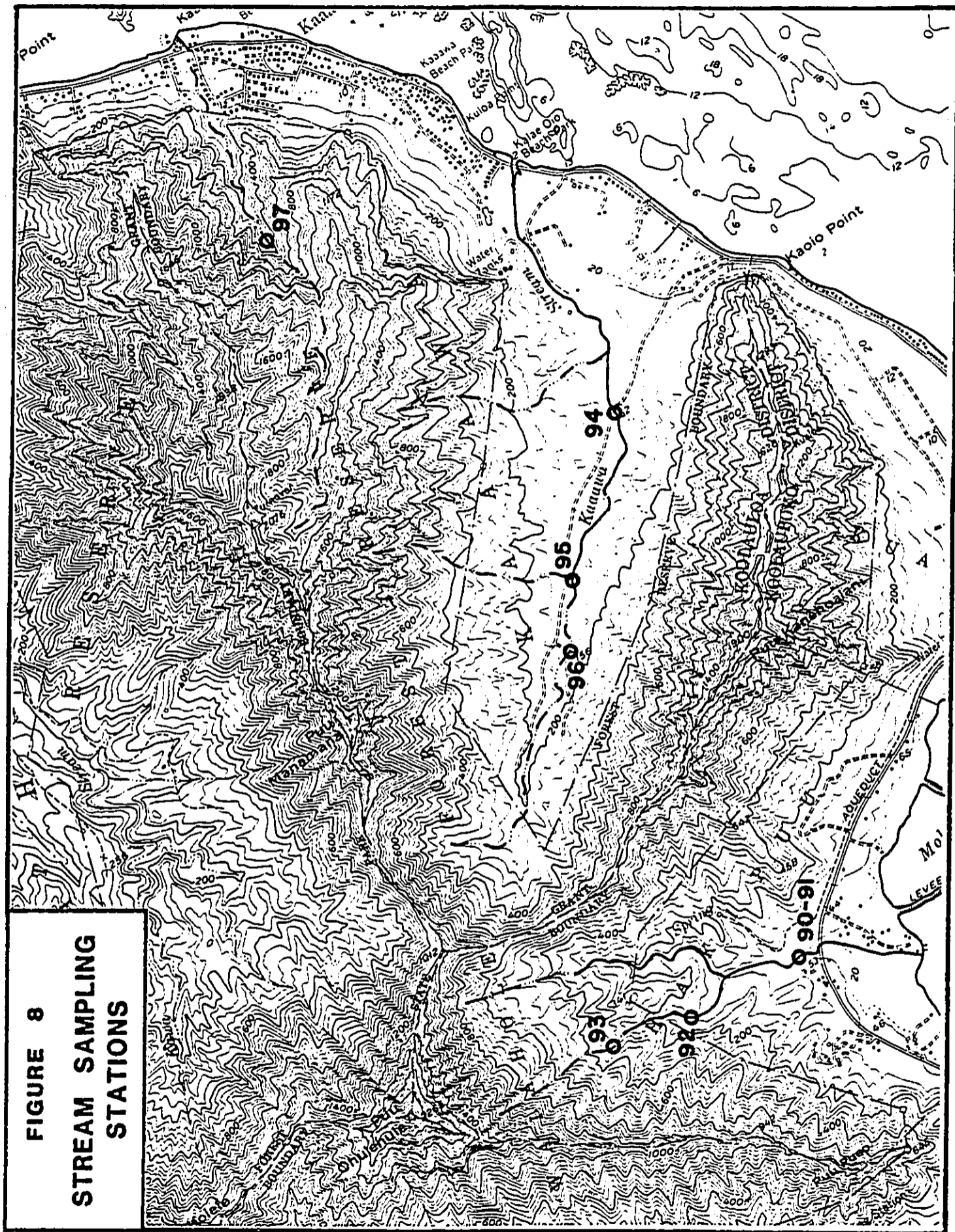


FIGURE 8
STREAM SAMPLING
STATIONS

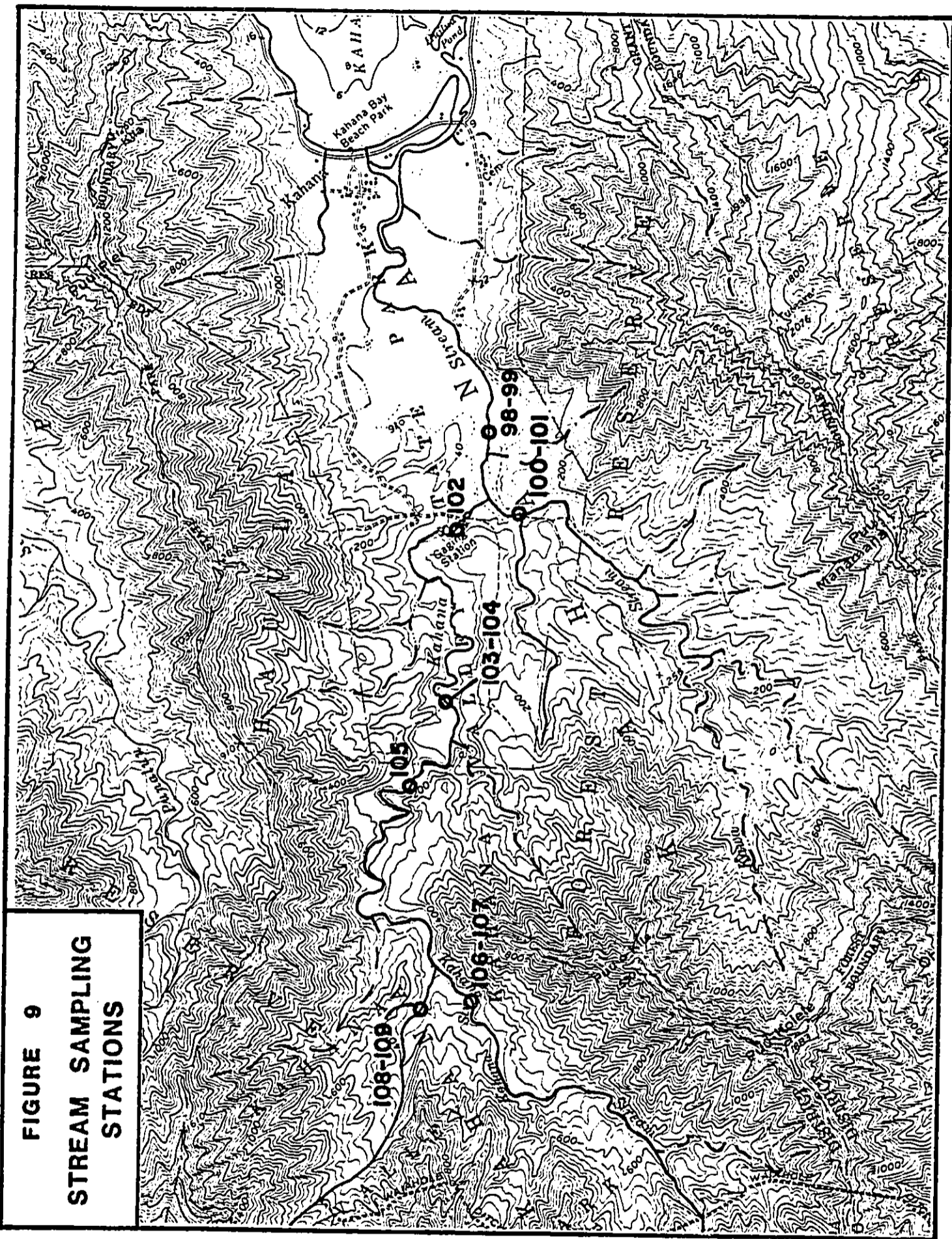
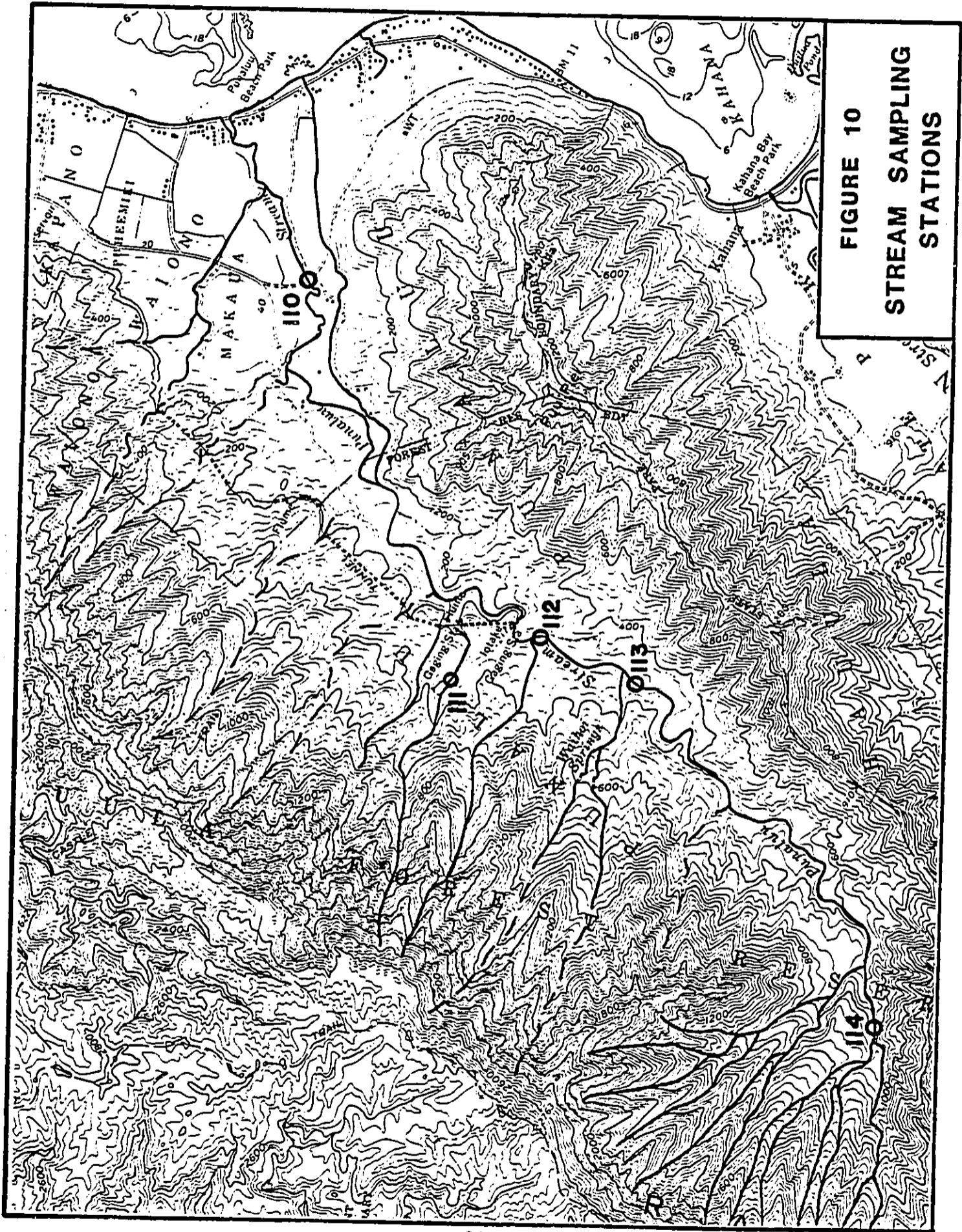


FIGURE 9
STREAM SAMPLING
STATIONS



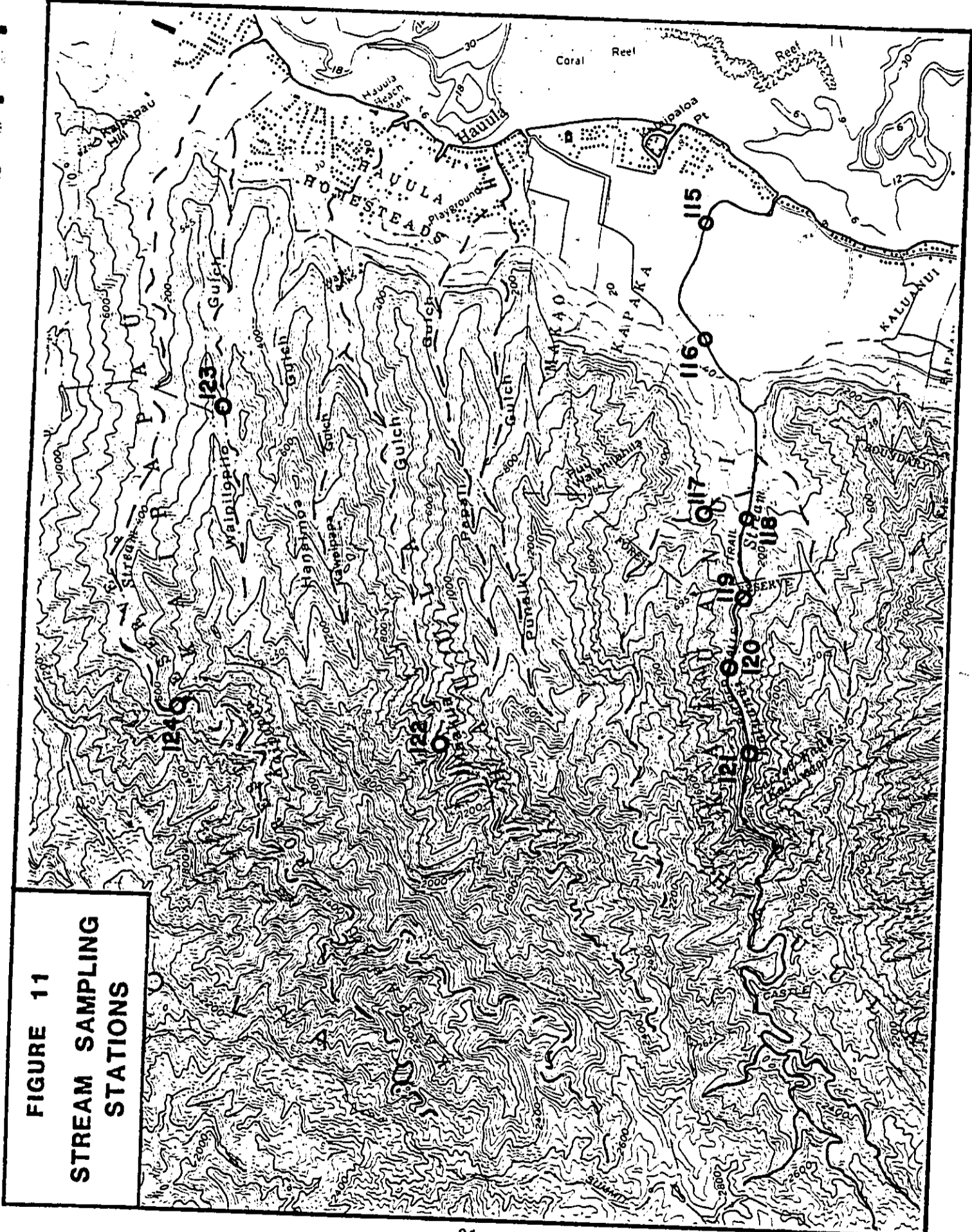


FIGURE 11
STREAM SAMPLING
STATIONS

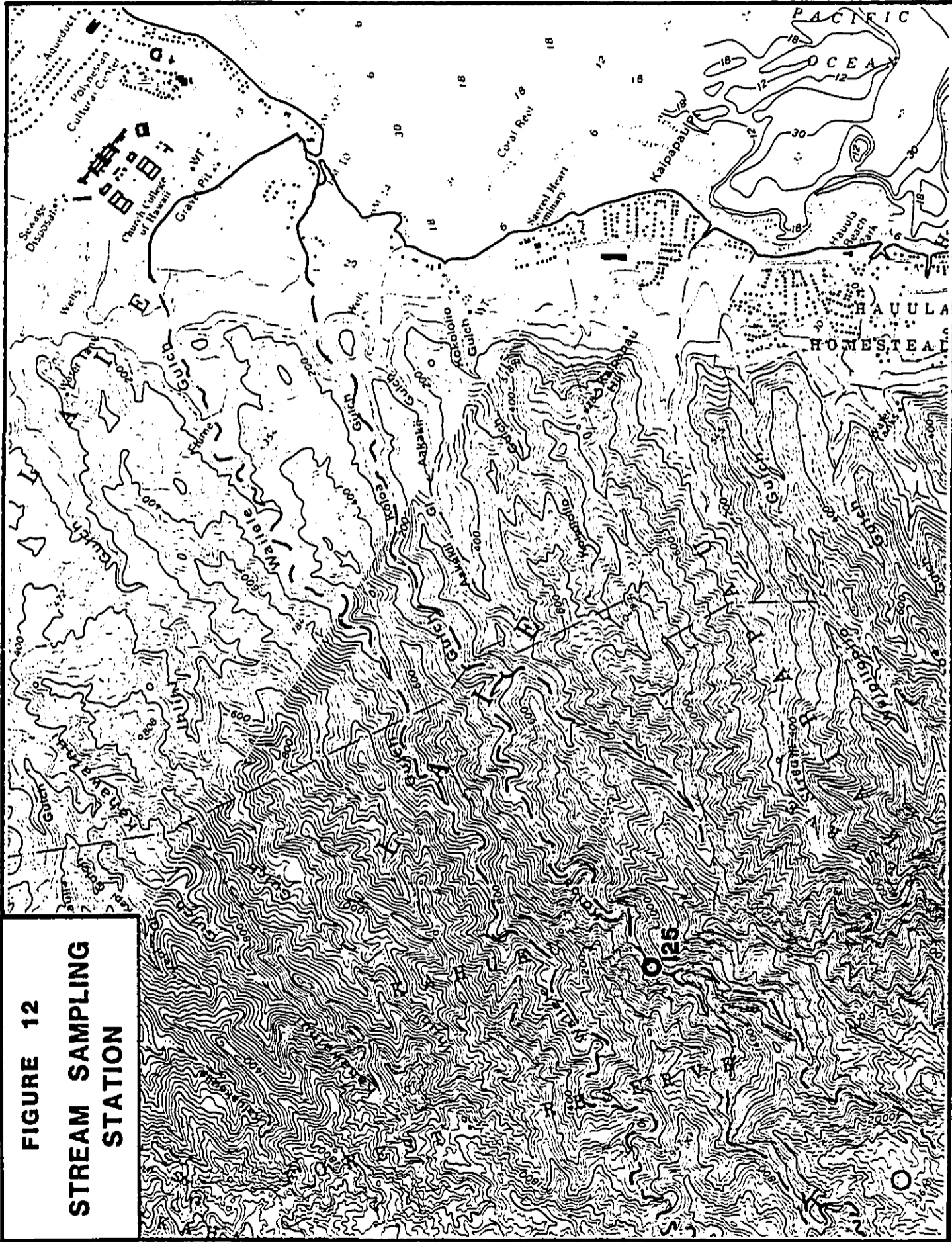


FIGURE 12
STREAM SAMPLING
STATION

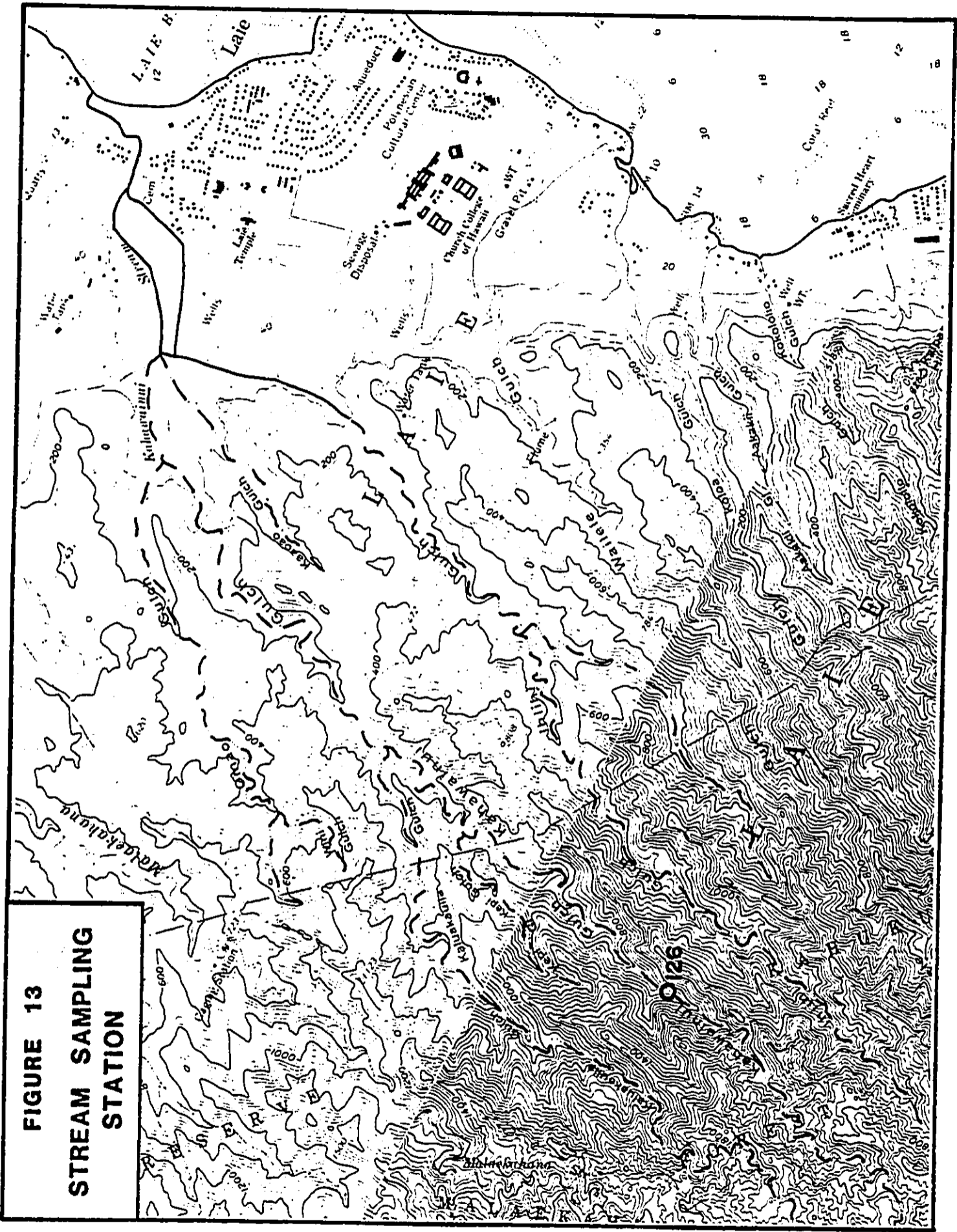


FIGURE 13
STREAM SAMPLING
STATION

Table 4. Macrofauna collected from streams in Windward O'ahu.

	Stations													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
CRUSTACEANS														
<i>Atyoida bisulcata</i> (a)														
<i>Macrobrachium grandimanus</i> (a)		+++			+++	+++	+++							
<i>Macrobrachium</i> lar		++	++											
<i>Procambarus clarkii</i>	++++										+++	+++	+++	++
MOLLUSCS														
<i>Melanoides</i> sp. (b)											+++	+++	+++	++
<i>Neritina granosa</i> (a)											+++		+++	
FISHES														
<i>Awaous stamineus</i> (a)			++			++	++							
<i>Clarias fuscus</i>											+++	+++	+++	+++
<i>Cichlasoma</i> sp.														
<i>Cyprinus carpio</i>														
<i>Eleotris sandwicensis</i> (a)						+++	+++				+			
<i>Gambusia affinis</i>														
<i>Kuhlia sandwicensis</i> (a)						+++	++							
<i>Lentipes concolor</i> (a)														
<i>Lepomis macrochirus</i>						+++	++							
<i>Micropterus dolomieu</i>						+++	++							
<i>Missurnus anauillicaudatus</i>														++
<i>Ophicephalus striatus</i>														
<i>Poecilia</i> spp.	++++	+++	++++	++++	++++	+++	+++	+++	+++	+++	+++	+++	+++	+++
<i>Sicyopterus stimpsoni</i> (a)														
<i>Stenosobius genivittatus</i> (b)		+				+++	++							
<i>Tilapia (Sarotherodon)</i> spp	+++			++++	++++	+	+	+	+++	+++	+++	+++	+++	++
<i>Xiphophorus helleri</i>		+++	++++	+++	+++									
<i>Xiphophorus maculatus</i>														
SOURCE	KA	14	KA	KA	KA	4	4	4	4	4	4	4	4	14
YEAR	83	78	83	83	83	75	75	75	75	75	75	75	75	78
(a) - endemic														
(b) - indigenous														

Table 4 cont.. Macrofauna collected from streams in Windward O'ahu.

++++ = Very abundant (over 11)
 +++ = Abundant (5-10)
 ++ = Common (2-4)
 + = Rare (1)

	Stations													
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
CRUSTACEANS														
<i>Atyoida bisulcata</i> (a)														
<i>Macrobrachium grandimanus</i> (a)								++				+++		
<i>Macrobrachium</i> lar								+		+				
<i>Procaerobius clarkii</i>	+++	+++	+++	+++	++	++	++	+	++	+	++		+++	++
<i>Melanoides</i> sp. (b)	+++	+++	+++	+++			++	+	+++				+++	+++
<i>Neritina granosa</i> (a)							++	+	+++					++
FISHES														
<i>Awaous stamineus</i> (a)														
<i>Clarias fuscus</i>	+++	+++												
<i>Cichlasoma</i> sp.														
<i>Cyprinus carpio</i>														
<i>Eleotris sandwicensis</i> (a)														
<i>Gambusia affinis</i>														
<i>Kuhlia sandwicensis</i> (a)														
<i>Lentipes concolor</i> (a)														
<i>Lepomis macrochirus</i>														
<i>Micropterus dolomieu</i>	++	++												
<i>Missurnus anquillicaudatus</i>														
<i>Ophicephalus striatus</i>														
<i>Poecilia</i> spp.														
<i>Sicyopterus stimpsoni</i> (a)	+++	+++	+++	+++	+++	+++	+++	++	+++	++	+++	+++	+++	+++
<i>Stenodobius genivittatus</i> (b)														
<i>Tilapia</i> (<i>Sarotherodon</i>) spp	++													
<i>Xiphophorus helleri</i>														
<i>Xiphophorus maculatus</i>														
SOURCE														
YEAR														
(a) - endemic	4	4	1	4	4	1	1	1	1	1	1	4	1	1
(b) - indigenus	75	75	83	75	75	84	84	84	84	84	84	75	84	84

Table 4 cont., Macrofauna collected from streams in Windward O'ahu.

++++ = Very abundant (over 11)
 +++ = Abundant (5-10)
 ++ = Common (2-4)
 + = Rare (1)

	Stations													
	29	30	31	32	33	34	35	36	37	38	39	40	41	42
CRUSTACEANS														
<i>Atyoida bisulcata</i> (a)	++			++										++
<i>Macrobrachium grandimanus</i> (a)										+	+	+++	++	+++
<i>Macrobrachium</i> lar				+						+	+	+++	+	++
<i>Procambarus clarkii</i>		++	++				++	++	++			++	+	++
MOLLUSCS														
<i>Melanooides</i> sp. (b)														+++
<i>Meritina granosa</i> (a)														
FISHES														
<i>Awaous stamineus</i> (a)														
<i>Clarias fuscus</i>										+		++	+	
<i>Cichlasoma</i> sp.												+++		
<i>Cyprinus carpio</i>												+		
<i>Eleotris sandwicensis</i> (a)												++		
<i>Gambusia affinis</i>												++		
<i>Kuhlia sandwicensis</i> (a)														++
<i>Lentipes concolor</i> (a)														
<i>Lepomis macrochirus</i>														
<i>Micropterus dolomieu</i>														
<i>Misgurnus anquillicaudatus</i>														
<i>Ophicephalus striatus</i>														
<i>Poecilia</i> spp.														
<i>Sicyopterus stimpsoni</i> (a)	++	++	++	+++	+++	+++	+++	+++	+++	++++	++++	+++	+++	+++
<i>Stenogobius senivittatus</i> (b)														
<i>Tilapia</i> (<i>Sarotherodon</i>) spp										+		++		
<i>Xiphophorus helleri</i>												++	+	
<i>Xiphophorus maculatus</i>												++		++
SOURCE														
YEAR														
(a) - endemic	1	1	1	4	4	14	3	3	8	8	8	14	3	12
(b) - indigenus	84	84	84	75	75	78	77	77	78	78	78	78	77	79

Table 4 cont.. Macrofauna collected from streams in Windward O'ahu.

++++ = Very abundant (over 11)
 +++ = Abundant (5-10)
 ++ = Common (2-4)
 + = Rare (1)

	Stations													
	43	44	45	46	47	48	49	50	51	52	53	54	55	56
CRUSTACEANS														
<i>Atyoida bisulcata</i> (a)														
<i>Macrobrachium grandimanus</i> (a)														
<i>Macrobrachium</i> lar														
<i>Procambarus clarkii</i>														
MOLLUSCS														
<i>Melanoides</i> sp. (b)														
<i>Neritina granosa</i> (a)														
FISHES														
<i>Awaous stamineus</i> (a)														
<i>Clarias fuscus</i>														
<i>Cichlasoma</i> sp.														
<i>Cyprinus carpio</i>														
<i>Eleotris sandwicensis</i> (a)														
<i>Gambusia affinis</i>														
<i>Kuhlia sandwicensis</i> (a)														
<i>Lentipes concolor</i> (a)														
<i>Lepomis macrochirus</i>														
<i>Micropterus dolomieu</i>														
<i>Misgurnus anquillicaudatus</i>														
<i>Ophicephalus striatus</i>														
<i>Poecilia</i> spp.														
<i>Sicyopterus stimpsoni</i> (a)														
<i>Stenogobius genivittatus</i> (b)														
<i>Tilapia</i> (<i>Sarotherodon</i>) spp														
<i>Xiphophorus helleri</i>														
<i>Xiphophorus maculatus</i>														
SOURCE	12	KA	8	8	12	12	12	14	3	14	KA	KA	3	14
YEAR	79	83	78	78	79	79	79	78	77	78	83	83	77	78

(a) - endemic
 (b) - indigenous

Table 4 cont.. Macrofauna collected from streams in Windward O'ahu.

++++ = Very abundant (over 11)
 +++ = Abundant (5-10)
 ++ = Common (2-4)
 + = Rare (1)

	Stations													
	57	58	59	60	61	62	63	64	65	66	67	68	69	70
CRUSTACEANS														
<i>Atyoida bisulcata</i> (a)														
<i>Macrobrachium grandimanus</i> (a)							+++	+++			++	+		
<i>Macrobrachium</i> lar.	+	+	+++	+	+		+	++			+	+		+++
<i>Procambarus clarkii</i>	++	++	++	++	++	+++	+	++	++	++	+++	++	+	+++
MOLLUSCS														
<i>Melanooides</i> sp. (b)											+++		+++	
<i>Neritina granosa</i> (a)														
FISHES														
<i>Awaous stamineus</i> (a)	+	+					++	+	+		+	+		+++
<i>Clarias fuscus</i>	++	+++	+											++
<i>Cichlasoma</i> sp.														
<i>Cyprinus carpio</i>														
<i>Eleotris sandwicensis</i> (a)	+	+						++		++	++			+
<i>Gambusia affinis</i>														
<i>Kuhlia sandwicensis</i> (a)						++								
<i>Lentipes concolor</i> (a)														
<i>Lepomis macrochirus</i>														
<i>Micropterus dolomieu</i>														
<i>Misgurnus anquillicaudatus</i>	+	++	++											
<i>Ophicephalus striatus</i>														
<i>Poecilia</i> spp.	++++	+++	+++	+++	+	+++	+++	+	+++	+++	+++	+++	+++	+++
<i>Sicyopterus stimpsoni</i> (a)														
<i>Stenogobius genivittatus</i> (b)								+++						++
<i>Tilapia</i> (<i>Sarotherodon</i>) spp												+++		+++
<i>Xiphophorus helleri</i>	++++	+++	+++	+		+	+++	++	+++	++	++	+++		+++
<i>Xiphophorus maculatus</i>														

SOURCE

YEAR

(a) - endemic

(b) - indigenous

KA	3	14	3	KA	14	3	14	3	14	9	3	9	14
83	77	78	77	83	78	77	78	78	78	78	77	78	78

Table 4 cont.. Macrofauna collected from streams in Windward O'ahu.

++++ = Very abundant (over 11)
 +++ = Abundant (5-10)
 ++ = Common (2-4)
 + = Rare (1)

	Stations													
	71	72	73	74	75	76	77	78	79	80	81	82	83	84
CRUSTACEANS														
<i>Atyoida bisulcata</i> (a)	++	+++				+++		+++	++	+	+	+++	+	+++
<i>Macrobrachium grandimanus</i> (a)						+	++				+++	++		+
<i>Macrobrachium</i> lar	++					++	++	+	++	+++	+	+	+	+
<i>Procambarus clarkii</i>	+++	++	+	++	+		+++	+++	+					+
MOLLUSCS														
<i>Melanooides</i> sp. (b)	+++	+++	++	+++	+++									
<i>Neritina granosa</i> (a)														
FISHES														
<i>Awaous stamineus</i> (a)	+	+	+	+	+	+	+				+			
<i>Clarias fuscus</i>	+	+	+	+	+	+								
<i>Cichlasoma</i> sp.														
<i>Cyprinus carpio</i>														
<i>Eleotris sandwicensis</i> (a)			++		+	+	++				+	+		
<i>Gambusia affinis</i>	++	++						++						
<i>Kuhlia sandwicensis</i> (a)											+			
<i>Lentipes concolor</i> (a)														
<i>Lepomis macrochirus</i>														
<i>Micropterus dolomieu</i>														
<i>Misgurnus anquillicaudatus</i>										+				
<i>Ophicephalus striatus</i>														
<i>Poecilia</i> spp.	+++	+++	+++	+++	+++	++	++	+++	+++	++++	+	+	+++	+
<i>Sicyopterus stimpsoni</i> (a)														
<i>Stenogobius denivittatus</i> (b)	++		+			+	+				+	+		+
<i>Tilapia</i> (<i>Sarotherodon</i>) spp	++		+			+	+++	++	+	+++	+	+		+
<i>Xiphophorus helleri</i>	++	+	+	+	+++	++	+++	+	+	+++	+	+	+	+
<i>Xiphophorus maculatus</i>														
SOURCE														
YEAR	9	9	10	10	10	3	14	14	3	KA	3	8	8	3
(a) - endemic	78	78	78	78	78	77	78	78	77	83	79	78	78	77
(b) - indigenus														

Table 4 cont.. Macrofauna collected from streams in Windward O'ahu.

	Stations													
	85	86	87	88	89	90	91	92	93	94	95	96	97	98
CRUSTACEANS														
<i>Atyoida bisulcata</i> (a)	++++	++++	++	+++			+++		+++			+++	+++	++++
<i>Macrobrachium grandimanus</i> (a)		+	+	+++	+++		+					+++	+++	++++
<i>Macrobrachium</i> lar	+++	+	+	+	+++	+++	++	++++	++	++++	+++	+++	+++	+
<i>Procambarus clarkii</i>	+						+							
MOLLUSCS														
<i>Melanooides</i> sp. (b)														
<i>Meritina granosa</i> (a)														
FISHES														
<i>Awaous stamineus</i> (a)	++	+	+	+			+	+	++			+++	+++	++
<i>Clarias fuscus</i>			+											
<i>Cichlasoma</i> sp.														
<i>Cyprinus carpio</i>														
<i>Eleotris sandwicensis</i> (a)				++										+
<i>Gambusia affinis</i>														
<i>Kuhlia sandwicensis</i> (a)														++
<i>Lentipes concolor</i> (a)														
<i>Lepomis macrochirus</i>														
<i>Micropterus dolomieu</i>														
<i>Misgurnus anquillicaudatus</i>														
<i>Ophicephalus striatus</i>														
<i>Poecilia</i> spp.	+++	++	+++	+		++++	+++	+++		++++	++++	++++	++++	+
<i>Sicyopterus stimpsoni</i> (a)														
<i>Stenobolus senivittatus</i> (b)				+										++
<i>Tilapia</i> (<i>Sarotherodon</i>) spp														
<i>Xiphophorus helleri</i>		+	+	+		++++	+++	++++		++++	++++	++++	++++	++
<i>Xiphophorus maculatus</i>														+
SOURCE														
YEAR	KA	8	8	3	KA	KA	3	KA	KA	KA	KA	KA	KA	13
(a) - endemic	83	78	78	77	83	83	77	83	83	83	83	83	83	79
(b) - indigenous														

Table 4 cont.. Macrofauna collected from streams in Windward O'ahu.

++++ = Very abundant (over 11)
 +++ = Abundant (5-10)
 ++ = Common (2-4)
 + = Rare (1)

	Stations													
	99	100	101	102	103	104	105	106	107	108	109	110	111	112
CRUSTACEANS														
<i>Atyoida bisulcata</i> (a)			+	++	++	++		+++	+++	+++	+++		+++	+++
<i>Macrobrachium grandimanus</i> (a)	++++		++	++	++	++		+++	+++	+++	+++		+++	+++
<i>Macrobrachium</i> lar	+	++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
<i>Procambarus clarkii</i>			+											
MOLLUSCS														
<i>Melanoides</i> sp. (b)			+											
<i>Neritina granosa</i> (a)														
FISHES														
<i>Awaous stamineus</i> (a)	++	+	+	+	+	++	++	++	+			++	+++	+++
<i>Clarias fuscus</i>	++	+	++	+	+	+	+							
<i>Cichlasoma</i> sp.														
<i>Cyprinus carpio</i>														
<i>Eleotris sandwicensis</i> (a)	+++		+											
<i>Gambusia affinis</i>	+		+											
<i>Kuhlia sandwicensis</i> (a)	++													
<i>Lentipes concolor</i> (a)														
<i>Lepomis macrochirus</i>														
<i>Micropterus dolomieu</i>														
<i>Misgurnus anquillicaudatus</i>														
<i>Ophicephalus striatus</i>														
<i>Poecilia</i> spp.	+++	+++	+++	++	+++	+++	++	++	+	+	+	++	++	++
<i>Sicyopterus stimpsoni</i> (a)														
<i>Stenosobius genivittatus</i> (b)	+++												+++	+++
<i>Tilapia</i> (<i>Sarotherodon</i>) spp														
<i>Xiphophorus helleri</i>	+++	+	+++	++	++	+	++	+	+	+	+	+	+	+
<i>Xiphophorus maculatus</i>														
SOURCE														
YEAR	2	13	2	2	2	13	2	2	13	2	13	2	5	KA
(a) - endemic	80	79	80	80	80	79	80	80	79	80	79	80	69	83
(b) - indisenous														83

Table 4 cont.. Macrofauna collected from streams in Windward O'ahu.

	Stations													
	113	114	115	116	117	118	119	120	121	122	123	124	125	126
CRUSTACEANS														
<i>Atyoida bisulcata</i> (a)	++++		+++	+++	+	+++	+++	+++	+++			+++	+++	+++
<i>Macrobrachium grandimanus</i> (a)				+++		++	++	+++	+++	+				
<i>Macrobrachium</i> lar	+++			++				+++	+++		+++		+++	
<i>Procambarus clarkii</i>														
MOLLUSCS														
<i>Melanoides</i> sp. (b)						+	+	+++					++++	
<i>Neritina granosa</i> (a)														
FISHES														
<i>Awaous stamineus</i> (a)		++	+	++		++	++	++	++		+++		+++	
<i>Clarias fuscus</i>			++		+									
<i>Cichlasoma</i> sp.														
<i>Cyprinus carpio</i>														
<i>Eleotris sandwicensis</i> (a)			+++	++										
<i>Gambusia affinis</i>														
<i>Kuhlia sandwicensis</i> (a)						+								
<i>Lentipes concolor</i> (a)														
<i>Lepomis macrochirus</i>														
<i>Micropterus dolomieu</i>														
<i>Misgurnus aneuillicaudatus</i>														
<i>Ophicephalus striatus</i>														
<i>Poecilia</i> spp.			++	+++										
<i>Sicyopterus stimpsoni</i> (a)														+
<i>Stenobolus senivittatus</i> (b)			++	+										
<i>Tilapia</i> (<i>Sarotherodon</i>) spp			+											
<i>Xiphophorus helleri</i>			+++	++										
<i>Xiphophorus maculatus</i>														
SOURCE	KA	5	11	11	11	11	11	11	11	11	KA	KA	KA	KA
YEAR	83	69	79	79	79	79	79	79	79	79	83	83	83	83
(a) - endemic														
(b) - indigenus														

Table 5. Stream quality rating designations for Windward O'ahu streams.

High Quality	Moderate Quality	Low Quality
Waiahole (Uwau trib.)	Waimanalo	Kahawai
Waikane	Maunawili	Makawao
Kahana (Kawa trib.)	Ainoni	Omao
Punaluu	Kamooalii	Kahanaiki
Kaluanui	Kaneohe	Palapu
Koloa	Luluku	Kawa
	Keaahala	Heeia
	Waihee	Haiku
	Ahuimanu	Kahaluu
	Waiola	Makaua
	Kaalaea	Waipilopilo
	Waianu	Kaipapau
	Hakipuu	Kahawainui
	Kaaawa	

APPENDIX E

**BOTANICAL SURVEYS FOR PROPOSED AHUIMANU INCLINED WELLS,
KAALAEA INCLINED WELLS, PUNALUU WELLS V-D, AND PUNALUU TUNNEL**

Evangeline J. Funk, Botanist

Botanical Surveys

240 Makee Road 7B

Honolulu, Hawaii 96815

Letter of Transmittal

To: VTN-Pacific

1164 Bishop Street

Suite 906

Honolulu, Hawaii 96813

Attn: Douglas Meller

Project Manager

Gentlemen:

Enclosed are botanical survey reports (3) for the proposed Ahuimanu Inclined Wells, Punaluu Wells V-D, Punaluu Tunnel, and Kaalaea Inclined Wells. Field work for the Ahuimanu and Punaluu sites was conducted on July 20, 1984 and field work for the Kaalaea site was conducted on July 30, 1984. Personnel from the BWS Geology Section were present on both days to point out the sites and access routes likely to be affected by BWS water development projects. Unfortunately, because of rugged terrain, it was not possible to identify and survey a reasonable access route to the proposed Kaalaea Inclined Wells.

Sincerely,



Evangeline J. Funk - Botanist

Proposed Punaluu Wells V-D and Punaluu Tunnel

Botanical Survey Report

Prepared by Evangeline J. Funk - Botanist

The access route - Punaluu Tunnel

Access to Punaluu Wells V-D is via a jeep road and trail which pass through very disturbed vegetation. No native Hawaiian plants were seen along this route. As the trail continues to the proposed Punaluu Tunnel it passes through a large Bamboo (Bambusa vulgaris) planting. It then enters Waihoe Stream bed which is overgrown with Pearl flower (Hetrocentron subtriplinervium). This introduced plant sometimes reaches a height of 4 m or more and has largely taken over the stream bed. It is a close relative of Clidemia hirta (Koster's curse) which is also found along the edges of the stream. Two native plants, Pisonia umbellifera (Papala-kepau) and Pipturus albidus (Mamaki) still grow in the area, as does the tree fern Cibotium splendens.

The Well Site -Punaluu Wells V-D

This proposed site is just mauka of Punaluu Stream at about 90 m elevation in the Guava Zone (Egler 1939). The vegetation in the area is highly disturbed. The plant cover is composed of introduced tree, shrubs, vines and forbs. No native plants were seen during a search of the site.

The canopy is made up of Trema (Trema orientalis) trees, some 30 m in height with 2.5 m diameters. The understory is made up of very aggressive shrubs or small trees such as Shoebutton ardisia (Ardisia humilis), Christmas berry (Schinus terebinthifolius), Java plum (Eugenia cumini) and young Hala (Pandanus odoratissimus). The ground cover is mainly Basket grass (Oplismenus hirtellus). Many of the trees are covered with Bitter yam (Dioscorea bulbifera) vines.

The Well Site - Punaluu Tunnel

At the proposed tunnel site, at an elevation of about 175 m the overstory is made up of Kukui (Aleurites moluccana), Mountain apple (Eugenia malaccensis), Octopus (Brassaia actinophylla), and Hala (Pandanus odoratissimus) trees. The principle ground cover is the aggressive Melastome already mentioned, H. subtriplinervium. The polynesian food plants, Taro (Colocasia esculenta), and 'Ape (Alcacia macrorhiza) still persist in a few places

No rare, threatened or endangered plants were found during the survey. The existing vegetation is secondary scrub made up almost entirely of introduced trees and forbs.

References

Egler, F.E. 1939. Vegetation zones of Oahu, Hawaii. Empire

Forestry Journal 18(1):1-14.

Neal, M.C. 1965. In Gardens of Hawaii. Bis. Mus. Special Publication 50.

Bishop Museum Press.

StJohn, H. 1973. List and Summary of the Flowering Plants in the Hawaiian

Islands. Pacific Tropical Botanical Garden Memoir 1. Lawai, Kauai.

Punaluu Wells V-D and Tunnel Species List

This list is arranged by family, scientific name, common name, and status.

E = Endemic;

P = Polynesian introduction;

A = Alien.

Family	Scientific name	Common name	Status
Anacardiaceae	<u>Schinus terebinthifolius</u> Raddi	Brazilian peppertree	A
Araceae	<u>Alocasia macrorrhiza</u> (L.) Sweet	Ape	P
	<u>Colocasia esculenta</u> (L.) Schott	Taro	P
Araliaceae	<u>Brassaia actinophylla</u> Endl.	Octopus tree	A
Commelinaceae	<u>Commelina diffusa</u>	Honohono grass	A
Dicksoniaceae	<u>Cibotium splendens</u> Krajin	Hapu'u	E
Discoreaceae	<u>Dioscorea bulbifera</u> Don.	Bitter yam	P
	<u>D. pentaphylla</u> L.	Five-leaf yam	P
Euphorbiaceae	<u>Aleurites moluccana</u> Willd.	Kukui	P
Gramineae	<u>Bambusa</u> sp.	Bamboo	P
	<u>Oplismenus hirtellus</u> Beauv.	Basketgrass	P
Lauraceae	<u>Persea americana</u> Mill.	Avocado	A
Liliaceae	<u>Cordyline terminalis</u> Kunth	Ti	P
Melastomataceae	<u>Clidemia hirta</u> D. Don	Kosters curse	P
	<u>Heterocentron subtriplenervium</u>	Pearl flower	P
Musaceae	<u>Musa paradisiaca</u> var. <u>normalis</u> Ktze	Banana	P
Myrsinaceae	<u>Ardisia humilis</u> Vahl.	Shoebuttan ardisia	P
Myrtaceae	<u>Eugenia cumini</u> (L.) Druce	Java plum	P
	<u>E. malaccensis</u> L.	Mountain apple	P
Nyctaginaceae	<u>Pisonia umbellifera</u> Seem	Papala-kepau	E
Pandanaceae	<u>Pandanus odoratissimus</u> L.	Hala	P
Polypodiaceae	<u>Cyclosorus dentata</u> Ching	Oak fern	A
	<u>Nephrolepis exaltata</u>	Sword fern	A
Ulmaceae	<u>Trema orientalis</u> (L.) Bl.	Gun powder tree	P
Urticaceae	<u>Pipturus albidus</u> (H & A) Gray	Mamaki	E
Zingiberaceae	<u>Zingiber zerumbet</u> (L.) Smith	Shampoo ginger	P

Proposed Kaalaea Inclined Wells

Botanical Survey Report

Prepared by Evangeline J. Funk - Botanist

The site of the proposed Kaalaea Inclined Water Wells is at the head of Kaalaea Stream at approximately 240 m elevation. The access route has not been determined, therefore the botanical survey covers only the site of the proposed inclined well.

The aboriginal Hawaiians farmed this area. The remnants of several Polynesian plantings are still to be found in and around the site. Among these, 'Awa (Piper methysticum) is the most unusual. A narcotic drink was made of the roots of this plant. This drink was an important part of various rites and ceremonies. The plant can only be grown from rooted cuttings. There is also Taro (Colocasia esculenta) and Pi'ia (Dioscorea pentaphylla), both well known food plants. Other useful plants known to have been planted by the early Hawaiians - Mountain apple (Eugenia malaccensis), Kukui (Aleurites moluccana), and Ti (Cordyline terminalis) are dominant parts of the existing vegetation. In addition to the large number of plants of known polynesian introduction, along the stream there are many rock walls which are the remains of ancient taro patches. All these indicate that the area has been under direct human influence for many many years.

The tree canopy where the wells will be drilled is made up of Kukui trees of 15 to 20 m in height. The intermediate vegetation layer is Mamaki (Pipturus albidus), Ti, and a few Hapu'u (Cibotium splendens) ferns. The viny Ie'ie (Freycinetia arborea) and several vegetative Crytandra plants are about

all that remain of the native vegetation. No rare, threatened, or endangered plants were found during the survey. The site was found to be very disturbed and most of the vegetation is secondary scrub or introduced weeds.

References

Egler, F.E. 1939. Vegetation zones of Oahu, Hawaii. *Empire Forestry Journal* 18 (1) : 1-14.

Neal, M.C. 1965. In Gardens of Hawaii. Bis. Mus. Special Publication 50. Bishop Museum Press.

StJohn, H. 1973. List and Summary of the Flowering Plants in the Hawaiian Islands. Pacific Tropical Botanical Garden Memoir Number 1. Lawai, Kauai.

Kaalaea Inclined Wells Species List

This list is arranged by family, scientific name, common and status.

E = Endemic; P = Polynesian introduction; A = Alien.

<u>Family</u>	<u>Species</u>	<u>Common Name</u>	<u>Status</u>
Araceae	<u>Colocasia esculenta</u> Schott	Taro	P
Compositae	<u>Erechtites hieracifolis</u> Raf.	Fireweed	A
	<u>Pluchea indica</u> Less	Pluchea	A
Convolvulaceae	<u>Ipomea alba</u> L.	White morningglory	A
Discoreaceae	<u>Dioscorea bulbifera</u> Dcne.	Bitter yam	P
	<u>D. pentaphylla</u> L.	Five-leaf yam	P
Dicksoniaceae	<u>Cibotium splendens</u> Krajinna	Hapu'u	E
Euphorbiaceae	<u>Aleurites moluccana</u> Willd.	Kukui	P
	<u>Niruri phyllanthus</u> L.	Niruri	A
Gesneriaceae	<u>Cyrtandra</u> sp.	Cyrtandra	E
Gramineae	<u>Oplismenus hirtellus</u> Beauv.	Basketgrass	P
Liliaceae	<u>Cordyline terminalis</u> Kunth	Ti	P
Loganiaceae	<u>Buddleja asiatica</u> Lour.	Dogtail	A
Lythraceae	<u>Cuphea carthagenensis</u> MacBride	Tarweed	A
Melastomataceae	<u>Clidemia hirta</u> (L.) D. Don	Koster's curse	A
Moraceae	<u>Ficus benghalensis</u> L.	Banyan	A
Myrtaceae	<u>Eugenia malaccensis</u> L.	Mountain apple	P
	<u>Psidium guajava</u> L.	Guava	A
Musaceae	<u>Musa paradisiaca</u> var. <u>normalis</u>	Banana	P
Nyctaginaceae	<u>Pisonia umbellifera</u> Seem.	Papala-kepau	E
Pandanaceae	<u>Freycinetia arborea</u> Gaud.	Ie'ie	E
Piperaceae	<u>Piper methysticum</u> Forst.	'Awa	P

Polypodiaceae	<u>Adiantum capillus-veneris</u>	Maidenhair fern	A
	<u>Cyclosorus dentata</u> (Forsk) Ching.	Oak fern	A
Psilotaceae	<u>Psilotum nudum</u> (L.) Griseb	Moa	E
Rosaceae	<u>Rubus rosaefolius</u> Sm.	Thimbleberry	A
Rubiaceae	<u>Paederia foetida</u> L.	Maile pilau	A
Urticaceae	<u>Pipturus albidus</u> (H&A) Gray	Mamaki	E
Zingiberaceae	<u>Zingiber zerumbet</u> Smith	Shampoo ginger	A

Proposed Ahuimanu Inclined Wells

Botanical Survey Report

Prepared by Evangeline J. Funk - Botanist

The proposed site of the Ahuimanu Incline Wells and the proposed access route to the wells are located in an area that has been subjected to heavy human impact since pre-Cook times. These sites are in an area which has been classified as the Guava Zone (Egler 1939). Most of the native plants have been displaced by introduced trees, shrubs and grasses. Aboriginal use of this site for farming can be assumed by the presence of several cultigens of known polynesian introduction which are still growing in the area.

The Access Route

From the end of Hui Kelu Street past the Ahuimanu "272" Reservoir for the first 100 m the path of the proposed access road goes through an abandoned Banana patch (Musa paradisiaca). Beyond this old field to the abandoned jeep road that leads to the well site, the native vegetation has mostly been replaced by secondary scrub. Two native shrubs, Mountain naupaka (Scaevola gaudichaudiana) and 'Akia (Wikstroemia oahuensis) are common along the proposed access route. Both these taxa are common in this zone on Oahu. The most outstanding botanical feature of the area is the huge old Mango trees (Mangifera indica). Marie Neal (1965) wrote that such trees often indicate the site where an Hawaiian home once stood.

The abandoned jeep road goes through solid patches of 'Uluhe fern (Dicranopteris linearis) and a grove of Rose apple trees (Eugenia jambos) before reaching the well site. A few Ohia trees (Metrosideros collina) persist along the route. There are scattered Java plum (Eugenia cumini), Hala (Pandanus odoratissimus), and Hau (Hibiscus tiliaceus) trees all of which are common lowland plants.

The Well Site

The proposed well site is at the base of the Pali at about 140 m elevation. The rock walls found here are a clear indication of early polynesian agriculture. Remnants of Taro patches (Colocasia esculenta) and Banana plantings (Musa paradisiaca) are left-overs from those early farms. (Taro and banana plants do not grow from seed - they must be planted from rooted cuttings).

The dominant tree at the well site is Rose apple. There is a dense understory of Yellow ginger (Hedychium flavens). There are Avocado (Persea americana) and Coffee trees (Coffea arabica) as well as some introduced ferns such as Oak fern (Cyclosorus dentata) and Maidenhair fern (Adiantum capillus-veneris). The only native plants left in this area are Pisonia umbellifera, Peperomia latifolia, and a few vegetative Cyrtandra plants. The rock face is covered with mosses and liverworts. High up on the rock face of a massive exposed dike mauka of the well site is the native grass, Eragrostis variabilis. These plants will be effected if all of the water is taken from the stream. None of the plants are endangered. Most are common to similar sites on Oahu.

References

- Egler, F.E. 1939. Vegetation zones of Oahu, Hawaii. Empire Forestry Journal 18(1) :1-14.
- Neal, M.C. 1965. In Gardens of Hawaii. Bis.Mus. Special Publication 50. Bishop Museum Press.
- St. John, H. 1973. List and Summary of the Flowering Plants of the Hawaiian Islands. Pacific Tropical Botanical Garden. Memoir Number 1. Lawai, Kauai.

Ahuimanu Inclined Wells Species List

This list is arranged by family, scientific name, common name and status.

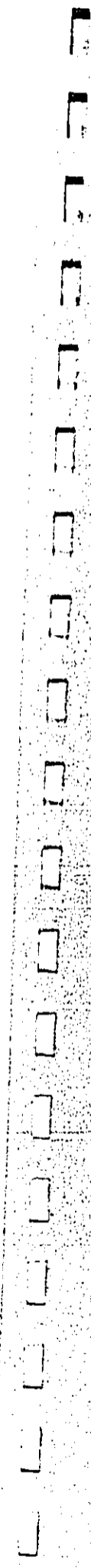
E = Endemic; P = Polynesian introduction; A = Alien.

Family	Scientific name	Common name	Status
Anacardeaceae	<u>Mangifera indica</u> L.	Mango	A
Araceae	<u>Colocasia esculenta</u> (L.) Schott	Taro	P
Comretaceae	<u>Terminalia catappa</u> L.	False kamari	A
Compositae	<u>Pluchea indica</u> (L.) Less	Indian pluchea	A
	<u>Wedelia trilobata</u> (L.) Hitchc	Wedelia	A
Convolvulaceae	<u>Ipomea alba</u> L.	White morningglory	A
Cyperaceae	<u>Machaerina angustifolia</u> Koyama	Uki	E
Dicksoniaceae	<u>Microlepia setosa</u> Alston	Palalai	E
Euphorbiaceae	<u>Aleurites moluccana</u> Willd.	Kukui	P
Gesneriaceae	<u>Cyrtandra</u> sp	--	E
Gleicheniaceae	<u>Dicranopteris linearis</u> Underw.	Uluhe	E
Goodeniaceae	<u>Scaevola gaudichaudiana</u>	Mauntain naupaka	E
Gramineae	<u>Andropogon virginicus</u> L.	Broomsedge	A
	<u>Eragrostis variabilis</u> (Gaud) Hbd.	Emo-loa	E
	<u>Heteropogon contortus</u> Beauv. ex R&S	Piligrass	P
	<u>Melinis minutiflora</u> Beauv.	Molassesgrass	A
	<u>Oplismenus hirtellus</u> Beauv.	Basketgrass	A
	<u>Paspalum conjugatum</u> Berg.	Hilograss	A
	<u>Sacciolepis striata</u> (L.) Nash	--	A
	<u>Setaria palmaefolia</u> Stapf.	Palmgrass	A
Lauraceae	<u>Persea americana</u> Mill.	Avocado	A
Leguminosae	<u>Leucaena leucocephala</u> deWit	Haole koa	A
	<u>Mimosa pudica</u> L.	Sensitive plant	A
Liliaceae	<u>Cordyline terminalis</u> Kunth	Ti	P
Malvaceae	<u>Hibiscus tiliaceus</u> L.	Hau	P
Melastomataceae	<u>Clidemia hirta</u> D. Don	Koster's curse	A
Musaceae	<u>Musa paradisiaca</u> var. <u>normalis</u> Ktze.	Banana	P
Myrtaceae	<u>Eugenia cumini</u> (L.) Druce	Java plum	A
	<u>Psidium cattleianum</u> f. <u>lucidum</u> Deg.	Waiawi	A
	<u>P. guajava</u> L.	Guava	A
	<u>Eugenia jambos</u> L.	Rose apple	A
	<u>Metrosideros collina</u> Gray	Ohia	E
Nyctaginaceae	<u>Pisonia umbellifera</u> Seem.	Papapa-kepau	E
Onagraceae	<u>Ludwigia octovalvis</u> Raven	Primerose willow	A
Orchidaceae	<u>Spathoglottis plicata</u> Bl.	Ground orchid	A
Pandanaceae	<u>Pandanus odoratissimus</u> L.	Hala	A
Piperaceae	<u>Peperomia latifolia</u> Miq.	Peperomia	E
Polypodiaceae	<u>Adiantum capillus-venieris</u>	Maidenhair fern	A
	<u>Cyclosorus dentata</u> Ching.	Oak fern	A
	<u>Nephrolepis exaltata</u>	Sword fern	A
Psilotaceae	<u>Psilotum nudum</u> Griseb.	Moa	E

Rubiaceae	<u>Coffea arabica</u> L.	Coffee	A
	<u>Paederia foetida</u> L.	Maile pilau	A
Thymeleaceae	<u>Wikstroemia oahuensis</u> Rock	Akia	A
Verbenaceae	<u>Stachytarpheta jamaicensis</u> Vahl	Jamaica vervain	A
Zingiberaceae	<u>Hedychium coronarium</u> Koenig	White ginger	A
	<u>H. flavens</u> Carey	Yellow ginger	A
	<u>Phaeomeria speciosa</u> Koord.	Torch ginger	A

APPENDIX F

ARCHAEOLOGICAL RECONNAISSANCE SURVEYS OF PROPOSED WELLS



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MALAEKAHANA, OAHU: ARCHAEOLOGICAL SURVEY
AT PROPOSED WELL LOCATION

Prepared for:
VTN PACIFIC
1164 Bishop Street
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Prepared by:
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CHINIAGO INC.
1040 B Smith St.
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AUGUST 1984

F-2

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by construction activities associated with the development of these wells. This report covers the proposed well at Malaekahana, which is to be located on a small eroded ridge above Malaekahana Stream at an elevation of approximately 130 feet [Figures 1 and 2].

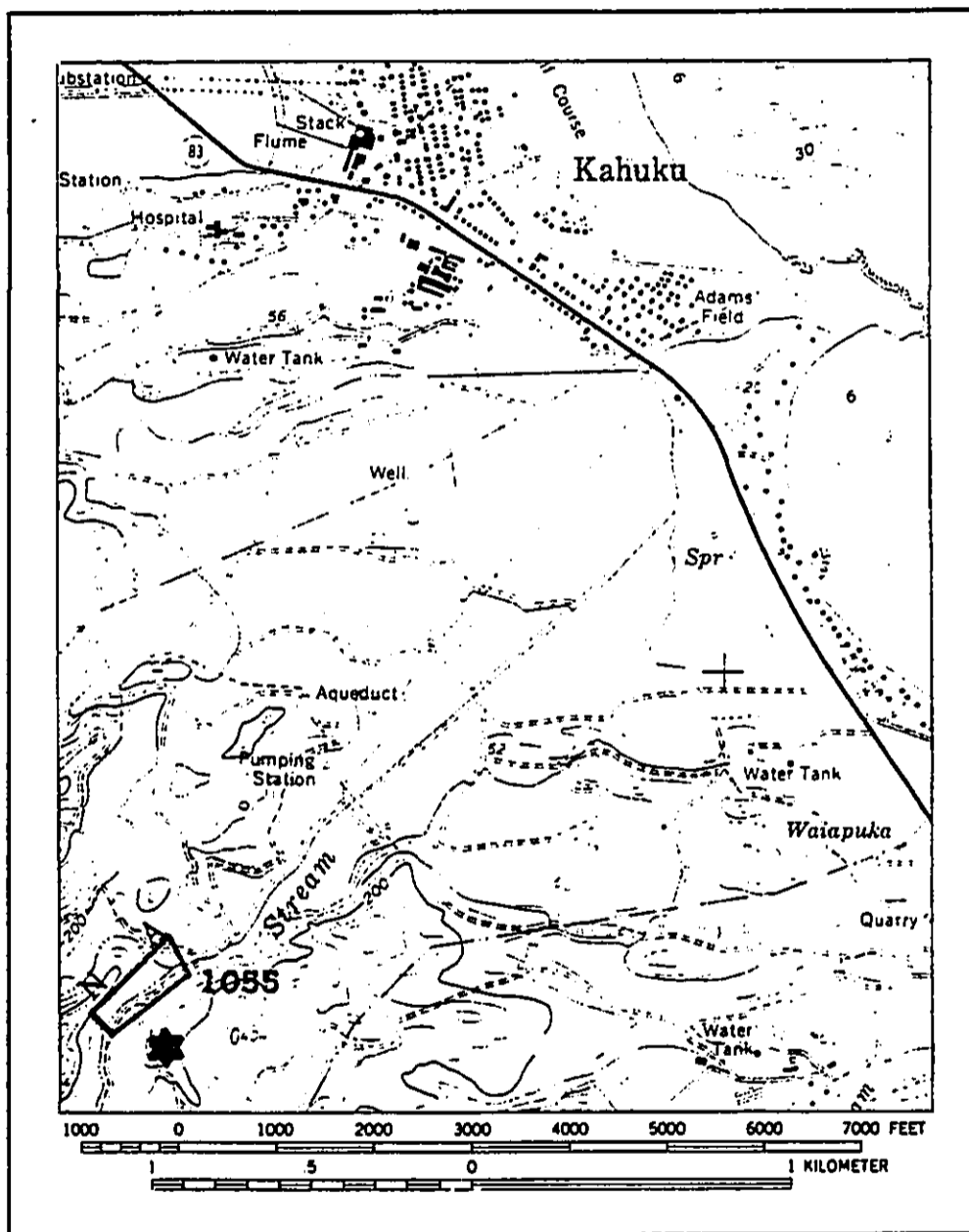


Figure 1. Location of Malaekahana Wellsite.



Figure 2. Malaekahana Well Site, Looking west.

Literature Search

Site maps on file at the Historic Sites Section of the Department of Land and Natural Resources indicate that Site 50-80-02-1055 is located in the streambed immediately below the proposed well location. However, an inspection of the descriptive records at the Historic Sites Section indicates that Site 1055 is a rock shelter located at Wailupe, on the other side of the island. There is apparently no way to determine the whereabouts of the correct records for the site at the Malaekahana location.

Handy is uncharacteristically brief in describing the agricultural resources of the valley:

"Malaekahana. There were terraces in this ahupua'a, irrigated by Kaukanalaau Stream" [Handy 1940:89].

McAllister [1933] reports a few sites along the coast, but none anywhere near the location presently in question, and the same goes for Sterling and Summers [1968].

An attempt to locate old maps at the State Survey Office revealed that the Malaekahana map was missing.

Field Inspection

No archaeological or historical sites were observed at the proposed location of the well nor along the existing jeep road, which is the intended right-of-way for its associated pipeline. Across Malaekahana Stream from the proposed well site is a complex of terrace walls and a possible auwai, or water channel. This is probably the site shown on the Historic Sites Section map under the incorrect number. On the south side of the jeep road is a large stacked basalt rock wall [Figure 3] and a concrete structure, neither of which would be endangered by construction of either the well or the pipeline.



Figure 3. Stone Wall on South Side of Malaekahana Stream.

Conclusions

Even though we did not observe any sites in proposed construction areas, the presence of terrace walls and a possible auwai on the opposite side of Malaekahana Stream indicate the possibility that sub-surface evidence of aboriginal agricultural practices may be present along the anticipated pipeline right-of-way. We therefore recommend that a test pit survey be conducted along that right-of-way prior to any ground disturbance in order to determine the presence or absence of such remains. If such evidence is found to be present, it is highly unlikely that it will be of such significance that it would have to be preserved, and archaeological salvage excavations will undoubtedly be a proper mitigative measure.

Sources Consulted

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop
Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin
104. Honolulu.

[This report presents the results of a selective arch-
aeological survey of the island of Oahu.]

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and
excavation reports on file at the Historic Sites Sec-
tion.

State of Hawaii Survey Office

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Educa-
tion, Bernice P. Bishop Museum. Honolulu.

[This is a compilation of information from numerous
sources concerning the archaeological sites, history,
traditions, legends, place names and land descriptions
from the island of Oahu.]

LAIE, OAHU: ARCHAEOLOGICAL SURVEY
AT EXISTING WELL LOCATION

Prepared for:
VTN PACIFIC
1164 Bishop Street
Honolulu, Hi. 96813

Prepared by:
William Barrera, Jr.

CHINIAGO INC.
1040 B Smith St.
Honolulu, Hawaii 96817

AUGUST 1984

F-7

Introduction

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply well sites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by construction activities associated with the development of these wells. This report covers an existing well at Laie, which is located on a ridge between Kaaao and Ihihi gulches at an elevation of 184 feet [Figures 1 and 2].

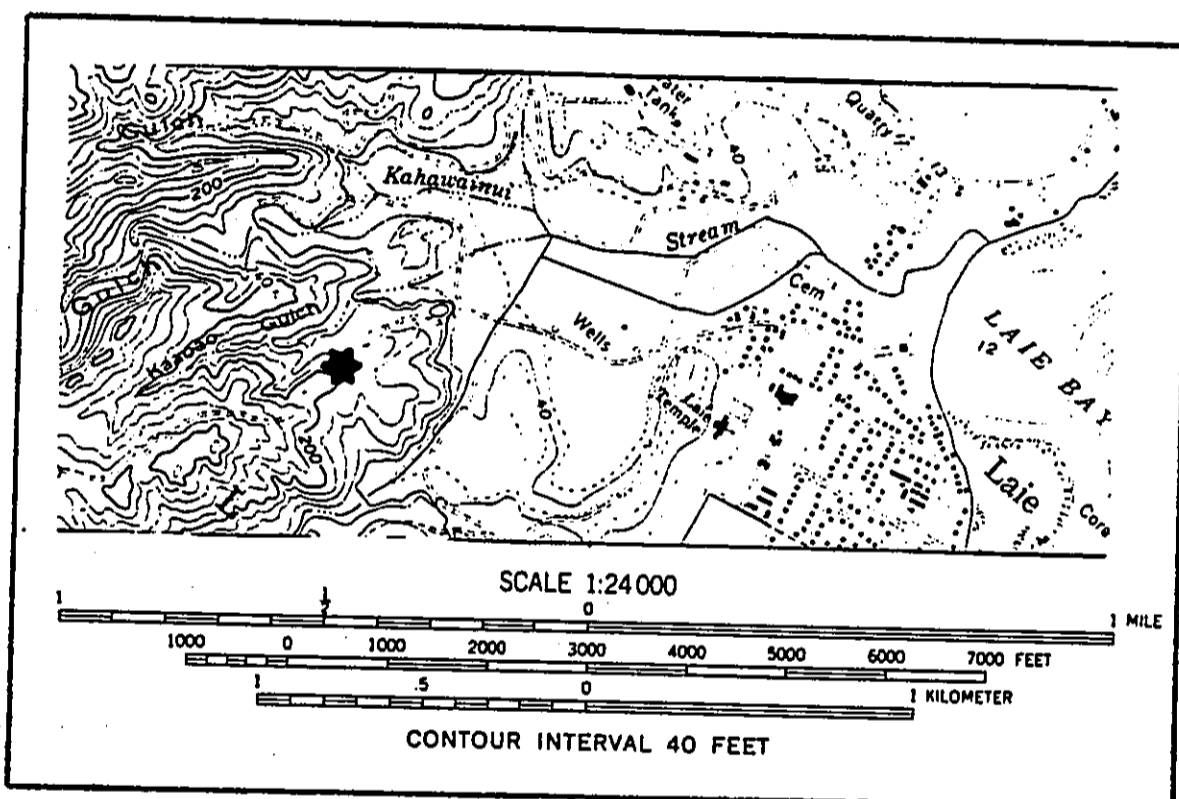


Figure 1. Location of Laie Well.

Literature Search

Handy [1940:89] provides the following information about the flat coastal strip below the well site:

"Kapuna--The comparatively flat land between the hills and the seacoast in Laie was divided into many clearly named small districts in the old days--a considerable portion of it, back from the beach strip, having been planted in



Figure 2. Location of Laie Well.

wet taro. Kekuku, 75-year old kamaaina of the place, says that one of the largest single areas formerly under taro cultivation was the land, over 60 acres in extent, lying back of the present Mormon Temple, and known as Kapuna [the spring] because it was watered by one large and several lesser springs."

McAllister [1933] discusses a number of agricultural, religious and legendary sites in the Laie region, but none in the vicinity of the Laie Well site.

Field Inspection

The field inspection demonstrated that there are no archaeological or historical sites at the well site, as construction of the existing well involved massive clearing by heavy equipment. There were also no sites observed along the jeep road which is under consideration as the pipeline route.

Conclusions

The well site itself has already been developed, so there is no need for further archaeological work there. However, where

the pipeline route crosses the coastal plain there is potential for disturbing sub-surface agricultural remains. For this reason we recommend that the proposed right-of-way through this area be subjected to an intensive sub-surface survey to determine the presence or absence of buried remains. If evidence of significant historic or prehistoric remains is found to be present, it is highly unlikely that it will be of such significance that it would have to be preserved, and archaeological salvage excavations will undoubtedly be a proper mitigative measure.

Sources Consulted

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

[This report presents the results of a selective archaeological survey of the island of Oahu.]

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and excavation reports on file at the Historic Sites Section.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Education, Bernice P. Bishop Museum. Honolulu.

[This is a compilation of information from numerous sources concerning the archaeological sites, history, traditions, legends, place names and land descriptions from the island of Oahu.]

WAILELE, OAHU: ARCHAEOLOGICAL SURVEY
AT PROPOSED WELL LOCATION

Prepared for:
VTN PACIFIC
1164 Bishop Street
Honolulu, Hi. 96813

Prepared by:
William Barrera, Jr.

CHINIAGO INC.
1040 B Smith St.
Honolulu, Hawaii 96817

AUGUST 1984

F-12

Introduction

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply well sites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by construction activities associated with the development of these wells. This report covers an existing well at Wailele, which is located adjacent to Wailele Gulch inland of the Polynesian Cultural Center at an elevation of 109 feet [Figures 1 and 2].

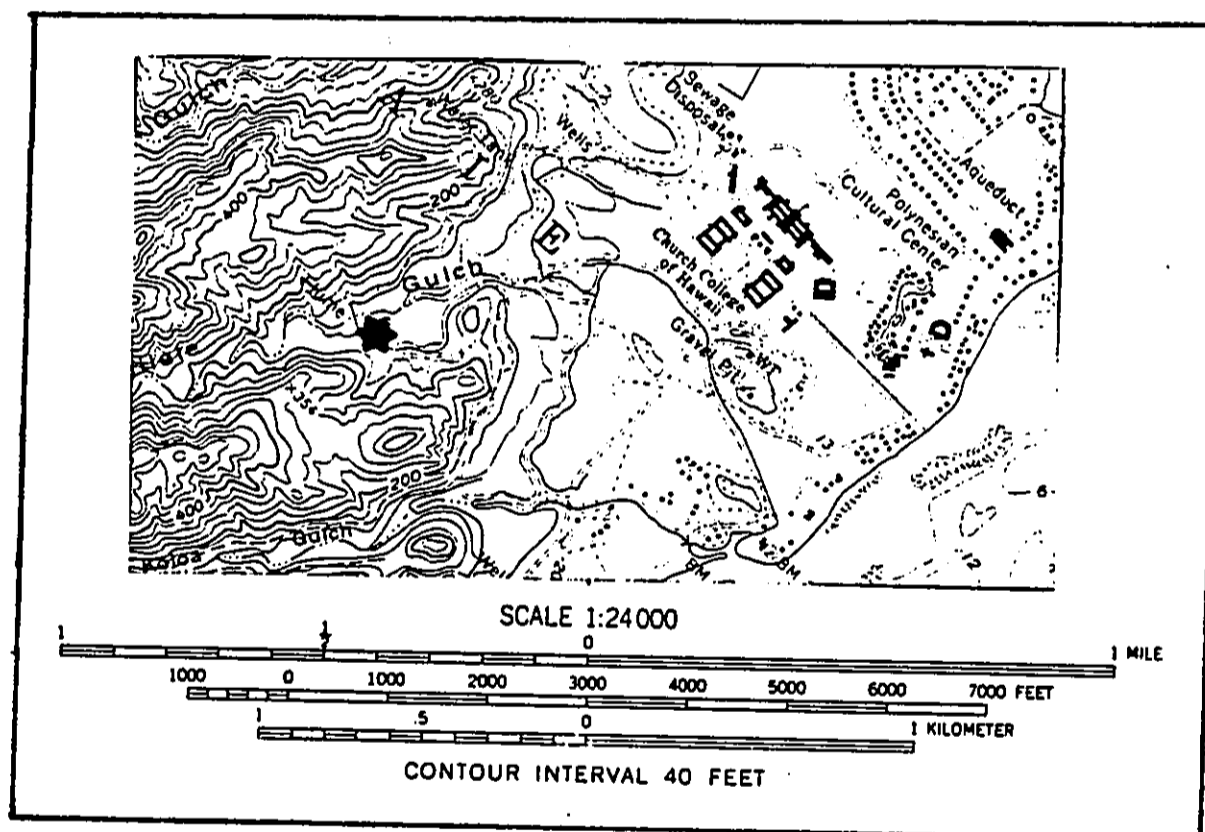


Figure 1. Location of Wailele Well.

Literature Search

Handy [1940:89] provides the following information about the flat coastal strip below the well site:

"Kapuna--The comparatively flat land between the hills and the seacoast in Laie was divided

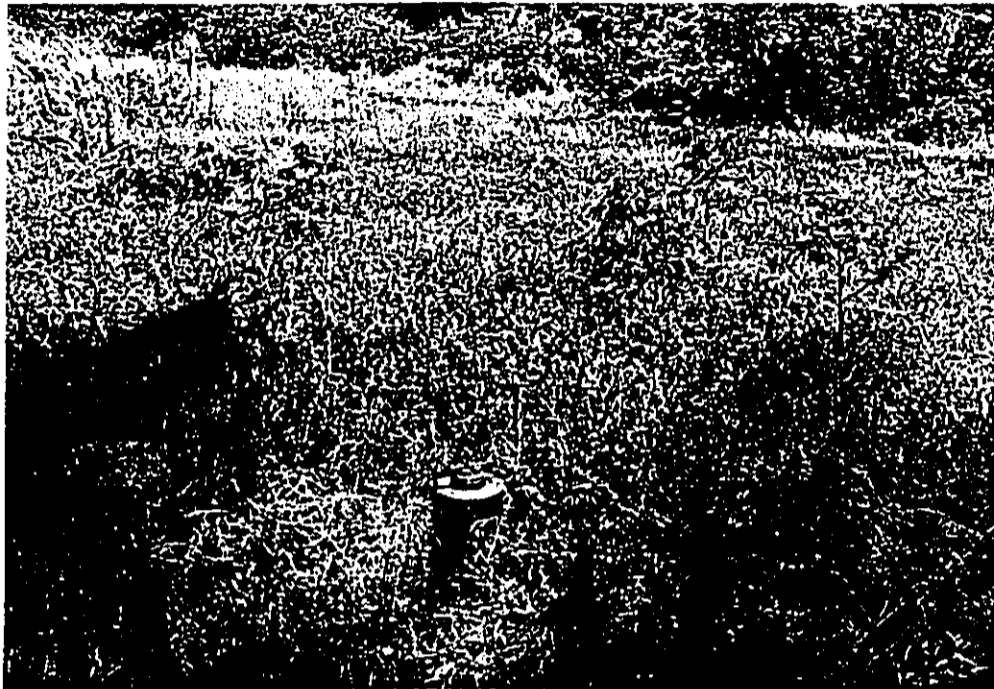


Figure 2. Location of Wailele Well.

into many clearly named small districts in the old days--a considerable portion of it, back from the beach strip, having been planted in wet taro. Kekuku, 75-year old kamaaina of the place, says that one of the largest single areas formerly under taro cultivation was the land, over 60 acres in extent, lying back of the present Mormon Temple, and known as Kapuna [the spring] because it was watered by one large and several lesser springs."

Of Wailele Gulch itself, Handy has only the following to offer:

"About 2.5 miles up Wailele Stream there are evidences of old taro terraces" [Ibid:89].

McAllister provides the following discussion of the area seaward of the wellsite:

"Site 282. Taro land, Hauula side of the Mormon temple. A flat lowland, now drained and planted in cane, formerly a famous taro land. The old Hawaiian name for the region is now

lost and it is known as Kanaana, an adaptation of Canaan, the Land of Promise of the Israelites. In with the taro were extremely large fish. One of the old Hawaiians remembers that one day in her childhood, while her parents were gathering taro, as she swam and played in the water she was knocked senseless by a fish. About this taro land the old Hawaiian settlement was located and on the mountain side of the site are the only foundations of a heiau in Laie" [McAllister 1933:158].

Field Inspection

The field inspection demonstrated that there are no archaeological or historical sites at the wellsite, and none were observed along the proposed pipeline route.

Conclusions

The wellsite itself has already been developed, so there is no need for further archaeological work there. However, the pipeline route has the potential for encountering sub-surface agricultural remains. For this reason we recommend that the proposed right-of-way through this area be subjected to an intensive sub-surface survey to determine the presence or absence of buried remains. If evidence of significant remains is found to be present, it is highly unlikely that it will be of such significance that it would have to be preserved, and archaeological salvage excavations will undoubtedly be a proper mitigative measure.

Sources Consulted

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

[This report presents the results of a selective archaeological survey of the island of Oahu.]

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and excavation reports on file at the Historic Sites Section.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Education, Bernice P. Bishop Museum. Honolulu.

[This is a compilation of information from numerous sources concerning the archaeological sites, history, traditions, legends, place names and land descriptions from the island of Oahu.]

**KAIPAPAU, OAHU: ARCHAEOLOGICAL SURVEY
AT PROPOSED WELL LOCATIONS**

**Prepared for:
VTN PACIFIC
1164 Bishop Street
Honolulu, Hi. 96813**

**Prepared by:
William Barrera, Jr.**

**CHINIAGO INC.
1040 B Smith St.
Honolulu, Hawaii 96817**

AUGUST 1984

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During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward side of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by construction activities associated with the development of these wells. This report covers the two proposed wellsites at Kaipapau [Figure 1]. The primary location is at an elevation of about 140 feet, about 3,000 feet into Kaipapau Gulch. The alternate site is at an elevation of about 120 feet, near the mouth of Kaipapau Gulch. Both sites are on the north side of Kaipapau Gulch.

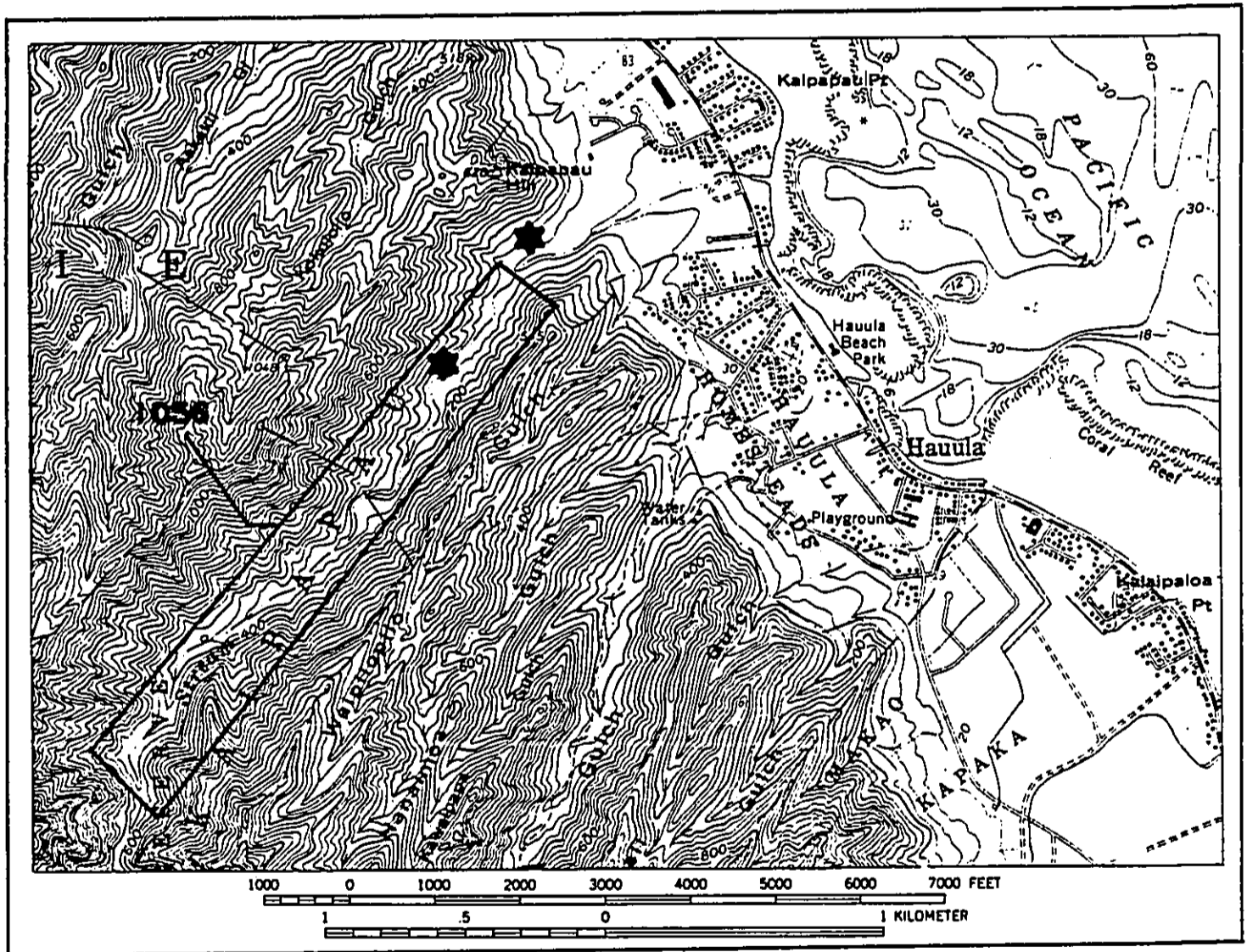


Figure 1. Location of Kaipapau Wellsites.

Literature Search

A number of published and unpublished sources were checked to determine the presence or absence of known archaeological or historical sites. McAllister's 1933 volume on the archaeology of the island of Oahu does not include any sites in Kaipapau valley. Handy [1940:91] states:

"Kaipapau was a large stream giving this ahupua'a its name. The level land opening out below the valley, now in cane, was presumably all in terraces. Hauula natives say that there are old taro flats along the stream up the valley, which is very narrow and steep."

A search of the records at the State Historic Preservation Office gives the following information about Site 50-80-05-1056 [Figure 1]:

"This area contained one platform; others reported but not surveyed due to thick vegetation."

"Vegetation cover was so thick that it was virtually impossible to get a clear idea of what the valley contains. However, to judge from the success of other valley surveys [Makaha and Kahana], it is possible that a taro complex and possibly house structures will be found. It is suggested that this be considered an area of moderate significance sufficient to warrant a survey prior to any disturbance."

Inspection of maps on file at the State Survey Office failed to reveal anything of historical or archaeological value in Kaipapau.

Field Investigation

The locations of the proposed wellsites could not be visited because of the lack of permission to enter onto the property. The localities were observed from the top of the ridge to the south, but of course this was insufficient for a determination of historical or archaeological significance.

Conclusions

Because first-hand observations were not made, conclusions can be based only on the sparse documentation quoted above. It is therefore recommended that before any construction is undertaken, including grubbing or clearing of an access road to the proposed wellsite, an archaeological reconnaissance be conducted to determine the presence or absence of significant archaeo-

logical or historical remains. If any are found, an assessment of significance and a determination of appropriate mitigative procedures would then have to be made.

Sources Consulted

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop
Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin
104. Honolulu.

[This report presents the results of a selective
archeological survey of the island of Oahu.]

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and
excavation reports on file at the Historic Sites
Section.

State Survey Office

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and
Education, Bernice P. Bishop Museum. Honolulu.

[This is a compilation of information from numerous
sources concerning the archaeological sites, history,
traditions, legends, place names and land descriptions
from the island of Oahu.]

MAAKUA, OAHU: ARCHAEOLOGICAL SURVEY
AT PROPOSED WELL LOCATIONS

Prepared for:
VTN PACIFIC
1164 Bishop Street
Honolulu, Hi. 96813

Prepared by:
William Barrera, Jr.

CHINIAGO INC.
1040 B Smith St.
Honolulu, Hawaii 96817

AUGUST 1984

F-22

Introduction

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by construction activities associated with the development of these wells. This report covers three locations at Maakua, two of which are Board of Water Supply choices and the third of which is the choice of the State of Hawaii Department of Land and Natural Resources, Water and Land Development Division. The primary site of the Board of Water Supply is located on the northwest side of Maakua Gulch at an elevation of approximately 160 feet, the alternate is situated at the mouth of Hanaimoa Gulch at an elevation of approximately 110 feet, and the DLNR site is located on the tip of the ridge on the east side of Maakua Gulch at an elevation of about 190 feet [Figures 1-3].

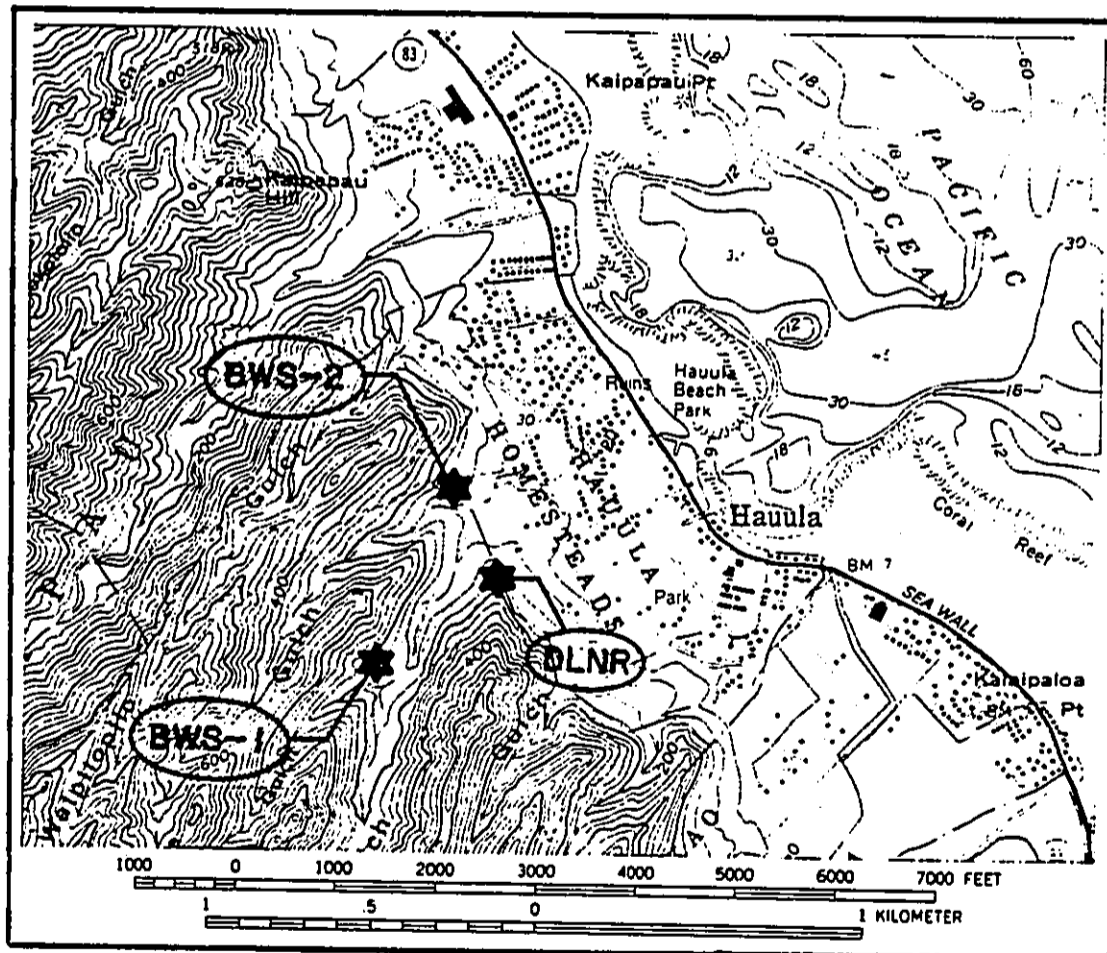


Figure 1. Locations of Maakua Wellsites.



Figure 2. Primary BWS Maakua Wellsite, looking southwest.



Figure 3. Alternate BWS Maakua Wellsite, looking south.

Literature Search .

Handy described the evidence for former agricultural practices in the area:

"Hauula. The flats along the coast in Hauula were once all in terraces, irrigated by the valley's five streams: Hanaimoa, Kawaipapa, Makua, Papale, and Punaiki. The courses of these streams are all very narrow and steep. There are the remains of a few small terrace sections in the interior of Makua. A number of small wet taro plantations are still under continuous cultivation between Papale and Makua Streams. Some of the old terraces between these streams, just inland from the highway, were being rehabilitated in 1935" [Handy 1940:91]

McAllister described a temple site which, judging from his imprecise map, may have been located near the DLNR well site:

"Site 286. Kaunihokahi heiau, Hauula.

"Only the upper platforms or portions on the mountain side of this heiau remain. The lower platforms have been used to make cattle pens for the dairy now located on the site. The remains of this one platform, which is roughly 160 by 40 feet, indicate a large heiau. The longest side, which is a high terrace ranging between 10 feet and 15 feet in length, is nearly parallel with the sea and faces almost due east" [McAllister 1933:158].

A map of kuleana at Hauula on file at the State Survey Office shows no historical or archaeological sites in the vicinities of the wellsites in question.

Field Inspection

No archaeological or historical remains were seen at any of the proposed wellsites. An extensive system of well-preserved rock walls, some free-standing and some of which may have been agricultural terraces, were observed on the south side of the trail to the primary Board of Water Supply Well site, and a long stone wall was observed on the north side of the trail.

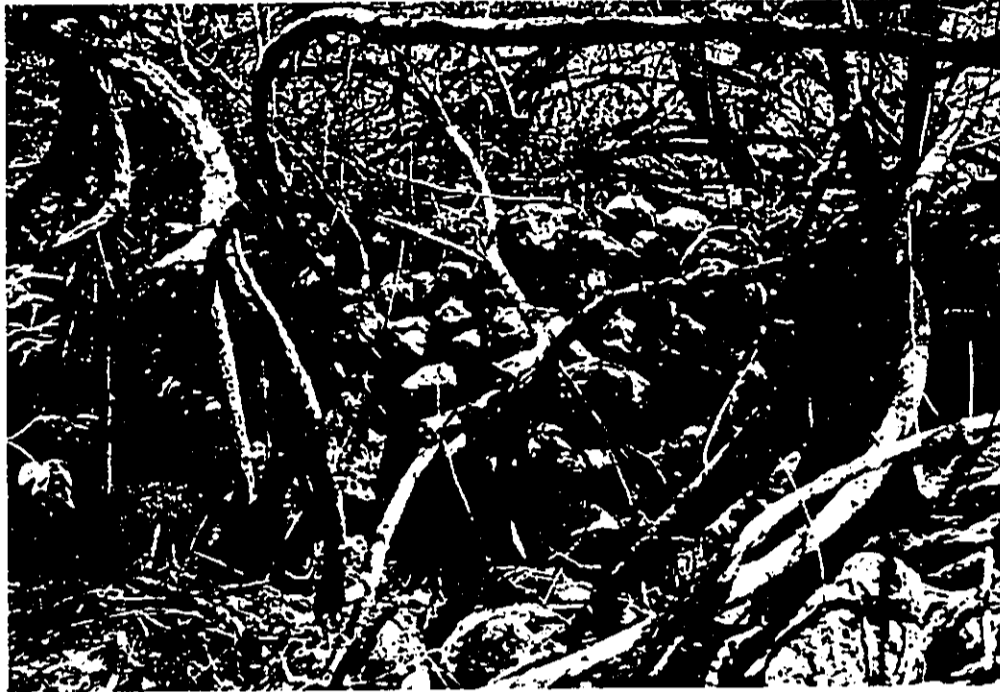


Figure 4. Stone Wall on south side of proposed pipeline right-of-way, primary BWS Maakua Wellsite.

Conclusions

Because old stone walls were found on either side of the trail which is the proposed right-of-way of the pipeline for the primary Board of Water Supply Maakua wellsite, we recommend that a test pit survey be conducted along that route prior to any ground disturbance in order to determine the presence or absence of sub-surface remains.

Handy's statements to the effect that the flatlands between the hills and the ocean were once extensively terraced indicate the possibility that sub-surface evidence of aboriginal agricultural practices may be present in those areas. We therefore recommend that the rights-of-way of any pipelines from any of the three proposed wellsites through this area be subjected to a test pit survey.

If evidence of significant historic or prehistoric remains is found to be present at any of these locations, it is highly unlikely that it will be of such significance that it would have to be preserved, and archaeological salvage excavations will undoubtedly be a proper mitigative measure.

Sources Consulted

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

[This report presents the results of a selective archaeological survey of the island of Oahu.]

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and excavation reports on file at the Historic Sites Section.

State of Hawaii Survey Office

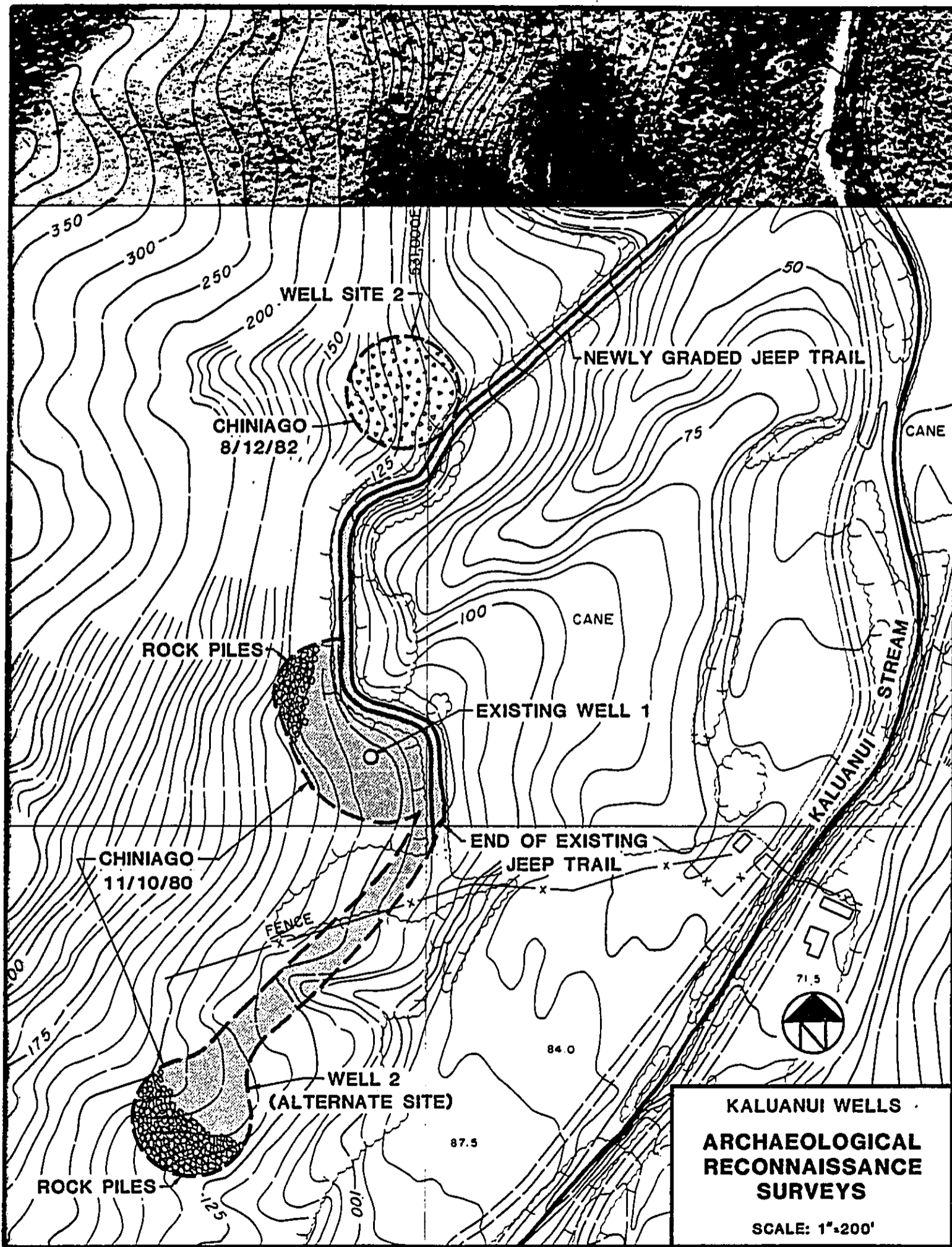
Registered Map No. 1999 of Hauula.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Education, Bernice P. Bishop Museum. Honolulu.

[This is a compilation of information from numerous sources concerning the archaeological sites, history, traditions, legends, place names and land descriptions from the island of Oahu.]

**KALUANUI, OAHU: ARCHAEOLOGICAL SURVEYS
AT PROPOSED WELL LOCATIONS**



CHINIAGO INC.

Archaeological Consulting

76 N. KING STREET, ROOM 202 • HONOLULU, HAWAII 96817 • TELEPHONE: (808) 521-2785

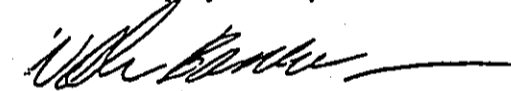
November 28, 1980

Mr. Fred Proby
VTN Pacific
1164 Bishop Street
Suite 906
Honolulu, Hawaii 96813

Dear Mr. Proby:

On November 10 we conducted an archaeological reconnaissance survey of two proposed well-sites at Kaluanui Valley, Oahu, each of which consisted of a 200-foot diameter circle [indicated on the enclosed map], plus a proposed roadway connecting them to the main valley access road. No definite archaeological or historical remains were found, but the presence of rock piles which may be of human origin requires that caution be exercised during construction. These remains, which are located at the northern edge of the easternmost well-site and on the western half of the westernmost well-site, should not represent any impediment to the project as there appears to be sufficient space available for the construction activities. We will be happy to show the Board of Water Supply people the locations of the areas which we recommend that they avoid.

Sincerely yours,



William Barrera, Jr.
President

E-1-10

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 521
HONOLULU, HAWAII 96809

SUSUMU ONO, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES
EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN
DIVISIONS:
CONSERVATION AND ENFORCEMENT
CONVEYANCES
FISH AND GAME
FORESTRY
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

JAN 12 1981

Mr. Larry Whang
Engineering Branch
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Whang:

SUBJECT: Evaluation of the archaeological report on the two Board of Water Supply well sites and access road in Kaluanui Valley, Koolauloa, Oahu. TMK: 5-3-11:por. 9

A review of the archaeological work carried out by William Barrera, Jr. for the Board of Water Supply well project at Kaluanui indicated that the work is not sufficient to evaluate the structural forms located during the archaeological survey. The report mentions the presence of several "rock piles" within the two well sites. From prior work in this vicinity, these piles appear cultural but of uncertain function and temporal period. For this phase of the archaeological survey, several recommendations for additional work in the well site areas are being made. These include:

- 1) A statement of the criteria for evaluating the features which involves criteria for cultural/non-cultural determinations and significance/non-significance.
- 2) A description of the rock piles with some indication of size, confirmation, and rock size and form.
- 3) A statement about the number of piles and their location. A more precise map would aid both the BWS planning and the State Park's archaeological program.
- 4) Photographs of the features would be a good means of recording the size and form of these rock piles and aid in the site evaluation. However, this need not be a requirement.

Mr. Larry Whang
Page 2

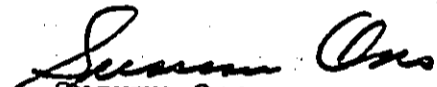
- 5) Consider the impact of the BWS project area on the adjacent archaeological site. There is a dryland agricultural complex located by Rosendahl during a 1973 survey that is near the southern well site.

There is agreement on Barrera's statement about exercising caution during construction. Because none of these rock piles have been tested, they are of uncertain value and significance. Consequently, it would be recommended that one of the piles be tested when the machinery is in the field and monitored by an archaeologist. The use of machinery will be required if the piles consist of huge boulders as noted elsewhere in Kaluanui. The BWS can determine if it is to their benefit to avoid these features or salvage them.

The planned trip with Barrera and the BWS engineers may alleviate some of the vagueness in the archaeological report. However, because there is a need to coordinate the BWS and State Park's archaeological programs, we are requesting a more detailed report. In this way, the cultural features in the BWS area can be incorporated into the larger Kaluanui archaeological complex.

Thank you for the opportunity to respond to this report.

Sincerely yours,



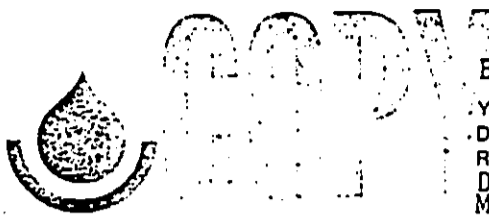
Susumu Ono
Chairman of the Board and
State Historic Preservation
Officer

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

630 SOUTH BERETANIA

HONOLULU, HAWAII 96843



EILEEN ANDERSON, Mayor

YOSHIE H. FUJINAKA, Chairman

DAT QUON PANG, Vice Chairman

RYOKICHI HIGASHIONNA

Donna M. Howard

Michael J. Chun

ROBERT A. SOUZA

CLAUDE T. YAMAMOTO

January 30, 1981

KAZU HAYASHIDA
Manager and Chief Engineer

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

Dear Mr. Ono:

Subject: Your Letter of January 12, 1981 on
the Evaluation of the Archaeological
Report on the Two Board of Water
Supply Well Sites and Access Road in
Kaluanui Valley, Koolauloa, Oahu
TMK: 5-3-11: por. 9

A field trip was made to the two well sites on Wednesday,
January 21, 1981, by the following persons:

1. State archaeologist, Martha Yent, Department of Land and Natural Resources
2. State archaeologist, Jason Ota, Department of Land and Natural Resources
3. Kaluanui Wells Environmental Impact Statement consultant, Fred Proby
4. Consultant's archaeologist, William Barrera, Jr.
5. Board of Water Supply engineers: Lawrence Whang, Francis Fung and Ernest Lau

After viewing and discussing the well sites with your staff, they informed us that William Barrera, Jr.'s archaeological report of the two well sites and access road was acceptable and no additional report is needed.

F-33



Mr. Susumu Ono

-2-

January 30, 1981

We have, however, selected the sites for the proposed well drilling, control building and appurtenances, and access road to avoid the rock piles.

Our project engineer for the Kaluanui Wells is Francis Fung who was present on the field trip. As project engineer, Francis Fung will coordinate any future construction and design to avoid the rock piles.

If you have any questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: IVTN Pacific

CHINIAGO INC.

Archaeological Consulting

1040-B SMITH STREET • HONOLULU, HAWAII 96817 • TELEPHONE: (808) 521-2785

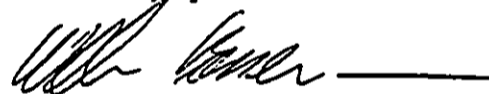
August 16, 1982

Mr. Fred Proby
VTN Pacific
1164 Bishop Street
Suite 906
Honolulu, Hi. 96813

Dear Mr. Proby:

On August 12, 1982 I accompanied you, Mr. Larry Whang of the Department of Water Supply and Ms. Martha Yent of the Division of State Parks on an inspection of the proposed site of Kaluanui Exploratory Well #2 at Sacred Falls, Oahu. This letter is to confirm that nothing of archaeological or historical interest was located and that in our opinion the project may proceed as planned without fear of disturbing any such sites.

Sincerely yours



William Barrera, Jr.
President

PUNALUU, OAHU: ARCHAEOLOGICAL SURVEY
AT PROPOSED WELL LOCATIONS

Prepared for:
VTN PACIFIC
1164 Bishop Street
Honolulu, Hi. 96813

Prepared by:
William Barrera, Jr.

CHINIAGO INC.
1040 B Smith St.
Honolulu, Hawaii 96817

AUGUST 1984

F-36

Introduction

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by construction activities associated with the development of these wells. This report covers seven wells at Punaluu [Figure 1].

Literature Search

Handy discussed the agricultural remains in Punaluu Valley:

"In the upper valley, reached by forest reserve trail, and above the water gate [about 2.5 miles from the sea] there is a level area beside the stream, now covered with puhala and hau, which was once planted in taro. Beyond this point, where the stream winds back into the mountains, are similar flatlands by the stream side. A quarter of a mile below the water gate, broad flats begin on alternate sides of the winding stream; at first these are only about 100 yards wide but gradually widen to 300 or 400 yards before the valley opens into the broad coastal plain of Punaluu. These flats were terraced. On the steep western hillside above the upper flats there are old breadfruit trees. At the lower end of the valley on the southern side is a flourishing plantation with about 25 terraces now in taro. From here the valley becomes increasingly broad for about three quarters of a mile and is planted in cane, with some grasslands along the stream and on the hillsides, and a few banana groves. All the way to the sea the grasslands and the canefields, when cut over or newly planted, show clearly the outlines of old terraces. This, then was formerly a continuous area of terraces, watered by Punaluu Stream, widening from a quarter of a mile above to half a mile at the base of the valley and spreading out like a fan on the coastal plain over an area four tenths of a mile long and eight tenths of a mile wide" [Handy 1940:91-2].

Figure 1 shows the locations of two clusters of sites reported by Denison, who conducted an archaeological reconnaissance survey in 1975. His site table is presented in the Appendix.

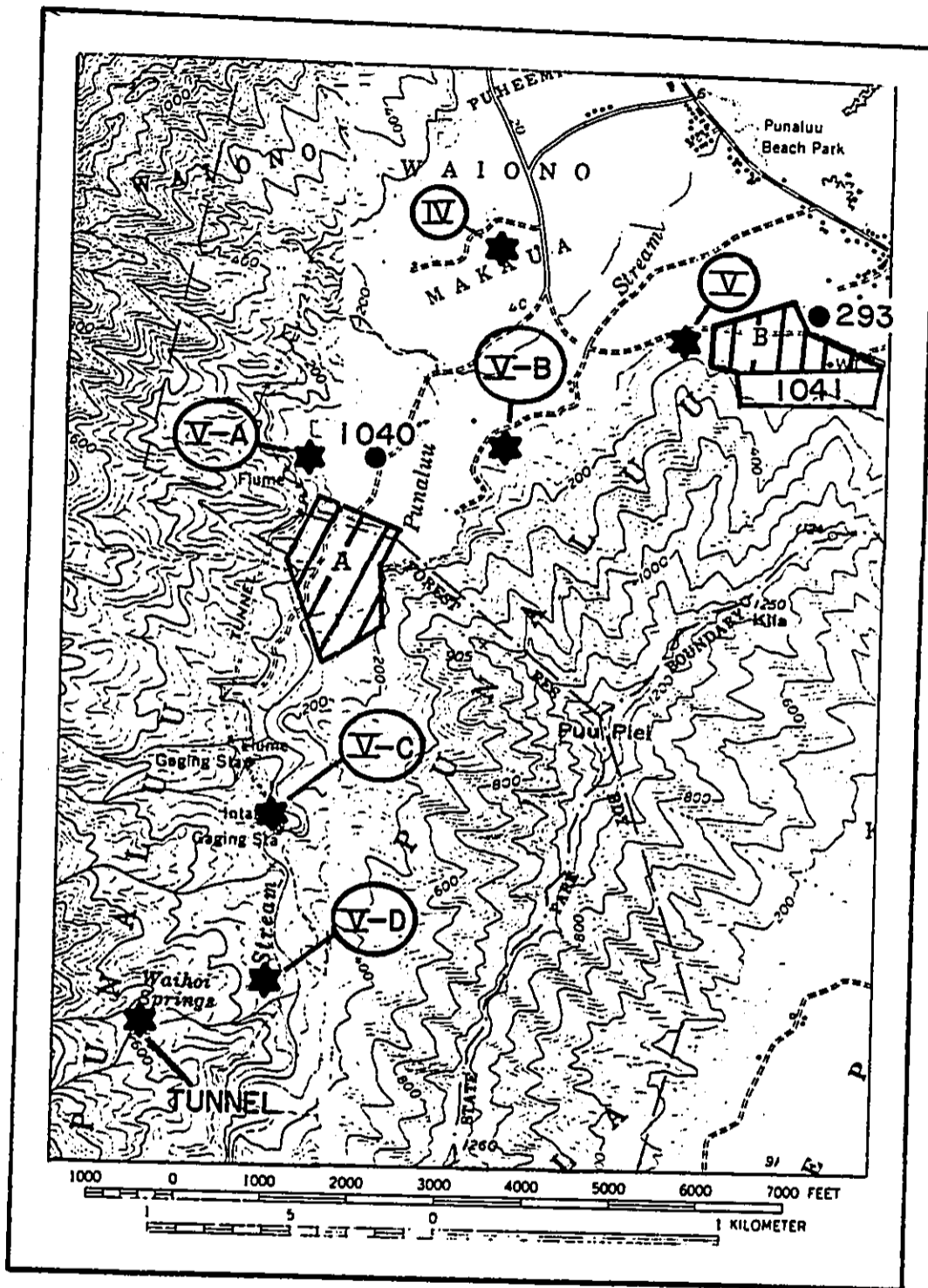


Figure 1. Locations of Punaluu Wellsites.
 A = Denison's Sites 4, 8-15, and 21-26
 B = Denison's Sites 2-3, 16-18, 27 and 30



Figure 2. Location of Punaluu Well V.



Figure 3. Location of Punaluu Well V-A.



Figure 4. Location of Punaluu Well V-B.



Figure 5. Location of Punaluu Well V-C.

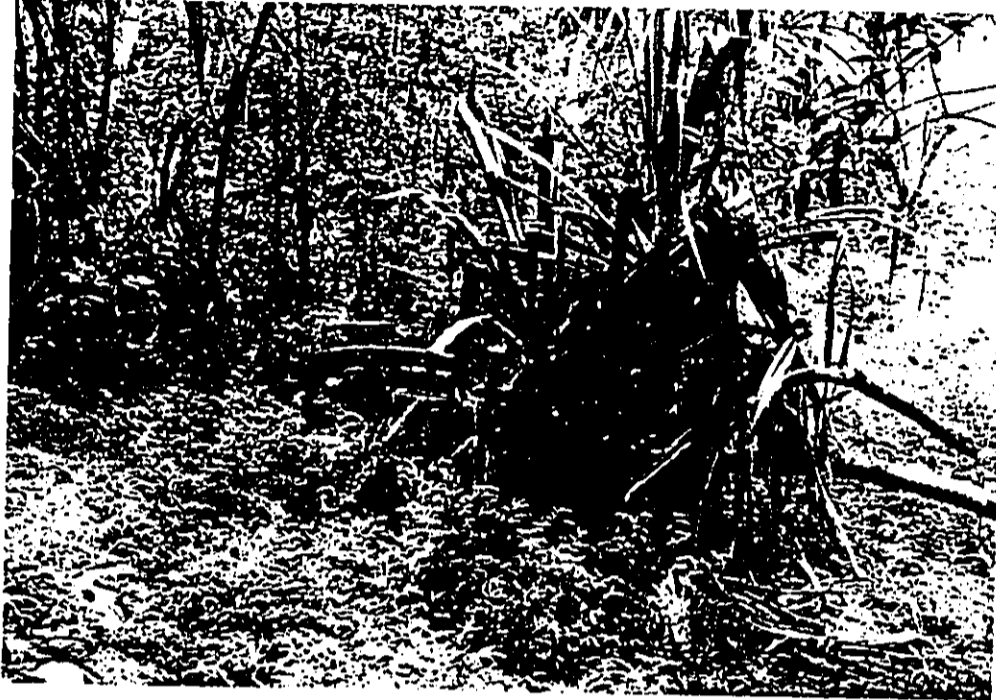


Figure 6. Location of Punaluu Well V-D.



Figure 7. Location of Punaluu Tunnel or Inclined Wells.

McAllister reported a heiau, Site 291, in the canefields somewhere seaward of the location of Punaluu Well V-A, and two more, Sites 292 and 293, just to the east of the location of Punaluu Well V [Site 292, not shown on the map, was located immediately south of Site 293]:

"Site 291. Maka heiau, Mahikee, Makaua-uka, Punaluu.

"A two-platform or possibly three-platform heiau measuring 70 by 150 feet. The platforms are separated one from the other by terraces and surrounded by walls which are now only a few feet in height. The structure is located within a cane field, and as the interior of the heiau is under cultivation any smaller features have been obliterated. Surrounding walls and terraces are all that remain."

"Site 292. Possible heiau, mountain side of Hanawao at the edge of a cane field, Punaluu,

"The name is not known. The remains indicate a heiau of at least three platforms, with a heavy rock terracing on the lower platform. Cane has been planted throughout the structure and the upper platforms have been almost completely demolished.

"Site 293. Hanawao heiau, Punaluu.

"The site of this heiau has been used for so many years as a cemetery that almost all of the features of the old temple have been obliterated. It was located on the top of a small hill that rises 75 feet or more from the surrounding fields and commands a view of the entire valley. The present remains indicate that it was a large heiau, 100 feet or more in width, and 200 feet or more in length. The longest side faced almost due east. On the southeast side of the hill a portion of a rock terrace remains which was built up with small rocks, less than 1 foot in size. On the west side is a portion of a terraced wall, about a 15-foot portion of which remains nearly intact. The bottom wall is 4.5 feet high, of large stones 2 to 3 feet in size, built up on a steep slope. The top of this wall forms a small step-like terrace 2.5 feet in width paved with stones 1 inch or less

Sources Consulted

Denison, David O.

1975 "An Archaeological Reconnaissance Survey of Punalu'u Lands, Punalu'u, Oahu." Department of Anthropology, Bernice P. Bishop Museum. Honolulu.

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

[This report presents the results of a selective archaeological survey of the island of Oahu.]

State Survey Office

1885 "Map of the Ahupuaas of Punaluu and Kaluanui in Koolauloa Oahu belonging to the Estate of Mrs. B. P. Bishop." Survey and Map by S. E. Bishop 1885.

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and excavation reports on file at the Historic Sites Section.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Education, Bernice P. Bishop Museum. Honolulu.

[This is a compilation of information from numerous sources concerning the archaeological sites, history, traditions, legends, place names and land descriptions from the island of Oahu.]

APPENDIX

Site Table from Denison [1975:6-7]

in size. From this step a wall built of 1-foot stones rises 3 feet to what was probably the top of the heiau platform. The probable platforms of the heiau are now used as a burial ground" [McAllister 1933:161-2].

The State Historic Preservation Office has records of two additional sites in the valley. The first, Site 1040, is an early twentieth century house site adjacent to the road east of Punaluu Well V-A. Its significance is discussed on a State Feature Description Form:

"It is suggested that this site may be potentially of research significance for it may well be of non-Hawaiian origin. It is apparently from the turn of the century era and may have been associated with the sugar cane plantation as a worker's house. It may be worthwhile to include it on the Register in a low priority category, but one sufficient to ensure its reconsideration prior to any destruction. It might also be worthy of evaluation by a research project oriented to non-Hawaiian structures of this period."

The second site indicated on the State site maps is Site 1041, an agricultural terrace complex located southeast of Punaluu Well V.

Inspection of an 1885 map of the valley revealed nothing of archaeological or historical interest in the vicinity of any of the wellsites.

Field Inspection

No archaeological sites were found at the locations of any of the proposed or existing wellsites.

Conclusions

Although no archaeological or historical sites were found at the locations of any of the wellsites, the demonstrated presence of historically and archaeologically significant agricultural, habitation and religious sites throughout the valley indicates that construction associated with trenching for pipelines has a high likelihood of representing an adverse effect. Therefore, archaeological test excavations should be conducted along the rights-of-way of all such pipelines prior to ground disturbance of any kind.

Table 1. SUMMARY OF SITES LOCATED DURING THE ARCHAEOLOGICAL RECONNAISSANCE SURVEY OF PUNALU'U LANDS.

Site No. 50-Oa-F8-	Type	Survey Area	Size (Approx.)	Condition	Period	Midden or Artifacts
2 (292)* ⁺	Heiau (?)	1	750 m ²	Poor	Prehistoric	None
3 (293)* ⁺⁺	Hanawao Heiau	1	1800 m ²	Poor	Prehistoric	None
4 (294)*	Fishpond	1	No data	Now a swamp	Prehistoric	--
5 (295)*	Heiau	1	No data	Destroyed	Prehistoric	--
6 (296)*	Heiau	1	1400 m ²	Not located	Prehistoric	--
7 (297)*	Pool	1	No data	Not located	Prehistoric	--
8	Irrigated agricultural complex	2	2500 m ²	Fair	Prehistoric	One piece of worked stone
9	Irrigation ditch (' <i>auwai</i>)	2	28 m long	Fair	Historic	None
10	Fireplace	2	1 m ²	Good	Historic	None
11	Residential terrace	2	84 m ²	Poor	Prehistoric	None
12	Irrigated agricultural complex	2	4500 m ²	Good	Prehistoric	One pounding stone One bifacial grinding stone
13**	Residential/agricultural complex	2	525 m ²	Poor	Historic	Various historic artifacts
14	Dryland agricultural complex	2	800 m ²	Poor	Prehistoric	None
15	Dryland agricultural complex	2	64 m ²	Poor	Prehistoric	None
16	Wall	1	70 m long	Poor	Historic	None
17	Mound complex	1	2000 m ²	Poor	Historic	None
18	Wall	1	32 m long	Good	Historic	None
19	Dryland agricultural complex	1	64 m ²	Poor	Prehistoric	None
20	Wall	1	20+ m long	Poor	Prehistoric	None
21	Irrigated agricultural complex	3	840 m ²	Fair	Prehistoric	None
22	Irrigated (?) agricultural complex	3	300 m ²	Fair	Prehistoric	None
23	Mound	3	3 m ²	Fair	Prehistoric	None
24	Irrigated (?) agricultural/residential complex	3	1010 m ²	Good	Prehistoric	None

Table 1. (cont'd.)

Site No. 50-Oa-F8-	Type	Survey Area	Size (Approx.)	Condition	Period	Midden or Artifacts
25	Retaining wall	3	2 m long	Poor	Prehistoric	None
26	Retaining walls	3	28+ m ²	Fair	Historic	None
27 ⁺	Dryland agricultural complex	1	1000 m ²	Fair	Prehistoric	None
28 ⁺	Mound complex	1	1600 m ²	Good	Historic	None
29	Mound	1	5 m ²	Fair	Historic	None
30	Dryland agricultural terrace	1	21 m ²	Poor	Prehistoric	None

*These sites were recorded by McAllister [1933]; numbers in parentheses are McAllister's site numbers. Sites 4 through 7 were not located.

⁺These sites are included in an area designated as Site 80-06-1041 in the Hawaii Register of Historic Places (see Appendix).

**This site is Site 80-06-1040 in the Hawaii Register of Historic Places (see Appendix).

++This site is Site 80-06-293 in the Hawaii Register of Historic Places (see Appendix).

**KAHANA, OAHU: ARCHAEOLOGICAL SURVEYS
AT PROPOSED WELL LOCATIONS**

Ms. 042580

ARCHAEOLOGICAL RECONNAISSANCE SURVEY
FOR PROPOSED RESERVOIR, KAHANA VALLEY, O'AHU

by
Susan Dobyns, M.A.

Prepared for
R. M. Towill Corporation
Honolulu, Hawai'i

April 1980

Addendum. Additional Archaeological Reconnaissance of
Three Well Fields and Access Trail, Kahana Valley

May 1980

Department of Anthropology
BERNICE P. BISHOP MUSEUM
Honolulu, Hawai'i

SURVEY RESULTS

An *'auwai* or irrigation ditch, previously recorded by Hommon and Barrera in 1971 (Bishop Museum Site No. 50-Oa-F9-105/State Site No. 50-80-06-1590) was the only surface archaeological site encountered in the survey areas. Hommon and Barrera (1971:14) described the site:

An *'auwai*, constructed by building walls up to 1.25 meters high against the banks of a natural stream. At some points, the walls extended above the ground level of the banks. The walls were eroded away in places, but enough remained so that it was apparent that the site extended from inside a steep-sided valley to the flat, marshy bottomland of Kahana Valley proper.

The present survey provides more complete description. The *'auwai* is oriented 100 degrees E of MN and travels under the existing Kahana Valley Road via a pipe and cement conduit. At this point, the site is approximately 1,045 meters from Kamehameha Highway. The *'auwai* is 2 meters wide; it has a 5 to 6 course stone facing on the *makai* Ka'a'awa side but the *mauka* Ka'a'awa and both Punalu'u sides are less clearly faced. Toward Ka'a'awa, it extends approximately 25 meters before losing its rock lining and flattening out, whereas toward Punalu'u, large boulders appear in the middle of the *'auwai* at 15 meters. The *'auwai* continues on, but no attempt was made to trace the boundaries more specifically.

RECOMMENDATIONS

The archaeological reconnaissance survey revealed only one surface site, an 'aawai, but it did not (and could not) evaluate subsurface archaeological resources. Recommendations for mitigating impacts of development depend on the nature of those impacts. In this proposed development, impacts will be largely subsurface, i.e., burying a transmission main and leveling the ridge for reservoir construction (K. Y. Siu, personal communication, March 31, 1980). Many archaeologists have addressed the relationship between surface and subsurface archaeological evidence (e.g., Mueller 1975; Schiffer & Gumerman 1977), but no one-to-one correlation exists. Although both Hommon and Bevacqua's (1973) and A. Sinoto's (Ms.) subsurface testing suggest the absence of material remains, this cannot be assumed for the rest of the valley. Since no surface material other than the 'aawai has been located in the survey area, a more intensive surface survey is unnecessary, and adequate subsurface testing would be an inefficient use of time, labor, and money. A more efficient alternative is archaeological monitoring--the on-site presence of an archaeologist during periods of construction activity. Specifically, the 'aawai and reservoir areas should be monitored, and the remaining areas can be monitored selectively:

- (1) 'Aawai: The 'aawai, the only known site to be impacted, is already crossed by the existing road and pipe and cement conduit, so that its integrity has, to some extent, been violated. Still, an archaeologist should be present so that further damage to the 'aawai can be minimized.
- (2) Reservoir: Although the steep slope and lack of surface structures make subsurface remains unlikely, an archaeological monitor should be on-site during ridge-leveling activities.
- (3) Selective Monitoring in Remaining Areas: The remaining areas along the access roads should also be monitored, but perhaps less intensively than the 'aawai and reservoir areas. The monitoring intensity will depend both on construction practices and on the discovery of additional archaeological data. If trenches are left open so that soil profiles are visible, the archaeologist may be able to do "spot-check" monitoring along the corridor. If, however, the pipe is to be laid immediately and the profile re-covered, then constant archaeological monitoring will be necessary. While both floodplain and talus slope areas should be checked, the exact monitoring schedule must

remain somewhat flexible so that the field monitor can determine amount and intensity based on the field conditions. Any subsurface archaeological structural features or other evidences of cultural occupation should be reported to the monitor. Of course, caution should be taken since this project will initiate subsurface disturbance and archaeological testing in the more *mauka* sections of the valley.

In summary, the area surveyed does not possess archaeological significance prohibitive of the proposed construction.

ADDENDUM

At the request of R. M. Towill, on May 21 and 22, 1980, Susan Dobyms and Ken Shun of Bishop Museum conducted additional archaeological reconnaissance of three well fields and the access trail in the Kahana Valley. The survey area, defined during an on-site visit with Towill personnel on May 9, consisted of:

(1) a 15-ft right-of-way corridor along each side of the Army road from the reservoir site at the 325-ft contour, extending *mauka* for approximately 3,500 ft, and

(2) three proposed well areas--site 1, a 200-by-400-ft area, located approximately 1,000 ft *mauka* of the reservoir; site 2, a 600-by-200 ft area approximately 2,400 ft from the reservoir; and site 3, a 300-by-200 ft area, approximately 3,200 ft from the reservoir.

The archaeologists encountered no significant archaeological remains. Since the area was once used as an Army road, it has already been greatly modified and disturbed.

Based on this surface reconnaissance, there are no archaeological objections to the proposed project. Although unlikely, it is possible that subsurface archaeological features such as stone alignments or artifacts could be encountered once the project has begun. If this occurs, archaeologists at Bishop Museum should be contacted immediately.

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF STATE PARKS
P. O. BOX 621
HONOLULU, HAWAII 96809

DIVISIONS:
CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FISH AND GAME
FORESTRY
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

January 11, 1982

Mr. Larry Whang
Engineering Branch
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96813

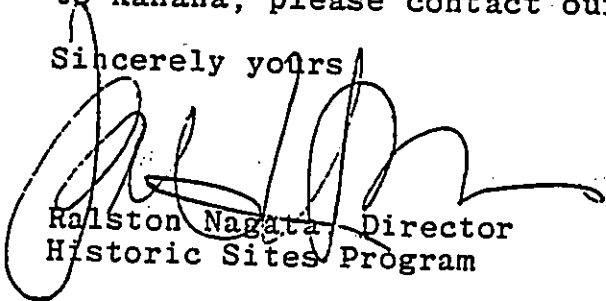
Dear Mr. Whang:

SUBJECT: Evaluation of Kahana Valley Proposed
Well Sites II, III, IV and V Relative
to Known Archaeological Sites

We are forwarding a copy of our review on the proposed BWS well sites in Kahana Valley. On the well site maps, we have located the known and recorded archaeological sites. As you can see, there are several sites in the vicinity of the well sites which are of archaeological concern.

State Parks archaeologists Martha Yent and Jason Ota will be conducting a fieldcheck of these well sites in January 1982. This fieldcheck will be to insure the absence of archaeological sites within the well site areas and determine if there are any impact factors to be considered for the known archaeological sites. Mr. Gene Renard has said that the well sites are marked out on the ground. However, if you wish to coordinate any trips to Kahana, please contact our office at 548-6408.

Sincerely yours


Ralston Nagata, Director
Historic Sites Program

Enclosure

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF STATE PARKS
P. O. BOX 621
HONOLULU, HAWAII 96809

DIVISIONS:
CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FISH AND GAME
FORESTRY
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

January 11, 1982

MEMORANDUM

TO: Planning Office

FROM: Ralston Nagata, Director
Historic Sites Program

SUBJECT: Review of the Board of Water Supply's Proposed
Well Sites in Kahana Valley State Park, Koolauloa,
Oahu, TMK 5-2-01: and 5-2-02

The four well sites proposed by the Board of Water Supply (BWS) in Kahana Valley State Park were reviewed relative to known and recorded archaeological sites. The archaeological survey done by Hommon and Barrera for Bishop Museum in 1971 reported several sites in the vicinity of these well sites. The archaeological sites are not within the defined well site areas but their proximity makes the archaeological sites subject to impact during construction and well drilling.

Well Site II

This site is located on the Kaaawa side of Kahana Valley and upslope of Trout Farm Road. This site was previously examined by State Parks archaeologists (May, 1981). At this time, two archaeological sites were noted in the vicinity and pointed out to the BWS and DOWALD personnel who were present (Fig. 1). Of archaeological concern was a walled enclosure (Site #1555) measuring 12 by 16 meters, and on the northern edge of the well site. The other archaeological site is a small agricultural terrace complex (Site #1556) which is just upslope of the well site.

The recommendation for Site #1555 is for further archaeological work if there is a possibility of impact to the site during construction. The site has been mapped and tested by Hommon in 1972. The testing indicated an early historic age but the function of the enclosure was not determined. The minimum recommendation is to flag at least 50 feet from the enclosure to prevent disturbance to the enclosure. Site #1556 should be mapped and flagged to designate impact limits.

Planning Office
Page 2
January 11, 1982

Well Sites III, IV, and V

Well Sites III, IV, and V are all located on the Hauula side of Kahana Valley and 8,000 - 10,000 feet inland from the coastline. These three well sites are all located at the 300' contour line and adjacent to an existing dirt road. This old military road will be used for access to the well sites. All three well sites are within an area 2,000 by 500 feet.

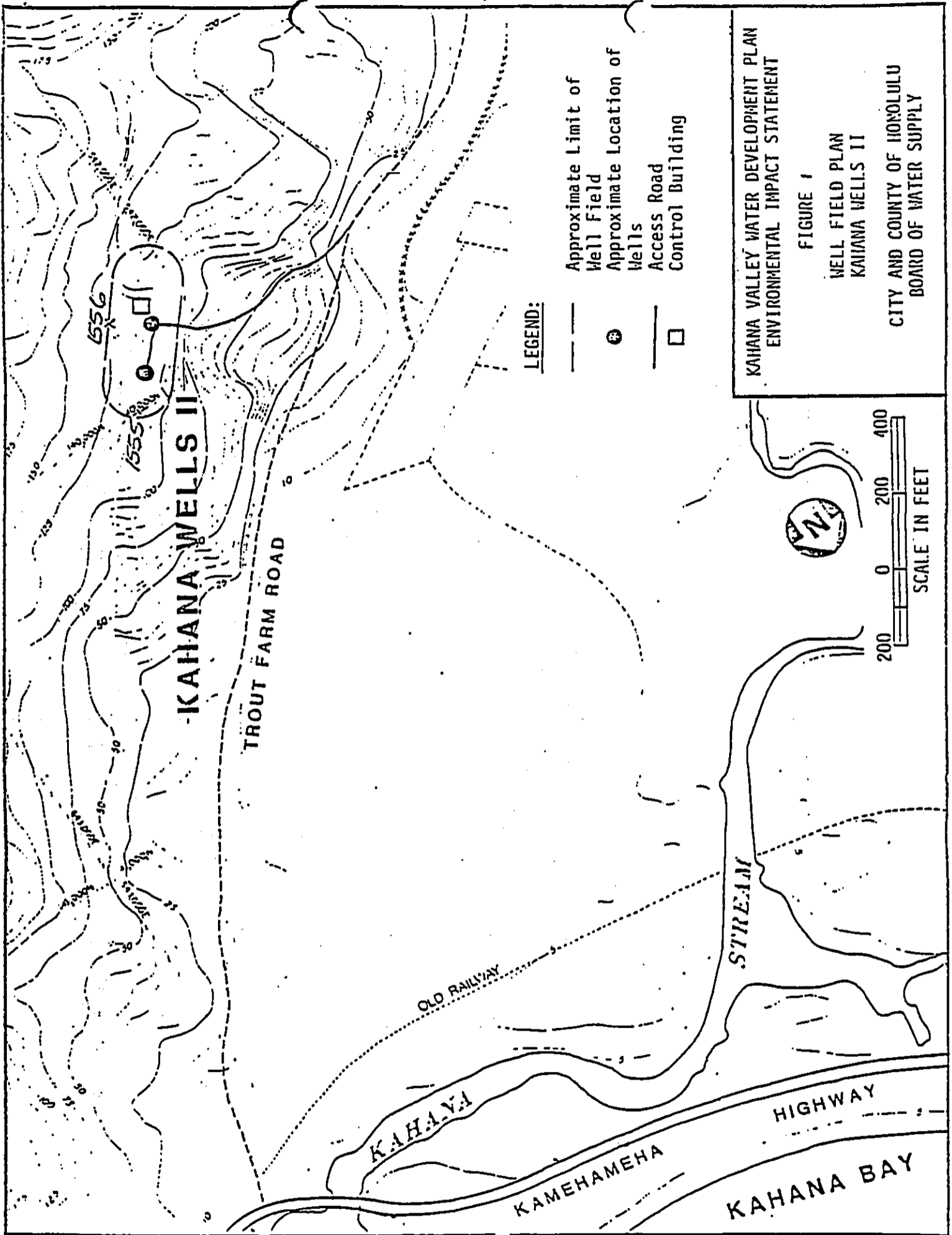
There were three archaeological sites recorded by Hommon and Barrera in 1971 in the vicinity of these three well sites (Fig. 2). Sites #1512 and #1543 are located in a small gully area between Well Sites III and IV and downslope of the road. Site #1542 is in another, adjacent gully and downslope of Well Site V. All three archaeological sites are described as terrace walls adjacent to dry sidestreams of Kahana Stream. Associated with Site #1512 is a boulder with vague petroglyphs.

Our recommendation is for the well sites and archaeological sites to be fieldchecked by the State Parks archaeologists. They will be able to determine the proximity of these sites to the well sites and delineate impact areas. Impact must consider not only construction, but possible erosional factors since the sites are near the gullies where an increased water flow from the drilling could increase silting and erosion.

Because the archaeological sites have not been affected by the road, it is unlikely that the well sites will directly affect the archaeological sites. However, as a precaution the archaeologists should flag the archaeological sites with some allowance for impact, again about 50 feet. At this time, the archaeologist can also evaluate the indirect impact.

Archaeological Work

The State Parks archaeologists will schedule a fieldcheck of Well Sites III, IV and V during the month of January, 1982. We foresee no problems with these well site locations but wish to take precautionary measures to insure that no archaeological sites will be disturbed or destroyed without adequate archaeological work. If there are any problems that are recognized during the fieldcheck, BWS and the appropriate agencies will be consulted about mitigative measures.



LEGEND:

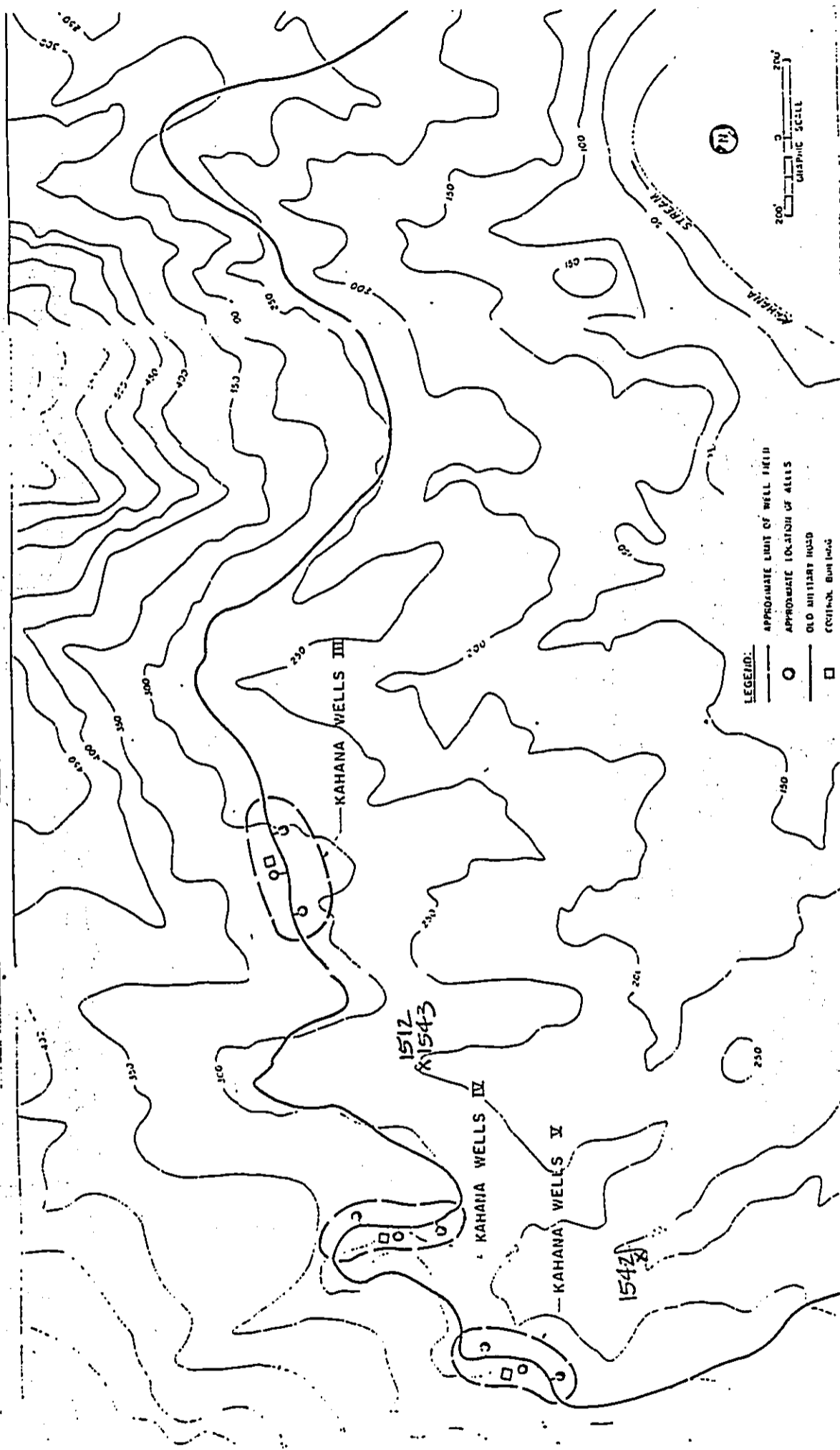
- Approximate Limit of Well Field
- ⊙ Approximate Location of Wells
- Access Road
- Control Building

KAHANA VALLEY WATER DEVELOPMENT PLAN
ENVIRONMENTAL IMPACT STATEMENT

FIGURE 1

WELL FIELD PLAN
KAHANA WELLS II

CITY AND COUNTY OF HONOLULU
BOARD OF WATER SUPPLY



F-57

U S G E O L O G I C A L S U R V E Y

826352

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
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DIVISIONS:
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FORESTRY
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

MGR *[Signature]*
AM *[Signature]*
P/E

February 8, 1982

Mr. Mike Shigetani
Environmental Section
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Shigetani:

SUBJECT: Archaeological Inspection of the
Board of Water Supply Well Sites in
Kahana Valley State Park, Kahana Valley,
Koolauloa, Oahu, TMK 5-2-01 and 5-2-02

A fieldtrip was made to Kahana Valley on January 28, 1982, by State Parks archaeologists Martha Yent and Jason Ota. They were accompanied by yourself and the BWS engineer for the project in Kahana Valley. The fieldtrip was in response to the EIS submitted for review to the State Parks-Historic Sites office. The location of the three well sites on the Punaluu side of Kahana Valley was considered relative to the archaeological sites identified in 1971 by Bishop Museum. Several archaeological sites were noted in the vicinity of the well sites. Therefore, the purpose of the fieldcheck was to try and locate these sites and determine if they would be impacted by the development of the well sites. Likewise, the well sites could be inspected for the presence of any unrecorded archaeological sites.

The well sites are located at about the 300' contour line and about 1.5 miles mauka of Kamehameha Highway. Access to the well sites is by an old military coral road. This road will be renovated and used by BWS. Consequently, the original road construction which involved slope cutting, has already impacted the immediate BWS project area. The recorded archaeological sites are all located about 400' downslope of the road along streambeds and on gully slopes (see map). The three sites of interest (#1512, #1542, and #1543) were all described as terrace/retaining walls that appeared to be individual features rather than part of a larger complex.

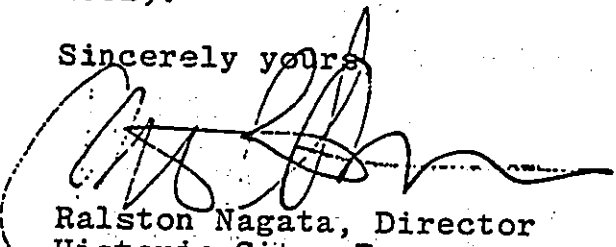
[Signature]

Mr. Mike Shigetani
Page 2
February 8, 1982

The sites could not be located during the fieldcheck. The vegetation was dense and hampered a thorough survey of the area and the site descriptions were not detailed enough to pinpoint site location. It was found that 400' downslope appears to be an area clear of impact from the well sites. The well sites were also examined and found to be flat areas that were probably created during road construction and leveling. The reservoir site which is located on the ridgetop above Well Site IV was surveyed. There were no archaeological sites observed in either the well sites or reservoir site.

Consequently, we have no further recommendations concerning the well sites at Kahana Valley. Well Sites I, III, IV, and V were found to be in areas lacking archaeological resources that would be destroyed or impacted during construction and use. However, we reiterate our concern about the recorded archaeological sites adjacent to Well Site II on the Kaaawa side of Kahana Valley (refer to our letter of January 11, 1982).

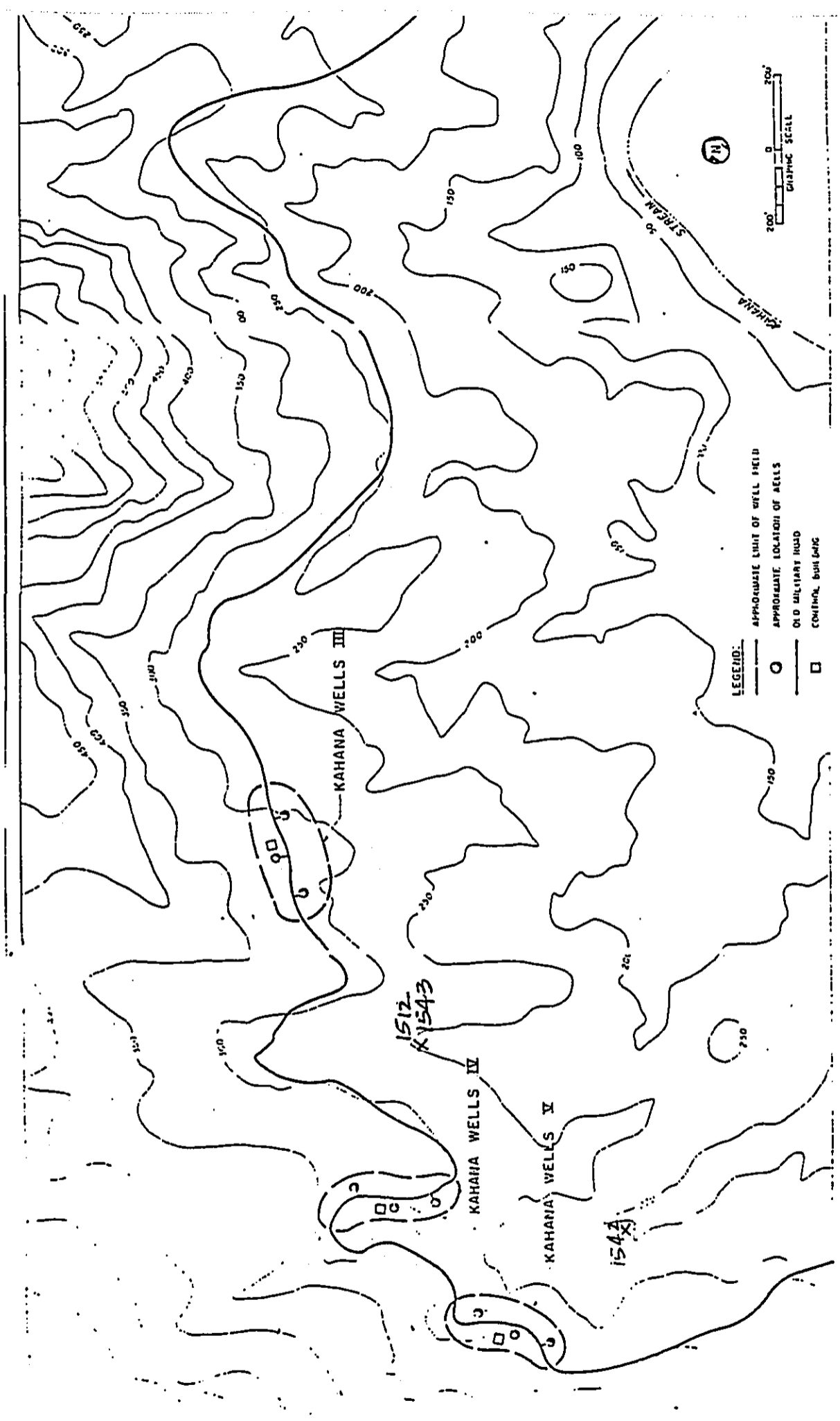
Sincerely yours,



Ralston Nagata, Director
Historic Sites Program

Enclosure

cc: Gene Renard, State Parks



KAAAWA, OAHU: ARCHAEOLOGICAL SURVEY
AT PROPOSED WELL LOCATIONS

Prepared for:
VTN PACIFIC
1164 Bishop Street
Honolulu, Hi. 96813

Prepared by:
William Barrera, Jr.

CHINIAGO INC.
1040 B Smith St.
Honolulu, Hawaii 96817

AUGUST 1984

F-61

Introduction

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by the construction activities associated with the development of these wells. This report covers the wells at Kaaawa [Figure 1].

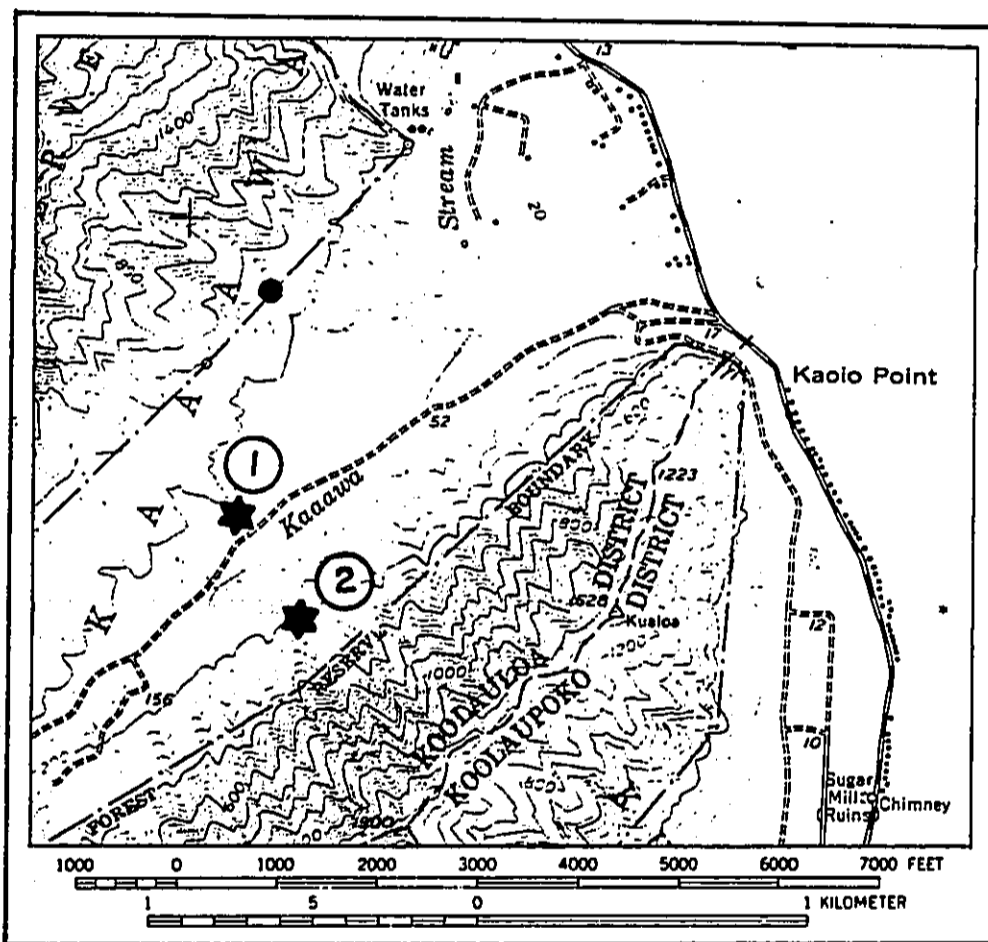


Figure 1. Locations of Kaaawa Wellsites.

The wellsites could not be visited because the property owner had refused right of entry to the Board of Water Supply. For this reason, firm conclusions cannot be drawn regarding the likely impact of well construction on any particular archaeological or historical resources that might be present.

Literature Search

The literature search revealed a legend about a famous cave, Pohukaina, one of the entrances of which is supposed to be located between Kualoa and Kaaawa Valley:

"Pohukaina was Oahu's most famous burial cave for chiefs and is situated at Kanehoalani hill between Kualoa and Kaaawa. The entrance is believed to be at Kaoio cliff, facing Kaaawa and another entrance is at Kaahuula spring. Hailikulamanu is another entrance a little way below the cave of Koluana in Moanalua [and there are still others] at Kalihi, Puiwa, at Waipahu in Ewa and at Kahuku in Koolauloa. Kauhuhu is the roof of the burial cave 'house', that is, the mountain of Konahuanui, sloping down toward Kahuku. It was said that many had gone into it in olden days with kukui nut candles, going in from here in Kona and out at Kahuku. In this cave are many creeks, river and streams. Some places are decorated and some places are level" [Ke Au Hou, June 28, 1911, quoted in Sterling and Summers 1978:176].

Kamakau discusses this same cave:

"There is only one famous hiding cave, ana huna, on Oahu. It is Pohukaina. The opening on Kalaeoka'o'io that faces toward Ka'a'awa is believed to be in the pali of Kanehoalani, between Kualoa and Ka'a'awa, and the second opening is at the spring Ka'ahu'ula-punawai. This is a burial cave for chiefs, and much wealth was hidden away there with the chiefs of old. On the Kona side of the island the cave had three openings, one at Hailikulamanu -- near the lower side of the cave of Koleana in Moanalua -- another in Kalihi, and another in Puiwa. There was an opening at Waipahu, in Ewa, and another at Kahuku in Ko'olauloa. The mountain peak of Konahuanui was the highest point of the ridgepole of this burial cave 'house,' which sloped down toward Kahuku. Many stories tell of people going into it with kukui-nut torches in Kona and coming out at Kahuku. Within this cave are pools of water, streams, creeks, and decorations by the hand of man [hana kinohinohi'ia], and in some places there is level land" [Kamakau 1964:38-9].

Handy discussed the agricultural remains in Kaaawa Valley as follows:

"At the upper end of the valley, where cattle are now pastured, there are slopes and vales of boggy land which presumably were once planted to forest taro. There is no sign of terracing. Wild taro was found in the stream bed about 2.5 miles inland from the highway. About half a mile below this there is much level, boggy land on both sides of the stream. At another point, perhaps a mile inland, much wild taro was found. In a gulch on the north side of the valley, less than 2 miles up from the sea, an old coconut tree still stands, indicating the former existence of a kuleana home site. There were probably terraces here and in other small gulches seaward of this point. Beginning about 1.5 miles inland where the valley broadens and flattens and continuing to the shore, there are traces of extensive terraces on either side of the stream, now overgrown with guavas, kukuis, and ape" [Handy 1940:93].

Field Inspection

As stated in the introduction, the landowner's permission to visit the locations of the Kaaawa wellsites was not available. For this reason, it was necessary to make our observations from the nearest public road, at a distance of about a mile. Needless to say, no significant archaeological or historical sites were observed at the locations of either of the proposed wellsites.

Conclusions

Because first-hand observations were not made, conclusions can be based only on the sparse documentation quoted above. Until such time as inspection of the proposed wellsites is possible, it must be assumed that the likelihood of finding archaeological remains at their locations is high. It is therefore recommended that before any construction is undertaken, including grubbing or clearing of an access road to the proposed wellsite, an archaeological reconnaissance be conducted to determine the presence or absence of significant archaeological or historical remains. If any are found, an assessment of significance and a determination of appropriate mitigative procedures would then have to be made.

Handy, E. S. Craighill

1940 The Hawaiian Planter. Vol. I. Bernice P. Bishop Museum, Bulletin 161. Honolulu.

Kamakau, S. M.

1964 "Ka Po'e Kahiko." Bernice P. Bishop Museum Special Publication No. 51. Honolulu.

Ke Au Hou

1911 "Ka Hookumu Ana o na Paemoku" Issue of June 28.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

[This report presents the results of a selective archeological survey of the island of Oahu.]

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and excavation reports on file at the Historic Sites Section.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Education, Bernice P. Bishop Museum. Honolulu.

This is a compilation of information from numerous sources concerning the archaeological sites, history, traditions, legends, place names and land descriptions from the island of Oahu.]

HAKIPUU, OAHU: ARCHAEOLOGICAL SURVEY
AT PROPOSED WELL LOCATION

Prepared for:
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AUGUST 1984

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During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by the construction activities associated with the development of these wells. This report covers the proposed wells at Hakipuu, which are to be located below Hakipuu Spring at an elevation of approximately 160 feet [Figure 1].

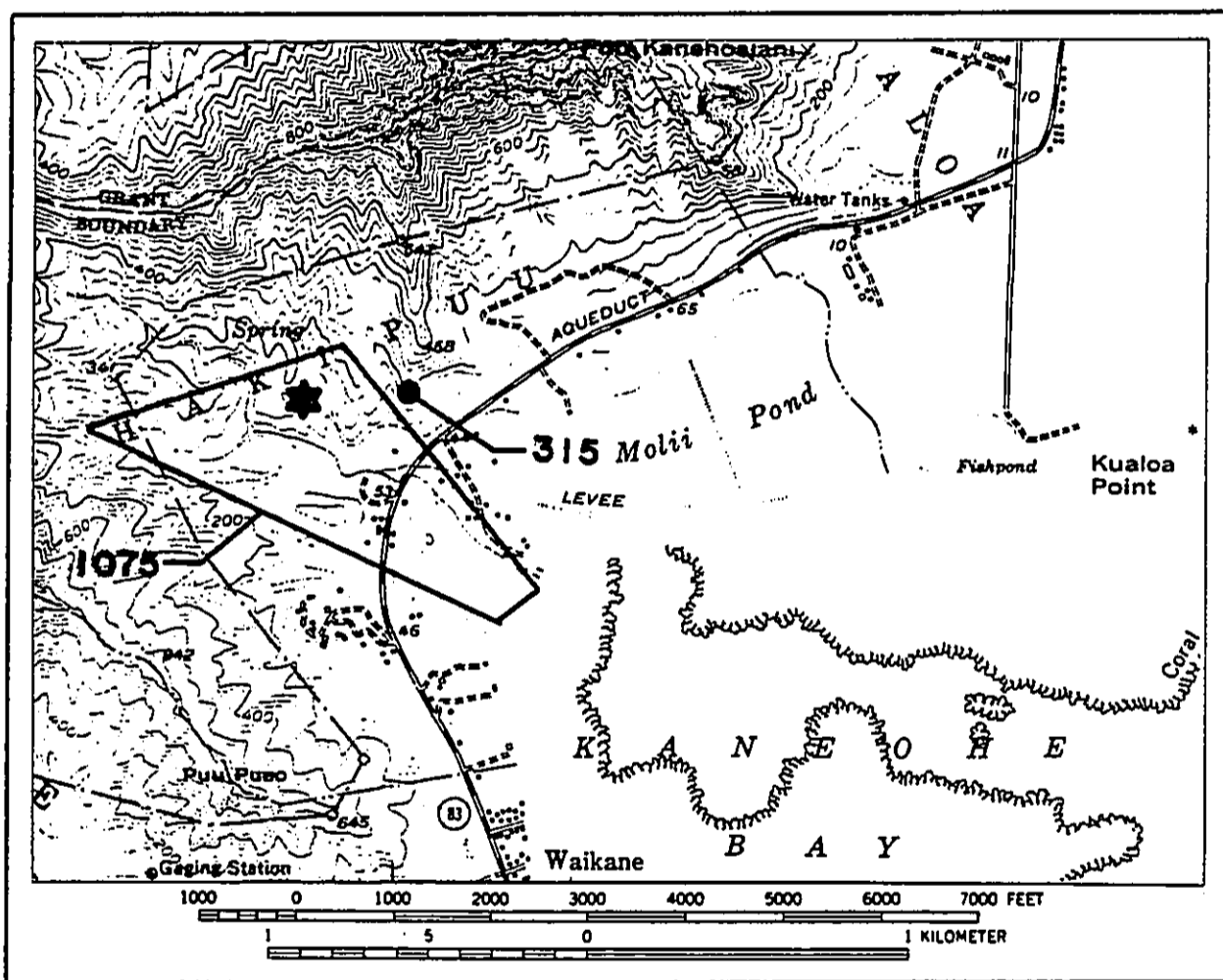


Figure 1. Location of Hakipuu Wellsite.

Literature Search

McAllister described two sites in the vicinity of the Hakipuu wellsite in his 1933 report on Oahu archaeological sites.

"Site 315. Puakea heiau, above the road at the foot of a ridge, Hakipuu.

"A large three-terrace structure. Almost all of the stones have been removed for road building, but enough of the earth foundation and occasional walls remain to indicate its former size and features. The two lower terraces were probably open, though there are indications of a wall on the west side of the lowest terrace. The highest terrace appears to have been cut into the ridge, and was surrounded on three sides with high embankments faced with stones. The fourth side, overlooking the remainder of the structure, was open. The foundations of the walls which remain indicate their large size. They were faced on each side with 2-foot to 3-foot stones and a rubble fill. Frank Lealoha was told by the former natives that the earth elevation on the east side of the lower terrace was a lele used for human sacrifice. The small elevation in the back-center of the highest terrace was probably the site of the oracle tower. Thrum says that the heiau was 'An ancient place of refuge to which is coupled the name of Kaopulupulu as supervising priest.' This is the only mention of Kaopulupulu in connection with this heiau. After his retirement from the court of Kahahana, Kaopulupulu returned [38, Vol. 2, p. 220] to '...his own estate in Waialua and Waimea.'

"The lower terrace was planted in pineapple, but now is planted in grass. The upper terraces are covered with Lantana and guava, with cow trails winding throughout."

"Site 316. Flexed burial, Hakipuu.

"Portions of skeletal material were found protruding above the ground by A. F. Judd and reported. Upon excavation it was found to be a flexed burial with the distal portions of the femurs and the proximal portion of the tibiae, fibulae, and of one humerus exposed. The body had been placed in a sitting posture, facing toward the sea, which is approximately east, with the head bent between the knees. Consequently the skull was upside down, with the norma basilaris uppermost and the skull cap facing downward. The right arm had apparently been placed about the knees; the left doubled up behind the body. The site is on the side of a slope and had been exposed by erosion. The material was very fragile and in a poor state of preservation.

This burial is similar to those described by Malo and Fornander" [McAllister 1933:168-70].

Handy [1940:94] described agricultural sites in Hakipuu:

"In 1935 there were about a dozen taro flats cultivated in the swampy land along the stream seaward of Kamehameha Highway, and about the same number inland of the road. This planting area originally extended over half a mile southward from Molii fishpond. It was about one third of a mile wide in its broadest part where the stream runs through it. All the level land along Hakipuu Stream was once in terraces. There were two terraces at Kealohiwai.

"An interesting area of abandoned terraces runs in an S-curve filling a small valley bottom, from Molii fishpond to a point above the highway. This area was formerly watered from Kailau Spring on the hillside above the fishpond."

In 1977 Barrera presented up-dates on a number of previously recorded sites in the Kaneohe Bay area, including Site 1075, the Hakipuu Taro Flats:

"The archaeologists of the State Parks Division divided this site into two sections. The lower portion extended from Kamehameha Highway towards the ocean and contained somewhat vague flat areas on differing elevations, marking the former locations of taro terraces. The mounds that once defined each field were gone. On the Kaneohe side of Hakipuu Stream the terraces measured about 25 meters in width and 80 to 100 meters in length; on the Kualoa side of the stream the terraces were closer to 10 or 15 meters wide and up to 20 or 30 meters in length. The full extent of the terraces was not traced, but the field staff felt that those on the Kaneohe side of the stream extended as far as the ocean.

"The upper portion of the site extended from about one-quarter of a mile above Kamehameha Highway inland for a distance of about 300 meters. These were in somewhat better condition than the lower terraces, as the earth and rock terraces were not difficult to locate, and a rock-lined auwai [irrigation channel] was observed. The terraces varied in size, but were generally in the range of 10 to 15 meters in width and 20 to 30 meters long" [Barrera 1977:41].

Barrera then went on to describe the site's condition at the time of his field survey:

"The large terraces on the seaward side of Kamehameha Highway have been bulldozed and converted into ponds for raising prawns, according to an informant. Those on the inland side of the highway are essentially as described by the HRHP" [Barrera 1977:42].

Examination of a map drawn in 1907 shows that the proposed well location is in the immediate vicinity of a group of 22 small kuleana which probably are the locations of the group of abandoned terraces which interested Handy, quoted above.

Field Investigation

The location of the proposed wellsite could not be visited because of the lack of permission to enter onto the property. The locality was observed from the highway, but of course this was insufficient for a determination of historical or archaeological significance.

Conclusions

Because first-hand observations were not made, conclusions can be based only on the documentation quoted above. That documentation indicates that the construction of a well, access roads and pipelines could represent a serious adverse effect to significant historic and prehistoric remains. It is therefore recommended that before any construction is undertaken, including clearing of an access road to the proposed wellsite, an archaeological reconnaissance be conducted to determine the presence or absence of significant archaeological or historical remains at the specific localities in question. If any are found, an assessment of significance and a determination of appropriate mitigative procedures would then have to be made.

Sources Consulted

Barrera, William M., Jr.

1977 Planning Alternatives for Historic Sites in the Kaneohe Bay Area. Prepared for U. S. Army Engineer District, Honolulu. Chiniago Inc. Honolulu.

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

[This report presents the results of a selective archaeological survey of the island of Oahu.]

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and excavation reports on file at the Historic Sites Section.

State of Hawaii Survey Office

Tracing of map entitled "Map of Hakipuu, Koolaupoko, Oahu." The survey and map were done by E. D. Baldwin in June, 1907.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Education, Bernice P. Bishop Museum. Honolulu.

[This is a compilation of information from numerous sources concerning the archaeological sites, history, traditions, legends, place names and land descriptions from the island of Oahu.]

WAIKANE, OAHU: ARCHAEOLOGICAL SURVEY
AT PROPOSED WELL LOCATIONS

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AUGUST 1984

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Introduction

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by construction activities associated with the development of these wells. This report covers two wells located at elevations of about 250 feet and 280 feet on the ridge on the south side of Waikane Stream in Waikane Valley [Figures 1 and 2].

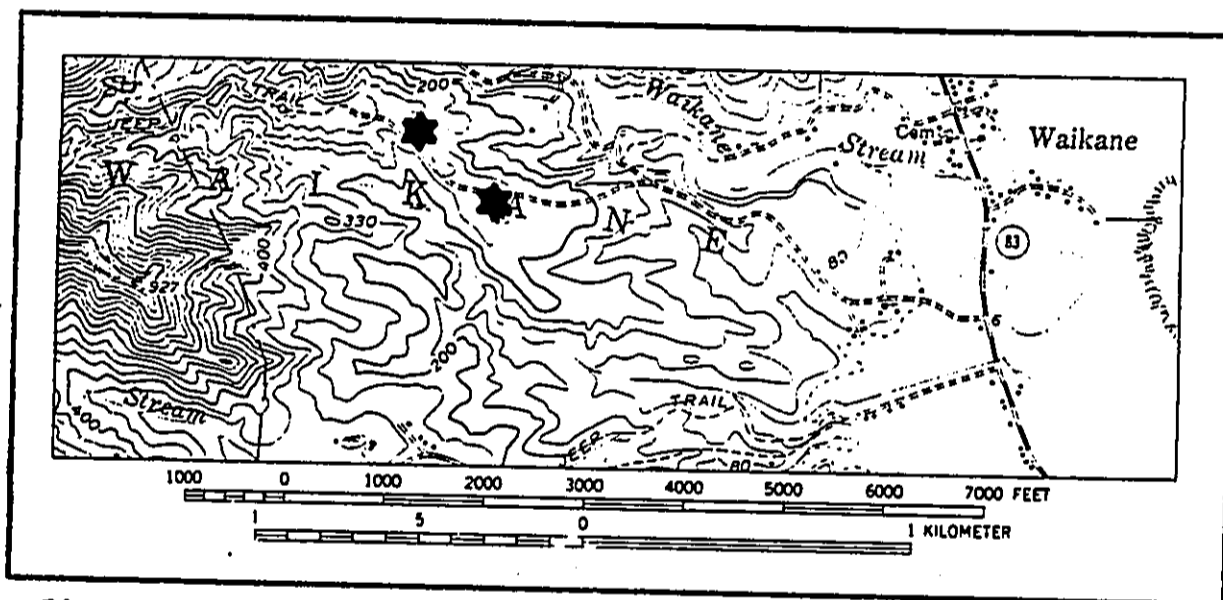


Figure 1. Location of Primary [lower right] and Alternate [upper left] Waikane Wellsites.

Literature Search

Handy described agricultural sites in Waikane:

"Waikane. Between the highway and the sea is a broad area of terraces where large crops of taro are raised to sell to poi factories. This section, with the terraces [also still planted] just inland of the road, made up a continuous area of terrace land covering almost the entire seaward end of this *ahupua'a*, watered by Waikane Stream. Terraces were built on the level land up the valley along the stream. About half a mile inland, where broad flats flank a wide curve in the stream, is a beautiful plantation of about 40 terraces, all planted in ta-



Figure 2. Location of Primary Waikane Well.

ro grown for milling. Following the road toward Na Puu Koiiele, small abandoned terraces are to be seen here and there along the stream. Just beyond the juncture of the two streams forming Waikane several small terrace sections were being cleared by Hawaiians in 1935. About 2 miles inland on the north side of the stream below Na Puu Koiiele, is a kuleana with half a dozen terraces planted with young taro. Above this point are other small abandoned kuleana.

"In the southern part of Waikane Valley, divided from the larger northern section by a low ridge, there is a gulch containing old terraces [now partially cultivated, but not in taro], small and narrow for the most part. This area begins about one mile above the highway, where the contour trail crosses the gulch, and extends to seaward and for about a half a mile or more inland from the trail as well. It is watered by Waikeeke Stream" [Handy 1940:94-5].

The Hawaii Register of Historic Places has records of three sites along Waikane Stream north of the well locations. The largest of these is Site 50-80-06-1078, the Waikane Taro Flats:

"The upper reaches of Waikane Valley contain an area where numerous old Hawaiian taro terraces are found. These terraces are flat bottomed areas near the stream beds, each with a low stone retaining wall about .5 meter high on the downstream side. The average size of the taro flats is about 6 by 12 meters.

"The general area is a valley bottom covered with lush tropical vegetation which precludes photographs. The vegetation consists of guava, mango, honohono grass, wild taro, and hau.

"Associated with the wet taro beds [lo'i] are several enclosures, habitation areas, and one large pit. Scattered throughout the area are a few rock alignments of unknown function. In one area, remains of the old auwai, or irrigation ditch, could be seen, which fed water from the nearby stream into the lo'i in succession.

"Especially interesting is the presence of taro lo'i with numerous low earthen mounds within. These mounds were known in the literature, but this is the only place where physical remains of them have been found. The mounds were used in a specialized technique of taro raising. Other crops, such as sweet potatoes, may have been grown in rock circles on the hillsides above the taro lo'i.

"These taro flats at Waikane are of significance for they are excellently preserved examples of old Hawaiian wet taro lo'i. They contain the only known examples of taro lo'i with interior mounds, used in a specialized taro growing technique. Associated habitation areas, and some indication of agriculture on the talus valley slopes, lend additional importance to this complex, particularly in the breadth of possible interpretation."

Site 50-80-10-1079 is listed on a "Form 51" at the Historic Sites Section as taro flats and terraces, destroyed.

Site 50-80-10-1057 is described on a Historic Sites Section Feature Description Form:

"Double to triple row of large stones set upright in ground closely paralleling one another to form front of a large enclosure right on Waikane stream bank.

"Rows of rocks 25-30 M long; 1M apart Seems to be a rectangular enclosure but hard to tell because of vegetation. No pavement visible within.

"Small paved area [2 X 2 M] outside of enclosure but contiguous to it.

"Function is unknown. Never seen anything similar.

"Interior riddled with minor depressions, mounds and scattered paved areas."

A tracing of a map at the State Survey Division dated 1897 indicates no kuleana or other cultural features at the proposed wellsites, but does show kuleana adjacent to the existing access road [along which a pipeline would presumably have to be constructed] between the wellsites and Kamehameha Highway.

Neither McAllister [1933] nor Sterling and Summers [1968] report any archaeological or historic sites in the vicinity of the wellsites.

Field Inspection

The field inspection did not locate any archaeological or historical sites at the locations of the wellsites.

Conclusions

Although no archaeological or historical remains were found at the wellsite locations, the literary documentation indicates that the construction of the pipeline may represent an adverse effect on historic and prehistoric remains, especially near the coast. It is therefore recommended that before any construction is undertaken an intensive sub-surface archaeological survey be conducted to determine the presence or absence of significant archaeological or historical remains along the specific route in question. If evidence of significant historic or prehistoric remains is found to be present, it is highly unlikely that it will be of such significance that it would have to be preserved, and archaeological salvage excavations will undoubtedly be a proper mitigative measure.

Sources Consulted

Barrera, William M., Jr.

1977 Planning Alternatives for Historic Sites in the Kaneohe Bay Area. Prepared for U. S. Army Engineer District, Honolulu. Chiniago Inc. Honolulu.

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archaeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

[This report presents the results of a selective archaeological survey of the island of Oahu.]

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and excavation reports on file at the Historic Sites Section.

State of Hawaii Survey Office

Tracing of map entitled "Portion of Waikane, Koolau-poko, Oahu, Showing Hui Divisions." The survey and map were done by M. D. Monsarrat in October, 1897.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Education, Bernice P. Bishop Museum. Honolulu.

[This is a compilation of information from numerous sources concerning the archaeological sites, history, traditions, legends, place names and land descriptions from the island of Oahu.]

UWAU, OAHU: ARCHAEOLOGICAL SURVEY
AT PROPOSED WELL LOCATIONS

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AUGUST 1984

F-78

Introduction

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by construction activities associated with the development of these wells. This report covers the proposed Uwau Wells, situated adjacent to Uwau Stream at an elevation of approximately 400 feet in Waiahole Valley [Figures 1 and 2].

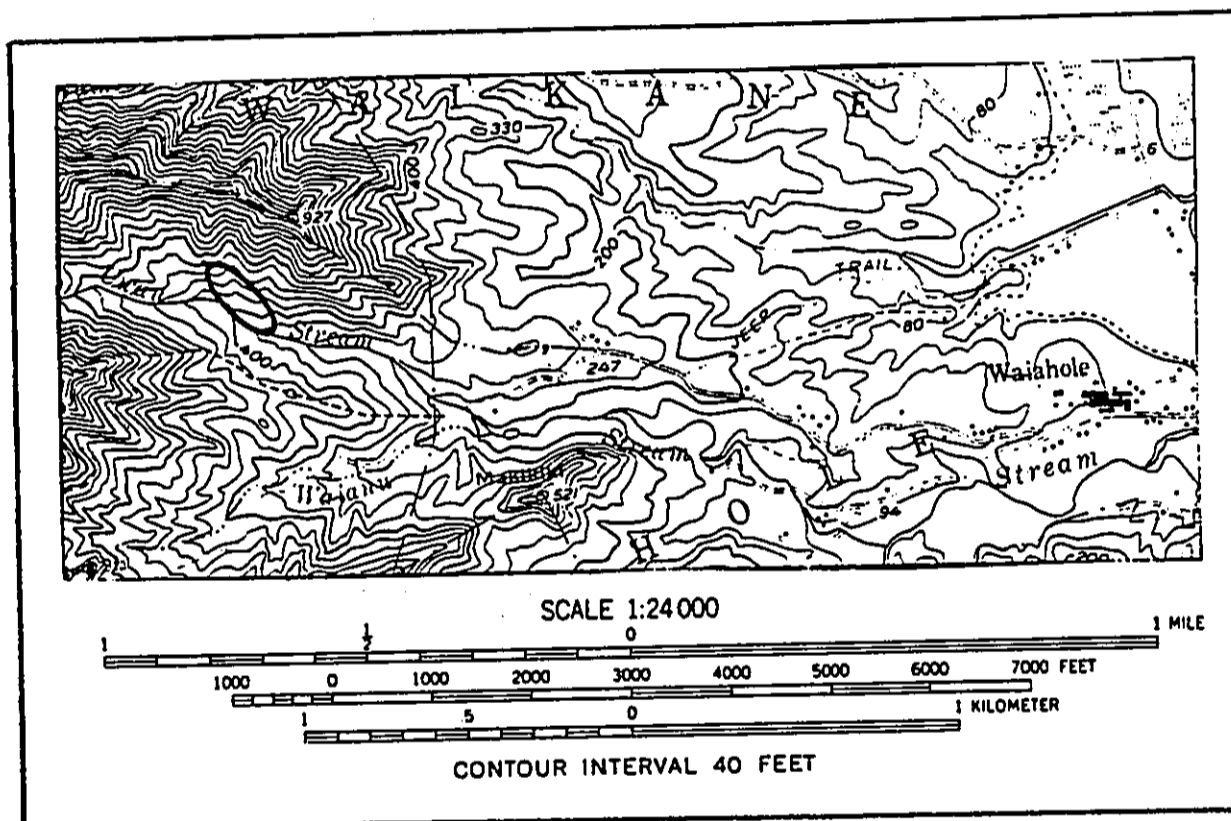


Figure 1. Location of Uwau Wellsites.

Literature Search

Handy [1940:95] described agricultural sites in Waiahole valley and mentions terraces along Uwau, which he refers to as a branch of Waianu Stream:

"There were formerly terraces throughout the seaward lowlands of Waiahole, some in swampy lands but most of them irrigated from Waiahole Stream. Groups of terraces adjoining Waikane



Figure 2. Location of Uwau Wellsites.

were planted in 1935. The land south of the stream and inland from the highway has reverted to swamp. Some kuleana a short way up the main stream, beyond its junction with Waianu, are cultivated by Hawaiians living in the lower valley; there was also a sizable terrace section planted in taro about half a mile up Waianu in 1935. Formerly taro was planted in terraces at least a mile farther inland along both the north and south branches of Waianu; and small terraces used to extend along Waiahole up into what is now forest reserve."

McAllister [1933] lists no archaeological sites in Waiahole, and Sterling and Summers [1968] make mention only of a brief 1964 survey report by William Kikuchi describing stone remains at several places in the uplands of the valley, none of which were in the vicinity of Waianu.

An undated map of Waiahole on file at the State Survey Office shows a land court award adjacent to the stream in the vicinity of the wellsites.

Site maps on file at the Historic Sites Section of the Department of Land and Natural Resources show that no sites have been reported in the vicinity of the wellsites.

Field Inspection

No archaeological or historical sites were located at the proposed wellsites. At one place along the existing jeep road which is to be the pipeline route, the road is embanked by a rock wall which forms one side of a ditch which might be an old auwai.

Conclusions

As the Uwau wellsites and the proposed pipeline are located in an area where there is a high probability that aboriginal cultivation was practiced, there is the possibility that their construction might disturb sub-surface evidence of former agricultural practices. We therefore recommend that a test pit survey be conducted prior to any construction activities. If evidence of significant historic or prehistoric remains is found to be present, it is highly unlikely that it will be of such significance that it would have to be preserved, and archaeological salvage excavations will undoubtedly be a proper mitigative measure.

Sources Consulted

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

[This report presents the results of a selective archaeological survey of the island of Oahu.]

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and excavation reports on file at the Historic Sites Section.

State of Hawaii Survey Office

Tracing of map entitled "Waiahole, Oahu." The survey was done by J. F. Brown in 1878.

Tracing of untitled and undated map of Waiahole.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Education, Bernice P. Bishop Museum. Honolulu.

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WAIANU, OAHU: ARCHAEOLOGICAL SURVEY
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AUGUST 1984

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Introduction

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by construction activities associated with the development of these wells. This report covers the proposed Waianu Wells, situated adjacent to Waianu Stream at an elevation of approximately 300 feet in Waiahole Valley [Figures 1 and 2].

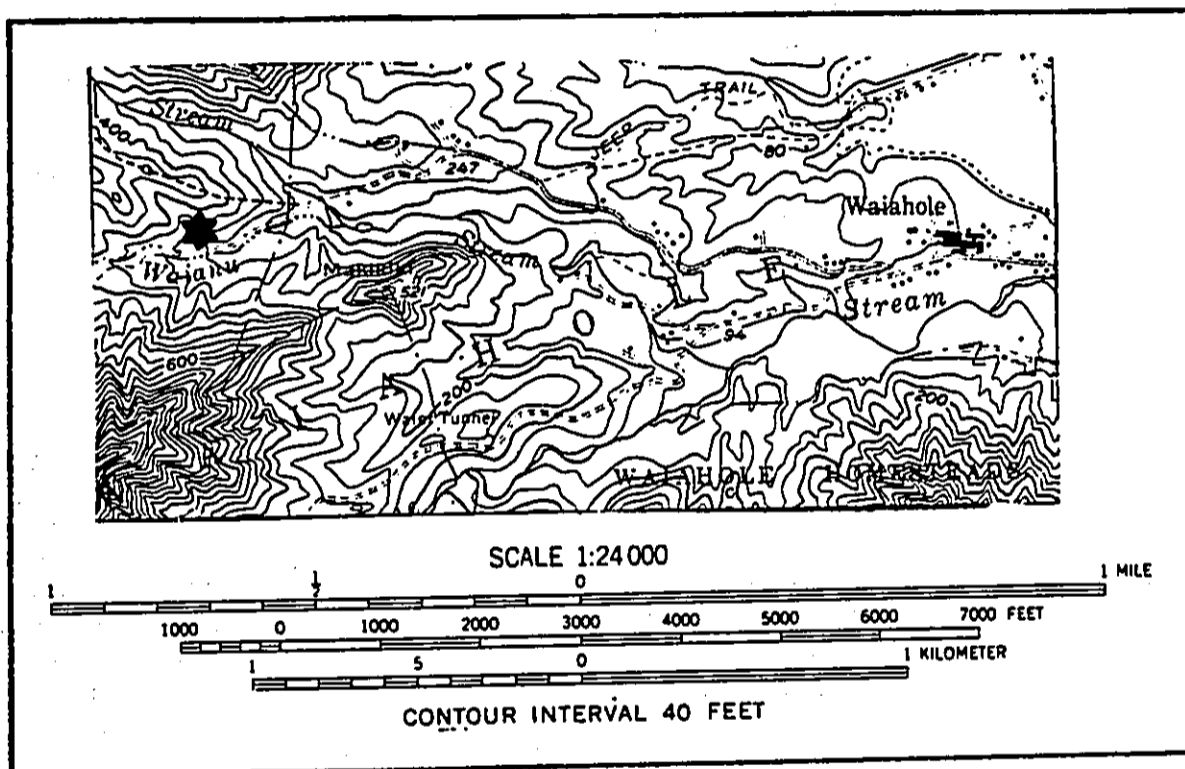


Figure 1. Location of Waianu Wellsites.

Literature Search

Handy [1940:95] described agricultural sites in Waiahole valley:

"There were formerly terraces throughout the seaward lowlands of Waiahole, some in swampy lands but most of them irrigated from Waiahole Stream. Groups of terraces adjoining Waikane were planted in 1935. The land south of the

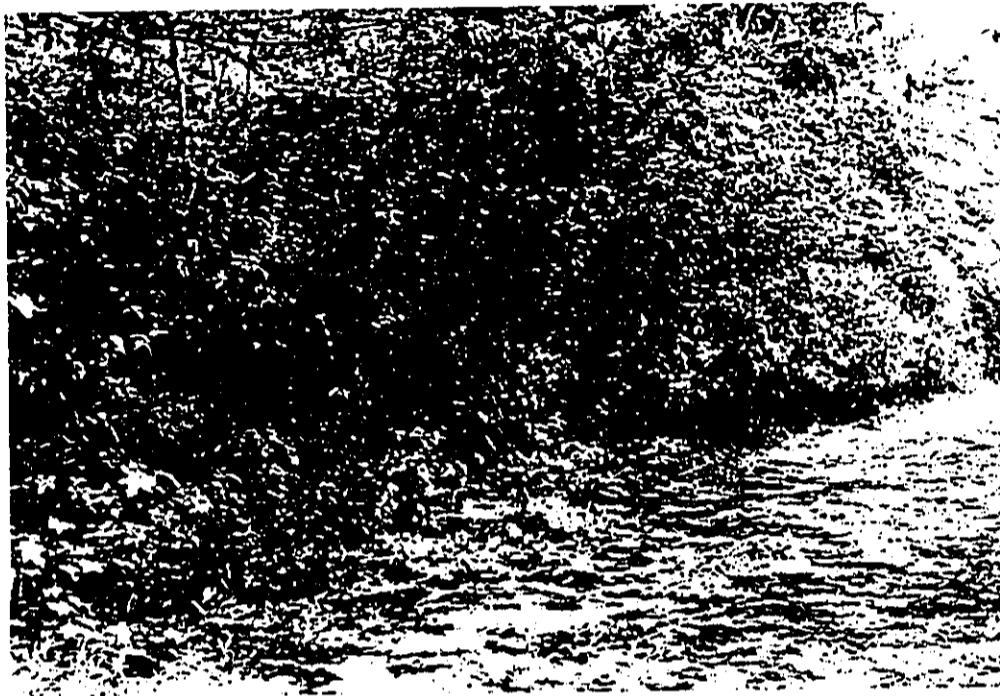


Figure 2. Location of Waianu Wellsites.

stream and inland from the highway has reverted to swamp. Some kuleana a short way up the main stream, beyond its junction with Waianu, are cultivated by Hawaiians living in the lower valley; there was also a sizable terrace section planted in taro about half a mile up Waianu in 1935. Formerly taro was planted in terraces at least a mile farther inland along both the north and south branches of Waianu; and small terraces used to extend along Waiahole up into what is now forest reserve."

McAllister [1933] lists no archaeological sites in Waiahole, and Sterling and Summers [1968] make mention only of a brief 1964 survey report by William Kikuchi describing stone remains at several places in the uplands of the valley, none of which were in the vicinity of Waianu.

An undated map of Waiahole on file at the State Survey Office shows six land court awards, three of which were planted in taro, adjacent to the stream in the vicinity of the wellsites.

Site maps on file at the Historic Sites Section of the Department of Land and Natural Resources show that no sites have been reported in the vicinity of the wellsites.

Field Inspection

No archaeological or historical sites were located at the proposed wellsites nor along the existing jeep road which is to be the pipeline route.

Conclusions

As the Waianu wellsites and the proposed pipeline are located in an area where there is a high probability that aboriginal cultivation was practiced, there is the possibility that their construction might disturb sub-surface evidence of former agricultural practices. We therefore recommend that a test pit survey be conducted prior to any construction activities. If evidence of significant historic or prehistoric remains is found to be present, it is highly unlikely that it will be of such significance that it would have to be preserved, and archaeological salvage excavations will undoubtedly be a proper mitigative measure.

Sources Consulted

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

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State of Hawaii Survey Office

Tracing of map entitled "Waiahole, Oahu." The survey was done by J. F. Brown in 1878.

Tracing of untitled and undated map of Waiahole.

Sterling, Elspeth P. and Catherine C. Summers

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WAIAHOLE, OAHU: ARCHAEOLOGICAL SURVEY
AT PROPOSED WELL LOCATIONS

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AUGUST 1984

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During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by construction activities associated with the development of these wells. This report covers two proposed wellsites situated at an elevation of approximately 500 feet in Waiahole Valley [Figure 1]. The easternmost is the primary site and the westernmost is the alternate.

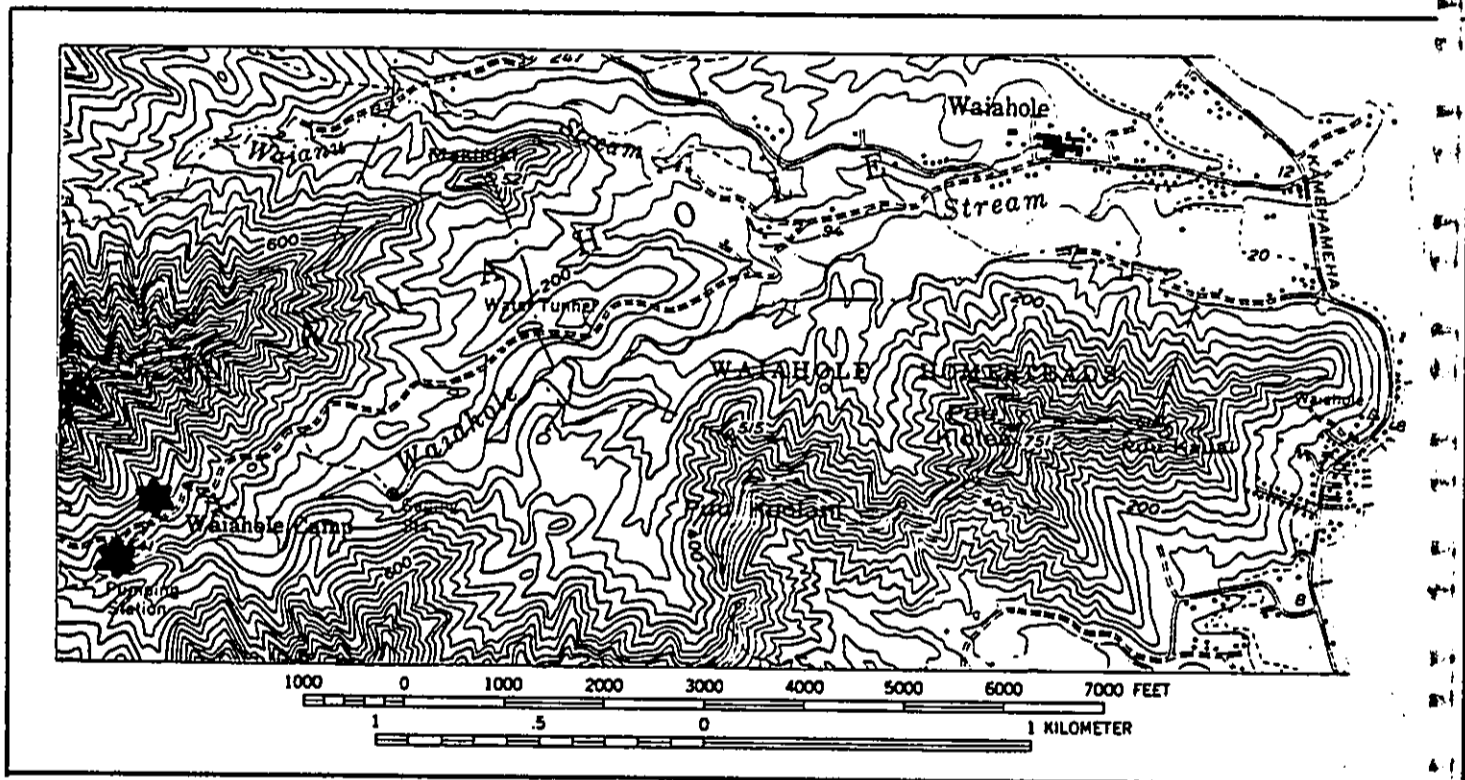


Figure 1. Location of Waiahole Wellsites.

Literature Search

Handy [1940:95] described agricultural sites in the valley:

"There were formerly terraces throughout the seaward lowlands of Waiahole, some in swampy lands but most of them irrigated from Waiahole Stream. Groups of terraces adjoining Waikane were planted in 1935. The land south of the stream and inland from the highway has reverted to swamp. Some kuleana a short way up the main

stream, beyond its junction with Waianu, are cultivated by Hawaiians living in the lower valley; there was also a sizable terrace section planted in taro about half a mile up Waianu in 1935. Formerly taro was planted in terraces at least a mile farther inland along both the north and south branches of Waianu; and small terraces used to extend along Waiahole up into what is now forest reserve."

McAllister [1933] lists no archaeological sites in Waiahole, and Sterling and Summers [1968] make mention only of a brief 1964 survey report by William Kikuchi describing stone remains at several places in the uplands of the valley, none of which were in the vicinity of the proposed wellsites.

Inspection of two maps at the State Survey Office, one dated 1878 and the other undated, show no kuleana or other such cultural features in the vicinity of the wellsites. However, they do indicate considerable numbers of kuleana along the stream, and these become more frequent nearer the ocean.

Site maps on file at the Historic Sites Section of the Department of Land and Natural Resources show that no sites have been reported in the vicinity of the wellsites.

Field Inspection

No archaeological or historical sites were located at either of the proposed wellsites.

Conclusions

As the primary Waiahole wellsite is located in a flat alluviated area adjacent to Waiahole Stream, there is the possibility that sub-surface evidence of former agricultural practices is present. We therefore recommend that this well-site be the subject of a test pit survey prior to any construction activities. If evidence of significant historic or pre-historic remains is found to be present, it is highly unlikely that it will be of such significance that it would have to be preserved, and archaeological salvage excavations will undoubtedly be a proper mitigative measure.

Because the alternate Waiahole wellsite is located in an area already disturbed by construction and because the proposed pipelines for both the primary and alternate sites follows the existing road, we see no need for further archaeological investigations in either of those areas.

Sources Consulted

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

[This report presents the results of a selective archaeological survey of the island of Oahu.]

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and excavation reports on file at the Historic Sites Section.

State of Hawaii Survey Office

Tracing of map entitled "Waiahole, Oahu." The survey was done by J. F. Brown in 1878.

Tracing of untitled and undated map of Waiahole.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Education, Bernice P. Bishop Museum. Honolulu.

[This is a compilation of information from numerous sources concerning the archaeological sites, history, traditions, legends, place names and land descriptions from the island of Oahu.]

KAALAEA, OAHU: ARCHAEOLOGICAL SURVEY
AT PROPOSED WELL LOCATIONS

Prepared for:
VTN PACIFIC
1164 Bishop Street
Honolulu, Hi. 96813

Prepared by:
William Barrera, Jr.

CHINIAGO INC.
1040 B Smith St.
Honolulu, Hawaii 96817

AUGUST 1984

F-92

Introduction

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by the construction activities associated with the development of these wells. This report covers two wellsites at Kaalaea [Figure 1], the westernmost of which is referred to as "Kaalaea Inclined Wells or Tunnel" and the easternmost of which is referred to simply as "Kaalaea Wells" [Figure 2].

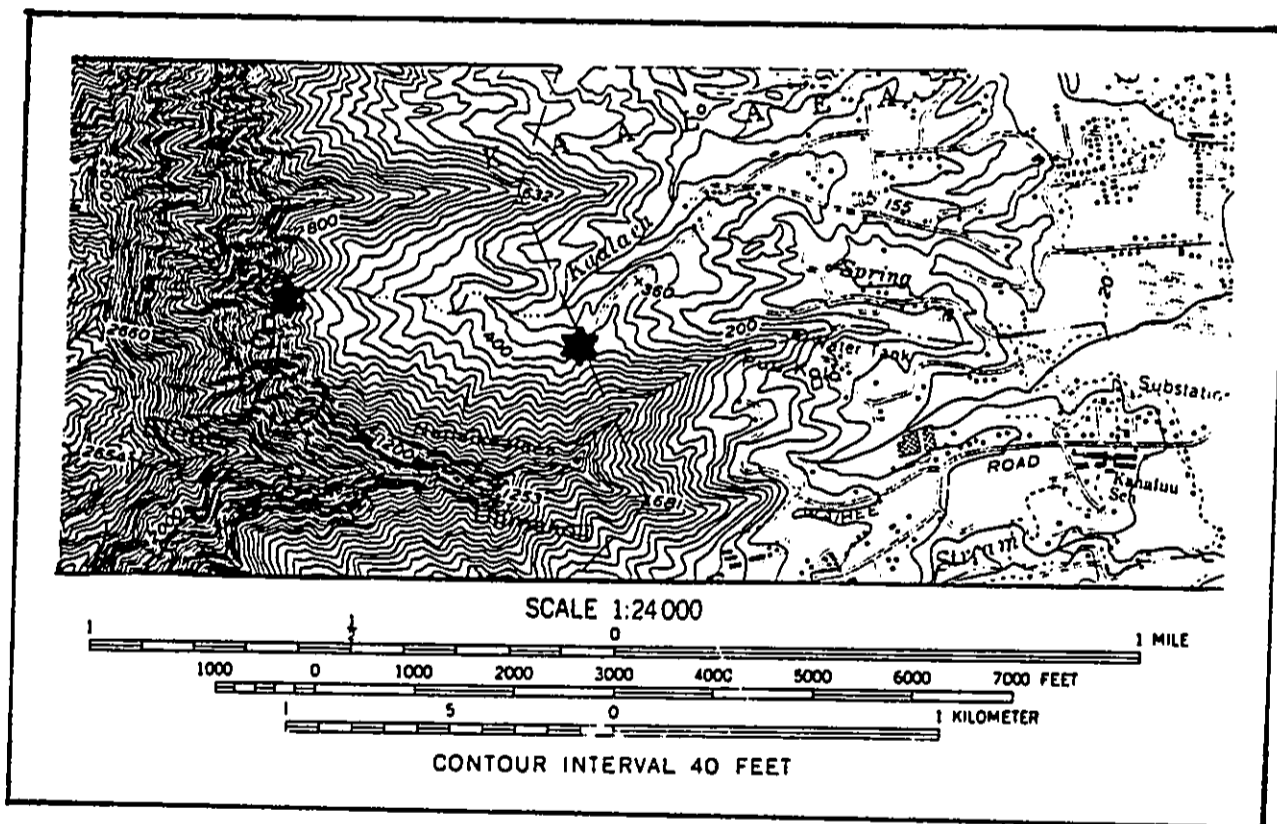


Figure 1. Location of Kaalaea Inclined Wells [left] and Kaalaea Wells [right].

Literature Search

Handy discussed legendary places in Kaalaea and their relationship to agricultural localities in the area:

"Kaalaea. Just south of the ridge separating Kaalaea from Waiahole is a small hill facing the sea, named Puu Kahea [Hill of Calling], where Hiiaka, the sister of Pele, is said to have chanted. Below



Figure 2. Kaalaea Wells Site, looking South.

the hill is a spring and pool named Hiiaka. This spring watered the fine group of terraces still owned and cultivated by Mrs. Kaaoaoloa Kukahiko, who lives with her family on Puu Kahea, from ancient times the home site of her forbears. The flats to seaward were also irrigated with water from this spring. Above Hiiaka pool were other terraces. There were a few small terraces watered by springs between Puu Kahea and the sea.

"Farther up the main valley on the north side is a spring named for the god Kanaloa [to whom, with Kane, is attributed the opening of many springs throughout these islands]. Near this spring is another named Ka-houpo-o-Kane [The-diaphragm-of-Kane]. These springs were the sources of water for irrigating terraces north of the main stream below the ridge toward Waiahole. Below this, also north of the stream, was another terrace section irrigated from a spring named Keahue.

"The main stream, Kaalaea, watered the exten-

sive flats from the seashore to the lower hills, about a quarter of a mile inland. Much of this land is still cultivated. Terrace sections, up to 1.5 miles inland, were watered by this stream.

"Kuana-auwai is a small stream [ditch?] said to flow westward into Kaalaea Stream in its upper course. Its name suggests that it was an artificial irrigation ditch [auwai], perhaps tapping a spring. I infer that this watered terraces called Kawailoa, inland of Kanaloa" [Handy 1940:95-6].

Neither McAllister [1933] nor Sterling and Summers [1968] mention any inland sites of historical or archaeological interest at Kaalaea.

Field Inspection

No archaeological or historical remains were located at the site of the Kaalaea Wells or along the proposed pipeline right-of-way, which follows an existing jeep road.

No sites were observed at the Kaalaea Inclined Wells or Tunnel site, but former cultivation is evidenced by the presence of wild taro [*Colocasia esculenta*] and ti [*Cordyline terminalis*], and extensive remains of agricultural terraces were located along Kaalaea Stream below the proposed well site.

Conclusions

As no sites were located at the Kaalaea Wells site or along the right-of-way of the pipeline, we feel that there are no archaeological or historical objections to the construction as planned.

The demonstrated presence of sites along the stream below the proposed Kaalaea Inclined Wells or Tunnel and the presence of cultigens at the proposed site itself lead us to recommend that the proposed wellsite be subjected to a test pit survey and the final pipeline right-of-way be the subject of an intensive surface and subsurface survey. If evidence of significant historic or prehistoric remains is found to be present at any of these locations, it is highly unlikely that it will be of such significance that it would have to be preserved, and archaeological salvage excavations will undoubtedly be a proper mitigative measure.

Sources Consulted

Handy, E. S. Craighill

1940 The Hawaiian Planter. Vol. I. Bernice P. Bishop Museum, Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

[This report presents the results of a selective archeological survey of the island of Oahu.]

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and excavation reports on file at the Historic Sites Section.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Education, Bernice P. Bishop Museum. Honolulu.

This is a compilation of information from numerous sources concerning the archaeological sites, history, traditions, legends, place names and land descriptions from the island of Oahu.]

**KAHALUU, OAHU: ARCHAEOLOGICAL SURVEY
AT PROPOSED WELL LOCATION**

BERNICE P. BISHOP MUSEUM

P. O. Box 6037, Honolulu, Hawaii 96818 • Telephone 847-3511

August 13, 1979

Mr. Calvin Kim
Calvin Kim & Associates, Inc.
Suite 201, 828 Fort Street Mall
Honolulu, Hawaii'i 96813

Dear Mr. Kim:

Re: Request for Services / Archaeological/Historical Inspection
for Kahalu'u Wells at Ko'olau Poko, O'ahu, Hawaii'i / TMK 7-7-08:2

On August 9, 1979, I was accompanied by Mr. Arnold Goto from your office to conduct a field inspection of the proposed Kahalu'u Exploratory Well Site. At this time it was somewhat difficult to determine the exact boundaries of the area to be impacted by the drilling activities, due to the presence of dense vegetation and to the fact that the area of construction has not yet been surveyed. It appears that the drilling will take place at a site near Kahalu'u Stream which is presently supporting a heavy growth of California grass (*Brachiaria mutica*). Such a stand of this type of vegetation has probably taken hold following relatively recent (20th century) clearing activities or other disturbances which removed the original vegetation cover. No remains of archaeological or historical significance were encountered in this immediate area occupied by the California grass.

However, north of the California grass, and beyond what appears to be the old coral road bed, lies an area where remnants of prehistoric Hawaiian field terraces may exist. We cleared away some of the vegetation in a few spots in this area to expose what appeared to be possible retaining walls for such terraces. This opinion is offered rather cautiously, because further work would be required to clear more vegetation in order to confirm or deny this possibility. We do have the following information from E. S. Craighill Handy (*The Hawaiian Planter*, Vol. I, 1940, p. 97):

"There must have been terraces throughout the broad part of the valley for several miles inland. Some of those in the lower portion of the valley are cultivated now; most of them are neglected....The terrace sections of Kahaluu are tucked away in pockets of land watered from several streams; there are few large continuous areas, but the total area under cultivation in ancient times must have been very considerable."

In summary, we can foresee no damage to archaeological or historical remains, assuming the areas of impact are confined to the old coral road bed and to the area presently under California grass cover. However, should construction activities go beyond these areas, we would recommend further archaeological investigation of adjacent areas. An equally appropriate alternative, in this case,

Mr. Calvin Kim

- 2 -

August 10, 1979

would be to have an archaeologist monitor the initial clearing activities, if the surveyed site does not lie entirely in the boundaries of the grass.

If I can be of further assistance, or if you have any questions, please call me at 847-3511. We appreciate the opportunity to work on this small survey with you and would be happy to offer our services in the future.

Yours sincerely,

Rose Schilt

Rose Schilt
Archaeologist

RS:gmc

KAHALUU, OAHU: ARCHAEOLOGICAL SURVEY
AT PROPOSED WELL LOCATIONS

Prepared for:
VTN PACIFIC
1164 Bishop Street
Honolulu, Hi. 96813

Prepared by:
William Barrera, Jr.

CHINIAGO INC.
1040 B Smith St.
Honolulu, Hawaii 96817

AUGUST 1984

F-100

Introduction

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by construction activities associated with the development of these wells. This report covers Kahaluu Wells IIA, IIB and IIC, which are to be located adjacent to Mapele Road at an elevation of approximately 40 feet [Figures 1 and 2].

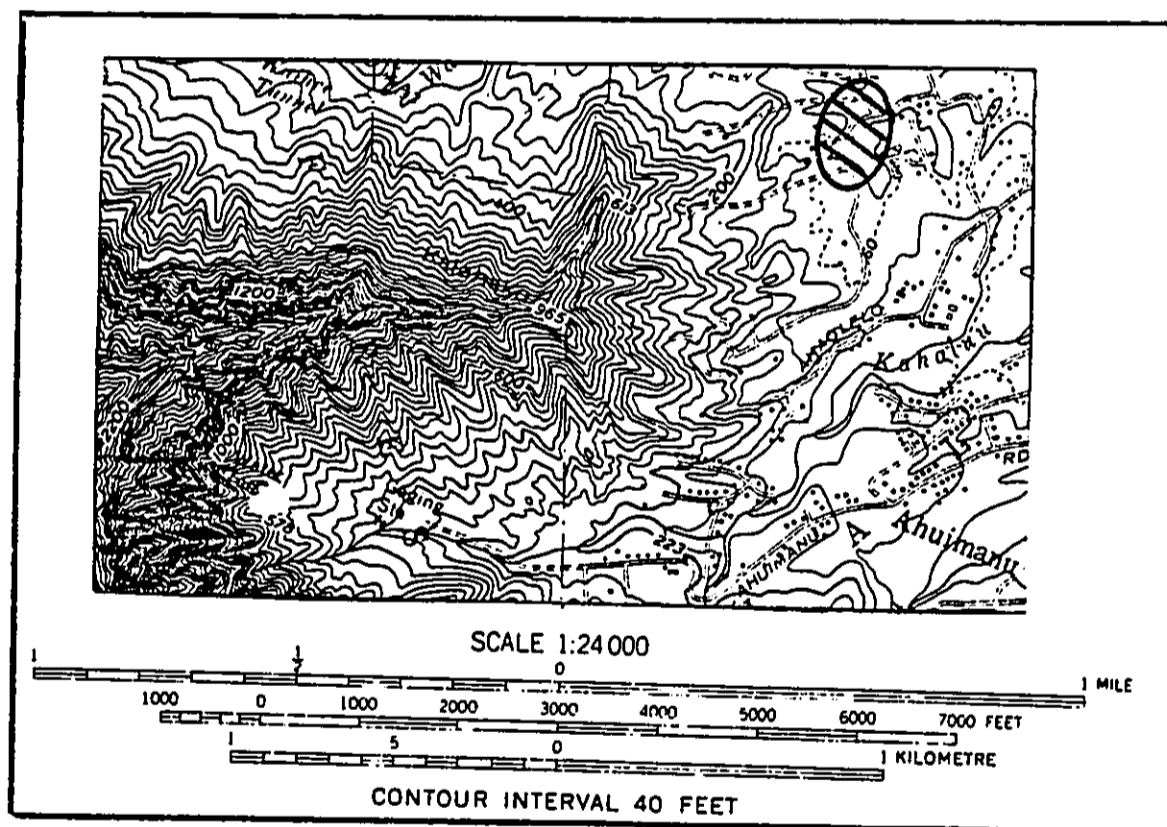


Figure 1. Location of Kahaluu Wells IIA, IIB, and IIC.

Literature Search

Handy discussed agricultural remains in Kahaluu:

"Kahaluu. Kahaluu Stream, after which the ahu-pua'a is named, is joined a quarter of a mile from the sea by a small stream named Kalohaka;



Figure 2. Location of Kahaluu Wellsites IIA, IIB and IIC.

about three quarters of a mile from the sea it is joined by Ahulumanu, which in its turn, is amplified three quarters of a mile farther inland by Waiola Stream. It was from all these streams that the water was taken to irrigate the lower flats of Kahaluu which are continuous with those of Waihee. Kahaluu Stream extends back to the Koolau Range through a broad valley. There must have been terraces throughout the broad part of the valley for several miles inland. Some of those in the lower portion of the valley are cultivated now; most of them are neglected.

"Dry taro now flourishing on the kula land between Kahaluu and Ahuimanu Streams is all planted by Orientals. There was no planting of this sort here in the old days.

"On either side of the valley of Waiola Stream is an area of broad level terraces, the most extensive now cultivated, which in 1935 were all planted in wet taro for commercial purposes. Beginning about seven tenths of a mile along the road from the sea, and extending be-

yond for about half a mile, the terraces are continuous along broad level flats on either side of the stream up to Ahuimanu; most of them are now under grass. One old Hawaiian has several large terraces under cultivation in interior flats watered by Ahuimanu Stream.

"The terrace sections of Kahaluu are tucked away in pockets of land watered from the several streams; there are few large continuous areas, but the total area under cultivation in ancient times must have been very considerable" [Handy 1940:97]

A June 1880 map of the Kaalaea Sugar Plantation surveyed by Monsarrat shows some kuleana in the vicinity of the proposed wellsites, and indicates that three branches of a major auwai [artificial water channel or ditch] originate or pass through there.

The only archaeological sites noted by McAllister [1933: 170-1] are three heiau and three fishponds, all located at the coast and therefore well away from any impact of well construction.

Field Inspection

The field inspection revealed the presence of numerous irrigated agricultural terraces and at least one auwai at the location of the proposed wellsites. Although the precise age of these features has not been determined, their origins could very well be prehistoric.

Conclusions

The demonstrated presence of possible historically or archaeologically significant agricultural remains near the proposed Kahaluu wellsites indicates that construction associated with the well will represent an adverse effect. Archaeological excavations should be conducted at all such construction locations prior to ground disturbance of any kind.

Sources Consulted

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

[This report presents the results of a selective archaeological survey of the island of Oahu.]

State Survey Office

1880 "Map of the Kaalaea Sugar Plantation, Koolaupoko, Oahu." M. D. Monsarrat, Surveyor. June, 1880.

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and excavation reports on file at the Historic Sites Section.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Education, Bernice P. Bishop Museum. Honolulu.

[This is a compilation of information from numerous sources concerning the archaeological sites, history, traditions, legends, place names and land descriptions from the island of Oahu.]

Introduction

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify significant archaeological or historical remains which might be adversely affected by the construction activities associated with the development of the wells. This report covers the proposed wellsite at Ahuimanu, which is to be located at the base of the cliffs at an elevation of approximately 450 feet [Figure 1].

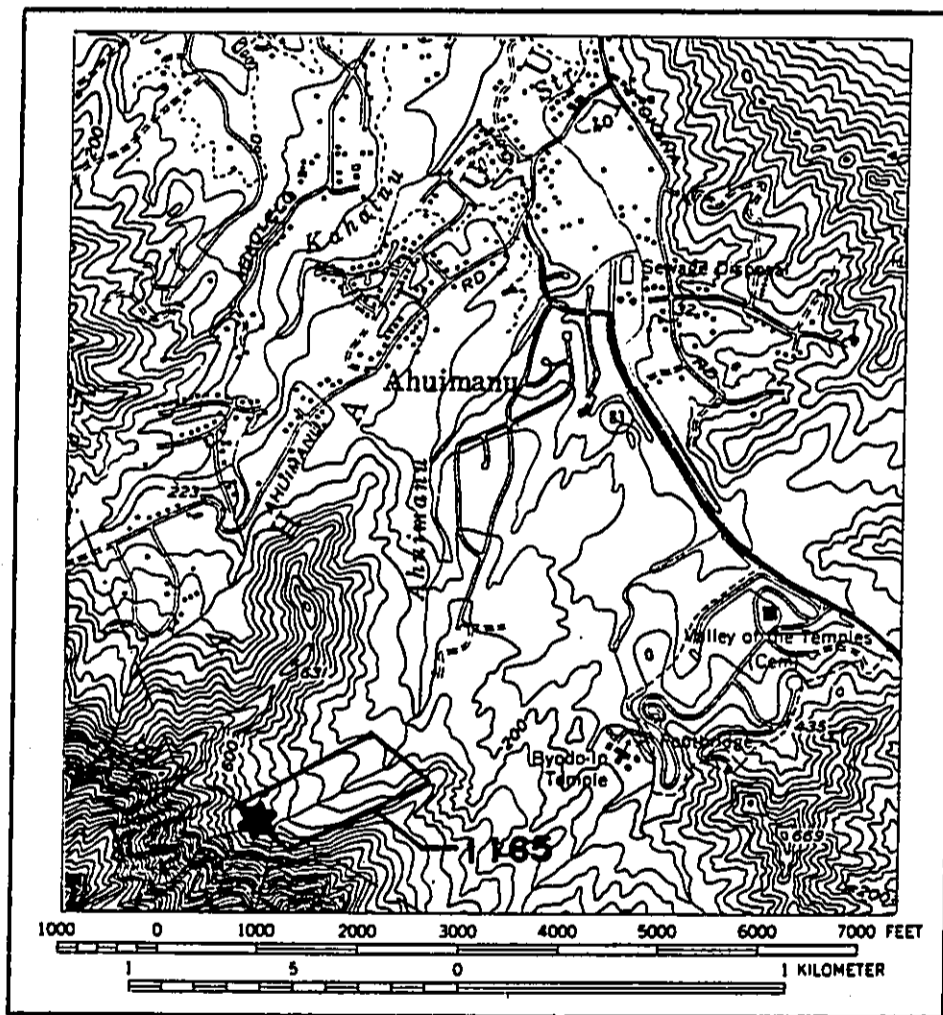


Figure 1. Location of Ahuimanu Wellsite

Literature Search

Handy's comments about the ahupua'a of Kahaluu are relevant to the area presently in question:

"Kahaluu. Kahaluu Stream, after which the ahupua'a is named, is joined a quarter of a mile from the sea by a small stream named Kalohaka; about three quarters of a mile from the sea it is joined by Ahulumanu, which in its turn, is amplified three quarters of a mile farther inland by Waiola Stream. It was from all these streams that the water was taken to irrigate the lower flats of Kahaluu which are continuous with those of Waihee. Kahaluu Stream extends back to the Koolau Range through a broad valley. There must have been terraces throughout the broad part of the valley for several miles inland. Some of those in the lower portion of the valley are cultivated now; most of them are neglected.

"Dry taro now flourishing on the kula land between Kahaluu and Ahuimanu Streams is all planted by Orientals. There was no planting of this sort here in the old days.

"On either side of the valley of Waiola Stream is an area of broad level terraces, the most extensive now cultivated, which in 1935 were all planted in wet taro for commercial purposes. Beginning about seven tenths of a mile along the road from the sea, and extending beyond for about half a mile, the terraces are continuous along broad level flats on either side of the stream up to Ahuimanu; most of them are now under grass. One old Hawaiian has several large terraces under cultivation in interior flats watered by Ahuimanu Stream" [Handy 1940:97].

Inspection of a map of the Catholic Mission property at Ahuimanu by Charles Dove indicates that the Ahuimanu wellsite is situated in an area designated as "Bishop's Garden," and that "Rose Apple, Banana, Kamane, Ginger Etc." were growing there. The Hawaiian name given for the area is Palikea, which includes a taro patch 300 feet to the east of the garden. This is undoubtedly a portion of Site 50-80-06-1165, discussed below.

The historical significance of the mission facility is discussed in an article in the magazine "Paradise of the Pacific," a quotation from which was included in Sterling and Summers' Sites of Oahu:

"...A ride of about one and one-half miles along this road [after leaving Kam. highway] brings you to Ahuimanu where from 1846 to 1882 the Fathers of the Catholic Mission conducted the first Catholic high school in Hawaii, the predecessor to the present St. Louis College....

"Late in 1845, King Kamehameha III granted to the Catholic Mission a tract of land 'to erect a school for the purpose of teaching the use of letters, such as reading, writing, arithmetic and geography, and such like studies tending to mental improvement.' It was further stipulated in the grant that when well versed in the above studies, the pupils should be taught another language French or Latin as well as history.

"The royal grant consisted of two hundred and sixteen acres at Ahuimanu, in the district of Koolaupoko, Oahu. Of the entire area, only about ninety acres was relatively flat and fertile, the remainder being steep, rocky land, unfit for purposes of cultivation.

"Ahuimanu: An Old Oahu Island School Site
Paradise of the Pacific
May 1927, p 26" [Sterling and Summers 1968:195].

The Hawaii Register of Historic Places in 1971 recorded Site 50-80-06-1165, the Kahaluu Taro Lo'i, immediately downslope from the proposed wellsite:

"The Kahaluu taro lo'i [wet terraces] are located on Ahuimanu Stream and lie just under the pali of the Koolau Range. The site consists of a series of terraces or lo'i used in growing wet taro. A heavy cover today of hau, mango and guava makes it very difficult to accurately survey the entire system; however, it does include approximately 18 terraces and covers an area of ca. 25 acres. These terraces have a front facing of stacked local stone with these facings often reaching a height of 2 - 2.5 meters. Behind the facings is a flat of earth fill. In shape, the terraces are generally rectangular and have an average size of 5 X 10 meters. Both the facings and the terraces proper are in generally good condition except for the heavy vegetation cover noted above.

"This system is the largest series of intact wet taro terraces, lo'i, known on Oahu as well as among the most complex. In addition, these terraces stand alone as the best example of ancient Hawaiian expertise in this type of engineering. Despite the inroads of the vegetation cover noted, the facings of stacked stone remain in much the same good condition as they did when used for cultivating taro, a staple in the basic subsistence pattern of the Hawaiian. Heavy rainfall, 150" annually, and rather steeply sloping terrain notwithstanding, these terraces are neither washed away

nor silted over; thus demonstrating still another facet of the expertise of the Hawaiians in conservation and flood-erosion control. Dates of use are not determinable at this time but could extend back into pre-contact times."

Tuggle [n.d.] mapped and conducted test excavations in the site between 1973 and 1975, and Barrera [1977:50] visited the site in preparing a report on planning alternatives for historic sites in the Kaneohe Bay area. That visit confirmed the Hawaii Register of Historic Places description, with the addition of an observation of minor wall collapse in places.



Figure 2. Wall Near Location of Ahuimanu Well-site.

Field Inspection

Our field inspection confirmed the presence of historic and/or prehistoric remains in and around the proposed well-site. The remains visible on the surface are walls [Figure 2] and terraces; sub-surface remains are undoubtedly present as well.

Conclusions

The demonstrated presence of significant historical or archaeological remains at and near the proposed Ahuimanu

wellsite indicates that any construction associated with the well, access roads, or pipelines will represent an adverse effect. Archaeological excavations will have to be conducted at all such construction locations prior to ground disturbance of any kind.

Sources Consulted

Barrera, William M., Jr.

1977 Planning Alternatives for Historic Sites in the Kaneohe Bay Area. Prepared for U. S. Army Engineer District, Honolulu. Chiniago Inc. Honolulu.

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

[This report presents the results of a selective archaeological survey of the island of Oahu.]

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and excavation reports on file at the Historic Sites Section.

State of Hawaii Survey Office

Tracing of map entitled "Map of Catholic Mission Property, Ahuimanu, Koolaupoko, Oahu." The survey and map were done by Charles V. E. Dove, probably sometime during the 1880s.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Education, Bernice P. Bishop Museum. Honolulu.

[This is a compilation of information from numerous sources concerning the archaeological sites, history, traditions, legends, place names and land descriptions from the island of Oahu.]

Tuggle, H. David

1975 "Report on Archaeological Research in the Ahuimanu
Terrace Complex." 1975 ms. on file at SHPO.

**KANEOTE, OAHU: ARCHAEOLOGICAL SURVEYS
AT PROPOSED WELL LOCATIONS**

CHINIAGO INC.

Archaeological Consulting

1040-B SMITH STREET • HONOLULU, HAWAII 96817 • TELEPHONE: (808) 521-2785

December 19, 1983

Mr. Douglas Meller
VTN Pacific
1164 Bishop Building
Suite 906
Honolulu, Hawaii 96813

Dear Mr. Meller:

On Friday, December 16, 1983, I accompanied you on an inspection of the locations of three proposed water wells in Kaneohe, Oahu. The two Kamooali'i locations are situated in the vicinity of the City and County maintenance yard on Nuuanu Pali Drive, adjacent to the Pali Golf course, and the third is situated on Luluku Stream immediately inland of Likelike Highway.

A literature search of the following sources revealed no previously-recorded archaeological or historical sites at these locations.

Rosendahl, Paul H.

1976 Archaeological Investigations in Upland Kaneohe.
Department of Anthropology, Bernice P. Bishop
Museum.

Handy, E. S. C.

1940 The Hawaiian Planter, Volume I. Bernice P.
Bishop Museum Bulletin 161.

Sterling, Elspeth P., and Catherine C. Summers

1978 Sites of Oahu. Departments of Anthropology and
Education, Bernice P. Bishop Museum.

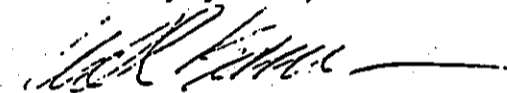
Streck, Charles

1982 Archaeological Reconnaissance Survey for Route
H-3 [Alternative A]. Kane'ohe, O'ahu, Hawai'i.
Department of Anthropology, Bernice P. Bishop
Museum.

Our field inspection also failed to reveal any such remains at any of the three locations. However, because the thick grass at the northernmost of the Kamooali'i locations could have obscured low walls or surficial evidence of midden deposits, we must recommend that all work at that location be monitored by an archaeologist. Monitoring will also be necessary at the Luluku site because, although nothing of archaeological or historical interest was seen on the site itself, the presence of a system of agricultural terraces on the alluvium opposite the proposed location indicates the possibility that sub-surface archaeological remains might be present.

If you have any questions, please do not hesitate to call.

Sincerely yours,



William Barrera, Jr.
President

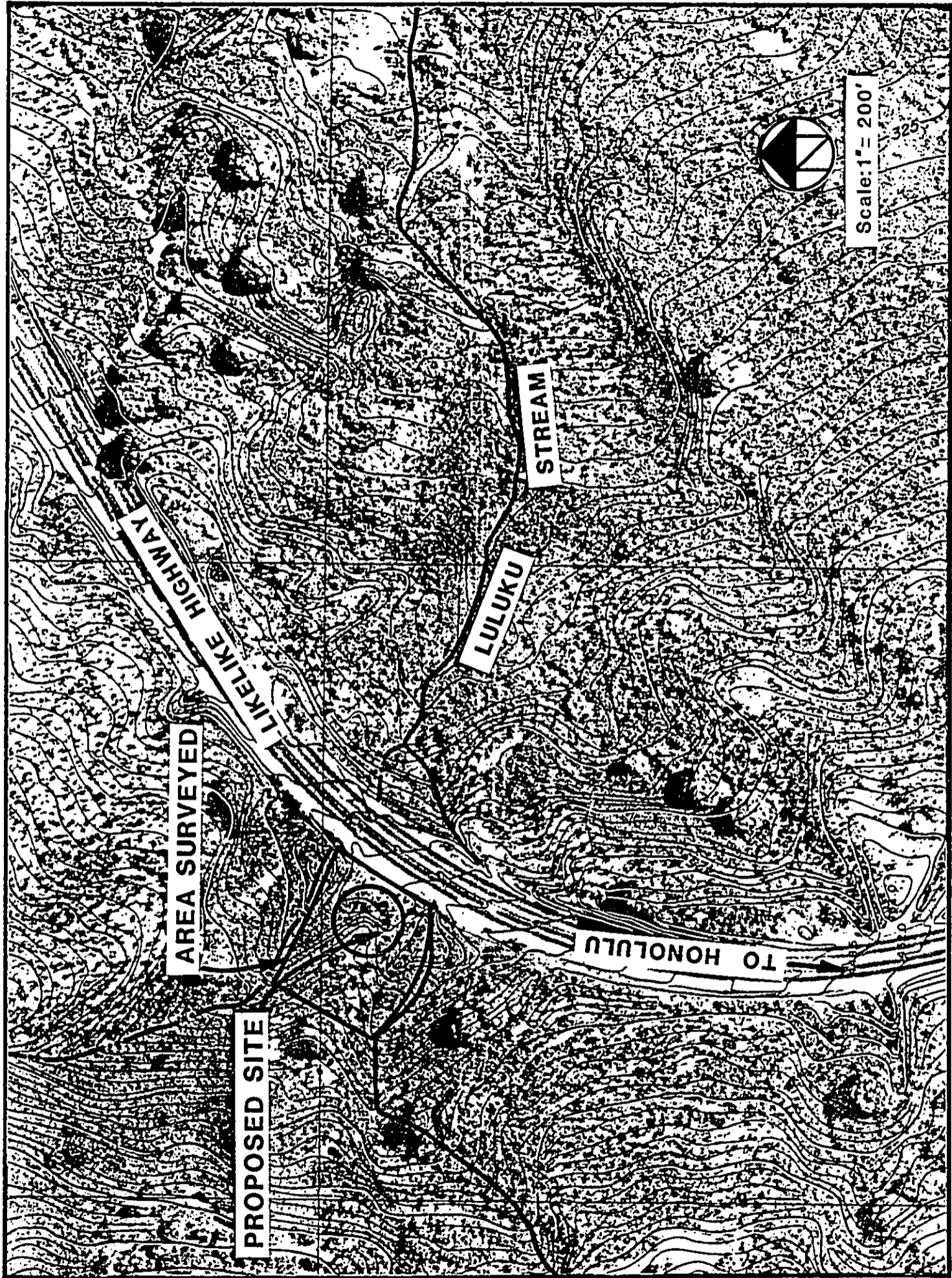


PLATE 1
LULUKU WELL FIELD SITE

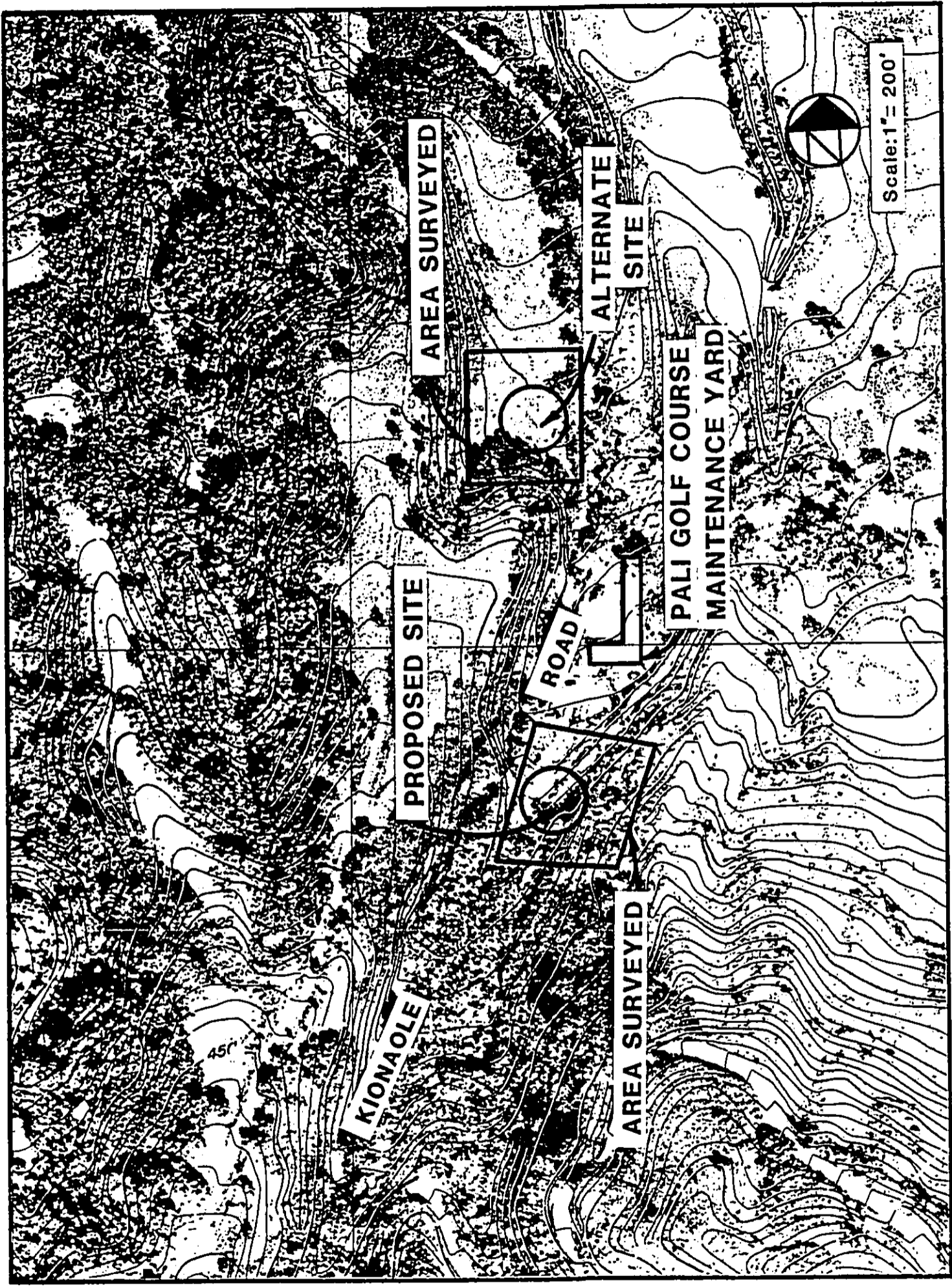


PLATE 2

ALERTI KOC II WE F D CTE

HALEKOU, OAHU: ARCHAEOLOGICAL SURVEY
AT EXISTING WELL LOCATIONS

Prepared for:
VTN PACIFIC
1164 Bishop Street
Honolulu, Hi. 96813

Prepared by:
William Barrera, Jr.

CHINIAGO INC.
1040 B Smith St.
Honolulu, Hawaii 96817

AUGUST 1984

F-118

Introduction

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by construction activities associated with the development of these wells. This report covers the two existing Halekou Wells in Kaneohe, situated at an elevation of approximately 200 feet [Figure 1]

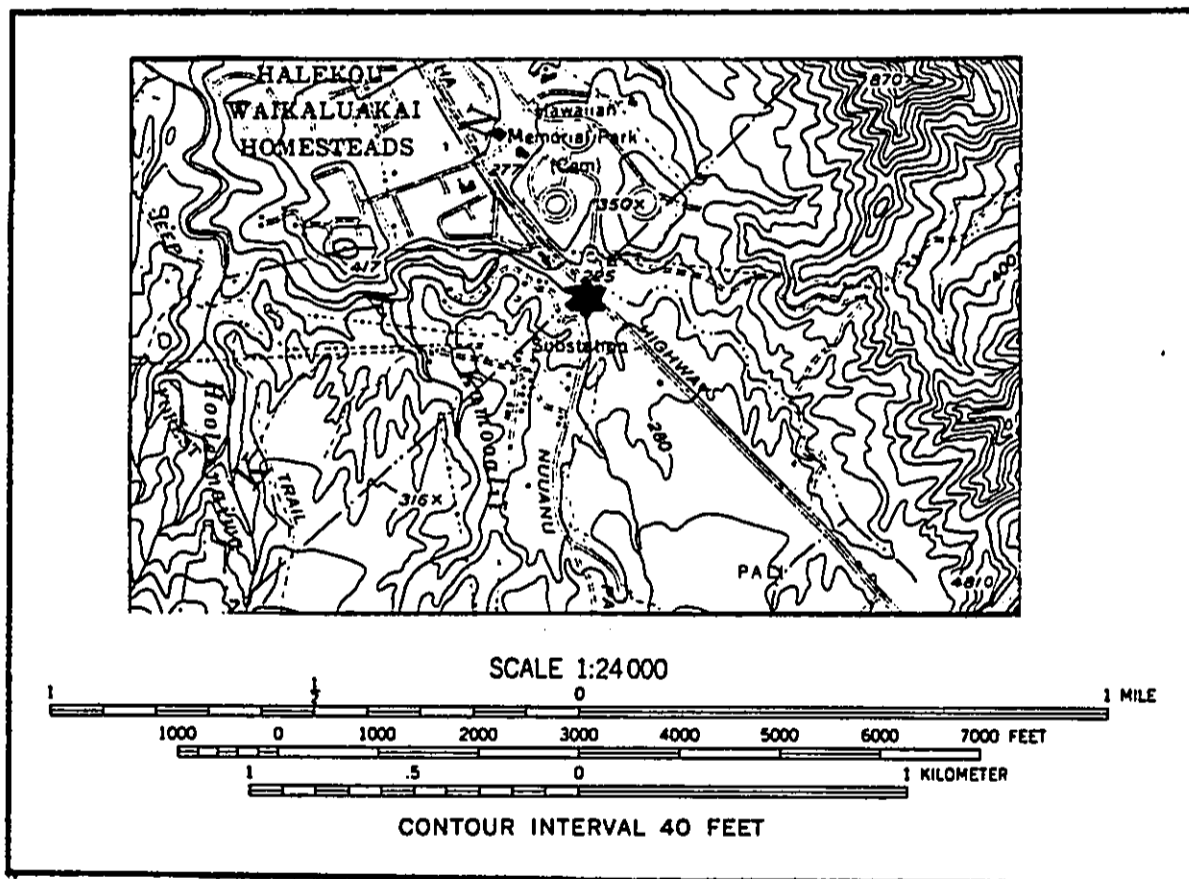


Figure 1. Location of Halekou Wells.

Literature Search

An 1874 map of Kaneohe and West Kailua surveyed by Lyons shows no agricultural fields, habitations or other points of interest at the location of the Halekou wells. No archaeological sites were noted by McAllister, and Sterling and Summers indicate no sites of importance there either.

Field Inspection

The field inspection revealed that the entire area surrounding the Halekou Wells has been extensively bulldozed, and that there are no sites of historical or archaeological significance located there.

Conclusions

No further archaeological work will be necessary at the location of the Halekou Wells.

Sources Consulted

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

[This report presents the results of a selective archaeological survey of the island of Oahu.]

State Survey Office

1874 "Map of Kaneohe, Oahu, with West Kailua." C. J. Lyons, Surveyor.

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and excavation reports on file at the Historic Sites Section.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Education, Bernice P. Bishop Museum. Honolulu.

[This is a compilation of information from numerous sources concerning the archaeological sites, history, traditions, legends, place names and land descriptions from the island of Oahu.]

PALI TUNNEL DRAINS, OAHU: ARCHAEOLOGICAL SURVEY
AT EXISTING LOCATION

Prepared for:
VTN PACIFIC
1164 Bishop Street
Honolulu, Hi. 96813

Prepared by:
William Barrera, Jr.

CHINIAGO INC.
1040 B Smith St.
Honolulu, Hawaii 96817

AUGUST 1984

F-122

Introduction

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify archaeological or historical remains which might be adversely affected by construction activities associated with the development of these wells. This report covers the Pali Highway Tunnel Drains which are situated at Nuuanu Pali at an elevation of approximately 900 feet [Figure 1].

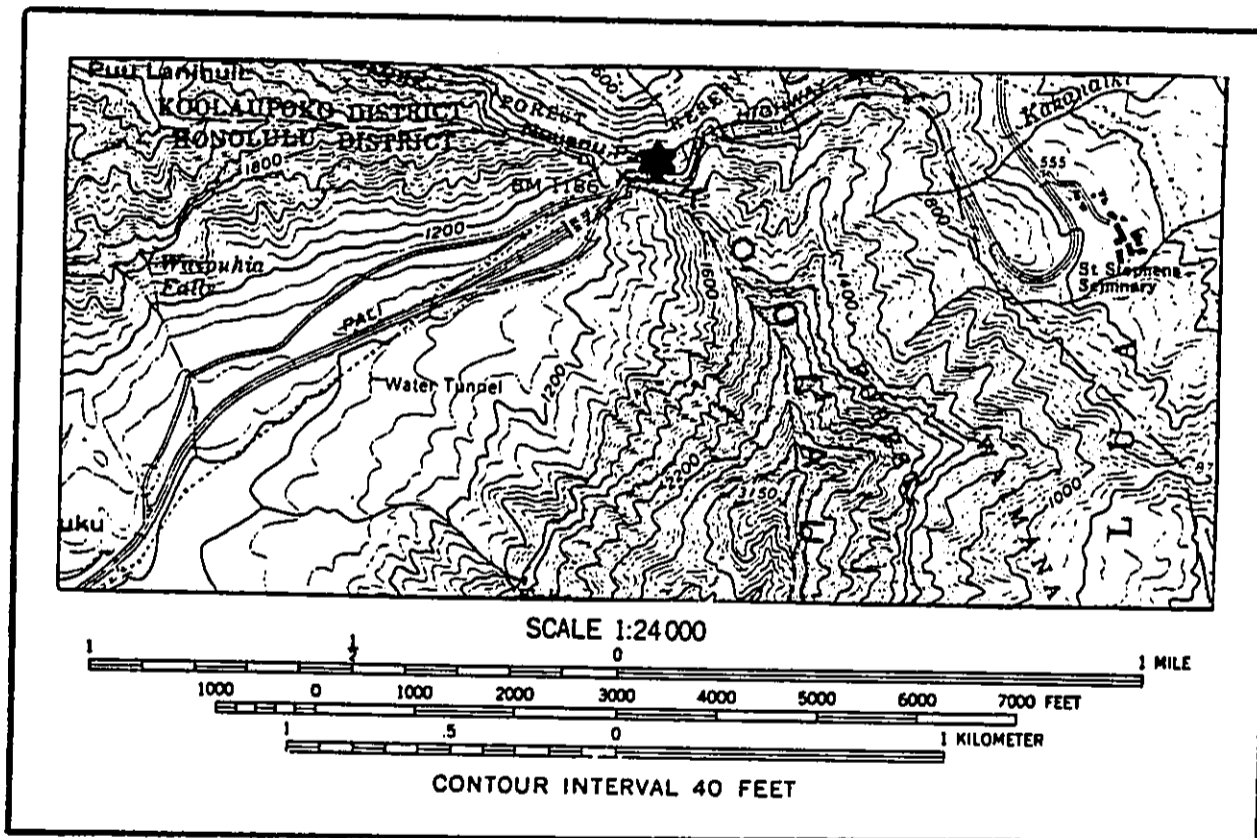


Figure 1. Location of Pali Highway Tunnel Drains.

Literature Search

McAllister discusses one site at the Nuuanu Pali:

"The two notches on the right hand side of Nuuanu Pali, as one approaches from Honolulu, have caused comment. The general impression is that they were fortifications. The Hawaiians now

say that they were built for the guns of Kamehameha, and that later his canoes were drawn up through the notches, the body of the canoe through one and the outrigger through the other. The notches are about 30 feet wide and 12 feet deep on the crest of the ridge, which is only a few feet broad. All evidence of artificiality has been weathered by the incessant strong winds that blow through the gap. The site directly commands the old trail down the gap and was probably occupied by fighters and their store of boulders to be rolled over the cliff on either side. Emory [1924] found similar notches on Lanai. Ellis [1831] writes: 'The Pari of Anuanu was an important position in time of war, and the parties in possession of it were usually masters of the island' [McAllister 1933:88].

The Nuuanu Pali was the site of the conclusion of one of the most famous battles in Hawaii history, at which Kamehameha subdued the Oahu army in 1795:

The forces of Kamehameha charged; in the onslaught many of the Oahuans were slain, and the rest pursued with great slaughter until they were driven to the end of the valley, which terminates in a precipice of 600 feet, nearly perpendicular in height,.... A few made their escape; some were driven headlong over its brink, and tumbled, mangled and lifeless corpses, on the rocks and trees beneath; others fought with desperation and met a warrior's death, among whom was Kalanikupule, who gallantly contested his inheritance to the last" [Thrum 1900:111, quoted in Sterling and Summers 1978:319].

During historic times the Nuuanu Pali has served as an important trade link between the leeward and windward sides of the island of Oahu:

"In the early nineteenth century it was reported that there were three routes from Honolulu to Windward Oahu: around the island by canoe; through Kalihi Valley and over the pali by ropes and ladders [Graham 1826:142]; and over the Nuuanu Pali, the easiest, quickest, and most direct route. The latter trail was treacherous in spots, and in places the people

had to climb straight up and down [Tinker Ms.: 3]. Regardless, it was travelled daily by scores of people crossing to Honolulu to sell their poi, pigs, sweet potatoes, and fruit to the city population" [Devaney et al. 1982:163].

Field Inspection

No archaeological or historical sites were located in the vicinity of the tunnel drains.

Conclusions

No further archaeological work will be necessary at the Pali Highway Tunnel Drains.

Sources Consulted

[*] indicates literature not directly consulted, but referenced by our sources.

Devaney, Dennis M., M. Kelly, P. J. Lee, and L. S. Motteler

1982 Kaneohe, A History of Change. The Bess Press. Honolulu.

*Ellis, William

1831 Polynesian Researches, Vol. 4. London.

*Emory, Kenneth P.

1924 The Island of Lanai. Bernice P. Bishop Museum Bulletin 53. Honolulu.

*Graham, Martha [Ed.]

1826 Voyage of H.M.S. "Blonde" to the Sandwich Islands in the Years 1824-1825. Capt. Lord Byron, Commander. John Murray. London.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

[This report presents the results of a selective archaeological survey of the island of Oahu.]

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and excavation reports on file at the Historic Sites Section.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Education, Bernice P. Bishop Museum. Honolulu.

[This is a compilation of information from numerous sources concerning the archaeological sites, history, traditions, legends, place names and land descriptions from the island of Oahu.]

Thrum, Thomas G.

1900 "The Battle of Nuuanu." Hawaiian Annual for the Year 1899, pp. 107-12.

*Tinker, Reuben

n.d. Extracts from Tinker's lectures dated Saturday, July 23, 1831. Unpublished ms. on file at Hawaiian Historical Society Library, Honolulu.

MAUNAWILI, OAHU: ARCHAEOLOGICAL SURVEY
AT PROPOSED WELL LOCATIONS

Prepared for:
VTN PACIFIC
1164 Bishop Street
Honolulu, Hi. 96813

Prepared by:
William Barrera, Jr.

CHINIAGO INC.
1040 B Smith St.
Honolulu, Hawaii 96817

AUGUST 1984

F-128

Introduction

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify significant archaeological or historical remains which might be adversely affected by the construction activities associated with the development of the wells. This report covers four proposed wellsites at Maunawili [Figure 1]. Maunawili Well I is to be located on the south side of Omao Stream, at an elevation of about 250 feet [Figure 2]. Maunawili Well II is on the stream terrace on the north side of Palapu Stream [Figure 3]. Maunawili Well III is to be located at one of two alternate sites adjacent to the existing Board of Water Supply Reservoir at the end of Lopaka Street: Alternative A is within the fenced area surrounding the reservoir and Alternative B is directly below A on a recently terraced slope.

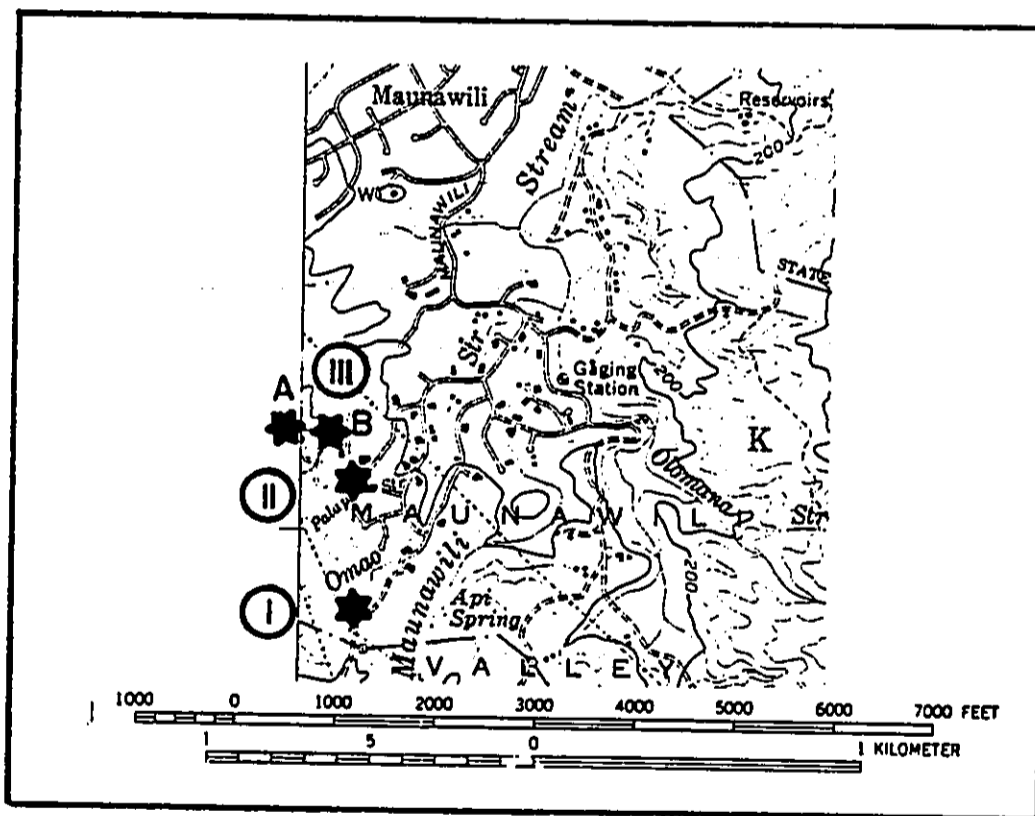


Figure 1. Location of Maunawili Wellsites.



Figure 2. Proposed Location of Maunawili Well I.



Figure 3. Proposed Location of Maunawili Well II.

Literature Search

Inspection of a tracing of Registered Map No. 2049 at the State Survey Office revealed that Maunawili Well I is located on an old kuleana [LCA 5882, to Kekuku], Maunawili Well III-A is in Grant 1933:2 to Samuel Jacobs, and Maunawili Wells II and III-B are in Grant 2455 to L. Andrews.

Inspection of records at the Historic Sites Section of the Department of Land and Natural Resources revealed that two brief reconnaissances had been conducted by their personnel along Omao Stream, resulting in the notation of the presence of terrace walls along the stream immediately below the proposed Maunawili Well I.

Field Inspection

Maunawili I - No significant historical or archaeological remains were found at the proposed location of the well, but terrace retaining walls were observed adjacent to Omao stream immediately downslope [Figure 4].

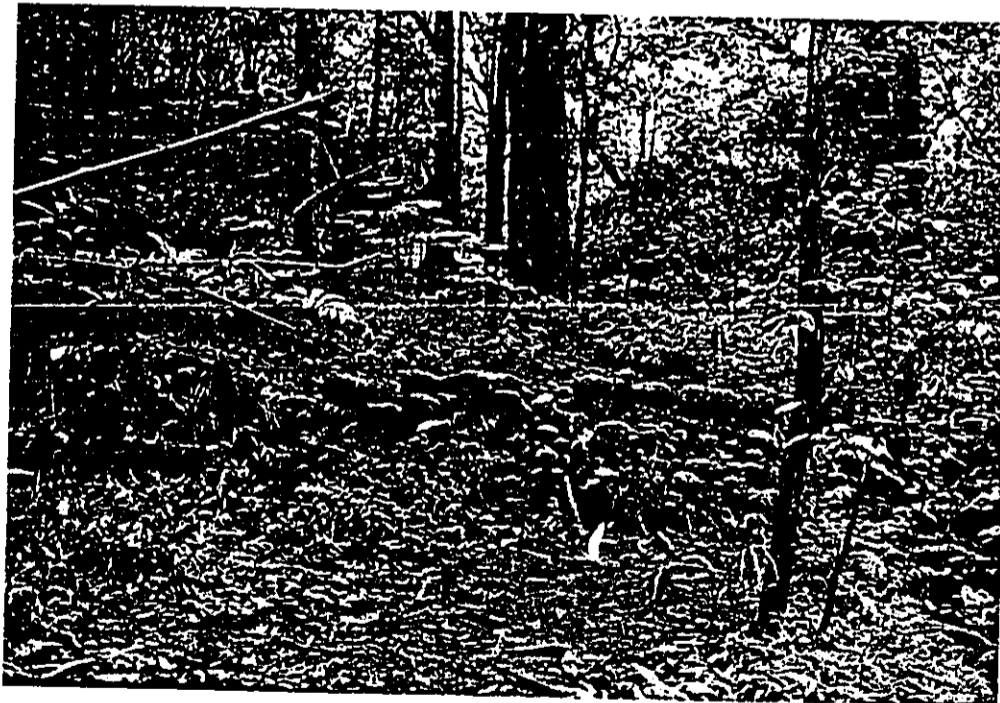


Figure 4. Terrace Retaining Wall Near Maunawili Wellsite I.

Maunawili Well II - No historical or archaeological remains of any kind were observed on this mostly undisturbed plot adjacent to Palapu Stream. Differences in the density of the vegetation suggest that a road or trail traversed the parcel at one time, but this is not seen as having any historical significance.

Maunawili Well III-A - No historical or archaeological remains of any kind were observed on this already-developed plot adjacent to the Board of Water Supply Reservoir.

Maunawili Well III-B - No historical or archaeological remains of any kind were observed on this already-developed plot on the terraced slope immediately below the Board of Water Supply Reservoir.

Conclusions

Maunawili Well I - Of the four proposed Maunawili locations this one is perhaps the most sensitive in terms of historical or archaeological value because of its situation on an old landholding and the presence of agricultural terraces adjacent to the nearby stream. There is nothing to suggest that any subsurface remains that might be present are of such significance that they must be preserved, but extensive archaeological excavations should be conducted prior to any ground disturbance.

Maunawili Well II - Although no surface remains were found during our field inspection, there is a possibility that deposits associated with former agricultural practices may be buried beneath the surface. We therefore recommend that, should this location be selected for a well, an archaeologist be retained to conduct a test pit survey to determine the presence or absence of such subsurface deposits prior to any construction activities. If any are found, an assessment of significance and a determination of appropriate mitigative procedures would then have to be made.

Maunawili Well III-A - We find no archaeological or historical objections to the construction of Maunawili Well II as planned.

Maunawili Well III-B - We find no archaeological or historical objections to the construction of Maunawili Well III-B as planned.

Sources Consulted

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin 104. Honolulu.

[This report presents the results of a selective archeological survey of the island of Oahu.]

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and excavation reports on file at the Historic Sites Section.

State of Hawaii Survey Office

Tracing of Registered Map No. 2049 entitled "Map of Kailua, Koolaupoko, Oahu." Surveyed by W. A. Wall in 1899.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and Education, Bernice P. Bishop Museum. Honolulu.

[This is a compilation of information from numerous sources concerning the archaeological sites, history, traditions, legends, place names and land descriptions from the island of Oahu.]

WAIMANALO, OAHU: ARCHAEOLOGICAL SURVEY
AT PROPOSED WELL LOCATIONS

Prepared for:
VTN PACIFIC
1164 Bishop Street
Honolulu, Hi. 96813

Prepared by:
William Barrera, Jr.

CHINIAGO INC.
1040 B Smith St.
Honolulu, Hawaii 96817

AUGUST 1984

F-134

Introduction

During December of 1983 and January of 1984, archaeological reconnaissance surveys were performed at the locations of a series of existing and proposed Board of Water Supply wellsites on the windward coast of the island of Oahu. The purpose of the work was to locate and identify significant archaeological or historical remains which might be adversely affected by the construction activities associated with the development of the wells. This report covers two proposed wellsites at Waimanalo [Figure 1]. Waimanalo Well III is to be located at the intersection of Kakaina and Mahailua Streets, and Waimanalo Well IV is to be located on the grounds of the University of Hawaii Experimental Station adjacent to Ahiki Street.

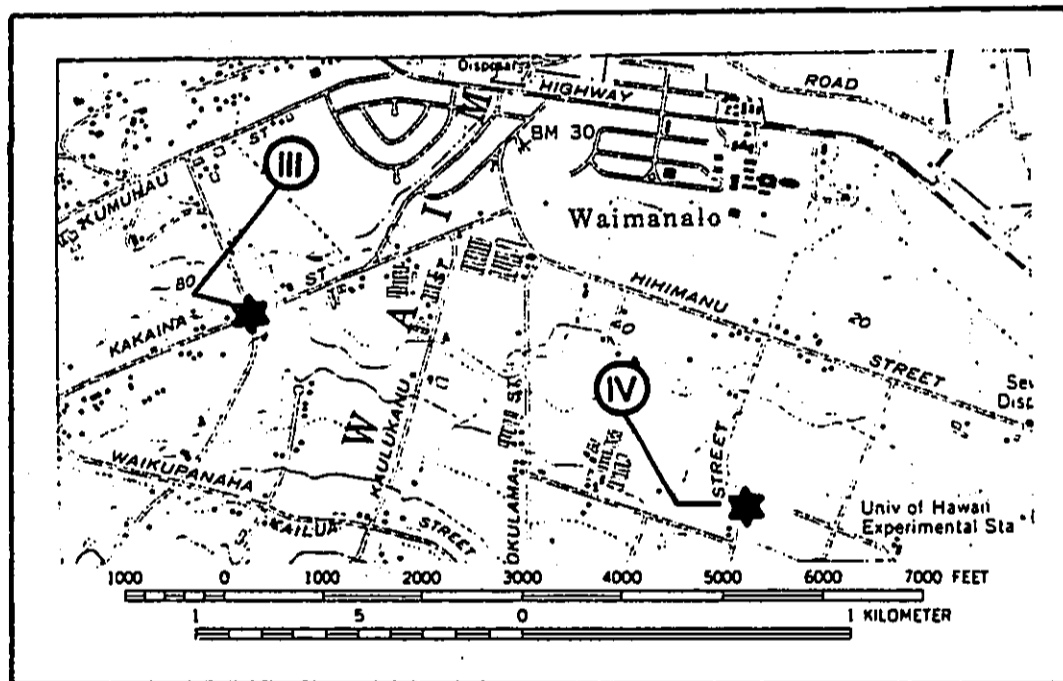


Figure 1. Location of Waimanalo Wellsites III and IV.

Literature Search

The only published reference which might concern these two wellsites is the following statement from Handy applying to Waimanalo in general:

"Waimanalo. This ahupua'a has only one large stream, from which it takes its name, the water of which irrigates the sugar cane now grown on the lower slopes and lowlands. Much of the lowland now under cane was formerly in taro. But wet taro is by no means limited to



Figure 2. Waimanalo Wellsite IV.

the lowlands irrigated from the main stream. The old kamaaina mentioned above named nine terrace sections whose water came from small streams and springs flowing out of the high mountain range. These sections ran for 1.5 miles in a semicircle at the foot of the mountains round the broad base of Waimanalo Valley, from below Puu Loa well toward Puu o Kona. Several of these, now covered with brush, were examined and found to be well preserved. The only taro grown in the district in 1934 was that planted by Edward Niaupio" [Handy 1940:100].

Inspection of a tracing of Registered Map No. 865 at the State Survey Office revealed that Waimanalo Well III is located approximately 700 feet inland of an old kuleana [LCA 8612:2, to Kanehoalani], and that the nearest that Waimanalo Well IV comes to such a recognized cultural feature is about 3500 feet.

Field Inspection

Field inspection of the proposed location of Waimanalo Well III revealed that all four corners at the intersection of Kakaia and Mahailu Streets are presently being used for agricultural purposes, and it is evident that had any significant

structural remains ever been present they have long since disappeared.

Field inspection of the proposed location of Waimanalo Well IV also revealed that the area has been used extensively for agricultural purposes, and that no historical or archaeological remains of a structural nature are present.

Conclusions

We find no archaeological or historical objections to the construction of Waimanalo Wells III and IV as planned. We would recommend only that an archaeologist be retained to monitor trenching activities associated with the laying of pipelines so as to ensure the adequate protection of any buried remains which might be present but not visible at the surface.

Sources Consulted

Handy, E. S. Craighill

1940 The Hawaiian Planter. Volume I. Bernice P. Bishop
Museum Bulletin 161. Honolulu.

McAllister, J. Gilbert

1933 Archeology of Oahu. Bernice P. Bishop Museum Bulletin
104. Honolulu.

[This report presents the results of a selective
archeological survey of the island of Oahu.]

State of Hawaii, Department of Land and Natural Resources

Site records, site maps and archaeological survey and
excavation reports on file at the Historic Sites
Section.

State of Hawaii Survey Office

Tracing of Registered Map No. 865 entitled "Waimanalo
Kuleanas, Koolaupoko, Oahu." Date Unknown.

Sterling, Elspeth P. and Catherine C. Summers

1968 Sites of Oahu. Departments of Anthropology and
Education, Bernice P. Bishop Museum. Honolulu.

[This is a compilation of information from numerous
sources concerning the archaeological sites, history,
traditions, legends, place names and land descriptions
from the island of Oahu.]

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APPENDIX G

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8422-197

Hgr. ENG
AM
P/E

SEP 24 10 40 AM DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
FT. SHAFTER, HAWAII 96858-5440

September 19, 1984



Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 S. Beretania St.
Honolulu, HI 96813

Dear Mr. Hayashida:

Thank you for the opportunity to review and comment on the EIS Preparation Notice for Windward Oahu Regional Water System Improvements. The following comments are offered:

a. Based on the generalized information provided, the projects located near waters of the US under the Corps' jurisdiction are Kaipapu Wells (Hauula), Punaluu Wells V-C (Punaluu), Punaluu Tunnel or Inclined Well (Punaluu) and Waiahole Wells (alternate, Waikane-Waiahole). Any temporary or permanent access roads, stream crossings, production facilities or water transmission mains that involve work in the waters of the US, including wetlands, will require a Department of the Army (DA) permit. In addition, any work of this nature associated with the other portions of the Windward Oahu Regional Water System will also require a DA permit. When specific alignments and locations of various structures are determined, permit requirements should be coordinated with Operations Branch at 438-9258.

b. According to the Flooding Insurance Study for Oahu prepared by the Federal Insurance Administration for the City and County of Honolulu, the proposed well and reservoir sites are designated Zone C, area of minimal flooding; or Zone D, area of undetermined but possible flood hazards.

Sincerely,

Stratford L. Whiting
Stratford L. Whiting
Chief, Engineering Division



P. 570/24
100 AM

P. O. Box 50006
Honolulu, Hawaii
96850

September 21, 1984

RECEIVED
BOARD OF WATER SUPPLY
SEP 23 1984

United States
Department of
Agriculture



Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania St.
Honolulu, HI 96843

Dear Mr. Hayashida:

Subject: EIS Preparation Notice for Windward Oahu Regional Water System Improvements, Oahu

We have reviewed the subject notice and have no comments. You have been sent a Watershed Plan and Environmental Impact Statement for the Naimanalo Watershed which is an irrigation project sponsored by the state with our assistance.

Thank you for the opportunity to review this notice.

Sincerely yours,

Stratford L. Whiting
STRATFORD L. WHITING
District Conservationist

Q-3

9



COPY



United States Department of the Interior

FISH AND WILDLIFE SERVICE
100 ALA MOANA BOULEVARD
P. O. BOX 58187
HONOLULU, HAWAII 96850

ES
ROOM 6307
SEP 25 1984

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
Honolulu, Hawaii 96843

October 1, 1984

Mr. Kisuk Cheung
Chief, Engineering Division
Pacific Ocean Division
Corps of Engineers
Department of the Army
Fort Shafter, Hawaii 96858-5440

Dear Mr. Cheung:

Subject: Your Letter of September 19, 1984, on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water
System Improvements, Maianakaha to Makapuu

Thank you for reviewing and commenting on the environmental
document for the proposed water system improvement projects.
Your comments will be incorporated in the text, and your
letter will be appended to the Draft EIS.

Should any phase of our projects involve work in waters
regulated by the Corps, we will coordinate any DA permit
requirements with your Operations Branch. We will also
indicate in the Draft EIS that our projects may be within
areas designated Zone C or Zone D according to the Flood
Insurance Rate Maps.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTH Pacific, Inc.

Re: Environmental Impact Statement,
Preparation Notice for Windward Oahu
Regional Water System Improvements, Oahu

Dear Mr. Hayashida:

We have reviewed the referenced Preparation Notice and offer the
following comments for your consideration.

The proposed Environmental Impact Statement (EIS) is a Master
Plan EIS that will address the long-term cumulative impacts of
the proposed Windward Oahu Regional Water System Improvements.
It is the Service's understanding that following the acceptance
of the Master Plan EIS, Supplemental EIS's or Negative
Declarations will be prepared for each of these water
development projects.

There are numerous long-term cumulative impacts associated with
the proposed water development projects. These impacts are
associated with the tapping of dike complexes and the associated
dewatering of streams. These impacts need to be addressed in the
EIS and appropriate mitigation and compensation measures adopted
by the Board of Water Supply (BWS).

Many of the indigenous stream animals are diadromous and require
a period of development in the ocean. These forms later migrate
into the streams where they mature and complete their life cycle.
Many of the Windward Oahu streams do not connect to the ocean
during periods of low stream discharge and therefore recruitment
of native diadromous animals into these streams is prevented.
If the proposed developments reduce stream discharge to the point
where the streams are capable of breaching the beach sand bars
only during freshets, resident populations of diadromous species
will probably decline.

Many of the wetlands along the Windward Oahu coast are associated
with and dependent upon streams and basal springs. These wetlands
support populations of Federally listed endangered waterbirds
(the Hawaiian duck, coot, gallinule, and stilt). Some of the



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proposed projects may lower the water table elevations in these wetlands and thus decrease the amount of available waterbird habitat. Since many of these wetlands are classified as essential habitat for the recovery of endangered waterbirds, the loss of wetland habitat could seriously affect these species. Kawaihi Marsh, Heeia Marsh, Kahana Marsh, Hoomuhia Park, Kualoa Pond, and Bellows Air Force Base are wetlands identified along the Windward Coast of Oahu that are considered important for the recovery of these endangered waterbirds (Draft Hawaiian Waterbirds Recovery Plan, U.S. Fish and Wildlife Service, 1984).

The tapping of high level groundwaters may reduce the recharge of some low elevation ground waters like the Koolauloa Basal Aquifer. The reduction in freshwater flow and the lowering of the basal aquifers could reduce the water surface elevation and head in these wetlands allowing saltwater intrusion. This would reduce the capacity of the wetlands to support endangered waterbirds.

The reduction in stream discharge can also alter the existing riparian communities. While most of these riparian communities are dominated by introduced and naturalized plant species, some of these areas, for example Kahana Stream, are used as habitat by the Hawaiian duck, coot, and gallinule.

The long-term cumulative impacts of concern to the Service are the potential extirpation of native biota from Windward Oahu streams and the loss of essential habitat for Federally listed endangered water birds.

The Service suggests the following topics be addressed in the Master Plan EIS:

- a. Appropriate instream flows for Windward Oahu streams should be adopted prior to the development of the exploratory well facilities. These instream flow standards should allow adequate flow for the passage of diadromous animals across beach sand bars and for the maintenance of stream life. The BWS should discuss the relationship of these actions with the Windward Oahu Instream Flow Protection Program of the Department of Land and Natural Resources.
- b. The BWS should determine the magnitude of the flow reduction for each of its water development projects. This will aid in determining the effects a particular project will have on streams and wetlands. The BWS should determine the effects of each project upon the water surface elevation in wetlands.
- c. The Master Plan EIS should have a thorough discussion of the alternatives to these projects. Discussion of alternatives should include detailed economic analysis and long-term projections for the desalination of brackish groundwater, and other promising technologies. For example, The Ewa District of Oahu could utilize brackish water for irrigation, thus freeing a large quantity of potable water for domestic use. Since this area is slated for

further growth, dual water systems could be incorporated into these developments with less disruption and cost than in areas already developed with single line water systems. The BWS should further explore the use of sewage reclaimed water for both potable and agricultural use. There are many alternatives to supply water to the leeward side of the island without affecting the streams and wetlands of the Windward side.

The Service suggests that long-term follow up studies on the effects of well pumping and stream discharge be conducted by the BWS. This study will help determine the effects a regional water system will have on associated streams and marshes.

Appropriate compensation for the reduction of instream flows and the potential loss of instream habitat for native aquatic animals could include the BWS purchasing the water rights in selected streams to provide continuous flows, purchasing water from sugar companies to restore flows in selected Oahu streams, improving stream habitats in selected streams, creating and restoring wetland and waterbird habitat, designing reservoirs that would function as habitat for waterbirds, and returning pumped water back to the stream to maintain adequate flows.

The Service is concerned about the continued insidious loss of instream habitat and flows by various water supply developments along the Windward Oahu coast. The decreased instream flows probably reduce habitat for native aquatic animals and native waterbirds. The continued loss of instream habitat is tantamount to a taking of a public resource and appropriate compensation must be instituted by the BWS.

We appreciate this opportunity to comment.

Sincerely yours,

Ernest Kosaka

Ernest Kosaka
Project Leader
Office of Environmental Services

cc: DAR
DE&W
DOWALD, Sherry Samuels
EPA, San Francisco
EO, FWS, Portland, OR (AMR)
✓VTN Pacific



COPY

RECEIVED

OCT 8 1984
VTN PACIFIC

Mr. Ernest Kosaka
Office of Environmental
Services
Fish and Wildlife Service
U. S. Department of the Interior
P. O. Box 50167
Honolulu, Hawaii 96850

Dear Mr. Kosaka:

Subject: Your Letter of September 25, 1984 on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water System
Improvements, Malanakahana to Makapuu

Q 1

Thank you for reviewing the environmental document for our proposed water system projects. Your concerns, where applicable, will be addressed in the text, and your letter will be appended in the Draft EIS.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

Lawrence Whang
For
Manager and Chief Engineer

cc: VTN Pacific



United States Department of the Interior

GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
P. O. Box 50166
Honolulu, Hawaii 96850

October 4, 1984

*AM dkr
P/E*

RECEIVED

OCT 18 1984
VTN PACIFIC

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

The Environmental Impact Statement (EIS) Preparation Notice for Windward Oahu Regional Water System Improvements project have been reviewed and have the following comments:

General comments:

1. A single EIS for all windward projects is too broad in scope. Because future circumstances may be different as compared to the present, we may be approving items that we may not be aware of.
2. There is little or no discussion on water-quality problems.

Itemized comments: (see attached comments from Kiyoshi)

Thank you for giving us the opportunity to review the EIS Preparation Notice for your Windward Oahu Regional Water Improvements.

Very truly yours,

Dan Davis
Dan Davis
Acting District Chief

Qn

10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

EIS - WINDWARD OAHU
by Kiyoshi Takasaki

Page	Paragraph	Line	Remarks
4	1	3	The phase "and will not be pumped" should be deleted. Our failure or refusal to "mine" stored dike-impounded water is not a wise policy. Water in storage should be mined during periods of low recharge and should be restored during periods of high discharge. This manipulation of storage for optimal development can be accomplished by either the use of bulkheads (restore and mine by free flow) or by pumping (mine). Water is restored during non-pumping periods.
4	3	9	After "bulkheads" add the following "for the purpose of restoring storage".
5	2	2	Delete remainder of paragraph following Table 2.
6	Table	Heading	Replace "MAXIMUM POTENTIAL YIELD" with "PLANNED DEVELOPMENT". Also replace given maximum with a more realistic range in yields estimated for development.
7	Table	Heading	Same as page 6.
28	1	5	Replace "maximum potential yield of about 46 to 51 mgd" with a more realistic "planned development potential of about _____ to _____ mgd. The figures being the new sums of the ranges in the tables on pages 6 and 7.
37	Table		Streams in Late and Hauula are gaining streams at high altitudes and losing streams at low altitudes.

October 16, 1984

RECEIVED
OCT 18 1984
VTN PACIFIC

Mr. Dan Davis
Acting District Chief
Water Resources Division
Geological Survey
U. S. Department of the Interior
P. O. Box 50166
Honolulu, Hawaii 96850

Dear Mr. Davis:

Subject: Your Letter of October 4, 1984 on the Environmental Impact Statement (EIS) Preparation Notice on the Windward Oahu Regional Water System Improvements, Malaekahana to Makapuu

Thank you for reviewing the environmental document for our proposed water system improvement projects. Your letter will be appended to the Draft EIS.

We will discuss potential water quality problems in more detail and will consider the editorial changes submitted by Kiyoshi Takasaki when the Draft EIS is prepared.

We decided to prepare a Regional EIS because the projects all have a common planning objective and to give a more broad and comprehensive overview of our water development program in that area. This objective will be discussed in more detail in the Draft EIS.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hayashida
for KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific, Inc.

GEORGE B. ABUYOSHI
GOVERNOR



RECEIVED
SEP 28 11 35 AM '84
JACK E. SUWA
CHAIRMAN, BOARD OF AGRICULTURE
SUZARNE D. PETERSON
DEPUTY TO THE CHAIRMAN

RECEIVED
OCT 18 1984

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
Honolulu, Hawaii 96814

VIN PACIFIC

September 26, 1984

Mailing Address:
P. O. Box 23159
Honolulu, Hawaii 96822

*Hyr. - en 90rd
AM
PE*

MEMORANDUM

To: Mr. Kazu Hayashida, Manager and Chief Engineer
Board of Water Supply, City and County of Honolulu

Subject: Environmental Impact Statement (EIS) Preparation
Notice for Windward Oahu Regional Water System
Improvements
THK: Zones 4 and 5

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

Our primary concerns in reviewing the document are that agricultural
uses and lands not be adversely affected by the location of a proposed
facility, or by the withdrawal of water. Our comments are organized
according to the order of projects found in Tables 4 and 11.

Table 4: Location of Proposed BWS Water Development Projects in Windward
Oahu

Laike:

Malaekahana Wells - The project area appears to be in pasture
use.

Laike Wells - The project area appears to be on the edge of a
papaya orchard.

Mailele Wells - The project area appears to be near a papaya
orchard.

Punaluu:

Punaluu Well IV - The project area appears to be situated
close to a number of agricultural uses.

Kaaawa:

Kaaawa Wells I and II - The project area appears to be in a
grazing area.

Maikane-Malahole:

Hakipuu Wells - The project area appears to be in a grazing
area.

Mr. Kazu Hayashida
Page -2-
September 26, 1984

Mahele-Kahaolu:

Kahaolu Wells II-A, II-B, II-C - The project area is in the
midst of an intensive agricultural area which includes
bananas, vegetables, and melons.

Kaneohe:

Luluku Wells - As noted on page 30 of the document, the proposed
wells and associated reservoir will be located within the
banana field along the Likelike Highway. In light of recent
developments concerning the landowner's agreement with banana
farmers in the area, we question whether the owner of the
banana farm still faces eviction.

Maunawili:

Maunawili Wells I - The project area is within a parcel being
studied as a possible site for an agricultural park.

Maunawili Wells II, III (Alternative A), III (Alternative B) -
The project sites are in the vicinity of the possible agri-
cultural park.

Maimanalo:

Maimanalo Well III - The project area is within the middle
of the Maimanalo farming area.

Maimanalo Well IV - The project area is also within the
Maimanalo farming area but appears to be in an area not in
agricultural use.

Table 11: Proposed State Water Development Projects in Windward Oahu

The State is developing an agricultural park in the Kahuku area.
Proposed improvements include upgrading an existing pump station, construc-
tion of a new 100,000 gallon reservoir, and installation of a water trans-
mission system (Revised Environmental Impact Statement, Kahuku Agricultural
Park, Department of Agriculture, May 30, 1984, pages II-3, II-4). The
Department of Land and Natural Resources is the agency responsible for these
improvements.

General Comments

We note that banana farmers whose fields will be affected by the
construction of BWS facilities will be compensated for loss of production
acreage (Notice, page 41). The same should apply to any other farm whose
operations may be affected.

We also note that the Board of Water Supply (BWS) will manage water
development to meet any minimum flow standards that may be established by
the Board of Land and Natural Resources (Notice, page 42). This is of
special importance to growers of taro and other wetland crops which require
regularity of streamflow for proper plant growth.

"Support Hawaiian Agricultural Products"

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

Mr. Kazu Hayashida
Page -3-
September 26, 1984

According to the document entitled "Agricultural Water Use: Selected Water Districts - Windward Oahu" (Hawaii Agricultural Reporting Service, Department of Agriculture, May 1982) a total of 158 Windward farms irrigated their crops in 1980-81. Of the 908.4 million gallons used for irrigation in 1980-81, only 10 percent came from BWS sources. The remaining water came from private wells and surface sources. The EIS should examine in detail whether the proposed development of groundwater sources will significantly affect these irrigation water users.

Thank you for the opportunity to comment.

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

cc: DLNR-DONALD

October 16, 1984

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OCT 18 1984

VTN PACIFIC

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

Dear Mr. Suwa:

Subject: Your Letter of September 26, 1984, on the Environmental Impact Statement (EIS) Preparation Notice for the Windward Oahu Regional Water System Improvements, Halaekahana to Makapuu

Thank you for reviewing the environmental document for our proposed water system projects. Your letter will be appended to the Draft EIS.

Your concerns on the impacts that project locations and water withdrawals will have on agricultural uses and lands, compensation for lost crop acreage, and impacts to existing private wells and surface sources used for agricultural purposes, will be considered in the preparation of the Draft EIS.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

K. Hayashida

For KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific

842526

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OCT 4 11 07 AM



STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 328
HONOLULU, HAWAII 96843

Leslie S. Mastrubara
SUPERVISOR
DIVISION OF HEALTH

IN REPLY, PLEASE REFER TO
EPH-88

October 2, 1984

RECEIVED
OCT 16 1984
VIN PACIFIC
MOR - 10:14 AM
AM - 10:14 AM

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
630 S. Beretania St.
Honolulu, Hawaii 96843

Attention: Mr. Lawrence Whang

Dear Mr. Hayashida:

Subject: Request for Comments on Environmental Assessment for Proposed
Regional Water System Improvement Project

Thank you for allowing us to review and comment on the subject environmental assessment. We wish to make the following comments.

Environmental Permit

1. On page 4, the notice states that the cuttings and excavated material generated from the construction of new wells and tunnels will be disposed of off-site. The completed EIS should address the disposal of these solid wastes in greater detail.
2. The following comments are associated with the contamination potential of the proposed water sources:
 - a. Several wells will develop alluvial aquifers. Such well sites should be examined very carefully for nearby potential sources of contamination.
 - b. The proposed Luluku Well is sited in a banana plantation. Banana is a crop upon which numerous pesticides are used. This site should be very carefully examined prior to its development.
 - c. The proposed Halekou Wells are sited approximately one-quarter of a mile makai of the Underground Injection Control Line and adjacent to a cemetery (Hawaiian Memorial Park). This site should also be carefully evaluated and examined prior to development.

Should you have any questions regarding the above comments, please contact Dayton Frain at telephone 548-6410.

9

Mr. Kazu Hayashida
October 2, 1984
Page 2

Drinking Water

Section 11-20-29 of Chapter 20 requires all new sources of potable water serving public water systems to be approved by the Director of Health prior to their use to serve potable water. Such approval is based primarily upon the satisfactory submission of an engineering report which adequately addresses all concerns as set down in Section 11-20-29. The engineering report must be prepared by a registered professional engineer and bear his or her seal upon submittal.

I hope this information will be of use to you. Should you have any questions regarding Chapter 20, Title 11, Administrative Rules, 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.

Sincerely,

MELVIN K. KOZUMI
Deputy Director for
Environmental Health

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

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HAWAIIAN
GEORGE B. JANTZEN
DIRECTOR OF RECORDS
MANAGEMENT

842559



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

842559
SPECIAL AGENT IN CHARGE
OFFICE OF THE ATTORNEY GENERAL
DIVISIONS:
GENERAL INVESTIGATION
PROPERTY RIGHTS
ADULTICIDE
CONSTITUTIONAL AND
STATUTE REVISIONS
GENERAL COUNSEL
LAND MANAGEMENT
WATER AND LAND DEVELOPMENT

October 11, 1984

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OCT 16 1984
VTN PACIFIC

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

Dear Mr. Koizumi:

Subject: Your Letter of October 2, 1984, on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water System
Improvements, Maalekahana to Makapuu

Thank you for reviewing the environmental document for our
proposed water system projects. Your letter will be appended
to the Draft EIS.

Your comments on potential sources of contamination and the
need to prepare an engineering report in accordance with
Section 11-20-29 of Chapter 20 will be addressed in the text
of the Draft EIS.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific

Honorable Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 So. Beretania
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

We have reviewed the environmental assessment covering development of the
Windward Oahu Regional Water System. We have a number of comments to offer:

Streamflow

Section III addresses impacts and mitigation measures at project sites and in
streams and wetlands separately. It is stated that development of dike
impounded groundwater may reduce the base flow of thirteen streams and their
tributaries; however, the resulting impact to stream fauna habitat and stream
fauna and waterbirds is not addressed, and only mentioned in Section VI,
assessment of the significance of impacts. No mitigation measures are
proposed.

The environmental impact statement should provide a full discussion of stream
flow reduction and the resulting impact to stream fauna and waterbirds and
their habitat. Impact to other instream uses - maintenance of stream eco-
systems, recreation and aesthetic enjoyment, maintenance of water quality,
and the conveyance of irrigation and domestic water to downstream points of
diversion should also be addressed. Where impacts are anticipated, proposed
mitigation measures should be indicated.

Aquatic Resources

In general, construction of transmission mains along highways is most likely
to have adverse effects on aquatic resources at stream crossings or through
release of eroded soil sediments, construction materials and wastes, and
vehicular substances (such as fuel) and lubricant residues, and trash) into
coastal waters along with surface runoff.

*Hgr. by 9-23de
AM
P/E*

September 24, 1984

9



COPY

Hon. Kazu Hayashida, BWS
Re: Windward Oahu Regional Water System
Page Two
September 24, 1984

We suggest the forthcoming environmental impact statement contain detailed discussions of potential impacts on aquatic resources. Specifically, the following concerns should be addressed:


1. Potential effects on base flow of perennial streams between Malaekahana and Makapuu, with reference to capacity of affected habitats to sustain aquatic life;
2. Potential effects on windward Oahu's wetlands, such as Kawaihuli Marsh and Hoomaluhia Park Wildlife Pond, with particular reference to effects on seepage of groundwater during periods of dry weather;
3. Potential for direct destruction of aquatic habitat and organisms at stream crossings; and
4. Construction and site work activities (i.e. erosion, debris, use of herbicides, fertilizers, pesticides, etc., that could have impact on aquatic resources and habitats).

We further suggest that the environmental impact statement specify measures that would be taken to mitigate the above.

Wildlife

The environmental impact statement should address what effects the water development for Windward Oahu would have on endangered water bird habitats and mitigation measures to cover loss of habitat. The list of wetlands on page 39 should be expanded to include Ukoa Pond, Loko Ea Pond, Punaohoopapa, the Haliwa agricultural wetlands, Heela Marsh, and Kahana Valley.

Sincerely,


SUSUMU ONO
Chairperson

October 16, 1984

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OCT 19 1984

VTN PACIFIC

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

Dear Mr. Ono:

Subject: Your Letter of September 24, 1984 on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water System
Improvements, Malaekahana to Makapuu

Thank you for reviewing the environmental document for our proposed water system improvement projects. Your concerns on stream flow, aquatic resources, and water bird habitats will be considered in the preparation of the Draft EIS. We will append your letter to the Draft EIS.

If you have any questions, please call Lawrence Khang at 527-6138.

Very truly yours,


For
KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific, Inc.

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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

To: Kazu Hayashida

Manager and Chief Engineer,
Board of Water Supply
City and County
630 South Beretania St.,
Honolulu, 96843

P/E

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OCT 10 1984

VIN PACIFIC

October 5, 1984

Dear sir:

Subject: Environmental Impact Statement;
Preparation notice for Windward Oahu Regional
Water System Improvements, Oahu.

The Kahana Valley State Park could be vastly affected by the Board of Water Supply plans for water development as proposed in the E.I.S. preparation notice. The Kahana Valley State Park Advisory Board wishes to participate in the review of this Environmental Impact Statement. Please consider this Board a consulting party.

Ms. Beatrice Soga, Co-chair
Kahana Valley Advisory Board
P. O. Box 504
Kaanawa, Hawaii 96730

Dear Ms. Soga:

Subject: Your letter on the Environmental Impact Statement Preparation Notice for the Windward Oahu Regional Water System Improvements, Maloekahana to Makapuu

Sincerely,

Co-chair, Kahana Valley Advisory Board.

Kazu Hayashida

Thank you for your interest in our projects. We have added your organization to our consultant parties list. Enclosed is a copy of the preparation notice for your review. If you have any comments, we would appreciate receiving them by November 10, 1984.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hayashida
KAZU HAYASHIDA
For Manager and Chief Engineer

Enclosure

cc: VIN Pacific, Inc.

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OCT 10 1984

VIN PACIFIC

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT
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 64-2595
 OCT 10 1984
 VIN PACIFIC



Ref. No. P-368

September 25, 1984

The Honorable Kazu Hayashida
 Manager and Chief Engineer
 Board of Water Supply
 City and County of Honolulu
 630 South Beretania Street
 Honolulu, Hawaii 96813

Dear Mr. Hayashida:

Subject: EIS Preparation Notice for the Windward Oahu Regional Water System Improvements

We have reviewed the subject document and offer the following comments with respect to the objectives and policies of the Hawaii Coastal Zone Management Program.

The environmental impact statement (EIS) that will be prepared will address numerous water source, storage, and transmission projects that have heretofore been addressed in separate EIS documents. Given the range of development activities, including the construction of wells, inclined wells, shafts, tunnels, reservoirs, access roads, and utility lines, we find a potential for impact on the following program resources:

coastal ecosystems: run-off from areas that are cleared of natural vegetation and graded to accommodate reservoirs, access roads, and utility lines, and a reduction of base stream flows into Windward wetlands (i.e., Kawaunui Marsh and Heeia Meadowlands).

scenic and open space: clearing of vegetation, grading, and construction of reservoirs on typically prominent upland sites.

historic resources: disruption of heretofore undisturbed areas with potential historic significance.

While the majority of proposed activities addressed in the document--namely, wells and test wells--would not pose significant impacts on the aforementioned coastal resources, there are a number of remaining projects that have that potential. The subject preparation notice indicates that precise locations and alignments for the facilities have not yet been determined. Thus, it would be difficult to assess the potential impacts.

The Honorable Kazu Hayashida
 Page 2
 September 25, 1984

We support the intent of combining smaller related projects into a single EIS document as long as the document provides adequate information by which the impacts of each project can be assessed. If this is not possible until the individual sites and alignments are determined, supplemental EIS documents may be necessary.

Finally, we wish to have the opportunity to review the environmental impact statement when it is prepared.

Very truly yours,

Kent M. Keith
 Kent M. Keith

cc: Office of Environmental Quality Control

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

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STATE OF HAWAII
DEPARTMENT OF SOCIAL SERVICES AND HOUSING
HAWAII HOUSING AUTHORITY
P. O. BOX 17897
HONOLULU, HAWAII 96817

0125007

MEK - copy 11-3-84
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84:DEV/5586

October 4, 1984

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OCT 10 1984
VTN PACIFIC

Mr. Kent M. Keith, Director
Department of Planning
and Economic Development
State of Hawaii
P. O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Keith:

Subject: Your Letter of September 25, 1984 on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water System
Improvements, Maiakehana to Makapuu

Thank you for reviewing the environmental document for our
proposed water system improvement projects. Your concerns on
coastal ecosystems, scenic and open space, and historic
resources shall be addressed in the Draft EIS. Your letter
will also be appended to the Draft EIS.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,

L. G. Rathbun

For KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific, Inc.

September 28, 1984

RECEIVED

OCT 15 1984
VTN PACIFIC

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Hayashida:

SUBJECT: Environmental Impact Statement Preparation
Notice for Windward Oahu Regional Water System
Improvements, Oahu

The Hawaii Housing Authority (HHA), by letter dated August 31,
1984, made its initial comment as being in support of the Windward
area water development. However, at this time, we are submitting
our supplemental comments in view of the proposed state systems
shown on Table 11 (page 36). We note that the HHA's proposed
source of its domestic water system seems to be the same source
proposed by your agency for water development in the Haikane-
Maiahole Region.

Sincerely,

Russell N. Fukuhoto

RUSSELL N. FUKUHOTO
Acting Executive Director

cc: The Hon. Franklin Sunn, Director, DSSH
The Hon. Susumu Ono, Chairman, DLNR
Mr. Bob Chuck, DLNR
Mr. David Slipper, Special Assistant on Housing

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

October 10, 1984

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OCT 15 1984

VTN PACIFIC

Mr. Russell N. Fukumoto
Acting Executive Director
Hawaii Housing Authority
Department of Social Services
and Housing
P. O. Box 17907
Honolulu, Hawaii 96817

Dear Mr. Fukumoto:

Subject: Your Letter of September 28, 1984, on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water System
Improvements, Maalaakaha to Makapuu

Thank you for reviewing the environmental document for our
proposed projects. Your letter will be appended to the Draft
EIS.

Regarding the drilling of wells in Waikane-Walahole, we have
no definite plans to develop water in that area at this time.
The EIS includes wells that may not be undertaken because of
problems which may become apparent when we investigate their
feasibility in more detail.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific

GEORGE B. ARYOSH
GOVERNOR

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
100 FALGOUT STREET
HONOLULU, HAWAII 96813

October 1, 1984

WAYNE J. TAMASAKI
DIRECTOR

DEPUTY DIRECTORS
JONATHAN K. SHIMADA, P.E.
WALTER M. HO
CHERYL D. SOON
ADAM B. VINCENT

WHEREBY REFER TO
STP 8.10217

*Not a copy 10-4-84
AM pick
P/E*

Mr. Kazu Hayashida
Manager & Chief Engineer
Board of Water Supply
630 South Beretania
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

Environmental Impact Statement
Preparation Notice
Windward Oahu Regional Water
System Improvements, Oahu

We have no comments to offer at this time on the
contents of the preparation notice. However, there is a
possibility that State highways, including the proposed
Interstate Route H-3, may be impacted by the access roads,
explorations or other related construction activities.
Consequently, we request full coordination with this De-
partment as the improvement plans are developed.

Very truly yours,

Wayne J. Tamasaki
Wayne J. Tamasaki
Director of Transportation

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OCT 16 1984

VTN PACIFIC

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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY



GEORGE R. ARTHUR
DIRECTOR

LETITIA N. UYEHARA
DIRECTOR
TELEPHONE NO.
844-8811

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
805 HALEKUAHUNA STREET
ROOM 201
HONOLULU, HAWAII 96813

October 11, 1984

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OCT 16 1984
VTN PACIFIC

Mr. Wayne J. Yamasaki
Director
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Yamasaki:

Subject: Your Letter of October 1, 1984 on the Environmental Impact Statement (EIS) Preparation Notice for the Windward Oahu Regional Water System Improvements, Malanakahana to Makapuu

Thank you for reviewing the environmental document for our proposed water system projects. Your letter will be appended to the Draft EIS.

We will coordinate our construction activities with your department whenever our projects impact on the State highways, including the proposed Interstate Route H-3.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific, Inc.

September 24, 1984

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

Subject: EIS Preparation Notice for Windward Oahu Regional Water System Improvements

The preparation of a regional EIS for water system development is a proposal which we support. It is in this way that the general public can establish what is being planned, how these systems interrelate, and how these systems will affect them.

This document, as presently being prepared, should cover the cumulative effects of future water projects on Windward Oahu. EISs for individual projects will still be required because the regional EIS may not contain the impacts specific to each project site.

Sincerely,

Letitia N. Uyehara
Letitia N. Uyehara
Director

cc: VTN Pacific



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University of Hawaii at Manoa

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

October 10, 1984

RECEIVED
OCT 15 1984

Mr. Letitia N. Uyehara
Director
Office of Environmental
Quality Control
State of Hawaii
Room 301
550 Halekauwila Street
Honolulu, Hawaii 96813

Dear Ms. Uyehara:

Subject: Your letter of September 24, 1984, on the EIS
Preparation Notice for the Windward Oahu Regional
Water System Improvements, Malaekahana to Makapuu

Thank you for reviewing the environmental document for our
proposed water system projects. Your letter will be appended
to the Draft EIS.

We shall be assessing each project in more detail and filing
Supplemental EIS's if additional significant impacts not
addressed in the Regional EIS are encountered.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific

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October 3, 1984

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OCT 16 1984

VTN PACIFIC

Mr. Kazu Hayashida
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

Preparation Notice
Environmental Impact Statement
Windward Oahu Regional Water System
Windward, Oahu

Introduction

We ordinarily comment on EIS Preparation Notices only if they are supported by and
accompanied by environmental assessments approaching EIS's in scope. Although a good
deal of the 50-page document supporting the preparation notice for Windward Oahu
Regional Water System Improvements is devoted to environmental assessment, the
treatment of environmental impacts falls far short of what will be expected in an EIS
covering these proposed improvements. This is entirely expectable considering that the
improvements include some 56 water developments (wells, or well fields), 6 reservoirs,
and 12 transmission mains and that, among the sites of these projects, there are
substantial environmental differences. Our aim in reviewing this document is as much to
provide you with some suggestions as to procedure in complying with State EIS
requirements for the proposed developments as to call attention to topics that should be
addressed in the EIS or EIS's to be prepared.

These comments have been prepared in-house in the Environmental Center without
drawing on pertinent competence elsewhere in the University.

AN EQUAL OPPORTUNITY EMPLOYER

9

Mr. Kazu Hayashida

-2-

October 3, 1984

Comments on procedure

As is recognized in the document, there are some commonalities among the water developments proposed, the environments in which they will take place, and the impacts that will result from their undertaking. It may be convenient for the BWS to address some of those commonalities in the overall EIS applying to all of the developments that it has elected to prepare. Coverage of the commonalities in an overall EIS would also be advantageous to reviewers whose environmental interests are general. Nevertheless, we suggest that it will be advantageous to both the public and the BWS if the BWS plans to prepare, not a single EIS for all of the water developments proposed, but either separate EIS's for the individual developments or a general EIS on the group of developments with supplementary EIS's on the individual developments.

We note, first, that, even if common features of the proposed projects, their sites, and their impacts, are treated in common, a comprehensive EIS on all 70-plus projects will be a very bulky document. Persons and institutions with general environmental interests will see some advantage in the overall treatment. However, they will find it extremely difficult to review it satisfactorily within the usual time limits. The document will, further, be much less useful to persons and institutions with interests in specific vicinities than separate EIS's on the developments proposed in those vicinities.

Tables 3, 6, and 7 in the document indicate that although many of the proposed projects are in an adopted 6-year capital improvement program, not all are; and that, although at the sites of some of the water developments in the CIP there are already exploratory wells, there are none at the sites of other developments. Hence some changes in plans may be anticipated as results are obtained from further exploration and as the demand increases even in the case of developments in the 6-year CIP.

There may be no changes in environmental conditions at the sites of the proposed developments during the 6-year period. However, the document recognizes some changes that may be expected in environmental management, e.g. the finalization of plans for the Kahana Valley State Park and the promulgation of minimum stream flow standards by DLNR. More extensive changes in water development plans and environmental management requirements, and perhaps some significant changes in the environments themselves, may be anticipated in the case of the projects not to be undertaken in the 6-year period.

Changes in the estimation of water demands, in the plans for meeting the demands, in environmental management, or in the environments of the development sites, if occurring after the preparation of an EIS on the projects but before the projects are undertaken might well invalidate the EIS, requiring the preparation of a supplement or supplements to it. If the BWS prepares an overall EIS covering common aspects of all 70-plus proposed projects as planned at present, we suggest that, as that EIS is prepared, the BWS consider for what parts of the development program the aims of the EIS system will best be met by supplementary EIS's.

Mr. Kazu Hayashida

-3-

October 3, 1984

Comments on the environmental impacts

The document identifies six generalized possibly significant impacts of the proposed projects, four of them water related. All six will be found highly site-specific. The water-related impacts are, however, simply specific manifestations of a general impact, that of groundwater development projects on water resources. We suggest that the overall appraisal of the water resources of windward Oahu (dike, basal-dike, and basal aquifers), and the relationship between the proposed drafts and present residual sustainable yields of the aquifers, will usefully be addressed in the overall EIS. With changes in plans as to development sites there would be some changes in impacts, but even in the case of dike-developments these changes would be relatively small if the overall rates of draft from wells in a particular vicinity are not changed.

The discussion of alternatives to the development of groundwater in windward Oahu is also a topic more usefully addressed in an overall EIS than in individual EIS's or supplements for particular projects.

The BWS proposes (p. 42) to manage its "windward water development to meet any minimum stream flow standards that may be established by the BLNR." It should be recognized in any EIS or EIS's on the projects that, because of storage effects, reduction in draft from a well will not result in rapid restoration of the seepage to streams from the aquifers tapped directly or indirectly by a well.

Conclusion remarks

We appreciate the opportunity to review the document and hope our suggestions will be found useful.

Yours very truly,

Doak C. Cox
Doak C. Cox
Director

cc: OEQC
Jacquelin Miller
Pamela Bahusen



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October 11, 1984

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OCT 16 1984
VIN PACIFIC

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

Dear Dr. Cox:

Subject: Your Letter of October 3, 1984 on the Environmental
Impact Statement (EIS) Preparation Notice for the
Windward Oahu Regional Water System Improvements,
Haleakalana to Makapuu

Thank you for reviewing the environmental document for our
proposed water system projects. Your letter will be appended
to the Draft EIS.

We agree with you that the information presented in the
environmental document is general and that supplemental EIS's
may be required. Your general comments and your concerns on
water-related impacts will be addressed in the preparation of
the Draft EIS.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: WTP Pacific, Inc.

University of Hawaii at Manoa

Water Resources Research Center
Holmes Hall 263 • 2540 Dole Street
Honolulu, Hawaii 96822

24 September 1984

RECEIVED
OCT 10 1984
VIN PACIFIC

Mr. Kazu Hayashida
Manager and Chief Engineer
Honolulu Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

SUBJECT: EIS Preparation Notice (EISPN) for Windward Oahu Regional
Water System Improvements, Oahu

We have reviewed the subject EISPN and offer the following comments:

1. We believe it is not a good idea to combine the entire future develop-
ment of Windward Oahu's water system under one EIS. This is based
on the following reasons:

- a. Reviewers need and appreciate as much detailed information as
reasonably possible on which to base their analysis. Sometimes
when the information provided is too general, suspicion is aroused
and the reaction is, "What are they trying to hide?" So the
question is, can an overall EIS provide the necessary details?
- b. In line with this, some of the projects proposed have not yet
been sited or planned, so detailed information would probably be
lacking. Is detailed information available so that an EIS can
be drafted? If there isn't and the overall EIS is approved,
will a supplemental EIS be required later to cover those aspects
that are inadequate? This legal question needs to be checked to
insure that the spirit and purpose of the EIS process is not cir-
cumvented.
- c. A single large document will be much more difficult to review
within the usual time limits. Also, the document will be less
useful to persons with interest in specific locations, that
separate EIS's would otherwise provide.
- d. Changes occur over time; therefore, an EIS prepared years in ad-
vance may not be applicable when the actual construction begins.
An EIS should be germane to the time the event takes place be-
cause this is when the environmental impact actually occurs.

AN EQUAL OPPORTUNITY EMPLOYER

qm

Mr. Kazu Hayashida
- 24 September 1984
Page 2

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

2. In Section III, Summary of Environmental Impacts, there is no reference made to impact on the groundwater; i.e., what is the effect of withdrawing up to 50 mgd on the quantity and quality of local groundwater bodies? It is strongly recommended that this be addressed.

It should be made clear that although these comments are made regarding BWS's Windward Oahu Regional Water System Improvements, its substance is applicable to other similar over-all and long-term EIS's produced by anyone.

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

Sincerely,

Edwin T. Murabayashi
Edwin T. Murabayashi
EIS Coordinator

WTH:jm

cc: OEQC
Environmental Center, OH

G-21

October 4, 1984

RECEIVED

OCT 10 1984

VIN PACIFIC

Water Resources Research Center
University of Hawaii at Manoa
Holmes Hall 283
2540 Dole Street
Honolulu, Hawaii 96822

Attention: Mr. Edwin T. Murabayashi
Gentlemen:

Subject: Your Letter of September 24, 1984 on the Environmental Impact Statement (EIS) Preparation Notice for the Windward Oahu Regional Water System Improvements, Halsekahana to Makapuu

Thank you for reviewing the environmental document for our proposed water system projects. Your concerns will be addressed in the text, and your letter will be appended to the Draft EIS.

In answer to your concerns, we decided to prepare a regional EIS rather than an individual EIS for each project because the planning objectives of each of the projects are the same. The Office of Environmental Quality Control recommended this approach and endorsed our efforts toward this end.

As we proceed with each project, we shall be assessing the projects in more detail and, if required, prepare a supplemental EIS for that particular project.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hayashida
For
KAZU HAYASHIDA
Manager and Chief Engineer

cc: VIN Pacific, Inc.

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU
630 SOUTH KING STREET
HONOLULU, HAWAII 96813



EILEEN B. ANDERSON
SECRETARY

September 17, 1984

DGPB/84-3062

WILLARD T. CHOW
CHIEF PLANNING OFFICER
RALPH KAWAHOTO
SENIOR CHIEF PLANNING OFFICER

MEMORANDUM

TO: Mr. Kazu Hayashida, Manager and Chief Engineer
Board of Water Supply

VIA: Mr. Andrew I. T. Chang, Managing Director

SUBJECT: Environmental Impact Statement (EIS) Preparation
Notice for Windward Oahu Regional Water System
Improvements, Oahu

The proposed new water sources will either develop dike-confined ground water, basal ground water or alluvial ground water in various parts of Windward Oahu.

In addition to the items discussed in the preparation notice, an area of concern is the impact on ground and surface water sources currently in use by (1) the private domestic water systems of Campbell Estate and Zions Securities Corporation, and (2) the agricultural industry located in the windward area. Will there be water reduction of their sources after completion of the regional water system improvements?

Ralph Kawahoto
RALPH KAWAHOTO
Planner

APPROVED:
W. Chow
WILLARD T. CHOW

September 26, 1984

TO: WILLARD T. CHOW, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

ATTN: RALPH KAWAHOTO

FROM: KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: YOUR MEMORANDUM OF SEPTEMBER 17, 1984 ON THE ENVIRONMENTAL IMPACT STATEMENT (EIS) PREPARATION NOTICE FOR THE WINDWARD OAHU REGIONAL WATER SYSTEM IMPROVEMENTS, PALAERAKAHANA TO MAKAPUU

Thank you for reviewing and commenting on the environmental document. Your concerns on the probable impact on water resources used by private domestic systems and the agricultural industry in the windward area will be addressed in the Draft EIS. We anticipate no adverse reduction to existing water uses.

If you have any questions, please call Lawrence Whang at 527-6138.

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: WTN Pacific

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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

RECEIVED

OCT 1 1984
VTN PACIFIC

September 24, 1984

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CITY AND COUNTY OF HONOLULU 10 50 41 741

450 SOUTH KING STREET
HONOLULU, HAWAII 96813
PHONE 522-1001



SILKEN R. ANDERSON
MAYOR

September 17, 1984

8422436

Mr. [Signature]
Joseph K. Conant
Director
Charles M. Tomase
City Engineer

Asst. Mgr. [Signature]
P/E

MEMORANDUM

TO: Kazu Hayashida, Manager and Chief Engineer
Board of Water Supply

FROM: Joseph K. Conant

SUBJECT: EIS: Preparation Notice for Windward Oahu Regional
Water System Improvements, Oahu

Thank you for the opportunity to review and comment on the proposed improvements to the Windward Water system. We note that the development of potable ground water, with wells and tunnels, promises to be the least costly and easiest means of supplying Oahu's future water needs. In order to meet the increasing demand for Oahu, on the leeward coast, water development projects on Windward Oahu have been accelerated. Water from Windward sources not used for Windward needs will be pumped to Hawaii Kai for use elsewhere in Honolulu.

We have no objection to the proposed Windward Oahu Water System Improvement proposal.

We will retain the Preparation Notice for our files.

[Signature]
JOSEPH K. CONANT

TO: JOSEPH K. CONANT, DIRECTOR
DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

FROM: KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: YOUR MEMORANDUM OF SEPTEMBER 17, 1984 ON THE ENVIRONMENTAL IMPACT STATEMENT (EIS) PREPARATION NOTICE FOR THE WINDWARD OAHU WATER SYSTEM IMPROVEMENT, HALAELAHANA TO MAKAPUU

Thank you for reviewing and commenting on the environmental document. Your letter and comments will be appended to the Draft EIS.

If you have any questions, please call Lawrence Whang at 527-6138.

[Signature]
KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
 450 SOUTH KING STREET
 HONOLULU, HAWAII 96813-2222

RECEIVED
 OCT 19 1984

842570



EILEEN M. ANDERSON
 MAIL ROOM

MICHAEL H. MCELROY
 DIRECTOR

ROBERT S. JONES
 DEPUTY DIRECTOR

LUB/84-4274 (JDN)

NR
 AM - NR
 P/E

VIN PACIFIC

September 28, 1984

MEMORANDUM

TO : KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
 BOARD OF WATER SUPPLY

FROM : MICHAEL H. MCELROY, DIRECTOR

SUBJECT : ENVIRONMENTAL IMPACT STATEMENT (EIS) PREPARATION
 NOTICE (EISPN) FOR WINDWARD OAHU REGIONAL WATER
 SYSTEM IMPROVEMENTS

We have reviewed the subject EISPN and have the following comments:

1. Scope of the EIS: The EISPN indicates that the scope of the EIS will be general and broad. A general document covering all the proposed water development projects for Windward Oahu cannot provide critical and detailed information on site specific impacts. Because there are specific concerns and issues pertinent to each site, the subject EIS should serve as a generic document with supplementals being prepared for each source.
2. Special Management Area (SMA): The proposed water development projects are identified by Tax Map Key in Table 4 (Pages 10-11). Of these, the following parcels are in the SMA: 5-5-6; Portion of 1, 5-3-9; Portion of 2, 5-3-3; Portion of 1, and 5-2-2; Portion of 1. Also, the proposed Windward Oahu transmission mains (Figure 13, Page 22) between Laniloa Point and the Inter-section of Kahakii and Kamehameha Highway are in the SMA.
 The EISPN did not identify well sites at two sources, Kaha'uu and Waimanalo, and details of all support facilities such as transmission mains, access roads, and utility lines were left as unresolved issues. This information is essential to determine whether development will be occurring in the SMA. Any development within the SMA is subject to review and approval under Ordinance No. 84-4.

MEMORANDUM
 Page 2

3. Support Facilities: The support facilities, including their construction, can have an equal or even greater impact than the wells themselves. Since the specific locations and details of the support facilities are left as unresolved issues, the information should be provided in supplemental EISs. The environmental impacts of the support facilities must be addressed specifically and in detail.

4. Alternatives: Chapter IV, Alternatives To The Proposed Project (Page 43) only addresses other options to the project. Alternative source locations and well sites were not discussed. The EIS must contain an explanation of the source and site selection process.

5. Project Objectives: According to the EISPN (Page 28), the principle project objective is to accommodate projected growth and water demands for Oahu. However, there is no discussion on data addressing the issue of demand vs. supply. Water supply is finite and pumpage can exceed recharge if limits are not established.

6. Stream Flow Standards (Page 41): Water development should not be implemented until the Board of Land and Natural Resources has established minimum stream flow standards.

Please contact John Hakagawa of our staff at 523-4648 if there are any questions.

Michael H. McElroy

MICHAEL H. MCELROY
 Director of Land Utilization

HHH:sl

cc: OEQC

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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

October 16, 1984

RECEIVED

OCT 19 1984

VTH PACIFIC

TO: MICHAEL M. McELROY, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: YOUR MEMORANDUM OF SEPTEMBER 28, 1984 ON THE ENVIRONMENTAL IMPACT STATEMENT (EIS) PREPARATION NOTICE FOR THE WINDWARD OAHU REGIONAL WATER SYSTEM IMPROVEMENTS, MALEKAHANA TO HAKAPUU

Thank you for reviewing the environmental document for our proposed water system improvement projects. Your letter will be appended to the Draft EIS.

We will consider your concerns in the preparation of the Draft EIS on the need for supplemental EIS's for each source, special management area, alternative source locations, demand versus supply data, and stream flow standards.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

for *Kazu Hayashida*
KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTH Pacific, Inc.

RECEIVED
DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU
550 SOUTH KING STREET
HONOLULU, HAWAII 96813



EILEEN M. ANDERSON
MARKER

EMIKO I. KUDO
DIRECTOR

SAM L. CARL
DEPUTY DIRECTOR

DEAN R. ASAHINA
EXECUTIVE ASSISTANT

September 19, 1984

Mr. McElroy
cc: Mr. Whang
cc: Mr. Carl

TO: KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

FROM: EMIKO I. KUDO

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE
WINDWARD OAHU REGIONAL WATER SYSTEM IMPROVEMENTS, OAHU

The proposed wells in the Kaneohe and Maunawili areas may cause adverse effects on Ho'omaluhia Park and the Kawaiui Marsh, respectively. The development of water system improvements in the remaining areas of Windward Oahu is not expected to result in detrimental impacts on recreation facilities in proximity to the project sites.

Additional comments will be provided after we have the opportunity to review the Draft EIS.

Emiko I. Kudo
(Mrs.) EMIKO I. KUDO, Director

EIK:vc

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

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DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
630 SOUTH KING STREET
HONOLULU, HAWAII 96813

RECEIVED
WATER SUPPLY
SEP 5 3 27 PM '84



MICHAEL J. CHUNG, Ph.D.
DIRECTOR AND CHIEF ENGINEER
MAURICE W. WATA
DEPUTY DIRECTOR

ENV 84-253

September 4, 1984

Asst. Mgr. RIE

EILEEN M. ANDERSON
MAIL

RECEIVED
OCT 5 1984
VTN PACIFIC

October 3, 1984

TO: EHIKO I. KUDO, DIRECTOR
DEPARTMENT OF PARKS AND RECREATION
FROM: KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: YOUR MEMORANDUM OF SEPTEMBER 19, 1984, ON THE EIS
PREPARATION NOTICE FOR THE WINDWARD OAHU REGIONAL
WATER SYSTEM IMPROVEMENTS, MALAEKAHANA TO MAKAPUU

Thank you for reviewing and commenting on the environmental document for the proposed projects. Your memorandum will be appended to the Draft EIS.

G-28

We shall address your concerns over the effects the proposed Maunawili wells may have on Kawaunui Marsh. Your concerns over any adverse effects on Ho'omauihin Park which our proposed Konehe wells may have, have already been addressed along with mitigative measures, in the Revised EIS for the Kamoanili Watershed Wells (Luluu, Kuou II, and Kamoanili I and II).

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

K. Hayashida
For
KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

Re: EISP for Windward Oahu Regional Water System
Improvements

We have reviewed the subject EISP and have the following comments.

1. An existing cesspool sump (injection well) is located near the Late Corporation Yard about one (1) mile makai from the proposed Late Wells (Figure 2). Planning for improvements to the lower reaches of Kawaunui Stream in Laie is being undertaken by the U.S. Army Corps of Engineers. No adverse effects on the Late Wells are anticipated from these projects.
2. Minor stream improvements is being considered at the stream crossing at Kakaia Street in Maimalo (Figure 12) near the proposed Maimalo Well III. No adverse effects are anticipated.
3. The injection wells at the Maimalo Wastewater Treatment Plant (Figure 12) are located about 4,000 feet makai from the proposed Maimalo Well IV. The environmental effects are not known.
4. There may be potential conflicts between proposed water transmission mains (Table 7) and proposed and existing storm drains and sewer mains; however, these can be resolved during the design period. Construction plans should be coordinated with the Divisions of Engineering and Wastewater Management.

He ke aloha pumehana,

Michael J. Chung
MICHAEL J. CHUNG
Director and Chief Engineer

9

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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

September 12, 1984

TO: MICHAEL J. CHUN, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: YOUR LETTER OF SEPTEMBER 4, 1984 ON THE EIS PREPARATION
NOTICE FOR THE WINDWARD OAHU REGIONAL WATER SYSTEM
IMPROVEMENTS

Thank you for reviewing the environmental document for the proposed project. We will incorporate your comments in the Draft EIS.

If you have any questions please call Lawrence Whang at 577-6138.

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: WTH Pacific, Inc.

Q-27

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813



EILEEN M. ANDERSON
MAIWA
ANDREW L.T. CHANG
MANAGING DIRECTOR

WILLIAM A. BONNETT
DIRECTOR
DALE WHEE
ASSISTANT DIRECTOR

P/E

RECEIVED
SEP 13 3 27 PM '84

September 13, 1984

TEB/84-3309

MEMORANDUM

TO: KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

FROM: WILLIAM A. BONNETT, DIRECTOR

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS)
PREPARATION NOTICE FOR WINDWARD OAHU
REGIONAL WATER SYSTEM IMPROVEMENTS, OAHU

We have no comments on the subject EIS Preparation Notice.
Thank you for the opportunity to review and comment on the assessment.

William A. Bonnett
WILLIAM A. BONNETT

JW

9

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



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SEP 27 11 47 AM '84
KAHALUU NEIGHBORHOOD BOARD NO. 29
47233 WAIHEE ROAD
KANEHOHE, HAWAII 96744



"Let us not ever have
an unhappy minority"

September 21, 1984

AM CLK
P/E

Mr. Kazu Hayashida, Manager
and Chief Engineer
630 South Beretania
Honolulu, Hawaii 96813

Dear Mr. Hayashida:

Subject: Environmental Impact Statement Preparation
Notice for Windward Oahu Regional Water System
Improvements, Oahu

This is to advise you that we would like to be consulted in the
preparation of the Draft EIS for the above named project.

We have not have sufficient time to review the Preparation Notice
and prepare comment. We will be submitting comments at a later date.

We would appreciate receiving a draft of the EIS when it becomes
available.

Sincerely,
KAHALUU NEIGHBORHOOD BOARD NO. 29

Chester T. Koga
Chester Koga
Chair

cc: Neighborhood Commission
Kahaluu Resource Center
Chair

October 3, 1984

RECEIVED

OCT 5 1984

VTH PACIFIC

Mr. Chester Koga, Chair
Kahaluu Neighborhood
Board No. 29
c/o Kahaluu Community Center
47-232 Waihee Road
Kaneohe, Hawaii 96744

Dear Mr. Koga:

Subject: Your letter of September 21, 1984 on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water System
Improvements, Malaekahana to Makapuu

Thank you for your interest in our project. We included
your organization in our consulted parties list when the EIS
Preparation Notice was sent to you. We would appreciate
receiving your comments by November 4, 1984.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,

L. G. Rathbun
For KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTH Pacific, Inc.

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Mr. Kazu Hayashida
Windward Oahu EIS Preparation Notice
Page 2

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RECEIVED
KAAHALUU NEIGHBORHOOD BOARD NO. 28
70 KAAHALUU COMMUNITY CENTER
4722 WAHIE ROAD
KAAHALUU, HAWAII 96731
|| 05 31 '84

WEEKS RES. CONSULTING, INC. 2100 KALANANĀHUI, SUITE 200, HONOLULU, HAWAII 96813



"Let us not ever have
an unhappy minority"

Kazu Hayashida
10-29-84
AHE

October 26, 1984

Mr. Kazu Hayashida, Manager
and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Hayashida:

SUBJECT: Environmental Impact Statement Preparation
Notice for the Windward Oahu Regional Water System
Improvements, Malaekahana to Makapuu

Thank you for the opportunity to comment on the endeavors of the Board of Water Supply. It is encouraging to note the Board has taken this opportunity to outline its total plan for water development in Windward Oahu.

The Kahaiau Neighborhood Board has and will continue to be an advocate for sound water planning that promotes the rational use of our water resources and at the same time protects these resources for the use and enjoyment of future generations. With this as our central thesis we offer the following comments.

We found the Preparation Notice enlightening and frightening at the same time. We are encouraged by the disclosure of the water planning on the Windward side. Thus for the first time we are able to examine the total efforts of the Board in water development. We are also frightened by the magnitude of development that is being proposed. To this end, we fully expect that the EIS will fully address the specific impacts as well as the cumulative impacts that may result from the development of water on the Windward area.

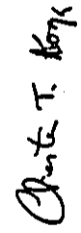
We would like to offer the following as points that we feel should be fully addressed in order that the EIS document can be considered a complete representation of the proposed actions and impacts:

1. The EIS should address the water issues on an Island wide basis as most of the new water development will be for the purpose of transport to the leeward side. To this end, an entire picture of the water situation on Oahu should be delineated and the identification of the contributions Windward Oahu will be expected to make.

- The EIS should fully describe each project (each well, reservoir, transmission system) fully. This includes a specific description of location, impacts, alternatives, and mitigation measure proposed for each individual project. We would propose that each project be described on a watershed basis in order that the impacts on a particular watershed can be evaluated. If it is not the intent of the EIS to do so, then we would suggest that an individual assessment, EIS, or negative declaration be prepared for each project as it is planned.
- The EIS should fully address current efforts of the Department of Land and Natural Resources with regard to in-stream flow standards. The EIS in this regard should identify and propose mitigation measures if there are impacts to down stream users.
- The EIS should fully address the impact to stream fauna which may result from reduction in stream flow. The PN briefly identified a few streams that have stream fauna that may be affected. The EIS should include a survey of all streams to identify stream fauna.
- The EIS should address the impacts to individuals who currently operate private wells.
- The EIS should provide for a specific archeological survey (with the review by the State archeologist) of each proposed project site. The EIS should further detail specific plans and actions in the event that an archeological site is discovered.
- The EIS should fully address the impact to native flora which may be impacted by the development of the well, roads, reservoirs, and transmission lines. The PN did not identify any plants that may be affected. The EIS should include a survey of all project sites to identify native plant species that may be impacted. The review should include the State botanist.
- The EIS should include a full discussion of the impacts to wetlands and the wildlife (vertebrates and invertebrates) it supports as a result of these proposed projects. The PN only identified known marshes, the COE wetland survey should be used.
- The EIS should include, in sufficient detail, the Boards plan to control run-off as a result of project development. The plans should further include details regarding to landscaping of graded sites.
- The EIS should fully discuss alternatives to ground water development as these projects are part of an Island-wide system. The EIS should further discuss what actions are being taken to develop these alternatives.

Mr. Kazu Hayashida
Windward Oahu EIS Preparation Notice
Page 3

- 11. The EIS should discuss the timing and scheduling of these projects. If transmission mains are to be placed along public rights-of-ways, the impacts to the travelling motorists and pedestrians should be discussed. Traffic control plans should be included.
 - 12. The EIS should discuss permits and approvals that are required.
 - 13. The EIS should discuss potential impacts to recreational uses that may be lost as a result of reduced stream flow.
- We hope that our comments prove useful in the preparation of the EIS documents. If there are any questions regarding our comments please call on us.

Sincerely,
 Kahaluu Neighborhood Board No. 29

 Chester Koga
 Chair

Approved by Board Action 10-10-84

cc: Councilmember David Kahanu
 Senator Charles Toyouchi
 Representative Robert Nakata
 WTI Pacific
 Department of Land and Natural Resources
 Koolauloa Neighborhood Board No. 28
 Kaneohe Neighborhood Board No. 30
 Kailua Neighborhood Board No. 31
 Waimanalo Neighborhood Board No. 32
 Kahaluu Neighborhood Board No. 29, Chair
 Hakamoto, Nakata, Shimamoto, Stevens
 Kahaluu Community Resource Center
 Neighborhood Commission

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

November 13, 1984

Mr. Chester Koga, Chair
 Kahaluu Neighborhood
 Board No. 29
 c/o Kahaluu Community Center
 47-232 Maiheo Road
 Kaneohe, Hawaii 96744

Dear Mr. Koga:

Subject: Your Letter of October 26, 1984, on the
 Environmental Impact Statement (EIS) Preparation
 Notice for the Windward Oahu Regional Water System
 Improvements, Malaekahana to Makapuu

Thank you for reviewing the environmental document for our
 proposed water system improvement projects. Your letter will
 be appended to the Draft EIS.

In response to your comments, we offer the following:

1. The EIS will address the water situation on an island-wide basis and identify the expected contribution of the Windward Oahu sources.
2. The EIS will be used as a planning document. Supplemental EIS's will be prepared, as necessary, for each project. However, no additional environmental document will be prepared for those projects that already have accepted EIS's or Negative Declarations published in the OEQC Bulletin.
3. Impacts to streamflow and stream uses will be addressed in the EIS including any mitigative measures that may be implemented and the State's in-stream flow standards.

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Mr. Chester Koga
Page 2

November 13, 1984

4. Impacts to stream fauna from anticipated reduction in streamflow will be addressed in the EIS.
5. Our proposed projects are planned to have negligible impacts, if any at all, on operating private wells.
6. All of our proposed sites that we were able to obtain access to were surveyed by a certified archaeologist. The archaeological reports will be appended in the EIS.
7. The botanical portion of the document was performed by a qualified botanist. The botanical surveys will be appended in the EIS.
8. Impacts to wetlands and the wildlife they support will be addressed in the EIS.
9. The Board's plans to control run-off by use of swales, ponding basins, landscaping, drains, or other acceptable methods will be included in the environmental document.
10. Discussions on alternatives to groundwater development will be included in the Draft EIS as well as actions being taken to develop these alternatives.
11. The Draft EIS will include the tentative scheduling of the projects, where applicable. Some of our proposed sources are only conceptual and, therefore, would not be scheduled.

As mentioned earlier, supplemental EIS's or Negative Declarations will be prepared as necessary for each project. For transmission mains, the applicable document will include impacts to motorists and pedestrians.

Mr. Chester Koga
Page 3

November 13, 1984

12. A list of permits and approvals that are required for the projects will be included in the EIS.
13. Potential loss of stream recreational uses will be discussed in the EIS.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,


KAZU HAYASHIDA
Manager and Chief Engineer

cc: WTN Pacific

842526

RECEIVED
SEP 25 11 39 AM '84
KOOLOAUA NEIGHBORHOOD BOARD NO. 28
Honolulu, Hawaii
54-010 Kukuna Road
Hauula, Hawaii 96717



September 22, 1984

Kazu Hayashida
Manager & Chief Engineer
Board of Water Supply
630 South Beretania
Honolulu, Hawaii, 96843

Mr. K. Kat.
AM JHE
P/E

Dear Sir:

Subject: Environmental Impact Statement (EIS) Preparation
Notice for Windward Oahu Regional Water System
Improvements, Oahu

The Koolauloa Neighborhood #28 received your request for comments on the EIS Preparation Notice for water development in the Windward Regional Water system at its regular meeting of September 13, 1984.

The best response we can provide your department on such a massive proposal follows:

1. There is no possible way of addressing the multitude of projects listed in the report in 30 days.
2. The Board of Water Supply cannot expect a proper assessment without providing complete information on all Windward water development plans including, but not limited to, those of Campbell Estates, Zion Securities, and Bishop Estate.
3. In consideration of the progress being made on the State Water Code, the Board of Water Supply should not be pursuing this sweeping program at this time.

Please consider the Koolauloa Neighborhood #28 a consulting party for this EIS.

Sincerely,
Cathleen J. Mattoon
Cathleen J. Mattoon, Chairman
Planning and Zoning Committee
M.B. #28

CJM
cc: VTN, INC.
1164 Bishop Street

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

October 1, 1984

RECEIVED
OCT 5 1984
VTN PACIFIC

Ms. Cathleen J. Mattoon
Chairman
Planning and Zoning Committee
Koolauloa Neighborhood
Board No. 28
c/o Hauula Satellite City Hall
54-010 Kukuna Road
Hauula, Hawaii 96717

Dear Ms. Mattoon:

Subject: Your Letter of September 22, 1984 on the Environmental Impact Statement (EIS) Preparation Notice for the Windward Oahu Regional Water System Improvements, Makalahana to Makapuu

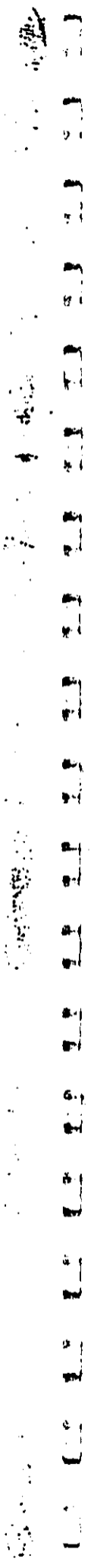
Thank you for reviewing the environmental document for our proposed projects. We will address your comments in the text, where applicable, and will append your letter to the Draft EIS.

Your organization has already been included in our consulted parties list. The EIS Preparation Notice was accordingly sent to you.


If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,
L. S. Hayashida
For
KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific, Inc.



BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

 COPY

September 20, 1984

Alu Like
c/o Mr. Rick Scudder
1316-A Kaunualii'i Street
Honolulu, Hawaii 96817

Gentlemen:

Subject: Your Letter of September 14, 1984, on the Windward
Oahu Water System Improvements, Malaekahana to
Makapuu

We have added your organization's name to our consulted
parties list. Enclosed is a copy of the environmental
assessment for your review. If you have any comments, we
would appreciate receiving them by October 18, 1984.

A copy of the assessment is also being sent to the Koolauloa
Community Council.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,


KAZUO HAYASHI
Manager and Chief Engineer

Enclosure

cc: YTN Pacific, Inc.



OAHU ISLAND CENTER
1116-A Kaunualii'i Street Honolulu Hawaii 96817
Telephone 408-5445-1436

September 14, 1984

Mr. Lawrence Whang
Board of Water Supply
City and County of Honolulu
630 S. Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Whang:

We wish to be a consulted party in the preparation of the Windward Oahu Regional Water
System Improvements, Malaekahana through Makapuu, Oahu Environmental Impact Statement.

Please send us a copy of the preparation notice for our review and please place our name
on the mailing list for the EIS. We recommend that you also send a copy to the Koolauloa
Community Council, c/o Owen Kim, QLOO - Hele Aha, 53-516 Kamehameha Highway, Houlia,
HI, 96717.

Thank you for your assistance.

Yours truly,



Rick Scudder
Community Specialist

cc: YTN Pacific

Let us work together, natives of Hawaii

E. alu like mal kaku. e ni'uhia o Hawaii
Let us work together, natives of Hawaii



B I S H O P M U S E U M
1525 BERNICE STREET • P.O. BOX 9900-A • HONOLULU, HAWAII 96817 • (808) 847-3511

24 December 1984

The Honolulu Board of Water Supply
Environmental Section
630 S. Beretania
Honolulu, HI 96813

To whom it may concern:

The Botany Department of the Bishop Museum would like to be placed on mailing lists for any information, reports, or proposals pertaining to the water redistribution plan to redistribute water from the windward to the leeward sides of the Ko'olau Mountains to allow development of the leeward side.

I would appreciate being informed if we have been placed on such a list. Thank you for your attention to this matter.

Yours sincerely,

W. L. Wagner
Warren L. Wagner
Associate Research Botanist

MLW:smw

G-34

DEC 29 8 07 AM '84

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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

January 4, 1985

RECEIVED

JAN 10 1985

VTN PACIFIC

Mr. Warren L. Wagner
Botany Department
Bishop Museum
P. O. Box 19000-A
Honolulu, Hawaii 96817

Dear Mr. Wagner:

Subject: Your Letter of December 24, 1984 on the Windward Oahu Regional Water System Improvements, Malaekahana to Makapuu

We have added your organization to our consulted parties list. A copy of the Draft Environmental Impact Statement (EIS) will be sent to you when it is made available for public review.

A copy of the EIS Preparation Notice is attached for your information.

If you have any questions, please contact Lawrence Whang at 527-6138.

Very truly yours,

Kevin Haysagida
KEVIN HAYSAGIDA
Manager and Chief Engineer

Attachment

cc: VTN Pacific, Inc.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31



CONSERVATION COUNCIL for HAWAII

STATE BOARD AND OAHU CHAPTER • P.O. BOX 2933 • HONOLULU, HI 96802 • (808) 941-074

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

September 14, 1984

September 20, 1984

Mr. Lawrence Whang
Board of Water Supply
City and County of Honolulu
630 S. Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Whang:

The Conservation Council for Hawaii wants to be a consulted party in the preparation of the Environmental Impact Statement for the Windward Oahu Regional Water System Improvements, Maiealahua through Makapuu, Oahu.

Please send us a copy of the preparation notice for our review and please place our name on the mailing list for the EIS.

Thank you for your assistance.

Yours truly,

Rick Scudder

Rick Scudder,
Chairman

cc: VTN Pacific

Q 135

Mr. Rick Scudder, Chairman
Conservation Council of Hawaii
P. O. Box 2923
Honolulu, Hawaii 96802

Dear Mr. Scudder:

Subject: Your Letter of September 14, 1984 on the Environmental Impact Statement Preparation Notice for the Windward Oahu Regional Water System Improvements, Maiealahua to Makapuu

We have added your organization's name to our consulted parties list. Enclosed is a copy of the environmental assessment for your review. Should you have any comments to offer, we would appreciate receiving them by October 19, 1984.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hayashi

KAZU HAYASHI
Manager and Chief Engineer

Enclosure

cc: VTN Pacific Inc.

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

C P-55-1/84

Mr. Lawrence Whang
Board of Water Supply
City and County of Honolulu
630 S. Beretania Street
Honolulu, Hawaii 96843

September 24, 1984

Mr. Herbert Hoe
Hakipuu Community Association
49-078 Johnson Road
Kaneohe, Hawaii 96744

Dear Mr. Hoe:

Subject: Your Letter of September 18, 1984 on the EIS
Preparation Notice for the Windward Oahu Water
System Improvements, Malaekahana to Makapuu

We have added your organization's name to our consulted parties list. Enclosed is a copy of the environmental document for your review. Should you have any comments, we would appreciate receiving them by October 20, 1984.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,
Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

Enclosure

cc: VTN Pacific

SEP 20 1 19 PM '84

September 18, 1984

Dear Mr. Whang,

We would like to be a consulted party on the Windward Oahu Regional Water System Improvements, Malaekahana Through Makapuu, Oahu, City and County of Honolulu Board of Water Supply EIS.
Your attention to our request is appreciated.

Sincerely,
Herbert Hoe
Herbert Hoe
Hakipuu Community Ass'n
49-078 Johnson Road
Kaneohe, Hawaii 96744

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

RECEIVED HAWAIIAN ELECTRIC COMPANY, INC. PO BOX 2750 - HONOLULU, HAWAII 96840

ENV 2-1 8/12/98
HW/G

SEP 24 10 39 AM '84

September 21, 1984



Brenner Munger, Ph.D., P.E.
Manager,
Environmental Department
(808) 548 6280

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

Subject: Environmental Impact Statement Preparation Notice for
Windward Oahu Regional Water System Improvements

We have reviewed the above Environmental Impact Statement Preparation Notice and offer the following comments:

1. Page 5, "utility lines for production facilities is mostly unresolved." Although unresolved, all construction activities shall be coordinated with HECO.
2. Since a few of the proposed water development projects are located in State Conservation District, any new line construction would require Conservation District Approval. It is HECO's position that it is the developer's responsibility to provide the necessary new easements as well as submit appropriate CDUAs on HECO's behalf.
3. We have previously commented on some of the Board of Water Supply (BWS) projects listed on Table 1 on Page 3. We assume that the BWS will contact HECO on a case by case project by project basis and make known their electrical demand requirements at the appropriate time for all projects covered (in general terms) by this EIS Preparation Notice.

Thank you for the opportunity to comment on this Environmental Impact Statement Preparation Notice.

Sincerely,

Brenner Munger

Brenner Munger, Ph.D., P.E.
Manager, Environmental Department

A Hawaiian Electric Industries Company

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

October 1, 1984

RECEIVED
OCT 4 1984

VTN PACIFIC

Dr. Brenner Munger, Manager
Environmental Department
Hawaiian Electric Company, Inc.
P. O. Box 2750
Honolulu, Hawaii 96840

Dear Dr. Munger:

Subject: Your letter of September 21, 1984, on the Environmental Impact Statement (EIS) Preparation Notice for the Windward Oahu Regional Water System Improvements, Malaekahana to Makapuu

Thank you for reviewing and commenting on the environmental document for the proposed water system improvement projects. Your comments will be incorporated in the text and your letter will be appended to the Draft EIS.

In response to your comments, we will be coordinating all of our electrical requirements with you on a project by project basis and will be taking the responsibility to provide new easements for power lines needed in conjunction with our projects in the conservation zoned areas.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific

RECEIVED
BOARD OF WATER SUPPLY

SEP 14 11 24 AM '84

HAWAIIAN TELEPHONE
EIS

September 11, 1984

RUSS K. SAITO
Network Engineering Director

Board of Water Supply
City & County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Attention: Kazu Hayashida
Manager and Chief Engineer

Gentlemen:

Environmental Impact Statement (EIS)
Preparation Notice for Windward Oahu Regional
Water System Improvements, Oahu

We have reviewed the Environmental Impact Assessment for the proposed Regional Water System Improvements project. The project will not have adverse impact on the telephone system.

Telephone lines at each site are not available, but will be provided upon request. The lines will be placed aerially along the access roads unless special requirements are made to place them underground.

Thank you for the opportunity to review the EIS.

Sincerely,

RK Saito

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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

September 20, 1984

Mr. Russ K. Saito
Network Engineering Director
Hawaiian Telephone
P. O. Box 2200
Honolulu, Hawaii 96841

Dear Mr. Saito:

Subject: Your Letter of September 11, 1984, on the Environmental Impact Statement (EIS) Preparation Notice for the Windward Oahu Regional Water System Improvements

Thank you for your comments on the environmental document for our proposed project. Your comments will be incorporated into the text of the Draft EIS and your letter appended in the appendix of the document.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

cc: WTN Pacific, Inc.

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY



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OCT 2 1984

VTN PACIFIC

September 26, 1984

Mr. Carl C. Christensen
Conservation Chairman
Hawaii Audubon Society
P. O. Box 22832
Honolulu, Hawaii 96822

Dear Mr. Christensen:

Subject: Your letter of September 20, 1984 on the EIS
Preparation Notice for the Windward Oahu Regional
Water System Improvements, Malanekahana to Makaiopuu

Thank you for reviewing and commenting on the environmental
document. Your concerns on endemic stream fauna and impacts
to their habitat will be addressed in the text of the Draft
EIS. Your letter will also be appended in the Draft EIS.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,

Kazu Hayasaka
KAZU HAYASAKA
Manager and Chief Engineer

cc: VTN Pacific

842181

P/E
P.O. BOX 21433
HONOLULU, HAWAII 96822

For the Protection of Hawaii's Native Wildlife
RECEIVED
HAWAII AUDUBON SOCIETY
SEP 27 4 36 PM '84
20 September 1984

Board of Water Supply
City and County of Honolulu
630 South Beretania
Honolulu, Hawaii 96813

Gentlemen:

Subject: Comments on Environmental Impact Statement Preparation Notice
(EISPN) for Windward Oahu Regional Water System Improvements

Hawaii Audubon Society's concerns regarding the proposed water system
improvements are with possible environmental effects of decreased stream
flow. We expect the EIS to fully address such concerns with regard to
endemic waterbirds and other native streamlife. We note that the discussion
of Stream Fauna on p. 36-38 of the EIS Preparation Notice significantly
understates the diversity of Hawaii's endemic stream fauna. In addition to
the species listed in the EISPN, Oahu's streams are inhabited by several
endemic lymanacid snails and a number of endemic aquatic insects; some of the
latter were recently identified by the U. S. Fish and Wildlife Service as
candidates for possible addition to the Federal List of Threatened or
Endangered Wildlife. We believe the EIS should consider the impacts of the
proposed developments on the full range of endemic stream-dwelling animals
that may occur in streams subject to modification. Pressures for
development of Oahu's water resources will inevitably increase as the
island's population continues to grow, and at present no Oahu stream has
adequate protection from loss of streamflow that would ensure its continued
ability to support native streamlife. For this reason, we believe one of
the alternatives that should be considered in the EIS would be the
designation of a selection of high-quality streams as refuges for Oahu's
fast-disappearing native stream-life, such streams to be permanently
protected from water loss due to water development. We thank you for this
opportunity to comment on this EIS Preparation Notice.

Sincerely,

Carl C. Christensen
Carl C. Christensen
Conservation Chairman

Q
1
CO



BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



Mailed on the Mail, Suite 402 • 1154 Fort Street • Honolulu, Hawaii 96813 • (808) 538-1246

September 18, 1984

September 24, 1984

Mr. Lawrence Whang
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Whang,

Hawaii's 1000 Friends requests that we be consulted in the preparation of the Environmental Impact Statement for its Windward Oahu water development proposed projects, reservoirs, and transmission mains in the region extending from Malaekahana through Makapu'u.

Thank you.

Sincerely,

Muriel B. Seto

Muriel B. Seto
Executive Director

MBS:rm

cc: VTN Pacific, Mr. Doug Maller

Subject: Your letter of September 18, 1984 on the FIS Preparation Notice for the Windward Oahu Water System Improvements, Malaekahana to Makapu'u

We have added your organization's name to our consulted parties list. Enclosed is a copy of the environmental document for your review. Should you have any comments to offer, we would appreciate receiving them by October 20, 1984.

If you have any questions, please call Lawrence Whang at 527-6138.

*Very truly yours,
Kazu Hayashida*

KAZU HAYASHIDA
Manager and Chief Engineer

Enclosure

cc: VTN Pacific



84-2500
Published on the Mail, Suite 402 • 1154 Fort Street • Honolulu, Hawaii 96813 • (808) 538-1294

October 18, 1984

Kazu Hayashida, Manager and Chief Engineer
The Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Hayashida,

Thank you for the opportunity to be a consulted party regarding the proposed Windward O'ahu Water System "Improvements", Malaekahana to Makapu'u. We question the title of the project, which appears to be a misnomer since the goal is to increase water systems for Kona and Leeward use.

In fact, we do not believe it is either possible or desirable to effect an EIS for the entire Windward Coast. Such an effort would still require valley-by-valley analyses and, in several locales, elaborate and in-depth attention to ecosystems lying within those valleys.

We were surprised that other private organizations do not appear to be consulted parties:

Hawaii Conservation Council
The Outdoor Circle and Branches:
Kaneohe Outdoor Circle
Lani-Kailua Outdoor Circle

Hawaii Federation of Garden Clubs
Society of Hawaiian Archaeologists
Kailua Community Council
Hawaii Fishing Coalition
Aku Boat Owners Association,

among others. Also, should not the several pertinent sections of the giant Department of Land and Natural Resources be invited to participate on the state level, and other agencies of interest from within the University of Hawaii system, Manoa and Windward?

At the Federal level, the Office of the National Register of the U.S. Department of the Interior would be a logical agency from which to request comments, since several listed sites, and sites eligible for listing located in Windward O'ahu, would be affected. Also, in the Department of Commerce, we believe the National Marine Fisheries would have

Mr. Kazu Hayashida, October 18, 1984
Page 2

interests if freshwater mixing in inshore waters will be reduced. Projections of impacts on such estuarine areas to be altered as La'ie, Kahana, Kane'one Bay, Kawai Nui Marsh and Channel, Kailua Bay and Waimanalo Bay would be valuable.

Hanohano Enterprises, of Punalu'u, should have an opportunity to respond as private property owners singularly interested in their valley's water resources; surely, there are other large kuleana land owners, as well. The Turtle Bay Resort is another private owner that is also conspicuously absent from your list.

In your introduction, previous Negative Declarations and EIS's for individual projects are summarized. We question the continued acceptance of such declarations in the light of the roles these projects would play in determining cumulative impacts for the entire area. The EIS would have to address their contributions to the impact on the whole region.

Is the Windward O'ahu Systems' proposal intended to end-run the forthcoming state water code? Is the Board of Water Supply attempting to jealously husband its powers by grandfathering a massive project prior to imposition of the statewide code and authority? It seems to us that a moratorium would be preferable to such a hasty and ill-advised exercise.

In illustrating the several water sources described, a windward map should be developed locating the several sources in relation to each other, perhaps with colors, so that those reviewing the EIS will sense the inter-dependence or states of proximity between perched, basal, groundwater and caprock waters.

Where wells to develop groundwater are proposed, will the EIS describe the large area to be impacted through de-watering at the source? In all cases, fully developed costs-to-benefits should attend each project, and be summed up for the whole district, for the regional plan you propose and for fully developed alternatives, as required by NEPA requirements.

For those reviewers lacking an engineer's expertise, technical jargon should be avoided so that the public will fully comprehend the magnitude and methodology for each type of well, shaft, and tunnel proposed. A glossary of terms would be desirable.

If yields are to be "maximized" wherever possible, the social impacts on Windward O'ahu may be more difficult to assess than the Board has expertise to attempt. Such costs as loss

of agriculture, loss of tourists and tourist destinations, loss of beauty, loss of plant and aquatic species, and loss of quality of life for all island residents, are only partially measurable in terms of dollars and cents. Nonetheless, we would expect the EIS to make a serious effort to do make these assessments.

Do Tables 2, 3, and 4 include the projects contained in Table 1? If so, those projects should be identified in some way so that cumulative impacts can be evaluated. For the monumental engineering effort you propose, the public must know what the resources are presently providing and/or are prepared to provide (if in reserve or at less than maximum capability) in order to project the likely results of what you now propose.

Generalities cannot be made willy-nilly for each activity. There would have to be ample discussion of impacts of the "construction roads" needed to provide access for equipment, as they would individually impact each valley, ridge, or ecosystem. Accessory operations, such as irrigation systems, control buildings, transmission mains, chlorinator facilities, piping, fencing, utility lines, and production facilities will have to be fully described, accurately located, costed, and environmentally evaluated for each separate site, followed by then collation of the information for cumulative windward impact.

We have the feeling that the Board is anxious to develop a "quick and dirty" method of resolving a host of EIS issues that they'd prefer not to do thoughtfully and separately. We believe both separate and cumulative potentials must be addressed for each action proposed.

If you cannot locate "off-site transmission mains, access roads, and utilities lines for production facilities" because such location "is mostly unresolved," then an effective environmental impact statement is not possible.

Also, if all projects were to be effected, the impacts on inshore waters and reefs would be extraordinary; therefore, a full discussion of such impacts would necessarily have to be undertaken in the EIS.

The discussion in the notice on new reservoirs, (p. 23) is illustrative of haphazard thinking. The BWS admits there are only "unresolved" plans for Windward O'ahu reservoirs, and makes uncertain references to proposed private reservoirs which, if approved, might be "oversized at BWS expense." This is too "iffy" to be credible, if one is to evaluate environmental impacts.

Another unresolved problem has to do with whether or not additional water mains will be needed. How can an EIS report to evaluate impacts if the total project cannot be identified?

(We might reference the sophistry that appears to have been present in an earlier BWS request for federal funding for a Waimanalo reservoir and closed system water diversion from Kailua (Maunawili), to replace open ditches and leaky flumes. The monies have been obtained, ostensibly to benefit Waimanalo agriculture, but the real purpose appears now to be for storage of potable water for Honolulu use, a less than candid use of the EIS process).

In the Notice's discussion of Objectives (p. 28), we note that the projected twenty-year increase in demand to meet leeward O'ahu growth can only barely be met by full development of all windward O'ahu water resources, a devastating prospect!

The statement is made that the BWS seeks to prevent "further" saltwater encroachment into the Honolulu and Pearl Harbor aquifers. Has such encroachment actually taken place? Has not the reduction in agribusiness use of hundreds of acres of land, formerly in cane or pineapple, resulted in lessened demand on those aquifers, as John Mink reported on September 28, 1984 in reference to the proposed state water code?

Part II

- A. Topography is inadequately described in the Notice: each ridge and valley to be impacted by the fully developed system must be completely described, along with the interrelating resources. As noted before, the maps are inadequate.
- B. Land Use is similarly given short shrift, with an extensive description necessary for each project, transmission mains, support buildings and structures, and roads.
- C. The discussion of climate is simplistic. An EIS would, of necessity, require full discussion for each valley because of the disparity of rainfall from valley to valley and coast to peak, as you state in the Notice. It takes no expert to observe that rainfall outermiles, in part, the nature, locale, quantity, and quality of the water resources. Therefore, discussion of seasonal changes would also be relevant and necessary as applied to each activity in their several locales.
- D. Soils and Geology, too, differ from one locale to another,

and would have to be discussed step by step in relation to each project and activity. Generalizations are unwelcome in an EIS.

E. Hydrology and Drainage are closely linked with all the foregoing and would need careful identification in relation to all the rest, in each unique locale. In addition, there are the co-existent and potential human uses to be considered, since many of these are located as they are - or might be so located - because of the water resources. Stripping the windward water sources would effectively destroy a variety of activities of economic, cultural, recreational, and environmental values. These would each require discussion for each activity proposed within each locale.

F. The data concerning Water Development would have to be fleshed out in Tables 8, 10, 11, and 12 to provide same kinds of information contained in Table 9. The totals of all existing withdrawals should be evaluated, on a resource-by-resource basis, in relationship to the increased amounts proposed to be withdrawn. Recovery estimates for resources replenishment are also in order, if true impacts on the natural environment are to be addressed by reviewers. In turn, will the massive withdrawals proposed weaken the natural geological systems, stimulating accelerated subsidence, sink holes, and earthquakes? Will costs attending any such possibilities be fully explored?

G. The perennial streams of windward O'ahu are important for all the environmental factors dealt with in the categories which follow. Under the proposed state code, (1.08(4)(a)), instream use and protection would be assured. It is here that BWS ambitions are most transparent: you are asking permission to do what you want, however you want, when you want - with no timetables - even if it means making windward O'ahu arid, because you want to prevent another authority from limiting your powers.

If you develop the EIS, we will expect full examination of what your project would mean to all the windward farmers you would put out of business, and the costs of the loss of their produce, prawns, etc., to our economy. Also, the evaluation of what your project would do to hasten the full urbanization of all windward O'ahu, and the resultant loss of quality of life for all residents of an island which becomes "Manhattan in the Pacific."

We do not understand the terminology of "losing" and "gaining" in Table 12 for Type of Stream definitions. This is an example of why a glossary is necessary.

H. Stream fauna also includes mullet, awa, etc., in addition to the o'opu mentioned. These and others are fish of commercial value which should be discussed in the EIS since streams will be dewatered. Historic data may be available to demonstrate the impacts of man's deprivations on certain windward streams, fishponds, and marshes as they relate to aquafauna production. In addition, the salinity or freshness of inshore seawaters is determined by the amounts of freshwater reaching the sea. This "zone of mixing" is critical to the kinds and numbers of fish important to commercial and recreational fishermen. It may be convenient for BWS engineers to have to consider the continuum of life forces present in island ecology, but the EIS will be expected to do so. Will the BWS fund the necessary studies to answer the questions raised in the Notice?

I. There are national concerns for certified wetlands, native waterfowl, and endangered waterbird species. There are, in addition, unevaluated perched meadows, ponds, and high mountain bogs still to be located and studied for obtaining increased information as to their significance to the several forms of life dependent on such resource areas, some of which may be threatened or endangered.

J. The Notice is wholly unsatisfactory in its offhand statements regarding Vegetation and Wildlife. Such assumptions are unscientific and unacceptable without supportive evidence, which is one of the most valuable aspects of the EIS process. This responder has been told of rare red ferns in the uplands of Kahalu'u, and a check with Bishop Museum scientists confirms a paucity of botanical, entomological, ichthyological, and other zoological information for windward O'ahu. The ecosystems mentioned in I. have had the benefit of some study and thus have some measure of protection: their numbers are few and it may be presumed that other valuable resource areas for other kinds of vegetation and wildlife are present in areas to be addressed in the EIS. What of the federal and state designated endangered land snails? What of the 1980 federal and state registers Category 1 and 2 native plants? What of the 1984 federal and state register of 335 invertebrates endangered species candidates? Because of direct and indirect federal funding for O'ahu water projects, NEPA criteria must be scrupulously applied in the EIS.

K. Each windward valley has its own archaeological features, some known and others unknown; we refer you to Native Planters, et al. For instance a great deal of informa-

tion exists for Waiahole, Waikane, Kahana, Punalu'u, Hau'ula, and Waianalo. However, archaeology is not sum of cultural concerns: Hawaiian oral traditions abound for this region, supported by scientific confirmation of early settlement, and the likelihood of impact on unknown subsurface sites of great significance is not only possible but likely. Therefore, just as oral traditions have been proven correct by explorations at Kawai Nui, Kualoa, Waianalo, etc., we must assume they are also correct for other windward areas within the vast scope of this project. We would expect your bibliography to be greatly expanded to include Sites of O'ahu, Archaeology of O'ahu, and publications pertinent to each resource area.

L. We would hope the EIS will examine the hazards inherent in effecting the sum of the activities contained within project. What affects on forests and soils will such dewatering have in terms of changing climate (as conjectured by meteorologists regarding Kula, Maui, and Kaho'olawe), or increasing slides, subsidence, etc.?

M. Air Quality and Noise factors are to be expected, one would suppose, during construction and development of each of the activities. Would these not include dust, insolation, truck traffic and bulldozing, etc., in areas formerly relatively pristine? These are pollutants.

III. It would be virtually impossible to adequately address either the environmental impacts on Windward O'ahu or to convincingly describe mitigation measures for this "project" without developing the impact statement on an individual valley or ecosystem basis. Extrapolation of information for blanket application to vastly differing resource areas is unrealistic, unscientific, and wholly inappropriate to the EIS process.

There is nonsense in the outdated contention that population growth on O'ahu is dependent on resident birth rates and availability of jobs. There is hypocrisy present in the claim that removing windward waters around the eastern end of the island will not directly influence "where population growth takes place on O'ahu." Exporting the water in itself makes the statement more than a little questionable.

IV. We are exceedingly disappointed by the fact that the full ramifications of Option 6.9 (page 52) of the BMS 1982 O'ahu Water Plan is not included as a viable alternative. This is an effective process seeking public cooperation. Since the drought we have been experiencing has already heightened the interest of the general public in water use,

supplies, and constraints, increasing supply by reducing demands would seem to be a most profitable and cost effective method, and should be a fully developed alternative in the EIS. Further, if such a monumental and costly project is of immediate necessity, which is extremely unlikely, another unmentioned alternative to be developed is that of moratorium, despite the BMS's vision of its mandate. Perhaps it is time for Charter Commission attention to the narrow focus taken by the existing BMS, as an entity separate from county and/or state planning agencies.

We would expect the other options being considered to be fully developed in the EIS for complete discussion throughout. We will look for discussion of the known negative impacts of using non-potable water, since the actual salinity of caprock water is presently unknown, and some plants are less tolerant to salt than others.

A thorough discussion of de-salinization in the EIS will make it possible to evaluate the project on the basis of total system costs and cost allocations to the various components. We are uncertain as to how the BMS would use diversion and treatment of stream water as an alternative, but will examine it in detail.

IV. In addition to those impacts listed as being significant project impacts, we suggest that item 3. be expanded to include inshore and offshore habitat alteration for ocean fauna, including the reef, seaweeds, and shellfish. We would like to see included an item 7. Social impacts, to include cultural and economic ramifications; and 8. Potential for stress within the drained geofoms: earthquake, subsidence, and slides.

Our final suggestion is for the BMS to abandon its ambitions, nakedly revealed in this preparation notice, and await adoption of the state's water code. How can the BMS propose such a project while participating within the state committee, mandated by an elected and concerned Legislature, to develop a protective, workable state water code? The rationale seems transparent to us, and distasteful.

Sincerely,

Muriel B. Seto

Muriel B. Seto
Executive Director

MBS:rm



January 7, 1985

RECEIVED
JAN 16 1985

VIN PACIFIC

Ms. Muriel B. Seto
Executive Director
Hawaii's Thousand Friends
Blaisdell on the Mall
1154 Fort Street, Suite 402
Honolulu, Hawaii 96813

Dear Ms. Seto:

Subject: Your letter of October 18, 1984 on the Environmental Impact Statement (EIS) Preparation Notice for the Windward Oahu Regional Water System Improvements, Malaekahana to Makapuu

Thank you for your comments on the EIS Preparation Notice for our proposed water system projects. Your letter will be appended to the draft EIS.

In response to your comments, we offer the following:

1. The EIS will discuss projects that should improve the Windward system. All water sources will be developed primarily for use in the Windward district with only the excess water transported for use in the Honolulu District.
2. The EIS reflects our long range planning program. Some of the proposed projects are conceptive in nature and may not be implemented and, therefore, it would not be feasible to fully describe each site at this time.

Supplemental EIS's will be prepared as necessary for individual projects.

Q 145



Ms. Muriel B. Seto
Page 2

January 7, 1985

The idea of regional EIS's was discussed with the Director and staff of OEQC over two years ago. We then initiated the regional EIS following OEQC's concurrence with this approach.

3. Copies of our EIS Preparation Notice were sent to organizations which we felt may have some comments on the environmental assessment. Private organizations which did not receive a copy of the EIS Preparation Notice can request to be a consulted party or can comment on the draft EIS. We have already received comments from the Hawaii Conservation Council while the Outdoor Circle may comment later on the draft EIS.

4. Both the State Department of Land and Natural Resources and University of Hawaii's Environmental Center (which includes comments from the various fields at the University of Hawaii) have already commented on the EIS Preparation Notice.

5. All of the proposed sites that we were able to obtain access to were surveyed by a certified archaeologist. The archaeological reports will be appended and discussed in the draft EIS. We have already received comments from the U. S. Fish and Wildlife Service and shall address their concerns in the draft EIS.

6. Our environmental impact assessments are filed as Negative Declarations only if our proposed projects are not expected to create any environmental problems.

7. Our proposed long range planning program is not "intended to end-run the forthcoming State Water Code". We are participating in developing the State Water Code.

8. The draft EIS will describe the various types of water sources that are proposed.

COPY



Ms. Muriel B. Seto
Page 3

January 7, 1985

9. All impacts that may result from any new source will be addressed in the draft EIS.
10. Tables 2, 3, and 4 do include projects contained in Table 1.
11. Response Number 2 notes that supplemental EIS's will be prepared as necessary for those projects that are conceptive in nature.
12. Environmental assessments are prepared for any oversized projects that are determined to have a potential impact on the environment.
13. The proposed Waimanalo reservoir will provide potable water and fire protection for residents and farmers in that area. The State Department of Land and Natural Resources' (DLNR) Maunawili Ditch improvements will provide more reliable irrigation water to the farmers. The reservoir project is being undertaken jointly with DLNR to service the new Waimanalo Agricultural Park.
14. By mandate of the City Charter, we are to provide water for the department's consumers. We use the State Department of Planning and Economic Development's population projection and City Department of General Planning's population distribution to estimate future water demands. We are working with DLNR on a future project for demineralization of brackish water for potable use. We are also considering desalting seawater at some future time.
15. DLNR has designated the Pearl Harbor, Waialua and Honolulu Basins as ground water control areas (GWCA). DLNR designates a basin as a GWCA when they believe that water withdrawal should be regulated to preserve the basins. Past use of ground water for irrigation has diminished slightly in the Pearl Harbor GWCA but remains the same for the Waialua basin.

Q 146



COPY

Ms. Muriel B. Seto
Page 4

January 7, 1985

16. The proposed draft EIS is the document for which environmental matters are fully addressed.
17. All of our EIS documents are reviewed and commented on by DLNR. We send our streamflow monitoring data for our production wells to them for their information and action.
18. Existing water use of farmers should not be affected by our water development projects.
19. "Losing" and "gaining" streams will be defined in the draft EIS.
20. We maintain a water conservation program all year round, but we still require additional water to serve the growing population.
21. We previously noted our participation in preparation of the State Water Code. As such, other participants are aware of our EIS and are free to ask questions or formally comment on our environmental documents.

We hope that we have answered your questions. However, we invite you to send us your comments when our draft EIS is completed and circulated for comments.

If you have any questions, please contact Lawrence Whang at 527-6138.

Very truly yours,
Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific, Inc.

P-520/84

HUI MALAMA AINO O KO'OLAU
47-410 ULUKU STREET
KANEHELE, HAWAII 96744

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September 20, 1984

Mr. Lawrence Whang
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Re: Windward Oahu Regional Water System Improvements,
Malaeakahana Through Makapuu, Oahu

Dear Mr. Whang:

Hui Malama Aino O Ko'olau wishes to be a consulted party to the above described Environmental Impact Statement ("EIS"). However, we strenuously object to the manner in which the Board of Water Supply is approaching these projects.

Windward Oahu is a diverse area, geographically and socially, to lump it all together is an insult, and appears to deliberately minimize the potential effects of these projects on separate ecosystems and separate communities.

The water projects described in the EIS Preparation Notice will, if completed, increase the total capacity of the Board of Water Supply by almost 40%. Such a major expansion of the BWS capacity should not be treated as only one project. In reality, this proposal is for dozens of separate projects, each one of which should have a separate EIS prepared. The approach being pursued by the Board of Water Supply will require affected Windward communities to respond to the information about all of these water development projects within a short 30 day comment period. Normally, community organizations and affected individuals would have 30 days to respond to an EIS for each of these projects. Thus, the

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Board of Water Supply appears to be attempting to circumvent the public's right to meaningful participation in the EIS process.

A second major objection to this proposal for so many water development projects is that they appear to be an attempt by the Board of Water Supply to appropriate all remaining water supply sources on the Windward side of Oahu before the Legislature has an opportunity to adopt a water code regulating such development.

The 1978 Constitutional Convention required that all water resources be held as a public trust and required that there be an agency created to regulate the development of these scarce resources. This attempt is even more egregious because the Manager and Chief Engineer of the Board of Water Supply is a member of the Legislature's Water Commission which is developing a recommendation for the proposed water code. Having been privy to the process for adopting this code, it is highly inappropriate for the Board of Water Supply to attempt to circumvent the laws which it supposedly is helping to formulate. Thus, Hui Malama Aino O Ko'olau strongly objects to any water development proposals of this magnitude at this time.

Our third major objection is that most, if not all, of these proposed water development projects appear to propose taking water unlawfully. The Hawaii Supreme Court has ruled in the case of Reppun v. Board of Water Supply and in the answers to certified questions in Robinson v. Arroyo that parties with water rights do not have any right to divert water away from land where the water right attaches. Therefore, it appears that the Board is planning to take water away from those having the right to the water just as it did in Reppun v. Board of Water Supply. Until the water code is adopted and a method is created for permitting the transfer of water lawfully, these projects are premature. For

all of these reasons, the Board of Water Supply should not proceed with this EIS. Since the Board of Water Supply will likely proceed with this EIS in spite of our objections, we also submit the following matters which must be discussed in any EIS for the development of water resources on the Windward side:

1. The EIS must determine how each of the proposed wells or other water diversion facilities and appurtenances will affect the flows of each of the Windward streams, springs, and waterfalls. The effects on the streams must be quantified into gallons per day and must discuss the impact on stream flows, especially during periods of low flow.

2. Existing uses must also be quantified and potential users and uses identified and quantified as to appurtenant, riparian and correlative water rights.

3. The BWS must identify what legal right it has to divert any of the waters away from Windward water sources in light of current Hawaii case law and the Hawaii Constitution. The BWS must also indicate whether it plans to pay any landowners or occupants of land for the right to divert water away from their lands.

4. The BWS must assess what economic and socioeconomic impacts will occur to the communities of the Windward side if water is diverted away from agriculturally designated lands and from natural stream environments. Similarly, the impact of dewatering Windward streams on revenue from tourism must be addressed since many tourists visit the Windward side because of its stream environments, recreational opportunities, and the water-dependent

agricultural/rural character of the Windward coast.

5. Impacts on stream life must be determined both in the Windward streams and at the mouths of the streams and surrounding ocean environments. The effects of stream discharge on the water quality of Windward bays, effects on coral reefs, fish propagation, and related water and marine recreation must also be addressed. Also, the increased risk of flooding and the potential damages which may result from overgrown streambeds must be assessed.

6. The BWS must discuss the consistency of the projects with land use plans, policies and controls for Windward Oahu.

7. The BWS must assess the environmental impacts of alternative methods of water development such as desalination, exchanges with agricultural users, slower population growth options so that the impacts of these alternatives on Windward Oahu can be compared with the proposed project.

8. All other potential impacts identified in the EIS Preparation Notice must also be fully addressed such as impacts upon archaeological/cultural resources (including impacts upon the people to whom those resources are important), impacts upon wetlands and waterbirds, and the other identified potential impacts. We have not discussed these impacts here because they have already been identified. Nevertheless, we want to stress the importance of those impacts and the necessity to address them.

Hui Malama Aino O Koloa and its members strongly urge the BWS to reconsider its wholesale approach to a very sensitive and fundamental issue for Windward

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Page 5

residents. The BWS should prepare individual EIS's for each project and wait for the adoption of the water code by the Legislature before attempting to implement what now appears to be impermissible projects.

Thank you for the opportunity to comment on this EIS Preparation Notice.

Sincerely,

Charlie Reppun
Charlie Reppun

President, Hui Mo'ome Aina O Ko'olau

G-49

cc: VTN Pacific

September 26, 1984

RECEIVED

OCT 2 1984

VTN PACIFIC

Mr. Charlie Reppun, President
Hui Malama Aina O Ko'olau
47-410 Lulani Street
Kaneohe, Hawaii 96744

Dear Mr. Reppun:

Subject: Your Letter of September 20, 1984 on the EIS Preparation Notice for the Windward Oahu Regional Water System Improvements, Malaekahana to Hakapuu

Thank you for reviewing and commenting on the environmental document for the proposed water system projects. Your concerns will be addressed in the text and your letter will be appended to the Draft EIS.

We have also added your organization to our consulted parties list.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

 COPY

KAAAWA COMMUNITY ASSOCIATION

P.O. Box 620
Kaaawa, Hawaii 96730

Dear Mr. Whang,

The Kaaawa Community Association is an interested party in the environmental impact statement on Windward Oahu water resources.

October 1, 1984

RECEIVED

OCT 3 1984

VTN PACIFIC

Mr. Reg Barley, President
Kaaawa Community Association
P. O. Box 620
Kaaawa, Hawaii 96730

Dear Mr. Barley:

Subject: Your letter on the Environmental Impact Statement (EIS) Preparation Notice for the Windward Oahu Regional Water System Improvements, Malakohana to Makapuu

We have added your association's name to our consulted parties list. A copy of the EIS Preparation Notice is enclosed for your review and comments. Should you have any comments, we would appreciate receiving them by October 30, 1984.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,
Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

Enclosure

cc: VTN Pacific

Sincerely Yours,

Reg Barley
Reg Barley
President

cc: Doug Mellor

Q-50

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*Mr. Miller
for Mr. Miller
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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



September 10, 1984

Kazu Hayashida, Director
Board of Water Supply
City and County of Honolulu
630 South Beretania
Honolulu, HI 96813

September 1, 1984

Dear Mr. Hayashida:

Reference O.E.Q. Bulletin August 23, 1984; E.I.S. Preparation Notices, Windward Oahu Regional Water System.

We are glad to see that Environmental Impact Statements will be done for exploratory wells. However, we believe that lumping 57 wells or tunnel projects, 6 reservoirs, and 12 transmission lines into one EIS will not be in the best interests of either the environment or the public. In our view, the effects of this will be insufficient attention to the impacts of these projects in individual valleys, and that it will result in discouraging the public from commenting because of the sheer volume of material. Furthermore, by the time later projects can be implemented, data used will be grossly outdated and invalid.

We have written Mr. Whang requesting we be listed as consulted party for the EIS.

cc: Mayor Anderson
James Morrow

Susan Miller

Susan Miller, President

KA KAI 'I PONO 'O KAWAI NUI

KAWAI NUI HERITAGE FOUNDATION
P.O. BOX 1101 KAILUA, HAWAII 96734

☞

Ms. Susan Miller, President
Kawai Nui Heritage Foundation
P. O. Box 1101
Kailua, Hawaii 96734

Dear Ms. Miller:

Subject: Your Letter of September 1, 1984 on the Environmental Impact Statement (EIS) Preparation Notice for the Windward Oahu Regional Water System Improvements

Your organization will be added to our consulted parties list.

Enclosed is a copy of the assessment for your review. We would appreciate receiving your comments by October 12, 1983.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

Enclosure

cc: VTH Pacific

Q-51

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Mr. Kazu Hayashida
P/E

29 October 1984

Mr. Kazu Hayashida, Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Re: Environmental Impact Statement Preparation Notice (EISPN)
for Windward Oahu Regional Water System Improvements, Oahu

Dear Mr. Hayashida:

We appreciate the opportunity to comment on the subject EISPN. We would like to preface our specific comments with some general observations.

We are concerned that there appears to be a basic philosophy that assumes it is the Board of Water Supply's mission to provide water to all who want it ad infinitum without any reference to the carrying capacity of the resource. Our present long period of low rainfall is a reminder that this island cannot count on continued abundant rainfall at all times. Perusal of early photographs of portions of Oahu now considered very green (e.g. Lanikai) will verify that much of the island as it evolved over time was not heavily vegetated before Western-style development began. If the water resource is burdened beyond its capacity to recover from such low-fall periods as the present one, is there not the potential for making the island uninhabitable for the large population which the current water system is attempting to support? In our view, water is the limiting factor to development, even if all developable land were not otherwise encumbered.

Sources are rarely given in this document for the data displayed. All sources should be identified, and, where possible, methodologies should be noted.

Finally, we wish to reiterate our position, previously expressed to you by letter, that it is inappropriate to have one Environmental Impact Statement for a system involving 57 wells, 12 transmission lines, and 6 reservoirs, particularly when many sites are not yet determined, making it impossible to accurately assess their effects.

Specific comments

p. 5: Last sentence. The potential environmental impact of transmission lines, access roads, and utility lines on archaeological and cultural sites and on introduction and disbursement of exotic plant species is probably greater than the impact of individual well sites. Until the location of these accessory facilities is determined, any environmental impact statement for this set of projects will be grossly inadequate.

p. 23: First paragraph. None of the reasons given for the need and use of reservoirs justify putting these structures on undeveloped lands such as Kahana Valley. Third paragraph. Some general comment as on p. 5 re unresolved siting. Also overizing--is this in anticipation of new housing already in County Development Plans? Or will it lead to unplanned increased urbanization?

p. 24: Table 5. Does not include dimensions for 6 mg reservoir (Kahana Valley).

p. 26: Table 7. 10th line should be Kihikihik Highway.

p. 28: First paragraph. There are new State population projections (1984 "M" population projections). Does that document agree with the figures given in the EISPN? Are there DGP assumptions based on "M" projections? If so, they should be incorporated in the EIS.

p. 31: What about water usage by taro farmers, who have already suffered from stream flow reduction?

"D. Soils and geology." Specific soil information should be given for each site.

p. 36-38: Table 12. Explanation of terminology in column headed "Type of stream"? Do figures for Kahanaiki and Maunawili Streams jibe with other information sources (e.g. State's "Resource Management Plan for Kawahau Marsh")?

There are no clear indications of the potential effect of changing stream flows and levels on stream flora and endemic fauna. Why should O'ahu have to depend on hiiwai hatching on Kaula', Moloka'i and Maui?

p. 39: Last sentence of Section J. Is statement true with respect to Invertebrates (e.g. Achatinella spp.)?

p. 40: How will archaeological surveys be done? More information is needed on methodology.

How will work areas and access roads affect the environment and/or access (actual as well as visual) to and for historic/archaeological/cultural sites?

p. 42: Second paragraph. EIS should include timetable for promulgation of minimum stream flow standards for streams affected by the project, as well as any standards already set and the basis for them.

p. 43: Since it is stated elsewhere that one of the project's prime goals is to provide water for the Honolulu side of the island, desalination plants on that side of the island should be included as an alternative.

Ma Ika'i Pono 'O Kawai Eui

KAWAI NUI HERITAGE FOUNDATION
P.O. BOX 1101 KAILUA, HAWAII 96734

Ma Ika'i Pono 'O Kawai Eui

KAWAI NUI HERITAGE FOUNDATION
P.O. BOX 1101 KAILUA, HAWAII 96734

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



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In closing, we encourage the Board of Water Supply to prepare a Master Plan for the use of windward O'ahu water that is based on the carrying capacity of the resource, not on an infinitely-increased-demand scenario. We took forward to commenting on draft EIS's for individual projects within the ahupua'a of Kailua, the heart of which is Kawai Nui Marsh.

Sincerely,

Susan E. Miller
Susan E. Miller
President

cc: Governor George R. Ariyoshi
Office of Environmental Quality Control
Mayor Eileen Anderson
Councilmember Welcome Fawcett
Councilmember David Kahanu
Kailua Neighborhood Board No. 31, c/o Annette Kinnicutt
Representative Whitney Anderson
Representative John Medeiros
Representative Norma Wong

November 29, 1984

RECEIVED

DEC 5 1984

VTN PACIFIC

Ms. Susan E. Miller, President
Kawai Nui Heritage Foundation
P. O. Box 1101
Kailua, Hawaii 96734

Dear Ms. Miller:

Subject: Your Letter of October 29, 1984 on the Environmental Impact Statement (EIS) Preparation Notice for the Windward Oahu Regional Water System Improvements, Malaekahana to Makapuu

Thank you for reviewing the environmental document for our proposed water system improvement projects. Your letter will be appended to the Draft EIS.

In response to your comments, we offer the following:

1. The intent of the EIS Preparation Notice is to identify all potential impacts that may result if the projects were constructed. Those potential impacts are then addressed in the Draft EIS as outlined in the Environmental Council's EIS Regulations. Therefore, your concerns on the Board's mission to provide water and on the sources of information will be addressed in the Draft EIS as applicable.

The idea of regional EIS's was discussed with the Director and staff of the Office of Environmental Quality Control (OEQC) over two years ago. We then initiated the EIS following OEQC's concurrence with this approach.

Ma Ika'i Ipono 'o Kawai Nui

KAWAI NUI HERITAGE FOUNDATION
P.O. BOX 1101 KAILUA, HAWAII 96734

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Ms. Susan E. Miller
Page 2

November 29, 1984

2. The EIS reflects our long range planning program. Some of the proposed projects are conceptive in nature; therefore, it would not be feasible to fully describe each site as well as their cumulative impacts at this time. Individual projects may need a supplemental EIS before they can be constructed. These subsequent environmental documents, as required, will address impacts to cultural and archaeological sites and the spreading of exotic plant species for the specific project.
- The reasons noted in the first paragraph are applicable to our proposed reservoirs. The accepted Revised EIS for Kahana "315" Reservoir Project addresses in detail why that site was chosen.

3. Page 23: The EIS will include justification for our proposed reservoirs including the need for oversizing where applicable.
4. Page 24: The dimensions for a six-million gallon reservoir will be added to table 5.
5. Page 26: The misspelling of Kahekill will be corrected.
6. Page 28: We are aware of the State's new "PM" population projections. However, until the City's population distributions are finalized, we will continue to use the current "II-P" projections.
7. Page 31: We will address impacts our projects may have on agriculture which includes taro farmers. Specific soil information for a particular project will be addressed in future Supplemental EIS's or Negative Declarations, as needed.

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Ms. Susan E. Miller
Page 3

November 29, 1984

8. Page 37, Table 12: We will add an explanatory note on "Type of Stream".
- There are no stream discharge figures listed in the "Resource Management Plan for Kawaiunui Marsh" that can be used for comparison. However, the figures in the preparation notice are preliminary estimates based on available data and are fairly reliable.
- The preparation notice does acknowledge on page 42 that some of our water development projects may affect streamflow. Also mentioned in the preparation notice is a statement that we plan to monitor streamflow and would manage our water development projects to meet in-stream flow standards.
- The statement on the hiihawai is an educated guess. Differing from that of other endemic stream animals, the hiihawai found on Oahu is the same as that found on Maui, Molokai, and Kauai.
9. Page 39: Habitats in respect to invertebrates, including *Achatinella* spp., will be discussed with Bishop Museum and addressed in the Draft EIS.
10. Page 40: Archaeological surveys were performed by a certified archaeologist, Mr. William Barerra. His reports on the various project sites will be appended to the EIS.
- Work areas and access roads will be designed to minimize effects on the environment and avoid, as much as possible, any historic/archaeological/cultural sites.

COPY



Ms. Susan E. Miller
Page 4

November 29, 1984

KOKOKAHI HUNGER MISSION MODEL
A MISSION OF KOKOKAHI CHURCH

September 21, 1984

Lawrence Whang
630 S. Beretania Street
Honolulu, HI 96813

Re: Hindward Oahu Regional Water System Improvements from Halekalahana to Makapu

Kokokahi Hunger Foundation wants to be a consulted party to the E.I.S. preparation.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hatahida
KAZU HATAHIDA
Manager and Chief Engineer

cc: VTN Pacific, Inc.

Q-55

cc: VTN Pacific
1164 Blahop St., Suite 906
Honolulu, HI 96813
Attn: Doug Maller

LAG:ems

45-711 KO STREET, KANEHOE, OAHU, HAWAII 96814 TELEPHONE 347-5641 UNITED CHURCH OF CHRIST



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KOKOKAHI HUNGER MISSION MODEL
A MISSION OF KOKOKAHI CHURCH

October 1, 1984

RECEIVED
OCT 4 1984

VIN PACIFIC

Ms. Lou Ann Guanson
Executive Director
Kokokahi Hunger Mission Model
45-741 Ko Street
Kaneohe, Hawaii 96744

Dear Ms. Guanson:

Subject: Your Letter of September 21, 1984, on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water System
Improvements, Makalahana to Makapuu

Thank you for your interest in our projects. Your organization's name has been added to our consulted parties list. A copy of the EIS Preparation Notice is enclosed for your review. Should you have any comments, we would appreciate receiving them by October 30, 1984.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

Enclosure

cc: VTN Pacific

October 25, 1984

RECEIVED
OCT 29 1984

VIN PACIFIC

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City & County of Honolulu
630 South Beretania Street
Honolulu, HI 96813

Dear Mr. Hayashida:

SUBJECT: Environmental Impact Statement Preparation Notice for the Windward Oahu Regional Water System Improvements, Makalahana to Makapuu

Thank you for the opportunity to comment on the EIS Preparation Notice. The Kokokahi Hunger Mission is concerned about sound water planning that promotes rational use of water resources. As a nonprofit agricultural demonstration program, we realize the importance of water as resource for the present and future generations.

We offer the following comments:

1. The EIS should fully describe each proposed project and its anticipated cumulative impacts. We strongly feel the approach of preparing a single EIS for all the currently proposed Windward Oahu water development projects objectionable.
2. The EIS should consider water issues on an island wide basis. The larger scope of the water situation on Oahu should be addressed in relation to Windward Oahu.
3. The EIS should determine how each of the proposed wells or other water diversion facilities will affect the flows of each of the windward streams.

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



MMW Ltr. dtd Oct 25, 1984, Subj: Environmental Impact Statement
Preparation Notice for the Windward Oahu Regional Water System Improve-
ments, Maalekaha to Makapuu

4. The EIS should assess the socio-economic impacts that will occur
to the windward communities if water is diverted away from agriculturally
designated lands and natural stream environments.

We hope that these comments will prove useful in preparing the EIS
documents.

Aloha,

Lou Ann Guanson
Executive Director

cc:
VTN Pacific
Hui Malama Aina O'Koolau
Mahaluu Neighborhood Board, No. 29
Maile-Maikane Community Association
Mauiua Neighborhood Board
Maianalo Neighborhood Board
Koolauloa Neighborhood Board
Mahaluu Neighborhood Resource Center

November 15, 1984

RECEIVED

NOV 23 1984

VTN PACIFIC

Ms. Lou Ann Guanson
Executive Director
Kokokahi Hunger Mission Model
45-741 Ko Street
Kaneohe, Hawaii 96744

Dear Ms. Guanson:

Subject: Your Letter of October 25, 1984 on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water System
Improvements, Maalekaha to Makapuu

Thank you for your comment on the EIS Preparation Notice for
our proposed water system projects. Your letter will be
appended to the Draft EIS.

In response to your comments, we offer the following:

1. The EIS reflects our long range planning program.
Some of the proposed projects are conceptive in
nature; therefore, it would not be feasible to
fully describe each site as well as their
cumulative impacts at this time.

Supplemental EIS's will be prepared as necessary
for our projects except for those that are already
addressed in accepted EIS's or have had Negative
Declarations published in the Office of
Environmental Quality Control (OEQC) Bulletin.

The idea of regional EIS's was discussed with the
Director and staff of OEQC over two years ago. We
then initiated the EIS following OEQC's concurrence
with this approach.

2. Water issues on an island-wide basis will be
addressed in the Draft EIS.

COPY



RECEIVED

Ms. Lou Ann Guanson
Page 2

NOV 23 1984

November 15, 1984

VTN PACIFIC



COPY

September 20, 1984

3. The Draft EIS will address anticipated impacts that our proposed wells or water diversion facilities may have on streamflow.

4. We do not expect to develop sources that will curtail water usage by existing farmers or will seriously affect streamflow. Future farmers and residential owners may obtain water service from us. We have also noted that we shall meet any in-stream flow standards developed by the State Department of Land and Natural Resources.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific, Inc.

9-5-84

Koolauloa Community Council
c/o Ms. Gwen Kim
OLCC - Hale Aha
53-516 Kamehameha Highway
Hauula, Hawaii 96717
Gentlemen:

Subject: Environmental Impact Statement Preparation
Notice for Windward Oahu Regional Water System
Improvements, Malaeakahana to Makopuu

We forward a copy of the environmental document for your review as requested by Mr. Rick Scudder of Alu Like. If you have any comments to offer, we would appreciate receiving them by October 19, 1984.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

Enclosure

cc: Alu Like
VTN Pacific, Inc.

RECEIVED
NOV 23 1984
VTN PACIFIC

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

RECEIVED

OCT 5 1984

VTN PACIFIC

October 1, 1984

LIFE OF THE LAND
250 S. Hotel
Honolulu, HI.
96813

Sept. 21, 1984

Lawrence Whang
Board of Water Supply
City and County of Honolulu
630 S. Beretania St.
Honolulu, HI., 96813

Dear Mr. Whang:

Life of the Land hereby requests to be a consulted party in the preparation of the Environmental Impact Statement for your upcoming /Windward Oahu Regional Water System Improvements.

Thank you very much.

Sincerely,

Dennis Callan
Dennis Callan
President

cc: VPH Pacific

Q 1 5 9

Mr. Dennis Callan, President
Life of the Land
250 South Hotel Street
Honolulu, Hawaii 96813

Dear Mr. Callan:

Subject: Your Letter of September 21, 1984 on the Environmental Impact Statement (EIS) Preparation Notice for the Windward Oahu Regional Water System Improvements, Malaekahana to Hakapuu

Your organization has already been included in our consulted parties list (p. 47). As a consulted party, a copy of our EIS Preparation Notice was also sent to you.

A copy of our Draft EIS will be sent to you after it is prepared and filed with the Office of Environmental Quality Control.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

K. K. HAYASHIDA

For KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific, Inc.

COPY

LULUKU BANANA GROWERS ASSOCIATION
c/o P.O. BOX 475
Kaneohe, Hawaii 96744

September 20, 1984

October 1, 1984

RECEIVED

OCT 4 1984

VIN PACIFIC

Mr. Fred Shiroma, President
Luluku Banana Growers
Association
P. O. BOX 475
Kaneohe, Hawaii 96744

Dear Mr. Shiroma:

Subject: Your Letter of September 20, 1984, on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water System
Improvements, Malaekahana to Makapuu

Thank you for your interest in the projects. We have added
your association's name to our consulted parties list. A
copy of the EIS Preparation Notice is enclosed for your
review. Should you have any comments, we would appreciate
receiving them by October 30, 1984.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,

Kazu Hayashi
KAZU HAYASHI
Manager and Chief Engineer

Enclosure

cc: VIN Pacific

Mr. Lawrence Whang
c/o Board of Water Supply
630 S. Berstanina Street
Honolulu, Hawaii 96813

Dear Sir:

The Luluku Banana Growers Association would like to be a
consulted party to the EIS preparation for the Windward
Oahu Regional Water System Improvements (Makapuu -
Malaekahana).

Sincerely,


Fred Shiroma

Fred Shiroma, President

cc: VIN Pacific

Attn: Doug Miller
1164 Bishop Street, Suite 906
Honolulu, Hawaii 96813

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

 COPY

November 26, 1984

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BB OF WATER SUPPLY

Oct 30 11 03 AM '84

*Mr. Kib
AM KAC
P/E*

LULUKU BANANA GROWERS ASSOCIATION
c/o P.O. Box 475
Kaneohe, Hawaii 96744

October 29, 1984

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
630 S. Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Hayashida:

Re: Environmental Impact Statement Preparation Notice for
the Windward Oahu Regional Water System Improvement

For many years we have been experiencing drier weather conditions in the Luluku area and we are very concerned that any new developments in the area will further dry the area. We have noticed that the Luluku Stream and the Kuou Stream have drastically reduced stream flows over the many years since the development of the Luluku Tunnel and the Kuou Well I. On page 35 of the EIS preparation notice it states that "development of high-level dike-impounded ground water have drastically reduced the dry weather flow of many perennial Windward Oahu streams...." We feel that with the reduction of stream flows and additional water being pumped out of the Luluku and Kamooolii areas, with the development of four additional wells (Luluku Well, Kuou Well II, Kamooolii Wells I and II), this area will dry-up even more.

The apple banana farmers in the Luluku area have no irrigation system and rely solely on natural rainfall and further drying of this area will significantly reduce production. We are very concerned over this development and would appreciate your comments.

Yours truly,



Fred Shiroma, President

cc: VTN Pacific

Mr. Fred Shiroma, President
Luluku Banana Growers
Association
c/o P. O. Box 475
Kaneohe, Hawaii 96744

Dear Mr. Shiroma:

Subject: Your Letter of October 29, 1984 on the
Environmental Impact Statement (EIS) Preparation
Notice on the Windward Oahu Regional Water System
Improvements, Maleekahana to Makapuu

Thank you for your comments on the environmental document for our proposed projects. Your letter will be appended to the Draft EIS.

The Windward Oahu Regional Water System EIS is an overview encompassing many areas, one of which is the Kamooolii Watershed. Within that area, there are several streams that may have been affected by water developments. Two developments, Luluku Tunnel and Kuou Wells I, were mentioned in your letter but there were others. Among them are: construction-related stream interruptions for the Ho'omaluhia Park dam and reservoir; the creation of a wildlife pond at Ho'omaluhia Park; eight relief wells drilled for the Malekou Interchange project; and the damming of Luluku Stream for the Shiroma Banana Farm use. Taken together, they produced some streamflow measurements of questionable value, especially while trying to determine the impact on the area.

The effects of Luluku Tunnel and Kuou Wells I have been acknowledged in the Kamooolii Watershed Wells EIS as affecting Luluku and Kuou Streams. Any streamflow reduction to Kuou, Piho, Hooleinaia, and Malekou Streams will affect Kamooolii Stream.



COPY

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SEP 25 9 12 AM '84
Native Hawaiian Legal Corporation

1164 BISHOP STREET, SUITE 1102, HONOLULU, HAWAII 96813 TELEPHONE (808) 521-2302

AM
P/E

Mr. Fred Shiroma
Page 2

November 26, 1984

September 22, 1984

The Kamoalii Watershed Wells EIS states that dry weather flows will continue in Kamoalii and Luluku Streams. "Kamoalii Watershed Wells are very unlikely to adversely affect any agricultural use of stream water or the feasibility of aquaculture ponds proposed along Kamoalii Stream". Additionally, the Board of Water Supply will monitor streamflows and will reduce pumpage from its wells, as necessary, to meet the instream flow standards that may be established by the State Department of Land and Natural Resources.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: WTN Pacific, Inc.

G 1 0 2

Mr. Lawrence Nhang
Board of Water Supply
630 South Beretania Street
Honolulu, HI 96843

Dear Mr. Whang:

I have been advised about anticipated construction of several deep water wells on Windward Oahu. Alan Murakami and I, both of the Native Hawaiian Legal Corporation, represent: Angel Pilago, Eric Enos, Livei Keawa, David Cullen, George Fukumitsu, Na Opio Aloha Aina, and Watanae Land Use Concerns Committee. These individuals and associations would like to be consulted parties through my office as part of the EIS process for these wells.

George Fukumitsu is a taro farmer on Windward Oahu. He is presently experiencing water problems which are the subject of on-going litigation. My other clients listed above are Waianae residents and associations of residents. They are aware of the Campbell Estate Water Plan for Eva and the anticipated further transshipment of water from Windward Oahu. They are concerned about overall water use on Oahu and would like to be consulted.

Please advise us of the status of this request.

Very truly yours,

Michael C. Davis
Michael C. Davis
Staff Attorney

Q

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

October 1, 1984

RECEIVED

OCT 3 1984

VIN PACIFIC

Mr. Michael C. Davis
Native Hawaiian Legal
Corporation
1164 Bishop Street, Suite 1102
Honolulu, Hawaii 96813

Dear Mr. Davis:

Subject: Your Letter of September 22, 1984, on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water System
Improvements, Malaekahana to Makapuu

Thank you for your interest in our proposed projects. We
have added your organization's name to our consulted parties
list. A copy of our EIS Preparation Notice is enclosed for
your review. Should you have any comments, we would
appreciate receiving them by October 30, 1984.

If you have any questions, please call Lawrence Mhang at
527-6138.

Very truly yours,

L. K. Hayashida
KAZU HAYASHIDA
For Manager and Chief Engineer

Enclosure

cc: VIN Pacific

Mhang
Dec 10 11 34 AM '84

Pohakupu

Community Association

843163

*Mgr. K. H. R.
Aug - 1982
P/E*

Zazu Hayashida
Manager & Chief Engineer
The Board of Water Supply
630 South Beretania Street
Honolulu, HI 96843

Dear Mr. Hayashida:

The Pohakupu/Kukanono Community Association represents 390
households in the Kailua area. We strongly urge you to consider
the informed comments by Hawaii's Thousand Friends, the Kawai Ili
Heritage Foundation, and the Outdoor Circle in regard to the
Environmental Impact Statement Preparation Notice for Windward
Oahu Regional Water System Improvements.

We feel that the essence of criticism for the proposal can be found
on p. 45 in the enumeration of project impacts. Surely there must
be a better solution if this one offers reduced base flow for most
perennial streams from Punahoa to Maunawili, reduced dry weather
seepage of ground water into Windward Oahu wetlands including areas
used for wetland agriculture, reduced habitats for and populations
of native stream fauna and waterbirds, removal or destruction of
native plants, and the damage or destruction of archaeological
sites.

We would prefer to see the Board of Water Supply working closely with
the state in its preparation of a state-wide code rather than working
in tangent to it.

Sincerely,

Lance K. Heilbrun
Lance K. Heilbrun

cc: Lanai Kailua Outdoor Circle

December 4, 1984

PO. BOX 1475, KAILUA, HAWAII 96734

P



COPY

PUNALUU COMMUNITY ASSOCIATION
Post Office Box 239
Houula, Hawaii 96717

December 20, 1984

RECEIVED

DEC 28 1984

VTH PACIFIC

Mr. Lance K. Heilbrun
Pohakupu Community Association
P. O. Box 1475
Kailua, Hawaii 96734

Dear Mr. Heilbrun:

Subject: Your Letter of December 4, 1984, on the Environmental Impact Statement (EIS) Preparation Notice for the Windward Oahu Regional Water System Improvements, Malaekahana to Makapuu

Thank you for reviewing the environmental assessment for our proposed water system improvement projects. Your letter will be appended to the EIS.

In response to your comments, the EIS will reflect our long range planning program. It will discuss the potential impacts that reduced stream flows may have on wetlands, wetland agriculture, stream fauna and waterbird habitats, as well as impacts to native plants and archaeological sites.

I serve on the Water Code Advisory Committee and you can be assured that we will be complying with the spirit of the provision in the Code until it is formally adopted by the Legislature.

If you have any questions, please call Lawrence Mhang at 527-6138.

Very truly yours,

L. K. Rathbun
KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTH Pacific, Inc.

September 22, 1984

Kazu Hayashida, Mgr. & Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania
Honolulu, Hawaii 96843

Dear Sir:

Subject: Environmental Impact Statement (EIS) Preparation Notice for Windward Oahu Regional Water System Improvements, Oahu

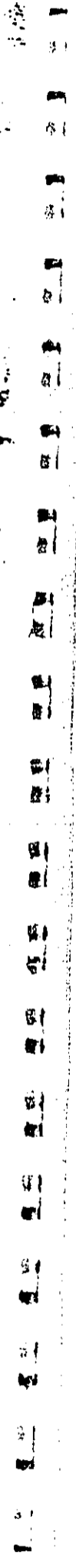
Your proposal for water system improvements in Windward Oahu will greatly affect the Punaluu area. The Punaluu Community Association would like to participate in the review of the EIS and therefore request to be a consulting party.

Sincerely,

PUNALUU COMMUNITY ASSOCIATION

Craigston U. Mattoon
Craigston U. Mattoon (Jim)
President

CHC:jm
cc: VTH, INC.
1164 Bishop Street
Honolulu, HI.



BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

September 26, 1984

RECEIVED

OCT 3 1984

VIN PACIFIC

Mr. Craighton U. Mattoon
President
Punaluu Community Association
P. O. Box 239
Hauula, Hawaii 96717

Dear Mr. Mattoon:

Subjects: Your letter of September 22, 1984 on the EIS
Preparation Notice for the Windward Oahu Water
System Improvements, Malaekahana to Makapuu

Thank you for reviewing and commenting on the environmental
document for our proposed water system improvement projects.
Your letter will be appended to the Draft EIS.

We have added your association to our consulted parties list
and will send you a copy of the Draft EIS when it is
completed.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,

L. S. Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: VIN Pacific



SIERRA CLUB, HAWAII CHARTER US 01184
P.O. BOX 22897 HONOLULU, HAWAII 96822
(808)946-8494

October 23, 1984

Kazu Hayashida, Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
Honolulu, Hawaii 96843

Re: Environmental Impact Statement Preparation Notice for Windward
Oahu Regional Water System Improvements.

We thank you for permitting us to comment. While your notice is dated
August 23, 1984 with a request for response within thirty days, we
trust that you appreciate that the time was short for a volunteer
organization.

It is beneficial to be able to review such a broad plan on proposed
water development. However, we strongly feel that the subsequent
EIS must be broken down into much smaller segments in order that all
of the desirable detail, concerns and impacts will be included in the
final discussions. In this preparation notice, cumulative impacts are
inadequately researched and dealt with, and we consider these impacts to
be the chief advantage of overall planning. Indeed, too much is as
yet unplanned to enable us to make a proper assessment.

We suggest that:

1. There is insufficient research on the cumulative effect on streams
and wetlands. In view of the fact that Windward Oahu has the only
two remaining viable stream systems on Oahu, the importance of the
plan's impact on these systems cannot be minimized. The wetlands serve
many purposes from vital flood control to acting as siltation basins
to keep off-shore waters clean, as well as the production and protection
of whole eco-systems. All of the important functions of stream systems
and wetlands must be recognized and must be protected.

2. The minimum stream flow protection provisions must be in place
before any further water developments are even considered. Irreversible
damage has been done in the past because the normal flow of the streams
has not been a consideration in water-use planning. With the present
philosophy of growth and development, future generations must be

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SIERRA CLUB, HAWAII CHAPTER
P.O. BOX 22897 HONOLULU, HAWAII 96822
(808)946-8494

-2-

considered by the practice of conservation and protection of valuable resources.

3. The cumulative aesthetic effect of so much water development on Windward Oahu has not been adequately dealt with. Mitigation is promised which may be impossible to accomplish, particularly in the drying of streams and wetlands. Access roads, water transmission mains, control buildings, reservoirs, telephone wires, etc., will definitely contribute to adverse scenic impacts. Today tourists are more interested in Windward Oahu, as the remainder of Oahu offers only developed visual impact that can be seen in any city anywhere. Tourists value the beauty of our vegetation, our mountains and our clean waters.
4. There are too many unresolved problems in relation to the water development. (Ex. page 24, re "water mains").
5. Sierra Club has consistently gone on record as opposed to extensive water development in the Kahana State Park, and are particularly opposed to the plan for a reservoir within the park boundaries.
6. According to banana farmers, any proposed compensation for loss of productive acreage is always inadequate. How can the loss of more banana acreage with farmers expected to make a sacrifice for what amounts to further urbanization of Oahu be justified? This is not fitting with the State Plan.
7. It is our understanding that net population growth on Oahu is not due primarily to resident birth rates but to immigration. Development that is aimed at growth, or accommodating growth, caters to the type of immigration that can afford what the local resident cannot afford in the way of housing and accommodation.
8. Sierra Club cannot agree with the philosophy that water development, particularly on an island, must be in response to proposed growth. We strongly feel that since water is the single most important resource to the sustenance of all life, the available water supply must



SIERRA CLUB, HAWAII CHAPTER
P.O. BOX 22897 HONOLULU, HAWAII 96822
(808)946-8494

-3-

determine the growth. In the long run water must cost a good deal more than it does now. This must be recognized now and dealt with. People are being given a false impression, and the education process needs to begin. The philosophy of the cheapest, most available water supply provided at demand for man's extravagant use to the "first come, first served", must change now! From this point of view, Sierra Club must disagree in essence with this whole water development plan.

Mahalo

Lola N. Mench

Lola N. Mench
Legislative Chair, Hawaii Chapter



COPY



COPY

November 9, 1984

Ms. Lola N. Mench
Legislative Chair
Sierra Club, Hawaii Chapter
P. O. Box 22897
Honolulu, Hawaii 96822

Dear Ms. Mench:

Subject: Your Letter of October 23, 1984 on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water System
Improvements

Thank you for reviewing the environmental document for our
proposed water system projects. Your letter will be appended
to the Draft EIS.

In response to your suggestions, we offer the following:

1. We recognize the importance of stream eco-systems
and wetlands. Every effort will be taken to
protect these resources. Furthermore, whenever we
undertake a well project, the monitoring of these
resources will be coordinated with the appropriate
governmental agencies.
2. We intend to monitor streamflow and are prepared to
reduce pumpage as necessary to meet any minimum
streamflow standard that may be established.
3. The aesthetic impacts of our proposed projects will
be addressed, both individually and cumulatively.
Many of our proposed facilities will be landscaped
to minimize their visual intrusion into the
surrounding area.
4. We agree that the proposed regional water system
EIS will leave many unresolved issues. Therefore,
we plan to prepare supplemental EIS's for
individual projects as necessary.

Ms. Lola N. Mench
Page 2

November 9, 1984

5. The water development projects and proposed
reservoir in Kahana Valley, their anticipated
impacts, and the mitigative measures are discussed
in two separate EIS's which have already been
completed and accepted.

6. The loss of banana lands affected by our projects
are addressed in the separate Kamooalii Watershed
Wells EIS.

7. Our long range water development plan is based on
the State Department of Planning and Economic
Development's population projection and the City's
Department of Planning population distribution.

8. We estimate that water demand should exceed
available groundwater supplies by the year 2000.
After that, there are many alternatives such as
blending, dual water systems and demineralization
of brackish water, that will be available to meet
the increasing water demand. We believe growth is
an issue that should be determined on the State
level, taking into consideration other factors
besides water.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTH Pacific, Inc.

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54-3070

THE OUTDOOR CIRCLE

200 No. Vineyard, Suite 502, Honolulu, Hawaii 96817
808-571-0074

Mr. Kuz - enj 11-27-84
Mr. - xbr
P/E

November 20, 1984

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

The Outdoor Circle wishes to thank you for giving us additional time to study the Environmental Impact Statement Preparation Notice for Windward Oahu Regional Water System Improvements and to formulate our response. Because the geographical area covered is extensive and varied, it is necessary to evaluate and respond to each area separately in addition to addressing the cumulative effects on the Windward area.

Hawaii is an island state, relatively isolated from the rest of the United States, prized for its great natural beauty, its recreational resources and because of its location in the middle of the Pacific, bridging East and West and attracting tourists, businessmen, and residents from everywhere.

Water is a precious resource in our state. There are no great flowing rivers or immense lakes. The availability of high quality water is a limiting factor basic to the preservation and enhancement of the quality of life for all living things. Water is essential not only to protect the habitats of the endangered species, but to our entire ecological system.

To be more specific:

1. The EISPH has many terms and concepts which are difficult for the average citizen to understand. A section which defines such terms as inclined shaft, dike, caprock, etc. would be helpful.
2. Page 4: There is no indication of whether the water is replenished by rainfall or whether when pumped to maximize their yield, the wells would run dry.

MAKAOHE OUTDOOR CIRCLE
MAKAOHE HAWAII
MAUI OUTDOOR CIRCLE
MAUI HAWAII

BRANCHES
KONA OUTDOOR CIRCLE
KONA HAWAII
THE KAUAI OUTDOOR CIRCLE
KAUAI HAWAII

LANI-KALIUA OUTDOOR CIRCLE
LANI-KALIUA HAWAII
WAI-MOMI OUTDOOR CIRCLE
WAI-MOMI HAWAII

Mr. Kazu Hayashida
November 20, 1984
Page Two (2)

3. In the discussion of the exploratory stage many unspecific and open-ended statements are made concerning a wide variety of types of water sources and methods of development which when combined with differences in topography, ecology, development, uses, flora and fauna, etc., make it difficult to evaluate possible environmental impacts. These areas (pg. 3-5, 23-4) should be looked at individually and in detail.

4. P. 4: Under what conditions would a standby chlorinator be used? What would the costs be?

5. P. 5: Underground utilities should be used wherever possible rather than only when required, especially when scenic vistas would be marred.

6. P. 28, a) A more detailed discussion of the development of salt water encroachment in the Honolulu and Pearl Harbor area and its effect on the basal lenses should be included. How would the term "excess water" be defined? Does this include the needs of the farmer for water for his crops and animals, the needs of the flora and fauna of the hillsides and valleys, as well as the future and projected household needs on the Windward side?

In many sections the use of the words "may" and "might" which imply a possibility occurs in conditions where "will" and "would" seem more appropriate. For example, water development might reduce base flows or dry weather seepage of ground water, adversely affect habitat and population of stream fauna. Reduction of areas of open water in wetlands could adversely affect habitat and population of native waterbirds. On page 45 the possible impacts are summarized without detailing their possible effects. It is not clear what your priorities will be nor how decisions will be made. We feel that it is a basic necessity to protect the source.

Sincerely,

Betty Crocker
Mrs. Theodore Crocker
President

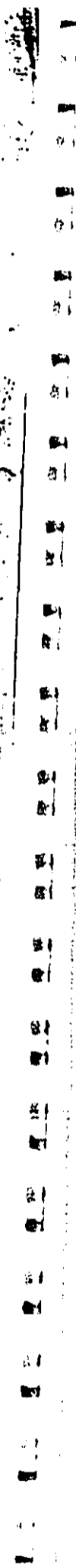
Liz Keller
Mrs. Howard Keller
Pres., Lani-Kaliua Branch

BC/cc

Jane E. Long
Mrs. Robert C. Looney
Pres., Kaneohe Branch

Jean Kaye JC
Mrs. Karwin Keys
Pres., Wai-Momi Branch

cc: Eileen Anderson, Mayor, City and County of Honolulu
Frank Fasi, Mayor-Elect, City and County of Honolulu
Members, Honolulu City Council





COPY



COPY

December 3, 1984

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DEC 6 1984

VTN PACIFIC

Mrs. Theodore Crocker
The Outdoor Circle
200 North Vineyard, Suite 502
Honolulu, Hawaii 96817

Dear Mrs. Crocker:

Subject: Your Letter of November 20, 1984, on the Environmental Impact Statement (EIS) Preparation Notice for the Windward Oahu Regional Water System Improvements, Malaekahana to Makapuu

Thank you for reviewing the environmental assessment for our proposed water system improvement projects. Your letter will be appended to the EIS.

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In response to your comments, we offer the following:

1. Figures and explanation of technical terms and concepts will be included in the Draft EIS.
2. Our wells are designed so that total pumpage from the groundwater aquifer would not exceed the amount replenished by rainfall. This will minimize depletion and degradation of the groundwater resources.
3. The EIS reflects our long range planning program. Some of the proposed projects are conceptive; therefore, it would not be feasible to fully describe each site as well as their cumulative impacts at this time. Supplemental EIS's will be prepared as necessary for our projects except for those that are already addressed in accepted EIS's or have had Negative Declarations published in the Office of Environmental Quality Control Bulletin.
4. A standby chlorinator would be used whenever an emergency occurs to disinfect the water to protect public health.

The initial cost for installing chlorination equipment including the building cost, is estimated at \$80,000.

Mrs. Theodore Crocker
Page 2

December 3, 1984

5. We will consider installing utilities underground whenever scenic vistas may be affected. Otherwise, the telephone and power lines will be installed overhead for the ease in installing and maintaining the lines.
6. Salt water encroachment is the movement of the salt water/fresh water interface inland due to shrinkage of the fresh water lens by excessive pumping of wells. As mentioned in the assessment, "excess water" is the amount of water developed that is not needed to meet the demands for the water use district. Water demand applies to water needed by all of our consumers including agricultural users. However, the demand does not apply to flora and fauna that rely on rainfall or streamflow.
7. The indefinite verbal auxiliary such as may and might is used when referring to environmental impacts, since we are only discussing potential impacts. If we are confident that an impact will occur from earlier studies, we will then use the definite verbal auxiliary forms.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

KASU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific, Inc.

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

September 20, 1984

Mr. Lawrence Whang
c/o Board of Water Supply
630 S. Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Whang,

The Waialeale Waikane Community Association wants to be a
consulted party to the E. I. S. preparation.

RE: Windward Oahu Regional Water
System Improvements; from Waialeale
through Makapuu

Sincerely,

David Y. Chinen
President

cc: WTN Pacific

October 1, 1984

RECEIVED

OCT 4 1984

VTN PACIFIC

Mr. David Y. Chinen, President
Waialeale-Waikane Community
Association
P. O. Box 845
Kaneohe, Hawaii 96744

Dear Mr. Chinen:

Subject: Your Letter of September 20, 1984, on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water
System Improvements, Waialeale to Makapuu

Thank you for your interest in our projects. Your
association's name has been added to our consulted parties
list. Enclosed is a copy of the EIS Preparation Notice for
your review. Should you have any comments, we would
appreciate receiving them by October 30, 1984.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

Enclosure

cc: WTN Pacific

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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

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THE ESTATE OF JAMES CAMPBELL

September 20, 1984

Mr. Kazu Hayashida
Board of Water Supply
City & County of Honolulu
630 S. Beretania Street
Honolulu, Hawaii 96843

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OCT 19 1984

VTN PACIFIC

Mr. K. Hayashida
PE

October 15, 1984

RECEIVED

OCT 19 1984

VTN PACIFIC

Mr. Samuel L. Keala, Jr.
Manager
Engineering/Construction
Services of James Campbell
The Estate of James Campbell
828 Fort Street Mall, Suite 500
Honolulu, Hawaii 96813

Dear Mr. Hayashida:

Environmental Impact Statement
Preparation Notice for Windward
Oahu Regional Water System Improvements

This is in response to your letter of August 23, 1984, requesting our comments on the subject EIS Preparation Notice.

Figure 2, Lale Location Map, indicates your proposed development of wells at mauka Malaekahana. It appears that this proposed site may be in conflict with the Estate's plans for the area. We therefore, would like to meet with you to discuss alternate sites that may be mutually agreeable to our respective interests.

The Estate plans to develop its own well source and water system for developments in the area. Discussion of our water source requirement is included in the "Management Guide to the Water Resource of the Kahuku Water Management Area Report" that has been submitted to the Board. It is anticipated that our source requirement is within the sustainable yield for the Malaekahana area.

If it is the intent of BWS to develop the well only for use in the immediate area of Campbell Estate land, there should be no problem, but if this is to service areas outside the Malaekahana area, the sustainable yield could be affected.

We appreciate the opportunity to comment on the Preparation Notice and will be meeting with your staff to discuss this matter.

Very truly yours,

Samuel L. Keala, Jr.
Samuel L. Keala, Jr.
Manager, Engineering/
Construction Services

SLK/bk

James Campbell Building, Suite 500, 828 Fort Street Mall, Honolulu, Hawaii 96813 Telephone 534-1941

Subject: Your Letter of September 20, 1984 on the Environmental Impact Statement (EIS) Preparation Notice for the Windward Oahu Regional Water System Improvements, Malaekahana to Makapuu

Thank you for reviewing the environmental document for our proposed water system improvement projects. Your letter will be appended to the Draft EIS.

We appreciate your concerns over our Malaekahana wells. We shall be happy to meet with you to discuss these concerns.

If you have any questions, please call Lawrence Khang at 527-6138.

Very truly yours,

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

VTN Pacific, Inc.

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SEP 19 11 00 AM '84

KUALOALO RANCH, INC.
641 BISHOP STREET
SUITE 1820
HONOLULU, HAWAII 96813

TELEPHONE 538-7638

842433

Mr. K. Morgan
ASST

September 17, 1984

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania
Honolulu, HI 96843

Dear Mr. Hayashida:

**SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS) PREPARATION
NOTICE FOR WINDWARD OAHU REGIONAL WATER SYSTEM
IMPROVEMENTS, OAHU**

Thank you for sending me a copy of the EIS Preparation Notice for Windward Oahu Regional Water System Improvements and your request for comments on this document.

In the Notice, two well fields, each with two wells and an infiltration gallery, are proposed on land belonging to Kualoa Ranch, Inc., in Kaaawa Valley and one well field, consisting of two wells, on the Ranch's land in Hakipuu. No recognition is given that the surface water and groundwater of both valleys is already being used to sustain ranching, agriculture, and aquaculture, nor that this water will be pre-empted if the Board's wells are drilled, then pumped at the rates projected in the Notice. The economies of Kualoa Ranch and its lessees could not survive appropriation of the Ranch's groundwater by the Board.

Kaaawa Stream, which at low flow, consists exclusively of ground-water, and Hakipuu Stream, which originates as groundwater springs, are essential to our ranching and agricultural activities. Additionally, two dug wells in Kaaawa sustain special crops and an existing drilled well is programmed to irrigate forage. Water from the Hakipuu Stream is diverted to provide for irrigation of pasture and other agricultural crops and for livestock drinking water in the valley and in nearby areas. Also, the 8.5 acre Aquatic Farms aquaculture venture is absolutely dependent on the flow of Hakipuu Stream, as are a few kuleanas nearby. Pumping of groundwater by the Board will, at the least, severely diminish the active springs and watercourses, which could only result in extirpation of the agriculture-ranching activities on the lands of Hakipuu, Kualoa, and Kaaawa.

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Mr. Kazu Hayashida
Page 2
September 17, 1984

In conclusion, I want to stress that Kaaawa-Kualoa-Hakipuu are zoned for agriculture and traditionally have been used for such purpose. I believe that agricultural activities, therefore, have a prior claim to the surface and groundwater supply. It is our intention to continue our agricultural activities, and since all of the water available in both the Kaaawa and Hakipuu watersheds are essential to the survival of these operations, we must prevent the establishment of the wells which are proposed for this area in your EIS Preparation Notice.

Very truly yours,

Francis S. Morgan
Francis S. Morgan
President

FSM:st

Q-72

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

September 24, 1984

RECEIVED

OCT 3 1984

VTN PACIFIC

Mr. Francis S. Morgan, President
Kualoa Ranch, Inc.
841 Bishop Street, Suite 1620
Honolulu, Hawaii 96813

Dear Mr. Morgan:

Subject: Your Letter of September 17, 1984 on the EIS
Preparation Notice for the Windward Oahu Regional Water
System Improvements, Malaekahana to Makapuu

Thank you for reviewing and commenting on the environmental
document. Your comments will be incorporated into the Draft EIS.

In response to your comments, we shall discuss our projects in
more detail with you and take into consideration your water
requirements before we seriously consider pursuing developing
wells on Kualoa Ranch Property.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,

L. S. Rathbun

For
KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTN Pacific

G-73

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WILLIAM
E.
WANKET
INC.

LAND USE CONSULTANTS

September 15, 1984

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
630 South Beretania
Honolulu, Hawaii 96843

SUBJECT: Environmental Impact Statement (EIS) Preparation
Notice for Windward Oahu Regional Water System
Improvements, Oahu.

Dear Mr. Hayashida:

On behalf of Mrs. Elizabeth L. Marks, I wish to thank you for the opportunity
to review and comment on the Environmental Impact Assessment for DHS's
proposed Regional Water System Improvement project.

At this time, I only wish to comment that I am in support of your efforts to
increase the production of potable water for domestic use on the windward side,
and would appreciate being given the chance to review and comment on the drafted
EIS.

Thank you very much.

Sincerely,

Elizabeth L. Marks
Elizabeth L. Marks

cc: Mrs. Elizabeth L. Marks

Pacific Tower
Suite 9010
1001 Bishop Street
Honolulu, Hawaii 96813
Phone
(808) 533-4937

*Asst. Mar. 1/2
EPL*



COPY

to
from

subject For the Record - date 1/18/85

September 20, 1984

Mr. William E. Manket
William E. Manket, Inc.
Pacific Tower, Suite 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Manket:

Subject: Your Letter of September 15, 1984 on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water System
Improvements, Malakahana to Makapuu

Thank you for your comment on the environmental assessment
for our proposed projects. Your letter will be appended to
the Draft EIS.

A copy of the Draft EIS will be sent to you when it is
completed and available for comments.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTI Pacific

*George Huda from Rep. Robert Nakata's office requested
a copy of the Draft EIS for the Windward Regional
Water System when it is published.*

*Mailing address: Rep. Robert Nakata
House of Representatives
State Capitol, Rm. 427*

Attention to: Mr. George Huda.

NGH



842525

PATRICK A. RIBELLIA

Attorney at Law

Suite 1913
700 Bishop Street
Honolulu, Hawaii 96813
(808) 536-0087

SEP 27 11 39 AM '84

September 23, 1984

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

Subject: Environmental Impact Statement Preparation
Notice - Windward Oahu Regional Water System
Improvements.

Thank you for permitting these comments on the above-captioned
EIS preparation notice on behalf of my clients, Pacific Union
Association of Seventh Day Adventists ("PUASDA"), which owns in
trust TMK 4-2-63: 38 containing approximately 351,152 sq. ft.
of land in Maunawili, Kailua, Oahu hereinafter referred to as
"Parcel 38".

We note that, at page 11 of your preparation notice, you identify
a Board of Water Supply (BWS) proposal to develop "Maunawili
Wells III (Alternate B)" which are described in your notice as
"1 operating and 1 standby well" on parcel 38. Since a City
reservoir (on TMK 4-2-63: 32 which is wholly within TMK 4-2-63:
38) including an improved roadway to it already exist within
parcel 38, we understand your proposal to mean the development of
two (2) new reservoir within parcel 38 at some undetermined time
in the future.

Please be informed that parcel 38 is part of a trust corpus
owned and administered by PUASDA as trustee. Expressed trust
obligations concerning the attainment of reasonable economic
use of all the trust corpus naturally compels PUASDA to disfavor
the development of Maunawili Wells III (Alternate B) within
parcel 38 as presently proposed.

Mr. Kazu Hayashida
Page 2.

There is, however, opportunity for coordination between City
plans for the development of the 2 wells and PUASDA's pursuit
of reasonable economic use of the trust corpus as required
under its duties as trustee. A case in point is a pending
PUASDA request to amend the City's Koolauoko Development Plan
Land Use Map designation of a lower portion of parcel 38
containing approximately 1.9 acres of land from Agriculture to
Residential to restore a prior "Residential" designation of
the 1.9 acres. Development of the 1.9 acres for two (2) single
family residences conforms to basic land use development
policies set forth in the Koolauoko DP. Therefore, an excellent
opportunity for PUASDA-City coordination as described presents
itself. I'm confident that PUASDA would be most happy to
discuss such planning and project coordination with the appro-
priate City officials at any time.

Thank you for allowing submission of these comments. Please
do not hesitate to contact me if you have any questions con-
cerning these comments.

Sincerely,

Patrick A. Ribellia
PATRICK A. RIBELLIA

copy: Messers Tom Carter and
Ron Lindsay
PUASDA.

cc: Dr. Willard T. Chow
Chief Planning Officer
City and County of Honolulu.



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BOARD OF WATER SUPPLY
Nov 2 11 08 AM '84

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OAHU SUGAR COMPANY, LIMITED

AN OFFSHORE COMPANY

P. O. BOX 70
WAIKAKU, HAWAII 96787
TELEPHONE 671-4869

October 29, 1984

RECEIVED
OCT 8 1984

October 3, 1984

VTH PACIFIC

Pacific Union Association
of Seventh Day Adventists
c/o 700 Bishop Street, Suite 1933
Honolulu, Hawaii 96813

Attention: Mr. Patrick A. Ribellia
Gentlemen:

Subject: Your Letter of September 23, 1984 on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water System
Improvements, Malaekahana to Makapuu

Thank you for reviewing the environmental documents for our
proposed projects. Your letter will be appended to the Draft
EIS.

Regarding the projects affecting your client's lands, we have
yet to establish any timetable as to when we plan to go ahead
with the projects and, therefore, it would be premature for
us to meet and discuss the projects with your client, PUASDA,
at this time. We will be glad to discuss the projects when
our plans are more definite.

If you have any questions, please call Lawrence Whang at
527-6138.

Very truly yours,
L. G. Rathbun
For KAZU HAYASHIDA
Manager and Chief Engineer

cc: VTH Pacific

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania
Honolulu, Hawaii 96943

Dear Mr. Hayashida:

Subject: Environmental Impact Statement (EIS) Preparation
Notice for Windward Oahu Regional Water System
Improvements, Oahu

We have reviewed the above subject matter and have several
comments.

Waihole Irrigation Company is contemplating rebuilding and
operating the pumping station in Waihole Camp. Consideration
must be given on how this may affect the proposal of your
Waihole wells.

The roads leading to the Waihole Camp area are in dire need of
repair and upgrading. The extra traffic that your proposed
Waihole wells will bring must be considered.

The Waihole Camp area is used as a vacation retreat by Oahu
Sugar Company personnel. This is mainly due to its pristine
beauty and relaxing qualities. We hope your proposed improve-
ments won't adversely affect this present use of these conserva-
tion lands.

Very truly yours,
William R. DeMent
William R. DeMent, Supt.
Waihole Irrigation Co.

WRD:mo
cc: W.D. Balfour, Jr.

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COPY

November 26, 1984

Mr. William R. DeMent
Superintendent
Waiahole Irrigation Company
c/o Oahu Sugar Company, Ltd.
P. O. Box "O"
Waipahu, Hawaii 96797

Dear Mr. DeMent:

Subject: Your Letter of October 29, 1984 on the
Environmental Impact Statement (EIS) Preparation
Notice for the Windward Oahu Regional Water System
Improvements, Malaekahana to Makapuu

Thank you for reviewing the environmental document for our
proposed water system improvement projects. Your letter will
be appended to the Draft EIS.

In response to your comments, we offer the following:

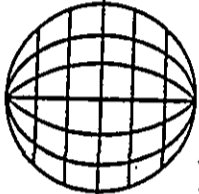
1. Consideration will be given to existing and planned private water sources. Our plans for water development in Waiahole valley are very tentative and no definite decision will be made on the proposed well project in the foreseeable future.
2. With any well projects that we undertake, the roads leading to the proposed site are repaired to allow construction and department personnel access to the project area during the construction phase. Only the roadway within the facility grounds is paved.
3. Our proposed facilities are designed to blend with the environment.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,
Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: WTN Pacific, Inc.

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SEP 24 10 43 AM '84



Lions Securities Corp.

8810 KAHU HIGHWAY • LAIE, HAWAII 9702 • 293-9201

September 20, 1984

Mr. Kazu Hayashida, Manager &
Chief Engineer,
Board of Water Supply,
City & County of Honolulu,
630 S. Beretania Street,
Honolulu, HI 96843.

Subject: Environmental Impact Statement (EIS)
Preparation Notice for Windward Oahu Regional
Water System Improvements

Dear Mr. Hayashida:

We have received the EIS Preparation Notice for the Windward Regional Water System Improvements project. Since the project involves two wells on property owned by Lions Securities Corp., we have some concerns which should be addressed in the Draft EIS. As you are aware, Lions currently provides water service to commercial, residential, agricultural and light industrial users in the area from Lalenalo'o to Malaekahana. In addition, Lions is currently in the process of developing a 115-unit ocean front residential project at Kakea Beach, and intends to develop a 350-unit low- and moderate-income project called Lalenalo'o. The plans are to develop the Kakea project first, sometime during 1985-1986, then the Lalenalo'o units. Both projects are located about one-half mile north of the Hanuula Shopping Center.

To meet the water demands of the existing users and the new projects, Lions has initiated the development of the old Kahuku Plantation wells (DOWD 10s. 3856-01 to-06). These wells will replace our existing wells. Based on these plans, Lions is very concerned about the effects the proposed Laie and Waialele wells will have on the water supply for our existing and future users. The EIS should address the following issues: (a) the effects on the use of our wells from pumping either the Laie or Waialele wells, or both wells; (b) mitigation measures which the BWS will undertake, if there is an adverse effect on our wells.

Thank you for the opportunity to comment on the EIS Preparation Notice. We will look forward to your reply.

Sincerely,
Marvin H. Stone
MANAGER

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COPY

September 27, 1984

RECEIVED

OCT 3 1984

WTN PACIFIC

Mr. Harvin H. Stone, Manager
Zions Securities Corp.
55-510 Kamehameha Highway
Laike, Hawaii 96762

Dear Mr. Stone:

Subject: Your Letter of September 20, 1984 on the EIS
Preparation Notice for the Windward Oahu Regional
Water System Improvements, Malaekahana to Makapuu

Thank you for reviewing and commenting on the environmental document for our proposed water system improvement projects. Your letter will be appended to the Draft EIS.

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We will address your concerns on the impacts that the Laie and Wai'ale'ale Wells may have on your existing and proposed water sources. We will also address mitigative measures that will be implemented should your wells be adversely affected by our projects.

Furthermore, we will contact you to discuss the Laie and Wai'ale'ale Well projects in more detail before proceeding with the projects.

If you have any questions, please call Lawrence Whang at 527-6138.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: WTN Pacific

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