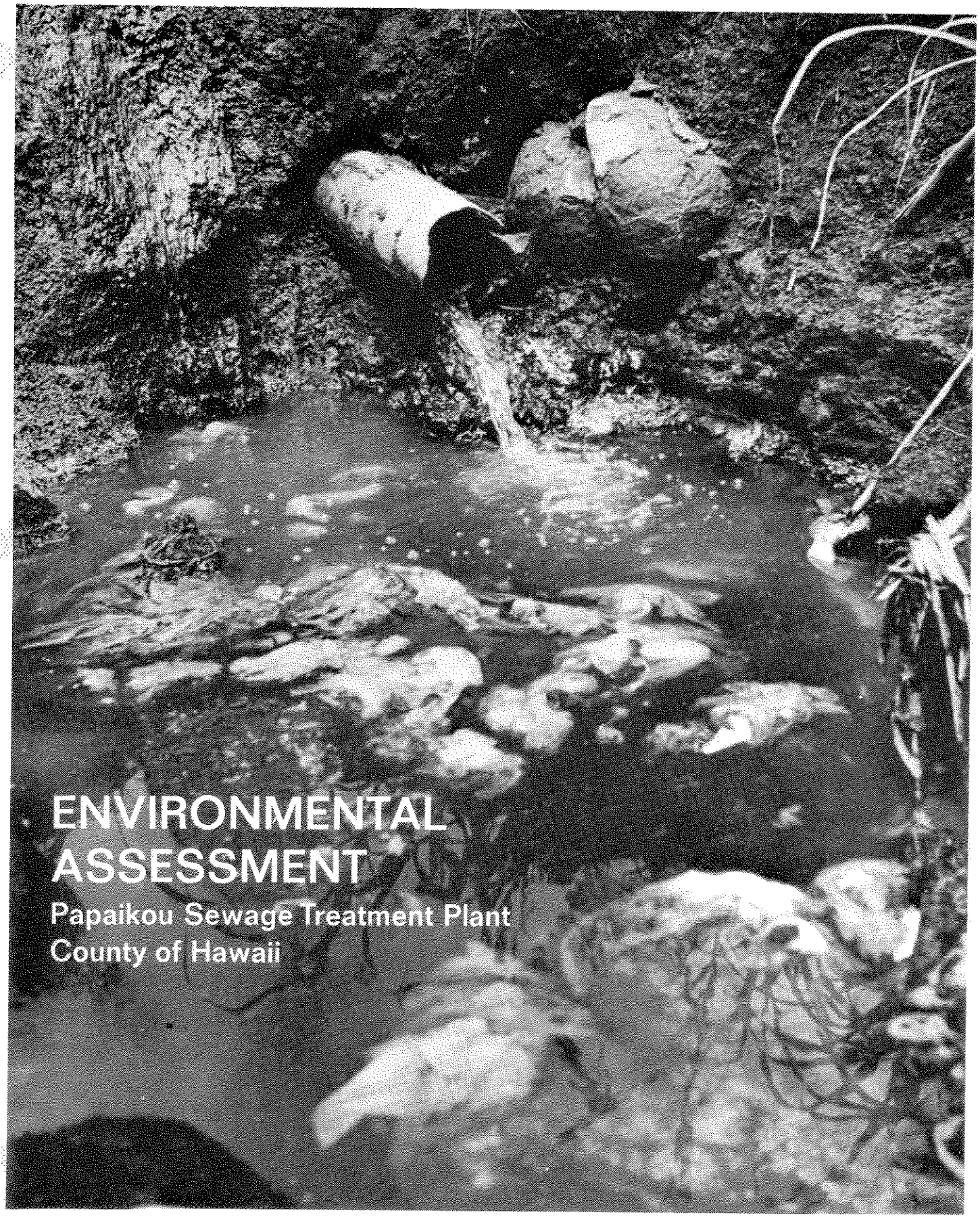

ENVIRONMENTAL ASSESSMENT

Papaikou Sewage Treatment Plant
County of Hawaii

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PROFILE OF THE COUNTY[1]

"The County of Hawaii encompasses the Island of Hawaii, which is the southernmost and largest island of the Hawaiian archipelago. Commonly referred to as the Big Island, the land area of Hawaii is nearly twice the combined size of all the other islands of the State.

"The island of Hawaii is a land of diverse climate, topography, and scenic beauty. Evnironments range from dense tropical forests to majestic snow-capped mountains. There are active volcanoes, black, white and green sand beaches, deeply eroded valleys, and large expanses of grazing lands.

"The island may have been the first of the group to be inhabited by the Polynesians. Tracings which date back to 750 A.D. have been found in the South Point area. Captain James Cook, the first European to set foot in Hawaii, met his death at Kealakekua Bay in 1779. The Hawaiian monarch who united all Hawaii under one rule, Kamehameha the Great, was born in Kohala and died in Kona. The entire island is rich in historical lore.

"Throughout the Country's history, agriculture has played an important economic role. There were many ventures and experiments and sugar production and cattle ranching emerged as leaders of the modern agricultural industry. In recent years, other forms of diversified agriculture, principally macadamia nuts, papaya and flowers, have experienced substantial growth. Most manufacturing concerns on the island are closely associated with the agricultural industry.

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[1]The General Plan - County of Hawaii, January 1971

"The County's population, numbering 63,468 in the 1970 census, consists of people from various ethnic backgrounds. No majority ethnic grouping is found on the island. This can be seen in the following percentages of ethnic backgrounds represented: Japanese, 39.9%; Caucasian, 15.0%; Filipino. 9.6%; Hawaiian, 2.6%; Puerto Rican, 1.9%; Chinese, 1.2%; Part Hawaiian, 18.9%; Cosmopolitan and others not reported, 10.9%. This diversity is largely the result of the practice started by the sugar plantations over a century ago of importing immigrant workers. The first laborers were the Chinese, followed by the Japanese, and the Portugese, and more recently, the Filipinos. The plantations had and still exert a large influence on the economic and social lives of many Big Islanders."

INTRODUCTION

This environmental assessment is prepared under Federal Environment Protection Agency interim guidelines published in the Federal Register, January 17, 1973. Vol. 38, No. 11. The applicable section under which this assessment is prepared is Section 6.56, "Procedures for preparation of impact statements for wastewater treatment works."

The provisions of paragraph (b)1-5 provide direction for content makeup and submittal of this assessment to the Regional Administrator (Region IX) in compliance with paragraph (b)(1)(i).

Text material is drawn from studies conducted by Environmental Communications, Inc., for Chung Dho Ahn & Associates, Inc., the retained design engineer consultants. Technical data were obtained by the following listed personnel on February 16-17, 1973.

- Karl H. Bathen, Ph.D., Oceanography
- Michael J. Chun, Ph. D., Sanitary Engineering
- Gordon L. Dugan, Ph. D., Sanitary Engineering
- Arthur G. Cropper, M.S., Marine Geology

Assessment of the Kapue Stream water quality was determined by field work consisting of sampling and analysis of samples collected to determine chemical, physical and biological quality of the stream. Existing data were also reviewed and evaluated so that as complete an analysis of the Kapue Stream sector could be developed.

Marine conditions existing offshore of Kapue Stream mouth were also examined. This work was principally concerned with nearshore coastal water quality, i.e., seaward to approximately two kilometers, since this portion of the coastal marine environment found at the site is the receiving water area for Kapue Stream and Papaikou Sugar mill waste water discharges. Parameters selected were chosen to quantify nutrient load, temperature, salinity, pH, BOD, visibility and turbidity conditions found in the marine environment a few kilometers each side of and around the Kapue Stream mouth. This portion of the coastal environment also accepts waste from two neighboring outfalls discharging untreated domestic waste water directly into the coastal environment. These outfalls service portions of the towns of Papaikou and Paukaa, 1.6 miles south of Papaikou. In addition to these discharges, numerous sugar mill discharges, as well as other domestic waste water discharges, are released directly into Kapue Stream.

The County of Hawaii proposes a design for constructing a waste water treatment facility which will provide a minimum of secondary treatment for raw sewage presently being generated by the towns of Papaikou and Paukaa. Also being determined is selection of the discharge point from the treatment plant.

I

COMPARATIVE EVALUATION OF MAJOR ALTERNATIVES, INCLUDING PROPOSED TREATMENT WORKS

Essentially, alternatives available to effectively deal with existing raw sewage discharges being generated at Papaikou and Paukaa fall into two categories: As proposed and presently acceptable under Chapter 37-A, or as required under recently approved Chapter 38. Chapter 38 could entail advanced tertiary treatment with deep ocean outfall, or irrigation reuse, or deep well injection for effluent disposal.

a. Proposed Secondary Treatment Plant

This would provide treatment with 85% removal of BOD and suspended solids. The following hardware would be included:

1. Grit Chamber Communitor
2. Aeration Tanks
3. Settling Tanks
4. Aerated Sludge Digestor Tanks
5. Blower-chlorinator System
6. Chlorine Contact Chamber
7. Sludge Dewatering Unit

b. As Required under Chapter 38 Regulations, Department of Health

1. To comply with the Department of Health Chapter 38, "Private Sewage Disposal Systems", design criteria would have to approximate tertiary treatment or beyond. The 85% removal capability of secondary treatment as outlined above would not permit compliance with current standards for discharge in Class 2 streams.

2. Deep Ocean Outfall - Considered an added financial burden for a treatment facility of this size. The need for utilizing a deep ocean outfall for a maximum volume of 350,000 gallons per day is not considered efficient from a cost benefit analysis standpoint. Availability of the proposed Kapue Stream as a vehicle for discharge of treated sewage effluent is consistent with the practiced definition of "best practicable treatment or control" being employed currently by the Director of Health. As defined by Dr. Doak C. Cox on September 13, 1971 ("The Meaning of 'Best Practicable Treatment of Control' in the Hawaii Water Quality Standards") the best practicable treatment or control prescribed for discharges to waters of the State must be interpreted to mean that feasible degree of treatment or control which is best from the standpoint of public welfare inclusive of health and safety considerations.

3. Irrigation Reuse - The Papaikou mill and many other mills along Hamakua Coast do not require irrigation of their fields since annual rainfall more than adequately meets the water needs for sugar culture. The industry has gone on record declaring that recycling of treated effluent for irrigation purposes is not viable or necessary at this time (Appendix 1).

4. Deep Well Injection Disposal - A relatively unexplored aspect of the disposal potential for treated effluent. The methods of deep well injection disposal would have to be designed with extreme care to prevent contamination of existing and potential sources of potable ground water, and wells would have to be placed in appropriate geologic formations if available, receive

good quality disinfectant, be adequately tested hydraulically, properly maintained and monitored in order to assure their operation in an environmentally acceptable manner. It should be noted that the Department of Water Supply operates a 12" well for domestic consumption above Papaikou Town. The tip elevation is -55' and the static water level is at +21'. The present pumping rate from this well is 350 gallons per minute (gpm). Should a hydraulic gradient be developed towards this well from a sewage effluent injection well, contamination will occur.

II

DESCRIPTION OF THE PROPOSED ACTION

The recommended action entails the design and construction of a secondary treatment sewage treatment plant with design flows to initially treat 180,000 gallons per day, and an ultimate treatment of 350,000 gallons per day. This ultimate rate is based on an existing population of 3,200 people. Due to high rainfall in the area, investigation may show that there will be high infiltration in this area. Peak wet weather flows can be assumed to 3.5 times the design flows. The treatment plant should include: Grit chamber communitor, aeration tanks, settling tanks, aerated sludge digestor tanks, blower-chlorinator system, chlorine contact chamber and sludge dewatering unit.

The exact location of the proposed facility and discharge points have not been finalized at this time. Availability of land for the facility will be provided by Papaikou mill management and is predicated on the degree of treatment required under State Health Department rules and regulations. At the present time the plant is approximately an acre in size and the proposed location site is indicated on the project site map. The desired location would provide for discharge into Kapue Stream which has been determined to be an acceptable solution to discharge of treated effluent.

Also under study are transmission lines which would carry sewage from Paukaa residential subdivision to the proposed facility. The inclusion of transmission lines within this project and therefore the size of the plant will be dependent upon the engineering study.

III

ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

In general terms the proposed action is expected to significantly improve the existing situation where raw sewage is being discharged presently from four locations into the ocean and Kapue Stream. Existing raw sewage discharge dates back to the 1920's and the Papaikou mill management has submitted a permit to the Department of Health to construct treatment facilities. Under consideration at the present time is a permit application which reflects the time schedule anticipated by County of Hawaii which will provide for final design and construction during Fiscal Year period 1974-75.

Primary impact of a beneficial nature will entail an improvement of nearshore waters, particularly from fecal coliform bacteria load which is presently in excess of State water quality Standards for Class A waters. Present minimal recreational use of nearshore waters and weak but consistent transport due to winds and tidal currents are factors both providing for dispersal minimizing the high concentrations of fecal coliform colonies resulting from existing raw discharge. Existing raw sewage discharged would be eliminated and processed through the proposed facility prior to discharge at the selected point. This improvement would significantly reduce presently high fecal coliform counts and improve water quality of Kapue Stream.

Distribution and concentration of population is not expected to change noticeably since the residential developments in the area are primarily housing units for sugar mill employees. Tourism has not been promoted for the area since agricultural activities predominate and previous practices of the mill to discharge their wastes into the stream and nearshore waters have not provided a favorable atmosphere for water contact sports. The clean-up process engaged in by the Papaikou mill will considerably improve both aesthetics, chemical, biological and physical qualities of both Kapue Stream and the nearshore waters. Educated opinions based on similar situations (sugar mills along Hamakua Coast discharging mill wastes into the ocean) indicate that a cleansing process can be naturally accomplished after elimination of discharging mill wastes directly into nearshore waters. Noticeable improvements to the color of the waters, decreased turbidity, and subsequent improvement to the ocean floor in the form of increased coral growth are distinct possibilities. As these physical improvements take place, the advent of marine life improves and increased recreational sport fishing potential becomes a reality. Access to the beach and shoreline will have to be resolved since the coastline is rugged and cliff-like in character. (Appendix 2)

IV

ADVERSE IMPACTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

Implementation of the proposed waste water treatment facility is designed to significantly improve the present water quality of both Kapue Stream and the nearshore waters. As the situation indicates, combined effects of the mill wastes and raw sewage discharges are creating a stress condition on Kapue Stream and the nearshore waters. Despite the proposed cleanup schedule of the mill and improved degree of treatment of domestic wastes, there is little doubt that treated waste water discharge will have an effect on the quality of receiving waters. One basic principle of physical chemistry is that for a system in equilibrium, such as a natural ecosystem, any change in any one of the factors upon which that equilibrium depends (such as nutrient concentrations) will cause the equilibrium to shift in such a way as to diminish the effects of the change (Le Chateliers Principle).

Overall gains to be achieved from the total cleanup of mill wastes and implementation of domestic waste treatment far outweigh "adverse impacts which cannot be avoided". Based on all data gathered from this area, it appears that any adverse effects resulting from this proposed facility will be insignificant and certainly far less detrimental than the effects currently produced by mill wastes and raw sewage. In previous sections, potential

gains from increased usage of the natural source of Kapue Stream and the coastline for recreational use are considered vital gains which must also be considered beneficial.

V

ALTERNATIVES TO THE PROPOSED ACTION

Alternatives considered included disposal of sewage effluent via injection wells or seepage pits. This alternative was discarded in view of geologic conditions as listed by H. T. Stearns and G. A. MacDonald, "Geology and Groundwater Resources of Hawaii", Bulletin No. 9, USGS. They comment

> ". . .The underlying geologic formations of the upper portion of the Kapue watershed are moderately permeable (labeled Pll) whereas the formation labeled Pml located in the middle to lower portion of the watershed is in an area that receives the greatest amount of precipitation (up to 300 inches per year). . .

This data correlates very well with the calculated rainfall-run-off coefficient of approximately 0.50.

Infiltration rate potential is apparently quite high considering that overall evaporation in this area (which could best be described as a rain forest) probably does not exceed 50 inches per year. Infiltrated water undoubtedly serves as the base flow for surface streams in this area. Perched water is prevalent in the Papaikou area as evidenced by three present water sources (Kaleie intake, Papaikou intake and Kalaoa intake). It should be noted that the Department of Water Supply operates a 12" well for domestic consumption above Papaikou Town. The tip elevation is -55' and the station water level is at +21'. The present pumping rate from this well is 350 gallons per minute (gpm). Should a hydraulic gradient be developed towards this well from a sewage effluent injection well, contamination will occur. On this basis

ground-well injection methods have been discarded as not being practical or in keeping with desired goals of the County to maintain adequate supplies of uncontaminated potable water.

Ground water contamination from use of treated effluent for crop irrigation purposes has also been a factor in turning down other alternatives of disposal. In addition, the present rainfall patterns for this area preclude irrigation of sugar cane since there is more than adequate water naturally provided.

VI

RELATIONSHIP BETWEEN LONG AND SHORT TERM USES OF MAN'S ENVIRONMENT

The improved uses of Man's environment, both long and short term, which will be accomplished through implementation of this proposed facility are in keeping with Section 101(b) of the National Environmental Policy Act. As population density increases throughout the State of Hawaii, it is not inconceivable that areas such as those presently engaged in agricultural activities relinquish more visually appealing portions of their land holdings for urban use. Included among these natural resources will be areas such as the watershed area of Kapue Stream and nearshore waters along Papaikou and Paukaa. Limited residential districts such as Paukaa are already evident along this shoreline, and their existence indicates that there is both a need and desire on the part of Man to enjoy those aesthetic qualities along this rugged coastline.

Improved technology in the sugar industry will provide for greater crop yields with less environmental degradation and subsequent reevaluation of shoreline for urban use as opposed to the less efficient factory operations of the early 1900's which dictated access to the shoreline and ocean for economical disposal of cane trash and mill wastes. Co-existence between urban use and agricultural activities are becoming more evident throughout the Islands. Open space and beneficial qualities of sugarcane fields have traditionally been minimized by abusive practices employed by factories along the Hamakua shoreline. This has been

declared unacceptable by both State and County, with the resulting cleanup operations presently being implemented by the sugar industry. As these procedures are completed in the mid-70's, gains for long term uses of Man's environment along this previously agricultural zone will increase as demand for urban space increases.

The proposed facility should be considered as an initial step in insuring that the basic requirement of adequate waste water treatment is being provided. Benefits accrued from improved quality of the stream and nearshore waters will be derived essentially from mill cleanup operations since the bulk of the stress being placed on marine biota is due to mill waste being discharged. Once completed, natural resources of stream and ocean will provide an aesthetic amenity which can be considered beneficial to long term use and enjoyment of the area by Man.

Long term land use planning by both the affected landowner (C. Brewer & Co.) and the County of Hawaii for the use of lands presently in sugar cane culture remains, for the most part, undetermined. The General Plan of the County of Hawaii, as reported in its January 1971 publication, had this to say about the Hamakua area, pp. 36 & 37:

> "The communities in this districtwere created as a direct result of the sugar industry. The sugar companies are pursuing subdivision to provide fee simple land for employees either for relocation purposes or new homes. The present subdivisions and those in the planning stage will be merely to allow for upgrading of the existing plantation rental homes. Therefore, these will not relieve the housing situation in the area since a number of residents do not work for the sugar companies and are not eligible for these homesites or homes. Outside of these plantation subdivisions, only a limited supply of land is available for immediate housing use.

"Courses of Action

- Support the plantations' plan to centralize housing in certain areas. This would not only minimize cost of services within the communities but would also maximize the efficiency of the available services.

- Support the Department of Education and Hawaii Housing Authority policy of dispersing teacher housing throughout the community rather than concentrating them all in one location.

- Aid and encourage the development of a wide variety of housing for this area to at ain a diversity of socio-economic housing mix.

- Since many of the lands in and around the existing urban centers are owned by the plantations, they should be encouraged to also make lands available for the private market."

Considerations as to ultimate use of lands, particularly from the standpoint of those lands makai of the Mamalahoa Highway for residential subdivisions are worth making even at this early stage. If Man s use of lands for purposes other than agricultural use is to be considered for long term future considerations, the necessary planning for the required public services (roads, schools, sewage treatment, parks, fire protection, crime control, commercial development, water, electrical power, and others) should start. These decisions will involve close working relationships between landowner and County as well as State Land Use Commission; urban encroachment on agricultural zoned lands are problems which are both real and here today, especially in the more densely populated areas of the State. Determinations of these needs should be made even on a tentative basis, so that prevention of urban sprawl on Hawaii may be prevented.

Environmental factors affecting advanced planning for urbanization of previously undeveloped lands have become increasingly important, with emphasis being placed on adequate provision of public services. Cost factors are also vital in development of lands requiring improvements which can meet existing regulations, as well as those more stringent requirements which will be imposed by Federal and State agencies. For the present, the assessment will deal only with the existing needs and requirements.

VII

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

Commitment of resources which fall in the category of "irreversible or irretrievable" are identified in two groups: Those utilized in construction and development process, and those natural resources which can be considered part of the total environment. As to the first group, resource commitment demands of the construction and development process are consistent with all activities of this nature. Components of water, sand, cement, wood, etc., which are used for construction are irretrievable. Their loss is accepted and considered essential since without this utilization the proposed facility could not become a reality.

It is in the second area, natural resources which can be considered part of the total environment, that spatial needs and requirements are considered more vital in the overall review. To accomplish the needs of the proposed facility, space requirements for the treatment plant will take approximately one acre of land at sites which have not yet been determined. The desired location would place the site behind existing residential housing below the residential property line adjacent to Kapue Stream for efficient effluent discharge access to the stream. The topography of the desired site is below and away from the residential sectors and slopes gently towards Kapue Stream. The result is that most of the proposed facility would not be visible from the residential

sector. Existing wind patterns would preclude odors which emanate from the facility except on those days when prevailing winds shift to a south-southeast direction. Visually, there would be little, if any, impact since plantings and positioning of the facility would effectively shield the facility from public view.

VIII

DISCUSSION OF PROBLEMS AND OBJECTIONS RAISED BY OTHER FEDERAL, STATE & LOCAL AGENCIES

It is proposed that during this stage of environmental assessment the review process will be accommodated by both an information meeting and a formal public hearing on the acceptability and desirability of this proposed facility. At this time the comments, both favorable and adverse, can be provided to the Agency for its review and evaluation.

Current problems and objections can be considered to fall, essentially, in the area of regulations developed by the Department of Health which provides for more stringent effluent standards. Problems or objections of a major nature are not anticipated and those that are brought forth will be resolved to the satisfaction of the Agency, as well as State and local agencies. Concerns of private citizens have been reviewed and evaluated with their merits fully considered in the final design and site selection.

IX

DESCRIPTION OF HOW TREATMENT WORKS AND CONSTRUCTION CONTROLS MINIMIZE ADVERSE IMPACT ON ALL ASPECTS OF THE ENVIRONMENT

If all problems and objections of a non-technical nature are resolved, design of the proposed facility is expected to improve significantly present quality of sewage being discharged. Factors to be considered include the following:

a. Odors

Due to the system under present design considerations, activated sludge with aerobic digestion will not constitute an odor problem similar to the Kailua Sewage Treatment Plant (Windward Oahu) where a bio-filtration trickling filter process is being employed.

b. Sludge Removal

Sludge to be removed daily is not expected to be a significant amount. Present plans call for this sludge to be trucked away and disposed of in sanitary landfill.

c. Noise

Treatment plant operations will not exceed existing State regulations for industrial noise. Ambient noise levels attributable to the Kapue Stream flow during peak flow periods is considered higher on the dba scale than the anticipated plant operations.

d. Erosion Controls

During the construction phase applicable County regulations covering clearing and grubbing will be complied with and all efforts to minimize soil erosion and runoff will be maintained. As much of the existing plant cover that can be retained for the site will be kept standing. Landscaping to retain the character of existing terrain would be placed on the proposed project site. This would also provide beneficial screening for visual, as well as odor, control. The prevalent birds and other endemic fauna would not be endangered by the proposed action.

SUMMARY

Examination of both the Kapue Stream and adjacent nearshore waters reveal that nutrient levels are in excess of State Department of Health Rules and Regulations, Chapter 37-A. This is due in large part to discharge of mill wastes from the Papaikou Mill and also raw sewage discharges from three existing outfalls emanating from sugar mill plantation housing.

The County of Hawaii proposes to design and build at the minimum a secondary treatment plant with a design capacity to handle present flow rates of 180,000 gallons per day and an ultimate design flow of 350,000 gallons per day. Under consideration are two plant sites: Alternate A which is located above the existing mill site behind Silverton Camp, and Alternate B, Directly mauka of the Mill site at the mouth of Kapue Stream. Determining factors as to ultimate site designation will be examined by information obtained at a public information meeting and the formal public hearing. At this time governmental, as well as citizen, objections or comments will be heard and reviewed. Also providing input will be the compliance requirement with the Department of Health's new effluent water quality standards contained in Chapter 38, Department of Health Public Health Regulations.

Studies of existing water quality found in Kapue Stream and nearshore waters were conducted in February 1973. These studies indicated the following:

1. Stressed conditions of both stream and nearshore waters was almost exclusively due to mill waste discharges of solid and liquid waste. Contributing to pollution of both receiving waters to a lesser extent was raw sewage discharge located above and below the mill in Kapue Stream, and two direct ocean discharges from Paukaa and Moirton Camp.

2. The mill is presently engaged in an extensive cleanup program which will find them in compliance with directives from the Department of Health in mid-1976 to treat and minimize effects from dumping cane trash, bagasse, silt, rocks, and process mill wastes. The natural ongoing cleaning process can anticipate a more efficient and accelerated rate of cleansing when both sources of pollutants are abated or improved in quality.

3. The proposed design and treatment process being initiated by the County and certified by the State to effectively abate water pollution from sewage discharges is not considered detrimental to the stream or receiving waters. Under the proposed design criteria, the definition of "best practicable treatment" will have been met if the interpretation means that method of treatment or control which is best from the standpoint of overall, long term public welfare.

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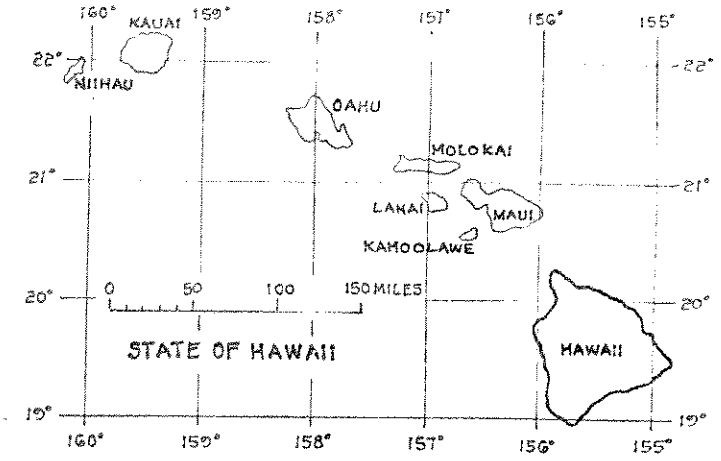
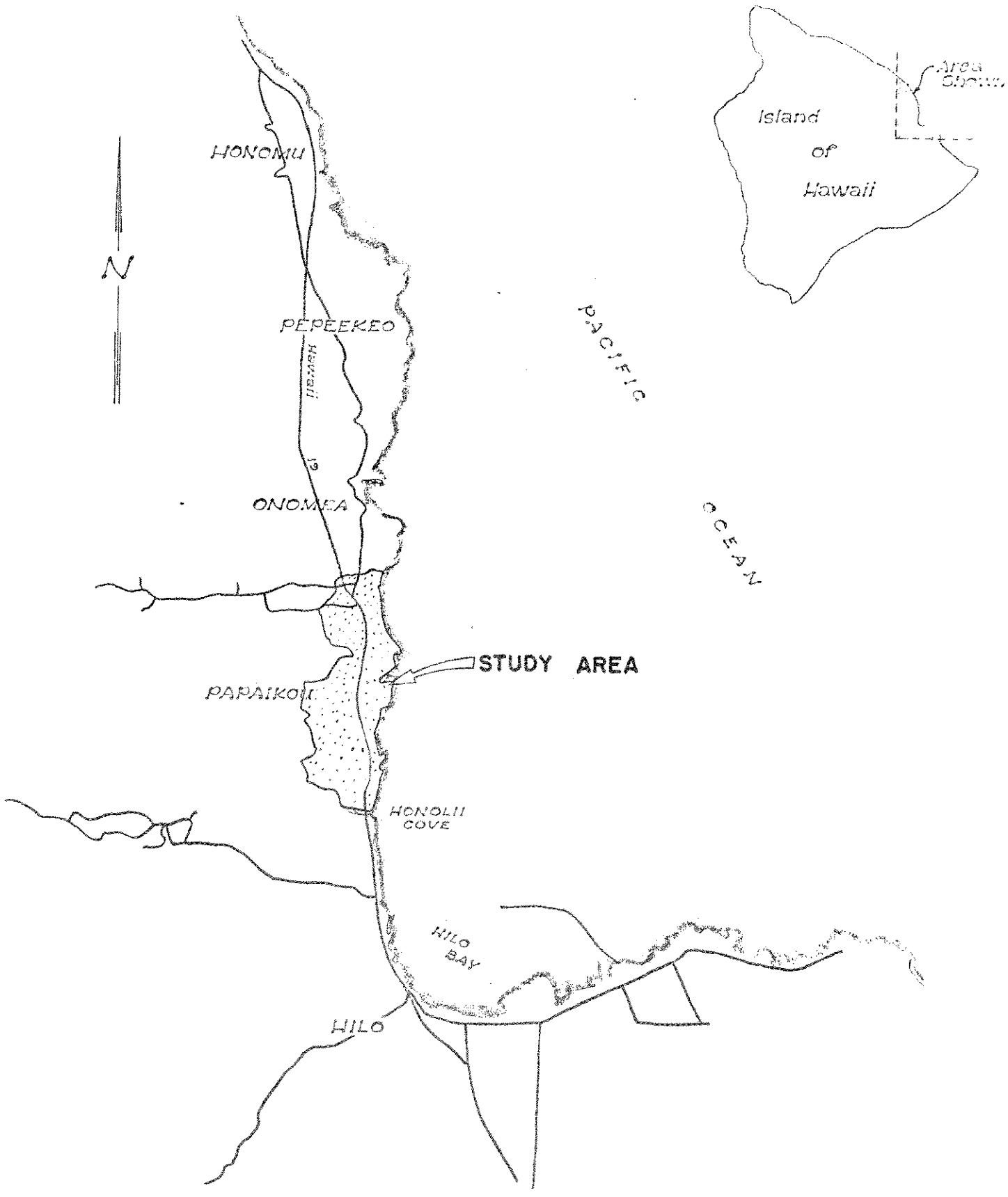
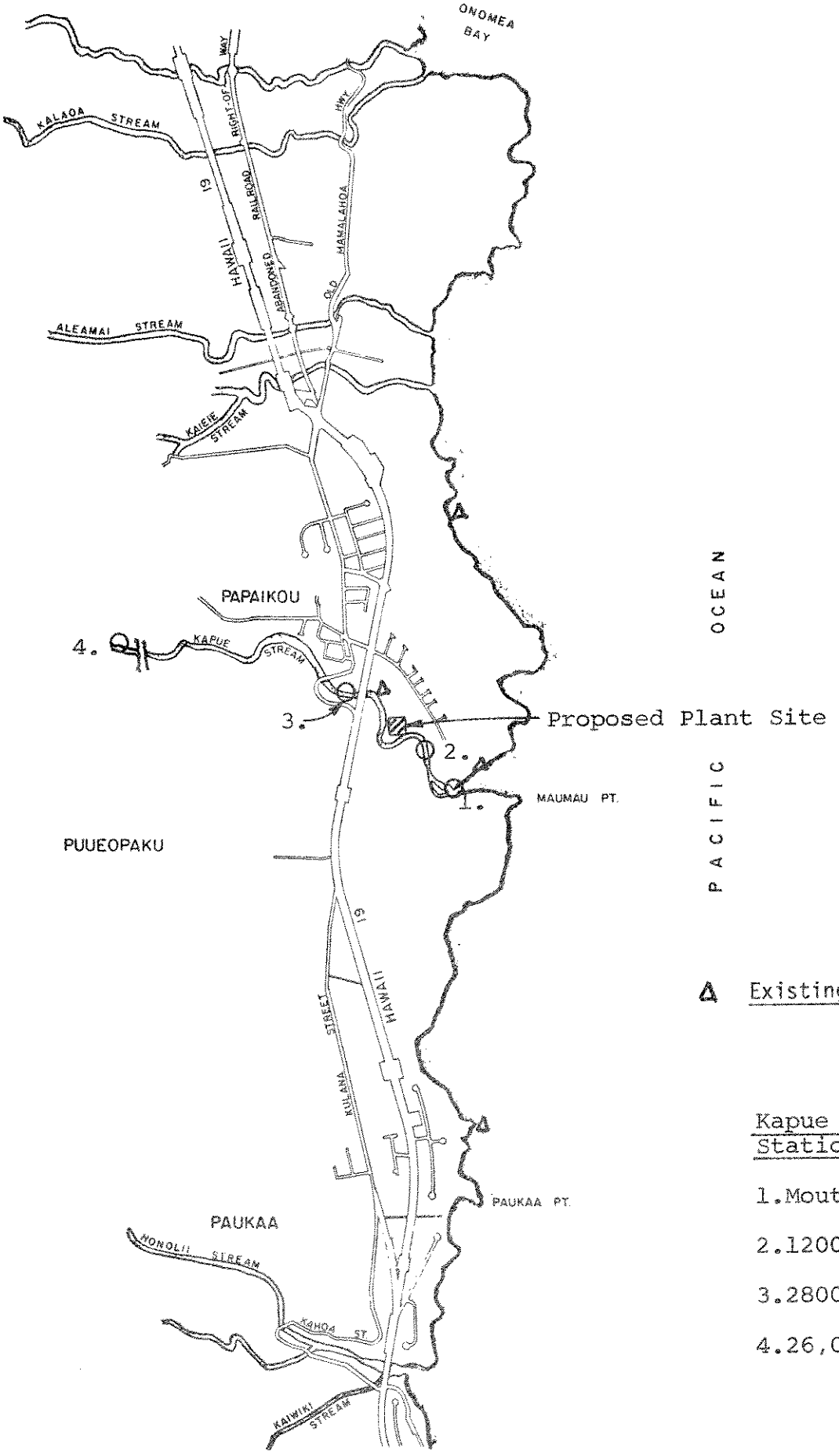


ISLAND OF HAWAII

LOCATION MAP



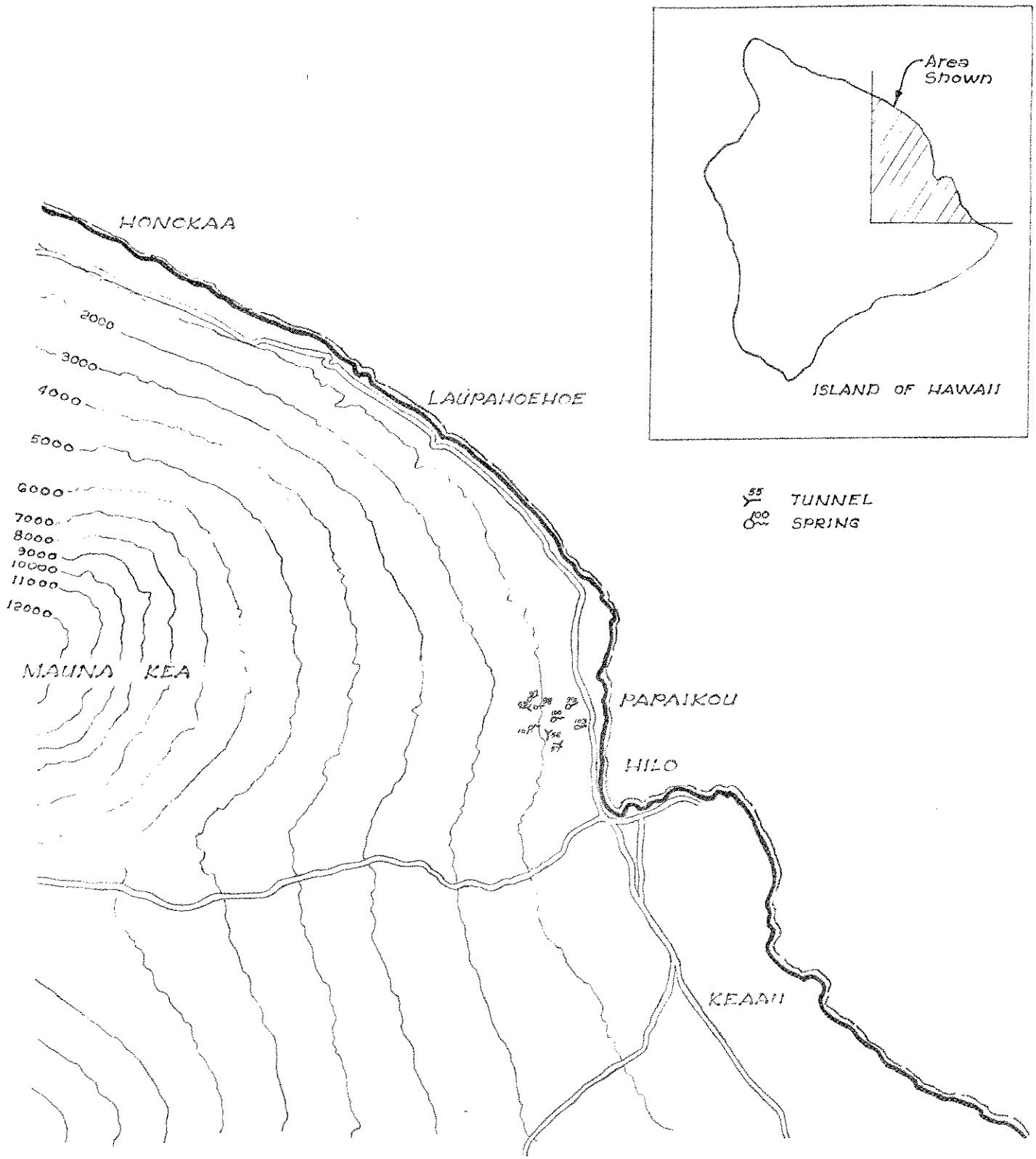
VICINITY MAP



Δ Existing Raw Discharges

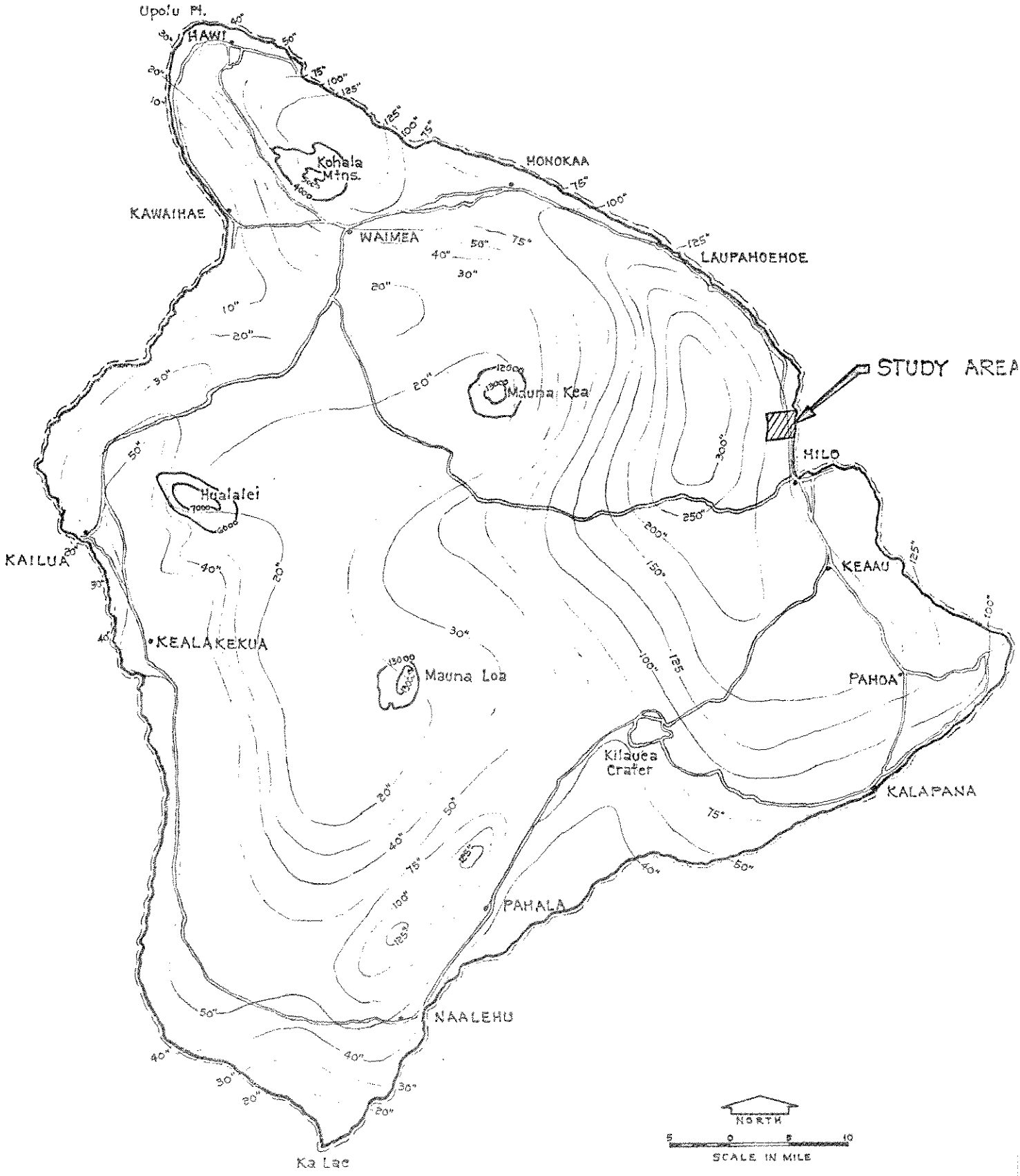
Kapue Stream Sampling Stations: Feb. 16, 1973

1. Mouth of Kapue Stream
2. 1200' upstream
3. 2800' upstream
4. 26,000' upstream



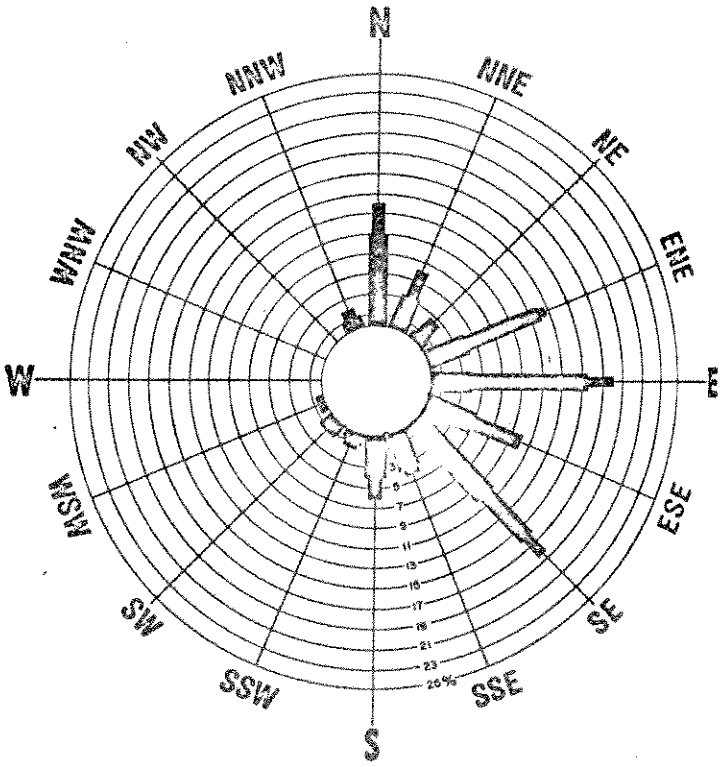
WATER SOURCE LOCATION

Source: An Inventory of Basic Water Resources Data: Island of Hawaii Dept. of Land and Natural Resources. Div. of Water and Land Development - Report R34



SOURCE: An Inventory of Basic Water Resources Data: Island of Hawaii Dept. of Land & Natural Resources, Div. of Water and Land Development - Report R34

MEAN ANNUAL RAINFALL



WIND ROSE @ HILO

Source: An Inventory of Basic Water Resources Data : Island of Hawaii Dept. of Land and Natural Resources, Division of Water and Land Development - Report R34

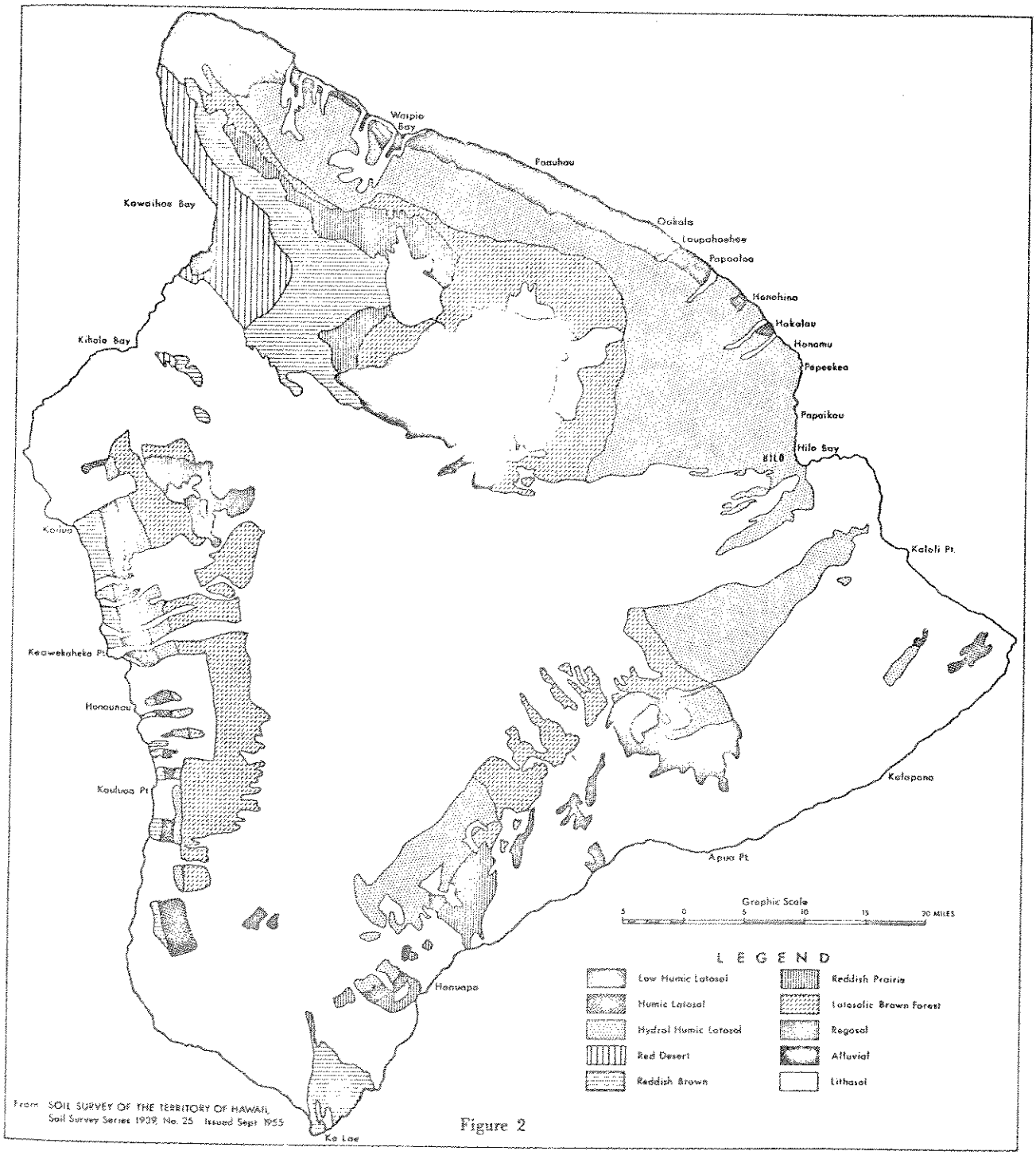


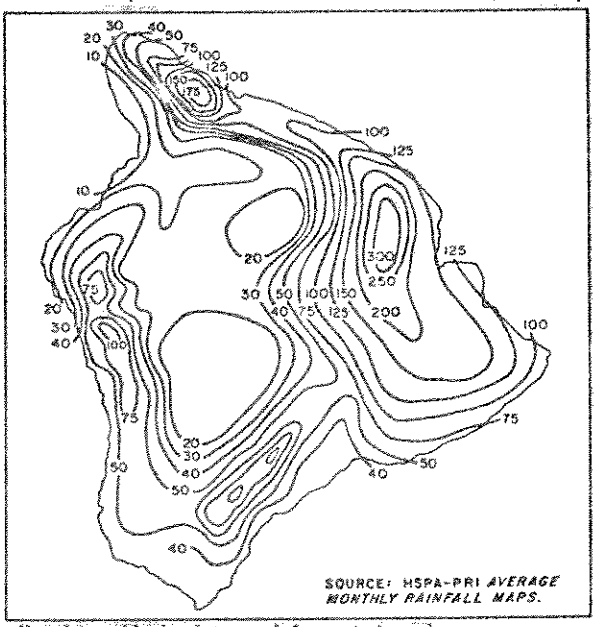
Figure 2

Source: Detailed Land Classification - Island of Hawaii, L. S. Bulletin No. 6, November 1965, Land Study Bureau, University of Hawaii, Honolulu, Hawaii, p. 2

PHYSICAL CHARACTERISTICS

The characteristics of Big Island lands can best be described in relation to their location and use.

The Hamakua Coast embraces the area from Hilo to Waipio Valley. This region is characterized by high rainfall (Figure 3), frequent cloudiness, and deep, virtually stone-free, highly weathered soils derived from volcanic ash and overlying aa and pahoehoe. Due to the abundant rainfall (ranging from 65 inches at Kukuihaele to 140 inches at Hilo), soils are highly leached of plant nutrients. Consequently, cultivated lands are intensively fertilized. Below 2000 feet elevation, virtually



all cultivatable land is used for unirrigated sugar cane production. The soils are predominantly Hydrol Humic Latosols. Above the cane is a very wet zone characterized by frequent rainfall (ranging from 150 inches above Kukuihaele to 275 inches or more above Hilo), fog, and low sunlight. The upper limits of this zone are about 3000 feet at Kukuihaele to about 4500 feet above Hilo. In this zone the soils (Hydrol Humic Latosols) are perennially wet and frequently swampy. Plant nutrients are highly leached from these soils, more so than from the sugar cane lands below and the grazing lands above. These conditions limit the agricultural use and productivity of the lands in this zone even though abundant soil material is present. This area is stocked with native forests and is used principally as a watershed.

Detailed Land Classification - Island of Hawaii
Land Study Bureau, L. S. Bulletin No. 6, November 1965, University of Hawaii, Honolulu, Hawaii, p. 4

Vegetation Zone	Elevation	Average Annual Rainfall	Great Soils Group	Indicator Plants	Present Use
	(feet)	(inches)			
A	0-1000	< 20	Red Desert, Reddish Brown, Low Humic Latosol, Lithosol	Keawe, Feather Fingergrass, Swollen Fingergrass, Bristly Foxtail	Grazing
B	0-3000	20-40	Low Humic Latosol, Reddish Brown, Reddish Prairie, Lithosol	Ekoa, Cactus, Guineagrass, Lantana, Hilna, Natal redtop	Grazing, Sugar cane, Orchard
C_1	0-3000	40-60	Low Humic Latosol, Reddish Brown, Humic Latosol, Lithosol	Guava, Guineagrass, Yellow Foxtail, Lantana, Molasses grass	Grazing, Sugar cane, Orchard, Forestry
C_2	2500-4000	30-60	Latosolic Brown Forest, Reddish Brown, Reddish Prairie, Regosol, Lithosol	Kikuyu, White Clover, Puakeawe, Plantain, Ohelo, Koa	Grazing, Forestry, Truck crops
D_1	0-2000	> 60	Humic Latosol, Hydrol Humic Latosol, Lithosol	Ohia lehua, Guava, Tree fern, Hilo grass	Grazing, Sugar cane, Orchard, Forestry, Truck corps
D_2	1000-6000	> 100	Hydrol Humic Latosol, Bog, Lithosol	Lobelia, Ohia lehua, Amaumau fern, Boston fern, Uluhe	Grazing, Forestry, Truck crops
D_3	2000-7000	> 60	Latosolic Brown Forest, Lithosol	Koa, Ohia lehua, Bracken fern	Grazing, Forestry
E_1	2000-4000	< 40	Latosolic Brown Forest, Lithosol, Regosol	Koa, Mamani, Puakeawe, Lovegrass	Grazing, Forestry
E_2	4000-9000	25-50	Lithosol, Latosolic Brown Forest	Mamani, Puakeawe, Kukainene, Naio	—
E_3	> 8000	< 25	Regosol, Lithosol	Lichen, Moss	—

Detailed Land Classification - Island of Hawaii
Land Study Bureau, L. S. Bulletin No. 6, November 1965, University of Hawaii, Honolulu, Hawaii, p. 3

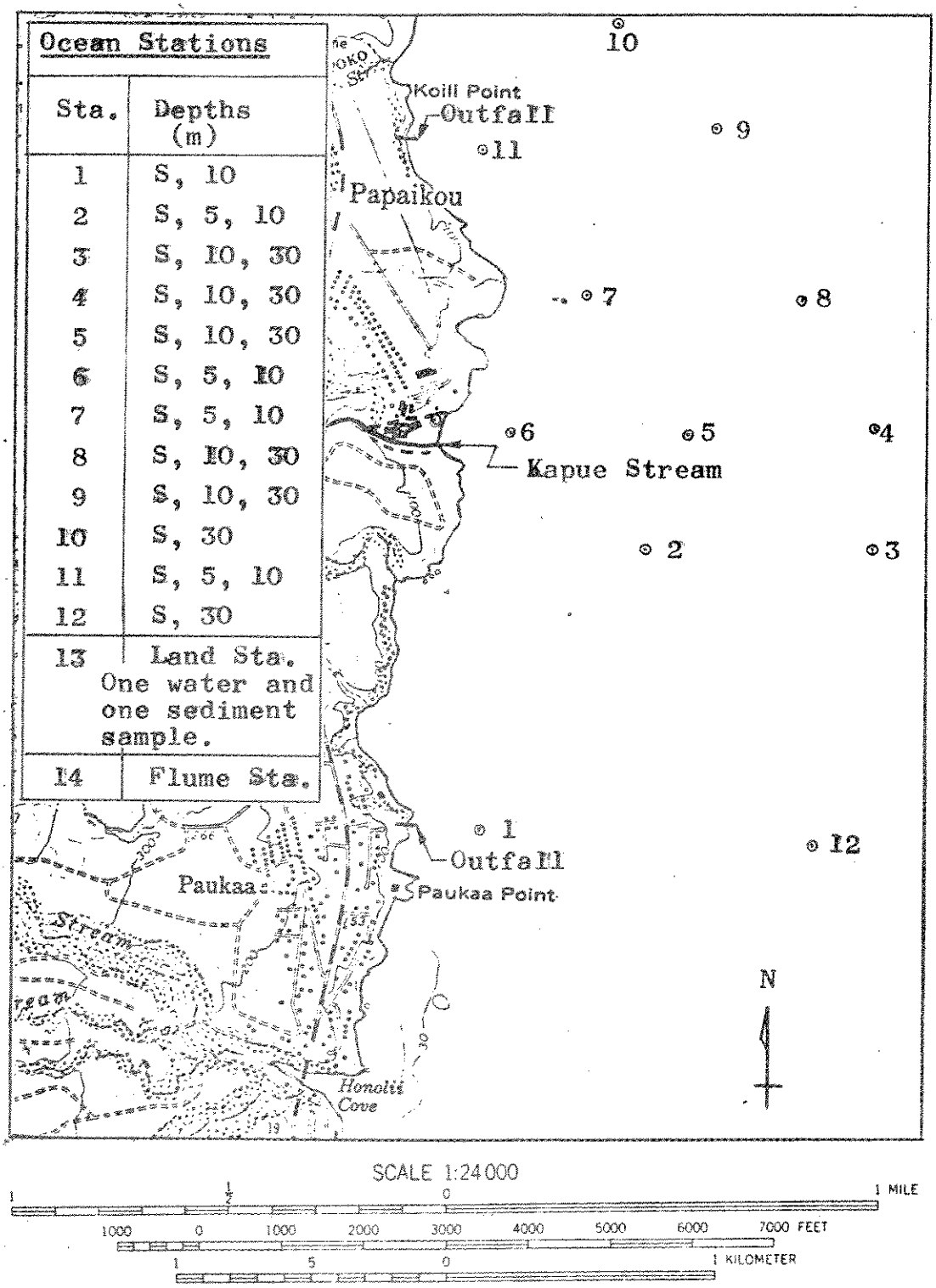


Figure 1. Oceanographic and beach sampling stations. Kapue Stream-Papaikou, Hawaii, Feb. 16 & 17, 1973.

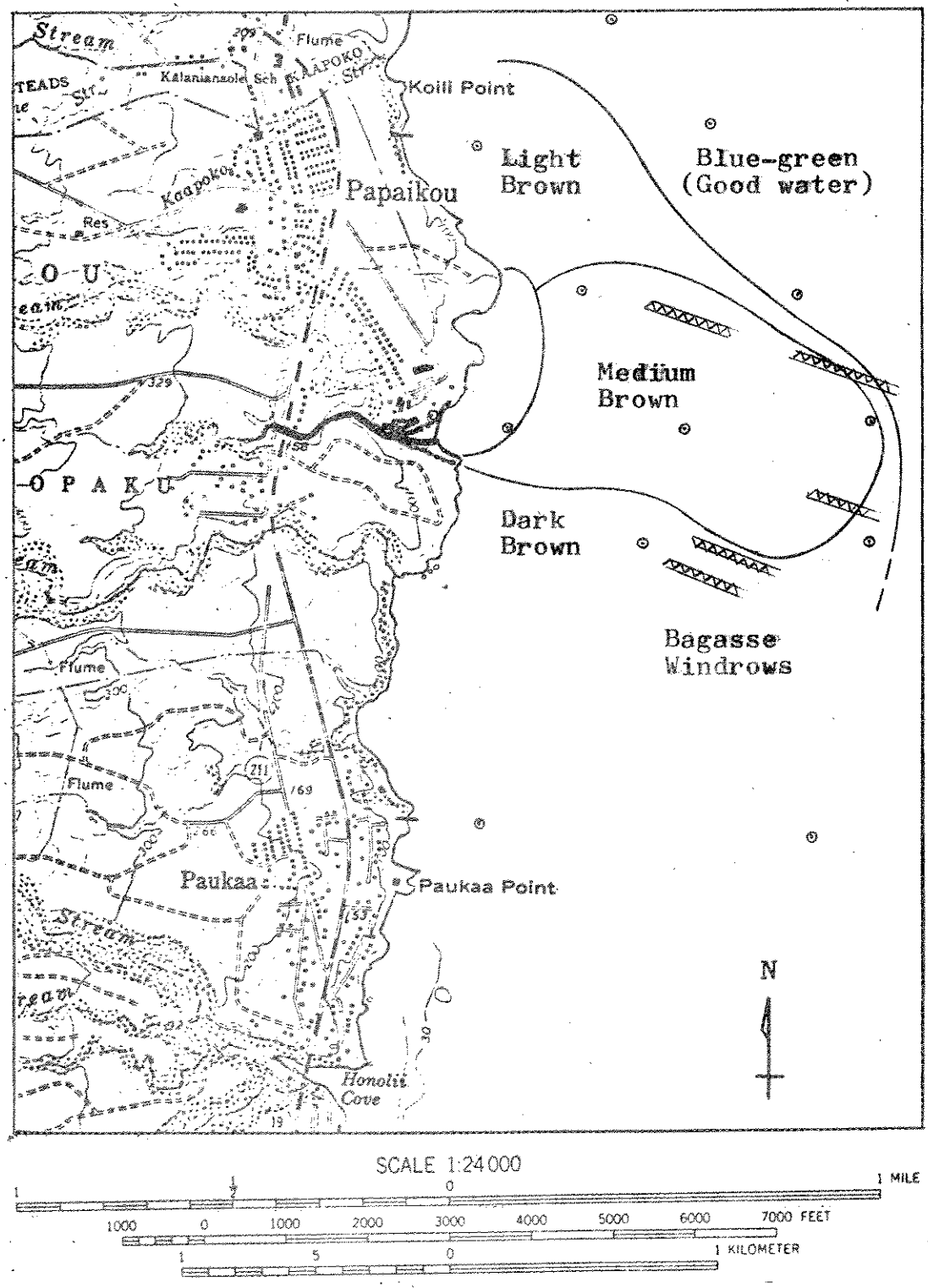


Figure 2. Visual observations of the Mauna Kea Sugar Mill plume off Papaikou, Hawaii, February 16, 1973.

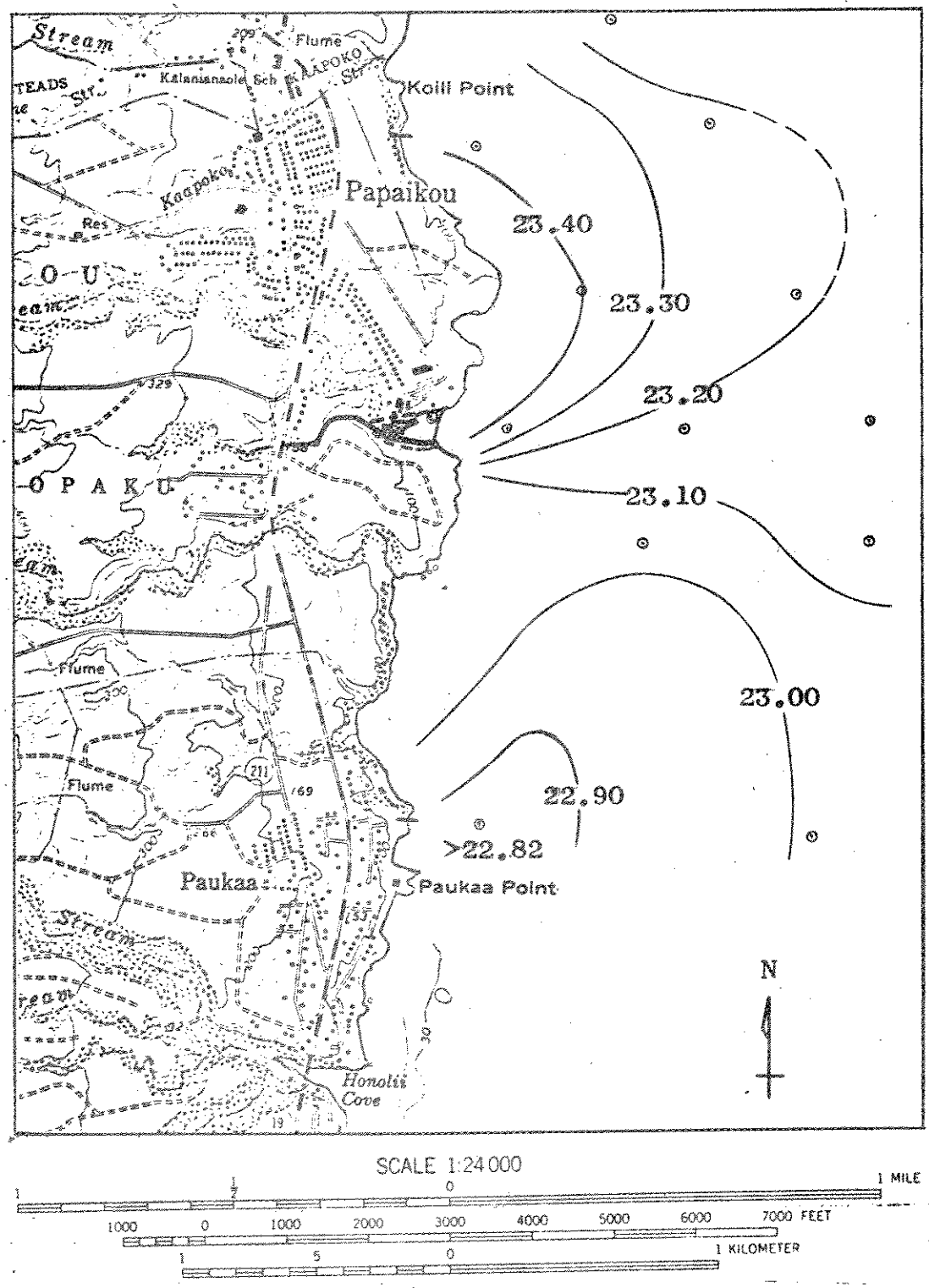


Figure 3. Temperature, surface, off Papaikou, Hawaii, February 17, 1973, °C.

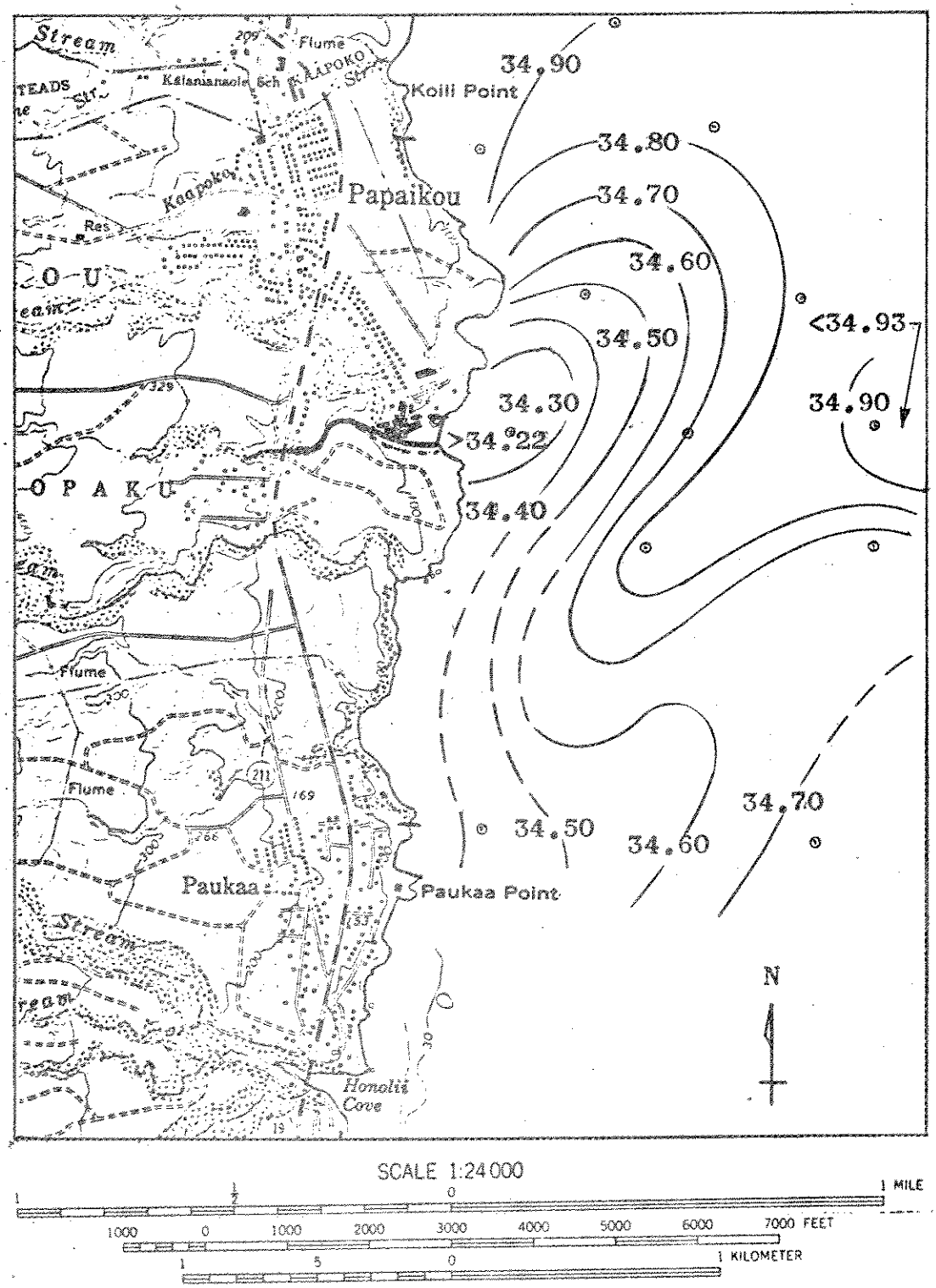


Figure 4. Salinity, surface, off Papaikou, Hawaii, February 17, 1973; parts/thousand.

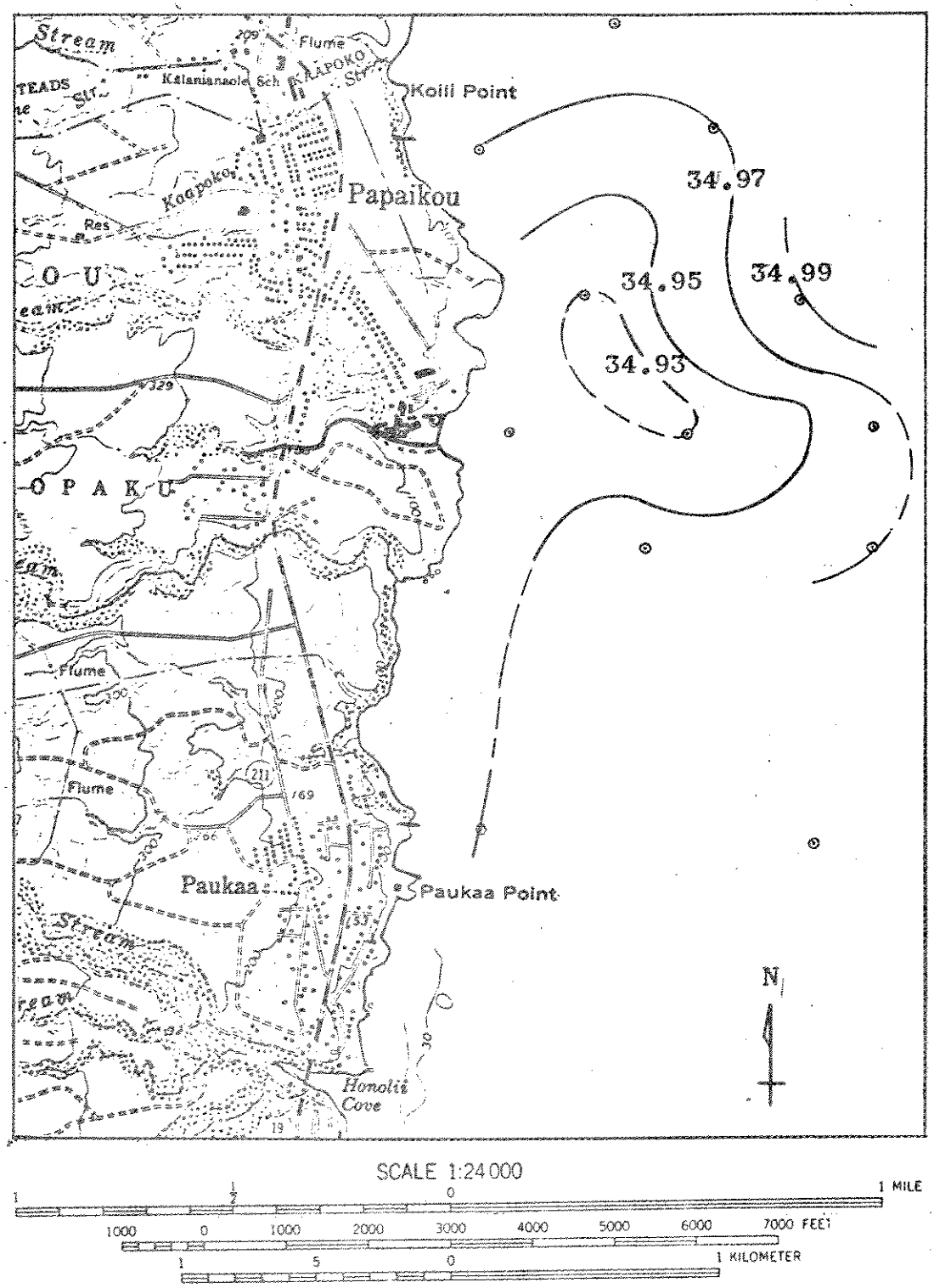


Figure 5. Salinity, 10 meters, off Papaikou, Hawaii, February 17, 1973; parts/thousand

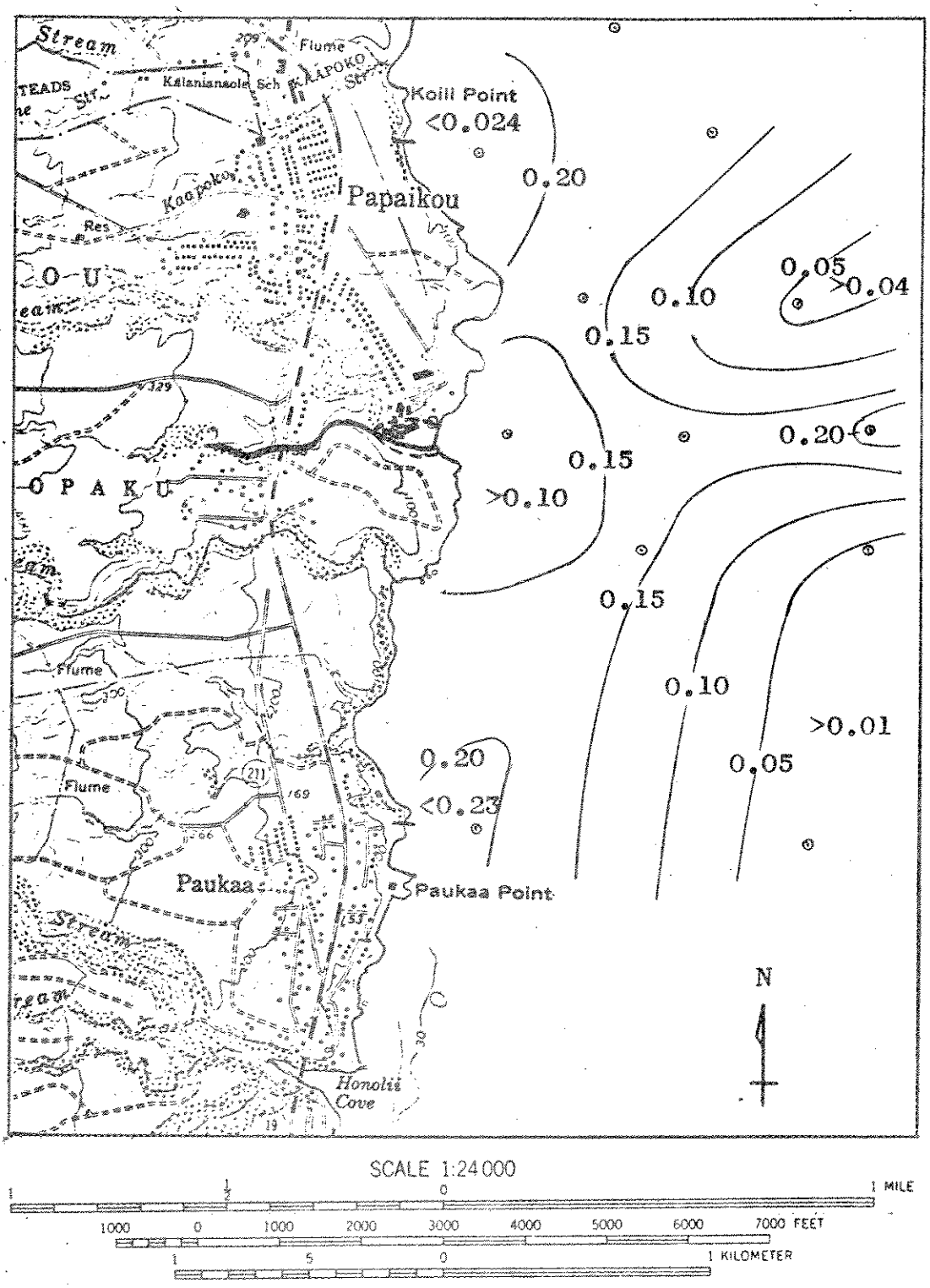


Figure 6. Total nitrogen, surface, off Papaikou, Hawaii February 17, 1973; mg/l.

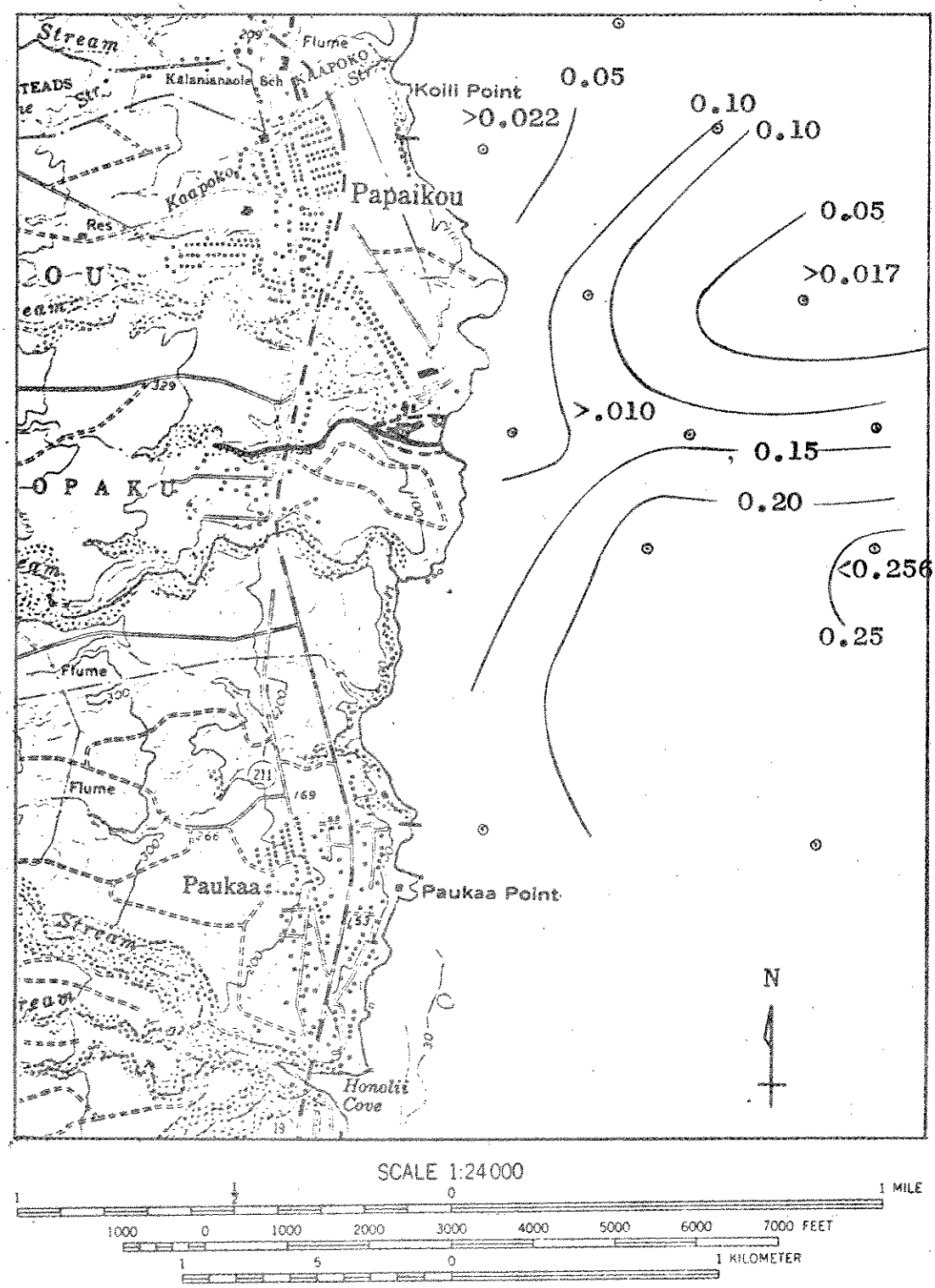


Figure 7. Total nitrogen, 10 meters, off Papaikou, Hawaii, February 17, 1973; mg/l.

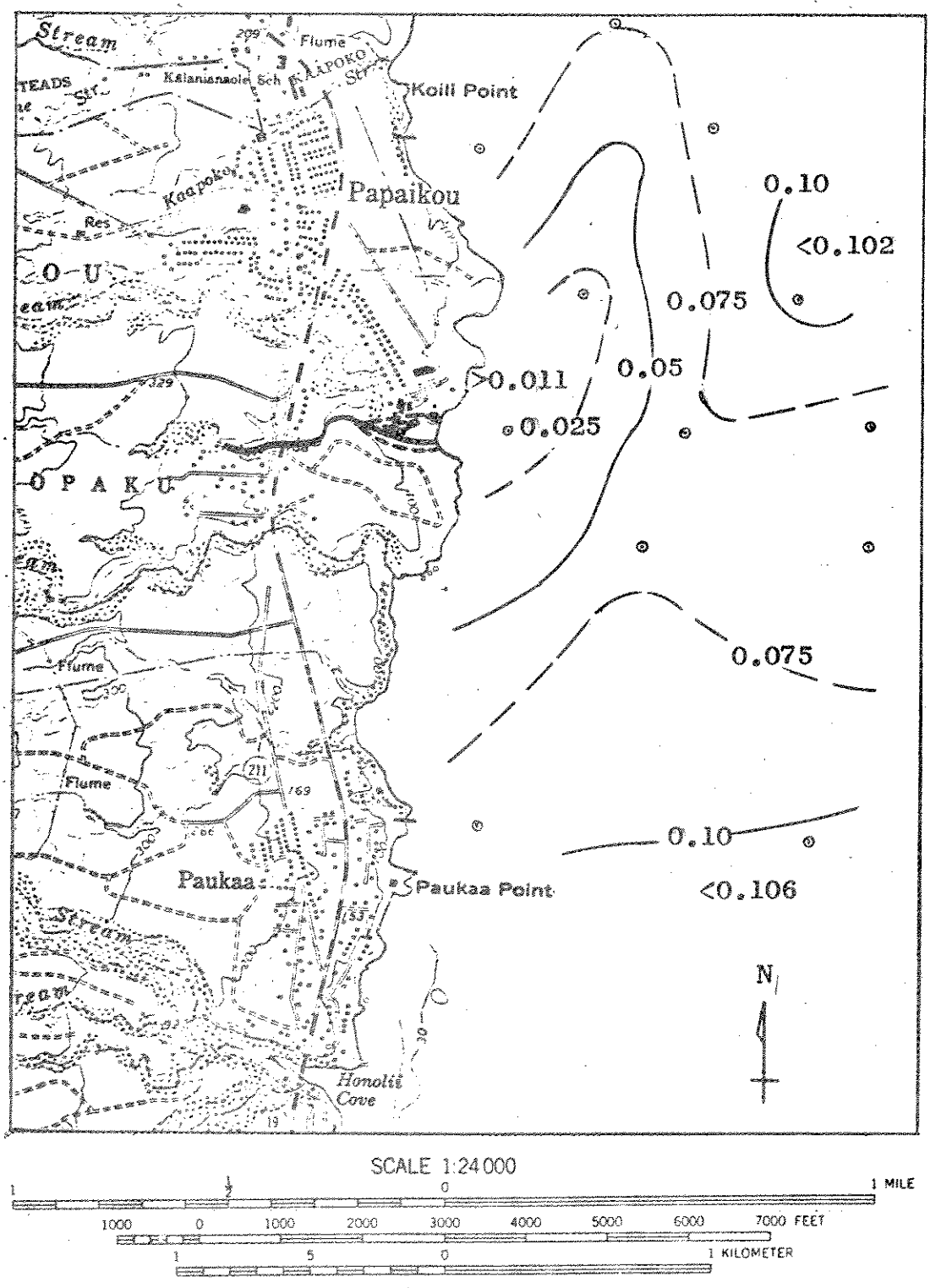


Figure 8. Total phosphorus, surface, off Papaikou, Hawaii, February 17, 1973; mg/l.

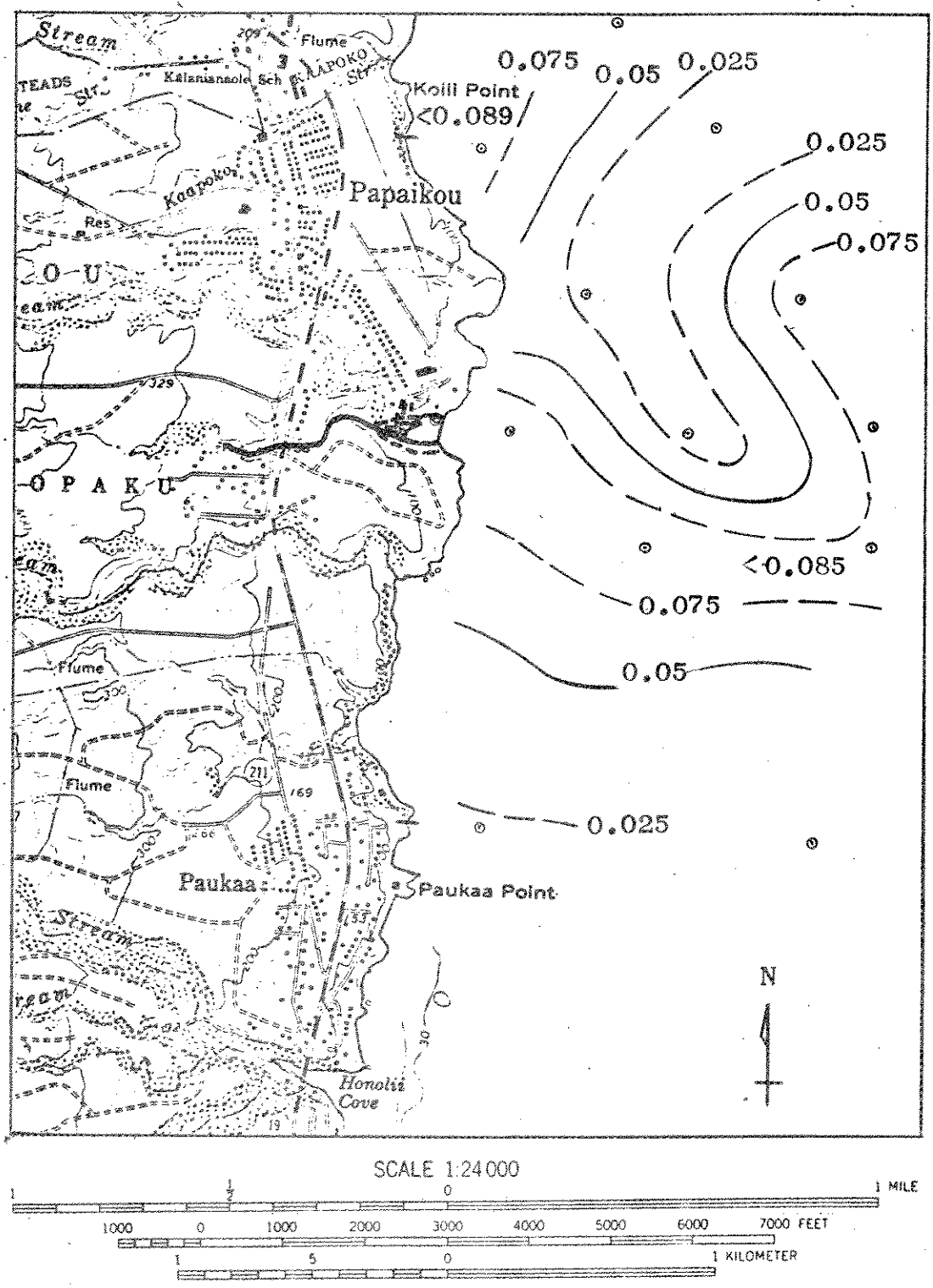


Figure 9. Total phosphorus, 10 meters, off Papaikou, Hawaii, February 17, 1973; mg/l.

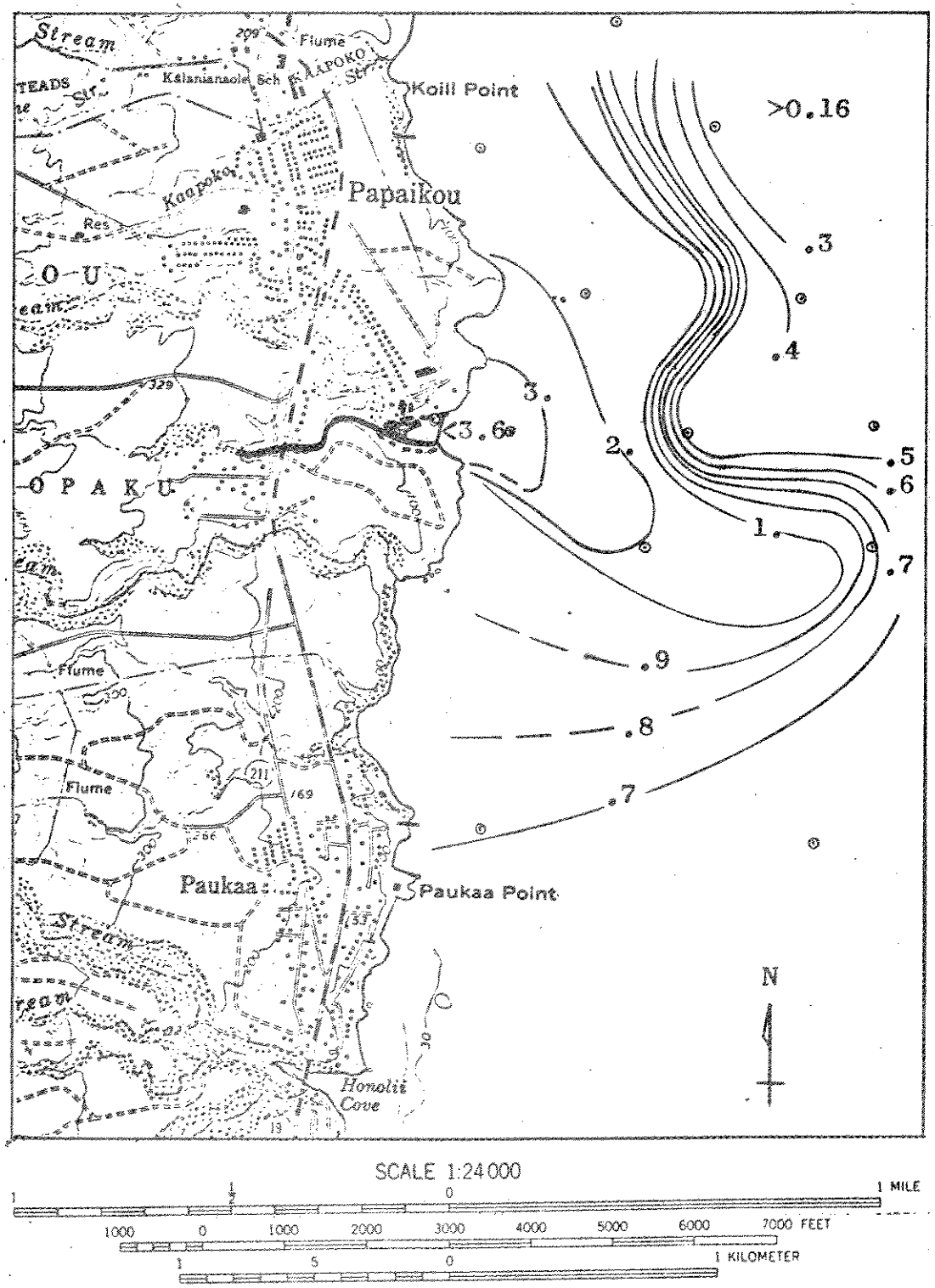


Figure 10. Turbidity, surface, off Papaikou, Hawaii, February 17, 1973; FTU.

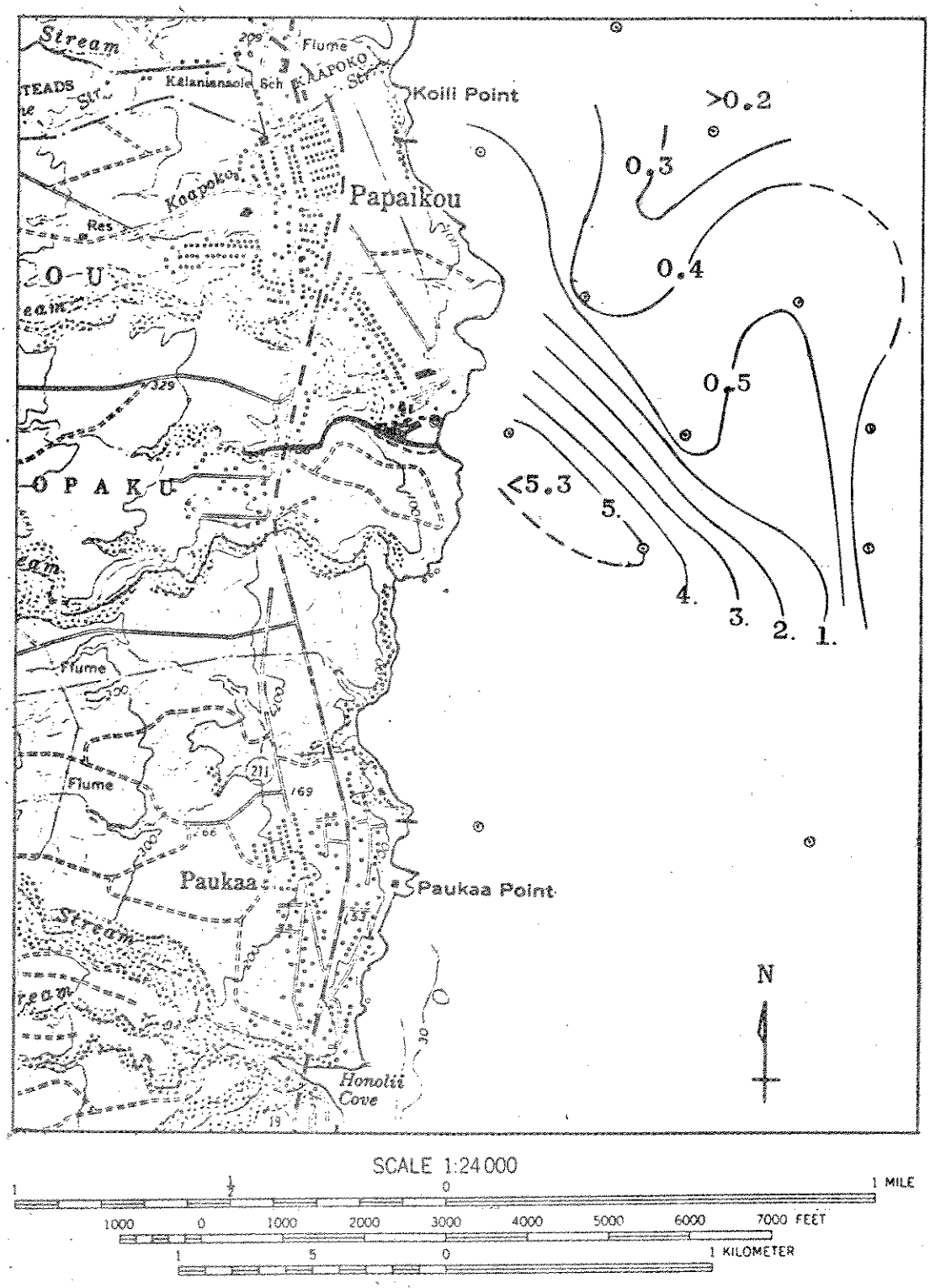


Figure 11. Turbidity, 10 meters, off Papaikou, Hawaii, February 17, 1973; FTU.

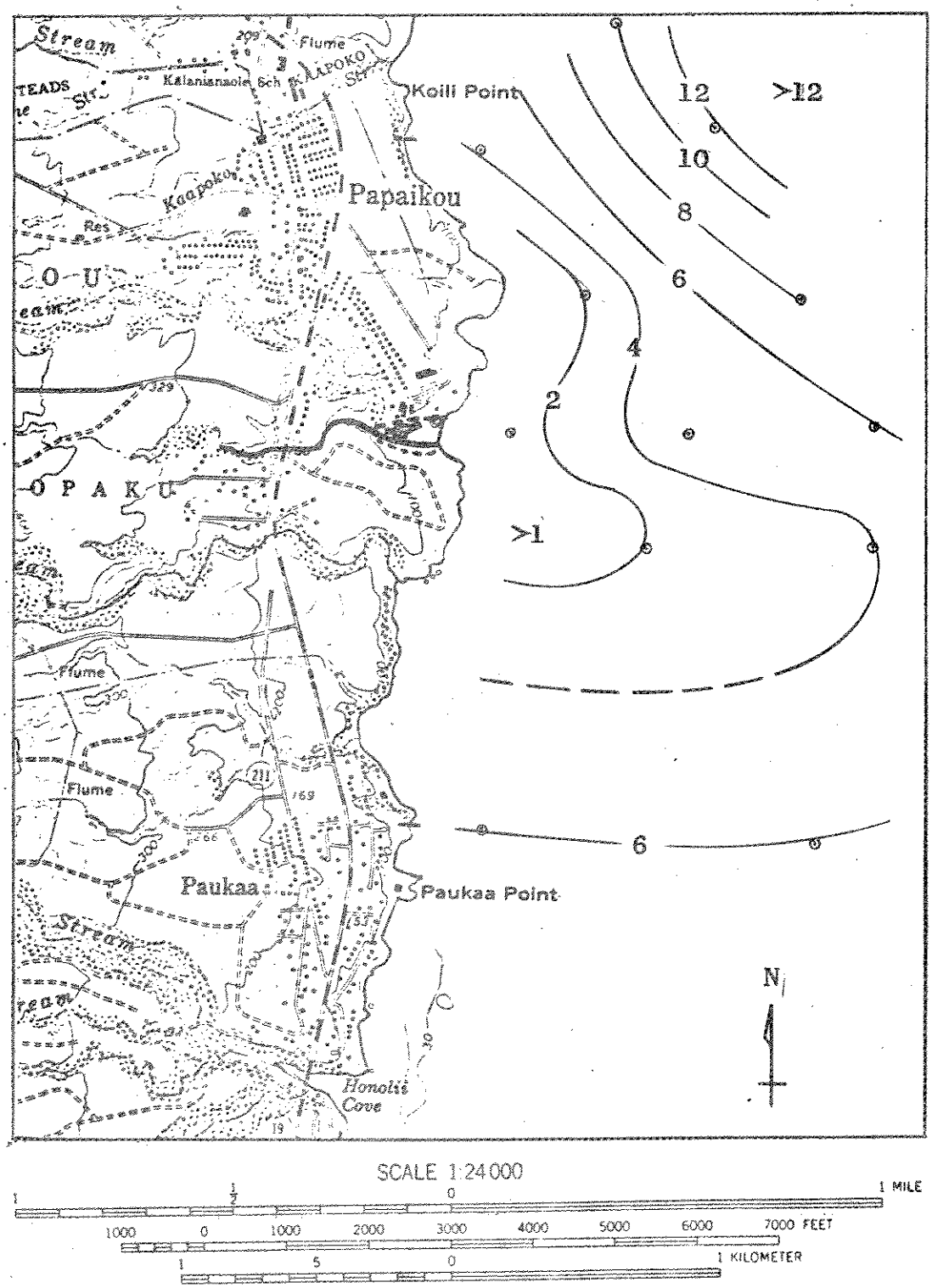


Figure 12. Secchi depth off Papaikou, Hawaii, February 17, 1973; meters.

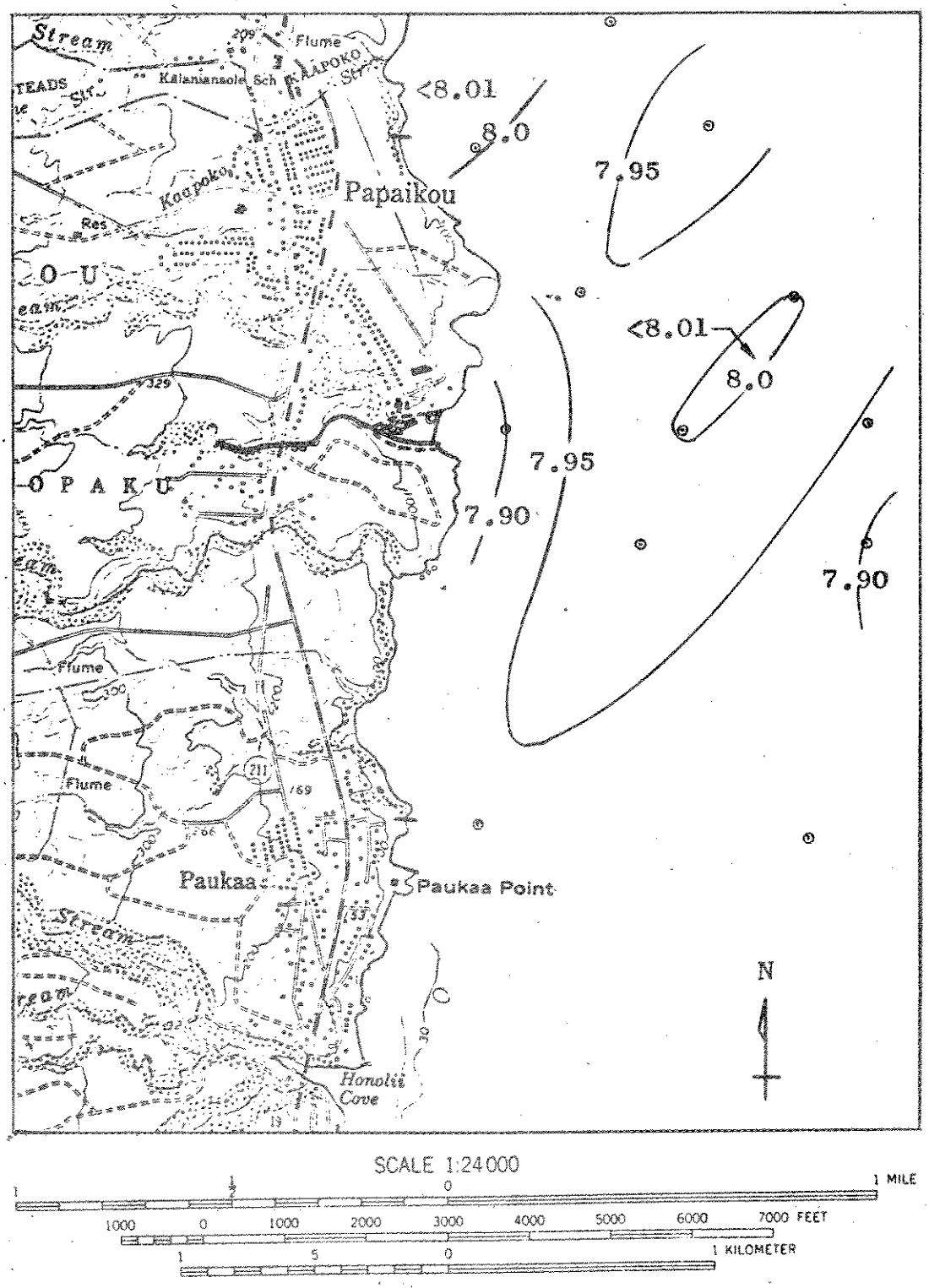


Figure 13. pH, surface, off Papaikou, Hawaii, February 17, 1973.

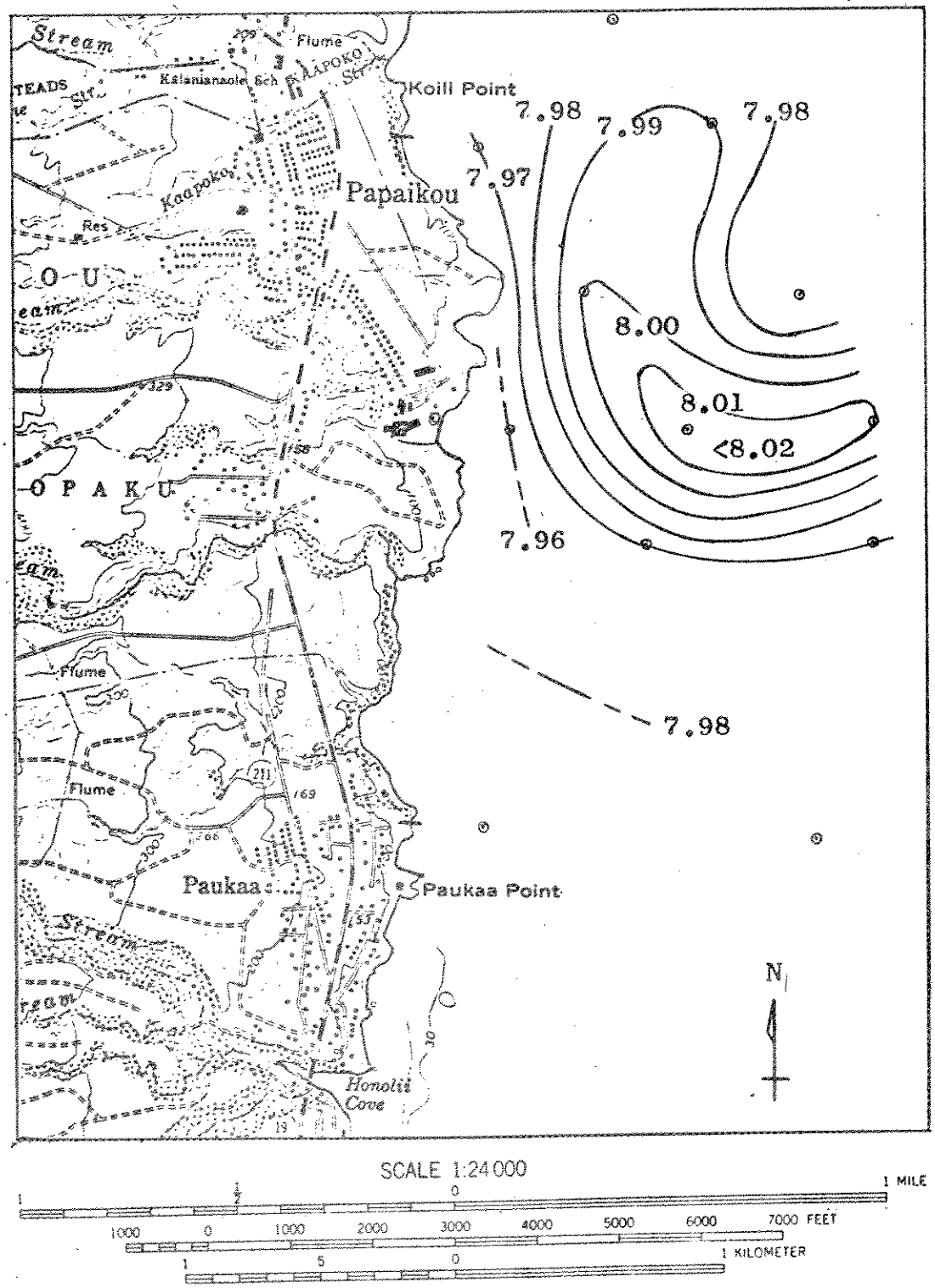


Figure 14. pH, 10 meters, Off Papaikou, Hawaii, February 17, 1973

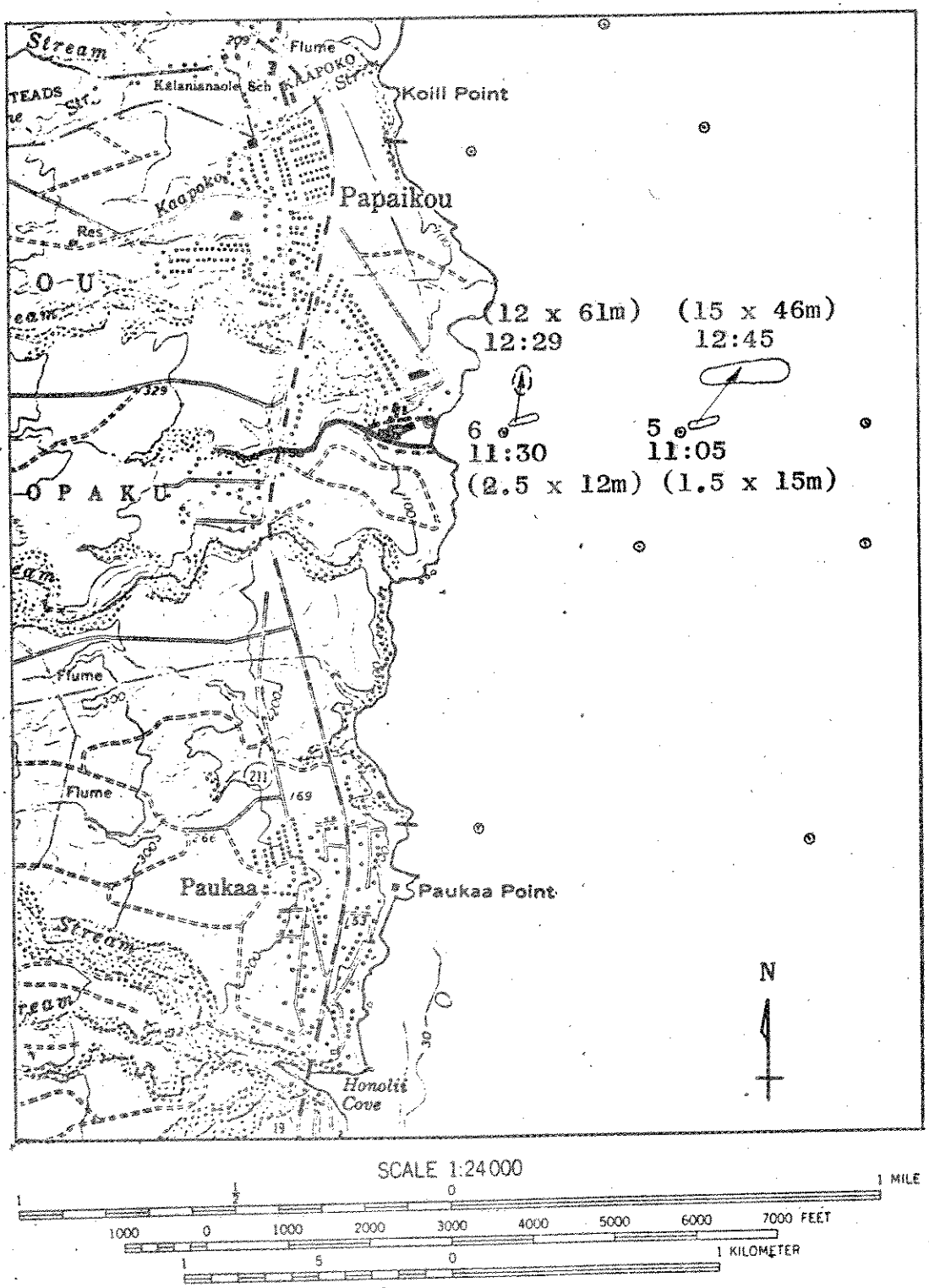


Figure 15. Visual observations of the dispersion of dye off Papaikou, Hawaii, February 17, 1973.

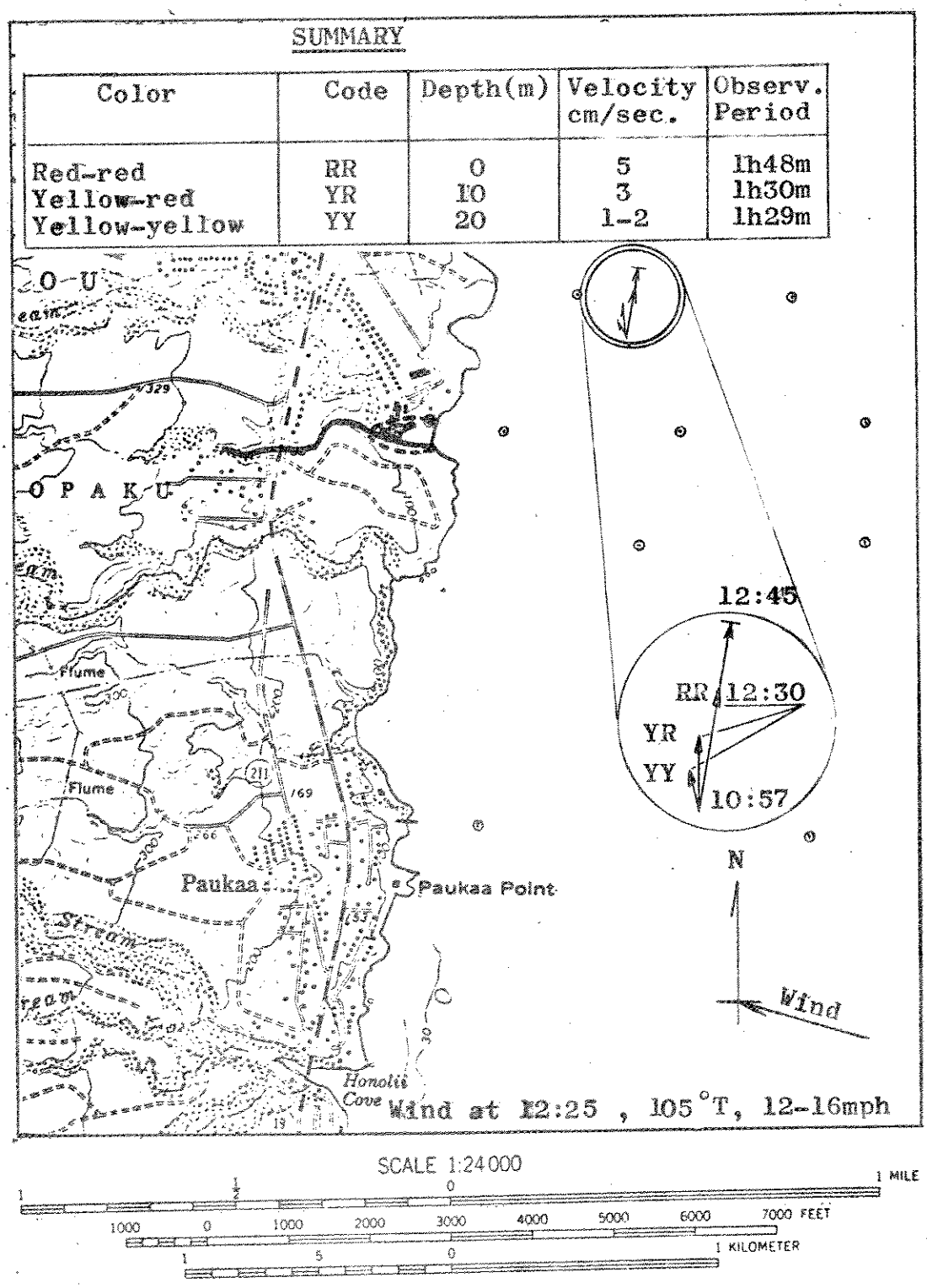
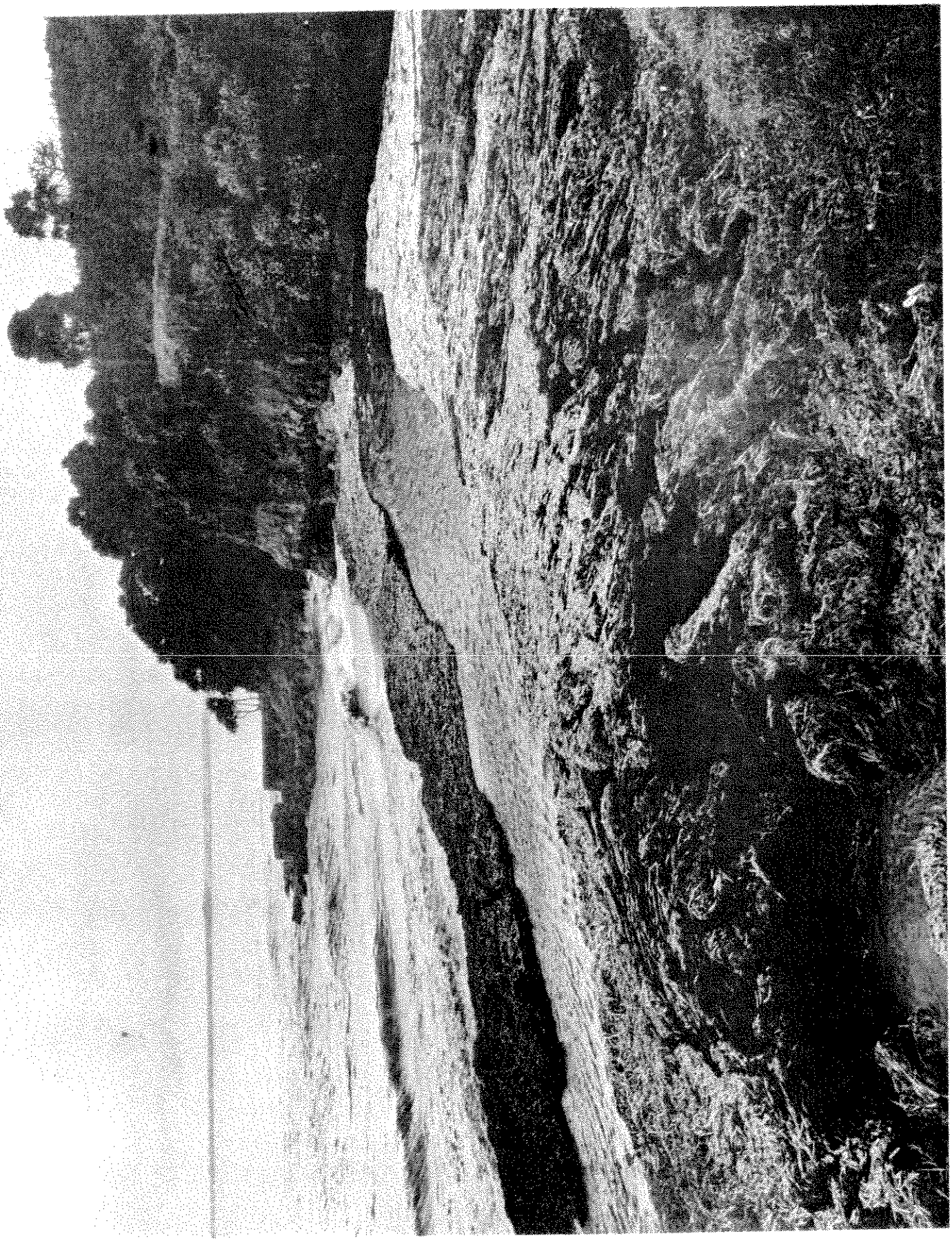
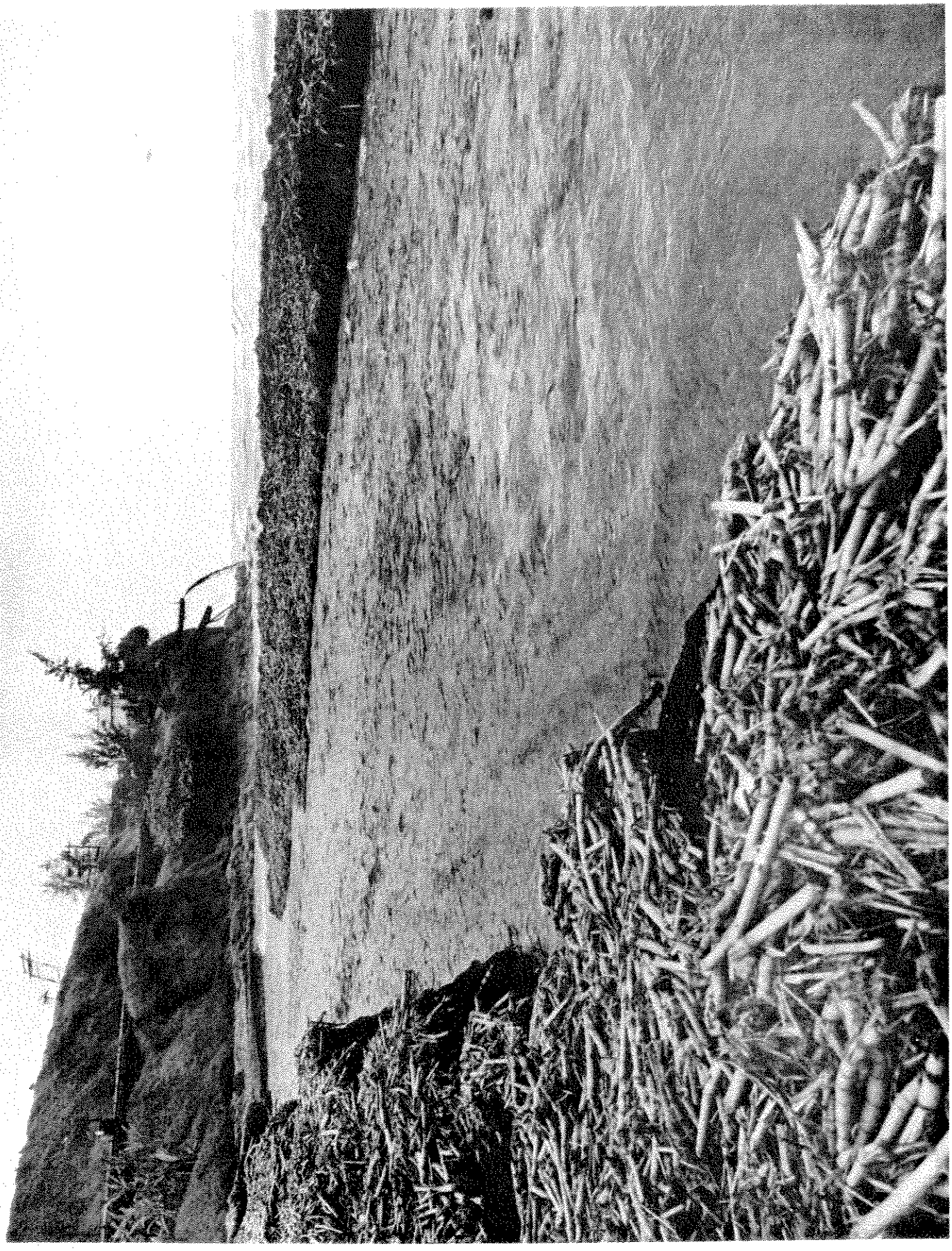


Figure 16. Visual observations of the current drogues off Papaikou, Hawaii, February 17, 1973.

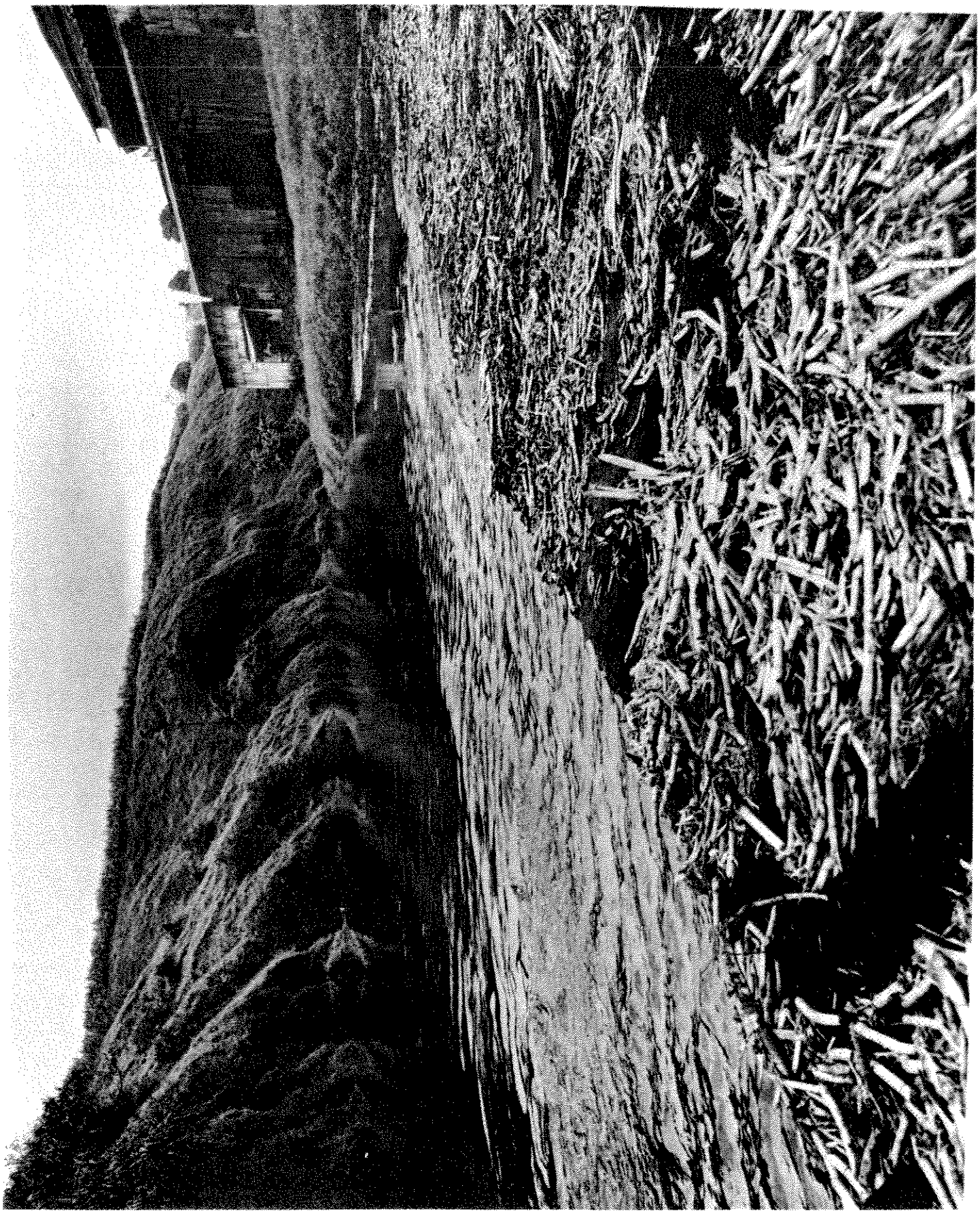


KAPUE STREAM MOUTH WITH WAIPAHI POINT IN BACKGROUND



KAPUE STREAM MOUTH WITH CANE TRASH FLUME

PAPAIKOU MILL WASTE DISCHARGE



KAPUE STREAM LOOKING MAUKA ABOVE MILL

SUMMARY OF HISTORICAL DATA

TABLE 1 - 1

PARAMETER	REFERENCE	CONCLUSIONS	REMARKS
WATER QUALITY			
Temperature	Kennedy Engineers, 1967 (S)	Temperatures, in general, were quite uniform around a factory waste outfall. Sugar mill waste water will, in general, be of somewhat higher temperature than the ocean; however, no difficulty in meeting the proposed water quality standards of temperature not to exceed 30°C with an allowance of a 200 foot dispersion zone, are anticipated. Practically uniform temperatures were detected in nearly all offshore locations to depths of several hundred feet.	Ranged from 23.2 - 23.6°C during the grinding season; ranged from 24.5 - 25.8°C during the non-grinding season.
	Environmental Protection Agency, 1971 (G)	The effect of mill discharges on ocean water temperature is considered to be minimal.	
	State of Hawaii, Dept of Health, 1971 (S)	No conclusions given.	Unpublished data. All surface samples. One day 5 stations. Surface temperature range 77.9 to 79.7°F during the grinding season.
Conductivity	Kennedy Engineers, 1967 (S)	Conductivity during grinding season ranged from 43.25 at 23.5°C to 45.05 MHOS/cm at 23.2°C. Lower conductivity near outfall, becomes nearly the same as seawater as waste flow progresses and disperses outward. During non-grinding season all stations show some conductivity.	Sampling: one day during grind-season, 10 stations, 2 depths each station; one day during non-grinding season, 6 stations 1 surface and 6 at depth.

SUMMARY OF HISTORICAL DATA

TABLE I - 2

PARAMETER	REFERENCE	CONCLUSIONS	REMARKS
WATER QUALITY			
Nutrients	Kennedy Engineers, 1967, Hawaiian Sugar Factory Waste Receiving Water Study (S)*	Nutrient levels of nitrate and phosphorous were not significantly increased in local waters receiving sugar factory waste discharge.	Sampling; one day during grinding season, 10 stations, 2 depths each station; non grinding season, one day, 7 stations 2 depths each station, Papaikou area. Total nitrogen - .01 - .29 mg/l, grinding season <.3mg/l, non grinding season
	Environmental Protection Agency, 1971, The Hawaiian Sugar Industry Waste Study (G)*	Sugar mill wastes contain levels of nitrogen and phosphorous in sufficient amounts to produce adverse ecological changes if discharged to confined receiving waters with limited circulation. Three mills each discharged in wash water per day, 12 pounds of total nitrogen and 5 pounds of total phosphorous, average, from an average of 210 tons of processed cane per mill.	General conclusion from studies of mill wastes from several mills.
	State of Hawaii, Dept. of Health, 1971 (S)	No conclusions given	Unpublished data. All surface samples. One day, 8 stations. One day 4 stations. Range of T nitrogen, 0.01 to 0.29 mg/l. Range of phosphorous, <.005 to .212mg/l. TN and TP higher near waste discharge points

*(S) denotes data off the Papaikou mill
(G) denotes general data

SUMMARY OF HISTORICAL DATA

Table I - 3

PARAMETER	REFERENCE	CONCLUSIONS	REMARKS
WATER QUALITY			
Turbidity	Kennedy Engineers, 1967 (S)	Turbid wastewaters and natural storm drainage lie in a thin layer on the surface of the ocean with clearer water below. Vertical and horizontal dispersion extended 1/4 to 5 miles from discharge depending upon the waste, receiving water, and current conditions.	During grinding season large turbid area from mill wastes. During non-grinding season turbidity from stream discharge and wave action near shore. 3 - 45 ft., grinding season 4 - 28 ft., non-grinding season
	State of Hawaii, Dept. of Health (S)	No conclusions given	Unpublished data. All surface samples. One day 8 stations. One day 4 stations. Turbidity range (JTU) 0-75 during grinding season. Turbidity increases approaching waste discharges.
	Environmental Protection Agency, 1971 (G)	Offshore surveys revealed that ocean waters, when not influenced by run-off or mill discharges, had a transparency in excess of 50 feet, as measured by a Secchi disc.	
pH	Kennedy Engineers, 1967 (S)	Waste from sugar mills tends to be slightly acid and normally below 7.0. Discharge into the ocean results in a rapid increase of pH to near normal values. This indicates the large pH buffering and alakline ion resources of the sea.	7.0 - 8.0 grinding season 8.2 - 8.3, non grinding season
	State of Hawaii, Dept. of Health, 1971 (S)	No conclusions given.	Unpublished data. All surface samples. One day 8 stations. One day 4 stations. Range of pH was 7.6 - 8.2 during grinding season.

SUMMARY OF HISTORICAL DATA

Table I - 4

PARAMETER	REFERENCE	CONCLUSIONS	REMARKS
WATER QUALITY			
Dissolved Oxygen	Kennedy Engineers, 1967 (S)	Dissolved oxygen concentrations were not substantially altered by sugar mill wastes except in closed bays.	Sampling: One day during grinding season, 10 stations, 2 depths each station; one day during non-grinding season, 6 stations, 2 depths each station. 7.0-7.3 mg/l, grinding season 7.3-8.0 mg/l, non-grinding season
	Environmental Protection Agency, 1971 (G)	The effect of the mill discharges on dissolved oxygen levels in the ocean is considered to be minimal.	
	State of Hawaii, Dept. of Health, 1971 (S)	No conclusions given.	Unpublished data. All surface samples. One day 8 stations. One day 4 stations. Range of surface DO was 6.2 to 7.5mg/l during grinding season.
B.O.D.	Kennedy Engineers, 1967	B.O.D. of receiving waters greater than 200 feet from outfall was quite low, less than 3 mg/l. Exceptions were found in bays with restricted circulation and dispersion.	2.5-5.4 mg/l, grinding season <0.2-18.3 mg/l, non-grinding season.

SUMMARY OF HISTORICAL DATA

TABLE I - 5

PARAMETER	REFERENCE	CONCLUSIONS	REMARKS
BIOLOGICAL			
Total Coliform Bacteria	Chan, J.G. and Chase, R. G. 1972, A Study of Coliform and Fecal Coliform Bacteria in Sugar Mill Waste Water and Soils - Pepeekeo Sugar Co. Hawaii (G)	Lack of epidemological data to substantiate the health hazard of marine waters contaminated by high numbers of coliform organisms.	Total coliform at effluent discharge onshore was 1,600,000/MPN/100ml. At stations 880 and 1,000 ft. offshore the count decreased to 790 and 7,900/MPN/100ml. Data from mill effluent discharge and 5 offshore stations, Pepeekeo Mill area.
	State of Hawaii, Dept. of Health, 1971 (S)	No conclusions given.	Surface samples only off Papaikou Mill. >2,400/MPN/100ml at discharge points and decreasing to 460/MPN/100ml one mile offshore, during grinding season.
	Kennedy Engineers, 1971 (S)	Concentrations of these organisms are not generally high except in areas within several hundred feet off a waste discharge outfall. The validity of using coliform or fecal coliform bacteria, as determined by standard methods, as pollution parameters of health hazards in ocean waters receiving sugar mill wastes is open to serious question.	Sampling: one day during grinding season, 10 stations, 2 depths each station; one day during non-grinding season, 6 stations 2 depths deach station. Ranged from 1,160/MPN at surface at sugar mill outfall to 2/MPN one mile north at a depth of 40 feet, during grinding season.

SUMMARY OF HISTORICAL DATA

TABLE I - 6

PARAMETER	REFERENCE	CONCLUSIONS	REMARKS
BIOLOGICAL			
Total Coliform Bacteria (Cont.)	Engineering Science, Inc., Sun, Low, Tom & Hara, Inc., and Dillingham Environmental Company, 1971 (OWQP)(G)	Found that the T-90 value in offshore Oahu waters ranged from 10 to 33 minutes. Similar short T-90 times have been found by others.	
Fecal Coliform Bacteria	Chan, J.G. and Chase, R. G.	Lack of epidemological data to substantiate the health hazard of marine waters contaminated by high numbers of coliform organisms.	Data from mill effluent discharge and 5 offshore stations, Pepeekeo Mill Area. Fecal coliform at effluent discharge onshore was 4,900/100ml. At sites 880 and 1,000 feet offshore the count decreased to 50 and 130/MPN/100ml.
	Kennedy Engineers, 1967 (S)	Same as Kennedy Engineers conclusions under Total Coliform Bacteria.	Same as Kennedy Engineers remarks under Total Coliform Bacteria except values for Fecal Coliform were; Range, 220/MPN/100ml at surface at sugar mill outfall to <1/MPN/100ml one mile out from discharge point, during grinding season.
	State of Hawaii, Dept. of Health, 1971 (S)	No conclusions given.	Surface samples only, off Papaikou Mill. 460 and ≧2,400/MPN/100ml at discharge points, decreasing to <3/MPN/100ml one mile offshore during grinding season.

SUMMARY OF HISTORICAL DATA

TABLE I - 7

PARAMETER	REFERENCE	CONCLUSIONS	REMARKS
BIOLOGICAL			
Benthic Biota	Grigg, R. W., 1972, Some Ecological Effects of Discharged Sugar Mill Wastes on Marine	Where sediments have accumulated, intertidal organisms, coral, and other benthic invertebrates have been covered. In the immediate vicinity of the mills, on rock outcrops, coral cover and diversity are reduced significantly. Normal reefs are present within 1.5km of all mills.	Results of 6 Hamakua Coast mills north of Papaikou Mill area.
	Environmental Protection Agency, 1971 (G)	In all cases, the bottom conditions around the mill discharges were characterized by major reductions in coral growths, and increases in sponges and benthic algae, two indicators of pollution.	
Pelagic Biota	Grigg, R.W., 1972 (G)	Changes in both species and abundance of nearshore fishes off sugar mills have been observed by fishermen since mechanical harvesting began. During this study fish catches off sugar mills were about one-third those off control stations. Some species have increased and others have declined off sugar mills.	Results of 6 Hamakua Coast Mills north of Papaikou Mill area.
	Environmental Protection Agency, 1971 (G)	In all cases, it was found that there was less fish life near the mill outfalls than in the various control areas. Mill discharges cause depletions in both quantity and diversity of fish life in the vicinity of the mill outfalls. The degree	

SUMMARY OF HISTORICAL DATA

TABLE I - 8

PARAMETER	REFERENCE	CONCLUSIONS	REMARKS
BIOLOGICAL Pelagic Biota/Cont.		of this reduction bears a direct relation to the degree and extent by which discharges affect the bottom area. Bio-assays found that Tilapia, Aholehole, and Mullet exhibited an ability to live in almost 100% sugar mill waste for a period of 96 hours, if adequate aeration was supplied. Nehu, a bait fish, indicated a much higher sensitivity to mill wastes than the other three species tested.	
	STATE OF HAWAII, Div. of Fish and Game, 1971-72 (S)	No conclusions given	Unpublished raw data sheets only for fiscal year July '71 to July '72. Gives area by species for area 105 (nearshore waters up to two miles offshore of Papaikou area).
PHYSICAL OCEANOGRAPHY			
Circulation	Kennedy Engineers, 1971 (S)	Tidal currents predominate in determining the path of travel of discolored mill waste water, while wind and wave currents predominate in determining the path of travel of floating fibrous material.	
	Laevastu, T. et al, 1964, Coastal Currents and Sewage Disposal in the Hawaiian Islands; HIG Rept. 64(1) (G)	Prevailing current along Hamakua Coast is parallel to shore and to the northwest during both ebb and flood tides.	

SUMMARY OF HISTORICAL DATA

TABLE I - 9

PARAMETER	REFERENCE	CONCLUSIONS	REMARKS
PHYSICAL OCEANOGRAPHY			
Circulation (Cont)	Wyrtki, K. et al, 1969.	Net flow 5 miles north of Papaikou was ESE at 33cm/sec. Resultant diurnal-semidiurnal tidal wave moves to NW at approximately 20cm/sec. during flood tide and to SE during ebb tide.	
Waves	Kennedy Engineers, 1971 (G)	Wind and wave currents predominate in determining the path of travel of floating fibrous material.	
Tides	Dillingham Corporation, 1973, Tide Calendar (G)	Tide time at Hilo occurs 59 minutes earlier than at Honolulu.	Shows tidal curves, moon phases, and time differences at different Hawaiian ports compared to Honolulu.
	Kennedy Engineers, 1971 (G)	Prevailing current along the Hamakua Coast is parallel to shore and to the northwest during both ebb and flood tides.	
	Wyrtki, K. et al, 1969, Current Observations in the Hawaiian Archipelago; HIG-69-15 (G)	Semidiurnal tide approached Hawaiian Archipelago from the northeast, diurnal tide from the west. Resultant tide apparently moves to northwest.	

SUMMARY OF HISTORICAL DATA

TABLE I - 10

PARAMETER	REFERENCE	CONCLUSIONS	REMARKS
METEOROLOGY			
Precipitation	U.S. Dept. of Commerce, National Weather Service (S)	Mean annual precipitation at Papaikou Station for 200 foot elevation 146.6 inches. At 1,400 foot elevation, 228.9 inches. For record period 1951-72.	Unpublished data sheets. Precipitation only.
	U.S. Dept. of Commerce, National Weather Service, 1961, Climates of the States, Hawaii. (G)	Normal annual total, Hilo 139.98 inches, maximum monthly total, 50.82 inches. Minimum monthly total 0.46 inches. For period of record 1921-50. 100 year-1 hour rainfall, 6-7 inches.	
Wind	U.S. Dept of Commerce, NOAA, Environmental Data Service, 1970, Local Climatological Data, Hilo, Hawaii (G)	Mean speed 7.4 mph from WSW. Maximum speed for 1 minute, 46 mph from 70° slope off Mauna Loa during the night and early morning hours.	The prevailing wind at Hilo Airport is not the northeasterly trade, but the southwesterly wind that drifts down.
Cloud Cover	Same as above. (G)	Mean number of days of cloud cover sunrise to sunset; clear, 30; partly cloudy, 125; cloudy, 210.	
Storms	Worthley, L. E., and Lee, C.H.B., 1967, Weather Phenomena in Hawaii; HIG-67-9 (G)	Number of frontal passages per winter season (Island of Hawaii); mean 9; maximum, 18; minimum, 2.	

SUMMARY OF HISTORICAL DATA

TABLE I - 11

PARAMETER	REFERENCE	CONCLUSIONS	REMARKS
NATURAL HAZARDS			
Tsunami	Adams, Wm. H., 1968, Potential Tsunami Inundation Zones for the Islands of Molokai and Lanai, Hawaiian Islands; HIG-68-15 (S)	Map, Fig. 26, shows runup at Papaikou as 35 feet in 1946; 9 feet, 1957 and 9 feet, 1960.	Highest tsunami runups on Island of Hawaii have occurred along the Hamakua Coast, 40 feet at Waipio, May 1946.
	Shepard, F.P., et al, 1950, The Tsunami of April 1, 1946 Univ. of California Press, Berkeley and Los Angeles (S)	Bathymetric surveys have shown evidence of submarine faulting off Hilo.	
	Macdonald, G.A. and Abbott, A., 1970, Volcanoes in the Sea; Univ. of Hawaii Press. (G)	Since the Island of Hawaii contains the only active volcanoes in the Hawaiian Islands, it is seismically active and, therefore, susceptible to locally generated tsunami.	
MAN INDUCED HAZARDS			
Bagasse	Environmental Protection Agency, 1971 (G)	Interferes with boating and fishing activities.	
AESTHETICS			
Discolored Water	Environmental Protection Agency, 1971 (G)	Discolored water opposed to the goals of the tourist industry which describes "the continuous blue, sparkling waters of the State" to potential tourists.	
Bagasse	Same as above (G)	Interferes with swimming activities. Also unsightly.	

SUMMARY OF FIELD OBSERVATIONS

February 17, 1973

Personnel: Dr. Karl Bathen
Arthur G. Cropper
Ronald Takazawa

Boat: 16' Boston Whaler
Lv. Landing 0920
Arr. Landing 1320

Tidal data, Hilo, Feb. 17, 1973: HH, 0300; LL, 1000; H, 1500; L, 2100

Sta. No.	Water Depth (M)	Time	Secchi Depth (M)	Temp. °C	Sample No.	Drifter Nos.	Remarks
1	S	0940	6	22.82	139	0356-0360	Light
	10				544		rain
2	S	1004	2	23.04	263	0351-0355	No
	5				264		rain
	10				446		
3	S	1017	4	23.17	135	0346-0350	No
	10				133		rain
	30				141		
4	S	1029	6	23.10	138	0341-0345	No
	10				147		rain
	30				281		
5	S	1042	6	23.13	282	0336-0340	Wind: 4 - 6 mph from 180°
	10				280		No
	30				279		rain
6	S	1112	1	23.32	283	0331-0335	No
	5				284		rain
	10				278		
7	S	1132	2	23.40	287	0326-0330	No
	5				288		rain
	10				285		

Table - II
Page 1

Summary of Field Observations (Continued)

Sta No.	Water Depth (M)	Time	Secchi Depth (M)	Temp. °C	Sample No.	Drifter Nos.	Remarks
8	S 10 30	1143	8	23.22	277 412 140	0319-0325	No rain
9	S 10 30	1154	12	23.28	136 542 413	0314-0318	No rain
10	S 30	1205	10	23.13	546 217	0309-0313	Most pristine water appearing in the site vicinity
11	S 5 10	1213	4	23.22	415 137 411	0304-0308	No rain
12	S 30	1257	6	23.08	409 286	0301-0303	On line between Pepeekeo Pt. and jetty at Hilo Harbor
13	2 ft above sea level on beach, below mill	1500	--	--	445	--	Water sample (See map for location)
	2 ft above sea level on beach below mill		--	--	261		Sediment sample from beach (See map for location)
14	--	1130 2-16-73	--	--	134	--	Flume sample

SUMMARY OF WATER QUALITY PARAMATERS FOR KAPUE STREAM

February 16-17, 1973

Site Sample	Flow[1] cfs	Temp °C	D.O. mg/l	Turb. FTU	pH	Salinity o/oo	Nitrogen as N: Total[2] kjedahl mg/l	NO_2 mg/l	NO_3 mg/l	Total mg/l	Total lbs/day	Phosphorus as P: Total mg/l	Total lbs/day	Coliforms: Fecal no/100ml	Total no/100ml
1	30	25	6.5	12.7	6.1	<0.1	0.567	0.002	0.026	0.595	96	0.135	22	10,000	410,000
2	18	19	9.4	0.8	6.4	<0.1	0.206	0.004	0.114	0.324	31	0.093	9	60,000	110,000
3	13	19	9.1	0.7	6.9	<0.1	0.189	0.006	0.153	0.348	24	—	—	500	30,000
4	10	17	10.9	0.6	6.0	<0.1	0.191	0.001	0.084	0.276	15	0.024	1	28	700

[1]Flow estimated by observed velocity and cross-section area at time of sampling.

[2]Total kjedahl nitrogen consists of organic plus ammonia nitrogen

Personnel:

Michael J. Chun, Ph. D.
Gordon L. Dugan, Ph. D.

SUMMARY OF WATER QUALITY DATA OFF PAPAIKOU, HAWAII, 2-17-73

Station and (Time)	Depth Meters	Temp. °C	Salinity 0/00	B.O.D. mg/l	pH Units	Nitrite mg/l	Nitrate mg/l	Total Kjeldahl N mg/l	React. P mg/l	Total P mg/l	Turbidity FTU	Secchi Depth m.
1	S	22.82	34.44	<1	7.93	0	.0042	.2263	0	.0968	0.72	6
(0940)	10	--	34.96	<1	7.99	0	0	.1819	.0078	.0260	0.86	
2	S	23.04	34.81	<1	7.99	0	0	.1677	.0090	.0731	2.0	
(1004)	5	--	34.91	<1	7.95	0	.0029	.2270	.0202	.0650	3.3	2
	10	--	34.96	<1	7.97	.0040	.1166	.2331	.0056	.0991	5.0	
3	S	23.17	34.67	<1	7.90	0	.0042	.0462	0	.0585	0.88	
(1017)	10	--	34.97	<1	7.97	0	.0028	.2559	0	.0845	0.39	4
	30	--	35.00	<1	7.93	0	.0029	.1505	0	.0910	0.25	
4	S	23.10	34.93	<1	7.94	0	.0015	.2004	0	.0682	0.45	
(1029)	10	--	34.96	<1	8.01	0	.0170	.1431	.0101	.0910	0.35	6
	30	--	35.04	<1	8.03	0	0	.0993	.0146	.0195	0.51	
5	S	23.13	34.77	<1	8.01	0	.0057	.1751	.0179	.0747	0.43	
(1042)	10	--	34.93	<1	8.02	0	.0184	.1486	.0090	.0114	0.45	6
	30	--	34.98	<1	8.04	0	.0014	.0678	.0078	.0991	0.36	
6	S	23.32	34.21	3.36	7.90	0	0	.1030	.0090	.0114	3.6	
(1112)	5	--	34.81	<1	7.83	0	.0085	.1548	.0246	.0503	3.6	1
	10	--	34.95	2.85	7.96	.0040	.0005	.1073	.0213	.0975	5.3	
7	S	23.40	34.46	<1	7.96	0	.0133	.1554	.0078	.0195	1.8	
(1132)	5	--	34.95	<1	8.03	0	0	-	.0090	.0211	0.55	2
	10	--	34.93	<1	8.00	0	.0767	.1116	.0101	.0146	0.37	
8	S	23.22	34.83	<1	8.00	0	.0044	.0469	.0034	.1023	0.32	
(1143)	10	--	34.99	<1	7.97	.0040	.0021	.0166	0	.0975	0.49	8
	30	--	35.01	<1	7.96	0	0	.1462	0	.0715	0.33	
9	S	23.28	34.85	<1	7.92	0	.0074	.1659	0	.0942	0.16	
(1154)	10	--	34.98	<1	7.99	0	0	.1048	0	.0146	0.20	12
	30	--	35.02	<1	8.03	.0020	.0108	.1307	0	.0828	0.22	
10	S	23.13	34.89	<1	7.97	0	0	.1838	0	.0747	0.84	
(120.)	30	--	35.03	<1	7.95	0	.0071	.2202	.0056	.0633	0.26	10
11	S	23.33	34.91	<1	8.01	.0059	.0091	.2374	0	.0828	1.70	
(1213)	5	--	34.96	<1	7.97	0	0	.1633	0	.0828	0.37	4
	10	--	34.97	<1	7.97	.0049	.0067	.0222	0	.0893	0.58	
12	S	23.08	34.76	<1	7.98	.0059	.0128	.0123s	0	.1055	0.64	
(1257)	30	--	35.00	<1	7.96	0	0	. -	.0067	.0097	0.44	6
13	Stream Sample	--	0.74	1.5	7.66	.0059	.0534	.3478	.0235	.0260	5.0	--
	Beach Sediment Sample	--	--	--	--	--	--	1.90	--	0.90	--	--
14	Flume Sample	--	0.1	<1	7.18	.0079	.0161	.2109	0	.0049	35.0	--

TABLE III

KAPUE STREAM-VISUAL OBSERVATIONS

Personnel: Dr. Michael J. Chun
Dr. Gordon L. Dugan

Date: February 16-17, 1973

Station Number	Observations
1. Mouth of Kapue Stream	Cane trash observed to depth of over two feet over half acre area. 300' above stream mouth, a very turbid mill discharge (5 cfs) containing fine black fibers. 750' above stream mouth, a second mill discharge observed (3 cfs) with digesting gas bubbles emitting along stream edge.
2. 1200' upstream from mouth	Stream is narrow with rapid flow around large boulders. Observed a refuse dump, 50' wide at base extending partially into stream. attached algae as well as long gray filamenous growths of what appear to be bacteria Sphaerotilus. Considerable amount of general trash and refuse observed in addition to refuse dump. Domestic sewage discharge (25 gpm) observed 200' below Stream sampling station 3.
3. 2800' upstream from mouth and 150' upstream from Belt Highway Bridge	Mildly foul odor together with abundance of refuse along this reach. Examination reveals that 500' upstream from station 3 (old highway bridge) is used regularly to dump household refuse. Many plastic bags caught in branches and on stream edge.
4. 26,000' above stream mouth.	Represents a pristine location on the stream that should represent an area unaffected by Man's domestic and agricultural activities. Appears to be the only area conforming with the present State of Hawaii "Water Quality Standards" for Class 1 and 2 waters.

HONOLULU AGENTS
C. BREWER & CO., LTD.
HONOLULU, HAWAII 96801

MAUNA KEA SUGAR COMPANY, INC.

P.O. Box 68
Papaikou, Hawaii 96781

THIS LETTER NO. MX-254

REFERS YOUR NO.

April 18, 1973

Mr. F. J. Rodriguez, President
Environmental Communications, Inc.
401 Kamakee Street
Honolulu, Hawaii 96814

Dear Sir:

We do not intend to use sewage effluent for irrigation of cane fields - as no irrigation is required in this wet area.

Very truly yours,

Ernest A. Smith

Ernest A. Smith,
Assistant Manager

EAS:hy

cc: Q. Dick Stephen-Hassard

APPENDIX 1

C. BREWER AND COMPANY, LIMITED
HILO BRANCH OFFICE

P.O. BOX 1801
HILO, HAWAII 96720
TELEPHONE 935-6671

April 23, 1973

E½C-560

Mr. Fred J. Rodriguez, President
Environmental Communications, Inc.
401 Kamakee Street
Honolulu, Hawaii 96814

Dear Fred:

In answer to your April 19 letter, to my knowledge there is no public access to the stream over either Mauna Kea Sugar Company lands or to the mouth of the stream through Hilo Coast Processing Papaikou factory. A major reason for this is because it is an industrial area and would be hazardous for the public to be in the area. Also it is expected that when the discharges of fibrous wastes and soil cease that the beach will disappear and the inlet which extisted before the beach was establised will return, further reducing the recreational value of the area.

Very truly yours,

C. BREWER AND COMPANY, LIMITED

Dick

Q. Dick Stephen-Hassard
Environmental Protection Coordinator

cc: Chung Dho Ahn

PUBLIC INFORMATION MEETING AND FORMAL PUBLIC HEARING

Two separate meetings were held in Papaikou, Hawaii, to discuss the proposed sewage treatment plant with the residents of the plantation community. The first meeting was an informal public meeting conducted by the County of Hawaii for purposes of advising the Community of the County's intent to build and operate the sewage treatment plant in Papaikou.

This meeting was held on June 28, 1973 at 7:30 PM, at the Papaikou Community Hall and the attendance was sparse. Presentations were made by the County Engineer's Office; engineering consultant, Chung Dho Ahn & Associates, and the environmental consultant, Environmental Communications, Inc.

Points covered during this informal public meeting were the recommended sites for the proposed treatment plant, the disposal means, implementation as required under PL 92-500; sewer use charges, and availability of the treatment facilities to Paukaa and Onomea.

On August 30, 1973, at 7:00 p.m., the Department of Health conducted a formal public hearing to take testimony on the request for a variance to Chapter 38, County of Hawaii; Mr. Edward Harada; the engineering consultant representative, Mr. Mike Yamaguchi; Mauna Kea Sugar Company representative, Mr. Ernest Smith; and Mr. Mitsuru Kakesako, a resident of Paukaa, who endorsed the proposed facility.

The balance of the hearing consisted of questions posed to the chief engineer re possible odors and their control; alternative sites to be considered; sewer use charges; time schedule when the treatment plant would be completed; and finally, various problems of connecting to the sewer lines from the street/roads to the individual homes.

Overall, the consensus of the audience at the formal hearing was in favor of the facility and questions and answers dealt with details of implementation.

APPENDIX 4

RESPONSES TO REVIEW OF

ENVIRONMENTAL ASSESSMENT

PAPAIKOU SEWAGE TREATMENT PLANT

COUNTY OF HAWAII

In response to the questions raised by the Corps of Engineers, we offer the following:

1. Existing Discharges

   Plate I is attached showing the "four locations" mentioned on page 8.

   The "three existing outfalls" mentioned on page 23 are labeled "A", "B", and "C" on Plate I. Mauna Kea Mill and Papaikou Mill are one and the same. Its location is shown on the attached Plates I and II. Also shown on Plate I are the plantation camps of Moirton, Anderton, and Silverton.

2. Proposed Project Site

   The Environmental Assessment is intended to evaluate the available sites, not make any recommendation.

3. Environmental Impact

   Page 71 has a summary of Water Quality Parameters of Kapue Stream for the locations shown on page 31-A.

   The basis and authority for determining the acceptability of the Kapue Stream discharge alternative is permissible by obtaining a variance from the State Department of Health. The Department of Health reviews each application for variance on a case by case basis, considering the location involved, and whether the actual use of the water areas will not be unreasonably interfered with. To qualify for a Federal Construction Grant administered by the U. S. Environmental Protection Agency, the minimum level of treatment is secondary biological treatment. Using a combination of EPA requirements and the State Health Department variance considerations, in conjunction with a suitable treatment facility, leads to the acceptability of stream discharge. Storage and usage of chlorine gas will be administered by trained personnel of the County of Hawaii.

4. Alternatives

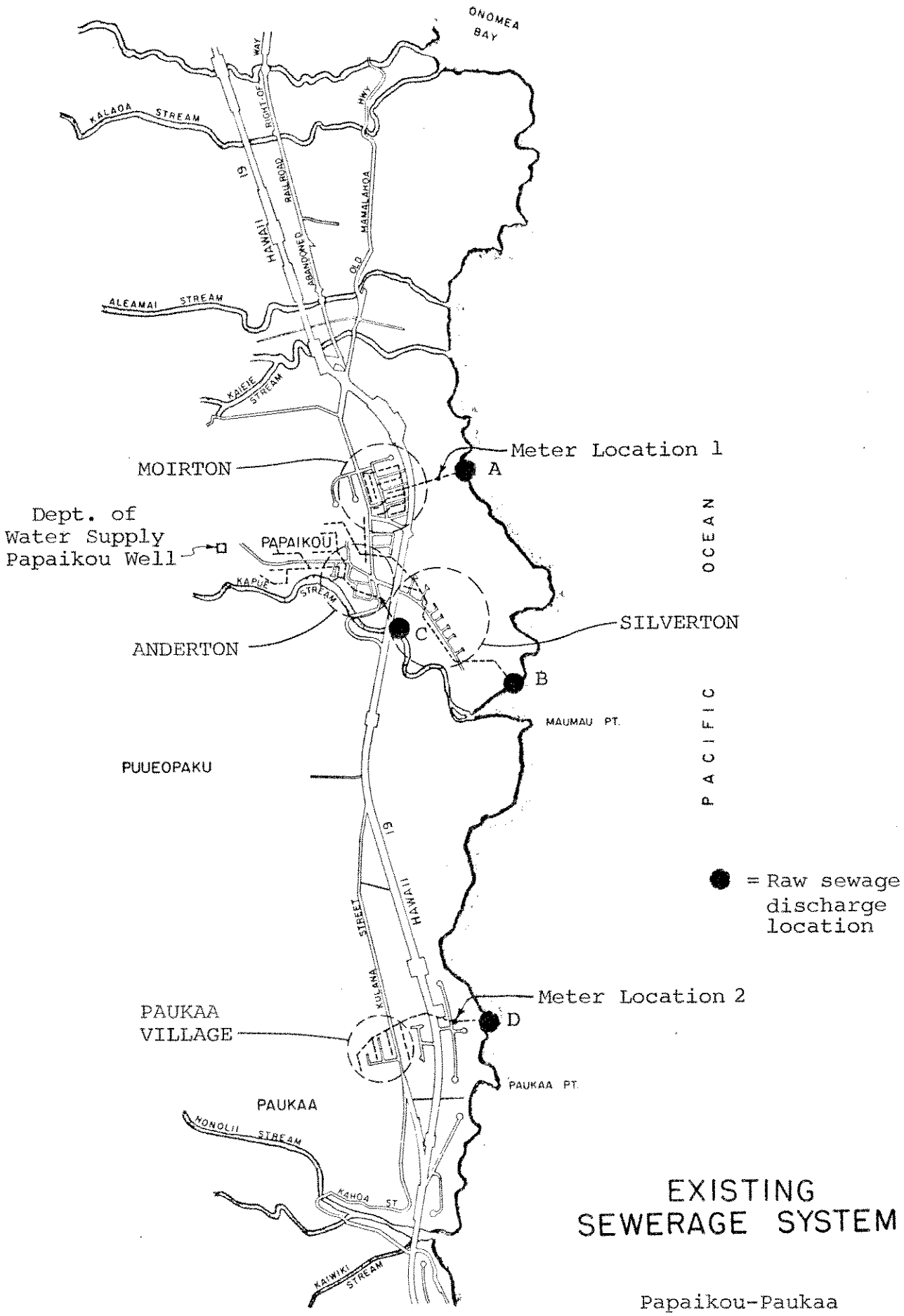
The term "tip elevation" used on pages 5 and 12 refer to the bottom of the hole drilled for the water well.

The location of the existing 12" well is shown on Plates I and II. The cost of drilling an injection well to a depth of 900 feet to avoid possible contamination of the ground water source was considered too high to justify any further investigations.

The alternative of "no action" would be against the objectives of the EPA and the State in cleaning up the waters of the State and the United States. The present condition and water quality of Kapue Stream is considered inferior to the proposed treatment and discharge of raw sewage effluent from the plantation camps. The mill administration is not proposing a private STP, but is cooperating by providing the necessary land area for the STP. The proposed treatment plant will be operated by the County of Hawaii.

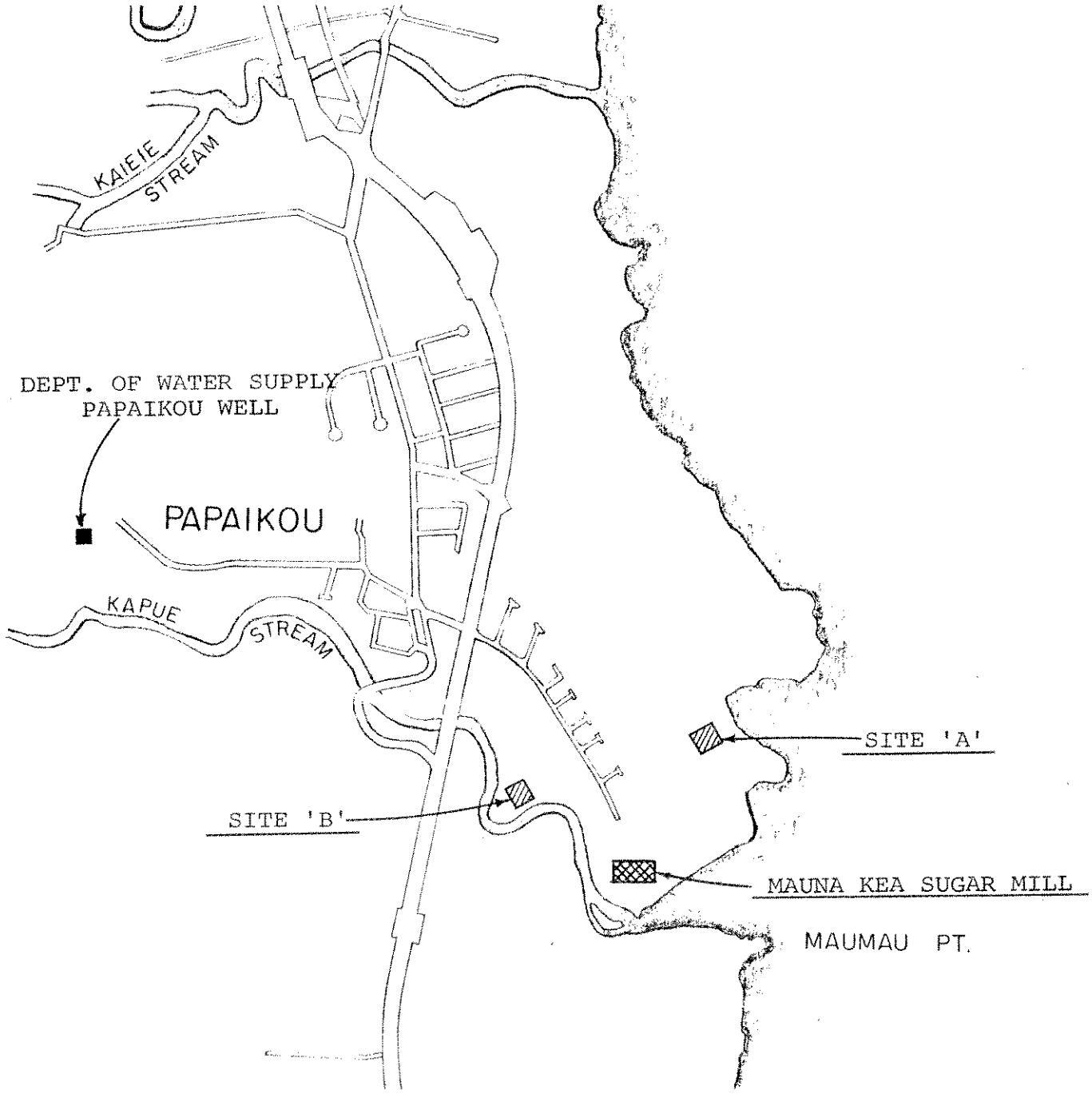
5. Cost and Financing

A portion of the engineering report is attached relating to the cost and financing of the project.



EXISTING SEWERAGE SYSTEM

Papaikou-Paukaa
Sewage System



ALTERNATE PLANT SITES

Papaikou-Paukaa
Sewage System

SECTION VI - PROGRAM COSTS

A. GENERAL

This section presents the construction costs for the proposed treatment plant and appurtenant items. The construction cost for the system will be analyzed in terms of monthly expenditures over a 20 year period. A discussion of operational and maintenance costs is included for development of user charges. The costs are preliminary estimates but are accurate enough for fiscal planning. Possible sources of funding are included in this section but policy decisions are necessary for the amount of Federal and State participation.

B. COST OF CONSTRUCTION

The cost of construction for the treatment plant and appurtenant items is presented in Table VI-1. These costs are 1973 costs on the Island of Hawaii and include allowances for construction inspection, construction administration, engineering and contingencies. Cost of land or interest on monies invested during construction are not included. The cost of the recommended system is $1,350,000.

TABLE VI-I
ESTIMATES OF COST

ITEM	DESCRIPTION	
1.	350,000 GPD Activated Sludge Treatment Plant	$ 350,000
2.	Effluent Disposal System	10,000
3.	Onomea Pump Station	12,000
4.	Transmission Line "A"	96,000
5.	Paukaa Pump Station	17,000
6.	Transmission Line "B"	145,000
7.	Paukaa Collection System	224,000
8.	Papaikou Collection System	173,000
9.	Onomea Collection System	98,000
	Sub-total	$1,125,000
	Engineering, Inspection and Contract Administration at 20%	225,000
	TOTAL	$1,350,000

Under the Federal Water Pollution Control Act Amendments of 1972, the Federal share of the cost of local treatment facilities is now 75% with State and local governments paying the balance. In order to qualify for a Federal construction grant, sewage treatment plants must provide a minimum of secondary treatment. Assuming that the State participates to the extent of 50% of the remaining cost, the capital expenditure of the County of Hawaii is reduced to 12½% of the eligible costs. With Federal and State participation as noted above the cost to the County of Hawaii is estimated at $168,750.

C. CONSTRUCTION COST PER CONNECTION

Based on the total treatment cost set forth and assuming an average of 590 connected services during the 20 year life of the project, the average annual expenditure per service would be approximately $190.00 or $15.83 per month on an interest free basis.

The collection and treatment of wastewater from a community provides a specific benefit for each dwelling or industry connected to a sewer and a general benefit in public health, improved environment and increased property values. The fact that sewer service is available creates values for

vacant lands and capacity in collection and treatment facilities must be pre-constructed and kept in standby for development of vacant lands.

D. WASTEWATER SERVICE CHARGE

Due to the aforementioned factors regarding the benefits of sewer service, most communities divide the cost of wastewater services between a tax rate for services giving general benefit and a direct monthly service charge. When this is done, the matter of service charges for commercial and industrial users becomes complex in that some industries with high assessed valuation produce small quantities of wastewater while others contribute large quantities of wastes and have low assessed valuation.

The Environmental Pollution Agency has set user-charge guidelines pursuant to Section 204 of the "Federal Water Pollution Control Act Amendments of 1972," PL 92-500. The act stipulates that Federal grant applicants shall receive such grants only after it has been determined that the applicant has adopted or will adopt a system of charges wherein each recipient of waste treatment services will pay its proportionate share of the costs of operation and maintenance including replacement.

The two basic types of user charge systems within the EPA guidelines are:

1. A system which charges each user a share of the treatment works operation and maintenance costs based on his proportional contribution to the total treatment works loading.

2. A system which establishes classes for users having similar wastewater characteristics. Each class is then assigned its share of the waste treatment works operation and maintenance costs based on its proportional contribution to the treatment works loading.

As established earlier, there are no industrial waste contributors in the study area. The assignment of commercial and institutional (schools) classes for this area appears unwarranted considering their size and flows in relation to the total amount. The type of discharge from these sectors will be quite similar to that from the residential sector. Therefore, a user-charge system based on proportional contribution to the total treatment works loading is appropriate.

A method of user charge development on a volume basis is as follows:

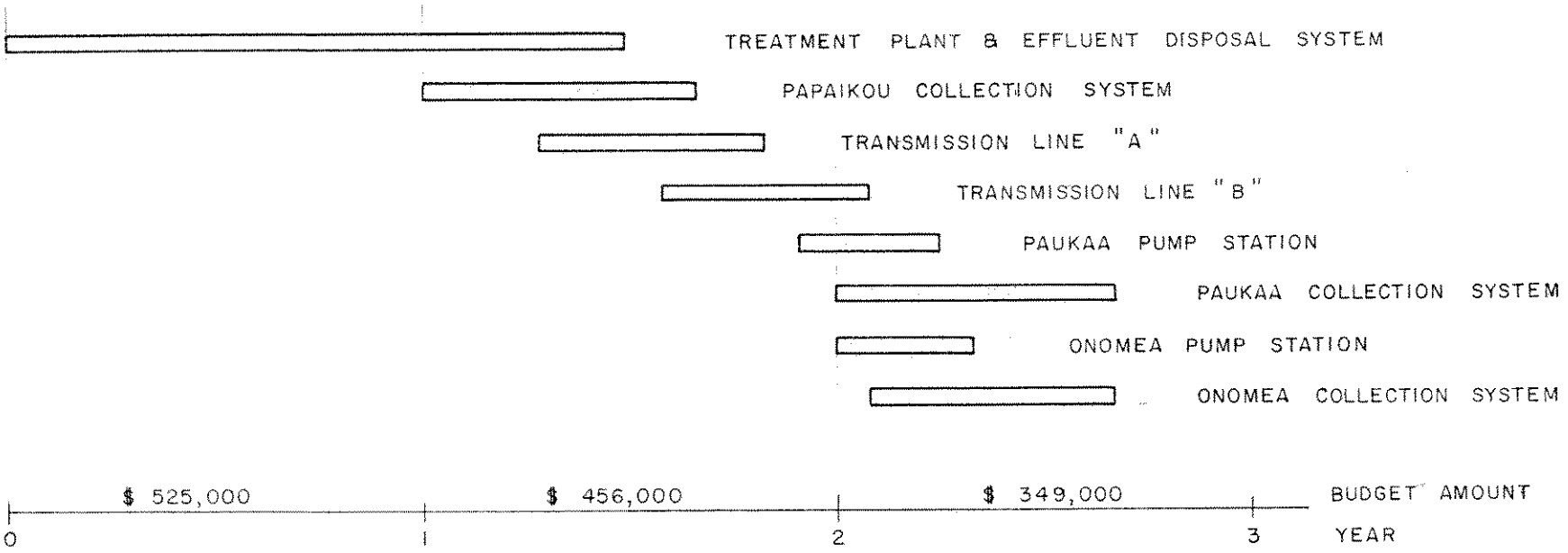
$$C_u = \frac{C_T}{V_T} \quad (V_u)$$

Where C_u = A user's annual charge
C_T = Total annual operation and maintenance costs
V_T = Total annual volume contribution from all users
V_u = Annual volume contribution from a user

The annual operation and maintenance costs for the proposed treatment plant is estimated at $38,000 as shown in Table VI-2. The operational costs were accrued from records of a sewage treatment plant of similar size on Oahu, Hawaii; the costs obtained were then revised to reflect the high utility cost of the Island of Hawaii. Operator pay and work schedules are shown in Table VI-3 and Table VI-4, respectively.

Based on the estimated operational and maintenance cost of Table VI-2, the annual user charge would be $64.00 per household. The monthly user charge is $5.33. The user charge should be reviewed annually and updated periodically to reflect the actual treatment works operation and maintenance costs.

An approximate timetable is shown in Figure VI-1. Interest and cost escalations were not included in the budget amounts indicated.



SCHEDULE OF IMPLEMENTATION

BUDGET AMOUNT INCLUDES ENGINEERING,
INSPECTION AND CONTRACT ADMINISTRATION

Papaikou-Paukaa
Sewage System
Figure VI-1

TABLE VI-2
ANNUAL OPERATIONAL AND MAINTENANCE COST

Operational Personnel	$21,500
Grounds Maintenance	$ 3,000
Power	$ 7,500
Water	$ 1,600
Telephone	$ 300
Telemetering	$ 300
Chlorine	$ 700
Dewatering Chemicals	$ 650
Miscellaneous Chemicals	$ 200
Lubricants	$ 200
Fuel and Oil	$ 100
Spare Parts Contingency	$ 1,000
Miscellaneous Supplies and Materials	$ 750
Expendable Supplies	$ 200
	$38,000