ENVIRONMENTAL IMPACT STATEMENT
OF THE
KULAIMANO SEWAGE DISPOSAL SYSTEM

Prepared for:

County of Hawaii

S. HIRATA, LOW, TOM & HARA, INC. ENVIRONMENTAL ENGINEERS

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Prepared for:

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Prepared by:

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September 1975

KULAIMANO SEWAGE DISPOSAL SYSTEM
Pepeekeo, Hawaii

( ) DRAFT (X) FINAL

Responsible Office: Department of Public Works
County of Hawaii

Name of Action: (X) Administrative ( ) Legislative

1. Proposed Action

The proposed action is the development of a sewage collection, treatment, and disposal system, including access road and offsite utilities, for the Kulaimano area on the island of Hawaii. This facility will serve the C. Brewer & Company's Kulaimano Heights development and portions of the adjoining Kulaimano Homestead. When fully developed, average sewage flows are anticipated to be 0.5 mgd. To accommodate possible future connections from the lower Kulaimano Homestead, the plant will be expandable to at least 0.8 mgd.

2. Environmental Impact

The environmental impact on the natural environment is not likely to be significant because of the small volume of sewage. Disposal of chlorinated effluent over the cliffs into the surf zone north of Waimaauou Stream is the proposed method of disposal. Water quality effects of this effluent are anticipated to be small since natural surface runoff, groundwater discharge, and discharge from sugar mill activities presently dictate the quality of the coastal waters.

The environmental impact of the proposed action is primarily on the human environment. The sewerage facilities are necessary to provide an adequate system for treatment of waste flows generated by the proposed Kulaimano Heights development. The development will make available new low-cost housing to plantation workers who presently reside in old, substandard housing.

3. Adverse Impact

Adverse impacts would be those primarily associated with the construction of the facility: dust, noise, traffic inconveniences. These impacts are temporary and can be mitigated by a conscientious effort by the contractor. Further, construction of the proposed facility would blend with the ongoing construction of the Kulaimano Heights development and sugar harvesting operations in the surrounding area.

4. Alternatives

Several alternatives were investigated. The first is to do nothing. This alternative would have the following adverse consequences:

a. Compelled use of individual disposal systems (cesspools) by the development. This form of treatment provides little water quality control, and its long-term applicability is questionable.

b. Continued habitation of the substandard homes. This would mean the continuation of raw wastewater disposal into streams, a violation of Public Law 92-500.

Another alternative is the implementation of a regional system, combining and treating waste flows from Kulaimano and Papaikou (the adjoining area) at a single plant. This alternative becomes viable only when ocean outfalls are mandatory for effluent disposal.

5. Irreversible and Irretrievable Resources

Irreversible and irretrievable resources include the capital, energy, and manpower to construct facilities and sustain operations. The effects of the effluent discharge on the surf zone are not irreversible because of the small volume of waste flows and the ability of the ecosystem to recover after discontinuation of discharge.

6. Long- and Short-Term Effects

The proposed action provides for the long-term productivity of resources of land, energy, and capital, as compared to separate facilities that would have been necessary in the short term to treat waste flows generated by the isolated communities.

The more promising direction in which to move is to phase out the old, inefficient methods of treating sewage and to build a central plant in their place. This plant will provide better sewage treatment in a more economical manner.

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ENVIRONMENTAL IMPACT STATEMENT
OF THE
KULAIMANO SEWAGE DISPOSAL SYSTEM

BACKGROUND

The Kulaimano area is about eight miles north of Hilo, the county seat (see Figure 1). It is situated on the eastern slope of Mauna Kea and is bounded on the north by Paheehee Stream, on the south by Kawainui Stream, and extends to the shoreline on the east. The location of the Kulaimano area is shown on Figure 1 along with the adjacent Paukaa-Papaikou area.

The major communities include Honomu, Pepeekeo Mill Camp, Andrade Camp, Kulaimano, and Kawainui. The area covers approximately 15,400 acres, much of which is planted in sugar cane or is unused open space.

Proposed Action

The proposed project is the development of a sewage collection, treatment, and disposal system, including access road and offsite utilities, for the Kulaimano area on the island of Hawaii. This facility will serve the C. Brewer & Company's Kulaimano Heights development and portions of the adjoining Kulaimano Homestead. The Kulaimano Heights development, covering an area of 300 acres, is planned to support approximately 740 residential units and small commercial establishments. Most of these units are anticipated to be sold at cost or rented to families of plantation workers who presently reside in substandard plantation houses. An excess of 200 units would be available to nonplantation workers. Discussions with C. Brewer & Company indicate that approximately 200 units are already existing, and the remaining 540 units are to be constructed by 1980.

Adjacent to C. Brewer & Company's Kulaimano Heights development is the Kulaimano Homestead, covering approximately 240 acres of privately-owned land that is committed to cane planting for the next ten years. Future urban development is possible here, with future land use controls and policy decisions on land zoning probably determining its degree and rate of urbanization.

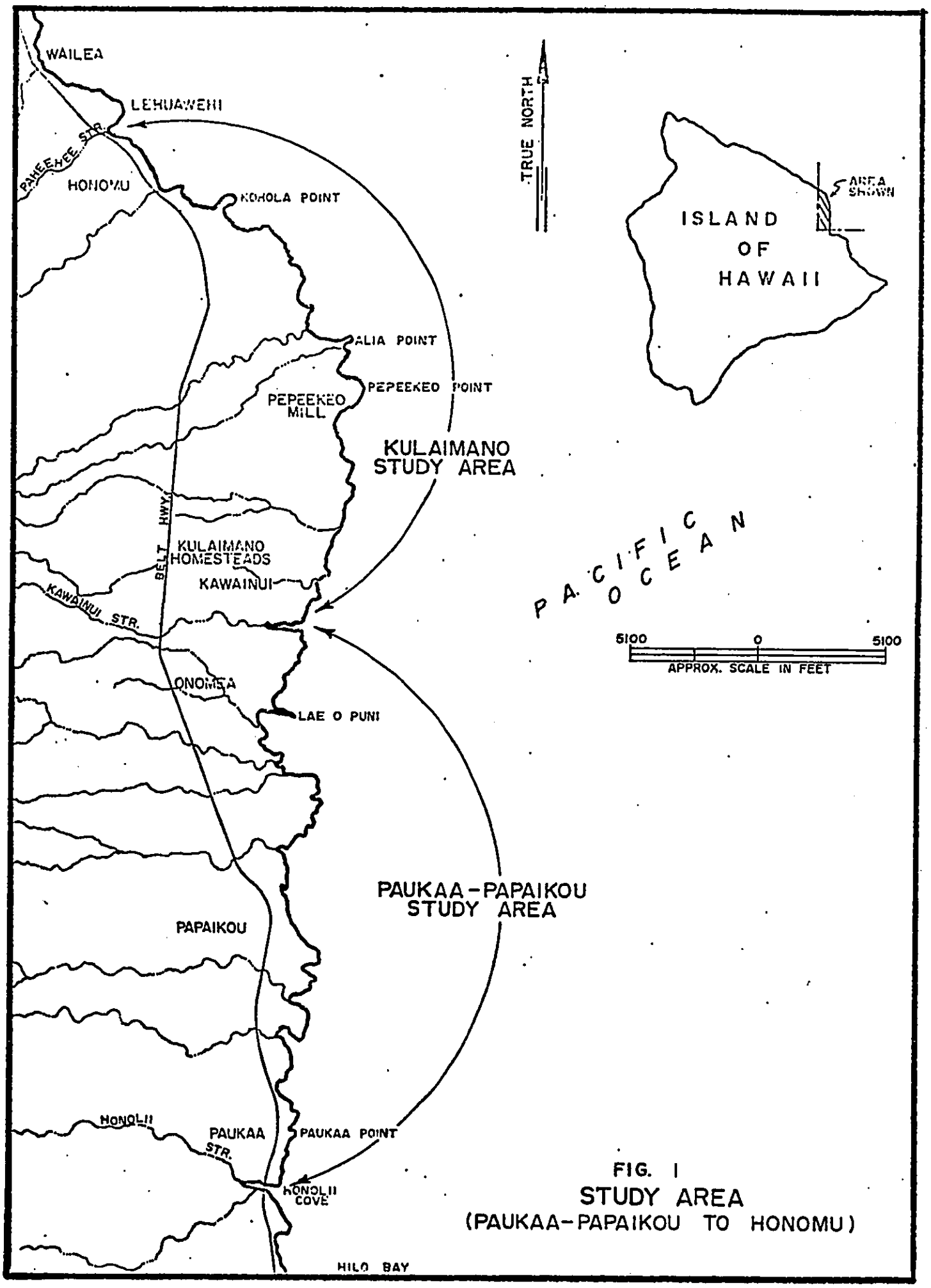


FIG. 1
STUDY AREA
(PAUKAA-PAPAIKOU TO HONOMU)

When the tributary area is fully developed, average sewage flows are anticipated to be 0.5 mgd. To accommodate possible future connections from the lower Kulaimano Homestead, the plant will be expandable to at least 0.8 mgd.

The planned secondary treatment facility is designed to meet the 1972 amendment of the Federal Water Pollution Control Act (PL 92-500) requirement that by July 1977 the "best practicable" control technology be applied to all point discharges. The Environmental Protection Agency (EPA) has, for the case of municipal sewage, interpreted "best practicable treatment" to mean any of several available secondary treatment processes. The proposed system selected for Kulaimano will utilize the activated sludge process to meet this requirement.

Presently the primary method for the disposal of sewage in the Kulaimano area is to discharge the untreated wastewater into streams. However, sewage flows from approximately 50 newly-constructed homes are to be treated by a stabilization pond in the interim period until completion of the new treatment plant.

Construction of the proposed sewage collection, treatment, and disposal system will be coordinated with the planned elimination of the old C. Brewer & Company plantation homes and the relocation of the families into a new community known as the Kulaimano Heights development.

Recommended Wastewater Management System

The tributary area, treatment plant location, and discharge line of the recommended system are shown on Figure 2. The treatment plant location was approved at a public hearing and meeting conducted by the State Land Use Commission. The plant is sized for 0.5 mgd; the sewerage tributary area is shown on Figure 2. However, if the Lower Kulaimano Homestead area east of the proposed plant location and between Waimaauou Stream and Waiaama Stream is developed, the plant can easily be expanded to approximately 0.8 mgd to accommodate the estimated increase in flow of 0.3 mgd.

The proposed treatment system schematic is shown on Figure 3. The basic unit components of the treatment plant include:

1. Grit chamber-comminution: to remove grit and reduce large-sized particles

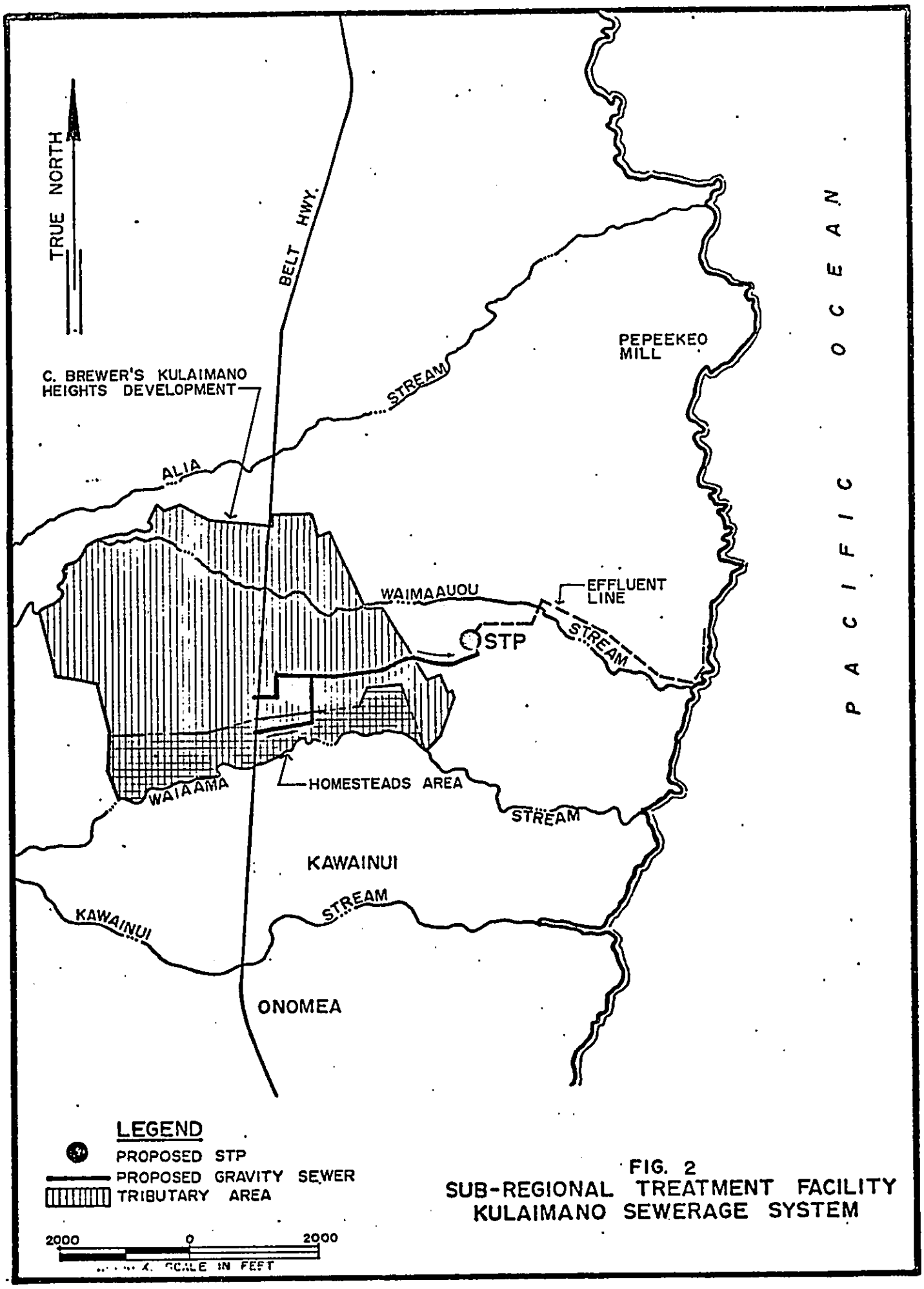


FIG. 2
SUB-REGIONAL TREATMENT FACILITY
KULAIMANO SEWERAGE SYSTEM

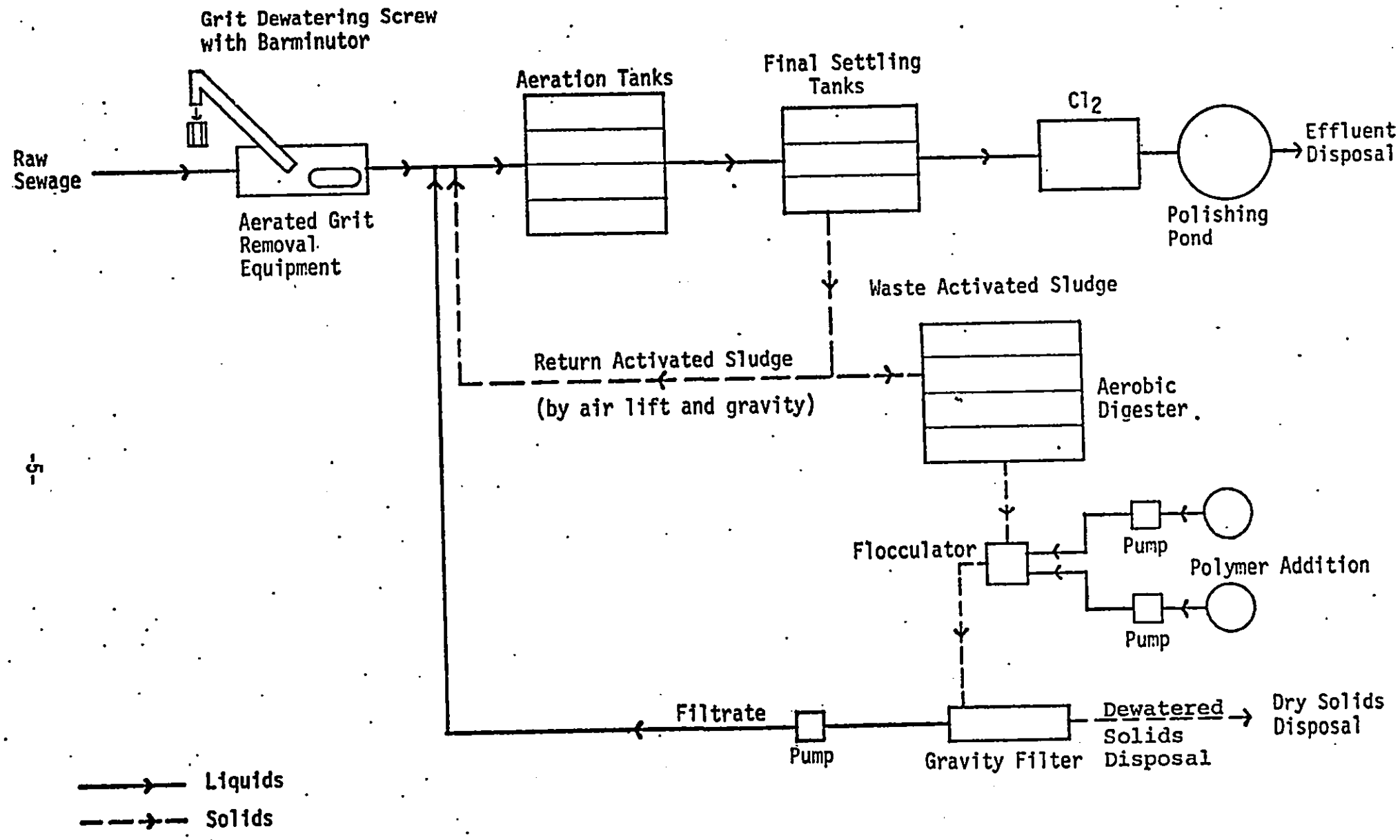


FIGURE 3

SCHEMATIC FLOW DIAGRAM OF RECOMMENDED TREATMENT PROCESS

2. Aeration units: to stabilize soluble and colloidal BOD
3. Final clarifiers: to remove settleable solids and biomass created in the aeration unit
4. Chlorination unit: to provide for disinfection of effluent
5. Aerobic digesters: to stabilize volatile organic solids
6. Gravity filtration: to dewater treated sludge for disposal of residue
7. Polishing pond: to further reduce organic matter prior to discharge

The dewatered, aerobically digested solids will be hauled to a municipal sanitary landfill for disposal.

Disposal of the treated and chlorinated effluent will be by gravity line discharging on the north side of Waimaauou Stream. (See Figure 4 for details of effluent discharge over the cliffs.)

Standby generators, rated at 400 kw, will be provided in the event of power failure.

The approximate budgetary cost of the proposed system is $2.9 million, and an itemization is given below.

Trunk sewers	$ 600,000
Sewage treatment plant	1,800,000
Outfall sewer	300,000
Offsite utilities, including water, power, road	200,000
Total	$2,900,000*

* Does not include cost of land, administration, and engineering. O&M cost is based on 0.5 mgd flow and estimated at $95,000/yr.

Funding for the project is based on these proportions:

Federal:	75%
State:	10%
County and C. Brewer:	15%

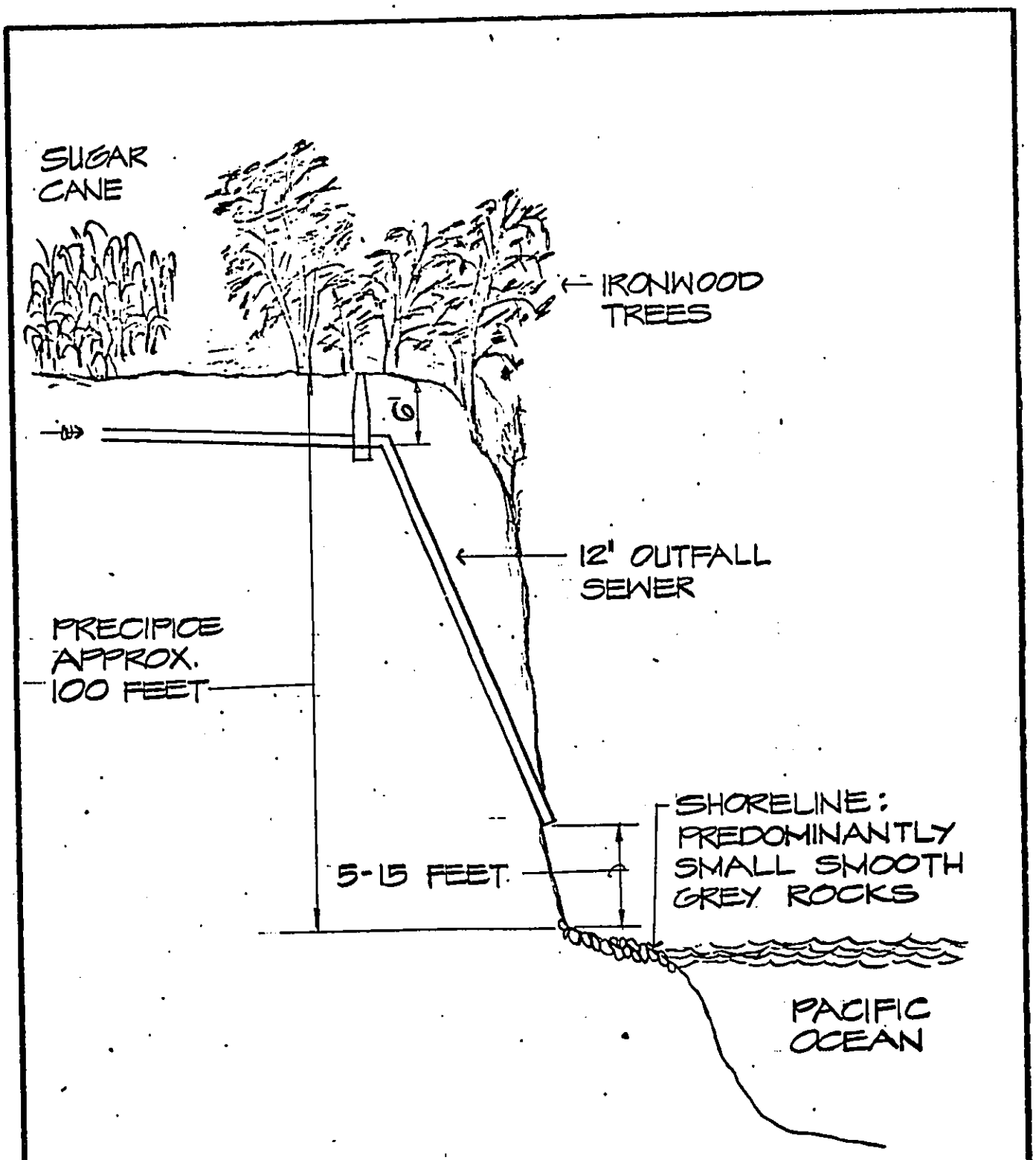


FIGURE 4

DISCHARGE AREA FOR EFFLUENT FROM KULAIMANO STP

NO SCALE

The County of Hawaii will be responsible for the operation and maintenance of the sewerage system.

DESCRIPTION OF THE AREA WITHOUT THE PROJECT

Topography and Climate

As noted previously, the Kulaimano study area is located about eight miles north of Hilo on the eastern slopes of Mauna Kea. At the lower elevations (about 40 percent of the area in question) the land slope is generally less than 10 percent, except for the cliffs along the coastline. The upper portion of the developed area, most of which is sugar cane fields, has a slope greater than 10 percent. The cane fields themselves presently cover approximately 30 percent of the total study area. The area is transected by several narrow valleys cut by perennial streams.

The mean annual rainfall varies from about 125 inches near the coastline to about 200 inches in the highlands. The highest rainfall occurs from November through March. Because of this ample rainfall, the sugar fields in this region are among the few in the state that do not require irrigation.

The wind rose for the Kulaimano area is believed to be similar to that for the Hilo Airport, which shows a predominance of easterly trade-winds with an average velocity of about 12 MPH (Appendix A).

Hydrology

The coast of the Pepeekeo region--in the sector between Hilo and Honohina, which includes the subject area--receives the highest range of direct surface runoff and groundwater flux for the entire island of Hawaii. Maximum annual average rainfall in the drainage basin exceeds 300 inches at the higher elevations. The runoff:rainfall ratio is estimated to be nearly 50 percent, giving an average surface runoff of about 7 mgd/sq mi. This is equivalent to about 55 mgd/mile of coast. By comparison, the Hanalei River drainage area on the island of Kauai has surface runoff of about 52 mgd/mile of coast, and the average runoff for the entire 94-mile Kauai coastline is 25 mgd/mile. For Oahu the value is much less, with an estimated surface runoff of 5.4 mgd/mile. It is evident from the estimate for the Pepeekeo region that the surface runoff rate for this area is among the highest in the state.

The groundwater flux is also estimated to be very large, on the order of 750 to 1,500 gpd/foot of coast, equivalent to 4 to 8 mgd/mile of coast, probably a conservative estimate. Together with the surface runoff, the total flux of water occurring naturally to the coastal waters in the region is about 60 to 65 mgd/mile of coast. During periods of low rainfall, only groundwaters discharge to the coastal water region.

Water Quality

Water quality sampling results have been reported by the State Department of Health and by Kennedy Engineers. A summary of the Department of Health's shoreline results is given in Table 1. The sampling station locations and outfall locations are shown on Figure 5. The results of the 1967 Kennedy Engineers' study of the water quality effects of the Pepeekeo mill discharge are given in Table 2, and the sampling station locations are shown on Figure 6.

The Department of Health data indicate a relatively high suspended solids concentration, which is probably due to stream runoff. The data also indicate that the shoreline waters in the area do not now always meet the State Water Quality Standards for bacteriological and nutrient concentrations. Similar observations have been made at numerous locations elsewhere in the state (e.g., Waimea, Kauai).

The following is a synopsis of the conclusions from the Kennedy Engineers' report.

1. A major effect of mill wastewater discharge into coastal waters is the impairment of their aesthetic quality, for example, the sight of fibrous cane trash and turbid, brown waters.
2. Tidal currents determine the path of travel of discolored water, while wind and wave action govern the path of travel of floating fibrous material.
3. Dissolved oxygen, pH, and temperature values were not substantially altered by mill waste discharge.
4. Nutrient levels of nitrogen and phosphorus were not significantly altered.

TABLE 1

SHORELINE WATER QUALITY DATA (DOH)

(Units in mg/l unless otherwise noted. See Figure 4 for sample site location.)

	Parameter	Median	Mean	Range	No. of Samples
Honolii - Ocean (Period: 9/71 to 9/73)	NO_2 and NO_3-N	0.030	0.030	0 to 0.050	8
	Total Kjeldahl Nitrogen	0.060	3.89	0 to 30	8
	Total Nitrogen	0.100	4.42	0.030 to 34	8
	Total Phosphorus	0.023	0.024	0.000 to 0.045	8
	Turbidity (JTU)	5	8.5	3.5 to 17	3
	Settleable Solids (ml/l)	0.7	0.7	--	1
	Total Coliform (no./100 ml)	460	2,500	9 to 11,000	17
	Fecal Coliform (no./100 ml)	9	200	3 to 1,100	17
Kolekole Gulch - Ocean (Period: 2/72 to 12/73)	NO_2 and NO_3-N	0.010	0.023	0 to 0.110	11
	Total Kjeldahl Nitrogen	0.140	0.223	0 to 0.920	11
	Total Nitrogen	0.150	0.245	0 to 0.920	11
	Total Phosphorus	0.020	0.026	0 to 0.080	11
	Turbidity (JTU)	5.300	5.932	0.090 to 14	6
	pH	8.2	8.2	--	1
	Total Solids	35,600	35,600	--	1
	Total Coliform (no./100 ml)	460	1,100	16 to 4,600	8
	Fecal Coliform (no./100 ml)	4	72	3 to 460	8

TABLE 2

RECEIVING WATER CHARACTERISTICS AT PEPEEKEO MILL

PLANTATION: Pepeekeo Sugar Company
Pepeekeo, Hawaii

SAMPLING DATE: 12/14/66 (N.G.)
WIND: SE 5K WAVES: E 3'

TIME: 11:30 - 12:30
TIDE: LO 12:46 + 0.3

Station	Sampling Depth (ft)	pH	Clarity			Temperature (oC)	Dissolved Oxygen		Color A.P.H.A. (units)	Cond. Mhos (cm)	Chlorides (g/l)	Solids			BOD (5-Day) (mg/l)	Nitrogen (mg/l)	Phosphorus (mg/l)	Coliform	
			Secchi (ft)	Vert. Extin Coefficient (per meter)	Jackson Turb units		MG/L	% Saturation				Settleable (ml/l)	Suspended (mg/l)	Volatile (mg/l)				Total (MPN)	Enteric (MPN)
A	40	8.1	4	0.5	3.2	25.5	7.4	100+	0	--	--	0.1	8.8		0.2	--	--	2	1
(Outf)	S	8.1			7.4	25.5	7.5	100+	0	34.97	--	0.1	20.0		2.2	--	--	28	18
B	35	8.1	30	0.15	3.7	25.0	7.5	100+	0	--	--	--	10.0		1.0	--	--	2	1
(1/4 S)	S	8.2			2.6	25.2	7.7	100+	0	33.29	--	--	7.2		--	--	--	2	1
C	100	8.1	55	0.09	2.6	25.2	7.5	100+	0	--	--	--	2.0		1.5	--	--	2	1
(1/4 E)	S	8.1			2.2	25.5	7.5	100+	0	34.97	--	--	10.4		0.6	--	--	2	1
D	70	8.1	40	0.11	--	25.5	7.5	100+	0	--	--	0.1	30.0		0.8	--	--	2	1
(1/4 N)	S	8.2			2.6	25.3	7.6	100+	0	--	--	--	5.2		--	--	--	2	1
E	70	8.2	28	0.16	--	25.0	7.5	100+	--	--	--	--	60.0		--	--	--	2	1
(1/2 S)	S	8.2			--	25.1	7.5	100+	--	--	--	--	2.0		--	--	--	2	1
F	100	8.1	42	0.11	2.1	24.7	7.5	100+	0	34.97	--	0.1	6.2		1.5	--	--	2	1
(1/2 E)	S	8.1			--	24.8	7.4	100+	--	--	--	--	--		--	--	--	2	1
G	60	8.1	14	0.31	4.0	25.1	7.5	100+	0	32.76	--	--	10.8		1.9	--	--	2	1
(1/2 N)	S	8.1			2.9	25.0	7.7	100+	0	--	--	--	4.0		--	--	--	2	1
H (1 S)																			
I (1 E)				N O		A V A	I L	A B L	E		D A T A								
J (1 N)																			

Visual Observations:
Brown discoloration extending about 500' offshore from the mill and 1,000' north and south along coast.

Source: "Report on Hawaiian Sugar Factory Waste Receiving Water Study", Kennedy Engineers, 1967.

Table 2, Cont.

PLANTATION: Pepeekeo Sugar Company
Pepeekeo, Hawaii

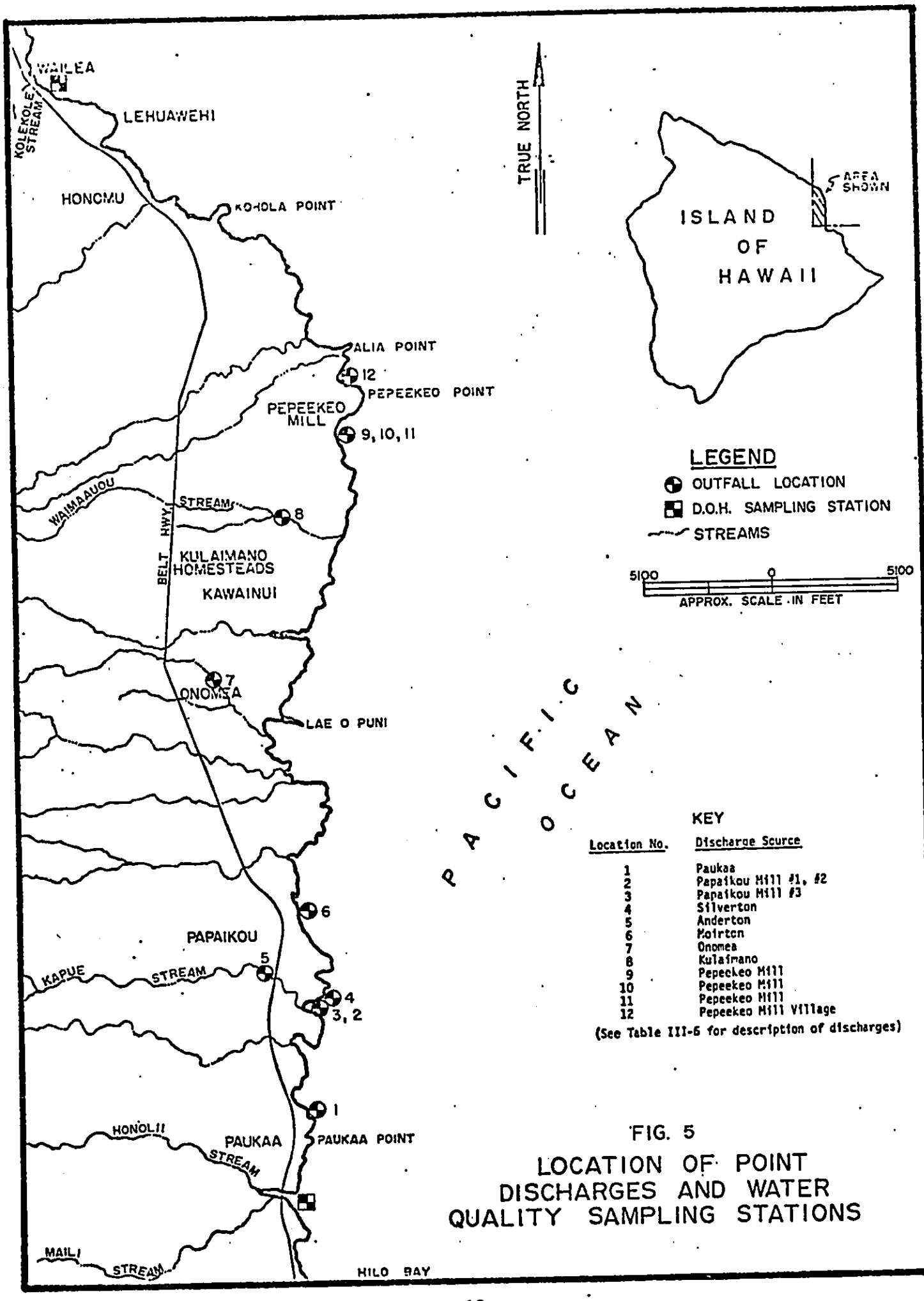
SAMPLING DATE: 1/16/67 (G.)
WIND: SE 5K WAVES: SE 2'

TIME: 13:30 - 14:30
TIDE: LO 13:52 + 0.2

Station	Sampling Depth (ft)	pH	Clarity: Secchi (ft)	Clarity: Vert. Extinc Coefficient (per meter)	Clarity: Jackson Turb units.	Temperature (°C)	Dissolved Oxygen: MG/L	Dissolved Oxygen: % Saturation	Color A.P.H.A. (units)	Cond. Mhos (cm)	Chlorides (g/l)	Solids: Settleable (ml/l)	Solids: Suspended (mg/l)	Solids: Volatile (mg/l)	BOD (5-Day) (mg/l)	Nitrogen (mg/l)	Phosphorus (mg/l)	Coliform: Total (MPN)	Coliform: Enteric (MPN)
A	20	7.8	2	0.5	3.7	23.5	7.3	100+	6.0	46.18	--	0.1	12.8	--	5.0	--	--	24	1
(Outf)	S	7.9			23.2	23.8	7.3	100+	16.0	44.2	--	0.1	27.5	--	12.1	--	--	100	4
B	50	7.8	19	0.22	5.5	24.0	7.2	100+	3.0	41.6	--	0.1	12.8	--	3.8	--	--	4	1
(1/4 S)	S	7.8			4.8	23.9	7.2	100+	4.0	42.23	--	0.1	10.4	--	4.8	--	--	12	1
C	50	7.9	22	0.19	3.1	24.0	7.2	100+	4.0	42.43	--	0.1	11.2	--	4.3	--	--	4	1
(1/4 E)	S	7.9			3.2	24.0	7.3	100+	4.0	46.18	--	0.1	12.4	--	4.3	--	--	4	1
D	50	7.9	12	0.33	3.0	23.5	7.2	100+	2.0	42.43	--	0.1	11.2	--	4.8	--	--	4	1
(1/4 N)	S	7.9			5.1	23.5	7.2	100+	3.0	42.43	--	0.1	12.0	--	5.0	--	--	82	1
E	50	7.7	19	0.22	3.8	24.0	7.3	100+	4.0	42.43	--	0.1	6.4	--	4.9	--	--	4	1
(1/2 S)	S	7.8			3.1	24.0	7.1	100+	3.0	42.43	--	0.1	10.8	--	4.8	--	--	4	1
F	50	7.8	29	0.15	--	24.0	7.3	100+	3.0	--	--	0.1	34.0	--	4.9	--	--	4	1
(1/2 E)	S	7.8			3.0	24.0	7.4	100+	6.0	42.43	--	0.1	14.0	--	5.2	--	--	4	1
G	50	7.9	7	0.46	2.3	24.0	7.0	100+	5.0	42.43	--	0.1	2.8	--	3.5	--	--	4	1
(1/2 N)	S	7.8			5.8	23.6	7.1	100+	5.0	42.43	--	0.1	10.4	--	4.1	--	--	60	1
H (1 S)																			
I (1 E)						NO AVAILABLE DATA													
J (1 N)																			

Visual Observations:
Waste discoloration extending about 1,000' around entrance of the bay at mill waste discharge.

Source: "Report on Hawaiian Sugar Factory Waste Receiving Water Study", Kennedy Engineers, 1967.



KEY

Location No.	Discharge Source
1	Paukaa
2	Papaikou Mill #1, #2
3	Papaikou Mill #3
4	Silverton
5	Anderton
6	Mo'ir'on
7	Onomea
8	Kulaimano
9	Pepeekeo Mill
10	Pepeekeo Mill
11	Pepeekeo Mill
12	Pepeekeo Mill Village

(See Table III-6 for description of discharges)

FIG. 5

LOCATION OF POINT DISCHARGES AND WATER QUALITY SAMPLING STATIONS

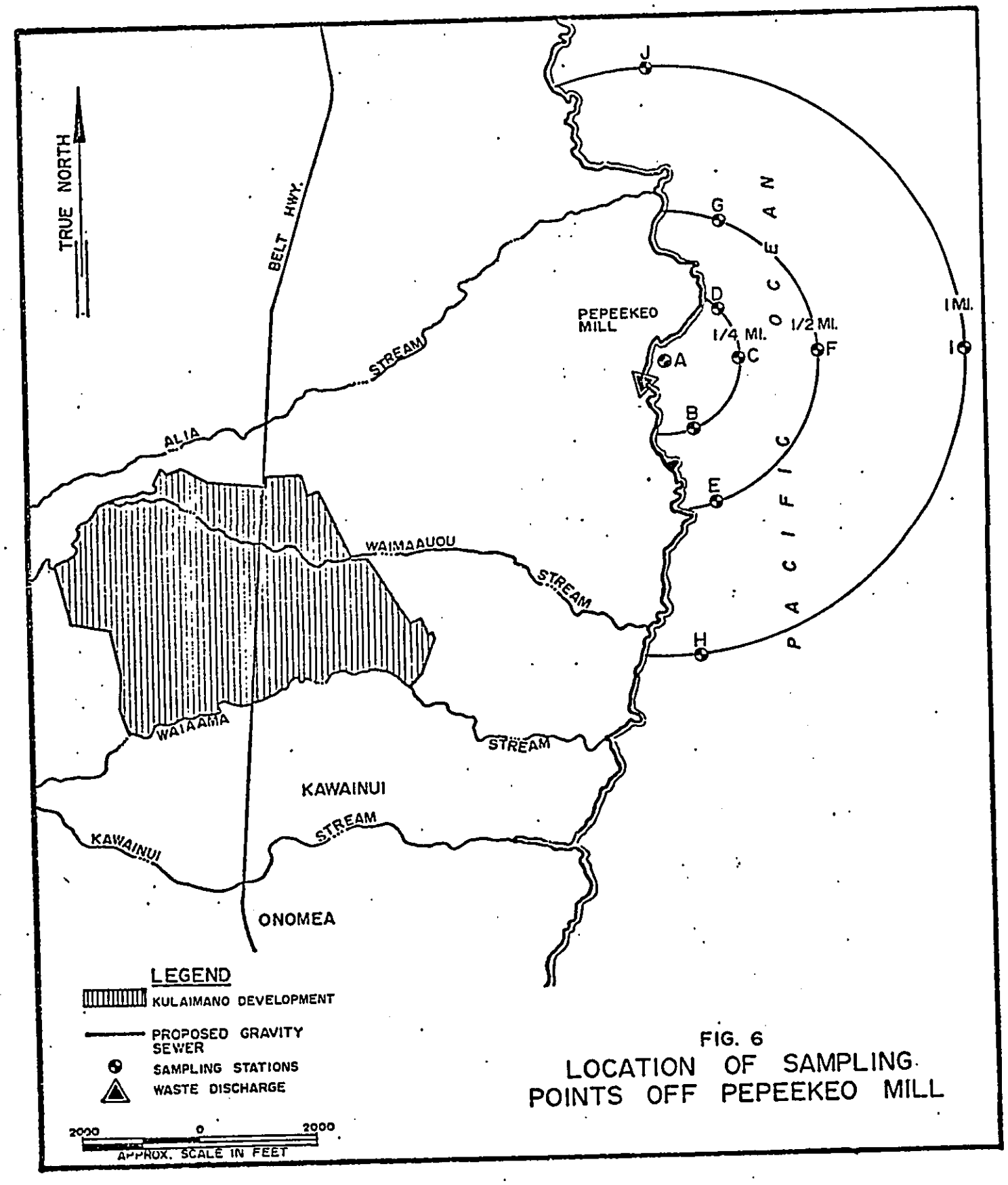


FIG. 6
LOCATION OF SAMPLING POINTS OFF PEPEEKEO MILL

A summary of present point discharges (locations are shown on Figure 5) is given in Table 3. It is readily apparent that the total wastewater volume of the point discharges in the area, of which the domestic sewage flows will constitute only a small portion, is much less than the natural drainage.

Data from the Kennedy Engineers' study and the State Department of Health were utilized in lieu of implementing a water quality sampling program for this project. A meaningful program would extend over a period of one year, preferably covering different climatic conditions. The time and cost constraints and the resultant cost-benefits precluded implementation of such a water quality program.

The best practicable control technology must be applied to point discharges in accordance with PL 92-500. For raw sewage discharges, this means at least secondary treatment. For the sugar mill discharges, this means treatment, but to an extent not yet defined by EPA. The state's constraints are set forth in the Public Health Regulations, Chapters 37 and 38. The waters are Class A, and are further classified as "Effluent Limitation Segment #1," which means that the waters presently do not meet the Water Quality Standards but supposedly will do so with the implementation of the "best practicable" control measures.

Description of Effluent Disposal Site

The proposed disposal site is approximately 500 to 700 feet north of the mouth of Waimaauou Stream. A near-vertical cliff, approximately 100 feet high, exists along the shoreline area. The base of the cliff shows signs of erosion, probably caused by the generally high wave conditions.

The inner region, the surf zone, extends seaward approximately 100 feet from the shoreline, with a depth varying from 0 to 3 feet. The bottom is comprised of small boulders, one to two feet in diameter. Movement of the boulders by rough wave conditions was noted during field investigations.

The ecosystem of the surf zone is considered "sparse," generally limited to the "splash" zone. Opihi, pipipi, ama crabs, and light green, fuzzy limu attached to rocks were observed in this zone. No observed

TABLE 3

WASTE DISCHARGES IN THE KULAIMANO-PAPAIKOU AREA

Source of Discharge	Type of Discharge	Q (mgd)	Treatment	Disposal	Location No.**
Domestic Wastes					
Onomea	Domestic sewage	0.01	None	Stream	7
Silverton	Domestic sewage	0.03	None	Shoreline	4
Moirton	Domestic sewage	0.04	None	Shoreline	6
Anderton	Domestic sewage	0.03	None	Stream	5
Paukaa	Domestic sewage	0.02	None	Shoreline	1
Kulaimano*	Domestic sewage	0.02	Pond	Injection Well	8
Pepeekeo Mill Village	Domestic sewage	0.03	None	Shoreline	12
Agricultural & Industrial Waste Discharge+					
Papaikou Mill #1, #2	Sugar processing	13.9,2.4	None	Ocean	2
Papaikou Mill #3	Sugar processing	0.40	None	Ocean	3
Pepeekeo Mill	Sugar processing	5.5	None	Ocean	9
Pepeekeo Mill	Sugar processing	0.5	None	Ocean	10
Pepeekeo Mill	Sugar processing	10	None	Ocean	11

* Not presently discharging
\+ Seasonal discharges
** See Figure III-3

Source: Department of Public Works, County of Hawaii, 1972 and Department of Health, State of Hawaii

organisms could be observed in the submerged portion of the surf zone. This was due to the rough wave conditions, which limited visibility.

Beyond the surf zone, the outer region (of which approximately 400 feet offshore were examined) varies in depth from 10 to 20 feet. The bottom is free of sediment deposits and is composed of large boulders, three to five feet in diameter. The following organisms were observed in the transect (800 feet long by 40 feet wide):

Organism	Number
Coral; Pocillopora type approx. 5 inch diameter	5
Fish:	
Mackerel scad (Opelu)	10
Wrasse (Hinalea)	4
Surgeon	20
Parrot fish (Uhu)	3
Triggerfish (Humuhumu)	3
Damsel fish (Kupipi)	4
Goat fish (Moano)	2

No attached limu, urchins, barnacles, or encrusting-type coral were observed.

Dispersion-Dilution Studies at the Disposal Site

Dispersion-dilution studies were conducted in the study area. In the inner region or surf zone, dilution is governed predominantly by the action of waves. This mixing action is directed in a predominantly seaward direction and crosses the surf zone in two to three minutes. Initial dilution measurements indicate that dilution varies from 20 to 50:1.

In the outer region beyond the surf zone, the dispersion mechanism is governed primarily by eddies and the longshore currents. The depth of the field was observed to be five feet.

The mixing coefficient was calculated to be $K = 0.002L^{4/3}$, where L (ft) is a characteristic dimension and K has the dimension of square foot per second. The derivation of the mixing coefficient is based on

Brooks' work (see Appendix B for calculations). This coefficient is comparable to the conditions found at Sandy Beach, Oahu, and is twice that found by Pearson in Santa Monica Bay and the Texas Gulf Coast.

The current in the outer region, which largely determines the degree of dispersion, varied from 0.08 knots to 0.03 knots in an offshore, northerly direction.

Biology

The biological makeup of the nearshore area off the Kulaimano site has not been studied extensively. To supplement data collected in this project, data from Dr. Richard Grigg's study (1972) on the ecological effects of sugar mill discharges provided some description and insight of the impact of point discharges to the ecosystem. The following conclusions were reached in Dr. Grigg's investigation:

1. No significant changes in temperature, salinity, or oxygen content were detected in the receiving waters off the sugar mills.
2. No sign of eutrophication was observed despite the high values of nitrogen and phosphorus in the mill discharge; lack of apparent eutrophication was attributable to the high transport rates of the receiving waters.
3. Coral coverage in the immediate area of mill discharge was zero, while coral coverage at control stations one mile away varied from 13 to 23 percent.
4. Only two species of coral were observed in the area near the mill discharge, while five to eight species were found in the control area.
5. A thick stratum of sediment (possibly as thick as 50 feet) was observed within one-quarter mile of the mill site; at stations deeper than 1,100 feet off Pepeekeo, cane waste was dispersed by currents.
6. In shallow waters (less than 40 feet deep) recovery of coral and associated benthos appeared to begin soon after mill operations ceased.

7. The number of species of fish observed and the quantity of spear-fishing catches were consistently less at stations near mill discharges than at the control stations.

The discharge of sugar mill wastewater has an adverse impact on coral and associated benthos, as reported by Grigg. This impact is attributable to the high concentration of suspended matter, which has an "accumulation" effect.

In comparison, secondary effluent is relatively low in suspended solids, and the impact is anticipated to be less severe. Past studies indicate that chlorinated effluent is toxic to aquatic organisms to a certain degree. This is due to a combination of suspended solids, chlorine, and ammonia, and to a lesser degree, to reduced substances, surfactants, and heavy metals. The degree of toxicity to the benthic organisms is concentration-dependent, and this impact at Kulaimano is mitigated by the following factors:

1. The dilution factors attributable to rough water conditions of the surf zone and deep ocean currents
2. No excess chlorine residuals anticipated because of automatic flow proportion chlorinators
3. A holding pond with a detention time of 6.5 hours further reduces chlorine residuals prior to discharge

Survey of Shoreline Fishing Activities in the Hamakua Region

Interviews were limited to those people known to do shoreline fishing in the Hamakua Coast region. Many of those interviewed are members of the Hakalau Fishing Club.

The following conclusions were derived from this limited survey:

1. Shoreline fishing is generally pursued on the Hamakua Coast between Onomea and Kohola Point (about two miles north of Pepeekeo Point), with the greatest activity near Pepeekeo Point (approximately 1.5 miles north of the proposed discharge site).
2. In the area of the proposed discharge, the area just north of Waimaauou Stream presently is used by fishermen and opihi

pickers, with "moi holes" just north of the mouth of the stream.

3. Access to the rocky shoreline near the proposed discharge site is generally achieved by climbing down into Waimaauou Gulch. On occasions, several fishermen have indicated that they climbed down the 50 to 100 foot cliffs to gain access to the shoreline. For this reason, people who frequent this area are generally the younger fishermen.

4. The major concern to the fishermen was the effect of chlorine and bleaches in the effluent on the fish. The effects of bacterial and viral contamination were of little concern since many indicated that they actively fish in other areas where raw sewage discharge occurs.

5. One fisherman suggested that the outfall discharge be located 300 to 400 feet north of the "moi hole."

Summary

The existing environmental conditions in the Kulaimano study area are primarily influenced by the topography and climatic conditions. The average rainfall of about 130 inches per year results in high rates of surface runoff and groundwater discharge. These natural discharges, along with the sugar mill discharges, influence the quality of the nearshore waters. Very little influence can be attributed to the discharge of domestic wastewaters.

The nearshore waters are well mixed because of the direct exposure of the tradewind-generated waves and the absence of a significant offshore reef formation.

The terrain in the region is generally steep and slopes seaward, terminating with steep cliffs 100 feet or more at the shoreline. The coastal waters, therefore, are generally inaccessible from shore.

There are several point discharges of raw sewage originating from plantation communities, and they must be eliminated or treated in accordance with the secondary treatment guidelines of EPA. The major point

discharge occurs from the sugar mill, bearing high sediment loads. Guidelines for best practicable control technology are yet to be put into final form for these discharges, but the plantations already have acted to control them by modifying harvesting and processing operations.

ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

The environmental impact of constructing and operating a sewage collection, treatment, and disposal system in the Kulaimano area is primarily one on the human environment. Because of the small volume of sewage involved, the effect on the natural environment is not likely to be significant.

Socio-Economics

The construction of the sewerage and treatment facilities is necessary to provide an adequate and relatively inexpensive sewage system for the Kulaimano development. New low-cost housing will be made available to the plantation workers and allow the plantation to phase out the old, substandard housing, which is the source of numerous raw sewage discharges.

The construction of the sewerage and treatment facilities will involve user charges, which are required by the federal construction grant program. To qualify for federal construction grants, the county must implement a user charge system to cover the cost of operation, maintenance, and replacement of the facilities. The user charge rates have not yet been determined, but the total cost for the operation and maintenance of the treatment plant is estimated to be approximately $95,000 per year at ultimate design flow. How this is allocated to the users of these facilities is a matter that must yet be decided by the County of Hawaii.

The county presently has a user charge; it is assessed on a percentage of the water bill: 75 percent of the water bill with a maximum of $10.00 for residential units.

Configuration of the Sewerage and Treatment System

The configuration of the system being proposed places some constraints on future land use and will cause some impact on water quality. The first of these considerations deals with the treatment plant site, the second with the method of disposal.

Site of the Treatment Plant. The treatment plant site was selected in deliberations of the State Land Use Commission. Kulaimano development planners selected the treatment plant site, as shown on Figure 2. Objections were raised by nearby property owners because of the potential odor and aesthetic impact of a treatment plant. Since then, these objections apparently have been satisfied by plans for implementing odor control measures at the proposed treatment plant. No objections were raised in the subsequent public hearing conducted by the Land Use Commission.

Population increases in the study area are projected initially to be the consequence of migration of plantation workers from within the region to the Kulaimano development. It is anticipated that population growth will continue into the future, according to the county's general plan. More land then must be made available to accommodate it.

The key factor in answering the question about which lands might be urbanized in the future is the commitment of C. Brewer & Company, the major landowner, to keep lands in sugar cane cultivation for 20 years because of the substantial capital improvements made in the plantation operations. The other individual planters of the Hilo Coast Processing Company, a cooperative of which C. Brewer & Company is a major shareholder, are committed for only 10 years; their lands are adjacent to the present Kulaimano Heights development.

Although the privately-owned lands in question are zoned for agriculture at the present time, if population increases are allowed to occur at the projected rate of two to three percent, the homestead lands are likely to be urbanized. If and when that happens, higher costs will arise from the need for pumping sewage to the treatment plant at the proposed location.

The county's Planning Department has no firm guidelines at this time concerning the possibility of restricting urban development in the lower homestead lands, so development of this area is a possibility and not a certainty.

The proposed treatment plant location and the configuration of the sewerage and treatment system will have an impact on the type of urban development that might occur in the homestead lands below Kulaimano.

Odor and Aesthetics. The proposed treatment plant site is close to the residential development (about 800 feet from the closest residence and about 50 feet from the homestead boundary). In the initial public hearings, objections to the plant were voiced by nearby residents. No objections, however, were raised at a later public hearing conducted by the State Land Use Commission, which has adopted the treatment plant site.

Provisions for odor control and for minimizing objectionable visual impact are critical considerations for the treatment plant design. A significant mitigating circumstance related to odor production is that the sewers will be located high above the groundwater table so that the inflow of sulfates, which serve as building blocks for odor-causing sulfides, will not occur as it does in sewer systems in low-lying areas near the coastline.

Provisions for odor control consist of covering the selected facilities, such as the headworks, and providing blowers and air scrubbing devices. The front portion of the aeration tank will be designed so that it can be covered in the future to contain odors. The aerobic digesting tank does not pose a special problem and will not be covered. Power failure on the order of one day should not cause odor problems at the aerobic digesters.

In general the facilities for odor control will be designed to contain odorous compounds by covering and by scrubbing the gases before venting them to the atmosphere. Provisions can be implemented for chemical treatment of the sewage flow as a backup procedure in the event scrubbers are inoperable due to maintenance requirements.

The sewage treatment plant will occupy an area of approximately two acres, which are presently planted in cane. No endangered terrestrial flora or fauna are known to be in the area since it has been under cane cultivation for several decades.

The plant site will be landscaped and fenced with hollow tile walls, rather than the less expensive chain link fence, to improve its aesthetic appeal.

Disinfection

Chemical agents such as chlorine, ozone, and hydrogen peroxide are

commonly used as disinfectants in the wastewater treatment field. Chlorine was selected for use at Kulaimano because--

1. It is used in other treatment plants on the island of Hawaii and can be purchased in bulk quantities at relatively low cost for distribution to all plants. Further, treatment plant operators at the existing treatment facilities are familiar with its operation.

2. Ozone, although it is a highly effective oxidizing agent, is expensive, primarily because of its high electrical cost related to its generation.

3. The use of hydrogen peroxide is limited to odor control, and its present high cost precludes its application to general disinfection.

Effluent Disposal

The proposed method of disposal of the 0.5 mgd of chlorinated secondary effluent is to discharge it into the surf zone north of Waimaauou Stream. Water quality effects are not likely to be significant in this area. The natural surface runoff and groundwater discharge, which are among the highest in the state, are the major factors dictating the quality of the coastal waters. The estimated total average natural discharge in the area is 60 to 65 mgd per mile of coast. By comparison, the sewage effluent discharge would average 0.5 mgd.

As shown on Figure 4, it is proposed that the terminus of the sewer outfall be constructed at a steep angle, terminating approximately 5 to 15 feet above the rocky shoreline at the cliff's face. This would minimize the aesthetic impact of the discharge, limit the extent of wind-induced sprays, limit the extent of erosion of the cliff's face, and minimize the already limited access to the area. Further, the discharge point is proposed to be located 500 to 700 feet north of the "moi holes" to mitigate the impact of effluent, if any, on the fish.

From results of field dispersion studies, it was found that the impact of the chlorinated secondary effluent on the ecosystem in the inner region or surf zone should be insignificant. This is based on the

short residence time of the effluent in the surf zone and the sparse benthic community that exists there.

The chlorine residual concentration in the effluent is anticipated to be approximately 0.5 mg/l, as exhibited in existing treatment facilities. No large residuals are expected since automatic, flow-proportioning chlorinators will be provided. Based on the dilution factors previously discussed (20 to 50:1), the chlorine concentrations lower than the published threshold values (by Krock) will be achieved easily in the surf zone.

It is possible that attached limu/algae growth may be enhanced by introducing effluent into the surf zone. By the observed distribution of the existing algae growth, however, the instability of the boulders may be an overriding factor for limited growth of attached algae.

Based on the observed depth of field of five feet, no significant impact on the benthic organisms beyond the surf zone is expected by the introduction of biostimulants in the effluent, nor is the deposition of suspended solids on the ocean bottom expected to occur.

Water column organisms in the outer region will not be significantly affected because of the short residence time and dispersion characteristics expected in this region. More specifically, dilution factors of 50 to 400 were derived from field studies in the outer area. This degree of dilution is more than adequate when compared to published bioassay results for secondary effluent. Similarly, planktonic organisms will not be measurably affected because of the short residence time.

In summary, the shoreline area intended for effluent discharge has limited accessibility because of the steep cliffs. The beneficial uses of these coastal waters have been limited primarily to shoreline fishing and have not been observed to include body contact sports, such as swimming or surfing. The waters generally are too rough for that, and hazardous conditions prevail most of the time. The discharge of the treated wastewater at the shoreline will curtail use of the shoreline in the immediate vicinity of the discharge area, primarily because of health safety considerations and not because of the substances in the discharge on the natural environment. The extent of the area affected is difficult

to predict, but it would not be extensive considering the magnitude of the discharge and the good mixing and dispersion characteristics in the nearshore area.

ADVERSE EFFECTS THAT CANNOT BE AVOIDED

Adverse effects would be present during construction. Dust, noise, and increased traffic will be noticeable. Mitigating measures include: watering for dust control, minimizing noise effects by regulating hours of construction, and scheduling construction traffic during off-peak hours. The impact would be less noticeable because of the widespread construction already underway at the Kulaimano development. The relatively small amount of construction required for the treatment facilities would simply blend into the ongoing housing construction. The effect should also be no more significant in terms of increases in noise, dust, and traffic than is cane harvesting.

Cane harvesting operations in the area of the treatment plant may possibly be hampered during construction, but the trucking routes can be coordinated with existing construction operations to mitigate this impact. Serious impact will occur, however, only if the construction period extends beyond two years from now because no harvesting is expected in the area for two years.

The key adverse impact would be the effect of effluent disposal at the shoreline because this results in the curtailment of the recreational use of the beach area near the point of discharge. The mitigating factors, however, are that the topography of the area greatly restricts access to the beach and that the generally rough water conditions preclude the extensive use of the area as a water-contact recreational site. No extensive adverse effect on the biological system in the area is expected because of the small volume of the discharge and the good mixing and dispersion conditions.

The anticipated adverse effects are summarized in Table 4.

ALTERNATIVES TO PROPOSED ACTION

The alternatives to the proposed plan that have been considered are organized according to a decision hierarchy, as shown in Table 5.

TABLE 4

SUMMARY OF PROBABLE ADVERSE EFFECTS

Probable Effect	Duration	Mitigating Conditions
Construction		
Inconveniences	Temporary	Regulating hours of construction. Staging of localized construction. Public information. Rapid completion of construction in critical areas.
Noise		Same as above.
Dust		Watering.
Disruption of Traffic		Traffic aids and flagmen. Regulating hours to avoid peak traffic hours.
Visible Structures		
Pumping Stations	Permanent	Architectural design. Coordination with other facilities in the area.
Treatment Plant		Architectural design and landscaping. Located away from residential areas.
Treatment Plant Operation		
Noise	Permanent	Housing of noisy equipment: air blowers, pumps. Insulation of office and laboratory.
Odor	Temporary	Implement odor control facilities. Infrequent occurrence. Operating control.
Disposal of Effluent		
Restriction on Recreational Use of Shoreline	Permanent	Limited accessibility, rough water conditions, making surf areas hazardous for swimming.

TABLE 5

ALTERNATIVES TO PROPOSED ACTION

Management Systems	Treatment Plant Site	Processes	Disposal
No Action	Present Site	Activated Sludge	Injection
Regional	Lower Site	Trickling Filter	Shoreline Discharge
Subregional		Ponds	Ocean Outfall
		Physico-Chemical	Stream Discharge

Management Systems

The alternatives considered in choosing a management system were (1) no action, (2) a regional system, and (3) a subregional system.

If no action were taken, one of the two following consequences would result:

1. The continuation of disposal of raw wastewater into streams by the scattered villages. This would violate PL 92-500, which requires all discharges to receive secondary treatment.

2. The growth of the Kulaimano development may continue, but with cesspools for wastewater treatment and disposal. The long-term applicability of this form of disposal strongly depends on the receptivity of the soil to the liquid waste, and there is generally little water quality control in a system of cesspools and greater risks of health and nuisance problems.

The regional system would have been the more economical alternative only if ocean outfall disposal were required. The key factor dictating the choice of ocean outfall is the magnitude of the discharge and its impact on water quality and beneficial uses. Because the sewage flow rate is small and construction costs are high, ocean outfall disposal is much less cost effective than the other alternatives. The subregional system, therefore, is recommended.

Treatment Plant Sites

The alternative plant sites are (1) the presently proposed site south of Waimaauou Stream on the eastern boundary of the Kulaimano development and (2) a lower site east of the development at the northern boundary of the Kulaimano homestead next to the cliffs.

The key factor in the choice of sites is the possible urbanization of the homestead lands below the Kulaimano development. These lands are zoned for agriculture; if the zoning is changed to urban, the required sewer system can be built to collect sewage by gravity, but it would then have to be pumped to the presently proposed STP site. Two pump stations would be required because of the high head. If the alternative STP site were utilized, only one pump station would be for the Kulaimano homestead.

Such a system would cost approximately $300,000 less than the collection and transmission system to the present STP site. The major impact, therefore, is the cost of land development, if these lands are rezoned to urban.

Treatment Processes

Alternative processes that were considered include (1) pond, (2) activated sludge, (3) trickling filter, and (4) physico-chemical. A cost summary of the treatment alternatives is shown in Table 6.

An examination of the unit cost components indicates the pond is the most cost-effective treatment process only when odor control measures are not required and the land costs are low. These two conditions are not present in the Kulaimano situation.

The trickling filter system requires a large amount of land because of the size of the filters and the need for primary clarifiers. Odor problems are inherent in this process because of the anaerobic portion of the biological film.

O&M costs for the physico-chemical process are high. Strict attention is necessary for proper control of this process, and a hydraulic equalization basin is required for the size of flow being considered here.

Disposal Methods

The four disposal methods considered included (1) ocean outfall, (2) injection wells, (3) stream discharge, and (4) shoreline discharge. A cost summary of various disposal alternatives is shown in Table 7.

Any disposal method other than ocean outfall and injection wells requires a variance from Chapter 38 of the Public Health Regulations in order to be considered, unless certain conditions (e.g., tertiary treatment) are met.

The small sewage flow and high construction costs eliminate an ocean outfall to 60-foot depth and 1,000 feet offshore as a viable alternative.

The injection well method was discarded in favor of shoreline discharge because of high costs and lack of reliability due to possible clogging and degradation of the fresh water basal lens. A study based on the

TABLE 6

COST SUMMARY OF TREATMENT ALTERNATIVES

Wastewater Treatment				Solids Handling			Odor Control-Aesthetics				Effluent Disposal+		Totals		
Process	Capital Cost	PW O&M	Total Cost PW	Capital Cost	PW O&M	Total Cost PW	Description of Control Measures	Capital Cost	PW O&M	Total Cost PW	Capital Cost	Total Cost PW	Capital Cost	PW O&M	Total Cost PW
Activated sludge, aerobic digestion, gravity filter (2 acres)	795	600	1,395	521	350	871[a]	Cover headworks, landscaping	138	80	218	290	290	1,744	1,030	2,774
Primary treatment & pond with anaerobic digestion, vacuum filtration (pond water area = 6 ac)	1,000**	500	1,500	570	400	970	Same as activated sludge plus covering primary clarifier & anaerobic digester, 100% effluent recycle	1,016	292	1,310	200	200	2,785	1,190	3,975
Oxidation ponds (37 acres)	1,810**	435	2,245	-	-	-	Same as aerated pond	1,497	300	1,797	200	200	3,510	735	4,245
Aerated ponds (35 acres, gross)	2,160**	650	2,810	-	-	-	Effluent recycle Covering influent section Mask odors	958	292	1,250	200	200	3,320	940	4,260
Trickling filter	2,690	235	2,925	521	350	871[a]	Covering primary clarifier, headworks, etc.	283	80	363	290	290	3,785	663	4,448
Physico-chemical treatment	1,255	2,225	3,480	555	578	1,133[a]	Same as A/S	138	80	218	290	290	2,238	2,883	5,121
Tertiary treatment plus activated sludge	2,295	2,045	4,340	521	350	871[a]	Same as A/S	138	80	218	30	30	2,985	2,475	5,460

+ Disposal by shoreline disposal; variance required from the State Department of Health.

* Cost evaluated for present worth at 7 percent over 20 years.

** Land costs included at $5,000 per acre.

a Solids handling based on aerobic digestion and gravity filtration.

hydrogeological characteristics of existing wells in the study area (located approximately one mile from the project site) and areal geological data indicate the permeability of the substrata to be 2,500 gpd per square foot, which is adequate for effluent disposal from the Kulaimano facility. An overriding consideration, however, is clogging by suspended matter. Further, the required conditions--injection is not viable and environmental impact of shoreline discharge is not significant--were present to warrant a variance from Chapter 38.

The rough coastal waters, ocean currents, high storm runoff, and small sewage flows make effluent discharge of small importance to the quality of the coastal waters. Furthermore, the effects of shoreline discharge are not irreversible, a fact demonstrated for the sugar mill discharges by Grigg (1972).

Discharge of effluent into the perennial stream near the Kulaimano development was discarded because (1) it precludes use of the limited recreational potential of the stream gully and urbanization of the adjoining homestead area, (2) it is more easily accessible to residents, and (3) a larger area of restricted use is realized by this alternative. This alternative would have similar water quality impact on the nearshore waters as would the shoreline discharge alternative. Also, prohibitively expensive tertiary treatment would be required by Chapter 38 for stream discharges.

IRREVERSIBLE AND IRRETRIEVABLE RESOURCES COMMITTED BY THE PROPOSED ACTION

There are several irreversible commitments of resources. The most prominent are the land area and the capital investment in facilities for collection, transmission, treatment, and disposal of sewage. The land area committed in the initial construction project is approximately two acres for the treatment plant site. According to present estimates, this site is sufficient to meet foreseeable needs for treatment in the Kulaimano area.

Capital investment in facilities for treatment plants is generally staged over short-term periods to match as closely as practicable the needs shown over those periods. Because of the usually large investment required, a commitment to certain facilities is almost irreversible.

TABLE 7

DISPOSAL ALTERNATIVES AND ESTIMATED COST

(April 1974 Price Level)

	Present Worth* ($1,000)
1. Discharge to gulch, 12" diameter, 600 feet Secondary treatment with variance**	30
2. Shoreline discharge, 12" diameter, 3,800 feet Secondary treatment with variance**	290
3. Injection wells, 15" diameter, 400 feet deep, replacement every five years, with 3,800-foot line No variance required	
Cost: Line 190 Two Wells 120 Well Replacement 220	530
4. Ocean outfall, 18" diameter, 1,000 feet 3,800-foot line No variance required	1,625
5. Tertiary treatment and stream discharge No variance required	3,000+[a]

* Present worth: 7 percent for 20 years.

** Variance from Public Health Regulations. Otherwise, tertiary treatment is required as in Alternative 5.

[a] Incremental cost not including the secondary treatment plant.

Commitment of manpower and energy to sustain operations and procurement of supplies and replacements for defective equipment are required over the long term.

The effect of the discharge on the surf zone at the point of discharge is not considered irreversible because of the anticipated small impact on the ecosystem and the ability of the ecosystem in the area to recover if the discharge is discontinued. This is based on Grigg's work on the effects of sugar mill discharge on the marine life along the Hamakua Coast. Grigg reported that recovery of coral and associated benthos appears to begin within six months after discharge ceases. Cessation of discharge into the surf zone may be realized by implementation of other means of effluent disposal, such as ground injection or conveying effluent to another point of discharge.

LONG- AND SHORT-TERM EFFECTS

The major factor in assessing long- and short-term effects was the initial decision by C. Brewer & Company to phase out the old plantation housing and consolidate the population in its new Kulaimano development. This proposed action provides for long-term productivity of resources of land, energy, and capital, as compared to separate facilities that would have been necessary in the short term for the isolated communities.

This is the more promising direction in which to move--phasing out the old, inefficient methods of treating sewage and building in their place a central plant that will provide better control over sewage treatment in a more economical manner.

SECONDARY IMPACT

The accelerated development caused by providing sewerage facilities is a major secondary impact, if indeed this occurs. Development has proceeded without municipal facilities in areas of Hawaii. Single-family residences have utilized cesspools, while multi-unit structures (hotels, commercial developments, and apartments) have private treatment facilities.

The immediate loss of agricultural lands in this study area to urban development is limited to the Kulaimano Homestead. These lands are the

only large-tract, privately-owned (individual) parcels in the study area. These lands, however, are committed to cane for ten years.

The remainder of the land in the study area is owned by C. Brewer & Company and is used primarily for cane cultivation. It appears likely that these lands will continue to remain in cane for the following reasons:

1. The Hilo Coast Processing Company, of which C. Brewer & Company is a major member, has committed capital in excess of $22 million for sugar operations.
2. Members of the cooperative are committed to maintaining their lands under sugar cultivation for the next 20 years.

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APPENDIX A

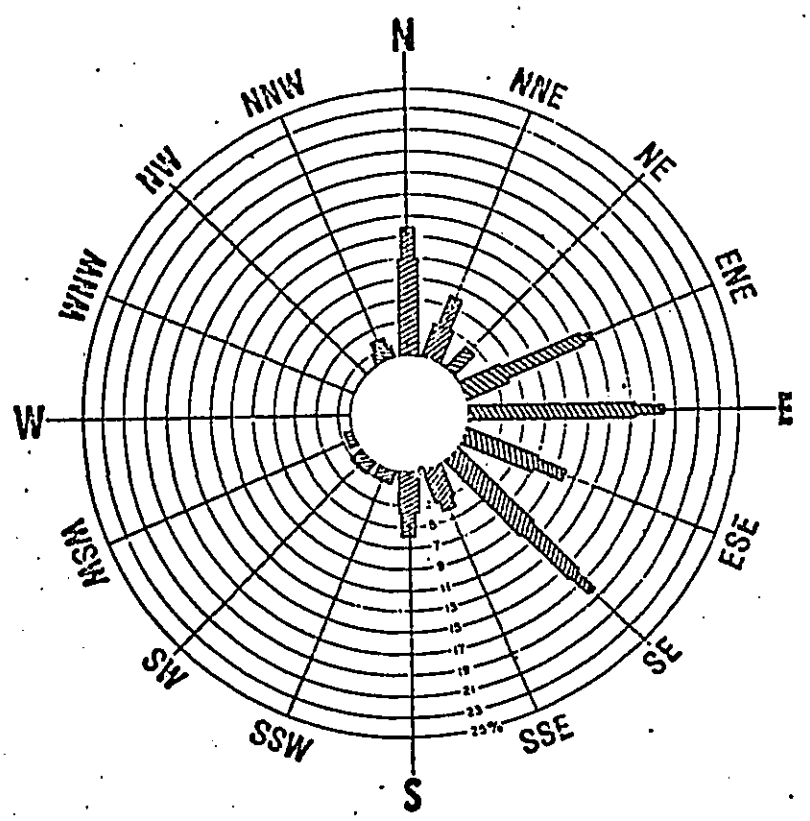
WIND SPEED IN M.P.H.

3.0 - 8.0

8.0 - 19.0

19.0 - 24.0

GREATER THAN 24.0



HILO

WIND ROSE AT HILO

A P P E N D I X B

Calculations for Dispersion Coefficients for
Nearshore Waters at Kulaimano, Pepeekeo, Hawaii

These calculations are based on two dye studies made on September 9 and 10, 1975 under mild wave conditions. Consequently, the results of these calculations are conservative, relative to the greater mixing and dispersion under average and high wave conditions.

Initial Dilution

The dilution zone for the proposed effluent disposal site is composed of two separate areas, the surf zone and the waters beyond the surf zone. Mixing within the surf zone is more vigorous than beyond the surf zone, but the net transport out of the area is dependent on the mixing and current structure beyond the surf zone.

The initial dilution occurring in the surf zone was calculated using the results of the two dye studies and the anticipated ultimate discharge volume of 0.5 mgd of chlorinated secondary effluent. The calculation and results are shown in Table B-1.

Transport and Dispersion

After the diluted effluent leaves the surf zone, it is transported by the longshore current and continues to be mixed by the eddy structure beyond the surf zone.

Figure B-1 gives the observed dispersion coefficient beyond the surf zone. The mixing coefficient was calculated based on a formula developed by Brooks (1960) as subsequently adapted to dye studies.

$$K = \frac{0.04\ (A_2 - A_1)}{T_2 - T_1}$$

where: K = dispersion coefficient (feet^2/second)
A_1 = area of dye patch at time, T_1
A_2 = area of dye patch at time, T_2

The characteristic length, L, according to Brooks (1960) is $2\sqrt{3}\ \sigma$, where σ is the length of one standard deviation of the dye concentration. This can be closely approximated by $\sqrt{A}$.

TABLE B-1

INITIAL DILUTION IN SURF ZONE

Dye Run	Initial Spread to Surf Line (sq ft)	Average Depth (ft)	Velocity of Patch Center (ft/min)	Time for Center to Reach Surf Line (minutes)	Effluent Discharge Volume (ft^3)	Initial Dilution Factor
1	4,848	1.5	36	2.8	130	56
2	8,368	1.5	13	7.7	357	35

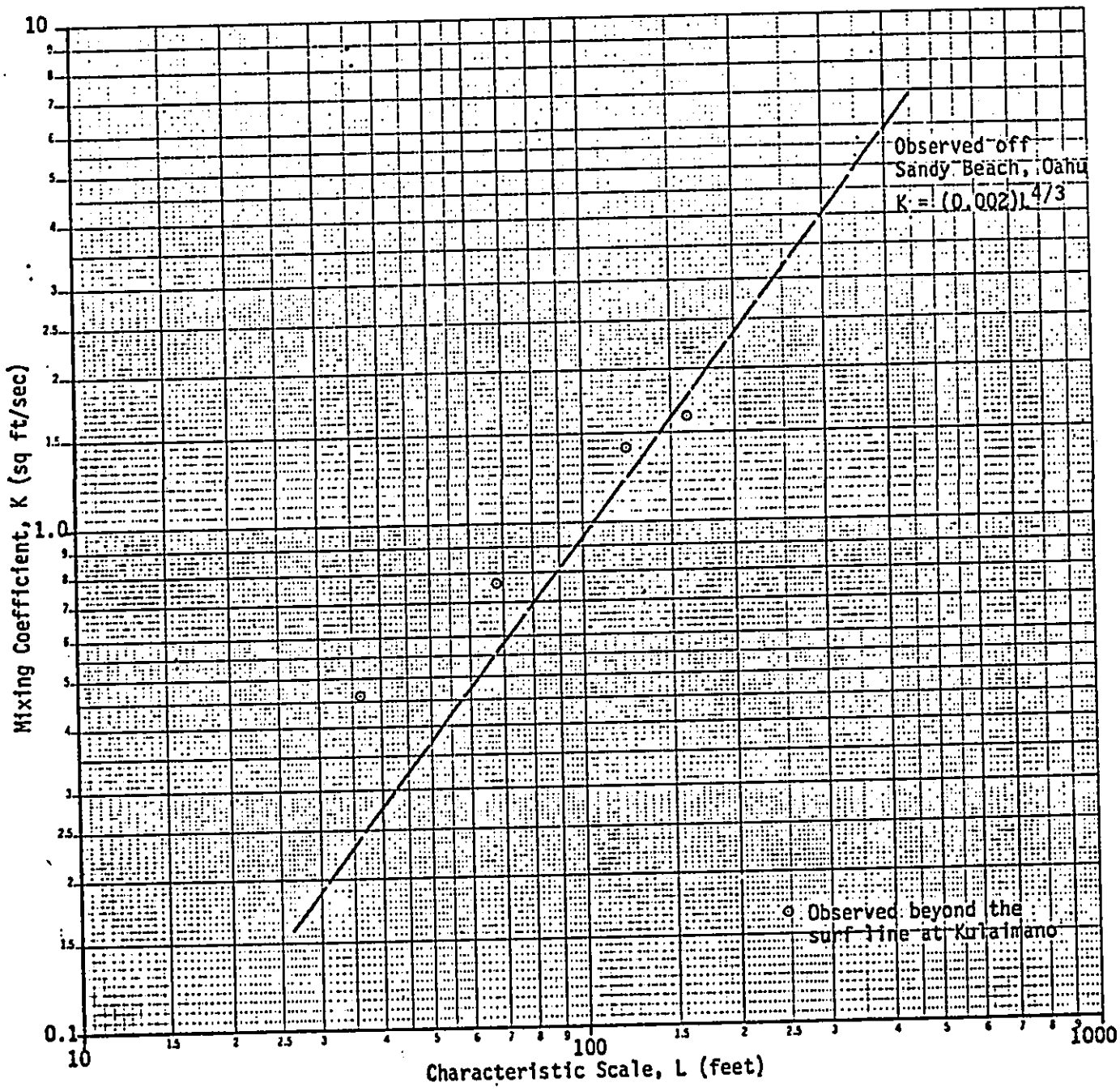


FIGURE B-1

DISPERSION COEFFICIENT

Figure B-1 shows that the observed values by Kulaimano are reasonably approximated by $K = 0.002\ L^{4/3}$, the relationship observed in dye studies off Sandy Beach, Oahu. The higher values of the first one or two points are explained by the more vigorous mixing found near the surf zone.

The dilution after the initial mixing in the surf zone is calculated by the formula developed by Brooks (1960):

$$\frac{C_X}{C_O} = \text{ERF} \sqrt{\frac{}{\left[1 + 2/3\,\beta\,\left(\frac{x}{b}\right)\right]^{3/2} - 1}}$$

where: C_O = initial concentration of conservative substance

C_X = concentration at distance X

X = distance in direction of current

b = length of line source

$$\beta = \frac{12\ K_O}{V_X b}$$

K_O = initial dispersion coefficient

V_X = current velocity

The length of the line source is assumed to be 60 feet, the observed width of the dye patch as it left the surf zone. The corresponding initial dispersion coefficient is 0.47 ft^2/sec. The observed current velocity was very slow at the time this study was made, varying from 0.055 to 0.133 feet per second.

Using these values, the dilution factor with distance was calculated and is given in Table B-2.

TABLE B-2

DILUTION WITH DISTANCE

Distance (feet)	Current of 0.055 ft/sec		Current of 0.133 ft/sec	
	C_x/C_o	Total Dilution*	C_x/C_o	Total Dilution*
100	0.441	127	0.7585	74
200	0.237	236	0.5087	110
500	0.0798	702	0.2278	246
700	0.0513	1092	0.1561	359
1000	0.0317	1767	0.1016	551
1500	0.0179	3128	0.0604	927

* Assuming an initial dilution of 56 (from Table B-1)

A P P E N D I X C

Survey of Shoreline Fishing Activities in the Hamakua Coast Region

Fishermen of the Hilo Coast Interviewed in Person

by Lane Thompson on August 28, 1975

Mitsugi Nagakane
Pepeekeo, Hawaii 96783

Ernesto Camero
P. O. Box 294
Pepeekeo, Hawaii 96783

Kenneth Ogata
Pepeekeo Mill Camp, Hawaii 96783

Antone Medieros
P. O. Box 294
Honomu, Hawaii 96728

Joven Quirit
Pepeekeo, Hawaii 96783

Ben Cabatu
Pepeekeo, Hawaii 96783

Matsuichi Heya
P. O. Box 56
Pepeekeo, Hawaii 96783

Alfred Alatan
Pepeekeo, Hawaii 96783

Kiyoto Nekoba
Pepeekeo, Hawaii 96783

Mitsuo Tanaka*
Hakalau, Hawaii 96710

Yoshikazu Kansako
P. O. Box 153
Honomu, Hawaii 96728

Takeshi "Groan" Yugawa
Kahalau, Hawaii 96710

Hisao Kaya
Papaikou, Hawaii 96781

Akira Sakoda
Papaikou, Hawaii 96781

Thomas Mitsuyoshi
55 Hiluhilu Street
Hilo, Hawaii 96720

Howard Kunimoto
300G Kulana Road
Hilo, Hawaii 96720

Richard Baker
P. O. Box 362
Pepeekeo, Hawaii 96783

Additional Hilo Coast Fishermen Who Were Not Available for Interviews on August 28, 1975

Domi Rances (believed to fish at proposed site)
Pepeekeo, Hawaii 96783

Clifford Tam (believed to fish at proposed site)
Pepeekeo, Hawaii 96783

Shinso Asato (fishes at Pepeekeo Point)
Pepeekeo, Hawaii 96783

Wallace Udo (fishes near Hakalau)
Hakalau, Hawaii 96710

Richard Yamada (used to fish at Hakalau, has moved to Kulaimano)
Pepeekeo, Hawaii 96783 (964-1612)

* contacted by telephone only

Interview with:

1. Mitsugi Nagakane (Age - late fifties)
   Pepeekeo, Hawaii 96783

   He fishes the shoreline area from the entrance of Waimaauou Stream (known locally as Kulaimano Stream, or "stream by old hospital,")to about the same distance north of Pepeekeo Mill. He fishes along the beach below the proposed outfall. He presently reaches the beach by climbing down into Waimaauou Gulch on the Pepeekeo Mill side and then using a rope at the stream mouth to climb off the lava promontory onto the beach. He says he could climb down onto the same beach a few hundred feet further north by using a rope down a low spot in the cliff. (This spot is in the immediate vicinity of the proposed outfall.)

   Fishing is limited by the size of the seas. During winter storms, there may be no fishing for a month at a time. Other times he says the trail appears beaten down enough to indicate weekly use. He does not know the names of the other people using the trail.

   If the outfall were built near the promontory, he would continue to fish the beach to the north by going down the cliff on a rope to the north of the outfall if it were possible. Says some fishermen also pick opihi on this section of coast, but only when the sea is very calm.

   Nagakane says that raw sewage from Andrade Camp and the old hospital used to flow down the gulch in question, which was good for fishing. Says that fishing at proposed discharge site also depends on whether cane roads are grown over with cane, requiring him to walk further.

2. Ernesto Camero (Age - late twenties)
   P. O. Box 294, Pepeekeo, Hawaii 96783

   Shoreline fishes from the mouth of Waimaauou Stream to Kohola Point (about two miles north of Pepeekeo Point). Fishes at proposed discharge site and picks opihi there. Says current generally sets to the north in summer and to the south in winter. He says that now is the start of the season for moi, menpachi, and aholehole at the proposed discharge site.

   We visited the proposed site and found the cobble beach next to the promontory much higher than at my visit several months ago. He says that the beach is much lower in winter, necessitating use of a rope to get on and off the lava promontory. He pointed out moi holes (just north of mouth of stream) and objected to the proposed location of the outfall. He suggested that a better location from the point of view of shoreline fishermen would be about 400 feet to the north or south of Waimaauou Stream. He is very concerned about the effects of chemicals in the secondary treated sewage on both fish and fish habitat and opihi.

   He says he has seen skin divers in area below proposed discharge but does not know their names.

3. Kenneth Ogata (Age - late twenties)
Pepeekeo Mill Camp, Hawaii 96783

Mr. Ogata is probably the most active of all the fishermen interviewed. He shoreline fishes from Onomea to Kohola Point using pole, casting tackle, and throw net. The throw net permits him to fish at times when line fishing is unsuccessful because the fish won't take bait. He also picks opihi. He fishes all year round and estimates that he fishes an average of 150 days per year. He says that he does not fish commercially and that his catch is for home use only. He says that he fishes at least once or twice a week and that storms stop him from fishing for a week at most. He is very familiar with the site of the proposed discharge and regularly fishes there by line and net and picks opihi. In the immediate area he fishes from a point about 350 feet south of the mouth of Waimaauou Stream to the end of the cobblestone beach about 1,200 feet north of the stream mouth. He also fishes from the point just north of Kaiwainui Stream (which is approximately 1,700 feet south of Waimaauou Stream) and from the "Picnic Grounds," which is approximately 1,800 feet north of Waimaauou Stream. He says that currents can be from north or south any time of the year and suggests that currents could carry discharged effluent to the two popular fishing points one-third mile to the north and south (mentioned in last sentence).

Ogata asked pointedly about the effect of chemicals in the secondary sewage discharge. He is concerned about (1) killing of fish, (2) killing of opihi, (3) deterioration of fish and opihi habitat causing a reduction in numbers, and (4) poisoning of humans by concentrations of poison in fish and opihi.

When asked if there were a more favorable point for discharge in the area he said that because of the shoreline currents, localized changes in outfall position would make little difference on effect on the fish. He was strongly opposed to a cliff top discharge, asserting that winds blowing parallel to the coast would carry the spray for several hundred feet. He suggested that it would be much more desirable from the fishermen's point of view to allow the discharge to trickle down the rock face. He suggests using a small, natural valley in the rock.

He has seen skin divers in area below the proposed discharge site. He is strongly opposed to any discharge that is toxic to fish, opihi, or their habitat.

4. Antone Medieros (Age - fifties)
P. O. Box 294, Honomu, Hawaii 96728

Shoreline fishes in proposed discharge area using trail on mill side (as do all others interviewed). He also fishes to north of Pepeekeo Mill but says this is the best area south of mill for aholehole and menpachi. Says season is just starting.

Is very concerned about effects of chlorine and other chemicals on fish. Thinks that dispersion and dilution of sewage will be much slower here than at ocean outfall such as Keaukaha.

5. Joven Quirit (Age - mid-twenties)
Pepeekeo, Hawaii 96783

Shoreline fishes from Waiaama Stream to Kohola Point. In immediate area he fishes from about 350 feet south of stream mouth to end of gravel beach about 1,200 feet to the north. He has been fishing here since childhood. He catches moi and papio at the proposed outfall site.

6. Ben Cabatu (Age - thirties)
Pepeekeo, Hawaii 96783
(Lives at Kulaimano Subdivision)

Shoreline fishes from stream at project site north to (field?) 28 (Hakalau?) but most of fishing is done just north of Pepeekeo Point. Most of his fishing is night fishing during off season (mid-winter). Along with many others living at Kulaimano, he has been too busy working on his new house during the past couple of years to spend as much time fishing as he hopes to.

At Waimaauou Stream he fishes with pole or spinner, mostly near the stream mouth. He picks opihi here when relatives come. He catches mostly moi or kumu at the stream mouth.

7. Matsuichi Heya (Age - late fifties)
P. O. Box 56, Pepeekeo, Hawaii 96783
(Lives at Pepeekeo Mill Camp)

Shoreline fishes in area that is close to his home just north of Pepeekeo Point. Does not fish in area of proposed outfall.

8. Alfred Alatan (Age - forties)
Pepeekeo, Hawaii 96783
(Lives at Kulaimano Subdivision)

Used to fish from mouth of Waimaauou Stream to Pepeekeo Point. Has not fished in area of proposed discharge for ten years because "not so many fish as before." He says there used to be lots of mamo, humuhumu, and moana. He now fishes during off season just north of Pepeekeo Point.

When I arrived he had just been cleaning a fish bought at a fish store in Hilo. Improved economic conditions, work on his new house, and steepness of the trail to the proposed discharge site may also have prevented recent trips to the project site.

Says that some younger men that he does not know fish in the area below Waimaauou Stream.

9. Kiyoto Nekoba (Age - early fifties)
Pepeekeo, Hawaii 96783

Used to fish at proposed discharge site but stopped five or six years ago because not so many fish. However, did more fishing just north of Pepeekeo Mill alongside raw sewage discharge. Says sewage discharge is best place

to catch fish. However, he believes that the bleaches associated with detergents have reduced fish population. He cites how the former use of a couple of drops of Clorox in a small tide pool would chase out all the small fish into a net for use as bait but would kill off the coral and almost all the living things in the tide pool - except some disagreeable growth that would then take over.

Presently fishes day or night north of Pepeekeo Point. Catches uhu and aholehole. He has picked opihi at proposed discharge site.

10. Mitsuo Tanaka
Hakalau, Hawaii 96710

Contacted by telephone only. He used to fish near mouth of Waimaauou Stream until about five or six years ago when he hurt himself in a fall there.

11. Yoshikazu Kansako (Age - fifties)
P. O. Box 153, Honomu, Hawaii 96728

Fishes mostly around Kohola Point (north of Pepeekeo Mill) and below Honomu. Has ladders to go down to beach in some places below Honomu. Says that the cane closes in the roads leading to the proposed discharge site, which makes access difficult. He says that the discharge site is a good moi hole. He has not fished at site for a long time. If easier access and ladder he would use. As an aside, he mentioned that moi and other fishing off Hakalau Mill have greatly decreased since the shut down last December (1974). He says that moi feed on little shrimp in the cane trash. The reef fish have not returned because of the sediment on the bottom. He says that the sediment does not support either the shrimp that the moi like or support the other fish usually found in this area.

12. Takeshi "Groan" Yugawa (Age - fifties)
Hakalau, Hawaii 96710

Shoreline fishes near Hakalau. President of Hakalau Fishing Club. Expressed strong concern about chemicals being discharged from STP.

13. Hisao Kaya (Age - forties)
Papaikou, Hawaii 96781

Fishes along coast but not in vicinity of proposed outfall. Says sewage helps fishing. He is concerned about use of disinfectants in sewage poisoning the fish but otherwise prefers to fish near sewage outfalls and has not heard of ill effects from such a practice along this section of coast.

14. Akira Sakoda
Papaikou, Hawaii 96781

Shoreline fishes along Hilo Coast but not at proposed discharge site. Did not make further comments.

15. Thomas Mitsuyoshi
55 Hiluhilu Street, Hilo, Hawaii 96720

Same as A. Sakoda above.

16. Howard Kunimoto (Age - late twenties)
300 G Kulana Road, Hilo, Hawaii 96720

Only boat fisherman interviewed. He brings boat to within 100 feet of shore in this section of the Hilo coast. He fishes by boat from Hilo to Laupahoehoe.

He pointed out that current is especially important in shoreline fishing, whether from the point of view of chumming, of utilizing the food that exits from natural streams, or the effects of a sewage discharge.

17. Richard Baker (Age - mid-twenties)
P. O. Box 362, Pepeekeo, Hawaii 96783

He is a newcomer to the Pepeekeo area but has fished elsewhere along the shoreline. He has joined the Hakalau Fishing Club (which is apparently the only shoreline fishing club active in the area) and plans to fish the coastal areas below Kulaimano, including the proposed outfall site. He expressed concern about injurious chemicals in the STP discharge.

APPENDIX D

Comments from Responding Agencies
on the Draft EIS
and Reply to Comments

GEORGE R. ARIYOSHI
GOVERNOR

RICHARD E. MARLAND, PH.D.
DIRECTOR

TELEPHONE NO.
548-6915

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
OFFICE OF THE GOVERNOR
550 HALEKAUWILA ST.
ROOM 301
HONOLULU, HAWAII 96813

May 29, 1975

The Honorable Herbert T. Matayoshi
Mayor
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

SUBJECT: Draft Environmental Impact Statement for the Kulaimano Sewage Disposal System

Dear Mayor Matayoshi,

This Office has completed its review of the subject draft EIS. As of this date we have received a total of twelve (12) comments as indicated on the attached list.

Provided below is a brief summary of our Office's comments and recommendations.

COMMENTS

Recommended Wastewater Management System

1. Is access to the sewage disposal system readily available? In other words, will roads have to be improved or built?

2. The EIS should include a cross sectional illustration along with an explanation of how the effluent will be discharged over the cliffs and into the surf zone. Further, we agree with the University of Hawaii's Environmental Center that more information is needed in regard to the diameter of the pipeline, distance of discharge from the shore, and the type of surface the discharge will be impacting upon. These details are essential to view the project completely.

3. How will the pipeline across Waimaauou Stream be handled? Will it affect the flow of the stream and vice-versa? Will the pipeline cross any other streams, ditches, waterways, etc.? Will they be affected by the pipeline and vice-versa in any way?

4 Besides chlorination, other methods of disinfection, such as ozonation, should be discussed along with their advantages and disadvantages.

5 What emergency procedures are proposed in case of malfunctions within the sewage disposal system?

6 Figure 2--Why the peculiar alignment of the effluent line versus a "direct" route via the south side of Waimaauou Stream?

Proposed Action

1 We suggest that the first paragraph be expanded. How many homes are involved in the C. Brewer & Company's Kulaimano Heights development and the Kulaimano Homestead? Has the Kulaimano development received all necessary approvals from government agencies? What are these needed approvals? Will the Kulaimano development be only for the relocated families of the C. Brewer & Company's old plantation homes? What is the price range for these low-cost housing? Will the old plantation residents be provided housing at no cost to them?

2 The source of funding for the proposed sewage disposal system should be itemized. How much county funds are involved? State funds? Federal funds?

3 What is the total cost of the sewage disposal system? Also, a breakdown of the total cost would be helpful.

4 Who is responsible for operation and maintenance of the sewage disposal system?

5 The construction schedule for the sewage disposal system and the Kulaimano Heights development should be given to show the relationship of timing between both projects as stated on pages 1 and 3.

Water Quality

1 Table 2--It would be useful if data for Station "H" were given, since this is the closest station to the proposed point of discharge. Also, this Office suggests an effort to obtain more recent data than 1966-67 for current conditions.

Biology

1 The relationship between sugar mill discharges and sewage effluent should be discussed. What is the significance of the seven conclusions in regard to sewage effluent?

Site of Treatment Plant

1 When were the two public hearings for the sewage disposal system held?

Effluent Disposal

On page 19, the EIS states that swimming and surfing have not been observed in the disposal area. Are there other recreational activities in this area? If so, how will they be affected?

Adverse Effects That Cannot be Avoided

The EIS states that: "Serious impact will occur, however, only if the construction period extends beyond two years from now because no harvesting is expected in the area for two years." What are these serious impacts? How will these impacts be mitigated if the construction period does extend beyond two years?

Disposal Methods

We suggest that the second paragraph be expanded to explain what these "certain conditions" are.

Irreversible and Irretrievable Resources Commented by the Proposed Action

We believe the issue of the sewage disposal system opening new avenues for future urban developments and the loss of agricultural lands for these developments be discussed.

Also, the last paragraph needs quantification. The EIS states that the effect of the discharge on the surf zone is not irreversible because of the ability of the ecosystem to recover if the discharge is discontinued. How many days, weeks, months, or years will this recovery take?

RECOMMENDATIONS

For brevity, we have not attempted to summarize each agency/organizations' comments. We recommend that they each be given individual concern with written responses sent to them indicating how specific concerns were considered, evaluated, disposed. This Office would appreciate a copy of these responses.

For the final EIS, we recommend that: 1) all comment and your responses be appended to the final EIS, incorporating comments as appropriate into the context of the final EIS; and 2) a copy of the final EIS be sent to those individuals who provided substantive comments to the draft EIS.

Thank you for the opportunity to review the subject draft environmental impact statement. We sincerely look forward to the final environmental impact statement.

Sincerely,

for Richard E. Marland
Director

D-3

Attachment

List of Commentors for Draft Environmental Impact Statement for Kulaimano Sewage Disposal System

	Date of Receipt
FEDERAL	
*Soil Conservation Service	May 1, 1975
*Department of the Army	May 15, 1975
Department of the Army, Engineering Division	May 19, 1975
STATE	
*Department of Health	May 1, 1975
Department of Land and Natural Resources	May 12, 1975
Department of Agriculture	May 19, 1975
*Department of Transportation	May 21, 1975
Department of Land and Natural Resources, Division of Fish and Game	May 23, 1975
Department of Planning and Economic Development	May 27, 1975
COUNTY OF HAWAII	
*Planning Department	April 30, 1975
UNIVERSITY OF HAWAII	
Water Resources Research Center	May 13, 1975
Environmental Center	May 20, 1975

*No comments

DEPARTMENT OF PLANNING
AND ECONOMIC DEVELOPMENT

GEORGE R. ARIYOSHI
Governor

HIDETO KONO
Director

FRANK SKRIVANEK
Deputy Director

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

May 22, 1975

Ref. No. 3794

MEMORANDUM

TO: Dr. Richard E. Marland, Director
Office of Environmental Quality Control

FROM: Hideto Kono, Director

SUBJECT: Environmental Impact Statement of the Kulaimano Sewage Disposal System, Pepeekeo, Hawaii

We have reviewed the subject statement and find that it has adequately assessed the probable environmental concerns that can be anticipated from the proposed development.

The proposed project consists of the development of a sewage collection, treatment and disposal system in an area where a need for one exists, particularly in view of the existing and planned residential development located within the area. Since the proposal is aimed at servicing a primary need and the system has been designed in accordance with appropriate Federal legislation, we concur with its development.

We appreciate the opportunity to review the subject statement.

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

CHRISTOPHER COBB, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES

EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

DIVISIONS:
- CONVEYANCES
- FISH AND GAME
- FORESTRY
- LAND MANAGEMENT
- STATE PARKS
- WATER AND LAND DEVELOPMENT

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

May 8, 1975

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

Gentlemen:

We have reviewed the draft EIS for the Kulaimano Sewage System.

A major environmental concern is the odors that may be generated by the treatment plant. However, we note that it is proposed to mitigate this problem by covering selected facilities and providing blowers and scrubbing devices. The effluent is proposed to be disposed of "over the cliffs into the surf zone". We suggest that the manner in which the effluent travels over the cliffs and its environmental effects be discussed and that environmental and aesthetic concerns be addressed.

Very truly yours,

for CHRISTOPHER COBB
Chairman of the Board

George R. ariyoshi
GOVERNOR OF HAWAII

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FISH AND GAME
1179 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

May 21, 1975

MEMORANDUM

TO: Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control

FROM: Michio Takata, Director, Division of Fish & Game

SUBJECT: Comments on Draft Environmental Impact Statement for Kulaimano Sewage System

This is in furtherance to DLNR's comments on the subject EIS. Enclosed are comments from the fisheries standpoint.

MICHIO TAKATA

MT:rfm

cc: Gordon Soh

State of Hawaii
Department of Land and Natural Resources
Division of Fish and Game

MEMORANDUM

Date May 20, 1975

TO: Michio Takata, Director, Division of Fish and Game

THROUGH: Kenji Ego, Chief, Fisheries Branch/Henry Sakuda, Chief, Marine Section

FROM: Steven Varrati, Aquatic Biologist

SUBJECT: Comments on: ___ 1. Conservation District Use Application _____
___ 2. Corps of Engineers Public Notice No. _____
_x_ 3. Draft EIS

Comment requested by Gordon Soh, Planning Office, DLNR Date of Request 4/29/75 Date Rec'd 5/2/75

Summary of Proposed Project

Title EIS for Kulaimano Sewage System

Project by Department of Public Works, County of Hawaii

Location Kulaimano, Hawaii

Brief Description The applicant proposes to build a sewage treatment plant in the Kulaimano Area, eight miles north of Hilo on the island of Hawaii. The facility will serve the C. Brewer & Company's Kulaimano Heights development and portions of the adjoining Kulaimano Homestead. The planned secondary treatment plant will utilize the activated sludge process to meet EPA regulations. Disposal of the chlorinated effluent over the cliffs into the surf zone just north of Waimaaou Stream is proposed. The dewatered, aerobically digested solids will be hauled to a sanitary landfill for disposal. The plant will be designed for an effluent disposal rate of 0.5 million gallons per day (mgd), but will be expandable to 0.8 mgd.

COMMENTS

___ 1. Comments for this proposed project were previously submitted; refer to: _____

EIS for Kulaimano Sewage System

In reviewing the draft EIS for the Kulaimano Sewage Treatment Plant, we find it to be lacking in supportive data for examination of alternative actions presented.

1 In discussing possible discharge alternatives, the use of an ocean outfall to the 60-ft. depth and 1,000 feet offshore is eliminated because of anticipated small sewage flow (0.5 mgd) and high costs (values not given). The EIS does not contain cost analyses, nor does it explore outfalls at other distances offshore.

2 High costs (values not given) also eliminated the use of injection wells; except in this case the EIS states that the 0.5 mgd discharge rate is too excessive to be handled by the injection well method (percolation rate not given to show this). No data is presented in the EIS to substantiate the statement that there will be any degradation to the fresh water basal lense. The placement of injection wells at lower levels and close to the cliffs so as not to affect the basal water has not been considered.

3 Stream discharge, while mentioned as a possibility, is not discussed in detail, other than to say it requires a variance from Chapter 38 of the Public Health Regulations unless certain conditions are met. A discussion of the variance and what conditions are to be met is not included.

4 The justification for a shoreline discharge over the cliffs is that normal surface runoff and groundwater discharge is enough to effectively wash away any effects of the sewer discharge. We contend that while the rainfall is high in the area, it is hardly consistent enough to be the only mitigating factor standing between a safe discharge and a polluted cliff and shoreline area.

5 As to the question of reversibility, the EIS is technically correct in that if discharge operations were stopped, the environment would eventually return to its original state. However, it is questioned whether the sewage treatment plant could shut down operations for the periods of time needed for the environment to return to normal. Further, the duration required for restoration of the affected area is not given. Therefore, while in theory the effects are reversible, practically speaking, the effect is irreversible as long as the plant continues to treat sewage.

6 Most conspicuous is the total absence of any relevant biological data concerning the project area. The only discussion included is a 3-year old study done in another area concerning sugar mill discharges.

7 A contradiction in the EIS is that it is stated, "Because of the small volume of sewage involved, the effect on the natural environment is not likely to be significant" (pg. 16), and on the other hand we find, "The discharge of the treated wastewater at the shoreline will curtail use of the shoreline in the immediate vicinity of the discharge area" (pg. 19). We question how an effect which will curtail the use of an area of shoreline not be significant?

EIS for Kulaimano Sewage System

In summary, we find the EIS to be lacking in areas of examining the impact of the proposed project on the total ecosystem involved. Therefore, it is recommended that the draft EIS include information and evaluations on:

1. Percolation studies to explore the possibility of injection wells.
2. Biological survey of proposed discharge area -- including vegetation to be affected along the face of the cliff and, both benthic and pelagic ocean surveys below the cliffs.
3. Survey of the recreational fishermen uses of the beach and surf zones.
4. Collection of updated water quality data and the discharge effects on said quality.
5. Cost analyses of alternative discharge methods.
6. Chlorination data -- effects of chlorinated discharge on cliff vegetation and shoreline organisms.

STEVEN VARRATI

CONCUR:

MICHIO TAKATA, Director
Division of Fish and Game

University of Hawaii at Manoa

Environmental Center
Maile Bldg. 10 • 2540 Maile Way
Honolulu, Hawaii 96822
Telephone (808) 948-7361

Office of the Director

May 15, 1975

MEMORANDUM

TO: Richard E. Marland

FROM: Doak C. Cox, Director

RE: Review of DEIS for Kulaimano Sewage Disposal System, Hawaii

The Environmental Center has been assisted in the review of the above cited DEIS by Michael Chun, Public Health; Jerry Johnson and Jacquelin Miller of the Environmental Center.

In general the DEIS prepared for this project adequately addresses many of the potential environmental impacts of the project. However, our reviewers have raised a few points which should be further elucidated in the final EIS.

Pg. 3

a. The site of the sanitary landfill proposed for disposal of the solids should be indicated on one of the figures. Will there be a need for road surfacing, expansion, or modification from the STP to the landfill site to handle the disposal trucks? How frequently will disposal trucks leave the STP?

b. With regard to the treated and chlorinated effluent disposal, the DEIS states that the disposal will be by gravity line discharging on the north side of Waimaauou Stream. What will be the actual physical configuration of the outfall? Will the outfall be from a pipe projecting from the cliff? What will be the diameter of the pipe or the dimensions of the discharge line? Will the discharge line affect the shoreline area with respect to erosion of the backshore?

Pg. 7

a. The summary of the Department of Health water quality results have limited application to evaluating the proposed project. The sampling areas are nearly 5 miles north and south of the proposed discharge area. Many of the parameters

cited (Total Kjeldahl nitrogen, Total Nitrogen, Turbidity (JTV), Total and Fecal Coliform), show a range so great that the standard deviation must be equal or greater than the mean in most if not all cases. Lacking further information to the contrary it appears that for these parameters at least, the relevance of their values to the evaluation of the environmental impact of the proposed sewage discharge on the coastal water quality at Kulaimano is not presented. We suggest that the relevance of these values to the proposed project be more fully discussed in the final EIS.

b. The water quality information presented in table 2 (pgs. 9-10) has two serious deficiencies. First, it does not include data for station "H" which is the only station shown on fig. 5 that is somewhat associated with the discharge area. Second, the data was collected in December 1966 and January 1967, and may not be representative of current conditions. Similarly, the relevance of R. Grigg's work on the biological effects of sugar mill discharges to the potential biological impact of chlorinated sewage effluent should be covered in the final EIS.

Pg. 16

A general breakdown of the costs of this project including land acquisition, construction and maintenance should be included in the EIS.

Pg. 18

Our reviewers have expressed some reservations as to the effectiveness of the methods described to provide odor control. The time schedule in the initial processing of sewage is most critical in the prevention of odor problems. Will the plant be operating initially at maximum capacity, i.e. .5 mgd or will it gradually reach this figure after some 5-7 years? If the latter schedule is anticipated, has a modular design been considered with additional units constructed as required? Such construction could effectively reduce the storage time for less than capacity inflows and thus reduce potential odor problems.

Because of the proximity of the STP to the adjacent urban and potential urban areas, and the prevailing onshore winds, odor management may well be the most serious and long-term environmental problem of the project.

What is meant by the statement regarding the location "above the ground water table so that the inflow of sulfates . . . will not occur . . . "?

The disposal method is indicated as being "over the cliffs" into the surf zone. A cross sectional diagram illustrating the dimensions of the discharge line, height of discharge above the shoreline, area of impact on the backshore, and type of ground surface at the impact area, i.e. sand, rock, etc. would be desirable. Is this particular area of the shoreline used by the local people for fishing, crabbing, or opihi gathering? If so, what provisions could be instituted to reduce the negative impact of the discharge on these recreational activities? We note that the dominant wind direction is onshore (North to

Southeast). What provision will be made to avoid or reduce spray from the discharge being carried onto the land? What is the estimated areal extent of the spray in a 24 mph wind from the ENE, E, ESE, and SE? What is the present and potential land use of the area so affected. The construction of a pipe discharge for .5 mgd of secondary treated sewage over the cliffs and onto a rocky beach may well have limited negative impact on the marine or coastal environment in this particular area, however, from the aesthetic standpoint it appears less than desirable. Have alternative methods of discharge into the coastal waters been considered? Could the discharge pipe be extended down to the base of the cliffs so as to reduce or eliminate the wind-borne spray problem?

Pg. 19

The simple comparison of the magnitude of the sewage effluent discharge to the magnitude of the natural drainage discharge does not in itself indicate the effect of the effluent discharge. Critical also to the quality of the coastal waters are the concentrations of pollutants in both discharges and especially the mixing conditions in the receiving waters.

We agree that the potential direct environmental impact of the effluent per se will probably be minimal with respect to the water quality of the near shore waters.

Pg. 23

Why was the alternative site discarded in favor of the proposed site? What are the land acquisition operation and maintenance costs associated with each alternative?

What is the physical configuration and mode of operation of the gravity filter (pg. 5, fig. 3)? How frequently will it be employed?

Pg. 24

It is true that the effects of shoreline discharge are theoretically "not irreversable" as stated, however, for the proposed project, for all practical purposes and for any forseeable future this plant once built will continue. Hence the environmental impact will be permanent.

Pg. 25

We assume, but would appreciate confirmation, that the existing old plantation housing and its accompanying sewer system will be removed upon the start of operation of the proposed Kulaimano STP.

We appreciate the opportunity to comment on this DEIS.

cc: WRRC

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
BLDG. 230, FT. SHAFTER
APO SAN FRANCISCO 96558

PODED-PV

16 May 1975

Dr. Richard E. Marland, Director
Office of Environmental Quality Control
State of Hawaii
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Dr. Marland:

We have reviewed the draft environmental impact statement for Kulaimano Sewage Disposal System and have the following comment.

In addition to the cost of operation and maintenance given on page 16, the cost of construction of the plant and the Federal and County contributions toward the construction should be stated.

Sincerely yours,

for KISUK CHUNG
Chief, Engineering Division

BICENTENNIAL AMERICAN REVOLUTION 1776-1976

GEORGE R. ARIYOSHI
GOVERNOR

JOHN FARIAS, JR.
CHAIRMAN, BOARD OF AGRICULTURE

YUKIO KITAGAWA
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF AGRICULTURE
1428 SO. KING STREET
HONOLULU, HAWAII 96814

May 15, 1975

MEMORANDUM

To: Dr. Richard E. Marland, Director
Office of Environmental Quality Control

Subject: EIS of the Kulaimano Sewage Disposal System
Pepeekeo, Hawaii

The Department of Agriculture has reviewed this draft statement for agricultural impact. This consolidated treatment of waste water flow is warranted.

Normally it would be desirable to consider recycling waste water rather than discharging to a stream. Such alternative uses are not feasible for the expected volume of discharge in this area.

Final acceptance of the impact statement is recommended.

John Farias, Jr.
Chairman, Board of Agriculture

JF:d:h

UNIVERSITY OF HAWAII

Water Resources Research Center
Office of the Director

MEMORANDUM

May 6, 1975

MEMO TO: Richard E. Marland
Director, OEQC

FROM: Reginald H. F. Young
Asst. Director, WRRC

SUBJECT: EIS, Kulaimano Sewage Disposal System

On Page 16 under Socio-Economics there is reference to user charge rates and the estimated cost for operation and maintenance of $95,000 per year, and under Treatment Plant Sites reference is made to the alternative of using one pump station resulting in $300,000 less for the collection and trnasmission system. These are the only two figures referring to costs. The EIS has not fully addressed the impact of resources requirements by listing and evaluating the total cost of the sewerage system, such as land cost, transmission and collection costs, actual treatment plant construction cost and federal grant contribution.

RHFY:jmn

cc: H. Gee
Env. Ctr.

DEPARTMENT OF THE ARMY
HEADQUARTERS UNITED STATES ARMY SUPPORT COMMAND, HAWAII
APO SAN FRANCISCO 96558

AFZV-SG-EC

9 May 1975

Richard E. Marland, Ph.D.
Director
Office of Environmental Quality Control
State of Hawaii
Room 301, 550 Halekauwila Street
Honolulu, Hawaii 96813

Dear Dr. Marland:

The Draft Environmental Impact Statement for the Kulaimano Sewage Disposal System was reviewed by our office.

We have no comments to offer at this time.

Thank you for the opportunity to review this statement.

Sincerely,

LEE C. HERWIG, JR.
Colonel, MSC
Environmental Consultant to Commander,
U.S. Army Support Command, Hawaii

E. A[illegible] Y Wright
Director

Deputy Directors
Douglas S. Sakamoto
Wallace Aoki

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

IN REPLY REFER TO:

May 16, 1975

ATP 8.3107

Dr. Richard E. Marland
Interim Director
Office of Environmental
Quality Control
550 Halekauwila St., Rm. 301
Honolulu, Hawaii 96813

Dear Dr. Marland:

Subject: Draft EIS for Kulaimano Sewage Disposal System

In reference to the subject environmental statement, we have no comments to offer as it relates to and affects our transportation system.

Sincerely,

Douglas S. Sakamoto
for E. OLVEY WRIGHT
Director

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

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

GEORGE A. L. YUEN
DIRECTOR OF HEALTH

Audrey W. Mertz, M.D., M.P.H.
Deputy Director of Health

Henry N. Thompson, M.A.
Deputy Director of Health

James S. Kumagai, Ph.D., P.E.
Deputy Director of Health

April 29, 1975

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

MEMORANDUM

To: Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control

From: Deputy Director for Environmental Health

Subject: Draft Environmental Impact Statement (EIS) for Kulaimano Sewage Disposal System, Hawaii

Thank you for allowing us to review and comment on the subject EIS. Please be informed that we have no objections to this project.

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

JAMES S. KUMAGAI, Ph.D.

COUNTY OF HAWAII

PLANNING DEPARTMENT

25 AUPUNI STREET • HILO, HAWAII 96720

HERBERT T. MATAYOSHI
Mayor

RAYMOND H. SUEFUJI
Director

April 23, 1975

Dr. Richard E. Marland
Director, Office of Environmental Quality Control
550 Halekauwila Street
Honolulu, Hawaii 96813

Re: Environmental Impact Statement
Kulaimano Sewage Disposal System
TMK: 2-8-7:por. 1

Thank you for the opportunity to review the above. We have had prior opportunities to review this document. Our concerns have already been met. We have no further comments to offer.

Raymond Suefuji

RAYMOND SUEFUJI
Director

RN:lgv

TO: Ri ard E. Marland, Interim Directc
Office of Environmental Quality Control

RE: EIS Kulaimano Sewage Disposal System

/ / EIS returned: project does not pertain to SCS activities and/or responsibilities.

/X/ EIS received: ~~xxxxxxxxxxxxxxxxxx~~ No comments

Francis C. H. Lum
State Conservationist

4/30/75
Date

Reply to Comments by Office of Environmental Quality Control

Recommended Wastewater Management System

1. Presently, a cane haul road serves as access to the proposed treatment facility site. It is proposed that improvement (asphaltic top) to the road (approximately 1300 lf) be implemented along with construction of the sewerage facilities.

2. We will concur.

3. The effluent line crossing Waimaauou Stream is proposed to be buried in an existing roadway (with culvert) and will not change the existing drainage patterns of the area nor affect the flow properties of the stream. The effluent line crosses no other streams, ditches, or waterways.

4. We concur and have included a discussion in the EIS on disinfection.

5. A standby generator rated at 400 kw will be provided in the event of power failure.

6. The discharge point of the outfall is proposed to be located north of Waimaauou Stream to minimize localized impact of the effluent concentration at the mouth of the stream. Since the predominant current is northerly (parallel to the shoreline), any discharge to the south of Waimaauou Stream presents the opportunity to concentrate in the cove-like mouth of Waimaauou Stream and the moi fishing holes to the north.

Proposed Action

1. We have expanded this portion of the EIS, as suggested.

2. The anticipated funding for the proposed sewerage system is based on the following proportion:

   Federal: 75 percent
   State: 10 percent
   Hawaii County and C. Brewer: 15 percent

3. We have included cost estimates in the EIS.

4. The County of Hawaii will be responsible for the operation and maintenance of the sewage disposal system.

5. The sewage disposal system is anticipated to be in operation in late 1977. This schedule, however, is dependent upon obtaining all approvals from government agencies and adequate financing.

Water Quality

1. No water quality data for station H are available. No available data to update the 1966-67 report are available, except for data at two

locations from the State Department of Health (see Table 1). Data were presented to illustrate the varying character of the nearshore water as influenced by existing discharges. Data also indicate that water quality of the nearshore water does not now consistently meet with State Water Quality Standards. A meaningful water sampling program would have to extend over a one-year period.

Biology

Compared to sewage effluent, discharge from sugar mills is characteristically extremely high in suspended solids (200 to 300 times) and BOD (30 times) and low in phosphorus content. Total nitrogen content is similar for both cane mill and sewage effluent discharges.

The seven conclusions were presented to illustrate the impact of sugar mill discharge on the ecosystem in lieu of the absence of data on the impact of sewage effluent in the Kulaimano area. Cane mill discharge would have a greater impact on the ecosystem than sewage effluent due to the high content of suspended solids and its "accumulation" effect.

In contrast, studies indicate the degree of toxicity of chlorinated effluent to bentic organics is concentration-dependent. At Kulaimano, this is mitigated by dilution of the surf zone and ocean currents.

Site of Treatment Plant

Public hearings on the subject project were held on July 9, 1973 and on April 28, 1975. An informational meeting was also held on July 26, 1973.

Effluent Disposal

Opihi picking and shoreline fishing may be other recreational activities curtailed in the immediate area of the discharge.

Adverse Effects That Cannot Be Avoided

The serious impact would be that trucks and equipment from both activities may be using the same avenues of access, with greater possibility for accidents. This may be mitigated by coordinating truck routes of the two activities.

Disposal Methods

Conditions to preclude the requirement of a variance utilizing the stream or shoreline discharge include tertiary treatment of the waste flows prior to discharge.

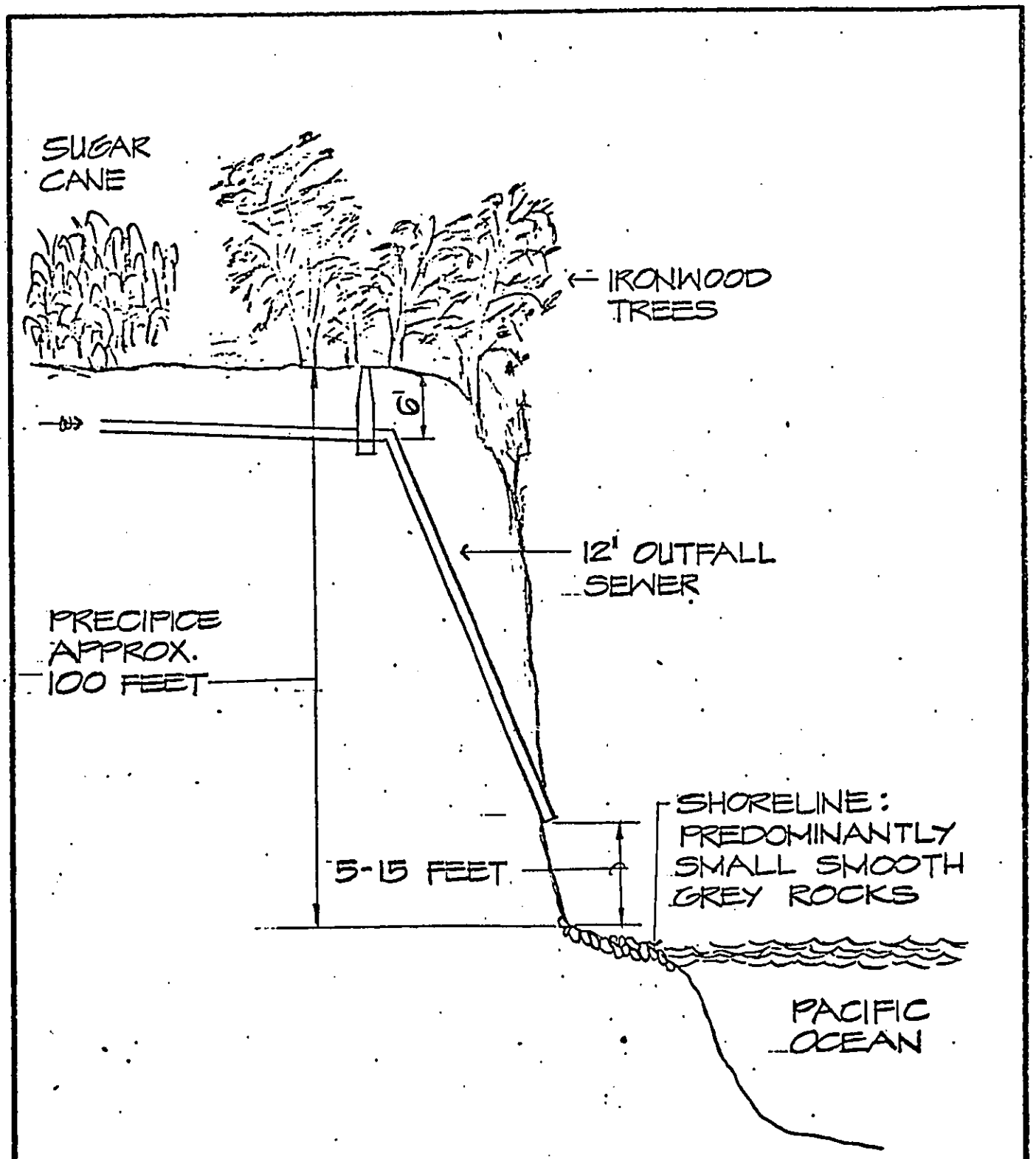
Irreversible and Irretrievable Resources Committed by the Proposed Action

1. We have included a section on secondary impact (future urban developments, loss of agricultural lands) in the EIS.

2. In a study of ecological effects of sugar mill waste on marine life along the Hamakua Coast, observations by Grigg indicated that recovery of coral and associated benthos appears to begin within six months after the mill ceases discharging sediments.

   Griggs also indicated that approximately 15 years are required before coral reaches its average maximum size. The estimate varies from locale to locale, dependent upon the degree of degradation, etc.

   The area affected by the effluent would recover even sooner since effluent at the discharge area has a lesser impact on the ecosystem.

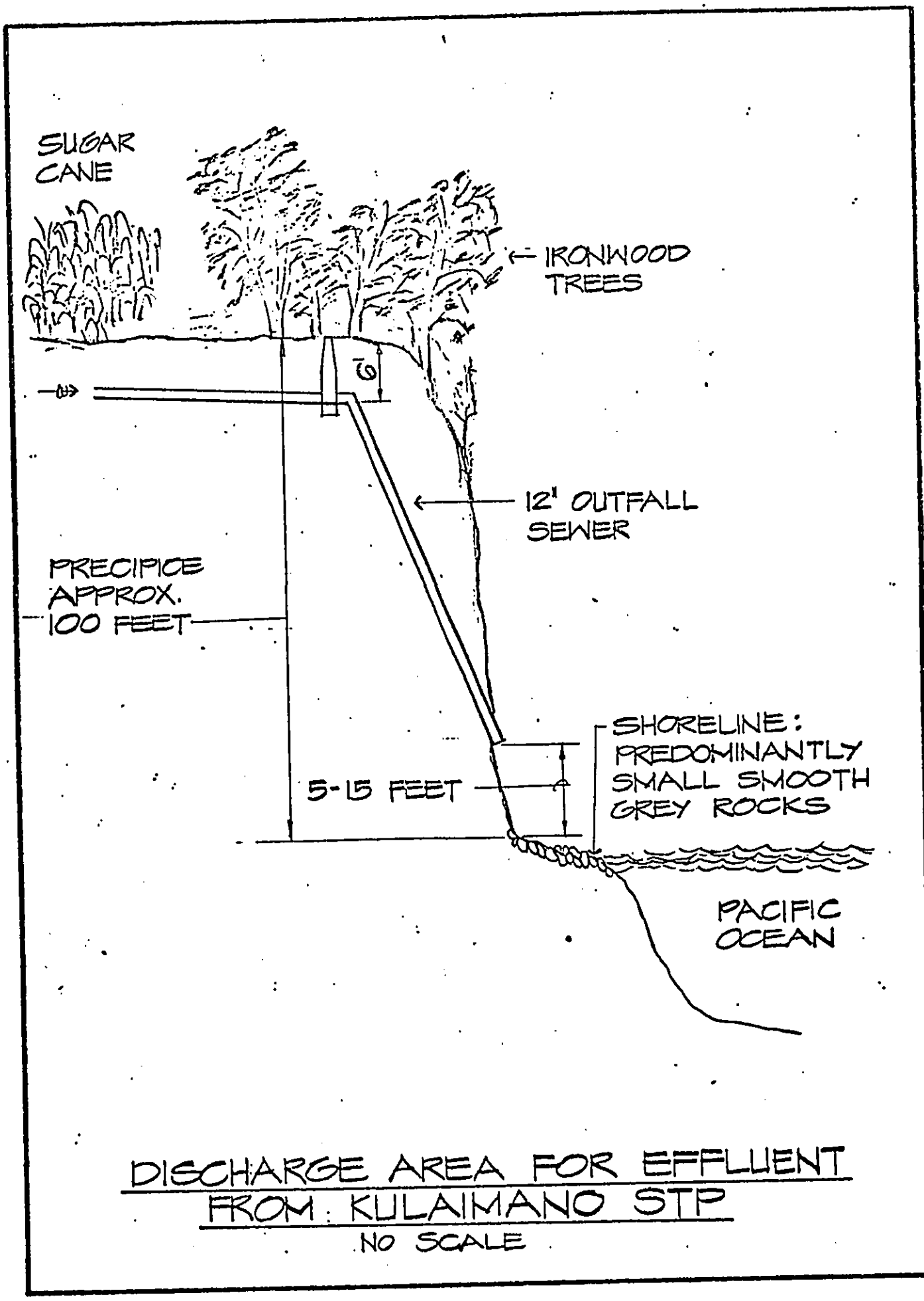


DISCHARGE AREA FOR EFFLUENT FROM KULAIMANO STP

NO SCALE

Reply to Comment by the Department of Land and Natural Resources

The discharge configuration of the outfall is shown on the attached sketch. This was proposed to minimize the aesthetic impact of the discharge, to limit the extent of wind-induced sprays, to minimize the already limited access to the area, and to minimize the extent of erosion of the cliff face.



DISCHARGE AREA FOR EFFLUENT FROM: KULAIMANO STP

NO SCALE

Reply to Comments by the Director, Division of Fish and Game, Department of Land and Natural Resources

1. We have included a cost comparison in the EIS. A minimum distance of 1,000 feet offshore for an outfall is mandated by the State Public Health Regulations, Chapters 37A and 38, and is used in the EIS as a basis of cost comparison.

2. We have included the cost of injection wells in the EIS. In considering the injection well alternative, a design factor is percolation rates (permeability), but an overriding factor is clogging by suspended matter, which reduces the capacity of the well. As used in the field of sewage disposal, injection wells are normally used as an interim measure for small flows. A study by Mr. John Mink, former hydrogeologist for the Board of Water Supply, City and County of Honolulu, on the applicability of injection wells in the Kulaimano area was conducted in conjunction with development of a sewage disposal system for Kulaimano. The following design parameters were recommended:

Transmissibility:	1×10^6 gpd/ft
Permeability:	2,500 gpd/sf
Porosity:	0.20
Gradient:	3 ft/2,000 ft

Based on these data, design flows for the Kulaimano area can be discharged by injection wells. However, as previously mentioned, the overriding factor is clogging by solids. Also, the time for recovery of the groundwater quality after discharge has ceased is much longer than that for shoreline discharge.

We have stated that there is a possibility of degradation of the basal lens. To determine the actual extent and degree of degradation by field testing may take several years. Further, the Department of Water Supply, County of Hawaii, has stated that it prefers injection wells not be the mode of effluent disposal since any disposal of effluent would preclude development of well fields in the immediate area.

We have considered placing the wells at a lower elevation and close to the cliffs in our cost analysis.

3. In the EIS we have included an additional discussion on stream discharge of effluent. This alternative was not selected because it would (1) preclude the use of limited potential for the stream gully and would present a potential hazard by accumulation of suspended solids of the effluent, (2) require a large area of restricted use, and (3) be more easily accessible to residents of the area. The impact on water quality of nearshore waters for stream discharge would be similar to that of shoreline discharge alternatives. The conditions to be met include achieving effluent quality and meeting tertiary treatment standards.

4. The data on surface runoff and groundwater discharge were presented not to imply that they would effectively wash away the effects of sewage discharge but to illustrate a comparison of magnitude between the natural flows and the proposed sewage flows and its corresponding impact on the nearshore waters.

5. In his study on the ecological effects of discharge from sugar mill operation on marine life, Grigg reported recovery appears to begin within six months after mill discharges cease. The impact of sewage effluent would have a lesser impact and recovery is anticipated to be sooner.

   The effect of the effluent is reversible, even if the plant continues to operate. Other possible disposal alternatives may be implemented, including injection wells or conveying the effluent out of the study area by a system of pump stations

6. A cursory benthic survey was undertaken, and the results are included in the EIS.

7. The two statements are not contradictions. It was felt that the discharge of effluent has little significant impact on the natural environment because of the dilution factor and the overriding impact of waste discharges from cane milling operations and natural flows. Curtailing the use of the shoreline in the immediate vicinity of the discharge area is based on solely safety considerations, and is not related to impact on the natural environment.

Summary

1. Design data regarding the disposal of effluent by injection wells were derived by John Mink. His results were based on the hydrogeological characteristics of existing wells (located approximately one mile from the project site) and areal geological data. For this reason, and in consideration of the time and cost constraints, it was felt that there was not an overwhelming need to implement field percolation studies.

2. A cursory benthic and pelagic survey was undertaken. The results of this survey have been incorporated in the final submittal of the EIS. A comprehensive survey was not implemented for the following reasons:

   a. The probable affected area would be limited to the shallow surf zone. Obtaining a comprehensive survey in this area would be difficult due to hazardous wave conditions and the limited visibility. (One of our investigators was slightly injured on the initial field trip.)

   b. Field investigation of the discharge site indicated movement of the cobble rocks in the surf zone by wave action. For this reason, the extent of benthic and attached organisms probably would be limited.

c. Dispersion studies undertaken in this project indicated that the discharge of secondary effluent is anticipated to have no measurable impact on the nearshore waters (see discussion in the final EIS).

3. A survey of the uses of the rocky shoreline and the surf zones has been included in the Final EIS.

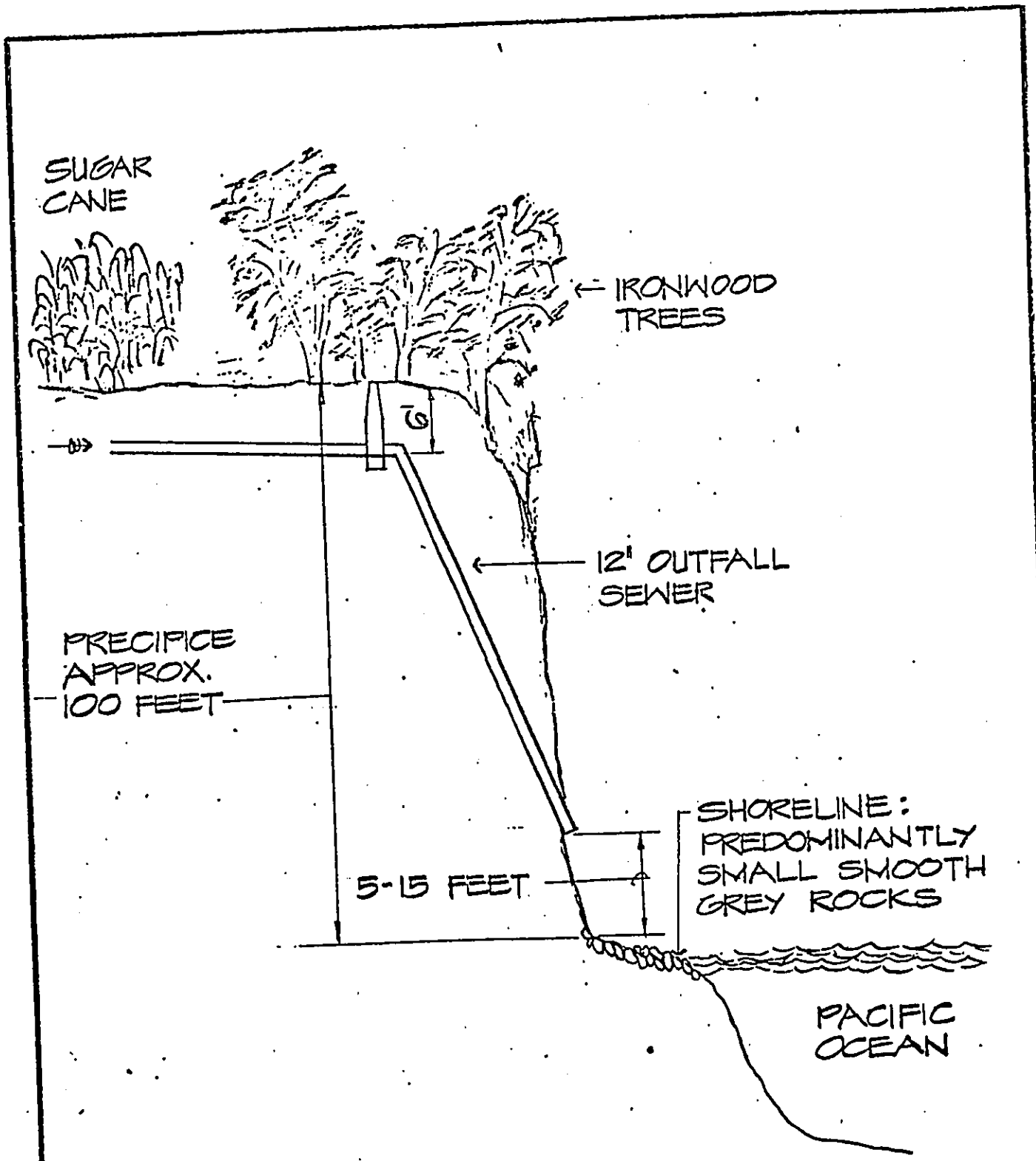
4. Implementation of a meaningful water quality sampling program would have to extend over a one-year period, and the cost would also be prohibitive. Further, there is no reason to suspect that water quality of the nearshore waters has changed since 1967.

5. We have included cost alternatives of the discharge methods.

6. The effects of chlorine on the shoreline organisms, if any, would be limited to a small area. Preliminary data from dye studies indicate an area of less than 100 feet by 60 feet may be affected. This is based on the anticipated chlorine residual in the effluent of 0.3 mg/l and on threshold levels of aquatic organisms of 0.03 mg/l chlorine ("Study on Toxicity and Biostimulation in San Francisco Bay Delta Area," by L.A. Esvelt, W.J. Kaufman, and R.E. Selleck, October 1967).

   The impact of chlorinated effluent on the ecosystem is mitigated by the generally rough water conditions and by the use of an automatic flow proportional chlorinator to control dosages prior to discharge into a holding pond.

   (See final EIS for a further discussion on the impact of chlorine on the ecosystem.)



DISCHARGE AREA FOR EFFLUENT FROM KULAIMANO STP

NO SCALE

Reply to Comments by the Environmental Center, University of Hawaii

Page 3 a

The present municipal sanitary landfills are in the Hilo area, approximately eight miles south. For this reason landfills are not indicated in the area map.

Trucks will use the existing state/county roads.

In the initial period (up to 1980-85) disposal truck is estimated to leave for disposal sites every other day. When plant capacity is reached (0.5 mgd), the trucks should depart for the landfill once per day.

Page 3b

The configuration of the outfall sewer is shown on the attached sheet. The discharge point on the shoreline is predominantly comprised of small (three to six inches in diameter), smooth, gray rocks during periods of low tide. No serious erosion problem is anticipated.

Page 7a

The data were presented to illustrate the varying character of the nearshore waters as influenced by existing discharges from natural sources and sugar mill waste flows. Data indicate that the water quality of the nearshore water does not consistently meet the State Water Quality Standards. A meaningful water sampling program to establish baseline conditions would have to extend over a one-year period. Also, there is no reason to anticipate any significant changes in the water quality.

Page 7b

No data are available at station H. We concur that data collected in December 1966 and January 1967 may not be representative of current conditions. However, this was the best available data at the time of report preparation.

We have included a discussion on the relevance of Grigg's work on the biological effects of sugar mill waste to that of chlorinated sewage effluent on the ecosystem.

Page 16

We have included a cost summary of the project in the EIS.

Page 18

Covering as measure of odor control is independent of flow quantity.

It is estimated that the plant capacity for the next five to ten years will be approximately 0.30 mgd. Modular design has been incorporated in the design.

Odor could be a problem based on the proximity to the residential units. It is for this reason that we have proposed to enclose specific units in the design, with provisions for air scrubbing. Chemical treatment also may be provided.

Odors generated in sewers are aggravated by infiltrating brackish groundwater containing high concentration of sulfates, which serve as building blocks for H_2S. This is exhibited in many of the sewer systems in the coastal area. However, this situation is not anticipated at Kulaimano, where the sewers are above the groundwater. Further, long detention times in the sewer system should not occur at Kulaimano since the tributary area is served by gravity sewers with relatively steep slopes.

The sketch on the following page illustrates the configuration of the terminus of the outfall and all pertinent information.

Field observations indicate that recreational activities in the discharge area are limited to occasional opihi picking and shoreline fishing. Limited use of the area is attributable to the limited accessibility because of the steep cliffs and the generally rough water conditions. The discharge of effluent will curtail use of the shoreline in the immediate vicinity of the discharge.

The terminus of the outfall has been extended down at an angle to mitigate the impact of wind-induced sprays and aesthetic considerations.

Page 19

We concur that the magnitude of any flow does not in itself indicate the impact of the discharge on water quality. However, although sediment data are lacking for streams in the study area, Grigg has indicated in his studies that large quantities of sediment are discharged to the nearshore waters by stream flow, larger than that anticipated for secondary effluent.

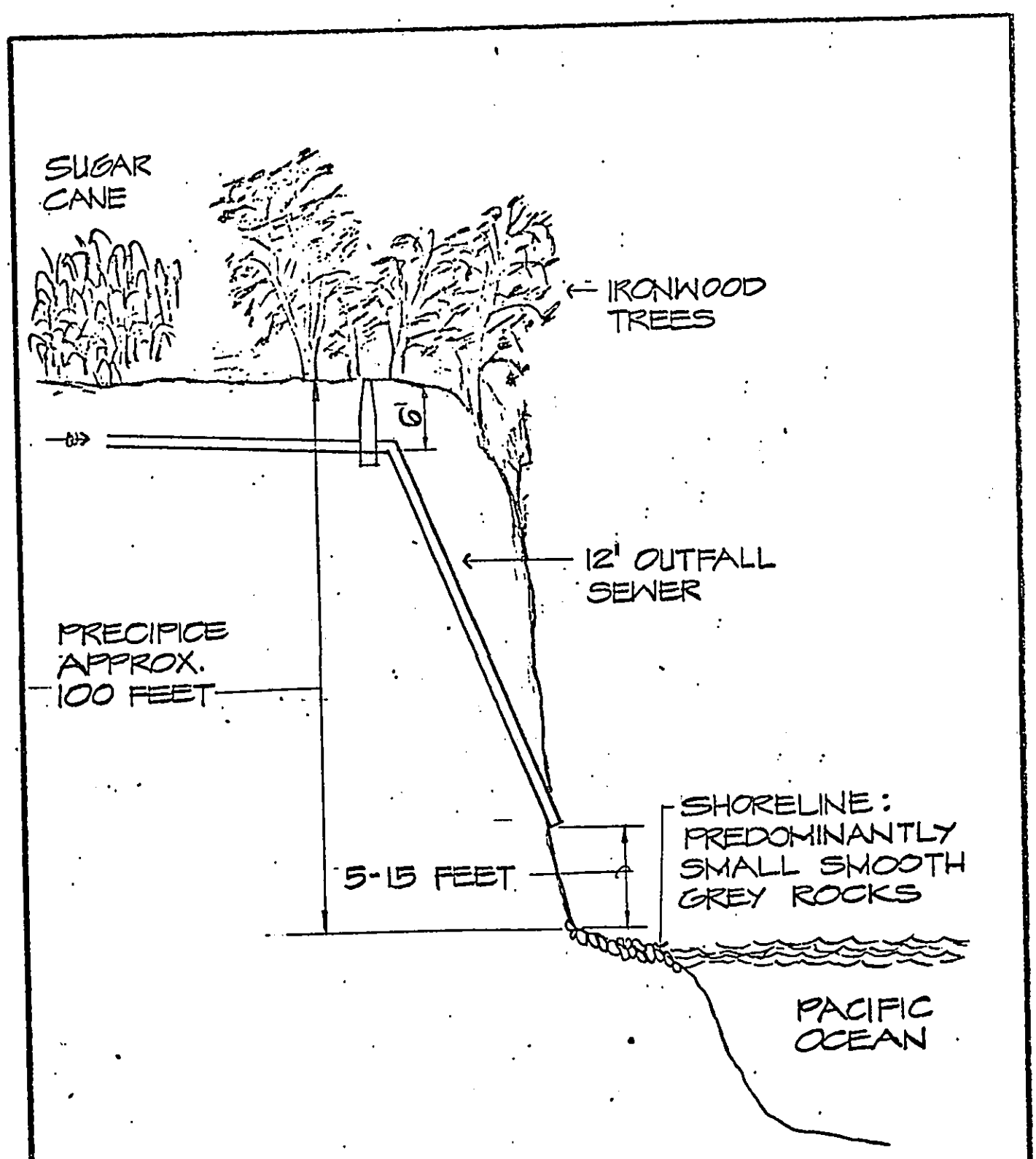
Page 23

The alternative site was discarded for the following reasons:

1. Cost differences between the site alternatives are negligible.

2. The lower site alternative becomes viable only when there is a certainty that the lower Kulaimano Homestead will be urbanized in the near future. At the present time the county's planning department has no specific guidelines to the possibility of changing the zoning from agriculture to urban.

3. Delays may be incurred in obtaining a special land use permit for the lower site. This would mean a delay in development of the Kulaimano Heights development and an increase in cost of homes, which would create additional hardship on the plantation personnel purchasing these homes.



DISCHARGE AREA FOR EFFLUENT FROM KULAIMANO STP

NO SCALE

The gravity filter has a dual cell configuration, with nylon netting serving as the filter media. A similar unit is operational at the Ahiamanu Sewage Treatment Plant, City and County of Honolulu.

In the initial period (0.25 mgd flow) filters are anticipated to be operated every other day. At the design loading (0.5 mgd) the unit is to be operated 30 hours per week.

Page 24

Other modes of disposal may be implemented, such as injection wells, reclamation, or conveying the effluent out of the study area.

Page 25

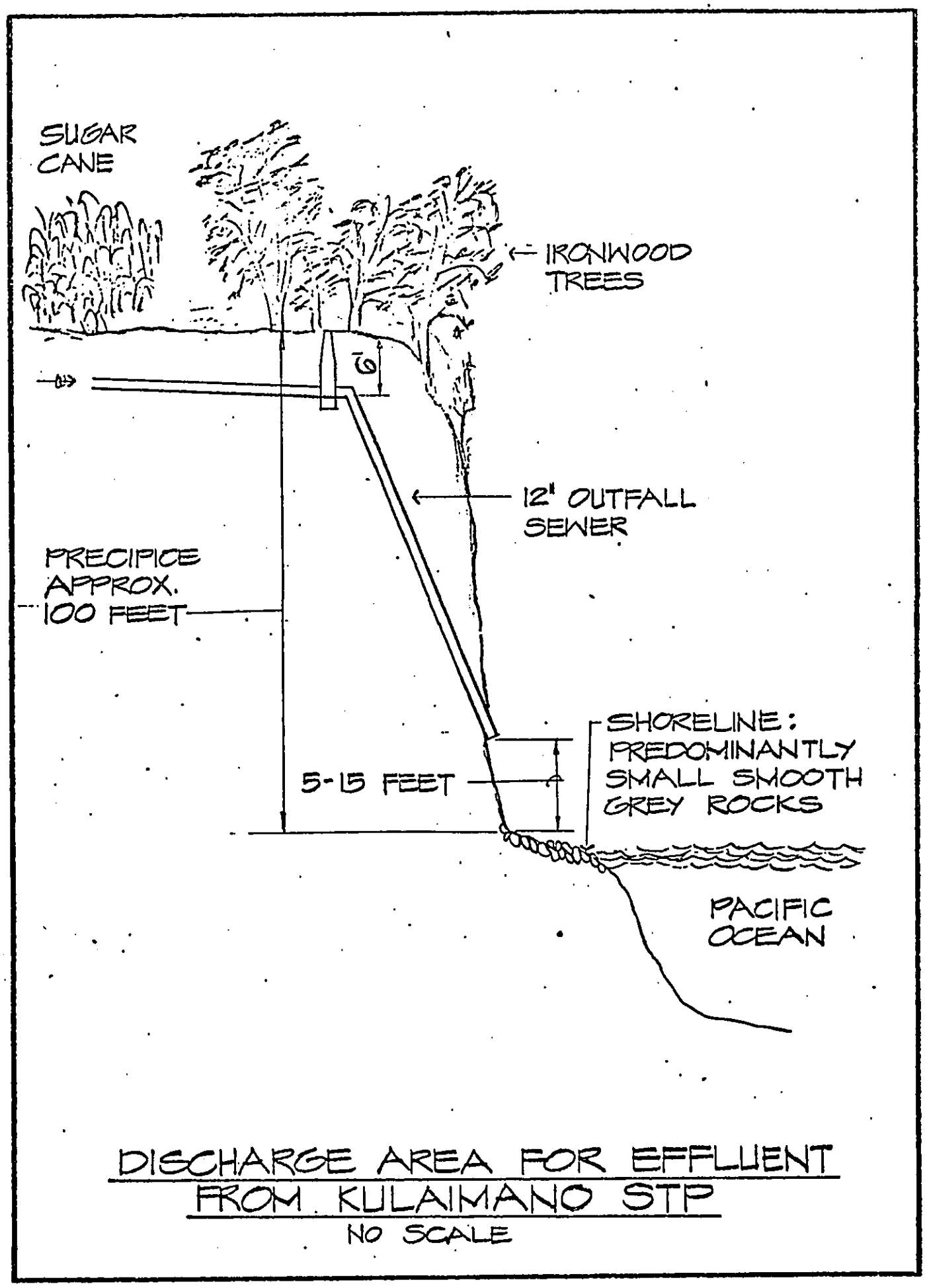
Discussion with C. Brewer & Company indicates that the substandard housings will be abandoned with relocation of plantation workers to the Kulaimano Heights development.

Reply to Comments by the U.S. Army Corps of Engineers

The estimated cost of constructing the sewerage system has been included in the EIS.

Reply to Comments by the Water Resources Research Center, University of Hawaii

We have included the estimated cost of the sewerage system and the funding sources in the EIS.



DISCHARGE AREA FOR EFFLUENT FROM KULAIMANO STP

NO SCALE