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AN EQUAL OPPORTUNITY EMPLOYER
COUNTY OF KAUA'I
DEPARTMENT OF PUBLIC WORKS
4444 RICE STREET
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LIHU'E, KAUA'I, HAWAI'I 96766

June 30, 2000

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
State of Hawaii
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Mr. Gill:

Subject: Final Environmental Assessment (EA) for the
Lihue Wastewater Treatment Plant Effluent Disposal System Phase 1
TMK: 3-5-01:27, 30 & 82
Lihue, Kauai, Hawaii

The County of Kauai, Department of Public Works, has reviewed the final environmental assessment for the subject project, and declares a Finding of No Significant Impact. Please publish notice of availability for this project in the July 23, 2000 OEQC Bulletin.

We have enclosed a completed OEQC Bulletin Publication Form and four copies of the final EA. Please contact Harry Funamura of the Division of Wastewater Management at (808) 241-6610 if you should have any questions.

Very truly yours,

CESAR C. PORTUGAL
County Engineer

FINAL

2000-07-23-KA-FEA-

ENVIRONMENTAL ASSESSMENT

LIHUE WASTEWATER TREATMENT PLANT EFFLUENT DISPOSAL SYSTEM

For the
County of Kauai
DEPARTMENT OF PUBLIC WORKS

June 2000

FUKUNAGA AND ASSOCIATES, INC.
Consulting Engineers
1388 Kapiolani Boulevard, Second Floor
Honolulu, Hawaii 96814
(808) 944-1821

FINAL
ENVIRONMENTAL ASSESSMENT

LIHUE WASTEWATER TREATMENT PLANT EFFLUENT DISPOSAL SYSTEM PHASE 1

T.M.K. 3-5-01:30
Lihue, Kauai, Hawaii

PROPOSING AGENCY:

DEPARTMENT OF PUBLIC WORKS
COUNTY OF KAUAI

Submitted Pursuant to Chapter 343, HRS

Responsible Official: _____ Date: 6/19/00
Cesar Portugal
County Engineer

Prepared by:

Fukunaga and Associates, Inc.
1388 Kapiolani Boulevard, Second Floor
Honolulu, Hawaii 96814

June 2000

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CHAPTER I

INTRODUCTION

A. GENERAL

The proposed project is the first phase of Kauai County's long range Lihue Wastewater Treatment Plant (WWTP) effluent disposal plan, and involves the development of additional injection wells on Kauai Lagoons Resort Company (KLRC) lands to be acquired as part of the expanded Lihue WWTP facilities. See **Figures I-1** and **I-2** for the project location.

Currently, treated effluent is conveyed to a pond (Pond 2) on adjacent KLRC land, where it is stored and reused to irrigate KLRC golf courses. An injection well located adjacent to the KLRC pond disposes of overflows from Pond 2 and functions as a partial backup to the effluent reuse system. A second injection well, located at the Lihue WWTP, functions as an emergency disposal system. See **Figure I-3** for site plan.

The proposed project will be Phase I of the Kauai County's long range Lihue WWTP effluent disposal plan, and will involve construction of six additional injection wells to meet the needs of the expanded Lihue WWTP.

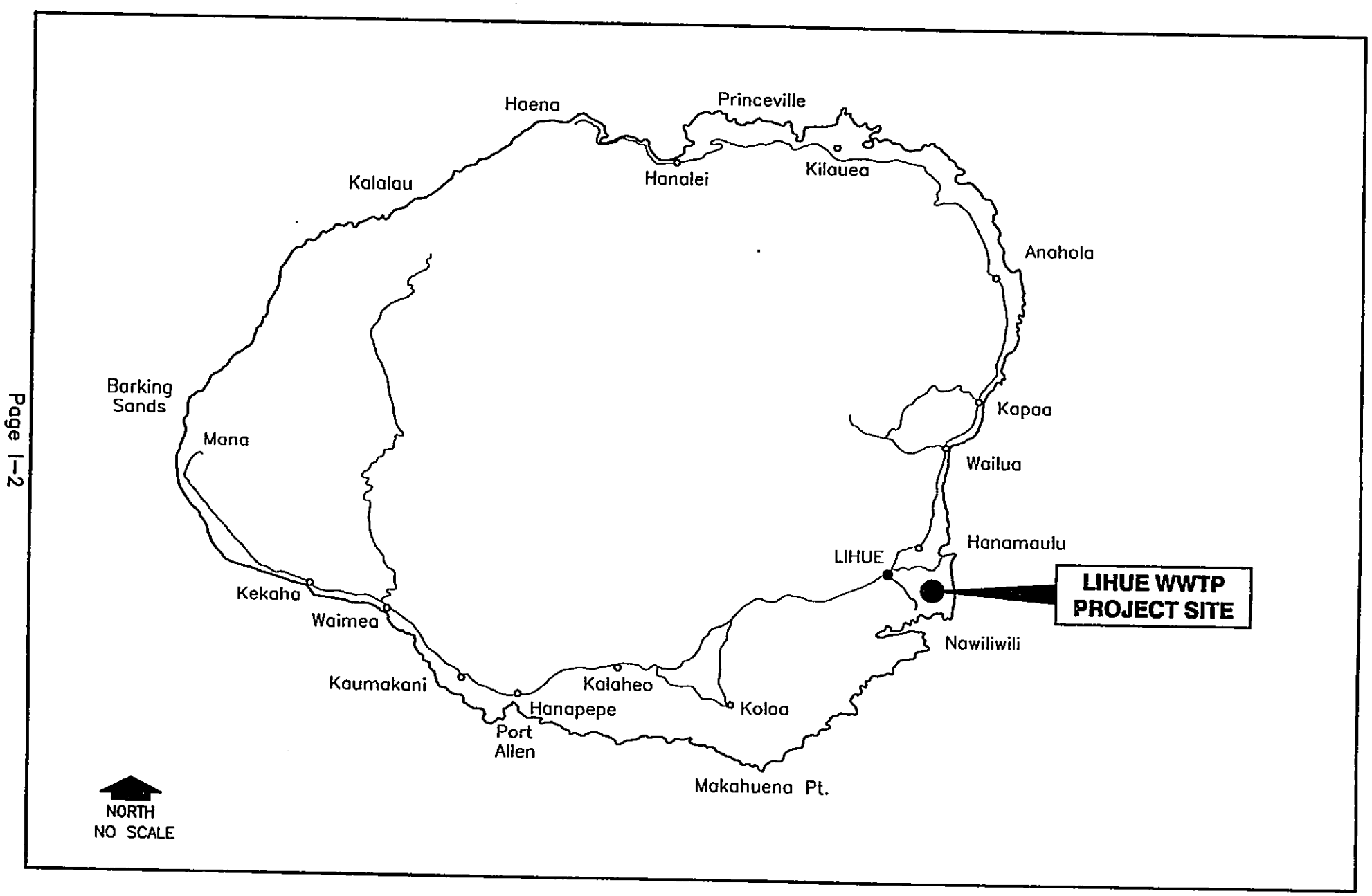
The proposed injection wells are located in an area adjacent to the existing Lihue WWTP on land currently owned by KLRC. See **Figure I-4**. The ownership of the land on which the proposed injection wells are located is in the process of being transferred to the County of Kauai, and will become part of an integrated Lihue WWTP site.

B. PROPOSING AGENCY

The proposing agency is the County of Kauai, Department of Public Works, Division of Wastewater Management.

C. APPROVING AGENCY

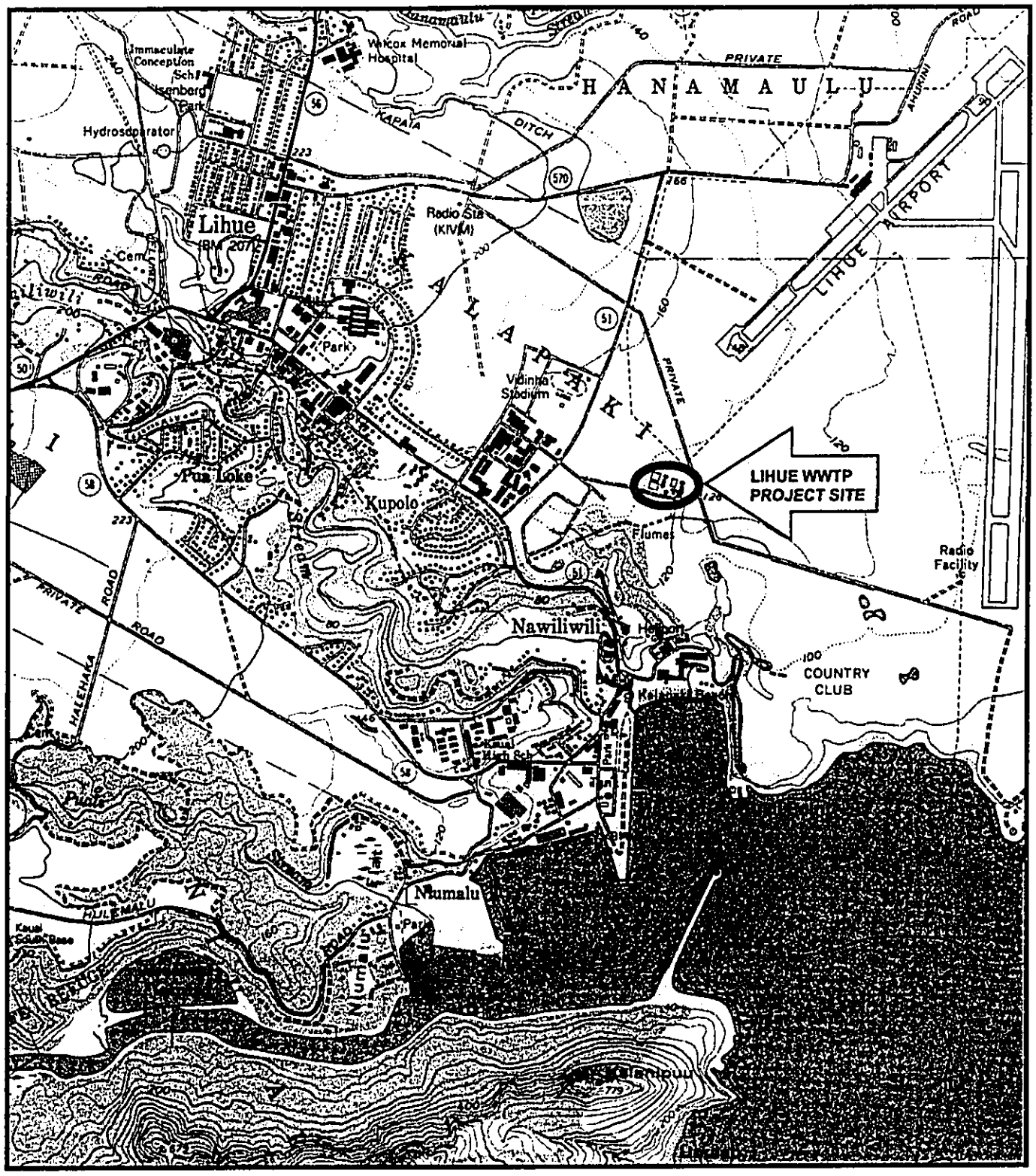
The approving agency for this project is the County of Kauai, Department of Public Works.



COUNTY OF KAUAI
Lihue WWTP Effluent Disposal System

ISLAND OF KAUAI

FIGURE I–1

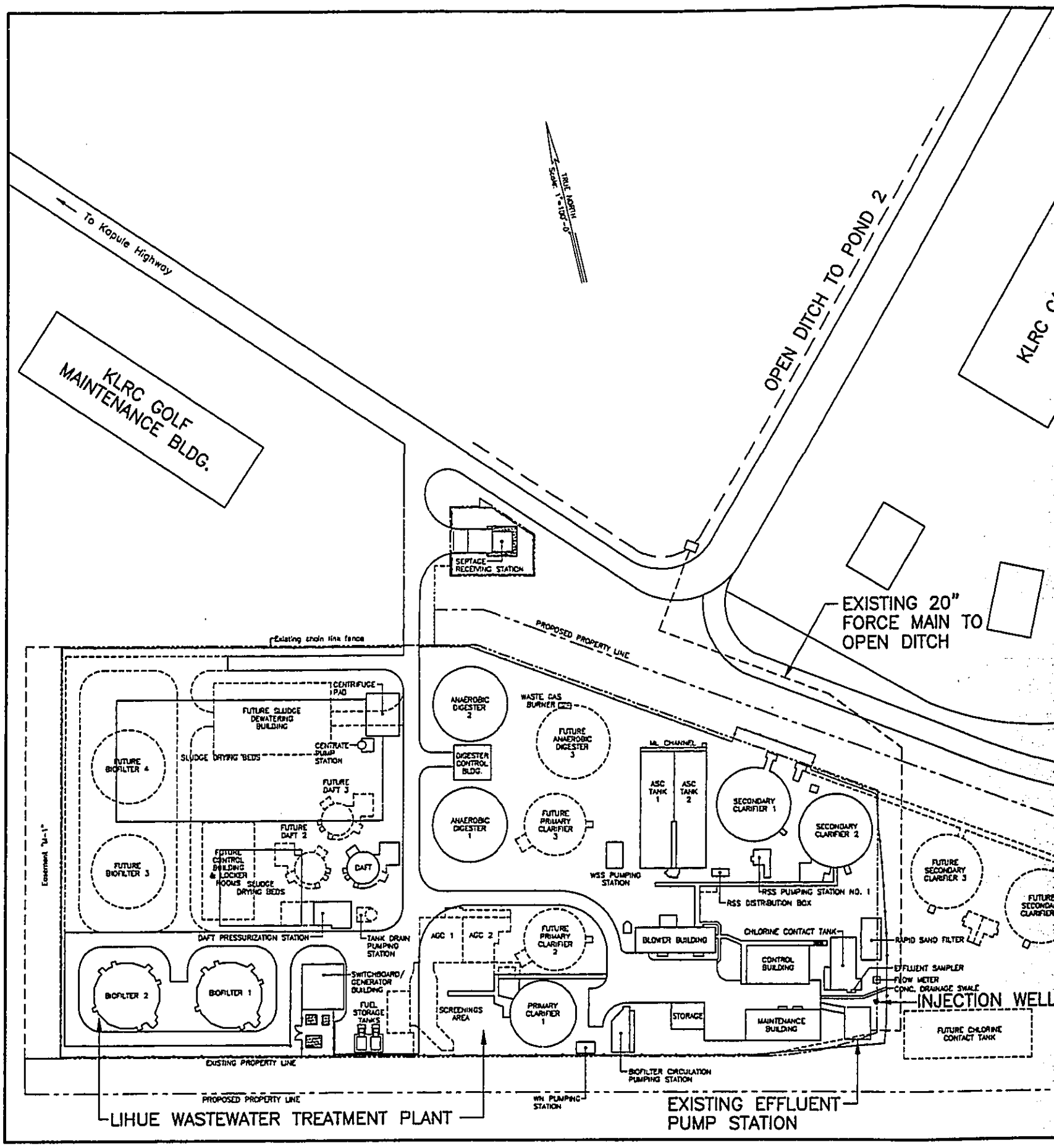


COUNTY OF KAUAI

Lihue WWTP Effluent Disposal System

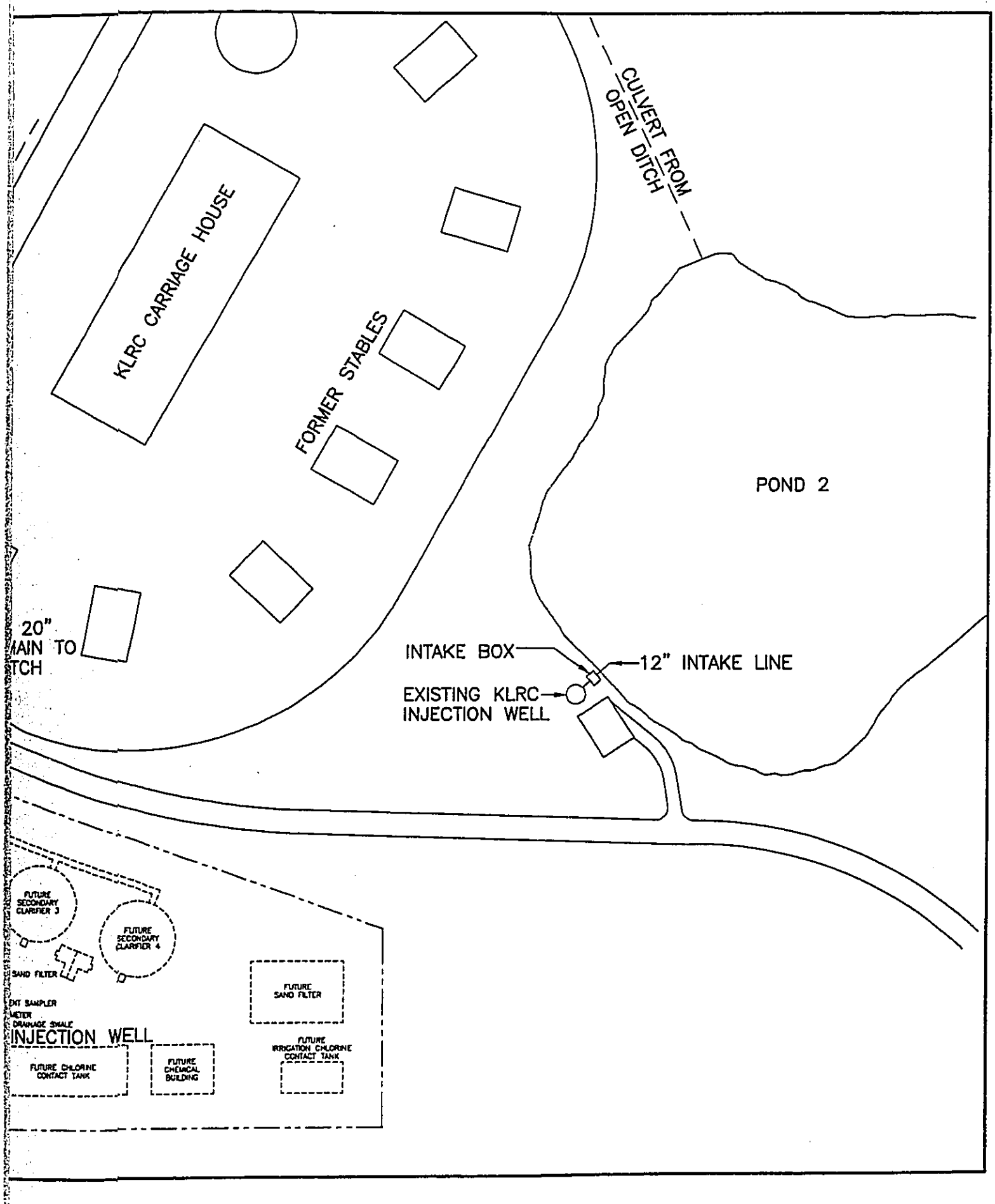
LOCATION MAP

FIGURE I-2



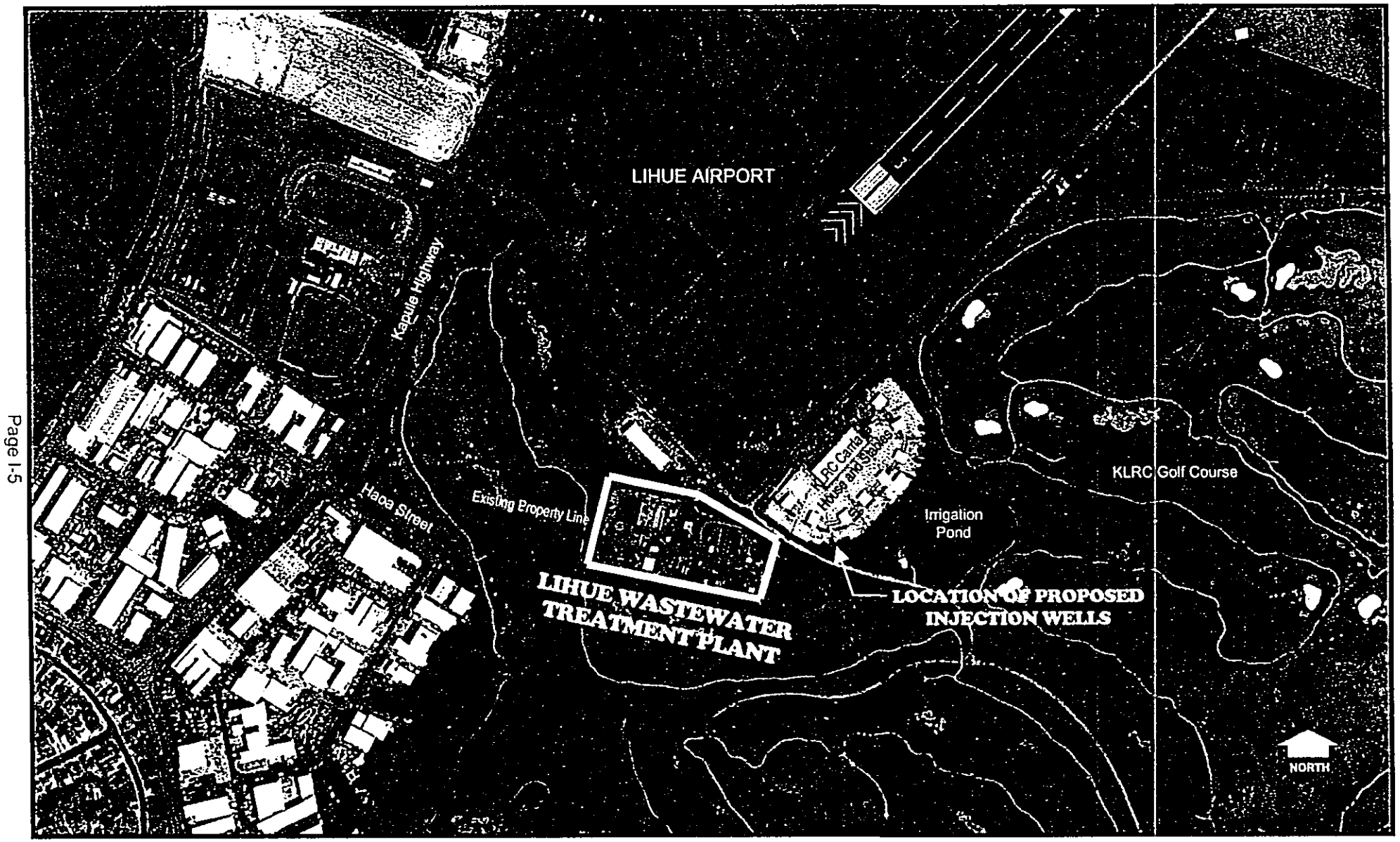
COUNTY OF KAUAI

Lihue WWTP Effluent Disposal System



LIHUE WWTP SITE PLAN AND EFFLUENT DISPOSAL SYSTEM

FIGURE I–3



COUNTY OF KAUAI
Lihue WWTP Effluent Disposal System

LIHUE WASTEWATER TREATMENT PLANT LOCATION

FIGURE I-4

D. BACKGROUND INFORMATION

1. Lihue WWTP

The Lihue WWTP was expanded in 1995 from an average daily treatment capacity of 1.5 mgd to 2.5 mgd. Current average daily inflow to the treatment plant is approximately 1.3 mgd. The Lihue WWTP was designed to accommodate:

Average Daily Flow (ADF)	2.5 mgd
Maximum Flow (MF)	5.0 mgd
Peak Flow (PF)	6.25 mgd

2. Status of Effluent Disposal

At present, treated sewage effluent is disposed of by irrigation on the adjacent KLRC golf courses. KLRC, having assumed the obligations of Hemmeter-VMS under a January 15, 1988 agreement, is required to accept up to 4.5 mgd of secondary treated effluent until August 22, 2003. The agreement may be extended for 10 more years after August 22, 2003 under the same terms, except that KLRC would be required to accept no more than 1.5 million gallons per 24-hour period of treated effluent during the 10 year extension period. The complete agreement terminates on August 22, 2013. The contractual expiration dates are approaching rapidly; and a long range effluent disposal plan is needed to assure that all of the treated effluent from the Lihue WWTP will be disposed of on a long term basis, economically, and in an environmentally acceptable manner. To meet these objectives, the County of Kauai is proposing a long range effluent disposal plan for Lihue WWTP.

3. Lihue WWTP Long Range Effluent Disposal Plan

The Lihue WWTP long range effluent disposal plan provides for disposal of the facility's design average daily flow of 2.5 mgd, a maximum flow of 5.0 mgd, and a peak flow of 6.25 mgd. Future plant expansion to accommodate more than the 2.5 mgd average daily flow will depend on the availability and feasibility of providing additional adequate effluent disposal capacities.

The long range Lihue WWTP effluent disposal plan will be implemented in phases:

a. Phase I

In Phase I (proposed action) facilities to dispose of an average daily flow of 2.2 mgd and associated design flows will be constructed. Secondary treated R-2 quality water up to 1.5 million gallons per 24-hour period average daily flow would continue to be conveyed to KLRC; and new injection wells would be constructed to dispose of excess flows and to provide backup capacity. As the average daily flows approach 2.2 mgd, an assessment of the demand for more reclaimed water would be made before the next increment of improvements (Phase II) is designed.

b. Phase II

If a market for more reclaimed water exists and if deemed feasible, Phase II would involve construction of additional treatment facilities and conveyance systems to serve reuse customers. If a market for more reclaimed water is not available, Phase II would involve construction of additional injection well(s) to accommodate the remaining anticipated future incremental flow of 0.3 mgd average daily flow and associated maximum and peak design flows.

Phase I construction will allow the Lihue WWTP to provide R-2 effluent meeting the State DOH effluent requirements and to increase to approximately 2.2 mgd ADF before a decision to provide tertiary treatment or continue with injection wells is needed. Based on the recent slow growth trend of Lihue, the anticipated time to reach 2.2 mgd ADF inflow is unpredictable.

CHAPTER II

DESCRIPTION OF THE ENVIRONMENT

A. PROJECT LOCATION AND LAND OWNERSHIP

The project involves development of effluent disposal facilities at the Lihue Wastewater Treatment Plant (WWTP). Lihue WWTP is owned and operated by the County of Kauai, and provides service to the Lihue Town area as indicated on **Figure II-1**. Land ownership in the vicinity of the Lihue WWTP is shown on **Figure II-2**. Lihue WWTP is identified by Tax Map Key (TMK) 3-5-01:30, 4th Division. The site is surrounded by Kauai Lagoons Resort Company (KLRC) property.

B. LAND CLASSIFICATION AND ZONING

Land use policies are governed by State of Hawaii and County of Kauai laws and regulations. The State Land Use Commission classifies all State lands as either Urban, Rural, Agriculture, or Conservation with the intent to accommodate growth and development and to retain the natural resources of the area. The Lihue WWTP and the KLRC property are within the Urban District. See **Figure II-3**.

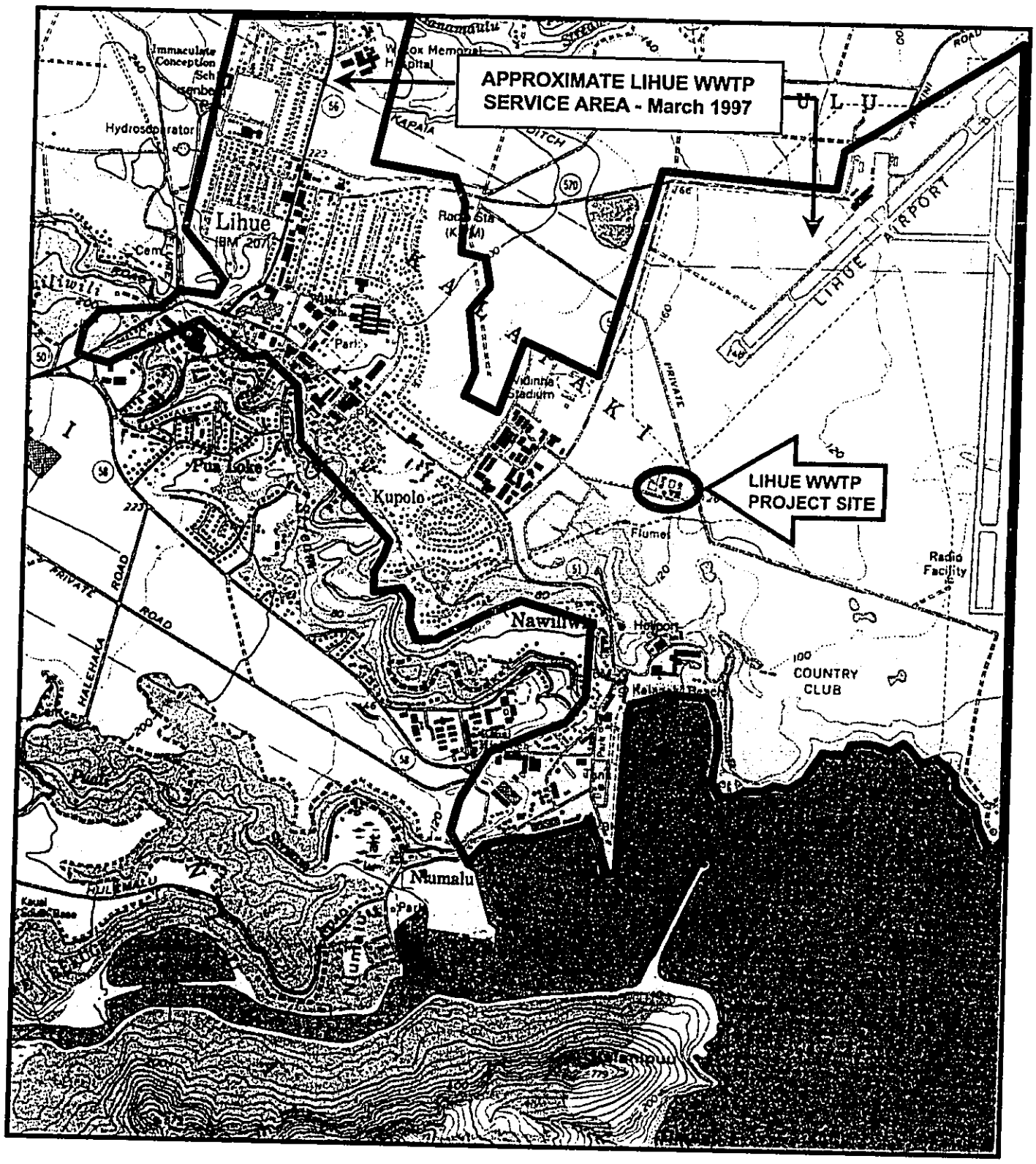
Detailed land use zoning for the above classifications are regulated by the Comprehensive Zoning Ordinance (CZO) for the County of Kauai. The County zoning designations include:

A	Agriculture
O	Open
PF	Public Facilities
R	Resort
RR	Rural Residential
UR	Urban
UMU	Urban Mixed Use

The Lihue WWTP has a land zoning designations of A (agriculture) and KLRC property is zoned R (resort). See **Figure II-4.**

C. POPULATION AND WASTEWATER FLOWS

The population of the Lihue District was approximately 11,237 (from State Department of Business and Economic Development data) as of July 1995. This represents a 5.4 percent increase in population since 1990. According to the Kauai Water Use and Development Plan, the resident population in the Lihue District is projected to be

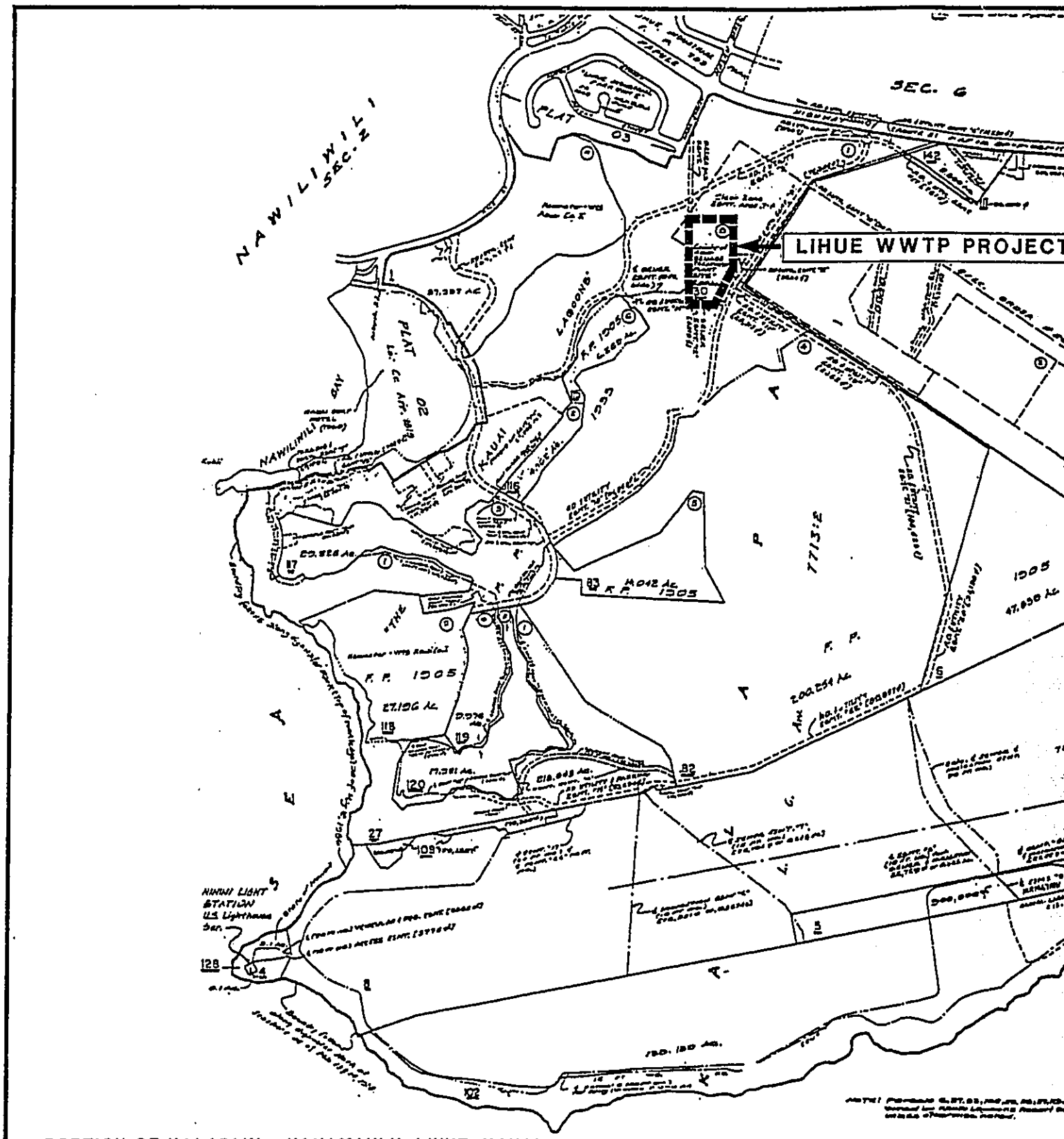


COUNTY OF KAUAI

Lihue WWTP Effluent Disposal System

LIHUE WWTP SERVICE AREA

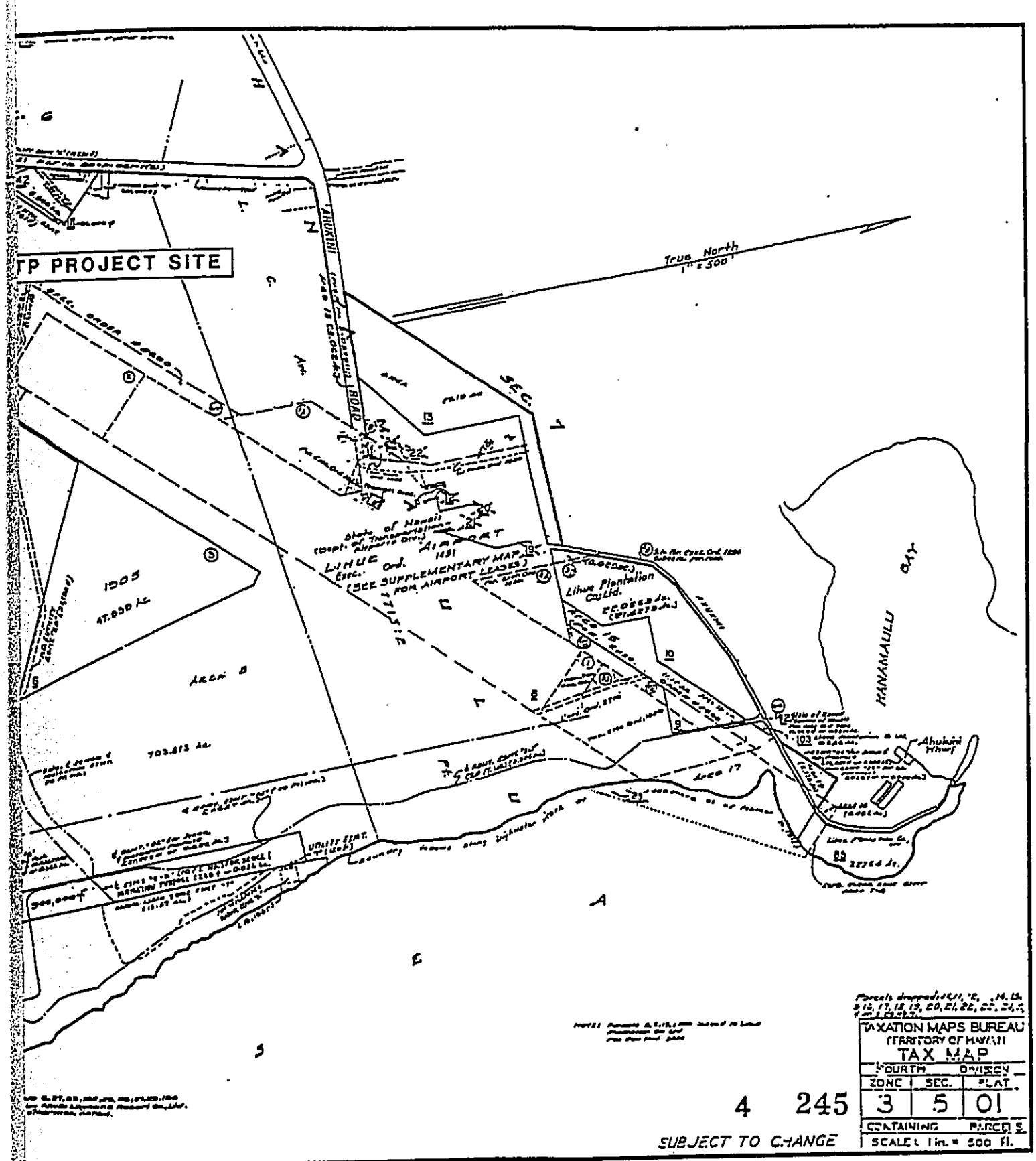
FIGURE II-1



PORTION OF KALAPAKI - HANAMAULU, LIHUE, KAUAI

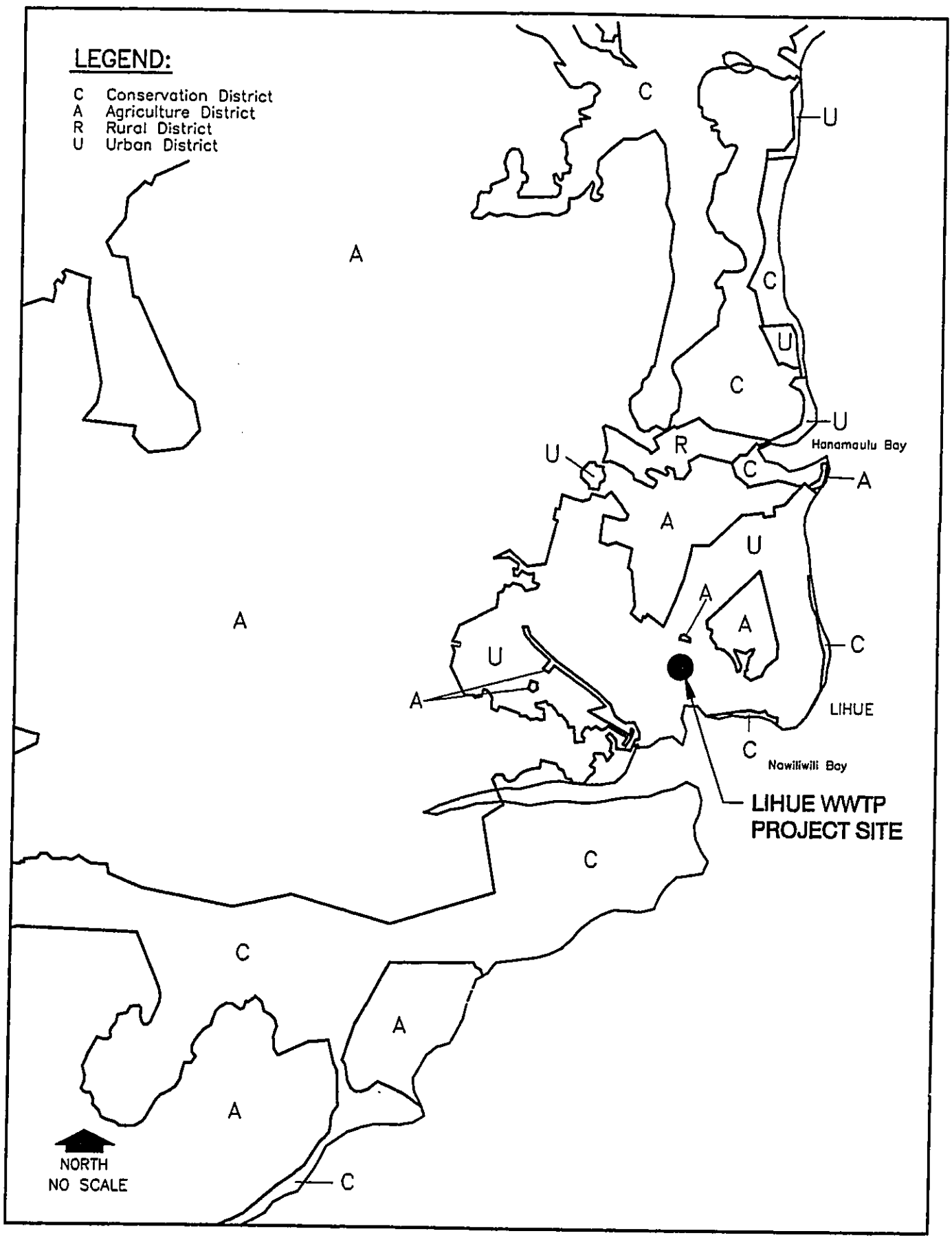
COUNTY OF KAUAI

Lihue WWTP Effluent Disposal System



TAX MAP KEY: 3-5-01:30

FIGURE II-2

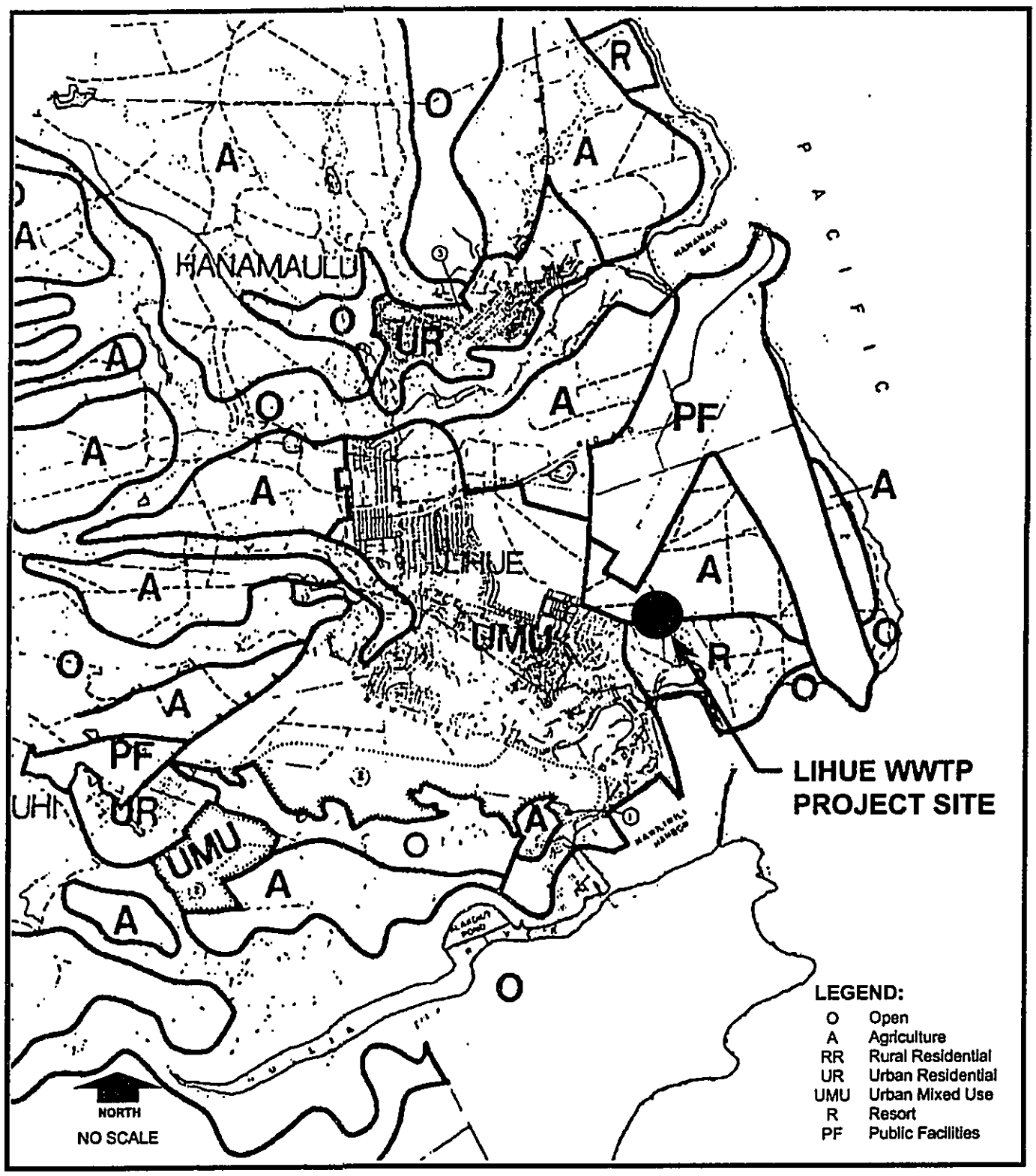


COUNTY OF KAUAI

STATE LAND USE MAP

Lihue WWTP Effluent Disposal System

FIGURE II-3



COUNTY OF KAUAI

KAUAI GENERAL PLAN

Lihue WWTP Effluent Disposal System

FIGURE II-4

20,860, based on full development in accordance with the existing County land use zoning map.

The Lihue WWTP service area was delineated and shown in the latest integrated planning document, the Lihue Wastewater Treatment Plant Preliminary Engineering Report for Phase IV Expansion, dated July 1990 by M&E Pacific. The service area for Lihue WWTP covers only part of the zoned areas in the Lihue District due to several planning considerations including current zoning, known planned developments, distance to Lihue WWTP, topography, existing sewers, and ease of sewer extension. **Figure II-1** was reproduced from the service area map shown in the 1990 M&E Pacific report.

Department of Public Works records indicated that 2,209 residential units and 149 non-residential units were connected to the Lihue Sewer System as of June 30, 1990. The present flow into the Lihue WWTP is approximately 1.3 mgd, and is expected to increase in the coming years. Pending connections and flow projections by the 1990 M&E Pacific report amounted to about 1.1 mgd. Accordingly, the total flow planned for the Phase IV expansion was rounded up to 2.5 mgd. A summary of wastewater flows from anticipated new connections from the 1990 M&E Pacific report is tabulated in **Table II-1.**

D. PHYSICAL FEATURES

1. Topography

The Lihue WWTP is located on flat terrain at an elevation of approximately 120 feet. Lihue Airport is located to the north of the treatment plant. Lihue WWTP is bounded by KLRC golf courses to the east, south and west. Kapule Highway is located west of the treatment plant beyond the golf course.

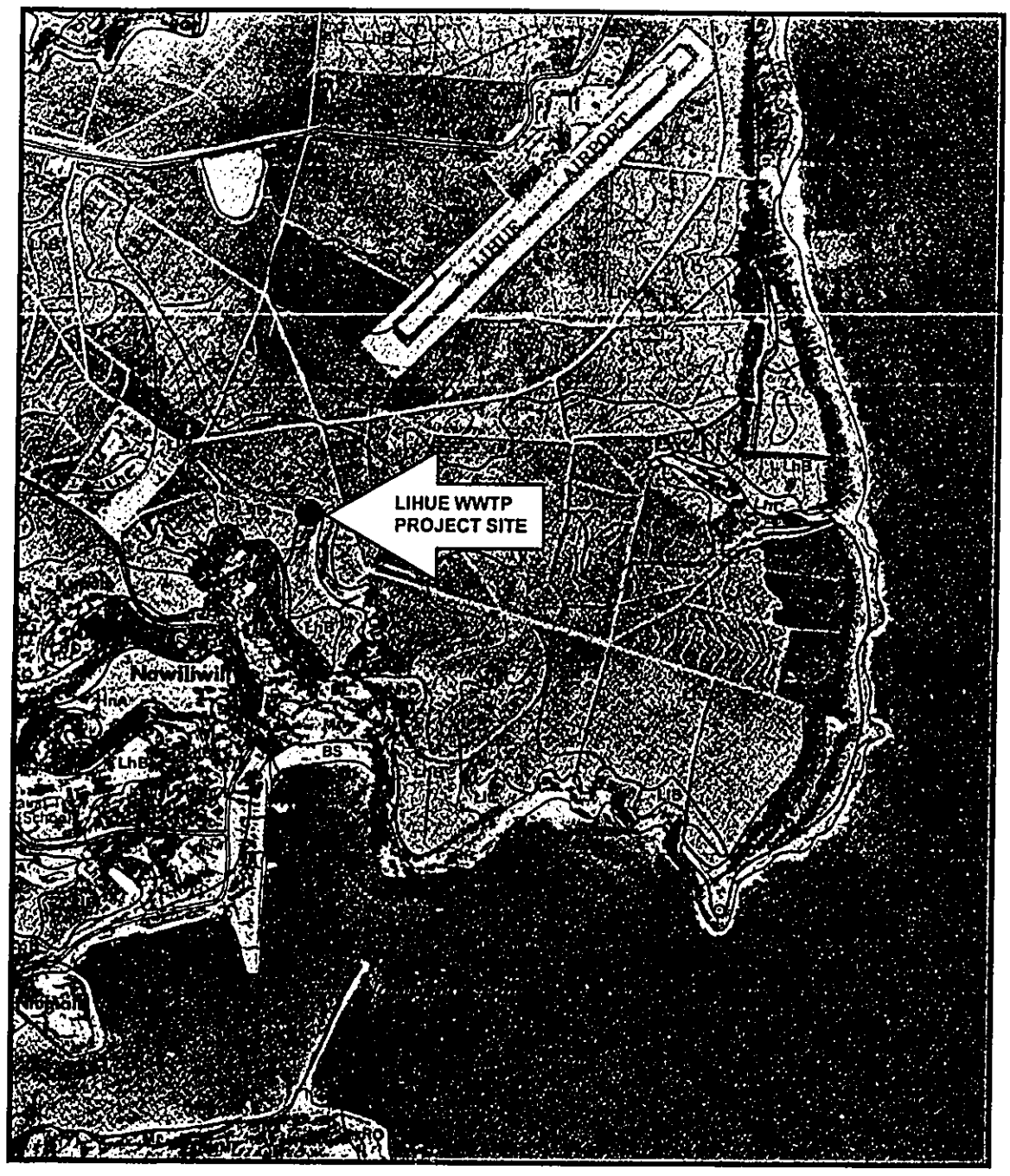
2. Soils

According to the Soil Survey issued in 1972 by the U.S. Department of Agriculture Soil Conservation Service (USDA-SCS), the soil on the Lihue WWTP property is Lihue silty clay, 0 to 8 percent slopes (LhB). The soils in the area surrounding the treatment plant are either classified as LhB or LIB, and are described as Lihue gravelly silty clay, 0 to 8 percent slopes. These soils are characterized as well-drained, fine-textured and medium-textured soils. The surface layer is dusky-red to dark reddish-brown, firm to friable silty clay. The subsoil is dark-red to dark reddish-brown, firm silty clay loam and silty clay. See **Figure II-5.**

TABLE II-1
WASTEWATER FLOWS FROM ANTICIPATED NEW CONNECTIONS

Description	TMK	Units/ Acre	Total (gpd)	Grand Total (gpd)
A. Permits to Connect to Public Sewer				
1. Single Family Residence (400 gpd/unit)	3-6	21 units	8,400	
	3-7	27 units	10,800	
	3-8	32 units	12,800	
Subtotal			32,000	
2. Commercial (6,000 gpd/acre)	3-5	3.14 acres	18,840	
	3-6	4.16 acres	24,960	
	3-8	4.04 acres	24,240	
Subtotal			68,040	
SUBTOTAL				100,040
B. Proposed Projects:				
1. Residences				
Charles River Housing (MF @ 250/unit)	3-8-02:4	243 units	60,750	
Kaumualii Investment (MF @ 250/unit)	3-8-05:22	273 units	68,250	
JMB/Amfac Hanamaulu				
Phase I - SF @ 400 gpd/unit	3-7-03	165 (S.F.)	66,000	
		60 (M.F.)	15,000	
Phase II	3-7-03	165 (S.F.)	66,000	
		60 (M.F.)	15,000	
Westville Subdivision	3-2-08:1	23 (S.F.)	9,200	
Molikoa Unit III	---	180 (S.F.)	72,000	
Banyan Harbor Condo (existing)	3-2-05:8	280 (M.F.)	70,000	
Kupolo Subdivision (cesspooled)		108 (S.F.)	43,200	
Subtotal			485,400	
2. Commercial/Resorts/Public Facilities				
Old Weinber Project - 6,000 gpd/acre	3-7-01:32	30 acres	180,000	
Acacemy of Golf (Westin)			17,000	
Kauai Lagoons - 300 gpd/unit		750 units	225,000	
Subtotal			422,000	
SUBTOTAL				907,400
C. Lihue Airport Expansion increment up to max133,000 gpd by agreement				71,000
TOTAL ADDITIONAL FLOW				1,078,440

Data for Table II-1 is taken from the Lihue Wastewater Treatment Plant Preliminary Engineering Report for Phase IV Expansion, July 1990, by M&E Pacific.



LEGEND:

BL	Badlands	LhC	Lihue silty clay, 8-15% slopes
BS	Beaches	LhE2	Lihue silty clay, 25-40% slopes, eroded
HfB	Halii gravelly silty clay, 3-8% slopes	L1B	Lihue gravelly silty clay, 0-8% slopes
HnA	Hanalei silty clay, 0-2% slopes	L1C	Lihue gravelly silty clay, 8-15% slopes
KvB	Koloa stony silty clay, 3-8% slopes	Mr	Mokuleia fine sandy loam
KvD	Koloa stony silty clay, 15-25% slopes	rRo	Rock outcrop
LhB	Lihue silty clay, 0-8% slopes	rRR	Rough broken land

SOURCE: Soil Survey of Island of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, U.S. Department of Agriculture, Soil Conservation Services, August 1972.

COUNTY OF KAUAI

Lihue WWTP Effluent Disposal System

USDA/SCS SOIL MAP

FIGURE II-5

3. Geology

The land area surrounding the project site was formed by lava from the Kilohana Crater shield of the Koloa volcanic series. This lava partially filled the "Lihue Depression" and overflowed seaward, forming the gently sloping plains which includes Lihue Town and the project area. The rim of the "Lihue Depression" consists of rocks from the older Waimea Canyon volcanic series.

4. Hydrology

a. Surface Water

The KLRC property surrounding Lihue WWTP is distinguished by man-made lagoons and ponds. The lagoons have a surface area of approximately 28 acres. and are filled with water pumped from two wells located on the KLRC property. Pond 1, which is located on the golf course, is supplied with water from two other KLRC wells. Pond 2 stores water for golf course irrigation and is supplied with treated effluent from the treatment plant, supplemented by water from a fifth KLRC well and overflows from Pond 1.

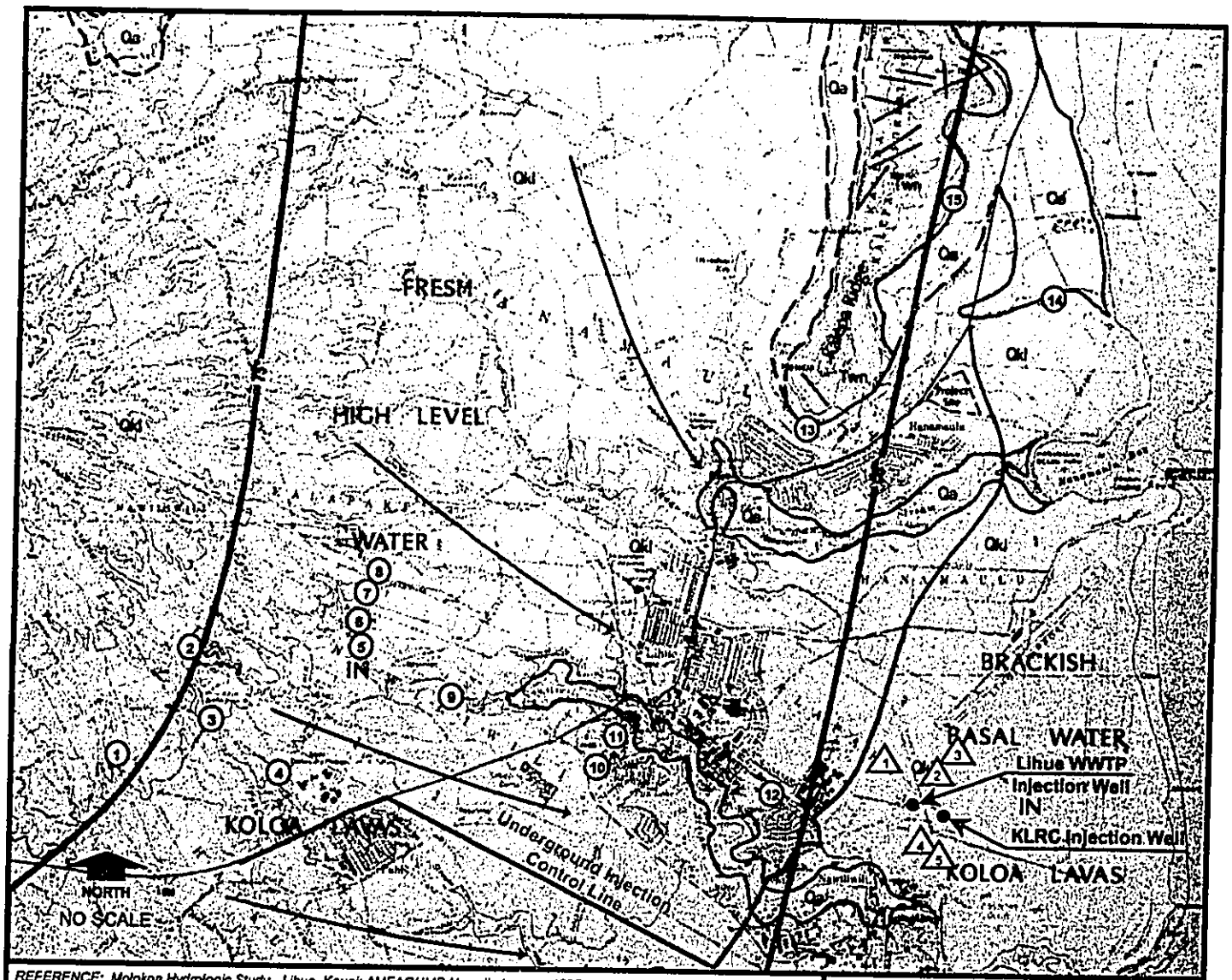
b. Groundwater

The Lihue WWTP and proposed injection wells are located outside of the DOH designated "Underground Source of Drinking Water (USDW)". The Lihue WWTP and proposed injection wells are within an "Exempted Aquifer", defined as an aquifer exempted from being used as an USDW. The "Underground Injection Control (UIC) Line" is the boundary separating the above defined aquifers, with the exempted aquifers identified as being on the ocean side of the UIC Line. See **Figure II-6**. The UIC Line was established to protect underground sources of drinking water from contamination by subsurface disposal of fluids.

5. Climate

The mean annual rainfall in the project area is approximately 50 inches per year. The temperature ranges from an average high of 85°F to an average low of 63°F. The prevailing winds are trade winds from the northeast, with wind velocities averaging 12 miles per hour.

The island of Kauai has been subject to occasional severe storms because of hurricane intensity storms hitting or passing nearby the island. In 1982, Hurricane



REFERENCE: Molokoa Hydrologic Study - Lihue, Kauai; AMFAC/JMB Hawaii, January 1995.

WELL LEGEND:

	WELL NAME	OWNER
Potable Water Wells:		
1	Puhi 4	Kauai DWS
2	Kilohana D	Kauai DWS
	Kilohana J	Kauai DWS
3	Puhi 2	Kauai DWS
	Puhi 3	Kauai DWS
4	Puhi 1	Kauai DWS
5	Kilohana A	Kauai DWS
	Kilohana B	Kauai DWS
	Kilohana F	Kauai DWS
	Kilohana I	Kauai DWS
6	Kilohana C	Kauai DWS
7	Kilohana G	Kauai DWS
8	Kilohana H	Kauai DWS
Potable Water Wells (continued):		
9	Garlinghouse Tunnel	Kauai DWS
10	Lihue Old School	Kauai DWS
11	Sugar Mill	Lihue Plantation
12	Kauai Inn Tank	Kauai DWS
13	Kalepa Ridge No. 1	Kauai DWS
14	Hanamaulu Shaft	Lihue Plantation
15	Kalepa Ridge Expl.	State
	WELL NAME	**OWNER**
Nonpotable Water Wells:		
1	Well No. 1	KLRC
2	Well No. 2	KLRC
3	Well No. 3	KLRC
4	Westin Kauai #5	KLRC
5	Westin Kauai #4	KLRC

LEGEND:

Formations & Water-Bearing Properties

Qa ***Alluvium*** - Mostly clay, poorly permeable, carries small amounts of water. Youngest formation in study area.

Oki ***Koloa Lavas*** - Flank flow basalts of Quarternary age. Moderately to deeply weathered, low to moderate yield. Wells develop fresh high-level water inland and fresh to brackish basal water toward the coast.

Twn ***Waimea Lavas*** - Dike-intruded lavas of Tertiary age. Mostly deeply weathered, low to moderate yield. Buried by Koloa lavas, except Kalepa and Haupu Ridges. Normally a high yield aquifer, wells in the study area develop basal water in limited quantities due to weathering and dikes.

50 — Median Annual Rainfall (inches)

Groundwater Movement

COUNTY OF KAUAI

Lihue WWTP Effluent Disposal System

REGIONAL GROUNDWATER MOVEMENT

FIGURE II-6

Iwa caused considerable damage to Kauai. Hurricane Iniki hit Kauai in 1992 and was particularly destructive.

6. Flood and Tsunami

The Federal Emergency Management Agency Flood Insurance Rate Map (FIRM) Community-Panel Number 150002 0202 C dated March 4, 1987, designates the project area to be within Zone X. Areas within Zone X are determined to be outside of the 500-year flood plain; therefore the project is not expected to have an impact on the flood zones.

Historical tsunami data indicated a maximum wave height of 18 feet (1946 tsunami) occurred along the shoreline near the project area. The project area has ground elevations well over 100 feet, so it is not expected to be affected by tsunamis.

E. WATER QUALITY

The ***Appendix*** *contains a report titled* "Assessment of Potential Impacts to Water Quality and Marine Community Structure from Effluent Disposal, Lihue Wastewater Treatment Plant". This report assesses the potential impacts on shoreline and nearshore water quality from effluent disposal from the Lihue WWTP. This report includes water chemistry analyses of samples taken from Lihue WWTP effluent, KLRC lagoons, KLRC wells for golf course irrigation and water replenishment for the lagoons, and five offshore sampling sites. The report concludes that there would be no significant adverse impacts to the offshore waters from treated effluent disposal via injection wells.

Lihue WWTP provides secondary level treatment, and the effluent is of R-2 quality. The water chemistry analysis from samples taken in October 1996 is shown in Table 3 of the report.

Results of the KLRC lagoons water chemistry analyses are also indicated in Table 3. The nutrient concentrations in the lagoons are much lower than in the Lihue WWTP effluent. The lagoons are considered to be in a "steady state" with respect to nutrient dynamics. Disposal of Lihue WWTP effluent into the lagoons was considered, but rejected because of the concern of possibly disturbing the "steady state" nutrient dynamics.

F. ARCHAEOLOGICAL AND HISTORICAL CONSIDERATIONS

The project site involves lands recently used for sugar cane cultivation, and currently used by KLRC for maintenance facilities, roadways, golf courses and irrigation ponds. There are no known archaeological sites within the project area. Should any evidence of archaeological remains be discovered during construction, work will be suspended and an archaeological survey will be conducted.

There are no historical facilities or sites within two miles of the project area.

G. FLORA

The plants found in the project area includes haole koa, hau trees, california grass, widelia, and bermuda grass. Hau trees outside the southern boundary of the Lihue WWTP serve as a buffer for the adjacent golf course. The KLRC golf courses are grassed with bermuda grass.

H. FAUNA

Animals in the project area includes rats, field mice, and small feral animals. Birds found in the project area include mynas, doves, cardinals and sparrows. Migratory Hawaiian coots (federally listed as an endangered waterbird), were observed swimming in KLRC irrigation Pond 2. Amphibians within the project area include toads and frogs.

The lagoons of the Kauai Lagoons Resort facility are inhabited by fish such as carp, tilapia, and tucanary bass. Apple snails were introduced into the lagoons recently and have multiplied to large numbers.

CHAPTER III

PROPOSED ACTION

A. INTRODUCTION

The proposed action would provide effluent disposal for an Average Daily Flow (ADF) of 2.2 mgd and a Peak Flow (PF) of 5.5 mgd. KLRC would continue to accept up to 1.5 million gallons per 24-hour period and manage the associated peak flow of 3.75 mgd. The County would construct injection wells to dispose of an ADF of 0.7 mgd and a PF of 1.75 mgd.

1. KLRC Effluent Disposal

KLRC desires to continue receiving up to 1.5 million gallons per 24-hour period beyond the ten year extension period. The County would supply up to 1.5 million gallons per 24-hour period of secondary treated effluent, and KLRC would continue to follow best management practices with their existing system to handle associated peak flows of 3.75 mgd and avoid spillage during prolonged rainy weather periods. The peak and maximum flows could be dampened by KLRC's existing Pond 2. Currently, excess flow from Pond 2 overflows directly into KLRC's injection well. The delivery system will be improved by construction of a 24-inch gravity main to the KLRC irrigation Pond 2 with facilities to divert flows directly to the injection wells when pond levels are too high. This will replace the existing open ditch system. The direct overflow from KLRC Pond 2 to the injection well will be eliminated.

KLRC has expressed concern over their ability to handle their 1.5 million gallons per 24-hour period flow during emergencies when their irrigation system is down. In order to provide an emergency backup for the 1.5 million gallons per 24-hour period, KLRC will refurbish their existing injection well to a capacity of at least 0.65 mgd and turn control and responsibility of the well to the County (contingent upon an acceptable irrigation water management plan). In addition, the County is amenable to providing the remaining portion (0.85 mgd) of the KLRC emergency backup in their injection wells subject to KLRC properly managing their irrigation system and Pond 2 to handle the 1.5 million gallons per 24-hour period ADF flow and its associated peak flow of 3.75 mgd.

2. County Effluent Disposal

The County proposes to construct sufficient injection wells to provide for the disposal of 0.7 mgd ADF of treated effluent and the associated 1.75 mgd peak flow. The new injection wells would be located off of the existing Lihue WWTP site in the KLRC carriage house and stables area across the road. Injection wells would be drilled in Phase I to accommodate the County's allocated peak flow of 1.75 mgd, plus 0.85 mgd of the KLRC emergency backup. An estimated six wells would

be drilled at an estimated capacity of 0.65 mgd each. Detailed explanation follows in Section B.

The new injection wells will need to be located offsite because the treatment plant site does not have enough space for the injection wells.

B. DESIGN BASIS FOR PROPOSED ACTION

The design basis for Phase I is summarized below:

1. Flow distribution is as follows:

	Total	KLRC Portion	County Portion
Average Plant Flow	2.2 mgd	1.50 mgd	0.70 mgd
Peak Flow	5.5 mgd	3.75mgd	1.75 mgd

2. KLRC to use Pond 2 to dampen daily maximum and peak flows. Effluent is currently conveyed to KLRC via an open ditch which will be replaced by a new piped system to Pond 2.

3. The County shall provide emergency disposal for KLRC when their irrigation system is out of service and during wet weather (contingent upon an acceptable irrigation management plan by KLRC).

4. A long term disposal rate of 0.65 mgd per well for both the new and existing wells will be assumed as recommended by the project's hydrogeologist.

5. County to take control of the existing KLRC injection well (contingent upon an acceptable irrigation management plan from KLRC). County proposed to provide well capacity to dispose of up to an additional 0.85 mgd from KLRC during emergencies.

6. The County proposes to construct injection wells to accommodate their 1.75 mgd peak flow, and 0.85 mgd of KLRC emergency backup. Five wells are to be constructed to accommodate the County's portion of the peak flow, and a sixth new well will be constructed to handle a portion of the 0.85 mgd emergency backup. See **Table III-1** for a breakdown of the new wells and how they are incorporated into the overall effluent disposal plan.

TABLE III-1
DISPOSAL COMPONENTS

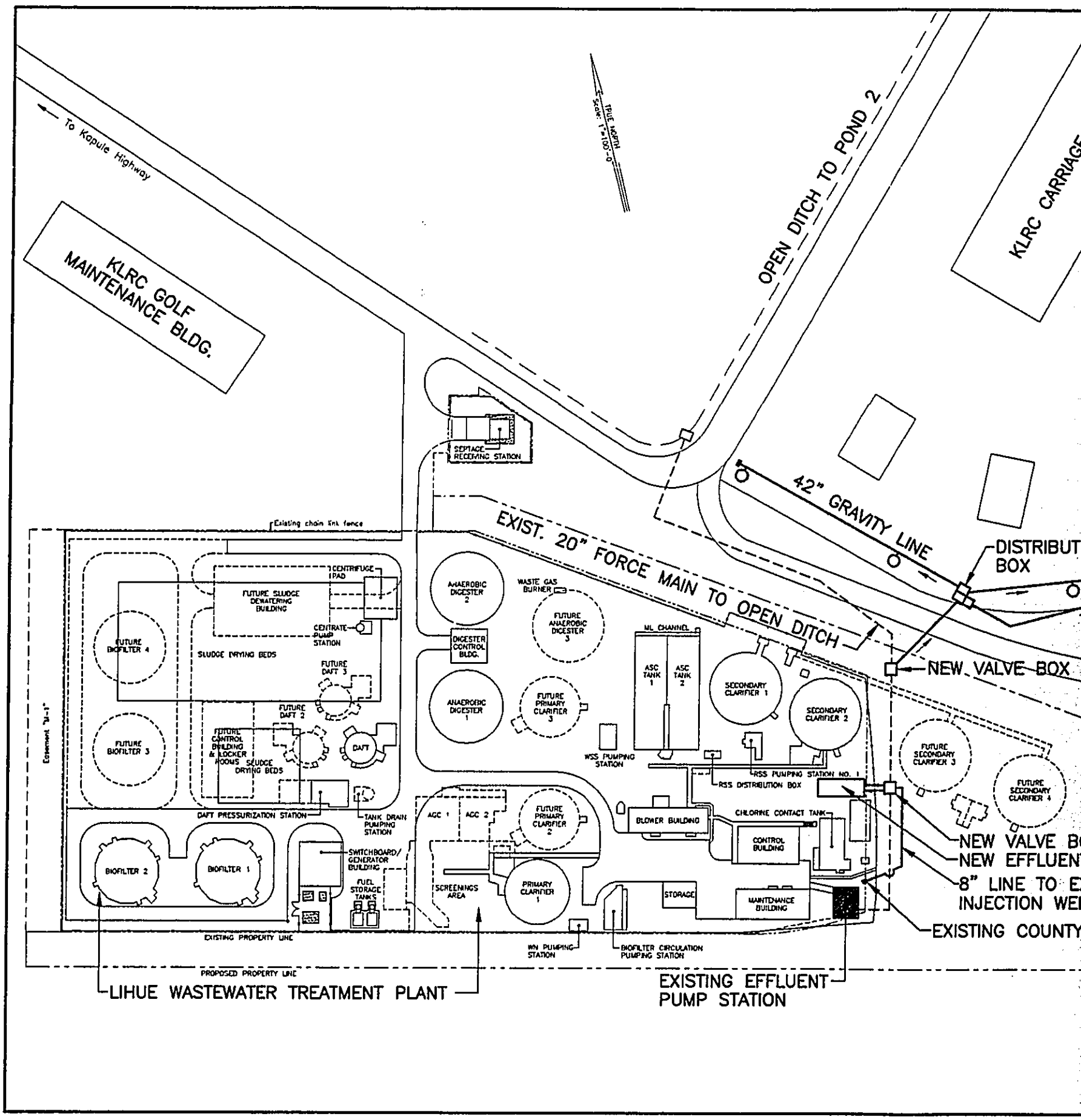
	Primary Components		Backup Components	
	Component	Capacity (mgd)	Component	Capacity (mgd)
County Disposal	New County Well #1	0.65	New County Well #4	0.65
	New County Well #2	0.65	New County Well #5	0.65
	New County Well #3	0.65	Existing County Well	0.65
Subtotals		1.95		1.95
County Required Capacity		1.75		1.75
Balance		0.20		0.20
	Primary Component		Emergency Backup	
	Component	Capacity (mgd)	Component	Capacity (mgd)
KLRC Disposal	Pond #2	3.75	♣New County Well #6	0.65
			♣County Balance	0.20
			Existing KLRC Well	0.65
Subtotals		3.75		1.50
KLRC Required Capacity		3.75		1.50♥
Balance		none		none

Notes:

♣ County proposes to provide additional 0.85 mgd backup for KLRC.
→0.65 mgd (New County Well #6) + 0.20 mgd (County Balance) = 0.85 mgd
♥ 1.5 is in million gallons per 24-hour period, and refers to a volume, not a rate.

C. PROPOSED ACTION

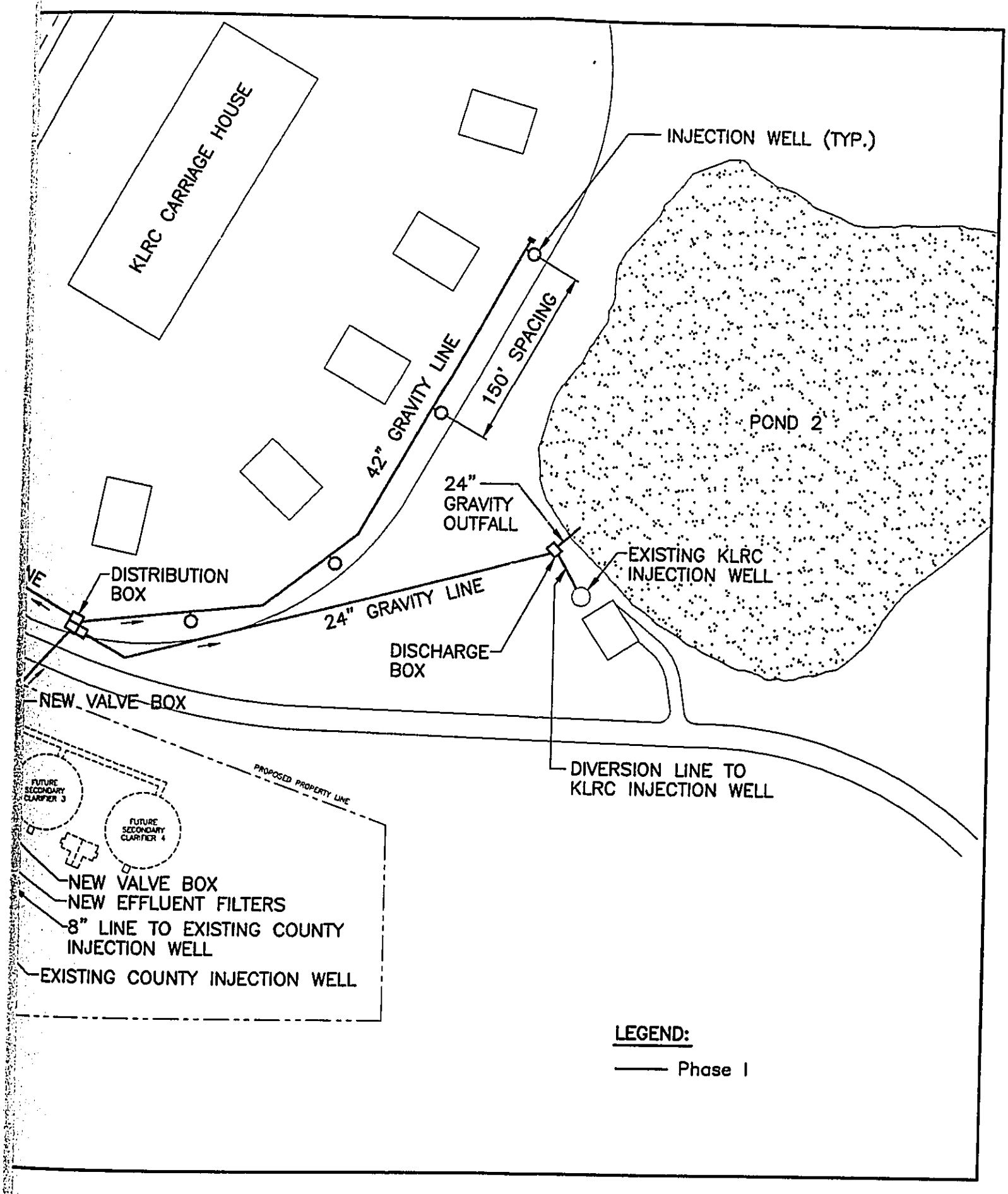
The Phase I facilities will include: new effluent pumps; new effluent filters; a new force main to convey effluent to a distribution box; three separate gravity sewers to distribute flows to the carriage house and stables area and KLRC Pond 2; new injection wells; and the necessary valves, instrumentation and appurtenances. See **Figure III-1** for the Phase I layout.



COUNTY OF KAUAI

Lihue WWTP Effluent Disposal System

LAYOUT - L



LAYOUT - LIHUE WWTP EFFLUENT DISPOSAL SYSTEM - PHASE I

FIGURE III–1

1. Effluent pumps

   The new effluent pumps will be provided at the existing effluent pump station and be sized for the Phase I peak flow of 5.5 mgd. The wastewater flow into the Lihue WWTP is not expected to approach the Phase I design rates for some time. Therefore, it is not necessary to provide the pumping capacity for the ultimate peak of 6.25 mgd at this time. When the wastewater flow approaches the Phase I design ADF of 2.2 mgd, the pumps installed as part of this project would probably be near the end of their useful life and could be replaced. Three new pumps would be provided, two for normal operation and one for emergency standby. Each pump would be sized for 1,900 gpm at 105 feet TDH. The relatively high head is needed for the effluent filtration system. The new pumps will be controlled by wet well level sensors, similar to the existing effluent pumps. A standby generator will be provided to provide power during outages.

2. Effluent filters

   The new effluent filters will be connected to piping downstream of the new effluent pumps and will be screen-type filters capable of removing particulates larger than 80 micron. This type of filter is most commonly used for agricultural irrigation systems. They are designed to remove large particles from the water to protect spray nozzles and drip systems. Typical screen filters consist of a metal screen within a housing or vessel. The water to be filtered enters the housing via an inlet pipe and is forced through the screen. The screened water is allowed to discharge from the housing through an outlet pipe. The particulates that accumulate in the filter are periodically washed out by allowing the finished water to backflow through the filter, thus dislodging the material from the screen. This type of backwashing system requires higher water pressures to allow proper cleaning. This backwash water is discharged from the filter to a sewer or sump. At the Lihue WWTP, the existing rapid sand filter will be converted to holding tank for the backwash. The accumulated backwash water would then be pumped to the headworks.

3. Effluent Force Main to Distribution Box

   The new 20" diameter effluent force main will convey the full 6.25 mgd peak flow associated with the existing design ADF of 2.5 mgd. Using a smaller pipe for interim flows would not be cost effective due to the replacement cost when a larger pipe is needed. A tee with valve and new section of 20-inch pipe will be provided to allow continued use of the existing ditch during construction. The piping and valves to the ditch can remain if the ditch is needed for emergencies.

4. Distribution Structure

   The force main will connect directly to a new distribution structure to split the flow between KLRC and the County's injection wells. Weirs will be used to proportion the flow. Different length weirs will be used to provide the flow split. The weirs will

also be adjustable so that the heights can be changed to proportion the flow properly depending on average total flow. A high liquid level alarm will be provided at this distribution structure. An Operations and Maintenance manual will be provided with emergency procedures to address any overflow problems. The structure will be covered to prevent debris from entering and to further minimize human contact. The covers will be easily removable and/or have hatches to allow observation and periodic maintenance.

5. Connection to Existing KLRC System

   A 24-inch gravity line will convey the effluent from the new distribution box to the new discharge box. From the discharge box, flow will be able to go to either Pond 2 through the new 24" gravity outfall, or the existing KLRC injection well through the new diversion line.

6. Connection to New County Injection Wells

   A 36-inch or 42-inch gravity flow pipe will convey effluent from the distribution structure to the injection wells. The pipe will be sized to carry 6.25 mgd peak flow in the event that KLRC chooses not to accept effluent in the future. Each injection well will have an inlet structure that will allow adjustments to the inflow rate. This is necessary because each well may have a different capacity. In addition, the well capacity may change with time, making a variable inflow type system advantageous. The inlet structure at each well will use valves to allow for inflow adjustment at each well.

7. County Injection Wells

   The depth of the new injection wells cannot be pre-determined due to the variable geology of the Lihue area. The new injection wells will be 12-inch diameter and are estimated to require about 600 feet of depth to produce a sustainable injection rate of 0.65 mgd. Some wells may need to be deeper. Larger bore diameters are not expected to produce better injection rates. Injection rates are expected to be high when the wells are first installed. However, based on observations made on the existing wells, injection rates appear to drop off in a short time from the initial rates. Isolation valves and flow meters will be installed at each well. Each well will also have a water level measuring device with a high liquid level alarm.

8. Existing Lihue WWTP SCADA System

   In addition to the new effluent pumping system, the existing Lihue WWTP Autocon telemetry and SCADA system will require additional monitoring and alarm points. This work will be performed by Autocon as a part of the construction contract due to the proprietary nature of the system.

9. Existing KLRC Facilities

The existing KLRC injection well discharge box requires modification as noted in item 5 above. Additional piping, valves, flow meter and well water level sensor are also recommended.

The existing KLRC injection well may require refurbishing to ensure that a minimum sustainable injection capacity of 0.65 mgd is maintained. This will be done by KLRC as a part of their irrigation management plan.

D. ESTIMATED COSTS

The estimated construction cost of Phase I work is $4.89 million. Estimated annual operation and maintenance costs associated with the Phase I improvements is about $227,230. The injection wells may also require periodic cleaning and refurbishing at least every 5 years, at an estimated cost of $20,000 per well, or 6 wells for a total of $120,000.

CHAPTER IV

PROBABLE IMPACTS AND MITIGATIVE MEASURES

A. SHORT TERM IMPACTS

1. Construction Related

Short term impacts are associated with construction activities to construct and test proposed injection wells at the Lihue WWTP site. Short term impacts include increased local traffic, noise and exhaust emissions from construction equipment, generation of spoils from drilling work, dust emissions, and mud during wet weather. All of these impacts are minimized and controlled by Federal, State, and County of Kauai laws, regulations, and permits requirements; and monitoring of construction by County inspectors. The project site is surrounded by the KLRC golf courses and maintenance facilities, and the Lihue Airport; thus, no residential occupants will be affected. The airport terminal building is over 2,000 feet away and it's occupants are expected to be minimally affected. KLRC maintenance workers working near the project site and golfers on the adjacent course would be most affected by construction activities.

2. Hydrogeology

Testing of the proposed wastewater effluent injection wells will involve pumping from one well into another and may result in the temporary high discharge of effluent into the wells. The relatively impermeable soils in the area, depth of injection wells, and dilution of effluent with ground water make it unlikely that the effluent will adversely affect the offshore marine environment during testing. See the report titled Assessment of Potential Impacts to Water Quality and Marine Community Structure from Effluent Disposal, Lihue Wastewater Treatment Plant in the **Appendix.**

B. LONG TERM IMPACTS

1. Lands

Additional land required to install and maintain the proposed wastewater force main, effluent injection wells, and appurtenances have been identified. These lands are currently owned by KLRC. The County of Kauai is negotiating with KLRC to acquire these lands and/or obtain easements for the proposed additional wastewater effluent disposal facilities.

2. Existing Access Road to KLRC Carriage House and Stables Area

   The existing access road coming from Kapule Highway, and continuing on the West side of the KLRC Carriage House and Stable Area will experience an increase in traffic with County personnel performing site visits for operations and maintenance of the injection wells. However, existing limited public access to the road will not be affected.

3. Flood Hazards and Wetlands

   The Lihue WWTP site is not within a flood hazard or flood prone area. There are no wetlands near the Lihue WWTP site.

4. Coastal Zone Management Area

   The project will conform to the State Coastal Management Program requirements. The project is not within the coastal zone Special Management Area (SMA), and a SMA permit is not required.

5. Groundwater Flow

   All of Kauai County's potable water supply sources are located upgradient of the groundwater flow through the project site. The location of the proposed injection wells will not adversely affect the domestic water supply in the Lihue area.

   Effluent from the injection wells is expected to be highly diluted by ground water as it approaches the ocean at depths approximately 500 feet below sea level (anticipated depths of the injection wells is 600 feet). According to the Marine Research Consultants report in the **Appendix**, the injection well effluent would not adversely affect the offshore marine and biotic communities.

6. Public Funds

   Public funds will be expended for the project. Costs for the proposed project will be shared between KLRC and the County of Kauai. Allocation of construction costs are being negotiated with KLRC. The costs allocated to the County will be paid for with public funds. Costs allocated to KLRC will be paid for by the exchange of lands or by cash. The Lihue WWTP is a public facility and must conform to Federal and State environmental regulations and requirements.

7. Energy

   The estimated increase in the annual energy required with the proposed action is 312,216 kW-h/yr.

8. KLRC Operations

   KLRC will have the responsibility to manage their irrigation system to accommodate 3.75 mgd, which is their portion of the peak flow.

9. Construction Materials

   Construction materials such as reinforced concrete, well casings, pipes, fittings, valves, and controls would be required for new injection wells. Construction materials would be chosen for their cost effectiveness, durability, and long service life as appropriate.

10. Endangered Species

    The migratory Hawaiian coot, the only endangered wildlife known to be in the project area, will not be affected by this project. This waterbird was observed swimming in Pond 2. The Hawaiian coot habitat will not be affected. Construction work in the area may cause temporary and minor short term disturbance to the birds activities, but the impact is not expected to be significant.

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

The proposed project at the Lihue WWTP is intended to provide the County with a long term means for disposing a design average daily flow of 2.2 mgd of secondary effluent. Currently, the KLRC golf course reuses all of the average daily flow of 1.3 mgd generated by the WWTP. By agreement, KLRC is obligated to dispose of up to 4.5 mgd of effluent until the year 2003. The agreement is extendable for another 10 years during which period KLRC is obligated to accept treated effluent at a reduced rate of 1.5 million gallons per 24-hour period. Implementation of this project and on-going negotiations with KLRC to extend the effluent disposal agreement beyond the year 2013, will allow the County to accept up to 2.2 mgd of wastewater.

KLRC desires to continue reusing up to 1.5 million gallons per 24-hour period of R-2 quality treated effluent on a long term basis. The proposed project recognizes and allows for the possibility of future additional reclamation and reuse of treated effluent. Future improvements will be compatible with Phase I to provide treated effluent if a demand develops for more reclaimed water within a reasonable and practical delivery distance. It is the County's goal to maximize reclamation and reuse of wastewater effluent whenever practical, because it conserves a natural resource by reducing the

demands for using potable water, and reduces the demands for effluent disposal.

D. MITIGATION MEASURES TO MINIMIZE IMPACTS

The purpose of this project is to provide long term effluent disposal with minimal adverse impacts on the environment.

To minimize short term construction impacts, Federal, State, and County regulations related to construction activities will be made a part of the construction contract requirements. County inspectors will monitor construction activities to assure compliance.

Over the long term, this project provides the flexibility for disposal of the Lihue WWTP design ADF of 2.5 mgd by alternate means. Prevailing future conditions may dictate the continued reuse of 1.5 million gallons per 24-hour period R-2 quality effluent on KLRC golf courses and disposal of the remaining 1 mgd by injection wells. Alternatively, it may be best to continue reuse of the 1.5 million gallons per 24-hour period R-2 effluent on KLRC golf courses, provide additional treatment to produce R-1 quality effluent for added reuse, and disposal of remaining effluent by injection wells. The quantity of R-1 effluent produced would depend upon the size of a viable market for reclaimed water. Both options will result in the disposal of treated wastewater effluent in an environmentally safe manner.

E. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The proposed project will permanently commit public funds and lands for construction and utilization of injection wells. However, the public will benefit by having a long term wastewater treatment and effluent disposal system which will be cost effective and not adversely affect the environment.

CHAPTER V

ALTERNATIVES TO THE PROPOSED PROJECT

Many alternatives were considered for reusing and disposing of the Lihue WWTP effluent. The alternatives address the planning requirements for the year 2003, when KLRC's obligation to take effluent is reduced to 1.5 million gallons per 24-hour period. Although the current agreement between the County and KLRC expires in 2013, it should be in the best interest of KLRC to reuse the treated effluent. Therefore, the alternatives assume KLRC will continue to reuse 1.5 million gallons per 24-hour period of treated effluent beyond the year 2013. The alternatives are also based on construction of a new piped delivery system to KLRC to replace the existing open ditch system.

A. DO NOTHING ALTERNATIVE

The "Do Nothing" alternative is not realistic and not acceptable. The agreement between KLRC and the County will be amended in August 2003 such that KLRC's obligation to take treated effluent is reduced from 4.5 mgd to 1.5 million gallons per 24-hour period. The new obligation reduces the amount of effluent taken by KLRC to below the average treatment plant capacity of 2.5 mgd. Therefore, the County must identify other users of one mgd of effluent and develop additional means of disposal as backup. The present situation requires that the County develop a plan to reuse and dispose of at least a portion of the effluent in anticipation of a future increase in flows up to the design flow of 2.5 mgd.

B. OCEAN OUTFALL DISPOSAL

An ocean outfall can be used to dispose of effluent not utilized for reuse or as a backup disposal method. However, the construction, operation and monitoring cost of an offshore outfall makes this option unfeasible. Ocean outfalls cost approximately $3,000 to $5,000 per lineal foot. Effluent conveyance facilities from the treatment plant to the ocean are also required. Assuming the ocean outfall needs to be one mile offshore, the estimated total cost for this option ranges from approximately $17 million to $28 million. In addition, extensive ocean water quality and marine community investigations are required before design and during operation to assure that the existing environment is not adversely affected by the treated effluent discharge. A National Pollutant Discharge Elimination System (NPDES) permit is required for discharging treated effluent into receiving bodies of water. This ocean outfall option is not considered to be viable.

C. IRRIGATION ALTERNATIVES

1. Drip Irrigation

Subsurface drip irrigation is a viable means of reusing the treated effluent. One of the main advantages of subsurface irrigation is the limited human contact thus allowing R-2 quality water to be utilized within the Guidelines set forth by the State DoH. An estimated 70 to 90 acres are required to reuse one mgd of effluent at an estimated construction cost of $15,000 to $18,000 per acre. In addition to the land area and irrigation system, an impoundment is required by the State DoH Guidelines to hold any reuse water not utilized during peak flow events or wet weather periods when irrigation is not needed, and an 80 micron filtration system is needed to protect the irrigation drip lines. The suggested impoundment capacity is 20 days of average flow or 20 million gallons storage per mgd. The Lihue Airport may object to locating a large pond in the vicinity. The pond will attract water fowl and other birds to the airport area causing a hazard to air traffic. In addition, the airport personnel were concerned with the type of vegetation grown as well and preferred that it be a type that does not attract birds.

2. Spray Irrigation

The spray irrigation alternatives are similar to the drip irrigation alternatives. Spray irrigation is less efficient than drip irrigation and therefore requires more land area. Spray irrigation with R-2 water also requires a large buffer zone of 500 feet between the irrigated area and any public areas. Spray irrigation with R-1 does not require a buffer zone so long as there is no overspray beyond the designated irrigation area. Approximately 100 to 120 acres are required to spray irrigate one mgd of treated effluent. If R-2 water is used, additional area is required for the buffer zone. Depending on shape and location, this buffer zone can be the same or greater than the irrigated area. The cost of a spray irrigation system ranges from about $12,000 to $15,000 per acre. Spray irrigation also requires an impoundment to hold reuse water not utilized during peak flow events and wet weather, and a filtration system capable of removing particulates larger than about 200 micron. As with drip irrigation, the suggested impoundment capacity is 20 days of average flow.

The drip and spray irrigation alternatives are not cost effective due to the extensive land area required (estimated 70 to 120 acres per one mgd disposed) and anticipated high capital costs for the County to construct pumping, transmission, storage, filtration and irrigation systems. In addition, irrigation of the area east of the Lihue Airport would probably not produce any viable crop that can be used. Growth of fodder crops such as alfalfa is one possibility but there is no market on Kauai for such crops. Irrigation of the area would serve no purpose but to get rid of the 1.0 mgd of effluent, at a higher cost than injection well disposal. In addition, the airport may object to fodder harvesting operations if any dust is produced. Therefore, irrigation of the area east of the Lihue Airport is not recommended.

CHAPTER VI

AGENCIES AND ORGANIZATIONS CONSULTED, AND APPROVALS REQUIRED

A. AGENCIES AND ORGANIZATIONS CONSULTED

1. Federal Government
   U.S. Corps of Engineers, Environmental Permits Section
   U.S.D.A. Natural Resources Conservation Service

2. State Government
   Department of Land and Natural Resources
      State Historic Preservation Division
   Department of Health
      Clean Water Branch
      Safe Drinking Water Branch
      Wastewater Branch
   Wastewater Branch
      Office of Environmental Quality Control

3. County Government
      Planning Department
      Department of Public Works
      Kauai Housing Agency (H.U.D.)

4. Kauai Lagoons Resort Company

B. APPROVALS REQUIRED

1. State Department of Health
      Wastewater Branch; Engineering report and Environmental Assessment
      Safe Drinking Water Branch; UIC application and Permit

2. State Office of Environmental Quality Control
      Environmental Assessment for Project

3. County Department of Public Works
      Engineering report and Environmental Assessment

4. County Planning Department
      Use Permit
      Class IV Zoning Permit

5. Kauai Lagoons Resort Company

CHAPTER VII

FINDINGS AND DETERMINATION

A. FINDINGS BASED ON DOH 11-200-12 SIGINIFICANT CRITERIA

According to DOH 11-200-12, an action may have a significant impact on the environment if it meets any of the Significant Criteria as follows:

1. **Involves an irrevocable commitment to loss or destruction of any natural or cultural resource.**

   There are no known historic or archaeological sites that would be destroyed or adversely affected by this project.

2. **Curtails the range of beneficial uses of the environment.**

   Offshore water quality sampling and analyses were conducted by Marine Research Consultants to determine if the present input of groundwater to the ocean is altering water quality to the extent that biotic community structure may be adversely affected. The coastal segment that is potentially affected is directly downslope from the existing injection wells and includes the outer portion of Nawiliwili Bay and areas seaward of the bay from approximately Ninini Point to Ahukini. Groundwater input was detected at the above noted offshore areas. However, the effect is minimal due to high levels of mixing which rapidly dilute the groundwater input to background ocean concentrations. It appears that there is no effect on water quality to the extent that it could affect biotic community composition. The report concludes that disposal of treated effluent into deep injection wells should not adversely affect marine water quality or community structure. The Marine Research Consultant's report is included in the **Appendix.**

3. **Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.**

   The proposed project is in accordance with the policies, goals and guidelines as expressed in Chapter 344, Hawaii Revised Statutes.

4. **Substantially affects the economic or social welfare of the community or state.**

   Construction of the proposed Phase I effluent disposal improvements will allow the County to continue receiving and treating increasing wastewater flows generated from the Lihue area communities, and provide long term disposal of the treated effluent in an environmentally safe and cost effective manner.

5. **Substantially affects public health.**

   The proposed project does not have any substantial affects on public health. As discussed in item 2 above and item 10 below, it will not substantially affect drinking water or the ocean water, which are the two areas with a high potential for public contact.

6. **Involves substantial secondary impacts, such as population changes or effects on public facilities.**

   The proposed project does not impact the treatment capacity of the Lihue WWTP, and thus does not affect the volume of wastewater that can be accommodated from the population or public facilities. It will only allow the Lihue WWTP to continue operating at it's current design capacity.

7. **Involves a substantial degradation of environmental quality.**

   As discussed in item 2 above and item 10 below, the proposed project does not involve substantial degradation of the environmental quality of drinking water or ocean waters.

8. **Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.**

   The proposed action is limited to the scope discussed in Chapter III, and does not have any cumulative effects.

9. **Substantially affects a rare, threatened, or endangered species, or its habitat.**

   There are no known endangered species of flora or fauna in the immediate area of the project site that would be disturbed.

10. **Detrimentally affects air or water quality or ambient noise levels.**

    The existing injection well at Lihue WWTP has been in operation as an emergency disposal system for more than twenty years, used sporadically during emergencies and monitoring.

    A second well is near KLRC Pond 2 and has been in operation for more than nine years as a partial backup to the effluent reuse system, disposing of overflows from Pond 2.

    During this time, no indications of contamination have occurred at the nearest potable water producing well, (USGS Well No. 11 near existing Department of Water office) located about 8,000 feet northwest and upgradient of Lihue WWTP.

Therefore, the proposed project should not detrimentally affect the water quality.

Dust, noise and some increase in traffic are expected during construction, but these will be temporary and are controllable. Their impacts to the environment are expected to be minimal.

11. **Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.**

    There are no environmentally sensitive areas such as flood plain, tsunami zones, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal water immediately near the project site that will be adversely affected by the project.

12. **Substantially affects scenic vistas and view planes identified in county or state plans or studies.**

    The proposed action does not involve the construction of any substantial structures that would affect view planes in the area. The majority of the action involves underground pipelines, utilities, and injection wells.

13. **Requires substantial energy consumption.**

    The estimated increase in the annual energy required with the proposed action is 312,216 kW-h/yr, while the existing annual energy consumption at the WWTP is approximately 1,900,000 kW-h/yr. This is a 16% increase in energy consumption, and is not considered to be substantial.

B. FINDINGS BASED ON DOH STATE ENVIRONMENTAL REVIEW PROCESS (SERP) CRITERIA

The proposed action involves the use of State Revolving Funds (SRF) and is subject to the DOH SERP criteria, which state that the analysis of alternatives and impacts shall include the following items.

1. **The primary and secondary (direct and indirect) impacts for all feasible alternatives (to include the "no action" alternative).**

   The proposed action and impacts is discussed in Chapters III and IV, and alternatives to the proposed action are discussed in Chapter V.

2. **The impacts on social parameters such as land use, recreation and open-space opportunities.**

Impacts on land use and access to recreation areas are discussed in Chapter IV, Section B, Paragraphs 1 and 2. The impacts are not anticipated to be significant.

3. **The cumulative impacts such as anticipated community growth (residential, commercial, institutional, and industrial) within the project and study area.**

   This is discussed above in Item 6 of the DOH 11-200-12 Significant Criteria.

4. **The impacts on other anticipated public works projects (if any) and the planned coordination with them.**

   No impacts on other public works projects are anticipated.

5. **The impacts on any individual sensitive environmental issues that have been identified through the public participation program.**

   No individual *sensitive environmental* issues have been identified during the 30-day public comment period for the Draft EA of the proposed action.

C. DOH CROSS-CUTTING AUTHORITIES

According to the DOH Environmental Documents Criteria, any Environmental Assessment Document submitted for an SRF (State Revolving Fund) project shall also address the impacts on other Federal "cross-cutting" authorities to include the following:

1. **Archeological and Historic Preservation Act.**

   Discussed in Chapter II, Section F., and Chapter VII, Section A, Item 1.

2. **Clean Air Act.**

   Dust is anticipated during construction, but will be temporary and controllable with mitigative measures covered in Federal, State, and County regulations related to construction activities. See Chapter IV for more details.

3. **Coastal Zone Management Act**

   Discussed in Chapter IV, Section B, Item 4.

4. **Endangered Species Act**

   Discussed in Chapter IV, Section B, Item 10, and Chapter VII, Section A, Item 9.

5. Farmland Protection Policy Act

The site of the proposed action is not considered prime, statewide importance, or unique farmlands. Therefore, the Farmland Protection Policy Act does not apply to this site.

6. Fish and Wildlife Coordination Act

Affects of proposed action on the biotic community are discussed in Chapter VII, Section A, Item 2.

7. Floodplain Management

Proposed action is not in a floodplain, as discussed in Chapter II, Section D, Item 6.

8. National Historic Preservation Act

There are no historic facilities within two miles of the proposed action, as mentioned in Chapter II, Section F.

9. Safe Drinking Water Act

Proposed action is not anticipated to violate the Safe Drinking Water Act, as discussed in Chapter II, Section E.; Chapter IV, Section B, Item 5, and Chapter ;II, Section A, Item 10.

10. Protection of Wetlands

There are no wetlands near the site of the proposed action, as mentioned in Chapter IV, Section B, Item 3.

C. DETERMINATION

Based upon the above data and analyses, the proposed project is not anticipated to have any significant adverse impacts on the coastal waters, local ecology, hydrology, and atmosphere. Mitigative measures will be implemented as deemed necessary and as required by the governmental agencies. A Finding of No Significant Impact has been determined for the proposed action.

CHAPTER VIII

DRAFT ENVIRONMENTAL ASSESSMENT COMMENTS AND RESPONSES

This chapter has been added to the Draft Environmental Assessment to be part of the Final Environmental Assessment document.

The Draft Environmental Assessment was submitted to the Office of Environmental Quality Control (OEQC) in December 1999, and was published in the OEQC Bulletin on December 23, 1999. The deadline for public comment was January 24, 2000. Attached are the comments received during this period, and the associated response letters.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

TIMOTHY E. JOHNS, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DEPUTIES
JANET E. KAWELO
LINNEL NISHIOKA

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS
WATER RESOURCE MANAGEMENT

December 27, 1999

Mr. Keith Yoshimoto
Fukunga and Associates, Inc.
1388 Kapiolani Blvd., 2nd Floor
Honolulu, Hawaii 96814

LOG NO: 24633 ✓
DOC NO: 9912NM09

Dear Mr. Yoshimoto:

SUBJECT: ***Historic Preservation Review -- DEA for Lihue Wastewater Treatment Plant Effluent Disposal System***
TMK: 3-5-01: 27, 30, 82, Lihue, Kauai

Thank you for the opportunity to review this DEA. We do not believe that there are any significant historic sites in this area, since the area has already been cleared in the past with construction of the Airport and cane cultivation. Therefore, we believe that this project will have "no effect" on significant historic sites.

If you have any questions, please call Nancy McMahon 742-7033.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

NM:amk

1388 KAPIOLANI BOULEVARD / 2ND FLOOR/HONOLULU, HAWAII 96814 / PH. (808) 944-1821 / FAX (808) 946-9339

June 26, 2000

Mr. Don Hibbard, Administrator
State of Hawaii
Department of Land and Natural Resources
State Historic Preservation Division
5532 Tapa Street
Koloa, Kauai, Hawaii 96756

Dear Mr. Hibbard:

Subject: Lihue Wastewater Treatment Plant Effluent Disposal System
Draft Environmental Assessment (DEA)

Thank you for reviewing the subject document. We have received your comment letter dated December 27, 1999, and understand that you believe the proposed action will have "no effect" on significant historic sites.

Thank you for your time and cooperation. Please call us if you have any questions.

Sincerely,

Keith M. Yoshimoto

cc: Kauai County Department of Public Works

FUKUNAGA&ASSOCIATES, INC.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

BRUCE S. ANDERSON, Ph.D., M.P.H.
DIRECTOR OF HEALTH

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

In reply, please refer to:
EMD / SDWB

December 28, 1999

Mr. Keith M. Yoshimoto
Fukunaga and Associates, Inc.
1388 Kapiolani Blvd., 2nd Floor
Honolulu, Hawaii 96814

Dear Mr. Yoshimoto:

SUBJECT: LIHUE WASTEWATER TREATMENT PLANT
DRAFT ENVIRONMENTAL ASSESSMENT
UNDERGROUND INJECTION CONTROL (UIC)
UIC PERMIT NO. UK-1213

We acknowledge receipt of the Draft Environmental Assessment (DEA) for the proposed effluent disposal system at the subject facility. We have reviewed the DEA and have no comment at this time.

If you have any questions regarding this subject, please contact Norris Uehara of the Safe Drinking Water Branch (SDWB) at 586-4258 (Honolulu) or call from Kauai the direct toll free number 274-3141, ext. 64258.

Sincerely,

William Wong

WILLIAM WONG, P.E., Chief
Safe Drinking Water Branch
Environmental Management Division

NU:chl

c: Harold Eichelberger, SDWB Sanitarian, Kauai

1388 KAPIOLANI BOULEVARD / 2ND FLOOR/HONOLULU, HAWAII 96814 / PH. (808) 944-1821 / FAX (808) 946-9339

June 26, 2000

Mr. William Wong, P.E., Chief
State of Hawaii
Department of Health
Safe Drinking Water Branch
Environmental Management Division
919 Ala Moana Boulevard, Room 308
Honolulu, Hawaii 96814

Dear Mr. Wong:

Subject: Lihue Wastewater Treatment Plant Effluent Disposal System
Draft Environmental Assessment (DEA)

Thank you for reviewing the subject document. We have received your comment letter dated December 28, 1999, and understand that you have no comments at this time.

Thank you for your time and cooperation. Please call us if you have any questions.

Sincerely,

Keith M. Yoshimoto

Keith M. Yoshimoto

cc: Kauai County Department of Public Works

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

December 30, 1999

Regulatory Branch

Mr. Keith M. Yoshimoto
Fukunaga & Associates, Inc.
1388 Kapiolani Blvd., Second Floor
Honolulu, Hawaii 96814

Dear Mr. Yoshimoto:

This responds to your request for review of the Draft Environmental Assessment (DEA) for the proposed Lihue Wastewater Treatment Plant Effluent Disposal System, Phase I, at Lihue, Kauai, Hawaii.

Based on the information provided in the DEA, I have determined that the proposed project will not require a Department of the Army permit.

Should you have any questions regarding this determination, please contact Peter Galloway of my staff at 438-8416 and refer to file number 200000060.

Sincerely,

for George P. Young, P.E.
Chief, Regulatory Branch

Copies Furnished:

Clean Water Branch, State of Hawaii Department of Health, P.O. Box 3378, Honolulu, HI 96801-3386
State of Hawaii, Department of Land and Natural Resources, Commission on Water Resource Management, P.O. Box 621 Honolulu, HI 96809
Kauai County Department of Public Works, 3021 Umi Street, Lihue, HI 96766

1388 KAPIOLANI BOULEVARD / 2ND FLOOR/HONOLULU, HAWAII 96814 / PH. (808) 944-1821 / FAX (808) 946-9339

June 26, 2000

Mr. George Young, Chief
U.S. Army Corps of Engineers
Regulatory Branch
U.S. Army Engineer District Honolulu, Bldg. 230
Fort Shafter, Hawaii 96858-5440

Dear Mr. Young:

Subject: Lihue Wastewater Treatment Plant Effluent Disposal System
Draft Environmental Assessment (DEA)

Thank you for reviewing the subject document. We have received your comment letter dated December 30, 1999, and understand that the proposed action will not require a Department of the Army permit.

Thank you for your time and cooperation. Please call us if you have any questions.

Sincerely,

Keith M. Yoshimoto

cc: Kauai County Department of Public Works

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

TIMOTHY E. JOHNS
CHAIRPERSON

BRUCE S. ANDERSON
ROBERT G. GIRALD
BRIAN C. NISHIDA
DAVID A. NOBRIGA
HERBERT M. RICHARDS, JR.

LINNEL T. NISHIOKA
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

JAN - 3 2000

Keith M.Yoshimoto
Fukunaga & Associates, Inc.
1388 Kapiolani Boulevard, 2nd Floor
Honolulu, HI 96814

SUBJECT: Draft Environmental Assessment, Lihue Wastewater Treatment Plant Effluent Disposal System

Thank you for the opportunity to review the subject document. Our comments related to water resources are marked below.

In general, the CWRM strongly promotes the efficient use of our water resources through conservation measures and use of alternative non-potable water resources whenever available, feasible, and there are no harmful effects to the ecosystem. Also, the CWRM encourages the protection of water recharge areas, which are important for the maintenance of streams and the replenishment of aquifers.

[ ] We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.

[ ] We recommend coordination with the Land Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

[X] We are concerned about the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

[ ] A Well Construction Permit and/or a Pump Installation Permit from the Commission would be required before ground water is developed as a source of supply for the project.

[ ] The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit from the Commission would be required prior to use of this source.

[ ] Groundwater withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

[ ] We recommend that no development take place affecting highly erodible slopes which drain into streams within or adjacent to the project.

[ ] If the proposed project includes construction of a stream diversion, the project may require a stream diversion works permit and amend the instream flow standard for the affected stream(s).

[ ] If the proposed project alters the bed and banks of a stream channel, the project may require a stream channel alteration permit.

[X] OTHER:

The State Water Code gives the Department of Health jurisdiction over matters related to water quality. We recommend that approvals for this project be conditioned upon a review by the Department of Health and the developer's acceptance of any resulting requirements related to water quality.

If there are any questions, please contact the Commission staff at 587-0218.

Sincerely,

LINNEL T. NISHIOKA
Deputy Director

LN:sd

1388 KAPIOLANI BOULEVARD / 2ND FLOOR/HONOLULU, HAWAII 96814 / PH. (808) 944-1821 / FAX (808) 946-9339

June 26, 2000

Ms. Linnel Nishioka, Director
State of Hawaii
Commission on Water Resource Management
P.O. Box 621
Honolulu, Hawaii 96809

Dear Ms. Nishioka:

Subject: Lihue Wastewater Treatment Plant Effluent Disposal System
Draft Environmental Assessment (DEA)

Thank you for reviewing the subject document. We have received your comment letter dated January 3, 2000, stating your concerns about the State Department of Health (DOH) and the developer's (County of Kauai) involvement in the approval of the proposed action. The State Department of Health as well as the County of Kauai have been and will continue to be involved in the review and approval process for the proposed action.

Thank you for your time and cooperation. Please call us if you have any questions.

Sincerely,

Keith M. Yoshimoto

Keith M. Yoshimoto

cc: Kauai County Department of Public Works

FUKUNAGA&ASSOCIATES, INC.

BENJAMIN J. CAYETANO
GOVERNOR

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

January 24, 2000

Mr. Cesar C. Portugal
County Engineer
County of Kauai
Department of Public Works
4444 Rice Street, Suite 275
Lihue, Hawaii 96766

Dear Mr. Portugal:

Subject: Draft Environmental Assessment for the Lihue Wastewater Treatment Plant Effluent Disposal System Phase 1, Kauai

Thank you for the opportunity to review and comment on the subject document. We have the following comments.

1. Please explain why continuing to send 4.5 mgd of secondary treated wastewater to Kauai Lagoons Resort Company is not feasible in the long term.

2. Please discuss the findings and reasons for supporting the FONSI determination based on all 13 significant criteria listed in §11-200-12 of the EIS rules. Please see the enclosed example.

3. Recently, several new projects (Kauai Police Station, the State Judiciary Facility, the Kauai Bus Maintenance Facility, Kauai Community Kitchen, etc.) have been proposed in the nearby area. Please investigate the feasibility of using the effluent at these new site for irrigation or other purposes.

Should you have any questions, please call Jeyan Thirugnanam at 586-4185.

Sincerely,

Genevieve Salmonson
Director

c: Fukunaga & Assoc.

6.0 DETERMINATION, FINDINGS AND REASONS FOR SUPPORTING DETERMINATION

To determine whether the proposed action may have a significant impact on the environment, the project and its expected consequences, both primary and secondary, and the cumulative as well as short– and long–term effects have been evaluated. Based on the studies performed and research evaluated, a finding of no significant impact is anticipated and is summarized below.

6.1 SIGNIFICANCE CRITERIA

According to the Department of Health Rules (11–200–12), an applicant or agency must determine whether an action may have a significant impact on the environment, including all phases of the project, its expected consequences both primary and secondary, its cumulative impact with other projects, and its short– and long–term effects. In making the determination, the Rules establish "Significance Criteria" to be used as a basis for identifying significant environmental impacts. According to the Rules, an action shall be determined to have significant impacts on the environment if it meets any one of the following criteria:

(1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resources;

An archaeological assessment and field reconnaissance study for the project has determined that cultural deposits and possibly historic burials may exist in the sand dunes adjacent to Farrington Highway. The Landscape Master Plan has therefore been designed to protect the cultural resources and stop the current practice of allowing unrestricted vehicular access onto these areas by limiting parking to designated areas. Planned treatments for the dune areas will include landscape plantings of low shrubs and vines consisting of coastal native species. In the event that any cultural deposits or human burials are uncovered, all work will immediately be halted and planting would shift to an area free of any cultural resources.

The proposed project will not impact scenic views of the ocean or any ridgelines from Farrington Highway or other heavily traveled roadways in the area. The visual character of the area will be enhanced by the additional landscaping with heritage trees and other coastal native plantings. The landscape plantings will also mitigate existing soil erosion. The existing three-mile park is designated as State Urban lands dedicated for Park purposes, an important natural and cultural resource. Presently, the study area is only minimally landscaped and not improved for aesthetic purposes.

(2) Curtails the range of beneficial uses of the environment;

The existing Ulehawa Beach Park has been dedicated for shoreline recreational uses for many decades. Its improvement as described by the Landscape Master Plan will enhance the range of beneficial uses of the environment.

Controlled access onto the property will directly enhance access to the shoreline while simultaneously protect the cultural and natural resources by restrictly vehicular access onto the sand dunes and beach. This shoreline has historically been used for food gathering and recreational purposes. The planned park improvements will enhance those functions.

(3) **Conflicts with the State's long–term environmental policies or goals and guidelines as expressed in Chapter 344, HRS; and any revisions thereof and amendments thereto, court decisions, or executive orders;**

The proposed development is consistent with the Environmental Policies established in Chapter 344, HRS.

(4) **Substantially affects the economic or social welfare of the community or state;**

The proposed project will provide a significant contribution to the Wai'anae District population by establishing an improved recreational resource. The proposed improvements are also consistent with the City's Development Plan for the area. Surrounding land use patterns will not be negatively or significantly altered, nor will unplanned population growth or its distribution be stimulated.

Consequently, development of the park improvements will provide Wai'anae coast residents with a quality recreational facility. This harmonious relationship between park and the existing community will significantly improve the quality of life for many residents.

(5) **Substantially affects public health;**

Although the public health may be affected by the short-term construction impacts which may affect air, noise, traffic and water quality, these should be insignificant especially when weighed against the positive economic, social, and quality of life implications associated with the project. Mitigation measures will be used to address impacts that could potentially affect public health.

(6) **Involves substantial secondary impacts, such as population changes or effects on public facilities;**

The improvement of this existing beach park will not have any secondary impact associated with population growth of the need for public facilities.

(7) **Involves a substantial degradation of environmental quality;**

The renovation of an exiting regional park will improve a much used natural resource. The proposed project may improve erosion control, reduce runoff into nearshore waters, and control access. There are no anticipated impacts that would degrade environmental quality. The addition of new landscaping with Hawaiian heritage plants will enhance the park environment by providing new natural materials and shade. The coastal visual resource from Farrington Highway will also be improved.

(8) **Is individually limited but cumulatively has considerable effect on the environment, or involves a commitment for larger actions;**

The planned improvements to an existing park is consistent with the existing and planned urban character expressed in the Wai'anae Development Plan and is not anticipated to have a considerable effect on the environment. The commitment of fiscal resources to construct the improvements will foreclose other uses of those resources.

(9) **Substantially affects a rare, threatened or endangered species or its habitat;**

Field wildlife and botanical studies indicate that there are no endangered plant or animal species located at this highly utilized beach park. The federal and state natural resource agencies have not

identified Ulehawa Beach Park as a site for monk seals or turtle nesting, however, it is possible that seals may beach there from time to time.

(10) Detrimentally affects air or water quality or ambient noise levels;

Any possible impact to near–shore ecosystems resulting from surface runoff will be mitigated by the establishment of on–site detention basins during the construction phases of development.

(11) Affects or is likely to suffer damage by being located in an environmentally sensitive area, such as a flood plain, tsunami zone, beach, erosion–prone area, geologically hazardous land, estuary, freshwater, or coastal waters;

Ulehawa Beach Park, like all other coastal parks in the State is susceptible to high wave and tsunami inundation.

(12) Substantially affects scenic vistas and view planes identified in county or state plans or studies;

The City and County of Honolulu's *Coastal View Study* identifies the Nānākuli Viewshed as a major viewshed within the Wai'anae area. Lateral coastal views which are available from all points along the shoreline are significant, especially in the Ka'ena direction due to the descending ridges which can be seen in the distance. The Pu'u o Hulu Kai / Pu'u o Hulu Uka landmark is designated as an important coastal land form. Although new landscape plantings will impact views, the overall visual resource will be enhanced. The proposed project is in conformance with both State and County plans for the area and no public facilities are designated on the Wai'anae Development Plan Public Facilities Map.

(13) Requires substantial energy consumption;

The location of the beach park is proximate to Wai'anae area communities and are all within short driving distances from the property, thereby reducing travel times and energy consumption. Construction of the proposed project will not require substantial energy consumption.

6.2 DETERMINATION

On the basis of the above criteria, and the discussion of impacts and mitigative measures contained in this document, it is anticipated that the proposed project will not have a significant negative effect on the environment and will conversely, result in positive effects to the natural, cultural, and social environments.

MARYANNE W. KUSAKA
MAYOR

WALLACE G. REZENTES, SR.
ADMINISTRATIVE ASSISTANT

CESAR C. PORTUGAL
COUNTY ENGINEER
TELEPHONE 241-6600

IAN K. COSTA
DEPUTY COUNTY ENGINEER
TELEPHONE 241-6640

AN EQUAL OPPORTUNITY EMPLOYER
COUNTY OF KAUA'I
DEPARTMENT OF PUBLIC WORKS
4444 RICE STREET
MO'IKEHA BUILDING, SUITE 275
LIHU'E, KAUA'I, HAWAI'I 96766

June 13, 2000

Ms. Genevieve Salmonson, Director
State of Hawaii
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Attention: Jeyan Thirugnanam

Dear Ms. Salmonson:

Subject: Draft Environmental Assessment for the Lihue Wastewater Treatment Plant Effluent Disposal System, December 1999

Thank you for the comments to the Draft Environmental Assessment for the Lihue Wastewater Treatment Plant Effluent Disposal System dated January 24, 2000. In response to your comments we offer the following responses:

1. Although the current Agreement in-force between the County of Kauai and Kauai Lagoons Resort Company (KLRC) (originally with Hemmeter-VMS) indicates that KLRC will take up to 4.5 mgd of effluent until August 2003, it is not feasible to send that volume of secondary treated effluent to KLRC. The original Agreement assumed more development in the area, including an additional golf course. The water usage for these additional facilities would have been able to use most of the effluent from the Lihue WWTP during dry months. However, due to the recent economic climate on Kauai, these additional developments were not constructed. Current reuse of effluent for irrigation by KLRC is limited to two golf courses. In addition, the golf courses do not require irrigation during most of the winter months when there is sufficient rainfall. The State Department of Health Wastewater Branch has expressed concern that the existing effluent storage capacity at KLRC may not be sufficient during prolonged periods of wet weather and prefers that the County of Kauai take the excess effluent not used for irrigation. Therefore, the long-range plan is to reduce the amount of effluent to the 1.5 million gallons per 24-hour period as stated in the current Agreement in force for the term from year 2003 to 2013. Negotiations are under way to extend the term beyond 2013, and to address KLRC's position of limiting the quantity of effluent to 1.5 mgd.

2. Complied, the reasons in support of the FONSI determination based on all thirteen criteria in §11-200-12 of the EIS rules has been included in Chapter VII "Findings and Determination" of the final Environmental Assessment.

3. The Preliminary Engineering Report submitted to the County of Kauai in August 1999 discusses the feasibility of using effluent for publicly accessible facilities such as those mentioned in the letter. Based on the current requirements of the State Department of Health, the quality of the effluent would have to be upgraded to R-1 as defined in the *Guidelines for the Treatment and Use of Reclaimed Water*, November 1993. The facilities required to upgrade part of the total effluent flow to meet the off-site demands are planned as another, future phase of the wastewater treatment plant. As demands arise and the infrastructure to deliver the effluent is constructed, the Lihue WWTP can be upgraded to produce R-1 quality effluent to meet these demands. Currently, the low off-site demand for reclaimed wastewater does not justify the cost of constructing the facilities to produce R-1 quality effluent. In addition, the infrastructure to deliver the effluent is not available and must be master-planned for the Lihue area.

Should you have any questions regarding these responses and the final EA, please call Mr. Harry Funamura, Chief Division of Wastewater Management at (808)241-6610.

Sincerely,

for CESAR PORTUGAL
County Engineer

WU

xc: Fukunaga & Associates Fax: 1-808-946-9339

REFERENCES

1. Assessment of Potential Impacts to Water Quality and Marine Community Structure From Effluent Disposal, Lihue Wastewater Treatment Plant Lihue, Kauai, Hawaii, Marine Research Consultants, March 10, 1997.

2. Lihue Wastewater Treatment Plant Preliminary Engineering Report for Phase IV Expansion, M&E Pacific, Inc. July 1990.

3. Kauai Water Use and Development Plant, Prepared fro the Department of Water, County of Kauai, R.M. Towill Corporation, February 1990.

4. National Flood Insurance Program Flood Insurance Rate Map, Kauai County, Hawaii, Federal Emergency Management Agency, March 4, 1987.

5. 208 Water Quality Management Plan for the County of Kauai, State Department of Health and County of Kauai, December 1980.

6. Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, United States Department of Agriculture Soil Conservation Service in cooperation with the University of Hawaii Agricultural Experiment Station, August 1972.

APPENDIX

ASESSMENT OF POTENTIAL IMPACTS TO WATER QUALITY AND MARINE COMMUNITY STRUCTURE FROM EFFLUENT DISPOSAL

Lihue Wastewater Treatment Plant

ASSESSMENT OF POTENTIAL IMPACTS TO WATER QUALITY AND MARINE COMMUNITY STRUCTURE FROM EFFLUENT DISPOSAL, LIHUE WASTEWATER TREATMENT PLANT LIHUE, KAUAI, HAWAII

Prepared for:

Tom Nance Water Resource Engineering
680 Ala Moana Blvd., Suite 406
Honolulu, HI 96813

By:

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

Revised
June 23, 1998

I. INTRODUCTION

Planning is underway to determine the most effective methods of disposing of treated sewage effluent from the Lihue Wastewater Treatment Plant (LWWTP). Current design capacity of the treatment plant is 2.5 million gallons per day (mgd). At present, inflow to the plant is approximately 1.3 mgd, and all treated effluent is utilized for irrigation of the Kauai Lagoons Golf Course. However, should the inflow to the plant increase beyond the present level, it will not be possible to dispose of the additional effluent on the golf course. As a result, several alternative disposal options are under investigation, including the development of new disposal wells, and disposal of effluent into the man-made lagoon located on the grounds of the Kauai Lagoons Hotel.

A fraction of treated sewage effluent applied to the golf course, and all of the effluent disposed through injection wells enters the water table and eventually reaches the ocean. Because there is a potential for these activities to effect the marine environment, it was deemed necessary to conduct a study to determine the likelihood and magnitude of changes to the marine environment that be expected to occur under the various alternative methods of effluent disposal.

More specifically, the investigation will establish the inter-relationship between the present conditions of marine water chemistry related to groundwater and surface water input and biological community structure in the coastal segment directly downslope from the proposed wells. For the primary site, the coastal segment that is potentially affected is within the outer portion of Nawiliwili Harbor, as well as the area seaward of the Harbor from approximately Ninini Point to Ahukini (see Figure 1). If it is determined that the present input of groundwater to the ocean is altering water quality to the extent that biotic community structure may be affected, it will be possible to evaluate what might happen with the change in disposal (e.g. increase in input to the ocean). However, if it is determined that groundwater is not affecting ocean water quality to the degree that there is an effect to community structure, there is justification to conclude that altering the input of groundwater will not result in changes to the marine communities.

II. METHODS

A. Water Chemistry

The sampling rationale of the study was to evaluate the extent of groundwater input from land to the coastal ocean, and to determine the fate of this groundwater once it enters the ocean. At each of five sampling sites, water chemistry was evaluated in a series of water samples that were collected from the shoreline to the open ocean on transects oriented perpendicular to the shoreline. In order to most accurately define the horizontal gradients where groundwater mixes with ocean water, sampling was most intense in the nearshore zone. Sampling also took place through the water column to determine the extent of vertical stratification.

Water samples were collected at the surface and near the bottom at five sites shown in Figure 1; Sites 1 and 2 were located along the exposed shoreline off of Ahukini and Kamilo Point, respectively. In general, the shoreline north of Ninini Point consists of near vertical rocky cliffs. Sampling sites were selected where small sand-rubble pocket beaches occurred along the rock shoreline. Sand beaches generally have higher groundwater discharge than rocky cliffs, so the sampling sites were selected to detect maximal groundwater discharge. Site 3 was located off a small sand beach inside of Ninini Point. Sites 4 and 5 were located along Kalapaki Beach in the outer portion of Nawiliwili Harbor. The entire study area appears to be down-gradient from the existing Lihue WWTP disposal wells.

Water sampling was conducted on November 25, 1996. Sea conditions during the sampling at all locations consisted of mild tradewinds (10-15 knots) and small swells of 2-3 feet. As a result of direct exposure to tradewinds and tradewind generated seas, typical marine conditions off the exposed cliff faces of Sites 1 and 2 result in very vigorous mixing of land-derived freshwater and oceanic water in the coastal zone. Thus, the day selected for sampling with mild winds and swell represents conditions of minimal mixing where dilution of effluxing freshwater with seawater is substantially lower than during more typical tradewind and surf conditions. As a result, the survey

results during calm conditions provide a representative estimate of what can be considered "end-point" conditions revealing maximum gradients of freshwater-seawater mixing.

Sampling was conducted using a 19-foot boat, and by divers swimming from the boat to the shoreline. Water samples were collected from the boat using a 1.8 liter Niskin-type oceanographic sampling bottle. The bottle was lowered to the desired sampling depth with endcaps cocked in an open position so that water flowed freely through the bottle. At the desired depth a weighted messenger released from the surface tripped the endcaps closed, isolating a volume of water from the desired sampling depth. At all sampling stations where water depth was greater than 1 meter, two water samples were collected; a surface sample from within 10 centimeters (cm) of the air-sea interface, and a deep sample within 50 cm of the ocean floor. Inshore samples were collected by swimmers who filled 1-liter polyethylene bottles at the desired locations.

Water quality constituents that were evaluated include the 10 specific criteria designated for open coastal waters in Chapter 11-54, Section 06 of the Water Quality Standards, Department of Health, State of Hawaii. These criteria include: total nitrogen (TN), nitrate + nitrite nitrogen (NO_3^- + NO_2^-), ammonium (NH_4^+), total phosphorus (TP), chlorophyll a (Chl a), turbidity, salinity, pH and temperature. In addition, orthophosphate phosphorus (PO_4^{-3}) and silica (Si) are reported because these constituents can be indicators of biological activity and the degree of groundwater or stream water mixing.

Subsamples for nutrient analyses were immediately passed through sub-micron filters (GF-F) into 125-milliliter (ml) acid-washed, triple rinsed, polyethylene bottles and stored on ice until returned to the laboratory. Analyses for NH_4^+, PO_4^{3-}, NO_3^-, and Si were performed using a Technicon autoanalyzer according to standard methods for seawater analysis (Strickland and Parsons 1968, Grasshoff 1983). TN and TP were analyzed in a similar fashion on unfiltered samples following oxidative digestion. Dissolved organic nitrogen (DON) and dissolved organic phosphorus (DOP) were calculated as the difference between TN and dissolved inorganic N, and TP and dissolved inorganic P,

respectively. The level of detection for the dissolved nutrients is 0.2 µM for TN and Si, 0.02 µM for TP, and 0.01 µM for PO_4^{3-}, NO_3^- and NH_4^+.

Water for other analyses was subsampled from 1-liter polyethylene bottles and kept chilled until analysis. Turbidity was determined on 60-ml subsamples fixed with $HgCl_2$ to terminate biological activity. Fixed samples were kept refrigerated until turbidity was measured on a Monitek Model 21 90-degree nephelometer, and reported in nephelometric turbidity units (ntu) (level of detection 0.01 ntu). Chl a was measured by filtering 300 ml of water through glass fiber filters; pigments on filters were extracted in 90% acetone in the dark at -5° C for 12-24 hours, and the fluorescence before and after acidification of the extract was measured with a Turner Designs fluorometer (level of detection 0.01 µg/L). Salinity was determined using an AGE Model 2100 laboratory salinometer with a precision of 0.0003‰. pH was determined using a field meter with a combination electrode with precision of 0.01 pH units.

Nutrient, turbidity, Chl a and salinity analyses were conducted by Marine Analytical Specialists (Laboratory Certification NO: HI-0009) of Honolulu, HI.

B. Biotic Community Structure

In order to characterize the response of biotic communities to input of groundwater (characterized by water chemistry analyses), community composition at each of the study sites was qualitatively assessed. This qualitative assessment included field reconnaissance of the environment, with emphasis on noting prominent differences in biotic composition of the study areas. Quantitative reconnaissance surveys were conducted by divers towing behind a slowly moving boat in the same five areas as water chemistry transect sites. These reconnaissance surveys were useful in making relative comparisons between areas, identifying any unique or unusual biotic resources, and providing a general picture of the physiographic structure and benthic assemblages occurring throughout the region of study.

III. RESULTS OF WATER CHEMISTRY ANALYSES

A. Horizontal and Vertical Stratification

Tables 1 and 2 show results of all water chemistry analyses for samples collected at the five sites within the influence of the Lihue WWTP disposal wells. Table 1 shows concentrations of nutrients in micromolar units (μM), while Table 2 shows the same data in units of micrograms per liter (μg/L). Also shown in Tables 1 and 2 are the concentrations of State of Hawaii Department of Health water quality criteria for open coastal waters under "wet" conditions.

Concentrations of eight dissolved nutrient constituents, salinity, turbidity and Chl a, in surface and deep samples are plotted as functions of distance from shore in Figures 2-3. It can be seen in Tables 1 and 2, and Figures 2-3 that with few exceptions, horizontal gradients of dissolved nutrients are steeper at the sample sites in Kalapaki Bay (Sites 4 and 5) compared to the sites along the exposed shorelines (Sites 1-3). At site 1, a small stream flowing into the ocean had concentrations of dissolved nutrients 1-2 orders of magnitude higher than the ocean sample collected at the shoreline. Between 1 and 250 meters from the shoreline, there are no distinguishable gradients of surface salinity and dissolved nutrients. At Site 2, where no stream occurred, there are also no distinguishable gradients in any of the measured constituents in surface waters. At both sites 1 and 2, the deep sample from a distance of 250 m from shore had depressed Si and NO_3^-, and elevated salinity (34.6‰). Low salinity groundwater which contains high concentrations of the inorganic nutrients Si, NO_3^-, and PO_4^{3-}, percolates to the ocean at the shoreline resulting in a nearshore area of mixing. Groundwater and surface water input appears to cause a small, but detectable effect on nearshore waters up to a distance of at least 100 m from shore off the exposed coastal area.

Off Site 3, concentrations of salinity, Si, NO_3^-, and PO_4^{3-} exhibit slightly larger gradients between the shoreline and offshore samples than at Sites 1 and 2. Owing to protection afforded by Ninini Point, water motion from waves and wind is substantially less at Site 3 than at Sites 1 and 2. Hence, mixing of groundwater with ocean water appears to be somewhat less, resulting the slightly steeper gradients. Salinity varies by approximately

1‰ at Site 3 compared to 0.3‰ at Site 2. Si at the shoreline at Site 3 is approximately twice that at Site 2 (8 µM vs 4 µM). However, at all of these sites, while the effect of groundwater mixing with ocean water is discernible, the changes in concentrations are extremely small.

The situation at Sites 4 and 5 is substantially different. Water from a seep on Kalapaki Beach had substantially elevated concentrations of silica, nitrogen (TN, NO_3^-, NH_4^+) and phosphorus (TP, PO_4^{3-}). Comparison of the concentrations of these constituents in the seep water with a potable well show that the seep was substantially enriched in nutrients compared to the well. Concentrations of nutrients in the waters of Kalapaki Bay (Sites 4 and 5) also had substantially elevated nutrient concentrations compared to the offshore sites (Sites 1-3). In general, concentrations decreased with distance from shore, and at each sampling point were higher in surface compared to deep samples. Salinity increased with distance from shore, and at each sampling point was lower in surface compared to deep samples. These relationships indicate that the increased nutrient concentrations are a result of input of groundwater at the shoreline that remains as a distinct surface layer as it mixes seaward in Kalapaki Bay. Owing to the input of high concentrations of nutrients in groundwater, and relatively low physical mixing processes, groundwater effects are very pronounced within Kalapaki Bay compared to outside the Bay.

The patterns of distribution of other dissolved nutrients which are not found in high concentrations in groundwater do not display the same tendencies with respect to distance from shore as the nutrients found in groundwater. Horizontal distributions of NH_4^+, DON and DOP do not show the same patterns of increased values in the nearshore water as Si, NO_3^- and PO_4^{3-}. The patterns of distribution of these constituents is somewhat random with no noticeable trends with respect to distance from shore.

With the exception of the samples collected within 1 meter from the shoreline, turbidity showed no little variation as a function of distance from shore. Overall, turbidity was higher at all stations along transects at Sites 4 and 5 compared to Sites 1-3. within 25 m of the shoreline). Similarly, concentrations of Chl a were uniformly lower

at Sites 1-3 compared to Sites 4 and 5. At Sites 4 and 5, nearshore concentrations of Chl a were approximately an order of magnitude higher than at other sites. The elevated concentrations of Chl a may reflect the high nutrient concentrations at these stations, or more likely, the reduced circulation and longer residence time of water in Kalapaki Bay compared to the exposed coastline at Sites 1-3.

B. Conservative Mixing Analysis

A useful treatment of water chemistry data for interpreting the extent of material inputs from land is application of a hydrographic mixing model. In the simplest form, such a model consists of plotting the concentration of a dissolved chemical species as a function of salinity. It is possible to evaluate the extent of nutrient input from sources other than groundwater efflux by plotting the concentration of the dissolved material as a function of salinity (Officer 1979, Dollar and Atkinson 1992, Smith and Atkinson 1993). Comparison of the curves produced by such plots with conservative mixing lines provides an indication of the origin and fate of the material in question. Figure 4 shows plots of concentrations of four constituents (Si, NO_3^-, NH_4^+, PO_4^{3-}) as functions of salinity for the samples collected in the Lihue area in November 1996. Each graph also shows conservative mixing lines that are constructed by connecting the end member concentrations of open ocean water and water collected from a potable well (5823-01) and a groundwater well used to supply the Kauai Lagoons water feature.

If the nutrient constituent in question displays purely conservative behavior (no input or removal resulting from any process other than physical mixing), data points should fall in a linear array on, or near, the conservative mixing line. If, however, external material is added to the system through processes such as leaching of fertilizer nutrients to groundwater, data points will fall above the mixing line. If material is being removed from the system by processes such as biological uptake, data points can fall below the mixing line.

Dissolved Si represents a check on the model as this material is present in high concentration in groundwater, but is not a major component of fertilizer, and is not utilized rapidly within the nearshore environment by biological processes. It can be seen

in Figure 4 that when Si concentrations are plotted versus salinity, data points for all survey sites 1, 2, 3 and 5 fall in a linear array, while data points for Site 4 have two distinct slopes. Data points at salinities above 28‰ fall on the same line as the other survey sites, while data points from samples with salinity less than 28‰ fall on line with substantially steeper slope. The sample with the lowest salinity (at the shoreline of Site 4) falls near the mixing line for potable water. However, while not shown because of the change in scale, the data point from the shoreline seep (salinity of 2‰) lies far above the mixing lines. These relationships indicate that there appear to be several sources of groundwater with different concentrations of Si entering the coastal ocean. One source, apparent only at Site 4 is substantially enriched in Si relative to groundwater collected in the two wells used to construct the mixing lines, while the other source has less Si at any given salinity than groundwater from sampled wells.

The plots of NO_3^- versus salinity in July 1996 show a similar pattern from to that of dissolved Si (Figure 4). As described above, data points for all sites fall in two linear arrays. However, for NO_3^- the data points at the two most shoreward sampling sites from Site 5 also appear to lie on the same line as points from Site 4. As with Si, all of the data points except the point at the shoreline of Site 4 fall well below the mixing lines. This relationship indicates that if naturally occurring groundwater with no subsidies from human activities mixed conservatively with ocean water (no biological uptake), the concentration of NO_3^- in coastal waters would be higher than measured in samples collected on the five survey transects.

It is also apparent that the relationship between Si and NO_3^- mixing lines varies with the two wells. In the potable well, the concentration of Si is higher at any salinity than in the lagoon well. However, in the lagoon well, the concentration of NO_3^- at any given salinity is substantially higher than in the potable well. Should these groundwaters come from the same source, it appears that there is a subsidy of NO_3^- between the elevation of the potable well and the lagoon well.

The distribution of the other form of dissolved inorganic nitrogen, NH_4^+, shows no overall inverse relationship with salinity at any of the survey sites during the present survey (Figure 4). Concentrations of NH_4^+ are similar in groundwater and open ocean

water resulting in a nearly "flat" conservative mixing lines. The lack of any linearity in the data points for NH_4^+ indicate that this material does not appear to be added to the ocean via input from land. Data points for nearly all of the measured concentrations of NH_4^+ as functions of salinity fall above all mixing lines. It appears that there is a natural input of this form of nitrogen from biological processes within the nearshore zone.

PO_4^{3-} is also a major component of fertilizer and sewage effluent, but is usually not found to leach to groundwater to the extent of NO_3^-, owing to a high absorptive affinity of phosphorus in soils. The distribution of data points of PO_4^{3-} versus salinity in the samples off of Lihue is similar to those of Si and NO_3^-. Most points from Sites 1-3 and 5 fall along a linear array below the conservative mixing lines, while the most shoreward samples from Site 4 appear to contain water with a distinctly different concentration of PO_4^{3-} than either of the wells.

C. Compliance with DOH Criteria

Tables 1 and 2 show State of Hawaii Department of Health (DOH) water quality standards for the "not to exceed 2% and 10% of the time" criteria for open coastal waters under "wet" conditions, which is the category applicable to Transect Sites 1-3, and embayments, which is the category applicable to Transect sites 4 and 5. While the 2% and 10% criteria are not technically meaningful with only a single sampling at each location, comparison of the data with these limits is useful for gaining a general understanding of the water quality of the area.

Inspection of Tables 1 and 2 indicates that at Sites 1-3 only one sample exceeds any of the water quality standards. At the shoreline of Site 1, NO_3^-. NH_4^+ and Chl a exceed the 10% limits. No samples from Sites 2 and 3 exceed any of the criteria for open coastal waters. At Sites 4 and 5, all of the surface samples, and one deep sample exceed the 10% and 2% criteria for NO_3^-. With the exception of a single sample at the shoreline of Site 4, which exceeds the 10% criteria for TN, none of the other constituents exceed DOH criteria within Kalapaki Bay.

As noted in the sections above, NO_3^- is a natural component of groundwater. In areas that receive substantial input of groundwater there is typically a zone of mixing near the shoreline where NO_3^- concentrations may consistently exceed DOH criteria as long as salinity remains low. Thus, it appears that natural processes can result in water quality that exceeds specified DOH limits. As discussed above, all of the concentrations of NO_3^- within Kalapaki Bay are lower than would be expected for conservative mixing of potable groundwater with ocean water. Hence, it appears that because of the low mixing of groundwater and ocean water in Kalapaki Bay, nearshore waters will exceed consistently exceed DOH criteria from input of natural groundwater.

IV. RESULTS OF BIOTIC COMMUNITY ASSESSMENT

When considering environmental changes caused by altered land use, benthic (bottom-dwelling) communities are probably the most useful biological assemblages for direct evaluation of marine environmental impacts. Because benthos are generally long-lived, immobile, and can be significantly affected by exogenous input of potential pollutants, these organisms must either tolerate the surrounding conditions within the limits of adaptability or die. Reef corals serve as ideal indicator because they are sensitive to salinity changes in the environment, and because they are have life spans from decades to centuries provide a good integration of environmental conditions. In addition, corals are considered "keystone" species that serve as sources of food and shelter for many other reef species. Benthic algae are important components of the benthic community because they have the potential to respond to changes in nutrient concentrations associated with groundwater flux by changes in biomass and abundance. Thus, determining the effects that the proposed project may exert on coral/algal communities provides a good indication of overall effects to the entire biotic community.

Concussive force from wave stress is probably the major natural determinant in shaping coral community structure by causing breakage of adult colonies and prevention of planular settlement on empty substrata. Suspended sediment loading is another important natural factor in defining coral community structure, as sediment

accumulation can bury living corals, and prevent settlement on shifting substrata. Moving sediment, such as shifting sands can cause abrasion and mortality of adult colonies.

Inspection of Sites 1 and 2 off of the exposed shoreline between Nawiliwili Harbor and Ahukini revealed a fairly consistent habitat. Because the area is exposed to open ocean sea and swell, the nearshore area is almost continually subjected to extreme wave energy. As a result, the region from the rocky shoreline to a distance of approximately 30 m offshore, and a water depth of 0 to 3 m is almost completely devoid of corals and benthic algae. Such a scenario is typical of most exposed Hawaiian shorelines where the energy from breaking waves results in such vigorous water motion that few or no attached organisms can survive. Seaward of this inshore region, corals occur as small encrusting patches on the rocky bottom. Predominant species are *Porites lobata* and *Pocillopora meandrina.* With distance seaward and increasing water depth, abundance of corals progressively increases as a function of reduced wave stress. The zone between approximately 50 m offshore to 200 m offshore (water depth 6-15 m) contains relatively high levels of coral cover (estimated at approximately 20-35% of bottom cover). Most coral colonies are sturdy lobate or encrusting growth forms that are able to withstand occasional stress from seasonally large storm waves. Few delicate growth forms such as finger coral or plating corals were observed. No areas of abundant benthic algae were observed anywhere on the exposed reefs off sites 1 and 2.

At Site 3, inland from Ninini Point, the marine habitat consisted of sand/rubble beach and nearshore area. No corals or benthic were observed in this area. At Site 4, in the eastern corner of Nawiliwili Bay the shoreline area consists of a rock/ sand flat that grades into a sand bottom that extends to the Nawiliwili Harbor channel. During the present survey, rocks in the nearshore zone were covered with an amorphous algal slime, with no macroalgae or coral. The sand floor extending out to the channel was also devoid of attached macrobiota. At Site 5, off of the central portion of Kalapaki Beach, the inner area in the surf zone consisted of sand bottom in constant resuspension from wave action. As at Site 4, moving seaward, bottom composition was predominantly barren rocks and sand out to the channel with little macrobenthos.

V. DISCUSSION

1. Present Conditions

In considering the Lihue WWTP disposal system alternatives, the only physical/chemical factor that may be altered is input of groundwater in the nearshore ocean. As discussed above, increases of groundwater input can result in a zone of mixing where salinity is lowered and inorganic nutrient concentration is elevated over open coastal oceanic conditions.

Under the present conditions, all treated effluent from the LWWTP is used to irrigate the Kauai Lagoons golf course. A fraction of the nutrients contained in the effluent will be taken up by the golf course turf; the remaining nutrients will percolate through the soil thatch layer to the groundwater table. Studies of other golf courses using treated sewage effluent reveal that about 10% of the applied effluent reaches groundwater (Chang and Young 1977, Dollar and Atkinson 1991). Groundwater subsequently flows seaward and enters the ocean and mixes with seawater in the nearshore zone.

Direct exposure to tradewind generated wind and swells, as well as long period swells from the north result in an extremely well-mixed nearshore environment off Lihue beyond the confines of Nawiliwili Bay. As a result, groundwater diffusing to the ocean is rapidly diluted by the infinitely large reservoir of ocean water to background oceanic concentrations. Measurements made during when seas were relatively calm showed only small horizontal and vertical gradients of groundwater constituents (freshwater, NO_3^- and PO_4^{3-}) that appear to have no effect on biotic community structure, nor appear to cause water quality to exceed DOH criteria.

Within Nawiliwili Bay, groundwater entering the nearshore zone exhibits elevated nutrient concentrations relative to the exposed coastal sites. However, mixing analyses indicate that the concentrations found in nearshore waters are less than what would be expected from the mixing of natural groundwater mixing with ocean water. As a result, it appears that the groundwater that is entering the nearshore zone may be groundwater that has percolated through the golf course with nutrient removal by

uptake from golf course turf. In any event, it appears that under the present scenario, there is no indication of excess nutrients entering the waters of Nawiliwili Bay.

2. Projected Disposal in Injection Wells

One alternative option for disposal of treated sewage effluent from the LWWTP is injection into disposal wells located within near to the treatment plant. Depth of the two existing wells is approximately 400 feet below sea level. Dye tracer studies of similar injection wells at the Lahaina Sewage Treatment Plant on Maui revealed virtually no areas of increased effluent concentrations in the nearshore ocean as a result of disposal in injection wells (TetraTech 1994, Dollar 1997). Lack of detection of the effluent plumes appears to be a result of high dilution and dispersal of the effluent in the water table, and lack of surfacing following deep injection as a result of multiple layers of impermeable strata underlying the Lahaina area. Because of these factors it appears that injected effluent is highly diluted within groundwater prior to discharge to the ocean, and is enters ocean waters at depths similar to the depth of injection (>200 feet). At these depths and dilutions, it appears that there is little or no potential for the effluent to affect water quality and biological processes in the nearshore zone.

The injection wells at Lahaina are considerably shallower (~200 feet below sea level) than the Lihue wells. Thus, if there are no major differences in the geological structure of the Lihue area which would facilitate rise of the effluent plume through strata to the surface, it could be expected that the effects to nearshore ocean processes from the Lihue wells would be similar to the Lahaina wells. Thus, injection of effluent into deep disposal wells would likely have no effect on the marine environment.

3. Projected Disposal into the Kauai Lagoons Water Feature.

Man-made, rubber lined lagoons on the grounds of the Kauai Lagoons Hotel hold an estimated 70 million gallons of water. Water is supplied to the lagoons from two wells at a flow rate of approximately 0.25 mgd. With no discharge from the lagoons and no leakage, the only water loss from the lagoons takes place through evaporation. Studies

of drawdown of water levels when pumps are not operating indicate that water loss approximately equals pumpage of about 0.25 mgd.

Nutrient concentrations in water in the lagoons, in water from the wells that supply the lagoons, and from the Lihue WWTP effluent are shown in Table 3. It can be seen that concentrations of NO_3^- and PO_4^{3-} in the lagoons is approximately an order of magnitude less than in the well water pumped into the lagoons, which is in turn an order of magnitude less than the concentrations in the sewage effluent.

As stated above, there are no major loss terms for the lagoon other than evaporation. Evaporation will not remove salt or dissolved nutrients from the lagoon. Hence, with no other processes at work, and evaporation and water input at equal rates, water in the lagoon should have similar salt and nutrients than the source well water. Inspection of the data in Table 3 shows that this is the case for salinity, with values in the lagoons similar to the source wells for the lagoons. However, most nutrient concentrations in the lagoons are substantially lower than in the source well waters. The exception is NH_4^+ which is virtually undetectable in the source wells, but in high concentration in the lagoon.

These results suggest that the lagoon system may be considered in an "equilibrium" with respect to nutrient dynamics. Dissolved inorganic nutrients are taken up by plants which are grazed by herbivores, which in turn excrete organic nutrients. The lowered inorganic nutrient composition suggest uptake by plants and the increased NH_4^+ suggests excretion of organic material that is typical of systems with high biological activity. It is somewhat surprising, however, that Si is also reduced in the lagoons relative to the source wells. Such a reduction indicates substantial uptake of Si by some plants in the lagoon, possibly silicious diatoms.

While the concentrations of the major plant nutrients NO_3^- and PO_4^{3-} is reduced in the lagoons relative to source waters, the concentrations in the lagoons are still detectable. However, concentrations of PO_4^{3-} are near the limit of detection, while there is comparatively high concentrations of NO_3^-. Hence, it appears that PO_4^{3-} is the limiting nutrient to the plant uptake in the lagoons. Inspection of the lagoons indicates that there

is no extensive algal growth in the lagoons, and that the aesthetic quality can be considered "good" for such a system. It appears that with the nutrient input from the supply wells, and P limitation to the system, the system remains in a favorable state.

Replacing the input water to the lagoons from the present well water to sewage effluent would increase the nutrient concentration in the incoming water substantially. Based on the data in Table 3, if the volume of effluent pumped into the lagoons equals the amount of well water presently pumped, the concentration of NO_3^- would increase by a factor of about 5, while the concentration of PO_4^{3-} would increase by a factor of about 36. If PO_4^{3-} is indeed the limiting nutrient in the lagoons, such an increase provides the potential for substantially more plant growth. While there are grazers in the lagoons (primarily herbivorous fish) that may be able to keep pace with such increased plant growth, it is also possible that plant growth will overwhelm the system resulting in a decline in aesthetic quality.

VI. CONCLUSIONS

Based on the data collected for the present study the following conclusions can be drawn:

1. Potential changes in the disposal scenarios for the Lihue Wastewater Treatment Plant could alter the input of materials (primarily dissolved nutrients) to the coastal ocean. Depending on the location that this input enters the marine environment and at what levels of dilution, such input could potentially affect water quality and biotic community structure.

2. Input of groundwater is detectable at offshore sites fronting the area of the Lihue WWTP. However, this effect of this input in minimal owing to high levels of physical mixing processes which rapidly dilute groundwater to background coastal ocean concentrations with a short distance from the shoreline. Because of the constant mixing, it appears that there is no effect of groundwater on water quality to the extent that it could affect biotic community composition.

2. Within Nawiliwili Bay, physical mixing processes are substantially less than in the exposed coastal region. As a result, nutrient concentrations are elevated in nearshore waters off Kalapaki Beach. However, when these concentrations are scaled to salinity, it appears that the concentrations of nutrients are lower than what would be expected if uncontaminated groundwater is mixed with ocean water. Such a result is either due to uptake of nutrients from groundwater prior to reaching the ocean, or that groundwater in the Kalapaki area is from a different source as the groundwater in a potable upland well. As groundwater entering the nearshore zone is a natural phenomenon throughout the Hawaiian Islands, it appears that at present the concentrations of nutrients entering the inshore waters of Nawiliwili Bay cannot be considered an impact to the environment.

3. At present, all effluent from the Lihue WWTP is disposed of as irrigant to the Kauai Lagoons Golf Course. As described above, there is presently no indication of environmental concerns with respect to nutrient addition to the coastal ocean. Therefore, it does not appear that continued irrigation of the golf course with treated sewage effluent should cause any environmental problems with respect to water quality or biotic community structure.

4. Disposal of treated effluent into deep injection wells should not result in any negative effects to marine water quality or community structure. Studies on similar, but much shallower, injection wells off Lahaina Maui, indicate that effluent probably enters the very dilute concentrations at depths near the depth of the injection wells. Barring significant differences in geological structure of the bedding layers in Kauai compared to Maui, effects of disposal of effluent in injection wells in Lihue should will probably not result in any detectable changes in water quality of the nearshore ocean.

5. Man-made lagoons on the grounds of the Kauai Lagoons Hotel are supplied with water through two wells. Water is removed from the lagoons only through evaporation. Because salinity in the lagoons is about the same as in the supply water, it appears that input equals evaporation. Nitrate and phosphate concentrations in the lagoons are substantially lower than in the supply water, while ammonium is higher in the lagoons than in the supply water, indicating biotic cycling with the lagoon. Phosphate levels in the

lagoons are drawn down to near the level of detection indicating that this is the limiting nutrient. If supply to the lagoons if changed from well water to effluent, phosphate concentrations in the input water will increase by about 40-fold. It is possible that such an increase will substantially change the apparent steady state that presently exists in the lagoons. Such a disruption could result in substantial algal growth which could seriously alter the aesthetic value of the lagoons. While grazing herbivores in the lagoons may have the capability of controlling increased plant growth, the possibility also exists that such growth could overwhelm the grazing capacity, or otherwise shift the dynamics of the lagoons to result in unfavorable conditions. Because the lagoons are essentially a "closed system" with respect to nutrients, there appears to be high potential for alteration should the nutrient loading increase to the magnitude that would occur if supply well water is replaced with treated effluent.

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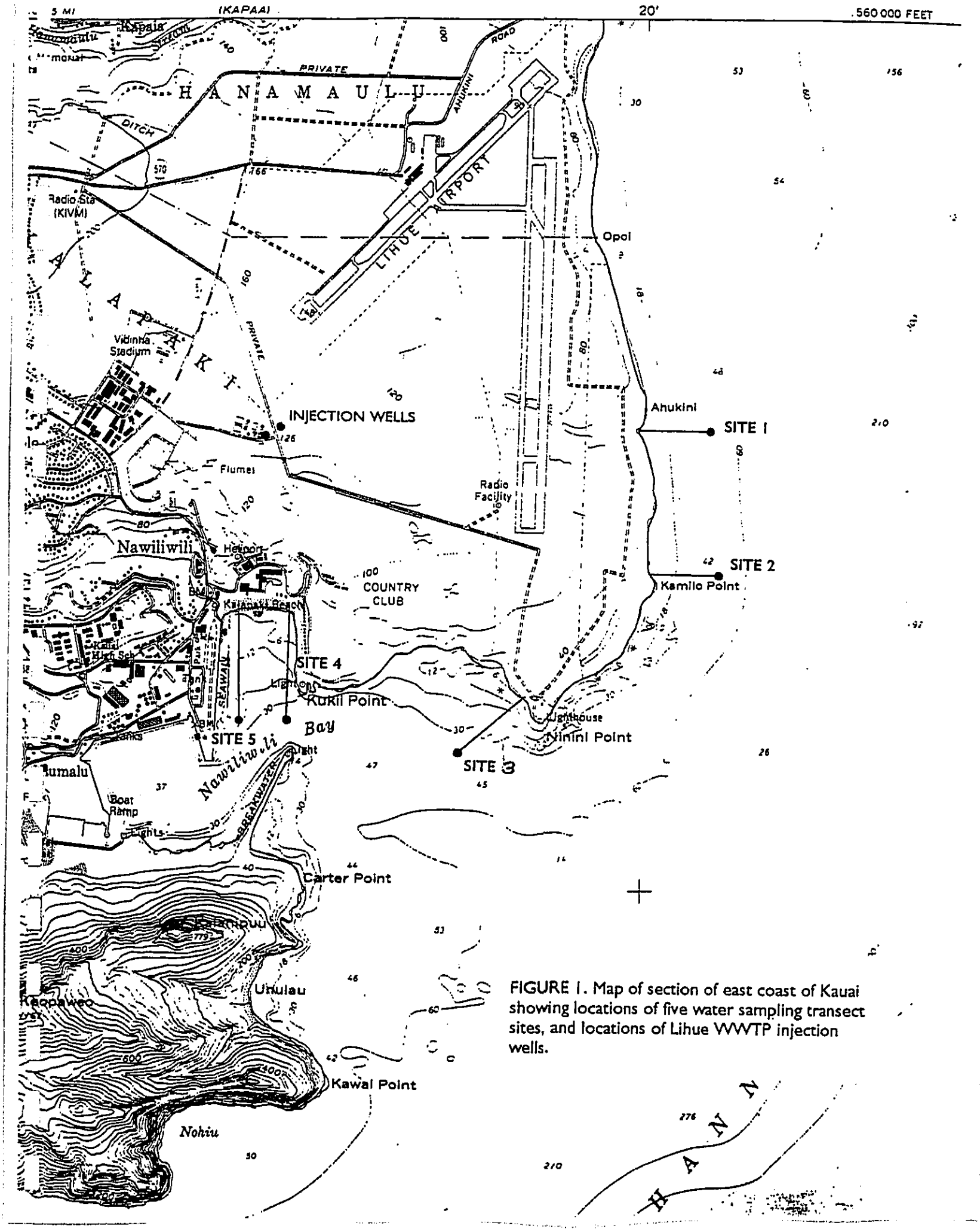

FIGURE 1. Map of section of east coast of Kauai showing locations of five water sampling transect sites, and locations of Lihue WWTP injection wells.

FINAL

2000-07-23-KA-FEA-

ENVIRONMENTAL ASSESSMENT

LIHUE WASTEWATER TREATMENT PLANT EFFLUENT DISPOSAL SYSTEM

For the
County of Kauai
DEPARTMENT OF PUBLIC WORKS

June 2000

FUKUNAGA AND ASSOCIATES, INC.
Consulting Engineers
1388 Kapiolani Boulevard, Second Floor
Honolulu, Hawaii 96814
(808) 944-1821

FINAL
ENVIRONMENTAL ASSESSMENT

LIHUE WASTEWATER TREATMENT PLANT EFFLUENT DISPOSAL SYSTEM PHASE 1

T.M.K. 3-5-01:30
Lihue, Kauai, Hawaii

PROPOSING AGENCY:

DEPARTMENT OF PUBLIC WORKS
COUNTY OF KAUAI

Submitted Pursuant to Chapter 343, HRS

Responsible Official: _____ Date: 6/19/00
Cesar Portugal
County Engineer

Prepared by:

Fukunaga and Associates, Inc.
1388 Kapiolani Boulevard, Second Floor
Honolulu, Hawaii 96814

June 2000

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CHAPTER I

INTRODUCTION

A. GENERAL

The proposed project is the first phase of Kauai County's long range Lihue Wastewater Treatment Plant (WWTP) effluent disposal plan, and involves the development of additional injection wells on Kauai Lagoons Resort Company (KLRC) lands to be acquired as part of the expanded Lihue WWTP facilities. See **Figures I-1** and **I-2** for the project location.

Currently, treated effluent is conveyed to a pond (Pond 2) on adjacent KLRC land, where it is stored and reused to irrigate KLRC golf courses. An injection well located adjacent to the KLRC pond disposes of overflows from Pond 2 and functions as a partial backup to the effluent reuse system. A second injection well, located at the Lihue WWTP, functions as an emergency disposal system. See **Figure I-3** for site plan.

The proposed project will be Phase I of the Kauai County's long range Lihue WWTP effluent disposal plan, and will involve construction of six additional injection wells to meet the needs of the expanded Lihue WWTP.

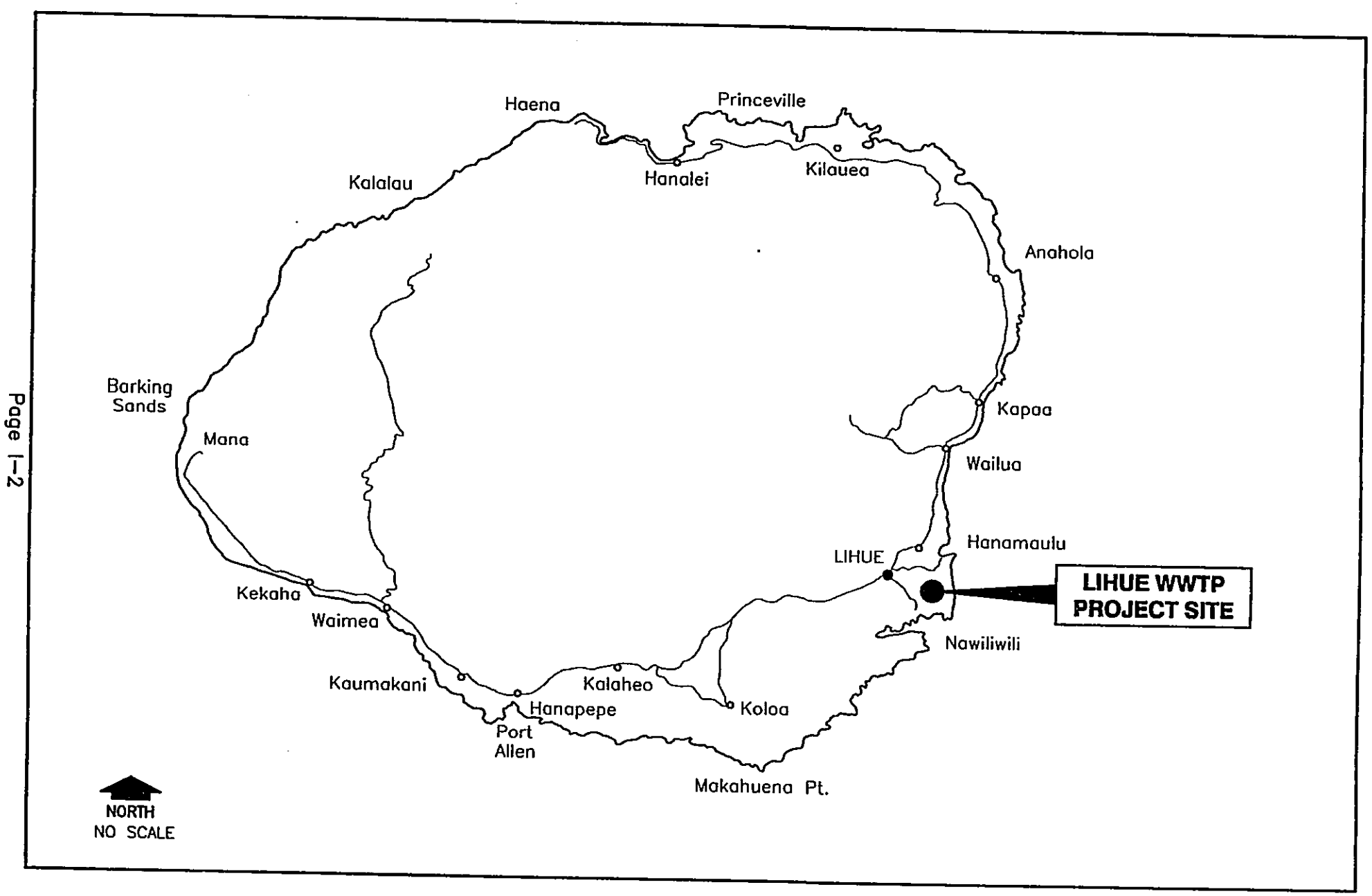
The proposed injection wells are located in an area adjacent to the existing Lihue WWTP on land currently owned by KLRC. See **Figure I-4**. The ownership of the land on which the proposed injection wells are located is in the process of being transferred to the County of Kauai, and will become part of an integrated Lihue WWTP site.

B. PROPOSING AGENCY

The proposing agency is the County of Kauai, Department of Public Works, Division of Wastewater Management.

C. APPROVING AGENCY

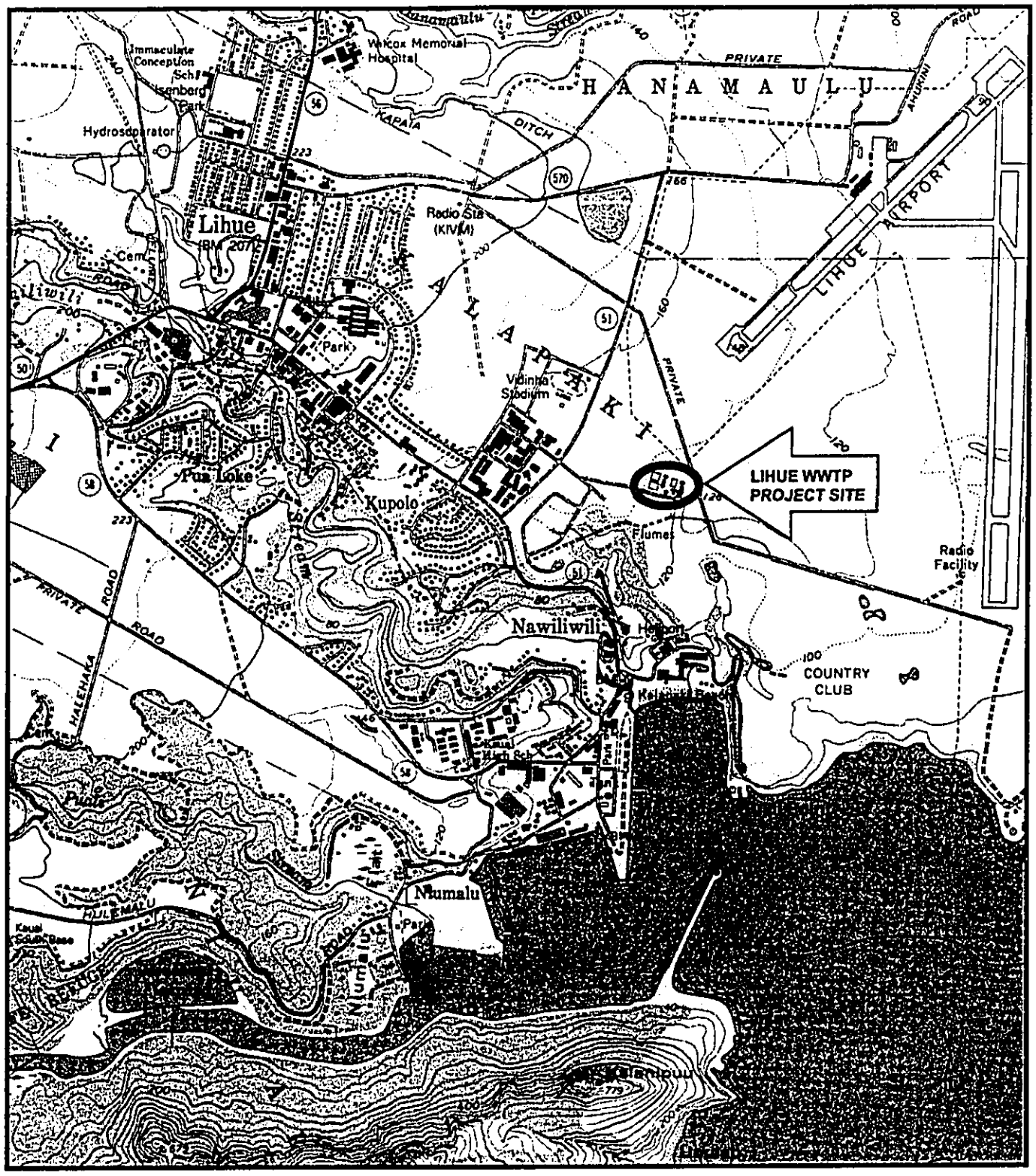
The approving agency for this project is the County of Kauai, Department of Public Works.



COUNTY OF KAUAI
Lihue WWTP Effluent Disposal System

ISLAND OF KAUAI

FIGURE I–1

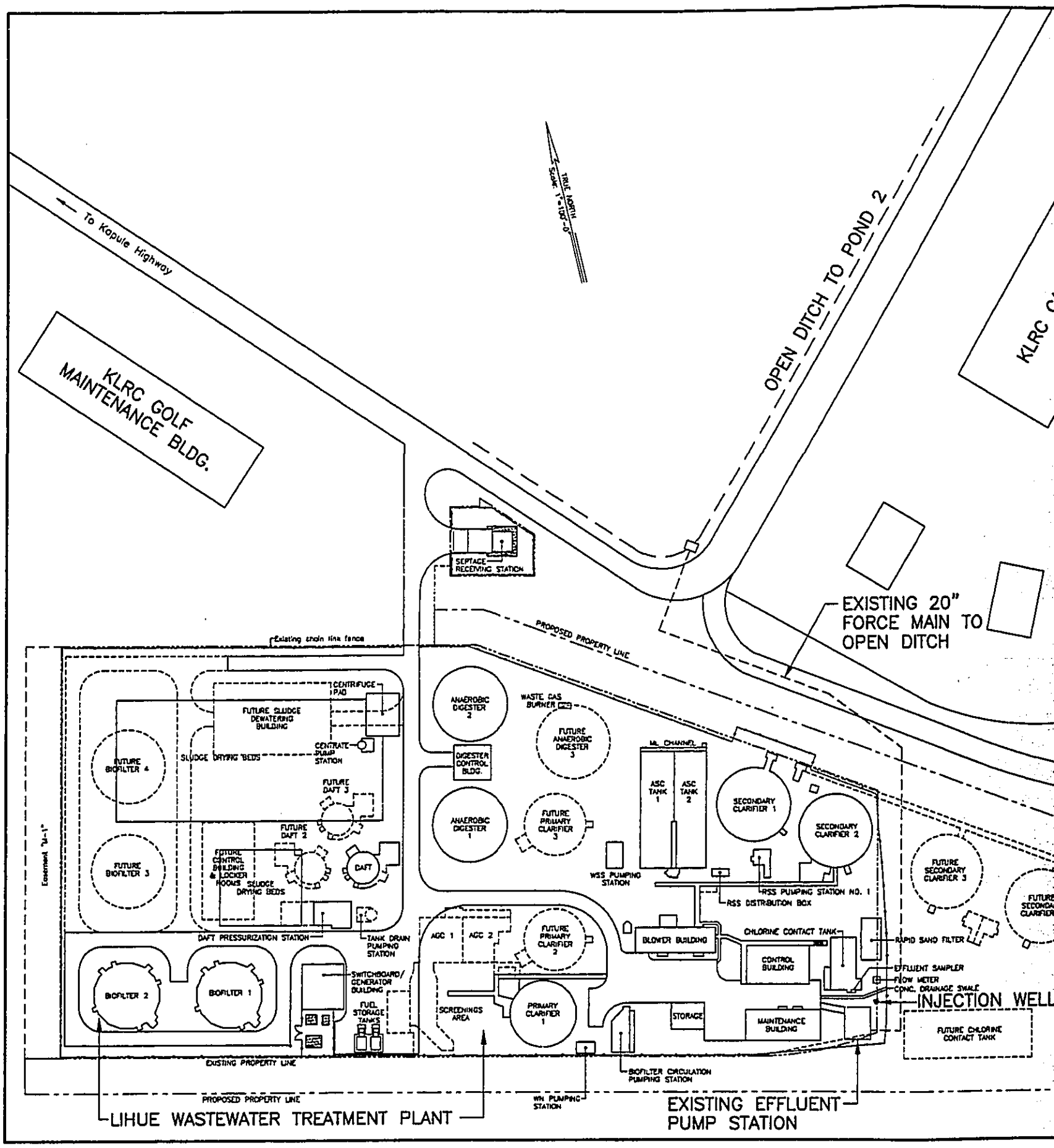


COUNTY OF KAUAI

Lihue WWTP Effluent Disposal System

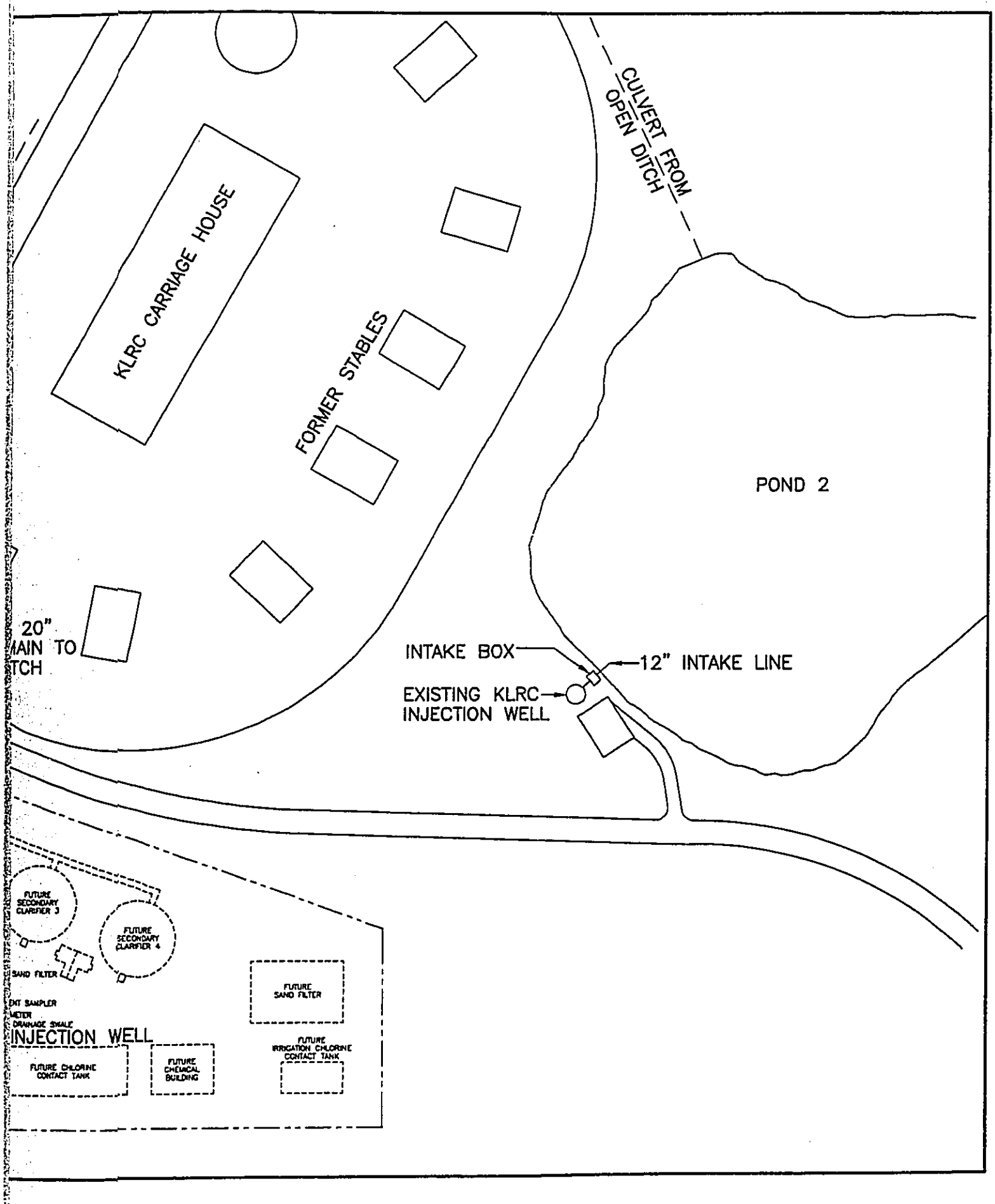
LOCATION MAP

FIGURE I-2



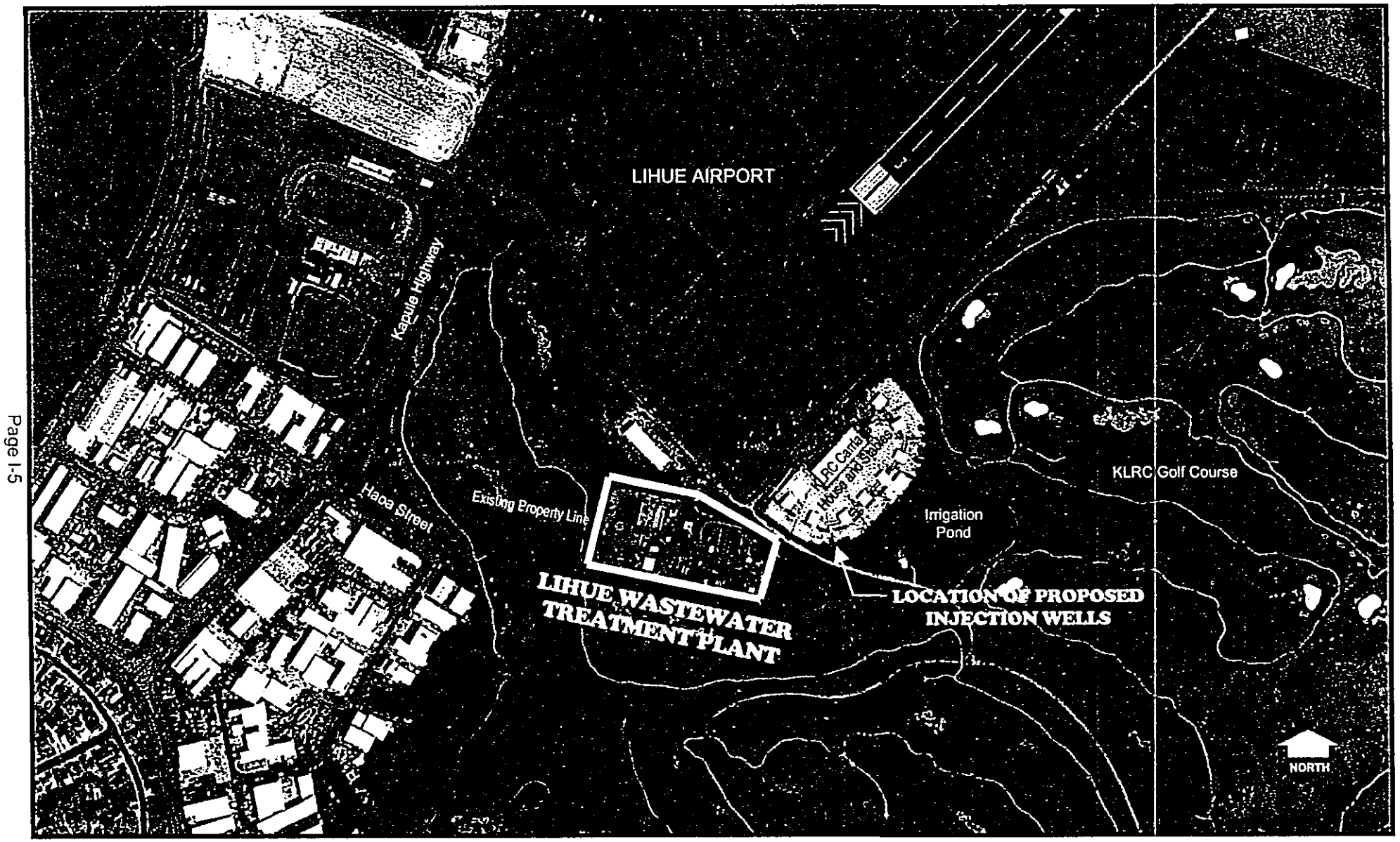
COUNTY OF KAUAI

Lihue WWTP Effluent Disposal System



LIHUE WWTP SITE PLAN AND EFFLUENT DISPOSAL SYSTEM

FIGURE I–3



COUNTY OF KAUAI
Lihue WWTP Effluent Disposal System

LIHUE WASTEWATER TREATMENT PLANT LOCATION

FIGURE I-4

D. BACKGROUND INFORMATION

1. Lihue WWTP

The Lihue WWTP was expanded in 1995 from an average daily treatment capacity of 1.5 mgd to 2.5 mgd. Current average daily inflow to the treatment plant is approximately 1.3 mgd. The Lihue WWTP was designed to accommodate:

Average Daily Flow (ADF)	2.5 mgd
Maximum Flow (MF)	5.0 mgd
Peak Flow (PF)	6.25 mgd

2. Status of Effluent Disposal

At present, treated sewage effluent is disposed of by irrigation on the adjacent KLRC golf courses. KLRC, having assumed the obligations of Hemmeter-VMS under a January 15, 1988 agreement, is required to accept up to 4.5 mgd of secondary treated effluent until August 22, 2003. The agreement may be extended for 10 more years after August 22, 2003 under the same terms, except that KLRC would be required to accept no more than 1.5 million gallons per 24-hour period of treated effluent during the 10 year extension period. The complete agreement terminates on August 22, 2013. The contractual expiration dates are approaching rapidly; and a long range effluent disposal plan is needed to assure that all of the treated effluent from the Lihue WWTP will be disposed of on a long term basis, economically, and in an environmentally acceptable manner. To meet these objectives, the County of Kauai is proposing a long range effluent disposal plan for Lihue WWTP.

3. Lihue WWTP Long Range Effluent Disposal Plan

The Lihue WWTP long range effluent disposal plan provides for disposal of the facility's design average daily flow of 2.5 mgd, a maximum flow of 5.0 mgd, and a peak flow of 6.25 mgd. Future plant expansion to accommodate more than the 2.5 mgd average daily flow will depend on the availability and feasibility of providing additional adequate effluent disposal capacities.

The long range Lihue WWTP effluent disposal plan will be implemented in phases:

a. Phase I

In Phase I (proposed action) facilities to dispose of an average daily flow of 2.2 mgd and associated design flows will be constructed. Secondary treated R-2 quality water up to 1.5 million gallons per 24-hour period average daily flow would continue to be conveyed to KLRC; and new injection wells would be constructed to dispose of excess flows and to provide backup capacity. As the average daily flows approach 2.2 mgd, an assessment of the demand for more reclaimed water would be made before the next increment of improvements (Phase II) is designed.

b. Phase II

If a market for more reclaimed water exists and if deemed feasible, Phase II would involve construction of additional treatment facilities and conveyance systems to serve reuse customers. If a market for more reclaimed water is not available, Phase II would involve construction of additional injection well(s) to accommodate the remaining anticipated future incremental flow of 0.3 mgd average daily flow and associated maximum and peak design flows.

Phase I construction will allow the Lihue WWTP to provide R-2 effluent meeting the State DOH effluent requirements and to increase to approximately 2.2 mgd ADF before a decision to provide tertiary treatment or continue with injection wells is needed. Based on the recent slow growth trend of Lihue, the anticipated time to reach 2.2 mgd ADF inflow is unpredictable.

CHAPTER II

DESCRIPTION OF THE ENVIRONMENT

A. PROJECT LOCATION AND LAND OWNERSHIP

The project involves development of effluent disposal facilities at the Lihue Wastewater Treatment Plant (WWTP). Lihue WWTP is owned and operated by the County of Kauai, and provides service to the Lihue Town area as indicated on **Figure II-1**. Land ownership in the vicinity of the Lihue WWTP is shown on **Figure II-2**. Lihue WWTP is identified by Tax Map Key (TMK) 3-5-01:30, 4th Division. The site is surrounded by Kauai Lagoons Resort Company (KLRC) property.

B. LAND CLASSIFICATION AND ZONING

Land use policies are governed by State of Hawaii and County of Kauai laws and regulations. The State Land Use Commission classifies all State lands as either Urban, Rural, Agriculture, or Conservation with the intent to accommodate growth and development and to retain the natural resources of the area. The Lihue WWTP and the KLRC property are within the Urban District. See **Figure II-3**.

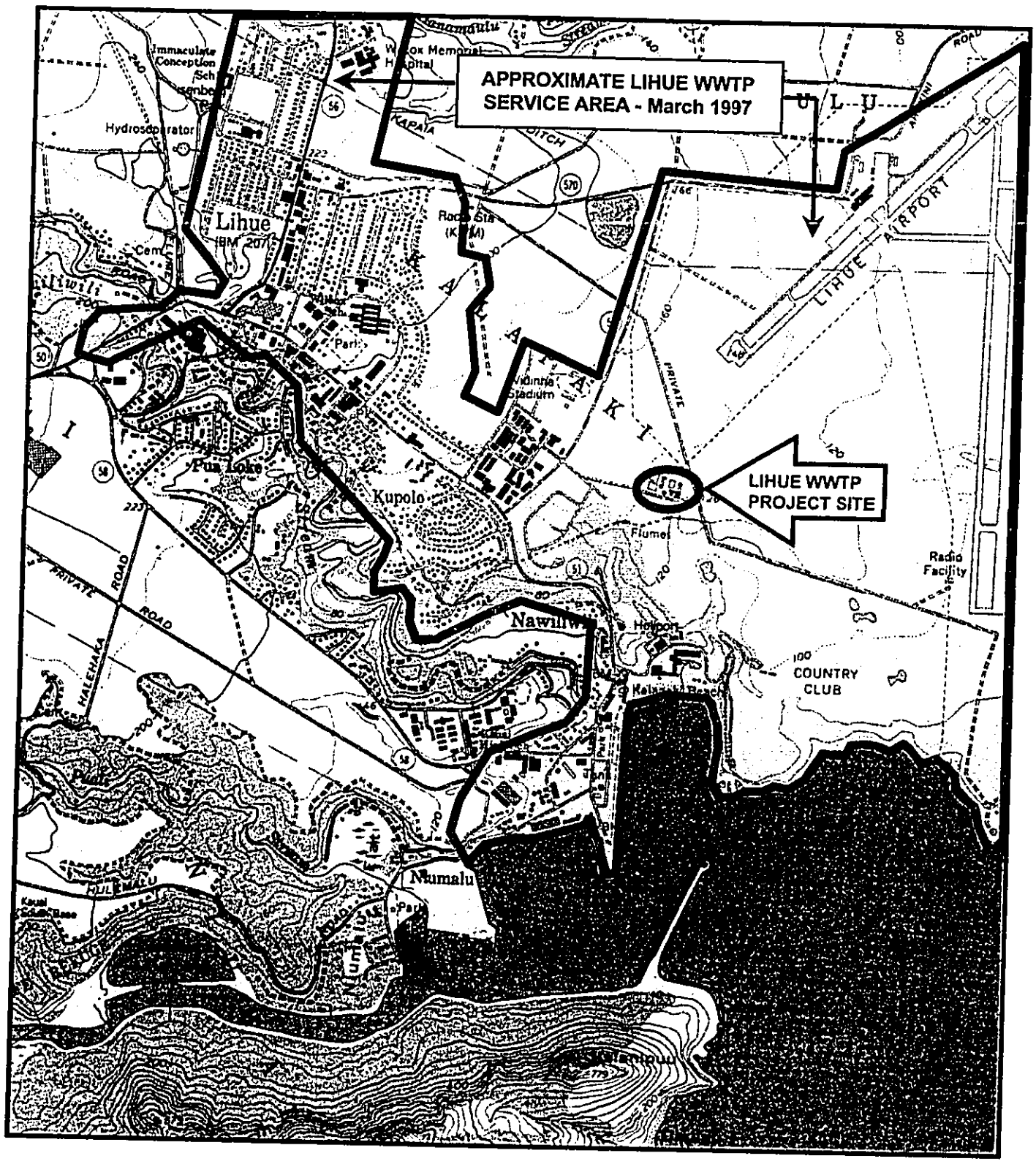
Detailed land use zoning for the above classifications are regulated by the Comprehensive Zoning Ordinance (CZO) for the County of Kauai. The County zoning designations include:

A	Agriculture
O	Open
PF	Public Facilities
R	Resort
RR	Rural Residential
UR	Urban
UMU	Urban Mixed Use

The Lihue WWTP has a land zoning designations of A (agriculture) and KLRC property is zoned R (resort). See **Figure II-4.**

C. POPULATION AND WASTEWATER FLOWS

The population of the Lihue District was approximately 11,237 (from State Department of Business and Economic Development data) as of July 1995. This represents a 5.4 percent increase in population since 1990. According to the Kauai Water Use and Development Plan, the resident population in the Lihue District is projected to be

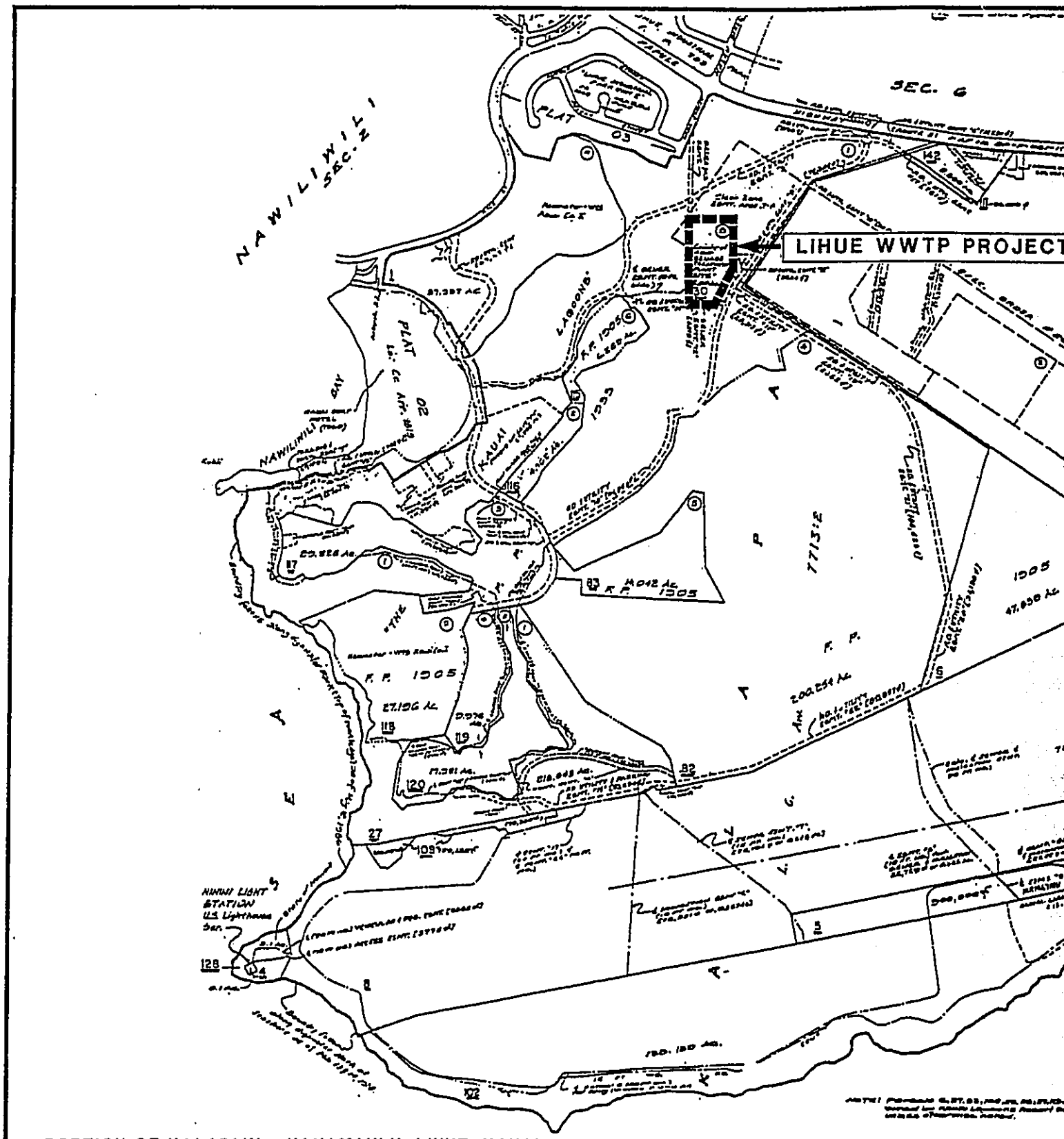


COUNTY OF KAUAI

Lihue WWTP Effluent Disposal System

LIHUE WWTP SERVICE AREA

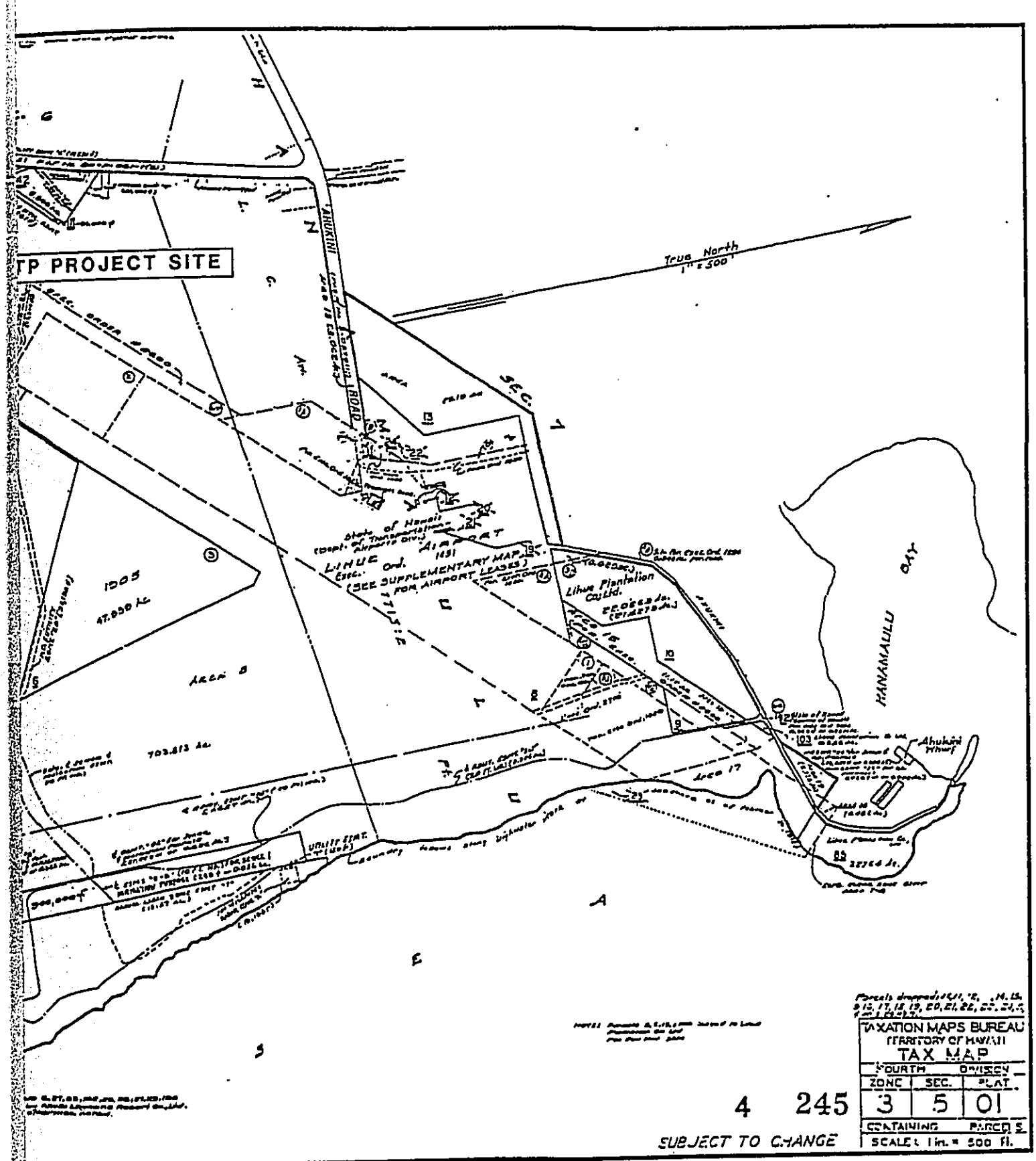
FIGURE II-1



PORTION OF KALAPAKI - HANAMAULU, LIHUE, KAUAI

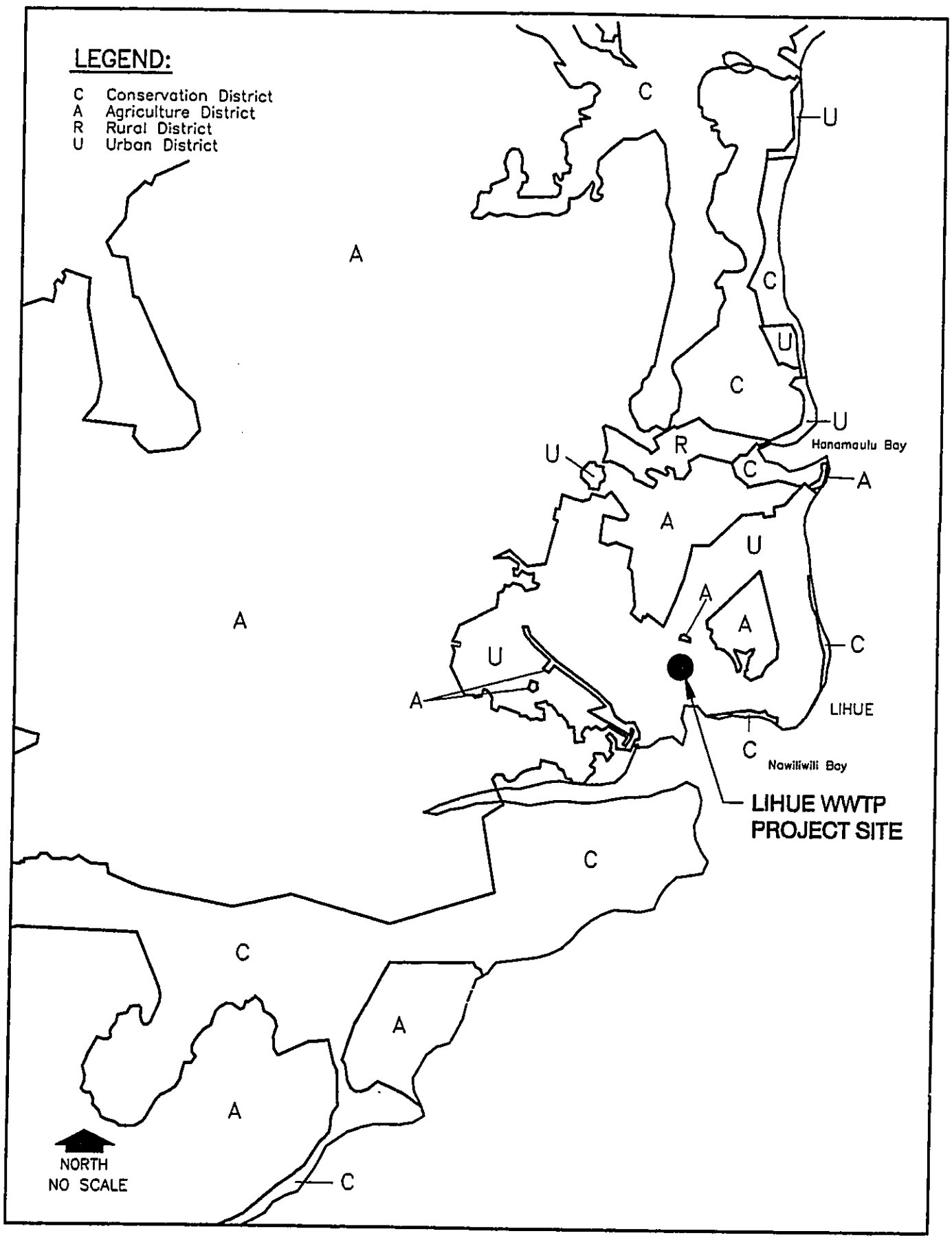
COUNTY OF KAUAI

Lihue WWTP Effluent Disposal System



TAX MAP KEY: 3-5-01:30

FIGURE II-2

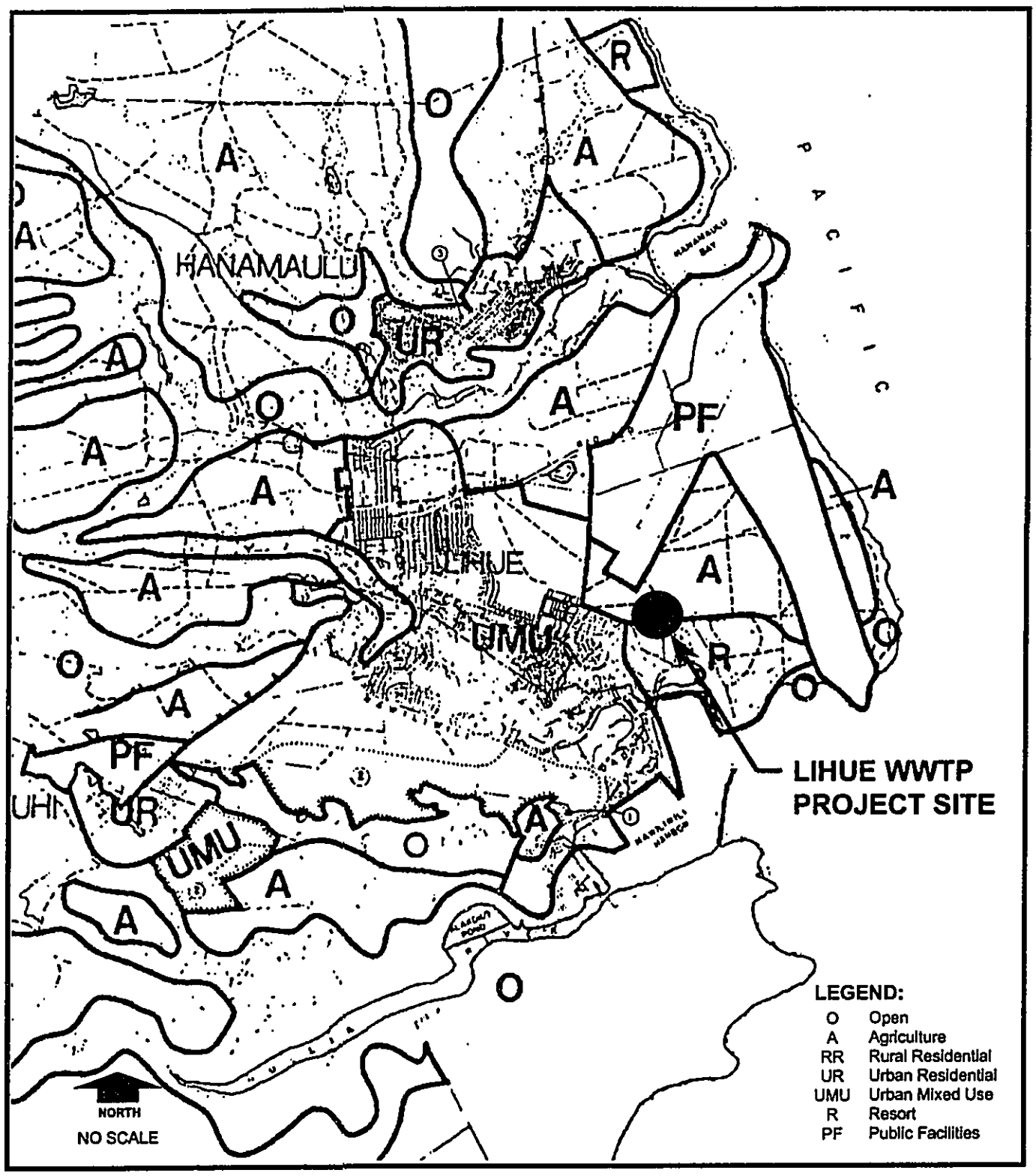


COUNTY OF KAUAI

STATE LAND USE MAP

Lihue WWTP Effluent Disposal System

FIGURE II-3



COUNTY OF KAUAI

KAUAI GENERAL PLAN

Lihue WWTP Effluent Disposal System

FIGURE II-4

20,860, based on full development in accordance with the existing County land use zoning map.

The Lihue WWTP service area was delineated and shown in the latest integrated planning document, the Lihue Wastewater Treatment Plant Preliminary Engineering Report for Phase IV Expansion, dated July 1990 by M&E Pacific. The service area for Lihue WWTP covers only part of the zoned areas in the Lihue District due to several planning considerations including current zoning, known planned developments, distance to Lihue WWTP, topography, existing sewers, and ease of sewer extension. **Figure II-1** was reproduced from the service area map shown in the 1990 M&E Pacific report.

Department of Public Works records indicated that 2,209 residential units and 149 non-residential units were connected to the Lihue Sewer System as of June 30, 1990. The present flow into the Lihue WWTP is approximately 1.3 mgd, and is expected to increase in the coming years. Pending connections and flow projections by the 1990 M&E Pacific report amounted to about 1.1 mgd. Accordingly, the total flow planned for the Phase IV expansion was rounded up to 2.5 mgd. A summary of wastewater flows from anticipated new connections from the 1990 M&E Pacific report is tabulated in **Table II-1.**

D. PHYSICAL FEATURES

1. Topography

The Lihue WWTP is located on flat terrain at an elevation of approximately 120 feet. Lihue Airport is located to the north of the treatment plant. Lihue WWTP is bounded by KLRC golf courses to the east, south and west. Kapule Highway is located west of the treatment plant beyond the golf course.

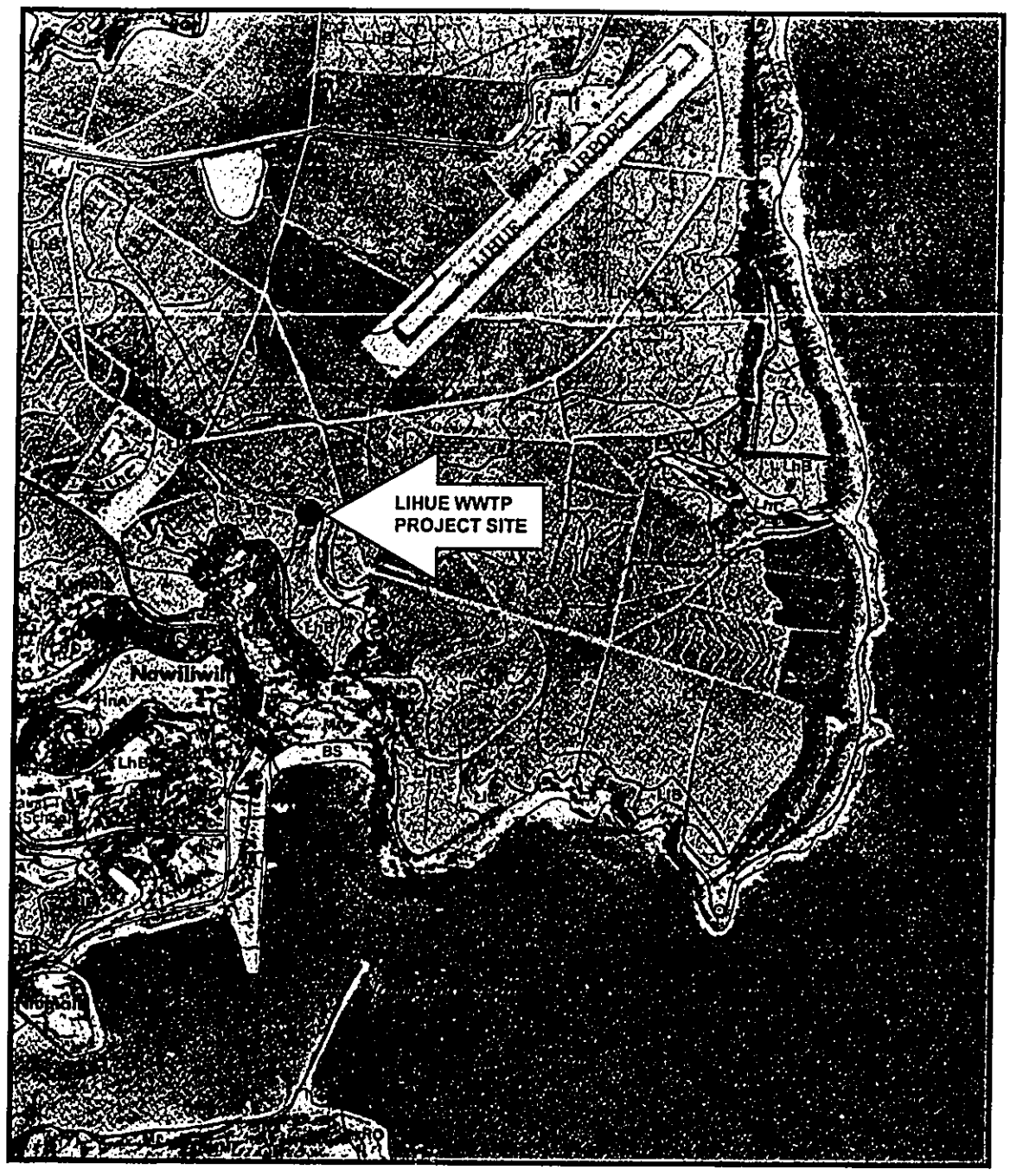
2. Soils

According to the Soil Survey issued in 1972 by the U.S. Department of Agriculture Soil Conservation Service (USDA-SCS), the soil on the Lihue WWTP property is Lihue silty clay, 0 to 8 percent slopes (LhB). The soils in the area surrounding the treatment plant are either classified as LhB or LIB, and are described as Lihue gravelly silty clay, 0 to 8 percent slopes. These soils are characterized as well-drained, fine-textured and medium-textured soils. The surface layer is dusky-red to dark reddish-brown, firm to friable silty clay. The subsoil is dark-red to dark reddish-brown, firm silty clay loam and silty clay. See **Figure II-5.**

TABLE II-1
WASTEWATER FLOWS FROM ANTICIPATED NEW CONNECTIONS

Description	TMK	Units/ Acre	Total (gpd)	Grand Total (gpd)
A. Permits to Connect to Public Sewer				
1. Single Family Residence (400 gpd/unit)	3-6	21 units	8,400	
	3-7	27 units	10,800	
	3-8	32 units	12,800	
Subtotal			32,000	
2. Commercial (6,000 gpd/acre)	3-5	3.14 acres	18,840	
	3-6	4.16 acres	24,960	
	3-8	4.04 acres	24,240	
Subtotal			68,040	
SUBTOTAL				100,040
B. Proposed Projects:				
1. Residences				
Charles River Housing (MF @ 250/unit)	3-8-02:4	243 units	60,750	
Kaumualii Investment (MF @ 250/unit)	3-8-05:22	273 units	68,250	
JMB/Amfac Hanamaulu				
Phase I - SF @ 400 gpd/unit	3-7-03	165 (S.F.)	66,000	
		60 (M.F.)	15,000	
Phase II	3-7-03	165 (S.F.)	66,000	
		60 (M.F.)	15,000	
Westville Subdivision	3-2-08:1	23 (S.F.)	9,200	
Molikoa Unit III	---	180 (S.F.)	72,000	
Banyan Harbor Condo (existing)	3-2-05:8	280 (M.F.)	70,000	
Kupolo Subdivision (cesspooled)		108 (S.F.)	43,200	
Subtotal			485,400	
2. Commercial/Resorts/Public Facilities				
Old Weinber Project - 6,000 gpd/acre	3-7-01:32	30 acres	180,000	
Acacemy of Golf (Westin)			17,000	
Kauai Lagoons - 300 gpd/unit		750 units	225,000	
Subtotal			422,000	
SUBTOTAL				907,400
C. Lihue Airport Expansion increment up to max133,000 gpd by agreement				71,000
TOTAL ADDITIONAL FLOW				1,078,440

Data for Table II-1 is taken from the Lihue Wastewater Treatment Plant Preliminary Engineering Report for Phase IV Expansion, July 1990, by M&E Pacific.



LEGEND:

BL	Badlands	LhC	Lihue silty clay, 8-15% slopes
BS	Beaches	LhE2	Lihue silty clay, 25-40% slopes, eroded
HfB	Halii gravelly silty clay, 3-8% slopes	L1B	Lihue gravelly silty clay, 0-8% slopes
HnA	Hanalei silty clay, 0-2% slopes	L1C	Lihue gravelly silty clay, 8-15% slopes
KvB	Koloa stony silty clay, 3-8% slopes	Mr	Mokuleia fine sandy loam
KvD	Koloa stony silty clay, 15-25% slopes	rRo	Rock outcrop
LhB	Lihue silty clay, 0-8% slopes	rRR	Rough broken land

SOURCE: Soil Survey of Island of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, U.S. Department of Agriculture, Soil Conservation Services, August 1972.

COUNTY OF KAUAI

Lihue WWTP Effluent Disposal System

USDA/SCS SOIL MAP

FIGURE II-5

3. Geology

The land area surrounding the project site was formed by lava from the Kilohana Crater shield of the Koloa volcanic series. This lava partially filled the "Lihue Depression" and overflowed seaward, forming the gently sloping plains which includes Lihue Town and the project area. The rim of the "Lihue Depression" consists of rocks from the older Waimea Canyon volcanic series.

4. Hydrology

a. Surface Water

The KLRC property surrounding Lihue WWTP is distinguished by man-made lagoons and ponds. The lagoons have a surface area of approximately 28 acres. and are filled with water pumped from two wells located on the KLRC property. Pond 1, which is located on the golf course, is supplied with water from two other KLRC wells. Pond 2 stores water for golf course irrigation and is supplied with treated effluent from the treatment plant, supplemented by water from a fifth KLRC well and overflows from Pond 1.

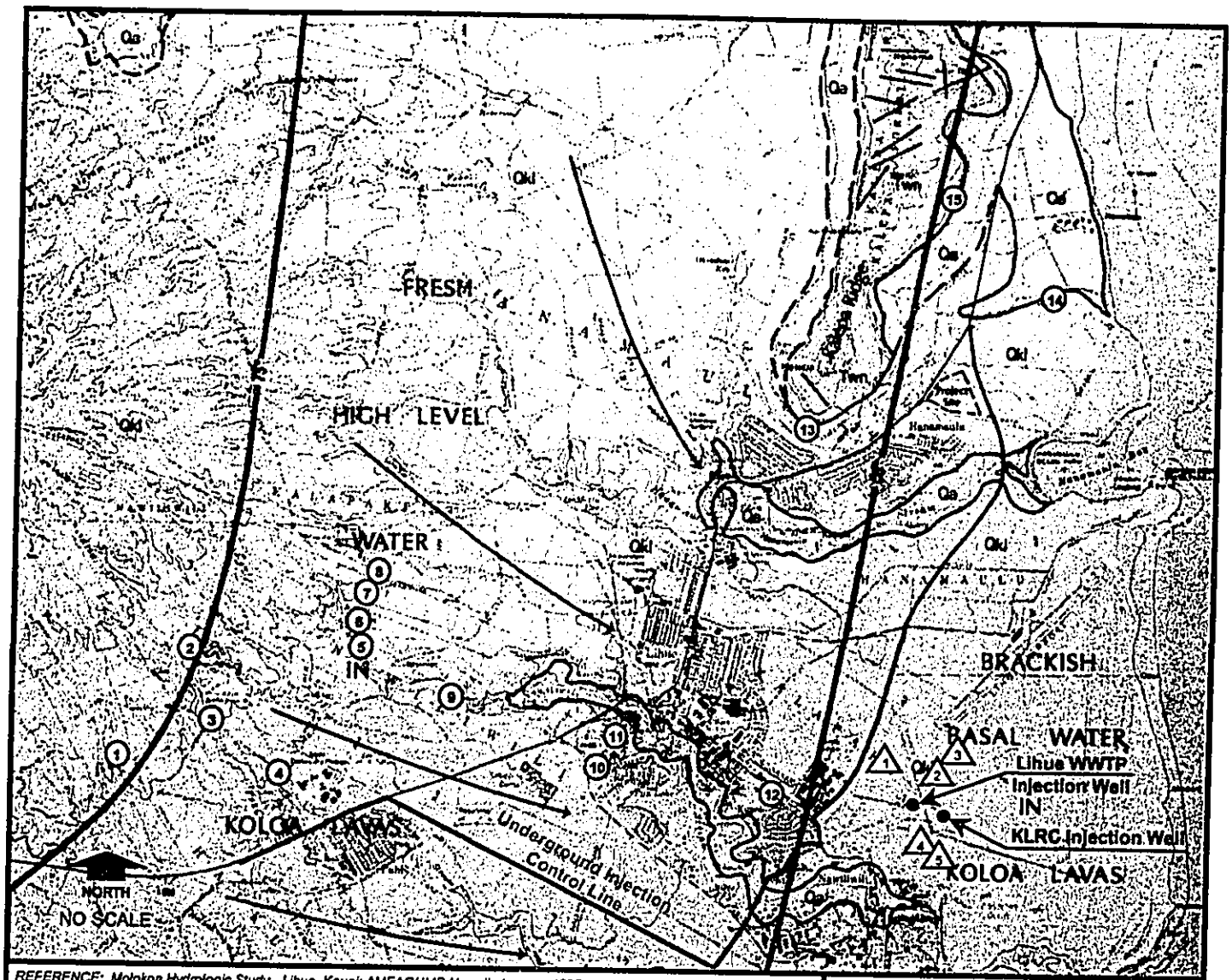
b. Groundwater

The Lihue WWTP and proposed injection wells are located outside of the DOH designated "Underground Source of Drinking Water (USDW)". The Lihue WWTP and proposed injection wells are within an "Exempted Aquifer", defined as an aquifer exempted from being used as an USDW. The "Underground Injection Control (UIC) Line" is the boundary separating the above defined aquifers, with the exempted aquifers identified as being on the ocean side of the UIC Line. See **Figure II-6**. The UIC Line was established to protect underground sources of drinking water from contamination by subsurface disposal of fluids.

5. Climate

The mean annual rainfall in the project area is approximately 50 inches per year. The temperature ranges from an average high of 85°F to an average low of 63°F. The prevailing winds are trade winds from the northeast, with wind velocities averaging 12 miles per hour.

The island of Kauai has been subject to occasional severe storms because of hurricane intensity storms hitting or passing nearby the island. In 1982, Hurricane



REFERENCE: Molokoa Hydrologic Study - Lihue, Kauai; AMFAC/JMB Hawaii, January 1995.

WELL LEGEND:

	WELL NAME	OWNER
Potable Water Wells:		
1	Puhi 4	Kauai DWS
2	Kilohana D	Kauai DWS
	Kilohana J	Kauai DWS
3	Puhi 2	Kauai DWS
	Puhi 3	Kauai DWS
4	Puhi 1	Kauai DWS
5	Kilohana A	Kauai DWS
	Kilohana B	Kauai DWS
	Kilohana F	Kauai DWS
	Kilohana I	Kauai DWS
6	Kilohana C	Kauai DWS
7	Kilohana G	Kauai DWS
8	Kilohana H	Kauai DWS
Potable Water Wells (continued):		
9	Garlinghouse Tunnel	Kauai DWS
10	Lihue Old School	Kauai DWS
11	Sugar Mill	Lihue Plantation
12	Kauai Inn Tank	Kauai DWS
13	Kalepa Ridge No. 1	Kauai DWS
14	Hanamaulu Shaft	Lihue Plantation
15	Kalepa Ridge Expl.	State
	WELL NAME	**OWNER**
Nonpotable Water Wells:		
1	Well No. 1	KLRC
2	Well No. 2	KLRC
3	Well No. 3	KLRC
4	Westin Kauai #5	KLRC
5	Westin Kauai #4	KLRC

LEGEND:

Formations & Water-Bearing Properties

Qa ***Alluvium*** - Mostly clay, poorly permeable, carries small amounts of water. Youngest formation in study area.

Oki ***Koloa Lavas*** - Flank flow basalts of Quarternary age. Moderately to deeply weathered, low to moderate yield. Wells develop fresh high-level water inland and fresh to brackish basal water toward the coast.

Twn ***Waimea Lavas*** - Dike-intruded lavas of Tertiary age. Mostly deeply weathered, low to moderate yield. Buried by Koloa lavas, except Kalepa and Haupu Ridges. Normally a high yield aquifer, wells in the study area develop basal water in limited quantities due to weathering and dikes.

50 — Median Annual Rainfall (inches)

Groundwater Movement

COUNTY OF KAUAI

Lihue WWTP Effluent Disposal System

REGIONAL GROUNDWATER MOVEMENT

FIGURE II-6

Iwa caused considerable damage to Kauai. Hurricane Iniki hit Kauai in 1992 and was particularly destructive.

6. Flood and Tsunami

The Federal Emergency Management Agency Flood Insurance Rate Map (FIRM) Community-Panel Number 150002 0202 C dated March 4, 1987, designates the project area to be within Zone X. Areas within Zone X are determined to be outside of the 500-year flood plain; therefore the project is not expected to have an impact on the flood zones.

Historical tsunami data indicated a maximum wave height of 18 feet (1946 tsunami) occurred along the shoreline near the project area. The project area has ground elevations well over 100 feet, so it is not expected to be affected by tsunamis.

E. WATER QUALITY

The ***Appendix*** *contains a report titled* "Assessment of Potential Impacts to Water Quality and Marine Community Structure from Effluent Disposal, Lihue Wastewater Treatment Plant". This report assesses the potential impacts on shoreline and nearshore water quality from effluent disposal from the Lihue WWTP. This report includes water chemistry analyses of samples taken from Lihue WWTP effluent, KLRC lagoons, KLRC wells for golf course irrigation and water replenishment for the lagoons, and five offshore sampling sites. The report concludes that there would be no significant adverse impacts to the offshore waters from treated effluent disposal via injection wells.

Lihue WWTP provides secondary level treatment, and the effluent is of R-2 quality. The water chemistry analysis from samples taken in October 1996 is shown in Table 3 of the report.

Results of the KLRC lagoons water chemistry analyses are also indicated in Table 3. The nutrient concentrations in the lagoons are much lower than in the Lihue WWTP effluent. The lagoons are considered to be in a "steady state" with respect to nutrient dynamics. Disposal of Lihue WWTP effluent into the lagoons was considered, but rejected because of the concern of possibly disturbing the "steady state" nutrient dynamics.

F. ARCHAEOLOGICAL AND HISTORICAL CONSIDERATIONS

The project site involves lands recently used for sugar cane cultivation, and currently used by KLRC for maintenance facilities, roadways, golf courses and irrigation ponds. There are no known archaeological sites within the project area. Should any evidence of archaeological remains be discovered during construction, work will be suspended and an archaeological survey will be conducted.

There are no historical facilities or sites within two miles of the project area.

G. FLORA

The plants found in the project area includes haole koa, hau trees, california grass, widelia, and bermuda grass. Hau trees outside the southern boundary of the Lihue WWTP serve as a buffer for the adjacent golf course. The KLRC golf courses are grassed with bermuda grass.

H. FAUNA

Animals in the project area includes rats, field mice, and small feral animals. Birds found in the project area include mynas, doves, cardinals and sparrows. Migratory Hawaiian coots (federally listed as an endangered waterbird), were observed swimming in KLRC irrigation Pond 2. Amphibians within the project area include toads and frogs.

The lagoons of the Kauai Lagoons Resort facility are inhabited by fish such as carp, tilapia, and tucanary bass. Apple snails were introduced into the lagoons recently and have multiplied to large numbers.

CHAPTER III

PROPOSED ACTION

A. INTRODUCTION

The proposed action would provide effluent disposal for an Average Daily Flow (ADF) of 2.2 mgd and a Peak Flow (PF) of 5.5 mgd. KLRC would continue to accept up to 1.5 million gallons per 24-hour period and manage the associated peak flow of 3.75 mgd. The County would construct injection wells to dispose of an ADF of 0.7 mgd and a PF of 1.75 mgd.

1. KLRC Effluent Disposal

KLRC desires to continue receiving up to 1.5 million gallons per 24-hour period beyond the ten year extension period. The County would supply up to 1.5 million gallons per 24-hour period of secondary treated effluent, and KLRC would continue to follow best management practices with their existing system to handle associated peak flows of 3.75 mgd and avoid spillage during prolonged rainy weather periods. The peak and maximum flows could be dampened by KLRC's existing Pond 2. Currently, excess flow from Pond 2 overflows directly into KLRC's injection well. The delivery system will be improved by construction of a 24-inch gravity main to the KLRC irrigation Pond 2 with facilities to divert flows directly to the injection wells when pond levels are too high. This will replace the existing open ditch system. The direct overflow from KLRC Pond 2 to the injection well will be eliminated.

KLRC has expressed concern over their ability to handle their 1.5 million gallons per 24-hour period flow during emergencies when their irrigation system is down. In order to provide an emergency backup for the 1.5 million gallons per 24-hour period, KLRC will refurbish their existing injection well to a capacity of at least 0.65 mgd and turn control and responsibility of the well to the County (contingent upon an acceptable irrigation water management plan). In addition, the County is amenable to providing the remaining portion (0.85 mgd) of the KLRC emergency backup in their injection wells subject to KLRC properly managing their irrigation system and Pond 2 to handle the 1.5 million gallons per 24-hour period ADF flow and its associated peak flow of 3.75 mgd.

2. County Effluent Disposal

The County proposes to construct sufficient injection wells to provide for the disposal of 0.7 mgd ADF of treated effluent and the associated 1.75 mgd peak flow. The new injection wells would be located off of the existing Lihue WWTP site in the KLRC carriage house and stables area across the road. Injection wells would be drilled in Phase I to accommodate the County's allocated peak flow of 1.75 mgd, plus 0.85 mgd of the KLRC emergency backup. An estimated six wells would

be drilled at an estimated capacity of 0.65 mgd each. Detailed explanation follows in Section B.

The new injection wells will need to be located offsite because the treatment plant site does not have enough space for the injection wells.

B. DESIGN BASIS FOR PROPOSED ACTION

The design basis for Phase I is summarized below:

1. Flow distribution is as follows:

	Total	KLRC Portion	County Portion
Average Plant Flow	2.2 mgd	1.50 mgd	0.70 mgd
Peak Flow	5.5 mgd	3.75mgd	1.75 mgd

2. KLRC to use Pond 2 to dampen daily maximum and peak flows. Effluent is currently conveyed to KLRC via an open ditch which will be replaced by a new piped system to Pond 2.

3. The County shall provide emergency disposal for KLRC when their irrigation system is out of service and during wet weather (contingent upon an acceptable irrigation management plan by KLRC).

4. A long term disposal rate of 0.65 mgd per well for both the new and existing wells will be assumed as recommended by the project's hydrogeologist.

5. County to take control of the existing KLRC injection well (contingent upon an acceptable irrigation management plan from KLRC). County proposed to provide well capacity to dispose of up to an additional 0.85 mgd from KLRC during emergencies.

6. The County proposes to construct injection wells to accommodate their 1.75 mgd peak flow, and 0.85 mgd of KLRC emergency backup. Five wells are to be constructed to accommodate the County's portion of the peak flow, and a sixth new well will be constructed to handle a portion of the 0.85 mgd emergency backup. See **Table III-1** for a breakdown of the new wells and how they are incorporated into the overall effluent disposal plan.

TABLE III-1
DISPOSAL COMPONENTS

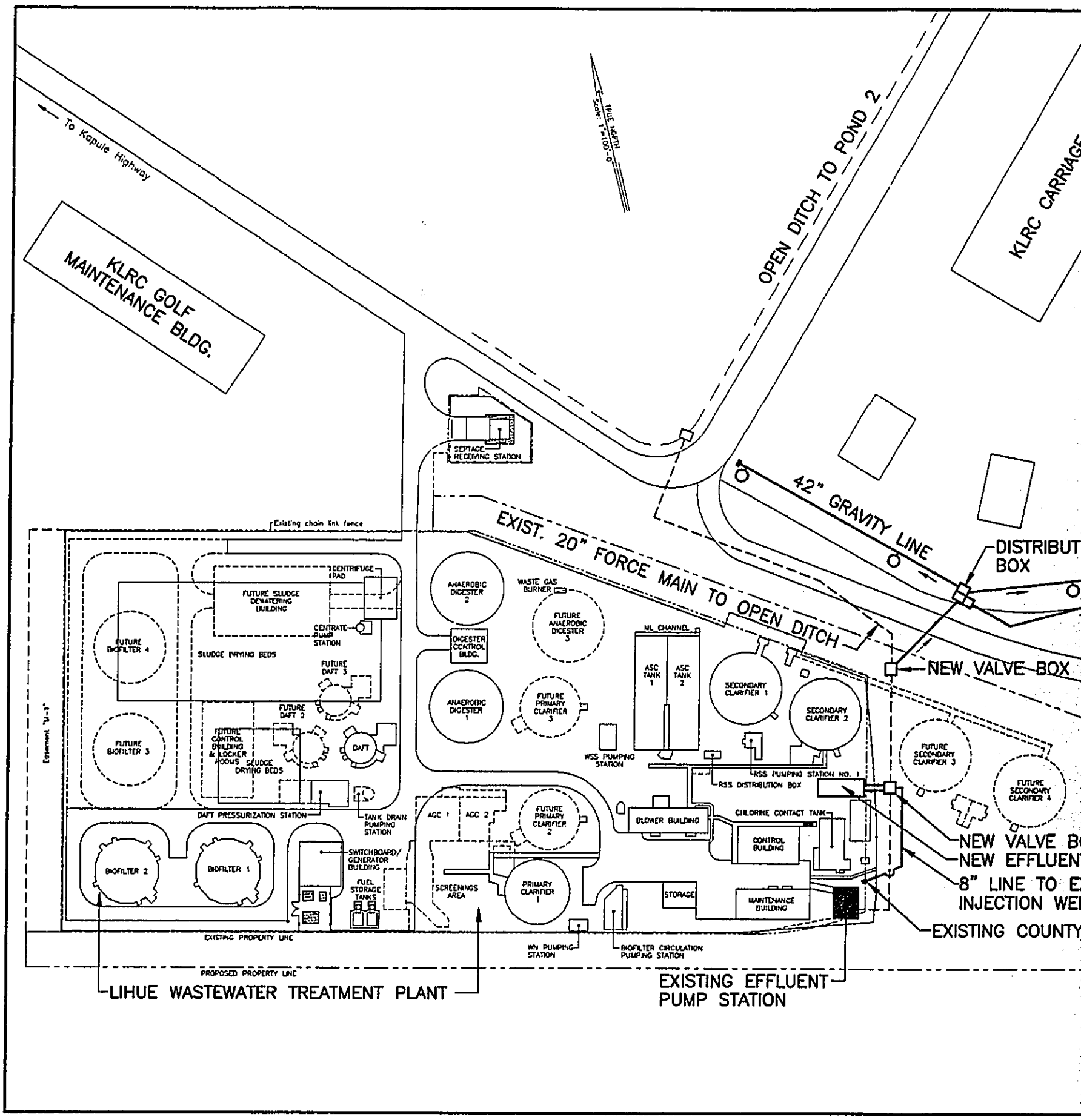
	Primary Components		Backup Components	
	Component	Capacity (mgd)	Component	Capacity (mgd)
County Disposal	New County Well #1	0.65	New County Well #4	0.65
	New County Well #2	0.65	New County Well #5	0.65
	New County Well #3	0.65	Existing County Well	0.65
Subtotals		1.95		1.95
County Required Capacity		1.75		1.75
Balance		0.20		0.20
	Primary Component		Emergency Backup	
	Component	Capacity (mgd)	Component	Capacity (mgd)
KLRC Disposal	Pond #2	3.75	♣New County Well #6	0.65
			♣County Balance	0.20
			Existing KLRC Well	0.65
Subtotals		3.75		1.50
KLRC Required Capacity		3.75		1.50♥
Balance		none		none

Notes:

♣ County proposes to provide additional 0.85 mgd backup for KLRC.
→0.65 mgd (New County Well #6) + 0.20 mgd (County Balance) = 0.85 mgd
♥ 1.5 is in million gallons per 24-hour period, and refers to a volume, not a rate.

C. PROPOSED ACTION

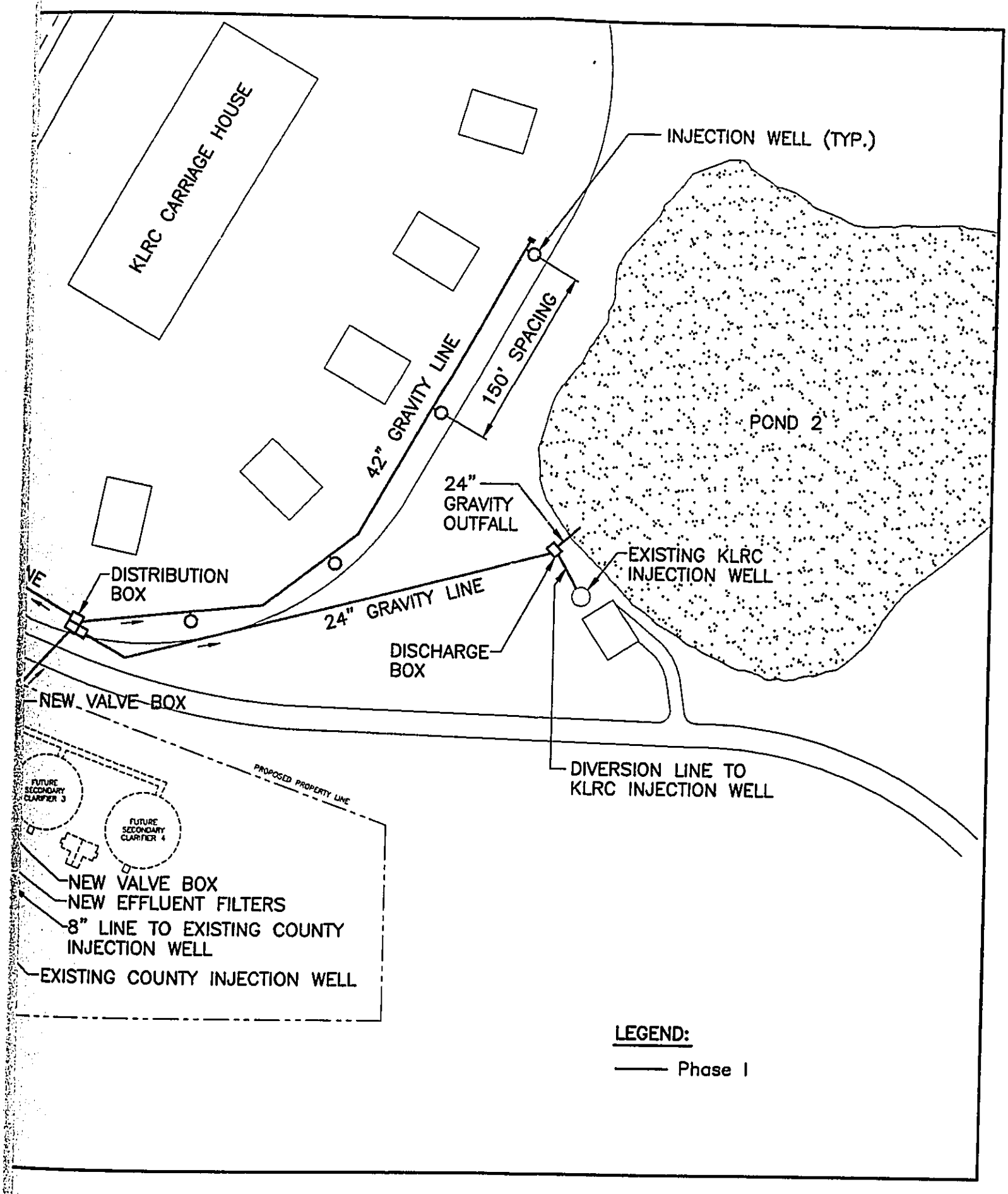
The Phase I facilities will include: new effluent pumps; new effluent filters; a new force main to convey effluent to a distribution box; three separate gravity sewers to distribute flows to the carriage house and stables area and KLRC Pond 2; new injection wells; and the necessary valves, instrumentation and appurtenances. See **Figure III-1** for the Phase I layout.



COUNTY OF KAUAI

Lihue WWTP Effluent Disposal System

LAYOUT - L



LAYOUT - LIHUE WWTP EFFLUENT DISPOSAL SYSTEM - PHASE I

FIGURE III–1

1. Effluent pumps

   The new effluent pumps will be provided at the existing effluent pump station and be sized for the Phase I peak flow of 5.5 mgd. The wastewater flow into the Lihue WWTP is not expected to approach the Phase I design rates for some time. Therefore, it is not necessary to provide the pumping capacity for the ultimate peak of 6.25 mgd at this time. When the wastewater flow approaches the Phase I design ADF of 2.2 mgd, the pumps installed as part of this project would probably be near the end of their useful life and could be replaced. Three new pumps would be provided, two for normal operation and one for emergency standby. Each pump would be sized for 1,900 gpm at 105 feet TDH. The relatively high head is needed for the effluent filtration system. The new pumps will be controlled by wet well level sensors, similar to the existing effluent pumps. A standby generator will be provided to provide power during outages.

2. Effluent filters

   The new effluent filters will be connected to piping downstream of the new effluent pumps and will be screen-type filters capable of removing particulates larger than 80 micron. This type of filter is most commonly used for agricultural irrigation systems. They are designed to remove large particles from the water to protect spray nozzles and drip systems. Typical screen filters consist of a metal screen within a housing or vessel. The water to be filtered enters the housing via an inlet pipe and is forced through the screen. The screened water is allowed to discharge from the housing through an outlet pipe. The particulates that accumulate in the filter are periodically washed out by allowing the finished water to backflow through the filter, thus dislodging the material from the screen. This type of backwashing system requires higher water pressures to allow proper cleaning. This backwash water is discharged from the filter to a sewer or sump. At the Lihue WWTP, the existing rapid sand filter will be converted to holding tank for the backwash. The accumulated backwash water would then be pumped to the headworks.

3. Effluent Force Main to Distribution Box

   The new 20" diameter effluent force main will convey the full 6.25 mgd peak flow associated with the existing design ADF of 2.5 mgd. Using a smaller pipe for interim flows would not be cost effective due to the replacement cost when a larger pipe is needed. A tee with valve and new section of 20-inch pipe will be provided to allow continued use of the existing ditch during construction. The piping and valves to the ditch can remain if the ditch is needed for emergencies.

4. Distribution Structure

   The force main will connect directly to a new distribution structure to split the flow between KLRC and the County's injection wells. Weirs will be used to proportion the flow. Different length weirs will be used to provide the flow split. The weirs will

also be adjustable so that the heights can be changed to proportion the flow properly depending on average total flow. A high liquid level alarm will be provided at this distribution structure. An Operations and Maintenance manual will be provided with emergency procedures to address any overflow problems. The structure will be covered to prevent debris from entering and to further minimize human contact. The covers will be easily removable and/or have hatches to allow observation and periodic maintenance.

5. Connection to Existing KLRC System

   A 24-inch gravity line will convey the effluent from the new distribution box to the new discharge box. From the discharge box, flow will be able to go to either Pond 2 through the new 24" gravity outfall, or the existing KLRC injection well through the new diversion line.

6. Connection to New County Injection Wells

   A 36-inch or 42-inch gravity flow pipe will convey effluent from the distribution structure to the injection wells. The pipe will be sized to carry 6.25 mgd peak flow in the event that KLRC chooses not to accept effluent in the future. Each injection well will have an inlet structure that will allow adjustments to the inflow rate. This is necessary because each well may have a different capacity. In addition, the well capacity may change with time, making a variable inflow type system advantageous. The inlet structure at each well will use valves to allow for inflow adjustment at each well.

7. County Injection Wells

   The depth of the new injection wells cannot be pre-determined due to the variable geology of the Lihue area. The new injection wells will be 12-inch diameter and are estimated to require about 600 feet of depth to produce a sustainable injection rate of 0.65 mgd. Some wells may need to be deeper. Larger bore diameters are not expected to produce better injection rates. Injection rates are expected to be high when the wells are first installed. However, based on observations made on the existing wells, injection rates appear to drop off in a short time from the initial rates. Isolation valves and flow meters will be installed at each well. Each well will also have a water level measuring device with a high liquid level alarm.

8. Existing Lihue WWTP SCADA System

   In addition to the new effluent pumping system, the existing Lihue WWTP Autocon telemetry and SCADA system will require additional monitoring and alarm points. This work will be performed by Autocon as a part of the construction contract due to the proprietary nature of the system.

9. Existing KLRC Facilities

The existing KLRC injection well discharge box requires modification as noted in item 5 above. Additional piping, valves, flow meter and well water level sensor are also recommended.

The existing KLRC injection well may require refurbishing to ensure that a minimum sustainable injection capacity of 0.65 mgd is maintained. This will be done by KLRC as a part of their irrigation management plan.

D. ESTIMATED COSTS

The estimated construction cost of Phase I work is $4.89 million. Estimated annual operation and maintenance costs associated with the Phase I improvements is about $227,230. The injection wells may also require periodic cleaning and refurbishing at least every 5 years, at an estimated cost of $20,000 per well, or 6 wells for a total of $120,000.

CHAPTER IV

PROBABLE IMPACTS AND MITIGATIVE MEASURES

A. SHORT TERM IMPACTS

1. Construction Related

Short term impacts are associated with construction activities to construct and test proposed injection wells at the Lihue WWTP site. Short term impacts include increased local traffic, noise and exhaust emissions from construction equipment, generation of spoils from drilling work, dust emissions, and mud during wet weather. All of these impacts are minimized and controlled by Federal, State, and County of Kauai laws, regulations, and permits requirements; and monitoring of construction by County inspectors. The project site is surrounded by the KLRC golf courses and maintenance facilities, and the Lihue Airport; thus, no residential occupants will be affected. The airport terminal building is over 2,000 feet away and it's occupants are expected to be minimally affected. KLRC maintenance workers working near the project site and golfers on the adjacent course would be most affected by construction activities.

2. Hydrogeology

Testing of the proposed wastewater effluent injection wells will involve pumping from one well into another and may result in the temporary high discharge of effluent into the wells. The relatively impermeable soils in the area, depth of injection wells, and dilution of effluent with ground water make it unlikely that the effluent will adversely affect the offshore marine environment during testing. See the report titled Assessment of Potential Impacts to Water Quality and Marine Community Structure from Effluent Disposal, Lihue Wastewater Treatment Plant in the **Appendix.**

B. LONG TERM IMPACTS

1. Lands

Additional land required to install and maintain the proposed wastewater force main, effluent injection wells, and appurtenances have been identified. These lands are currently owned by KLRC. The County of Kauai is negotiating with KLRC to acquire these lands and/or obtain easements for the proposed additional wastewater effluent disposal facilities.

2. Existing Access Road to KLRC Carriage House and Stables Area

   The existing access road coming from Kapule Highway, and continuing on the West side of the KLRC Carriage House and Stable Area will experience an increase in traffic with County personnel performing site visits for operations and maintenance of the injection wells. However, existing limited public access to the road will not be affected.

3. Flood Hazards and Wetlands

   The Lihue WWTP site is not within a flood hazard or flood prone area. There are no wetlands near the Lihue WWTP site.

4. Coastal Zone Management Area

   The project will conform to the State Coastal Management Program requirements. The project is not within the coastal zone Special Management Area (SMA), and a SMA permit is not required.

5. Groundwater Flow

   All of Kauai County's potable water supply sources are located upgradient of the groundwater flow through the project site. The location of the proposed injection wells will not adversely affect the domestic water supply in the Lihue area.

   Effluent from the injection wells is expected to be highly diluted by ground water as it approaches the ocean at depths approximately 500 feet below sea level (anticipated depths of the injection wells is 600 feet). According to the Marine Research Consultants report in the **Appendix**, the injection well effluent would not adversely affect the offshore marine and biotic communities.

6. Public Funds

   Public funds will be expended for the project. Costs for the proposed project will be shared between KLRC and the County of Kauai. Allocation of construction costs are being negotiated with KLRC. The costs allocated to the County will be paid for with public funds. Costs allocated to KLRC will be paid for by the exchange of lands or by cash. The Lihue WWTP is a public facility and must conform to Federal and State environmental regulations and requirements.

7. Energy

   The estimated increase in the annual energy required with the proposed action is 312,216 kW-h/yr.

8. KLRC Operations

   KLRC will have the responsibility to manage their irrigation system to accommodate 3.75 mgd, which is their portion of the peak flow.

9. Construction Materials

   Construction materials such as reinforced concrete, well casings, pipes, fittings, valves, and controls would be required for new injection wells. Construction materials would be chosen for their cost effectiveness, durability, and long service life as appropriate.

10. Endangered Species

    The migratory Hawaiian coot, the only endangered wildlife known to be in the project area, will not be affected by this project. This waterbird was observed swimming in Pond 2. The Hawaiian coot habitat will not be affected. Construction work in the area may cause temporary and minor short term disturbance to the birds activities, but the impact is not expected to be significant.

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

The proposed project at the Lihue WWTP is intended to provide the County with a long term means for disposing a design average daily flow of 2.2 mgd of secondary effluent. Currently, the KLRC golf course reuses all of the average daily flow of 1.3 mgd generated by the WWTP. By agreement, KLRC is obligated to dispose of up to 4.5 mgd of effluent until the year 2003. The agreement is extendable for another 10 years during which period KLRC is obligated to accept treated effluent at a reduced rate of 1.5 million gallons per 24-hour period. Implementation of this project and on-going negotiations with KLRC to extend the effluent disposal agreement beyond the year 2013, will allow the County to accept up to 2.2 mgd of wastewater.

KLRC desires to continue reusing up to 1.5 million gallons per 24-hour period of R-2 quality treated effluent on a long term basis. The proposed project recognizes and allows for the possibility of future additional reclamation and reuse of treated effluent. Future improvements will be compatible with Phase I to provide treated effluent if a demand develops for more reclaimed water within a reasonable and practical delivery distance. It is the County's goal to maximize reclamation and reuse of wastewater effluent whenever practical, because it conserves a natural resource by reducing the

demands for using potable water, and reduces the demands for effluent disposal.

D. MITIGATION MEASURES TO MINIMIZE IMPACTS

The purpose of this project is to provide long term effluent disposal with minimal adverse impacts on the environment.

To minimize short term construction impacts, Federal, State, and County regulations related to construction activities will be made a part of the construction contract requirements. County inspectors will monitor construction activities to assure compliance.

Over the long term, this project provides the flexibility for disposal of the Lihue WWTP design ADF of 2.5 mgd by alternate means. Prevailing future conditions may dictate the continued reuse of 1.5 million gallons per 24-hour period R-2 quality effluent on KLRC golf courses and disposal of the remaining 1 mgd by injection wells. Alternatively, it may be best to continue reuse of the 1.5 million gallons per 24-hour period R-2 effluent on KLRC golf courses, provide additional treatment to produce R-1 quality effluent for added reuse, and disposal of remaining effluent by injection wells. The quantity of R-1 effluent produced would depend upon the size of a viable market for reclaimed water. Both options will result in the disposal of treated wastewater effluent in an environmentally safe manner.

E. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The proposed project will permanently commit public funds and lands for construction and utilization of injection wells. However, the public will benefit by having a long term wastewater treatment and effluent disposal system which will be cost effective and not adversely affect the environment.

CHAPTER V

ALTERNATIVES TO THE PROPOSED PROJECT

Many alternatives were considered for reusing and disposing of the Lihue WWTP effluent. The alternatives address the planning requirements for the year 2003, when KLRC's obligation to take effluent is reduced to 1.5 million gallons per 24-hour period. Although the current agreement between the County and KLRC expires in 2013, it should be in the best interest of KLRC to reuse the treated effluent. Therefore, the alternatives assume KLRC will continue to reuse 1.5 million gallons per 24-hour period of treated effluent beyond the year 2013. The alternatives are also based on construction of a new piped delivery system to KLRC to replace the existing open ditch system.

A. DO NOTHING ALTERNATIVE

The "Do Nothing" alternative is not realistic and not acceptable. The agreement between KLRC and the County will be amended in August 2003 such that KLRC's obligation to take treated effluent is reduced from 4.5 mgd to 1.5 million gallons per 24-hour period. The new obligation reduces the amount of effluent taken by KLRC to below the average treatment plant capacity of 2.5 mgd. Therefore, the County must identify other users of one mgd of effluent and develop additional means of disposal as backup. The present situation requires that the County develop a plan to reuse and dispose of at least a portion of the effluent in anticipation of a future increase in flows up to the design flow of 2.5 mgd.

B. OCEAN OUTFALL DISPOSAL

An ocean outfall can be used to dispose of effluent not utilized for reuse or as a backup disposal method. However, the construction, operation and monitoring cost of an offshore outfall makes this option unfeasible. Ocean outfalls cost approximately $3,000 to $5,000 per lineal foot. Effluent conveyance facilities from the treatment plant to the ocean are also required. Assuming the ocean outfall needs to be one mile offshore, the estimated total cost for this option ranges from approximately $17 million to $28 million. In addition, extensive ocean water quality and marine community investigations are required before design and during operation to assure that the existing environment is not adversely affected by the treated effluent discharge. A National Pollutant Discharge Elimination System (NPDES) permit is required for discharging treated effluent into receiving bodies of water. This ocean outfall option is not considered to be viable.

C. IRRIGATION ALTERNATIVES

1. Drip Irrigation

Subsurface drip irrigation is a viable means of reusing the treated effluent. One of the main advantages of subsurface irrigation is the limited human contact thus allowing R-2 quality water to be utilized within the Guidelines set forth by the State DoH. An estimated 70 to 90 acres are required to reuse one mgd of effluent at an estimated construction cost of $15,000 to $18,000 per acre. In addition to the land area and irrigation system, an impoundment is required by the State DoH Guidelines to hold any reuse water not utilized during peak flow events or wet weather periods when irrigation is not needed, and an 80 micron filtration system is needed to protect the irrigation drip lines. The suggested impoundment capacity is 20 days of average flow or 20 million gallons storage per mgd. The Lihue Airport may object to locating a large pond in the vicinity. The pond will attract water fowl and other birds to the airport area causing a hazard to air traffic. In addition, the airport personnel were concerned with the type of vegetation grown as well and preferred that it be a type that does not attract birds.

2. Spray Irrigation

The spray irrigation alternatives are similar to the drip irrigation alternatives. Spray irrigation is less efficient than drip irrigation and therefore requires more land area. Spray irrigation with R-2 water also requires a large buffer zone of 500 feet between the irrigated area and any public areas. Spray irrigation with R-1 does not require a buffer zone so long as there is no overspray beyond the designated irrigation area. Approximately 100 to 120 acres are required to spray irrigate one mgd of treated effluent. If R-2 water is used, additional area is required for the buffer zone. Depending on shape and location, this buffer zone can be the same or greater than the irrigated area. The cost of a spray irrigation system ranges from about $12,000 to $15,000 per acre. Spray irrigation also requires an impoundment to hold reuse water not utilized during peak flow events and wet weather, and a filtration system capable of removing particulates larger than about 200 micron. As with drip irrigation, the suggested impoundment capacity is 20 days of average flow.

The drip and spray irrigation alternatives are not cost effective due to the extensive land area required (estimated 70 to 120 acres per one mgd disposed) and anticipated high capital costs for the County to construct pumping, transmission, storage, filtration and irrigation systems. In addition, irrigation of the area east of the Lihue Airport would probably not produce any viable crop that can be used. Growth of fodder crops such as alfalfa is one possibility but there is no market on Kauai for such crops. Irrigation of the area would serve no purpose but to get rid of the 1.0 mgd of effluent, at a higher cost than injection well disposal. In addition, the airport may object to fodder harvesting operations if any dust is produced. Therefore, irrigation of the area east of the Lihue Airport is not recommended.

CHAPTER VI

AGENCIES AND ORGANIZATIONS CONSULTED, AND APPROVALS REQUIRED

A. AGENCIES AND ORGANIZATIONS CONSULTED

1. Federal Government
   U.S. Corps of Engineers, Environmental Permits Section
   U.S.D.A. Natural Resources Conservation Service

2. State Government
   Department of Land and Natural Resources
      State Historic Preservation Division
   Department of Health
      Clean Water Branch
      Safe Drinking Water Branch
      Wastewater Branch
   Wastewater Branch
      Office of Environmental Quality Control

3. County Government
      Planning Department
      Department of Public Works
      Kauai Housing Agency (H.U.D.)

4. Kauai Lagoons Resort Company

B. APPROVALS REQUIRED

1. State Department of Health
      Wastewater Branch; Engineering report and Environmental Assessment
      Safe Drinking Water Branch; UIC application and Permit

2. State Office of Environmental Quality Control
      Environmental Assessment for Project

3. County Department of Public Works
      Engineering report and Environmental Assessment

4. County Planning Department
      Use Permit
      Class IV Zoning Permit

5. Kauai Lagoons Resort Company

CHAPTER VII

FINDINGS AND DETERMINATION

A. FINDINGS BASED ON DOH 11-200-12 SIGINIFICANT CRITERIA

According to DOH 11-200-12, an action may have a significant impact on the environment if it meets any of the Significant Criteria as follows:

1. **Involves an irrevocable commitment to loss or destruction of any natural or cultural resource.**

   There are no known historic or archaeological sites that would be destroyed or adversely affected by this project.

2. **Curtails the range of beneficial uses of the environment.**

   Offshore water quality sampling and analyses were conducted by Marine Research Consultants to determine if the present input of groundwater to the ocean is altering water quality to the extent that biotic community structure may be adversely affected. The coastal segment that is potentially affected is directly downslope from the existing injection wells and includes the outer portion of Nawiliwili Bay and areas seaward of the bay from approximately Ninini Point to Ahukini. Groundwater input was detected at the above noted offshore areas. However, the effect is minimal due to high levels of mixing which rapidly dilute the groundwater input to background ocean concentrations. It appears that there is no effect on water quality to the extent that it could affect biotic community composition. The report concludes that disposal of treated effluent into deep injection wells should not adversely affect marine water quality or community structure. The Marine Research Consultant's report is included in the **Appendix.**

3. **Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.**

   The proposed project is in accordance with the policies, goals and guidelines as expressed in Chapter 344, Hawaii Revised Statutes.

4. **Substantially affects the economic or social welfare of the community or state.**

   Construction of the proposed Phase I effluent disposal improvements will allow the County to continue receiving and treating increasing wastewater flows generated from the Lihue area communities, and provide long term disposal of the treated effluent in an environmentally safe and cost effective manner.

5. **Substantially affects public health.**

   The proposed project does not have any substantial affects on public health. As discussed in item 2 above and item 10 below, it will not substantially affect drinking water or the ocean water, which are the two areas with a high potential for public contact.

6. **Involves substantial secondary impacts, such as population changes or effects on public facilities.**

   The proposed project does not impact the treatment capacity of the Lihue WWTP, and thus does not affect the volume of wastewater that can be accommodated from the population or public facilities. It will only allow the Lihue WWTP to continue operating at it's current design capacity.

7. **Involves a substantial degradation of environmental quality.**

   As discussed in item 2 above and item 10 below, the proposed project does not involve substantial degradation of the environmental quality of drinking water or ocean waters.

8. **Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.**

   The proposed action is limited to the scope discussed in Chapter III, and does not have any cumulative effects.

9. **Substantially affects a rare, threatened, or endangered species, or its habitat.**

   There are no known endangered species of flora or fauna in the immediate area of the project site that would be disturbed.

10. **Detrimentally affects air or water quality or ambient noise levels.**

    The existing injection well at Lihue WWTP has been in operation as an emergency disposal system for more than twenty years, used sporadically during emergencies and monitoring.

    A second well is near KLRC Pond 2 and has been in operation for more than nine years as a partial backup to the effluent reuse system, disposing of overflows from Pond 2.

    During this time, no indications of contamination have occurred at the nearest potable water producing well, (USGS Well No. 11 near existing Department of Water office) located about 8,000 feet northwest and upgradient of Lihue WWTP.

Therefore, the proposed project should not detrimentally affect the water quality.

Dust, noise and some increase in traffic are expected during construction, but these will be temporary and are controllable. Their impacts to the environment are expected to be minimal.

11. **Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.**

    There are no environmentally sensitive areas such as flood plain, tsunami zones, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal water immediately near the project site that will be adversely affected by the project.

12. **Substantially affects scenic vistas and view planes identified in county or state plans or studies.**

    The proposed action does not involve the construction of any substantial structures that would affect view planes in the area. The majority of the action involves underground pipelines, utilities, and injection wells.

13. **Requires substantial energy consumption.**

    The estimated increase in the annual energy required with the proposed action is 312,216 kW-h/yr, while the existing annual energy consumption at the WWTP is approximately 1,900,000 kW-h/yr. This is a 16% increase in energy consumption, and is not considered to be substantial.

B. FINDINGS BASED ON DOH STATE ENVIRONMENTAL REVIEW PROCESS (SERP) CRITERIA

The proposed action involves the use of State Revolving Funds (SRF) and is subject to the DOH SERP criteria, which state that the analysis of alternatives and impacts shall include the following items.

1. **The primary and secondary (direct and indirect) impacts for all feasible alternatives (to include the "no action" alternative).**

   The proposed action and impacts is discussed in Chapters III and IV, and alternatives to the proposed action are discussed in Chapter V.

2. **The impacts on social parameters such as land use, recreation and open-space opportunities.**

Impacts on land use and access to recreation areas are discussed in Chapter IV, Section B, Paragraphs 1 and 2. The impacts are not anticipated to be significant.

3. **The cumulative impacts such as anticipated community growth (residential, commercial, institutional, and industrial) within the project and study area.**

   This is discussed above in Item 6 of the DOH 11-200-12 Significant Criteria.

4. **The impacts on other anticipated public works projects (if any) and the planned coordination with them.**

   No impacts on other public works projects are anticipated.

5. **The impacts on any individual sensitive environmental issues that have been identified through the public participation program.**

   No individual *sensitive environmental* issues have been identified during the 30-day public comment period for the Draft EA of the proposed action.

C. DOH CROSS-CUTTING AUTHORITIES

According to the DOH Environmental Documents Criteria, any Environmental Assessment Document submitted for an SRF (State Revolving Fund) project shall also address the impacts on other Federal "cross-cutting" authorities to include the following:

1. **Archeological and Historic Preservation Act.**

   Discussed in Chapter II, Section F., and Chapter VII, Section A, Item 1.

2. **Clean Air Act.**

   Dust is anticipated during construction, but will be temporary and controllable with mitigative measures covered in Federal, State, and County regulations related to construction activities. See Chapter IV for more details.

3. **Coastal Zone Management Act**

   Discussed in Chapter IV, Section B, Item 4.

4. **Endangered Species Act**

   Discussed in Chapter IV, Section B, Item 10, and Chapter VII, Section A, Item 9.

5. Farmland Protection Policy Act

The site of the proposed action is not considered prime, statewide importance, or unique farmlands. Therefore, the Farmland Protection Policy Act does not apply to this site.

6. Fish and Wildlife Coordination Act

Affects of proposed action on the biotic community are discussed in Chapter VII, Section A, Item 2.

7. Floodplain Management

Proposed action is not in a floodplain, as discussed in Chapter II, Section D, Item 6.

8. National Historic Preservation Act

There are no historic facilities within two miles of the proposed action, as mentioned in Chapter II, Section F.

9. Safe Drinking Water Act

Proposed action is not anticipated to violate the Safe Drinking Water Act, as discussed in Chapter II, Section E.; Chapter IV, Section B, Item 5, and Chapter ;II, Section A, Item 10.

10. Protection of Wetlands

There are no wetlands near the site of the proposed action, as mentioned in Chapter IV, Section B, Item 3.

C. DETERMINATION

Based upon the above data and analyses, the proposed project is not anticipated to have any significant adverse impacts on the coastal waters, local ecology, hydrology, and atmosphere. Mitigative measures will be implemented as deemed necessary and as required by the governmental agencies. A Finding of No Significant Impact has been determined for the proposed action.

CHAPTER VIII

DRAFT ENVIRONMENTAL ASSESSMENT COMMENTS AND RESPONSES

This chapter has been added to the Draft Environmental Assessment to be part of the Final Environmental Assessment document.

The Draft Environmental Assessment was submitted to the Office of Environmental Quality Control (OEQC) in December 1999, and was published in the OEQC Bulletin on December 23, 1999. The deadline for public comment was January 24, 2000. Attached are the comments received during this period, and the associated response letters.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

TIMOTHY E. JOHNS, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DEPUTIES
JANET E. KAWELO
LINNEL NISHIOKA

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS
WATER RESOURCE MANAGEMENT

December 27, 1999

Mr. Keith Yoshimoto
Fukunga and Associates, Inc.
1388 Kapiolani Blvd., 2nd Floor
Honolulu, Hawaii 96814

LOG NO: 24633 ✓
DOC NO: 9912NM09

Dear Mr. Yoshimoto:

SUBJECT: ***Historic Preservation Review -- DEA for Lihue Wastewater Treatment Plant Effluent Disposal System***
TMK: 3-5-01: 27, 30, 82, Lihue, Kauai

Thank you for the opportunity to review this DEA. We do not believe that there are any significant historic sites in this area, since the area has already been cleared in the past with construction of the Airport and cane cultivation. Therefore, we believe that this project will have "no effect" on significant historic sites.

If you have any questions, please call Nancy McMahon 742-7033.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

NM:amk

1388 KAPIOLANI BOULEVARD / 2ND FLOOR/HONOLULU, HAWAII 96814 / PH. (808) 944-1821 / FAX (808) 946-9339

June 26, 2000

Mr. Don Hibbard, Administrator
State of Hawaii
Department of Land and Natural Resources
State Historic Preservation Division
5532 Tapa Street
Koloa, Kauai, Hawaii 96756

Dear Mr. Hibbard:

Subject: Lihue Wastewater Treatment Plant Effluent Disposal System
Draft Environmental Assessment (DEA)

Thank you for reviewing the subject document. We have received your comment letter dated December 27, 1999, and understand that you believe the proposed action will have "no effect" on significant historic sites.

Thank you for your time and cooperation. Please call us if you have any questions.

Sincerely,

Keith M. Yoshimoto

cc: Kauai County Department of Public Works

FUKUNAGA&ASSOCIATES, INC.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

BRUCE S. ANDERSON, Ph.D., M.P.H.
DIRECTOR OF HEALTH

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

In reply, please refer to:
EMD / SDWB

December 28, 1999

Mr. Keith M. Yoshimoto
Fukunaga and Associates, Inc.
1388 Kapiolani Blvd., 2nd Floor
Honolulu, Hawaii 96814

Dear Mr. Yoshimoto:

SUBJECT: LIHUE WASTEWATER TREATMENT PLANT
DRAFT ENVIRONMENTAL ASSESSMENT
UNDERGROUND INJECTION CONTROL (UIC)
UIC PERMIT NO. UK-1213

We acknowledge receipt of the Draft Environmental Assessment (DEA) for the proposed effluent disposal system at the subject facility. We have reviewed the DEA and have no comment at this time.

If you have any questions regarding this subject, please contact Norris Uehara of the Safe Drinking Water Branch (SDWB) at 586-4258 (Honolulu) or call from Kauai the direct toll free number 274-3141, ext. 64258.

Sincerely,

William Wong

WILLIAM WONG, P.E., Chief
Safe Drinking Water Branch
Environmental Management Division

NU:chl

c: Harold Eichelberger, SDWB Sanitarian, Kauai

1388 KAPIOLANI BOULEVARD / 2ND FLOOR/HONOLULU, HAWAII 96814 / PH. (808) 944-1821 / FAX (808) 946-9339

June 26, 2000

Mr. William Wong, P.E., Chief
State of Hawaii
Department of Health
Safe Drinking Water Branch
Environmental Management Division
919 Ala Moana Boulevard, Room 308
Honolulu, Hawaii 96814

Dear Mr. Wong:

Subject: Lihue Wastewater Treatment Plant Effluent Disposal System
Draft Environmental Assessment (DEA)

Thank you for reviewing the subject document. We have received your comment letter dated December 28, 1999, and understand that you have no comments at this time.

Thank you for your time and cooperation. Please call us if you have any questions.

Sincerely,

Keith M. Yoshimoto

Keith M. Yoshimoto

cc: Kauai County Department of Public Works

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

December 30, 1999

Regulatory Branch

Mr. Keith M. Yoshimoto
Fukunaga & Associates, Inc.
1388 Kapiolani Blvd., Second Floor
Honolulu, Hawaii 96814

Dear Mr. Yoshimoto:

This responds to your request for review of the Draft Environmental Assessment (DEA) for the proposed Lihue Wastewater Treatment Plant Effluent Disposal System, Phase I, at Lihue, Kauai, Hawaii.

Based on the information provided in the DEA, I have determined that the proposed project will not require a Department of the Army permit.

Should you have any questions regarding this determination, please contact Peter Galloway of my staff at 438-8416 and refer to file number 200000060.

Sincerely,

for George P. Young, P.E.
Chief, Regulatory Branch

Copies Furnished:

Clean Water Branch, State of Hawaii Department of Health, P.O. Box 3378, Honolulu, HI 96801-3386
State of Hawaii, Department of Land and Natural Resources, Commission on Water Resource Management, P.O. Box 621 Honolulu, HI 96809
Kauai County Department of Public Works, 3021 Umi Street, Lihue, HI 96766

1388 KAPIOLANI BOULEVARD / 2ND FLOOR/HONOLULU, HAWAII 96814 / PH. (808) 944-1821 / FAX (808) 946-9339

June 26, 2000

Mr. George Young, Chief
U.S. Army Corps of Engineers
Regulatory Branch
U.S. Army Engineer District Honolulu, Bldg. 230
Fort Shafter, Hawaii 96858-5440

Dear Mr. Young:

Subject: Lihue Wastewater Treatment Plant Effluent Disposal System
Draft Environmental Assessment (DEA)

Thank you for reviewing the subject document. We have received your comment letter dated December 30, 1999, and understand that the proposed action will not require a Department of the Army permit.

Thank you for your time and cooperation. Please call us if you have any questions.

Sincerely,

Keith M. Yoshimoto

cc: Kauai County Department of Public Works

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

TIMOTHY E. JOHNS
CHAIRPERSON

BRUCE S. ANDERSON
ROBERT G. GIRALD
BRIAN C. NISHIDA
DAVID A. NOBRIGA
HERBERT M. RICHARDS, JR.

LINNEL T. NISHIOKA
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

JAN - 3 2000

Keith M.Yoshimoto
Fukunaga & Associates, Inc.
1388 Kapiolani Boulevard, 2nd Floor
Honolulu, HI 96814

SUBJECT: Draft Environmental Assessment, Lihue Wastewater Treatment Plant Effluent Disposal System

Thank you for the opportunity to review the subject document. Our comments related to water resources are marked below.

In general, the CWRM strongly promotes the efficient use of our water resources through conservation measures and use of alternative non-potable water resources whenever available, feasible, and there are no harmful effects to the ecosystem. Also, the CWRM encourages the protection of water recharge areas, which are important for the maintenance of streams and the replenishment of aquifers.

[ ] We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.

[ ] We recommend coordination with the Land Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

[X] We are concerned about the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

[ ] A Well Construction Permit and/or a Pump Installation Permit from the Commission would be required before ground water is developed as a source of supply for the project.

[ ] The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit from the Commission would be required prior to use of this source.

[ ] Groundwater withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

[ ] We recommend that no development take place affecting highly erodible slopes which drain into streams within or adjacent to the project.

[ ] If the proposed project includes construction of a stream diversion, the project may require a stream diversion works permit and amend the instream flow standard for the affected stream(s).

[ ] If the proposed project alters the bed and banks of a stream channel, the project may require a stream channel alteration permit.

[X] OTHER:

The State Water Code gives the Department of Health jurisdiction over matters related to water quality. We recommend that approvals for this project be conditioned upon a review by the Department of Health and the developer's acceptance of any resulting requirements related to water quality.

If there are any questions, please contact the Commission staff at 587-0218.

Sincerely,

LINNEL T. NISHIOKA
Deputy Director

LN:sd

1388 KAPIOLANI BOULEVARD / 2ND FLOOR/HONOLULU, HAWAII 96814 / PH. (808) 944-1821 / FAX (808) 946-9339

June 26, 2000

Ms. Linnel Nishioka, Director
State of Hawaii
Commission on Water Resource Management
P.O. Box 621
Honolulu, Hawaii 96809

Dear Ms. Nishioka:

Subject: Lihue Wastewater Treatment Plant Effluent Disposal System
Draft Environmental Assessment (DEA)

Thank you for reviewing the subject document. We have received your comment letter dated January 3, 2000, stating your concerns about the State Department of Health (DOH) and the developer's (County of Kauai) involvement in the approval of the proposed action. The State Department of Health as well as the County of Kauai have been and will continue to be involved in the review and approval process for the proposed action.

Thank you for your time and cooperation. Please call us if you have any questions.

Sincerely,

Keith M. Yoshimoto

Keith M. Yoshimoto

cc: Kauai County Department of Public Works

FUKUNAGA&ASSOCIATES, INC.

BENJAMIN J. CAYETANO
GOVERNOR

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

January 24, 2000

Mr. Cesar C. Portugal
County Engineer
County of Kauai
Department of Public Works
4444 Rice Street, Suite 275
Lihue, Hawaii 96766

Dear Mr. Portugal:

Subject: Draft Environmental Assessment for the Lihue Wastewater Treatment Plant Effluent Disposal System Phase 1, Kauai

Thank you for the opportunity to review and comment on the subject document. We have the following comments.

1. Please explain why continuing to send 4.5 mgd of secondary treated wastewater to Kauai Lagoons Resort Company is not feasible in the long term.

2. Please discuss the findings and reasons for supporting the FONSI determination based on all 13 significant criteria listed in §11-200-12 of the EIS rules. Please see the enclosed example.

3. Recently, several new projects (Kauai Police Station, the State Judiciary Facility, the Kauai Bus Maintenance Facility, Kauai Community Kitchen, etc.) have been proposed in the nearby area. Please investigate the feasibility of using the effluent at these new site for irrigation or other purposes.

Should you have any questions, please call Jeyan Thirugnanam at 586-4185.

Sincerely,

Genevieve Salmonson
Director

c: Fukunaga & Assoc.

6.0 DETERMINATION, FINDINGS AND REASONS FOR SUPPORTING DETERMINATION

To determine whether the proposed action may have a significant impact on the environment, the project and its expected consequences, both primary and secondary, and the cumulative as well as short– and long–term effects have been evaluated. Based on the studies performed and research evaluated, a finding of no significant impact is anticipated and is summarized below.

6.1 SIGNIFICANCE CRITERIA

According to the Department of Health Rules (11–200–12), an applicant or agency must determine whether an action may have a significant impact on the environment, including all phases of the project, its expected consequences both primary and secondary, its cumulative impact with other projects, and its short– and long–term effects. In making the determination, the Rules establish "Significance Criteria" to be used as a basis for identifying significant environmental impacts. According to the Rules, an action shall be determined to have significant impacts on the environment if it meets any one of the following criteria:

(1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resources;

An archaeological assessment and field reconnaissance study for the project has determined that cultural deposits and possibly historic burials may exist in the sand dunes adjacent to Farrington Highway. The Landscape Master Plan has therefore been designed to protect the cultural resources and stop the current practice of allowing unrestricted vehicular access onto these areas by limiting parking to designated areas. Planned treatments for the dune areas will include landscape plantings of low shrubs and vines consisting of coastal native species. In the event that any cultural deposits or human burials are uncovered, all work will immediately be halted and planting would shift to an area free of any cultural resources.

The proposed project will not impact scenic views of the ocean or any ridgelines from Farrington Highway or other heavily traveled roadways in the area. The visual character of the area will be enhanced by the additional landscaping with heritage trees and other coastal native plantings. The landscape plantings will also mitigate existing soil erosion. The existing three-mile park is designated as State Urban lands dedicated for Park purposes, an important natural and cultural resource. Presently, the study area is only minimally landscaped and not improved for aesthetic purposes.

(2) Curtails the range of beneficial uses of the environment;

The existing Ulehawa Beach Park has been dedicated for shoreline recreational uses for many decades. Its improvement as described by the Landscape Master Plan will enhance the range of beneficial uses of the environment.

Controlled access onto the property will directly enhance access to the shoreline while simultaneously protect the cultural and natural resources by restrictly vehicular access onto the sand dunes and beach. This shoreline has historically been used for food gathering and recreational purposes. The planned park improvements will enhance those functions.

(3) **Conflicts with the State's long–term environmental policies or goals and guidelines as expressed in Chapter 344, HRS; and any revisions thereof and amendments thereto, court decisions, or executive orders;**

The proposed development is consistent with the Environmental Policies established in Chapter 344, HRS.

(4) **Substantially affects the economic or social welfare of the community or state;**

The proposed project will provide a significant contribution to the Wai'anae District population by establishing an improved recreational resource. The proposed improvements are also consistent with the City's Development Plan for the area. Surrounding land use patterns will not be negatively or significantly altered, nor will unplanned population growth or its distribution be stimulated.

Consequently, development of the park improvements will provide Wai'anae coast residents with a quality recreational facility. This harmonious relationship between park and the existing community will significantly improve the quality of life for many residents.

(5) **Substantially affects public health;**

Although the public health may be affected by the short-term construction impacts which may affect air, noise, traffic and water quality, these should be insignificant especially when weighed against the positive economic, social, and quality of life implications associated with the project. Mitigation measures will be used to address impacts that could potentially affect public health.

(6) **Involves substantial secondary impacts, such as population changes or effects on public facilities;**

The improvement of this existing beach park will not have any secondary impact associated with population growth of the need for public facilities.

(7) **Involves a substantial degradation of environmental quality;**

The renovation of an exiting regional park will improve a much used natural resource. The proposed project may improve erosion control, reduce runoff into nearshore waters, and control access. There are no anticipated impacts that would degrade environmental quality. The addition of new landscaping with Hawaiian heritage plants will enhance the park environment by providing new natural materials and shade. The coastal visual resource from Farrington Highway will also be improved.

(8) **Is individually limited but cumulatively has considerable effect on the environment, or involves a commitment for larger actions;**

The planned improvements to an existing park is consistent with the existing and planned urban character expressed in the Wai'anae Development Plan and is not anticipated to have a considerable effect on the environment. The commitment of fiscal resources to construct the improvements will foreclose other uses of those resources.

(9) **Substantially affects a rare, threatened or endangered species or its habitat;**

Field wildlife and botanical studies indicate that there are no endangered plant or animal species located at this highly utilized beach park. The federal and state natural resource agencies have not

identified Ulehawa Beach Park as a site for monk seals or turtle nesting, however, it is possible that seals may beach there from time to time.

(10) Detrimentally affects air or water quality or ambient noise levels;

Any possible impact to near–shore ecosystems resulting from surface runoff will be mitigated by the establishment of on–site detention basins during the construction phases of development.

(11) Affects or is likely to suffer damage by being located in an environmentally sensitive area, such as a flood plain, tsunami zone, beach, erosion–prone area, geologically hazardous land, estuary, freshwater, or coastal waters;

Ulehawa Beach Park, like all other coastal parks in the State is susceptible to high wave and tsunami inundation.

(12) Substantially affects scenic vistas and view planes identified in county or state plans or studies;

The City and County of Honolulu's *Coastal View Study* identifies the Nānākuli Viewshed as a major viewshed within the Wai'anae area. Lateral coastal views which are available from all points along the shoreline are significant, especially in the Ka'ena direction due to the descending ridges which can be seen in the distance. The Pu'u o Hulu Kai / Pu'u o Hulu Uka landmark is designated as an important coastal land form. Although new landscape plantings will impact views, the overall visual resource will be enhanced. The proposed project is in conformance with both State and County plans for the area and no public facilities are designated on the Wai'anae Development Plan Public Facilities Map.

(13) Requires substantial energy consumption;

The location of the beach park is proximate to Wai'anae area communities and are all within short driving distances from the property, thereby reducing travel times and energy consumption. Construction of the proposed project will not require substantial energy consumption.

6.2 DETERMINATION

On the basis of the above criteria, and the discussion of impacts and mitigative measures contained in this document, it is anticipated that the proposed project will not have a significant negative effect on the environment and will conversely, result in positive effects to the natural, cultural, and social environments.

MARYANNE W. KUSAKA
MAYOR

WALLACE G. REZENTES, SR.
ADMINISTRATIVE ASSISTANT

CESAR C. PORTUGAL
COUNTY ENGINEER
TELEPHONE 241-6600

IAN K. COSTA
DEPUTY COUNTY ENGINEER
TELEPHONE 241-6640

AN EQUAL OPPORTUNITY EMPLOYER
COUNTY OF KAUA'I
DEPARTMENT OF PUBLIC WORKS
4444 RICE STREET
MO'IKEHA BUILDING, SUITE 275
LIHU'E, KAUA'I, HAWAI'I 96766

June 13, 2000

Ms. Genevieve Salmonson, Director
State of Hawaii
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Attention: Jeyan Thirugnanam

Dear Ms. Salmonson:

Subject: Draft Environmental Assessment for the Lihue Wastewater Treatment Plant Effluent Disposal System, December 1999

Thank you for the comments to the Draft Environmental Assessment for the Lihue Wastewater Treatment Plant Effluent Disposal System dated January 24, 2000. In response to your comments we offer the following responses:

1. Although the current Agreement in-force between the County of Kauai and Kauai Lagoons Resort Company (KLRC) (originally with Hemmeter-VMS) indicates that KLRC will take up to 4.5 mgd of effluent until August 2003, it is not feasible to send that volume of secondary treated effluent to KLRC. The original Agreement assumed more development in the area, including an additional golf course. The water usage for these additional facilities would have been able to use most of the effluent from the Lihue WWTP during dry months. However, due to the recent economic climate on Kauai, these additional developments were not constructed. Current reuse of effluent for irrigation by KLRC is limited to two golf courses. In addition, the golf courses do not require irrigation during most of the winter months when there is sufficient rainfall. The State Department of Health Wastewater Branch has expressed concern that the existing effluent storage capacity at KLRC may not be sufficient during prolonged periods of wet weather and prefers that the County of Kauai take the excess effluent not used for irrigation. Therefore, the long-range plan is to reduce the amount of effluent to the 1.5 million gallons per 24-hour period as stated in the current Agreement in force for the term from year 2003 to 2013. Negotiations are under way to extend the term beyond 2013, and to address KLRC's position of limiting the quantity of effluent to 1.5 mgd.

2. Complied, the reasons in support of the FONSI determination based on all thirteen criteria in §11-200-12 of the EIS rules has been included in Chapter VII "Findings and Determination" of the final Environmental Assessment.

3. The Preliminary Engineering Report submitted to the County of Kauai in August 1999 discusses the feasibility of using effluent for publicly accessible facilities such as those mentioned in the letter. Based on the current requirements of the State Department of Health, the quality of the effluent would have to be upgraded to R-1 as defined in the *Guidelines for the Treatment and Use of Reclaimed Water*, November 1993. The facilities required to upgrade part of the total effluent flow to meet the off-site demands are planned as another, future phase of the wastewater treatment plant. As demands arise and the infrastructure to deliver the effluent is constructed, the Lihue WWTP can be upgraded to produce R-1 quality effluent to meet these demands. Currently, the low off-site demand for reclaimed wastewater does not justify the cost of constructing the facilities to produce R-1 quality effluent. In addition, the infrastructure to deliver the effluent is not available and must be master-planned for the Lihue area.

Should you have any questions regarding these responses and the final EA, please call Mr. Harry Funamura, Chief Division of Wastewater Management at (808)241-6610.

Sincerely,

for CESAR PORTUGAL
County Engineer

WU

xc: Fukunaga & Associates Fax: 1-808-946-9339

REFERENCES

1. Assessment of Potential Impacts to Water Quality and Marine Community Structure From Effluent Disposal, Lihue Wastewater Treatment Plant Lihue, Kauai, Hawaii, Marine Research Consultants, March 10, 1997.

2. Lihue Wastewater Treatment Plant Preliminary Engineering Report for Phase IV Expansion, M&E Pacific, Inc. July 1990.

3. Kauai Water Use and Development Plant, Prepared fro the Department of Water, County of Kauai, R.M. Towill Corporation, February 1990.

4. National Flood Insurance Program Flood Insurance Rate Map, Kauai County, Hawaii, Federal Emergency Management Agency, March 4, 1987.

5. 208 Water Quality Management Plan for the County of Kauai, State Department of Health and County of Kauai, December 1980.

6. Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, United States Department of Agriculture Soil Conservation Service in cooperation with the University of Hawaii Agricultural Experiment Station, August 1972.

APPENDIX

ASESSMENT OF POTENTIAL IMPACTS TO WATER QUALITY AND MARINE COMMUNITY STRUCTURE FROM EFFLUENT DISPOSAL

Lihue Wastewater Treatment Plant

ASSESSMENT OF POTENTIAL IMPACTS TO WATER QUALITY AND MARINE COMMUNITY STRUCTURE FROM EFFLUENT DISPOSAL, LIHUE WASTEWATER TREATMENT PLANT LIHUE, KAUAI, HAWAII

Prepared for:

Tom Nance Water Resource Engineering
680 Ala Moana Blvd., Suite 406
Honolulu, HI 96813

By:

Marine Research Consultants
4467 Sierra Dr.
Honolulu, HI 96816

Revised
June 23, 1998

I. INTRODUCTION

Planning is underway to determine the most effective methods of disposing of treated sewage effluent from the Lihue Wastewater Treatment Plant (LWWTP). Current design capacity of the treatment plant is 2.5 million gallons per day (mgd). At present, inflow to the plant is approximately 1.3 mgd, and all treated effluent is utilized for irrigation of the Kauai Lagoons Golf Course. However, should the inflow to the plant increase beyond the present level, it will not be possible to dispose of the additional effluent on the golf course. As a result, several alternative disposal options are under investigation, including the development of new disposal wells, and disposal of effluent into the man-made lagoon located on the grounds of the Kauai Lagoons Hotel.

A fraction of treated sewage effluent applied to the golf course, and all of the effluent disposed through injection wells enters the water table and eventually reaches the ocean. Because there is a potential for these activities to effect the marine environment, it was deemed necessary to conduct a study to determine the likelihood and magnitude of changes to the marine environment that be expected to occur under the various alternative methods of effluent disposal.

More specifically, the investigation will establish the inter-relationship between the present conditions of marine water chemistry related to groundwater and surface water input and biological community structure in the coastal segment directly downslope from the proposed wells. For the primary site, the coastal segment that is potentially affected is within the outer portion of Nawiliwili Harbor, as well as the area seaward of the Harbor from approximately Ninini Point to Ahukini (see Figure 1). If it is determined that the present input of groundwater to the ocean is altering water quality to the extent that biotic community structure may be affected, it will be possible to evaluate what might happen with the change in disposal (e.g. increase in input to the ocean). However, if it is determined that groundwater is not affecting ocean water quality to the degree that there is an effect to community structure, there is justification to conclude that altering the input of groundwater will not result in changes to the marine communities.

II. METHODS

A. Water Chemistry

The sampling rationale of the study was to evaluate the extent of groundwater input from land to the coastal ocean, and to determine the fate of this groundwater once it enters the ocean. At each of five sampling sites, water chemistry was evaluated in a series of water samples that were collected from the shoreline to the open ocean on transects oriented perpendicular to the shoreline. In order to most accurately define the horizontal gradients where groundwater mixes with ocean water, sampling was most intense in the nearshore zone. Sampling also took place through the water column to determine the extent of vertical stratification.

Water samples were collected at the surface and near the bottom at five sites shown in Figure 1; Sites 1 and 2 were located along the exposed shoreline off of Ahukini and Kamilo Point, respectively. In general, the shoreline north of Ninini Point consists of near vertical rocky cliffs. Sampling sites were selected where small sand-rubble pocket beaches occurred along the rock shoreline. Sand beaches generally have higher groundwater discharge than rocky cliffs, so the sampling sites were selected to detect maximal groundwater discharge. Site 3 was located off a small sand beach inside of Ninini Point. Sites 4 and 5 were located along Kalapaki Beach in the outer portion of Nawiliwili Harbor. The entire study area appears to be down-gradient from the existing Lihue WWTP disposal wells.

Water sampling was conducted on November 25, 1996. Sea conditions during the sampling at all locations consisted of mild tradewinds (10-15 knots) and small swells of 2-3 feet. As a result of direct exposure to tradewinds and tradewind generated seas, typical marine conditions off the exposed cliff faces of Sites 1 and 2 result in very vigorous mixing of land-derived freshwater and oceanic water in the coastal zone. Thus, the day selected for sampling with mild winds and swell represents conditions of minimal mixing where dilution of effluxing freshwater with seawater is substantially lower than during more typical tradewind and surf conditions. As a result, the survey

results during calm conditions provide a representative estimate of what can be considered "end-point" conditions revealing maximum gradients of freshwater-seawater mixing.

Sampling was conducted using a 19-foot boat, and by divers swimming from the boat to the shoreline. Water samples were collected from the boat using a 1.8 liter Niskin-type oceanographic sampling bottle. The bottle was lowered to the desired sampling depth with endcaps cocked in an open position so that water flowed freely through the bottle. At the desired depth a weighted messenger released from the surface tripped the endcaps closed, isolating a volume of water from the desired sampling depth. At all sampling stations where water depth was greater than 1 meter, two water samples were collected; a surface sample from within 10 centimeters (cm) of the air-sea interface, and a deep sample within 50 cm of the ocean floor. Inshore samples were collected by swimmers who filled 1-liter polyethylene bottles at the desired locations.

Water quality constituents that were evaluated include the 10 specific criteria designated for open coastal waters in Chapter 11-54, Section 06 of the Water Quality Standards, Department of Health, State of Hawaii. These criteria include: total nitrogen (TN), nitrate + nitrite nitrogen (NO_3^- + NO_2^-), ammonium (NH_4^+), total phosphorus (TP), chlorophyll a (Chl a), turbidity, salinity, pH and temperature. In addition, orthophosphate phosphorus (PO_4^{-3}) and silica (Si) are reported because these constituents can be indicators of biological activity and the degree of groundwater or stream water mixing.

Subsamples for nutrient analyses were immediately passed through sub-micron filters (GF-F) into 125-milliliter (ml) acid-washed, triple rinsed, polyethylene bottles and stored on ice until returned to the laboratory. Analyses for NH_4^+, PO_4^{3-}, NO_3^-, and Si were performed using a Technicon autoanalyzer according to standard methods for seawater analysis (Strickland and Parsons 1968, Grasshoff 1983). TN and TP were analyzed in a similar fashion on unfiltered samples following oxidative digestion. Dissolved organic nitrogen (DON) and dissolved organic phosphorus (DOP) were calculated as the difference between TN and dissolved inorganic N, and TP and dissolved inorganic P,

respectively. The level of detection for the dissolved nutrients is 0.2 µM for TN and Si, 0.02 µM for TP, and 0.01 µM for PO_4^{3-}, NO_3^- and NH_4^+.

Water for other analyses was subsampled from 1-liter polyethylene bottles and kept chilled until analysis. Turbidity was determined on 60-ml subsamples fixed with $HgCl_2$ to terminate biological activity. Fixed samples were kept refrigerated until turbidity was measured on a Monitek Model 21 90-degree nephelometer, and reported in nephelometric turbidity units (ntu) (level of detection 0.01 ntu). Chl a was measured by filtering 300 ml of water through glass fiber filters; pigments on filters were extracted in 90% acetone in the dark at -5° C for 12-24 hours, and the fluorescence before and after acidification of the extract was measured with a Turner Designs fluorometer (level of detection 0.01 µg/L). Salinity was determined using an AGE Model 2100 laboratory salinometer with a precision of 0.0003‰. pH was determined using a field meter with a combination electrode with precision of 0.01 pH units.

Nutrient, turbidity, Chl a and salinity analyses were conducted by Marine Analytical Specialists (Laboratory Certification NO: HI-0009) of Honolulu, HI.

B. Biotic Community Structure

In order to characterize the response of biotic communities to input of groundwater (characterized by water chemistry analyses), community composition at each of the study sites was qualitatively assessed. This qualitative assessment included field reconnaissance of the environment, with emphasis on noting prominent differences in biotic composition of the study areas. Quantitative reconnaissance surveys were conducted by divers towing behind a slowly moving boat in the same five areas as water chemistry transect sites. These reconnaissance surveys were useful in making relative comparisons between areas, identifying any unique or unusual biotic resources, and providing a general picture of the physiographic structure and benthic assemblages occurring throughout the region of study.

III. RESULTS OF WATER CHEMISTRY ANALYSES

A. Horizontal and Vertical Stratification

Tables 1 and 2 show results of all water chemistry analyses for samples collected at the five sites within the influence of the Lihue WWTP disposal wells. Table 1 shows concentrations of nutrients in micromolar units (μM), while Table 2 shows the same data in units of micrograms per liter (μg/L). Also shown in Tables 1 and 2 are the concentrations of State of Hawaii Department of Health water quality criteria for open coastal waters under "wet" conditions.

Concentrations of eight dissolved nutrient constituents, salinity, turbidity and Chl a, in surface and deep samples are plotted as functions of distance from shore in Figures 2-3. It can be seen in Tables 1 and 2, and Figures 2-3 that with few exceptions, horizontal gradients of dissolved nutrients are steeper at the sample sites in Kalapaki Bay (Sites 4 and 5) compared to the sites along the exposed shorelines (Sites 1-3). At site 1, a small stream flowing into the ocean had concentrations of dissolved nutrients 1-2 orders of magnitude higher than the ocean sample collected at the shoreline. Between 1 and 250 meters from the shoreline, there are no distinguishable gradients of surface salinity and dissolved nutrients. At Site 2, where no stream occurred, there are also no distinguishable gradients in any of the measured constituents in surface waters. At both sites 1 and 2, the deep sample from a distance of 250 m from shore had depressed Si and NO_3^-, and elevated salinity (34.6‰). Low salinity groundwater which contains high concentrations of the inorganic nutrients Si, NO_3^-, and PO_4^{3-}, percolates to the ocean at the shoreline resulting in a nearshore area of mixing. Groundwater and surface water input appears to cause a small, but detectable effect on nearshore waters up to a distance of at least 100 m from shore off the exposed coastal area.

Off Site 3, concentrations of salinity, Si, NO_3^-, and PO_4^{3-} exhibit slightly larger gradients between the shoreline and offshore samples than at Sites 1 and 2. Owing to protection afforded by Ninini Point, water motion from waves and wind is substantially less at Site 3 than at Sites 1 and 2. Hence, mixing of groundwater with ocean water appears to be somewhat less, resulting the slightly steeper gradients. Salinity varies by approximately

1‰ at Site 3 compared to 0.3‰ at Site 2. Si at the shoreline at Site 3 is approximately twice that at Site 2 (8 µM vs 4 µM). However, at all of these sites, while the effect of groundwater mixing with ocean water is discernible, the changes in concentrations are extremely small.

The situation at Sites 4 and 5 is substantially different. Water from a seep on Kalapaki Beach had substantially elevated concentrations of silica, nitrogen (TN, NO_3^-, NH_4^+) and phosphorus (TP, PO_4^{3-}). Comparison of the concentrations of these constituents in the seep water with a potable well show that the seep was substantially enriched in nutrients compared to the well. Concentrations of nutrients in the waters of Kalapaki Bay (Sites 4 and 5) also had substantially elevated nutrient concentrations compared to the offshore sites (Sites 1-3). In general, concentrations decreased with distance from shore, and at each sampling point were higher in surface compared to deep samples. Salinity increased with distance from shore, and at each sampling point was lower in surface compared to deep samples. These relationships indicate that the increased nutrient concentrations are a result of input of groundwater at the shoreline that remains as a distinct surface layer as it mixes seaward in Kalapaki Bay. Owing to the input of high concentrations of nutrients in groundwater, and relatively low physical mixing processes, groundwater effects are very pronounced within Kalapaki Bay compared to outside the Bay.

The patterns of distribution of other dissolved nutrients which are not found in high concentrations in groundwater do not display the same tendencies with respect to distance from shore as the nutrients found in groundwater. Horizontal distributions of NH_4^+, DON and DOP do not show the same patterns of increased values in the nearshore water as Si, NO_3^- and PO_4^{3-}. The patterns of distribution of these constituents is somewhat random with no noticeable trends with respect to distance from shore.

With the exception of the samples collected within 1 meter from the shoreline, turbidity showed no little variation as a function of distance from shore. Overall, turbidity was higher at all stations along transects at Sites 4 and 5 compared to Sites 1-3. within 25 m of the shoreline). Similarly, concentrations of Chl a were uniformly lower

at Sites 1-3 compared to Sites 4 and 5. At Sites 4 and 5, nearshore concentrations of Chl a were approximately an order of magnitude higher than at other sites. The elevated concentrations of Chl a may reflect the high nutrient concentrations at these stations, or more likely, the reduced circulation and longer residence time of water in Kalapaki Bay compared to the exposed coastline at Sites 1-3.

B. Conservative Mixing Analysis

A useful treatment of water chemistry data for interpreting the extent of material inputs from land is application of a hydrographic mixing model. In the simplest form, such a model consists of plotting the concentration of a dissolved chemical species as a function of salinity. It is possible to evaluate the extent of nutrient input from sources other than groundwater efflux by plotting the concentration of the dissolved material as a function of salinity (Officer 1979, Dollar and Atkinson 1992, Smith and Atkinson 1993). Comparison of the curves produced by such plots with conservative mixing lines provides an indication of the origin and fate of the material in question. Figure 4 shows plots of concentrations of four constituents (Si, NO_3^-, NH_4^+, PO_4^{3-}) as functions of salinity for the samples collected in the Lihue area in November 1996. Each graph also shows conservative mixing lines that are constructed by connecting the end member concentrations of open ocean water and water collected from a potable well (5823-01) and a groundwater well used to supply the Kauai Lagoons water feature.

If the nutrient constituent in question displays purely conservative behavior (no input or removal resulting from any process other than physical mixing), data points should fall in a linear array on, or near, the conservative mixing line. If, however, external material is added to the system through processes such as leaching of fertilizer nutrients to groundwater, data points will fall above the mixing line. If material is being removed from the system by processes such as biological uptake, data points can fall below the mixing line.

Dissolved Si represents a check on the model as this material is present in high concentration in groundwater, but is not a major component of fertilizer, and is not utilized rapidly within the nearshore environment by biological processes. It can be seen

in Figure 4 that when Si concentrations are plotted versus salinity, data points for all survey sites 1, 2, 3 and 5 fall in a linear array, while data points for Site 4 have two distinct slopes. Data points at salinities above 28‰ fall on the same line as the other survey sites, while data points from samples with salinity less than 28‰ fall on line with substantially steeper slope. The sample with the lowest salinity (at the shoreline of Site 4) falls near the mixing line for potable water. However, while not shown because of the change in scale, the data point from the shoreline seep (salinity of 2‰) lies far above the mixing lines. These relationships indicate that there appear to be several sources of groundwater with different concentrations of Si entering the coastal ocean. One source, apparent only at Site 4 is substantially enriched in Si relative to groundwater collected in the two wells used to construct the mixing lines, while the other source has less Si at any given salinity than groundwater from sampled wells.

The plots of NO_3^- versus salinity in July 1996 show a similar pattern from to that of dissolved Si (Figure 4). As described above, data points for all sites fall in two linear arrays. However, for NO_3^- the data points at the two most shoreward sampling sites from Site 5 also appear to lie on the same line as points from Site 4. As with Si, all of the data points except the point at the shoreline of Site 4 fall well below the mixing lines. This relationship indicates that if naturally occurring groundwater with no subsidies from human activities mixed conservatively with ocean water (no biological uptake), the concentration of NO_3^- in coastal waters would be higher than measured in samples collected on the five survey transects.

It is also apparent that the relationship between Si and NO_3^- mixing lines varies with the two wells. In the potable well, the concentration of Si is higher at any salinity than in the lagoon well. However, in the lagoon well, the concentration of NO_3^- at any given salinity is substantially higher than in the potable well. Should these groundwaters come from the same source, it appears that there is a subsidy of NO_3^- between the elevation of the potable well and the lagoon well.

The distribution of the other form of dissolved inorganic nitrogen, NH_4^+, shows no overall inverse relationship with salinity at any of the survey sites during the present survey (Figure 4). Concentrations of NH_4^+ are similar in groundwater and open ocean

water resulting in a nearly "flat" conservative mixing lines. The lack of any linearity in the data points for NH_4^+ indicate that this material does not appear to be added to the ocean via input from land. Data points for nearly all of the measured concentrations of NH_4^+ as functions of salinity fall above all mixing lines. It appears that there is a natural input of this form of nitrogen from biological processes within the nearshore zone.

PO_4^{3-} is also a major component of fertilizer and sewage effluent, but is usually not found to leach to groundwater to the extent of NO_3^-, owing to a high absorptive affinity of phosphorus in soils. The distribution of data points of PO_4^{3-} versus salinity in the samples off of Lihue is similar to those of Si and NO_3^-. Most points from Sites 1-3 and 5 fall along a linear array below the conservative mixing lines, while the most shoreward samples from Site 4 appear to contain water with a distinctly different concentration of PO_4^{3-} than either of the wells.

C. Compliance with DOH Criteria

Tables 1 and 2 show State of Hawaii Department of Health (DOH) water quality standards for the "not to exceed 2% and 10% of the time" criteria for open coastal waters under "wet" conditions, which is the category applicable to Transect Sites 1-3, and embayments, which is the category applicable to Transect sites 4 and 5. While the 2% and 10% criteria are not technically meaningful with only a single sampling at each location, comparison of the data with these limits is useful for gaining a general understanding of the water quality of the area.

Inspection of Tables 1 and 2 indicates that at Sites 1-3 only one sample exceeds any of the water quality standards. At the shoreline of Site 1, NO_3^-. NH_4^+ and Chl a exceed the 10% limits. No samples from Sites 2 and 3 exceed any of the criteria for open coastal waters. At Sites 4 and 5, all of the surface samples, and one deep sample exceed the 10% and 2% criteria for NO_3^-. With the exception of a single sample at the shoreline of Site 4, which exceeds the 10% criteria for TN, none of the other constituents exceed DOH criteria within Kalapaki Bay.

As noted in the sections above, NO_3^- is a natural component of groundwater. In areas that receive substantial input of groundwater there is typically a zone of mixing near the shoreline where NO_3^- concentrations may consistently exceed DOH criteria as long as salinity remains low. Thus, it appears that natural processes can result in water quality that exceeds specified DOH limits. As discussed above, all of the concentrations of NO_3^- within Kalapaki Bay are lower than would be expected for conservative mixing of potable groundwater with ocean water. Hence, it appears that because of the low mixing of groundwater and ocean water in Kalapaki Bay, nearshore waters will exceed consistently exceed DOH criteria from input of natural groundwater.

IV. RESULTS OF BIOTIC COMMUNITY ASSESSMENT

When considering environmental changes caused by altered land use, benthic (bottom-dwelling) communities are probably the most useful biological assemblages for direct evaluation of marine environmental impacts. Because benthos are generally long-lived, immobile, and can be significantly affected by exogenous input of potential pollutants, these organisms must either tolerate the surrounding conditions within the limits of adaptability or die. Reef corals serve as ideal indicator because they are sensitive to salinity changes in the environment, and because they are have life spans from decades to centuries provide a good integration of environmental conditions. In addition, corals are considered "keystone" species that serve as sources of food and shelter for many other reef species. Benthic algae are important components of the benthic community because they have the potential to respond to changes in nutrient concentrations associated with groundwater flux by changes in biomass and abundance. Thus, determining the effects that the proposed project may exert on coral/algal communities provides a good indication of overall effects to the entire biotic community.

Concussive force from wave stress is probably the major natural determinant in shaping coral community structure by causing breakage of adult colonies and prevention of planular settlement on empty substrata. Suspended sediment loading is another important natural factor in defining coral community structure, as sediment

accumulation can bury living corals, and prevent settlement on shifting substrata. Moving sediment, such as shifting sands can cause abrasion and mortality of adult colonies.

Inspection of Sites 1 and 2 off of the exposed shoreline between Nawiliwili Harbor and Ahukini revealed a fairly consistent habitat. Because the area is exposed to open ocean sea and swell, the nearshore area is almost continually subjected to extreme wave energy. As a result, the region from the rocky shoreline to a distance of approximately 30 m offshore, and a water depth of 0 to 3 m is almost completely devoid of corals and benthic algae. Such a scenario is typical of most exposed Hawaiian shorelines where the energy from breaking waves results in such vigorous water motion that few or no attached organisms can survive. Seaward of this inshore region, corals occur as small encrusting patches on the rocky bottom. Predominant species are *Porites lobata* and *Pocillopora meandrina.* With distance seaward and increasing water depth, abundance of corals progressively increases as a function of reduced wave stress. The zone between approximately 50 m offshore to 200 m offshore (water depth 6-15 m) contains relatively high levels of coral cover (estimated at approximately 20-35% of bottom cover). Most coral colonies are sturdy lobate or encrusting growth forms that are able to withstand occasional stress from seasonally large storm waves. Few delicate growth forms such as finger coral or plating corals were observed. No areas of abundant benthic algae were observed anywhere on the exposed reefs off sites 1 and 2.

At Site 3, inland from Ninini Point, the marine habitat consisted of sand/rubble beach and nearshore area. No corals or benthic were observed in this area. At Site 4, in the eastern corner of Nawiliwili Bay the shoreline area consists of a rock/ sand flat that grades into a sand bottom that extends to the Nawiliwili Harbor channel. During the present survey, rocks in the nearshore zone were covered with an amorphous algal slime, with no macroalgae or coral. The sand floor extending out to the channel was also devoid of attached macrobiota. At Site 5, off of the central portion of Kalapaki Beach, the inner area in the surf zone consisted of sand bottom in constant resuspension from wave action. As at Site 4, moving seaward, bottom composition was predominantly barren rocks and sand out to the channel with little macrobenthos.

V. DISCUSSION

1. Present Conditions

In considering the Lihue WWTP disposal system alternatives, the only physical/chemical factor that may be altered is input of groundwater in the nearshore ocean. As discussed above, increases of groundwater input can result in a zone of mixing where salinity is lowered and inorganic nutrient concentration is elevated over open coastal oceanic conditions.

Under the present conditions, all treated effluent from the LWWTP is used to irrigate the Kauai Lagoons golf course. A fraction of the nutrients contained in the effluent will be taken up by the golf course turf; the remaining nutrients will percolate through the soil thatch layer to the groundwater table. Studies of other golf courses using treated sewage effluent reveal that about 10% of the applied effluent reaches groundwater (Chang and Young 1977, Dollar and Atkinson 1991). Groundwater subsequently flows seaward and enters the ocean and mixes with seawater in the nearshore zone.

Direct exposure to tradewind generated wind and swells, as well as long period swells from the north result in an extremely well-mixed nearshore environment off Lihue beyond the confines of Nawiliwili Bay. As a result, groundwater diffusing to the ocean is rapidly diluted by the infinitely large reservoir of ocean water to background oceanic concentrations. Measurements made during when seas were relatively calm showed only small horizontal and vertical gradients of groundwater constituents (freshwater, NO_3^- and PO_4^{3-}) that appear to have no effect on biotic community structure, nor appear to cause water quality to exceed DOH criteria.

Within Nawiliwili Bay, groundwater entering the nearshore zone exhibits elevated nutrient concentrations relative to the exposed coastal sites. However, mixing analyses indicate that the concentrations found in nearshore waters are less than what would be expected from the mixing of natural groundwater mixing with ocean water. As a result, it appears that the groundwater that is entering the nearshore zone may be groundwater that has percolated through the golf course with nutrient removal by

uptake from golf course turf. In any event, it appears that under the present scenario, there is no indication of excess nutrients entering the waters of Nawiliwili Bay.

2. Projected Disposal in Injection Wells

One alternative option for disposal of treated sewage effluent from the LWWTP is injection into disposal wells located within near to the treatment plant. Depth of the two existing wells is approximately 400 feet below sea level. Dye tracer studies of similar injection wells at the Lahaina Sewage Treatment Plant on Maui revealed virtually no areas of increased effluent concentrations in the nearshore ocean as a result of disposal in injection wells (TetraTech 1994, Dollar 1997). Lack of detection of the effluent plumes appears to be a result of high dilution and dispersal of the effluent in the water table, and lack of surfacing following deep injection as a result of multiple layers of impermeable strata underlying the Lahaina area. Because of these factors it appears that injected effluent is highly diluted within groundwater prior to discharge to the ocean, and is enters ocean waters at depths similar to the depth of injection (>200 feet). At these depths and dilutions, it appears that there is little or no potential for the effluent to affect water quality and biological processes in the nearshore zone.

The injection wells at Lahaina are considerably shallower (~200 feet below sea level) than the Lihue wells. Thus, if there are no major differences in the geological structure of the Lihue area which would facilitate rise of the effluent plume through strata to the surface, it could be expected that the effects to nearshore ocean processes from the Lihue wells would be similar to the Lahaina wells. Thus, injection of effluent into deep disposal wells would likely have no effect on the marine environment.

3. Projected Disposal into the Kauai Lagoons Water Feature.

Man-made, rubber lined lagoons on the grounds of the Kauai Lagoons Hotel hold an estimated 70 million gallons of water. Water is supplied to the lagoons from two wells at a flow rate of approximately 0.25 mgd. With no discharge from the lagoons and no leakage, the only water loss from the lagoons takes place through evaporation. Studies

of drawdown of water levels when pumps are not operating indicate that water loss approximately equals pumpage of about 0.25 mgd.

Nutrient concentrations in water in the lagoons, in water from the wells that supply the lagoons, and from the Lihue WWTP effluent are shown in Table 3. It can be seen that concentrations of NO_3^- and PO_4^{3-} in the lagoons is approximately an order of magnitude less than in the well water pumped into the lagoons, which is in turn an order of magnitude less than the concentrations in the sewage effluent.

As stated above, there are no major loss terms for the lagoon other than evaporation. Evaporation will not remove salt or dissolved nutrients from the lagoon. Hence, with no other processes at work, and evaporation and water input at equal rates, water in the lagoon should have similar salt and nutrients than the source well water. Inspection of the data in Table 3 shows that this is the case for salinity, with values in the lagoons similar to the source wells for the lagoons. However, most nutrient concentrations in the lagoons are substantially lower than in the source well waters. The exception is NH_4^+ which is virtually undetectable in the source wells, but in high concentration in the lagoon.

These results suggest that the lagoon system may be considered in an "equilibrium" with respect to nutrient dynamics. Dissolved inorganic nutrients are taken up by plants which are grazed by herbivores, which in turn excrete organic nutrients. The lowered inorganic nutrient composition suggest uptake by plants and the increased NH_4^+ suggests excretion of organic material that is typical of systems with high biological activity. It is somewhat surprising, however, that Si is also reduced in the lagoons relative to the source wells. Such a reduction indicates substantial uptake of Si by some plants in the lagoon, possibly silicious diatoms.

While the concentrations of the major plant nutrients NO_3^- and PO_4^{3-} is reduced in the lagoons relative to source waters, the concentrations in the lagoons are still detectable. However, concentrations of PO_4^{3-} are near the limit of detection, while there is comparatively high concentrations of NO_3^-. Hence, it appears that PO_4^{3-} is the limiting nutrient to the plant uptake in the lagoons. Inspection of the lagoons indicates that there

is no extensive algal growth in the lagoons, and that the aesthetic quality can be considered "good" for such a system. It appears that with the nutrient input from the supply wells, and P limitation to the system, the system remains in a favorable state.

Replacing the input water to the lagoons from the present well water to sewage effluent would increase the nutrient concentration in the incoming water substantially. Based on the data in Table 3, if the volume of effluent pumped into the lagoons equals the amount of well water presently pumped, the concentration of NO_3^- would increase by a factor of about 5, while the concentration of PO_4^{3-} would increase by a factor of about 36. If PO_4^{3-} is indeed the limiting nutrient in the lagoons, such an increase provides the potential for substantially more plant growth. While there are grazers in the lagoons (primarily herbivorous fish) that may be able to keep pace with such increased plant growth, it is also possible that plant growth will overwhelm the system resulting in a decline in aesthetic quality.

VI. CONCLUSIONS

Based on the data collected for the present study the following conclusions can be drawn:

1. Potential changes in the disposal scenarios for the Lihue Wastewater Treatment Plant could alter the input of materials (primarily dissolved nutrients) to the coastal ocean. Depending on the location that this input enters the marine environment and at what levels of dilution, such input could potentially affect water quality and biotic community structure.

2. Input of groundwater is detectable at offshore sites fronting the area of the Lihue WWTP. However, this effect of this input in minimal owing to high levels of physical mixing processes which rapidly dilute groundwater to background coastal ocean concentrations with a short distance from the shoreline. Because of the constant mixing, it appears that there is no effect of groundwater on water quality to the extent that it could affect biotic community composition.

2. Within Nawiliwili Bay, physical mixing processes are substantially less than in the exposed coastal region. As a result, nutrient concentrations are elevated in nearshore waters off Kalapaki Beach. However, when these concentrations are scaled to salinity, it appears that the concentrations of nutrients are lower than what would be expected if uncontaminated groundwater is mixed with ocean water. Such a result is either due to uptake of nutrients from groundwater prior to reaching the ocean, or that groundwater in the Kalapaki area is from a different source as the groundwater in a potable upland well. As groundwater entering the nearshore zone is a natural phenomenon throughout the Hawaiian Islands, it appears that at present the concentrations of nutrients entering the inshore waters of Nawiliwili Bay cannot be considered an impact to the environment.

3. At present, all effluent from the Lihue WWTP is disposed of as irrigant to the Kauai Lagoons Golf Course. As described above, there is presently no indication of environmental concerns with respect to nutrient addition to the coastal ocean. Therefore, it does not appear that continued irrigation of the golf course with treated sewage effluent should cause any environmental problems with respect to water quality or biotic community structure.

4. Disposal of treated effluent into deep injection wells should not result in any negative effects to marine water quality or community structure. Studies on similar, but much shallower, injection wells off Lahaina Maui, indicate that effluent probably enters the very dilute concentrations at depths near the depth of the injection wells. Barring significant differences in geological structure of the bedding layers in Kauai compared to Maui, effects of disposal of effluent in injection wells in Lihue should will probably not result in any detectable changes in water quality of the nearshore ocean.

5. Man-made lagoons on the grounds of the Kauai Lagoons Hotel are supplied with water through two wells. Water is removed from the lagoons only through evaporation. Because salinity in the lagoons is about the same as in the supply water, it appears that input equals evaporation. Nitrate and phosphate concentrations in the lagoons are substantially lower than in the supply water, while ammonium is higher in the lagoons than in the supply water, indicating biotic cycling with the lagoon. Phosphate levels in the

lagoons are drawn down to near the level of detection indicating that this is the limiting nutrient. If supply to the lagoons if changed from well water to effluent, phosphate concentrations in the input water will increase by about 40-fold. It is possible that such an increase will substantially change the apparent steady state that presently exists in the lagoons. Such a disruption could result in substantial algal growth which could seriously alter the aesthetic value of the lagoons. While grazing herbivores in the lagoons may have the capability of controlling increased plant growth, the possibility also exists that such growth could overwhelm the grazing capacity, or otherwise shift the dynamics of the lagoons to result in unfavorable conditions. Because the lagoons are essentially a "closed system" with respect to nutrients, there appears to be high potential for alteration should the nutrient loading increase to the magnitude that would occur if supply well water is replaced with treated effluent.

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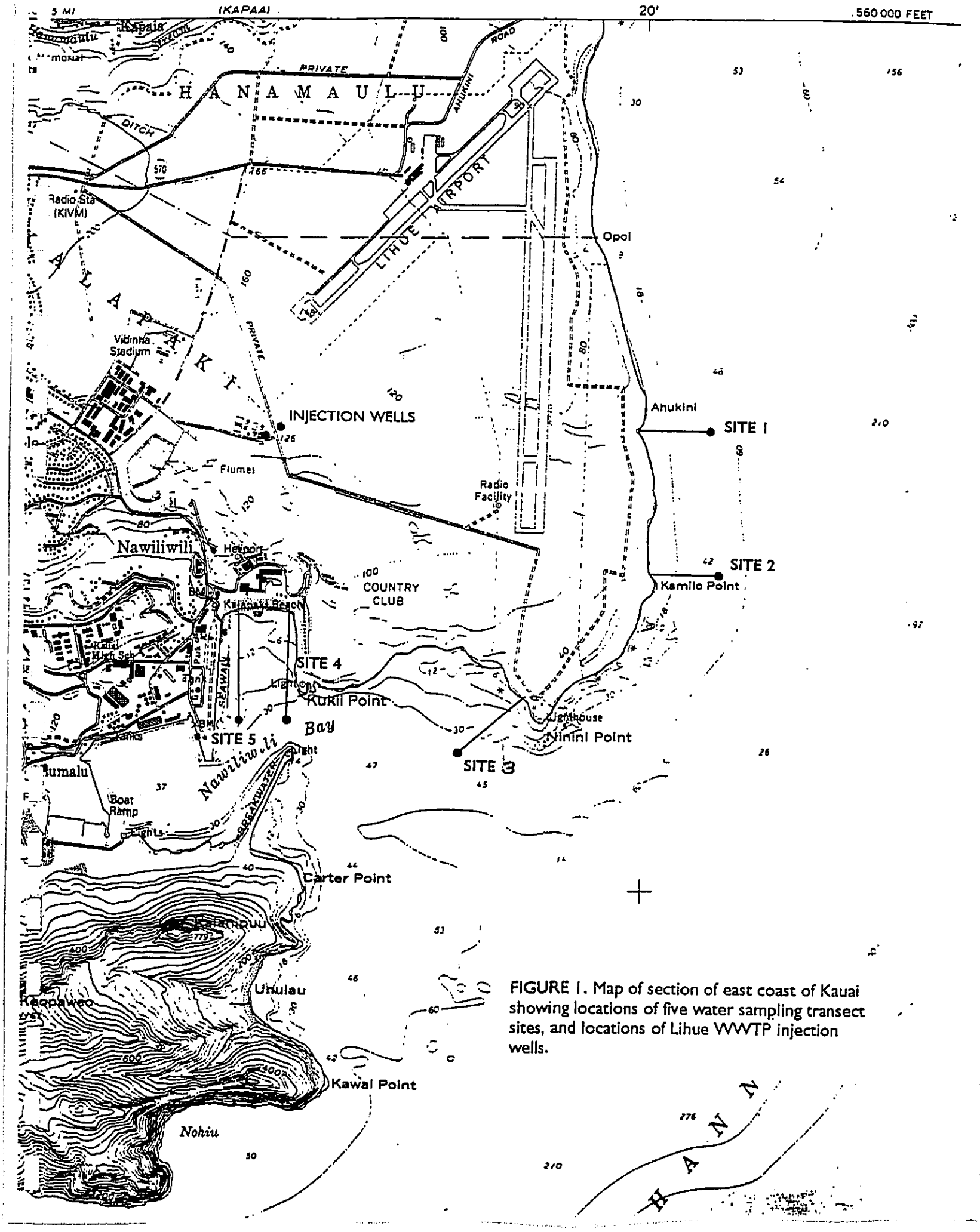

FIGURE 1. Map of section of east coast of Kauai showing locations of five water sampling transect sites, and locations of Lihue WWTP injection wells.