BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

March 27, 2001

'01 APR 26 P2:36

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

Dear Ms. Salmonson:

Subject: Finding of No Significant Impact for the Board of Water Supply's Honolulu Desalination Study

The Board of Water Supply has reviewed the comments received during the public comment period, which began on October 23, 2000. We have determined that the environmental impacts of this project have been adequately addressed as discussed in the Final Environmental Assessment (EA) and are therefore, issuing a Finding of No Significant Impact. We request that our proposed desalination study and exploratory well project be published as Finding of No Significant Impact in the next Office of Environmental Quality Control (OEQC) Bulletin.

Attached are the completed OEQC Bulletin Publication Form and four (4) copies of the EA for your review.

If you have any questions, please contact Iris Oda at 527-5245.

Very truly yours,

FOR CLIFFORD S. JAMILE
Manager and Chief Engineer

Attachments

DOCUMENT CAPTURED AS RECEIVED

P-752/00

RECEIVED
BD OF WATER SUPPLY
Nov 20 5 26 PM '00

Nov 17 3 32 PM '00

Joseph N. A. Ryan, Jr.
41-430 Waikupanaha Street
P. O. Box 562
Waimanalo, Hawaii 96795

November 17, 2000

Honolulu Board of Water Supply
Clifford S. Jamile
630 South Beretania Street
Honolulu, Hawaii 96843

RE: Desalinization Study, Draft Environmental Assessment Comments

Dear Mr. Jamile:

I am opposed to the premature implementation of a desalinization program in the C&C of Honolulu for the following reasons:

1) Agriculture demands on the potable water supply have been greatly reduced since the closing of the sugar mills and the EA does not seem to address the lessened draw on the existing water supplies.

2) Desalinization is very expensive and it is "new technology" which is likely to undergo great changes at great expense in a short time. There is no way to predict how expensive future retrofitting and remodeling to keep up with new innovations will be to water consumers in Honolulu.

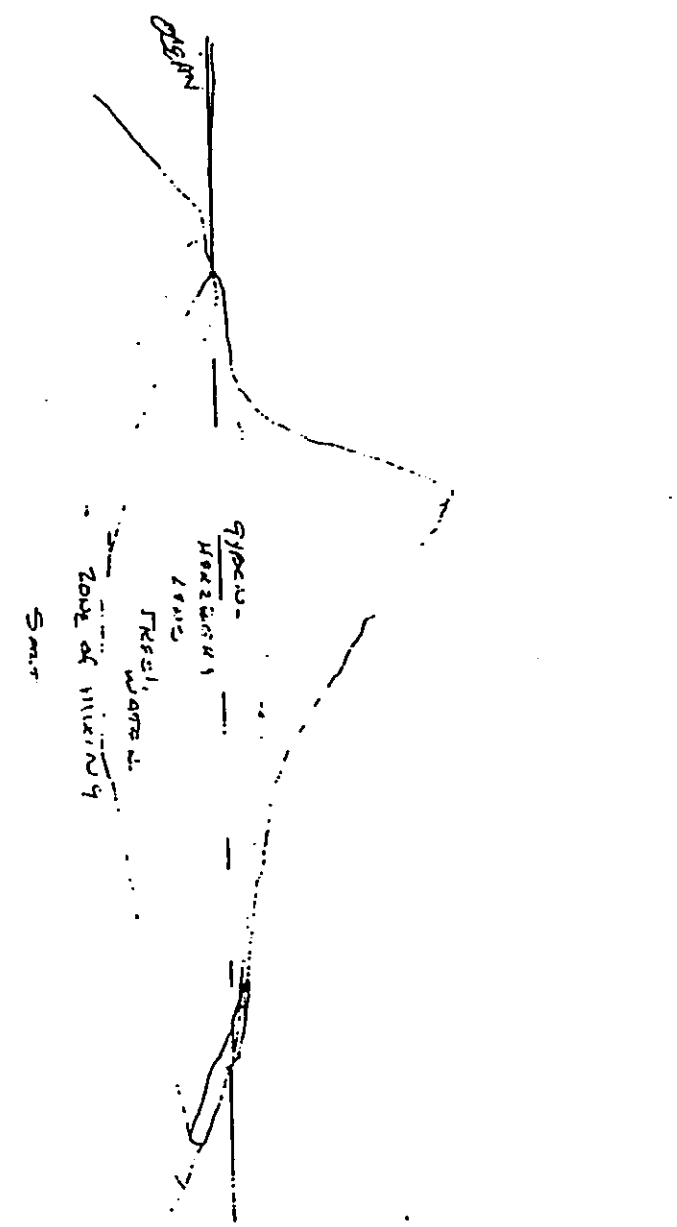
3) There is no reliable inventory of available water supplies. The BOWS develops water supplies based on projected demand by proposed development. This is essentially a process of land development controlled by politicians and not based on the carrying capacity of the natural resource.

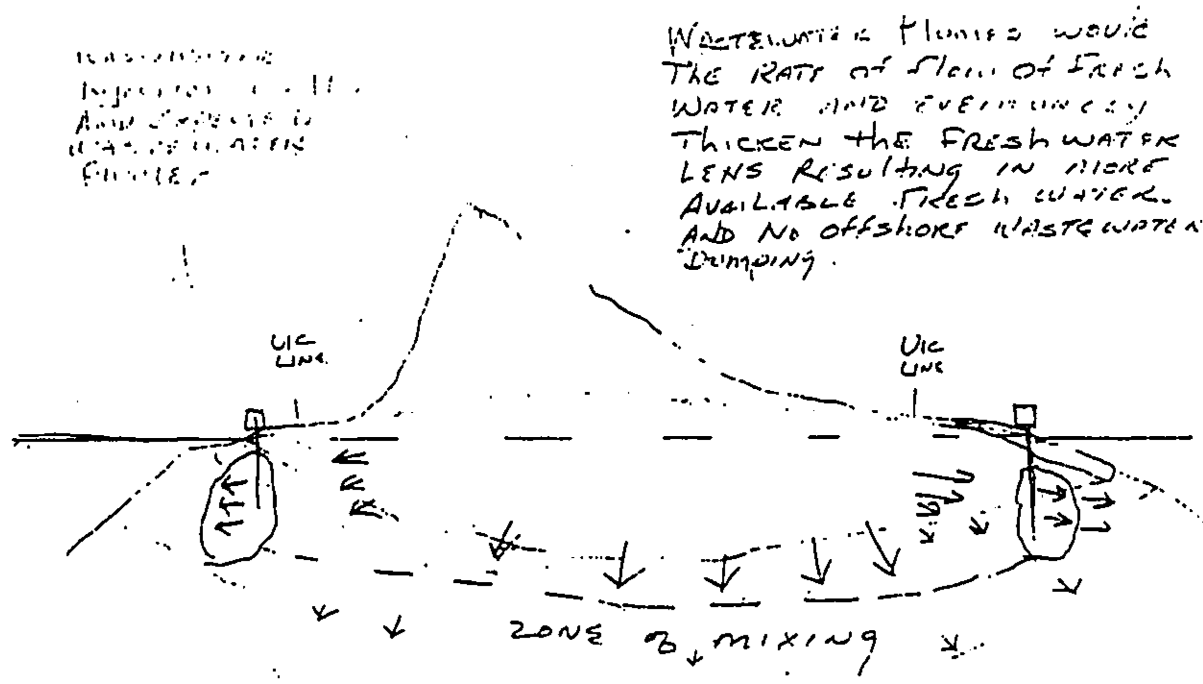
4) A greater benefit may be found at less expense through the use of recycled wastewater to protect and increase the basal lens water reservoir. This system is based on the theory that all water on the island eventually goes to the sea and that water pressure seeks equilibrium. A series of wastewater injection wells oceanward of the UIC line would increase the pressure gradient upslope thereby slowing the rate at which fresh water leaves the island and result in thickening the Gyben-Herzberg fresh water lens and increased storage of excellent quality groundwater. The injection wells would be a beneficial reuse qualifying for federal funding and improving the water quality surrounding the various wastewater outfalls, i.e., Kaneohe Bay and Mamala Bay over which the city has been sued so often. It appears possible that the 100 million gallons of wastewater dumped from Oahu everyday could be used to increase the basal lens at the rate of 100 million gallons a day. The attached diagrams illustrate this suggestion. (It is my understanding, from a 1998 Legislative Reference Bureau report, that should the federal exemption for the Sand Island Wastewater Treatment Plant be revoked, bringing the plant into compliance with federal law would cost $200,000,000.00. Changing the plant discharge to injection well eliminates the need for NPDES permitting for the deep water discharge.)

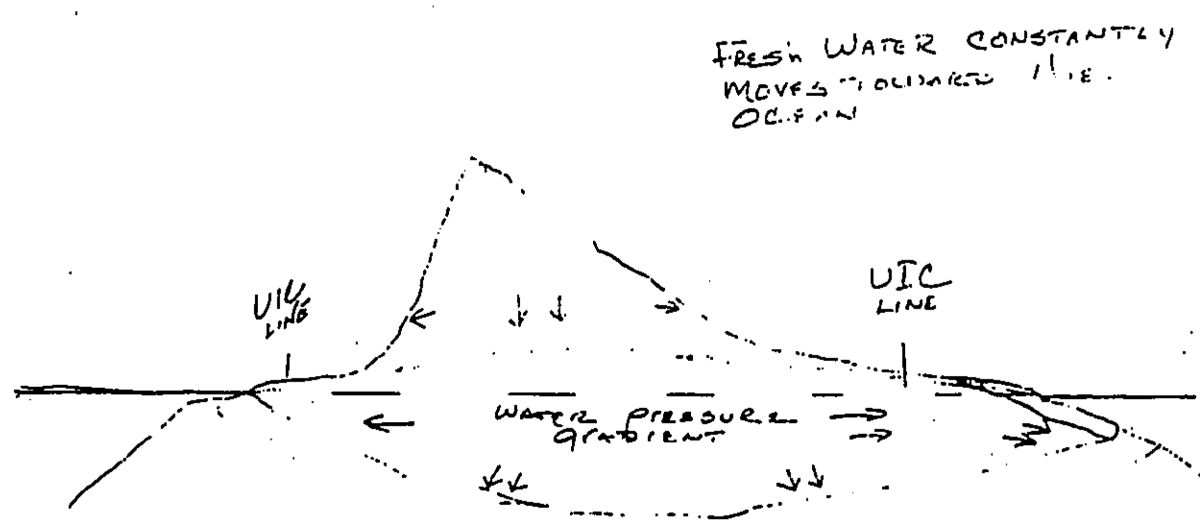
Thank you for the opportunity to provide comments.

Sincerely

Joe Ryan Jr. (phone 259-8463)







BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

December 1, 2000

Mr. Joseph N. Ryan, Jr.
41-430 Waikupanaha Street
Waimanalo, Hawaii 96795

Dear Mr. Ryan:

Subject: Your Letter Dated November 19, 2000 on Draft Environmental Assessment of the Desalinization Project

Thank you for your letter and your thoughtful comments on the Draft Environmental Assessment for our desalinization project at Kalaeloa, Barbers Point. Our replies to your comments follow:

1. "Agriculture demands on the potable water supply have been greatly reduced since the closing of the sugar mills and the Environmental Assessment (EA) does not seem to address the lessened draw on the existing water supplies."

   The closing of the sugar plantations has substantially reduced pumping of ground water in the Pearl Harbor and Waialua areas. Replacement diversified agriculture now utilizes some of the water used by the plantation. The purpose of the EA is to address the impact of the proposed project upon salt water and brackish water taken from wells that do affect the potable aquifer.

2. "Desalinization is very expensive and it is "new technology" which is likely to undergo great changes at great expense in a short time. There is no way to predict how expensive future retrofitting and remodeling to keep up with new innovations will be to water consumers in Honolulu."

   Desalination is currently expensive compared to use of ground water. The process is not new and has been practiced for many years on board ships and for high quality industrial water for boilers. The process is energy dependent whether supplied by fuel for the various distillation methods or electricity for the freezing or the reverse osmosis methods. Over the past 30 years, the cost has declined particularly for the reverse osmosis method and the cost of ground water has increased. We do not know, however, whether desalinization costs will further decline to more closely match ground water.

3. "There is no reliable inventory of available water supplies. The BOWS develops water supplies based on projected demand by proposed development. This is essentially a process of land development controlled by politicians and not based on the carrying capacity of the natural resource."

   The Commission on Water Resource Management (CWRM) is charged with the responsibility for inventory and establishment of sustainable yields for Oahu. Although CWRM has revised the Sustainable Yield for the Waipahu-Waiawa subarea of the Pearl Harbor Aquifer, it has not changed values for the remaining areas. Land development requires various approvals and meeting of criteria; change of land use by the State Land Use Commission, review for conformance to the General and Development Plans of the City and County Council approval, availability of water and sewer service, and so forth.

4. "A greater benefit may be found at less expense through the use of recycled wastewater to protect and increase the basal lens water reservoir. This system . . . deep water discharge.)"

   Injection of reclaimed wastewater to recover fresh ground water and to control sea water intrusion into aquifers has been successfully practiced in Orange County, California for over 40 years. Success of the method in California is dependent upon relatively thin alluvial aquifers confined at the top and bottom by impermeable clay strata. Hawaiian basal aquifers lack this structure and are much thicker. The broad horizontal extent of Oahu basal aquifers also requires lines of closely spaced injection well miles long and nearly a thousand feet deep across the entire aquifer to provide an effective barrier to end around leakage of salt water and fresh water.

   Rather than injection of reclaimed wastewater for a barrier to control loss of fresh water into the sea, the Board of Water Supply has reclaimed 13 million gallons a day (mgd) of suitable quality treated wastewater from the Honouliuli Waste Water Treatment Plant (HWWTP) for irrigation of golf courses, landscaping, and common grounds. The reclaimed water which meets R-1 standards of the Health

Department is sold at a lower price than potable water to encourage its use over the Ewa Plains caprock. A reverse osmosis plant produces high quality water from the R-1 water for industrial use at Campbell Industrial Park. Replacement of existing water uses with reclaimed water serves the purposes of reducing demand on potable water, which reduces the need for additional new sources to meet development.

The Sand Island Waste Water Treatment Plant the largest on Oahu at over 60 mgd, has an effluent that is half the salinity of ocean water and is too salty for most user. The salinity is due to seepage of salt water into sewer lines in the coastal areas of Honolulu. The effluent would have to be treated by additional processes such as reverse osmosis to render it suitable to other uses which would raise the cost.

The ocean outfalls for sewage disposal on Oahu are by permit from the U.S. Environmental Protection Agency. The findings of the outfall study on the Honouliuli WWTP indicate that the effluent is impossible to detect a short distance from the discharge because dilution occurs rapidly in the diffuser system and from the strong currents that sweep the coastline from Koko Head towards Barbers Point and beyond Oahu. Neither beneficial nor detrimental effects from nutrients in the effluent can be detected from the outfall. The only beneficial effect has been provision of additional substrate for bottom dwelling organisms to colonize and prosper.

If you have any questions on this reply, contact Chester Lao at 527-5286.

Very truly yours,

CLIFFORD S. JAMILE
Manager and Chief Engineer

CL:lk
cc: B. Uyagawa
C. Lao
P-752/00

2001-05-08-OA-FEA-

Honolulu Desalination Study
Final Environmental Assessment
And
Finding of No Significant Impact (FONSI)

Kalaeloa, Ewa, Oahu, Hawaii
TMK: 9-1-031-028

April 2001

Prepared by:
Board of Water Supply
City and County of Honolulu
State of Hawaii

HONOLULU DESALINATION STUDY ENVIRONMENTAL ASSESSMENT

Table of Contents

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Section 1. PREFACE

This Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) is prepared pursuant to Chapter 343, Hawaii Revised Statutes (HRS) and Title 11, Chapter 200, Administrative Rules, Department of Health, State of Hawaii. Proposed is an agency action involving the expenditure of City and County of Honolulu funds by the Board of Water Supply.

This EA discloses the preliminary planning & engineering, exploratory well construction, test pumping and preliminary desalination technology testing that must occur prior to adequately designing and constructing a full-scale seawater desalination facility. At this time, it is impossible to fully identify all of the impacts and mitigative measures from the construction and operation of a full-scale desalination plant without the design construction plans, specifications and operational plan of the facility. However, the design cannot occur without first conducting preliminary planning, engineering and field-testing. As such, the environmental disclosure process will be conducted in two phases. Phase I for preliminary work and Phase II for the design and construction of the full-scale production facility. This two-step environmental disclosure process is similar to why BWS phases the groundwater well stations into an exploratory well phase and a production well phase.

This EA, to disclose Phase I, which includes conducting the preliminary planning, engineering and field-testing, will be processed as a FONSI by the BWS, determining that the impacts of this portion of the project are not sufficient to require the preparation of an Environmental Impact Statement and thus satisfying the requirement of Chapter 343, HRS.

An Environmental Impact Statement will be conducted for Phase II, the design and construction of the Reverse Osmosis Desalination Facility.

Section 2. PROJECT SUMMARY

Proposing Agency:	City and County of Honolulu Board of Water Supply 630 South Beretania Street Honolulu, Hawaii 96843 Contact: Mr. Barry Usagawa Phone: (808) 527-5235 Fax: (808) 527-5703	
EA Preparer:	City and County of Honolulu Board of Water Supply 630 South Beretania Street Honolulu, Hawaii 96843 Contact: Miss. Iris Oda Phone: (808) 527-5245 Fax: (808) 527-5703	
Approving Agency:	City and County of Honolulu Board of Water Supply 630 South Beretania Street Honolulu, Hawaii 96843 Contact: Clifford S. Jamile Manager and Chief Engineer Phone: (808) 527-6180 Fax: (808) 533-2714	
Project Location:	Preferred: Alt. 1. Alt. 2.	Kalaeloa, Ewa, Oahu Sand Island Wastewater Treatment Plant Keehi Lagoon Beach Park
Tax Map Key/ Recorded Fee Owner:	Preferred: Alt. 1. Alt. 2.	9-1-031:028/Department of Navy 1-5-041:005/State of Hawaii 1-1-003:006/State of Hawaii
Area:	Exploratory Well area: 0.5 acre	
Existing Land Use:	Preferred: Alt. 1. Alt. 2.	undeveloped wastewater treatment plant public recreational facility
State Land Use Classification / Zoning	Preferred: Alt. 1. Alt. 2.	Urban District / F –1 Military and Federal Urban District / I – 3 Waterfront Industrial Urban District / P – 2 General Preservation

Impacts: No significant impacts are anticipated from the construction and testing of the exploratory wells and desalination technology testing. Construction work, primarily drilling, is anticipated to have insignificant short-term noise and air quality impacts in the surrounding area. All government rules and regulations will be followed during construction to minimize impacts.

Permits required:

Federal

Corps of Engineers

- Department of Army Permit (possible)

State of Hawaii

Department of Health, Noise, Radiation and Indoor Air Quality Branch

- Community Noise Permit (possible)

Department of Health, Clean Water Branch

- Nation Pollutant Discharge Elimination System (NPDES) permit (possible)

Department of Land and Natural Resources, Commission on Water Resource Management

- Well Construction permit

City and County of Honolulu

Department of Planning and Permitting

- Grubbing, Grading, and Stockpiling permit (possible)
- Building Permit (possible)
- Zoning Waiver (possible)

Proposed Action: The City and County of Honolulu Board of Water Supply proposes to drill, case and test two (2) exploratory wells on approximately half (1/2) an acre of land at the Kalaeloa Site. The proposed action also

includes the temporary installation of two (2) test pumps and equipment to collect data on productivity and water quality. Also, this environmental assessment discloses the preliminary planning & engineering and preliminary desalination technology testing that must occur prior to the design and construction of a full-scale seawater desalination facility. At this time, it is impossible to fully identify all of the impacts and mitigation measures from the construction and operation of a full-scale desalination plant without the design construction plans, specifications and operational plan of the facility. However, the design cannot occur without first conducting preliminary planning, engineering and field-testing. As such, the environmental disclosure process will be conducted in two phases. Phase I for preliminary work and Phase II for the design and construction of the full-scale production facility. This two-step environmental disclosure process is similar to why BWS phases the groundwater well stations into an exploratory well phase and a production well phase.

Section 3. INTRODUCTION

The BWS is responsible for the management, control and operation of Oahu's municipal water system. As part of this responsibility, the BWS is investigating alternative methods to obtain potable water. In the 1980's, we estimated that the sustainable yield of Oahu's freshwater resources would be attained by the year 2000, however, due to the closure of the water-intensive sugar industry, combined with a flat economy and successful conservation measures, the estimate has been pushed back to beyond the year 2020. However, prudent planning means planning for uncertainty and increased reliability for public health and safety purposes. In 1983 and again in 1995, BWS has had to close major well stations when pesticide levels rose beyond maximum contaminant levels. Development moratoriums had to be imposed in 1983 until treatment systems were built. Recently, the Supreme Court decision on Waiahole Ditch emphasized water resource management of streams. The uncertainty of these judicial decisions on natural resource planning places a greater emphasis on developing alternative resources. Taking advantage of new technologies in alternative water development will reduce the need for new groundwater sources and allow more efficient use of all resources by matching use with water quality. Reclamation and desalination plants for the arid Ewa district add multiple water supplies and associated reliability and flexibility to continue to best serve our customers.

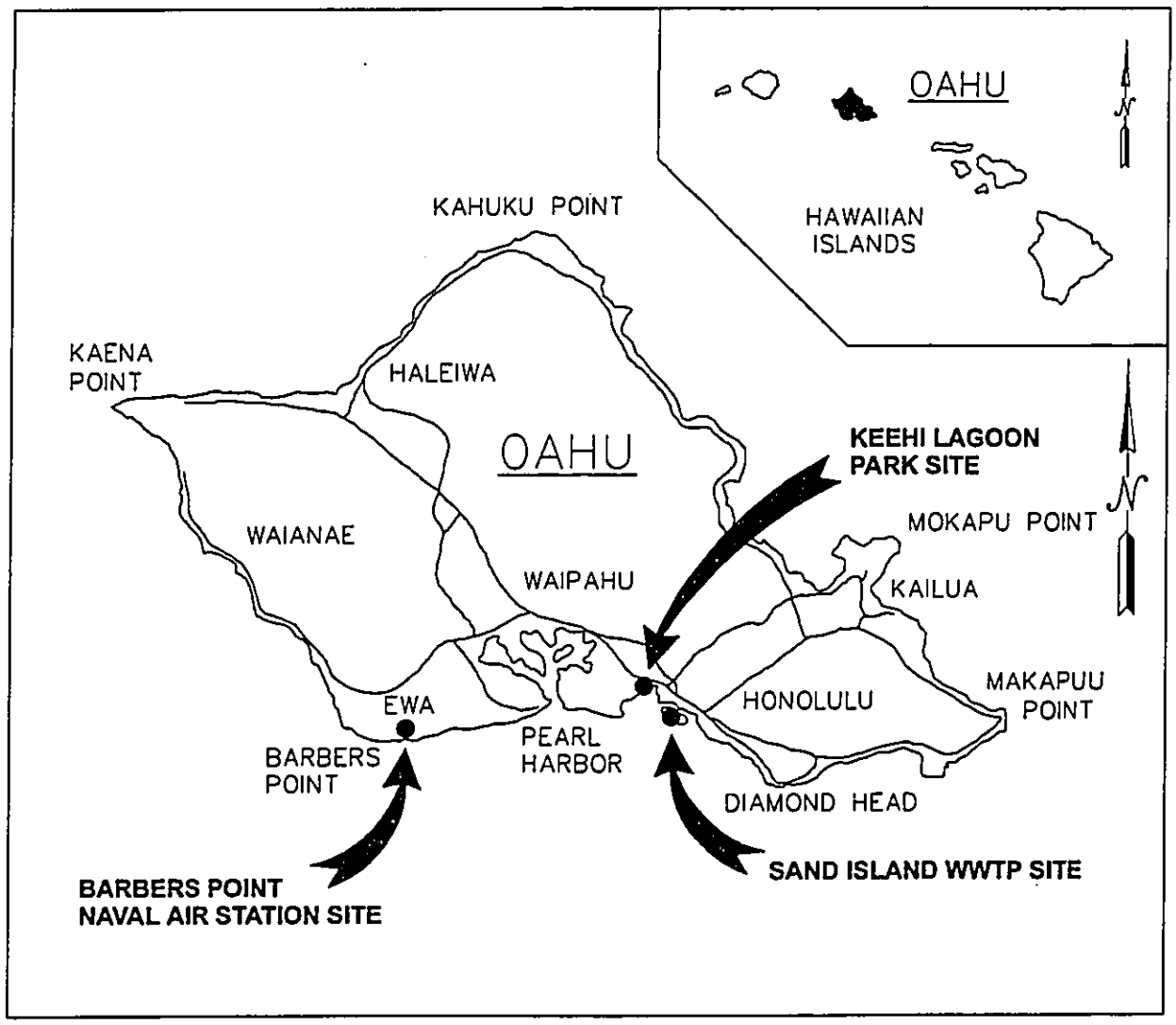
A desalination feasibility study was completed by GMP & Associates, Inc. as part of the planning for a large-scale desalination plant. Desalination is the process used to remove salt and other dissolved minerals from water. In the last few decades, desalination technologies have been used increasingly throughout the world to produce drinking water from brackish groundwater and seawater. Desalination also improves the quality of water supplies for industrial purposes and treated wastewater for recycling.

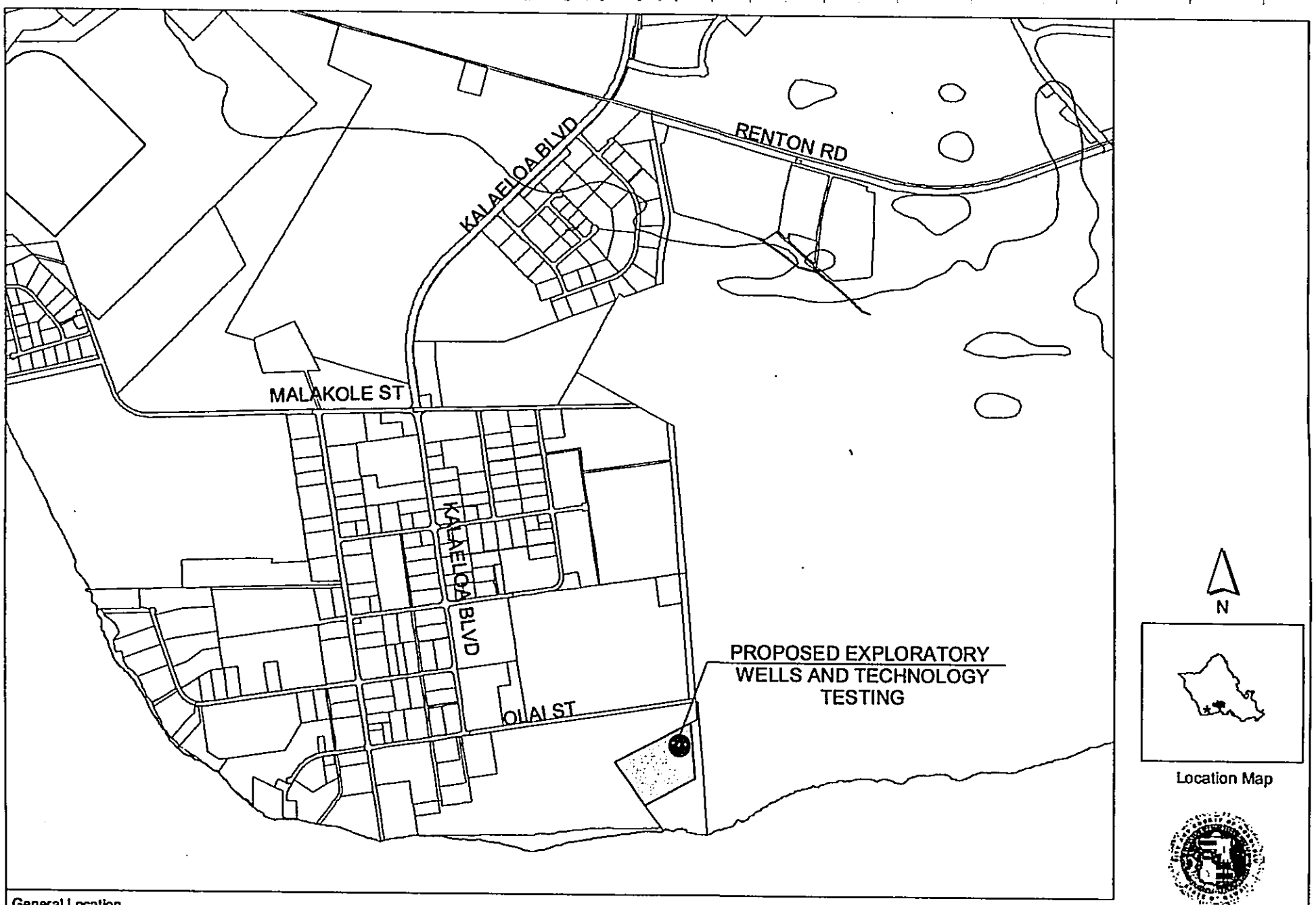
3.1 Study Purpose

The facility would have an initial capacity of 5 million gallons per day and may be expanded incrementally to 35 million gallons per day based on the total projected growth of the Ewa District. The feasibility study project scope included conducting a state-of-the-art technology

survey (DEA, Ref. 1-1), site location and evaluation analysis (DEA, Ref. 1-2) an evaluation of the recommended site and the top two (2) alternative sites, see Figure 3-1, (DEA, Ref. 1-3), which included a review of available water quality data, a review of utility requirements and availability, identification of permits needed, an estimation of project cost, a discussion of the project's impact to long-range planning, a review of the options available for financing, preparation of the conceptual design plans at the preferred site and a draft environmental assessment.

Figure 3-1
Vicinity Map




KALAELOA BLVD
RENTON RD
MALAKOLE ST
KALAELOA BLVD
OIAI ST
PROPOSED EXPLORATORY
WELLS AND TECHNOLOGY
TESTING
N
Location Map
General Location
Prepared By: BOARD OF WATER SUPPLY
City & County of Honolulu
Date Prepared: 07/24/2000
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1:24000
ARCVIEW 3.0B
HONOLULU LAND INFORMATION SYSTEM
COPYRIGHT CITY & COUNTY OF HONOLULU
ALL RIGHTS RESERVED 1998
DATA DOES NOT REPLACE SITE SURVEYS

Figure 3-2

A site in Ewa, which was formerly part of the Barbers Point Naval Air Station, was selected for the project after comparison with sites on Sand Island and within the Keehi Lagoon Beach Park. The Ewa site, which adjoins James A. Campbell Industrial Park, is an ideal location for the desalination project because of its proximity to the ocean and the secondary urban center of Kapolei and because the site has be declared excess Navy land. The 20 acres of land, Figure 3-2, is in the process of being transferred to the Board of Water Supply as a public benefit conveyance.

Reverse osmosis was selected as the preferred desalination technology after an economic comparison between reverse osmosis and multistage flash distillation. Although two potential hosts for distillation steam were identified, the estimated cost for the steam was found to be uneconomical in comparison to electrical costs for a reverse osmosis plant. Conceptual design plans were developed for a reverse osmosis desalination facility at the Ewa site.

There are two (2) seawater aquifers identified as potential sources at the site. The Lower Caprock Aquifer lies between 50 to 800 feet and the basal aquifer lies below the caprock aquifer. The lower caprock aquifer could be tapped to produce up to 10 million gallons per day of product water and the balance of the required source water be made up by the basal aquifer. The seawater qualities from each aquifer are expected to differ in chemical content.

A review of available water quality data from existing wells near the proposed Kalaeloa desalination site found most of the data to be of limited significance due to the shallow depths of the wells. Research of available sources on environmental contamination found no direct evidence for contamination of near-shore ocean water or either the Lower Caprock or Basal Aquifers.

Prior to design and construction of the desalination facility, exploratory wells will be drilled and test pumped for yield and quality. The on-site field tests will allow for an evaluation of site specific characteristics of the geology, water chemistry, and source water parameters that would impact the pretreatment requirements and membrane performance for the reverse osmosis process.

3.2 Project Location

The preferred site, Figure 3-2, is located in the Kalaeloa Community Development District of the Ewa District of Oahu, adjacent and south of the Tesoro refinery and was part of the recently released lands of the Barbers Point Naval Air Station. The 0.5-acre area targeted for testing is the Northeastern corner of Tax map Key 9-1-031:028. The 20 acres of land to be acquired for the desalination facility is a portion of the 30.8 acres of land area considered by the U.S. Department of Health and Human Services to be eligible for no-cost public benefit conveyance to the Board of Water Supply. Vehicular access to the project will be via Olai Road from Kalaeloa Boulevard.

3.3 Project Cost

The cost for the lower caprock exploratory well is $ 200,000 and deep basal exploratory well is *$ 650,000.*

A capital cost of $12 per gallon of product water capacity and an annual operations and maintenance cost of $6.80 per 1,000 gallons were estimated for the initial 5-million-gallons-per-day desalination facility. The capital cost is within the upper range of comparable ground water source development costs. The O&M cost is higher that the costs for groundwater production, however, a 5 mgd production cost is not expected to affect water rates.

Desalination plays an important role in the Board of Water Supply's long-range planning for water development. As the sustainable yield of Oahu's freshwater resources is approached and as the importance of identifying and protecting natural resources are elevated, desalination becomes a viable alternative for potable water production. Desalination may also become a cost-effective alternative for source development should costs and environmental and regulatory constraints to develop additional groundwater sources continue to increase.

3.4 Description of the Proposed Action

3.4.1 Selection of Preferred Technology

Twelve (12) specific technologies for desalination of seawater were evaluated and reviewed. While many technologies have been developed to desalinate saline water, all fall within four broad categories defined as: distillation processes, membrane separation, crystallization extraction and chemical exchange. The technologies reviewed were: 1) Multistage Flash Distillation, 2) Multi-effect Distillation, 3) Vapor Compression, 4) Solar Distillation, 5) Reverse Osmosis, 6) Electrodialysis, 7) Electrodialysis Reversal, 8) Vacuum Freezing Vapor Compression, 9) Secondary Refrigerant Freezing, 10) Eutectic Freezing, 11) Hydrate Formation and 12) Ion Exchange.

The review included an assessment of the status of each as of 1992, a determination of the quality of water produced, an estimation of energy usage and performance, and requirements for operation and maintenance.

Results of this review found that reverse osmosis and distillation were the most widely used processes for desalination of seawater. In addition, the review found that these processes offered advantages over the other processes surveyed. Based upon these conclusions, reverse osmosis and distillation processes were selected for further evaluation. Subsequently, reverse osmosis was found to be more cost effective than distillation due to the lack of an economical source of steam and the expense of providing a steam generator to serve the facility. The conceptual design plan was based upon reverse osmosis.

3.4.2 Site Selection Process, Criteria and Preferred Site

Initial project work identified twelve (12) potential desalination sites. Each site was rated as to: its existing land use; its hydrogeology (i.e., quality of feedwater present); available utilities such as electric power, sewers and water system integration; environmental impacts such as air and water quality, noise impacts and visual aesthetics; options available for brine disposal; and the proximity of steam suppliers. Table 3.1 presents a ranking of the 12 sites. Of the 12 sites reviewed, the top five sites were all in Ewa and of those, three were in a site adjacent to Campbell Industrial Park. Of the sites evaluated that were not in Ewa, Sand

Island ranked first, followed by Kewalo Corporation Yard in Kakaako and Keehi Lagoon Park. The conclusion drawn from this initial survey was that a site within or in proximity to the Campbell Industrial Park would be ideal for the desalination facility.

Table 3.1

Desalination Facility Site Survey Ranking of 12 Prospective Sites

(ref. Site Selection Study)

Ranking	Site	Location	Tax Map Key	Owner
1.	Pacific Tsunami Warning Center	Ewa	9-1-01	Federal Government
2.	Barbers Point Naval Air Station White Plains Beach	Ewa	9-1-13:01	Federal Government
3.	Hawaii Meat Packers	Ewa	9-1-31:01	State of Hawaii
4.	BHP Site at Campbell Industrial Park	Ewa	9-1-32:01	Campbell Estate
5.	Hawaii Project Managers	Ewa	9-1-26:36	Hawaii Project Managers
6.	Sand Island WWTP	Honolulu	1-5-41:05	State of Hawaii
7.	City/Campbell Estate Swap	Ewa	9-1-26:04	Campbell Estate
8.	Kenai Industrial Park	Ewa	9-1-14:04, 05	CIRI Land Development
9.	*Kewalo Corporation Yard*	Honolulu	2-1-60:05	State of Hawaii
10.	Keehi Lagoon Park	Honolulu	1-1-03:06	State of Hawaii
11.	Ewa Demonstration Desalination Plant	Ewa	9-1-15:12	State of Hawaii
12.	Honouliuli WWTP	Ewa	9-1-13:07	City and County of Honolulu

3.4.3 Preliminary Engineering Evaluation & Design

Prior to design and construction, water quality testing to determine the "best" pretreatment option and field tests would be conducted. The conceptual process flow diagram for a 5 mgd desalination facility was completed for the reverse osmosis process. The proposed process would include feed water intake from the caprock or basal wells, feed water chemical conditioning, ultrafiltration pretreatment with wastewater disposal into the upper caprock, reverse osmosis filtration, brine disposal, chemical cleaning of the ultrafiltration and reverse osmosis membranes, post-treatment chemical conditioning, and distribution of potable water into the system.

3.4.4 Exploratory Well Construction

Prior to the start of preliminary desalination technology testing, design and construction, the BWS will drill two (2) exploratory wells on the proposed Kalaeloa site. Following the construction of the exploratory wells, tests will be conducted to determine the quantity and quality of the water that can be produced. Quantity testing will include yield drawdown tests spanning approximately five (5) hours at one (1) hour for each rate and a sustained pumping test spanning seventy-two (72) hours. Power for the pump will be supplied by the contractor using a diesel motor or electric generator. Water withdrawn from these tests will be disposed of on-site to test the soil percolation rates for the brine pond or disposed of in an adjacent drainage canal. The water quality tests will define the treatment process that will be required if the wells are put into production. Following testing, the wells will be capped and all equipment removed. An NPDES permit for exploratory well drilling will be developed if discharge effluent is expected to reach State receiving waters. If the wells are put into production, the specific site requirements for the production well facility and its impacts will be addressed in a separate EIS, which will be conducted for the design and construction of the desalination facility.

Approximately 0.5 acres at the northeast corner of the parcel will be required to accommodate the well drilling, support equipment and necessary supplies. The caprock well will have a 26-inch borehole, cased with 17.4" PVC casing and about 300 feet deep, Figure 3-3. The basal well will have a 24-inch borehole, cased with 20-inch PVC casing and approximately 1,700 feet deep, Figure 3-4. Both wells will be drilled with a reverse circulation rotary rig. A total of 3 to 5 people may be on-site to construct both wells and conduct the quantity testing, which will take about six months. Cuttings from the drilling will be disposed of in an approved manner.

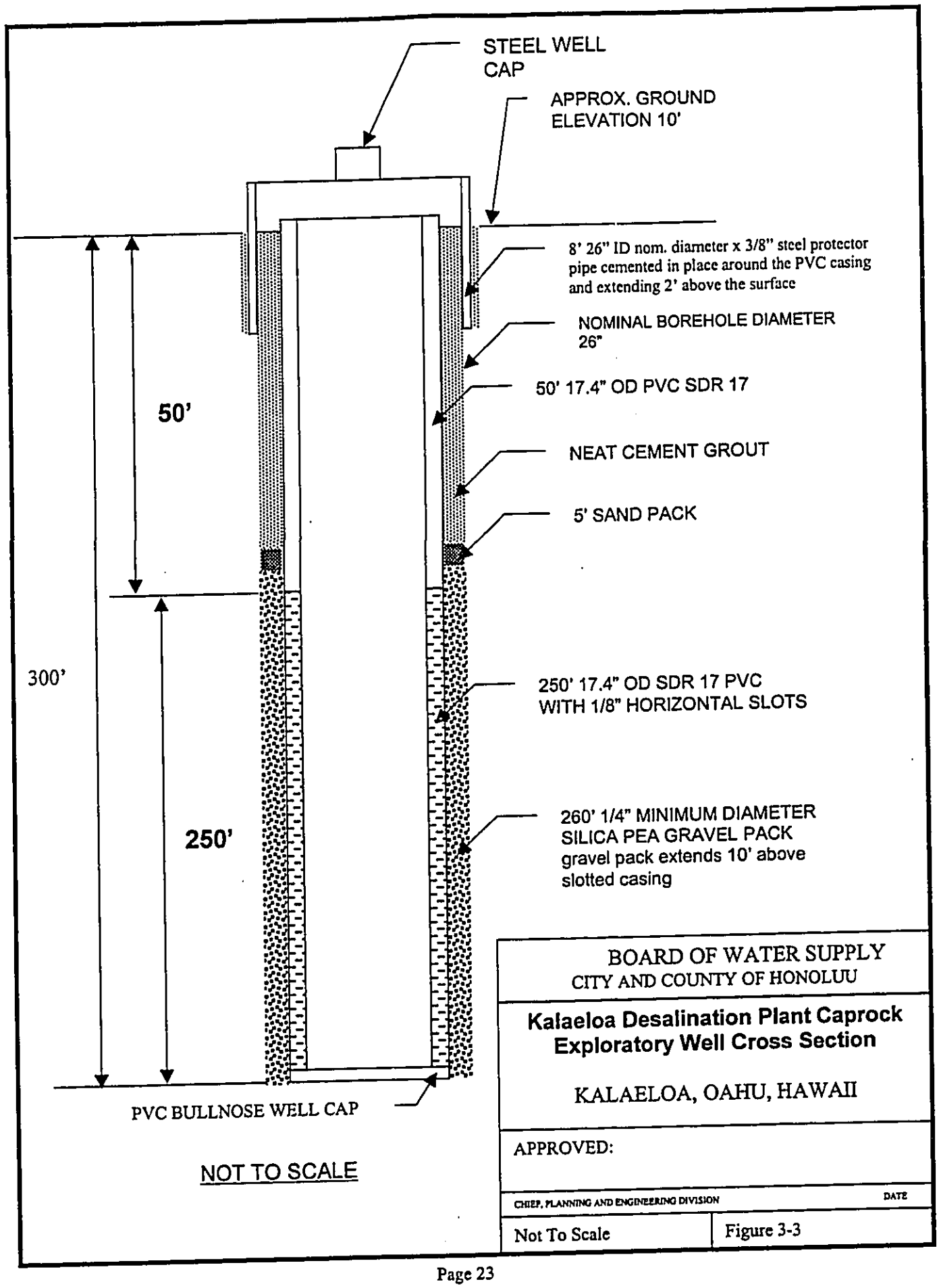
3.4.5 Preliminary Technology Testing

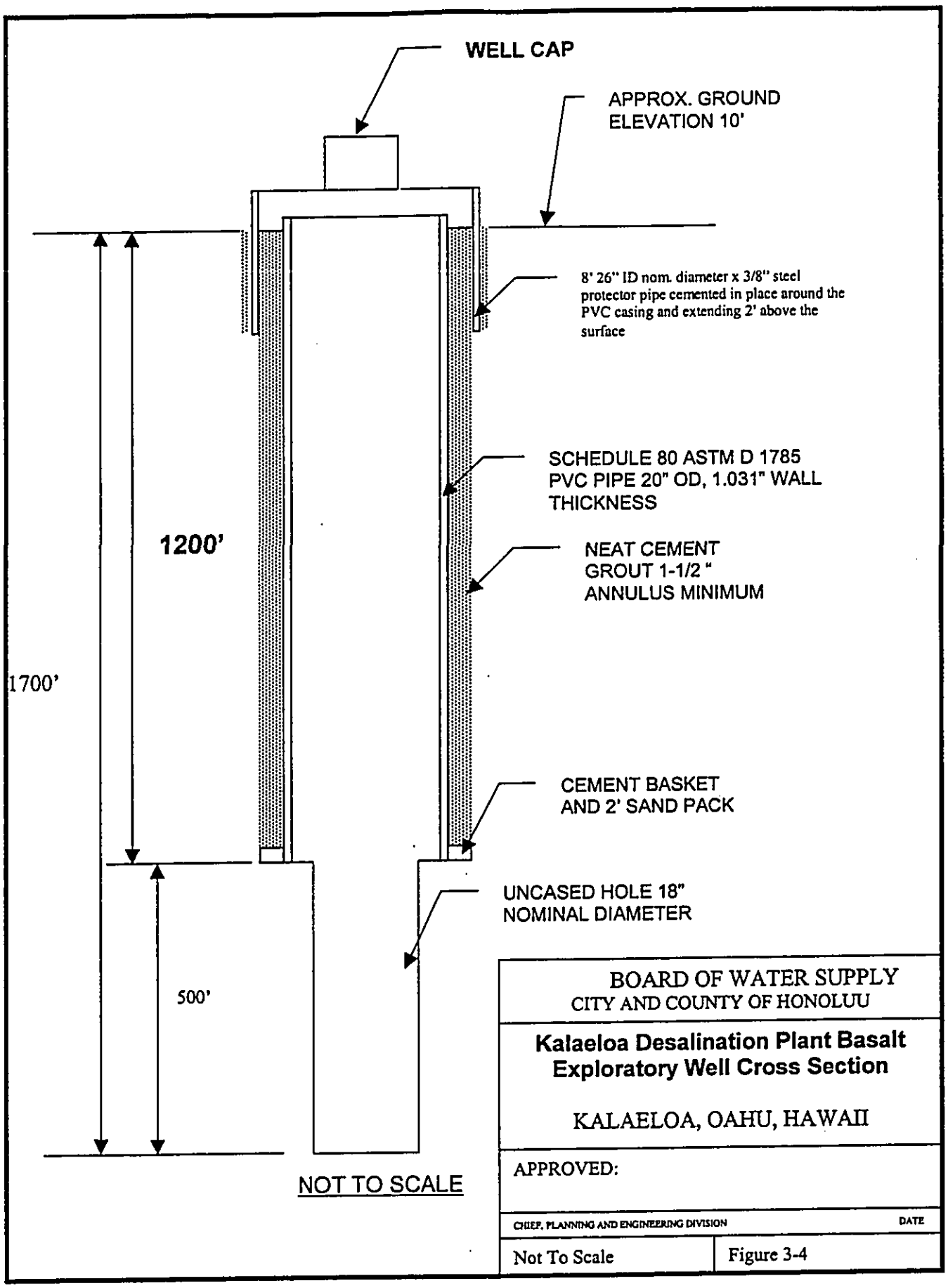
The preliminary desalination technology testing would include the chemistry evaluation and water quality testing of the source water of both the caprock and basal wells. Field tests, such as percolation rates to design the brine pond, pretreatment testing of the filtration equipment, soil borings for the building foundation, and biofouling to determine the optimal

membrane life, would be conducted for a period of 3 to 6 months. The on-site preliminary testing would include a temporary shelter to protect the equipment from the elements, concrete foundation, piping, generator, sensors, electricity, and communication equipment such as telephone or wireless telemetry. A total of 2 to 6 people may be on-site at various times to conduct the testing. The quantity of water to be tested on-site is expected to be less than 1 MGD.

3.4.6 Future Design and Construction of a Production Facility

A phased construction scheme was developed for the facility based upon 5 million gallon per day (MGD) increments, which may be expandable up to 35 MGD, based on the total projected growth of the Ewa district. The proposed BWS desalination facility would be constructed in phases to keep pace with Oahu's growing water demand and is expected to take place over 30 to 50 years. A typical schedule for the installation of an additional 5 mgd phase would take about 5 years, which includes design, permits and construction. The remaining 10 acres, of the 30.8 acres will be acquired to be consistent with the Community Redevelopment Plan to allow for future expansion.


STEEL WELL CAP
APPROX. GROUND ELEVATION 10'
8' 26" ID nom. diameter x 3/8" steel protector pipe cemented in place around the PVC casing and extending 2' above the surface
NOMINAL BOREHOLE DIAMETER 26"
50' 17.4" OD PVC SDR 17
NEAT CEMENT GROUT
5' SAND PACK
250' 17.4" OD SDR 17 PVC WITH 1/8" HORIZONTAL SLOTS
260' 1/4" MINIMUM DIAMETER SILICA PEA GRAVEL PACK gravel pack extends 10' above slotted casing
50'
300'
250'
PVC BULLNOSE WELL CAP
NOT TO SCALE
BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLUU
Kalaeloa Desalination Plant Caprock Exploratory Well Cross Section
KALAELOA, OAHU, HAWAII
APPROVED:
CHIEF, PLANNING AND ENGINEERING DIVISION
DATE
Not To Scale
Figure 3-3


WELL CAP
APPROX. GROUND ELEVATION 10'
8' 26" ID nom. diameter x 3/8" steel protector pipe cemented in place around the PVC casing and extending 2' above the surface
SCHEDULE 80 ASTM D 1785 PVC PIPE 20" OD, 1.031" WALL THICKNESS
NEAT CEMENT GROUT 1-1/2 " ANNULUS MINIMUM
1200'
1700'
CEMENT BASKET AND 2' SAND PACK
UNCASED HOLE 18" NOMINAL DIAMETER
500'
NOT TO SCALE
BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLUU
Kalaeloa Desalination Plant Basalt Exploratory Well Cross Section
KALAELOA, OAHU, HAWAII
APPROVED:
CHIEF, PLANNING AND ENGINEERING DIVISION
DATE
Not To Scale
Figure 3-4

Section 4. STATE-OF-THE-ART DESALINATION TECHNOLOGY SURVEY

A state-of-the-art desalination technology survey was completed in August 1995, with an emphasis on processes, which could produce potable water under island conditions. A total of 12 specific technologies were identified within the four major desalination categories (distillation, membrane, crystallization, and chemical): multistage flash (MSF), Multieffect (MED), Vapor Compression (VC), Solar Distillation, Reverse Osmosis (RO), Electrodialysis (ED), Electrodialysis Reversal (EDR), Vacuum Freezing Vapor Compression (VFVC), Secondary Refrigerant Freezing (SRF), Eutectic Freezing (EF), Hydrate Formation (HF), and Ion Exchange. The discussions on each technology included: 1992 status, feed water requirements, product water quality, energy consumption, performance, operation and maintenance, general advantages and disadvantages, and principal applications. The information obtained for these discussions was often a function of the worldwide or nationwide use of that particular technology. Information on distillation and membrane processes was most prevalent, since both categories comprise over 90% of the total worldwide desalination capacity in 1992. As a part of this technology survey, information on worldwide plant locations and capacities was obtained using the 1992 International Desalination Association (ID) Worldwide Desalting Plants Inventory Report No. 12, dated April 1992 (Technology, Ref. 3) lists a total of 8,886 desalination plants of capacity greater than 25,000 gpd. The use of the MSF and RO processes is most clearly dominant in the inventory of plants larger than 1 mgd. The MSF process represents 73% of the worldwide capacity, while the RO process represents 18% of the total. Multiple effect (ME) and electrodialysis (ED) plants lagged behind at 4% and 2%, respectively. Not surprisingly, 63% of all plants are treating seawater (typically MSF) and 25% are treating brackish water (RO typically). 81% of the plants with capacity greater than 1 mgd treat seawater, and 14% treat brackish water.

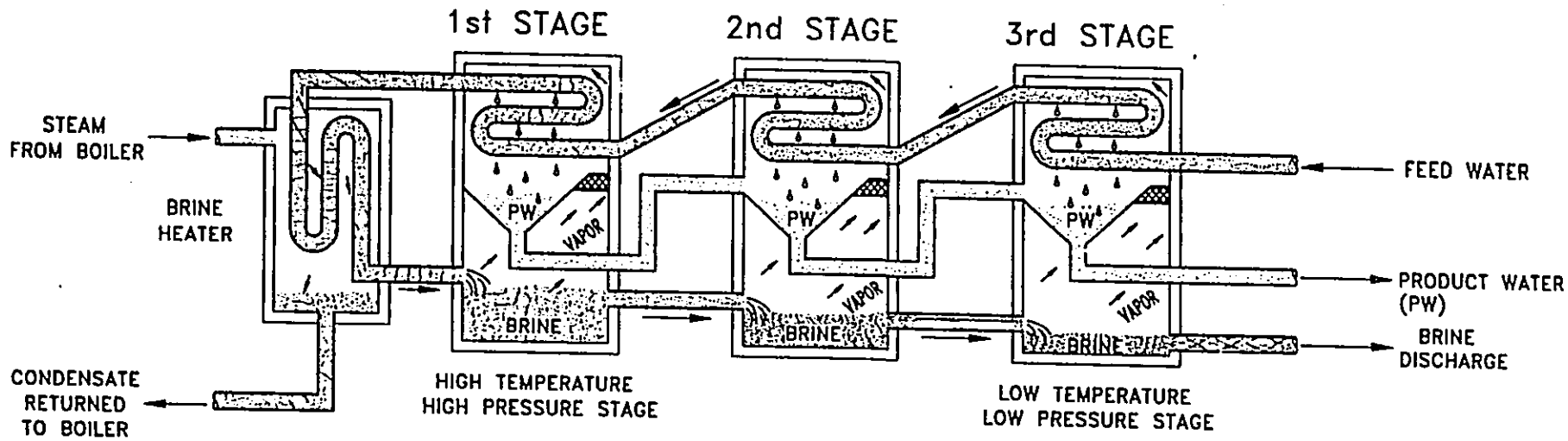


Figure 4-1

Schematic of Multistage Flash (MSF) Distillation

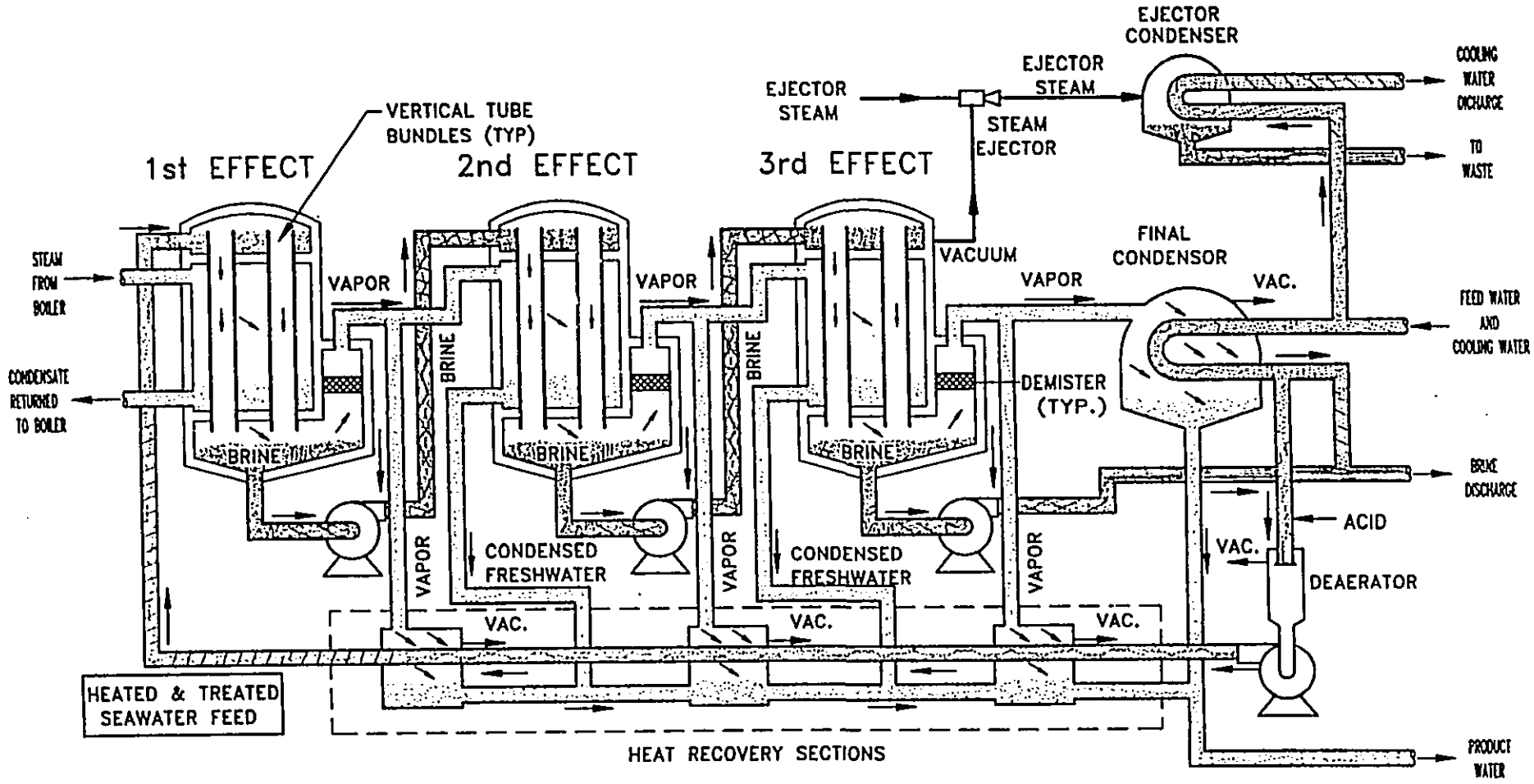
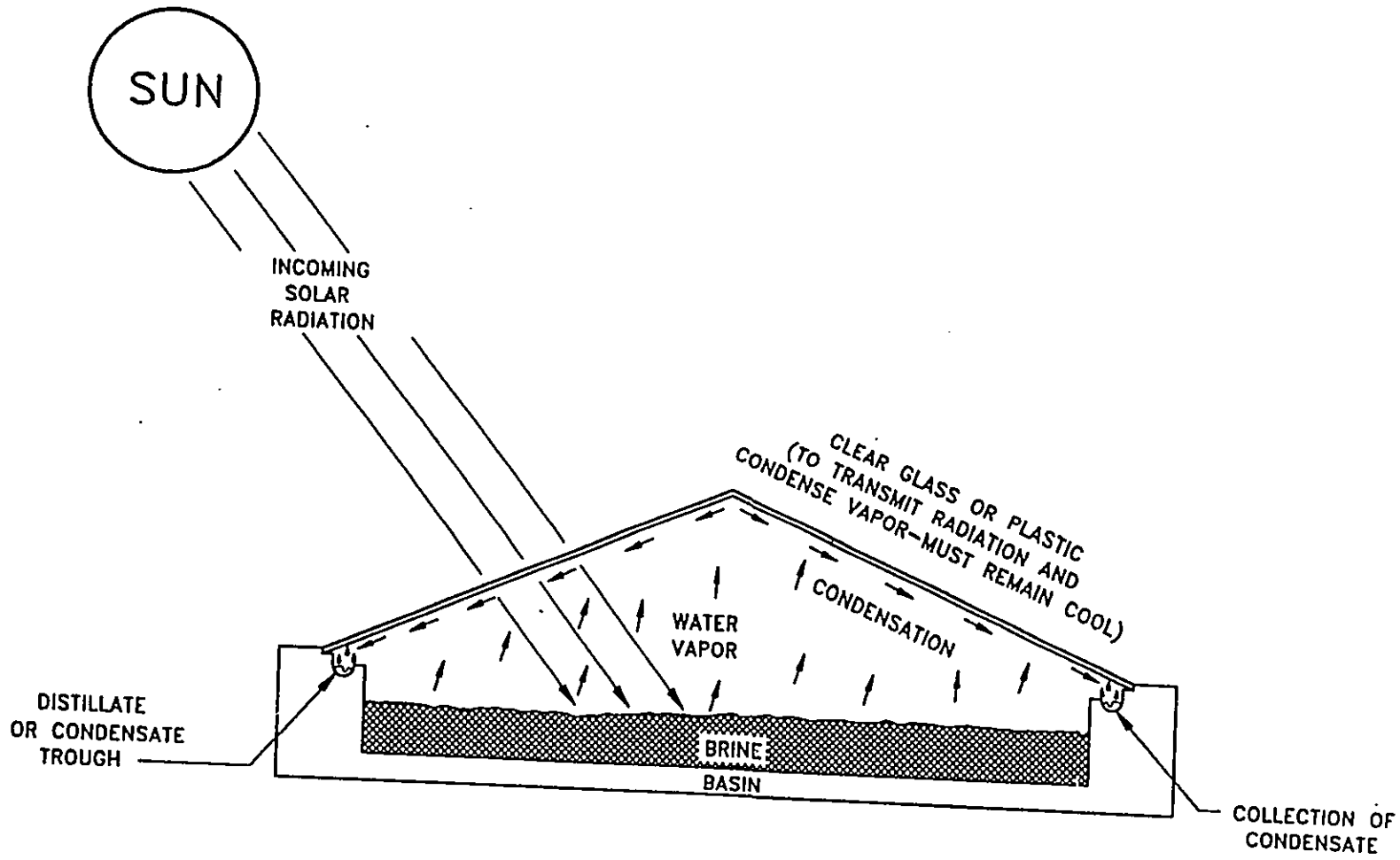


Figure 4-2

Schematic of Vertical Tubes Multi-effect (VTME) Distillation



THE INSIDE OF THE BASIN IS USUALLY BLACK TO EFFICIENTLY ABSORB RADIATION AND INSULATED ON THE BOTTOM TO RETAIN HEAT.

Figure 4-3

Schematic of Solar Still Desalination

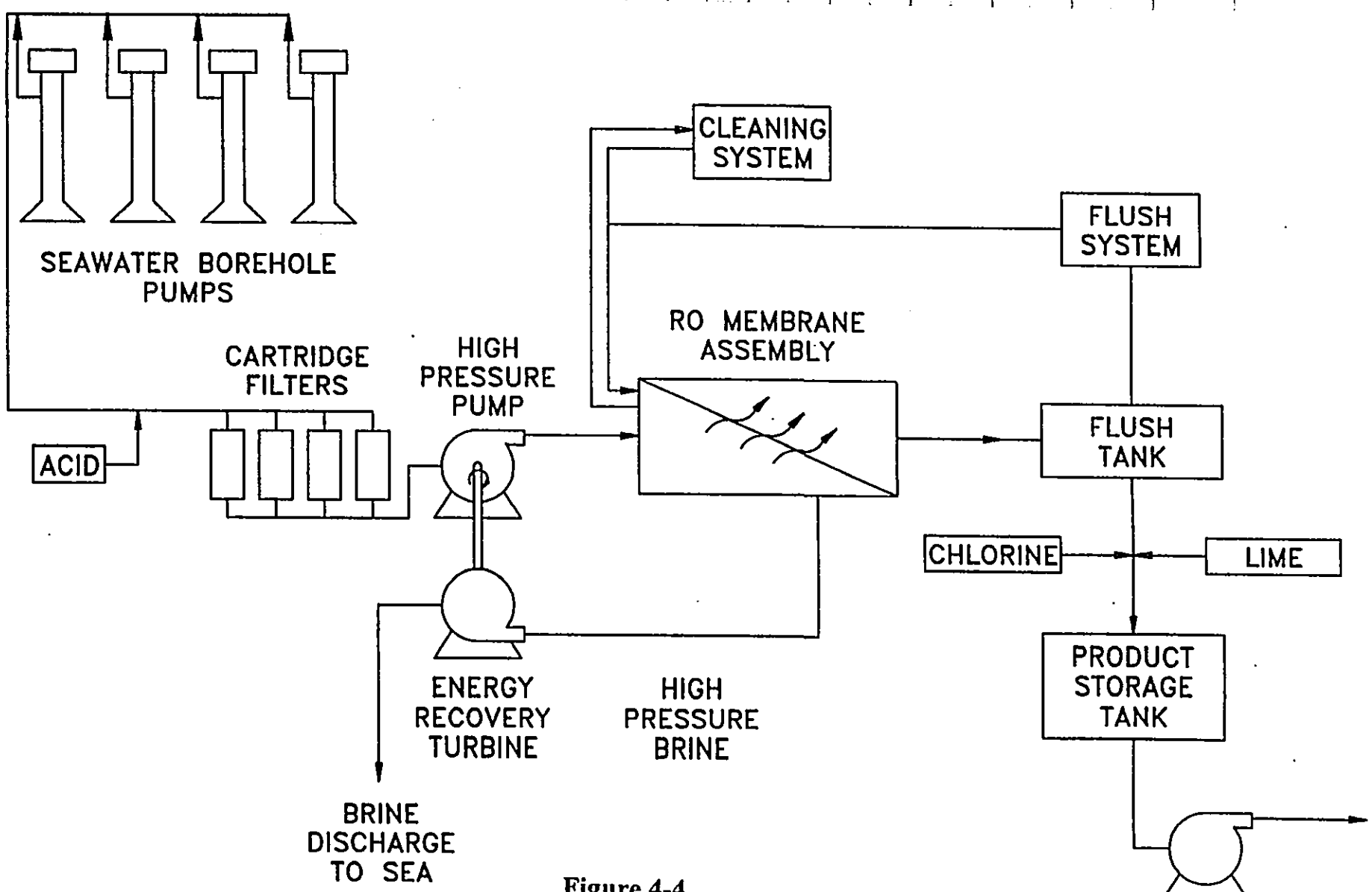


Figure 4-4

Schematic of Reverse Osmosis (RO)

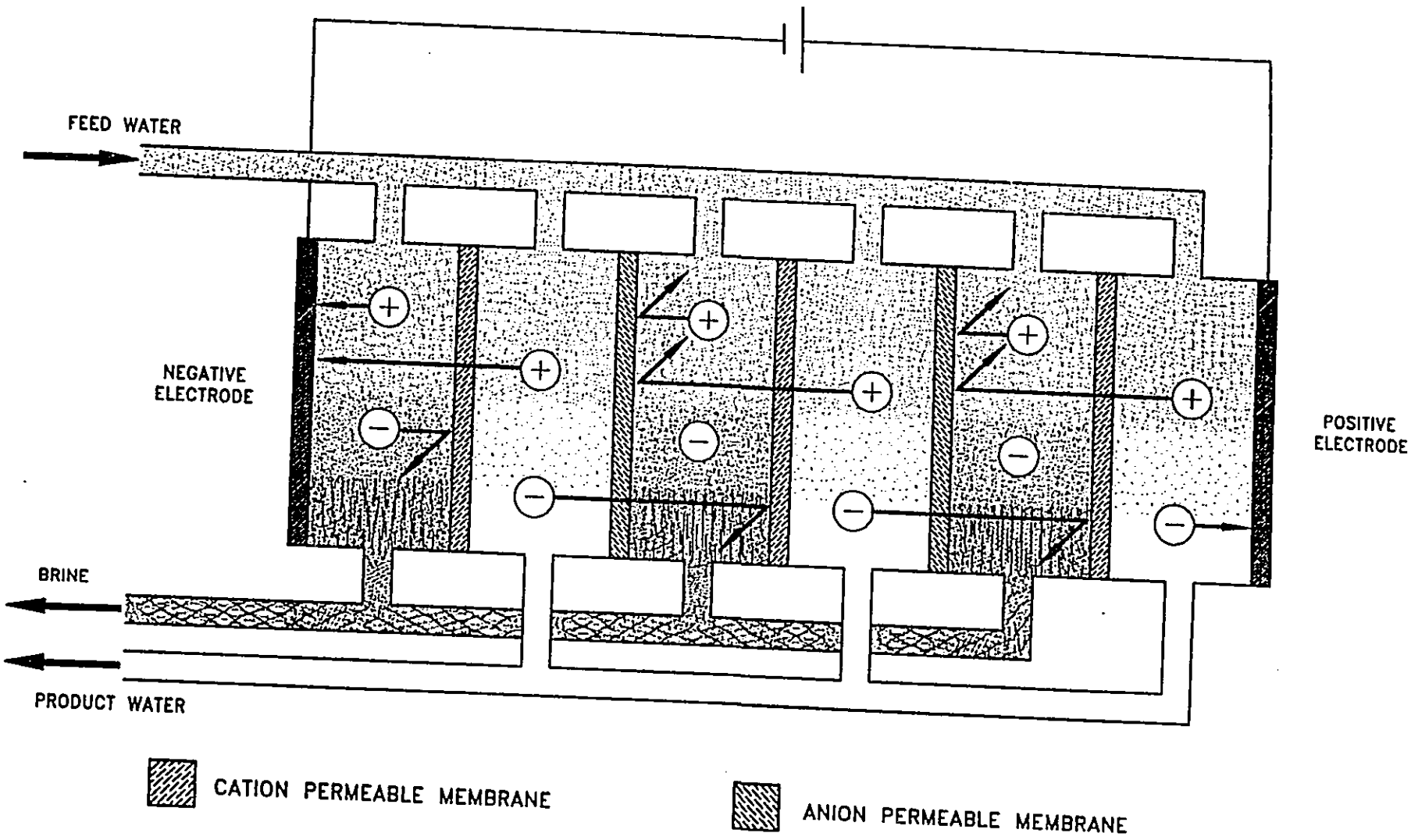


Figure 4-5

Schematic of Electrodialysis (ED)

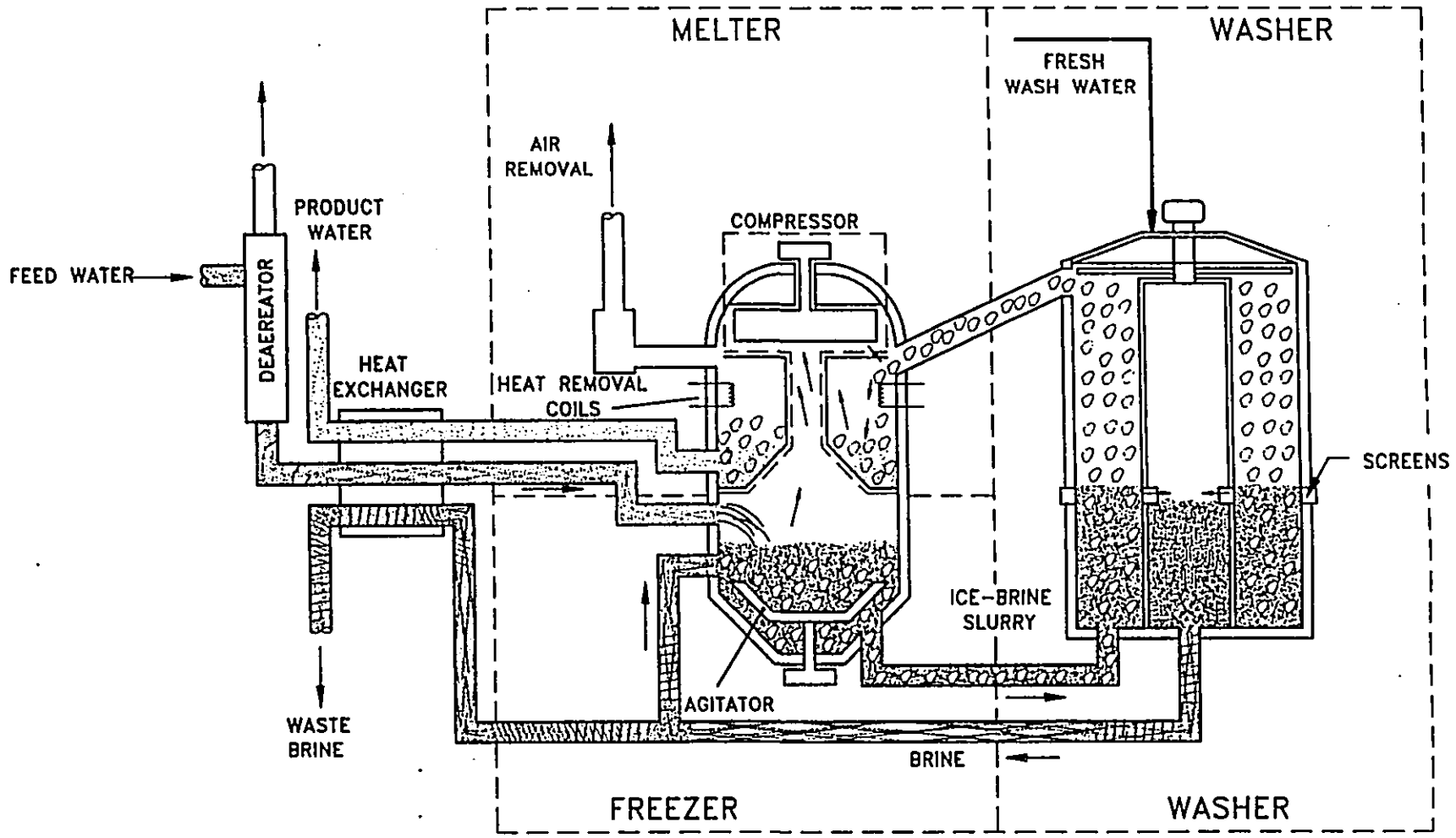


Figure 4-6

Schematic of Vacuum Freezing Vapor Compression (VFVC)

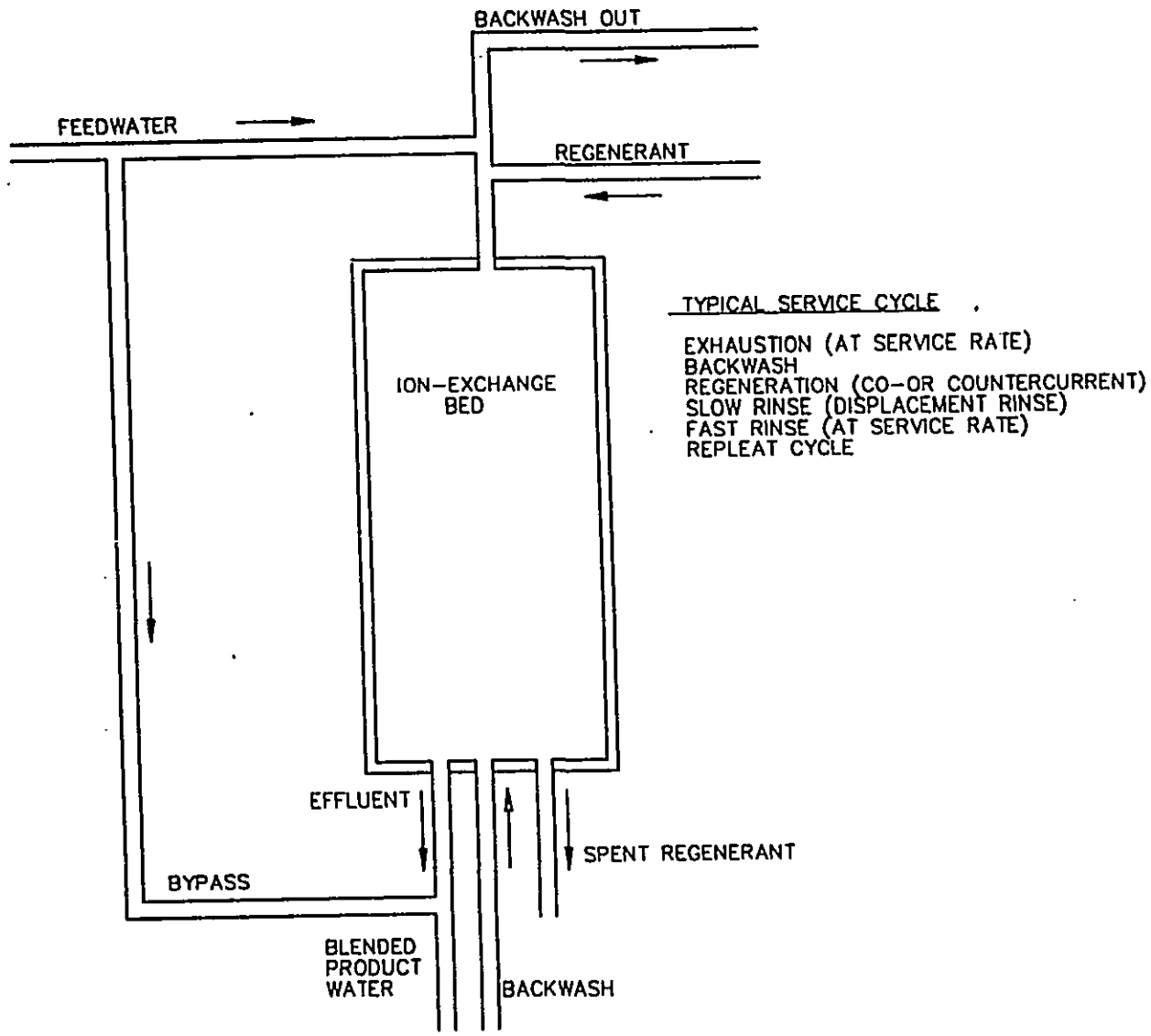


Figure 4-7

Schematic Service Cycle of Ion Exchange

4.1 Distillation

Distillation processes utilize thermal energy to vaporize water from a saline solution, the water vapor generated is then condensed to form the product water. There are several variations on this technology depending upon operating temperatures applied, the number of stages used (i.e., the number of times the saline solution undergoes evaporation) and operating pressure (or vacuum). Distillation technology, as it applies to desalination, is fairly stable.

Multi-stage Flash and Multi-effect

The performance ratio of Multi-stage Flash Distillation (MSF), Figure 4-1, and Multi-effect Distillation (ME), Figure 4-2, processes are limited by the maximum temperature difference between the first stage or effect, and the last (known as the flash range for MSF). Since the operating temperature of the last stage is limited to ambient, maximum efficiency is obtained by operating at the highest possible temperature in the first stage or effect. However, as the temperature of these processes is increased, scaling and corrosion also increase. Scaling is controlled by the addition of chemicals, which either inhibit the precipitation of the dissolved solids or cause the scales to form in a manner permitting easier removal, such as sludge. The current acids and high temperature polyphosphate additives are only effective up to about 121°C, and the dosage required increases rapidly above 100 degrees. Furthermore, improper acid treatment can accelerate corrosion. Advances in the area of distillation are therefore likely to be in the development of more effective pretreatment to prevent scaling, permitting higher operating temperatures and greater performance ratios. Improvements in corrosion resistant alloys for inexpensive heat transfer surfaces can also be expected to reduce maintenance and make distillation plants more economical. However, such improvements will be modest. The performance ratios of MSF and ME processes are likely to remain below 30 for the foreseeable future, with ME offering the higher performance.

Multi-stage Flash Distillation (MSF) and Multi-effect Distillation (ME) plants will continue to be competitive for seawater desalination in applications where they are combined with power generation stations. Such dual purpose plants use heat rejected by steam or gas turbines as the

heat input for the distillation process. Under such conditions less energy is usually extracted from the power generation cycle in order to obtain the desired performance of the distillation process. This is offset by the savings in energy costs by the distillation plant and the economy of shared plant infrastructure. Session 2 of the NWSIA 1992 Biennial Conference examined several such designs, usually employing ME processes. ME processes have not been as widely used as MSF because of scaling and corrosion problems. As energy costs continue to rise and advances are made on controlling scaling and corrosion of heat transfer surfaces, ME processes will increase their share of the distillation market due to their higher efficiency compared to MSF.

The primary energy input for Multi-stage Flash Distillation (MSF) and Multi-effect Distillation (ME) is low pressure steam. MSF steam is less than 2 ½ atmosphere (37psia) and is used for final heating of seawater feed before it is flashed in the first stage. High pressure steam at about 150 – 200 psia is used to run steam ejectors. Electrical power is required to operate the feed, brine recycle, brine disposal and product pumps. MSF and ME re-circulation plants may have very significant pumping costs because of the high percentage of brine re-circulated. MSF plants have been operating at performance ratios of about 8 (Technology, Ref. 23)

Advantages

Product water quality is very high for Multi-stage Flash Distillation (MSF) plants, having total dissolved solids between 5 and 50 ppm, and usually less than 25 ppm. MSF is the leading process used for very large scale desalination, particularly for seawater. Given its 40-year history, there is a wealth of experience in its operation. MSF is much less susceptible to scaling than Multi-effect Distillation processes, which are the major competitors for large scale desalination by distillation. This is because boiling does not take place at the heat transfer surfaces. When scaling does take place, output can be maintained by increasing steam input. MSF has been built in very large capacities. Waste steam from other processes can also be used for the major energy input. Like MSF, Multi-effect Distillation (ME) produces very pure water, and waste heat from other processes can be used for the primary energy source. Higher recovery ratio means less feed water per unit product water, about twice the product water flow for ME processes versus ten times for MSF which results in lower chemical treatment costs for

ME. Operation such as start-up and shutdown are much simpler, and output can be varied from 25% to 100%. Depending on design, effects may be bypassed for maintenance, allowing operation to continue. For a given output, ME requires less space than MSF. ME has a higher performance ratio and lower pumping costs than MSF. ME has a lower capital costs than MSF because higher heat transfer ratios permit less heat transfer surface. There is considerable experience with ME processes. However, it is unclear why the economies of scale favor MSF over ME plants. However, several sources support this conclusion, and in practice ME plants have not been built in sizes as large as MSF plants have. (Technology, Ref. 3 and 7).

Disadvantages

The Multi-stage Flash Distillation (MSF) process is not the most efficient distillation process. It requires a large energy input and requires high maintenance. It takes up much more space than other desalination processes. Most of the experience has been with desalting seawater in the Middle East, where energy costs are less of a factor. MSF is only used for seawater desalination. There is little savings when treating brackish water. The MSF process is difficult to control. Plant start-up is difficult. The process cannot be run at less than 60% of design capacity. Performance ratio is lower than that for other processes and a large amount of seawater is required, both for product and for cooling. Brine is discharged at an elevated temperature. Only a small percentage of the brine is evaporated during flashing, so very high re-circulation rates are often used. This leads to high pumping costs and slow reaction to sudden input changes. Multi-effect Distillation ME plants with capacities of 10 mgd and above has not been built yet. The potential for scaling and corrosion with improper maintenance is greater for ME processes than for MSF processes. Because of high heat transfer coefficients used, ME processes are inherently more severely affected by fouling than MSF processes. Decreased output is inevitable when fouling occurs, whereas with MSF, output can be maintained by increasing steam input.

Vapor Compression

Vapor compression operates on the principle that water will evaporate when its pressure is reduced sufficiently, and the resulting vapor will condense when it is recompressed. A vacuum pump, compressor or steam ejector is used to draw vapor from a evaporation chamber

containing brine, reducing the pressure and causing some brine to flash into steam (water vapor). The vapor is then compressed in a vacuum chamber, such that the condensing vapor returns its latent energy to the evaporation liquid. In fact, any of the previously discussed effect designs may be used, but in this case the temperature difference to drive the heat flow from the condensing vapor back into the evaporating brine comes from the compression of the vapor. This process typically employs just one effect, although multiple effects may be used.

The primary energy input is mechanical energy by either a vapor compressor or a stream jet. Most plants operate near the atmospheric boiling point, so the incoming feed must be heated. During start-up this is accomplished using an auxiliary heat source. During operation preheating is done by extracting heat from the brine and distillate streams with auxiliary heat as required. Thermo compression is often used in conjunction with evaporators. Currently, several vapor compression distillation processes are commercially available.

Advantages

Vapor Compression (VC) plants are very simple and compact. Plants using mechanical compression make very efficient use of mechanical or electrical energy. Capital costs are low.

Disadvantages

Vapor Compression (VC) plants are limited to small scales: thermo VC-1.25 mgd and mechanical VC-100,000 gpd. VC also raises the sensitivity, complexity and cost of the whole system. The cycles are very sensitive to the quality and consistency of the steam, and O&M responsibilities increase due to the need for expert maintenance.

Solar

Use of solar energy, Figure 4-3, is more economical than any other fossil fuel system. For most countries located near the equator, there is sufficient amount of solar energy available year-round. Because energy can be converted from one form to another, it is possible to use solar energy as the primary or secondary energy source for any desalination process.

Two major problems limit the application of solar energy in desalination plants: low efficiency of energy conversion and the inefficient storage of energy. Thus solar stills are typically not economical for medium or large capacity fresh water production. Solar-assisted or solar-powered plants do not differ much from conventional desalination systems, except for the fact that solar collectors and heat storage subsystems will be needed.

Advantages

Energy requirements for solar stills are relatively low compared to other desalination processes, whose dependency on oil-based fuel results in energy costs as high as one-third the operating cost. Solar stilling processes will continue to have this advantage as long as the cost of oil-based fuels continue to rise. Studies have shown solar stills or solar-assisted Multi-Effect distillation processes to be more economical at producing quality drinking water for small scale plants (up to 100 m^3 per day or 26,000 gallons per day) when the land value is low (Technology, Ref. 12). Solar energy is free, so a process whose energy needs were fully met with solar energy would have no fuel costs and would impose no further burden on the island's electrical distribution system. The Ewa Plain has a fairly high average annual solar radiation, either flat plate collectors, solar ponds or concentrating collectors could be used.

Disadvantages

Although solar stills are relatively easy to build and operate, there are few, if any, economies-of-scale associated with larger plants. For example, the largest solar stills yet tested have produced only a few thousand gallons of water per day (Technology, Ref. 3). Because solar stills are single-effect processes, i.e. utilize the input energy only once, they are of low efficiency and require very large area. Oahu does not have the quantity of unused, low productivity land that is characteristic of the other areas of the world where solar power has been used for desalination. The Ewa Plain does not have the year-round clear skies that are found for example in the desert south-west of the United States, so that there will be periods when a solar assisted plant could not operate. Solar collectors have large surface area and would be vulnerable to high winds such as hurricanes. Each form of solar collector has some form of maintenance demand unique to it. For example, maintenance of the correct salt gradient in a solar pond is absolutely

essential. Finally, all of the high capacity solar assisted methods still require energy inputs in the form of electricity.

4.2 Membrane Processes

Membrane processes operate on an entirely different principal than distillation processes. There is no phase change for membrane processes. Most membrane processes are conceptually similar to filtration in that a barrier permits selective transmission of only certain constituents of a solution, thereby separating them. They differ in that when operating properly neither constituent builds up at the membrane. There is both product stream and a brine stream, so continuous operation at a steady state is achieved.

Reverse osmosis (RO), Figure 4-4, relies on the use of a membrane, which is highly permeable to water and only slightly permeable to salt. High pressure is used to drive pure water through the membrane, separating the pure water from the brine solution. Electrodialysis (ED), Figure 4-5, and Electrodialysis Reversal (EDR) employ membranes, which are permeable to the salt ions and impermeable to water. Instead of hydraulic pressure, an electric field provides the force to move the positively and negatively charged ions through the membranes, separating two feed streams into one product stream and one brine stream.

The primary energy demand of reverse osmosis (RO) is for pumping the feedwater up to the high pressures required. This pressure varies with the feedwater salinity. Brine discharged at pressure represents a total loss of energy used to pump that volume of feedwater. The feedwater pressures used for brackish water are lower than for seawater. Seawater RO costs are more closely matched to MSF of ME, however, the availability of waste heat must still be considered. Energy recovery devices, such as hydraulic turbines and work exchangers, can recover up to 90% of the brine energy. It is becoming a standard on seawater plant, since high brine pressures make energy recovery economical.

The primary energy input for Electrodialysis (ED) and Electrodialysis Reversal (EDR) is electricity. DC power is required to operate the stack and AC power is required for pumping. Pumping power varies with hydraulic resistance to the flow path and volume flow rate, which is

depends on the amount of brine recycled and the recovery ratio. Feedwater salinity has the greatest impact on the energy consumption per unit product and the product quality.

Reverse osmosis (RO) has achieved dominance in the field of brackish water desalination and acceptance in the field of seawater desalination. Desalting of seawater is by far the more rigorous test of the technology. Higher salinity increases scaling and may increase energy requirements several fold due to higher pumping pressures required and lower recovery ratio achieved. High pressures accelerate degradation of the membranes due to compaction and stress. For both brackish water and seawater RO, the fouling characteristics of the membranes and their tolerance for various chemicals have a great impact on the successful operation of the plant. Characteristics such as water flux, salt rejection, resistance to compaction, physical strength and resistance to scaling, fouling and chemical degradation are consistently being improved. It is reasonable to expect membrane performance to continue improving, while the performance of Multi Stage Flash (MSF) and Multi Effect (ME) plants levels off. The application of RO to large scale seawater desalting has occurred much more recently than with MSF and ME. Few large RO plants are more than 10 years, leaving much valuable operation and maintenance experience to be gathered.

Recovery of energy from the high-pressure brine is another area in which improvements can be expected. This is particularly important for the desalination of seawater, where recovery ratios may be as low as 35%. Effective energy recovery can reduce energy consumption per unit product water by almost half. Most of the newer seawater reverse osmosis (RO) plants use hydraulic turbines to generate electricity from the discharged brine or hydroturbines to pump feedwater directly.

Electrodialysis (ED) and Electrodialysis Reversal (EDR) are similar to reverse osmosis (RO) in that future improvements in the performance of the process are linked to advances in membrane technology. Membrane characteristics can be expected to continue improving. Since the minimum power required for desalination is dictated by the number of ions to be removed, the cost per unit of product water cannot be brought down below a certain minimum level as long as energy costs are significant. Energy requirements for ED and EDR vary with feed-water

concentration to a greater degree than for RO. ED and EDR are therefore likely to remain competitive only for salinities less than 5,000 ppm.

As with Reverse osmosis, maintenance costs associated with membrane fouling are a large part of the total operating costs of an Electrodialysis (ED) plant. The energy savings associated with membrane improvement will be small compared to the maintenance costs saved by the development of membranes less prone to fouling. Transport depletion is an existing modification of the ED process in which anion permeable membranes are replaced with non-specific ion permeable membranes. This reduces the problems associated with the fouling of anion permeable membranes. This process uses somewhat more power than standard ED or Electrodialysis Reversal and is not used commercially. However, it illustrates the degree to which developments in control of membrane fouling can affect process viability.

Advantages

Reverse osmosis (RO) and electrodialysis (ED) processes require only a fraction of the energy of distillation processes for the desalination of seawater; therefore RO and ED are more economical when desalting brackish water. RO also removes a wider range of contaminants than ED, such as organic molecules, viruses, bacteria, silica and turbidity. Plus, RO has higher water recovery than distillation, which reduces the volume of concentrate disposal. RO using brackish water requires low energy consumption, low corrosion materials and low temperatures. These advantages apply to the desalination of seawater as well, although the energy savings over distillation processes are not as great.

Reverse osmosis (RO) remains competitive for seawater desalination, whereas ED and Electrodialysis Reversal (EDR) are not. With increasing salinity, ED becomes less competitive more quickly than RO. The modular nature of RO plants permits easier and faster expansion than with multi-stage flash. Plant automation is possible. Process performance is limited by membrane development, which can be expected to improve. ED and EDR are competitive with RO for desalination of brackish water having less than 5,000 ppm TDS. ED and EDR are also capable of desalting much higher salinity water including seawater although energy consumption is high.

Electrodialysis (ED) was one of the first membrane processes commercially used for desalination, so there is extensive operating experience. The largest Electrodialysis Reversal (EDR) plant is a 12 mgd plant in Florida. Due to the polarity reversal, EDR has greatly reduced the requirement for continuous chemical pretreatment to prevent scaling. If severe scaling or fouling does occur, most ED and EDR stacks can be broken down and manually cleaned. The membranes themselves last longer (10 years) than reverse osmosis (RO) membranes. ED and EDR operate at much lower pressures than RO so pumps are less costly and there are fewer leaks. At low Total Dissolved Solids (TDS), EDR uses less energy than RO. ED and EDR are more tolerant of operator error than is RO. EDR is capable of higher recovery than RO, which reduces the concentrate volume for disposal.

Disadvantages

The reverse osmosis (RO) process is extremely sensitive to feedwater quality and proper feedwater treatment is essential to avoid scaling or biofouling of the membranes. Feedwater pretreatment may be more complicated and expensive than for distillation processes. Some types of fouling are irreversible and may require premature membrane replacement. Regardless of the membrane material or element configuration, membranes have a finite life and usually must be replaced every 3 to 5 years.

Electrodialysis (ED) and Electrodialysis Reversal (EDR) have not been widely applied to the desalination of seawater. Currently, there are no seawater ED plants larger than 1 mgd. Energy requirements for ED and EDR are proportional to the concentration of dissolved solids to be removed, so ED is not competitive for desalination of high TDS water unless energy costs are low.

ED and EDR have the same feedwater pretreatment requirements as reverse osmosis (RO). Colloidal solids must be effectively filtered out or they will clog the membranes. In addition, bacteria, viruses and large non-ionic molecules such as silica, which is common to groundwater from volcanic island geologies, are passed through ED and EDR processes in their original concentrations. Only ions are removed. Certain types of dissolved organic molecules such as

humic or flavic acid form ions which are too large to pass through the membranes causing additional fouling beyond that experienced by RO. Membranes require replacement every 5 to 7 years or sooner if pretreatment and periodic cleaning are not sufficient, and electrodes require yearly replacement. Chemicals and techniques used for periodic cleaning are similar to those used in RO plants, resulting in similar disposal problems. In general, EDR is hydraulically more complex and potentially more sensitive to iron and magnesium than RO.

4.3 Crystallization

Crystallization or "freeze desalination" is based on the concept that a salt solution, cooled to its freezing point will separate, forming crystals of pure water and pockets of higher salinity brine. The traditional process involves five main steps: precooling of the feedwater, crystallization of the ice and brine into a slurry, separation of ice from the brine, washing the ice and melting the ice.

Crystallization processes utilize energy to cool saline solution to the temperature at which water forms ice to the exclusion of salt. The ice crystals are then physically separated from the salt solution and melted to form the product water. Crystallization processes vary mainly in their operating pressure (i.e. vacuum), operating temperatures and the separation technology used to collect the ice.

Freeze desalination plants require a complex list of equipment including a refrigerant plant, heat exchangers, separators, washers, etc., which have not been proven commercially viable for large scale operations.

There are four basic types of freezing processes: vacuum freezing-vapor compression, secondary refrigerant freezing, eutectic freezing, hydrate formation. Vacuum Freezing-Vapor Compression, Figure 4-6, takes precooled seawater and flash evaporates it, at very low pressures in a tank to produce pure water vapor and ice and brine slurry. The ice/brine slurry moves through a separation column where the ice crystals are compacted and separated from the brine. The ice crystals are washed and mechanically scraped into a melter. Secondary Refrigerant Freezing (SRF) is a "direct contact" freezing process, which uses a refrigerant,

like liquid butane, in direct contact with the seawater to produce the crystallized ice/brine slurry. Eutectic Freezing process is similar to the SRF process. Ice and salt crystals form simultaneously, and the freezing point and concentration of the solution remain constant. The hydrate formation process is based on the formation of a crystalline compound by combining low-molecular weight hydrocarbons, or their derivatives, with water. These crystalline compounds are called solid clathrate substances. In seawater desalination, clathrate substances reject salt ions and form hydrate crystals. A hydrating agent such as propane is sometimes used to come in contact with seawater in a crystallizer. As temperature and pressure are adjusted to the proper level, hydrate crystals are formed. The crystals are separated from the brine and washed and melted. The propane and water are then separated in a decanting facility.

Advantages

Theoretical advantages are: *smallest energy requirement of any process utilizing* a phase change (Reference: Weigandt, 1960) and (Reference: Brian, 1971); no need for pretreatment due to low temperature operating conditions; minimal scaling and corrosion; lower capital costs due to higher recovery rate and milder operating conditions allowing less expensive materials.

Disadvantages

Disadvantages are: complex design and operation, commercial feasibility of large scale plants are unknown, remixing of ice crystals and brine slurry can limit purity of product water. Also, the butane or propane must be separated from the water and has the potential of unpleasant odors or taste in the product water. The process works most efficiently in colder climates where less energy would be necessary to maintain required temperatures. Hawaii's year round tropical climate is completely opposite, making the process unsuitable for consideration.

4.4 Chemical (Ion Exchange)

Ion exchange, Figure 4-7, is a unit process which utilizes ion-exchange resin beads or alumina granules within a packed-bed column or batch reactor to reduce total dissolved solids, soften hard waters, and produce mineral-free water.

The application of the ion exchange technology varies from softening of municipal drinking water at a point of entry in to a single home to use by small water utilities. The ion exchange process produces product water, which is essentially contaminant free or mineral free, for use in pure and ultrapure industrial water applications.

Ion exchange units operate similarly to downflow granular filters and have similar energy requirements (i.e. pumping for backwash). Additional pumping energy is required for upflow operation and continuous feed operation. Ion exchange does not require high pressure pumping or preheating inputs.

Advantages

The ion exchange process boasts several advantages over the more commonly used membrane and distillation processes: 1. Process is relatively insensitive to flow variations and therefore can operate on demand; 2. Essentially zero level of contaminant in effluent possible; 3. Large variety of ion-specific resins available; 4. Low energy costs and 5. Small land requirements.

Disadvantages

Disadvantages of the ion exchange process include: 1. Limited application to feedwater in excess of 3,000 mg/L Total Dissolved Solids; 2. High capital costs due to need for chemical and corrosion resistant material requirements; 3. Spent regenerant containing potentially toxic contaminants must be disposed of and 4. Process is not actively used on a large scale basis in municipal water systems.

Section 5. DESALINATION FACILITY SITE LOCATION AND EVALUATION ANALYSIS

The next portion of the study was the Desalination Site Location and Evaluation Analysis completed in May 1996. A progressive two-part site identification process was utilized to identify potential desalination plant candidate sites.

The first part of the process initially acknowledged the existing and future water needs of the Honolulu Board of Water Supply's Honolulu and Ewa Water Districts. These two of Oahu's seven major water districts, Figure 5-1, were evaluated for their potential for a desalination plant site. The Board of Water Supply water use districts roughly follow the City and County of Honolulu's Development Plan areas, Figure 5-2. The Honolulu and Ewa water districts represent approximately 59 percent of Oahu's current water consumption. The, 2020 projections for the Honolulu district is 103.03 mgd. The Ewa district year 2020 estimate is 35.6 mgd. The two districts were initially subdivided into project "study areas", which are identified by using commonly accepted jurisdictional, physical, land ownership, and predominant land use boundaries. A total of seven study areas were identified Kakaako (mauka and makai), Sand Island, Airport, West Ewa, BPNAS, and East Ewa. Within the seven areas, the following 12 sites, Figure 5-3, Figure 5-4 and Figure 5-5, were selected for further evaluation:

1. Pacific Tsunami Warning Center
2. BPNAS White Plains Beach
3. Hawaii Meat Packers
4. BHP Petroleum
5. Hawaii Project Managers
6. Sand Island Wastewater Treatment Plant
7. City / Campbell Estate Swap
8. Kenai Industrial Park
9. Kewalo Corporation Yard
10. Keehi Lagoon Park
11. Ewa Demonstration Desalting Plant
12. Honouliuli Wastewater Treatment Plant

The second part of the process located and evaluated the study areas based on a total of six major criteria which are: land issues, hydrogeology, utility services, environmental / socioeconomic issues, concentrate disposal, and steam availability. The criteria were derived from a review of utility installation studies for wastewater treatment plants, power plants and desalination plants.

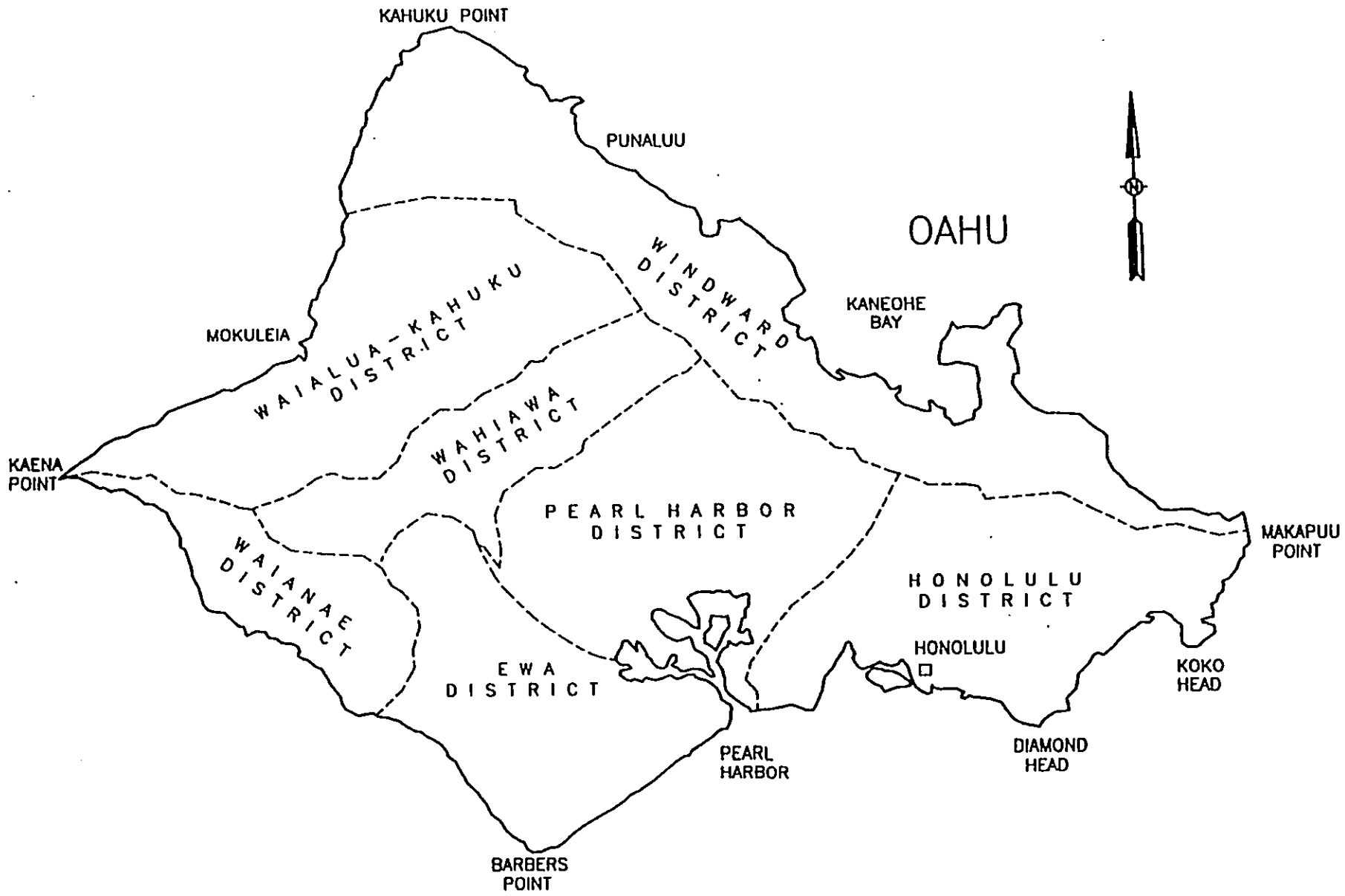


Figure 5-1

Honolulu Board of Water Supply Water Use District

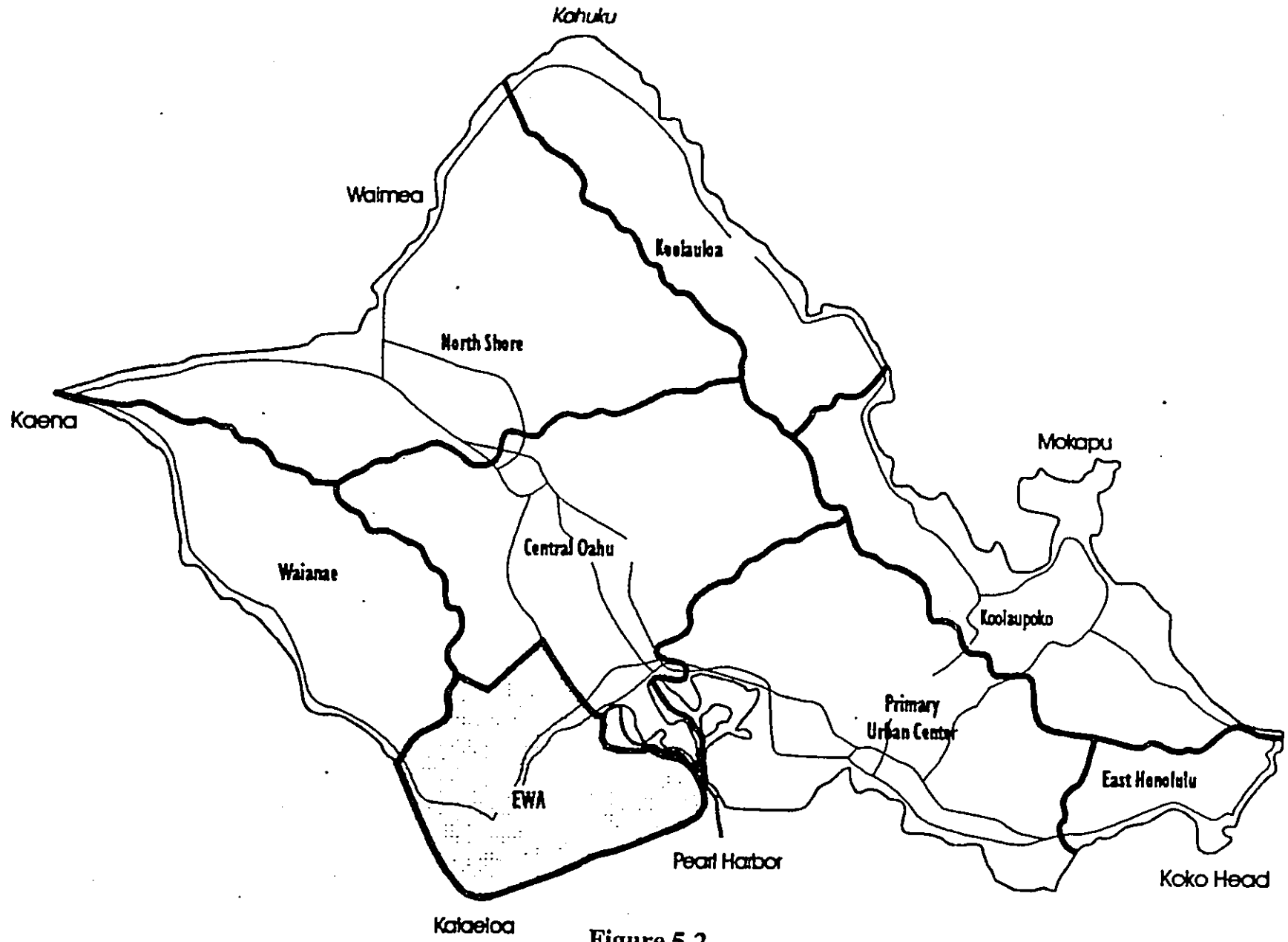


Figure 5-2

Development Plan Areas for Oahu

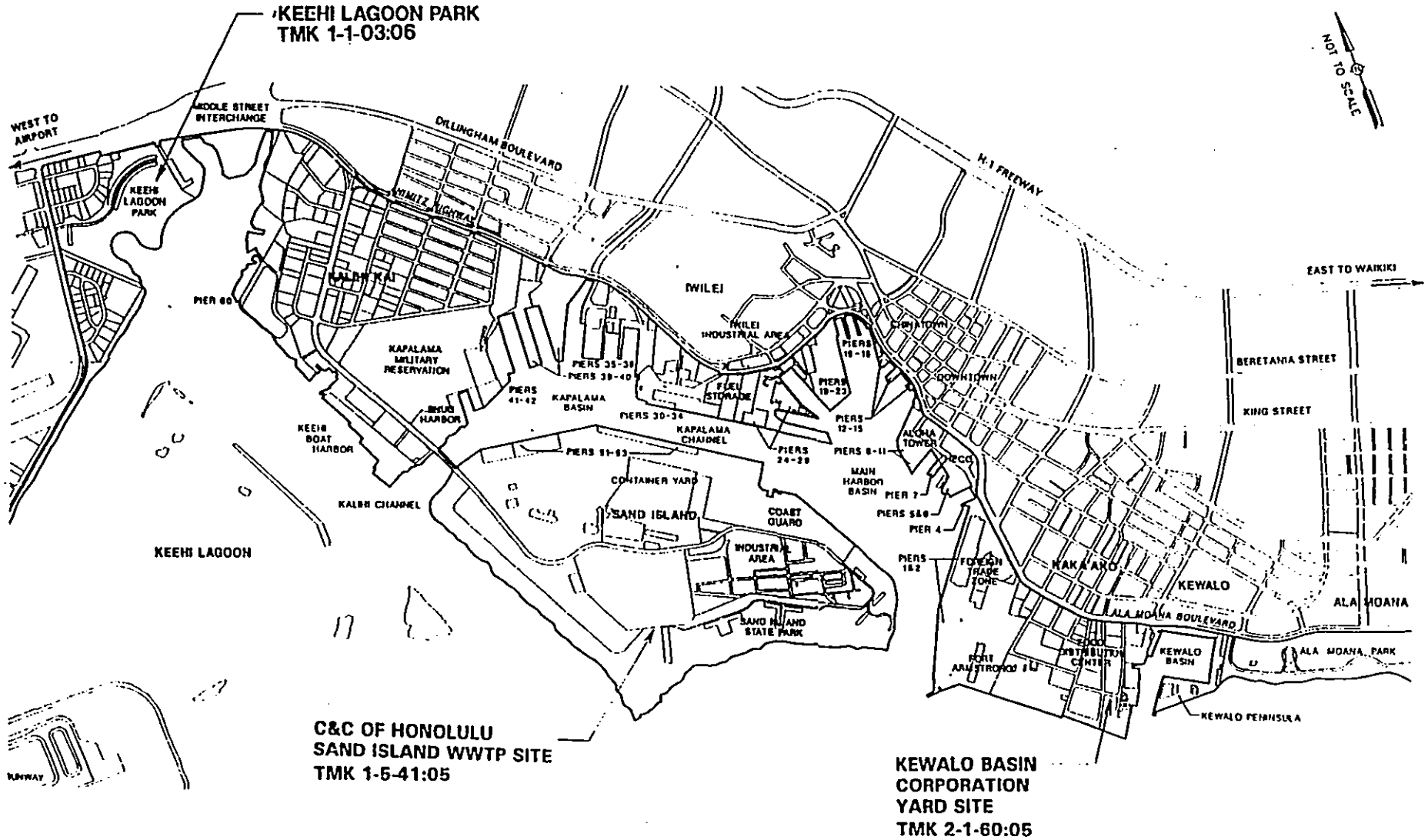


Figure 5-3

Honolulu District Desalination Plant Candidate Sites

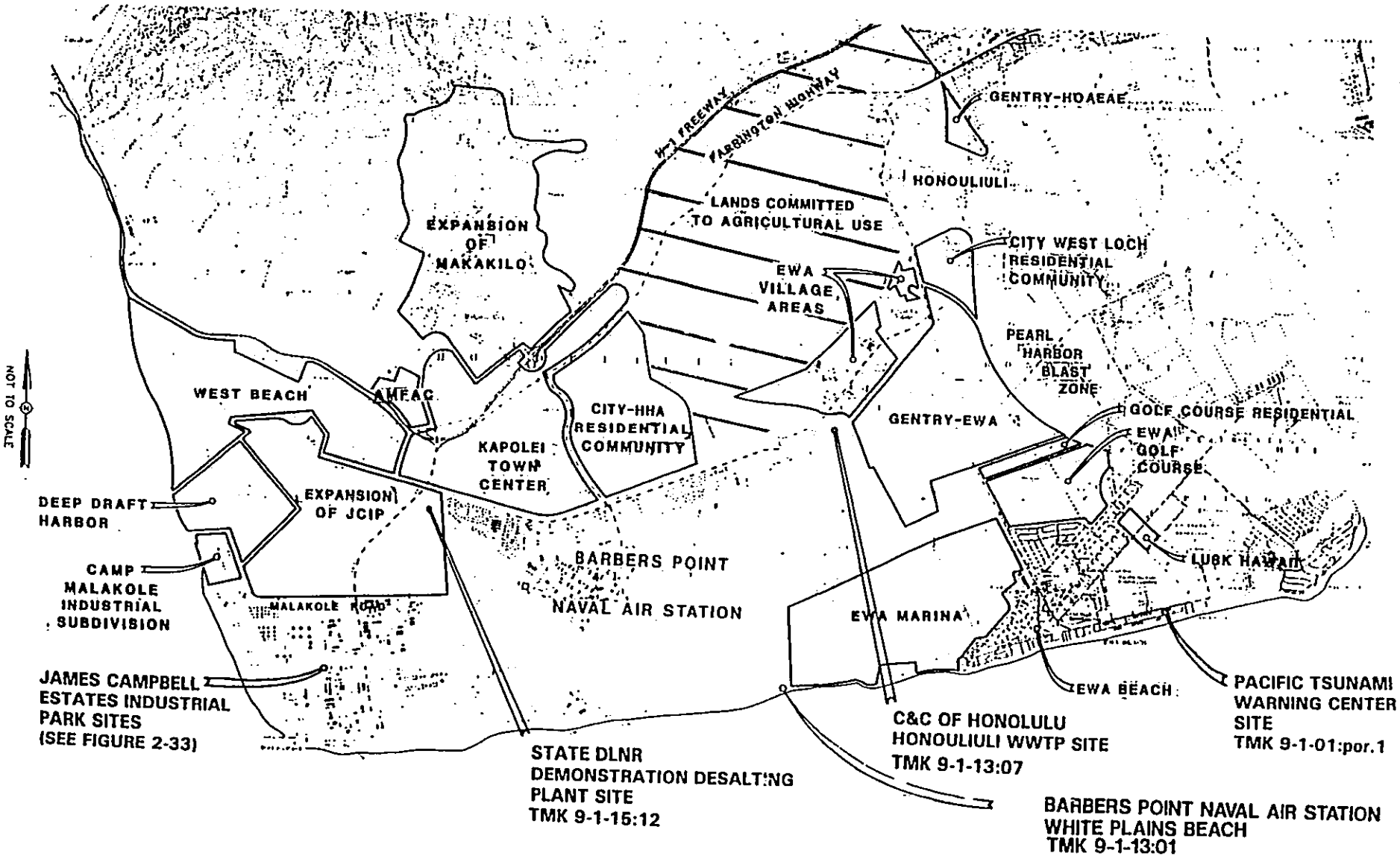


Figure 5-4

Ewa District Desalination Plant Candidate Sites

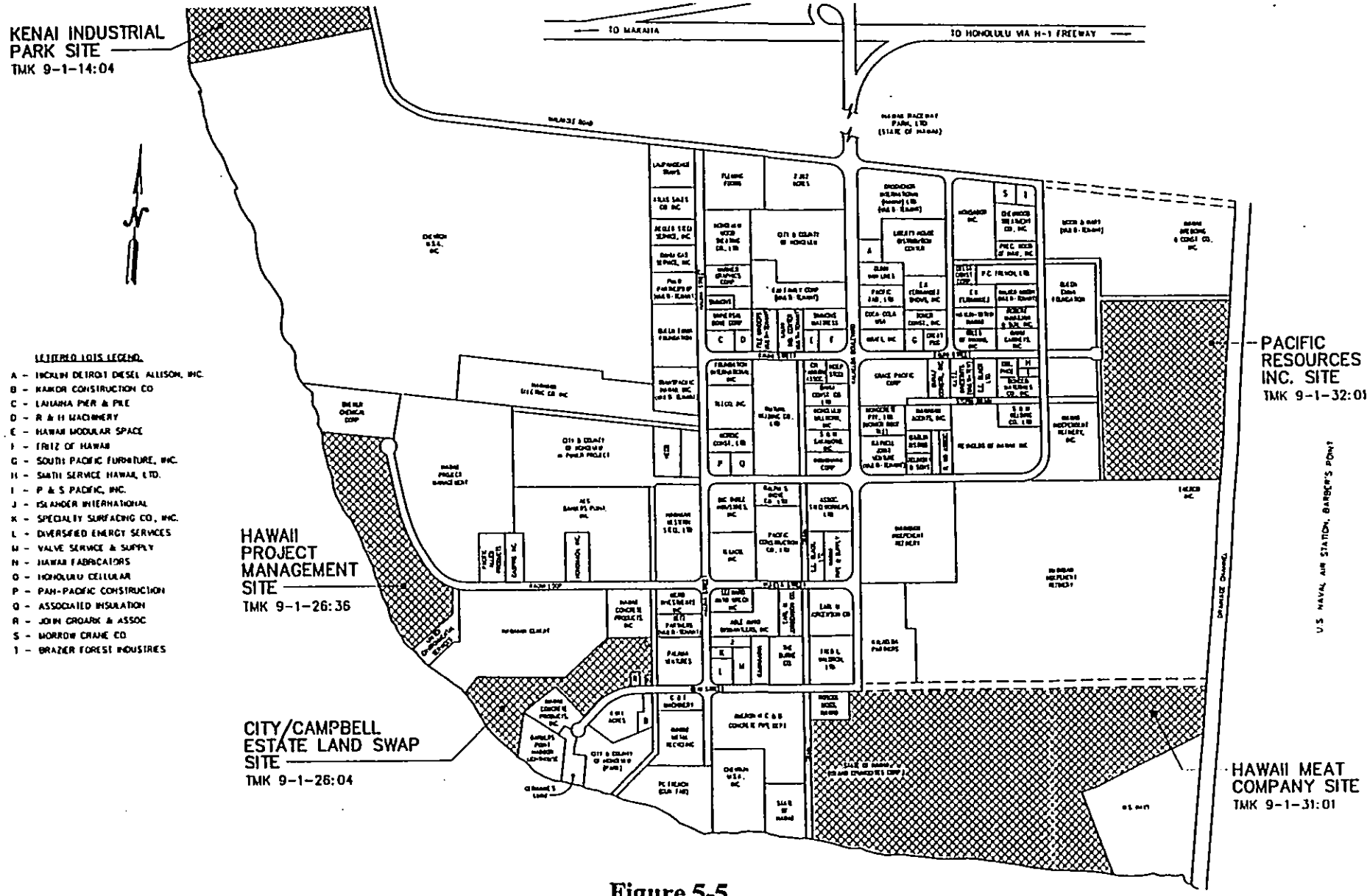


Figure 5-5

Campbell Industrial Park Desalination Plant Candidate Sites

5.1 METHODOLOGY

The Site Selection Matrix took a two-tiered approach to evaluating the 12 initial pool sites by assigning weighting factors to the major criteria and evaluating the individual sites through the more specific minor criteria. Roughly 80 percent of the weighting was concentrated in the top three major criteria, while the bottom three comprised the remaining 20 percent.

The calculations were carried out in the following manner:

1. A score from 0 to 20 (in increments of 5 unless otherwise noted in the matrix) was assigned to every minor criteria for each site.
2. Each minor criteria score was multiplied by the corresponding weighting factor from the major criteria column.
3. The "weighted" scores in the column are added, and a total weighted score is entered at the bottom.
4. Steps 1,2 and 3 are repeated for all 12 sites.
5. The 10 scores are then ranked from first through 12 based on the total weighted score achieved.
6. A sensitivity analysis was undertaken to try and validate the matrix methodology.

A sensitivity analysis determines whether the proposed methodology is sensitive to changes in the weighting factors assigned to each of the criteria, or to the numerical score given to each individual site.

Generally speaking, the high degree of subjectivity and uncertainty in estimating the weighting factors requires an investigation into their sensitivity to small changes. Criteria which are well defined with respect to the individual sites, such as minor criteria in the study, are less sensitive to changes in their numerical values. Therefore the study focused on sensitivity analysis of the major criteria weighting factors.

5.2.1 Major Criteria

Concentrate disposal is considered the most important criteria by virtue of its documented environmental and economic impacts on the ultimate developability of a desalination project. It therefore receives the highest weighting of all the major criteria.

The hydrogeology and steam availability categories are considered equally important, but well below concentrate disposal in terms of overall environmental and economic impacts. The lower weighting is based on the fact that unfavorable characteristics of the hydrogeological and steam availability categories can be screened out through the careful selection of plant site, feedwater type, and process selected. On the other hand, all desalination processes produce and require the disposal of concentrate. The persistence and magnitude of this problem, therefore, justifies its importance as pointed out earlier.

The environmental/socioeconomic category is considered the most important of the three bottom-weighted categories because of the unpredictability of the local community's response to the plant, and the large number of environmental and socioeconomic issues, which need to be addressed. These issues, however, are typically not volatile enough to endanger the overall viability of a project site.

The utility services and land issues categories are assigned the lowest weight for this site ranking exercise due to their relatively lower impact on site viability.

Weighting factors were assigned to the six major categories in terms of percent, as shown in Table 5.1.

TABLE 5.1
MAJOR CATEGORY WEIGHTING FACTORS

Category	Weighting Factor (%)
Concentrate Disposal	50
Steam Availability	15
Hydrogeology	15
Environmental/Socioeconomic	10
Utility Services	5
Land Issues	5
TOTAL	100%

Each of the six major criteria was further defined by minor criteria. These minor criteria allow for a more sensitive comparison between sites.

5.2.2 Minor Criteria

Minor criteria are identified for each of the six major criteria. As a result, the score for each of the major criteria represents the total of several minor criteria scores. The advantage of this system is that the minor criteria help to better define the major criteria, resulting in a score more sensitive to the unique characteristics of that site. A total of 13 minor criteria are shown in Table 5.2

TABLE 5.2
MINOR CRITERIA LISTING

Major Criteria	Minor Criteria
Concentrate Disposal	Available options: o Use of Existing WWTP Outfall o Injection Wells o Dedicated Outfall Number/ Quality of Available Options Assessed Practicality
Steam Availability	Available Options: o Surplus Steam Available Nearby o Cogeneration Option o Dedicated Steam Production Community/Environmental Concerns
Hydrogeology	Feedwater Source Quality Pumping Impacts on Quality Offsite Contamination Potential
Environmental/ Socioeconomic	Air Quality Concerns Noise Quality Concerns Visual Aesthetics Concerns
Utility Services	Water System Integration Electrical Availability
Land Issues	Zoning/Land Use Compatibility

Each minor criterion was scored for each site. The scoring was based on a 0 to 20 scale, in increments of five.

Concentrate Disposal Criteria

The two most frequently used disposal options are regulated by the State DOH and the U.S. EPA: ocean outfall discharge with an NPDES individual permit; and injection well disposal with a UIC permit. The disposal option, or options, available to a site depend on the site's proximity to the coast (more specifically the UIC line) and the offshore marine conditions.

The use of an existing WWTP outfall is considered the most desirable option due to the low capital and O&M costs, and the added benefit of "enhancing" the buoyancy characteristics of the existing wastewater effluent plume in the open ocean. The mixing of high salinity

concentrate and the relatively "fresh" wastewater in the right proportion prior to outfall discharge can increase the density of the resulting effluent plume in the ocean, thus preventing the plume from rising to the surface, a desirable end result. Initial dilution ratios will be reduced depending on the mixing ratio of concentrate to wastewater effluent, and their respective concentrations. A plume modeling study would be conducted if the WWTP outfalls were utilized and coordinated the appropriate agencies.

The construction of an injection well field is a favorable option, especially for coastal sites where the subsurface geology is highly permeable, and comes under significant seawater intrusion and tidal influence, creating ideal flushing and dispersion effects. Injection of high salinity concentrate, as much as 80% higher than seawater, is currently practiced by several industries in the JCIP area. The costs associated with a new injection well field include well drilling and casing, concentrate storage (if required), and possibly pumping facilities. Land acquisition may also be an added cost if the desalination plant site is not located right on the ocean. The costs of constructing an injection well field, however, are typically well below that of building a dedicated outfall. The environmental impacts could offset the cost savings, however, especially the impacts on coastal hydrogeology and the nearshore marine environment. High salinity concentrate may increase the salinity of nearby wells and aggravate scaling and corrosion problems in the nearby well user's industrial cooling equipment. The higher salinities may also show up in the nearshore environment and affect coastal marine life.

A dedicated outfall is the least desirable choice due to high capital costs. In fact, the cost of a dedicated outfall alone could challenge the viability of an entire project. However, this may be the most viable option to accommodate higher flows from large scale production.

Based on the above discussion, the different options were scored in the following manner:

Use of Existing WWTP	= 15-20 points
Construct Injection Wells	= 0-15 points
Construct Dedicated Outfall	= 0-5 points
Quality of Available Options	= 0-20 points

Steam Availability Criteria

Steam availability is considered crucial to the development of a desalination plant employing distillation technology. Three general categories are acknowledged in this report: surplus steam available from a nearby source; cogeneration through the use of low cost alternate fuels; and steam generation through a dedicated boiler.

Surplus steam availability is considered the cheapest option by far, allowing the plant itself to act as the existing power plant's condenser of waste steam. As an added benefit, electrical power may be generated from the steam's energy. Cogeneration is an available option, given a favorable fuel price, and has the additional benefit of generating electrical power. Dedicating a boiler to the production of steam for a desalination plant is generally considered to be a non-option. That is, competing technologies like seawater reverse osmosis are a more viable option. Only one of the twelve candidate sites was deemed to have the potential for the development of available surplus steam was the BHP site. However, capital costs for intake and concentrate disposal structures are expected to be significant, resulting in a lower overall rating in the site selection matrix evaluation. The cogeneration option was assumed to be available at all sites. The difference between having waste steam and having to produce it with a dedicated boiler is reflected in the score assigned to each of the three options:

Surplus Steam Available Nearby	20 points
Cogeneration Option	5 points
Dedicated Steam Production	0 points

Hydrogeological Criteria

Three hydrogeological parameters affect the evaluation of a feedwater source: source quality, pumping impacts, and contamination potential. The effect of source quality on the operation of a desalination plant could determine the process type, pre-treatment requirements, materials selection, and ultimately, the feasibility of its use for desalination. Pumping impact problems can occur in several ways: water quality degradation (seawater intrusion, migration of contaminants), lowering of the water table in the zone of influence, and potential subsidence of building foundations in the area due to dewatering and compression of underlying soils. The contamination potential of a site is often based on a historical survey of nearby land uses and, if resources allow for it, a hydrogeological modeling study.

As a general rule, candidate sites outside of the James Campbell Industrial Park (JCIP) area scored better (20 and 15 points, coastal and inland, respectively) than their industrialized counterparts (15 and 10 points, coastal and inland, respectively) in evaluating feedwater source quality, with the exception of the Kewalo Corporation Yard site (10 points) which has some landfill leachate concerns. Likewise, candidate sites outside of JCIP (20 and 15 points, coastal and inland, respectively) were often located in areas which were not receiving nearby industrial injection fluids, or were located away from areas influenced by industrial well development and pumping (10 points). Thus, the impacts of prolonged pumping on feedwater quality were minimized. Finally, the offsite contamination potential was considered to be the greatest at JCIP sites (10 points). Coastal and inland sites away from JCIP (20 and 15 points, respectively) fared the best in this minor criteria category.

Environmental/Socioeconomical Concerns Criteria

Environmental concerns relating to noise, air quality and aesthetics could be minimized if a plant was sited within an existing industrial area. Archaeological concerns could also be minimized for potential plant sites located in well-developed industrial areas or on man-made lands, like Sand Island or the Kakaako Community Development District - Makai Area. Community concerns may become an issue for plant sites located near primary urban areas, like residential Honolulu or the residential areas of the proposed second city of Kapolei.

Air quality concerns were considered to be most critical at the James Campbell Industrial Park (JCIP) area sites (10 points) due to the large number of industries, which contribute emissions to the local airshed. Sites outside of JCIP scored better (15 points) but were hindered slightly by their proximity to populated residential and commercial areas. Noise quality concerns were judged to be the most critical in urban areas (15 and 10 points typically), and the least critical in heavily industrialized areas like JCIP (20 points). The same line of reasoning in addressing noise quality concerns was applied to the evaluation of the candidate sites with respect to visual aesthetics concerns.

Utility Services Criteria

Areas characterized by industry, e.g. Campbell Industrial Park and Sand Island, often have the benefit of significant roadway, sewer, water, drain, and power infrastructure (20 points). Agricultural and residential subdivision areas may be infrastructure poor relative to the water and power needs of a desalination plant (15 points). Older industrial areas undergoing revitalization, like the Kakaako Community Development District - Makai Area, are having their undersized utility systems upsized to meet the projected population's needs (20 points).

Land Use Criteria

The land use and zoning information obtained from the City and County of Honolulu was used for an initial screening of the ten potential sites. Industrial sites are given favorable scoring (20 points), while agricultural lands adjacent to industrial areas receive slightly lower scores. Agricultural lands in close proximity to residential developments, e.g. east of the Barbers Point Naval Air Station (BPNAS), and residentially zoned lands receive less favorable scoring (15 points). Sites requiring relocation of existing tenants, especially long-term government agencies or heavy industries, receive low marks (10 points). Vacant land owned by the City or State is considered ideal. Federally owned lands are considered a remote acquisition option. If necessary, BWS may exercise their powers of eminent domain to obtain privately held land at fair market value.

5.2.3 Sensitivity Analysis

The major criteria weighting factors are repeated below. The three heaviest weighted factors, concentrate disposal, hydrogeology, and steam availability, together total 80 percent. This combined percentage is referred to as the three-factor total.

MAJOR CATEGORY WEIGHTING FACTORS

Category	Weighting Factor (%)
Concentrate Disposal	50
Steam Availability	15
Hydrogeology	15
Environmental/Socioeconomic	10
Utility Services	5
Land Issues	5
TOTAL	100%

The identification of a sensitivity range to evaluate the proposed weighting factor was based on several assumptions. First, the three-factor total must maintain a minimum value of around two-thirds (67%) the total weight of the six major categories. This is to assure that a site score well in the bottom three major categories does not slip into the top five rankings without scoring well in the concentrate disposal category, a to a lesser extent, in the steam availability and hyrodrogeology categories.

At the same time, the bottom three factors need to maintain a minimum combined value in order to remain a significant part of the evaluation. This minimum value is assumed to be 10 percent.

Thus, in order for the sensitivity analysis to meet the above criteria, the three-factor total was varied from 65% to 90%, Tables 5-3 to 5-8. The site selection matrix calculations are applied to the range in 5 percent increments of the three-factor total.

TABLE 5.3
SENSITIVITY ANALYSIS - RANKING SUMMARY

	SITE INFORMATION	PACIFIC TSUNAMI WARNING CENTER	BARBERS POINT NAS	HAWAII MEAT PACKERS	BHP SITE	HAWAII PROJECT MANAGERS	SAI
	LOCATION	EAST EWA	BPNAS	WEST EWA	WEST EWA	WEST EWA	SAI
	T.M.K.	9-1-01:por. 1	9-1-13.01	9-1-31:01	9-1-32.01	9-1-26:36	
	OWNER	U.S. GOVERNMENT	U.S. GOVERNMENT	STATE OF HAWAII	CAMPBELL	HAWAII PROJ. MGRS.	STAT
	ACREAGE(AC)	175	20+	94	52	29	
S-FACTOR PERCENTAGE	*REFERENCE TABLE*						
65	2.19-A	1	2	3	6	4	
70	2.19-B	1	2	4	3	5	
75	2.19-C	1	2	4	3	5	
80	2.18	1	2	3	8	4	
85	2.19-D	1	2	5	3	6	
90	2.19-E	1	2	5	3	6	
	AVE. RANKING	1.00	2.00	4.00	4.33	5.00	
	OVERALL RANKING	1	2	3	4	5	

UMMARY

WAII PROJECT MANAGERS	*SAND ISLAND WWTP*	*CITY/CAMPBELL ESTATE SWAP*	*KENAI IND. PARK*	*KEWALO CORP. YD.*	*KEEHI LAGOON PARK*	*EWA DEMO. DESALT. PLANT*	*HONOULIULI WWTP*
WEST EWA 9-1-26:36 VAII PROJ. MGRS. 29	SAND ISLAND 1-5-11:05 STATE OF HAWAII 50	WEST EWA 9-1-26:04 CAMPBELL 19	WEST EWA 9-1-14:04,05 CIRI LAND DEV. 69	KAKAAKO 2-1-60.05 STATE OF HAWAII 5	AIRPORT 1-1-03 06 STATE OF HAWAII 69	WEST EWA 9-1-15:12 STATE OF HAWAII 8	EAST EWA 9-1-13.07 C&C HONOLULU 49
				SITE RANKING			
4	7	5	8	9	10	11	12
5	7	6	8	9	10	11	12
5	7	6	8	9	10	11	12
4	7	5	6	9	10	11	12
6	4	7	8	9	10	12	11
6	4	7	8	9	10	12	11
5 00 5	6 00 6	6 00 7	7.67 8	9 00 9	10 00 10	11 33 11	11 67 12

TABLE 5.4

SITE SELECTION MATRIX

	Wt (%)	PACIFIC TSUNAMI WARNING CENTER	BARBERS POINT NAS	HAWAII MEAT PACKERS	HAWAII PROJECT MANAGERS	CITY/CAMPBELL ESTATE SWAP
SITE INFORMATION						
LOCATION		EAST EWA	BPNAS	WEST EWA	WEST EWA	WEST EWA
T.M.K.		9-1-01:por. 1	9-1-13:01	9-1-31:01	9-1-26:36	9-1-26:04
OWNER		U.S. GOVERNMENT	U.S. GOVERNMENT	STATE OF HAWAII	HAWAII PROJ. MGRS	CAMPBELL
ACREAGE(AC)		175	201	94	29	
FEED/TECH/DISP. *		M	M	M	M	M
						Sub-Criteria Scale = 0 TO
Land Issues	10					
Existing Zoning/Land Use Compatibility		15	10	20	20	20
Hydrogeology	15					
Freshwater Source Quality		15	15	15	15	15
Pumping Impacts on Quality		15	15	10	10	10
Offsite Contamination Potential		20	15	10	10	10
Utility Services	10					
Water System Integration		20	10	15	15	15
Electrical Availability		10	15	15	15	15
Environmental/Socioeconomic	15					
Air Quality Concerns		15	10	10	10	10
Noise Quality Concerns		15	10	20	20	20
Visual Aesthetics Concerns		15	10	20	20	20
Brine Disposal Costs	35					
Pick one:						
- Existing Outfall = 15-20 points		0	0	0	0	0
- Injection Wells = 5-15 points		15	15	10	10	10
- Dedicated Outfall = 0-5 points		0	5	5	5	5
Quality of Available Options (0 - 20)		20	20	15	15	15
Steam Availability/Generating Capacity	15					
Pick one:						
- Surplus Steam Available Nearby = 20 points		0	0	0	0	0
- Cogeneration Option = 10 points		10	10	10	10	10
- Dedicated Steam Production = 0 points		0	0	0	0	0
Community/Environmental Concerns		15	15	15	15	15
TOTAL COMPOSITE SCORE		34.75	32.50	32.00	32.00	32.00
RANK		1	2	3	4	5

* FEED / TECHNOLOGY / DISPOSAL CONFIG :
M - SW WELL/SWRO/INJ. WELLS
D - SW INTAKE/DISTILLATION/DED. OUTFALL

BLE 5.4
ECTION MATRIX

CITY/CAMPBELL ESTATE SWAP	BHP SITE	SAND ISLAND WWTP	KENAI IND. PARK	KEWALO CORP. YD.	KEEHI LAGOON PARK	EWA DESAL. DESALT. PLANT	HONOULIULI WWTP
WEST EWA 9-1-26:04 CAMPBELL	WEST EWA 9-1-32:01 CAMPBELL	SAND ISLAND 1-3-41:05 STATE OF HAWAII	WEST EWA 9-1-14:04,05 CIRI LAND DEV.	KAKAAKO 2-1-60:05 STATE OF HAWAII	AIRPORT 1-1-03:06 STATE OF HAWAII	WEST EWA 9-1-15:12 STATE OF HAWAII	EAST EWA 9-1-13:07 C&C HONOLULU
M	52 D	50 None	69 M	5 M	69 M	8 None	49 None
Sub-Criteria Scale = 0 TO 20							
20	20	0	5	0	5	20	0
15	15	15	15	15	15	15	20
10	20	15	10	10	10	10	10
10	20	15	10	10	5	15	15
15	15	20	15	20	20	20	20
15	15	10	15	10	10	20	20
10	10	15	10	10	10	15	15
20	20	20	20	10	10	15	15
20	20	20	20	10	10	15	15
0	0	0	0	0	0	0	0
10	0	10	10	15	15	5	5
5	5	5	5	5	0	0	0
15	5	10	15	10	10	0	0
0	20	0	0	0	0	0	0
10	10	10	10	15	10	10	10
0	0	0	0	0	0	0	0
15	15	15	15	5	5	10	10
32.00	31.00	30.50	30.50	25.50	24.25	23.50	22.25
5	6	7	8	9	10	11	12

TABLE 5.5

SITE SELECTION MATRIX

		PACIFIC TSUNAMI WARNING CENTER	BARBERS POINT NAS	BHP SITE	HAWAII MEAT PACKERS	HAWAII PROJECT MANAGERS	CI E
SITE INFORMATION							
LOCATION		EAST EWA	BPNAS	WEST EWA	WEST EWA	WEST EWA	
T.M.K.		9-1-01:por. 1	9-1-13:01	9-1-32:01	9-1-31:01	9-1-26:36	
OWNER		U.S. GOVERNMENT	U.S. GOVERNMENT	CAMPBELL	STATE OF HAWAII	HAWAII PROJ. MGRS	
ACREAGE(AC)		175	20+	52	94	29	
FEED/TECH./DISP. *		M	M	D	M	M	
	Wt (%)						Sub-Criteria
Land Issues	10						
Existing Zoning/Land Use Compatibility		15	10	20	20	20	
Hydrogeology	20						
Feedwater Source Quality		15	15	15	15	15	
Pumping Impacts on Quality		15	15	20	10	10	
Offsite Contamination Potential		20	15	20	10	10	
Utility Services	10						
Water System Integration		20	10	15	15	15	
Electrical Availability		10	15	15	15	15	
Environmental/Socioeconomic	10						
Air Quality Concerns		15	10	10	10	10	
Noise Quality Concerns		15	10	20	20	20	
Visual Aesthetics Concerns		15	10	20	20	20	
Brine Disposal Costs	35						
Pick one:							
• Existing Outfall = 15-20 points		0	0	0	0	0	
• Injection Wells = 5-15 points		15	15	0	10	10	
• Dedicated Outfall = 0-5 points		0	5	5	5	5	
Quality of Available Options (0 - 20)		20	20	5	15	15	
Steam Availability/Generating Capacity	15						
Pick one:							
• Surplus Steam Available Nearby = 20 points		0	0	20	0	0	
• Cogeneration Option = 10 points		10	10	10	10	10	
• Dedicated Steam Production = 0 points		0	0	0	0	0	
Community/Environmental Concerns		15	15	15	15	15	
TOTAL COMPOSITE SCORE		35.00	33.25	31.25	31.25	31.25	
RANK		1	2	3	4	5	

* FEED / TECHNOLOGY / DISPOSAL CONFIG :
M - SW WELL/SWRO/INJ. WELLS
D - SW INTAKE/DISTILLATION/DED. OUTFALL

.5.5
TION MATRIX

ROJECT GERS	*CITY/CAMPBELL ESTATE SWAP*	*SAND ISLAND WWTP*	*KENAI IND. PARK*	*KEWALO CORP. YD.*	*KEEHI LAGOON PARK*	*EWA DEMO. DESALT. PLANT*	*HONOULIULI WWTP*
EWA	WEST EWA	SAND ISLAND	WEST EWA	KAKAAKO	AIRPORT	WEST EWA	EAST EWA
6:36	9-1-26:04	1-5-41.03	9-1-14.04,05	2-1-60.03	1-1-03:06	9-1-15:12	9-1-13.07
OJ. MGRS	CAMPBELL	STATE OF HAWAII	CIRI LAND DEV	STATE OF HAWAII	STATE OF HAWAII	STATE OF HAWAII	C&C HONOLULU
?		50	69	5	69	8	49
I	M	None	M	M	M	None	None
	Sub-Criteria Scale = 0 TO 20						
)	20	0	5	0	5	20	0
)	15	15	15	15	15	15	20
)	10	15	10	10	10	10	10
)	10	15	10	10	5	15	15
)	15	20	15	20	20	20	20
)	15	10	15	10	10	20	20
)	10	15	10	10	10	15	15
)	20	20	20	10	10	15	15
)	20	20	20	10	10	15	15
)	0	0	0	0	0	0	0
)	10	10	10	15	15	5	5
)	5	5	5	5	0	0	0
)	15	10	15	10	10	0	0
)	0	0	0	0	0	0	0
)	10	10	10	10	10	10	10
)	0	0	0	0	0	0	0
)	15	15	15	5	5	10	10
5	31 25	30 00	29 75	25.75	24.25	23 25	22.25
	6	7	8	9	10	11	12

TABLE 5.6

SITE SELECTION MATRIX

		PACIFIC TSUNAMI WARNING CENTER	BARBERS POINT NAS	BHP SITE	HAWAII MEAT PACKERS	HAWAII PROJECT MANAGERS
SITE INFORMATION						
LOCATION		EAST EWA	BPNAS	WEST EWA	WEST EWA	WEST EWA
T.M.K.		9-1-01:por. 1	9-1-13.01	9-1-32.01	9-1-31:01	9-1-26:36
OWNER		U.S. GOVERNMENT	U.S. GOVERNMENT	CAMPBELL	STATE OF HAWAII	HAWAII PROJ. MGRS.
ACREAGE(AC)		175	20+	52	94	29
FEED/TECH/DISP. *		M	M	D	M	M
	Wt (%)					Sub-Ct
Land Issues	10					
Existing Zoning/Land Use Compatibility		15	10	20	20	20
Hydrogeology	25					
Feedwater Source Quality		15	15	15	15	15
Pumping Impacts on Quality		15	15	20	10	10
Offsite Contamination Potential		20	15	20	10	10
Utility Services	5					
Water System Integration		20	10	15	15	15
Electrical Availability		10	15	15	15	15
Environmental/Socioeconomic	10					
Air Quality Concerns		15	10	10	10	10
Noise Quality Concerns		15	10	20	20	20
Visual Aesthetics Concerns		15	10	20	20	20
Brine Disposal Costs	35					
Pick one:						
- Existing Outfall = 15-20 points		0	0	0	0	0
- Injection Wells = 5-15 points		15	15	0	10	10
- Dedicated Outfall = 0-5 points		0	5	5	5	5
Quality of Available Options (0 - 20)		20	20	5	15	15
Steam Availability/Generating Capacity	15					
Pick one:						
- Surplus Steam Available Nearby = 20 points		0	0	20	0	0
- Cogeneration Option = 10 points		10	10	10	10	10
- Dedicated Steam Production = 0 points		0	0	0	0	0
Community/Environmental Concerns		15	15	15	15	15
TOTAL COMPOSITE SCORE		36.00	34.25	32.50	31.50	31.50
RANK		1	2	3	4	5

* FEED / TECHNOLOGY / DISPOSAL CONFIG :
M - SW WELL/SWRO/INJ. WELLS
D - SW INTAKE/DISTILLATION/DED. OUTFALL

LE 5.6

CTION MATRIX

II PROJECT NAGERS	CITY/CAMPBELL ESTATE SWAP	SAND ISLAND HWTP	KENAI IND. PARK	KEHALO CORP. YD.	KEEHI LAGOON PARK	EWA DEMO. DESALT. PLANT	HONOULIULI HWTP
ST EWA 1-26;36 PROJ. MGRS.	WEST EWA 9-1-76.04 CAMPBELL	SAND ISLAND 1-5-41.05 STATE OF HAWAII	WEST EWA 9-1-14;04,05 CIRI LAND DEV	KAKAAKO 2-1-60.05 STATE OF HAWAII	AIRPORT 1-1-03.06 STATE OF HAWAII	WEST EWA 9-1-15;12 STATE OF HAWAII	EAST EWA 9-1-13.07 C&C HONOLULU
29 M	M	50 None	69 M	3 H	69 M	8 None	49 None
Sub-Criteria Scale = 0 TO 20							
20	20	0	5	0	5	20	0
15	15	15	15	15	15	15	20
10	10	15	10	10	10	10	10
10	10	15	10	10	5	15	15
15	15	20	15	20	20	20	20
15	15	10	15	10	10	20	20
10	10	15	10	10	10	15	15
20	20	20	20	10	10	15	15
20	20	20	20	10	10	15	15
0	0	0	0	0	0	0	0
10	10	10	10	15	15	5	5
5	5	5	5	5	0	0	0
15	15	10	15	10	10	0	0
0	0	0	0	0	0	0	0
10	10	10	10	10	10	10	10
0	0	0	0	0	0	0	0
15	15	15	15	5	5	10	10
1.50	31 50	30 75	30.00	26 00	24.25	23.25	22.50
5	6	7	8	9	10	11	12

TABLE: 5.7

SITE SELECTION MATRIX

		PACIFIC TSUNAMI WARNING CENTER	BARBERS POINT NAS	BHP SITE	SAND ISLAND WWTP	HAWAII MEAT PACKERS	HAWAII PRO. MANAGEI
SITE INFORMATION							
LOCATION		EAST EWA	BPNAS	WEST EWA	SAND ISLAND	WEST EWA	WEST EW
T.M.K.		9-1-01:por. 1	9-1-13:01	9-1-32.01	1-5-41.05	9-1-31:01	9-1-26:36
OWNER		U.S. GOVERNMENT	U.S. GOVERNMENT	CAMPBELL	STATE OF HAWAII	STATE OF HAWAII	HAWAII PROJ.
ACREAGE(AC)		175	204	52	50	94	29
FEED/TECH/DISP *		M	M	D	None	M	M
	Wt (%)						
Land Issues	5						
Existing Zoning/Land Use Compatibility		15	10	20	0	20	20
Hydrogeology	30						
Feedwater Source Quality		15	15	15	15	15	15
Pumping Impacts on Quality		15	15	20	15	10	10
Offsite Contamination Potential		20	15	20	15	10	10
Utility Services	5						
Water System Integration		20	10	15	20	15	15
Electrical Availability		10	15	15	10	15	15
Environmental/Socioeconomic	5						
Air Quality Concerns		15	10	10	15	10	10
Noise Quality Concerns		15	10	20	20	20	20
Visual Aesthetics Concerns		15	10	20	20	20	20
Brine Disposal Costs	40						
Pick one:							
• Existing Outfall = 15-20 points		0	0	0	0	0	0
• Injection Wells = 5-15 points		15	15	0	10	10	10
• Dedicated Outfall = 0-5 points		0	5	5	5	5	5
Quality of Available Options (0 - 20)		20	20	5	10	15	15
Steam Availability/Generating Capacity	15						
Pick one:							
• Surplus Steam Available Nearby = 20 points		0	0	20	0	0	0
• Cogeneration Option = 10 points		10	10	10	10	10	10
• Dedicated Steam Production = 0 points		0	0	0	0	0	0
Community/Environmental Concerns		15	15	15	15	15	15
TOTAL COMPOSITE SCORE		37.25	36.50	32.25	31.50	31.25	31.25
RANK		1	2	3	4	5	6

* FEED / TECHNOLOGY / DISPOSAL CONFIG :
M - SW WELL/SWRO/I.U. WELLS
D - SW INTAKE/DISTILLATION/DED. OUTFALL

:5.7

TION MATRIX

EAT *S*	*HAWAII PROJECT MANAGERS*	*CITY/CAMPBELL ESTATE SWAP*	*KENAI IND. PARK*	*KEWALO CORP. ID.*	*KEEHI LAGOON PARK*	*HONOULIULI HWTP*	*EWA DEMO. DESALT. PLANT*
IA	WEST EWA	WEST EWA	WEST EWA	KAKAAKO	AIRPORT	EAST EWA	WEST EWA
I	9-1-26:36	9-1-26.04	9-1-14.04,05	2-1-60 05	1-1-03.06	9-1-13:07	9-1-15:12
AWAII	HAWAII PROJ. MGRS.	CAMPBELL	CIRI LAND DEV.	STATE OF HAWAII	STATE OF HAWAII	C&C HONOLULU	STATE OF HAWAII
	29		69	5	69	49	8
	M	M	M	M	M	None	None
	Sub-Criteria Scale = 0 TO 20						
	20	20	5	0	5	0	20
	15	15	15	15	15	20	15
	10	10	10	10	10	10	10
	10	10	10	10	5	15	15
	15	15	15	20	20	20	20
	15	15	15	10	10	20	20
	10	10	10	10	10	15	15
	20	20	20	10	10	15	15
	20	20	20	10	10	15	15
	0	0	0	0	0	0	0
	10	10	10	15	15	5	5
	5	5	5	5	0	0	0
	15	15	15	10	10	0	0
	0	0	0	0	0	0	0
	10	10	10	10	10	10	10
	0	0	0	0	0	0	0
	15	15	15	5	5	10	10
	31.25	31.25	30.50	27.75	24.25	22.75	22.25
	6	7	8	9	10	11	12

TABLE 5.8
SITE SELECTION MATRIX

		PACIFIC TSUNAMI WARNING CENTER	BARBERS POINT NAS	BHP SITE	SAND ISLAND WWTP	HAWAII MEAT PACKERS	HAWAII PROJEC MANAGERS
SITE INFORMATION							
LOCATION		EAST EWA	BPNAS	WEST EWA	SAND ISLAND	WEST EWA	WEST EWA
T.M.K.		9-1-01:por. 1	9-1-13:01	9-1-32:01	1-3-41:05	9-1-31:01	9-1-26:36
OWNER		U.S. GOVERNMENT	U.S. GOVERNMENT	CAMPBELL	STATE OF HAWAII	STATE OF HAWAII	HAWAII PROJ MGI
ACREAGE(AC)		175	20+	52	50	94	29
FEED/TECH/DISP. *		M	M	D	None	M	M
	Wt (%)						
Land Issues	5						
Existing Zoning/Land Use Compatibility		15	10	20	0	20	20
Hydrogeology	30						
Feedwater Source Quality		15	15	15	15	15	15
Pumping Impacts on Quality		15	15	20	15	10	10
Offsite Contamination Potential		20	15	20	15	10	10
Utility Services	0						
Water System Integration		20	10	15	20	15	15
Electrical Availability		10	15	15	10	15	15
Environmental/Socioeconomic	5						
Air Quality Concerns		15	10	10	15	10	10
Noise Quality Concerns		15	10	20	20	20	20
Visual Aesthetics Concerns		15	10	20	20	20	20
Brine Disposal Costs	45						
Pick one:							
- Existing Outfall = 15-20 points		0	0	0	0	0	0
- Injection Wells = 5-15 points		15	15	0	10	10	10
- Dedicated Outfall = 0-5 points		0	5	5	5	5	5
Quality of Available Options (0 - 20)		20	20	5	10	15	15
Steam Availability/Generating Capacity	15						
Pick one:							
- Surplus Steam Available Nearby = 20 points		0	0	20	0	0	0
- Cogeneration Option = 10 points		10	10	10	10	10	10
- Dedicated Steam Production = 0 points		0	0	0	0	0	0
Community/Environmental Concerns		15	15	15	15	15	15
TOTAL COMPOSITE SCORE		37.50	37.25	31.25	31.25	31.25	31.25
RANK		1	2	3	4	5	6

* FEED / TECHNOLOGY / DISPOSAL CONFIG :
M - SW WELL/SWRO/INJ. WELLS
D - SW INTAKE/DISTILLATION/DED. OUTFALL

5.8

TION MATRIX

EAT IS	*HAWAII PROJECT MANAGERS*	*CITY/CAMPBELL ESTATE SWAP*	*KENAI IND. PARK*	*KEHALO CORP. YD.*	*KEEHI LAGOON PARK*	*HONOULIULI WWTP*	*EWA DESAL. DESALT. PLANT*
VA II AWAII	WEST EWA 9-1-26:36 HAWAII PROJ MGRS 29 M	WEST EWA 9-1-26:01 CAMPBELL M	WEST EWA 9-1-14.04,05 CITI LAND DEV. 69 M	KAKAAKO 2-1-60:05 STATE OF HAWAII 5 M	AIRPORT 1-1-03.06 STATE OF HAWAII 69 M	EAST EWA 9-1-13.07 C&C HONOLULU 49 None	WEST EWA 9-1-15:12 STATE OF HAWAII 8 None
Sub-Criteria Scale = 0 TO 20							
	20	20	5	0	5	0	20
	15 10 10	15 10 10	15 10 10	15 10 10	15 10 5	20 10 15	15 10 15
	15 15	15 15	15 15	20 10	20 10	20 20	20 20
	10 20 20	10 20 20	10 20 20	10 10 10	10 10 10	15 15 15	15 15 15
	0 10 5 15	0 10 5 15	0 10 5 15	0 15 5 10	0 15 0 10	0 5 0 0	0 5 0 0
	0 10 0 15	0 10 0 15	0 10 0 15	0 10 0 5	0 10 0 5	0 10 0 10	0 10 0 10
	31.25 6	31.25 7	30 50 8	27.75 9	24.25 10	21 00 11	20.50 12

5.2 SUMMARY OF RESULTS AND RECOMMENDATIONS

The results are consistent with several major issues such as concentrate disposal options, feed water accessibility and quality, government-owned land, and industrial land uses. The bottom sites suffered from uncertain land issues, relatively far distance from the coast, anticipated poor feed water quality, and a lack of economical concentrate disposal options.

The Site Selection Matrix, Table 5.9, shows that the following five sites are suitable for further investigation:

1. Pacific Tsunami Warning Center
2. BPNAS White Plains Beach
3. Hawaii Meat Packers
4. BHP Petroleum
5. Hawaii Project Managers

TABLE 5.9

SITE SELECTION MATRIX

	Wt (%)	PACIFIC TSUNAMI WARNING CENTER	BARBERS POINT NAS	HAWAII MEAT PACKERS	HAWAII PROJECT MANAGERS	CITY/CAMPBELL ESTATE SWAP
SITE INFORMATION						
LOCATION		EAST EWA	BPNAS	WEST EWA	WEST EWA	WEST EWA
T.M.K.		9-1-01:por. 1	9-1-13:01	9-1-31:01	9-1-26:36	9-1-26.04
OWNER		U.S. GOVERNMENT	U.S. GOVERNMENT	STATE OF HAWAII	HAWAII PROJ. MGRS	CAMPBELL
ACREAGE(AC)		175	201	94	29	
FEED/TECH./DISP. *		M	M	M	M	M
						Sub-Criteria Scale = 0 TO 20
Land Issues	5					
Existing Zoning/Land Use Compatibility		15	10	20	20	20
Hydrogeology	15					
Feedwater Source Quality		15	15	15	15	15
Pumping Impacts on Quality		15	15	10	10	10
Offsite Contamination Potential		20	15	10	10	10
Utility Services	5					
Water System Integration		20	10	15	15	15
Electrical Availability		10	15	15	15	15
Environmental/Socioeconomic	10					
Air Quality Concerns		15	10	10	10	10
Noise Quality Concerns		15	10	20	20	20
Visual Aesthetics Concerns		15	10	20	20	20
Brine Disposal Costs	50					
Pick one:						
- Existing Outfall = 15-20 points		0	0	0	0	0
- Injection Wells = 5-15 points		15	15	10	10	10
- Dedicated Outfall = 0-5 points		0	5	5	5	5
Quality of Available Options (0 - 20)		20	20	15	15	15
Steam Availability/Generating Capacity	15					
Pick one:						
- Surplus Steam Available Nearby = 20 points		0	0	0	0	0
- Cogeneration Option = 10 points		10	10	10	10	10
- Dedicated Steam Production = 0 points		0	0	0	0	0
Community/Environmental Concerns		15	15	15	15	15
TOTAL COMPOSITE SCORE		35.50	35.25	31.50	31.50	31.50
RANK		1	2	3	4	5

* FEED / TECHNOLOGY / DISPOSAL CONFIG :
M - SW WELL/SWRO/INJ. WELLS
D - SW INTAKE/DISTILLATION/DED. OUTFALL

GB

ABLE 5.9
ECTION MATRIX

CITY/CAMPBELL ESTATE SWAP	*KENAI IND. PARK*	*SAND ISLAND WWTP*	*BHP SITE*	*KEWALO CORP. YD.*	*KEEHI LAGOON PARK*	*EWA DEMO. DESALT. PLANT*	*HONOULIULI WWTP*
WEST EWA	WEST EWA	SAND ISLAND	WEST EWA	KAKAAKO	AIRPORT	WEST EWA	EAST EWA
9-1-26.04	9-1-14:04,05	1-3-41.05	9-1-32:01	2-1-60.05	1-1-03.06	9-1-15:12	9-1-13.07
CAMPBELL	CIRI LAND DEV.	STATE OF HAWAII	CAMPBELL	STATE OF HAWAII	STATE OF HAWAII	STATE OF HAWAII	C&C HONOLULU
	69	50	52	5	69	8	49
M	M	None	D	M	M	None	None
Sub-Criteria Scale = 0 TO 20							
20	5	0	20	0	5	20	0
15	15	15	15	15	15	15	20
10	10	15	20	10	10	10	10
10	10	15	20	10	5	15	15
15	15	20	15	20	20	20	20
15	15	10	15	10	10	20	20
10	10	15	10	10	10	15	15
20	20	20	20	10	10	15	15
20	20	20	20	10	10	15	15
0	0	0	0	0	0	0	0
10	10	10	0	15	15	5	5
5	5	5	5	5	0	0	0
15	15	10	5	15	10	0	0
0	0	0	20	0	0	0	0
10	10	10	10	10	10	10	10
0	0	0	0	0	0	0	0
15	15	15	15	5	5	10	10
31.50	30.75	30.00	27.50	27.00	24.25	19.00	18.75
5	6	7	8	9	10	11	12

SECTION 6. PROPOSED DESALINATION FACILITY

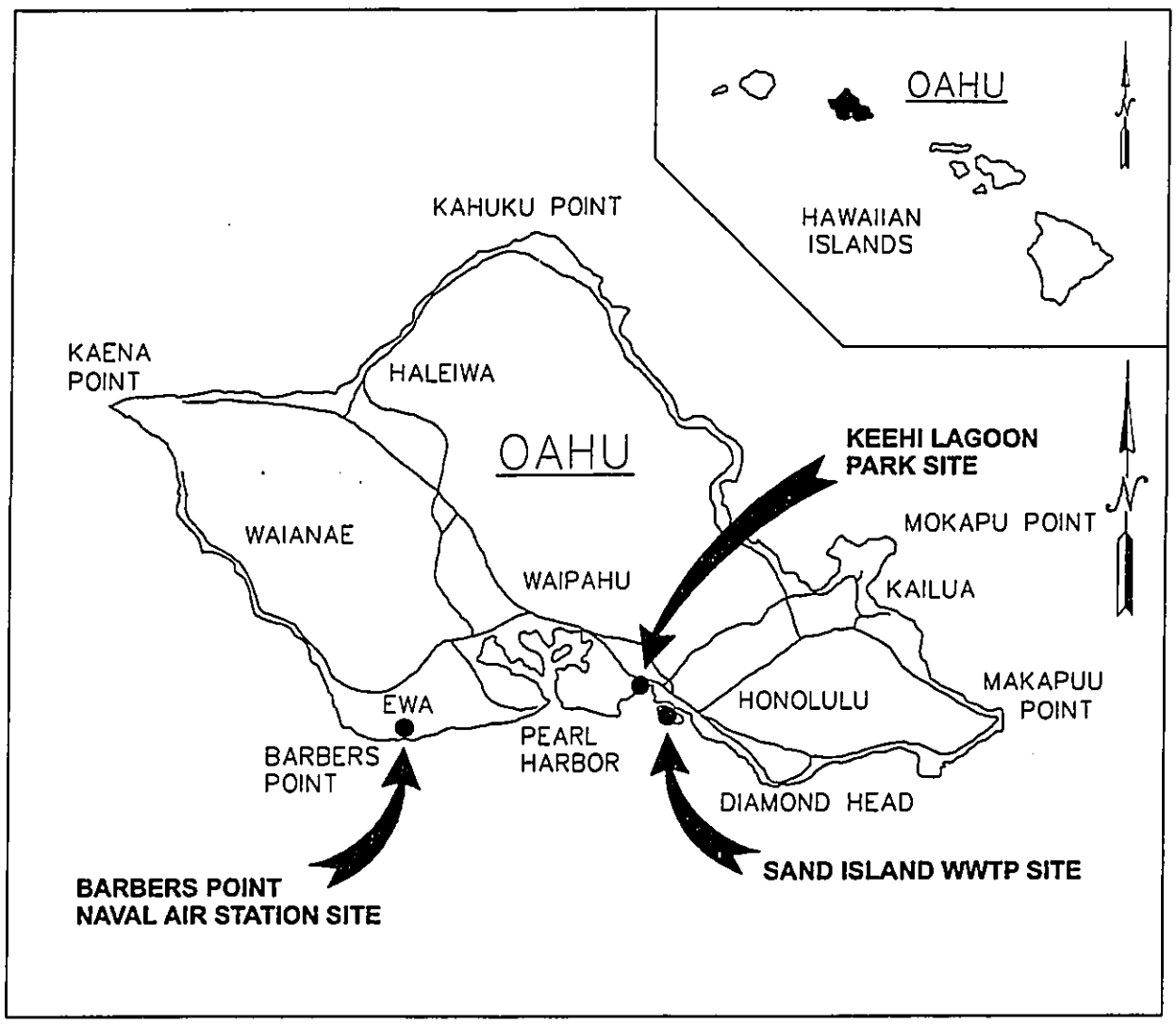
6.1 Introduction

After the completion of the state of the art technology survey and site selection process, further evaluation was conducted for the recommended technologies of Reverse osmosis and Distillation in relation to the preferred site and 2 alternative sites within Honolulu and Ewa. The proposed desalination facility will be constructed in phases over a 30 to 50-year period. The phases may consist of 5-MGD increments, with the total product water capacity of 35 MGD.

6.2 Location

Following an evaluation of 12 potential sites and the opportunity to obtain 20 acres of a 30.8-acre parcel on the western boundary of the Kalaeloa Community Development District (previously called Barbers Point Naval Air Station), three sites were selected as potential locations for the desalination facility. The sites are the Kalaeloa site, located at the southeast portion of Campbell Industrial Park, the Sand Island Wastewater Treatment Plant site, and the Keehi Lagoon Park site. Locations of these three sites are given in Figure 6-1. Although the Kalaeloa site was not included in the initial evaluation of the 12 potential sites, five of the top sites were in Ewa and in proximity to the Campbell Industrial Park.

Figure 6-1
Vicinity Map



A brief discussion of the evaluation of the three sites considered is as follows:

6.2.1 Kalaeloa Site (previously Barbers Point Naval Air Station)

The 20 acres of land to be acquired for the desalination facility is a portion of the 30.8 acres of land area considered by the U.S. Department of Health and Human Services to be eligible for no-cost public benefit conveyance to the Board of Water Supply, Figure 6-2. The proposed desalination facility meets the conditions for no cost benefit conveyance. As a condition of conveyance, there is a three-year period to develop the desalination facility.

The Kalaeloa Desalination Facility is located at the southwestern end of the Kalaeloa Community Development District. A portion of the site lies within an aircraft clearance zone runway easement. A storm drainage channel (80 to 90 feet wide) is situated along the eastern boundary of the site, which separates the site from the rest of the Kalaeloa Community Development District. James A. Campbell Industrial Park (JACIP) adjoins the prospective Kalaeloa desalination site to the north and west and the remaining 10 acres to be acquired by BWS is the southern boundary of property that runs along the Pacific Ocean.

Advantages

The land that constitutes the prospective Kalaeloa desalination site is in the process of being deeded to the City and County of Honolulu following the federal government's closure of Barbers Point Naval Air Station on July 1, 1999. The BWS will obtain 20 acres of land without cost. The site is located near the coast, which makes brine disposal and direct ocean intake relatively straightforward tasks. Obtaining the 30.8 acres permits sufficient space to allow for the future expansion of the feed water wells, brine evaporation pond and 35-million gallon per day (MGD) desalination facility. The site's close proximity to the population density centroid of Oahu makes the location an ideal drinking water source.

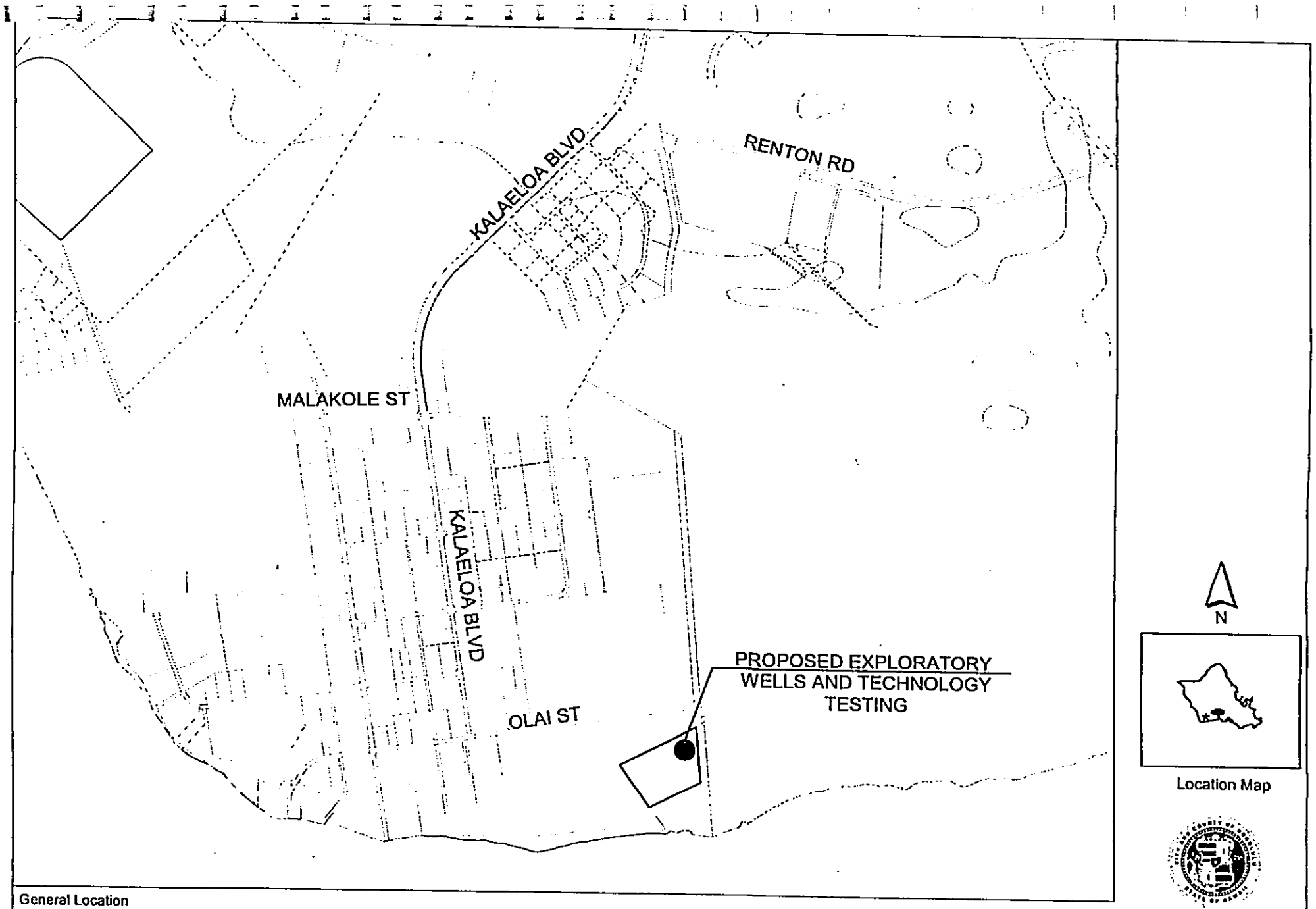

KALAELOA BLVD
RENTON RD
MALAKOLE ST
KALAELOA BLVD
OLAI ST
PROPOSED EXPLORATORY
WELLS AND TECHNOLOGY
TESTING
N
Location Map
General Location
Prepared By: BOARD OF WATER SUPPLY
City & County of Honolulu
Date Prepared: 07/24/2000
2000 0 2000 4000 Feet
1:24000
ARCVIEW 3.0B
HONOLULU LAND INFORMATION SYSTEM
COPYRIGHT CITY & COUNTY OF HONOLULU
ALL RIGHTS RESERVED 1998
DATA DOES NOT REPLACE SITE SURVEYS

Figure 6-2

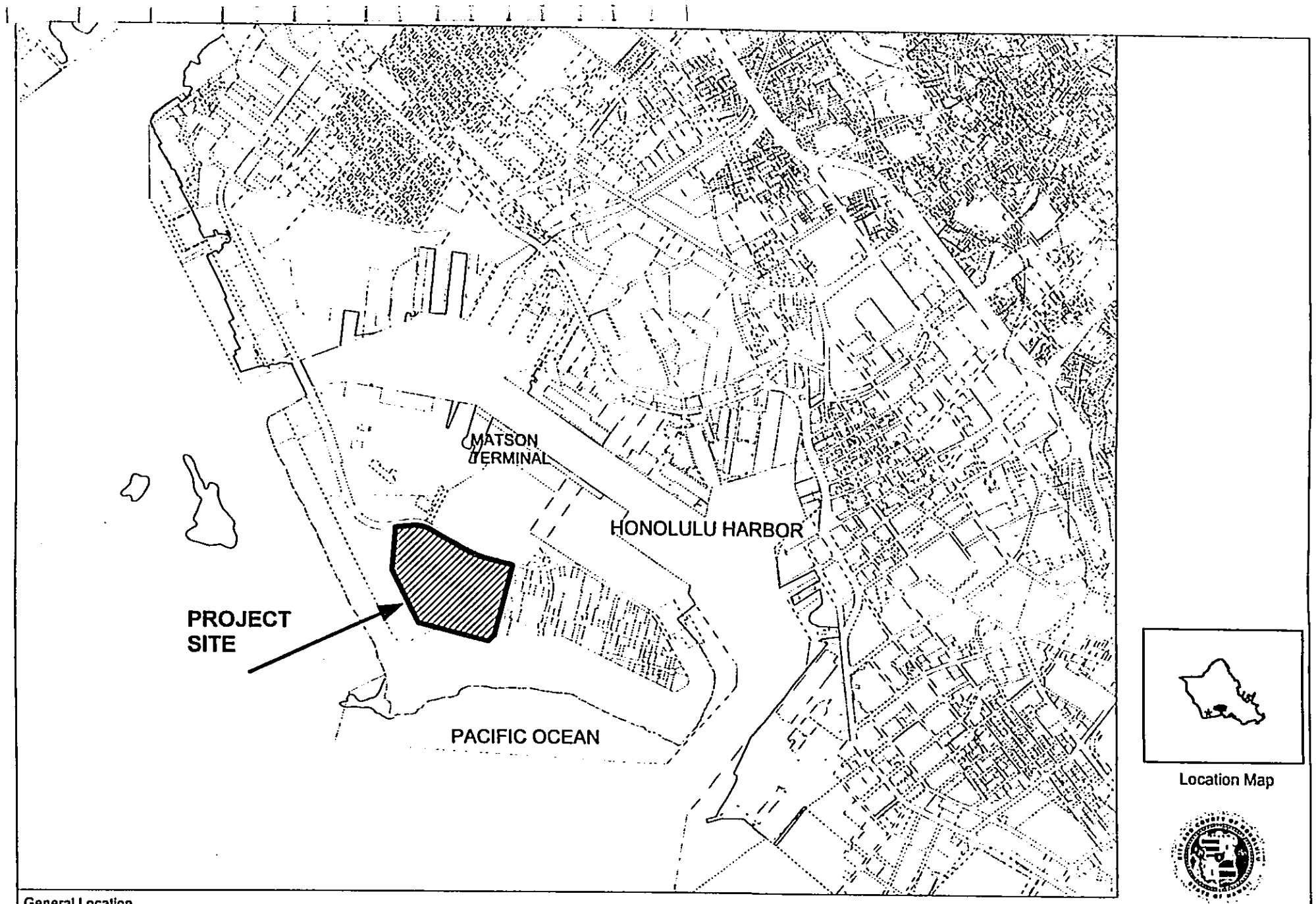
Many water wells exist in James Campbell Industrial Park (JCIP) and hydrogeological data accumulated from a variety of sources including the University of Hawaii at Manoa (UH), State Department of Land and Natural Resources (DLNR), United States Geological Survey (USGS) and other consultants were reviewed. Based on the research, it appears that the caprock aquifer within the site may supply feedwater for up to 10-MGD. However, yield tests will be conducted during the exploratory well stage to verify the estimate. Additional production capacity would require development of off-site caprock wells or on-site basal wells.

Disadvantages

The hydrogeological characteristics of the area encompassing Kalaeloa site and James Campbell Industrial Park (JCIP) are extremely variable over relatively short distances. Although there is an abundance of hydrogeological information for JCIP, there is virtually no site-specific data for the prospective Kalaeloa desalination site. Also, a limit to facility design is the existing runway easement that renders any structures on the site to be 60 feet or less in height.

6.2.2 Sand Island Wastewater Treatment Plant Site

The Sand Island Wastewater Treatment Plant site lies within the Honolulu area. The site is located south of downtown Honolulu on an island approximately one mile long and ¾ mile wide as shown in Figure 6-3. The island was built from material dredged from Honolulu Harbor. The island is accessible only via a bridge located on the western end of the island.



General Location

Prepared By: BOARD OF WATER SUPPLY
City & County of Honolulu

Date Prepared: 07/24/2000

Figure 6-3

N

2000 0 2000 4000 Feet

1:24000

ARCVIEW 3.0B
HONOLULU LAND INFORMATION SYSTEM

DATA DOES NOT REPLACE SITE SURVEYS

Advantages

Sufficient groundwater capacity is available at the site for a 10-MGD desalting plant. The site is near the coast so brine disposal and direct ocean intake is possible. The feedwater supply for the desalination plant expansion for 35-MGD of product water is attainable at the site. A direct ocean intake would be constructed or feed wells must be built in the adjacent Sand Island Recreational Beach Park (or Sand Island State Recreational Area, SISRA) in order to achieve the ultimate target production capacity.

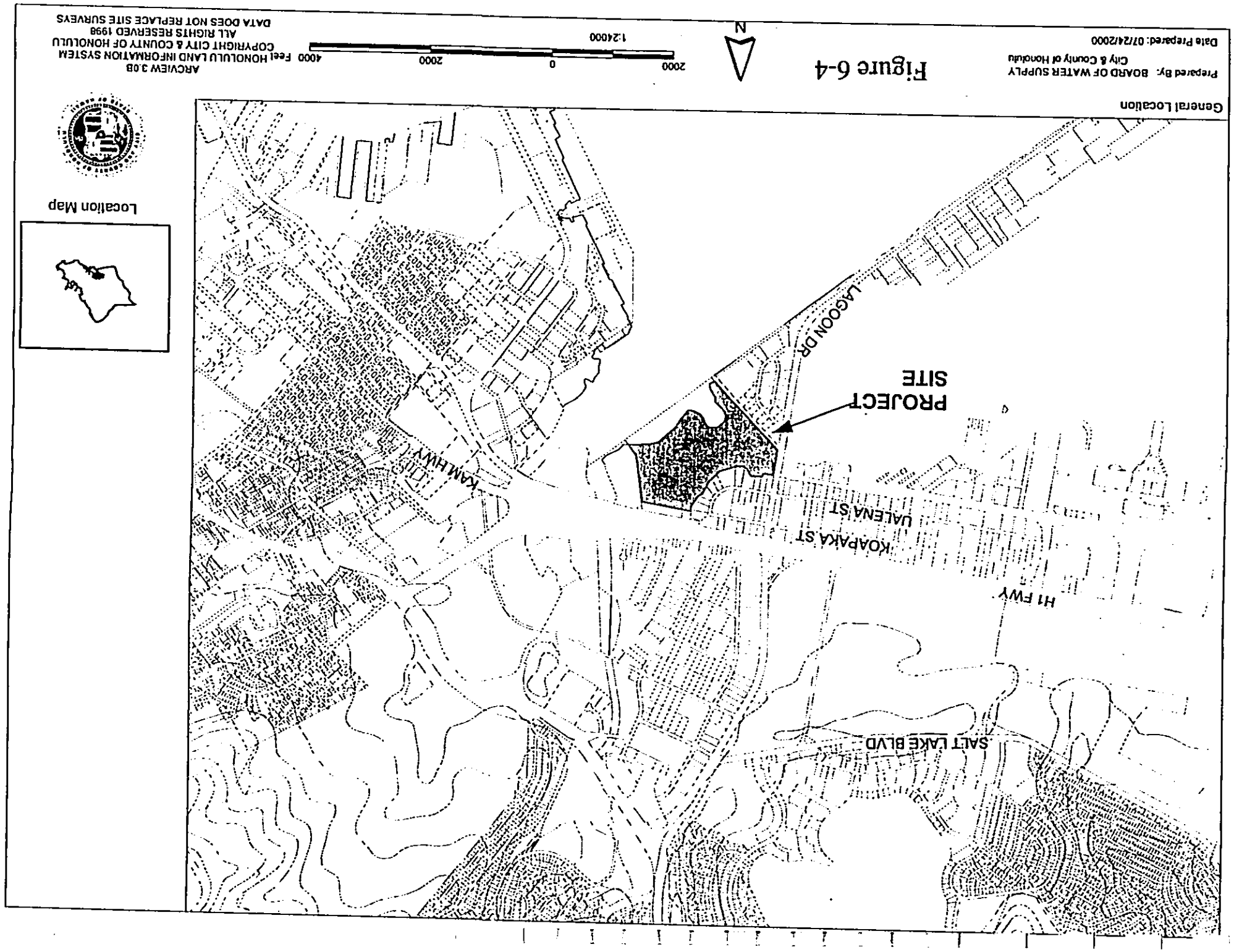
Several existing wells are located on Sand Island from which water quality data was obtained. The hydro-geological characteristics of the site and the surrounding areas are known relatively well. Brine may possibly be disposed of via injection wells or blended with the existing wastewater treatment plant effluent outfall.

Disadvantages

Unlike the Kalaeloa site, the Sand Island site is occupied by an existing facility that may be expanded in the future. The construction of a desalination facility at Sand Island Wastewater Treatment Plant must be coordinated with the master plan for the Sand Island Plant. The City may decide on expanding the Wastewater Treatment Plant and use the entire site. If so, a desalination facility of up to 10 MGD may not be developable at the site due to area restrictions.

6.2.3 Keehi Lagoon Beach Park Site

The Keehi Lagoon Beach Park is located at the northernmost portion of Keehi Lagoon and is situated between Honolulu International Airport to the west and downtown Honolulu to the east as shown in Figure 6-4. Keehi Lagoon Beach Park is located about a mile northwest from Sand Island within the Honolulu area.



Advantages

The site encompasses just over 60 acres, which would easily sustain additional structures associated with plant expansion of up to 35 MGD. The feed water supply for the desalination plant expansion for 35-MGD of product water is attainable at the site. A direct ocean intake would be constructed or feed wells must be built in order to achieve the ultimate target production capacity. The site is near the coast so brine disposal and direct ocean intake is possible. Existing wells have been drilled near the site that provided water quality data.

Disadvantages

The land needed for constructing a desalination plant at Keehi Lagoon Beach Park must be coordinated with the master plan for the park. The BWS would need to purchase or lease the land from the State in order to construct a desalination facility at the site. Stagnant ocean water conditions necessitate the use of lengthy and costly intake and outfall pipelines for feed water and brine disposal. The pipelines would have to extend past the mouth of the lagoon.

The park is used extensively and any facility construction will reduce the open park area and may adversely impact park uses. For these reasons, the availability of land will be limited and will restrict the size of the desalination facility.

6.2.4 Preferred Site

The preferred location for the construction of the proposed exploratory wells and technology testing is at the Kalaeloa site, Figure 6-2. The preferred Kalaeloa site has a total area of 35 acres, of which 20 acres are in the process of being transferred to the City and County of Honolulu following the federal government's closure of BPNAS on July 1, 1999. The Board of Water Supply will obtain the Kalaeloa site as a public benefit conveyance. Approximately 0.5 acres of the 20 acres will be utilized for the exploratory wells and technology testing. Other favorable aspects are that the Kalaeloa site is vacant and undeveloped, and is not presently planned for other uses.

Construction at either of the other two alternate sites requires utilizing land currently in use or planned for other purposes. In the case of Sand Island, the land available for future expansion of the wastewater treatment plant will be reduced, while at the Keehi site, land currently in use for recreation would be reduced.

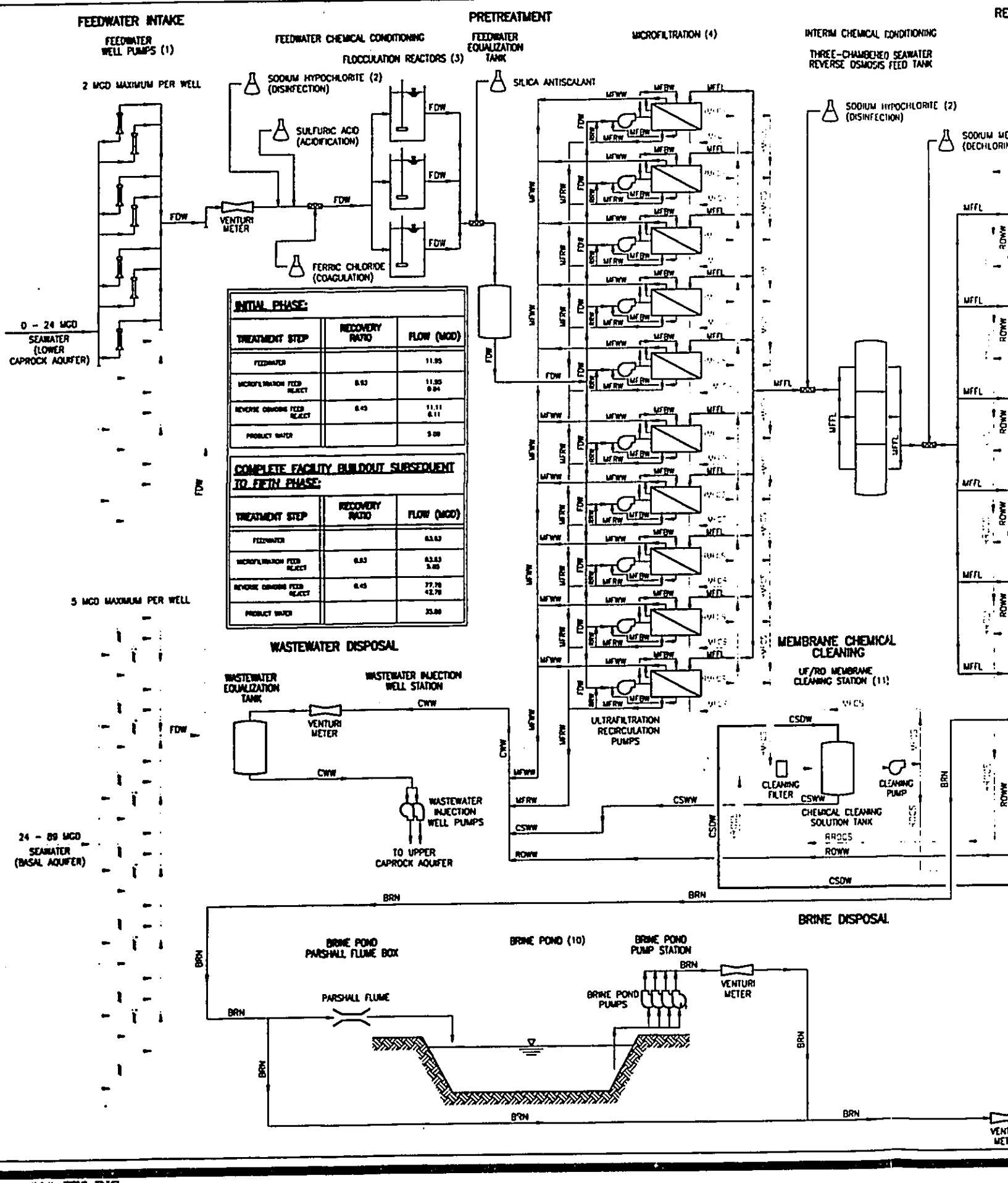
Although not in Honolulu, the Ewa location is still within the population center and moreover, the Kalaeloa site is near to the areas of Oahu that will experience rapid growth in the near future. The Kalaeloa site's close proximity to the secondary urban center of Kapolei makes this location an ideal place to develop a new, large drinking water source. In addition, the site borders an industrial area and is adjacent to the ocean.

6.3 Desalination Process

Distillation and reverse osmosis were evaluated as candidate processes for desalination. These processes were identified as the leading technologies from the review of the initial 12 technologies for desalination.

Reverse Osmosis was determined to be the most feasible after an economic comparison with distillation. Although two hosts for the supply of distillation stream were identified, the estimate cost for the stream was found to be uneconomical in comparison to electric costs for a desalination facility. Utilizing waste heat recovery from industries in Campbell Industrial Park was evaluated and determined as impractical because of the lack of significant source of waste energy. Also, technology that recovers heat from the condensation cycle of an electric power station was found impractical for a large-scale facility. The process design for the plant at the Kalaeloa site was developed based upon the reverse osmosis process.

Conceptual process flow for two pretreatment options for potable water production via reverse osmosis was developed. Pretreatment may either utilize microfiltration, Figure 6-5, which would include coagulant addition and flocculation reactors or ultrafiltration, Figure 6-6, and does not require coagulant addition and flocculation.



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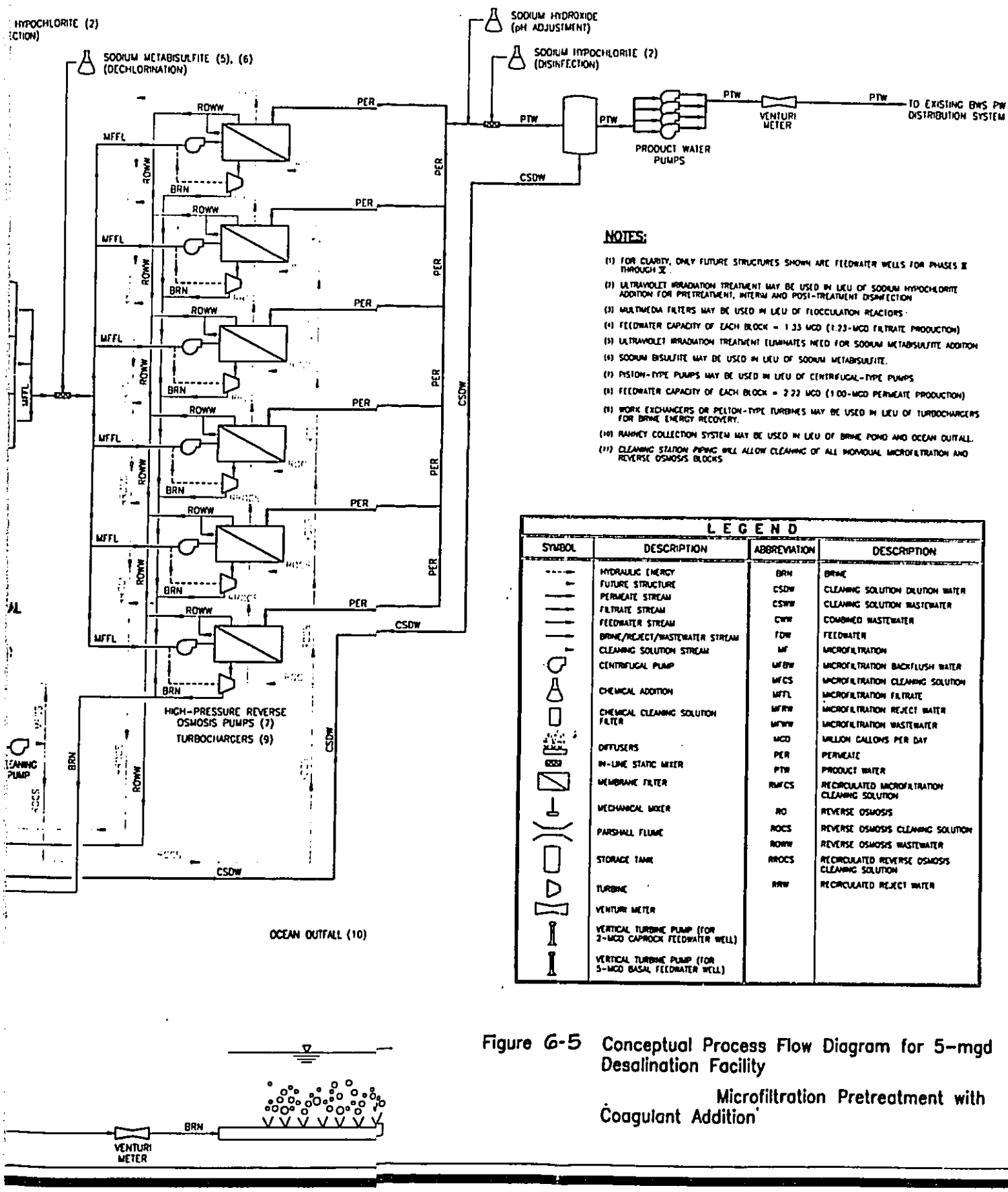


NOTES:

(1) FOR CLARITY, ONLY FUTURE STRUCTURES SHOWN ARE FEEDWATER WELLS FOR PHASES II THROUGH IV.

(2) ULTRAVIOLET IRRADIATION TREATMENT MAY BE USED IN LIEU OF SODIUM HYPOCHLORITE ADDITION FOR PRETREATMENT, INTERIM AND POST-TREATMENT DISINFECTION

(3) MULTIMEDIA FILTERS MAY BE USED IN LIEU OF FLOCCULATION REACTORS

(4) FEEDWATER CAPACITY OF EACH BLOCK = 1.33 MGD (1.23-MGD FILTRATE PRODUCTION)

(5) ULTRAVIOLET IRRADIATION TREATMENT ELIMINATES NEED FOR SODIUM METABISULFITE ADDITION

(6) SODIUM BISULFITE MAY BE USED IN LIEU OF SODIUM METABISULFITE.

(7) PISTON-TYPE PUMPS MAY BE USED IN LIEU OF CENTRIFUGAL-TYPE PUMPS

(8) FEEDWATER CAPACITY OF EACH BLOCK = 2.22 MGD (1.00-MGD PERMEATE PRODUCTION)

(9) WORK EXCHANGERS OR PELTON-TYPE TURBINES MAY BE USED IN LIEU OF TURBOCHARGERS FOR BRINE ENERGY RECOVERY.

(10) RANNEY COLLECTION SYSTEM MAY BE USED IN LIEU OF BRINE POND AND OCEAN OUTFALL.

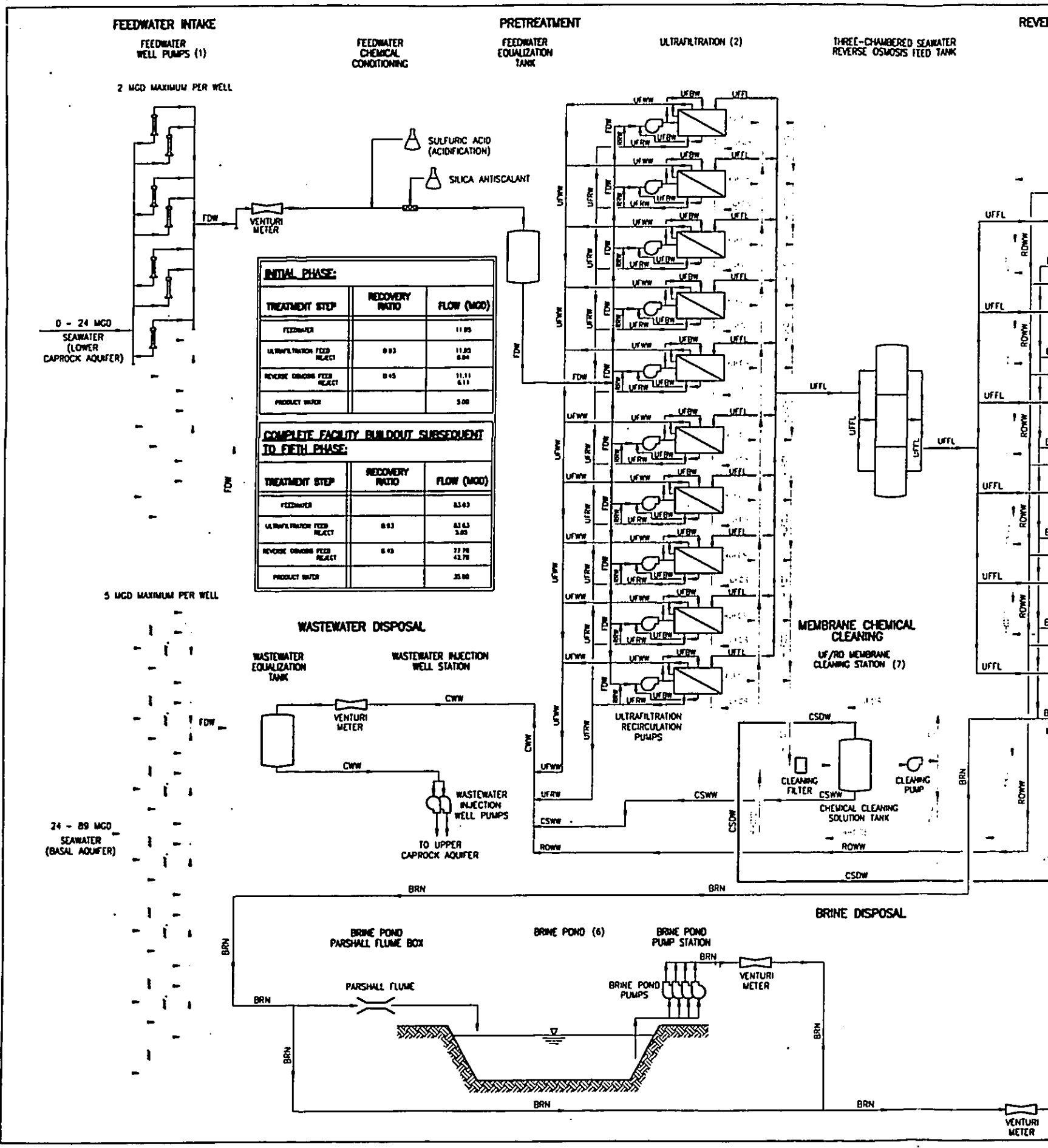
(11) CLEANING STATION PIPING WILL ALLOW CLEANING OF ALL INDIVIDUAL MICROFILTRATION AND REVERSE OSMOSIS BLOCKS

LEGEND

SYMBOL	DESCRIPTION	ABBREVIATION	DESCRIPTION
	HYDRAULIC ENERGY	BRN	BRINE
	FUTURE STRUCTURE	CSDW	CLEANING SOLUTION DILUTION WATER
	PERMEATE STREAM	CSWW	CLEANING SOLUTION WASTEWATER
	FILTRATE STREAM	CWW	COMBINED WASTEWATER
	FEEDWATER STREAM	FDW	FEEDWATER
	BRINE/REJECT/WASTEWATER STREAM	MF	MICROFILTRATION
	CLEANING SOLUTION STREAM	MFBW	MICROFILTRATION BACKFLUSH WATER
	CENTRIFUGAL PUMP	MFCS	MICROFILTRATION CLEANING SOLUTION
	CHEMICAL ADDITION	MFFL	MICROFILTRATION FILTRATE
	CHEMICAL CLEANING SOLUTION FILTER	MFRW	MICROFILTRATION REJECT WATER
	DIFFUSERS	MFWW	MICROFILTRATION WASTEWATER
	IN-LINE STATIC MIXER	MGD	MILLION GALLONS PER DAY
	MEMBRANE FILTER	PER	PERMEATE
	MECHANICAL MIXER	PTW	PRODUCT WATER
	PARSHALL FLUME	RMFCS	RECIRCULATED MICROFILTRATION CLEANING SOLUTION
	STORAGE TANK	RO	REVERSE OSMOSIS
	TURBINE	ROCS	REVERSE OSMOSIS CLEANING SOLUTION
	VENTURI METER	ROWW	REVERSE OSMOSIS WASTEWATER
	VERTICAL TURBINE PUMP (FOR 2-MGD CAPROCK FEEDWATER WELL)	RROCS	RECIRCULATED REVERSE OSMOSIS CLEANING SOLUTION
	VERTICAL TURBINE PUMP (FOR 5-MGD BASAL FEEDWATER WELL)	RRW	RECIRCULATED REJECT WATER

Figure 6-5 Conceptual Process Flow Diagram for 5-mgd Desalination Facility

Microfiltration Pretreatment with Coagulant Addition



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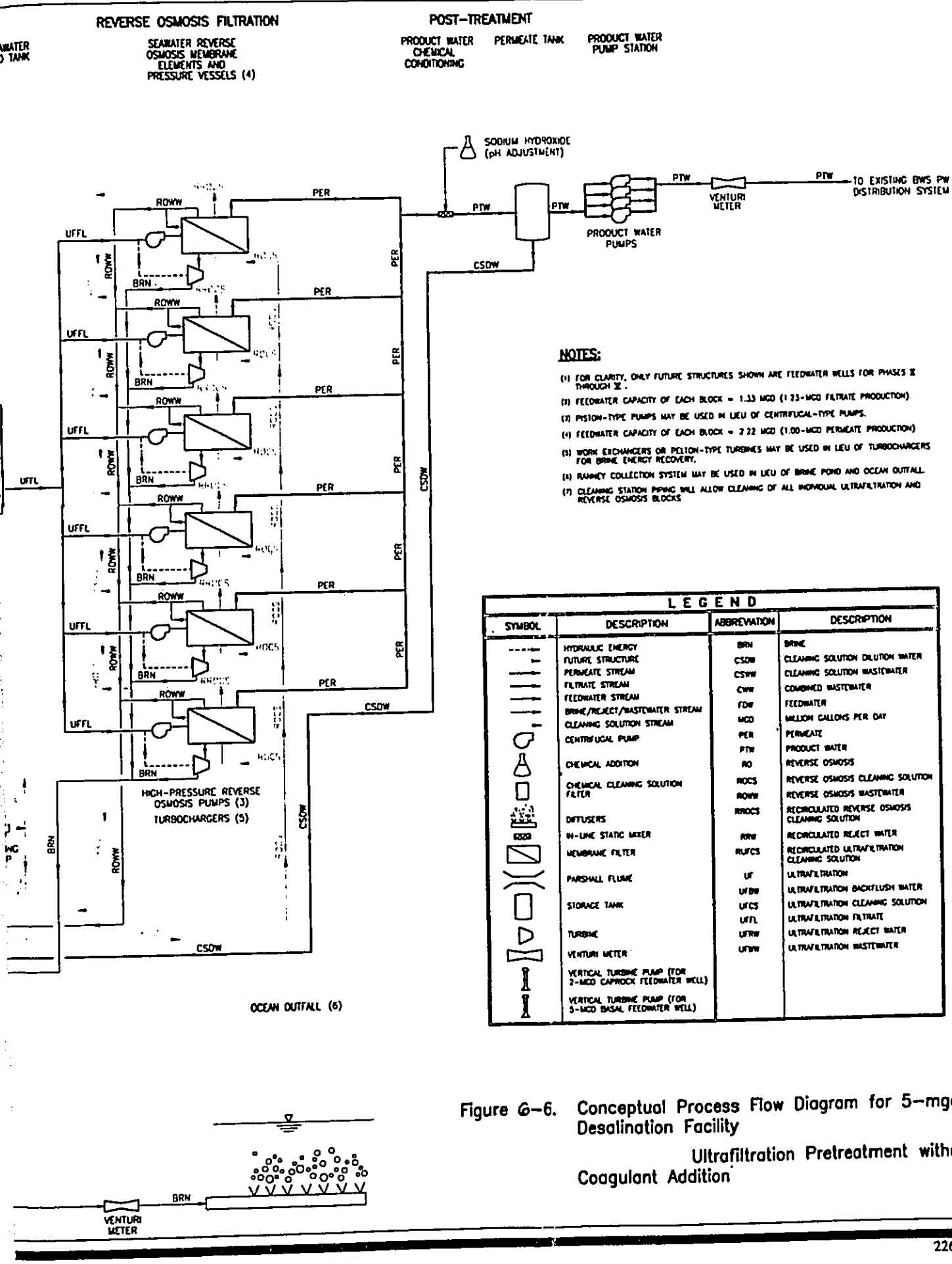

Figure 6-6. Conceptual Process Flow Diagram for 5-mgd Desalination Facility

Ultrafiltration Pretreatment without Coagulant Addition

The conceptual desalination processes are as follows:

6.3.1 Feed water System

A combination of caprock and basal wells will be used for the feed water for the initial phases of the project. The Lower Caprock Seawater Aquifer (LCA) at the Kalaeloa site may supply the feed water of up to 10-mgd. Seawater will be extracted from the LCA at the Kalaeloa site through a series of wells at a rate of 1 to 2-MGD per well. The basal wells would draw water of seawater quality from the Basal Aquifer, which lies below the lower caprock at a rate up to 5 mgd per well to meet the feed water demands of a possible 35-mgd desalination plant.

If the desalination plant were located at either of the alternative sites, deep basal wells and open ocean intake may possibly be used to acquire feed water of up to 35-mgd for the proposed desalination facility.

6.3.2 Feed water Pretreatment

Feed water for the proposed desalination facility will undergo pretreatment before actually passing through the reverse osmosis (RO) units. Pretreatment maximizes the performance of the RO process by removing various particles and compounds that tend to foul the RO membranes and decrease the passage of water through the membranes. Pretreatment consists of chemical conditioning and filtration. Ultrafiltration was chosen as the optimum pretreatment filtration technology based on cost, operational complexity, and effectiveness because it does not require chemical addition and post treatment disinfection. Micro filtration was chosen as the top alternative candidate.

Chemical conditioning will be performed on feed water for disinfection, pH adjustment and scale prevention during the pretreatment stage of the desalination process. Proper chemical conditioning will improve the performance and lengthen the life of both the pretreatment filter and reverse osmosis membranes.

In the optimum scenario, feed water will pass through ultra filters following pretreatment chemical conditioning. The ultra filters have pore sizes that range from 0.003 to 0.1 microns and remove impurities from feed water predominantly via physical separation. Ultrafiltration removes suspended solids, all bacteria and spores, viruses and macromolecules as well as some larger-sized ions. The UF process will not reduce the amount of total dissolved solids (TDS) in the feed water. The recovery rate of the UF process is about 93%; thus, approximately 12 MGD of source water will need to be processed by the ultra filters in order to produce the 11 MGD of RO feed water required for a 5 MGD desalination plant. These membranes will operate at pressures of 30 to 50 psi.

6.3.3 Reverse Osmosis Filtration

Ultra filtered water (filtrate) will be subjected to a disinfection/de-chlorination treatment process before passing through the reverse osmosis (RO) units. The RO units will reduce the total dissolved solids (TDS) in the filtrate from an estimated 37,700 milligrams per liter (mg/L) to 300-350 mg/L. The RO membranes will operate at pressures of 800 to 1,200 psi. The RO process will also treat the filtrate to the following product water (permeate) characteristics:

Chlorides	—	110 mg/L
Silica	—	70 mg/L
pH	—	7.5 mg/L
Hardness	—	110 mg/L as calcium carbonate ($CaCO_3$)
Total alkalinity	—	90 mg/L $CaCO_3$

The recovery rate of the RO process is about 45%; thus, approximately 11 MGD of filtrate will need to be desalted in order to produce 5-MGD of potable water. Brine concentration will be approximately twice that of seawater.

6.3.4 Post-treatment

Sodium hydroxide will be added to the permeate for pH adjustment before the final product water is introduced into the existing BWS drinking water distribution system. Permeate from the Kalaeloa site may either be piped to the existing water main along Kalaeloa Boulevard or blended with the existing Barbers Point 215-foot Reservoir.

6.3.5 Waste Stream Generation and Disposal

Four waste streams will be generated by the desalination facility. The waste streams are:

- Reject water from the ultrafiltration process (UF);
- Backflush water from the UF membrane cleaning process;
- Wasted membrane cleaning solution (WMCS); and
- Reject water (brine) from the RO process

Ultrafiltration (UF) reject water (retentate) will contain chemicals that were added to the feed water to minimize membrane fouling through scaling. These chemicals will include antiscalant for silica and sulfuric acid for acidification. UF reject water will also contain all suspended solids, all bacteria and spores, macromolecules and some larger-sized ions from the feed water.

Ultrafiltration (UF) backflush water will contain material identical to the substances contained in UF reject water, material removed from the feed water: suspended solids, bacteria, spores, viruses, macromolecules and ions and pretreatment chemicals.

Membrane cleaning solution (MCS) will be needed to periodically dose the UF and RO membranes with a stronger cleaning agent than backflush water. The MCS will help loosen biological and precipitated inorganic buildup on the membranes. The MCS contains citric acid. Although a majority of the MCS is recirculated, a portion is wasted after its cleaning strength has been exhausted.

Retentate, UF backflush water and WMCS will be disposed of through the use of injection wells. The injection wells will terminate about 40 feet below grade in the brackish Upper Caprock Aquifer (UCA). The UCA is located above a thin aquitard and the underlying saltwater LCA from which up to 10 mgd of feed water would be drawn, if available. The semi-permeable characteristic of the aquitard and the difference in salinities of the Upper and Lower Caprock Aquifers will discourage short-circuiting of UF wastewater with plant feed water. An application for an Underground Injection Control permit for the operation of the desalination plant brine disposal well will be submitted prior to construction.

The waste stream generated by the reverse osmosis (RO) process is brine. Brine will be discharged to a pond prior to disposal through an ocean outfall. The pond may store, evaporate and/or blend brine with ocean water. Brine will contain chemicals that were added during the pretreatment stage. Brine will contain about twice the total dissolved solids (TDS) of the feed water.

6.4 Preliminary Desalination Technology Testing

Prior to design, water quality testing to determine the "best" pretreatment option and field tests would be conducted. The preliminary desalination technology testing would include water quality testing of the source water, chemistry evaluation of both the caprock and basal wells. The on-site field tests will allow for an evaluation of site specific characteristics of the geology, water chemistry, and source water parameters that would impact the pretreatment requirements and membrane performance for the reverse osmosis process. Field tests would be conducted for a period of 3 to 6 months to aide in completing the design such as percolation rates to design the brine pond, pretreatment testing of the filtration equipment, soil borings for the building foundation, and biofouling to determine the optimal membrane life. The on-site preliminary testing would include a temporary shelter protect the equipment from the elements, concrete foundation, piping, generator, sensors, electricity, communication equipment such as a telephone or wireless telemetry. A total of 2 to 6 people may be on-site at various times up to 24-hour periods to conduct the testing. The quantity of water to be tested on-site is expected to be less than 1 MGD.

The State of Hawaii Department of Land and Natural Resources (DLNR) previously conducted desalination testing, however, the proposed project's conditions are different and require testing of basal and caprock seawater to determine the most efficient pretreatment process. The DLNR pilot desalination plant only tested brackish water, which is different from the proposed seawater testing.

6.5 Exploratory Wells

Prior to the start of preliminary desalination technology testing, design and construction, the BWS will drill two (2) exploratory wells on the proposed Kalaeloa site. Following the

construction of the exploratory wells, tests will be conducted to determine the quantity and quality of the water that can be withdrawn. Quantity testing will include yield drawdown tests spanning approximately five (5) hours at one (1) hour for each rate and a sustained pumping test spanning seventy-two (72) hours. Power for the pump will be a diesel motor or electric generator, supplied by the contractor. Water withdrawn from these tests will be disposed of on-site to test soil percolation rates for the brine pond or disposed of in an adjacent drainage canal. Water quality testing will include those for detecting minerals, dissolved solids, as well as pesticides, heavy metals and organics. The water quality tests will define the treatment process that will be required if the wells are put into production. Following testing, the wells will be capped and all equipment removed. An NPDES permit for exploratory well drilling will be developed if discharge effluent is expected to reach the State receiving waters. If the wells are placed into production, the specific site requirements for the production well facility and its impacts will be addressed in a separate EIS, which will be conducted for the design and construction of the desalination facility.

Approximately 0.5 acres at the northeast corner of the parcel will be required to accommodate the well drilling, support equipment and necessary supplies. The caprock well will have a 26-inch borehole, cased with 17.4" PVC casing and about 300 feet deep. The basal well will have a 24-inch borehole, cased with 20-inch PVC casing and approximately 1,700 feet deep. Both wells will be drilled with a reverse circulation rotary rig. A total of 3 to 5 people may be on-site to construct both wells and conduct the quantity testing, which will take about six months. Cuttings from the drilling will be disposed of in an approved manner.

The well drilling will require the temporary erection of a 90-foot high drilling derrick. The exploratory well site will not be within the aviation easement for the Barbers Point Airport. The Board of Water Supply has submitted Federal Aviation Administration Form 7460-1, Notice of Proposed Construction or Alteration for review and comment by the Federal Aviation Administration (FAA) and State of Hawaii, Department of Transportation (DOT), Airports Division. The FAA review determined no hazard to air navigation and the result has been forwarded to the State DOT Airports Division.

6.6 FUTURE DEVELOPMENT

A phased construction scheme was developed for the facility based upon 5 million gallon per day (MGD) increments, which may be expandable up to 35 MGD. The proposed BWS desalination facility would be constructed in phases to keep pace with Oahu's growing water demand and is expected to take place over 30 to 50 years. A typical schedule for the installation of an additional 5 mgd phase would take about 5 years, which includes design, permits and construction. The remaining 10 acres, of the 30.8 acres will be acquired to be consistent with the Community Redevelopment Plan to allow for the future expansion of the desalination facility.

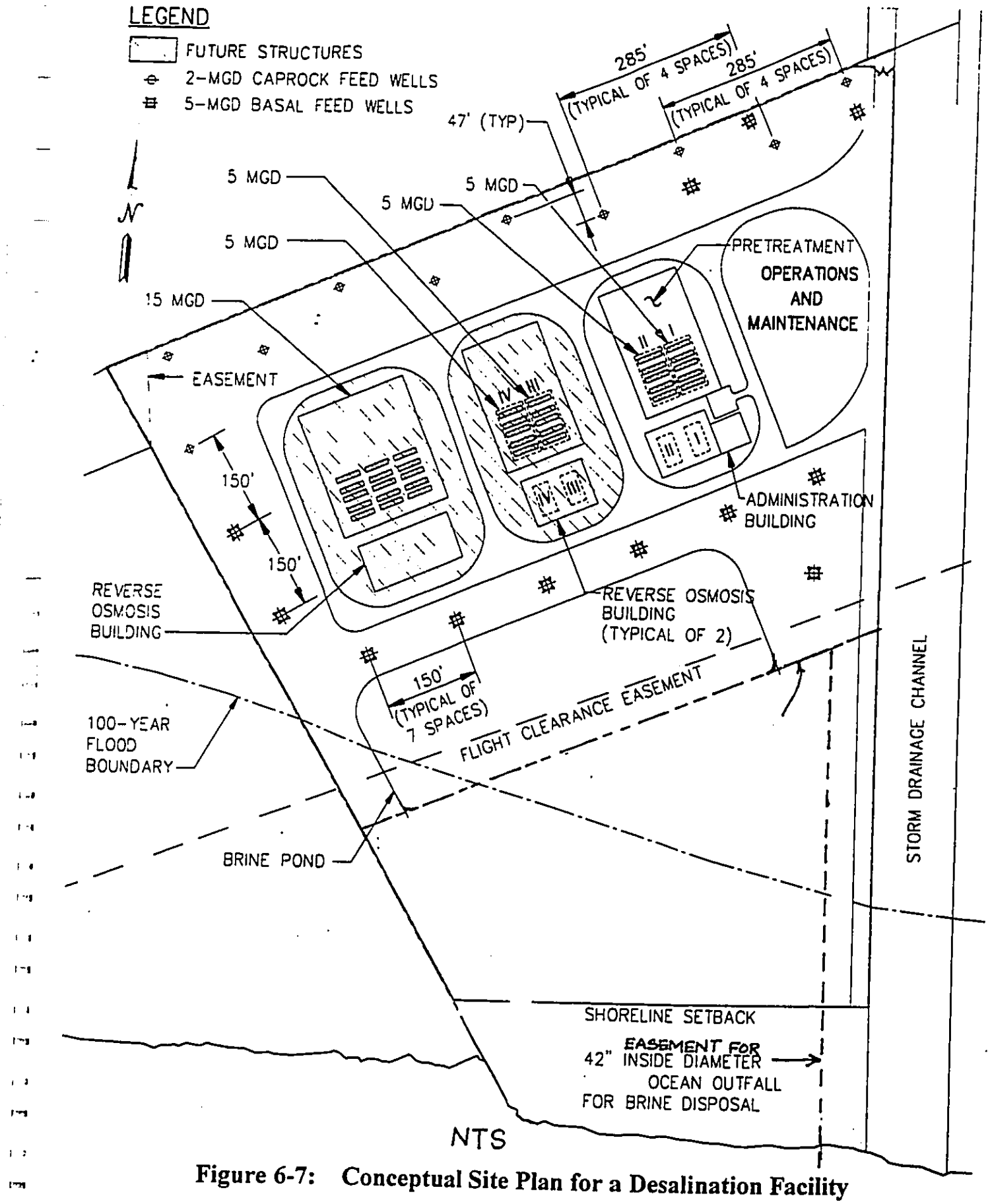

Figure 6-7: Conceptual Site Plan for a Desalination Facility

SECTION 7 – ENVIRONMENTAL SETTING, POTENTIAL IMPACTS AND PROPOSED MITIGATION MEASURES

7.1 Kalaeloa Site

The Kalaeloa site is a broad, flat, coastal plain with a relatively hot and dry climate (annual rainfall about 20 inches). The plain consists of an exposed, emerged coral reef that presents a relatively flat topography (Dames and Moore, 1995). Historically, land use was predominantly military. A location map for the Kalaeloa site is shown in Figure 7-1.

7.1.1 Geologic Conditions

The structure of the Ewa Coastal Plain (ECP) evolved over geologic time from lava flows and weathering. The following subsections focus on the geology of the proposed Kalaeloa site.

7.1.1.1 Geology

The island of Oahu consists of the eroded remnants of two large shield volcanoes—Waianae and Koolau. The Waianae and Koolau volcanoes that form Oahu were active during the Pliocene and Pleistocene epochs.

The project site is located within the Ewa Coastal Plain (ECP) of southwest Oahu, Figure 7-2. The ECP covers an area of approximately 28 square miles and consists of an exposed, emergent reef. The caprock is composed of sequences of relatively flat pleistocene marine sedimentary deposits (calcareous silts, sands and gravels and reef limestone layers) intercalated with terrestrial alluvium deposits (silts and clays derived from upslope volcanic material). About 75 percent of the plain is underlain by the reef limestone that forms the uppermost caprock aquifer formation and is 100 to 200 feet thick throughout most of its extent. The sediments of the Ewa caprock form a wedge that starts several miles inland and increases in thickness to a maximum of about 1,100 feet at the southern coast near Ewa Beach Park. The inland boundary of the Ewa caprock is approximately parallel to Farrington Highway. The caprock thins northward where it interfingers with the alluvium and underlying weathered volcanics.

In 1989, George A. L. Yuen & Associates (1989), in conjunction with the State Department of Land and Natural Resources (DLNR) Commission on Water Resource Management, divided the Ewa Plain into five management sectors on the basis of land and water utilization. One of these sectors encompassed the Kalaeloa site, which lies south of Kapolei. Kalaeloa area contains coralline limestone at its ground surface.

7.1.1.2 Topography

The terrain within the Kalaeloa area is almost flat. The maximum elevation within the site is about 11 feet above mean sea level and the site is located near the coastline.

7.1.1.3 Soil

The Soil Conservation Service (SCS) describes the soil and rock materials within Kalaeloa area as being coralline outcrops, calcareous sand and Mamala stony silty clay loam, Figure 7-3. These stony soils range from being well-drained to excessively drained, have moderate to high permeability, and have slight to moderate erosion hazards.

7.1.1.4 Potential Impacts and Mitigation Measures

Impacts of the proposed exploratory wells on the existing geology and topography of the Kalaeloa area should be minimal. The soil does not appear to be susceptible to erosion, since the topography is relatively level and the soils are shallow and highly permeable. Also, rainfall is very limited in the Ewa Plain area. No major problems or impacts are anticipated to result during the excavation of the soil for the proposed desalination facility.

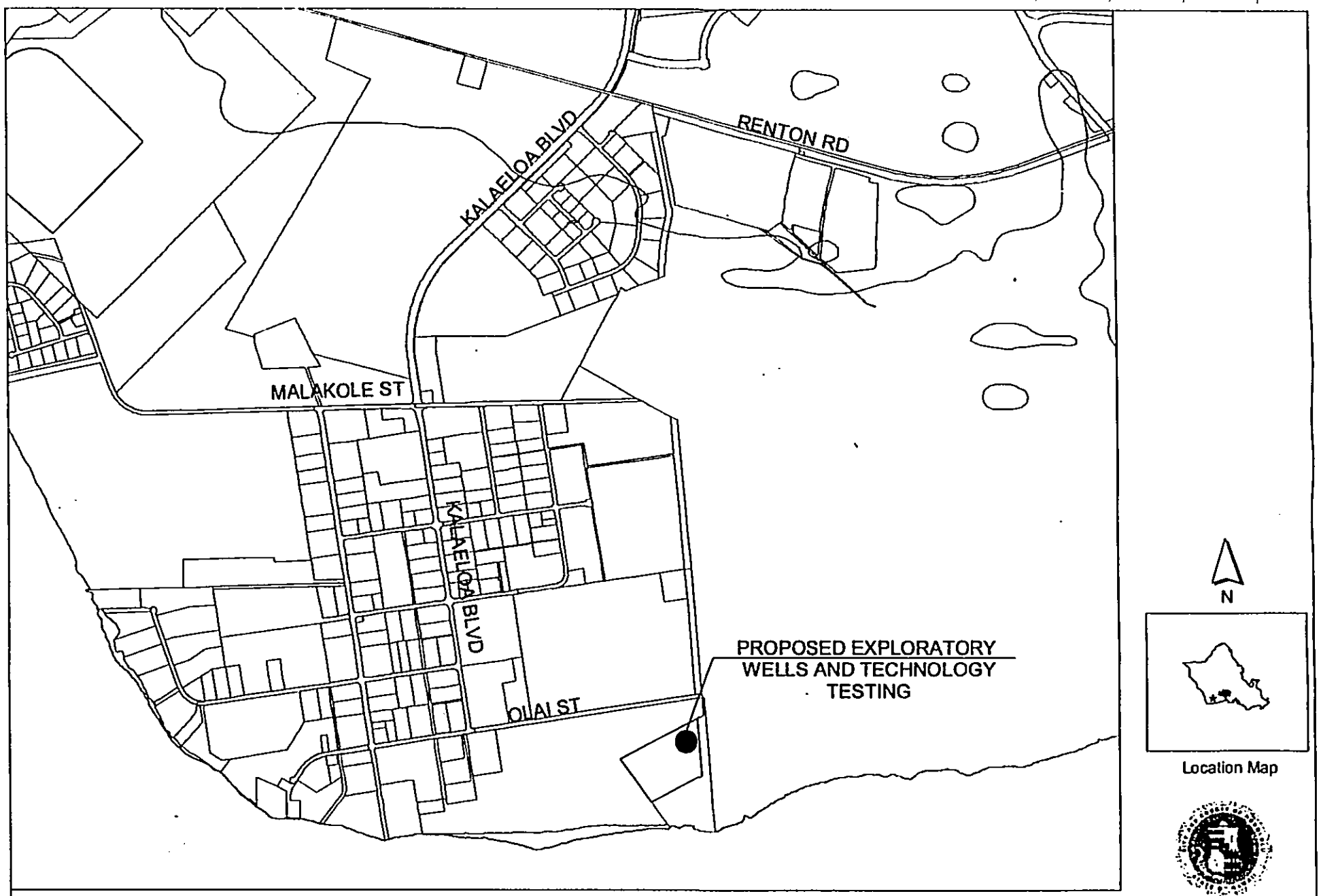
RENTON RD
KALAELOA BLVD
MALAKOLE ST
KALAELOA BLVD
OLAI ST
PROPOSED EXPLORATORY
WELLS AND TECHNOLOGY
TESTING
N
Location Map
General Site Plan
Prepared By: BOARD OF WATER SUPPLY
City & County of Honolulu
Date Prepared: 07/24/2000
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Figure 7-1

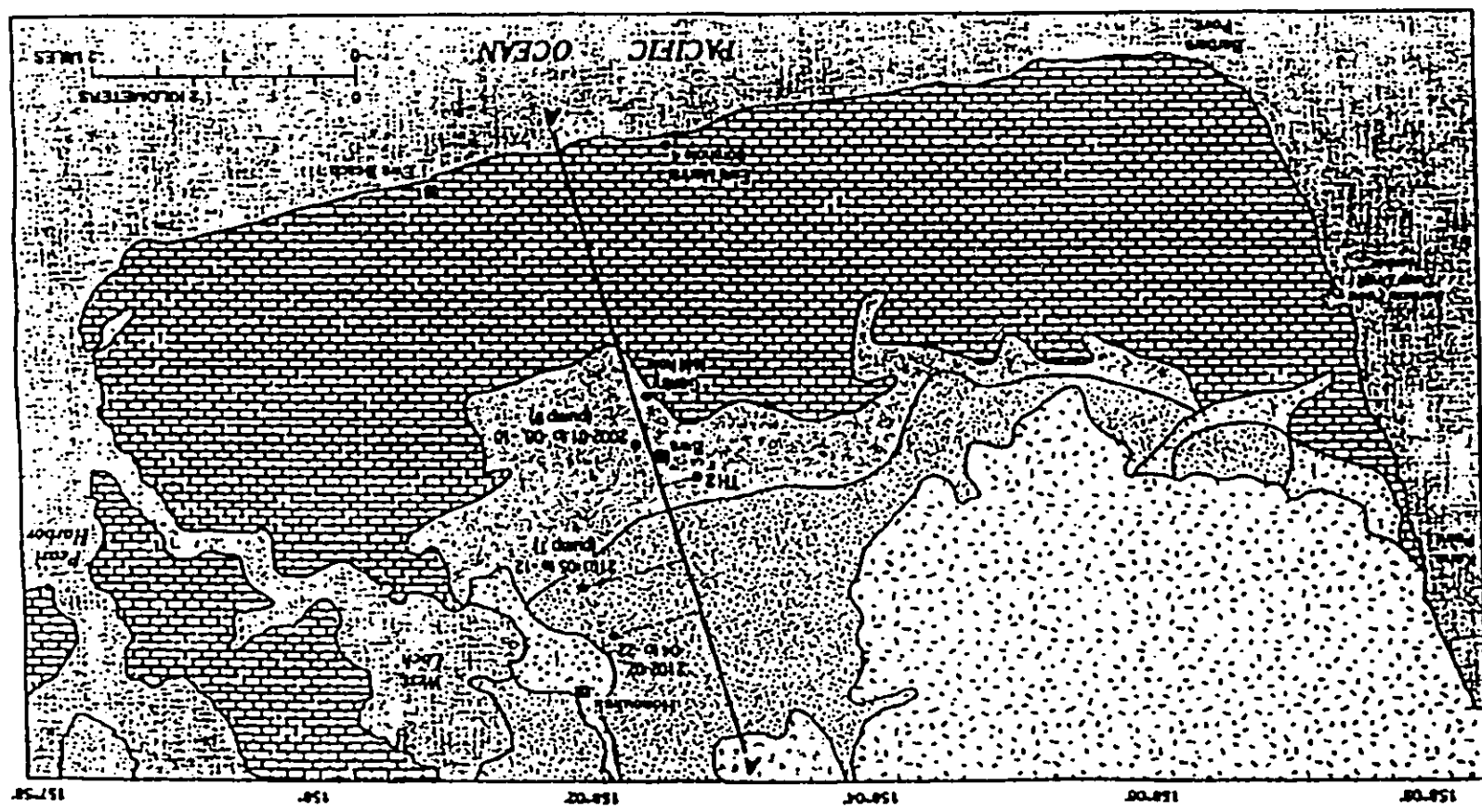

Figure 7-2

Geology of Ewa Plain

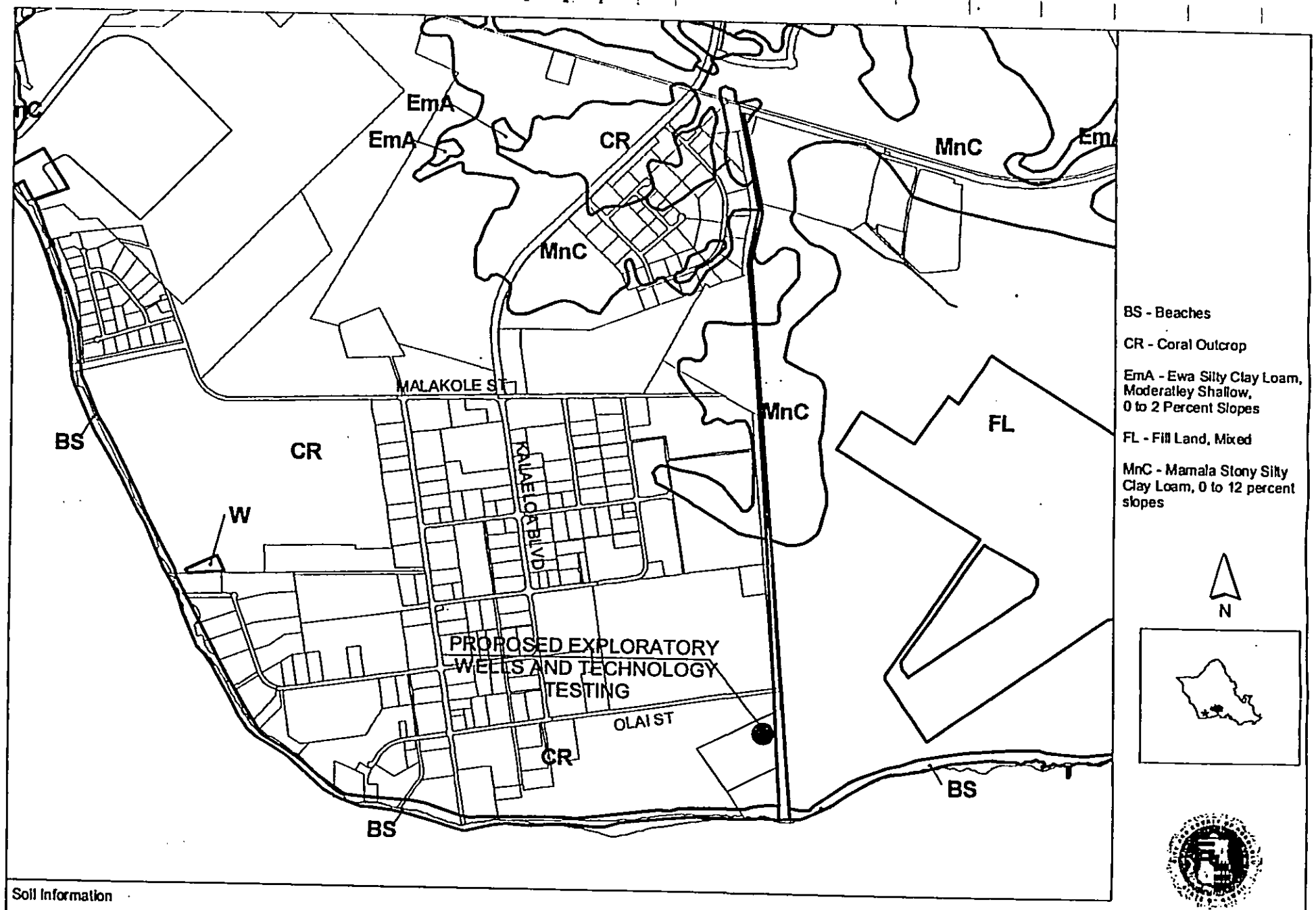
EmA
EmA
CR
MnC
MnC
MALAKOLE ST
BS
CR
MnC
FL
KALAELOA BLVD
W
PROPOSED EXPLORATORY WELLS AND TECHNOLOGY TESTING
OLAI ST
CR
BS
BS
BS - Beaches
CR - Coral Outcrop
EmA - Ewa Silty Clay Loam, Moderatley Shallow, 0 to 2 Percent Slopes
FL - Fill Land, Mixed
MnC - Mamala Stony Silty Clay Loam, 0 to 12 percent slopes
N
Soil Information
Prepared By: BOARD OF WATER SUPPLY
City & County of Honolulu
Date Prepared: 07/24/2000
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Figure 7-3

7.1.2 Climate and Air Quality

Impacts on the climate and ambient air quality are minimal for the operation of the plant and environmental impacts during construction of the facility will be temporary.

7.1.2.1 Climate

Northeasterly tradewinds prevail over Oahu during all months of the year but are weakest from November through March. The tradewinds are occasionally interrupted by moderate to strong southerly winds that are often accompanied by rainy weather. Under typical trade wind conditions, the Ewa Coastal Plain (ECP) lies in the leeward side of the Koolau mountain range. As moist tradewinds approach the island, orographic lifting cools the air and rainfalls on the mountains. The leeward areas of the island are generally sunny and dry. Mean annual rainfall on the ECP is about 20 inches. About 90 percent of the rainfall is recorded during the months from October though April and is non-orographic. January is normally the wettest month of the year, averaging 4.3 inches of rain from winter storms. The months from May through September average less than a half an inch of rain each.

The mean temperature of the ECP region is 72 degrees Fahrenheit (°F) in the winter (November–February) and 79 °F during the summer (June–August). The mean annual temperature is 76 °F.

7.1.2.2 Air Quality

Air quality on Oahu is excellent overall due to prevailing northeast trade winds. The well site also benefits from these trade winds and enjoys generally good air quality. The Atlas of Hawaii, indicates that particulate matter at the site averages 40 micrograms per cubic meter of suspended particulates over a twelve-hour daytime period. The maximum concentration of carbon monoxide for any one-hour period falls between 20 and 30 micrograms per cubic meter (1983:67-68). Existing air pollution at the project site is minimal, primarily resulting from vehicles and existing industry. Many businesses in the Campbell Industrial Park area are major stationary sources of air pollution. Construction activities associated with the proposed exploratory well would produce air pollutants mainly from two different types of

sources: exhaust emissions from construction equipment and vehicles, and fugitive dust emissions from construction activities.

7.1.2.3 Potential Impacts and Mitigation Measures

Potential air quality impacts during the drilling phase of the proposed project will be mitigated by complying with the State of Hawaii Department of Health Administrative Rules. The emissions associated with construction vehicles will be of short-term duration, and would cease upon completion of the project construction. The fugitive dust emissions would also be of short term duration and would be minimized by implementing best management practices to control dust.

The construction contractor will be required to comply with State of Hawaii Department of Health rules (HAR Chapter 43, Section 10) and the conditions of the grading permit. Proper maintenance of construction vehicles and equipment will serve to minimize combustion emissions. Construction vehicle and equipment idling will be kept to a minimum when equipment is not in use.

Best management practices will be implemented during construction to ensure compliance with State of Hawaii Department of Health regulations. Dust control measures will include watering of the work area, use of wind screens, keeping adjacent roadways clean and covering of open-bodied trucks. Other dust control measures may include mulching or stabilizing inactive exposed areas.

Once the facility is in operation, air quality impacts will be limited to the effects of the vehicular exhaust emissions of the workers traveling to and from the site, and emissions from occasional testing of the standby generators (exempt from emission standards by HAR Chapter 60). These impacts will be insignificant and mitigation measures are unwarranted.

7.1.3 Water Resources

The Ewa Coastal Plain (ECP) contains a comprehensive hydrologic system that includes

many hydrologic subsystems and variables. The following subsections focus on the major hydrologic systems possibly affected by the construction of the exploratory well and technology testing at the Kalaeloa site. Water resources are sensitive to many factors; thus, a careful analysis of the project's environmental impacts is warranted.

7.1.3.1 Hydrogeology

The project area overlies the Malakole area of the Ewa Caprock Aquifer, Figure 7-4A and Figure 7-4B, a nonpotable water resource, unique the Ewa region. The Ewa caprock has been traditionally recharged from irrigation and rainfall infiltrating the land surface, and lateral and upward subsurface flow from the volcanic or basal aquifer.

The Kalaeloa site is located on the southwestern portion of land known as the Ewa Plain (EP). This coastal plain stretches from the west side of Pearl Harbor to the west coast of Oahu. The EP is part of a larger, nearly continuous coastal plain that forms the southern shore of Oahu. The area is somewhat arid, receiving 15 to 20 inches of rain per year, while the pan evaporation for the area is approximately 85 inches per year. Storm runoff from nearby mountain ranges occasionally flows over the EP and into the Pacific Ocean.

Less than 200 feet below the Ewa Plain ground surface, lies two hydrogeologic formations known as the Upper Caprock Aquifer (UCA) and the Lower Caprock Aquifer (LCA), Figure 7-5. These aquifers are composed primarily of coralline limestone and younger alluvium. The UCA and LCA are separated by a brown mud lens, known as an aquitard that was deposited during the area's geologic history when the EP was predominantly a lagoonal environment. The partially permeable mud lens is relatively thin—about 1 to 2 feet thick—and is composed primarily of clay and silt. The UCA is unconfined and has been developed as a non-potable groundwater source for irrigation. The water table in this aquifer is near sea level at the coast and rises very slightly some distance inland. A series of limestone aquifers underlies the Ewa Coastal Plain (ECP). The uppermost is an unconfined brackish basal lens. Deeper aquifers are thin and contain saline water. The salinity profile within the UCA indicates thin brackish water lens. The LCA is confined and has a composition comparable to seawater. Except for the uppermost aquifer, the deeper aquifers are thin and pinch out.

Below the Lower Caprock Aquifer (LCA) is an aquifer, known as the Underlying Caprock Aquifer (ULCA), that is composed of interbedded marine and terrestrial sediments of high and low permeabilities with underlying weathered volcanic rocks. The water contained within this aquifer is predominantly seawater. The ULCA can span depths of around 1,000 feet below the ground surface near the shoreline and is characterized by a wedge shape that pinches off in the inland direction similar to the Upper and Lower Caprock Aquifers. The UCA, LCA and ULCA are collectively referred to as "Caprock" because they impede free discharge of groundwater from the underlying volcanic aquifer.

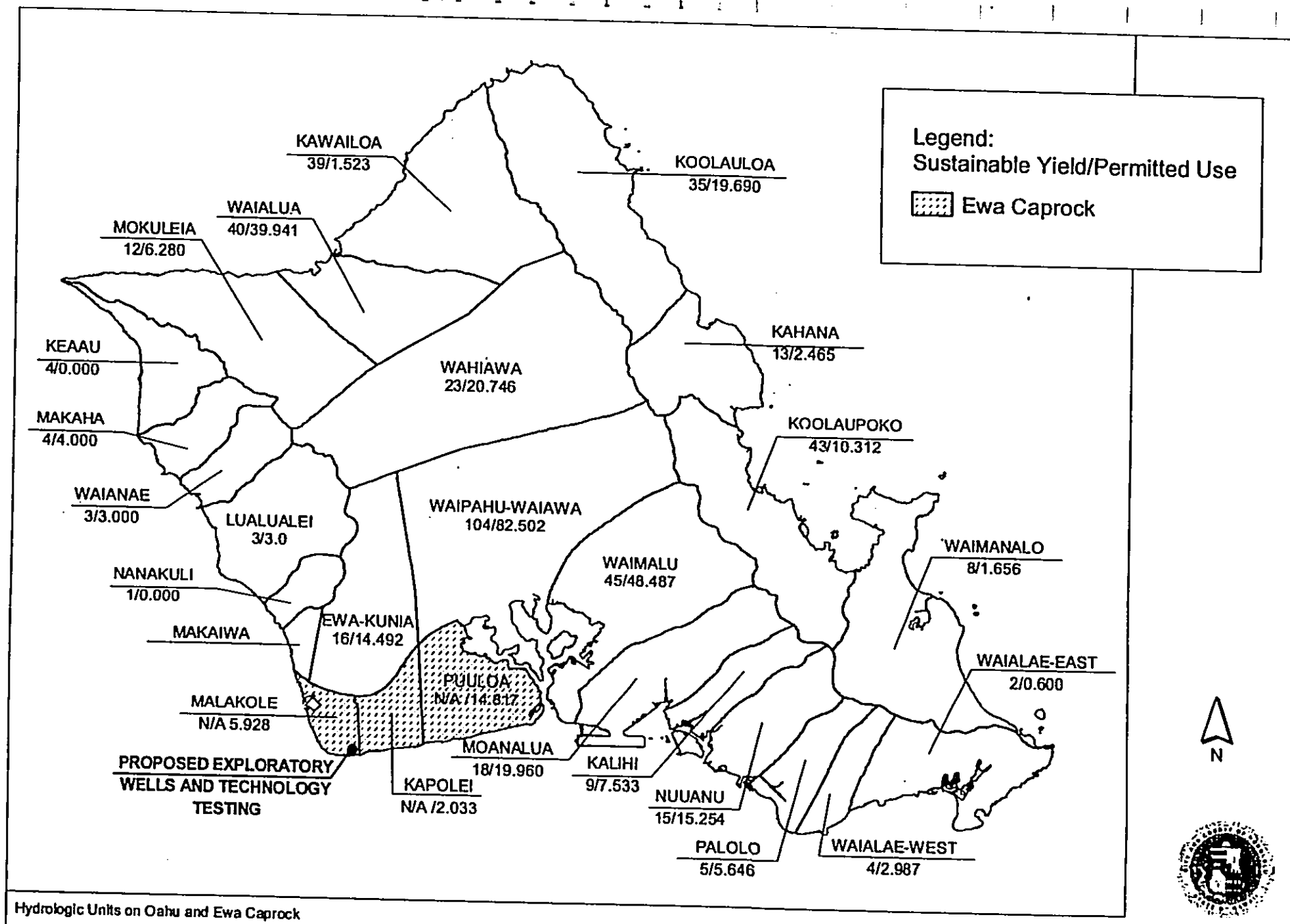
Below the Caprock is the Basal Aquifer (BA), contained in the volcanic formation of the area. The BA is saturated with seawater and confined by the caprock at about 1,100 feet deep at the coast and rises at a 3 to 5 percent rate in the inland direction. Groundwater flow within the BA is generally toward the Pacific Ocean in the inland area and from the sea landward in this area. The inland interface between the BA and the Caprock is characterized by a confining unit of alluvium.

7.1.3.2 Surface Water Quality

No natural lakes, reservoirs, ponds, rivers, streams or wetlands exist within the Ewa Coastal Plain region. Surface waters in the form of perennial stream flows or ponds do not occur in the nearshore outwash region of the Ewa Coastal Plain. Surface water bodies that are nearest to the Kalaeloa site include several small constructed reservoirs in the Kapolei sector that lies north of the project site.

7.1.3.3 Potential Impacts and Mitigation Measures

The Caprock Aquifer has a finite brackish water yield. The basal well will develop salt water and should not affect the sustainable yield of the caprock or Pearl Harbor aquifer. Testing pumping will be conducted on the caprock source to determine the yield and impact on the caprock aquifer. The withdrawal of seawater from the LCA would most likely neither impact the yield nor alter the salinity of the UCA.

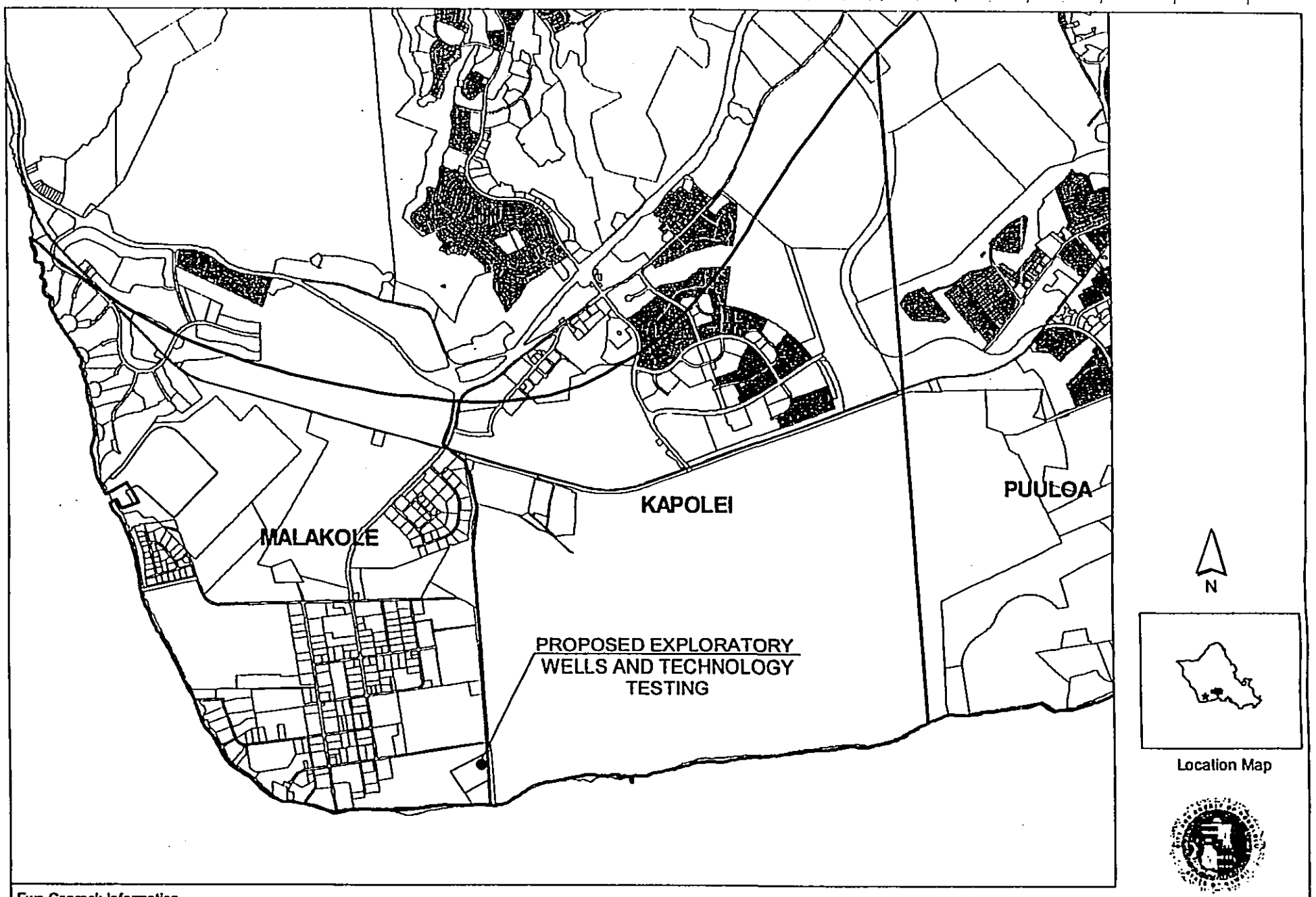


Hydrologic Units on Oahu and Ewa Caprock

Prepared By: BOARD OF WATER SUPPLY
City & County of Honolulu

Date Prepared: 10/10/2000

Figure 7-4A


KAPOLEI
PUULOA
MALAKOLE
PROPOSED EXPLORATORY
WELLS AND TECHNOLOGY
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Location Map
Ewa Caprock Information
Prepared By: BOARD OF WATER SUPPLY
City & County of Honolulu
Date Prepared: 07/24/2000
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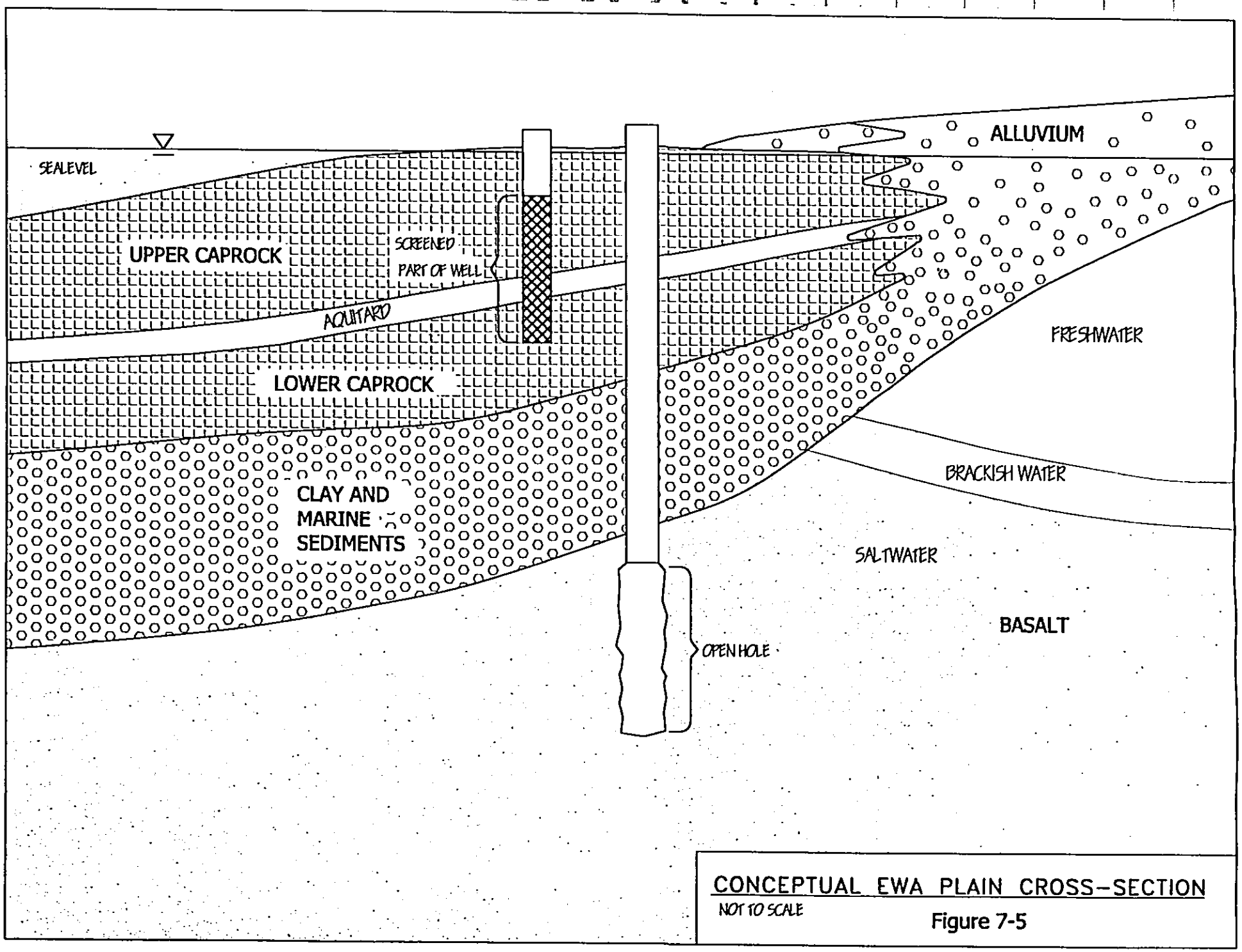
Figure 7-4B



CONCEPTUAL EWA PLAIN CROSS-SECTION

NOT TO SCALE

Figure 7-5

7.1.4 Natural Hazards

The purpose of analyzing the existing natural hazard conditions is twofold: (1) to identify the existing natural hazards that could occur during construction of the exploratory wells and technology testing and (2) to examine the potential for occurrence of these natural hazards during construction and operation. Natural hazards that present a potential for occurrence at the Kalaeloa site include earthquakes, floods, and tsunamis.

7.1.4.1 Seismic

The Uniform Building Code (UBC) provides minimum design criteria to address potential for damages due to seismic disturbances. The UBC scale is rated from Seismic Zone 1 through Zone 4, with 1 the lowest level for potential seismic induced ground movement. Oahu has been designated within Seismic Zone 1. The Board of Water Supply, in the interest of public health and safety has adopted UBC Seismic Zone 3 standards for all its structures. All permanent structures proposed for this project, therefore, will be built according to standards for UBC Seismic Zone 3.

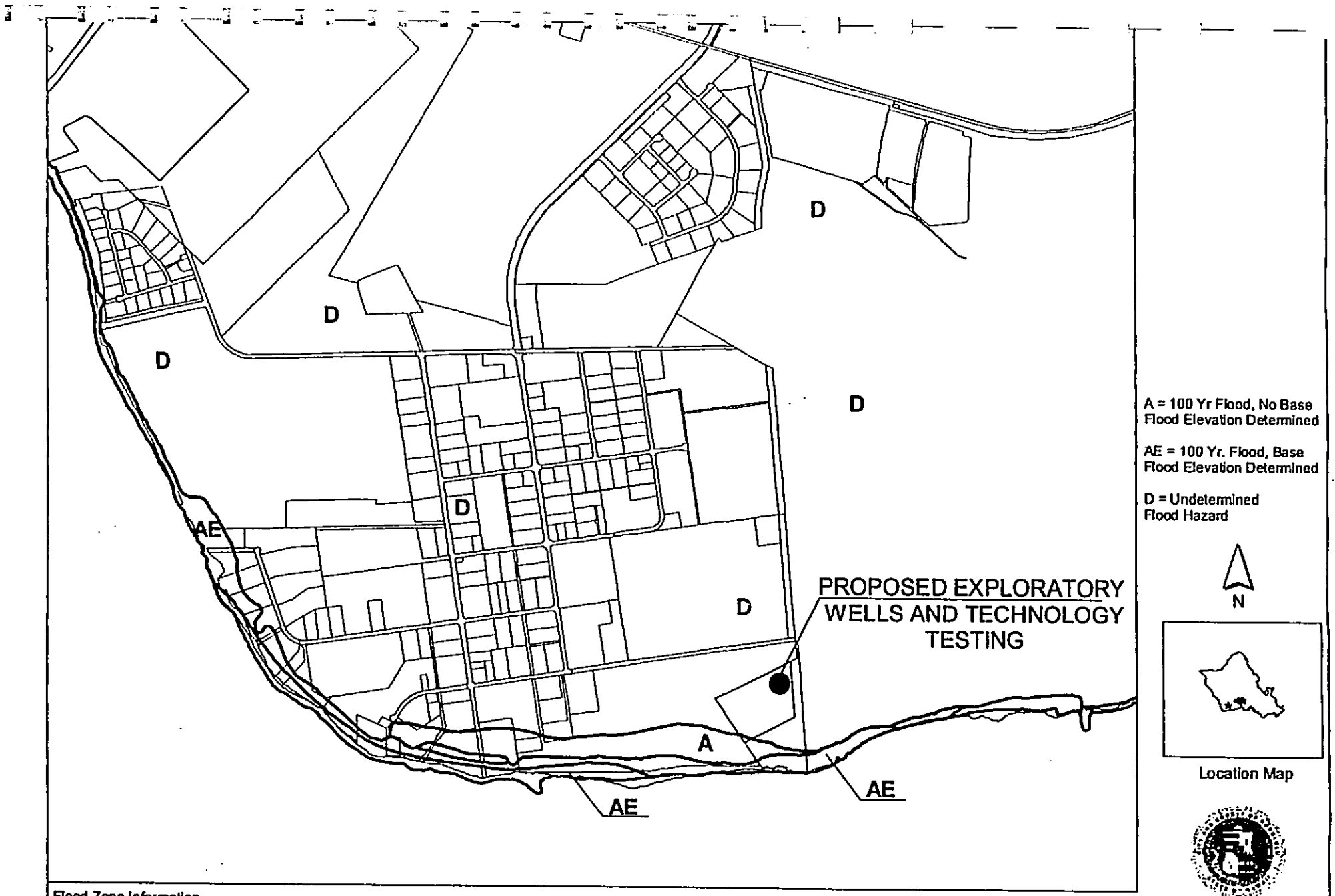
7.1.4.2 Flood and Tsunami Hazard

According to the Flood Insurance Rate Maps (FIRMs), the proposed exploratory site and field testing area will be located mostly within Zone D—areas in which flood hazards are undetermined, Figure 7-6. The proposed 20 acres of land to be acquired for the full-scale plant is mostly within Zone D with a small portion within Zone A.

The project site is completely within the 100-year tsunami inundation area as depicted in the Oahu Tsunami Evacuation (Kahe point to Ewa Beach), Figure 7-7. The project site is inside the anticipated tsunami flood hazard area (Tsunami Warning Center, 1998).

7.1.4.3 Potential Impacts and Mitigation Measures

The exploratory wells and desalination facility will be located within the tsunami inundation area. Since the tsunami and seismic risk at the project site is minimal, the proposed project is not expected to be affected.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WELLS AND TECHNOLOGY
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Flood Elevation Determined
D = Undetermined
Flood Hazard
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Location Map
Flood Zone Information
Prepared By: BOARD OF WATER SUPPLY
City & County of Honolulu
Date Prepared: 07/24/2000
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Figure 7-6

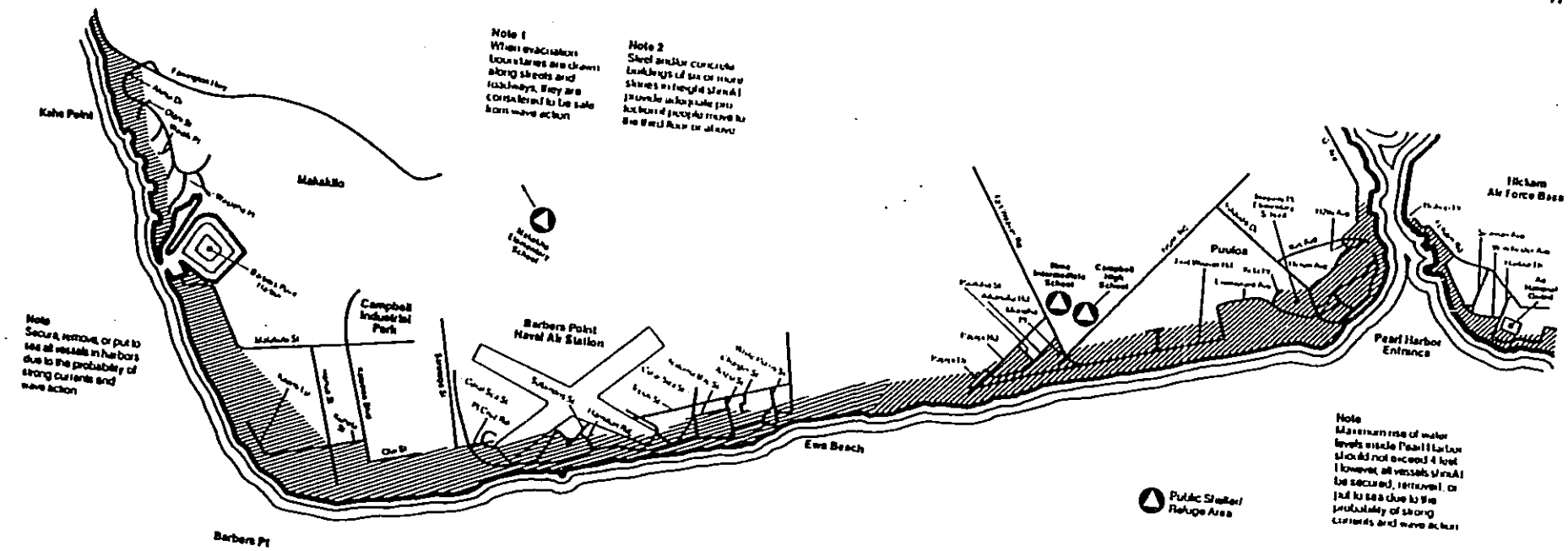


Figure 7-7

Tsunami Inundation Areas – Ewa District

7.1.5 Biological Environment

7.1.5.1 Terrestrial Flora and Fauna

Plants and animals potentially affected by any impacts from the proposed desalination facility include terrestrial and marine species. This subsection focuses on flora and fauna that inhabit the land within the Ewa Coastal Plain. There are no known endangered or threatened species inhabiting the project site. While some loss of habitat will occur as a result of construction activities, none of the species affected are known to be threatened or endangered.

Existing Conditions

The Kalaeloa site is dominated by lowland shrub, grass and vegetation. The dominant vegetation zone on the Ewa Plain is the Kiawe and Lowland Shrub Zone. The second largest vegetation zone on the Ewa Plain is the Coastal Strand Zone.

Plant species (endemic to Hawaii) that are found on the Ewa Plain include the small shrub-like sandlewood tree (*Santalum ellipticum*) in the Kiawe and Lowland Shrub Zone, the sub-shrub *hinahina* (*Heliotropium anomalum* var. *argentum*) and the herb *nama* (*Nama sandwichensis*) in the Coastal Strand Zone and the round-leafed chaff-flowered shrub (Achyranthes splendens var. rotunda) (Ogden, 1994) in the low elevations in open, dry forest remnants, open thickets, on talus or rock slopes, or on coralline plains (Wagner, Gerbst, and Shomer, 1990).

Indigenous plant species (native plants found in Hawaii and elsewhere) in the coastal zone include the seaside heliotrope (*Helitropium currassavicum*) and the *`ohelo kai* shrub (*Lycium sandwichensis*).

Birds are the dominant forms of wildlife on the Ewa Plain. They include at least 17 ubiquitous introduced species and five indigenous species (black-crowned night heron, great frigate bird, Pacific golden plover, sanderling, wandering tattler and ruddy turnstone). The five most common ubiquitous bird species are the zebra dove, Japanese white-eye, Northern

cardinal, red-crested cardinal and red-vented bulbul. The Pacific golden plover, sanderling, wandering tattler and ruddy turnstone are migratory and frequent Hawaii on a regular basis. Other wildlife includes feral dogs and cats, rodents and mongooses and introduced freshwater fish species including mosquito fish and tilapia.

7.1.5.2 Surface Water Ecosystems

No streams or wetlands exist within the project site.

7.1.5.3 Coastal Marine Ecosystems

This subsection focuses on flora and fauna that inhabit the ocean adjacent to the Ewa Coastal Plain. The marine area in the vicinity of the project site spans along the Ewa coast specifically along Nimitz Beach within the Kalaeloa redevelopment district to the coastal shelf adjacent to the old Hawaii Meat Company, Ltd. Site, which adjoins the proposed Kalaeloa site.

Existing Conditions

The existing coastal marine conditions of the Ewa Coastal Plain were analyzed to identify the existing water quality conditions that could be affected by the construction of the exploratory well and technology testing.

The nearshore waters of Ewa are classified by the State of Hawaii Department of Health as Class A Open Coastal Waters (DoH, 1992). The objective of Class A waters is to protect their use for recreation and aesthetic enjoyment. This classification allows other uses of the ocean as long as they are compatible with the protection and propagation of fish, shellfish and wildlife, and with ocean-related recreational activities. Class A waters should not receive any discharges that have not undergone the best degree of treatment or control that is in agreement with the criteria established for this class. Coastal waters adjacent to the Ewa Coastal Plain are fertilized by nutrient-rich water seeping from springs below sea level.

The nutrients originate from upland agricultural fertilization, leaching from cesspools and septic tanks, domestic waste injection wells and urban applications of fertilizers. This

nutrient subsidy promotes the thick growth of benthic algae (limu) and make the Ewa Coast a popular seaweed harvesting area on Oahu. Nearshore waters are often turbid due to rough wave action that suspends sediments and nutrients.

Marine macroinvertebrates found offshore of the Ewa Coastal Plain include reef-building corals, several species of sea cucumber, sea urchins and colonial soft corals (Ogden, 1994). Marine vertebrates include reef fish, although abundance and diversity are low. Marine macroalgae are very abundant offshore.

7.1.5.4 Threatened and Endangered Species

No threatened and endangered species exist within the project site.

7.1.5.5 Potential Impacts and Mitigation Measures

Site work during construction will require clearing of heavy foliage, large rocks and assorted debris at the Kalaeloa site. No sensitive habitats or protected species, threatened species of vegetation are expected due to the construction of the exploratory wells and technology testing. According to the US Fish and Wildlife Service, there are no federally endangered, threatened, or candidate species, wetlands or other federal trust resources directly within the Kalaeloa desalination site. The round-leafed chaff-flowered shrub (Achyranthes splendens var. rotunda) is located across the drainage canal and should not be affected by the proposed project. The project will be designed to avoid unnecessary adverse impact and minimize unavoidable impacts to native resources.

During the future operation of the desalination facility the generated brine may be discharged to an earthen pond prior to ocean disposal. Ocean disposal shall be through an ocean outfall extending approximately 1 mile offshore. Several permits (Department of the Army, Clean Water Branch Department of Health) will be required prior to the construction and operation of the outfall. An Environmental Impact Statement will be completed for the design and construction of the desalination plant, which will include the outfall.

7.1.6 Social and Economic Resources

In the immediate project vicinity is the Kalaeloa Community Development District, Kapolei and other neighboring towns, James Campbell Industrial Park and the proposed Ewa Marina. The site is within the Ewa Development Plan area. The Ewa region is presently in transition from mostly agricultural to mainly urban uses, and is the location of Oahu's fastest growing residential communities.

7.1.6.1 Demographics

The State of Hawaii currently has approximately 1.2 million residents and receives nearly 7 million visitors a year. Oahu is home to approximately 871,469 (1995 figures), or nearly 75 percent of the state population. The Ewa Development Plan (DP) area has 51,286 residents, and is projected to grow from having 5.1 percent in 1990 to 12 percent by the year 2020.

7.1.6.2 Potential Impacts and Mitigation Measures

The construction of the exploratory wells and technology testing will have no significant effect on population or demographics.

Construction of a desalination facility will have indirect effects on population growth, which will allow for planned and approved development of Ewa and other leeward areas with consideration of available adequate potable water supply. An Environmental Impact Statement will be conducted for the design and construction of the Reverse Osmosis Desalination Facility.

7.1.6.3 Employment

Oahu currently has two urban areas—primary (Honolulu) and secondary (Ewa). Economic activity on Oahu is concentrated in the primary urban center, which has about three-quarters of island jobs and about half of the population. The job share in the secondary urban center in the Ewa Development Plan area is expected to grow a rate of 4 percent a year, going from 3 percent of island jobs in 1990 to 10 percent in 2020. The City of Kapolei is expected to become the major employment center for the Ewa region.

For the Ewa Development Plan area, the potential civilian labor force numbers about 25,556 (71 percent of its population). Unemployment is 5 percent. Twenty-one percent of the residents commute for more than 45 minutes each way to and from work.

7.1.6.4 Potential Impacts and Mitigation Measures

Construction of the exploratory wells and technology testing at the Kalaeloa site will employ approximately 10 workers for about a year.

Construction of the desalination facility will employ approximately 30 workers for about a year. Once operational, the first 5 mgd desalination facility will employ a permanent operating staff of about 16 employees. An Environmental Impact Statement will be conducted for the design and construction of the Reverse Osmosis Desalination Facility.

7.1.6.5 Fiscal Implications

The desalination facility is proposed to eliminate a shortage of projected potable water supplies. Consequently, the "no-action" alternative has significant social and economic disincentives.

7.1.6.6 Potential Impacts and Mitigation Measures

The project has a number of aspects with positive fiscal impacts. Creation of jobs and purchase of supplies and materials will stimulate tax revenues to the City and the State.

The project has a number of aspects with positive fiscal impacts. The creation of jobs and purchase of supplies and materials will stimulate tax revenues for both the City and the State.

7.1.7 Recreational Resources

The beach fronting the site is used for diving, shell collecting, pole fishing, swimming and throw-netting.

7.1.7.1 Potential Impacts and Mitigation Measures

The construction of the exploratory wells and technology testing will have no impacts on the existing beach parks. Access to the beaches will not be impacted.

7.1.8 Aesthetic Value

Visual landmarks and significant vistas that are identified in the Ewa Development Plan (C&C of Honolulu, 1996) include distant vistas of the shoreline from H-1 Freeway, mountain and ocean views, and views of central Honolulu and Diamond Head.

7.1.8.1 Potential Impacts and Mitigation Measures

The construction of the exploratory wells and technology testing will not affect views from surrounding areas. The facility will enhance the visual effects of the BPNAS.

7.1.9 Archaeological, Cultural and Historical Resources

According to the State Historic Preservation Division records a human burial, SIHP # 50-80-12-4209, Figure 7-8, was identified on the edge of the channel bank. Their records do not show that this parcel has undergone previous archaeological survey, or that any major land alteration has occurred at this site. However, a field inspection in October 2000 revealed that the proposed exploratory well and testing area has been extensively cleared and base coral has been exposed.

7.1.9.1 Potential Impacts and Mitigation Measures

The State Historic Preservation Division indicated that an archaeological inventory survey is not warranted for the 0.5-acre exploratory well and technology testing area. The cleared area will be flagged prior to any ground disturbing activities to ensure construction activities are confined within the cleared area, where the project would have "no effect" on significant historic sites. In the event that testing activities extend beyond the modified area, an archaeological survey will be prepared for those areas. Should any archaeological, cultural or historical sites be uncovered during construction or drilling activities, all work in the vicinity will cease and the State Historic Preservation Division will be notified immediately.

If the Kalaeloa site is selected for the full-scale desalination facility, an archaeological inventory survey will be prepared during Phase II of this project for those areas that have not been previously modified. A report of the finds will be submitted to the State Historic Preservation Division for adequacy review, prior to any construction activities. In addition, if significant historic sites are found during the survey, a mitigation plan may be prepared and submitted to the State Historic Preservation Division for adequacy review, prior to construction activities.

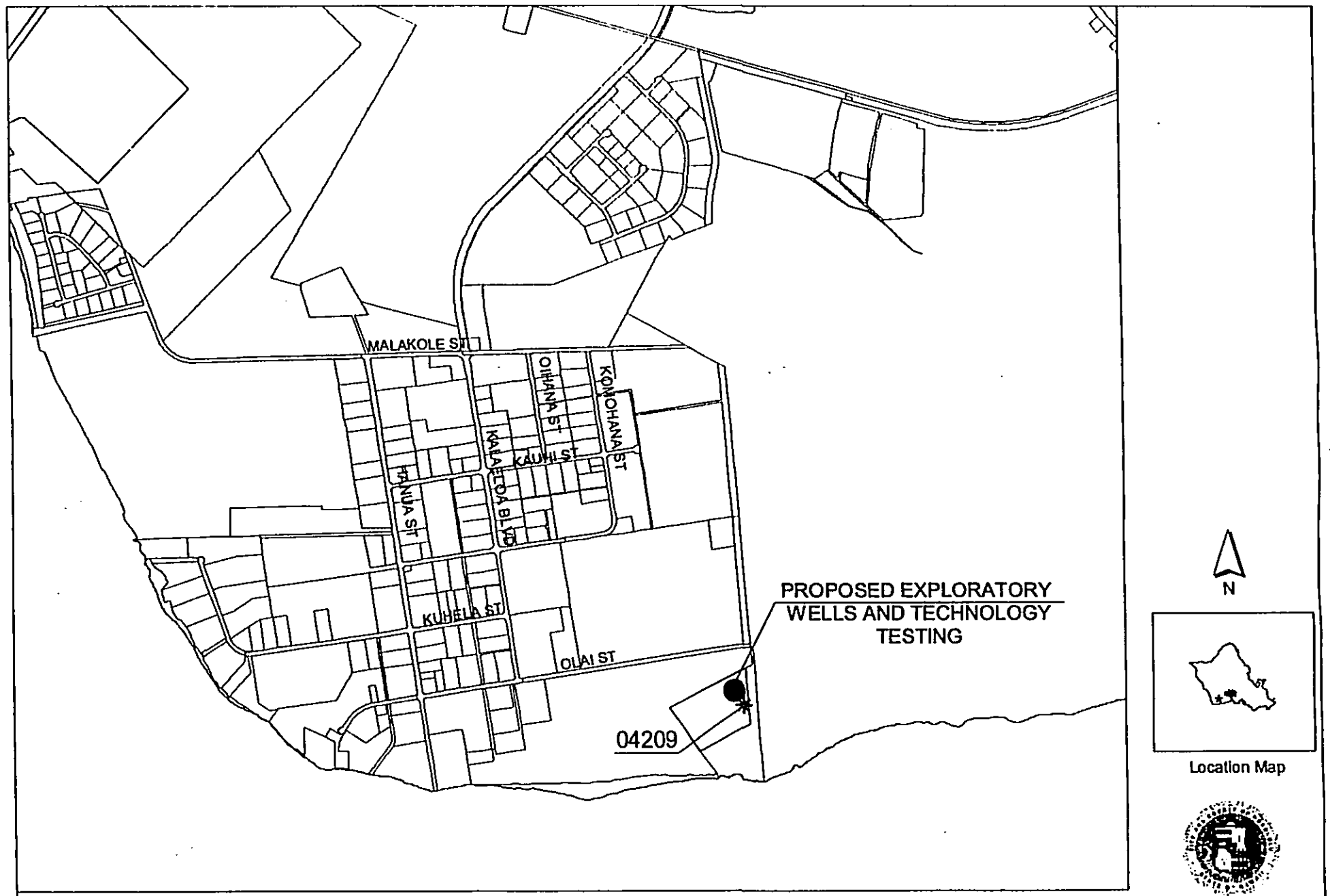
Cultural assessment consultations for the exploratory well and technology testing was handled through the Draft Environmental Assessment (EA) review process, with a copy of the Draft EA provided to the State Department of Hawaiian Home Lands and Office of Hawaiian Affairs (OHA). OHA's comments and our response are included in the Appendix.

7.1.10 Traffic

The site is currently accessed by Olai Street. Construction will be limited to weekdays during daylight hours between 8:30 am and 3:30 pm, or as required by the Board of Water Supply. This construction schedule will help minimize morning and afternoon peak traffic periods. No work shall be scheduled on weekends or on federal and state holidays.

7.1.10.1 Potential Impacts and Mitigation Measures

During the construction of the exploratory wells and technology testing, any temporary increase in traffic congestion that could result from the movement of construction related vehicles is unlikely to inconvenience motorists in the immediate vicinity of the project site due to the lack of businesses and residences. If necessary to mitigate potential traffic congestion, the movement of construction vehicles can be restricted during the morning and afternoon peak traffic hours or through an approved traffic control plan. Such restrictions will probably be unnecessary, however, since traffic is usually light on the surrounding streets.



Burial Site Information

Prepared By: BOARD OF WATER SUPPLY
City & County of Honolulu

Date Prepared: 07/24/2000

Figure 7-8

2000 0 2000 4000 Feet

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7.1.11 Noise

Regulation of noise in residential areas of Oahu are governed by the State Department of Health, HAR, Title 11, Chapter 53, Noise. The predominant source of noise near the site is aircraft performing takeoff and landing operations at the nearby airfield. A 1989 Naval Air Station Barbers Point Air Installations Compatible Use Zones Noise Contours and Supporting Data (Harris Miller & Hanson, Inc., July 1989) evaluated noise impacts associated with 1987 aircrafts operations and the Barbers Point Naval Air Station (Kalaeloa). At that time the levels in the vicinity of the proposed site ranged from 65 to 75 dBA. Aircraft operations were reduced by 24% between the years 1987 and 1993 (DEA. Ref. 2). While the noise impacts are not only a function of the number of aircrafts, a decline of that magnitude would be expected to cause a decrease in noise levels.

Allowable day and nighttime noise standards for sensitive receptors have been established for *residential, preservation, hotel, apartment, and business districts.* The maximum allowable day and night levels in the surrounding I-2 general, Class C zoning are as follows:

Time	Allowable Levels
7:00 am to 10:00 pm	70 dBA
10:00 pm to 7:00 am	70 dBA

7.1.11.1 Potential Impacts and Mitigation Measures

During the construction of the exploratory wells and technology testing, noise will be generated during clearing, grading, bulldozing, and installation of well equipment. Additional noise levels may be generated by vehicular travel along Olai Street in the early morning and afternoon. These impacts, however, are expected to be relatively minor and only temporary during construction activities.

Mitigation measures to address noise impacts include the use of construction equipment appropriate to surrounding land use type; use of mufflers on construction vehicles; and maintaining all equipment in good working order. In addition, construction will be limited to

weekdays during daylight hours between 8:30 am and 3:30 pm, or as required by the Board of Water Supply. This construction schedule will help minimize morning and afternoon peak traffic periods. No work shall be scheduled on weekends or on federal and state holidays.

Pump and drilling equipment will be regulated for noise by State Department of Health Community Noise Control Rules. The contractor will obtain a noise permit if noise levels from construction activities are expected to exceed allowable levels. Drills and surface pumps will be fitted with sound attenuation devices including, but not limited to, mutes or structural enclosures. Subsurface pumps will be similarly treated to reduce noise levels to below the regulatory limit.

7.1.12 Land Use and Zoning Designation

7.1.12.1 Current Land Use

The Kalaeloa Community Development District (previously called Barbers Point Naval Air Station) is roughly three miles long and two miles wide and covers approximately 3,700 acres. About one-third of the land area is utilized for three runways and associated taxiways, aprons and aircraft tie-downs areas. North of the runways is an urban core consisting of residential, commercial and supporting services areas. To the east of the urban core is an industrial support area consisting of maintenance shops, warehouses and paved areas (DEA, Ref. 3). The proposed Kalaeloa exploratory well site is located at the southwestern portion of the Kalaeloa Community Development District and is separated by a man made canal. The site is undeveloped and overgrown with natural vegetation.

7.1.12.2 Planning Framework and Regulatory Status

Regulatory controls over land use are affected by both State and County governments.

A. State

At the State level, land use districts are established to control broad scale land use patterns. Districts include Urban, Rural, Agriculture and Conservation. State land use in the Kalaeloa area is within the Urban growth boundary, Figure 7-9. Uses proposed under the development would be consistent with objectives and policies of the State land use law, Chapter 205,

Hawaii Revised Statues. The proposed project lies within the State's Pass Zone for effluent disposal, Figure 7-10, and makai of the underground injection control (UIC) boundary line, Figure 7-11.

B. City and County

At the County level, land use regulation evolves from broad principles established in a general plan. The City and County of Honolulu General Plan (1992) is a statement of the long-range social, economic, environmental and design objectives for the general welfare and prosperity of the people of Oahu. In addition, the plan provides broad policy directives intended to facilitate attainment of the objectives. Objectives and policies are divided into eleven major areas. The relationship to the proposed project to the relevant objectives and policies of the General Plan area as follows:

Population

Objective B To plan for future population growth

Policy 1: Allocate efficiently the money and resources of the City and County in order to meet the needs of Oahu's anticipated future population.

Policy 2: Provide adequate support facilities to accommodate future growth in the number of visitors to Oahu.

Objective C To establish a pattern of population distribution that will allow the people of Oahu to live and work in harmony.

Policy 2: Encourage development within the secondary urban center at Kapolei and the Ewa and Central Oahu urban-fringe and rural areas and to meet housing needs not readily provided in the primary urban center.

Policy 4: Seek a year 2010 distribution of Oahu's residential population which would be in accord with the following:

Location	% of year 2010 Islandwide population
Primary Urban Center	45.1 – 48.8 %
Ewa	12 –13.3 %

Economic Activity

Objective G To bring about orderly economic growth on Oahu.

Policy 1: Direct major economic activity and government services to the primary urban center and the secondary urban center at Kapolei.

Transportation and Utilities

Objective B To meet the needs of the people of Oahu for an adequate supply of water and for environmentally sound systems of waste disposal.

Policy 1: Develop and maintain an adequate supply of water for both residents and visitors.

Policy 2: Develop and maintain an adequate supply of water for agricultural and industrial needs.

Physical Development and Urban Design

Objective C To develop a secondary urban center in Ewa with its nucleus in the Kapolei area.

Policy 1: Allocate funds from the City and County's capital improvement program for public projects that are needed to facilitate develop of the secondary urban center at Kapolei.

Policy 3: Encourage the continuing development of Barbers Point as a major industrial center.

The City and County of Honolulu Development Plans (DP) and Sustainable Community Plans (SCP) provide a relatively detailed framework for implementing the objectives and policies of the General Plan on an area wide basis. The DP and SCP provide for land use and public facilities planning and must implement and accomplish the objectives and policies of the General Plan. The proposed Kalaeloa site falls within the boundaries of the Ewa DP.

The development of Kalaeloa (previously the BPNAS) will be guided by a Special Area Plan, which will be consistent with the general polices and guidelines in the Ewa DP. The

proposed project is consistent with Section 4.2 Water Allocation and Water System Development of the Ewa DP. The BWS projects that an additional 35 million gallons per day (mgd) will be needed in Ewa by the year 2020 for projected growth in residential and commercial demand. Meeting the projected demand will require reallocation of water within the island-wide system, as well as development of new sources. The proposed desalination facility is identified on Table 4.2 in the Ewa DP as an alternative potable water resource.

An amendment to the Ewa Public Infrastructure Map, to include the Desalination Facility at the proposed Kalaeloa site has been submitted to the Department of Planning and Permitting for processing.

The zoning of the base prior to closure was F1 (federal), Figure 7-13, and when the land is conveyed to the Board of Water Supply it will be converted to City and County P-2 General Preservation District. A designation change is being proposed as a Special Area Plan to I-2 Intensive Industrial District.

The exploratory well and technology testing area is outside of the City and County of Honolulu's Special Management Area (SMA), Figure 7-14. A Special Management Area Use Permit will be applied for if the exploratory well and testing technology area extends into the SMA. The future Kalaeloa desalination facility is within the SMA and BWS will apply for a SMA Use Permit at that time.

C. Long-Range Plans

Changes to the Ewa region will result from background growth consequent to the implementation of the land use plans now in place, which includes the Naval Air Station Barbers Point Community Redevelopment Plan completed for the State of Hawaii Barbers Point Redevelopment Commission.

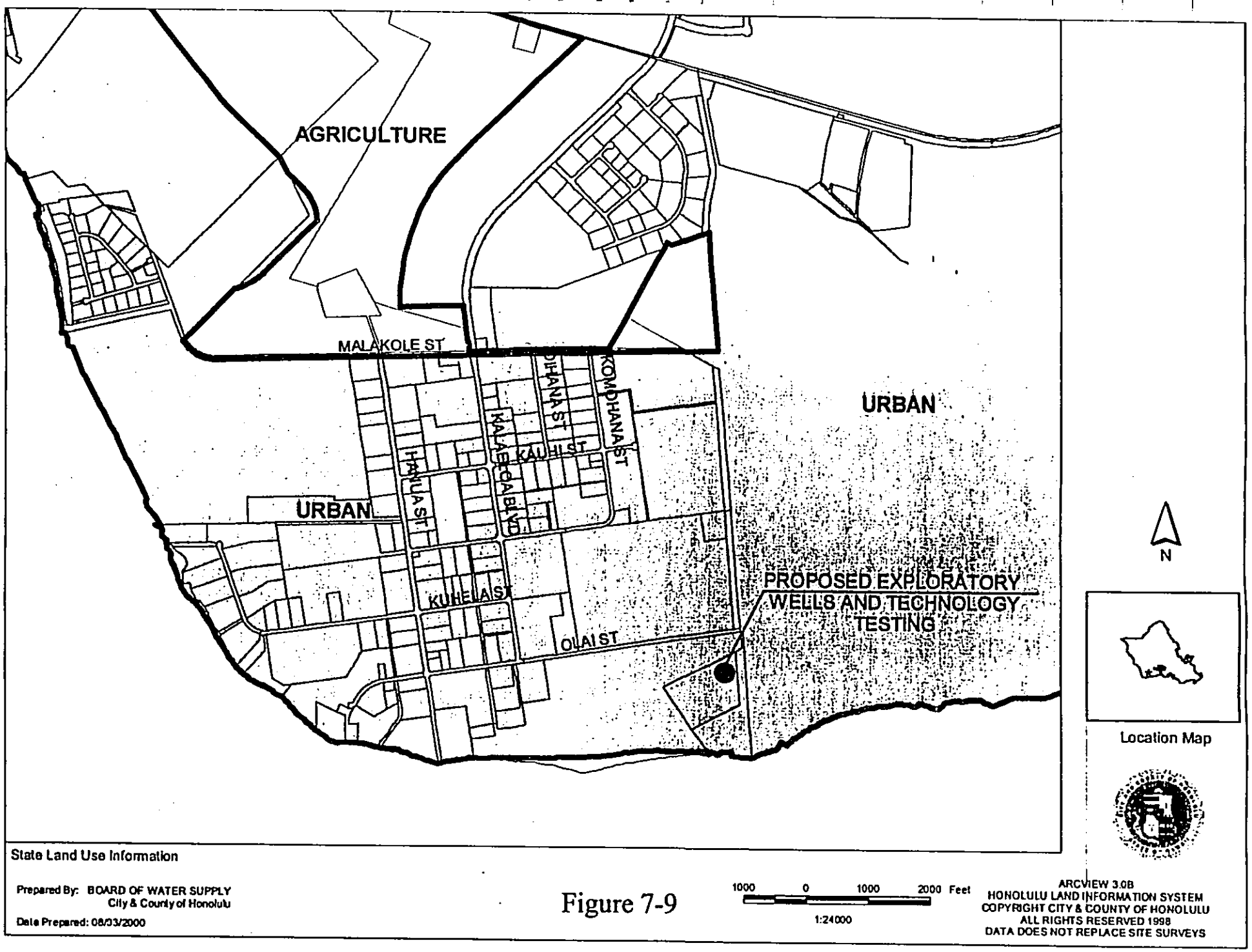
Barbers Point Naval Air Station Redevelopment Plan:

A major land use just east of James Campbell Industrial Park is Barbers Point Naval Air Station (also known as the Kalaeloa Community Development District) Figure 7-12A. In

1993, the Base Realignment and Closure Commission recommended the closure of Barbers Point Naval Air Station (BPNAS). The recommendation was confirmed soon after, and BPNAS was closed on July 1, 1999. The State of Hawaii BPNAS Redevelopment Commission was formed and a BPNAS Community Redevelopment Plan was published in March 1997. The intention of the plan was to integrate base lands into the surrounding region. The proposed site for the desalination facility is identified in the adopted land use plan, Figure 7-12B. The Ewa Development Plan indicates that the Barbers Point Naval Air Station (BPNAS) is the only area in Ewa identified for Special Area Plan (SAP) Status. The SAP is a summary of the Community Redevelopment Plan and presents the recommended plan for the reuse of the BPNAS. The SAP will be submitted to the City Council for adoption by resolution and will become part of the City's Development Plan if adopted.

7.1.12.3 Potential Impacts and Mitigation Measures

No specific impacts are anticipated by the construction of the exploratory wells and technology testing at the Kalaeloa site. Drilling of the exploratory wells and implementation of the technology testing should not change the surrounding land uses. No mitigation measures are proposed regarding land use.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KALAEPOA BLVD
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Location Map
State Land Use Information
Prepared By: BOARD OF WATER SUPPLY
City & County of Honolulu
Date Prepared: 08/03/2000
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Figure 7-9

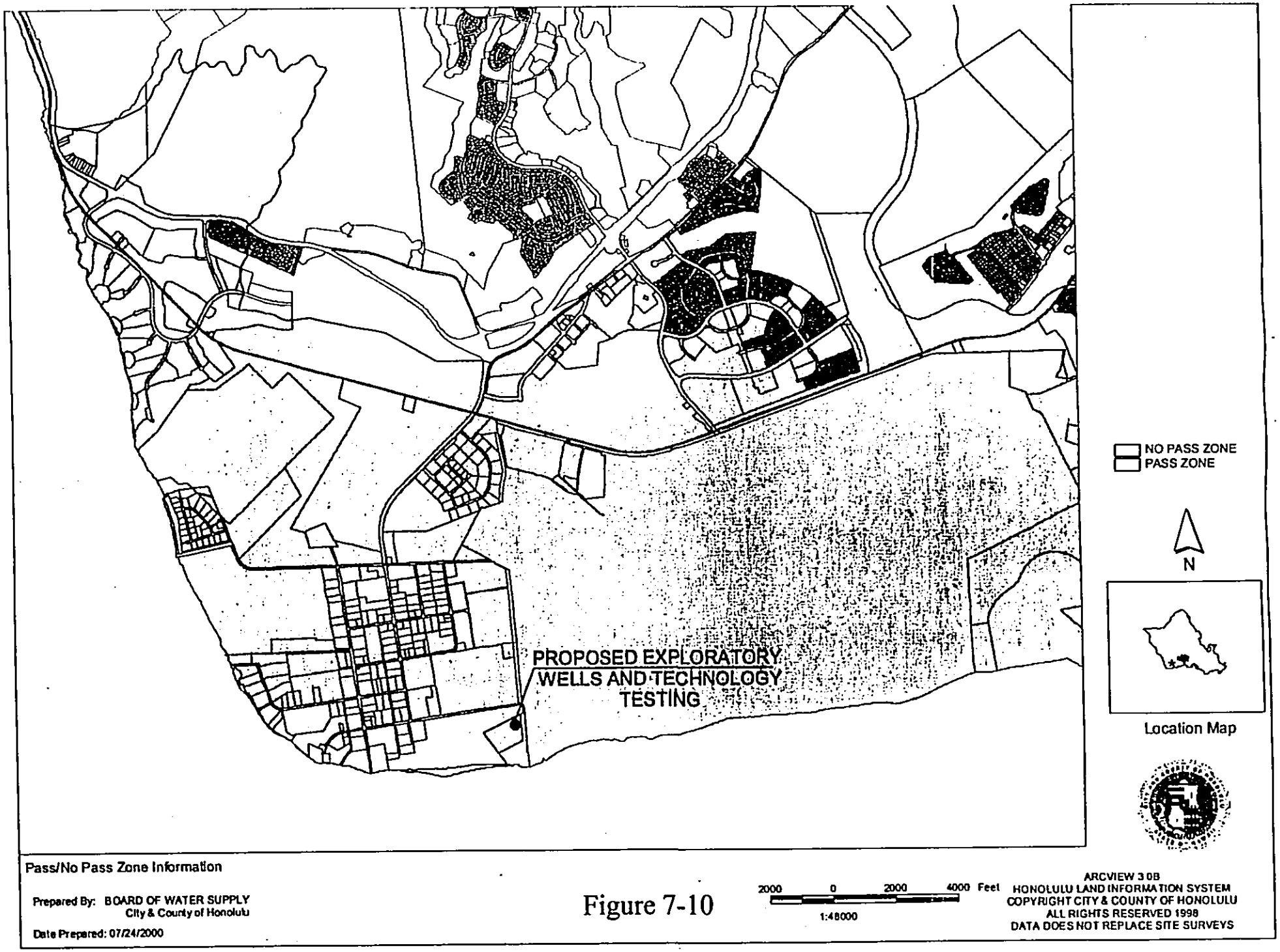
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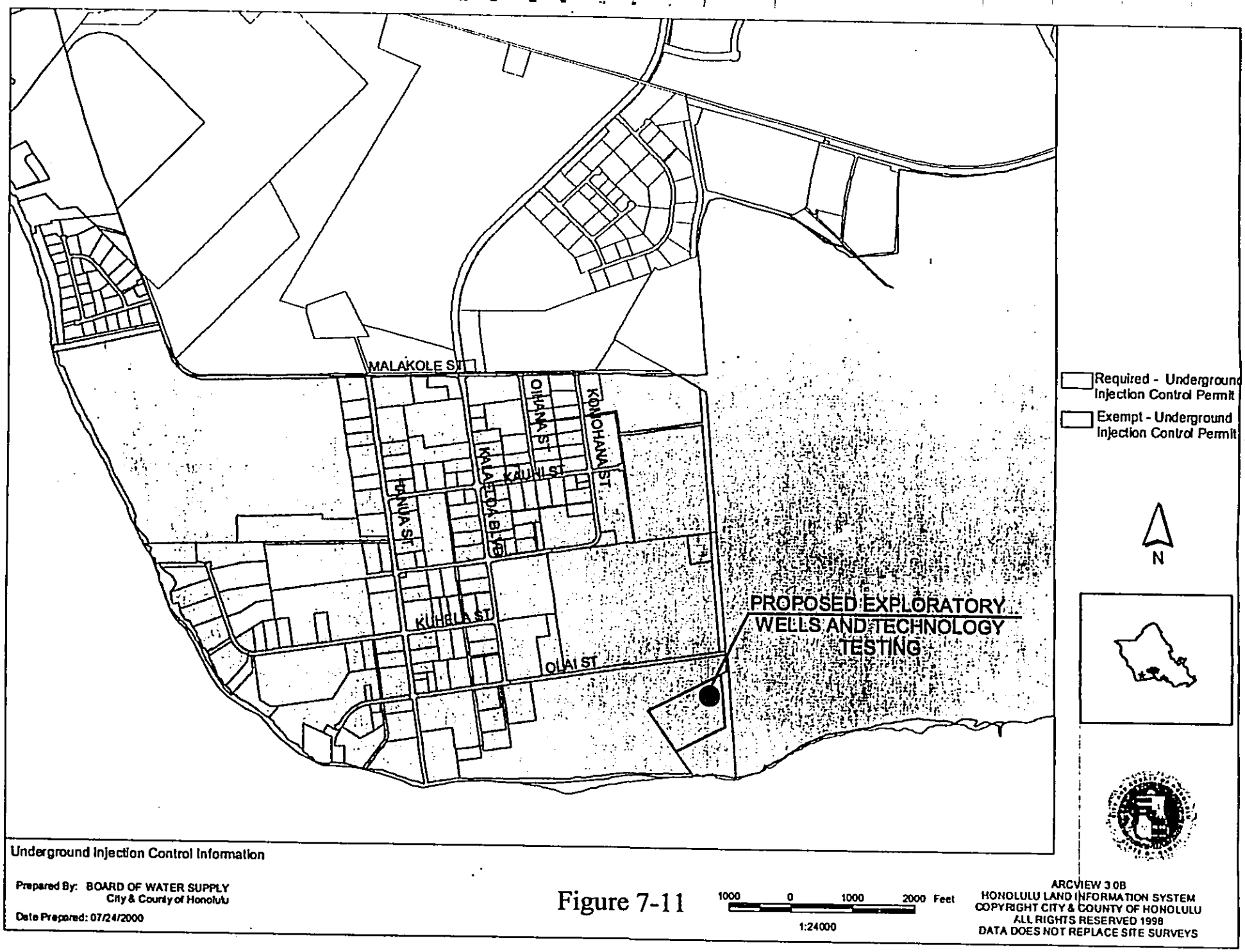
Figure 7-10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KALAELOA BLVD
KUUI ST
HANUA ST
KUHELA ST
OLAI ST
PROPOSED EXPLORATORY WELLS AND TECHNOLOGY TESTING
Required - Underground Injection Control Permit
Exempt - Underground Injection Control Permit
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Underground Injection Control Information
Prepared By: BOARD OF WATER SUPPLY
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Figure 7-11

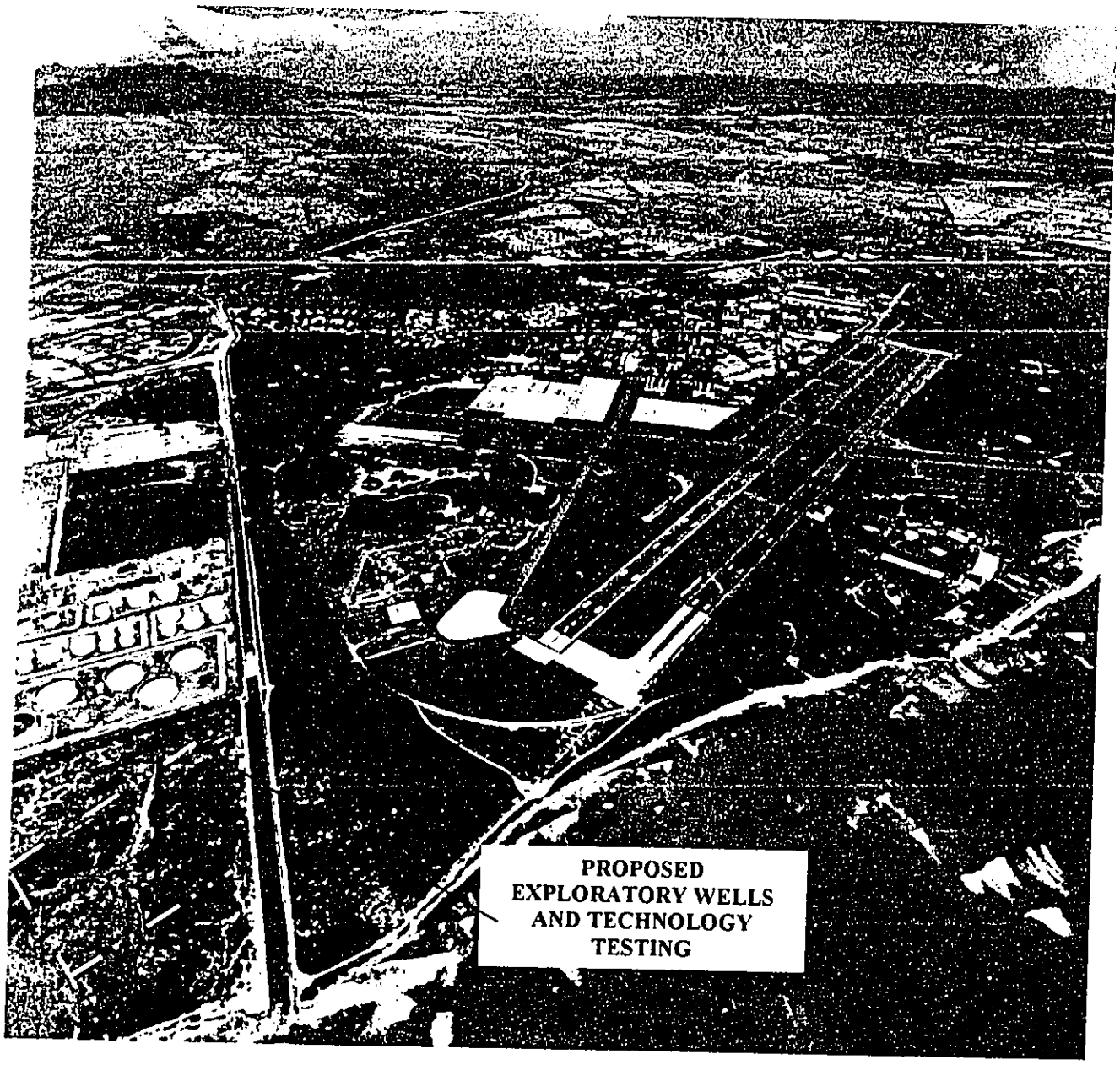
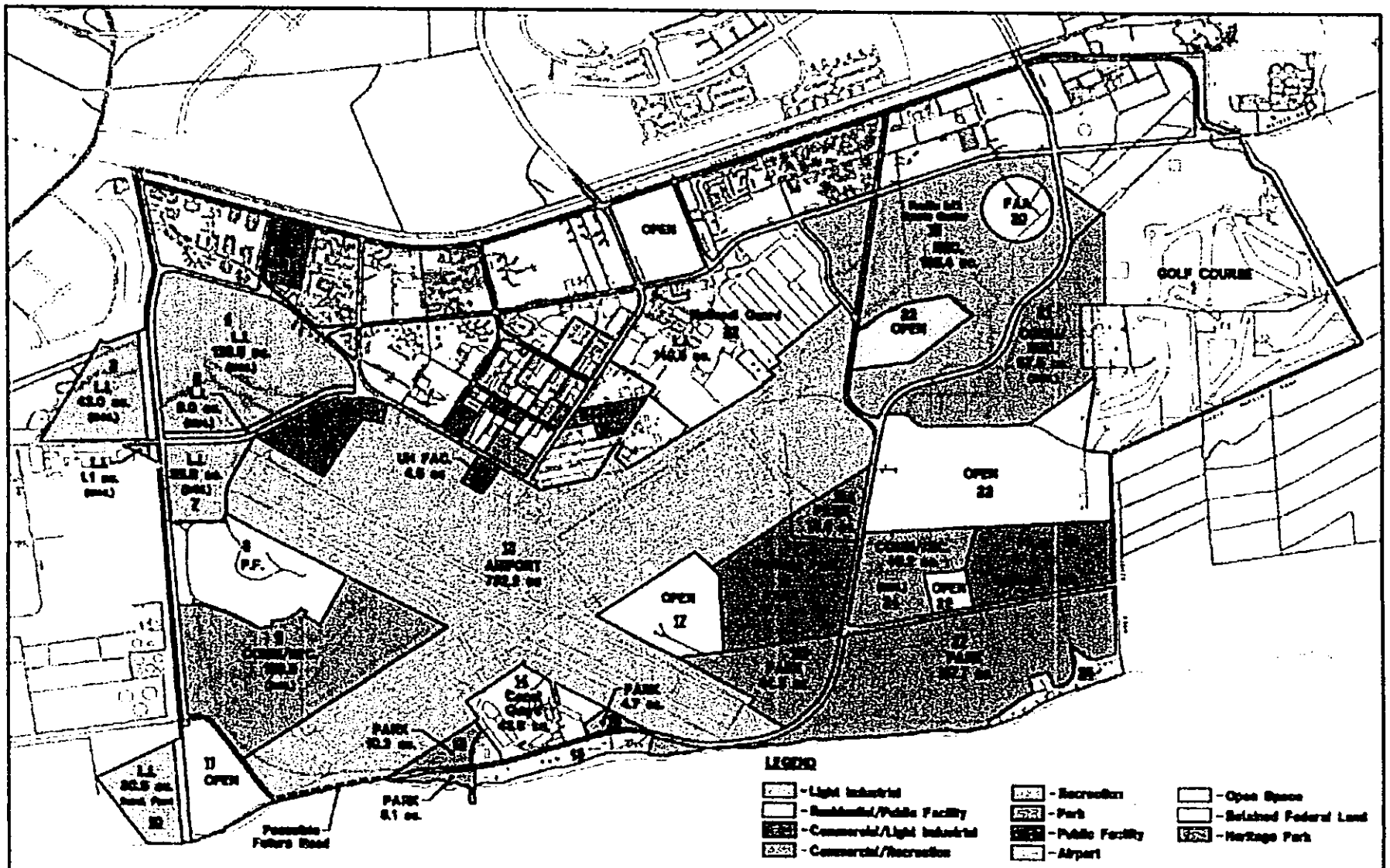


Figure 7-12A

Kalaeloa Community Development District
Aerial View

Not to Scale



Basewide Redevelopment Plan

Kalaeloa Redevelopment Plan

Source: Community Redevelopment Plan, 2000

Feet
0 1000 2000 3000

Figure
7-12 B

CORRECTION

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

Kalaeloa Redevelopment Plan Source: Community Redevelopment Plan, 2000

Basewide Redevelopment Plan

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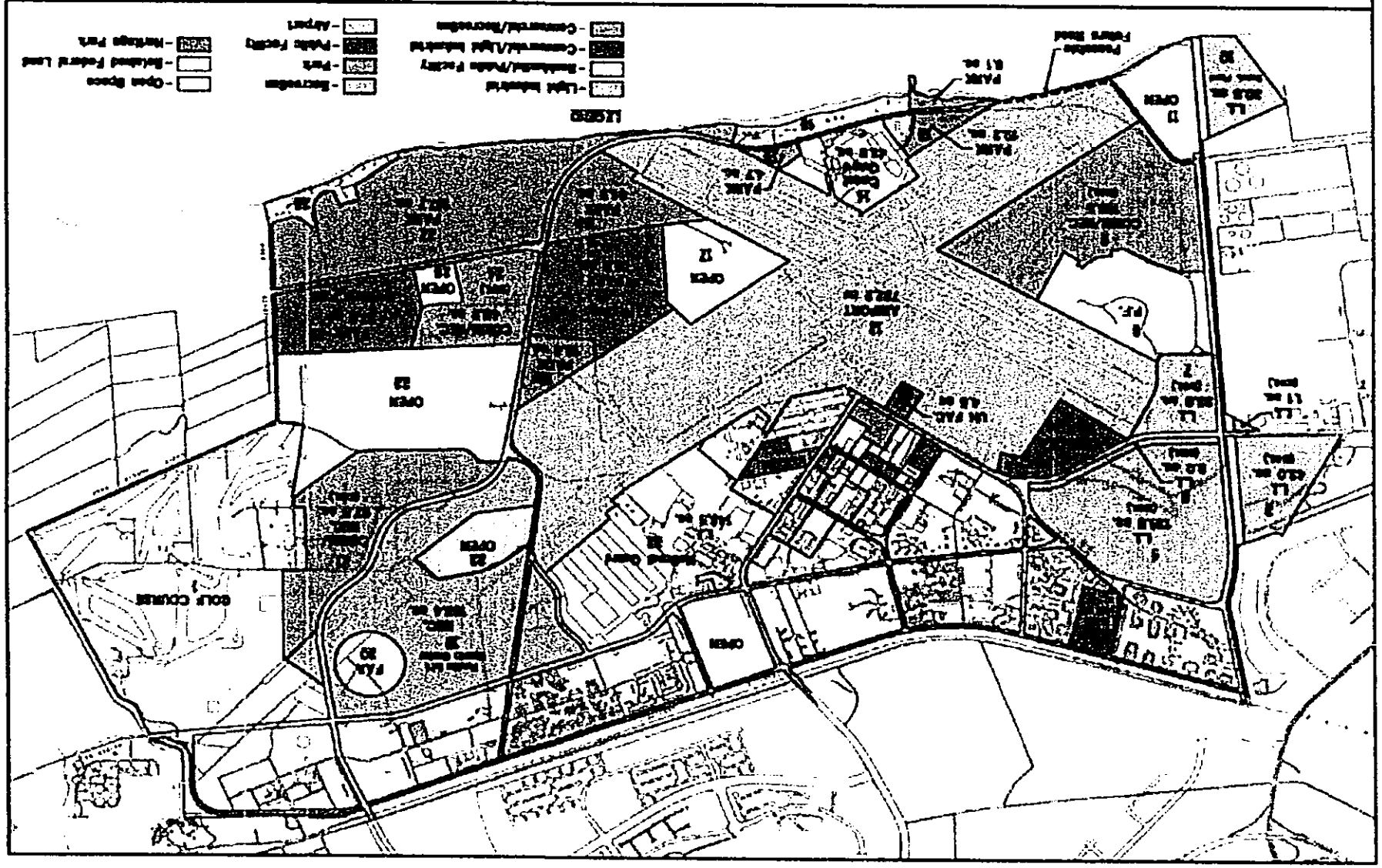
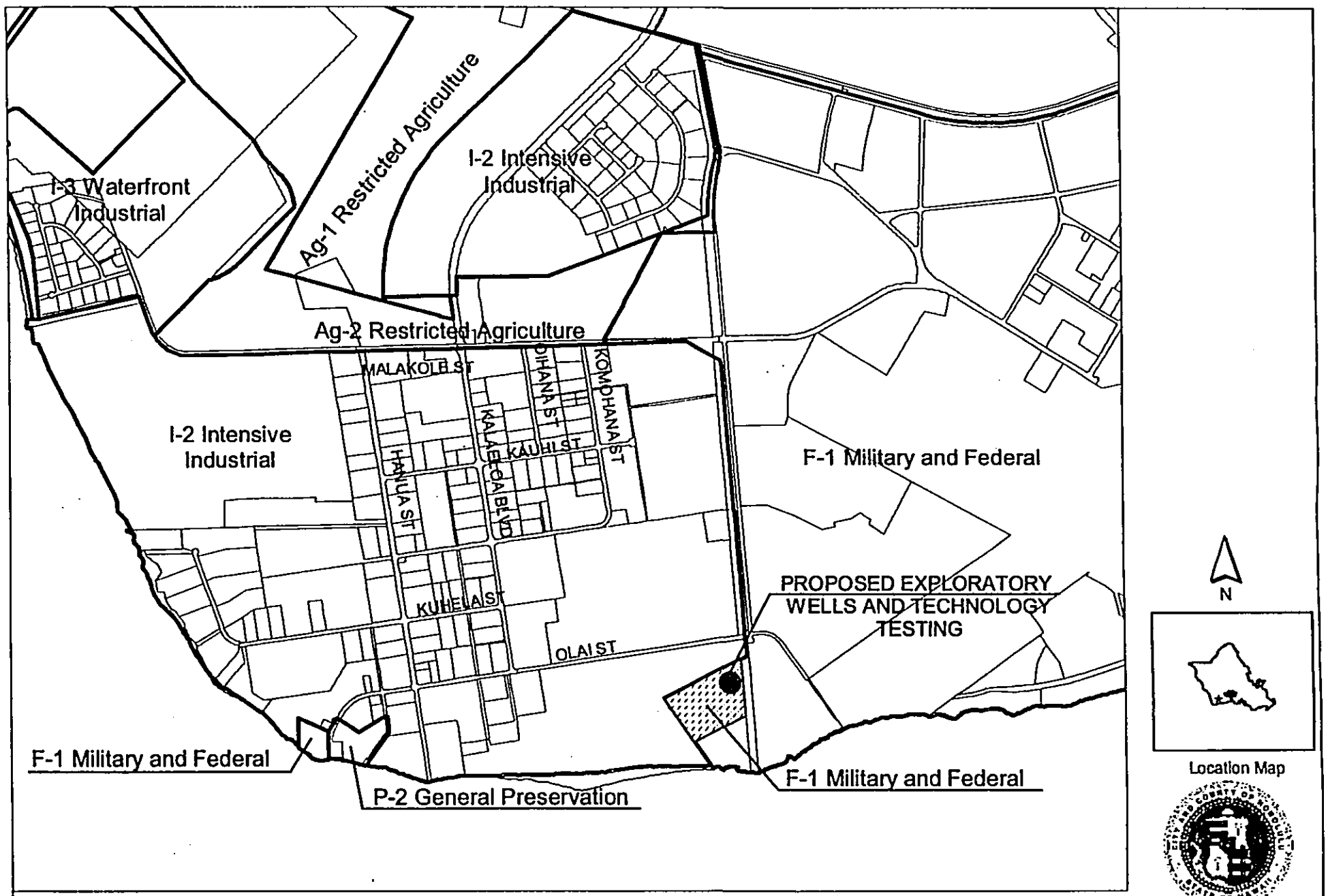
Figure 7-12 B





City Zoning Information

Prepared By: BOARD OF WATER SUPPLY
City & County of Honolulu

Date Prepared: 08/03/2000

Figure 7-13

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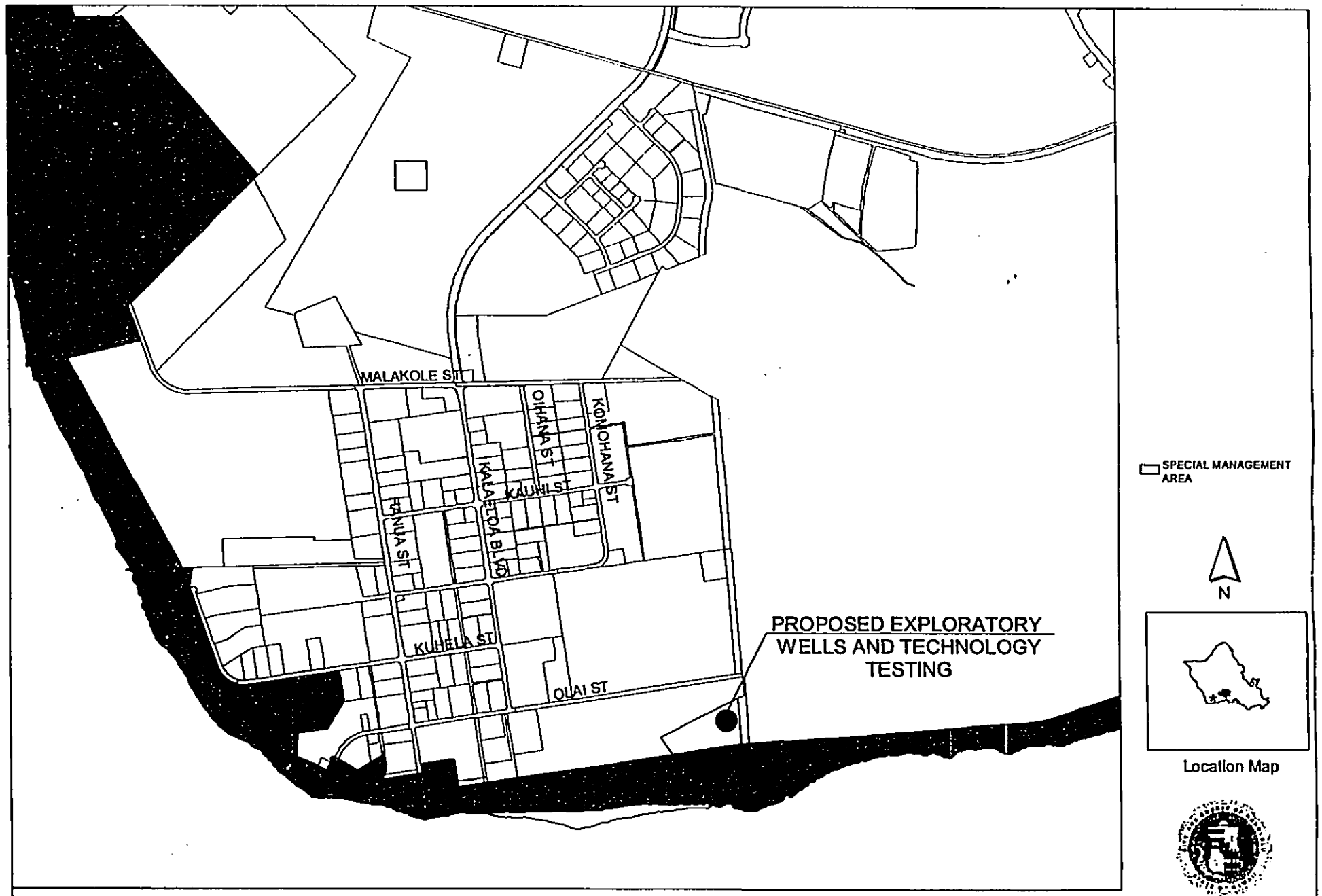

Figure 7-14

7.2 Sand Island Wastewater Treatment Plant – Alternative Site 1

Most of the Sand Island Wastewater Treatment Plant site is occupied by existing wastewater treatment facilities. The prospective location for the proposed exploratory well and technology testing is the southeast corner of the site. A location map for the Sand Island Wastewater Treatment Plant site is shown in Figure 7-15.

The City and County of Honolulu is currently looking into expanding the existing wastewater treatment plant to include secondary treatment units and a septage treatment facility. If the City and County of Honolulu decides to follow through with the plant expansion plans, all of the current vacant area on the Sand Island Wastewater Treatment Plant site would become occupied leaving no space for the desalination facility. Since the City and County of Honolulu is uncertain as to whether the existing Wastewater Treatment Plant will be expanded, the area remains a feasible option for the location of the proposed desalination facility.

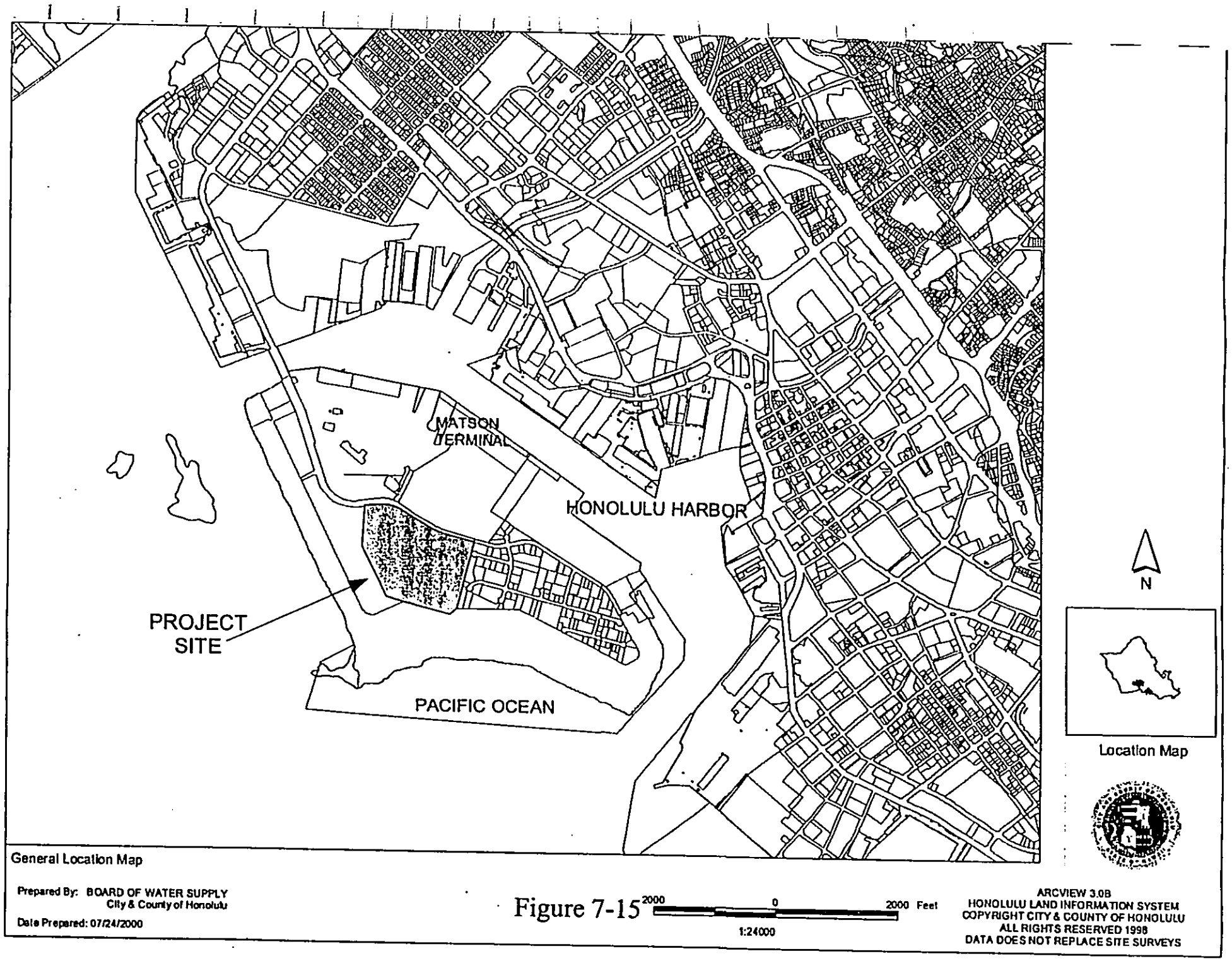

Figure 7-15

7.2.1 Geologic Conditions

The geologic structure of southern Oahu was formed slowly over historical time from lava flows, weathering and changes of sea level during the Pleistocene epoch. The following subsections focus on the geology of the proposed Sand Island Wastewater Treatment Plant site.

7.2.1.1 Geology

The island of Oahu consists of the eroded remnants of two large shield volcanoes -- Waianae and Koolau. The Waianae and Koolau volcanoes formed Oahu during their active lives that spanned the Pliocene and Pleistocene epochs. Sand Island was formed by material that was dredged from Honolulu Harbor and placed onto a shallow reef structure, which overlies caprock sedimentation.

7.2.1.2 Topography

The terrain within the Sand Island Wastewater Treatment Plant is almost flat and has previously been graded. The maximum elevation within the Sand Island Wastewater Treatment Plant site is about 5 to 8 feet above mean sea level and varies by no more than several feet.

7.2.1.3 Soil

The Soils Conservation Service describes the soil and rock materials within the Sand Island Wastewater Treatment Plant as being mixed fill land (FL) and jaucus sand (JaC) with 0 to 15 percent slopes, Figure 7-16. Sand Island Wastewater Treatment Plant has deep, nearly level to moderately sloping, well-drained soils that have a fine-textured or moderately fine-textured subsoil or underlying material on a coastal plain. Drainage is good to moderately good. Permeability is moderately rapid to slow. The mixed fill is created from dredged material, garbage, or material hauled from other sources.

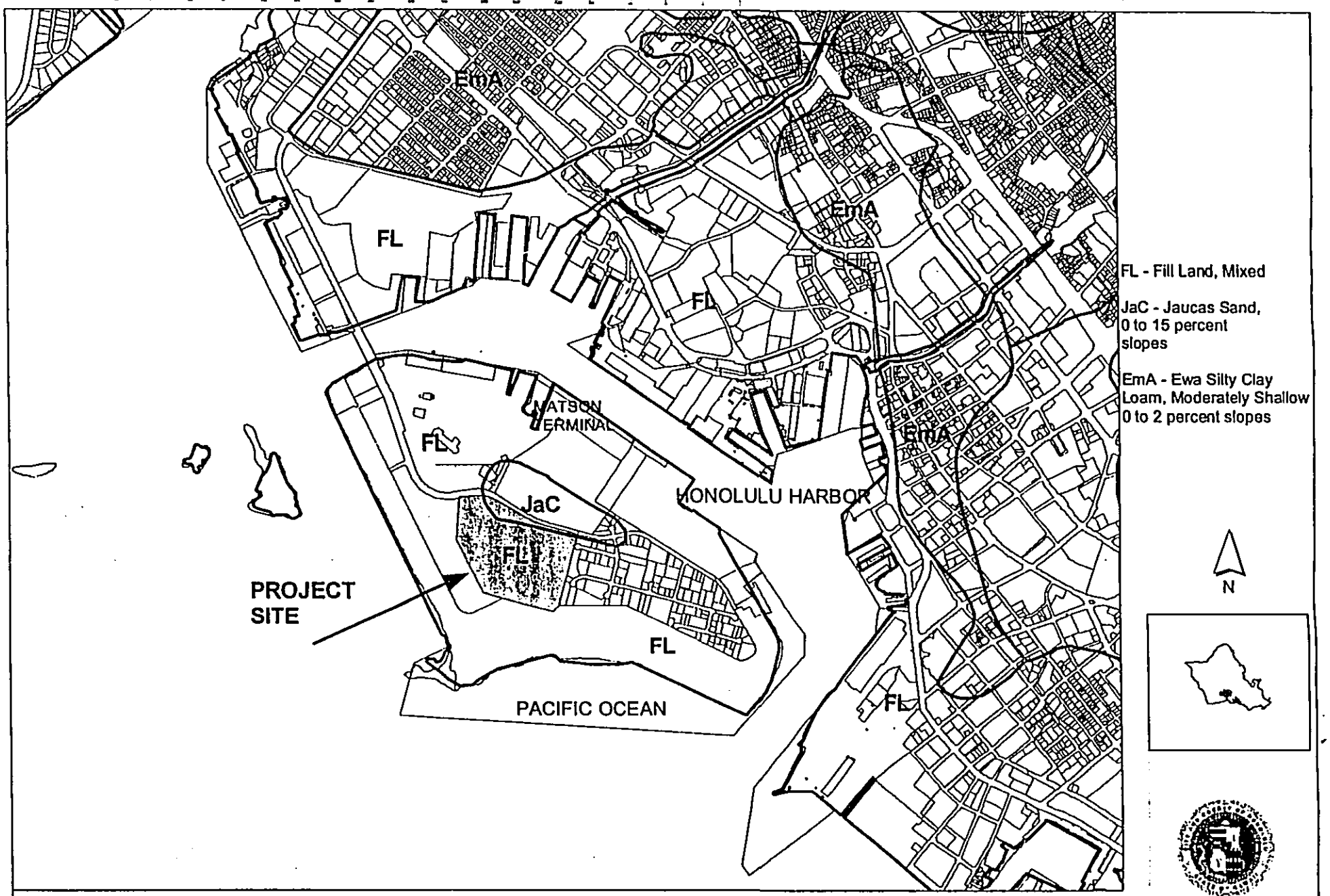

Figure 7-16

7.2.1.4 Potential Impacts and Mitigation Measures

Impacts of the proposed exploratory well and technology testing on the existing geology and topography of the Sand Island Wastewater Treatment Plant site were determined to be minimal. The soil does not appear to be susceptible to erosion, since the topography is relatively level and the soils are shallow and highly permeable. Also, rainfall is very limited in the lower Honolulu area. No major problems or impacts are anticipated to develop during the excavation of the soil for the proposed exploratory well and technology testing; however, dewatering may be a problem due to the site's close proximity to the ocean. Mitigation will consist of contractor compliance with all relevant provisions of the Revised Ordinances of Honolulu, Chapter 14 Public Works Infrastructure Requirements (1990).

7.2.2 Climate and Air Quality

Impacts on the climate and ambient air quality are minimal for the operation of the plant. In addition, environmental impacts during construction of the exploratory well and technology testing will be temporary. Any impacts from the proposed desalination facility on the climate and ambient air quality will be negligible.

7.2.2.1 Climate

Northeasterly tradewinds prevail over Oahu during all months of the year. From November through March the tradewinds are weakest and replaced with winter storms that bring rain to the island. Mean annual rainfall is about 20 inches and derived from winter rainfall. About 90 percent of the rainfall is recorded during the months from October though April. January is normally the wettest month of the year, averaging 4.3 inches of rain. The months from May through September average less than half an inch of rain each.

The mean temperature of the lower Honolulu region is 72°F in the winter (November-February) and 79°F during the summer (June-August). The mean annual temperature is 76°F.

7.2.2.2 Air Quality

Air quality on Oahu is excellent overall due to prevailing northeast trade winds. The well site also benefits from these trade winds and enjoys generally good air quality. The Atlas of Hawaii, indicates that particulate matter at the site averages 40 micrograms per cubic meter of suspended particulates over a twelve-hour daytime period. The maximum concentration of carbon monoxide for any one-hour period falls between 20 and 30 micrograms per cubic meter.

Existing air pollution at the project site is minimal, primarily resulting from vehicles. There are no significant stationary sources of air pollution in the area

Construction activities associated with the exploratory well and technology testing would produce air pollutants mainly from two different types of sources: exhaust emissions from construction equipment and vehicles, and fugitive dust emissions, from human activities. The emissions associated with construction activities are, by their nature, of short-term duration, and would cease upon completion of the project.

7.2.2.3 Potential Impacts and Mitigation Measures

Potential air quality impacts during the exploratory well drilling and technology testing will be mitigated by complying with the State of Hawaii Department of Health Administrative Rules.

The construction contractor will be required to comply with Department of Health rules (HAR Chapter 43, Section 10) and the grading permit. Proper maintenance of construction vehicles and equipment will serve to minimize combustion emissions. Construction vehicle and equipment idling should be kept to a minimum when equipment is not in use.

An effective dust control plan will be implemented during construction to ensure compliance with Department of Health regulations. Dust control measures will include watering of the work area, use of wind screens, keeping adjacent roadways clean and covering of open-

bodied trucks. Other dust control measures may include mulching or stabilizing inactive exposed areas and scheduling permanent paving or landscaping early in the construction schedule.

7.2.3 Water Resources

The southern Honolulu region contains a comprehensive hydrologic system that includes many hydrologic subsystems and variables. The following subsections focus on the major hydrologic systems possibly affected by the construction and operation of the proposed desalination facility at the Sand Island Wastewater Treatment Plant site.

7.2.3.1 Hydrogeology

Groundwater within the Sand Island Wastewater Treatment Plant site is essentially seawater. The aquifer is primarily made of man made fill, lagoonal deposits, coral fill and reef limestone. There is no fresh water aquifer at the site.

7.2.3.2 Surface Water Quality

No lakes, reservoirs, ponds, rivers, streams or wetlands exist within or near the Sand Island Wastewater Treatment Plant (SIWWTP) site. Surface waters in the form of perennial stream flows or ponds do not occur within or near the SIWWTP site. A small, shallow, dry earthen ditch runs north-south through the center of the SIWWTP site.

7.2.3.3 Potential Impacts and Mitigation Measures

With respect to impacts on sustainable water resources, the most important consideration is protection of the basal drinking water aquifer. Since only salt water occurs at the site, the withdrawal of seawater from the Basal Aquifer should not impact the freshwater lens.

7.2.4 Natural Hazards

The purpose of analyzing the existing natural hazard conditions is twofold: (1) to identify the existing natural hazards that could occur during construction of the exploratory well and technology testing (2) to examine the potential of occurrence of these natural hazards during construction of the exploratory well and technology testing. Natural hazards that present a

potential for occurrence at the Sand Island Wastewater Treatment Plant site include earthquakes, floods, and tsunamis.

7.2.4.1 Seismic

The Uniform Building Code (UBC) provides minimum design criteria to address potential for damages due to seismic disturbances. The UBC scale is rated from Seismic Zone 1 through Zone 4, with 1 the lowest level for potential seismic induced ground movement. Oahu has been designated within Seismic Zone 1. BWS, in the interest of public health and safety has adopted UBC Seismic Zone 3 standards for all its structures. All permanent structures proposed for this project, therefore, will be built according to standards for UBC Seismic Zone 3.

7.2.4.2 Flood and Tsunami Hazard

According to the Flood Insurance Rate Maps (FIRMs), a portion of the project site is in Zone X, "Areas determined to be outside the 500-year flood", Figure 7-17. The eastern portion of the WWTP is in Zone A, "Special flood hazard areas inundated by 100-year flood, No base flood elevation determined." The City's department of Planning and Permitting has indicated that this portion designated as Zone A is located in Flood Fringe District, with a regulatory flood elevation which ranges from 5.9 feet to 5.7 feet above mean sea level.

The project site is located completely within the 100-year tsunami inundation area as depicted in the Oahu Tsunami Evacuation Maps. The project site is inside the anticipated tsunami flood hazard area (Tsunami Warning Center, 1998), Figure 7-18.

7.2.4.3 Potential Impacts and Mitigation Measures

The proposed exploratory well and technology testing may be located within the flood and tsunami hazard areas. Flooding is not anticipated to affect the proposed project. Any structures located in Zone A will be designed in compliance with Land Use Ordinance flood hazard district requirement. Because seismic risk at the project site is minimal, the proposed project is not expected to be affected by seismic activity.

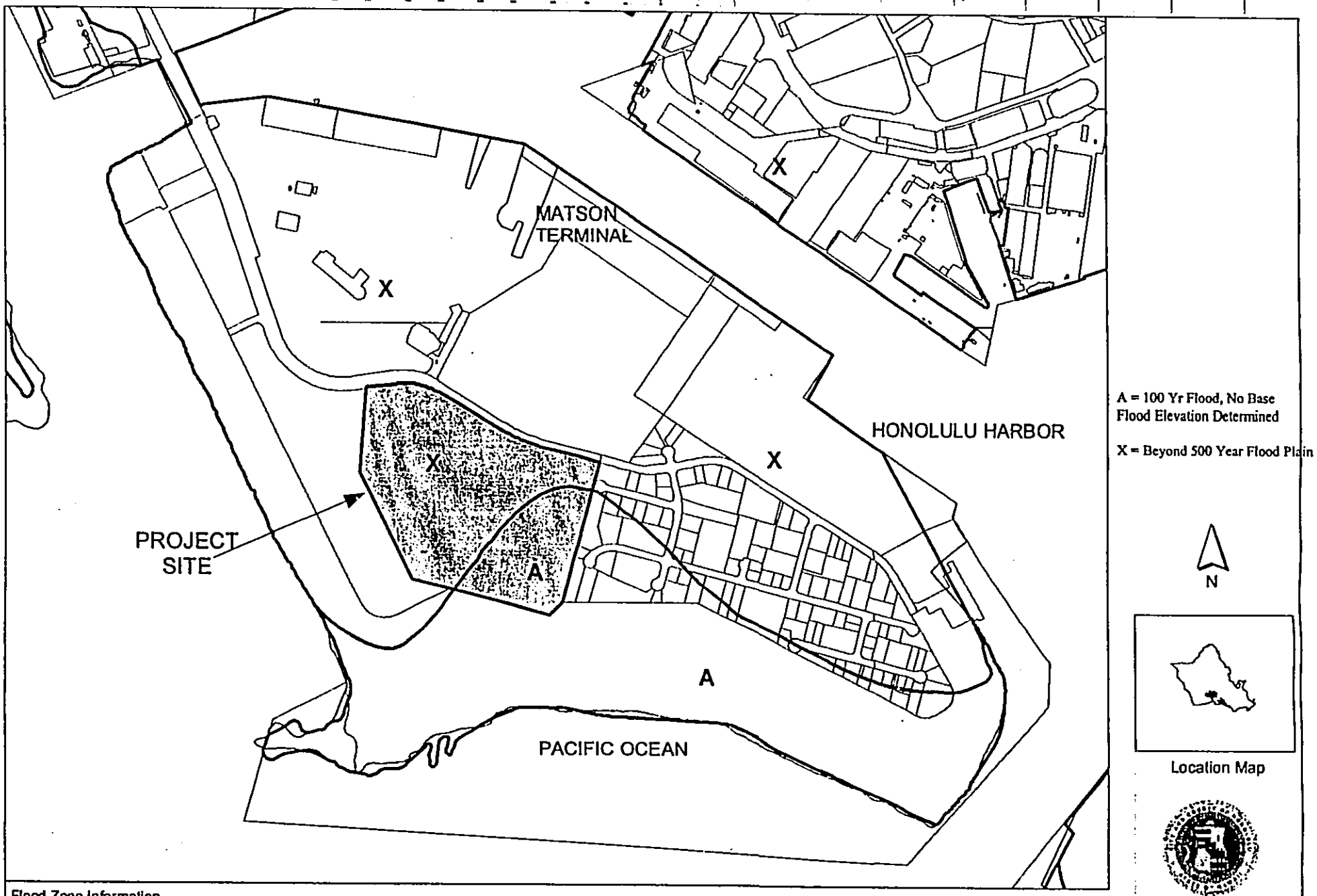
MATSON
TERMINAL
HONOLULU HARBOR
PROJECT
SITE
PACIFIC OCEAN
X
A
A = 100 Yr Flood, No Base
Flood Elevation Determined
X = Beyond 500 Year Flood Plain
N
Location Map
Flood Zone Information
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Figure 7-17

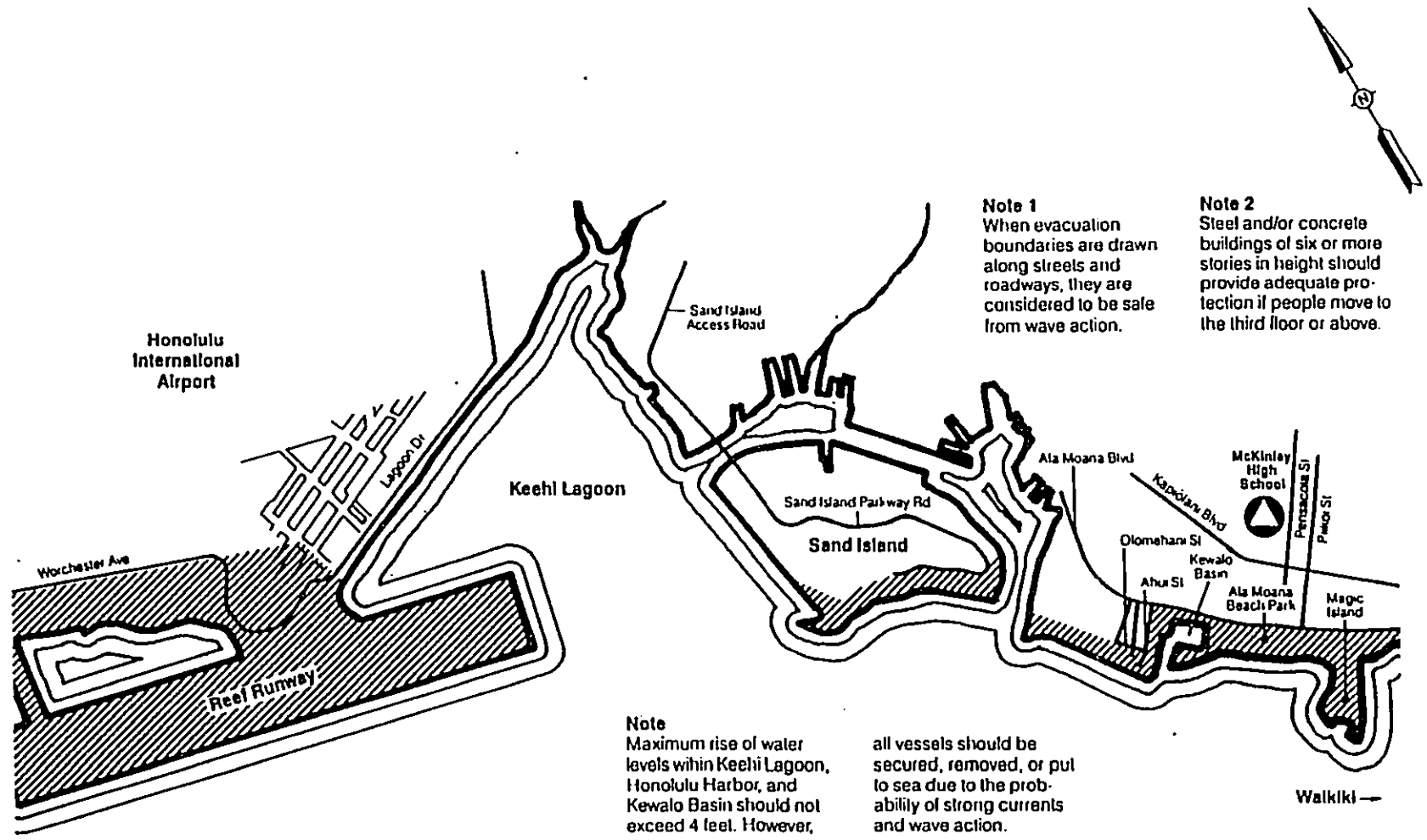


Figure 7-18

Tsunami Inundation Areas – Honolulu District

7.2.5 Biological Environment

The location of the proposed project within the Sand Island Wastewater Treatment Plant land area is on fully improved and previously disturbed lands. There will be little, if any, impacts to the existing biota due to this project.

7.2.5.1 Terrestrial Flora and Fauna

Plants and animals potentially affected by any impacts from the proposed desalination facility include terrestrial and marine species. Plant and animal species prevalent at the site are exotic or introduced species and will not be affected by this project.

Existing conditions

The treatment plant area consists of roadways, landscaping, and grassed areas. Wild animal life within the area include small Indian mongoose, rate, mice and feral cats. There are no known endangered or threatened species inhabiting the project site. While some loss of habitat will occur as a result of construction activities, none of the species affected are known to be threatened or endangered. .

7.2.5.2 Surface Water Ecosystems

No streams or wetlands are present within the Sand Island Wastewater Treatment Plant site.

7.2.5.3 Coastal Marine Ecosystems

The marine area in the vicinity of the project site spans the along the southern Oahu coast specifically along Kakaako, Honolulu Harbor, Kahili Channel, Kapalama Basin, Keehi Lagoon and Mamala Bay.

Existing Conditions

The existing coastal marine conditions of southern Honolulu were analyzed to identify the existing water quality conditions that could be affected by the construction of the exploratory wells and technology testing.

The nearshore waters of southern Honolulu are classified by the State Department of Health (DOH) as Class A Open Coastal Waters (DOH, 1992). The objective of Class A waters is to project their use for recreation and aesthetic enjoyment. This classification allows other uses of the ocean as long as they are compatible with the protection and propagation of fish, shellfish and wildlife, and with ocean-related recreational activities. Class A waters should not receive any discharges that have not undergone the best degree of treatment or control that is in agreement with the criteria established for this class. Coastal water adjacent to southern Honolulu are fertilized by nutrient-rich water seeping from springs below sea level.

The nutrients originate from upland landscape fertilization and urban applications of fertilizers. Nearshore waters are often turbid due to rough wave action that suspends sediments and nutrients.

Marine macroinvertebrates found offshore of southern Honolulu include reef-building corals, several species of sea cucumber, sea urchins and colonial soft corals (Ogden 1994). Marine vertebrates include reef fish, although abundance and diversity are low. Marine macroalgae are very abundant offshore.

7.2.5.4 Threatened and Endangered Species

No threatened or endangered species are present within the Sand Island Wastewater Treatment Plant site.

7.2.5.5 Potential Impacts and Mitigation Measures

No threatened or protected wildlife species exist at the Sand Island Wastewater Treatment Plant site. No sensitive habitats or protected species, threatened species of vegetation and threatened or endangered species are expected will be affected during construction of the exploratory well and technology testing.

7.2.6 Social and Economic Resources

The southern Honolulu region is presently heavily urban and industrial, and is the location of Oahu's most stable-growing residential communities. The desired distribution of the

population for Oahu is concentrated in two areas: the Primary Urban Center (PUC) and the Secondary Urban Center at the city of Kaploei.

7.2.6.1 Demographics

The State of Hawaii has approximately 1.2 million residents and receives nearly 7 million visitors a year. The most recent forecasts (1990) for 2020 population is 1,071,000 of which 47% or approximately 503,000 people, has been allocated for the PUC. The number represents an increase of 71,000 people over the 1990 level, or a growth of 30% over the existing population of the PUC.

7.2.6.2 Potential Impacts and Mitigation Measures

The construction of the exploratory well and technology testing will have no significant effects on population or demographics.

The construction of a desalination facility will have indirect effects on population growth, which will allow for planned and approved development of development of Honolulu and other areas with consideration of available adequate potable water supply. An Environmental Impact Statement will be conducted for the design and construction of the Reverse Osmosis Desalination Facility.

7.2.6.3 Employment

Oahu currently has two urban areas--primary (Honolulu) and secondary (Ewa). Economic activity on Oahu is concentrated in the primary urban center (PUC), which has about three-quarters of island jobs and about half of the population. The forecast for job creation (non-construction jobs) in the PUC over the 1990 to 2020 projection period is 160,000 new jobs or 45% of new jobs on Oahu. This represents approximately 71% of the total jobs islandwide.

7.2.6.4 Potential Impacts and Mitigation Measures

Construction of the exploratory well and technology testing will employ approximately 10 workers for about a year may be more.

7.2.6.5 Fiscal Implications

Construction of the exploratory well and technology testing and future construction of the desalination facility is proposed to head off shortage of projected potable water supplies. Consequently, the "no-action" alternative has significant social and economic disincentives.

7.2.6.6 Potential Impacts and Mitigation Measures

The project has a number of aspects with positive fiscal impacts. Creation of jobs and purchase of supplies and materials will stimulate tax revenues to the City and the State.

7.2.7 Recreational Resources

No beaches exist within the Sand Island Wastewater Treatment Plant site. Sand Island State Recreation Area lies south of the Sand Island Wastewater Treatment Plant. The park has a collection of trees, restroom facilities, World War II memorial structures, paved parking lots and baseball fields.

7.2.7.1 Potential Impacts and Mitigation Measures

Construction of the exploratory well and technology testing will have no impacts on the existing beach parks.

7.2.8 Aesthetic Value

Visual landmarks and significant vistas include distant vistas of the shoreline from H-1 Freeway, mountain and ocean views, and views of central Honolulu and Diamond Head.

7.2.8.1 Potential Impacts and Mitigation Measures

The proposed construction of the exploratory well and technology testing will not affect views from surrounding areas.

7.2.9 Archaeological, Cultural and Historical Resources

According to State Historic Preservation Division records, there are no known archaeological material have been found at either Sand Island Wastewater Treatment Plant or Sand Island State Recreation Area. There are some World War II structures exist in Sand Island State

Recreation Area. Because Sand Island Wastewater Treatment Plant and Sand Island State Recreation Area are situated on in-filled land, it is highly unlikely that any subsurface archaeological or historical objects would be present at either location.

7.2.9.1 Potential Impacts and Mitigation Measures

No archaeological impacts are foreseen to develop at either Sand Island Wastewater Treatment Plant or Sand Island State Recreation Area due to the lack of archaeological material at both locations. Should any archaeological, cultural or historical sites be uncovered during construction or drilling activities, all work in the vicinity will cease and the State of Hawaii Department of Land and Natural Resources Historic Preservation officer will be notified immediately.

7.2.10 Traffic

Primary access to the site is from Sand Island Parkway. Construction will be limited to weekdays during daylight hours between 8:30 am and 3:30 pm, or as required by the Board of Water Supply. This construction schedule will help minimize morning and afternoon peak traffic periods.

7.2.10.1 Potential Impact and Mitigation Measures

During the construction of the exploratory wells and technology testing, any temporary increase in traffic congestion that could result from the movement of construction related vehicles is unlikely to inconvenience motorists in the immediate vicinity of the project site. If necessary to mitigate potential traffic congestion, the movement of construction vehicles can be restricted during the morning and afternoon peak traffic hours on weekdays and will suspend activities on weekends and State and Federal holidays.

7.2.11 Noise

Regulation of noise in residential areas of Oahu are governed by the State Department of Health, HAR, Title 11, Chapter 53, Noise. The major contribution to noise level at the project site is air traffic from the Honolulu International Airport, in addition to industrial activities, treatment plant operations, and vehicular traffic along Sand Island Parkway.

Allowable day and nighttime noise standards for sensitive receptors have been established for residential, preservation, hotel, apartment, and business districts. The maximum allowable day and night levels in the surrounding I – 3 waterfront, Class C zone are as follows:

Time	Allowable Levels
7:00 am to 10:00 pm	70 dBA
10:00 pm to 7:00 am	70 dBA

7.2.11.1 Potential Impacts and Mitigation Measures

During the construction of the exploratory well and technology testing, noise will be generated by construction during clearing, grading, bulldozing, and installation of well equipment. Additional noise levels may be generated by vehicular travel along the Sand Island Parkway in the early morning and afternoon. These impacts, however, are expected to be relatively minor and only of short duration.

Mitigation measures to address noise impacts include the use of construction equipment appropriate to surrounding land use type; use of mufflers on construction vehicles; maintaining all equipment in good working order; and, limiting construction to weekdays during daylight hours between 8:30 am and 3:30 pm or as required by the Board of Water Supply. No work shall be scheduled on weekends or on federal and state holidays.

Pump and drilling equipment will be regulated for noise by State Department of Health Community Noise Rules. The contractor will obtain a noise permit if noise levels from construction activities are expected to exceed allowable levels. Drills and surface pumps will be fitted with sound attenuation devices including, but not limited to, mutes or structural enclosures. Subsurface pumps will be similarly treated to reduce noise levels to below the regulatory limit.

7.2.12 Land Use and Zoning Designation

7.2.12.1 Current Land Uses

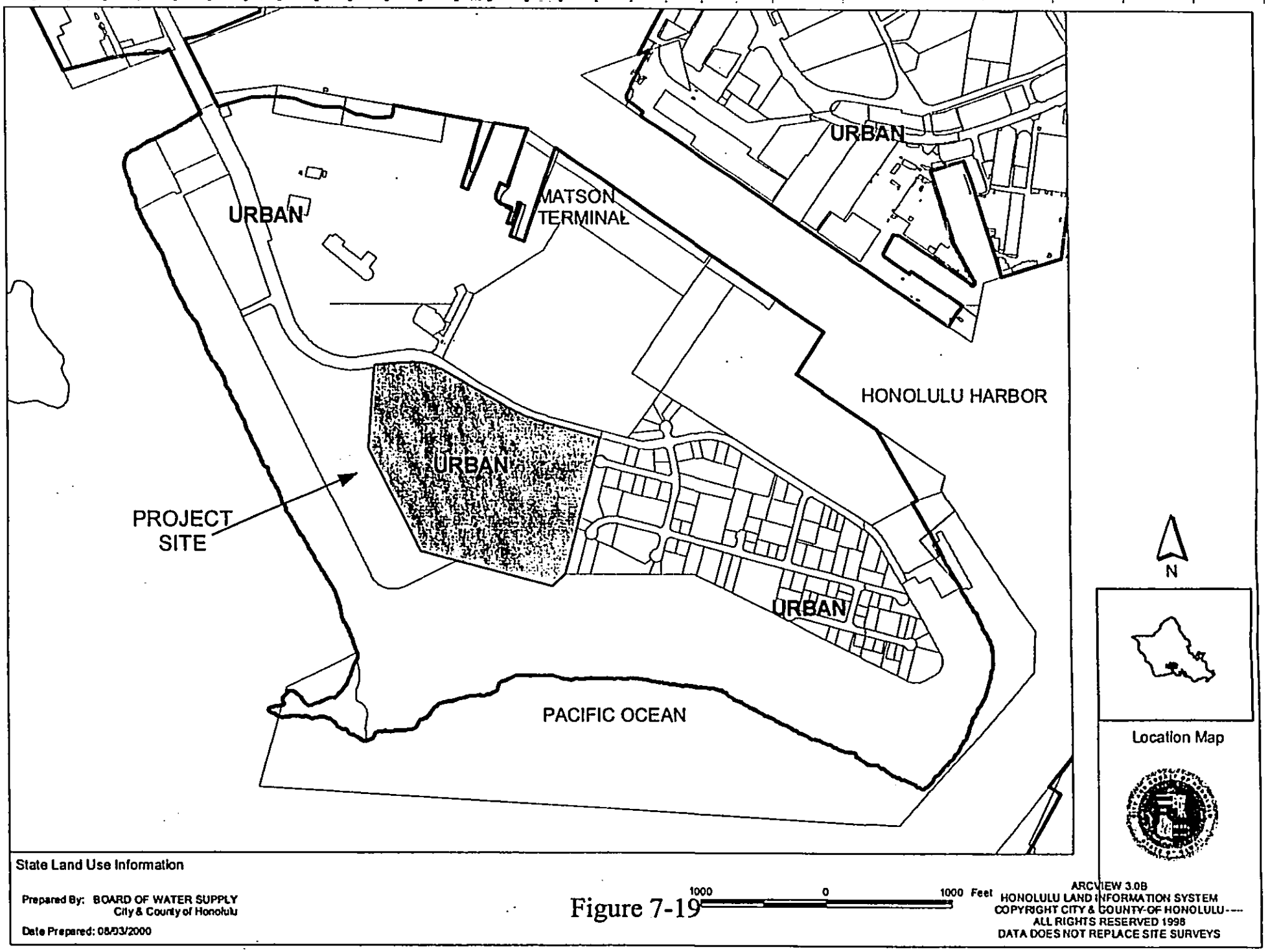
The Sand Island Wastewater Treatment Plant is occupied by wastewater treatment facilities.

7.2.12.2 Planning Framework and Regulatory Status

In Hawaii, regulatory controls over land use in Hawaii are affected by both State and County governments.

A. State Land Use Districts

At the State level, land use districts are established to control broad scale land use patterns. Districts include Urban, Rural, Agriculture and Conservation. State land use designation at the Sand Island Wastewater Treatment Plant site is Urban, Figure 7-19. Uses proposed under the development would be consistent with objectives and policies of the State land use law, Chapter 205, Hawaii Revised Statues. The proposed project lies within the State's Pass Zone for effluent disposal, Figure 7-20, and makai of the underground injection control (UIC) boundary line, Figure 7-21.


URBAN
MATSON
TERMINAL
URBAN
HONOLULU HARBOR
URBAN
PROJECT
SITE
URBAN
PACIFIC OCEAN
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Location Map
State Land Use Information
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City & County of Honolulu
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Figure 7-19

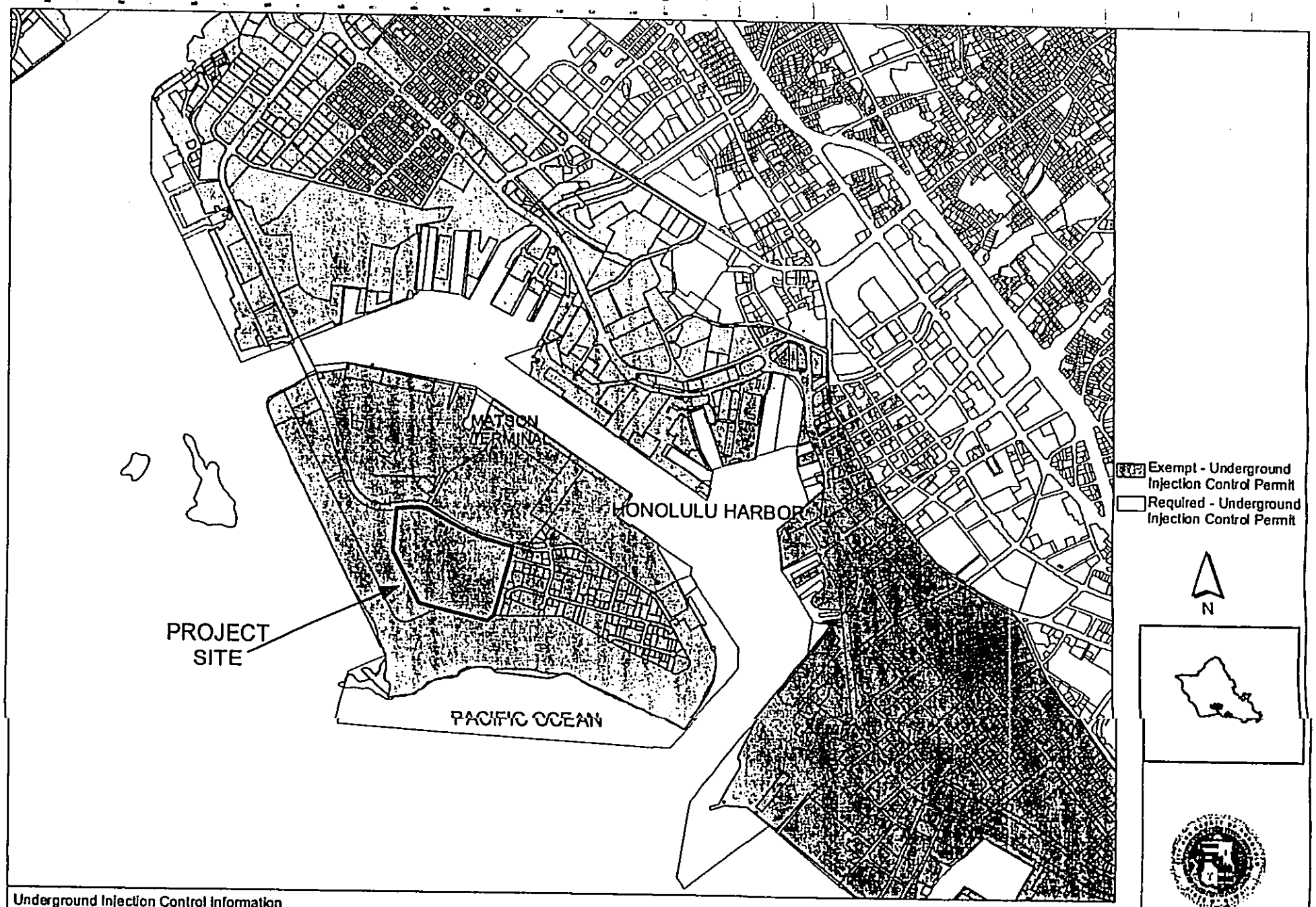
MATSON TERMINAL
HONOLULU HARBOR
PROJECT SITE
PACIFIC OCEAN
Exempt - Underground Injection Control Permit
Required - Underground Injection Control Permit
N
Underground Injection Control Information
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Figure 7-21

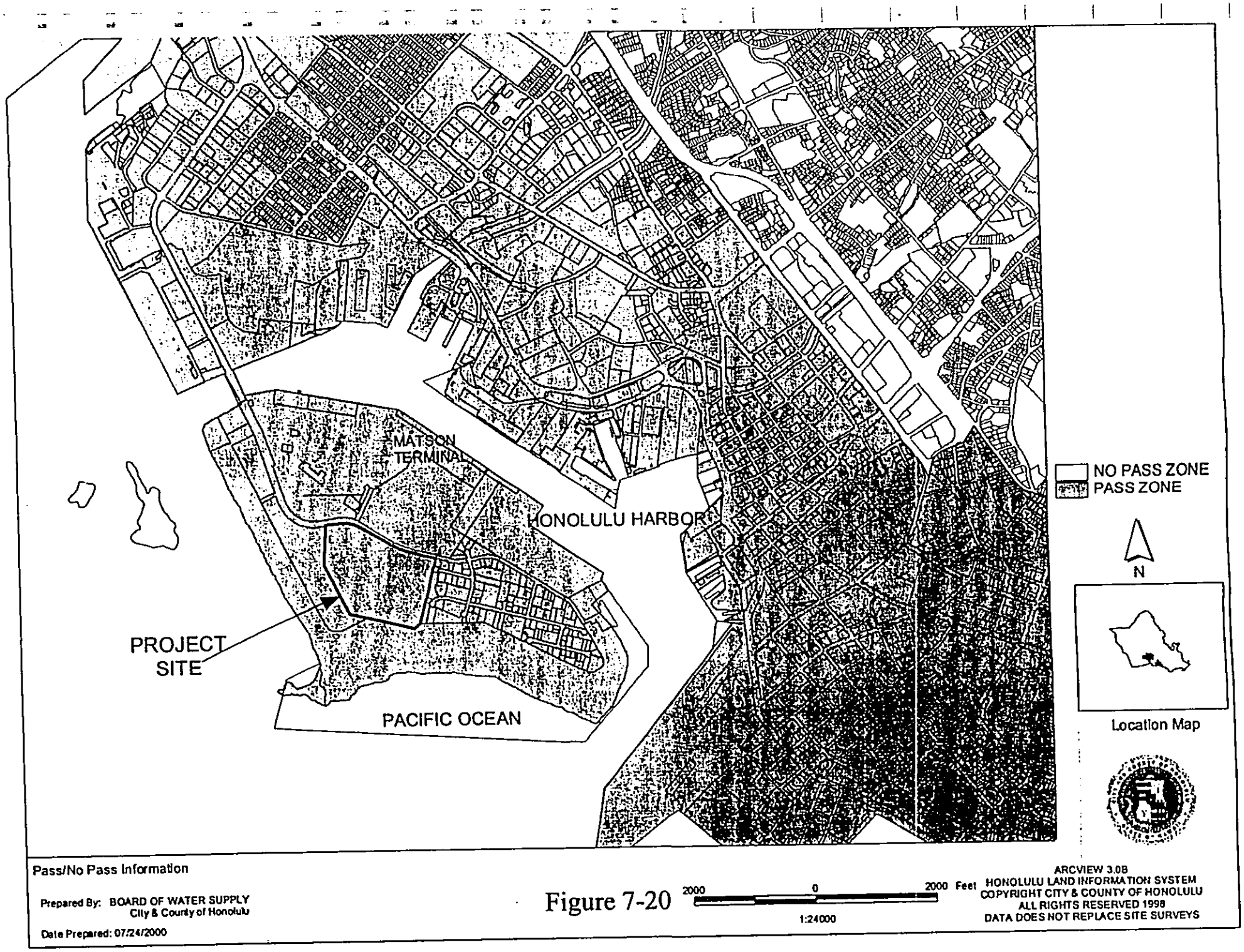
MATSON TERMINAL
HONOLULU HARBOR
PROJECT SITE
PACIFIC OCEAN
NO PASS ZONE
PASS ZONE
N
Location Map
Pass/No Pass Information
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Figure 7-20

B. County General Plan

At the County level, land use regulation evolves from broad principles that are established in a general plan. The City and County of Honolulu General Plan (1992) is a statement of the long-range social, economic, environmental, and design objectives for the general welfare and prosperity of the people of Oahu. In addition, the Plan provides broad policy directives intended to facilitate attainment of the objectives. Objectives and policies are divided into eleven major areas. Of relevance to the present discussion are the objective and policies concerning population, economic activity and physical development:

- With respect to population, an objective of the General Plan calls for "the full development of the Primary Urban Center" directing that the 2010 residential population in the PUC should be between 45.1% and 49.8% of the island's total population.
- With respect to economic activity, an objective in the general plan calls for "major economic activity and government services (should be directed) to the primary urban center and the secondary urban center at Kapolei."
- With respect to utilities, the objects are to "provide adequate infrastructure to maintain and enhance quality of life" and the plan also discusses the importance of developing and maintaining potable and nonpotable water sources and systems.
- With respect to physical development and urban design, several objectives are to "stimulate development in the primary urban center by means of City and County's capital improvement program and State and Federal grant and loan programs," "foster the development of Honolulu's waterfront as the State's major port and maritime center, as a people oriented mixed-use area, and as a major recreation area" and to "facilitate the redevelopment of Kakaako as major residential, as well as commercial and light industrial area."

C. Long-range Plans

Changes to the region will result from background growth consequent to implementation of the land use plans now in place.

County Land Use Ordinance

Implementation of the Development Plan's broad land use goals is done through zoning as established by the City and County's Land Use Ordinance. Designations of land uses in the Development Plan usually precede designations of zoning precincts. The project site is I-3 Waterfront, Figure 7-22. The entire Sand Island Waste Water Treatment Site is within the City's Special Management Area (SMA), Figure 7-23. An SMA permit would be applied for if this alternative site is chosen to be developed.

If this alternative site is chosen to be developed, a Development Plan Public Facilities Map Amendment would need to be submitted to the Department of Planning and Permitting for processing.

7.2.12.3 Potential Impacts and Mitigation Measures

No specific impacts are anticipated by constructing the exploratory well and technology testing at the Sand Island Wastewater Treatment Plant site. Drilling of the exploratory wells and implementation of the technology testing should not change the surrounding land uses. No mitigation measures are proposed regarding land use.

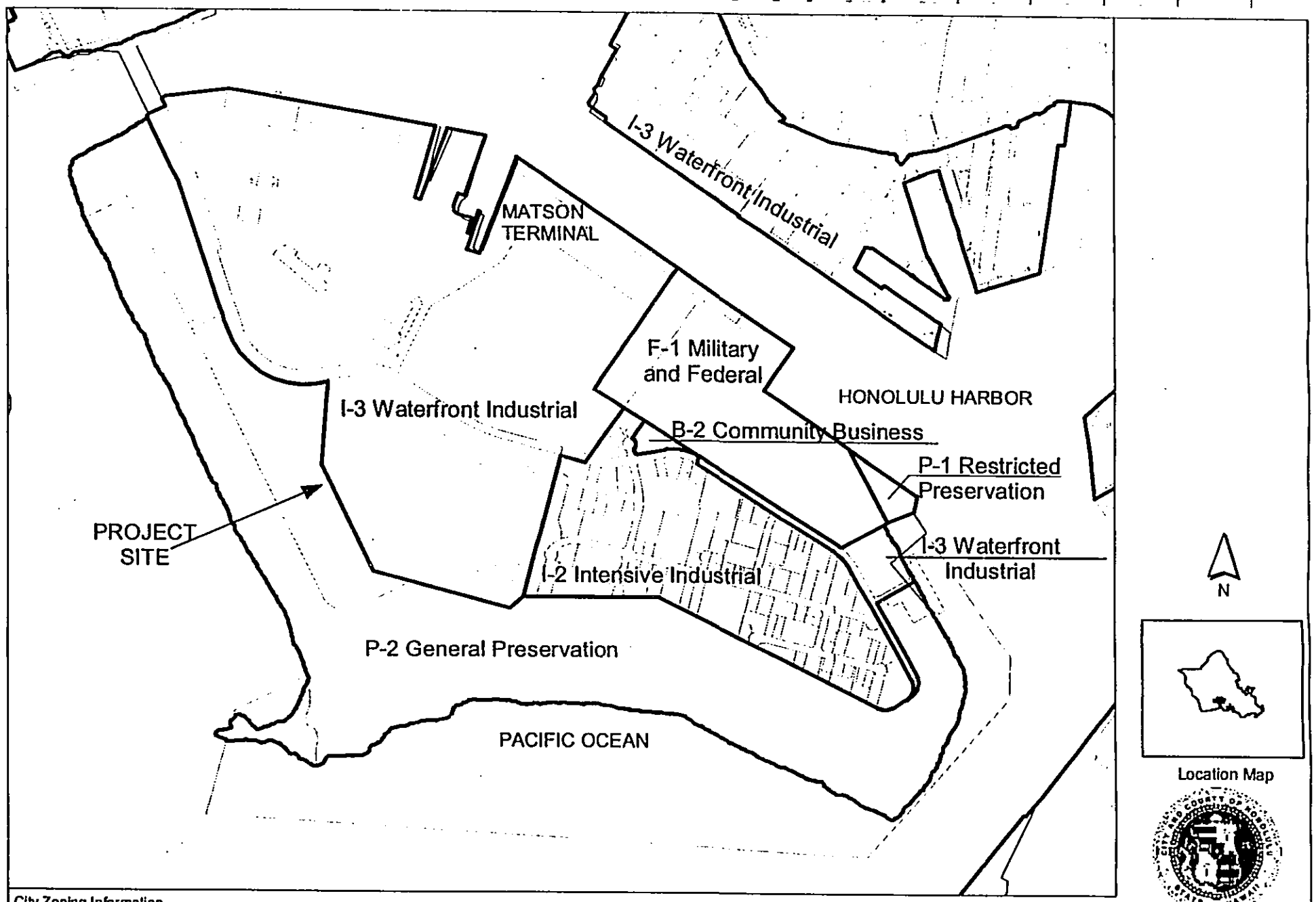
I-3 Waterfront Industrial
MATSON TERMINAL
F-1 Military and Federal
HONOLULU HARBOR
I-3 Waterfront Industrial
B-2 Community Business
P-1 Restricted Preservation
PROJECT SITE
I-3 Waterfront Industrial
I-2 Intensive Industrial
P-2 General Preservation
PACIFIC OCEAN
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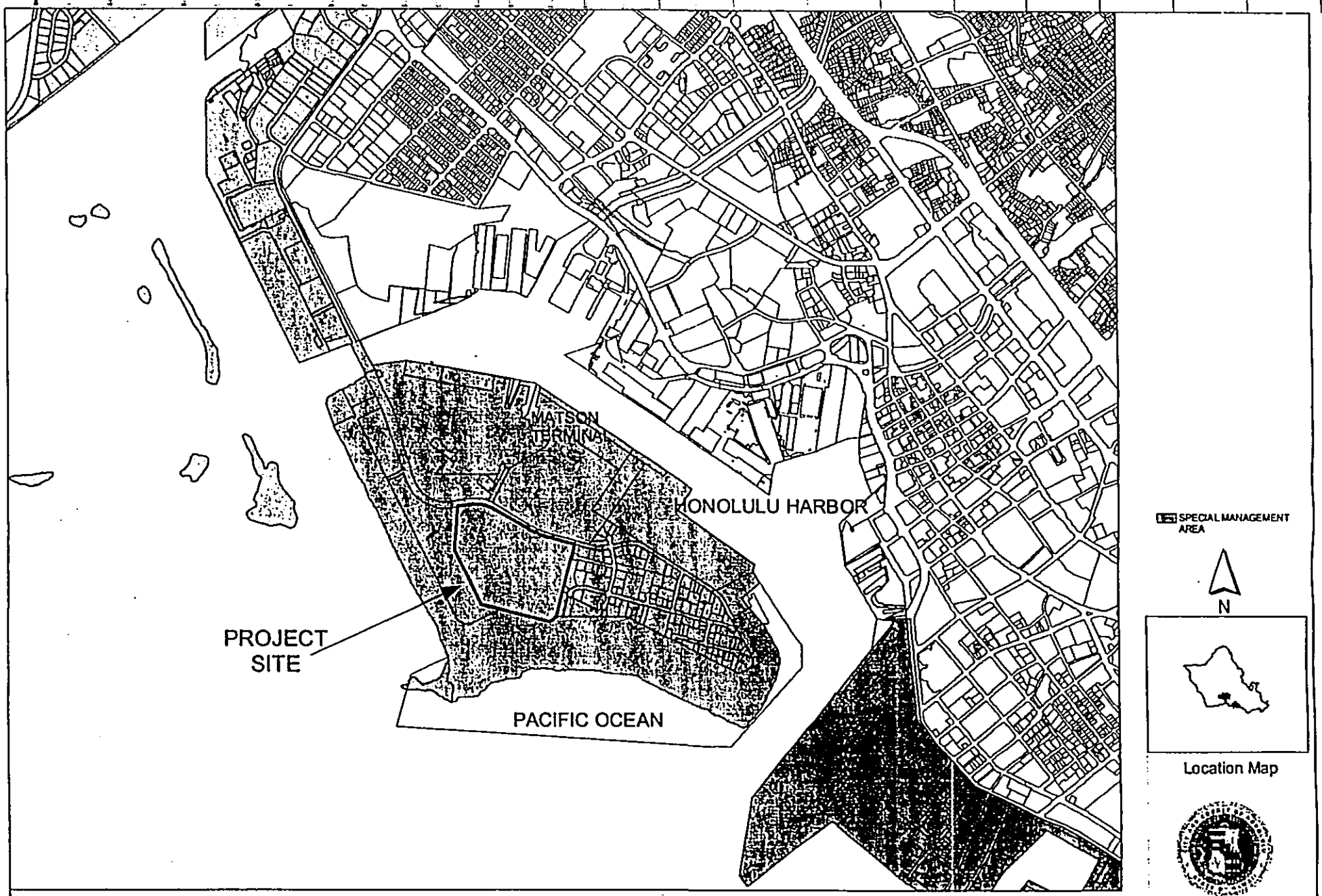
Figure 7-22


MATSON TERMINAL
HONOLULU HARBOR
PROJECT SITE
PACIFIC OCEAN
SPECIAL MANAGEMENT AREA
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Location Map
Special Management Area Information
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Figure 7-23

7.3 Keehi Lagoon Beach Park – Alternative Site 2

Keehi Lagoon Beach Park encompasses over 60 acres of costly landscaped City land. The park includes a large grass field, seating pavilions, picnic tables, softball and baseball fields, tennis courts, a sand beach and restrooms. The park also has a two-lane paved road, paved stall parking lots and a bike pathway. The beach allows drydocking of canoes and fronts placid Keehi Lagoon. A location map for Keehi Lagoon Beach Park is shown in Figure 7-24.

7.3.1 Geologic Conditions

The structure of southern Oahu was formed slowly over geologic time from lava flows, weathering and changes in sea level. The following subsections focus on the geology of the proposed Keehi Lagoon Beach Park site.

7.3.1.1 Geology

The island of Oahu consists of the eroded remnants of two large shield volcanoes -- Waianae and Koolau. The Waianae and Koolau volcanoes formed Oahu during their active lives that spanned the Pliocene and Pleistocene epochs. Keehi Lagoon Beach Park lies on the southern coastal plan of the Koolau Range and is located in lower Honolulu just east of the Honolulu International Airport.

7.3.1.2 Topography

The terrain within the Park is almost flat. The maximum elevation within Keehi Lagoon Beach Park is about 11 feet above msl and varies by no more than several feet.

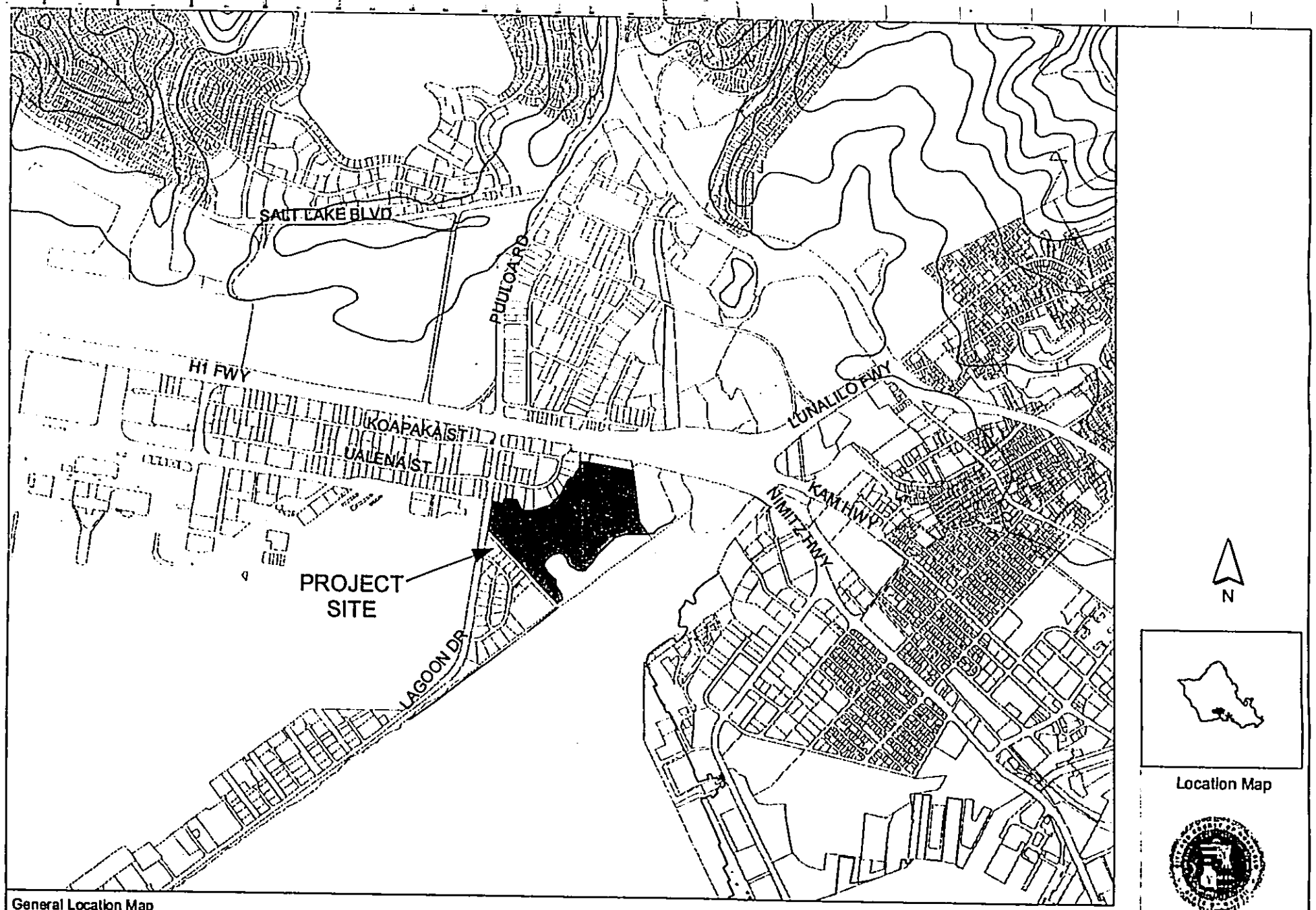
SALT LAKE BLVD
PUULOA RD
H1 FWY
KOAPAKA ST
UALENA ST
LUNALILO FWY
KAM HWY
NIMITZ HWY
PROJECT SITE
LAGOON DR
N
Location Map
General Location Map
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Figure 7-24

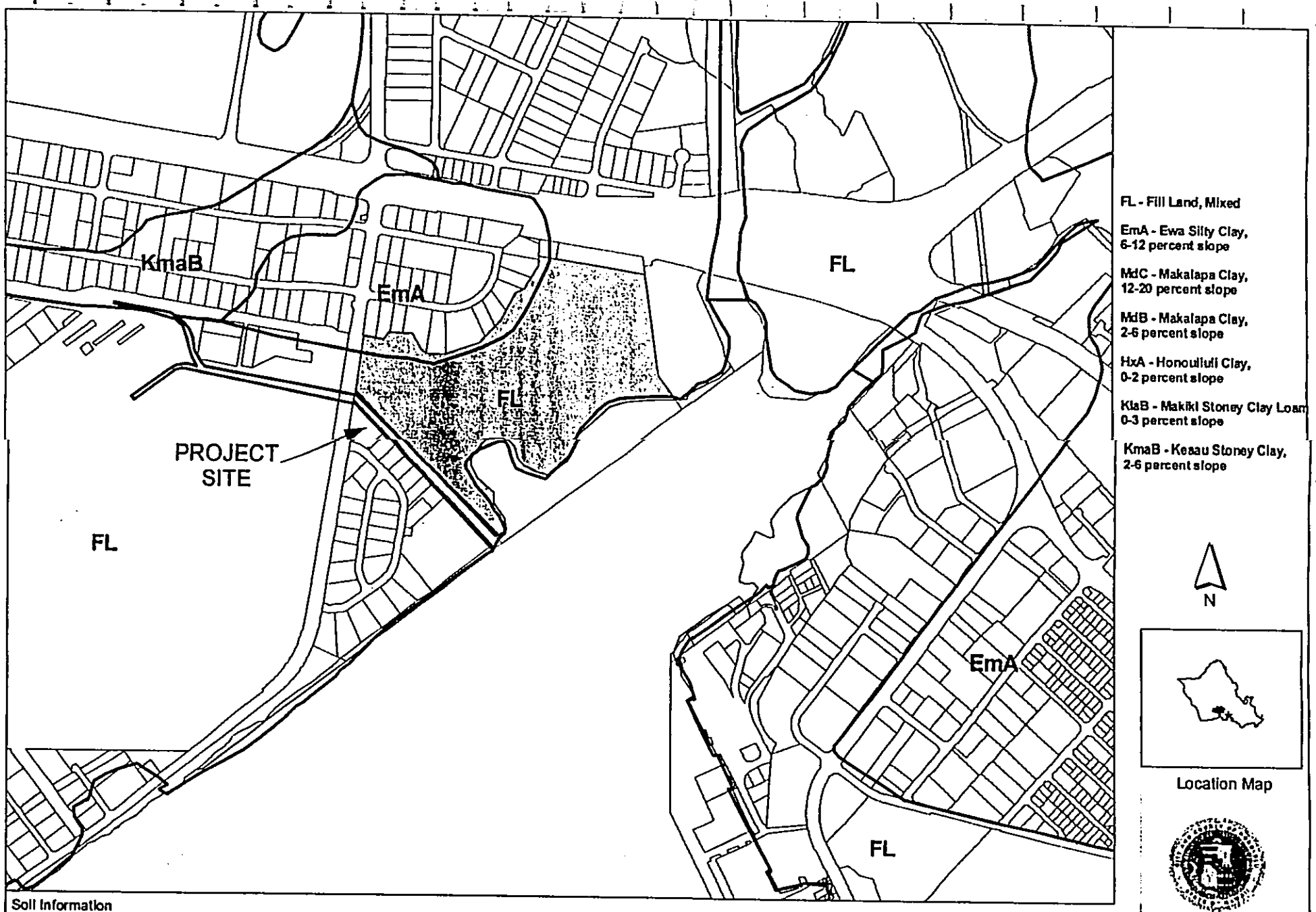
7.3.1.3 Soil

The US Department of Agriculture Soil Conservation Service (SCS) describes the soil and rock materials within Keehi Lagoon Beach Park as being mixed fill land (FL) and ewa silty clay with 6 – 12% slope (EmA), Figure 7-25. Keehi Lagoon Beach Park has deep, nearly level to moderately sloping, well-drained soils that have a fine-textured or moderately fine-textured subsoil or underlying material on a coastal plain. Drainage is good to moderately good and permeability is moderately rapid.

7.3.1.4 Potential Impacts and Mitigation Measures

Impacts of the proposed exploratory well and technology testing on the existing geology and topography at the Keehi Lagoon Beach Park were determined to be minimal. Silt deposit may be a potential problem for this site; Moanalua Stream discharges into Keehi Lagoon. The stream discharge contains substantial amounts of silt, debris and any other material or chemicals contained in upstream runoff. The sediment may accumulate in the coralline lagoon locally reducing the permeability and seawater recharge of the site's aquifer but is not expected to seriously reduce production of the wells. Any decrease in the quality of feedwater due to stream discharge may also necessitate an increase in the level of pretreatment which consequently increases the capital investment for the desalination facility.

The soil does not appear to be susceptible to erosion, since the topography is relatively level and the soils are shallow and highly permeable for the most part. Also, rainfall is very limited in the lower Honolulu area. No major problems or impacts are anticipated to develop during the excavation of the soil for the proposed exploratory well and technology testing; however, dewatering may be a problem due to the site's close proximity to the ocean. Mitigation will consist of contractor compliance with all relevant provisions of the Revised Ordinances of Honolulu, Chapter 14 Public Works Infrastructure Requirements (1990).


KmaB
EmA
FL
PROJECT SITE
FL
FL
EmA
FL
FL - Fill Land, Mixed
EmA - Ewa Silty Clay, 6-12 percent slope
MdC - Makalapa Clay, 12-20 percent slope
MdB - Makalapa Clay, 2-6 percent slope
HxA - Honouliuli Clay, 0-2 percent slope
KlaB - Makiki Stoney Clay Loam 0-3 percent slope
KmaB - Keaau Stoney Clay, 2-6 percent slope
N
Location Map
Soil Information
Prepared By: BOARD OF WATER SUPPLY
City & County of Honolulu
Date Prepared: 07/24/2000
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ARCVIEW 3.0B
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Figure 7-25

7.3.2 Climate and Air Quality

Any impacts of the proposed desalination facility on the climate and ambient air quality are crucial since the climate and air quality affect a relatively large region, including areas beyond the limits of Keehi Lagoon Beach Park. Impacts on the climate and ambient air quality are minimal for the operation of the plant. In addition environmental impacts during construction of the facility will be temporary.

7.3.2.1 Climate

Northeasterly tradewinds prevail over Oahu during all months of the year. From November through March the tradewinds are weakest and replaced with winter storms that bring rain to the island. Mean annual rainfall is about 20 inches and derived from winter rainfall. About 90 percent of the rainfall is recorded during the months from October though April. January is normally the wettest month of the year, averaging 4.3 inches of rain. The months from May through September average less than half an inch of rain each.

The mean temperature of the lower Honolulu region is 72°F in the winter (November-February) and 79°F during the summer (June-August). The mean annual temperature is 76°F.

7.3.2.2 Air Quality

Air quality on Oahu is excellent overall due to prevailing northeast trade winds. The well site also benefits from these trade winds and enjoys generally good air quality.

Existing air pollution at the project site is minimal, primarily resulting from vehicles. There are no significant stationary sources of air pollution in the area

Construction activities associated with the exploratory well and technology testing would produce air pollutants mainly from two different types of sources: exhaust emissions from construction equipment and vehicles, and fugitive dust emissions, from human activities.

The emissions associated with construction activities are, by their nature, of short-term duration, and would cease upon completion of the project.

7.3.2.3 Potential Impacts and Mitigation Measures

Potential air quality impacts during the exploratory well drilling and technology testing will be mitigated by complying with the State of Hawaii Department of Health Administrative Rules.

The construction contractor will be required to comply with Department of Health rules (HAR Chapter 43, Section 10) and the grading permit. Proper maintenance of construction vehicles and equipment will serve to minimize combustion emissions. Construction vehicle and equipment idling should be kept to a minimum when equipment is not in use.

An effective dust control plan will be implemented during construction to ensure compliance with Department of Health regulations. Dust control measures will include watering of the work area, use of wind screens, keeping adjacent roadways clean and covering of open-bodied trucks. Other dust control measures may include mulching or stabilizing inactive exposed areas and scheduling permanent paving or landscaping early in the construction schedule.

7.3.3 Water Resources

The southern Honolulu region contains a comprehensive hydrologic system that includes many hydrologic subsystems and variables. The following subsections focus on the major hydrologic systems possibly affected by the construction and operation of the proposed exploratory well and technology testing at the Keehi Lagoon Beach Park site.

7.3.3.1 Hydrogeology

Groundwater within the Keehi Lagoon Beach Park site is of seawater salinity both in the caprock aquifers and the Koolau volcanic aquifer. Fresh groundwater does not occur at the site.

7.3.3.2 Surface Water Quality

The only surface water body near the Keehi Lagoon Beach Park (KLBP) site is Moanalua Stream that discharges into Keehi Lagoon. Keehi lagoon has little water movement and thus minimal mixing. Other surface waters in the form of perennial stream flows or ponds do not occur within or near the KLBP site. No lakes, reservoirs, ponds, rivers, streams or wetlands exist within or near the Sand Island Wastewater Treatment Plant site. A 50 to 60 foot wide storm drainage channel exists on the southwestern edge of the park.

7.3.3.3 Potential Impacts and Mitigation Measures

With respect to impacts on sustainable water resources, the most important consideration is protection of the basal drinking water aquifer. Since only salt water occurs at this site, the withdrawal of seawater from the Basal Aquifer should not impact the freshwater lens.

7.3.4 Natural Hazards

The purpose of analyzing the existing natural hazard conditions is twofold: (1) to identify the existing natural hazards that could occur during construction of the exploratory well and technology testing (2) to examine the potential of occurrence of these natural hazards during construction of the exploratory well and technology testing. Natural hazards that present a potential for occurrence at the Keehi Lagoon Beach Park site include earthquakes, floods, tsunamis and volcanic lava flows.

7.3.4.1 Seismic

The Uniform Building Code (UBC) provides minimum design criteria to address potential for damages due to seismic disturbances. The UBC scale is rated from Seismic Zone 1 through Zone 4, with 1 the lowest level for potential seismic induced ground movement. Oahu has been designated within Seismic Zone 1. BWS, in the interest of public health and safety has adopted UBC Seismic Zone 3 standards for all its structures. All permanent structures proposed for this project, therefore, will be built according to standards for UBC Seismic Zone 3.

7.3.4.2 Flood and Tsunami Hazard

According to the Flood Insurance Rate Maps (FIRMs), a portion of the project site is in Zone X, "Areas determined to be outside the 500-year flood", Zone XS, "Areas determined to be within 500-year flood plain", Zone AE, " Areas determined to be within 100-year flood, base flood elevation determined, " and Zone D, "Areas designated as undetermined flood hazard," Figure 7-26.

The project site not located within the 100-year tsunami inundation area as depicted in the Oahu Tsunami Evacuation Maps, Figure 7-27. The project site is outside the anticipated tsunami flood hazard area (Tsunami Warning Center, 1998).

7.3.4.3 Potential Impacts and Mitigation Measures

The proposed exploratory well and technology testing is located outside of the tsunami inundation zone but is located within the flood area. Flooding is not anticipated to affect the proposed project. Because seismic risk at the project site is minimal, the proposed project is not expected to be affected by seismic activity.

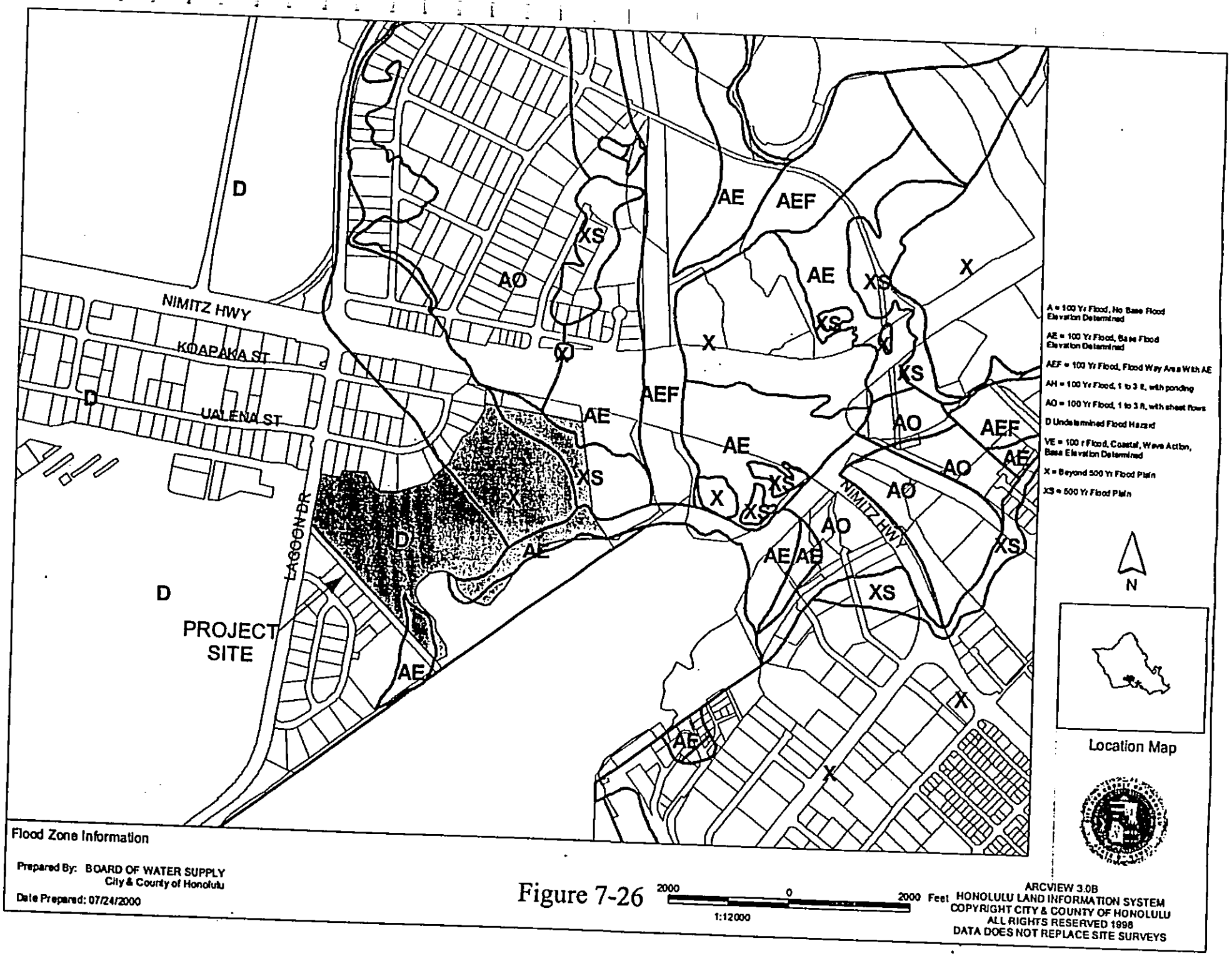
D
NIMITZ HWY
KAPAKA ST
UALENA ST
LAGOON DR
PROJECT SITE
AE
AEF
AO
X
XS
A = 100 Yr Flood, No Base Flood Elevation Determined
AE = 100 Yr Flood, Base Flood Elevation Determined
AEF = 100 Yr Flood, Flood Way Area With AE
AH = 100 Yr Flood, 1 to 3 ft, with ponding
AO = 100 Yr Flood, 1 to 3 ft, with sheet flows
D Undetermined Flood Hazard
VE = 100 r Flood, Coastal, Wave Action, Base Elevation Determined
X = Beyond 500 Yr Flood Plain
XS = 500 Yr Flood Plain
N
Location Map
Flood Zone Information
Prepared By: BOARD OF WATER SUPPLY
City & County of Honolulu
Date Prepared: 07/24/2000
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Figure 7-26

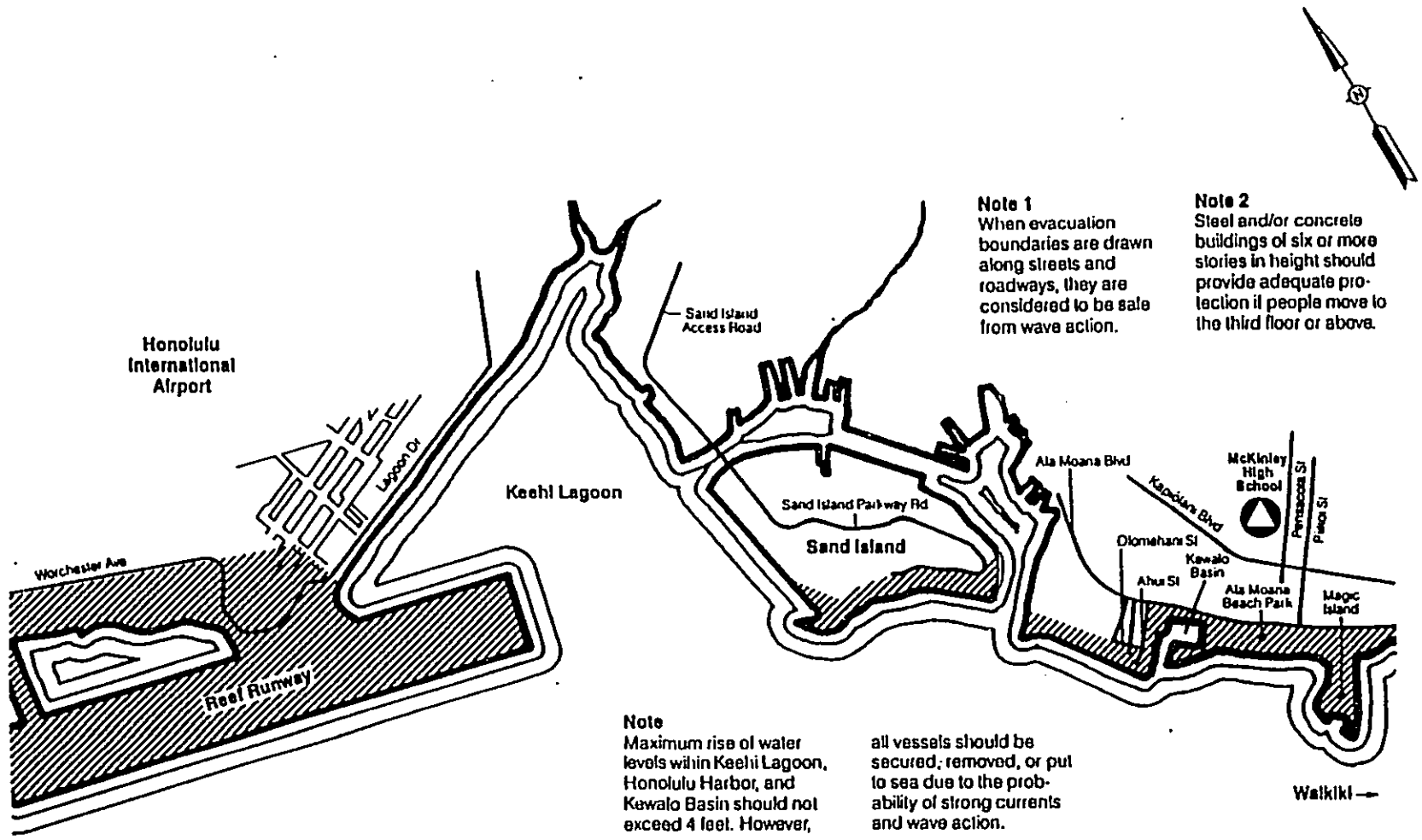


Figure 7-27

Tsunami Inundation Zone Areas – Honolulu District

7.3.5 Biological Environment

7.3.5.1 Terrestrial Flora and Fauna

Plants and animals potentially affected by any impacts from the proposed exploratory well and technology testing include terrestrial and marine species.

Existing Conditions.

Indigenous plant species (native plants found in Hawaii and elsewhere) in the coastal zone include the seaside heliotrope (Helitropium currassavicum) and the `ohelo kai shrub (Lycium sandwichensis).

Birds are the dominant forms of wildlife in southern Honolulu. They include at least 17 ubiquitous introduced species and five indigenous species (black-crowned night heron, great frigate bird, Pacific golden plover, sanderling, wandering tattler and ruddy turnstone). The five most common ubiquitous bird species are the zebra dove, Japanese white-eye, Northern cardinal, red-crested cardinal and red-vented bulbul. The Pacific golden plover, sanderling, wandering tattler and ruddy turnstone are migratory and frequent Hawaii on a regular basis. Migratory birds, though not necessarily protected as endangered species, are protected under a variety of state, federal and international laws, regulations, treaties and conventions. Other wildlife includes feral dogs and cats, rodents and mongooses.

7.3.5.2 Surface Water Ecosystems

No ponds or wetlands are present within the project site. Moanalua Stream discharges into Keehi Lagoon just east of Keehi Lagoon Beach Park.

7.3.5.3 Coastal Marine Ecosystems

This subsection focuses on flora and fauna that inhabit the ocean adjacent to southern Honolulu. The marine area in the vicinity of the project site spans along the southern Oahu coast specifically along Kakaako, Honolulu Harbor, Kahili Channel, Kapalama Basin, Keehi Lagoon and Mamala Bay.

Keehi Lagoon has very little water movement; thus, KLBP is a popular location for many water-related recreational activities. The shore provides access to sandy beach and canoeing. Across the lagoon opposite the park are two active harbors--Keehi Boat Harbor North and Keehi Board Harbor South. Many boat owners utilize the two harbors.

Existing Conditions

The existing coastal marine conditions of southern Honolulu were analyzed to identify the existing water quality conditions that could be affected by the construction and operation of the proposed desalination facility.

The nearshore waters of southern Honolulu are classified by the State DOH as Class A Open Coastal Waters (DOH, 1992). The objective of Class A waters is to protect their use for recreation and aesthetic enjoyment. This classification allows others uses of the ocean as long as they are compatible with the protection and propagation of fish, shellfish and wildlife, and with ocean-related recreational activities. Class A waters should not receive any discharges that have not undergone the best degree of treatment or control that is in agreement with the criteria established for this class. Coastal waters adjacent to southern Honolulu are fertilized by nutrient-rich water seeping from springs below sea level.

The nutrients originate from upland agricultural fertilization, leaching from cesspools and septic tanks, domestic waste injection wells and urban applications of fertilizers. This nutrient subsidy promotes the thick growth of benthic algae (limu). Nearshore waters are often turbid due to suspended sediments and nutrients from the Moanalua Stream discharge. The water within Keehi Lagoon is stagnant with minimal movement.

Marine macroinvertebrates found offshore of southern Honolulu include reef-building corals, several species of sea cucumber, sea urchins and colonial soft corals (Ogden, 1994). Marine vertebrates include reef fish, although abundance and diversity are low. Marine macroalgae are very abundant offshore.

7.3.5.4 Threatened and Endangered Species

No threatened or protected wildlife species exist at the Keehi Lagoon Beach Park site.

7.3.5.5 Potential Impacts and Mitigation Measures

No threatened or protected wildlife species exist at the Keehi Lagoon Beach Park site. No sensitive habitats or protected species, threatened species of vegetation and threatened or endangered species are expected will be affected during construction of the exploratory well and technology testing.

7.3.6 Social and Economic Resources

The southern Honolulu region is presently heavily urban and industrial, and is the location of Oahu's most stable-growing residential communities.

7.3.6.1 Demographics

The State of Hawaii has approximately 1.2 million residents and receives nearly 7 million visitors a year. The most recent forecasts (1990) for 2020 population is 1,071,000 of which 47% or approximately 503,000 people, has been allocated for the PUC. The number represents an increase of 71,000 people over the 1990 level, or a growth of 30% over the existing population of the PUC.

7.3.6.2 Potential Impacts and Mitigation Measures

The construction of the exploratory well and technology testing will have no significant effects on population or demographics. The construction of the exploratory well and technology testing will have an indirect effect of population growth. It will allow planned development of Honolulu and other areas with consideration of available adequate potable water supply.

7.3.6.3 Employment

Oahu currently has two urban areas--primary (Honolulu) and secondary (Ewa). Economic activity on Oahu is concentrated in the primary urban center (PUC), which has about three-

quarters of island jobs and about half of the population. The forecast for job creation (non-construction jobs) in the PUC over the 1990 to 2020 projection period is 160,000 new johs or 45% of new jobs on Oahu. This represents approximately 71% of the total jobs islandwide.

7.3.6.4 Potential Impacts and Mitigation Measures

Construction of the exploratory well and technology testing will employ approximately 10 workers for about a year may be more.

7.3.6.5 Fiscal Implications

The construction of the exploratory well and technology testing will have no significant effects on fiscal implications.

7.3.6.6 Potential Impacts and Mitigation Measures

The project has a number of aspects with positive fiscal impacts. Creation of jobs and purchase of supplies and materials will stimulate tax revenues to the City and the State.

7.3.7 Recreational Resources

The Keehi Lagoon Beach Park is a well landscaped and developed park with a sandy beach located at the east end of the park.

7.3.7.1 Potential Impacts and Mitigation Measures

The construction of the exploratory well and technology testing will have no detrimental impacts on the existing beach parks.

7.3.8 Aesthetic Value

Some aesthetic values of Keehi Lagoon Beach Park include visual landmarks and ocean views and views of central Honolulu and Diamond Head.

7.3.8.1 Potential Impacts and Mitigation Measures

The proposed of the exploratory well and technology testing will not affect views from surrounding areas.

7.3.9 Archaeological, Cultural and Historical Resources

According to State Historic Preservation Division, no archaeological or historic sites are known to exist at Keehi Lagoon Beach Park. Keehi Lagoon is located on land that has been in-filled to enlarge the shoreline.

7.3.9.1 Potential Impacts and Mitigation Measures

No archaeological or historical impacts are expected to develop if the desalination facility is constructed at Keehi Lagoon Beach Park since no archaeological or historical material have been found.

7.3.10 Traffic

Primary access to the site is from Lagoon Drive. Construction will be limited to weekdays during daylight hours between 8:30 am and 3:30 pm, or as required by the Board of Water Supply. This construction schedule will help minimize morning and afternoon peak traffic periods.

7.3.10.1 Potential Impact and Mitigation Measures

During the construction of the exploratory wells and technology testing, any temporary increase in traffic congestion that could result from the movement of construction related vehicles is unlikely to inconvenience motorists in the immediate vicinity of the project site. If necessary to mitigate potential traffic congestion, the movement of construction vehicles can be restricted during the morning and afternoon peak traffic hours on weekdays and will suspend activities on weekends and State and Federal holidays.

7.3.11 Noise

Regulation of noise in residential areas of Oahu are governed by the State Department of Health, HAR, Title 11, Chapter 53, Noise. The major contribution to noise level at the project site is air traffic from the Honolulu International Airport, in addition to industrial activities, treatment plant operations, and vehicular traffic along Keehi Lagoon Drive.

Allowable day and nighttime noise standards for sensitive receptors have been established for residential, preservation, hotel, apartment, and

Allowable day and nighttime noise standards for sensitive receptors have been established for residential, preservation, hotel, apartment, and business districts. The maximum allowable day and night levels in the surrounding P-2 general, Class A zone are as follows:

Time	Allowable Levels
7:00 am to 10:00 pm	55 dBA
10:00 pm to 7:00 am	45 dBA

7.3.11.1 Potential Impacts and Mitigation Measures

Noise will be generated by construction during clearing, grading, bulldozing, and installation of well equipment. Additional noise levels may be generated by vehicular travel along Keehi Lagoon Drive in the early morning and afternoon. These impacts, however, are expected to be relatively minor and only of short duration.

Mitigation measures to address noise impacts include the use of construction equipment appropriate to surrounding land use type; use of mufflers on construction vehicles; maintaining all equipment in good working order; and, limiting construction to weekdays during daylight hours between 7:30 am and 3:30 pm as required by the Board of Water Supply. No work shall be scheduled on weekends or on federal and state holidays.

Pump and drilling equipment will be regulated for noise by DOH. Drills and surface pumps will be fitted with sound attenuation devices including, but not limited to, mutes or structural enclosures. Subsurface pumps will be similarly treated to reduce noise levels to below the regulatory limit.

7.3.12 Land Use and Zoning Designation

Keehi Lagoon Beach Park is well developed and landscaped with many recreational facilities.

7.3.12.1 Current Land Uses

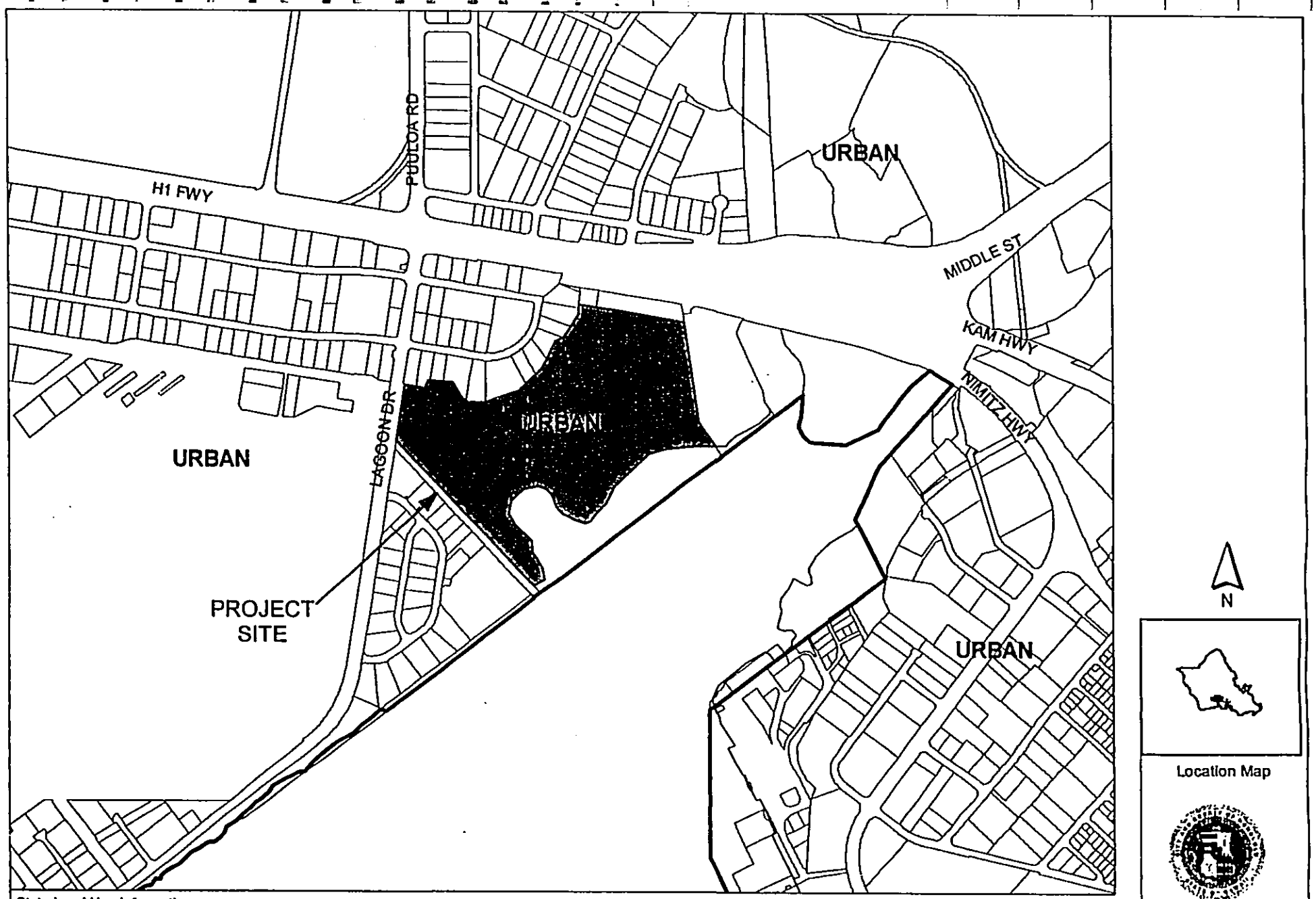
The site is currently utilized for various recreational facilities. The construction of the proposed desalination plant would necessitate the destruction of most of the park.

7.3.12.2 Planning Framework and Regulatory Status

In Hawaii, regulatory controls over land use in Hawaii are affected by both State and County governments.

A. State Land Use Districts

At the State level, land use districts are established to control broad scale land use patterns. Districts include Urban, Rural, Agriculture and Conservation. State land use designation at the Keehi Lagoon Beach Park site is Urban, Figure 7-28. Uses proposed under the development would be consistent with objectives and policies of the State land use law, Chapter 205, Hawaii Revised Statues. The proposed project lies within the State's Pass Zone for effluent disposal, Figure 7-29, and makai of the underground injection control (UIC) boundary line, Figure 7-30.



State Land Use Information

Prepared By: BOARD OF WATER SUPPLY
City & County of Honolulu

Date Prepared: 08/03/2000

Figure 7-28

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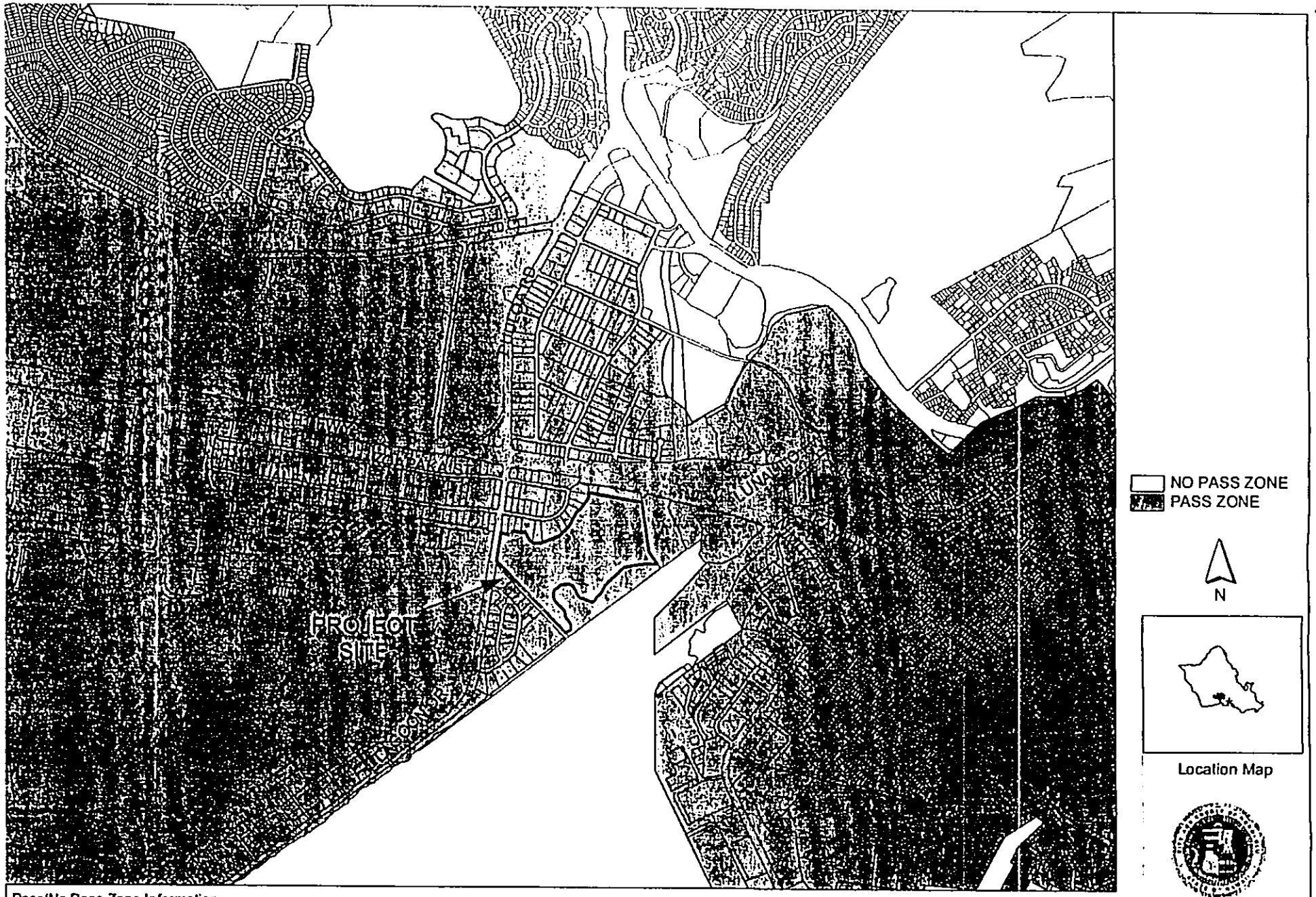

Figure 7-29

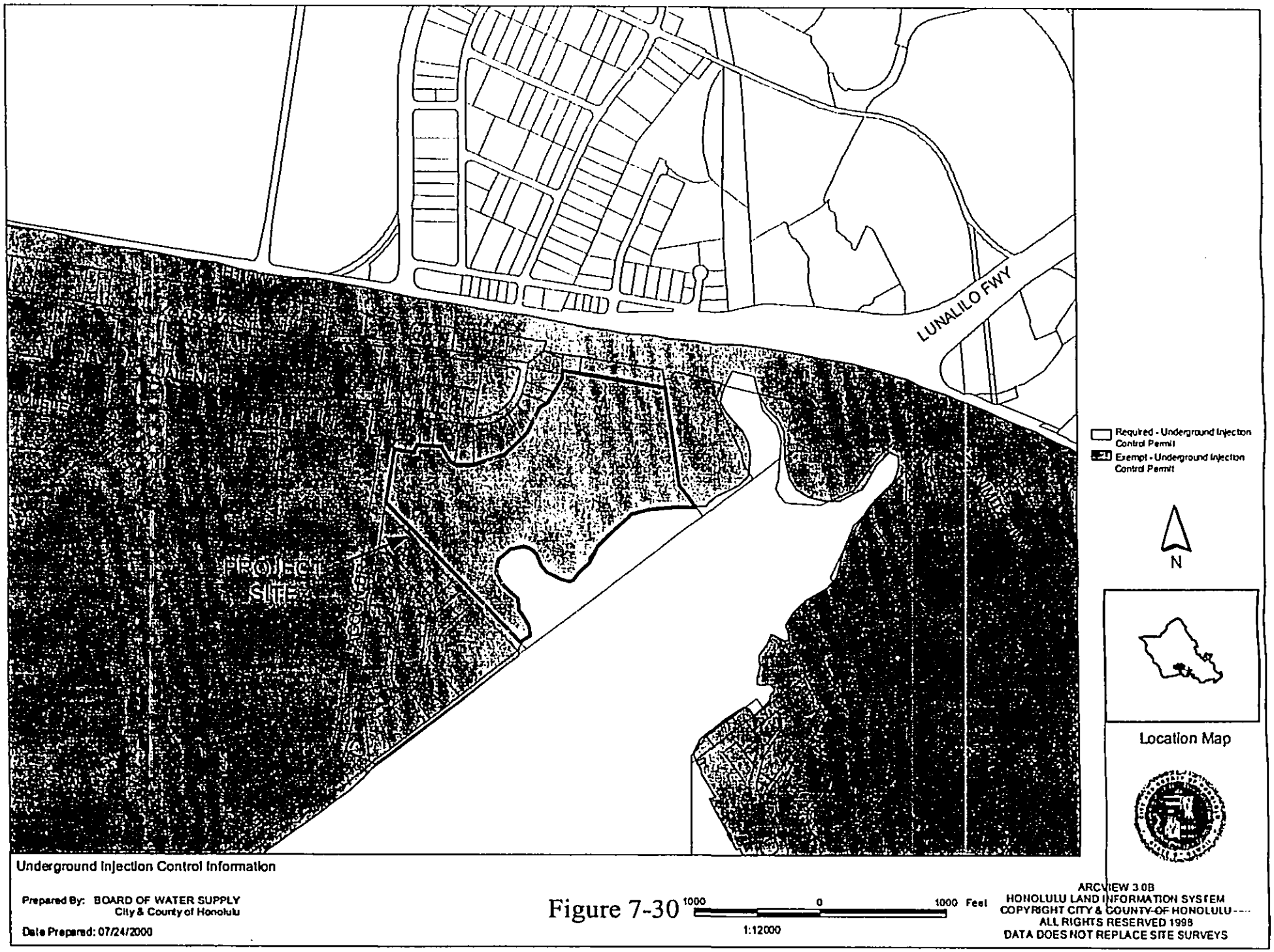

Figure 7-30

B. County General Plan

At the County level, land use regulation evolves from broad principles that are established in a general plan. The City and County of Honolulu General Plan (1992) is a statement of the long-range social, economic, environmental, and design objectives for the general welfare and prosperity of the people of Oahu. In addition, the Plan provides broad policy directives intended to facilitate attainment of the objectives. Objectives and policies are divided into eleven major areas. Of relevance to the present discussion are the objective and policies concerning population, economic activity and physical development:

- With respect to population, an objective of the General Plan calls for "the full development of the Primary Urban Center" directing that the 2010 residential population in the PUC should be between 45.1% and 49.8% of the island's total population.

- With respect to economic activity, an objective in the general plan calls for "major economic activity and government services (should be directed) to the primary urban center and the secondary urban center at Kapolei."

- With respect to utilities, the objects are to "provide adequate infrastructure to maintain and enhance quality of life" and the plan also discusses the importance of developing and maintaining potable and nonpotable water sources and systems.

- With respect to physical development and urban design, several objectives are to "stimulate development in the primary urban center by means of City and County's capital improvement program and State and Federal grant and loan programs," "foster the development of Honolulu's waterfront as the State's major port and maritime center, as a people oriented mixed-use area, and as a major recreation area" and to "facilitate the redevelopment of Kakaako as major residential, as well as commercial and light industrial area."

C. Long-range Plans

Changes to the region will result from background growth consequent to implementation of the land use plans now in place.

County Land Use Ordinance

Implementation of the Development Plans's broad land use goals is done through zoning as established by the Ctiy and County's Land Use Ordinance. Designations of land uses in the Development Plan usually precede designations of zoning precincts. The project site is P-2, General, Figure 7-31. The entire Keehi Lagoon Beach Park Site is within the City's Special Management Area (SMA), Figure 7-32. An SMA permit would be applied for, if this alternative site is chosen to be developed.

If this alternative site is chosen to be developed, a Development Plan Public Facilities Map Amendment would need to be submitted to the Department of Planning and Permitting for processing.

7.3.12.3 Potential Impacts and Mitigation Measures

No specific impacts are anticipated by constructing of the exploratory well and technology testing at the Keehi Lagoon site. Drilling of the exploratory wells and implementation of the technology testing should not change the surrounding land uses. No mitigation measures are proposed regarding land use.

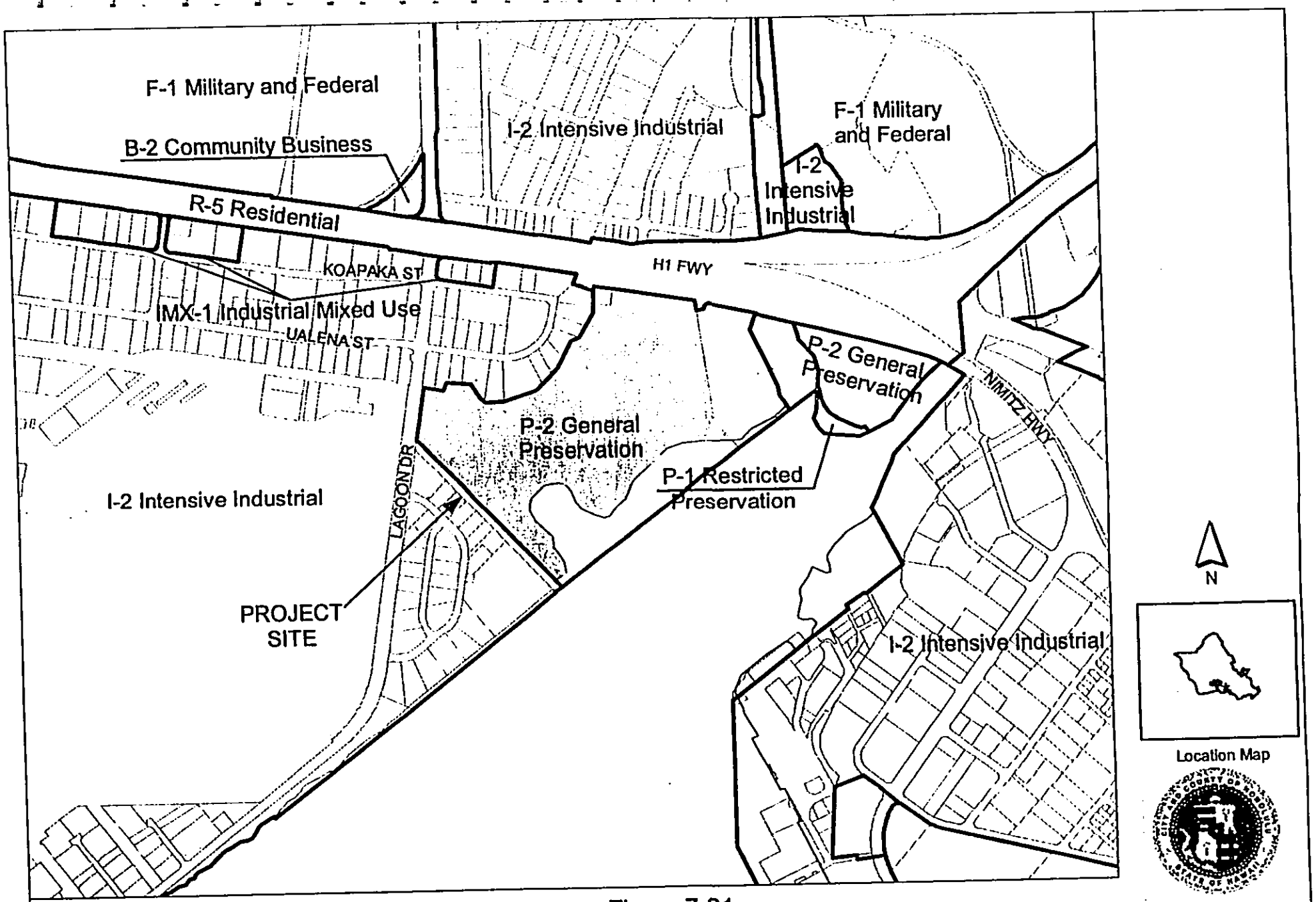
F-1 Military and Federal
B-2 Community Business
I-2 Intensive Industrial
F-1 Military and Federal
I-2 Intensive Industrial
R-5 Residential
H1 FWY
KOAPAKA ST
IMX-1 Industrial Mixed Use
UALENA ST
P-2 General Preservation
NIMITZ HWY
P-2 General Preservation
P-1 Restricted Preservation
I-2 Intensive Industrial
LAGOON DR
PROJECT SITE
I-2 Intensive Industrial
N
Location Map
City Zoning Information
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Figure 7-31

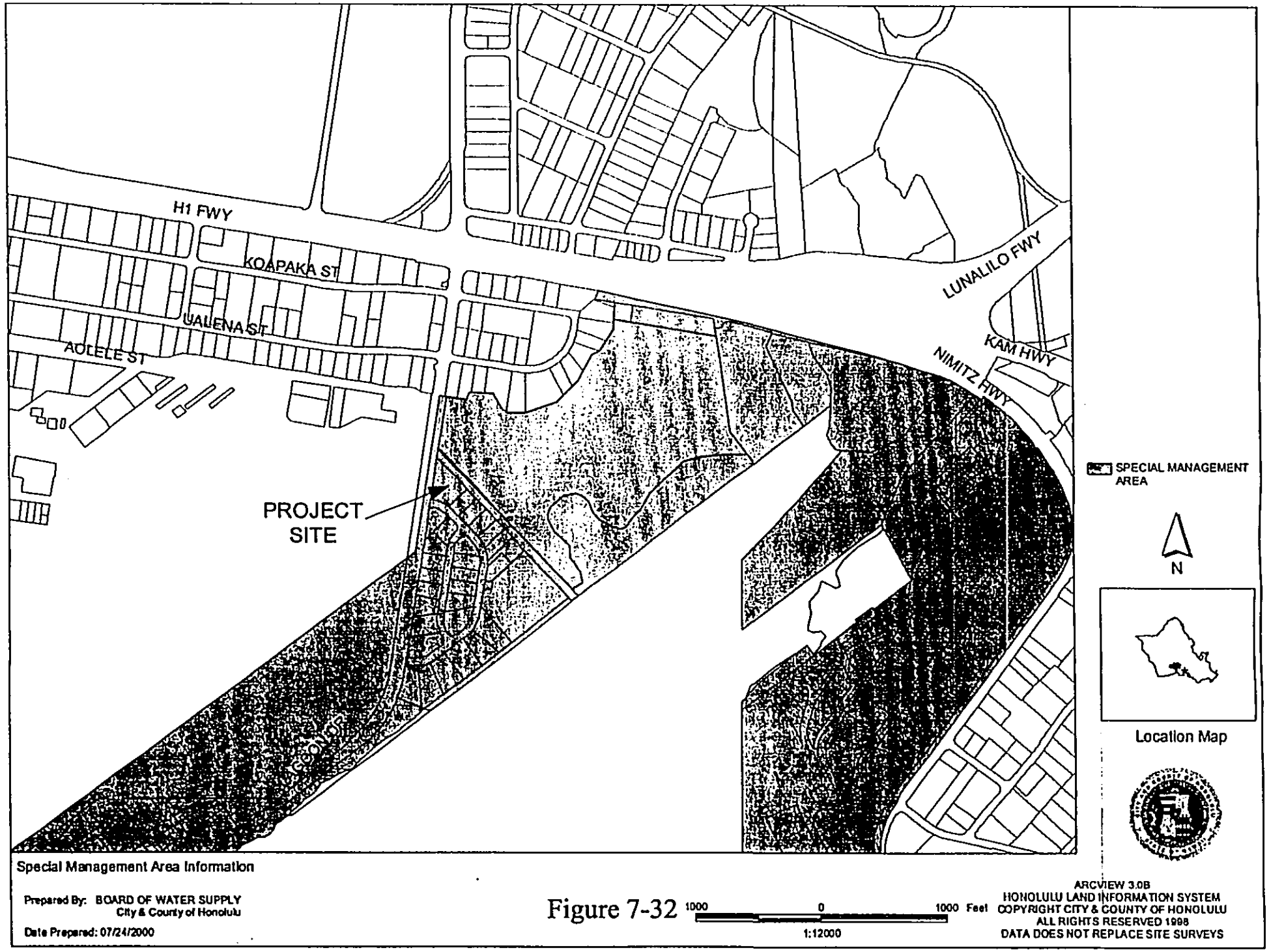

Figure 7-32

SECTION 8 – ALTERNATIVES TO THE PROPOSED ACTION

No Action Alternative

The Board of Water Supply has a legal requirement to provide potable water to the residents of the City and County of Honolulu. The proposed project would help meet this requirement while the no action alternative would prevent the Board of Water Supply from doing so. The no action alternative:

- does not address the mandate of the Board of Water Supply to develop safe potable water resources for the residents of the City and County of Honolulu; and
- would result in the lost opportunity to increase Oahu's exiting potable resources.

Delayed Action

Development of the proposed site at a later date was not considered to be viable. BWS has programmed development of the proposed project as part of an overall strategy for ensuring availability of potable resources. They delayed action alternative:

- would delay the BWS implementation schedule and result in little to no change in the potential environmental impact of the project;
- would result in higher future cost due to inflation; and
- increase the risk that population growth will generate water demands in excess of available, developable supplies.

Alternative Sites

The Kalaeloa site is one of several sites evaluated. The Kalaeloa site was determined to be the most viable location for the exploratory well drilling and potential desalination facility at this time.

Alternative Sources

Alternatives to desalination are identified in the Oahu Water Management Plan (1995). The alternatives investigated include potable groundwater development, surface and brackish water development, recycling of treated wastewater and conservation of existing resources. Alternative source development will help to protect and preserve the future of Oahu's potable aquifer.

The BWS has acquired the Honouliuli Water Recycling Facility, providing an estimated 12 million gallons of water a day to the Ewa area. This safe and reliable alternative water source will replace and conserve the potable water supply. The recycled water means we can save the drinking water for people.

Recommended Action

The recommended action is to proceed with development of the proposed project at the site in Kalaeloa, Oahu. The proposed project is part of the Board of Water Supply program for alternative source development and has been carefully considered to meet the future needs of the City and County of Honolulu.

SECTION 9 – NECESSARY PERMITS AND APPROVALS

The following is a list of permits and approvals, which may be required prior to the construction of the exploratory wells and technology testing:

9.1 State of Hawaii

Department of Health, Noise, Radiation and Indoor Air Quality Branch

- Community Noise Permit

Department of Health, Clean Water Branch

- National Pollutant Discharge Elimination System (NPDES) permit

Department of Land and Natural Resources, Commission on Water Resource Management

- Well Construction permit

A Community Noise Permit may be required if the noise levels from construction activities are expected to exceed the allowable levels stated in State DOH Administrative Rules, Section 11-46-4.

An NPDES may be required if water withdrawn during test pumping and from the technology testing will be discharged into any coastal waters.

Should the exploratory wells be converted to full production, a permanent Pump Installation Permit and Water Use Permit will be required from the State Commission on Water Resource Management.

Should the exploratory well and technology testing prove successful, future development of the well for production will comply with Hawaii Administration Rules, Title 11, Chapter 20, "Rules Relating to Potable Water Systems." An engineering report addressing the requirements of Section 11-20-29 of Chapter 20 will be submitted to the Director of Health for approval.

9.2 City and County of Honolulu

Department of Planning and Permitting

- Grubbing, Grading, and Stockpiling permit
- Building Permit
- Zoning Waiver

A Grubbing, Grading and Stockpiling permit and Building Permit may be required if a temporary structure to protect the testing equipment from the elements is constructed.

Depending on the specific location and/or design of the exploratory wells, test pumps and accessory equipment, the project may require a zoning waiver.

An exploratory well is considered a minor action and is not required to be shown on the Public Infrastructure Map (PIM). However, the Board of Water Supply has submitted a PIM amendment for a Desalination Plant at the Kalaeloa Site.

9.3 Federal

Corps of Engineers

- Department of Army Permit (Corps of Engineers)

The Department of the Army (DA) has indicated that a DA permit is not required for Phase I activities, however a DA permit may be required for the discharge structures for the disposal of water in the adjacent waterway that is possibly under the jurisdiction of the Corps of Engineers.

The drilling derrick is not within the flight aviation easement, however, the Form 7460-1 has been submitted to the FAA. The FAA indicated a "Determination of No Hazard to Air Navigation" which has been forwarded to the State of Hawaii, Department of Transportation.

SECTION 10 - FINDINGS AND NOTICE OF ANTICIPATED DETERMINATION

This environmental assessment discloses the preliminary planning & engineering, exploratory wells construction, test pumping and small-scale desalination technology testing that must occur prior to adequately designing and constructing a full-scale seawater desalination facility. At this time, it is impossible to fully identify all of the impacts and mitigative measures from the construction and operation of a full-scale desalination plant without the design construction plans, specifications and operational plan of the facility. However, the design cannot occur without first conducting preliminary planning, engineering and field-testing. As such, the environmental disclosure process will be conducted in two phases. Phase I for preliminary work and Phase II for the design and construction of the full-scale production facility. This two-step environmental disclosure process is similar to how BWS phases groundwater well stations into an exploratory well phase and a production well phase.

Based on the "Significance Criteria" listed in Section 12 of Title 11-200 HAR, an 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 an long term impacts. In making a determination, the significance criteria rules are established as the basis for identifying whether the proposed project has significant environmental impacts. Based on the analysis, the following conclusions are reached:

1. Irrevocable commitment to loss or destruction of natural or cultural resources – *The exploratory wells construction and desalination technology testing would not result in irrevocable commitment to loss or destruction of any natural or cultural resources. The preferred desalination site is vacant scrubland.*

   The State Historic Preservation Division (SHPD) has indicated that an archaeological inventory survey is not warranted for the proposed exploratory wells and technology testing area (approximately 0.5 acre) because it has been

extensively cleared and it does not appear that there are any historic sites within that area. The cleared area will be flagged prior to any ground disturbing activities to ensure confinement within the cleared area, where the project should have "no effect" on historic sites. If the testing activities extend beyond the modified area, an archaeological survey will be prepared for those areas. If the Kalaeloa site is selected for the full-scale desalination facility, an archaeological survey will be prepared during Phase II of this project for those areas not previously modified.

A cultural impact assessment of the affected land area for the exploratory wells and technology testing is not warranted during Phase I because the area has been extensively cleared. The cultural impact assessment for the remaining land area will be prepared during the Desalination Facility Environmental Impact Statement.

2. Curtailment of the range of beneficial uses of the environment –
The exploratory wells construction and desalination technology testing would not curtail the range of beneficial uses of the environment.

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 exploratory wells construction and desalination technology testing would not conflict with the state's long term environmental policies or goals and guidelines.

4. Substantially affects the economic or social welfare of the community or State –
The exploratory wells construction and desalination technology testing would not affect the economic or social welfare of the community or state.

5. Substantially affects public health –
The exploratory wells construction and desalination technology testing would not substantially affect public health.

6. Involves substantial secondary impacts, such as population changes or effects on public facilities –
No substantial secondary impacts, such as population change, or effects on public facilities are anticipated.

7. Involves substantial degradation of environmental quality –
No substantial degradation of environmental quality is anticipated.

8. Is individually limited but cumulatively has considerable effect on the environment, or involves a commitment for large actions –
The exploratory wells construction and desalination technology testing may involve a commitment to larger actions if the exploratory well and technology testing is successful. The construction of the production seawater desalination facility would have considerable cumulative impacts on the environment. If the BWS decides to construct the full production facility a full environmental impact statement will be prepared and disclosed.

9. Substantially affects a rare, threatened or endangered species or its habitat –
No rare, threatened or endangered species of their habitats would be affected.

10. Detrimentally affects air or water quality or ambient noise levels –
Air quality, water quality or ambient noise levels would not be detrimentally affected.
Short-term impacts from the well construction activity include noise generated during clearing, grading, bulldozing, and installation of well equipment. Additional noise levels may be generated by vehicular travel along nearby roads in the early morning and afternoon. These impacts, however, are expected to be

relatively minor and only of short duration. Mitigation measures to address noise impacts include the use of construction equipment appropriate to surrounding land use type; use of mufflers on construction vehicles; maintaining all equipment in good working order; and, limiting construction to weekdays during daylight hours between 8:30 am and 3:30 pm as required by the Board of Water Supply. No work shall be scheduled on weekends or on federal and state holidays.

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

The exploratory wells construction and desalination technology testing would not affect environmentally sensitive areas. The parcel is located within a flood plain, tsunami inundation zone and is adjacent to coastal waters. Mitigation of the seawater well and testing equipment will account for flooding. Seawater effluent from the well will be disposed of on site to test the soil percolation rates for the brine pond or disposed of into the adjacent drainage culvert and is not expected to impact the coastal waters. The parcel is not erosion-prone or geologically hazardous lands. There are no fresh water aquifers or streams nearby.

12. Substantially affects scenic view planes identified in county or state plans or studies–

Scenic vistas and view plans identified in county or state plans or studies will not be affected by the exploratory wells construction and preliminary desalination technology-testing phase.

13. Requires substantial energy consumption –

The exploratory wells construction and desalination technology testing would not require substantial energy consumption.

Based on the significance criteria set forth in Section 11-200-12 of Title 11, Chapter 200, Administrative Rules, Department of Health, State of Hawaii, it is anticipated that Phase I of the project, will not have a significant effect on the environment, and a Finding of No Significant Impact (FONSI) has been filed with the State Office of Environmental Quality Control.

This finding is based on the short duration of the project and absence of significant impacts and adequate mitigation resulting from planning & engineering, seawater exploratory well construction, pump, field and technology testing. Short-term impacts resulting from construction activities, primarily drilling and test pumping of saltwater, will be minimized through standard well construction mitigation measures, the application of Best Management Practices and adherence to all governmental rules and regulations.

This report also provides a discussion of the Phase II design, construction and operation of the production seawater desalination facility. An Environmental Impact Statement (EIS) will be conducted for Phase II of the project.

Section 11 - Parties Consulted in Draft EA Process

The following parties were consulted during the Draft EA 30-day review period. The parties which transmitted comment letters are indicated with a ✓. All written comments and responses are reproduced and included in the Appendix.

Federal

✓ Corps of Engineers

Fish and Wildlife

National Marine Fisheries, Pacific Islands Area Office

✓ Federal Aviation Administration, Western Pacific Regional Office

✓ Department of the Navy, Navy Region Hawaii

State

Office of Environmental Quality Control

UH Manoa - Environmental Center

Hawaii Community Development Authority

✓ Department of Land and Natural Resources – State Historic Preservation Division

Department of Business and Economic Development and Tourism – Office of Planning and Coastal Zone Management

Department of Transportation

Department of Transportation, Airport Administration

✓ Department of Education

✓ Office of Hawaiian Affairs

✓ Department of Health - Clean Water Branch and Safe Drinking Water

Department of Hawaiian Home Lands

Senator Colleen Hanabusa, District 21

Representative Michael Puanamo Kahikina, District 43

Council member John DeSoto, District 9

Ewa Beach Public and School Library

Continued

City

Environmental Services

✓ Planning and Permitting

Transportation Services

✓ Honolulu Police Department

✓ Honolulu Fire Department

✓ Design and Construction

✓ Facility Maintenance

Parks and Recreation

Private Citizens/Groups

Ewa, NB # 23 – Chair Mary A. Miyashiro

Makakilo / Kapolei / Honokai Hale, NB # 34 – Chair Maeda C. Timson

✓ Oceanic Cable

✓ The Gas Company, (previously BHP Gas)

✓ Verizon Hawaii (previously GTE Hawaiian Telephone)

✓ Hawaiian Electric Company

Estate of James Campbell

✓ Tesoro Hawaii – Refinery

Barbers Point Community Association

✓ Barbers Point Community Redevelopment Commission

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Appendix

Draft Environmental Assessment Consultation

The following parties were consulted during the Draft EA 30-day review period. The parties which transmitted comment letters are indicated with a ✓. All written comments and responses are reproduced and included herein.

Federal

✓ Corps of Engineers

Fish and Wildlife

National Marine Fisheries, Pacific Islands Area Office

✓ Federal Aviation Administration, Western Pacific Regional Office

✓ Department of the Navy, Navy Region Hawaii

State

Office of Environmental Quality Control

UH Manoa - Environmental Center

Hawaii Community Development Authority

✓ Department of Land and Natural Resources – State Historic Preservation Division

Department of Business and Economic Development and Tourism – Office of Planning and Coastal Zone Management

Department of Transportation

Department of Transportation, Airport Administration

✓ Department of Education

✓ Office of Hawaiian Affairs

✓ Department of Health - Clean Water Branch and Safe Drinking Water

Department of Hawaiian Home Lands

Senator Colleen Hanabusa, District 21

Representative Michael Puanamo Kahikina, District 43

Council member John DeSoto, District 9

Ewa Beach Public and School Library

Continued

City

Environmental Services

✓ Planning and Permitting

Transportation Services

✓ Honolulu Police Department

✓ Honolulu Fire Department

✓ Design and Construction

✓ Facility Maintenance

Parks and Recreation

Private Citizens/Groups

Ewa, NB # 23 – Chair Mary A. Miyashiro

Makakilo / Kapolei / Honokai Hale, NB # 34 – Chair Maeda C. Timson

✓ Oceanic Cable

✓ The Gas Company. (previously BHP Gas)

✓ Verizon Hawaii (previously GTE Hawaiian Telephone)

✓ Hawaiian Electric Company

Estate of James Campbell

✓ Tesoro Hawaii – Refinery

Barbers Point Community Association

✓ Barbers Point Community Redevelopment Commission

✓ Sierra Club, Oahu Group

✓ Joseph N. A. Ryan

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

REPLY TO ATTENTION OF

November 17, 2000

Civil Works Technical Branch

Ms. Iris Oda
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Ms. Oda:

Thank you for the opportunity to review and comment on the Draft Environmental Assessment (DEA) for the Board of Water Supply's Proposed Honolulu Desalination Study, Ewa, Oahu (TMK 9-1-31: 28). The following comments are provided in accordance with Corps of Engineers authorities to provide flood hazard information and to issue Department of the Army (DA) permits.

a. Based on the information provided, no wetlands or other waters of the U.S. are present within the three alternative project sites; therefore, a DA permit is not required for Phase I activities. However, please be aware that construction of any temporary or other discharge structures in adjacent waters of the U.S. (e.g., as for disposal of water in the adjacent drainage canal mentioned in Section 6.3.7 of the DEA) may require a DA permit. For further information, please contact Mr. Peter Galloway at (808) 438-8416 and refer to file number 200111133.

b. The flood hazard information provided on page 102 of the DEA is correct.

Sincerely,

James Pennaz, P.E.
Chief, Civil Works
Technical Branch

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

March 22, 2001

JEREMY HARRIS Mayor

EDDIE FLORES JR. Chairman
CHARLES A. STED Vice-Chairman
JAN M. L. Y. AHN
HERBERT S.K. KAOPUA SR.
BARBARA KIM STANTON

BRIAN K. MINAAI, Ex Officio
ROSS S. SASAMURA Ex Officio

CLIFFORD S. JAMILE
Manager and Chief Engineer

Mr. James Pennaz, P.E., Chief
Civil Works Technical Branch
Department of the Army
U.S. Army Engineer District, Honolulu
Fort Shafter, Hawaii 96858-5440

Dear Mr. Pennaz:

Subject: Your Letter of November 17, 2000 on the Draft Environmental Assessment for the Board of Water Supply's Honolulu Desalination Study

Thank you for your letter regarding the Honolulu Desalination Study Draft Environmental Assessment (EA).

We acknowledge that a Department of the Army (DA) permit is not required for Phase I activities. We understand that construction of any temporary or other discharge structures in adjacent waters of the United States may require a DA permit. We note that the flood hazard information provided in the Draft EA is accurate.

If you have any questions, please contact Iris Oda at 527-5245.

Very truly yours,

FOR CLIFFORD S. JAMILE
Manager and Chief Engineer

Iolsm:js
cc: maintenance · Engineering
B. Hsagawa
S. Murata
G. Kwo

Pure Water ... our greatest need ... use it wisely

001204

U S Department of Transportation
Federal Aviation Administration

Western-Pacific Region
Honolulu Airports District Office

300 Ala Moana Blvd., Room 7-128
Honolulu, Hawaii 96813
MAIL Box 50244
Honolulu, Hawaii 96850-0001
Phone (808) 541-1232
FAX (808) 541-3462

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Dec 1 1 01 PM '00

DEC 4 2000

Novemeber 29, 2000

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

Dear Sir:

We have reviewed the Draft Environmental Assessment for the Board of Water Supply's Proposed Honolulu Desalination Study dated October 2000.

We have no comments on the Environmental Assessment; however, we note that a Notice of Proposed Construction or Alteration, FAA Form 7460-1, must be submitted for any construction to assess the impacts on Kalaeloa Airport. We also suggest coordination with the State Airports Division.

If you have any questions, please call David Welhouse at 541-1243.

Sincerely,

for Daniel S. Matsumoto, Acting Manager
Honolulu Airports District Office

cc: Ben Schlapak, DOTA

DEC 4 7 13 PM '00

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

JEREMY HARRIS, Mayor

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ROSS S. SASAMURA, Ex-Officio

CLIFFORD S. JAMILE
Manager and Chief Engineer

December 15, 2000

Mr. Daniel S. Matsumoto, Acting Manager
Honolulu Airports District Office
U.S. Department of Transportation
Federal Aviation Administration
P. O. Box 50244
Honolulu, Hawaii 96850

Dear Mr. Matsumoto:

Subject: Your Letter of November 29, 2000 Regarding the Draft Environmental Assessment for the Board of Water Supply's Honolulu Desalination Study

Thank you for your letter regarding the Honolulu Desalination Study Draft Environmental Assessment.

We acknowledge that you have no comments to offer. We note that a Notice of Proposed Construction or Alteration, FAA Form 7460-1, must be submitted for any construction to assess the impacts on Kalaeloa Airport. A Form 7460-1 has been submitted for the exploratory well drilling rig. An Aeronautical Study No. 00-AWP-3002 was conducted and issued on October 17, 2000 by the FAA office in Los Angeles, California with a determination of no hazard to air navigation. We also intend to coordinate the proposed study with the State Airports Division.

If you have any questions, please contact Scot Muraoka at 527-5221.

Very truly yours,

FOR CLIFFORD S. JAMILE
Manager and Chief Engineer

SM:js
cc: B. Usagawa
00-1204

DEPARTMENT OF THE NAVY
COMMANDER
NAVY REGION HAWAII
517 RUSSELL AVENUE, SUITE 110
PEARL HARBOR, HAWAII 96860-4884

IN REPLY REFER TO:
5090P.1H7A
Ser N465/ 16971
21 [illegible]

Ms. Iris Oda
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, HI 96843

Dear Ms. Oda:

Subj: DRAFT ENVIRONMENTAL ASSESSMENT (EA) FOR THE BOARD OF WATER SUPPLY'S PROPOSED HONOLULU DESALINATION STUDY

As requested by your letter of October 23, 2000 addressed to Pacific Division, Naval Facilities Engineering Command, we reviewed the subject draft EA and have the following comments to offer:

Page 110, Section 7.1.9.

Based on our records, the subject parcel has undergone two archaeological surveys. In 1984-85, Bishop Museum conducted high intensity survey of the southern (seaward) half of the parcel and a low intensity survey of the northern half. The results are reported in *An Archaeological Survey of the Naval Air Station, Barbers Point, Oahu*, by A.E. Haun (1991). No archaeological sites were reported for the parcel. In 1994, JARII conducted a "reconnaissance sweep" of the parcel and reported no sites in the area. The results are reported in *A Cultural Resource Inventory of Naval Air Station, Barbers Point, Oahu, Hawaii: Part I: Phase I Survey and Inventory Summary*, by H.D. Tuggle and H.J. Tomonari-Tuggle (1997).

The parcel was characterized during the most recent archaeological survey as heavily disturbed with extensive bulldozing and dumping. There was no evidence of earlier cultural material, even in disturbed condition (Tuggle & Tomonari-Tuggle 1997:90).

The burial site (SIHP 50-80-12-4209) is not located on the subject parcel, but is located on the edge of the drainage canal property.

Thank you for the opportunity to review the draft EA.

The Navy's point of contact is Mr. Randy Miyashiro at 471-1171 extension 233.

Sincerely,

C.K. Yokota

C. K. YOKOTA
REC Engineer
Regional Environmental Department
By direction of
Commander, Navy Region Hawaii

Copy to: Commander, Pacific Division, Naval Facilities Engineering Command (PLN 23)

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

February 27, 2001

Mr. C.K: Yokota, REC Engineer
Department of the Navy
517 Russell Avenue, Suite 110
Pearl Harbor, Hawaii 96860-4884

Dear Mr. Yokota:

Subject: Your Letter of November 21, 2000 on the Draft Environmental Assessment for the Board of Water Supply's Honolulu Desalination Study

Thank you for your letter (reference:5090P.1H7A Ser N465) regarding the Draft Environmental Assessment (EA) for the Honolulu Desalination Study.

We acknowledge that your records indicate the subject parcel has undergone two archaeological surveys. We understand the surveys revealed no archaeological sites and that the most recent survey (1997) characterized the subject parcel as heavily disturbed with extensive bulldozing and dumping. In addition, we note your disclosure that a burial site is located on the edge of the drainage canal property outside the subject parcel.

If you have any questions, please contact Iris Oda at 527-5245.

Very truly yours,

FOR CLIFFORD S. JAMILE
Manager and Chief Engineer

Io/SM:rL
cc: E.R. Planning

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

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

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

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JANET E. KAWELO
LAWRENCE H. MIIKE

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

00 NOV 5 | 24 PM '00

November 17, 2000

Clifford Jamile
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96813
Attn.: Iris Oda

LOG NO: 26504
DOC NO: 0011EJ08

Dear Mr. Jamile:

SUBJECT: Chapter 6E-8 Historic Preservation Review – Draft Environmental Assessment for the Board of Water Supply's Proposed Honolulu Desalination Study at Kalaeloa, `Ewa, O`ahu
Honouliuli, `Ewa, O`ahu
TMK: 9-1-031:028

Thank you for the opportunity to comment on the DEA for the Honolulu Desalination Study. Our review is based on historic reports, maps, and aerial photographs maintained at the State Historic Preservation Division. SHPD staff archaeologists Sara Collins and Elaine Jourdane met with your staff on October 16, 2000, to conduct a field inspection of the Kalaeloa test location.

The DEA summarizes in Section 7.1.9 Archaeological, Cultural and Historic Resources, that one known historic site SIHP # 50-80-12-4209, a human burial, was identified in the channeled bank on the eastern edge of the parcel. We agree with the DEA that no known archaeological survey has been conduced for this parcel. However, our field meeting with your staff clearly showed that the 0.5-acre proposed for testing has been recently modified through mechanized clearing and illegal dumping activities. Because the test area has been extensively modified and base coral has been exposed, we do not believe that historic sites remain on the 0.5-acre parcel or that an archeological inventory survey is warranted for the 0.5-acre parcel. It was agreed that adequate flagging of the cleared area be done prior to any ground disturbing activities related to the proposed testing and that the testing be confined to the cleared area. If all test activities are confined to the 0.5-acre cleared area, then we believe that this project would have "no effect" on significant historic sites.

In the event that testing activities extends beyond the agreed upon limits, into areas that have not been identified during the field inspected as modified, then an archaeological survey should be conducted of those areas.

We understand that Phase II of this project, the design and construction of the full-scale production facility, will be forthcoming pending results of the test activities and selection of a final site. We look forward to providing comment on that phase of the project. Undoubtedly if the Kalaeloa site is chosen, we would recommend that an archaeological inventory survey be conducted of the facility parcel in those areas to be used which have not been modified.

The DEA also addresses the alternative sites located at Sand Island and at Keehi Lagoon Beach Park. We concur that there are no known historic sites at those locations and that it is unlikely that any significant subsurface historic site would be found in these areas. These lands have been filled to enlarge either the shoreline around Keehi Lagoon, or Sand Island itself.

Should you have any questions, please feel free to call Sara Collins at 692-8026 or Elaine Jourdane at 692-8027.

Aloha,

Don Hibbard, Administrator
State Historic Preservation Division

EJ:jk

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

February 28, 2001

Mr. Don Hibbard, Administrator
Historic Preservation Division
Department of Land and Natural Resources
State of Hawaii
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

Dear Mr. Hibbard:

Subject: Draft Environmental Assessment for the Board of Water Supply's Honolulu Desalination Study

Thank you for your letter regarding the Honolulu Desalination Study Draft Environmental Assessment.

We have the following responses:

1. We extend our appreciation to staff archaeologists Sara Collins and Elaine Jourdaine for their presence at our field inspection in October 2000. We acknowledge that an archaeological inventory survey is not warranted for the desalination test area because it has been extensively cleared and base coral has been exposed. We concur that flagging of the cleared area will be performed prior to any ground disturbing activities to ensure construction activities are confined within the cleared area, where the project would have "no effect" on significant historic sites.

2. In the event that desalination testing activities extend beyond the modified area, an archaeological survey will be prepared for those areas. If the Kalaeloa site is selected for the full-scale desalination facility, an archaeological inventory survey will be prepared during Phase II of this project for those areas which have not been previously modified.

3. We acknowledge that there are no known historic sites at the alternative desalination sites at Sand Island and Keehi Lagoon Beach Park.

If you have any questions, please contact Scot Muraoka at 527-5221.

Very truly yours,

FOR CLIFFORD S. JAMILE
Manager and Chief Engineer

P

BENJAMIN J. CAYETANO
GOVERNOR

PLN-132/00

PAUL G. LeMAHIEU, PhD
SUPERINTENDENT

PB

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

OFFICE OF THE SUPERINTENDENT

November 15, 2000

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Mr. Clifford S. Jamile
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Jamile:

Subject: Honolulu Desalination Study Draft EA

The Department of Education has no comment on the subject draft environmental assessment.

Thank you for the opportunity respond.

Very truly yours,

Paul G. LeMahieu, Ph.D.
Superintendent of Education

PLeM:hy

cc: P. Yoshioka, DAS

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

December 4, 2000

JEREMY HARRIS, Mayor

EDDIE FLORES, JR., Chairman
CHARLES A. STED, Vice Chairman
JAN M. L. Y. AMI
HERBERT S. K. KAOPUA, SR.
BARBARA KIM STANTON

KAZU HAYASHIDA, Ex-Officio
ROSS S. SASAMURA, Ex-Officio

CLIFFORD S. JAMILE
Manager and Chief Engineer

Paul G. LeMahieu, Ph.D.
Superintendent of Education
Department of Education
State of Hawaii
P. O. Box 2360
Honolulu, Hawaii 96804

Dear Dr. LeMahieu:

Subject: Your Letter of November 15, 2000 Regarding the Draft Environmental Assessment for the Board of Water Supply's Honolulu Desalination Study

Thank you for your letter regarding the Draft Environmental Assessment for the Honolulu Desalination Study.

We acknowledge that the Department of Education has no comments to offer.

If you have any questions, please contact Scot Muraoka at 527-5221.

Very truly yours,

CLIFFORD S. JAMILE
Manager and Chief Engineer

SM:jj
cc: B. Usagawa
PLN-132/00

PHONE (808) 594-1888

FAX (808) 594-1865

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DEC 6 2000 PE

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

DEC 6 2 22 PM '00

November 28, 2000

Mr. Clifford S. Jamile
Manager and Chief Engineer
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Jamile:

Subject: Draft Environmental Assessment for the Board of Water Supply Proposed Honolulu Desalination Study

This is in response to your letter of October 23, 2000, within which you had requested the Office of Hawaiian Affairs to review and comment on the Draft Environmental Assessment for the above proposed project by your agency at Kalaeloa. Upon review of the draft environmental assessment, we would recommend that your agency complete a cultural impact assessment before rendering a decision of no impact concerning the above project.

As you may be aware, Act 50 requires your agency to address impacts that your proposed project may have on the Native Hawaiian culture in addition to addressing environmental impacts and concerns. The contents of the current draft assessment do not seem to have taken full account of cultural impacts and concerns that the project raises.

Before rendering a decision of no impact, it is recommended that the Board complete a cultural impact assessment of the project area. The Board stated that there was discovery and inventory of human remains registered by the State Historic Preservation Division relatively nearby the location of the project, and admits of the possibility that there may be other subsurface archaeological deposits because of the known historic sites in the area.

In light of the above situation, OHA recommends a cultural assessment that includes the consultations with individuals and organizations with expertise and knowledge of the Kalaeloa area. These consultations should concern the types of cultural resources, practices and beliefs found within the broad geographical area (e.g., district or ahupua'a). From the list of persons and organizations consulted that was attached, it does not appear that the Board has either contacted or determined people or groups that may be resources to determining the cultural importance of the area.

In the process of completing a cultural assessment of the project area, the Board will be better able to identify and describe any significant resources, practices, beliefs or historical, cultural, archaeological or burial sites, as appropriate, that may lie within or have connection to the project area. After such a consultation, the Board will be able to assess the impact of the proposed action in its final environmental assessment, and whether it will have a significant effect or not. Perhaps after completing its cultural assessment, the Board may find that the completion of an environmental impact statement could be more appropriate for the project. The current definition of "significant effect" does include effects on cultural resources, and OHA feels that a cultural assessment would help to address any effects or impacts that this proposed project might have on these resources.

It is commendable that the Board wishes to complete an archaeological inventory of the project area to determine the significance of any historical sites or resources found. With due respect to those who are completing the archaeological inventory survey, one is caused to wonder whether the Board will be properly apprised of what may constitute a significant find, or by what standard the Board evaluates "significance, especially in light of the fact that people with knowledge of the area or its cultural significance do not appear to have been fully consulted.

OHA recommends that the Board's final assessment of impacts in the project area include discussion concerning any cultural resources, practices and beliefs identified, and, for resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site. The assessment should also include discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area, affected directly or indirectly by the proposed project. Before rendering a finding of no significant impact, the Board should show that it has completed a cultural impact assessment of the project area, and has analyzed the potential effects of any proposed physical alteration on cultural resources, practices or beliefs; the potential of the proposed action to isolate cultural resources, practices or beliefs from their setting; and the potential of the proposed action to introduce elements which may alter the setting in which cultural practices take place. Moreover, the Board should indicate mitigation measures which are either culturally appropriate or which minimize detrimental impacts, effects, or harms to any valuable cultural resources which are within or nearby the project area.

If you have any questions, please contact Wayne Kawamura, Policy Analyst at 594-1945, or email him at waynek@oha.org.

Sincerely,

Colin Kippen Jr

Colin Kippen, Jr.
Deputy Administrator

cc: BOT

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

February 9, 2001

Mr. Colin C. Kippen, Jr., Deputy Administrator
Office of Hawaiian Affairs
State of Hawaii
711 Kapiolani Boulevard, Suite 500
Honolulu, Hawaii 96813

Dear Mr. Kippen:

Subject: Your Letter of November 28, 2000 on the Draft Environmental Assessment for the Board of Water Supply's Honolulu Desalination Study

Thank you for your letter regarding the Honolulu Desalination Study Draft Environmental Assessment. We have the following response to your comments:

1. We will continue to coordinate the archaeological requirements with the State of Hawaii Historic Preservation Division (SHPD). A field visit by SHPD and the Board of Water Supply (BWS) staff indicated the estimated 0.5 acres of land to be utilized for the exploratory well drilling and preliminary desalination technology testing has been recently modified through mechanized clearing and illegal dumping activities. The base coral has been exposed and it does not appear that there are any historic sites within that area. We concur with SHPD that if all test activities are confined to the 0.5 acre cleared area, the project should have "no effect" on historic sites.

2. An Environmental Impact Statement (EIS) for the Kalaeloa site will be conducted in conjunction with the desalination plant design. The EIS will include an archaeological inventory survey and impact mitigation, which includes cultural, historical, and archaeological background research, interviews and consultation with individuals and organizations with expertise and knowledge of the Kalaeloa area and pedestrian inspection of the project area for the purposes of site inventory.

If you have any questions, please contact Iris Oda at 527-5245.

Very truly yours,

CLIFFORD S. JAMILE
Manager and Chief Engineer

Io:s
cc: Eng., B. Usagawa
00-1218

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
PO BOX 3378
HONOLULU, HAWAII 96801

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

In reply, please refer to
File:

00-218/cpo

December 15, 2000

JAN 3 2 01 PM '01

Ms. Iris Oda
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Ms. Oda:

Subject: Draft Environmental Assessment (DEA)
Honolulu Desalination Study
Kalaeloa, Oahu
TMK: 9-1-31:28

Thank you for allowing us to review and comment on the subject study. We have the following comments to offer:

Safe Drinking Water Branch (SDWB)

It is stated on Page 84 of the document that certain waste fluids will be disposed through injection wells. Please be advised that the operation of an injection well for the disposal of wastewater requires an Underground Injection Control (UIC) permit issued by the Department of Health. The operation of an injection well without authorization by a UIC permit is a violation of Chapter 11-23 "Underground Injection Control," and Chapter 340E, H.R.S.

Injection wells for wastewater disposal are generally permissible below (makai of) the UIC line. Injection wells above (mauka of) the UIC line are limited to the disposal of non-polluting fluids.

Also, please be aware that Chapter 11-23 prohibits the construction of new injection wells within one-quarter mile of a drinking water source. In the event that this study successfully demonstrates the viability of the desalination plant and its production well as a source of potable water, the one-quarter mile restriction for an injection well would apply.

Should you have questions about the administration of the Underground Injection Control Program and required permits, please contact Mr. Chauncey Hew of the Safe Drinking Water Branch at 586-4258.

Sincerely,

GARY GILL
Deputy Director
Environmental Health Administration

c: SDWB

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

March 6, 2001

Mr. Gary Gill, Deputy Director
Department of Health
State of Hawaii
P. O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Gill:

Subject: Your Letter of December 15, 2000 on the Draft Environmental Assessment for the Board of Water Supply's Honolulu Desalination Study

Thank you for your letter regarding the Draft Environmental Assessment (EA) for the Honolulu Desalination Study. We have the following response to your comments:

An application for an Underground Injection Control (UIC) permit for the operation of our desalination plant brine disposal well will be submitted prior to construction.

We will request a waiver to allow construction of our injection wells within one-quarter mile of our feed water wells of seawater quality. We anticipate no adverse effects to drinking water quality because the seawater will be processed by reverse osmosis into potable water, and our preliminary engineering study indicated the geology of the area has an aquitard that may prevent any influence from the proposed injection wells located in the upper caprock aquifer. Any impacts from the brine disposal injection wells upon the quality of the proposed feed water wells will be tested as part of the exploratory well testing.

If you have any questions, please contact Iris Oda at 527-5245.

Very truly yours,

FOR CLIFFORD S. JAMILE
Manager and Chief Engineer

IO:nk
cc: Maunakanai Engineering
B. Usagawa

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET • HONOLULU, HAWAII 96813
TELEPHONE: (808) 523-4414 • FAX: (808) 527-6743 • INTERNET: www.co.honolulu.hi.us/planning

JEREMY HARRIS
MAYOR

RANDALL K. FUJIKI, AIA
DIRECTOR

LORETTA K.C. CHEE
DEPUTY DIRECTOR

2000/ACT-11-410

November 28, 2000

TO: CLIFFORD JAMILE, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

FROM: for RANDALL K. FUJIKI, AIA, DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

SUBJECT: HONOLULU DESALINATION STUDY
DRAFT ENVIRONMENTAL ASSESSMENT

Thank you for giving us the opportunity to review the Draft Environmental Assessment for the proposed desalination exploration well and testing facility. We have reviewed the subject document and offer the following comments:

- Section 2, Project Summary - Permits required (page 12): Depending on the specific location and/or design of the exploratory wells, test pumps and accessory equipment, the project may also require a zoning waiver. The proposed project is considered a "public use and structure" for purposes of the Land Use Ordinance (LUO), and is therefore eligible to apply for a waiver from the strict application of development and design standards.

- Section 7.1.12, Kalaeloa Site - Land Use and Zoning Designations (page 114): When land within an F-1 Military and Federal Preservation District has been removed from federal jurisdiction, which has occurred for this site, all uses, structures and development standards for the site shall be as specified for the P-2 General Preservation District.

  The site is proposed for a desalination plant under the Naval Air Station Barbers Point Community Redevelopment Plan and the proposed Kalaeloa Special Area Plan (SAP). The intended zoning proposed by the SAP is I-1 Light Industrial District.

- Section 7.1.12.2.B, [Kalaeloa Site] Planning Framework and Regulatory Status, County General Plan - County Land Use Ordinance (page 122): Until such time as new zoning districts have been established for the former Barbers Point Naval Area Station site, all uses, structures and development standards for the site shall be regulated under the LUO

as specified for the P-2 General Preservation District. Public uses and structures are permitted uses under P-2 District regulations.

- Figures 7-22 and 7-31: The correct title for the I-2 District is "I-2 Intensive Industrial District," as opposed to "General."

- Section 7.2.12.2.C, [Sand Island Site] Planning Framework and Regulatory Status, Long-range Plans - County Land Use Ordinance (page 146): The more accurate name for this site's zoning is the "I-3 Waterfront Industrial District." Also, the more accurate name for the type of permit required for new development within the Shoreline Management Area (SMA) is a "Special Management Area Use Permit" or SMP. Development of a new desalination facility within the SMA would require a Major SMP, which is subject to City Council approval by resolution.

- Section 7.3.12.2.C, [Keehi Lagoon Beach Park Site] Planning Framework and Regulatory Status, Long-range Plans - County Land Use Ordinance (page 170): See previous nomenclature. Development of a new desalination facility within the SMA would require a Major SMP, which is subject to City Council approval by resolution.

- Section 9, Necessary Permits and Approvals (page 175): This is Section 9 of the DEA, however, the subsections appear to have been incorrectly numbered as if they were part of a [nonexistent] Section 11. Also, depending on the specific location and/or design of the exploratory wells, test pumps and accessory equipment, the project may also require a zoning waiver.

- A portion of the site is within the SMA. However, the location of the exploratory well is outside of the SMA. Therefore, an SMA permit would not be required.

- The Kalaeloa site will be required to be identified on the Ewa Public Infrastructure Map (PIM). An application to revise the Ewa PIM to identify a proposed desalination facility has been submitted by the Board of Water Supply (BWS). The processing of this application have been deferred until the BWS presents the proposed project to the neighborhood board.

  Page 122, second paragraph, of DEA should be revised to begin with "A proposed revision to the Ewa Public infrastructure Map," and not "A Development Plan Public Facilities Map Amendment,".

- If selected, the Keehi and Sand Island alternate sites would require an amendment to the Primary Urban Center Public Facilities Map to recognize a proposed desalination facility.

This proposed alternative should be closely coordinated with our Department for inclusion in the proposed Primary Urban Center Development Plan.

- We support the Board of Water Supply's preferred site (Kalaeloa) which is vacant and undeveloped. This site is in close proximity to Kapolei and the development of a new large drinking water source at this location is consistent with the City's policy and efforts to encourage development within the secondary urban center at Kapolei.

- The proposed project is also consistent with, and support the following Objectives and Policies of the City and County of Honolulu's General Plan:

  Transportation and Utilities

  Objective B: "To meet the needs of the people of Oahu for an adequate supply of water and for environmentally sound systems of waste disposal."

  Policy 1: "Develop and maintain an adequate supply of water for both residents and visitors."

  Policy 2: "Develop and maintain an adequate supply of water for agricultural and industrial needs."

- The proposed project is also consistent with Section 4.2 WATER ALLOCATION AND SYSTEM DEVELOPMENT of the Ewa Development Plan. Specifically, the Board of Water Supply projects that an additional 35 million gallons per day of potable water will be needed in Ewa by 2020 to meet projected growth in residential and commercial demand. Meeting this demand will require reallocation of water within the island-wide system, as well as development of new sources. According to Table 4.2 of the Ewa Development Plan, the Board of Water Supply has identified the Ewa Desalinization Plant as a potential alternative water resource for potable water.

- The Final Environmental Assessment (FEA) should provide some discussion on the City's Development Plans.

- If the proposed facility will be built in Kalaeloa, the FEA should provide some discussion on the relationship between the proposed desalination facility and the existing Reclamation Facility at Honouliuli.

- The FEA should provide some discussion on the State's Demonstration Desalination Facility findings.

Should you have any questions, please contact Eugene Takahashi of our staff at 527-6022.

RKF:et
g:\dbw\general\cpd\dpecb\kalaeloa.doc

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

March 12, 2001

TO: RANDALL K. FUJIKI, AIA, DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

FROM: FOR CLIFFORD S. JAMILE, MANAGER AND CHIEF ENGINEER

SUBJECT: YOUR MEMORANDUM OF NOVEMBER 28, 2000 ON THE DRAFT ENVIRONMENTAL ASSESSMENT FOR THE BOARD OF WATER SUPPLY'S HONOLULU DESALINATION STUDY

Thank you for your memorandum regarding the Draft Environmental Assessment (EA) for the Honolulu Desalination Study. We acknowledge your support of the desalination facility at the preferred Kalaeloa site, which is consistent with both the City's General Plan Objectives and Policies for Transportation and Utilities and efforts to encourage development within the secondary urban center at Kapolei. We have the following response to your comments:

1. We acknowledge the exploratory wells, test pump and accessory equipment may require a zoning waiver and we will apply for any required waivers to development and design standards prior to construction.

2. Section 7.1.12 will be revised to indicate when the land is conveyed to the Board of Water Supply (BWS), it will be regulated under the City's Land Use Ordinance and converted to City and County P-2 General Preservation District. We understand a designation change is being proposed as a Kalaeloa Special Area Plan to I-2 Intensive Industrial District.

3. We understand the Kalaeloa exploratory well site is outside of the Special Management Area (SMA) and a Special Management Area Use Permit (SMP) will not be required. The future Kalaeloa desalination facility is in the SMA and we will apply for the Major SMP at that time. If the Sand Island or Keehi Lagoon Beach Park sites are selected in the future, we will apply for the Major SMP.

4. The Draft EA reference to the Ewa Development Plan Public Facilities Map Amendment will be revised to Ewa Public Infrastructure Map (PIM). We will request processing be resumed for the PIM after we have presented the project to the respective neighborhood board. If the Sand Island or Keehi Lagoon Beach Park sites are selected in the future, we will submit an amendment to the Primary Urban Center Public Facilities Map and coordinate the inclusion in the Primary Urban Center Development Plan with your department.

5. We will make the following revisions to the Final EA:

   a. Figures 7-22 and 7-31 and applicable text will be revised to "I-2 Intensive Industrial District" and "I-3 Waterfront Industrial District."

   b. Section 9 subsections numbering will be corrected.

   c. Policy 1 and 2 of Objective B from the City and County of Honolulu's General Plan will be included.

   d. Discussion of the City's Development Plans (DP) will be included. We acknowledge the proposed project is consistent with the Water Allocation and System Development Section of the Ewa DP.

   e. Discussion of the relationship between the proposed BWS Kalaeloa Desalination Plant to the Honouliuli Recycled Water Facility and the results of the State's Demonstration Desalination Project will be included.

If you have any questions, please contact Iris Oda at 527-5245.

Io:rk
cc: Maintenance - Engineering
B. Usagawa
G. Kuo

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

801 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96813 - AREA CODE (808) 529-3111
http://www.honolulupd.org
www.co.honolulu.hi.us

JEREMY HARRIS
MAYOR

LEE D. DONOHUE
CHIEF

MICHAEL CARVALHO
ROBERT AU
DEPUTY CHIEFS

OUR REFERENCE CS-LS

November 20, 2000

TO: CLIFFORD S. JAMILE, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

ATTENTION: IRIS ODA

FROM: LEE D. DONOHUE, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR THE BOARD OF WATER SUPPLY'S PROPOSED HONOLULU DESALINATION STUDY

Thank you for the opportunity to review and comment on the subject document.

As with any other construction project, dust, noise, odors, and traffic complaints are inevitable and will cause a negative impact on calls for police service in the area. However, when the facility becomes operational, there should be no significant impact on our services.

If there are any questions, please call Carol Sodetani of the Support Services Bureau at 529-3658.

LEE D. DONOHUE
Chief of Police

By
EUGENE UEMURA, Assistant Chief
Support Services Bureau

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

January 24, 2001

TO: MR. LEE D. DONOHUE, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

FROM: FOR CLIFFORD S. JAMILE

SUBJECT: YOUR MEMORANDUM OF NOVEMBER 20, 2000 ON THE DRAFT ENVIRONMENTAL ASSESSMENT FOR THE BOARD OF WATER SUPPLY'S HONOLULU DESALINATION STUDY

Thank you for your memorandum regarding the Draft Environmental Assessment for the Honolulu Desalination Study. We have the following response to your comments:

1. The Board of Water Supply currently requires all construction work to comply with dust and noise limits set forth by the State Department of Health.

2. Temporary traffic impacts during construction will be mitigated through an approved traffic control plan.

3. We acknowledge that there should not be a significant impact to your services when the facility becomes operational.

If you have any questions, please contact Iris Oda at 527-5245.

To: js
cc: Eng.
B. Usagawa
00-1154

P

RECEIVED
BD OF WATER SUPPLY
Nov 13 2 57 PM '00

FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU
3375 KOAPAKA STREET, SUITE H425 • HONOLULU, HAWAII 96819-1869
TELEPHONE (808) 831-7761 • FAX (808) 831-7750 • INTERNET www.co.honolulu.hi.us

JEREMY HARRIS
Mayor

ATTILIO K. LEONARDI
Fire Chief

JOHN CLARK
Deputy Fire Chief

November 9, 2000

TO: CLIFFORD S. JAMILE, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

ATTN: IRIS ODA
PLANNING AND ENGINEERING DIVISION

FROM: ATTILIO K. LEONARDI, FIRE CHIEF

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR THE BOARD OF WATER SUPPLY'S PROPOSED HONOLULU DESALINATION STUDY

We received your memorandum dated October 23, 2000, regarding the proposed Honolulu desalination study and have no objections to the proposed project.

Should you have any questions, please call Battalion Chief Kenneth Silva of our Fire Prevention Bureau at 831-7778.

Attilio K. Leonardi

ATTILIO K. LEONARDI
Fire Chief

AKL/KS:ms

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

JEREMY HARRIS Mayor
EDDIE FLORES, JR., Chairman
CHARLES A. STED, Vice Chairman
JAN M. L. Y. AMI
HERBERT S. K. KAOPUA, SR.
BARBARA KIM STANTON
KAZU HAYASHIDA, Ex-Officio
ROSS S. SASAMURA, Ex-Officio
CLIFFORD S. JAMILE
Manager and Chief Engineer

January 24, 2001

TO: MR. ATTILIO K. LEONARDI, FIRE CHIEF
HONOLULU FIRE DEPARTMENT

FROM: FOR CLIFFORD S. JAMILE

SUBJECT: YOUR MEMORANDUM OF NOVEMBER 9, 2000 ON THE DRAFT ENVIRONMENTAL ASSESSMENT FOR THE BOARD OF WATER SUPPLY'S HONOLULU DESALINATION STUDY

Thank you for your memorandum regarding the Draft Environmental Assessment for the Honolulu Desalination Study.

We acknowledge that the Fire Department has no objections to the proposed project.

If you have any questions, please contact Iris Oda at 527-5245.

FO: js
cc: Eng.
B. Usagawa

RECEIVED
BD OF WATER SUPPLY
Nov 16 12 56 PM '00
JEREMY HARRIS
MAYOR

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 523-4566 Fax: (808) 523-4567
Website: www.co.honolulu.hi.us

001135
NOV 16 2000 PE

GARY Q. L. YEE, AIA
DIRECTOR

ROLAND D. LIBBY, JR., AIA
DEPUTY DIRECTOR

WWDE.P 00-724

November 15, 2000

NOV 17 11 16 AM '00

MEMORANDUM

TO: MR. CLIFFORD S. JAMILE, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

ATTN: MR. BARRY USAGAWA

FROM: for GARY Q. L. YEE, AIA, DIRECTOR
DEPARTMENT OF DESIGN AND CONSTRUCTION

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT (DEA) FOR THE BOARD OF WATER SUPPLY'S PROPOSED HONOLULU DESALINATION STUDY

Thank you for allowing us to review and comment on the subject DEA. We have no comments to offer at this time. We look forward to receiving a copy of the final environmental assessment.

Should you have any questions, please contact Bill Liu of the Wastewater Design and Engineering Division at 527-6871.

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

JEREMY HARRIS, Mayor
EDDIE FLORES JR., Chairman
CHARLES A. STED, Vice Chairman
JAN M. L. Y. AMI
HERBERT B.K. KAOPUA SR.
BARBARA KIM STANTON
KAZU HAYASHIDA, Ex Officio
ROSS S. SASAMURA, Ex-Officio
CLIFFORD S. JAMILE
Manager and Chief Engineer

January 24, 2001

TO: MS. RAE LOUI, DIRECTOR
DEPARTMENT OF DESIGN AND CONSTRUCTION

FROM: FOR CLIFFORD S. JAMILE

SUBJECT: YOUR MEMORANDUM OF NOVEMBER 15, 2000 ON THE DRAFT ENVIRONMENTAL ASSESSMENT FOR THE BOARD OF WATER SUPPLY'S HONOLULU DESALINATION STUDY

Thank you for your memorandum regarding the Draft Environmental Assessment (EA) for the Honolulu Desalination Study.

We acknowledge that the Department of Design and Construction has no comments to offer at this time. We will forward a copy of the Final EA upon completion.

If you have any questions, please contact Iris Oda at 527-5245.

To: js
cc: B. Usagawa
00-1135

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

October 23, 2000

TO: ROSS S. SASAMURA, DIRECTOR
DEPARTMENT OF FACILITY MAINTENANCE

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR THE BOARD OF WATER SUPPLY'S PROPOSED HONOLULU DESALINATION STUDY

A Draft Environmental Assessment (DEA) for the proposed project has been prepared by the Board of Water Supply. A Finding of No Significant Impact is anticipated. The DEA will be published in the October 23, 2000 Office of Environmental Quality Control Bulletin.

We have enclosed a copy of the DEA and request your review and comments by November 22, 2000.

If you have any questions, please contact Iris Oda at 527-5245.

Enclosure

October 25, 2000
We do not have any comments. If you have any questions, please call Laverne Higa at 527-6246.

ROSS S. SASAMURA
Director and Chief Engineer

Oceanic Cable
200 Akamainui Street • Mililani, Hawaii 96789-3999 • Telephone: (808) 625-2100

November 6, 2000

Ms. Iris Oda
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Ms. Oda:

Subject: Draft Environmental Assessment for the Board of Water Supply's Proposed Honolulu Desalination Study

Thank you for the ppportunity to review and comment on the proposed project.

Oceanic Cable has no comments at this time, but may have as plans are developed for specific areas.

If you have any questions, please contact me at 625-8480.

Sincerely,

Alvin Park
Supervising Engineer

Cc: Darryl Osato, Oceanic Project Engineer
Office file

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

January 24, 2001

Mr. Alvin Park, Supervising Engineer
Oceanic Cable
200 Akamainui Street
Mililani, Hawaii 96789-3999

Dear Mr. Park:

Subject: Your Letter of November 6, 2000 on the Draft Environmental Assessment for the Board of Water Supply's Honolulu Desalination Study

Thank you for your letter regarding the Draft Environmental Assessment for the Honolulu Desalination Study.

We acknowledge that Oceanic Cable has no comments to offer at this time.

The construction drawings will be submitted to your agency for review and approval to minimize any potential conflicts with your facilities.

If you have any questions, please contact Iris Oda at 527-5245.

Very truly yours,

FOR CLIFFORD S. JAMILE
Manager and Chief Engineer

To: JS
cc: Eng.
B. Usagawa

THE GAS COMPANY
Citizens Energy Services

October 26, 2000

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

Attention: Ms. Iris Oda

Subject: Draft Environmental Assessment for the Board of Water Supply's Proposed Honolulu Desalination Study

Please be advised that The Gas Company has no objections or comments on the proposed project. We would appreciate your consideration during the project planning and design process to minimize any potential conflicts with the existing gas facilities in the project area.

Thank you for the opportunity to comment on the Draft Environmental Assessment. Should there be any questions, or if additional information is desired, please call me at 594-5570.

Very truly yours,

Charles Calvet
Manager, Engineering

CEC:sa
10-261

THE GAS COMPANY
913 Kamehaa Street Honolulu Hawaii 96814
PO Box 3000 Honolulu Hawaii 96802-3000
Telephone 808 535 5800 Facsimile 808 594 5630 Sales

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

January 24, 2001

Mr. Charles Calvet, Manager, Engineering
The Gas Company
P. O. Box 3000
Honolulu, Hawaii 96802-3000

Dear Mr. Calvet:

Subject: Your Letter of October 26, 2000 on the Draft Environmental Assessment for the Board of Water Supply's Honolulu Desalination Study

Thank you for your letter regarding the Draft Environmental Assessment for the Honolulu Desalination Study.

We acknowledge that The Gas Company has no objections or comments to the proposed project.

The construction drawings will be submitted to your agency for review and approval to minimize any potential conflicts with existing facilities in the project area.

If you have any questions, please contact Iris Oda at 527-5245.

Very truly yours,

FOR CLIFFORD S. JAMILE
Manager and Chief Engineer

To: js
cc: Eng.
B. Usagawa

verizon

Verizon Hawaii Inc.
P.O. Box 2200
Honolulu, HI 96841

November 16, 2000

Ms. Iris Oda, P.E.
City and County of Honolulu
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Ms. Oda:

Subject: **Draft Environmental Assessment for the Board of Water Supply's Proposed Honolulu Desalination Study**

Thank you for the opportunity to review and comment on the Draft Environmental Assessment (DEA) for the Board of Water Supply's proposed Honolulu Desalination Study.

At this time, Verizon Hawaii has no comments regarding this DEA for the various locations. However, please be aware that Verizon Hawaii will require further review during the design stages of the project to determine if there will be any impact to our facilities and for service requirements, if any.

If you have any questions or require assistance in the future on this project, please call Kevin Ayano at 546-3541.

Sincerely,

Keith H. Yoshino
Section Manager – Access Design
Verizon Hawaii

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

January 24, 2001

Mr. Keith H. Yoshino, Section Manager
Access Design
Verizon Hawaii, Inc.
P. O. Box 2200
Honolulu, Hawaii 96841

Dear Mr. Yoshino:

Subject: Your Letter of November 16, 2000 on the Draft Environmental Assessment for the Board of Water Supply's Honolulu Desalination Study

Thank you for your letter regarding the Draft Environmental Assessment for the Honolulu Desalination Study.

We acknowledge that Verizon Hawaii, Inc. has no comments to the proposed project for the various locations at this time.

The construction drawings will be submitted to your agency for review and approval to minimize any potential conflicts with existing facilities in the project area and coordinate any service requirements.

If you have any questions, please contact Iris Oda at 527-5245.

Very truly yours,

FOR CLIFFORD S. JAMILE
Manager and Chief Engineer

To: Eng.
cc: B. Usagawa

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

Scott W H Seu, P.E.
Manager
Environmental Department

December 18, 2000

Ms. Iris Oda, P.E.
City and County of Honolulu
630 South Beretania Street
Honolulu, HI 96834

Dear Ms. Oda:

Subject: **Honolulu Desalination Study**

Thank you for the opportunity to comment on the October 2000 Draft EA for the Honolulu Desalination Study, as proposed by the Board of Water Supply, City and County of Honolulu. We have reviewed the subject document and have no comments at this time.

HECO shall reserve further comments pertaining to the protection of existing powerlines bordering the project area until construction plans are finalized. Again, thank you for the opportunity to comment on this Draft EA.

Sincerely,

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

January 24, 2001

Mr. Scott W.H. Seu, Manager
Environmental Department
Hawaiian Electric Company, Inc.
P. O. Box 2750
Honolulu, Hawaii 96840-0001

Dear Mr. Seu:

Subject: Your Letter of December 18, 2000 on the Draft Environmental Assessment for the Board of Water Supply's Honolulu Desalination Study

Thank you for your letter regarding the Draft Environmental Assessment for the Honolulu Desalination Study.

We acknowledge that Hawaiian Electric Company, Inc. has no comments at this time.

The construction drawings will be submitted to your agency for review and approval to minimize any potential conflicts with existing powerlines bordering the project area.

If you have any questions, please contact Iris Oda at 527-5245.

Very truly yours,

FOR CLIFFORD S. JAMILE
Manager and Chief Engineer

Io:jr
cc: Eng. B. Nagawa

November 13, 2000

Ms. Iris Oda
City and County of Honolulu
Board of Water Supply
630 South Beretania Street
Honolulu, HI 96843

TESORO

Tesoro Hawaii Corporation
733 Bishop Street Suite 2700
PO Box 3379
Honolulu, Hawaii 96842-0001
808 547 3111
808 547 3145 Fax

Dear Ms. Oda:

Subject: **Draft Environmental Assessment for the Board of Water Supply's Proposed Honolulu Desalination Study**

Tesoro Hawaii Corporation wishes to thank you for the opportunity to comment on the subject report. We have the following comments and/or concerns:

1. The Hawaii State Department of Land and Natural Resources conducted a similar study in August 1985 using the same reverse osmosis technology and targeted the same formations (cap rock aquifer and the volcanic aquifer). In addition, a desalination plant was built and operated until 1995 in Kapolei. Why does the Board of Water Supply want to conduct another study when the information from the previous study is available from the DLNR? Has the reverse osmosis technology improved during the past few years such that it justifies another study?

2. Since the draft environmental assessment report has stated that the water extracted from the proposed wells at the Kalaeloa site would be sea-water like quality, why not use the sea water from the ocean directly?

3. Many businesses in the Campbell Industrial Park have waste water disposal wells permitted by the State of Hawaii Safe Drinking Water Branch located in the same target aquifers that this proposed project intends to withdraw water from. Is there a need to address the impact of this waste water injection on the water quality being used for the RO project?

4. In Section 7.1.2.2, it is stated that there are no significant stationary sources of air pollution in the area. This may not be true since many businesses in the Campbell Industrial Park have covered source permits for major stationary sources from the State of Hawaii Clean Air Branch. Is there a need to further address air quality in light of this fact?

5. Olai Street, which is the main access road to the proposed project location, is unpaved, consisting of dirt and gravel. Should Section 7.1.2.3 or 7.1.10 address any dust generation issues or control measures as a result of vehicle traffic during construction and operating phases of the project?

Should you have any questions regarding this letter, please contact me at 547-3930. We look forward to feed back on our questions and comments above.

Very truly yours,

Robert G. Jungbluth
Manager, Refinery Environmental Affairs

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

March 9, 2001

Mr. Robert G. Jungbluth
Manager, Refinery Environmental Affairs
Tesoro Hawaii Corporation
P. O. Box 3379
Honolulu, Hawaii 96842-0001

Dear Mr. Jungbluth:

Subject: Your Letter of November 13, 2000 on the Draft Environmental Assessment for the Board of Water Supply's Honolulu Desalination Study

Thank you for your letter regarding the Draft Environmental Assessment (EA) for the Honolulu Desalination Study. We have the following response to your comments:

1. Although the State Department of Land and Natural Resources (DLNR) previously conducted desalination testing, our conditions are different and require testing of basal and caprock seawater to determine the most efficient pretreatment process. Whereas, the DLNR pilot desalination plant only tested brackish water which is very different from our proposed seawater testing. Also, data is needed for ground percolation rates to design a brine disposal pond. The technology for reverse osmosis (RO) has improved and we need to determine operating costs during our initial testing phase before proceeding with developing a large-scale plant.

2. Using wells in lieu of a direct ocean intake will have less environmental impacts to the reef area and will allow for a higher quality of feed water by reducing the intake of marine biota, large debris and potential toxic contamination from an oil or fuel spill.

3. We understand that wastewater disposal wells from the Campbell Industrial Park businesses are in the upper caprock aquifer and have potential impacts to nearby wells. However, we anticipate no impacts from injection wells in the vicinity because we intend to draw water from the lower caprock and deep basal aquifer, which are separated from the upper caprock by an aquitard. The source water quality will be tested for any effects from injection wells during the exploratory well phase and during the operation of the desalination facility. We will seek a determination and approval from the State Department of Health for our proposed brine disposal wells and other injection wells in the area as having no impact on our source water wells.

4. The EA will be revised to indicate that many businesses in the Campbell Industrial Park are significant stationary sources of air pollution. The impacts to air quality from the exploratory well and preliminary technology testing activities will be short term and temporary. Any potential temporary or long-term air quality impacts from the desalination facility will be addressed in the Environmental Impact Statement to be completed during the design phase of the project.

5. The impact of dust emissions due to the construction activities associated with vehicles was included in section 7.1.2.2 and will be moved into Section 7.1.2.3 in the final EA. Section 7.1.10 addresses vehicular and pedestrian traffic impacts during construction and the anticipated impacts from the operations of the production facility will be addressed in the future Environmental Impact Statement.

If you have any questions, please contact Iris Oda at 527-5245.

Very truly yours,

FOR CLIFFORD S. JAMILE
Manager and Chief Engineer

ID:rk
cc: Maintenance - Engineering
C. Law
B. Usagawa
G. Kuo

BPNAS
Barbers Point
Naval Air Station
Redevelopment Commission

Developing the Community at Kalaeloa

P-742/00

Benjamin J. Cayetano
Governor

Rick Egged
Chairman

William M. Bass
Executive Director

NOV 8 12 08 PM '00

Ref. No.: BP-0886

October 30, 2000

Mr. Clifford S. Jamile
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96813
Attention: Mr. Barry Usagawa

Subject: Honolulu Desalination Study, Draft Environmental Assessment

Dear Mr. Jamile:

Thank you for forwarding a copy of the Honolulu Desalination Study to our office. The study indicates that the preferred site for the desalination plant is at Kalaeloa, within the Kalaeloa Community Development District (KCDD).

The State of Hawaii Barbers Point Naval Air Station Redevelopment Commission (BPNAS-RC) is in support of the exploratory well and test pumping at the proposed site. The testing is located within a 30.8-acre site shown on the Community Redevelopment Plan (CRP) for a future desalination plant, and is thus consistent with the plans of the BPNAS-RC. Our comments are limited to the Kalaeloa site and are as follows:

1. **Section 6.4, Future Development, page 86.** Figure 6-7, Conceptual Site Plan for a Desalination Facility, shows that the BWS has plans for desalination facilities only on about two-thirds of the 30.8-acre site. We understand that future development plans were constrained to two-thirds of the site since this was the land area considered by the U.S. Department of Health and Human Services to be eligible for a no-cost public benefit conveyance to the BWS. However, it is suggested that the "Future Development" section indicate that BWS seeks to obtain the remaining one-third of the site for future expansion. The BPNAS-RC would support such an action which would be consistent with the CRP.

P.O. Box 75948 • Kapolei, Hawaii 96707-0948 • Phone (808) 682-4381 • Fax (808) 682-4384

2. **Section 7.1.12. Land Use and Zoning Requirements. Page 114.** Once the land is conveyed from the U.S. Navy to the Board of Water Supply (BWS), the zoning for the site automatically converts to P-2, Preservation, as provided by the City's Land Use Ordinance. The BPNAS-RC is in the process of preparing a Special Area Plan (SAP) which will be submitted to the City Council for adoption by resolution. If the SAP is adopted by the City Council, the SAP will become part of the City's Ewa Development Plan. In the proposed SAP, an "I-2, Industrial" zoning is recommended for the BWS site.

3. **Section 7.1.12.1 Current Land Use. Page 114.** The correct name of the district is the "Kalaeloa Community Development District."

4. **Section 7.12.12.2 B. Planning Framework and Regulatory Status. Long Range Plans. Page 119.** The Barbers Point Naval Air Station Redevelopment Commission is not a City and County agency, it is a State of Hawaii agency.

5. **Section 7.12.12.2 B. Planning Framework and Regulatory Status. Long Range Plans. Page 119.** The land use map referred to as Figure 7-12B, although correctly depicting the desalination plant site's land use, has been amended. The latest amendment to the CRP was approved by the BPNAS-RC on August 24, 2000. The CRP land use maps are attached for your use. The CRP land use map consists of a Basewide Redevelopment Plan, Figure 2-1, and a Downtown Area Redevelopment Plan, Figure 2-2.

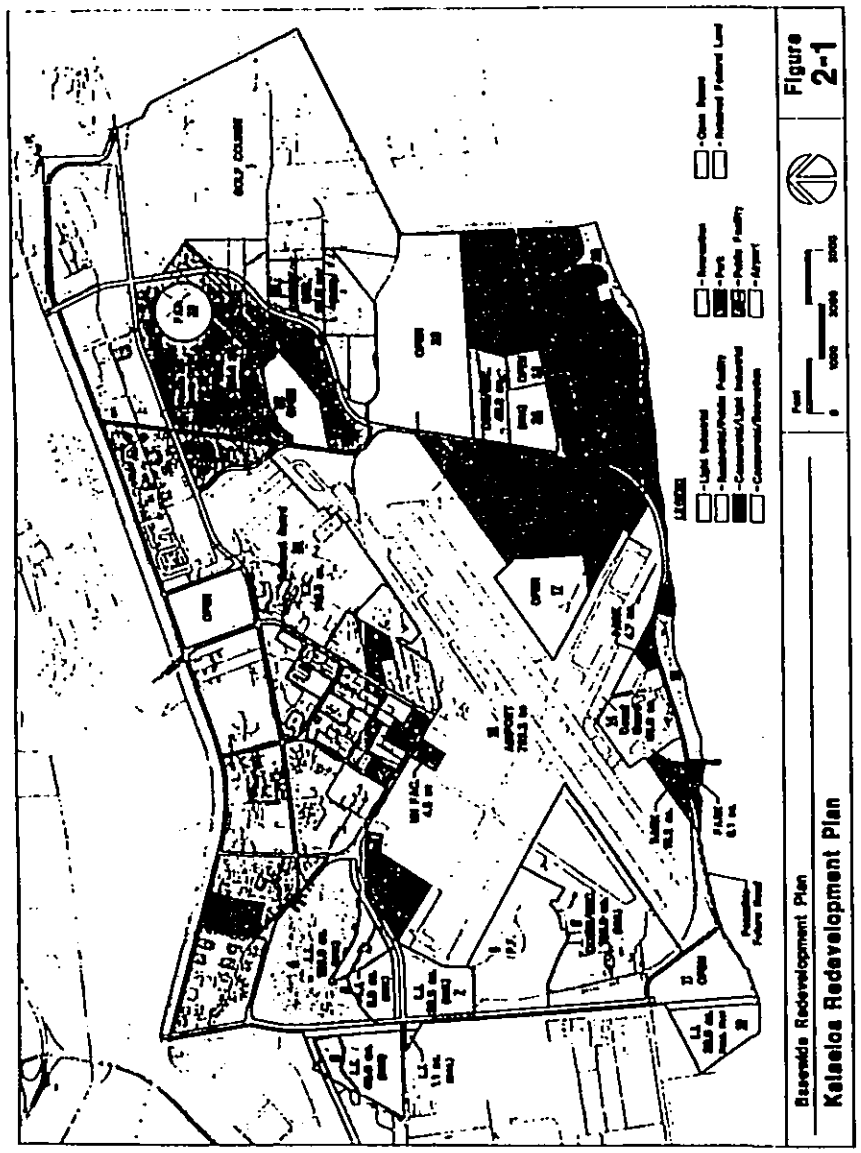
Thank you for the opportunity to comment. If there any questions regarding these comments, please call Infrastructure Development Manager Bennett Mark at 682-6384.

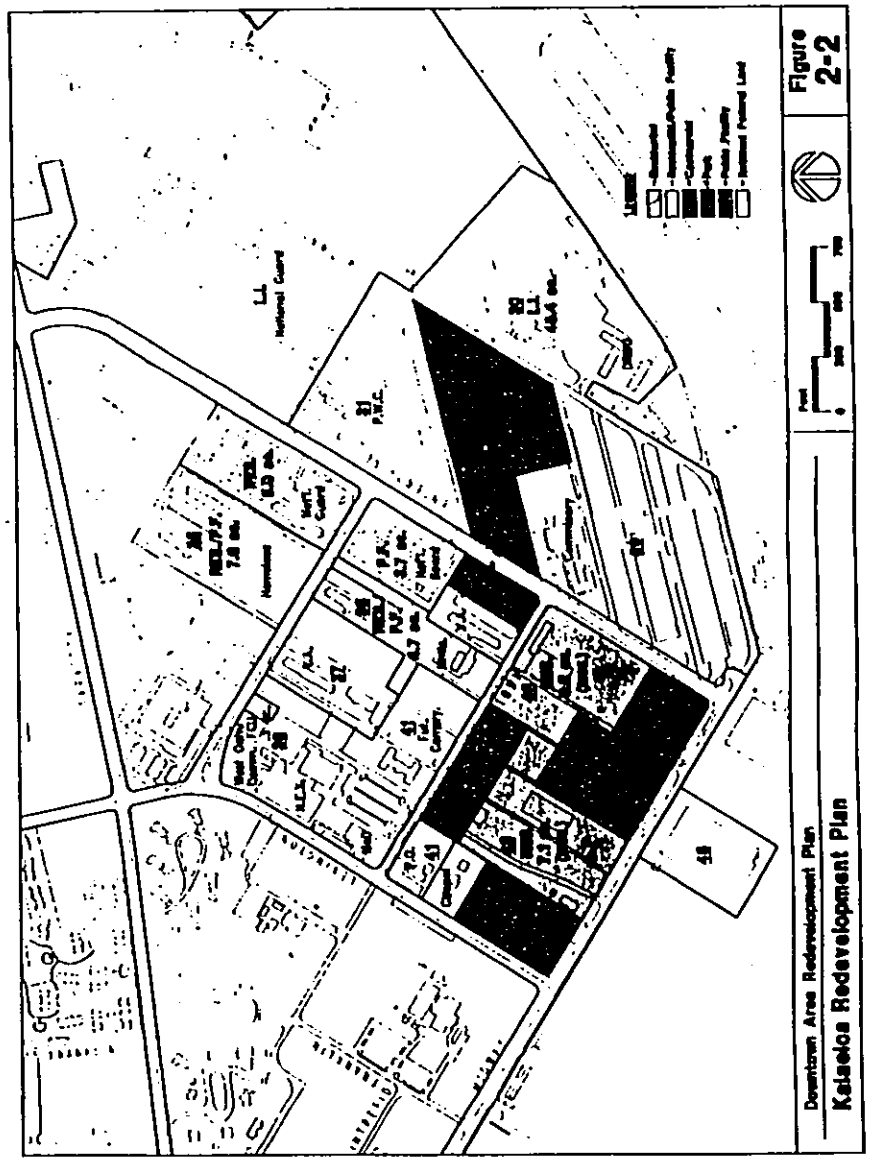
Sincerely,

William M. Bass

William M. Bass
Executive Director

Attachments





BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

March 9, 2001

Mr. William M. Bass, Executive Director
Barbers Point Naval Air Station
Redevelopment Commission
State of Hawaii
P. O. Box 75268
Kapolei, Hawaii 96707-0268

Dear Mr. Bass:

Subject: Your Letter of October 30, 2000 on the Draft Environmental Assessment for the Board of Water Supply's Honolulu Desalination Study

Thank you for reviewing the Draft Environmental Assessment (EA) for the Honolulu Desalination Study and for supporting the exploratory well and test pumping.

We will make the following revisions to the Final EA:

1. Sections 3.4.6 and 6.4 will indicate the remaining 10 acres will be acquired to be consistent with the Community Redevelopment Plan to allow for future expansion of the Desalination Plant.

2. Section 7.1.12 will be revised to indicate when the land is conveyed to the Board of Water Supply, it will be converted to City and County P-2 General Preservation District and regulated under the City's Land Use Ordinance. We understand a designation change is being proposed as a Special Area Plan to I-2 Intensive Industrial District. The district name will be corrected to the "Kalaeloa Community Development District," and the Barbers Point Naval Area Station Redevelopment Commission will be identified as a State of Hawaii agency. Figure 7-12B will be replaced with the amended Community Redevelopment Plan land use map.

If you have any questions, please contact Iris Oda at 527-5245.

Very truly yours,

FOR CLIFFORD S. JAMILE
Manager and Chief Engineer

IO:rk
cc: Maunkanana - Engineering
G. Kuo

P-784/00

DEC 4 9 43 AM '00 RECEIVED BD OF WATER SUPPLY

DEC 4 1 55 PM '00

SIERRA CLUB, O`AHU GROUP

P.O. Box 2577
Honolulu, HI 96803
mikulina@lava.net

tel: 538.6616
fax: 537.9019
ww.hi.sierraclub.org

Malama i ka Honua

NOV 24 11 39 AM '00 RECEIVED BD OF WATER SUPPLY

20 November 2000

Board of Water Supply, City and County of Honolulu
Attn: Clifford S. Jamile
630 S. Beretania St.
Honolulu, HI 96843

RE: Desalination Plant Draft Environmental Assessment

The Sierra Club, O'ahu Group, has a number of concerns regarding the proposed desalination facility. While a good deal of the environmental assessment was devoted to selecting a location, our comments are broader in scope and independent of location.

URBANIZATION
While we recognize that utilizing brackish water sources could *potentially* decrease pressure on potable groundwater resources as well as reduce pressure to divert natural streams, the Sierra Club is concerned that availing more freshwater will only enable more development and urbanization of O'ahu. Increasing development and population only exacerbates existing environmental problems. Increasing population results in additional non-point source pollution, air pollution, solid waste, sewage, energy use, traffic, and open space and habitat loss. While some may believe that desalinated water will be used to *offset* use of groundwater resources, thereby extending the length of time before the aquifer sustainable yields are reached, there is nothing preventing desalinated water from providing for *new* water demands coming online. Water is a contributing attribute in understanding the carrying capacity of O'ahu. By increasing availability of freshwater, carrying capacity may be exceeded in other environmental attributes.

Please discuss the relationship between constructing desalination plants and inducing development on O'ahu in the Final EA or the EIS.

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COST EQUITY
According to the DEA, the cost of desalinated water will be in the "upper range" for development of new water sources. When compared with existing water sources (groundwater), the cost per gallon is much greater. This cost will be spread across all Board of Water Supply ratepayers, yet the water will be used to support new development. Why should existing water users have to foot the bill for new development? Is it fair that low-income residents in Waianae will have to pay more for their water because more water users want to come online?

ENERGY USE
The amount of energy (both electrical and/or petroleum) needed to produce desalinated water through the microfiltration and reverse osmosis system was not adequately discussed in the DEA. Will the turbines, compressors, pumps, auxiliaries, and other equipment be powered by electricity from the Hawaiian Electric Company grid? Does HECO have the existing generating capacity to meet the electricity needs at full plant capacity? If not, will new fossil fuel plants be built—with the cost spread across existing electricity ratepayers? How would a rate increase impact the cost of desalinated water? What are the other petroleum needs for the plant?

We appreciate the opportunity to comment on this draft environmental assessment and look forward to your response.

Sincerely,

Jeff Mikulina

cc. Office of Environmental Quality Control
Mr. Barry Usagawa, BWS

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

March 29, 2001

Mr. Jeff Mikulina
Sierra Club, O'ahu Group
P.O. Box 2577
Honolulu, Hawaii 96803

Dear Mr. Mikulina:

Subject: Your Letter of November 20, 2000 on the Draft Environmental Assessment for the Board of Water Supply's Honolulu Desalination Study

Thank you for your letter regarding the Honolulu Desalination Study Draft Environmental Assessment (EA). We have the following response to your comments:

1. Urbanization

We agree with your discussion on urbanization, carrying capacity and the implications of additional fresh water supply from seawater desalination. There is an increasingly concurrent interrelationship between land use and water planning as inexpensive, natural groundwater supply limits are reached and alternative cost effective water source technologies emerge. There is a continuous flow of information between the land use and water plans, a feedback loop that with each iteration creates more effective plans. Our objective is to provide the land use planners and decision-makers with an integrated resource plan identifying the costs and benefits of a range of water scenario futures such that informed decisions could be made. By developing several types of water supplies, such as seawater desalination, recycled wastewater and deep ocean water/Ocean Thermal Energy Conversion (OTEC) technologies, in addition to surface and groundwater supplies, the Board of Water Supply (BWS) can provide the flexibility to adapt to future uncertainty, to continue to meet consumer demand with enhanced water resource stewardship. This discussion will be included in the future Environmental Impact Statement (EIS) for the Kalaeloa desalination plant.

2. Cost Equity

The capital development cost of the desalination plant on a cost per gallon of capacity basis, is comparable to the cost of constructing a well in rural Oahu and transporting that water to urban Oahu. By developing alternative source within the growth areas, we avoid the impacts on rural

watersheds and water rights. In this respect, the entire island benefits from desalination and, therefore, the cost can be distributed across the entire island. The desalination plant will be funded with our impact fee and by floating municipal bonds. These financial mechanisms place the capital costs on future water users. The initial amount of desalination capacity developed will be limited to where the Operating & Maintenance costs do not require an increase in the water rates. The BWS is evaluating the creation of "lifeline rates" for low income families that have difficulty paying for their water service.

3. Energy Use

The desalination plant's entire energy requirements will be powered from the Hawaiian Electric Company's (HECO) grid. The estimated power requirement for the initial 5 million gallons per day facility is 5 Mega Watts (MW). HECO's planning staff has indicated adequate existing generating capacity is available to meet our initial phase as well as the future plant expansion power requirement of 35 MW. Transmission infrastructure may require upgrading, however, no new electrical plants need to be built for this project. The BWS is also evaluating other alternative energy resources, such as OTEC to provide power to the desalination plant in the long term. There are no other petroleum power needs projected for the plant to those discussed in the Draft EA. The power requirements for the desalination plant will be discussed further in the forthcoming EIS for the desalination plant.

If you have any questions, please contact Iris Oda at 527-5245.

Very truly yours,

FOR CLIFFORD S. JAMILE
Manager and Chief Engineer

cc: Oceanit Laboratories, Inc.

IO/GK/BU:js
cc: Maintenance - Engineering
B. Usagawa
G. Kuo
P-768/00
P-784/00